Deliverable D2.5: First report on technical upgrades and QA activities at EARLINET and Cloudnet stations

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This report summarizes the status of ACTRIS aerosol and cloud profiling stations during the first year of the ACTRIS-2 project. A map of EARLINET and Cloudnet stations is shown in Fig. 1. Station IDs are related to the full station names in Tab. 1. Reporting sheets summarizing the status of instrumentation, data delivery, upgrades, and performed quality checks of all EARLINET and Cloudnet stations are provided in Sec. 1 and 2, respectively. Sec. 3 gives an overview on the results of QA tests for EARLINET stations.

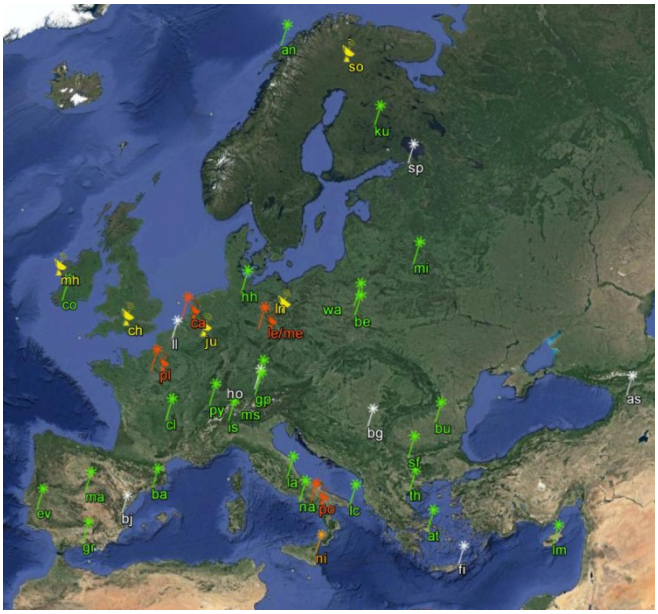

Fig. 1: Map of EARLINET and Cloudnet stations. Orange: combined EARLINET/Cloudnet stations, yellow: Cloudnet stations, green: permanent EARLINET stations, dark yellow: non-permanent EARLINET stations, white: emerging EARLINET stations.

Tab. 1: EARLINET and Cloudnet station IDs and full names

EARLINET permanent stations					
an	Andoya	at	Athens	ba	Barcelona
be	Belsk	bu	Bucharest	ca	Cabauw
cl	Clermont-Ferrand	co	Cork	ev	Evora
gp	Garmisch-Partenkirch.	gr	Granada	hh	Hamburg
is	Ispra	ku	Kuopio	la	L'Aquila
lc	Lecce	le	Leipzig	lm	Limassol
ma	Madrid	mi	Minsk	ms	Maisach
na	Naples	pl	Palaiseau	po	Potenza
py	Payerne	sf	Sofia	th	Thessaloniki
wa	Warsaw				
EARLINET non-permanent stations					
ni	Nicolosi				
EARLINET emerging stations*					
as	Abastumi	bg	Belgrade	bj	Burjassot
fi	Finokalia	ho	Hohenpeissenberg	ll	Lille
sp	Sankt Petersburg				
Cloudnet stations					
ca	Cabauw	ch	Chilbolton	ju	Julich
mh	Mace Head	le/me	Leipzig/Melpitz	ln	Lindenberg
pl	Palaiseau	po	Potenza	so	Sodankyla

* Stations which have applied for EARLINET but which are not yet fully integrated.

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Section 1

EARLINET Station Reports

Period: April 2015 – March 2016

Summary

- **Regular observations:** Regular measurements following the EARLINET schedule have been performed at 22 out of 28 permanent stations. Two stations reported problems because of missing personal power. The other stations underwent substantial upgrades during the reporting period.
- **QA tests:** Most of the active stations performed the QA tests (23 out of 28 permanent stations).
- **Data submission:** 15 out of 22 stations performing regular measurements submitted the data to the database on a regular basis.
- **Use of Single Calculus Chain (SCC):** The SCC is still mainly used for testing. Five stations process their data regularly with the SCC.
- **Handbook of Instruments (HoI):** The HoI is up-to-date for 18 out of 28 permanent stations. Recent updates are reported as major reason for missing data in the HoI.
- **Upgrades:** Five systems at permanent EARLINET stations were either newly installed or substantially upgraded during the reporting period. Upgrades and modifications to systems were reported by another 9 permanent stations. The upgrades comprise new measurement channels (rotational Raman, polarization), near-range receivers, and data acquisition.

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Station **Andoya (an)** Period: 01/04/2015 - 31/03/2016

Measurements have been regularly performed

○ Yes ◉ No

Comment:

Internal quality checks have been performed

◉ Yes ○ No

Comment:

Data have been regularly submitted to the database

○ Yes ◉ No

Comment:

Data have been evaluated with the Single Calculus Chain

○ Yes ◉ No

Comment:

Handbook of Instruments is up-to-date

○ Yes ◉ No Checked on:

Comment:

Upgrades and status changes during the reporting period, other comments

Station **Athens (at)** Period: 01/04/2015 - 31/03/2016

Measurements have been regularly performed

(●) Yes ( ) No

Comment:

Measurements are regularly performed, except for the August period (personnel restrictions). No measurements are performed under cloudy or rainy conditions.

Internal quality checks have been performed

(●) Yes ( ) No

Comment:

Telecover tests have been performed for the EOLE system on 26 February 2016. Rayleigh fits are available. The depolarization lidar (EOLE-DEPOL) is calibrated each time a measurement is performed. However, telecover tests are to be performed.

Data have been regularly submitted to the database

( ) Yes (●) No

Comment:

For the reporting period no data have been submitted to the database. This is due to lack of personnel due to limited budget.

Data have been evaluated with the Single Calculus Chain

( ) Yes (●) No

Comment:

New personnel has to be trained to use the developer version of the SCC. Data are to be delivered in the near future.

Handbook of Instruments is up-to-date

(●) Yes ( ) No Checked on: 2016/03/07

Comment:

The EOLE and EOLE-DEPOL HoI is up-to-date.

Upgrades and status changes during the reporting period, other comments

EOLE and EOLE-DEPOL are not upgraded during the reporting period.

Station **Barcelona (ba)** Period: 01/04/2015 - 31/03/2016

Measurements have been regularly performed

(•) Yes ( ) No

Comment:

Internal quality checks have been performed

(•) Yes ( ) No

Comment:

Data have been regularly submitted to the database

( ) Yes (•) No

Comment:

Data will be uploaded soon, at the latest before the summer.

Data have been evaluated with the Single Calculus Chain

(•) Yes ( ) No

Comment:

We do use regularly the SCC and make comparison with our manual inversions. However, so far, all the inversions uploaded to the EARLINET DB are manual inversions.

Handbook of Instruments is up-to-date

( ) Yes (•) No Checked on:

Comment:

The laser was changed before ACTRIS-2 starts and the HoI needs to be updated. We shall make it as soon as possible.

Upgrades and status changes during the reporting period, other comments

Station **Belsk (be)** Period: 01/04/2015 - 31/03/2016

Measurements have been regularly performed

(•) Yes ( ) No

Comment:

Continous mesurements have been available since May 2015.

Internal quality checks have been performed

(•) Yes ( ) No

Comment:

Data have been regularly submitted to the database

(•) Yes ( ) No

Comment:

However, we have some delay.

Data have been evaluated with the Single Calculus Chain

( ) Yes (•) No

Comment:

Handbook of Instruments is up-to-date

(•) Yes ( ) No Checked on: 2016/03/21

Comment:

The instrument has not changed for last 6 years.

Upgrades and status changes during the reporting period, other comments

The system was prepared to add near range telescope system. This work is in progress now.

Station **Bucharest (bu)** Period: 01/04/2015 - 31/03/2016

Measurements have been regularly performed

(•) Yes ( ) No

Comment:

Continuous measurements with the Multi-wavelength Raman Lidar RALI are available until July 2015. After this date, the lidar instrument was subject to maintenance and upgrades: the laser of the instrument was send to the manufacturer for maintenance and during this period, the emission unit was redesigned to be optimized for depolarization measurements. The instrument will return to normal operation during April 2016.

Internal quality checks have been performed

(•) Yes ( ) No

Comment:

Data have been regularly submitted to the database

(•) Yes ( ) No

Comment:

Data have been evaluated with the Single Calculus Chain

( ) Yes (•) No

Comment:

For some particular cases we used the SCC but since the cloud screening module is not yet implemented, we use the local lidar processing software.

Handbook of Instruments is up-to-date

(•) Yes ( ) No Checked on: 2016/01/01

Comment:

RALI HOI is up to date but since the instrument will be subject to hardware upgrades, the RALI HOI will also require revision.

Upgrades and status changes during the reporting period, other comments

The instrument is offline since July 2015 for maintenance and upgrades. The laser of the instrument required maintenance services at the manufacturer. During this period, the system emission unit was modified: the beam expander and emission optics were replaced with custom made components to optimize the transmission of polarized radiation. A second identical laser will be purchased in order to cover data gaps due to periodic maintenance services. All upgrades will be completed at the end of April 2016.

Station **Cabauw (ca)** Period: 01/04/2015 - 31/03/2016

Measurements have been regularly performed

(•) Yes ( ) No

Comment:

Measurements are performed in operator controlled mode following the EARLINET schedule. Limiting factors are weather, availability of manpower and technical problems. Quicklooks of all data are generated on the web with a latency of about 15 min. and are available from
http://projects.knmi.nl/earlinet/quicklookpages/lidar/Cabauw/images/

Internal quality checks have been performed

(•) Yes ( ) No

Comment:

Telecover and Rayleigh fits are available. Telecover data have been submitted under the LiCal TNA procedure in fall 2015 and winter 2016.

Data have been regularly submitted to the database

( ) Yes (•) No

Comment:

Data have been evaluated by a student but still need to be quality checked before submission. Some recent data has been submitted to the database, but a backlog exists. This is a problem of manpower.

Data have been evaluated with the Single Calculus Chain

( ) Yes (•) No

Comment:

Regular measurements are processed with in-house software.

Handbook of Instruments is up-to-date

(•) Yes ( ) No Checked on: 2016/03/23

Comment:

Caveat is that the Caeli polarisation receiver has been upgraded with the +/- 45 deg calibrator (lambda/2 plate). However, the polarisation data is not yet part of the data submitted to the EARLINET database.

Upgrades and status changes during the reporting period, other comments

1. The Caeli polarisation receiver has been upgraded with the +/- 45 deg calibrator (lambda/2 plate).

2. Experiments have been done with 530 nm interference filters (PRR lines) to eventually replace 607 channels. Additional work is needed to angle tune the filters.

3. A project is currently ongoing to automate Caeli. Target for unattended data collection is Sept. 2016.

Station **Clermont-Ferrand (cl)** Period: 01/04/2015 - 31/03/2016

Measurements have been regularly performed

(•) Yes ( ) No

Comment:

Internal quality checks have been performed

(•) Yes ( ) No

Comment:

Data have been regularly submitted to the database

(•) Yes ( ) No

Comment:

We have requested to unfinalize the 2015 year in order to reprocess it with a better cloudmasking.

Data have been evaluated with the Single Calculus Chain

( ) Yes (•) No

Comment:

Handbook of Instruments is up-to-date

(•) Yes ( ) No Checked on: 2016/03/21

Comment:

The HOI has been checked in order to suppress uncoherent values. New characterization measurements of components would have to be carried out to better fill the HOI (e.g. : the PBS cube).

Upgrades and status changes during the reporting period, other comments

Station **Cork (co)** Period: 01/04/2015 - 31/03/2016

Measurements have been regularly performed

○ Yes ◉ No

Comment:

A system upgrade began in early 2015. We had many hardware and software issues during this period. System alignment and testing began in Nov 15. Measurements have been performed since 27th January, but data has not yet been quality assured.

Internal quality checks have been performed

◉ Yes ○ No

Comment:

Quality checks are in progress, poor weather and alignment issues have been a hindrance. It is planned to submit the required tests by the end of the month.

Data have been regularly submitted to the database

○ Yes ◉ No

Comment:

Measurements performed from January 2016 will be uploaded as 'level 0' until data is quality assured.

Data have been evaluated with the Single Calculus Chain

○ Yes ◉ No

Comment:

Will be used in due course. Measurements have typically been processed with homemade software.

Handbook of Instruments is up-to-date

◉ Yes ○ No Checked on: 2016/03/18

Comment:

Upgrades and status changes during the reporting period, other comments

Our system, UCLID, was upgraded with depolarisation detection capabilities on the elastic channel (532 nm). The following changes were made:
- A new frame and light tight box for detection optics was built.
- Detection optics were designed from scratch.
- New optics throughout and a robust optical cage system was implemented.
- An additional transient card was installed (Fast Comtec MCA-3)
- The data acquisition software was upgraded.

Station **Evora (ev)** Period: 01/04/2015 - 31/03/2016

Measurements have been regularly performed

(•) Yes ( ) No

Comment:

starting from 2015/06/15

Internal quality checks have been performed

(•) Yes ( ) No

Comment:

Data have been regularly submitted to the database

(•) Yes ( ) No

Comment:

Due to changes in the LIDAR's team, the data submission suffered some delay, but actually all the products (quick looks and optical retrievals) are in the database.

Data have been evaluated with the Single Calculus Chain

(•) Yes ( ) No

Comment:

As for the previous point, the change of the LIDAR's management team caused some delay. Actually raw data are regularly evaluated with SCC.

Handbook of Instruments is up-to-date

(•) Yes ( ) No Checked on: 2016/03/21

Comment:

Upgrades and status changes during the reporting period, other comments

The PAOLI-POLLYXT system resumed the operation on 2015/06/15 thanks to the installation of a new laser device. The full system has been aligned and checked. Still problems with the 1064 channel, but regular measurements are performed on the remaining 5 channels (355, 387, 532, 532x, 607) for the whole period.

Station **Garmisch-Partenkirchen (gp)** Period: 01/04/2015 - 31/03/2016

Measurements have been regularly performed

(•) Yes ( ) No

Comment:

Measurements were performed and archived until November 19; then an extended phase of laser repair started that is expected to end in April 2016.

Internal quality checks have been performed

(•) Yes ( ) No

Comment:

Rayleigh fit under aerosol-free conditions submitted; telecover testing is missing due to laser repair.

Data have been regularly submitted to the database

(•) Yes ( ) No

Comment:

Near real time

Data have been evaluated with the Single Calculus Chain

( ) Yes (•) No

Comment:

Handbook of Instruments is up-to-date

( ) Yes (•) No Checked on:

Comment:

Description of 313-nm channel will be added later this month.

Upgrades and status changes during the reporting period, other comments

NDACC lidar is completely damaged; it is planned to integrate both a 532-nm and a 1064-nm channel into the ozone DIAL to benefit from the operating procedures of that system.

Station **Granada (gr)** Period: 01/04/2015 - 31/03/2016

Measurements have been regularly performed

(●) Yes ( ) No

Comment:

EARLINET scheduled measurements with MULHACEN (LR331-D400) and VELETA (LR111-ESS-D200) from second half of May 2015. During November and December 2015 no measurements with MULHACEN were performed due to alignment improvements.

Internal quality checks have been performed

(●) Yes ( ) No

Comment:

Telecover and Rayleigh Fit tests have been performed for both systems. Depolarization calibration is carried out at least once a month.

Data have been regularly submitted to the database

(●) Yes ( ) No

Comment:

Data have been evaluated with the Single Calculus Chain

( ) Yes (●) No

Comment:

Not for this period. Regular measurements are processed with in-house software.

Handbook of Instruments is up-to-date

(●) Yes ( ) No Checked on:

Comment:

Upgrades and status changes during the reporting period, other comments

MULHACEN old Laser Source was replaced with a new one with same specifications in April 2015. VELETA adquisition software was updated for higher-frequency detection (1-s recording).

Station **Hamburg (hh)** Period: 01/04/2015 - 31/03/2016

Measurements have been regularly performed

○ Yes ◉ No

Comment:

Internal quality checks have been performed

○ Yes ◉ No

Comment:

Data have been regularly submitted to the database

○ Yes ◉ No

Comment:

Data have been evaluated with the Single Calculus Chain

○ Yes ◉ No

Comment:

Handbook of Instruments is up-to-date

○ Yes ◉ No Checked on:

Comment:

Upgrades and status changes during the reporting period, other comments

Station **Ispra (is)** Period: 01/04/2015 - 31/03/2016

Measurements have been regularly performed

(•) Yes ( ) No

Comment:

Measurements have been performed with the ADAM system according to the EARLINET schedule (weather permitting) from 7 October 2015. The laser had broke down in August 2014 and could not be re-installed before 01 October 2015.

Internal quality checks have been performed

(•) Yes ( ) No

Comment:

Several telecover tests have been performed and submitted between 23 March and 6 April 2016.
Rayleigh fits have been checked with the manufacturer's software but not submitted.
Depolarisation calibration not performed yet.

Data have been regularly submitted to the database

( ) Yes (•) No

Comment:

Due to limited human resources, data from October 2015 have not been submitted yet.
NB: no data available from April to September 2015

Data have been evaluated with the Single Calculus Chain

( ) Yes (•) No

Comment:

See above.
Due to limited human resources, data from October 2015 will be evaluated ONLY with the SCC.

Handbook of Instruments is up-to-date

( ) Yes (•) No Checked on: 2016/03/15

Comment:

I happened to realise that the iris dimension was shifted to 7 mm on 01 October 2015.
HoI to be updated.

Upgrades and status changes during the reporting period, other comments

Reconditioned laser installed on 01/10/2015
Hardware upgrade: tweaking of ND filters in front of PMTs, 10 mm increase of the distance betwen the primary and secondary mirror (no significant chage of the FoV), decrease of the iris dimension from 9 to 7 mm.

Station **Kuopio (ku)** Period: 01/04/2015 - 31/03/2016

Measurements have been regularly performed

(•) Yes ( ) No

Comment:

Continuous measurements performed at the site except 17 Sept - 10 Dec 2015 (a campaign in Pallas, Northern Finland).

Internal quality checks have been performed

(•) Yes ( ) No

Comment:

Data have been regularly submitted to the database

(•) Yes ( ) No

Comment:

Data have been evaluated with the Single Calculus Chain

( ) Yes (•) No

Comment:

Single cases have been tested.

Handbook of Instruments is up-to-date

(•) Yes ( ) No Checked on: 2016/03/17

Comment:

Upgrades and status changes during the reporting period, other comments

No specific changes during the period.

Station **L'Aquila (la)** Period: 01/04/2015 - 31/03/2016

Measurements have been regularly performed

○ Yes ◉ No

Comment:

The new system (3+2) is in building stage.

Internal quality checks have been performed

○ Yes ◉ No

Comment:

The new system (3+2) is in building stage.

Data have been regularly submitted to the database

○ Yes ◉ No

Comment:

The new system (3+2) is in building stage.

Data have been evaluated with the Single Calculus Chain

○ Yes ◉ No

Comment:

The new system (3+2) is in building stage.

Handbook of Instruments is up-to-date

○ Yes ◉ No Checked on:

Comment:

The new system (3+2) is in building stage.

Upgrades and status changes during the reporting period, other comments

The new laser was installed and we are building the receiver.

Station **Lecce (lc)** Period: 01/04/2015 - 31/03/2016

Measurements have been regularly performed

(•) Yes ( ) No

Comment:

Internal quality checks have been performed

( ) Yes (•) No

Comment:

Data have been regularly submitted to the database

(•) Yes ( ) No

Comment:

Data have been evaluated with the Single Calculus Chain

( ) Yes (•) No

Comment:

Handbook of Instruments is up-to-date

( ) Yes (•) No Checked on:

Comment:

Upgrades and status changes during the reporting period, other comments

Station **Leipzig (le)** Period: 01/04/2015 - 31/03/2016

Measurements have been regularly performed

(•) Yes ( ) No

Comment:

Continuos measurements with Polly systems (OCEANET, lft, 1st) are available until end of Sep 2015. Afterwards, the systems were used for specific campaigns and measurements in Leipzig were performed with the stationary MARTHA system following EARLINET measurement schedule.

Internal quality checks have been performed

(•) Yes ( ) No

Comment:

Telecover tests have been performed except for Polly_1st (see below). Rayleigh fits are available. Depolarization calibration is performed regularly 3 times a day with Polly systems.

Data have been regularly submitted to the database

(•) Yes ( ) No

Comment:

Data have been evaluated with the Single Calculus Chain

( ) Yes (•) No

Comment:

Developer version of the SCC is used for developing and testing purposes. Regular measurements are processed with in-house software.

Handbook of Instruments is up-to-date

(•) Yes ( ) No Checked on: 2016/02/23

Comment:

MARTHA, PollyXT_TROPOS and PollyXT_OCEANET HoI are up-to-date. HoI for Polly_1st will be updated after upgrate is finished.

Upgrades and status changes during the reporting period, other comments

PollyXT_OCEANET was upgraded with two-wavelength near-range telescope (355, 387, 532, and 607 nm) in Aug 2015.
PollyXT_lft was upgraded with new channels and new data acquisition in January 2015. This system is applied at Dushanbe (Tajikistan) currently (2015-2016) and data will be submitted to EARLINET database. The systems will be referred to as PollyXT_TROPOS in future.
Polly_1st was damaged during a heavy rain event/thunderstorm on 4th of July 2015 and is under complete reconstruction.

Station **Limassol (lm)** Period: 01/04/2015 - 31/03/2016

Measurements have been regularly performed

(•) Yes ( ) No

Comment:

CUT system follows EARLINET measurement schedule and performs measurements under dust intrusions in Cyprus.

Internal quality checks have been performed

(•) Yes ( ) No

Comment:

Telecover tests have not been performed in 2015. Rayleigh fits are available. Depolarization calibration is performed regularly during each measurement.

Data have been regularly submitted to the database

(•) Yes ( ) No

Comment:

Published and selected cases have been submitted to the database.

Data have been evaluated with the Single Calculus Chain

( ) Yes (•) No

Comment:

Regular measurements are processed with in-house software. SCC netcdf files are available.

Handbook of Instruments is up-to-date

(•) Yes ( ) No Checked on: 2016/03/21

Comment:

No changes have been made to the system.

Upgrades and status changes during the reporting period, other comments

Station **Madrid (ma)** Period: 01/04/2015 - 31/03/2016

Measurements have been regularly performed

○ Yes ◉ No

Comment:

The lack of manpower and some important technical problems with the control computer of the lidar have prevented the normal use of the instrument. Regular measurements had been performed only from 01/02/2016, with 14 sets of measurements (regular & CALIPSO) accumulated.

Internal quality checks have been performed

◉ Yes ○ No

Comment:

Different Telecover tests and Rayleigh fits have been performed in several occasions but they used to be uncompleted due to bad weather conditions of this winter. However, the QC results obtained on 11/03/2016 have been sent to Volker Freudenthaler.

Data have been regularly submitted to the database

○ Yes ◉ No

Comment:

As the valid measurements have been obtained in the last two months and the radiosoundings are not yet available, we have not uploaded any new data to the DB. We expect to begin this process next week.

Data have been evaluated with the Single Calculus Chain

○ Yes ◉ No

Comment:

The regular measurements are processed with our own software. We are planning to start using the SCC in the near future.

Handbook of Instruments is up-to-date

◉ Yes ○ No Checked on: 2015/06/30

Comment:

Upgrades and status changes during the reporting period, other comments

The recent upgrading actions of the instrument have consisted on a software upgrade to Windows 7 (required for our institution network connection) and A/D card´s drivers upgrade to version 7.2.1. These changes do not have any effect related to HoI.

Station **Minsk (mi)** Period: 01/04/2015 - 31/03/2016

Measurements have been regularly performed

(●) Yes ( ) No

Comment:

Continous measurements with MSTL-2 lidar system are carried out in Minsk. A break of measurements from October 2015 to March 2016 was caused by the repair of the building where the lidar has been placed. MRL-Mobile system are used for seasonal measurements in Antarctic.

Internal quality checks have been performed

(●) Yes ( ) No

Comment:

Telecover tests, Reyleight fits and Dark measurements are carried out.

Data have been regularly submitted to the database

(●) Yes ( ) No

Comment:

Data have been evaluated with the Single Calculus Chain

( ) Yes (●) No

Comment:

Regular measurements are processed with in-house software.

Handbook of Instruments is up-to-date

(●) Yes ( ) No Checked on: 2015/10/01

Comment:

Upgrades and status changes during the reporting period, other comments

Upgrade of the lidar systems was begun in October, 2015, simultaneously with the repairing of the laboratory room, and, in the main, will be completed in April, 2016. The aim of the improvements is automation of measurement procedure.

Station **Maisach (ms)** Period: 01/04/2015 - 31/03/2016

Measurements have been regularly performed

○ Yes ◉ No

Comment:

Due to lack of personnel.

Internal quality checks have been performed

○ Yes ◉ No

Comment:

Data have been regularly submitted to the database

○ Yes ◉ No

Comment:

Data have been evaluated with the Single Calculus Chain

○ Yes ◉ No

Comment:

Handbook of Instruments is up-to-date

◉ Yes ○ No Checked on:

Comment:

Upgrades and status changes during the reporting period, other comments

No.

Station **Naples (na)** Period: 01/04/2015 - 31/03/2016

Measurements have been regularly performed

(•) Yes ( ) No

Comment:

Measurements were regularly performed in Naples with MALIA lidar system following EARLINET measurement schedule.

Internal quality checks have been performed

(•) Yes ( ) No

Comment:

Rayleigh Fit results were mailed.
Telecover Test results will be mailed as soon as possible.

Data have been regularly submitted to the database

( ) Yes (•) No

Comment:

Data have been evaluated with the Single Calculus Chain

( ) Yes (•) No

Comment:

Regular measuremens were processed using our software. SCC has been used only during NALI13 measurement campaign.

Handbook of Instruments is up-to-date

(•) Yes ( ) No Checked on: 2016/03/18

Comment:

Upgrades and status changes during the reporting period, other comments

Station **Palaiseau (pl)** Period: 01/04/2015 - 31/03/2016

Measurements have been regularly performed

(•) Yes ( ) No

Comment:

Regular measurements are performed with IPRAL system following EARLINET recommendations. Data are not submitted pending quality check analysis and performance evaluation of the system stated. Measurements in coincidence with CALIPSO overpasses are also scheduled.

Internal quality checks have been performed

(•) Yes ( ) No

Comment:

Telecover, Dark Current and pulse generator tests and Rayleigh fit have been performed.
Zero-bin test has been scheduled to be performed before the end of March.

Data have been regularly submitted to the database

( ) Yes (•) No

Comment:

Performances of the IPRAL system are still under evaluation. Data collected has to be checked before being submitted.

Data have been evaluated with the Single Calculus Chain

( ) Yes (•) No

Comment:

Hoi-SCC information have been partially filled and submitted for IPRAL. We have contacted with the manufacturer for further details.

Handbook of Instruments is up-to-date

( ) Yes (•) No Checked on:

Comment:

IPRAL Hoi was partially filled with current information available. Excel sheet was submitted but requires updated when last information of the system will be provided.

Upgrades and status changes during the reporting period, other comments

Since installation in 2015, IPRAL performances are evaluated but data were collected and quality checks were performed. IPRAL system is operating following EARLINET recommendations and data is collected since January 2016.

Station **Potenza (po)** Period: 01/04/2015 - 31/03/2016

Measurements have been regularly performed

(•) Yes ( ) No

Comment:

Systematic measurements following EARLINET measurement schedule, and measurements correponding to special events and CALIPSO have been performed with MUSA until end of March 2016.

Internal quality checks have been performed

(•) Yes ( ) No

Comment:

Telecover tests have been performed. Rayleigh fits are available.

Data have been regularly submitted to the database

(•) Yes ( ) No

Comment:

Until end of February 2015.

Data have been evaluated with the Single Calculus Chain

(•) Yes ( ) No

Comment:

Handbook of Instruments is up-to-date

(•) Yes ( ) No Checked on: 2016/03/22

Comment:

Upgrades and status changes during the reporting period, other comments

No upgrades and status changes for MUSA during the reporting period.

Station **Payerne (py)** Period: 01/04/2015 - 31/03/2016

Measurements have been regularly performed

(•) Yes ( ) No

Comment:

Data from RALMO have been continously collected until October 2015, measurements disruption occurred repeatedly during Oct 2015 - Jan 2016 due to the implementation of a new PRR data acquisition system. Data were back to operational mode on 15 Jan 2016.

Internal quality checks have been performed

( ) Yes (•) No

Comment:

Telecover test and the Rayleigh fits have not been performed this year due to the interruption on the data collection during October 2015 - Jan 2016 and due to the implementation of a new PRR data acquisition system. It's intended to perform IQC later before summer and again at the end of 2016.

Data have been regularly submitted to the database

( ) Yes (•) No

Comment:

Data submission has interrupted during Sept 2015 - Jan 2016 due to the implementation of a new PRR data acquisition system.

Data have been evaluated with the Single Calculus Chain

( ) Yes (•) No

Comment:

In-house ADT (Automatic Data Treatment) is used operationally and for data evaluation.

Handbook of Instruments is up-to-date

( ) Yes (•) No Checked on: 2016/02/23

Comment:

Some information are reported wrongly, the correct ones are listed below:
latitude: 46.8128 N, longitude:: 6.943 E, number of measurements: 857

Upgrades and status changes during the reporting period, other comments

RALMO underwent two major improvements of both hardware and software. The 355-nm Pure Rotational Raman acquisition system has been changed from Licel to FastCom with higher repetition sampling and full-photoncounting system. Accordingly, the ADT algorithm has been adapted to the new acquisition system with new desaturation and glueing routines. The calculation of Raman temperature is operational since 15 January 2016.

Station **Sofia (sf)** Period: 01/04/2015 - 31/03/2016

Measurements have been regularly performed

(●) Yes ( ) No

Comment:

Two lidars, one with a CuAu (sf01) and one with a Nd:YAG laser (sf02), are operated at Sofia station. No measurements were performed with the sf02 system because of substantial technical reconstruction/upgrade. The laser of the sf01 sytem was in reparations from April 2015 till July 2015.

Internal quality checks have been performed

(●) Yes ( ) No

Comment:

Telecover test and Rayleigh-fit test were been performed in October 2015 for the channel at 510.6 nm. Last quality check for the sf02 system was accomplished on 23.05.2014. Performing a new quality test is immediately forthcoming.

Data have been regularly submitted to the database

(●) Yes ( ) No

Comment:

Calculated profiles of aerosol backscatter coefficient at wavelength 510.6 nm (and estimated errors) were been uploaded regularly to the database. No data were submitted for the sf02 system because of reconstruction.

Data have been evaluated with the Single Calculus Chain

( ) Yes (●) No

Comment:

Measurement data processing is performed by using another software suite.

Handbook of Instruments is up-to-date

( ) Yes (●) No Checked on: 2016/03/21

Comment:

Due to recent upgrades, the HoI needs to be updated.

Upgrades and status changes during the reporting period, other comments

The sf01 lidar has been upgraded with a new CuAu-laser, which emits three wavelengths: 510.6 nm, 578.2 nm and 627.8 nm. The receiving system was also upgraded to use 3 telescopes and 3 photomultipliers to detect separately the 3 wavelengths in 3 channels. All mechanical support construction was changed. Testing of this new system is now in progress.
A general reconstruction/upgrade of the sf02 system will be finished soon.

Station **Thessaloniki (th)** Period: 01/04/2015 - 31/03/2016

Measurements have been regularly performed

(•) Yes ( ) No

Comment:

Internal quality checks have been performed

(•) Yes ( ) No

Comment:

QA checks have been performed in 2015 and will repeated this March in the frame of LiCal.

Data have been regularly submitted to the database

(•) Yes ( ) No

Comment:

The entire dataset from Thessaloniki till October 2015 has been submitted to the database.

Data have been evaluated with the Single Calculus Chain

(•) Yes ( ) No

Comment:

There is an ongoing study to process all the data (2001-2016) with SCC. Up to know the results are ready for the years till 2007 and a relevant paper has been submitted to a conference.

Handbook of Instruments is up-to-date

(•) Yes ( ) No Checked on: 2016/03/03

Comment:

Upgrades and status changes during the reporting period, other comments

Access to LiCalCheck has been requested for the 1st week of April 2016. It concerns problems with our depolarization measurements.

Station **Warsaw (wa)** Period: 01/04/2015 - 31/03/2016

Measurements have been regularly performed

(●) Yes ( ) No

Comment:

Quai-continuous observations with Polly-XT we performed. EARLINET measurement schedule was followed, when possible. Low number of measurements during certain periods is due to the crane operation at the site.

Internal quality checks have been performed

(●) Yes ( ) No

Comment:

Telecover test was performed on 19/05/2015, it is representative for the entire period. Rayleigh fits are available. Depolarization calibration (+/- 45deg) is performed twice a day.

Data have been regularly submitted to the database

(●) Yes ( ) No

Comment:

Profiles evaluated for 2013 and 2014 are finalized in the data base. At present all profiles for 2015 are re-evaluated - necessity to correct for the dead-time measured recently (Feb 2016).

Data have been evaluated with the Single Calculus Chain

( ) Yes (●) No

Comment:

We intend to contribute data to the SCC only after the training at the LiCalCenter in mid 2016.

Handbook of Instruments is up-to-date

(●) Yes ( ) No Checked on: 2016/03/23

Comment:

HoI has ben accepted by QA PI.

Upgrades and status changes during the reporting period, other comments

Station **Nicolosi (ni)** Period: 01/04/2015 - 31/03/2016

Measurements have been regularly performed

(•) Yes ( ) No

Comment:

Measurements were regularly performed in Serra La Nave (Mt. Etna) with mobile lidar system AMPLE.

Internal quality checks have been performed

(•) Yes ( ) No

Comment:

Rayleigh Fit and Telecover Test were mailed.

Data have been regularly submitted to the database

( ) Yes (•) No

Comment:

Data have been evaluated with the Single Calculus Chain

( ) Yes (•) No

Comment:

Regular mesurements were processed using DALA software developed specifically for our system.

Handbook of Instruments is up-to-date

( ) Yes (•) No Checked on:

Comment:

Not yet but as soon as possible.

Upgrades and status changes during the reporting period, other comments

Station **Abastumani (as)** Period: 01/04/2015 - 31/03/2016

Measurements have been regularly performed

○ Yes ◉ No

Comment:

During this period the laser beam has been unstable and measurements have not been carried out regularly.

Internal quality checks have been performed

○ Yes ◉ No

Comment:

It will be done when the problem of laser beam instability will be resolved.

Data have been regularly submitted to the database

○ Yes ◉ No

Comment:

Data have been evaluated with the Single Calculus Chain

○ Yes ◉ No

Comment:

Handbook of Instruments is up-to-date

○ Yes ◉ No Checked on:

Comment:

Upgrades and status changes during the reporting period, other comments

In the Abastumani Astrophysical Observatory we have installed all-sky imager for cloud monitoring. It will be very important a new multi-channel lidar to perform parallel monitoring of troposphere aerosols vertical distribution above Abastumani.

Station **Belgrade (bg)** Period: 01/04/2015 - 31/03/2016

Measurements have been regularly performed

○ Yes ◉ No

Comment:

Some measurements have been performed during dust intrusion episodes, but not regularly.

Internal quality checks have been performed

○ Yes ◉ No

Comment:

Only telecover tests have been performed.

Data have been regularly submitted to the database

○ Yes ◉ No

Comment:

Since quality checks and measurements have not been regularly performed, date are not being submitted to the database.

Data have been evaluated with the Single Calculus Chain

○ Yes ◉ No

Comment:

In house software is being developed. Data are processed with manufacturer's (Raymetrics) software.

Handbook of Instruments is up-to-date

◉ Yes ○ No Checked on:

Comment:

Upgrades and status changes during the reporting period, other comments

Station **Burjassot (bj)** Period: 01/04/2015 - 31/03/2016

Measurements have been regularly performed

(•) Yes ( ) No

Comment:

Regular 30-minute long measurements centered in 00, 03, 06, 09, 12, 15, 18 and 21 (UTC) in the station of Burjassot. The measuring frequency is increased during special events.

Internal quality checks have been performed

(•) Yes ( ) No

Comment:

Telecover test and Rayleigh fit have been performed (already not sent to Volker). No depolarization calibration has been done yet.

Data have been regularly submitted to the database

( ) Yes (•) No

Comment:

Data have been evaluated with the Single Calculus Chain

( ) Yes (•) No

Comment:

Data are processed with in-house algorithm.

Handbook of Instruments is up-to-date

( ) Yes (•) No Checked on:

Comment:

The HoI has not been done yet. We expect support of the manufacturer (Leosphere) in this regard.

Upgrades and status changes during the reporting period, other comments

The system has remained unchanged since it started operating.

Station **Finokalia (fi)** Period: 01/04/2015 - 31/03/2016

Measurements have been regularly performed

○ Yes ◉ No

Comment:

The PollyXT instrument was operated continuously since May 2015 in the temporary location of Athens, Greece, for testing and participation in the ACTRIS smog campaign.

Internal quality checks have been performed

○ Yes ◉ No

Comment:

Telecover test have been performed for testing, but were analyzed locally.

Data have been regularly submitted to the database

○ Yes ◉ No

Comment:

Data have been evaluated with the Single Calculus Chain

○ Yes ◉ No

Comment:

Handbook of Instruments is up-to-date

○ Yes ◉ No Checked on:

Comment:

It is under review and will be submitted soon.

Upgrades and status changes during the reporting period, other comments

The PollyXT lidar was operated in the temporary location in Athens, Greece for testing and training. After a planned upgrade, it will be installed at Finokalia station in Q3 2016.

Station **Hohenpeissenberg (ho)** Period: 01/04/2015 - 31/03/2016

Measurements have been regularly performed

(●) Yes ( ) No

Comment:

The instrument was installed at Hohenpeissenberg in September 2015. Since January 2016, it is operated continously.

Internal quality checks have been performed

(●) Yes ( ) No

Comment:

Telecover and Rayleigh fit have been sent to Volker for analysis. Depolarization calibration measurements have not yet been submitted.

Data have been regularly submitted to the database

( ) Yes (●) No

Comment:

The quality of retrieved extinction profiles is not sufficient. Further tests for possible corrections/improvements are necessary.

Data have been evaluated with the Single Calculus Chain

(●) Yes ( ) No

Comment:

Usually, signals are pre-processed by SCC and optical data are retrieved with a local test version of ELDA.

Handbook of Instruments is up-to-date

(●) Yes ( ) No Checked on: 2015/09/17

Comment:

The HoI at SCC was filled with main parameters, not yet all details.

Upgrades and status changes during the reporting period, other comments

Station **Lille (II)** Period: 01/04/2015 - 31/03/2016

Measurements have been regularly performed

○ Yes ◉ No

Comment:

Measurements have been performed during SHADOW campaign (Senegal) between March and April 2015 during dust period and in Dec-January 2016 during biomass-burning period.

Internal quality checks have been performed

◉ Yes ○ No

Comment:

In January 2016, we did telecover test , Rayleight fit and calibration for 532 nm.
These QC has been sent to Volker with a lot of comments.

Data have been regularly submitted to the database

○ Yes ◉ No

Comment:

Data have been evaluated with the Single Calculus Chain

○ Yes ◉ No

Comment:

Handbook of Instruments is up-to-date

◉ Yes ○ No Checked on: 2016/04/18

Comment:

Upgrades and status changes during the reporting period, other comments

LILAS was upgraded for this campaign with new rotational Raman channel at 530 nm instead of 607 nm. It keeps the same PM as 607 nm.
The polarisation at 355 nm wasn't used during first part.
Then in December and January 2016, we used polarisation at 355 nm.

Station **St. Petersburg (sp)** Period: 01/04/2015 - 31/03/2016

Measurements have been regularly performed

(•) Yes ( ) No

Comment:

Regular lidar measurements are performed on Monday (noon and sunset) and Thursday (noon). Daily measurements are performed in daytime on working days.

Internal quality checks have been performed

( ) Yes (•) No

Comment:

Telecover test is in process. Rayleigh fits and depolarization calibration are planned after completing telecover test.

Data have been regularly submitted to the database

( ) Yes (•) No

Comment:

Data submission is planned after completing internal quality checks.

Data have been evaluated with the Single Calculus Chain

( ) Yes (•) No

Comment:

Handbook of Instruments is up-to-date

( ) Yes (•) No Checked on: 2016/04/19

Comment:

Documentation collection is in process.

Upgrades and status changes during the reporting period, other comments

Optical scheme was changed.

Section 2

Cloudnet Station Reports

Period: April 2015 – March 2016

Summary

- **Calibration:** No standardised or regular calibration for every instrument is done at an individual site.
    - Cloud radar - No absolute calibration except for Palaiseau (fixed target) and Chilbolton (intercomparison with calibrated S-band radar). Most sites monitor transmit pulse and noise.
    - Ceilometer - Occasional use of cloud calibration technique. Some sites use intercomparison with Raman instruments. Implementation of cloud calibration technique at regular intervals is suggested.
    - MWR - Almost all sites use standardised MWRNET/TOPROF procedures, with tip curves and liquid nitrogen. These procedures should be implemented at regular intervals and applicability of clear-sky LWP cross-check (Gaussiat et al., 2004) at all sites should be investigated.
- **Model data:** ECMWF model data are standard for most sites, but provision for 'local' model data is present (e.g., RACMO at Cabauw, COSMO-EU at Lindenberg). Since model/radiosonde data are necessary for Cloudnet operation, but not always available, other options have been explored. GDAS data will also be provided for every site, and WRF is also being tested at Leipzig.
- **Processing up to date, NRT and transfer:** NRT operation requires reliable NRT transfer of model/radiosonde data. All sites have NRT capability (data for Mace Head, Palaiseau and Sodankylä processed at Cloudnet server), and most sites now run Cloudnet processing in NRT when possible.
- **Manual QC inspection:** Data at each site has been inspected for data quality issues, but this is not yet routine at all sites.
- **Suitability for publication:** Data at each site are suitable for specific publications (e.g. those written by members of the station), but not yet for wider dissemination (used by those not familiar with the specific dataset).

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Station **Cabauw (ca)** Period: 01/04/2015 - 31/03/2016

Instrumentation	Date and method of last calibration
☑ Cloud Radar	none external, once daily transmit pulse and noise figure
☑ Ceilometer/Lidar	none
☑ Microwave Radiometer	LN2 calibration: 8-jan-2016
☑ Rain Gauge/Disdrometer	unknown
☐ Doppler Lidar	
☐ Other	

Model data/radiosonde data available

◉ Yes ○ No

Comment:

RACMO model is used in Cloudnet processing

Cloudnet processing up to date

○ Yes ◉ No

Comment:

older version with modifications for local instruments and database structure

NRT operation

◉ Yes ○ No

Comment:

daily run

Data transferred to server

○ Yes ◉ No

Comment:

no transfer yet due to cloudradar calibration and processing issues

Processed data manually inspected

○ Yes ◉ No

Comment:

not implemented (yet)

Data suitable for publication

○ Yes ◉ No

Comment:

radiometer data missing from may till november, issues with cloudradar calibration, data publication expected in 2016

Upgrades and status changes during the reporting period, other comments

Station **Chilbolton (ch)** Period: 01/04/2015 - 31/03/2016

Instrumentation	Date and method of last calibration
☑ Cloud Radar	Calibration data collected Feb 2016. Calibration against 3-GHz radar in Rayleigh scattering upper regions of thick cirrus.
☑ Ceilometer/Lidar	Monthly, last done Feb. 2016. Automatically select suitable optically thick strato-cumulus.
☑ Microwave Radiometer	Tip curves performed alternately with zenith measurements 24/7, applied every 3-6 months. Integrated water vapour and water vapour profile via comparison with Larkhill radiosonde. Monthly, last done Jan. 2016. No calibration for liquid water.
☑ Rain Gauge/Disdrometer	Drop-counting raingauges calibrated using known flow rate of water in 2013. Other gauges routinely compared to drop-counting gauges.
☑ Doppler Lidar	As ceilometer/lidar. No calibration method for Doppler velocity.
☐ Other	

Model data/radiosonde data available
○ Yes ◉ No
Comment:

Cloudnet processing up to date
○ Yes ◉ No
Comment:

NRT operation
○ Yes ◉ No
Comment:

Data transferred to server
○ Yes ◉ No
Comment:

Processed data manually inspected
○ Yes ◉ No
Comment:

Data suitable for publication
○ Yes ◉ No
Comment:

Upgrades and status changes during the reporting period, other comments

Personnel changes during this period have delayed submission of data for processing. Cloudnet processing will be set up locally at Chilbolton shortly, and should enable NRT operation.

Microwave radiometer out of operation from 26/01/2016 due to fault. Replacement part on order.

Station **Juelich (ju)** Period: 01/04/2015 - 31/03/2016

Instrumentation	Date and method of last calibration
☑ Cloud Radar	
☑ Ceilometer/Lidar	
☑ Microwave Radiometer	Liquid nitrogen calibration on 06/05/15 and 30/10/15
☑ Rain Gauge/Disdrometer	Pluvio, Parsivel, MRR
☑ Doppler Lidar	
☑ Other	AERI, Aeronet (Cimel), Radiation

Model data/radiosonde data available

◉ Yes ○ No

Comment:

ECMWF data is missing from time to time

Cloudnet processing up to date

○ Yes ◉ No

Comment:

Missing ECMWF data:
2015: 04/19,05/04-05/06,05/08-05/12,
05/14-06/10,06/12-06/18,08/27-08/31,10/09-10/16
2016: since 02/29

NRT operation

◉ Yes ○ No

Comment:

Data transferred to server

◉ Yes ○ No

Comment:

Processed data manually inspected

◉ Yes ○ No

Comment:

Categorization/classification is being checked.

Data suitable for publication

○ Yes ◉ No

Comment:

Since 04/01/16 missing MWR data causes unreliable attenuation

Upgrades and status changes during the reporting period, other comments

MWR is currently at RPG (manufacturer) for an update (g5). Observations missing since 04/01/16. No model evaluation statistics running, which we would like.

Station **Leipzig (le)** Period: 01/04/2015 - 31/03/2016

Instrumentation	Date and method of last calibration
☑ Cloud Radar	None
☑ Ceilometer/Lidar	CHM-15kx: 2011 (cloud); PollyXT: regularly via Raman methods
☑ Microwave Radiometer	HATPRO: Liquid-nitrogen calibration, 12/2015
☑ Rain Gauge/Disdrometer	OTT Parsivel 2: factory calibrated
☑ Doppler Lidar	Doppler velocity used only. Vertical alignment: precision scale
☐ Other	

Model data/radiosonde data available

◉ Yes ○ No

Comment:

ECMWF: provided by 'Reading'. 3 days delay
GDAS1: 1 day delay
WRF: current-day forecast (experimental)

Cloudnet processing up to date

◉ Yes ○ No

Comment:

PollyXT used as lidar, if available. Otherwise, Ceilometer Jenoptik CHM-15kx is used. Final processing is done with ECMWF data.

NRT operation

◉ Yes ○ No

Comment:

Processing based on GDAS1 data is available with 1 day delay.

Data transferred to server

◉ Yes ○ No

Comment:

All processed standard files transferred to server. Datasets with age < 3 days are based on GDAS1, older ones were processed with ECMWF data (if available).

Processed data manually inspected

◉ Yes ○ No

Comment:

Data suitable for publication

◉ Yes ○ No

Comment:

Upgrades and status changes during the reporting period, other comments

- WRF NRT processing is expected to be realized by end of second quarter of 2016
- From 09/2016 on a PollyXT system will be permanently added to the Cloudnet instrument suite LACROS of TROPOS (LACROS: Leipzig Aerosol and Cloud Remote Observations System)
- LACROS is a mobile station. Thus, the measurements at Leipzig (main Cloudnet site of LACROS) are not continuous. Station reports for the other Cloudnet sites of LACROS (i.e., Melpitz) were submitted as well.
- Date range, during which LACROS was not present at the Cloudnet site Leipzig:
28 April - 07 July 2015

Station **Lindenberg (In)** Period: 01/04/2015 - 31/03/2016

Instrumentation	Date and method of last calibration
☑ Cloud Radar	
☑ Ceilometer/Lidar	
☑ Microwave Radiometer	Liquid nitrogen calibration, 13.01.15; 05.11.15
☑ Rain Gauge/Disdrometer	
☐ Doppler Lidar	
☐ Other	

Model data/radiosonde data available
◉ Yes ○ No
Comment:
COSMO-EU

Cloudnet processing up to date
◉ Yes ○ No
Comment:

NRT operation
◉ Yes ○ No
Comment:
once a day

Data transferred to server
◉ Yes ○ No
Comment:

Processed data manually inspected
◉ Yes ○ No
Comment:

Data suitable for publication
◉ Yes ○ No
Comment:

Upgrades and status changes during the reporting period, other comments

No cloudnet products available (because of failed cloud radar) for:
- 30.06.15 - 06.07.15
- 06.08.15.- 12.08.15

Quality flags for iwc-retrievals are wrong, it will be updated as soon as possibel

Station **Melpitz (me)** Period: 05/05/2015 - 06/07/2016

Instrumentation	Date and method of last calibration
☑ Cloud Radar	None
☑ Ceilometer/Lidar	CHM-15kx: 2011 (cloud); PollyXT: regularly via Raman methods
☑ Microwave Radiometer	HATPRO: Liquid-nitrogen calibration, 05/2015
☑ Rain Gauge/Disdrometer	OTT Parsivel 2: factory calibrated
☑ Doppler Lidar	Doppler velocity used only. Vertical alignment: precision scale
☐ Other	

Model data/radiosonde data available

◉ Yes ○ No

Comment:

ECMWF: provided for the site of Leipzig (40 km SW of Melpitz) by 'Reading'. 3 days delay
GDAS1: 1 day delay

Cloudnet processing up to date

◉ Yes ○ No

Comment:

PollyXT used as lidar, if available. Otherwise, Ceilometer Jenoptik CHM-15kx is used. Final processing is done with ECMWF data.

NRT operation

◉ Yes ○ No

Comment:

Processing based on GDAS1 data is available with 1 day delay.

Data transferred to server

○ Yes ◉ No

Comment:

Transfer would be possible. Was not activated yet.

Processed data manually inspected

◉ Yes ○ No

Comment:

Data suitable for publication

◉ Yes ○ No

Comment:

Upon request/agreement, the data products can be transferred to the Cloudnet server.

Upgrades and status changes during the reporting period, other comments

- LACROS (Leipzig Aerosol and Cloud Remote Observations System) is a mobile station. The measurements at Melpitz were conducted in the frame of a measurment campaign. Standard Cloudnet site of LACROS is Leipzig. A station report for the Cloudnet site of Leipzig was submitted in addition.

Station **Mace Head (mh)** Period: 01/04/2015 - 31/03/2016

Instrumentation	Date and method of last calibration
☑ Cloud Radar	None
☑ Ceilometer/Lidar	None
☑ Microwave Radiometer	None (instrument for repair since June 2015)
☐ Rain Gauge/Disdrometer	
☑ Doppler Lidar	None
☐ Other	

Model data/radiosonde data available

◉ Yes ○ No

Comment:

Cloudnet processing up to date

○ Yes ◉ No

Comment:

Some Cloudnet products are available until January 2016.

NRT operation

◉ Yes ○ No

Comment:

Data transferred to server

◉ Yes ○ No

Comment:

The unprocessed data is transferred in NRT.

Processed data manually inspected

○ Yes ◉ No

Comment:

Data suitable for publication

○ Yes ◉ No

Comment:

There are gaps in the Cloudnet products. Besides, the microwave radiometer data is missing for most of the evaluation period, and might not be properly calibrated before.

Upgrades and status changes during the reporting period, other comments

The microwave radiometer was sent to the manufacturer (RPG) in the beginning of June 2015. One receiver channel has to be replaced, other parts need repairing. The repair has been delayed by lack of funding on our side, and lack of man-power on RPG side.
The roof of the radar was replaced in September 2015, which accounts for a down time of the instrument of 2 weeks.

Station **Palaiseau (pl)** Period: 01/04/2015 - 31/03/2016

Instrumentation	Date and method of last calibration
☑ Cloud Radar	Fixed target calibration
☑ Ceilometer/Lidar	Cloud calibration on CL31 ceilometer September 2015
☑ Microwave Radiometer	Liquid nitrogen calibration following MWRNET/TOPROF procedure
☑ Rain Gauge/Disdrometer	December 2015
☑ Doppler Lidar	Unknown
☐ Other	

Model data/radiosonde data available

◉ Yes ○ No

Comment:

Two radiosondes per day (12, 00 UTC)

Cloudnet processing up to date

◉ Yes ○ No

Comment:

Until Dec 2015 according to Cloud-net web site

NRT operation

○ Yes ◉ No

Comment:

Data transferred to server

◉ Yes ○ No

Comment:

Processed data manually inspected

○ Yes ◉ No

Comment:

No regular inspection of CloudNet processed products is performed by us at this time.

Data suitable for publication

○ Yes ◉ No

Comment:

Upgrades and status changes during the reporting period, other comments

CL31 ceilometer H2 status changed to "ON" in May 2015.
CHM15k ceilometer is available since May 2015 (could replace CL31 data).

BASTA Cloud radar to be upgraded June 2016.

Station **Potenza (po)** Period: 01/04/2015 - 31/03/2016

Instrumentation	Date and method of last calibration
☑ Cloud Radar	None
☑ Ceilometer/Lidar	CT25K: cloud calibration (15/01/2015); CHM15k calibration on MUSA EARLINET lidar profiles (15/01/2015)
☑ Microwave Radiometer	TIP (30/01/2016); LN2 (30/01/2016)
☐ Rain Gauge/Disdrometer	
☐ Doppler Lidar	
☐ Other	

Model data/radiosonde data available

◉ Yes ○ No

Comment:

GRUAN regular radiosondes (once per week).

Cloudnet processing up to date

◉ Yes ○ No

Comment:

Data missing since mid of December 2015 because of a radar maintenance.
Data should be available again since the second week of April 2016.

NRT operation

◉ Yes ○ No

Comment:

Data transferred to server

◉ Yes ○ No

Comment:

Processed data manually inspected

◉ Yes ○ No

Comment:

Not routinely, only for periods used for specific studies or publications; consistency check with other instruments performed as well.

Data suitable for publication

◉ Yes ○ No

Comment:

We currently use data for publication; radar calibration might increase data quality.

Upgrades and status changes during the reporting period, other comments

Radar maintenance: mid December 2015 - mid April 2016.

Station **Sodankylä (so)** Period: 01/04/2015 - 31/03/2016

Instrumentation	Date and method of last calibration
☑ Cloud Radar	None
☑ Ceilometer/Lidar	Cloud calibration 1/10/2015 (Ceilometer)
☐ Microwave Radiometer	
☐ Rain Gauge/Disdrometer	
☑ Doppler Lidar	Cloud calibration 1/10/2015
☐ Other	

Model data/radiosonde data available

◉ Yes ○ No

Comment:

Using GDAS dataset for Kuopio and Pallas

Cloudnet processing up to date

◉ Yes ○ No

Comment:

NRT operation

○ Yes ◉ No

Comment:

No model data was available during the two campaigns - the model data is now available in NRT but the cloud radar is not functioning.

Data transferred to server

◉ Yes ○ No

Comment:

Processed data manually inspected

◉ Yes ○ No

Comment:

Categorization/classification is being checked.

Data suitable for publication

○ Yes ◉ No

Comment:

The lack of a microwave radiometer means that certain products will not be reliable.

Upgrades and status changes during the reporting period, other comments

Cloudnet station was operating at two campaigns during this period (both in Finland) - Kuopio (until Sep 2015) and Pallas (Oct-Dec 2015) - together with PollyXT.

Cloud radar is currently not operating since its return from Pallas - the computer crashes randomly (uptimes of an hour to a few days).

Section 3

EARLINET QA Tests

Period: April 2015 – March 2016

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3.1 Internal quality check-up tools for hardware

3.1.1 Rayleigh Fit test

The Rayleigh fit test shows the accuracy of agreement between a lidar signal and a calculated molecular (Rayleigh) signal in a lidar range presumably without aerosols. Figure 3.1.1 shows an example where an aerosol free range is assumed between 5 km and 6 km. Although there are several aerosol signatures, the deviation plot at right indicates that the lidar signal can be used up to about 11 km, above which the analogue signal distortions become too strong. Usually the quality of such a fit is evaluated "by eye" by a lidar expert, and an estimation of the signal uncertainty can be retrieved in the scale of the backscatter ratio. This uncertainty can be directly used in error calculations for the retrieval of aerosol scattering parameters. In the frame of NA3 we developed objective criteria for the quality of a Rayleigh fit, which were presented at the EARLINET workshop in Madrid, 2008. The description of the Rayleigh fit criteria can be found on the earlinet.org website.

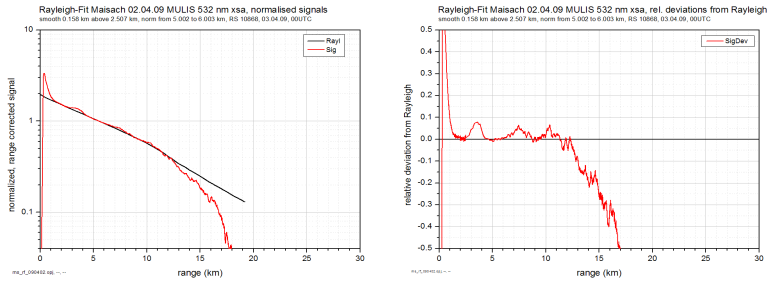


Figure 3.1.1: Left: measured lidar signal (red) and calculated Rayleigh signal (black), Normalised between 5 and 6 km range. Right: difference between the lidar signal and the Rayleigh signal relative to the Rayleigh signal, which is approximately the backscatter ratio assuming negligible aerosol extinction.

The Rayleigh fit requires the calculation of Rayleigh (molecular) backscatter coefficients and of the Rayleigh lidar signal. The latter is proportional to the backscatter coefficients attenuated by the optical depth between ground and the lidar range/height. By means of conversion factors the Rayleigh signal is calculated from height dependent pressure and temperature values, which are measured by radiosondes, determined by weather models, or taken from standard atmospheres. The conversion factors stem from the scattering theory and measurements. We collected conversion factors used by different EARLINET groups, which are shown in figure 3.1.2.

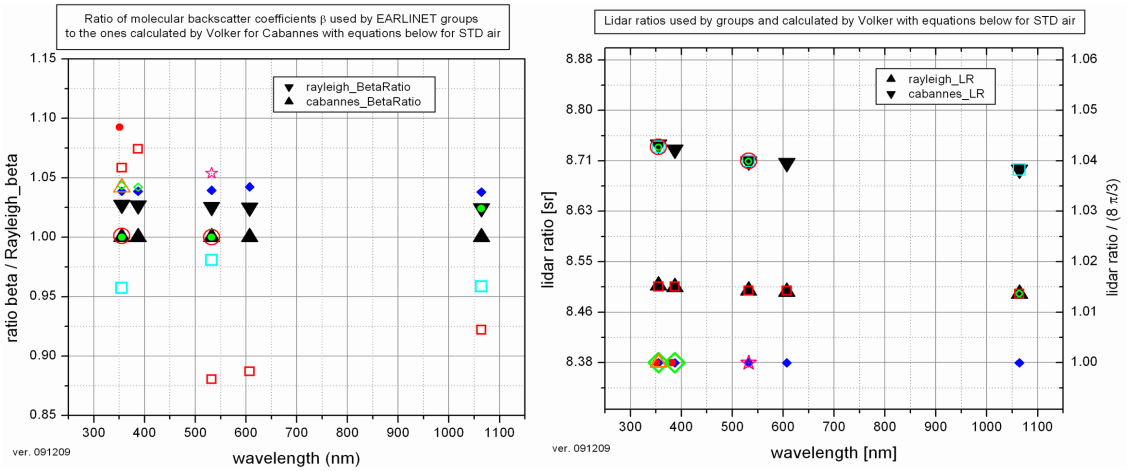


Figure 3.1.2: *In the left plot the ratio of the molecular backscatter coefficients at STD conditions* used by several EARLINET groups (different symbols) to the ones calculated for the Cabannes line (upward black triangle) with the formulas below (see table 1). The downward black triangles show values for the total Rayleigh scattering relative to the Cabannes values. The right plot shows the reported lidar ratios used (same symbols as left plot); the right scale of the right plot shows the ratio to (8π/3). * Standard conditions: 1013.25 hPa and 288.15 K; see e.g. ICAO, ISA, and ISO 13443 STD conditions*

In order to homogenise the calculation of the Rayleigh signals, we surveyed the necessary theory, collected the formulas in the document Rayleigh scattering coefficients ..., and provide there a table with the conversion factors for common EARLINET lidar wavelengths.

Table of scattering conversion factors and related values (ver. 1.4f)

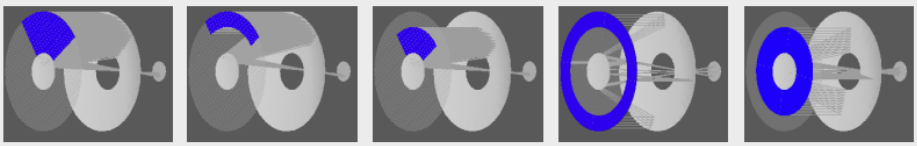
wave-length	$(n_s - 1)$	King factor F_k	C_s	B_s^T	B_s^C	k_{bw}^T	k_{bw}^C	σ_m	β_m^T	β_m^C	δ_m^T	δ_m^C
(air/vacuum)			(17)(14)(10)	(18)	(18)	(20)	(22)	(17)	(18)	(18)	(15)	(16)
[nm]	[*1e-8]		[K/hPa/m]	[K/hPa/(m*sr)]	[K/hPa/(m*sr)]			[1/m]	[1/(m*sr)]	[1/(m*sr)]	[*1e-2]	[*1e-2]
	STD air	STD air						STD air	STD air	STD air	STD air	STD air
308 / 308.089	29046.6	1.05574	3.6506e-5	4.2886E-6	4.1678E-6	1.01610	1.04554	1.2837E-4	1.5080E-5	1.4656E-5	0.01636	0.004158
351 / 351.100	28602.7	1.05307	2.0934e-5	2.4610E-6	2.3949E-6	1.01535	1.04338	7.3611E-5	8.6539E-6	8.4214E-6	0.01559	0.003959
354.717 / 354.818	28572.4	1.05290	2.0024E-5	2.3542E-6	2.2912E-6	1.01530	1.04324	7.0414E-5	8.2783E-6	8.0566E-6	0.01554	0.003946
355 / 355.101	28570.2	1.05288	1.9957E-5	2.3463E-6	2.2835E-6	1.01530	1.04323	7.0177E-5	8.2506E-6	8.0393E-6	0.01554	0.003946
386.890 / 387.000	28350.2	1.05166	1.3942e-5					4.8925E-5				
400 / 400.113	28275.2	1.05125	1.2109E-5	1.4242E-6	1.3872E-6	1.01484	1.04191	4.2579E-5	5.00810E-6	4.8780E-6	0.01507	0.003825
407.558 / 407.673	28235.1	1.05105	1.1202e-5					3.9389E-5				
510.6 / 510.742	27869.4	1.04922	4.4221E-6	5.2042E-7	5.0742E-7	1.01427	1.04026	1.5550E-5	1.8300E-6	1.7843E-6	0.01448	0.003673
532 / 532.148	27819.9	1.04899	3.7382E-6	4.3997E-7	4.2903E-7	1.01421	1.04007	1.3145E-5	1.5471E-6	1.5086E-6	0.01441	0.003656
532.075 / 532.223	27819.4	1.04899	3.7361E-6	4.3971E-7	4.2878E-7	1.01421	1.04007	1.3138E-5	1.5462E-6	1.5078E-6	0.01441	0.003656
607.435 / 607.603	27686.3	1.04839	2.1772e-6					7.6559E-6				
710 / 710.196	27570.4	1.04790	1.1561E-6	1.3611E-7	1.3280E-7	1.01390	1.03919	4.0655E-6	4.7863E-7	4.66698E-7	0.01410	0.003575
800 / 800.220	27503.8	1.04763	7.1364E-7	8.4022E-8	8.1989E-8	1.01383	1.03897	2.5094E-6	2.9546E-7	2.8831E-7	0.01402	0.003555
1064 / 1064.292	27397.5	1.04721	2.2622E-7	2.6638E-8	2.5999E-8	1.01371	1.03863	7.95949E-7	9.3670E-8	9.1423E-8	0.01390	0.003524
1064.150 / 1064.442	27397.4	1.04721	2.2609E-7	2.6623E-8	2.5984E-8	1.01371	1.03863	7.9504E-7	9.3617E-8	9.1371E-8	0.01390	0.003524

Table 1: Refractive index (n_s), King factor (F_k), extinction coefficients (σ_m), Cabannes (β_m^C) and total Rayleigh (β_m^T) backscatter coefficients, proportionality factors (see text above), and Cabannes (δ_m^C) and total Rayleigh (δ_m^T) linear depolarisation ratios caclulated with the equations in row two, for STD air conditions where mentioned (STD air: p_s = 1013.25 hPa, T_s = 288.15 K). The refractive indices and the King factors are calculated according to Tomasi et al. (2005) and Ciddor (2002) with 385 ppmv CO_2 and 0% RH. Please note that the values in the table of the Tomasi paper were caclulated for slightly different conditions. NdYAG elastic and Raman wavelenghts (underlined) are for vacuum, calculated from the fundamental air wavelength 1064.15 nm (1064.442 nm in vacuum) at 300 K rod temperature according to Kaminskii. (RAMAN3G.ods, Laserlinien.ods, Rayleigh1.vbs) (This tabel is version 1.4f from Feb. 2013: some "exact" wavelengths added to version 1.1 and corrected from ver. 1.3; 1.4f: wavelengths in air and vacuum). In order to enable the comparison of the accuracy of the calculatuions by the readers, more decimal digits are shown than certified by the accuracy of the model and the assumtions.

Table 3.1.1: *Table 1 from Rayleigh scattering coefficients (ver. 1.4f)*

3.1.2 Telecover test

The Rayleigh fit is a very good check-up tool for the far range in the free troposphere or above, where frequently aerosol-free regions can be found. The accuracy of this test is only limited by the small signal, which decreases with range. On the other hand, in the boundary layer, which is the most interesting region for the EARLINET climatology of aerosol scattering parameters, all lidar systems suffer from signal saturation and are limited by the optical overlap function. In this near range region the telecover test can be used to estimate the optical overlap function and other near range distortions. This test has been described in detail in report D3.1, and recently on a conference poster "The telecover test", which is recommended as introduction to the telecover test tool. The image below is a copy from the poster and explains the nomenclature of the sectors.



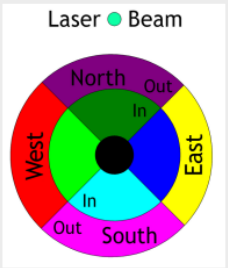


Figure 1: **Nomenclature** of the telecover parts (plot at right) with respect to the laser position at North (biaxial systems) or any prominent orientation of the receiver optics (monoaxial systems). Using the four quarters N,E,S, and W in the left picture is called the quadrant test. Using the outer and inner parts of the quadrants is called the octant test. The pictures above show (from left to right) the sectors North (**N**), North-Out (**NO**), North-In (**NI**), Full-Out (**FO**), and Full-In (**FI**) on a Cassegrain telescope, assuming the laser on top.

Figure 3.1.3: *Fig. 1 from https://epub.ub.uni-muenchen.de/12958/index.html*

Due to the spatial inhomogeneity of detectors, the lidar signals from different sectors usually differ by constant factors for a are otherwise well performing lidar system. The drawback of the telecover test is, that the sectors can be measured only one after each other, which allows for atmospheric changes in the meantime. Hence the test should be accomplished in time period when the atmosphere changes as little as possible. In order to compare the sector signals they must be normalised, and the normalisation range must be selected below any major atmospheric changes. A test is needed to estimate the amount of the atmospheric change during the period of the telecover test from the first measurement to the last one. For this purpose the measurement of the first sector (usually the N-sector) can be repeated at the end. This test measurement (**N2**) of atmospheric stability is then directly compared to the first (N) with the formula **N2Dev** = 2(N – N2) / (N+N2).

Atmospheric changes have more effect at longer wavelengths due to the relatively higher backscatter ratio compared to shorter wavelengths and are hence most visible at 1064 nm. A relatively strong effect can also be seen

in depolarisation channels, especially when atmospheric changes are caused by high depolarizing aerosols like Saharan dust. Additionally, atmospheric changes produce different attenuation between the normalisation range and ranges below, resulting in additional deviation of the sectors. Currently this influence can only be estimated by eye. Below is an example for the plots in chapter 3.3 showing an octant telecover test with NI2 and NO2 .

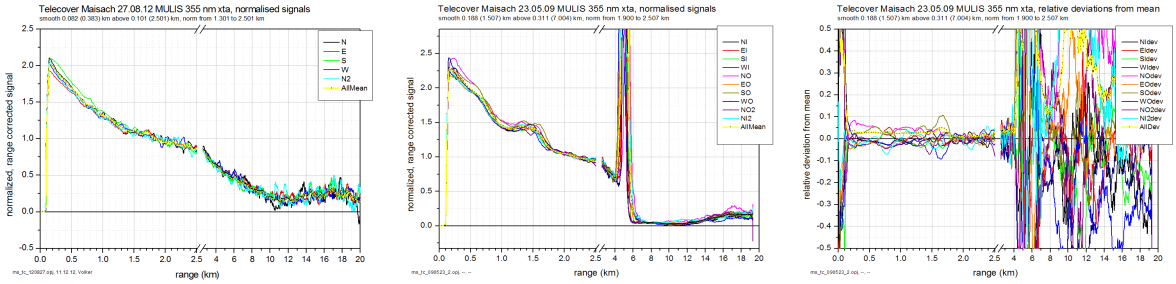
We first show for all channels the raw signals without spatial smooth and normalisation. The overall absolute differences between the sector signals are caused mainly by the spatial inhomogeneity of the detector sensitivity, which is large for the standard LICEL PMTs as in the example above, but may also stem from unsymmetrical beam truncation or differences in the transmission of the optical paths. The amount of noise in the far range gives an estimate of the validity range of this test. When signals are too noisy, the comparison between the sectors is distorted by noise fluctuations.

In the following plots we show for each channel the Normalised signals at left and the relative deviations from the mean signal at right. The mean signal is an arithmetic mean of all signals but the atmospheric test measurement **N2**. The relative deviations are calculated like **NDev** = (N – mean) / mean, and e.g. **AllDev** = sqrt [($NDev^2$ + $Edev^2$ + $Sdev^2$ + $Wdev^2$) /4]. For the octant test all eight signals are considered.

As we don't know a priory which of the sectors signal is closest to the truth, these plots give only a rough estimation of the range dependent uncertainty of the full telescope signal. In the worst case the error of the total signal is in the range of the difference between the lowest and highest sector signal. At best all deviations compensate each other well, except in the overlap region, where they always differ for a biaxial lidar. We never know a priory which is the case.

MS Maisach: MULIS – Telecover

Raw signals	Normalised signals	Relative deviations



Only one deviation curve, which is always the cyan curve in the right plot, shows the relative difference of the two atmospheric change measurements, the NI sector (not the NO) in this case (=> **NI2dev**), which gives an estimate of the range dependent atmospheric changes. In this case the atmospheric changes seem to be in the range of 5% up to about 4 km. As the sector deviations from the mean signal are also in this range, the relative uncertainty of the total signal can be roughly estimated to about 5% between about 0.2 km and 4 km range.

Well designed and aligned lidar systems exhibit a *relative deviation from the mean*, **AllDev,** below 5% (0.05). Depending on the wavelength, on the type of the retrieval (e.g. scattering coefficients or depolarization), and on the amount of aerosol load, a *relative deviation from the mean* of 10% could be acceptable. But deviations above 10% should be carefully investigated. Due to the complex nature and different effects of this uncertainty, it is not possible to define a maximal allowable limit.

3.1.3 Trigger delay / Zero bin

In contrast to the standardized telecover test measurements, the partners trigger delay or zero bin test reports are accepted in any format, because it is assumed that once the tests have been made, the groups are aware of the fact and of the problems caused by the documented deviations. Hence the trigger delay test has to be performed only once during EALRINET-ASOS. The errors caused by trigger delay uncertainties can be analytically described. A detailed description of the measurement and effect of trigger delays can be found on the here. An example was presented on the EARLINET workshop in Alomar, 2008.

3.1.4 Dark measurement test

The dark measurement test has been added to the check-up tools since report EA-D3.1. It is a normal measurement but with fully covered telescope, so that no light from the atmosphere and from the backscattered laser pulse is collected by the detectors. In such signals we can see EM-interferences from the electro-magnetic laser

pulses or other electronic interferences which are synchronous to the laser trigger, but also rests of low frequency noise, which can never be completely removed by means of spatial or temporal averaging. As there are different sources of such disturbances with different effects on averaged lidar signals, we currently don't have a standardized procedure for the dark measurements and cannot use them for the evaluation of the lidar signal quality in a standardized way. However, we encouraged all partners to do such measurements and report about peculiar interferences on the EARLINET workshops in order to bring such disturbances to the attention of all partners. As these disturbances are only relevant in analogue signals, they are only documented for analogue channels. In some cases the disturbances are temporally stable. In these cases the dark measurement signals can be subtracted from the normal measurement signals to improve their accuracy. Figure 3.1.4 shows an example of a LICEL APD signal where the subtraction of a dark measurement from the raw signal could be applied, which is verified by a Rayleigh fit test. The variety of influences makes it necessary to investigate each channel separately.

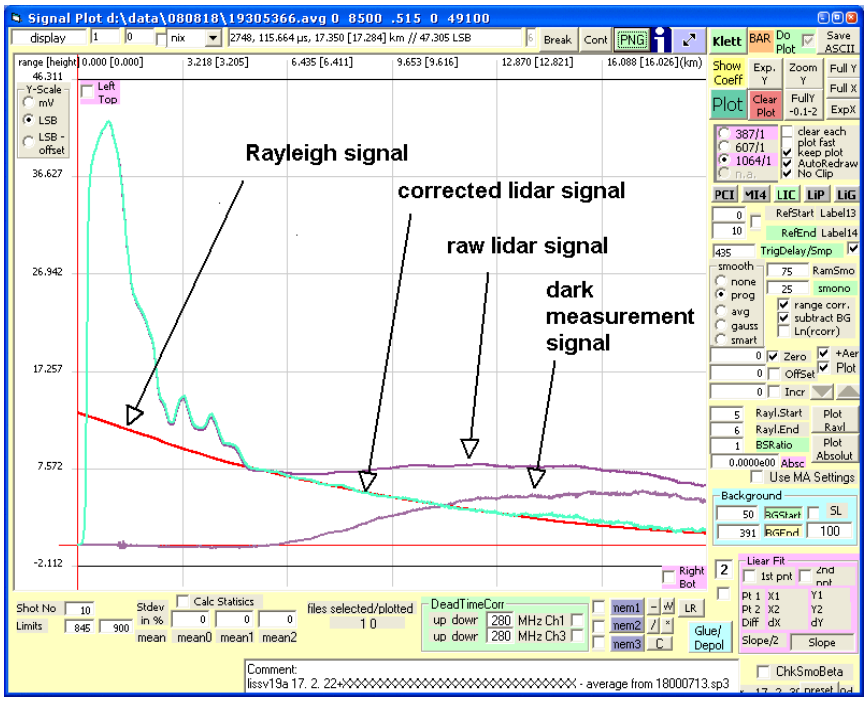


***Figure 3.1.4**: 1064 nm lidar signal with a LICEL 3 mm APD, dark measurement, and corrected lidar signal (cyan) together with the calculated Rayleigh signal (red).*

3.1.5 Depolarisation calibration

Most depolarisation sensitive lidar systems in EARLINET calibrate the relative amplification factor between the cross and parallel polarised channels with one variant of the ±45° calibration (Freudenthaler et al. 2009). Not considered there is the influence of the receiver optics diattenuation (Biele et al. 2000; Mattis et al. 2009), which is also not considered in this test yet, but will be in the future.

For this test the following signals have to be measured
ITplus45 : **transmitted** signal of PBS, i.e. usually the parallel (p) signal relative to PBS, with calibrator at **+45°** orientation
IRplus45 : **reflected** signal of PBS, i.e. usually the perpendicular (s) signal relative to PBS, with calibrator at **+45°** orientation
ITminus45 : **transmitted** signal of PBS, i.e. usually the parallel (p) signal relative to PBS, with calibrator at **-45°** orientation
IRminus45 : **reflected** signal of PBS, i.e. usually the perpendicular (s) signal relative to PBS, with calibrator at **-45°** orientation
ITRayleigh : **transmitted** signal of PBS, i.e. usually the parallel (p) signal relative to PBS, **without calibrator** or calibrator at **0°** orientation
IRRayleigh : **reflected** signal of PBS, i.e. usually the perpendicular (s) signal relative to PBS, **without calibrator** or calibrator at **0°** orientation

The latter two "Rayleigh" signals are the same as the signals for the Rayleigh fit. In this context I will use them

to determine the Rayleigh (molecular) linear depolarisation ratio using the calibration constant from the first four signals. For these Rayleigh signals the same measurements as for the Rayleigh fit can be used, even if they are from another date - as long as the depolarization calibration factor is still valid.

Additionally the transmission and reflection parameters of the polarising beamsplitter cube have to be known, i.e. Tp, Ts, Rp, and Rs. In case a cleaning analyser is used behind the transmitting side of the PBS => e.g. Tp = 0.95, Ts = 0, and in case a cleaning analyser is used behind the reflecting side of the PBS => e.g. Rp = 0, Rs = 0.99

According to Freudenthaler et al. (2009) the calibration factor η^* can be determined by

$$\eta^*\left(\mathrm{y,x45°}+\varepsilon\right)=\frac{I_R\left(\mathrm{y,x45°}+\varepsilon\right)}{I_T\left(\mathrm{y,x45°}+\varepsilon\right)}$$

$$\eta^*\left(\mathrm{y}\right)=\sqrt{\frac{I_R\left(\mathrm{y,+45°}+\varepsilon\right)}{I_T\left(\mathrm{y,+45°}+\varepsilon\right)}\frac{I_R\left(\mathrm{y,-45°}+\varepsilon\right)}{I_T\left(\mathrm{y,-45°}+\varepsilon\right)}}$$

where y = ±1 indicates whether the linear laser polarisation is measured in the transmitted (y = +1) or in the reflected (y = -1) channel of the receiver optics, and x = ±1 indicates the orientation of the calibration measurement with the constant rotation error ε. While η^*(y, x45°+ε) can be very different for x = ±1, η^*(y) should be largely independent of ε – and independent of range and atmospheric changes.
With the calibration factor η^* and the signals IRRayleigh = I_R(y) and ITRayleigh = I_T(y) the calibrated signal ratio δ* can be calculated

$$\delta^*\left(\mathrm{y},\varepsilon\right)=\frac{1}{\eta^*\left(\mathrm{y}\right)}\frac{I_R\left(\mathrm{y}\right)}{I_T\left(\mathrm{y}\right)},$$

which still includes the cross talk from the polarizing beam splitter. With the cross talk parameter T^*, which is determined by the transmittances and reflectances of p- and s- polarized light of the polarising beamsplitter,

$$T^*=\frac{T_T}{T_R}=\frac{T^p+T^s}{R^p+R^s}$$

the measured volume linear depolarisation ratios δ' (VLDR) are calculated:

$$\mathrm{y}=-1\Rightarrow\Psi=90°\Rightarrow\delta'=\frac{\delta^*T_T^s-T^*T_R^s}{T^*T_R^p-\delta^*T_T^p}$$

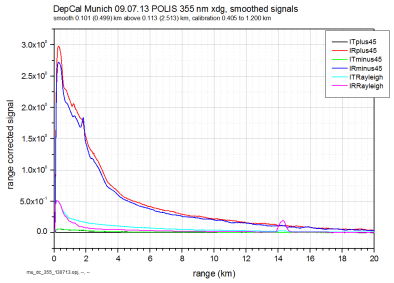
$$\mathrm{y}=+1\Rightarrow\Psi=0°\Rightarrow\delta'=\frac{\delta^*T_T^p-T^*T_R^p}{T^*T_R^s-\delta^*T_T^s}$$

In the following example for the depolarisation calibration test measurements we see the six measured signals in the left plot, the (possibly) range dependent ±45° calibration factors Vplus = η*(y, +45°+ε) and Vminus = η*(y, -45°+ε) and the hopefully range independent V = η*(y) in the middle plot, and the measured volume linear depolarisation ratio in the right plot, where LDRmeas = δ*(+1) or 1/δ*(-1), and LDRcorr = δ'.

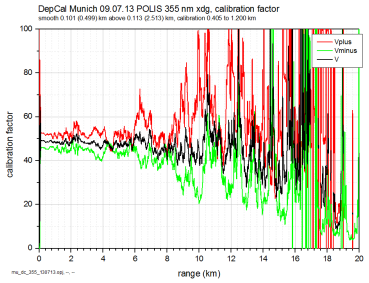
Examples:

MU Munich: POLIS-3 – Depolarisation calibration - **mechanical rotation ±45°**

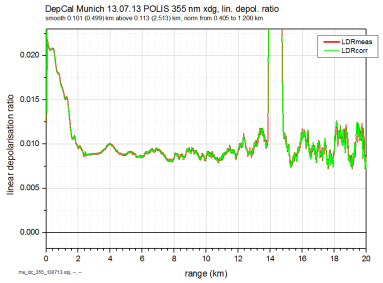
range corrected calibration signals



calibration factor

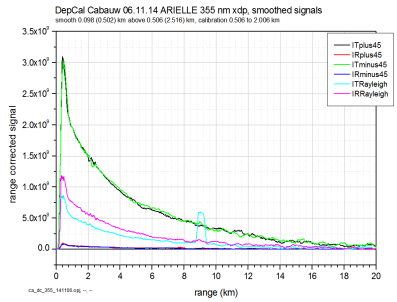


VLDR of Rayleigh signals

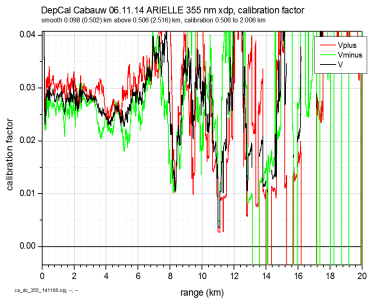


LE Leipzig: POLLY-XT_sea (ARIELLE) – Depolarisation calibration – **linear polariser ±45°**

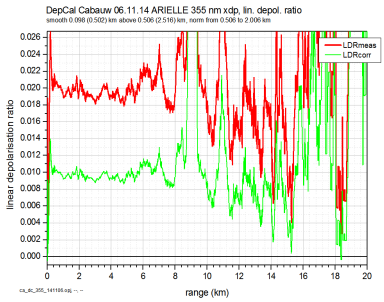
range corrected calibration signals



calibration factor



VLDR of Rayleigh data



3.2 QA check-up nomenclature and overview

3.2.1 Nomenclature of the lidar channel short cuts

Each lidar channel/signal has a name composed of the wavelength (in nm) and a three character (fouth optinal) short-cut like **532 nm xtg**, which mean :

1st character
f__ = far range telescope signal
n__ = near range telescope signal
s__ = sum (glue) of far range and near range telescope signals
x__ = a single telescope
h__ = high range signal (single telescope, attenuation adjusted for far range)
l__ = low range signal (single telescope, attenuation adjusted for near range)

2nd character
_t_ = total signal (no depol. measurement)
_p_ = parallel signal
_c_ = cross signal
_s_ = sum of p and c
_v_ = volume linear depolarization ratio
_a_ = aerosol linear depolarization ratio
_e_ = extinction coefficient
_b_ = backscatter coefficient

3rd character
__a = analogue signal
__p = photon counting signal
__g = analogue and photon counting glued signal (e.g. LICEL)

4th character (optional)
___l = rotational Raman **l**ower wavelengths
___h = rotational Raman **h**igher wavelengths
___r = rotational Raman high and low wavelengths
___c = high spectral resolution **M**ie signals / centre line

The following table for the reporting period 2015 shows a list of all the channels of all active lidar systems, which are supposed to deliver lidar signal products to the EARLINET data base, and which have to be quality assured every year with the QA measurements RF (Rayleigh fit), TC (telecover), and Dark (dark measurement). Delivered tests for a certain channel are marked green, red for not delivered, ochre for partially delivered, and grey for not necessary. Not necessary are QA measurements for lidar systems which did not deliver data to the EARLINET data base within the reporting period. Channels which are not present in a lidar system are left blank. The right most columns contain not so common channels and 1064-dark measurements in case no other analogue channels are present.

3.3 QA check-ups of the report period 2015

2015 overview (mandatory annual tests)

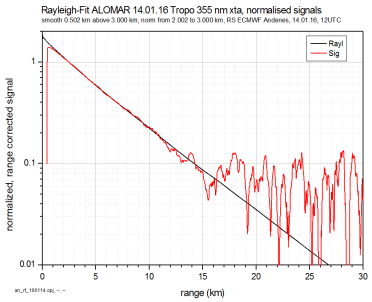
2015	The channels are listed as mentioned in the HOI										
an	RF	355xt			387xt		532xc	532xp	607xt	1064xt	1064xt-dark
	TC	355xt			387xt		532xc	532xp	607xt	1064xt	
at	RF	355xt			387xt	532xt			607xt	1064xt	1064xt-dark
	TC	355xt			387xt	532xt			607xt	1064xt	
ba UPC_MRL	RF	355xt			387xt	532xt			607xt	1064xt	
	TC	355xt			387xt	532xt			607xt	1064xt	
	Dark	355xt			387xt	532xt			607xt	1064xt	
be	RF	355xt				532xt				1064xt	
	TC	355xt				532xt				1064xt	
	Dark	355xt				532xt				1064xt	
bu	RF	355xt			387xt		532xc	532xp	607xt	1064xt	1064xt-dark
	TC	355xt			387xt		532xc	532xp	607xt	1064xt	532depcal
ca near tele	RF	355nt			387nt	532nt			607nt	1064nt	1064nt-dark
	TC	355nt			387nt	532nt			607nt	1064nt	
ca far tele	RF	355ft			387ft	532ft			607ft	1064ft	1064ft-dark
	TC	355ft			387ft	532ft			607ft	1064ft	
ca dep tele	RF						532dc	532dp			532depcal
	TC						532dc	532dp			
cl	RF		355xc	355xp	387xt						355depcal
	TC		355xc	355xp	387xt						
co	RF					532xt			607xt		
	TC					532xt			607xt		
ev	RF	355xt			387xt	532xt	532xc		607xt	1064xt	
	TC	355xt			387xt	532xt	532xc		607xt	1064xt	532depcal
gp HSRL	RF	355xt				532xt				1064xt	532xtac
	TC	355xt				532xt				1064xt	532xtac
	Dark	355xt				532xt				1064xt	532xtac
gp DIAL	RF	313fta	313nta								313nta-dark
	TC	313fta	313nta								313fta-dark
gr LR321	RF	355xt			387xt		532xc	532xp	607xt	1064xt	1064xt-dark
	TC	355xt			387xt		532xc	532xp	607xt	1064xt	532depcal
gr LR111	RF		355xc	355xp	387xt						
	TC		355xc	355xp	387xt						355depcal
hh ARL2 near	RF	355nt			387nt	532nt			607nt	1064nt	1064nt-dark
	TC	355nt			387nt	532nt			607nt	1064nt	
hh ARL2 far	RF	355ft			387ft	532ft			607ft	1064ft	1064ft-dark
	TC	355ft			387ft	532ft			607ft	1064ft	
hh ARL2 dep	RF						532xc	532xp			
	TC						532xc	532xp			
is ADAM	RF	355xt			387xt		532xc	532xp	607xt	1064xt	1064xt-dark
	TC	355xt			387xt		532xc	532xp	607xt	1064xt	532depcal
ku	RF	355xt			387xt	532xt	532xc		607xt	1064xt	
	TC	355xt			387xt	532xt	532xc		607xt	1064xt	532depcal
la	RF	351xt			382xt						
	TC	351xt			382xt						
lc	RF	355xt			387xt	532xt			607xt	1064xt	1064ft-dark
	TC	355xt			387xt	532xt			607xt	1064xt	
le MARTHA	RF	355xt			387xt	532xt	532xc	532xp	607xt	1064xt	
	TC	355xt			387xt	532xt	532xc	532xp	607xt	1064xt	532depcal

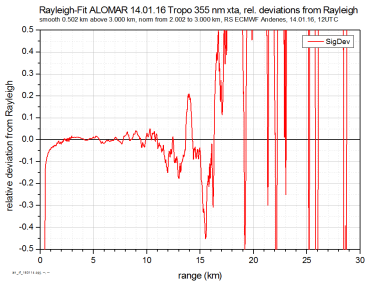
le PollyXT TROPOS	RF	355xt	355xc		387xt	532xt	532xc		607xt	1064xt	355depcal
	TC	355xt	355xc		387xt	532xt	532xc		607xt	1064xt	532depcal
le PollyXT OCEANET	RF	355xt	355xc		387xt	532xt	532xc		607xt	1064xt	355depcal
	TC	355xt	355xc		387xt	532xt	532xc		607xt	1064xt	532depcal
ll LILAS	RF		355xc	355xp	387xt	530xt	532xc	532xp		1064xt	355depcal
	TC		355xc	355xp	387xt	530xt	532xc	532xp		1064xt	532depcal
	Dark		355xc	355xp	387xt	530xt	532xc	532xp		1064xt	
lm	RF						532xc	532xp	607xt	1064xt	1064xt-dark
	TC						532xc	532xp	607xt	1064xt	532depcal
ma	RF	355xt			387xt	532xt			607xt	1064xt	
	TC	355xt			387xt	532xt			607xt	1064xt	
	Dark	355xt				532xt				1064xt	
mi MSTL-2	RF	355xt			387xt		532xc	532xp	607xt	1064xt	
	TC	355xt			387xt	532xt	532xc	532xp	607xt	1064xt	532depcal
	Dark	355xt					532xc	532xp		1064xt	
mi LMR-mob	RF	355xt			387xt	532xt	532xc		607xt	1064xt	
	TC	355xt			387xt	532xt	532xc		607xt	1064xt	532depcal
	Dark	355xt				532xt	532xc			1064xt	
mu POLIS	RF		355xc	355xp	387xt		532xc	532xp	607xt		355depcal
	TC		355xc	355xp	387xt		532xc	532xp	607xt		532depcal
ms MULIS	RF	355xt			387xt		532xc	532xp	607xt	1064xt	1064xt-dark
	TC	355xt			387xt		532xc	532xp	607xt	1064xt	532depcal
	Dark	355xt					532xc	532xp		1064xt	
na MALIA high	RF	355xt			387xt		532xc	532xp	607xt		532depcal
	TC	355xt			387xt		532xc	532xp	607xt		
na MALIA low	RF	355xt					532xc	532xp			532depcal
	TC	355xt					532xc	532xp			
	Dark	355xt					532xc	532xp			
na AMPLE	RF		355xc	355xp	387xt						355depcal
	TC		355xc	355xp	387xt						
oh Ralph	RF	355xt			387xt	532xp	532xc		607xt	1064xt	
	TC	355xt			387xt	532xp	532xc		607xt	1064xt	532depcal
py	RF	356xt			387xt						358xtgr
	TC	356xt			387xt						358xtgr
pl IPRAL	RF	355nt	355fc	355fp	387ft	532nt	532ft		607ft	1064ft	1064tt-dark
	TC	355nt	355fc	355fp	387ft	532nt	532ft		607ft	1064ft	355depcal
po MUSA	RF	355xt			387xt		532xc	532xp	607xt	1064xt	1064xt-dark
	TC	355xt			387xt		532xc	532xp	607xt	1064xt	532depcal
po PEARL	RF	355xt			387xt	532xt	532xc	532xp	607xt	1064xt	1064xt-dark
	TC	355xt			387xt	532xt	532xc	532xp	607xt	1064xt	532depcal
sf-CuBr	RF					510xt			578xt		
	TC					510xt			578xt		
sf-Cu&Au	RF					510xt			628xt		
	TC					510xt			628xt		
sf-NdYAG	RF						532xt			1064xt	1064xt-dark
	TC						532xt			1064xt	532xt-dark
sp PELI	RF		355xc	355xp		532xt			607xt	1064xt	1064xt-dark
	TC		355xc	355xp		532xt			607xt	1064xt	
th	RF	355xt			387xt	532xt	532xc	532xp	607xt	1064xt	1064xt-dark
	TC	355xt			387xt	532xt	532xc	532xp	607xt	1064xt	532depcal
wa	RF	355xt			387xt	532xt	532xc		607xt	1064xt	355depcal
	TC	355xt			387xt	532xt	532xc		607xt	1064xt	532depcal

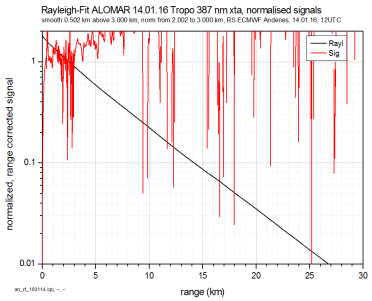
Legend	done	not necessary	partial	delivered	
pdatetd 02.05.16					
	RF = Rayleigh fit		TC = telecover		

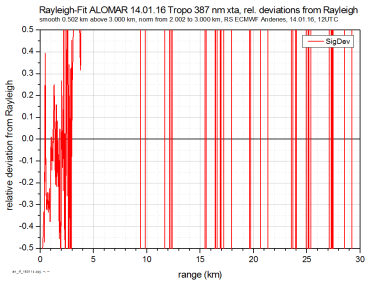
AN Andoya: Alomar Tropo – Rayleigh Fit

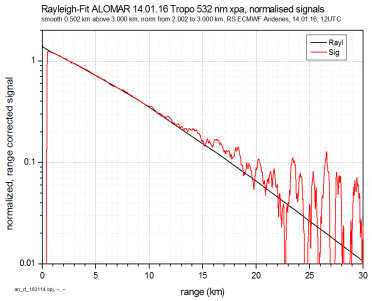
Normalised signals	Relative deviations

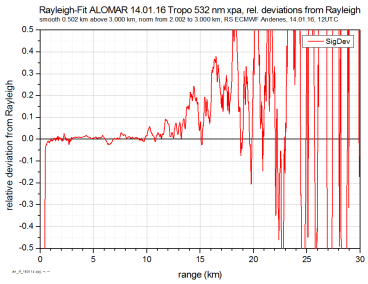


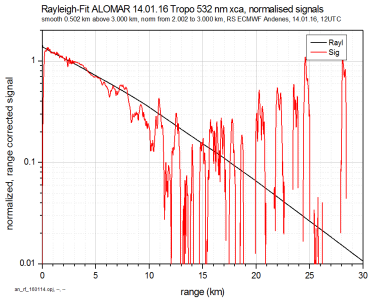


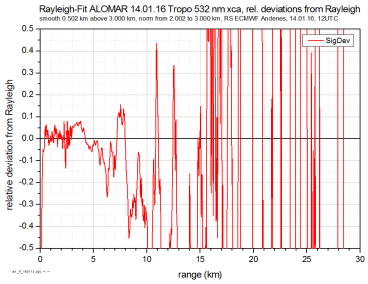


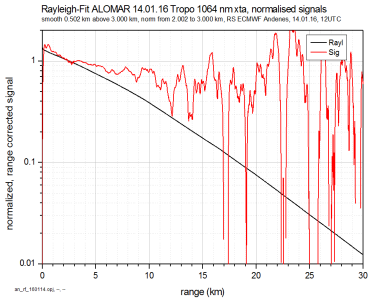


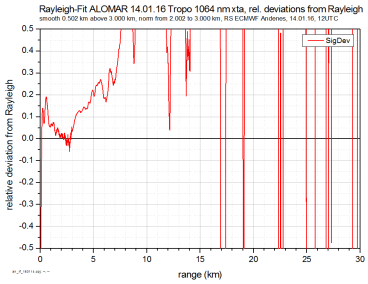




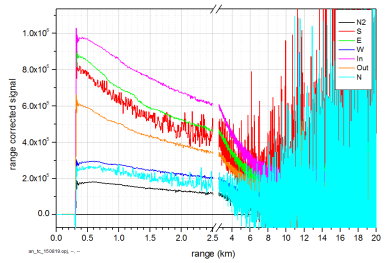
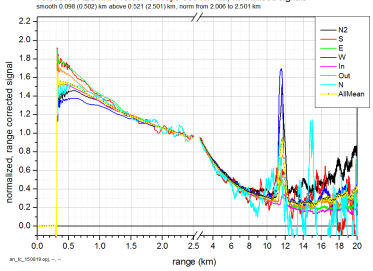
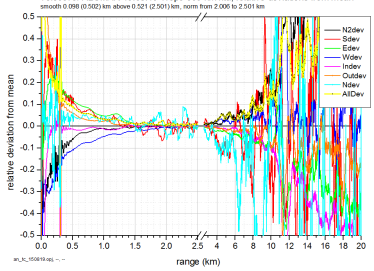
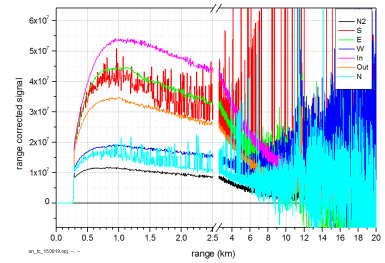
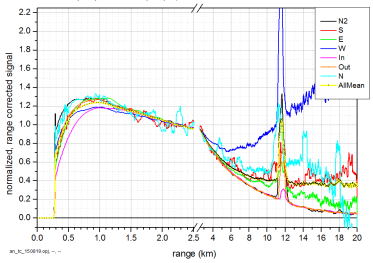
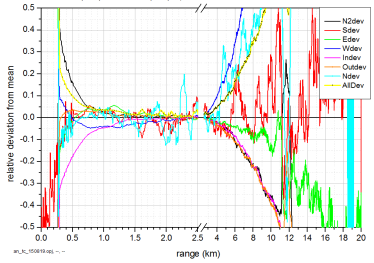
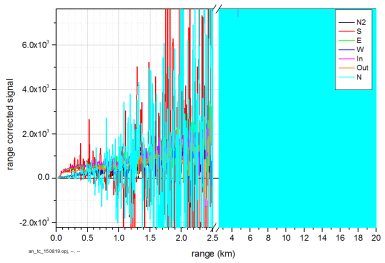
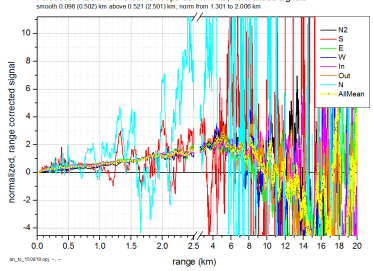
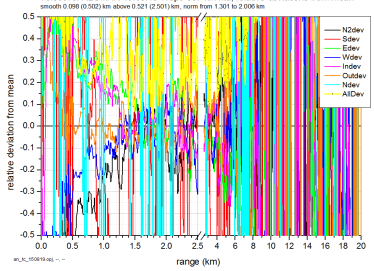
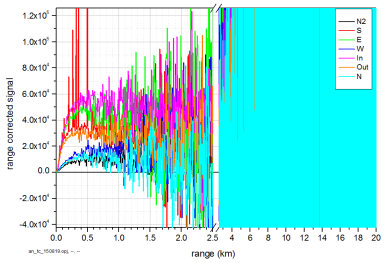
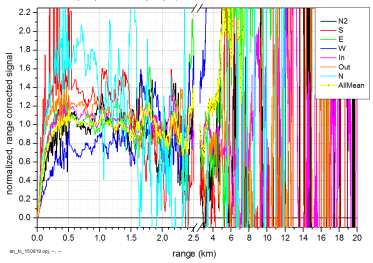
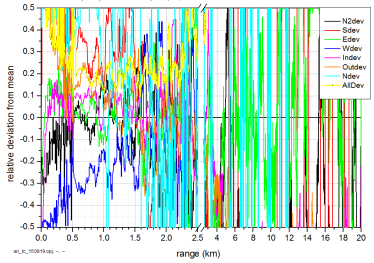
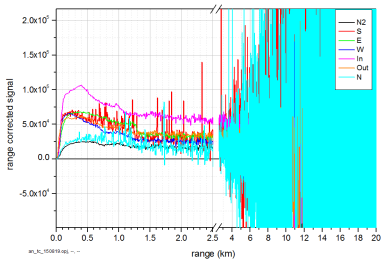
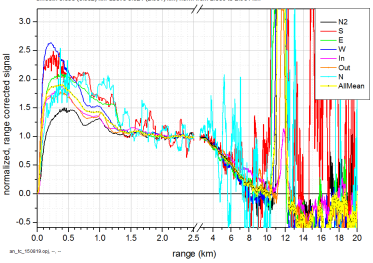
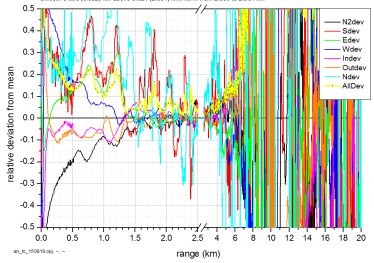
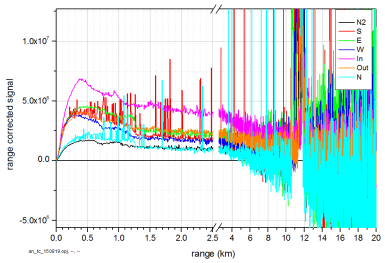
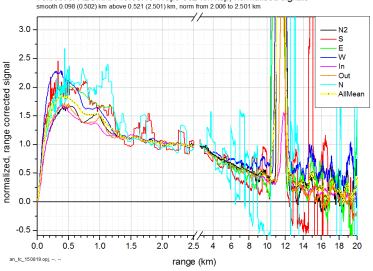
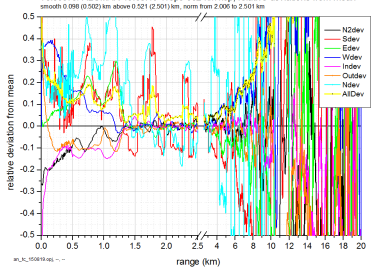


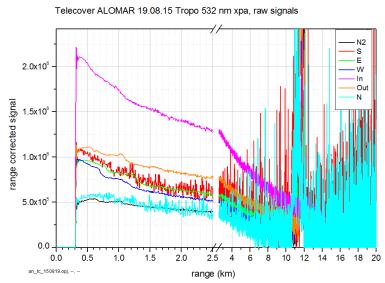
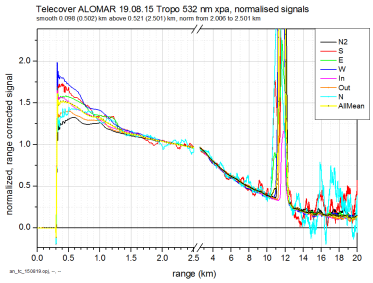
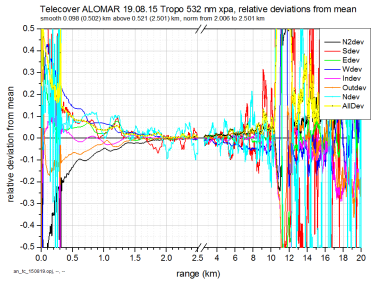
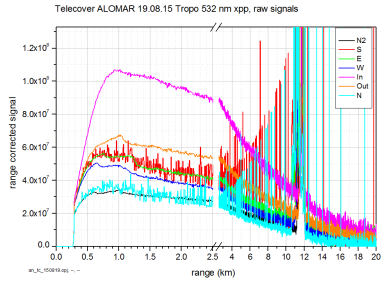
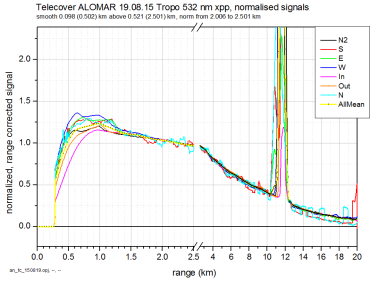
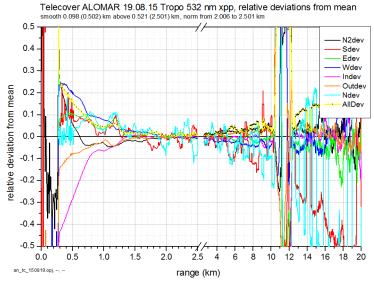
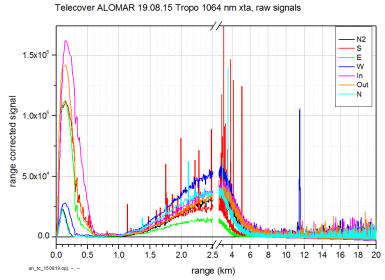
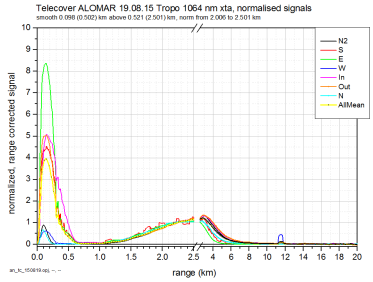
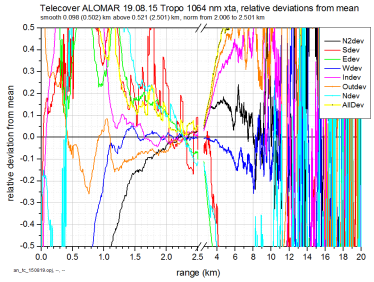




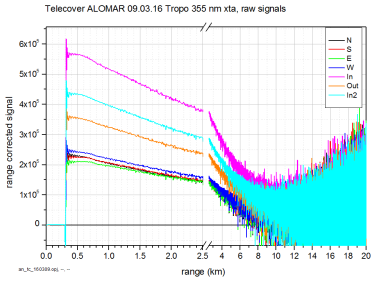
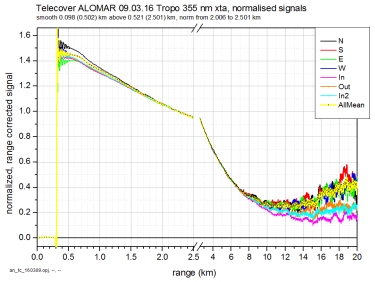
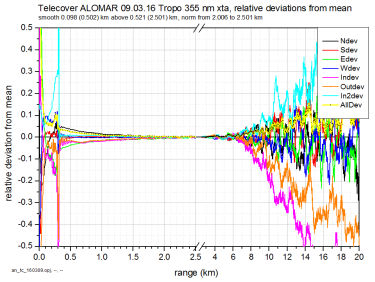
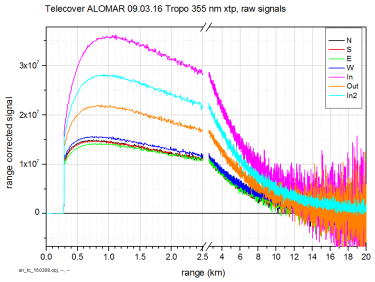
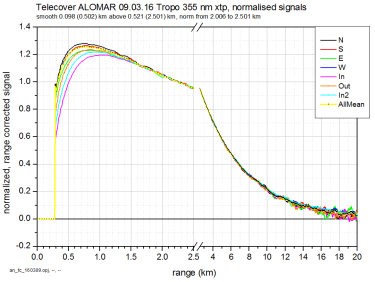
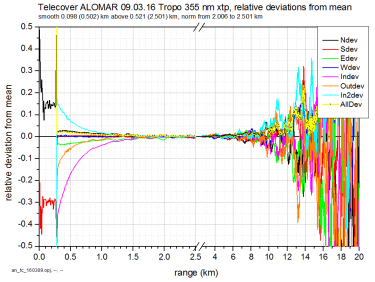
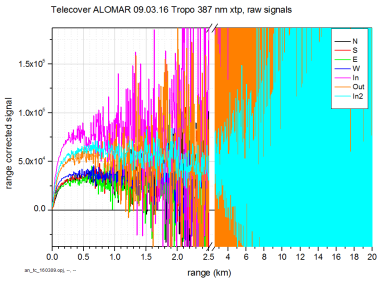
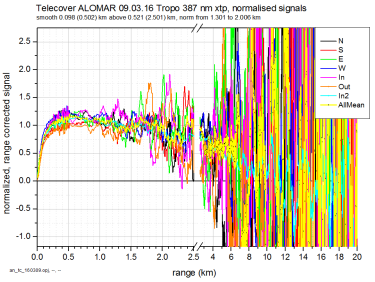
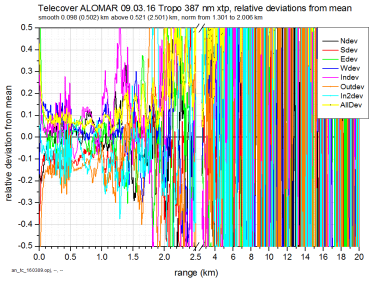
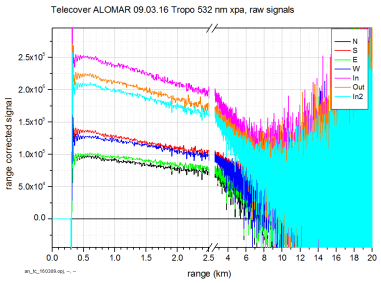
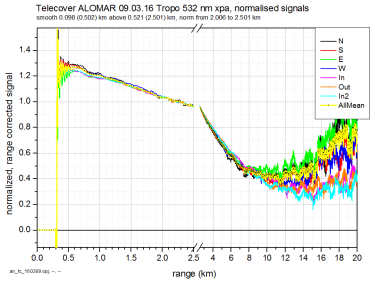
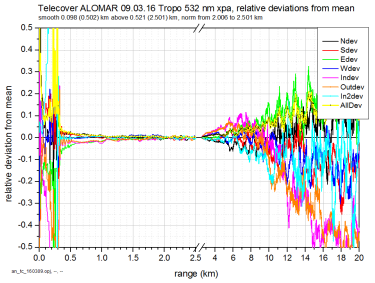
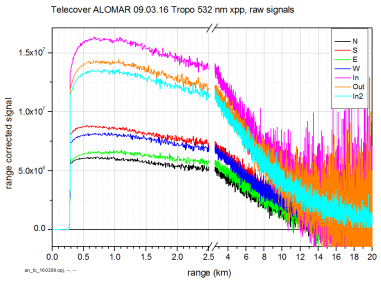
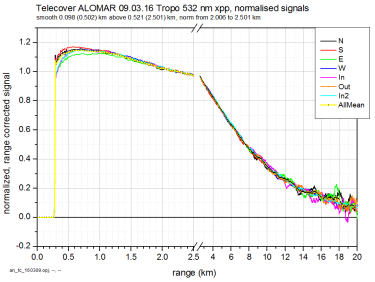
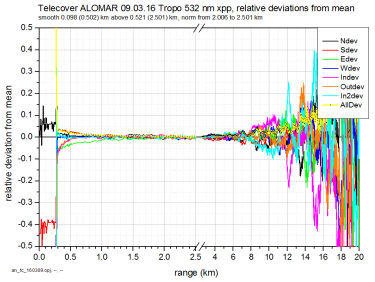


AN Andoya: Alomar Tropo – Telecover 19.08.15

Raw signals	Normalised signals	Relative deviations
Telecover ALOMAR 19.08.15 Tropo 355 nm xta, raw signals	Telecover ALOMAR 19.08.15 Tropo 355 nm xta, normalised signals	Telecover ALOMAR 19.08.15 Tropo 355 nm xta, relative deviations from mean
		
Telecover ALOMAR 19.08.15 Tropo 355 nm xtp, raw signals	Telecover ALOMAR 19.08.15 Tropo 355 nm xtp, normalised signals	Telecover ALOMAR 19.08.15 Tropo 355 nm xtp, relative deviations from mean
		
Telecover ALOMAR 19.08.15 Tropo 387 nm xta, raw signals	Telecover ALOMAR 19.08.15 Tropo 387 nm xta, normalised signals	Telecover ALOMAR 19.08.15 Tropo 387 nm xta, relative deviations from mean
		
Telecover ALOMAR 19.08.15 Tropo 387 nm xtp, raw signals	Telecover ALOMAR 19.08.15 Tropo 387 nm xtp, normalised signals	Telecover ALOMAR 19.08.15 Tropo 387 nm xtp, relative deviations from mean
		
Telecover ALOMAR 19.08.15 Tropo 532 nm xca, raw signals	Telecover ALOMAR 19.08.15 Tropo 532 nm xca, normalised signals	Telecover ALOMAR 19.08.15 Tropo 532 nm xca, relative deviations from mean
		
Telecover ALOMAR 19.08.15 Tropo 532 nm xcp, raw signals	Telecover ALOMAR 19.08.15 Tropo 532 nm xcp, normalised signals	Telecover ALOMAR 19.08.15 Tropo 532 nm xcp, relative deviations from mean
		

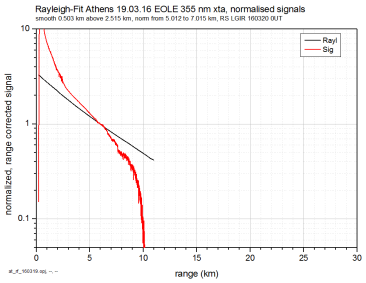
Raw signals	Normalised signals	Relative deviations
		
		
		

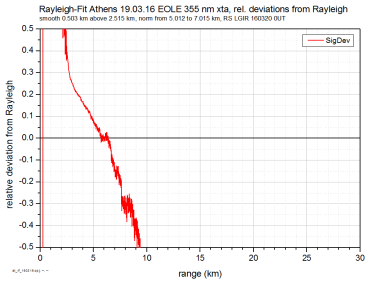
AN Andoya: Alomar Tropo – Telecover 09.03.16

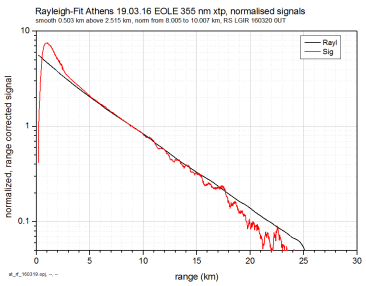
Raw signals	Normalised signals	Relative deviations
		
		
		
		
		

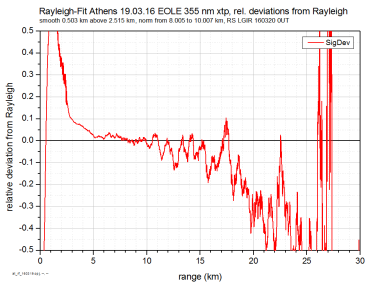
AT Athens: EOLE – Rayleigh Fit

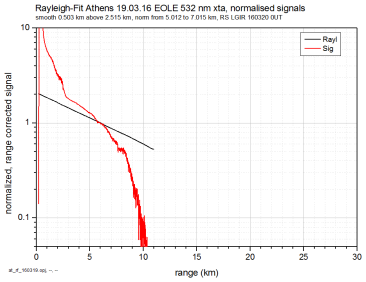
Normalised signals	Relative deviations

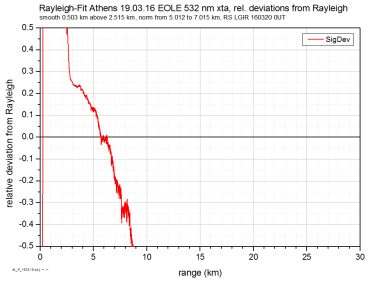


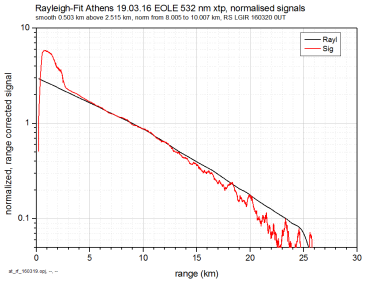


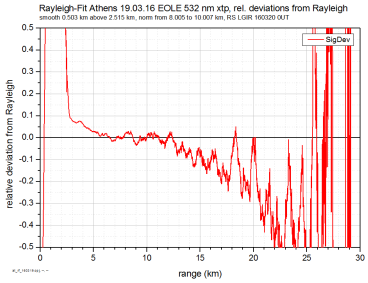


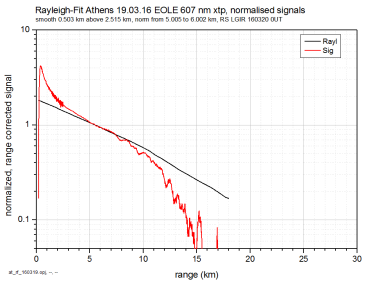


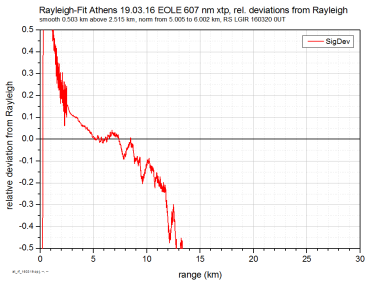


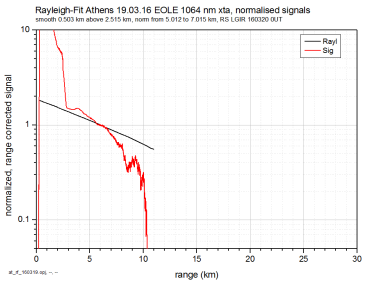


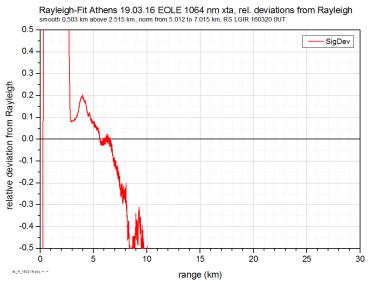






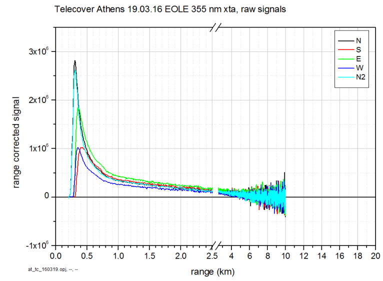


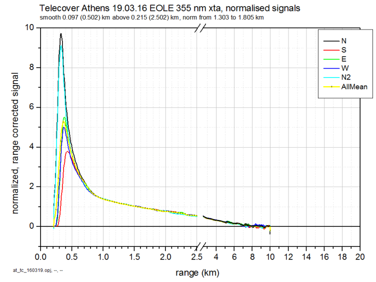


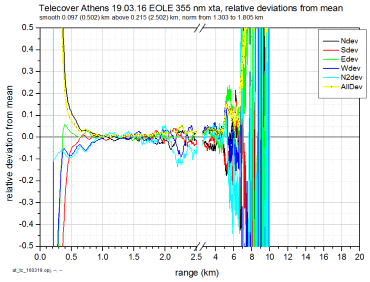


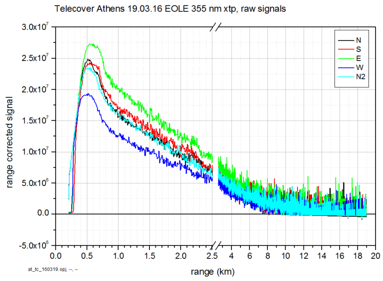
AT Athens: EOLE – Telecover

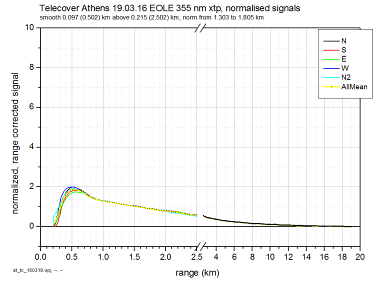
Raw signals	Normalised signals	Relative deviations

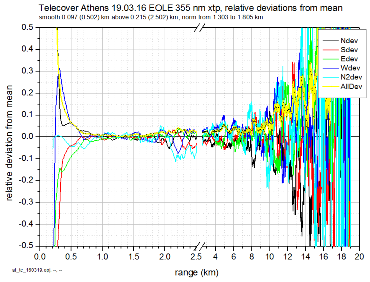


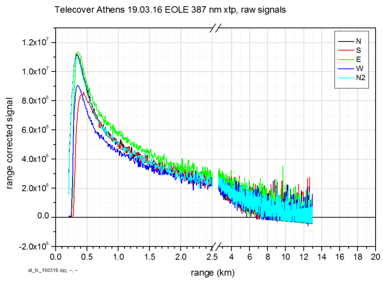


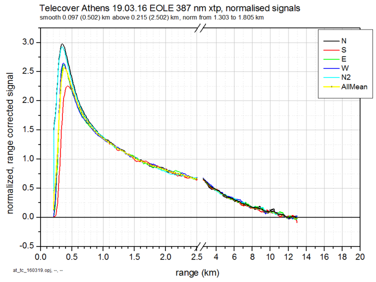


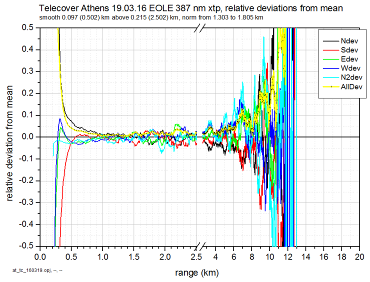


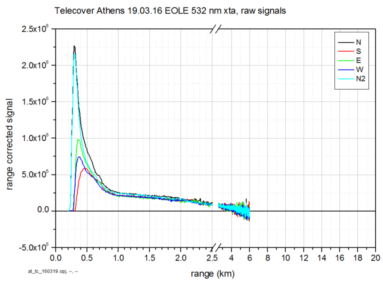


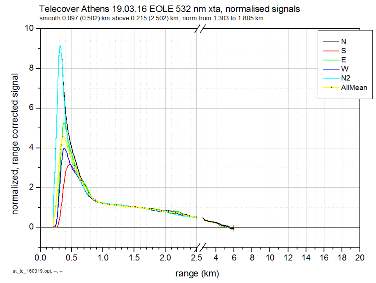


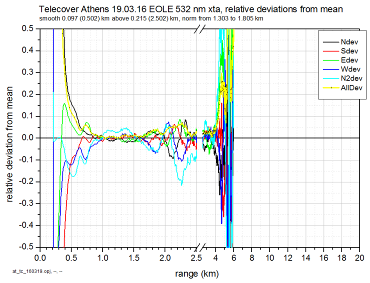


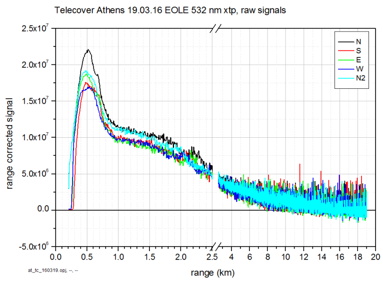


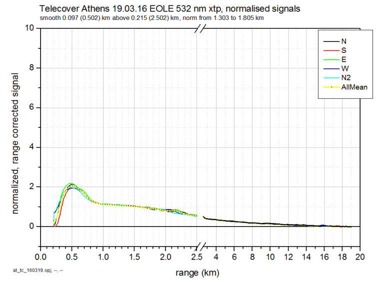


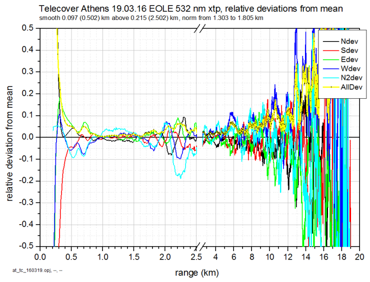


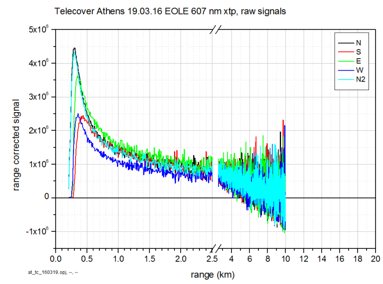


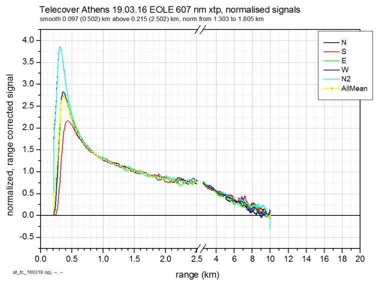


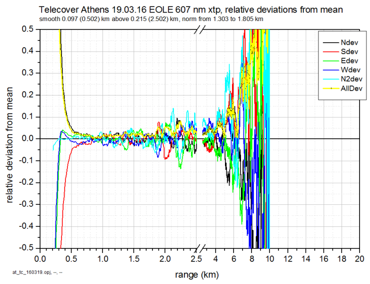


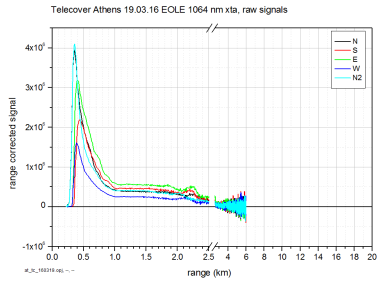


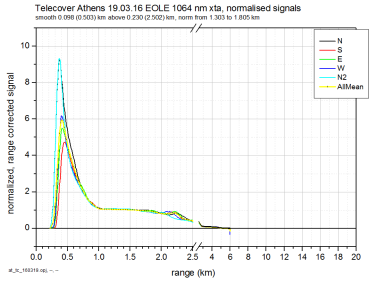


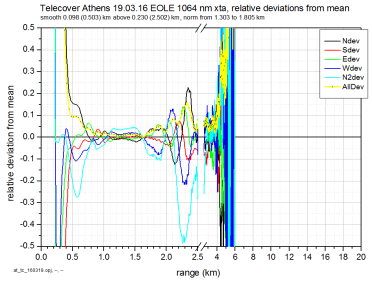




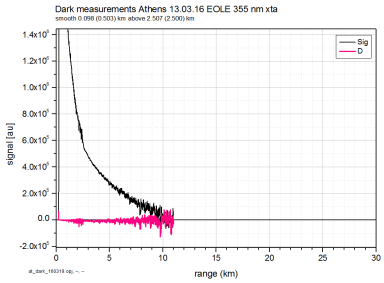


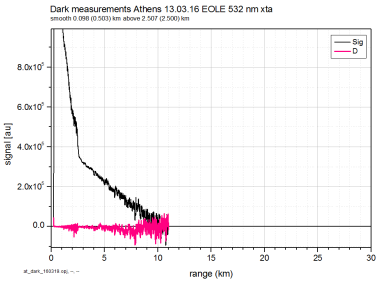


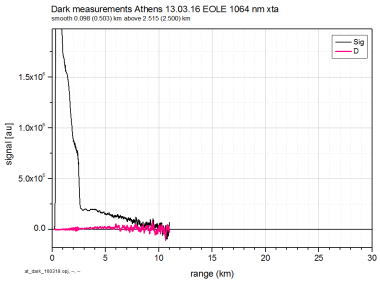




AT Athens: EOLE – Dark Measurements





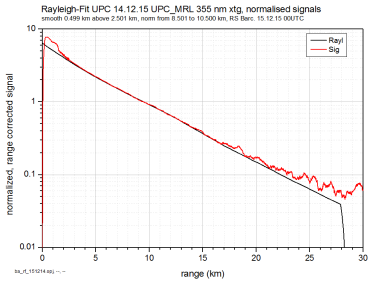
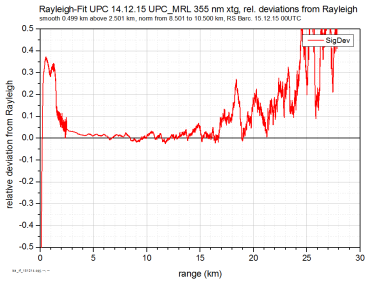
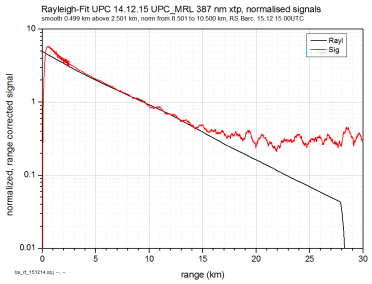
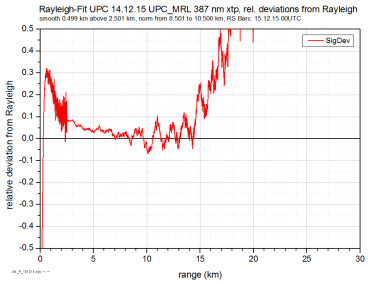
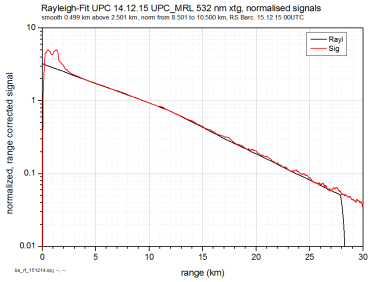
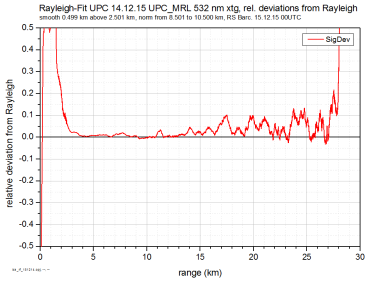
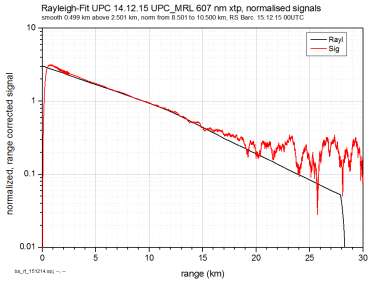
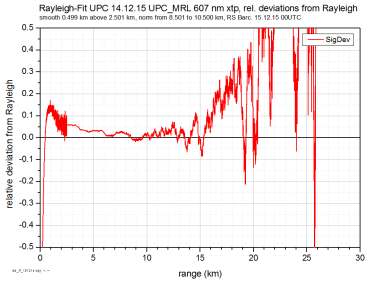
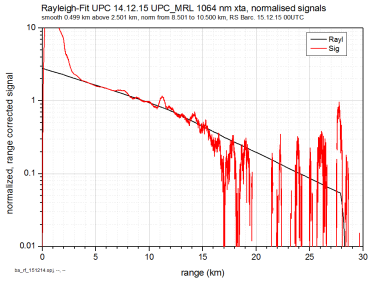
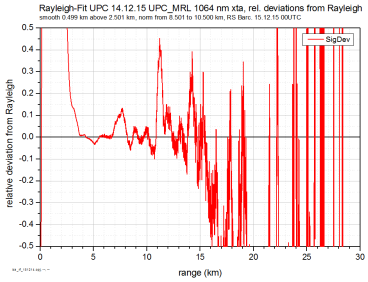


AT Athens: EOLE – Trigger delay

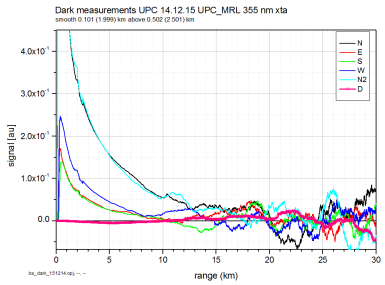
(1 bin = 7.5m)

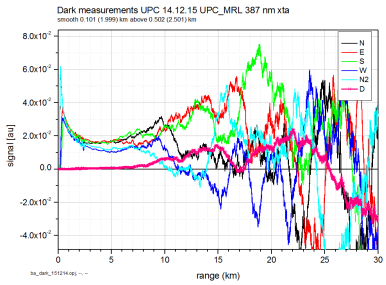
355a	2 bins
355p	1 bin
532a	2 bins
532p	0 bins
1064a	4 bins
387p	0 bins
407p	0 bins
607p	1 bin

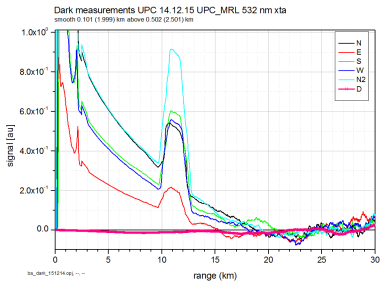
BA Barcelona: UPC_MRL – Rayleigh Fit

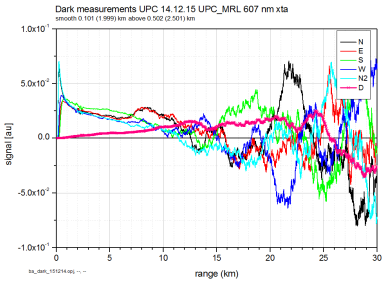
Normalised signals	Relative deviations
	
	
	
	
	

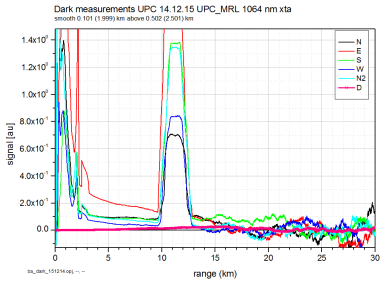
BA Barcelona: UPC_MRL – Dark Measurements



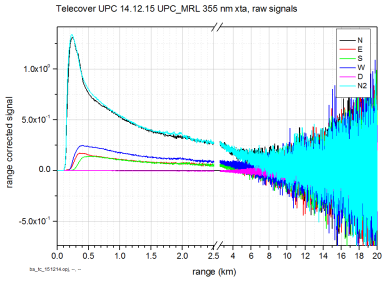
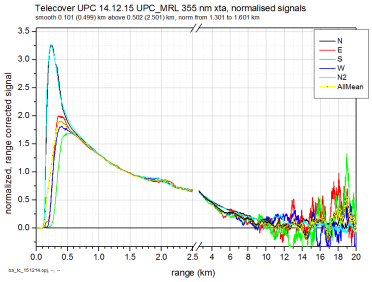
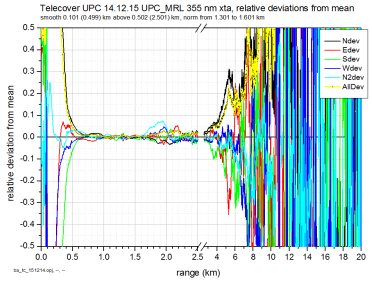
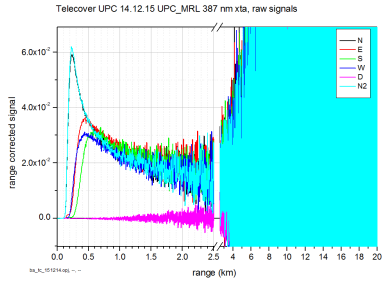
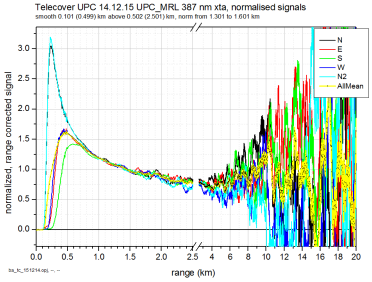
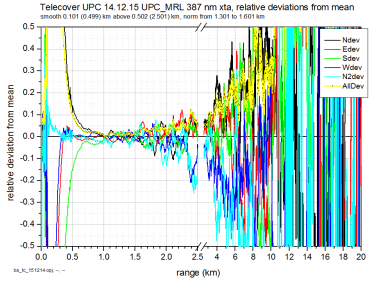
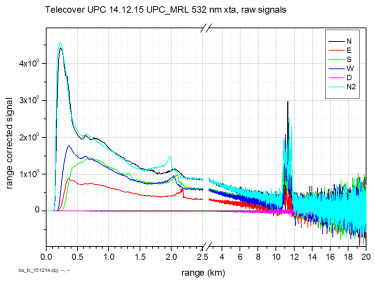
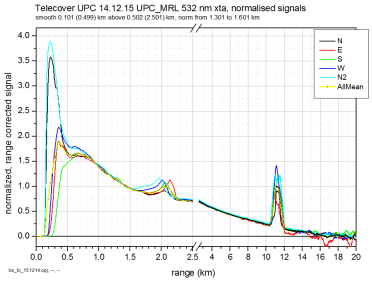
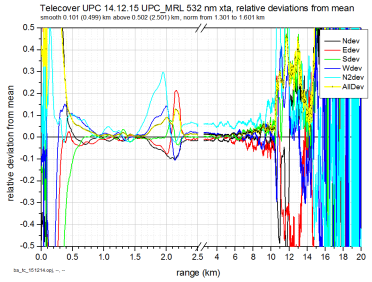
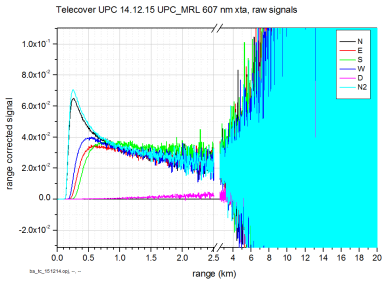
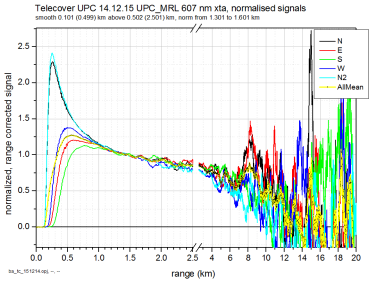
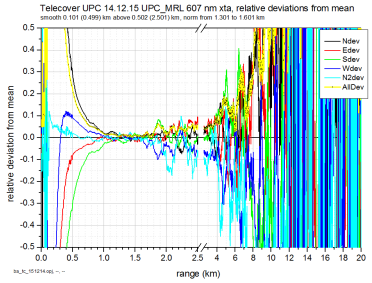
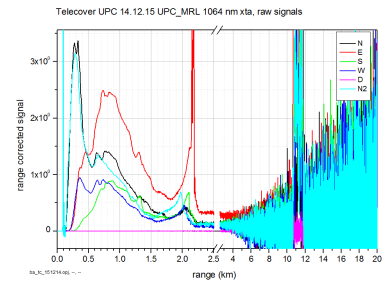
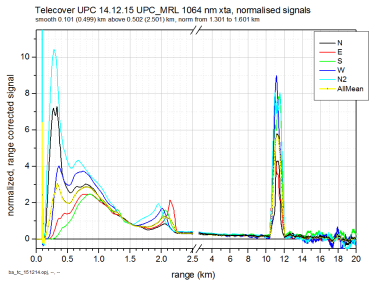
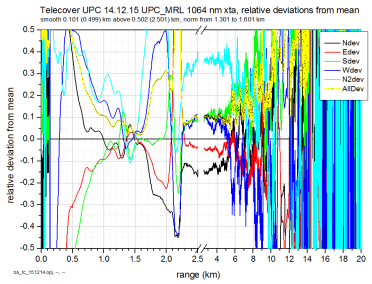






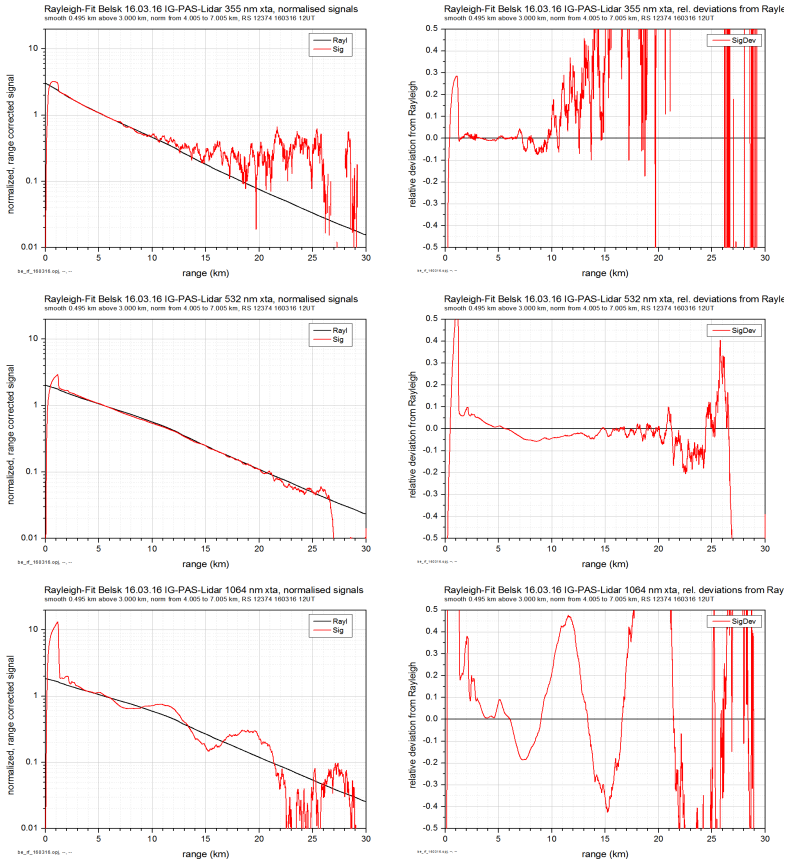


BA Barcelona: UPC_MRL – Telecover – 02.10.14

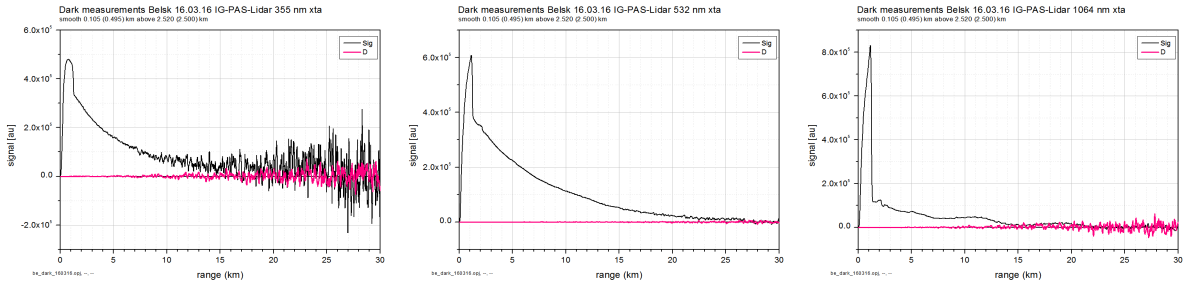
Raw signals	Normalised signals	Relative deviations
		
		
		
		
		

BE Belsk: IG-PAS-Lidar – Rayleigh Fit

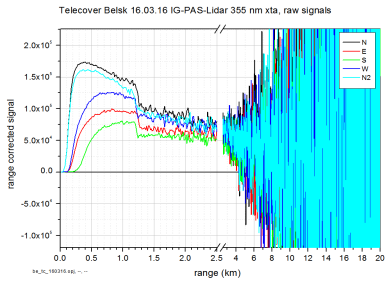
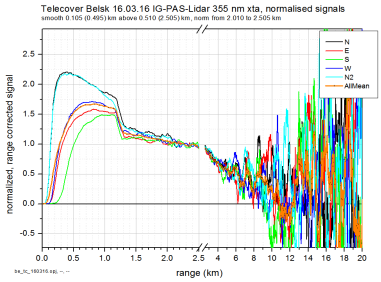
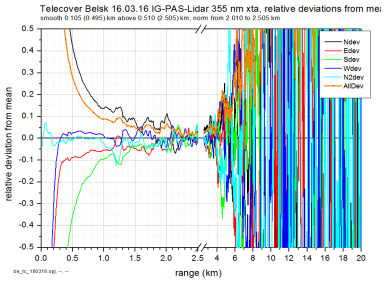
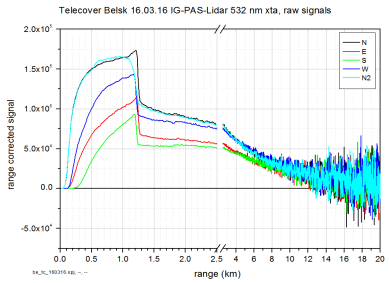
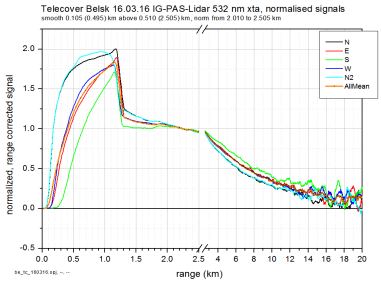
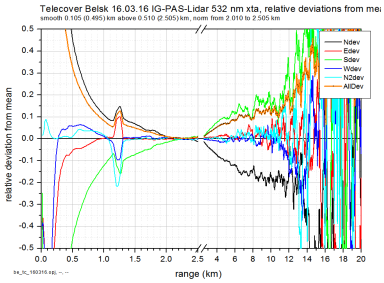
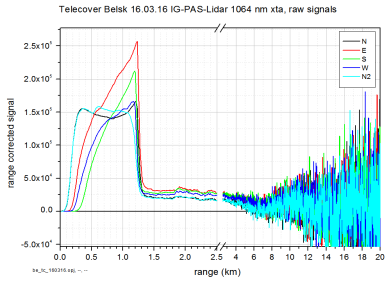
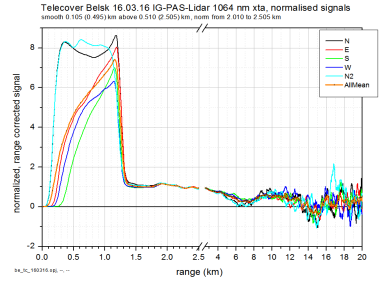
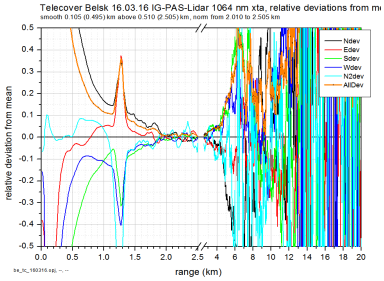
Normalised signals	Relative deviations



BE Belsk: IG-PAS-Lidar – Dark Measurements

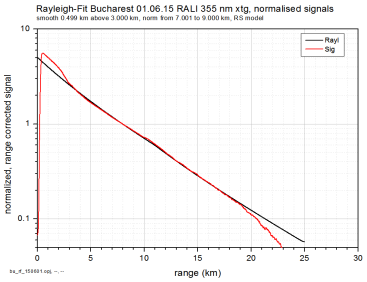


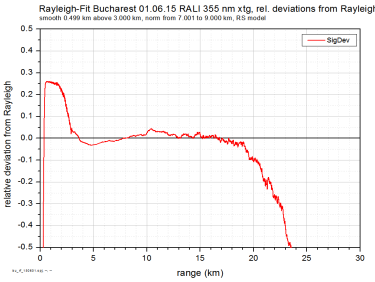
BE Belsk: IG-PAS-Lidar – Telecover

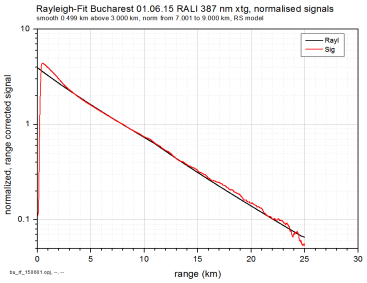
Raw signals	Normalised signals	Relative deviations
		
		
		

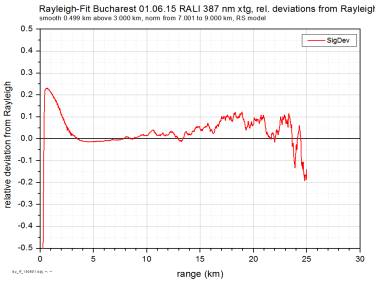
BU Bucharest: RALI (Raymetrics LR313 – D400) – Rayleigh fit

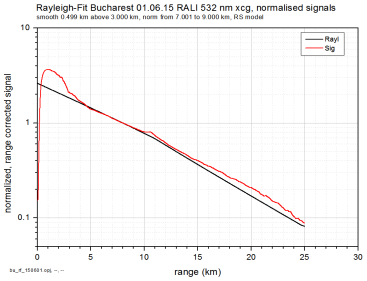
Normalised signals	Relative deviations

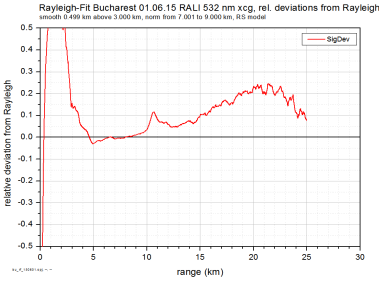


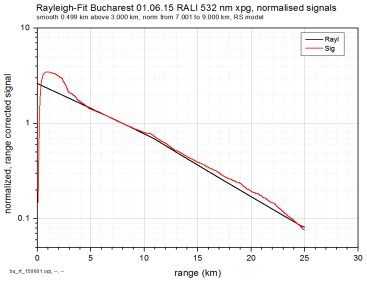


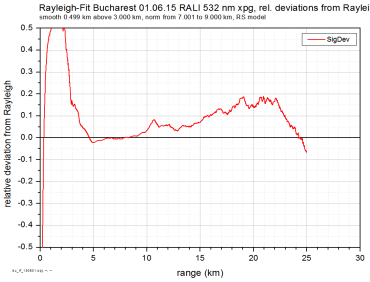


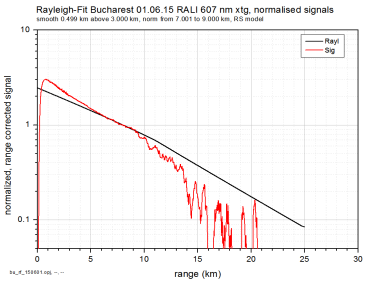


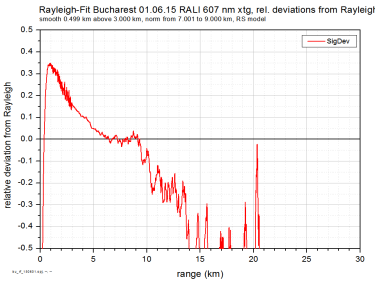


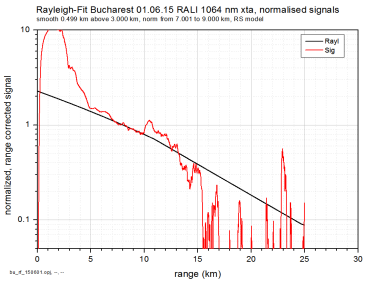


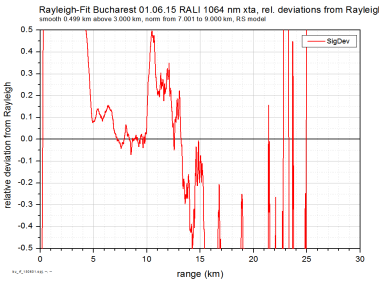




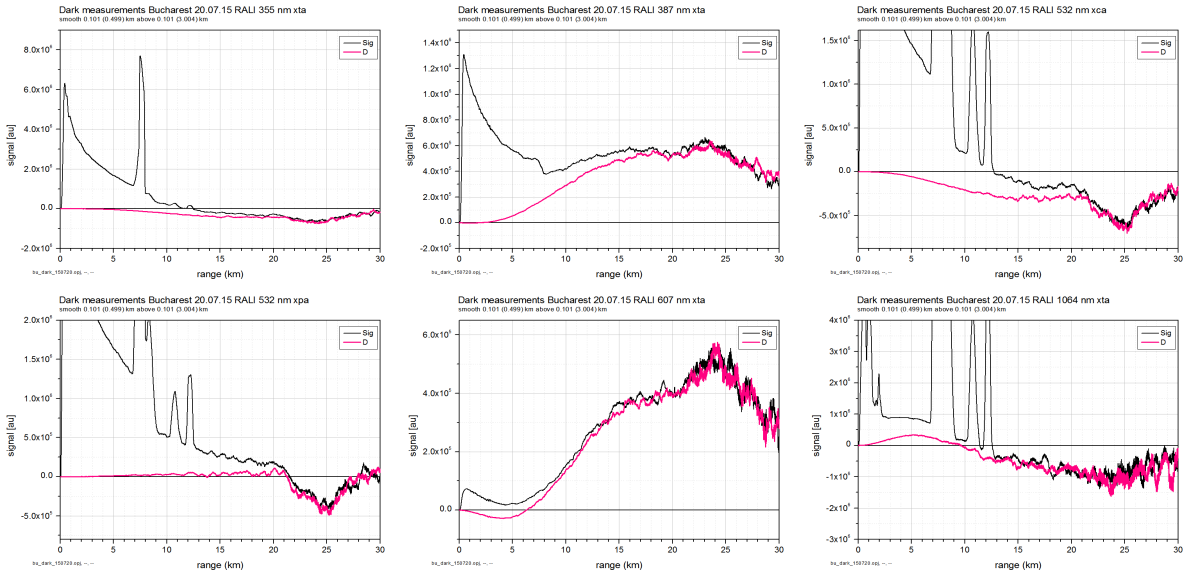






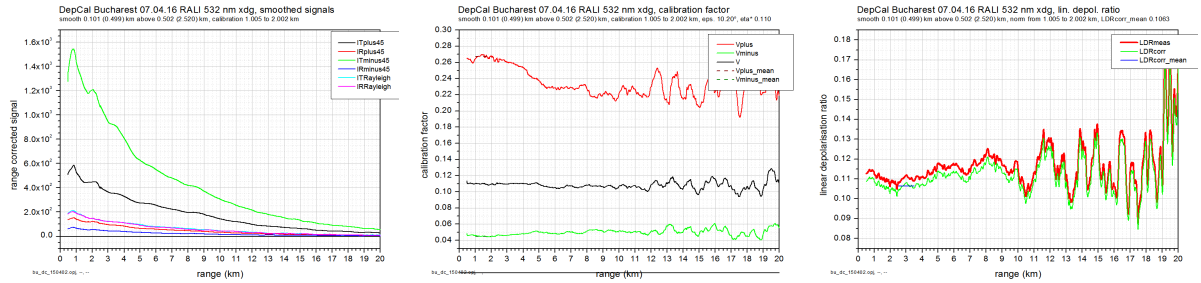


BU Bucharest: RALI (Raymetrics LR313 – D400) – Dark measurements



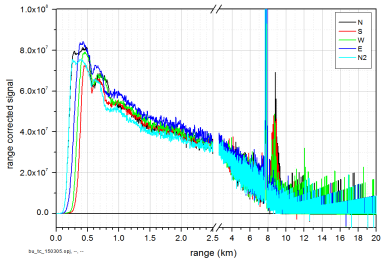
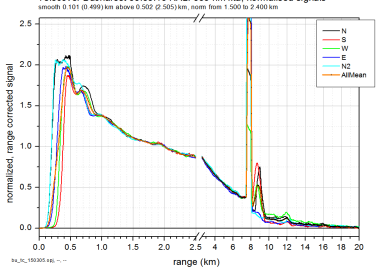
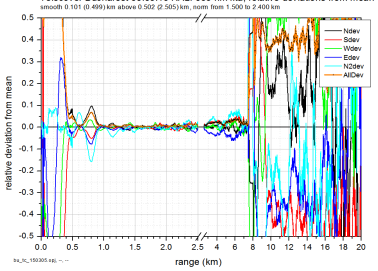
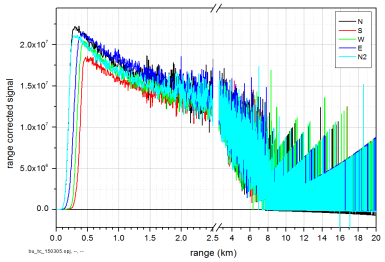
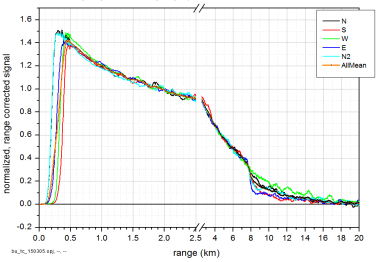
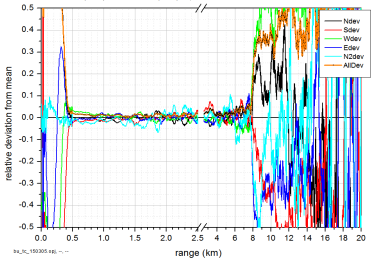
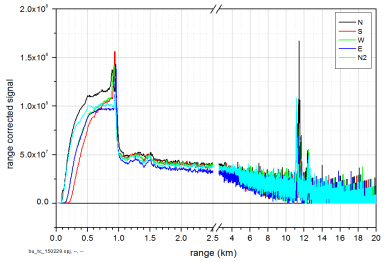
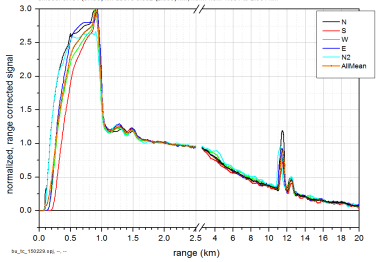
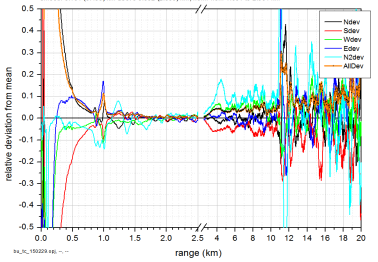
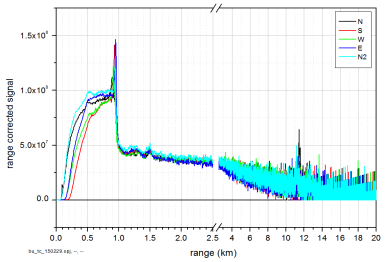
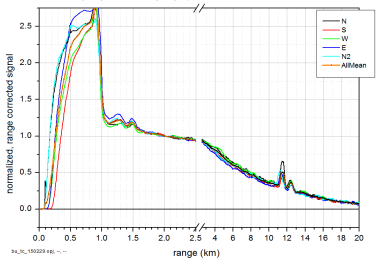
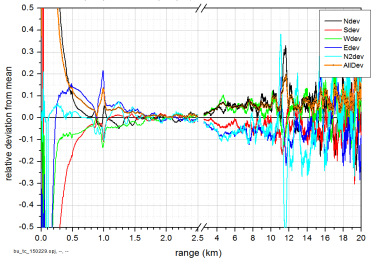
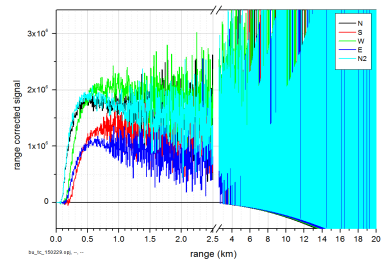
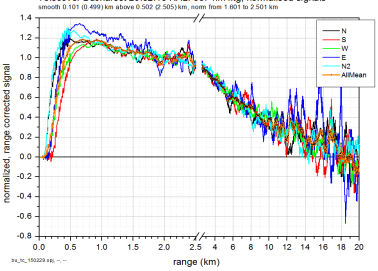
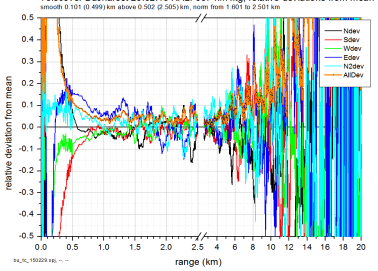
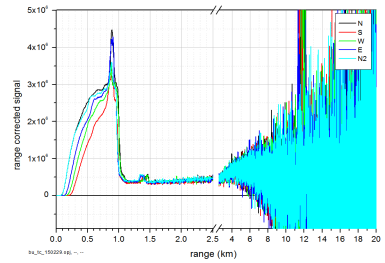
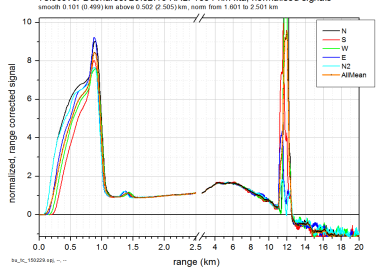
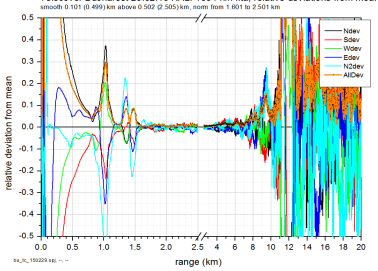
BU Bucharest: RALI (Raymetrics LR313 – D400) – Depolarisation calibration - mech. rotation ±45°

range corrected calibration signals | calibration factor | VLDR of Rayleigh data



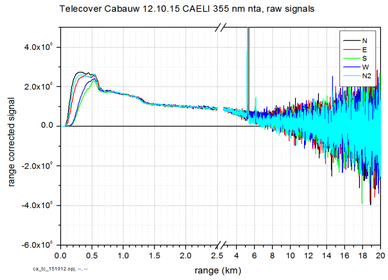
Calibration measurements are done with a yet uncalibrated attenuation of the perpendicular signal.

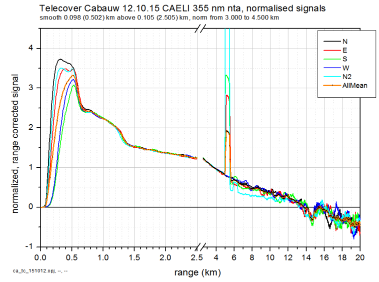
BU Bucharest: RALI (Raymetrics LR313 – D400) – Telecover – 05.03.15 and 29.02.15

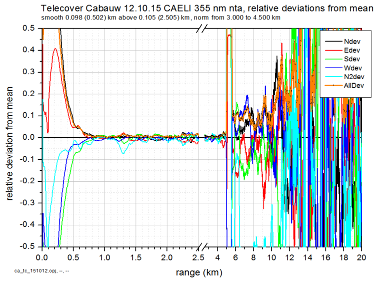
Raw signals	Normalised signals	Relative deviations
Telecover Bucharest 05.03.15 RALI 355 nm xta, raw signals	Telecover Bucharest 05.03.15 RALI 355 nm xta, normalised signals	Telecover Bucharest 05.03.15 RALI 355 nm xta, relative deviations from mean
		
Telecover Bucharest 05.03.15 RALI 387 nm xta, raw signals	Telecover Bucharest 05.03.15 RALI 387 nm xta, normalised signals	Telecover Bucharest 05.03.15 RALI 387 nm xta, relative deviations from mean
		
Telecover Bucharest 29.02.15 RALI 532 nm xcg, raw signals	Telecover Bucharest 29.02.15 RALI 532 nm xcg, normalised signals	Telecover Bucharest 29.02.15 RALI 532 nm xcg, relative deviations from mean
		
Telecover Bucharest 29.02.15 RALI 532 nm xpg, raw signals	Telecover Bucharest 29.02.15 RALI 532 nm xpg, normalised signals	Telecover Bucharest 29.02.15 RALI 532 nm xpg, relative deviations from mean
		
Telecover Bucharest 29.02.15 RALI 607 nm xtg, raw signals	Telecover Bucharest 29.02.15 RALI 607 nm xtg, normalised signals	Telecover Bucharest 29.02.15 RALI 607 nm xtg, relative deviations from mean
		
Telecover Bucharest 29.02.15 RALI 1064 nm xta, raw signals	Telecover Bucharest 29.02.15 RALI 1064 nm xta, normalised signals	Telecover Bucharest 29.02.15 RALI 1064 nm xta, relative deviations from mean
		

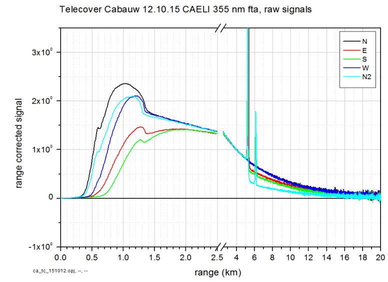
CA Cabauw: CAELI – Telecover 12.10.15

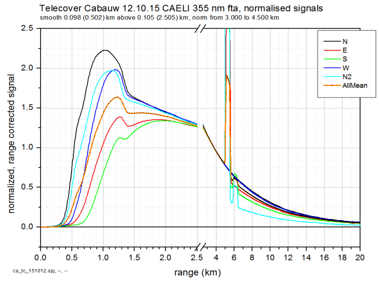
Raw signals	Normalised signals	Relative deviations

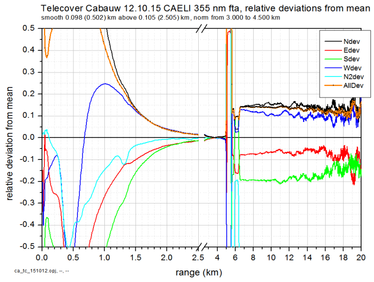


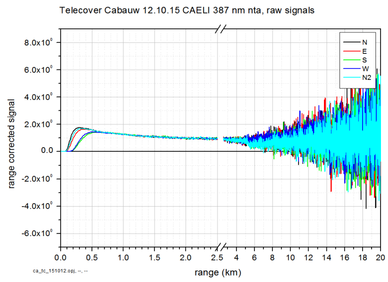


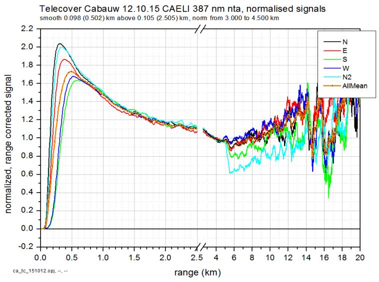


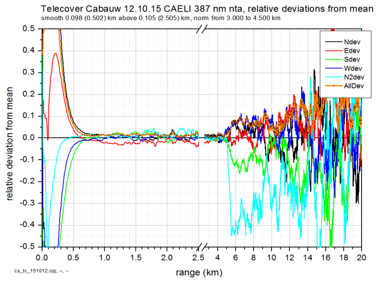


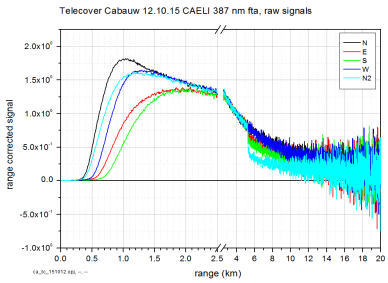


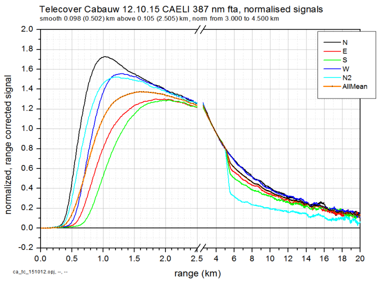


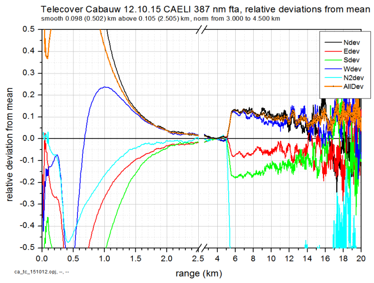


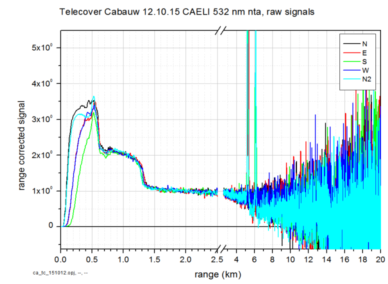


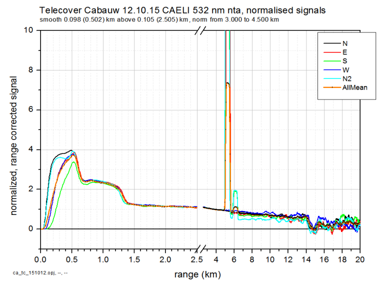


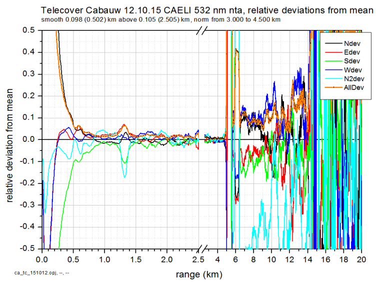


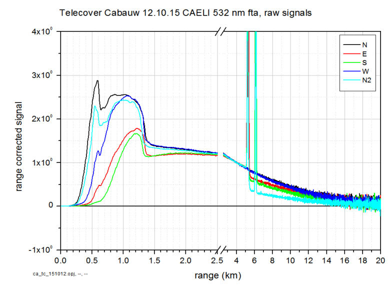


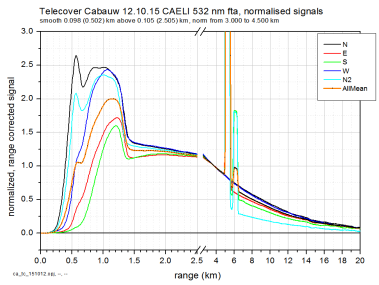


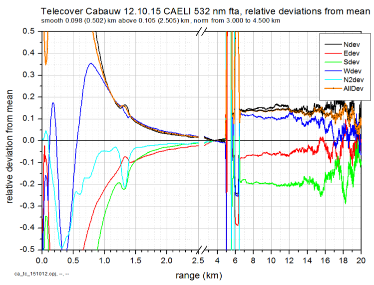


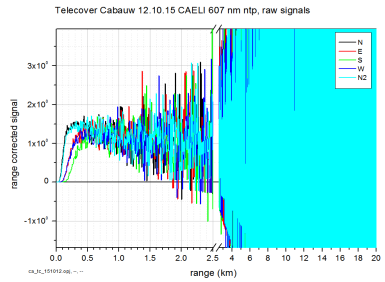
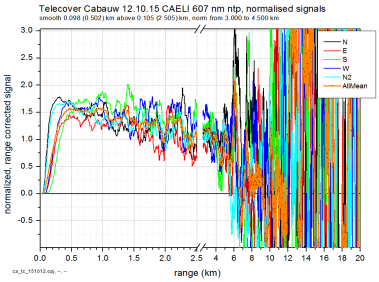
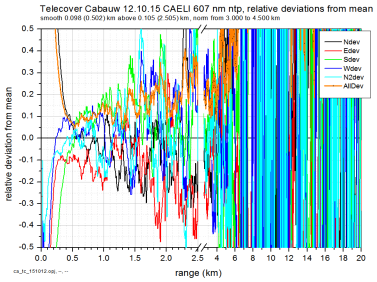
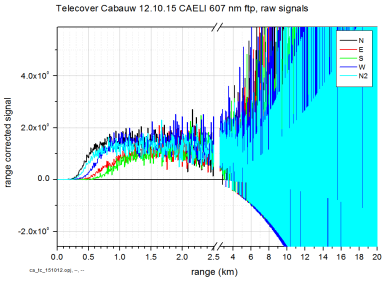
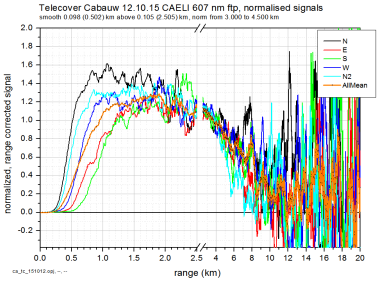
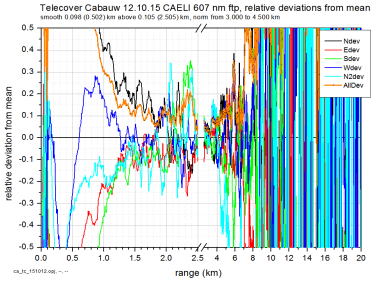
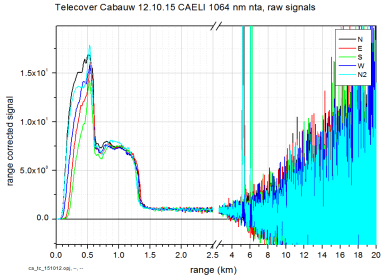
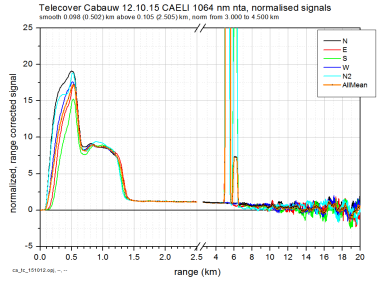
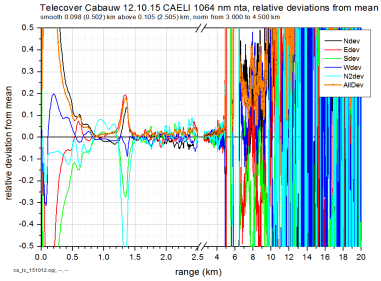
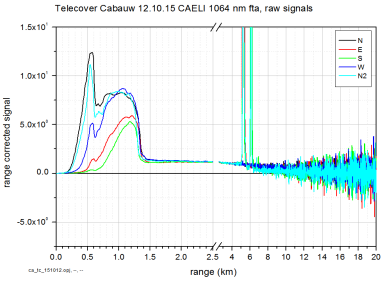
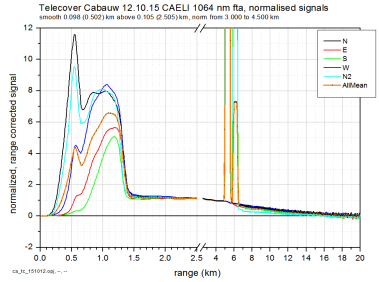
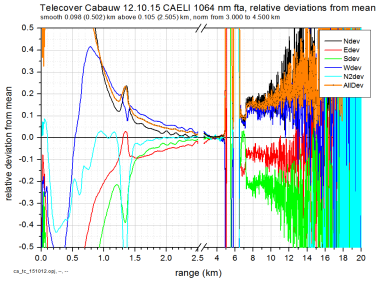






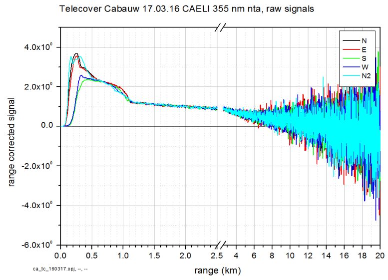


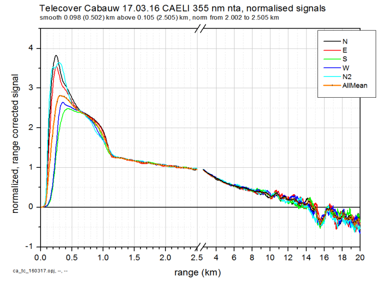


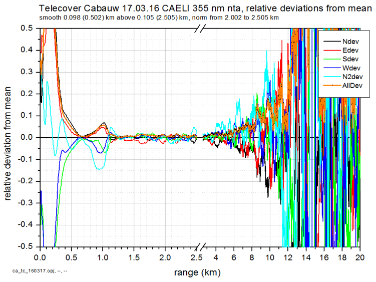
Raw signals	Normalised signals	Relative deviations
		
		
		
		

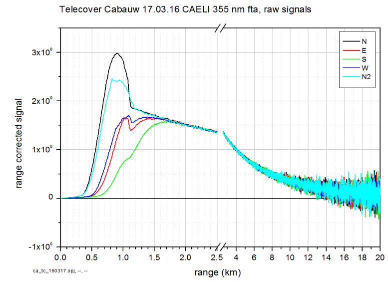
CA Cabauw: CAELI – Telecover 17.03.16

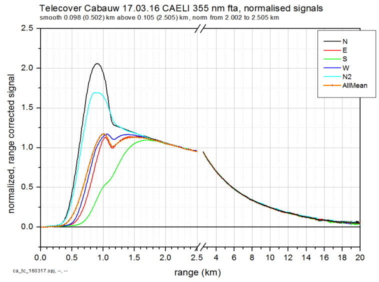
Raw signals	Normalised signals	Relative deviations

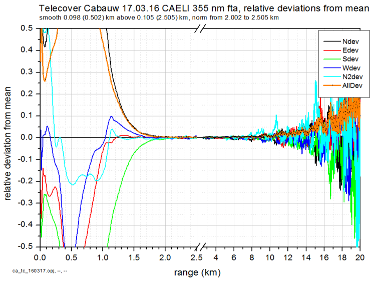


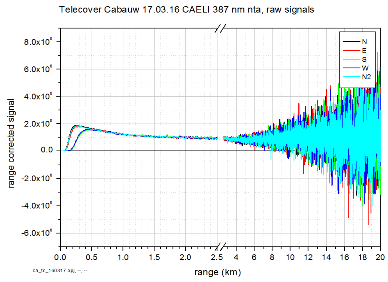


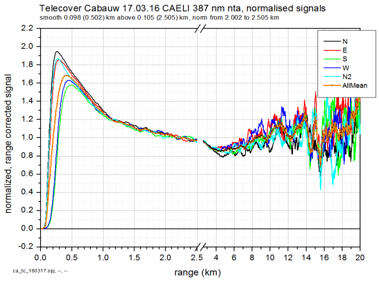


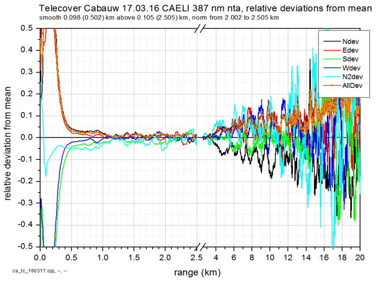


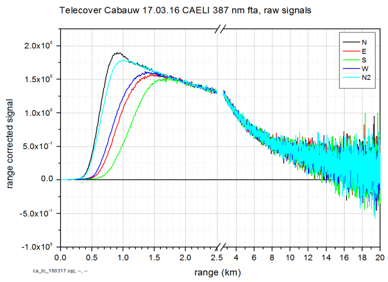


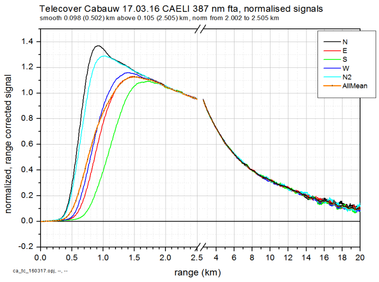


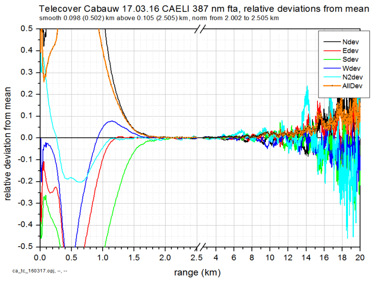


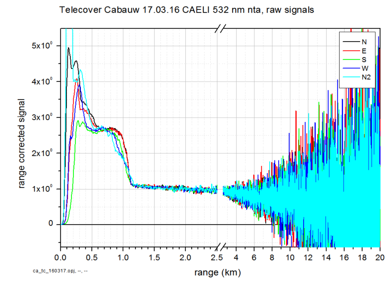


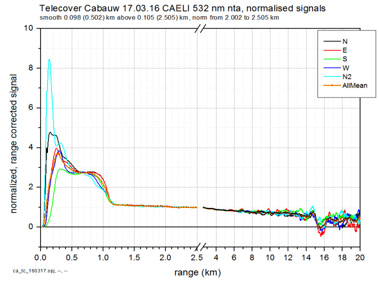


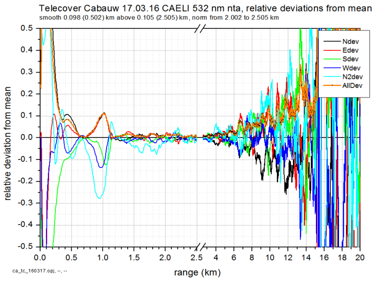


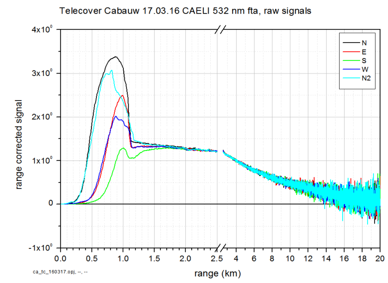


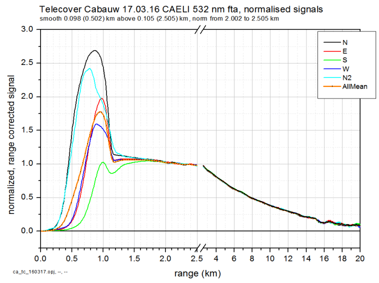


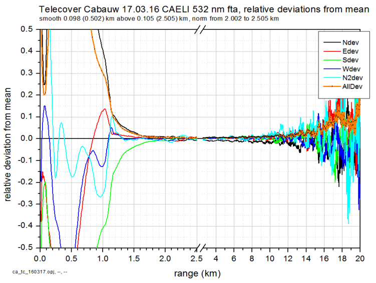


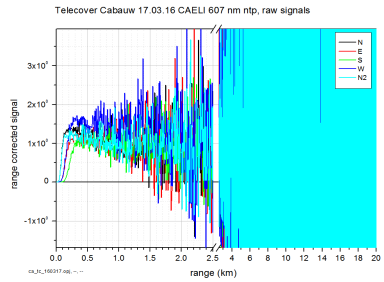
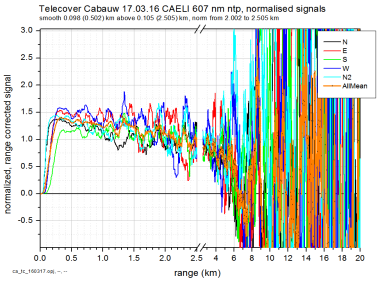
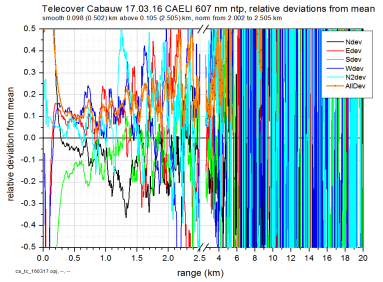
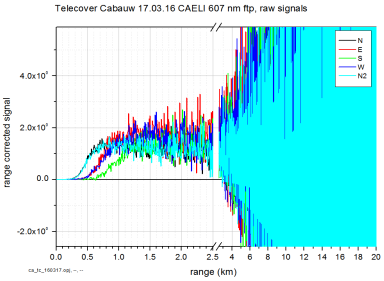
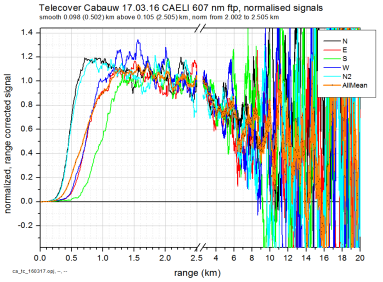
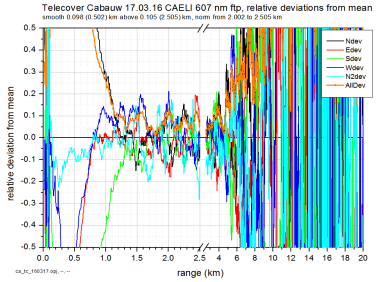
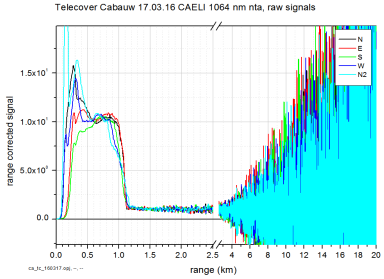
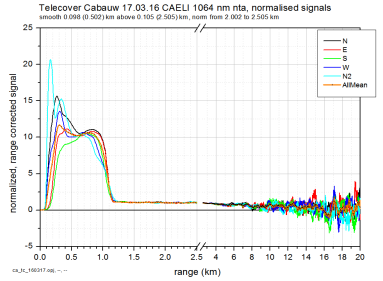
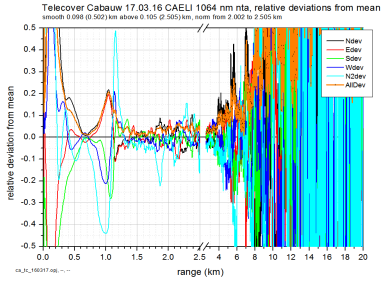
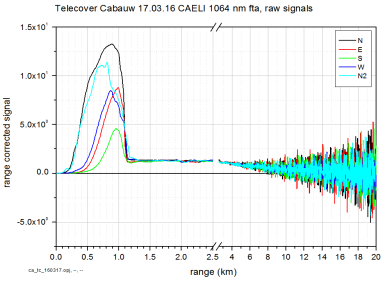
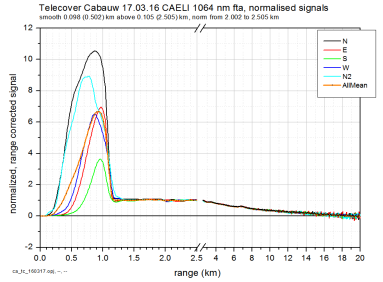
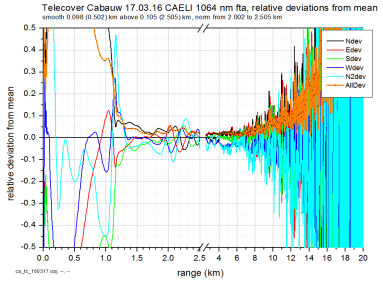






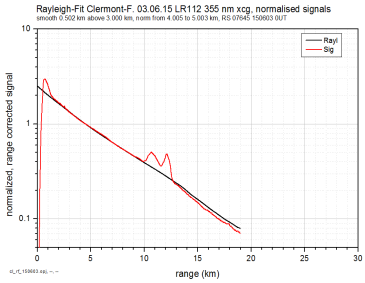


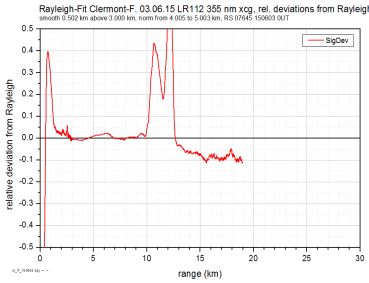


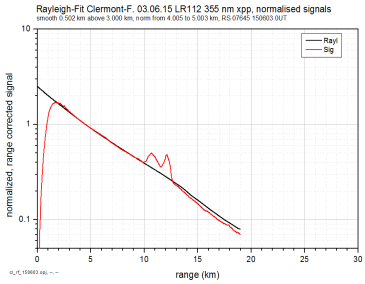
Raw signals	Normalised signals	Relative deviations
		
		
		
		

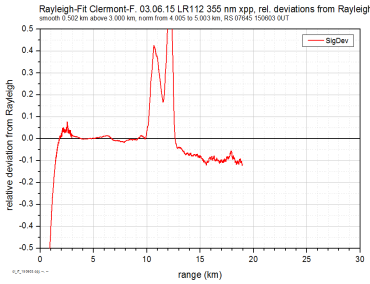
CL Clermont-Ferrand: LR112-U-D400 – Rayleigh fit

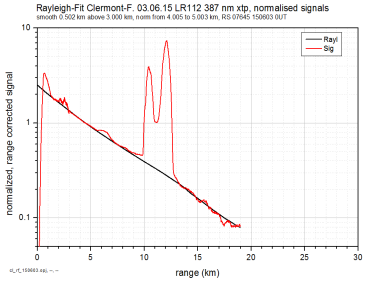
Normalised signals	Relative deviations

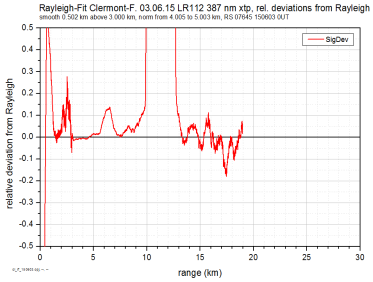






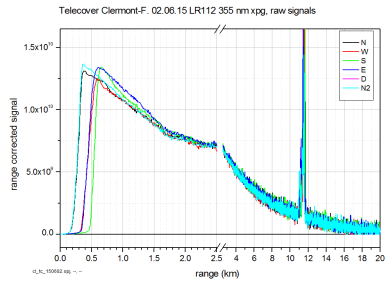


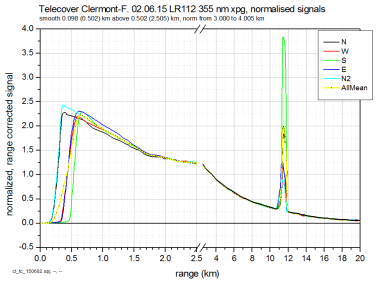


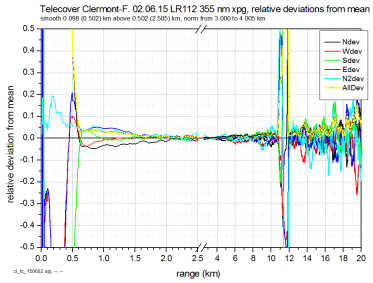


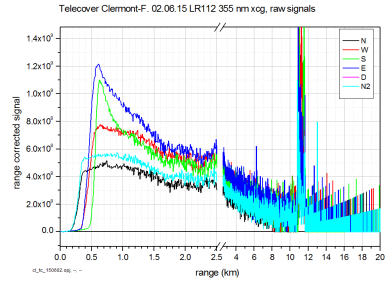
CL Clermont-Ferrand: LR112-U-D400 – Telecover

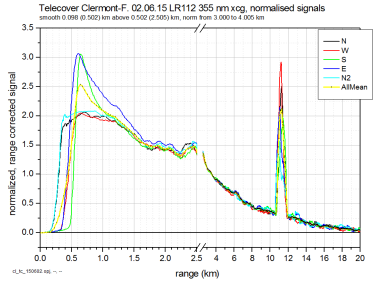
Raw signals	Normalised signals	Relative deviations

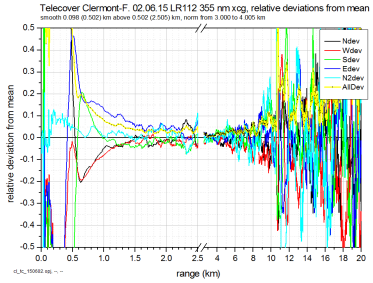


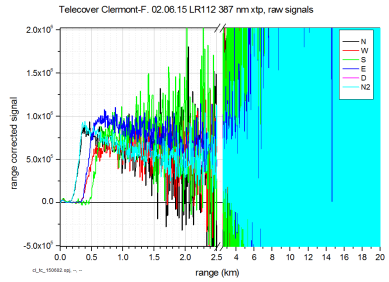


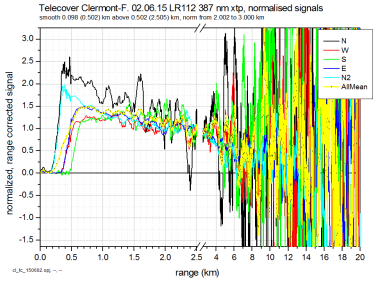


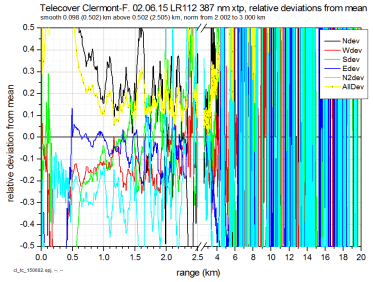






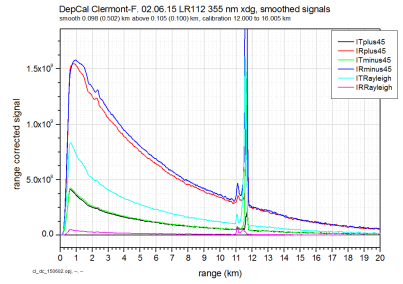


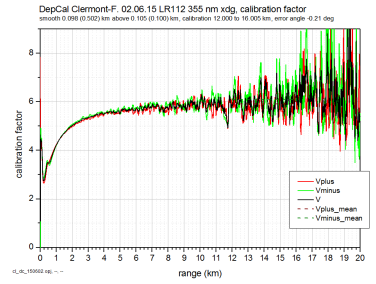


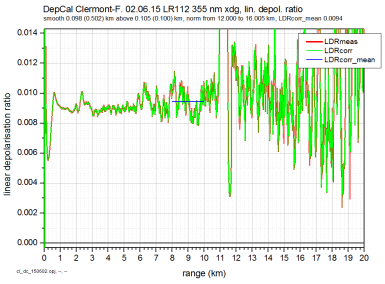


CL Clermont-Ferrand: LR112-U-D400 – Depolarisation calibration - wave-plate rotation ±45°

range corrected calibration signals	calibration factor	VLDR of Rayleigh data

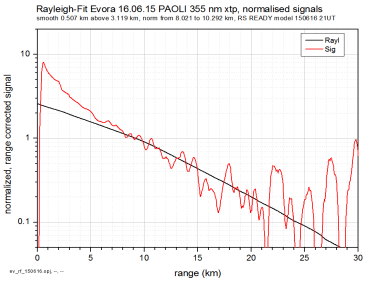


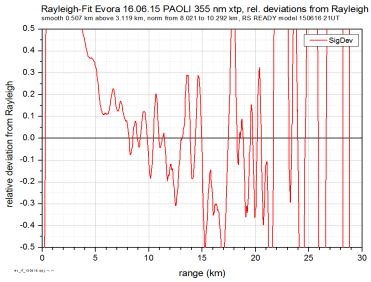


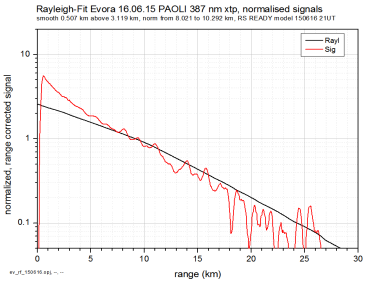


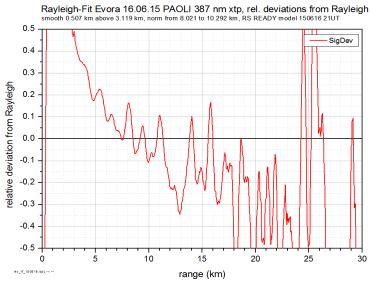
EV Evora: PAOLI – Rayleigh fit

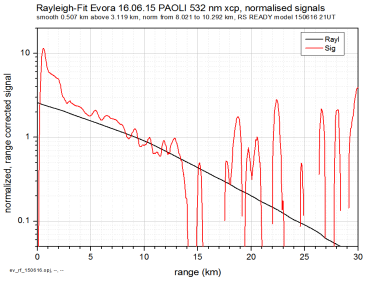
Normalised signals	Relative deviations

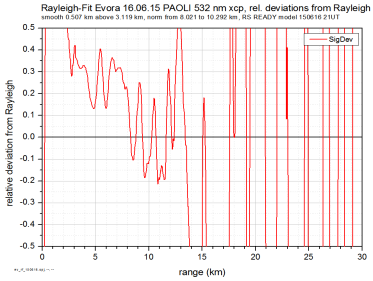


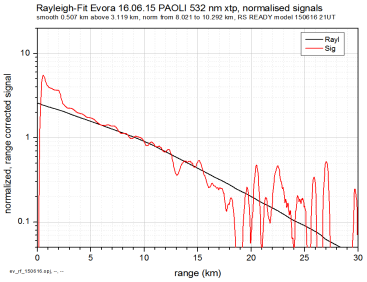


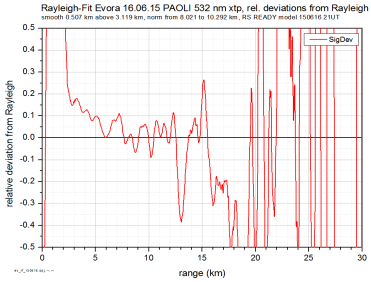


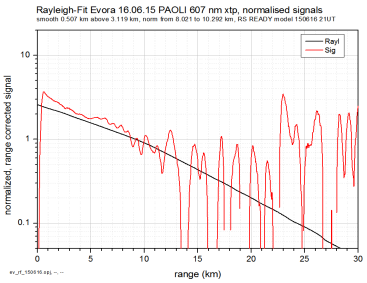


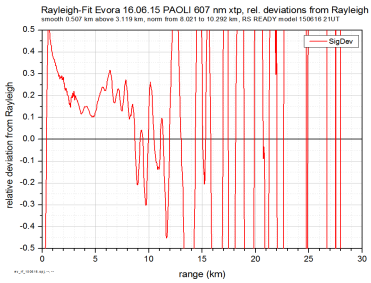




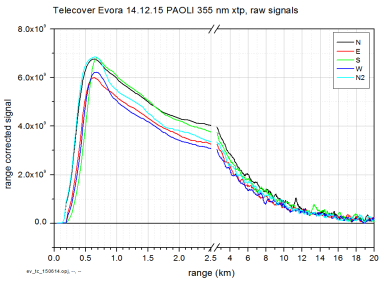
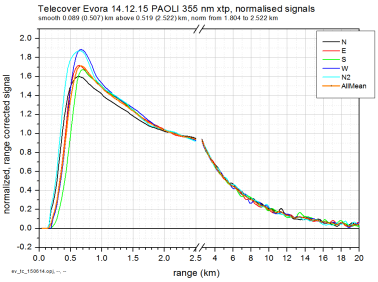
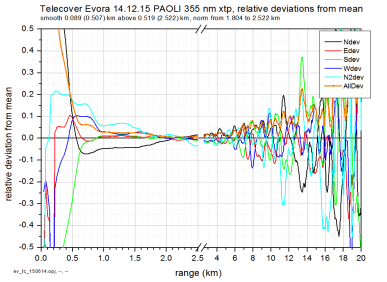
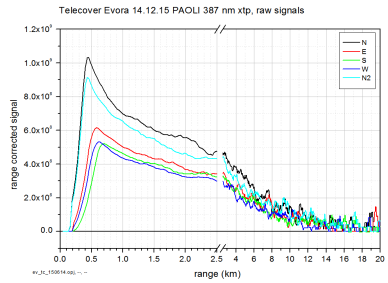
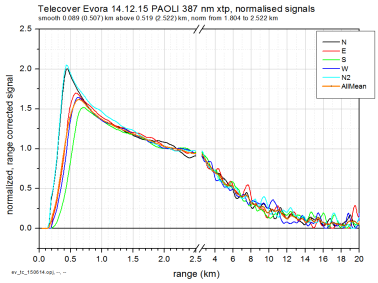
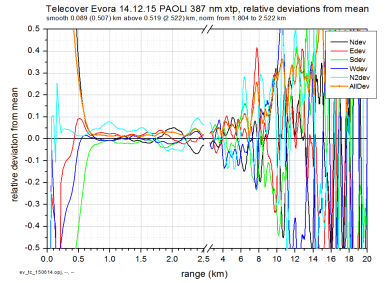
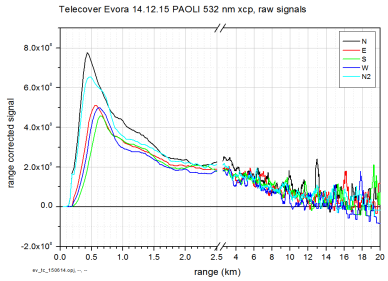
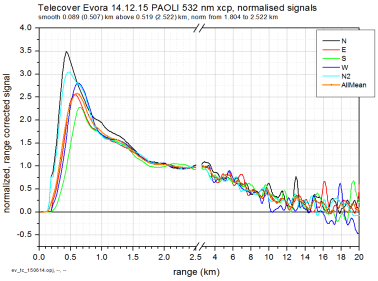
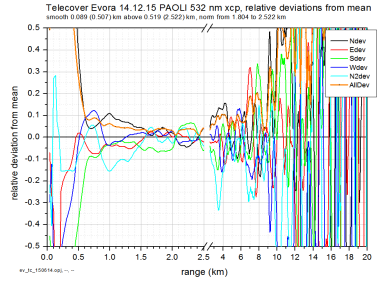
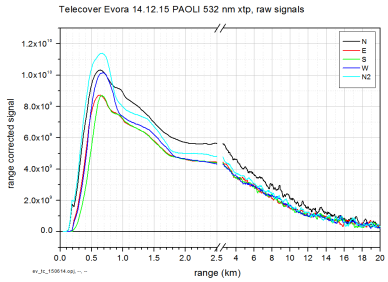
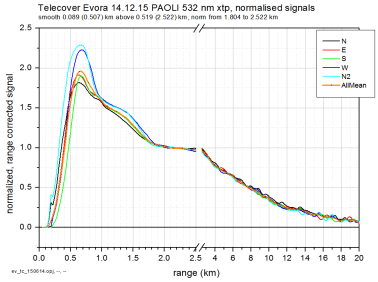
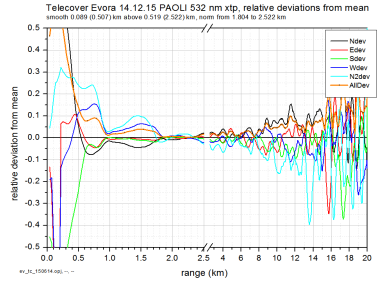
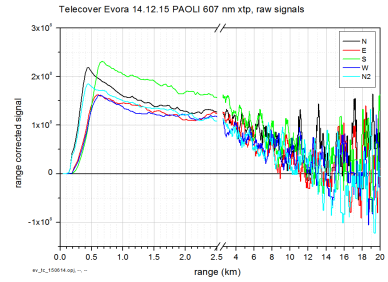
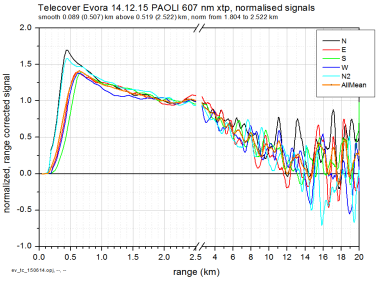
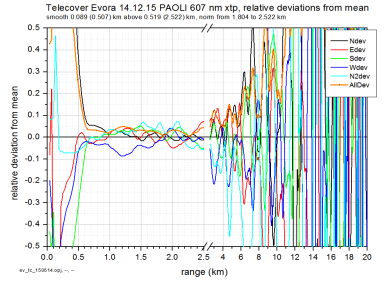




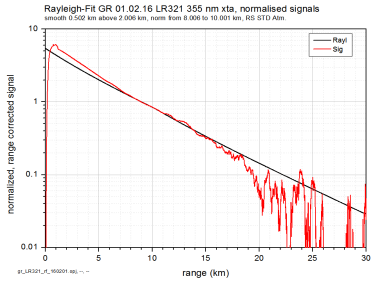
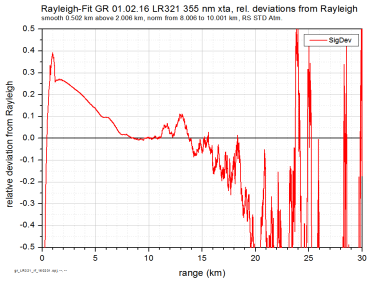
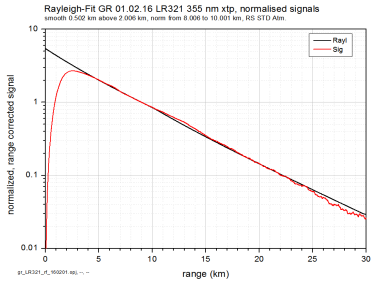
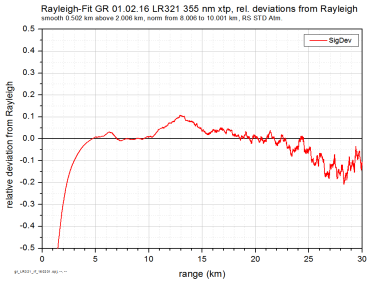
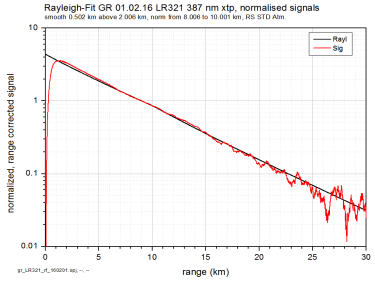
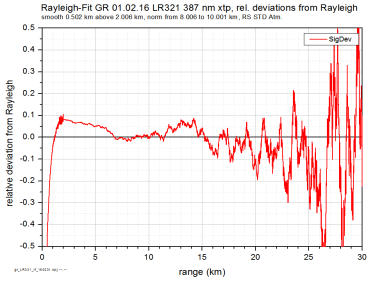
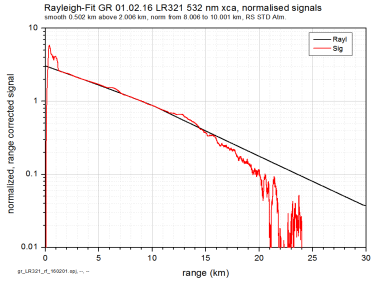
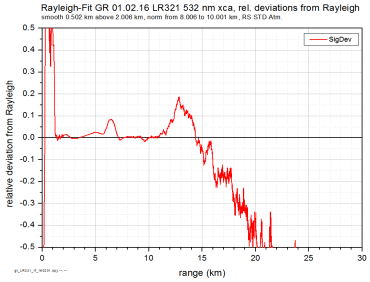
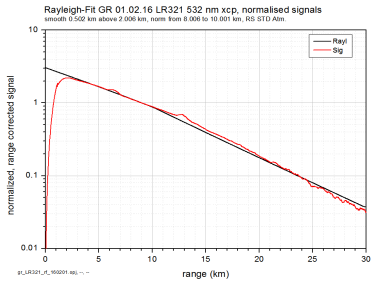
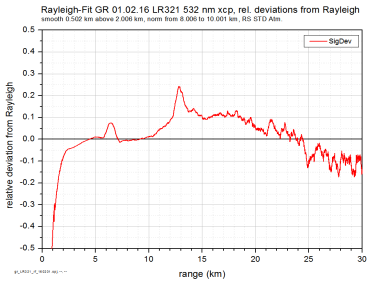




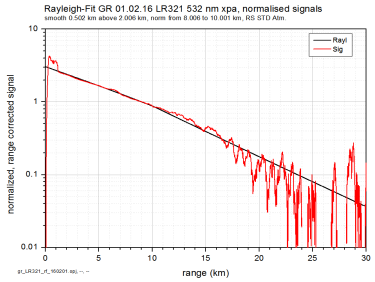
EV Evora: PAOLI – Telecover

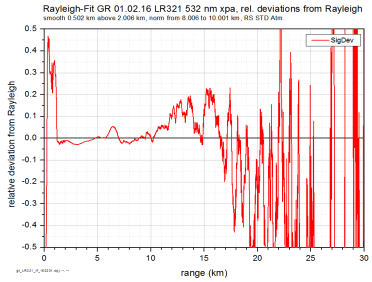
Raw signals	Normalised signals	Relative deviations
		
		
		
		
		

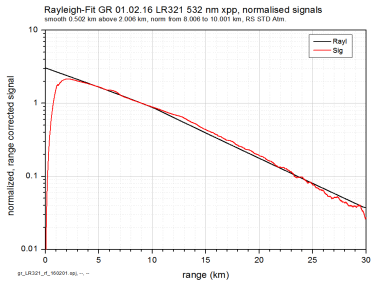
GR Granada: Raymetrics LR321 - D400 – Rayleigh Fit

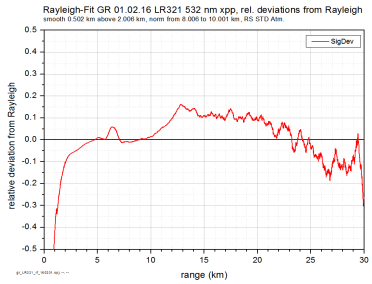
Normalised signals	Relative deviations
	
	
	
	
	

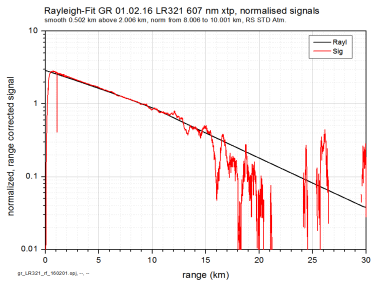
Normalised signals	Relative deviations

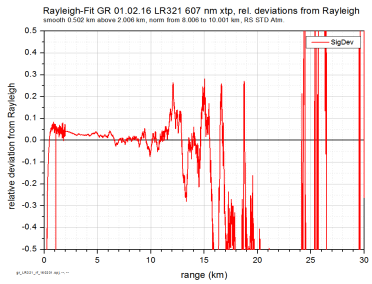


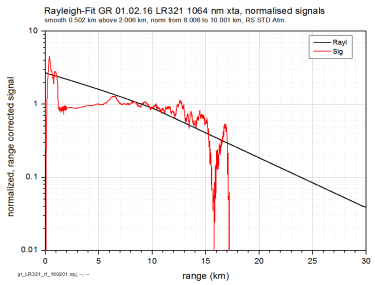


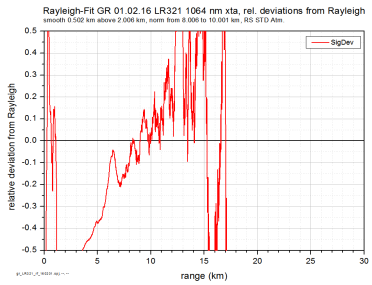




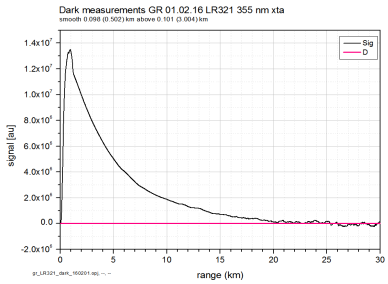


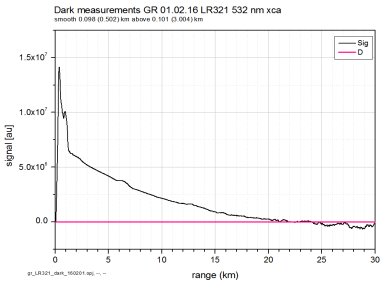


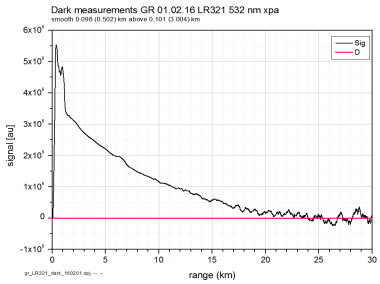


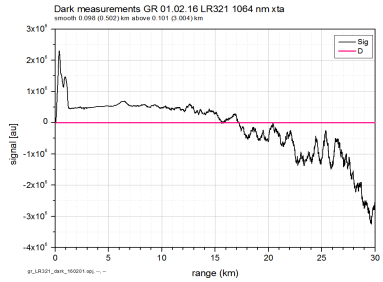


GR Granada: Raymetrics LR321 - D400 – Dark measurements



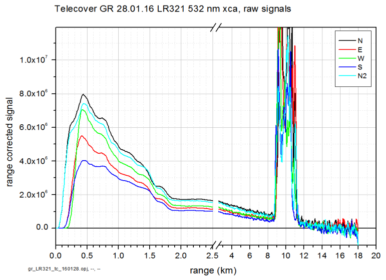


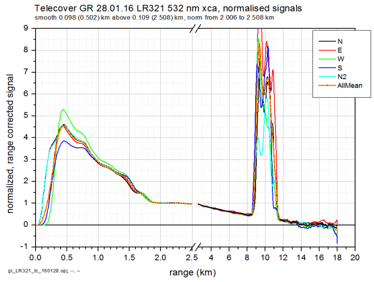


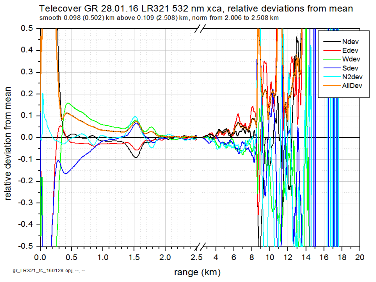


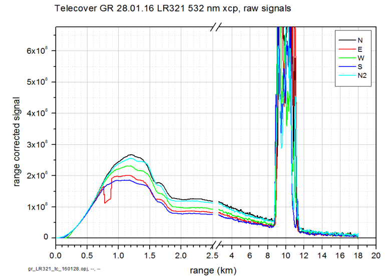
GR Granada: Raymetrics LR321 - D400 – Telecover

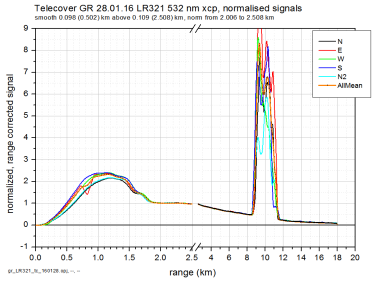
Raw signals	Normalised signals	Relative deviations

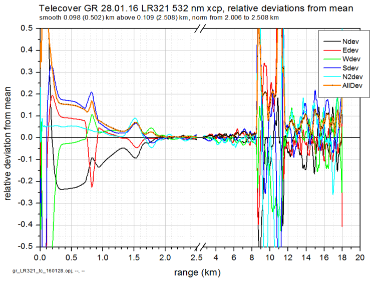


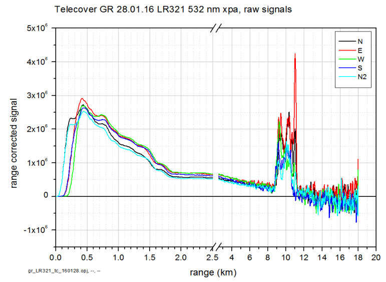


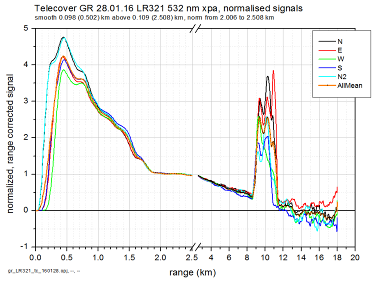


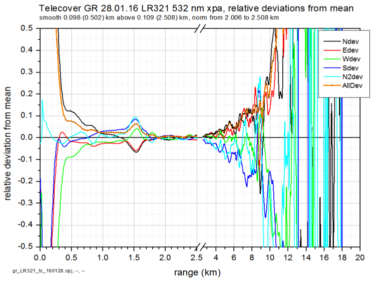


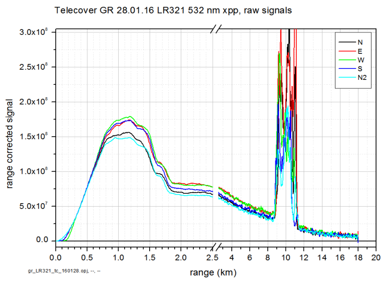


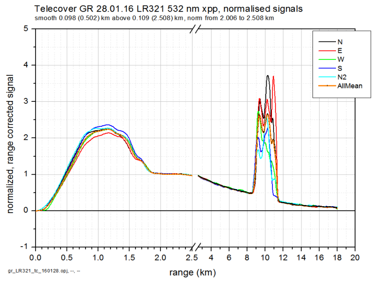


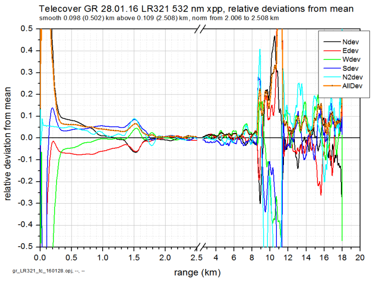


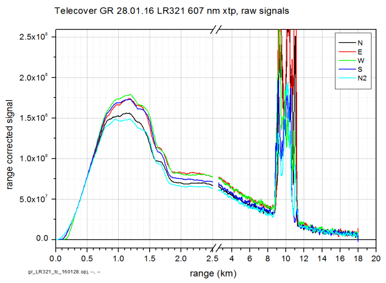


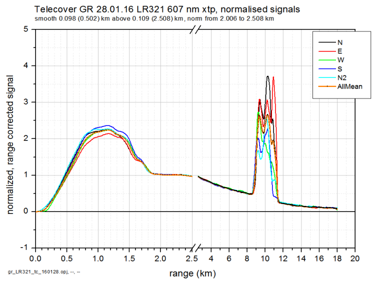


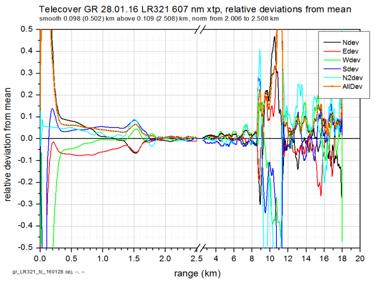


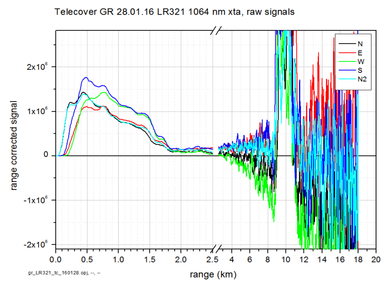


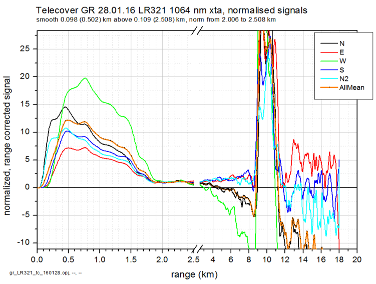


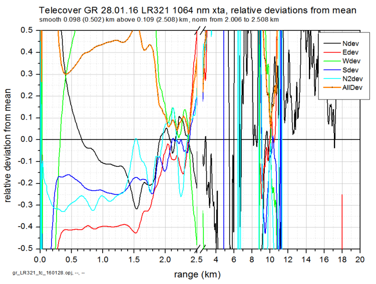










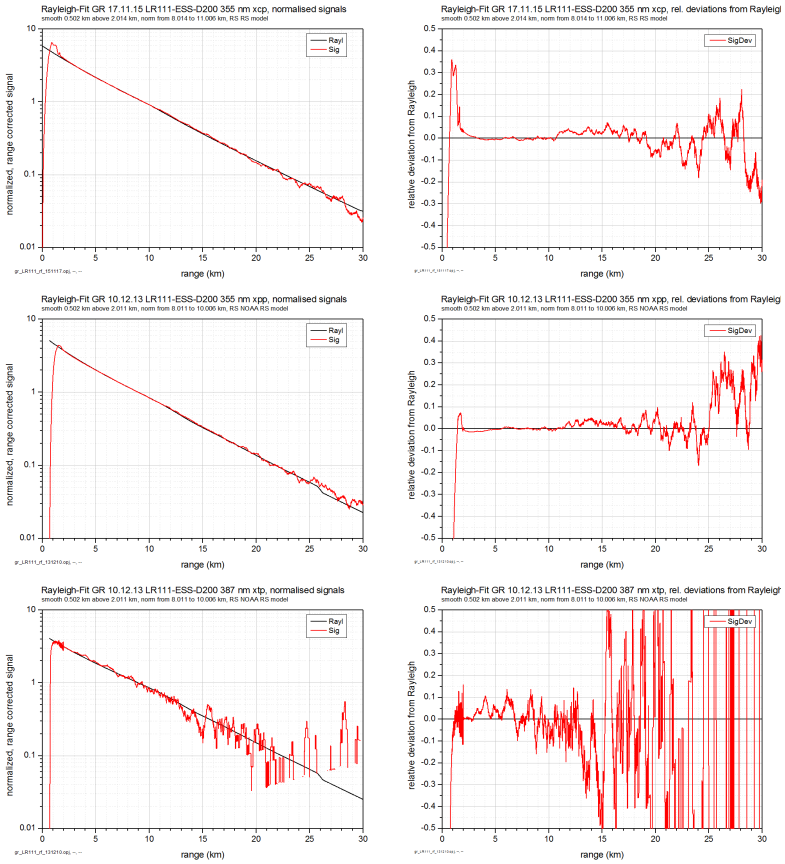


GR Granada: Raymetrics LR321 - D400 – Trigger delay

Channel	DA-mode (pc, analogue)	Trigger delay [rangebin]	Resolution [m/rb]	Methode	Comment
532 xpa	analogue	6	7.5	Diffuse reflection	
532 xpp	pc	-2	7.5	Bin shift	
532 xca	analogue	6	7.5	Diffuse reflection	
532 xcp	pc	-2	7.5	Bin shift	
355 xta	analogue	6	7.5	Diffuse reflection	
355 xtp	pc	-2	7.5	Bin shift	
1064 xta	analogue	6	7.5	Diffuse reflection	

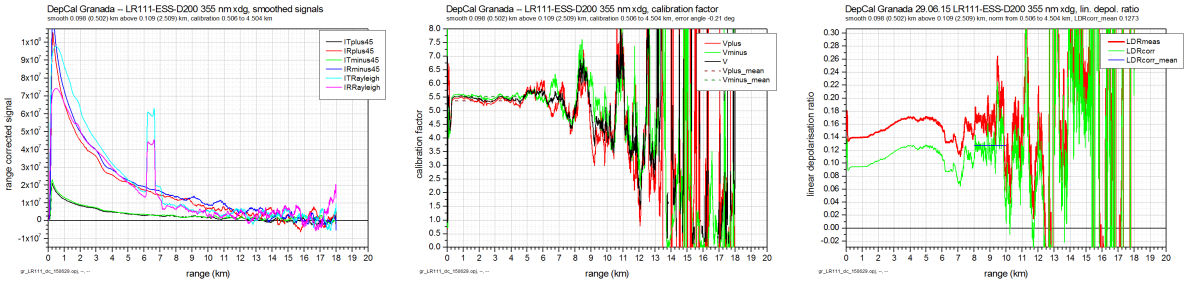
GR Granada: Raymetrics LR111-ESS-D200 – Rayleigh Fit

Normalised signals | Relative deviations

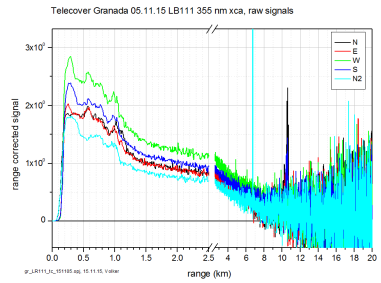
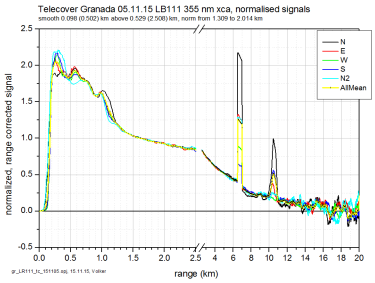
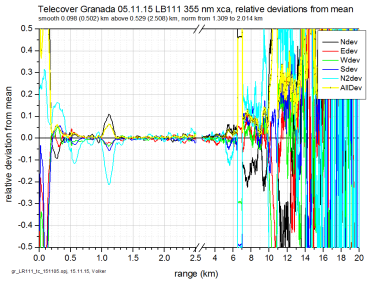
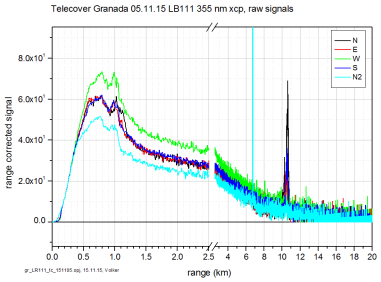
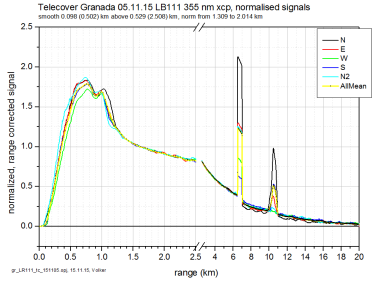
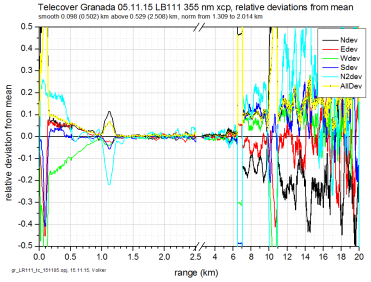
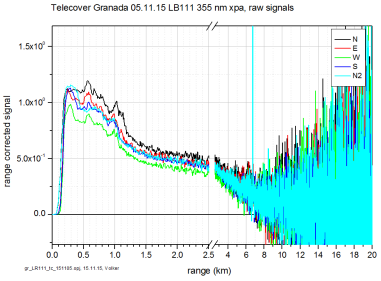
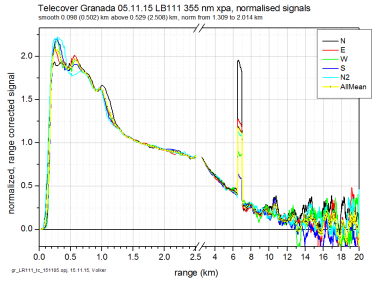
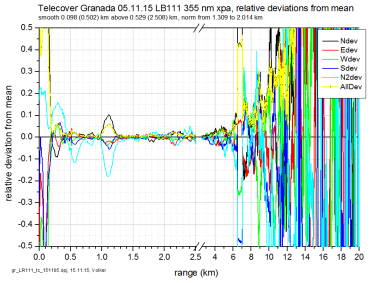
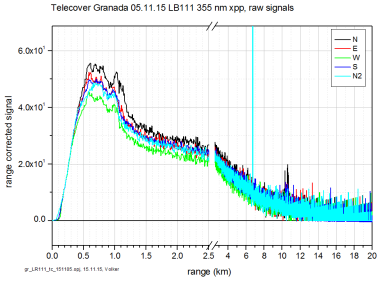
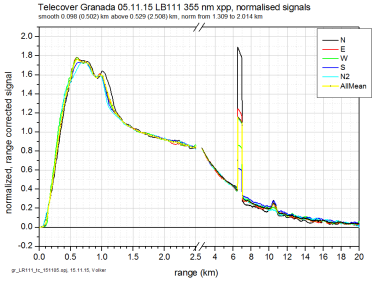
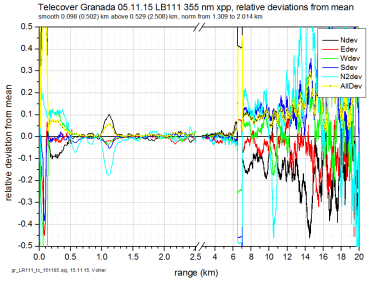
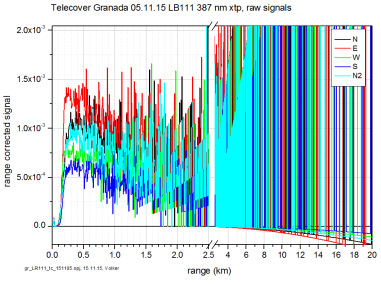
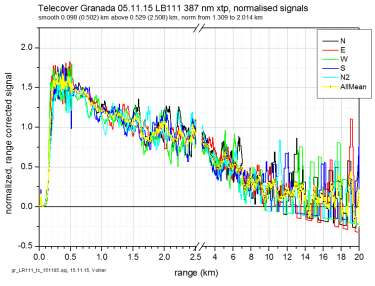
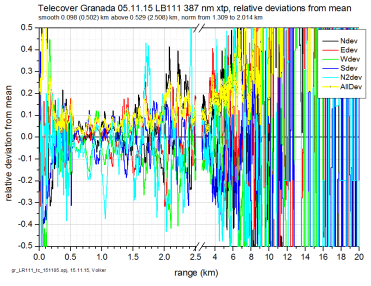


GR Granada: Raymetrics LR111-ESS-D200 – Polarisation calibration - mechanical rotation ±45°

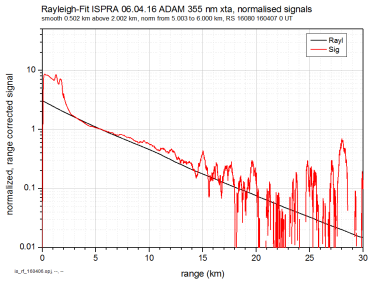
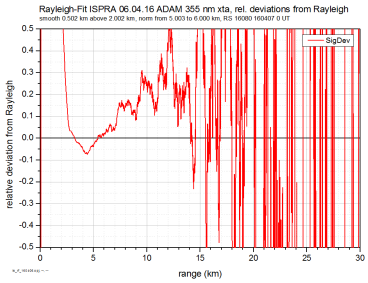
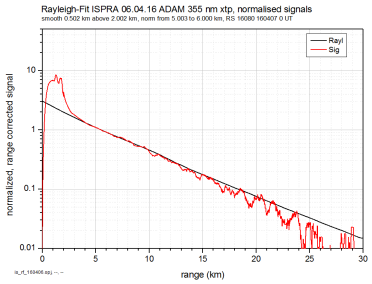
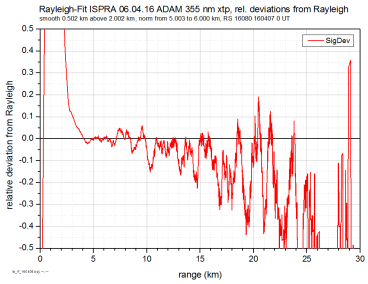
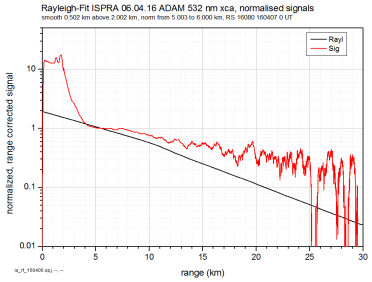
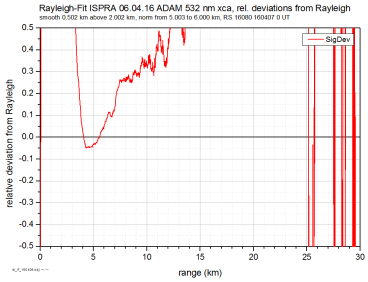
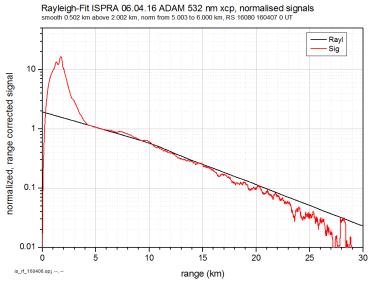
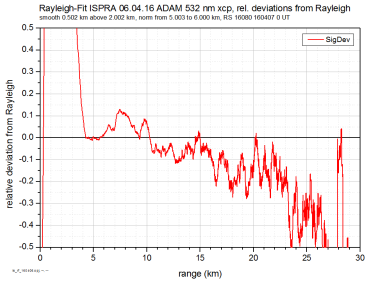
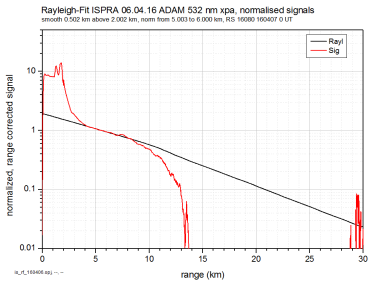
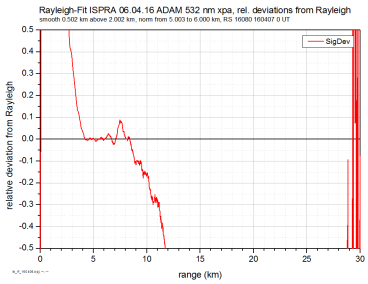
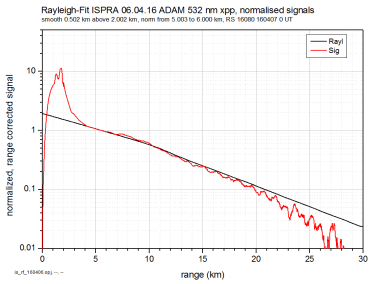
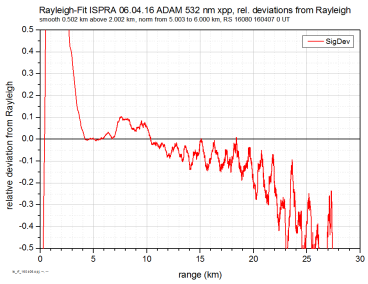
range corrected signals | calibration | volume lin. dep. ratio

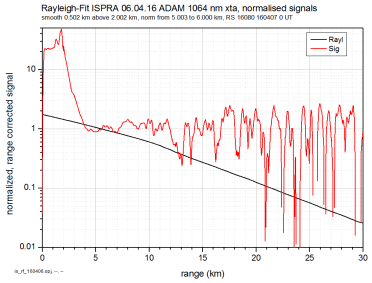


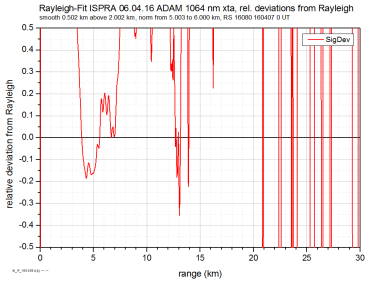
GR Granada: Raymetrics LR111-ESS-D200 – Telecover

Raw signals	Normalised signals	Relative deviations
		
		
		
		
		

IS Ispra: ADAM – Rayleigh fit

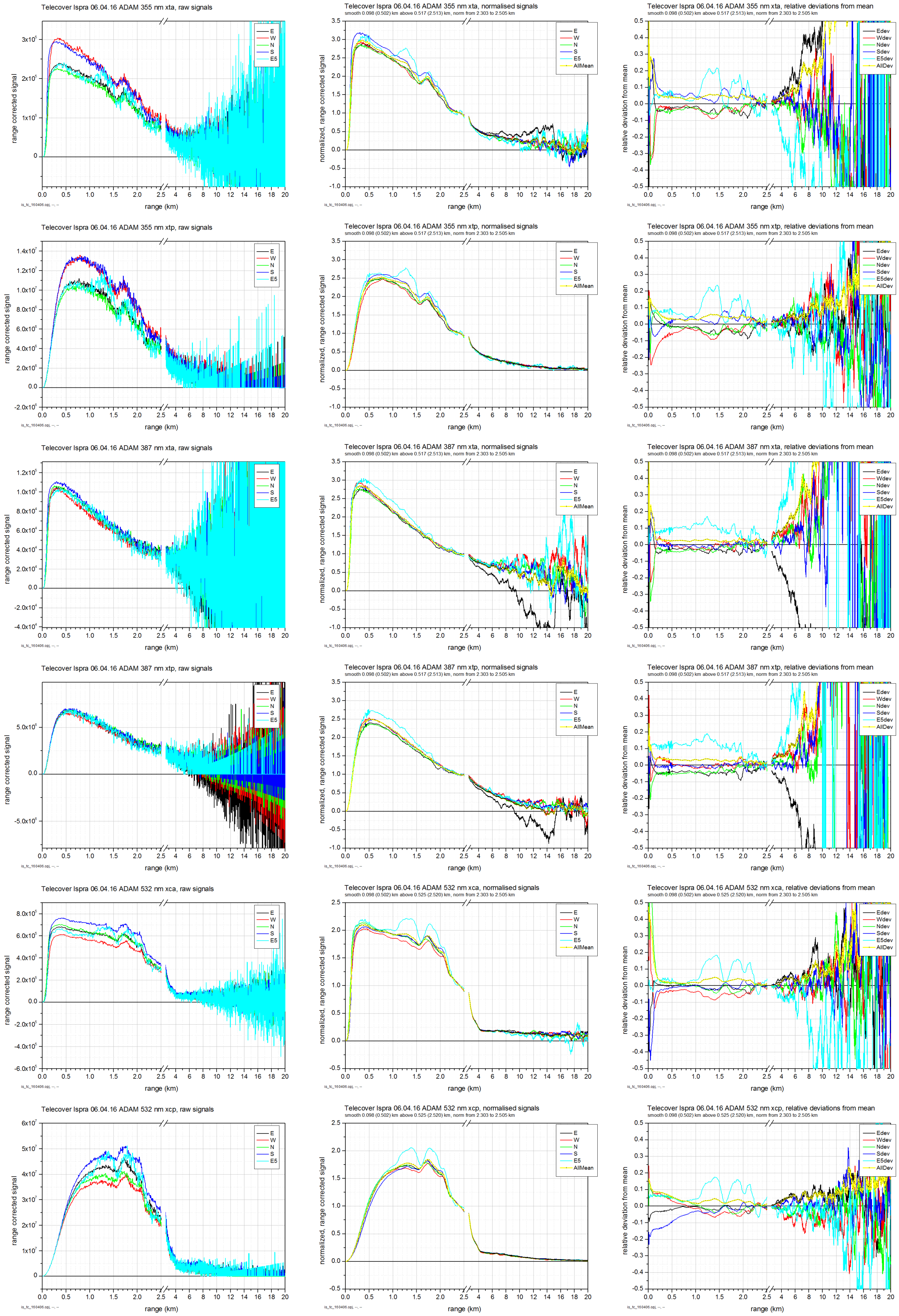
Normalised signals	Relative deviations
	
	
	
	
	
	

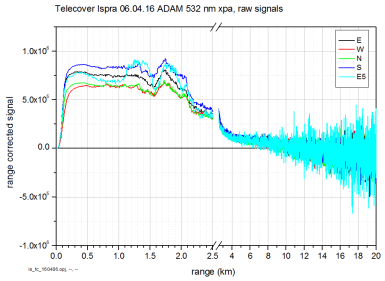
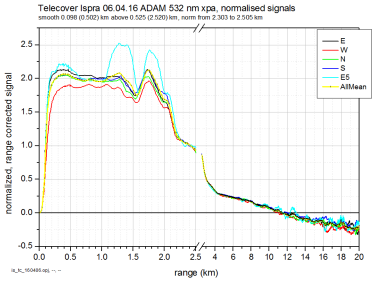
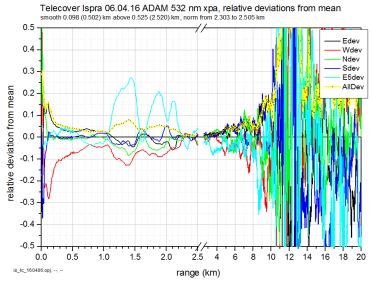
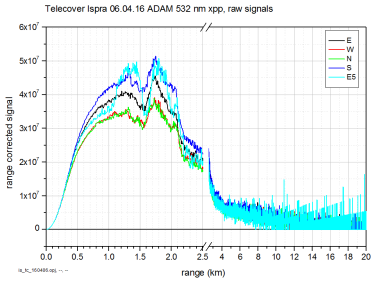
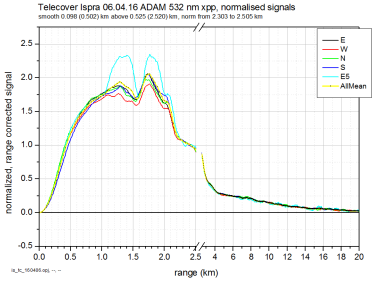
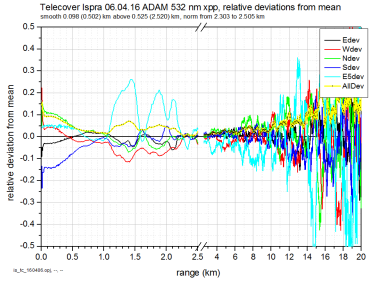
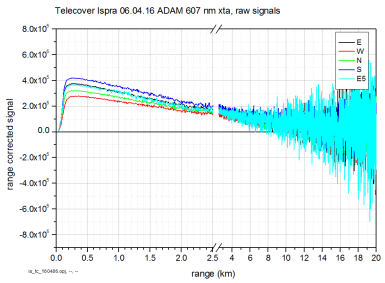
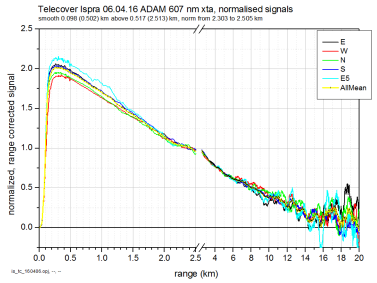
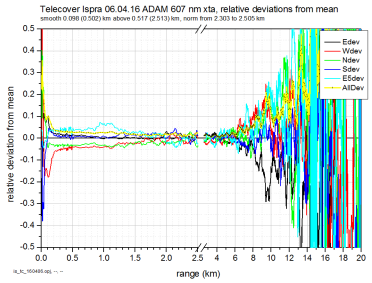
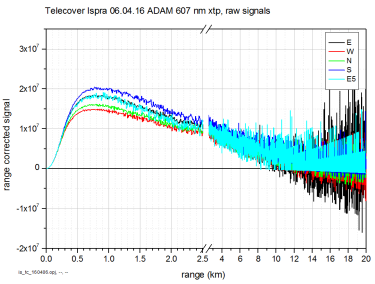
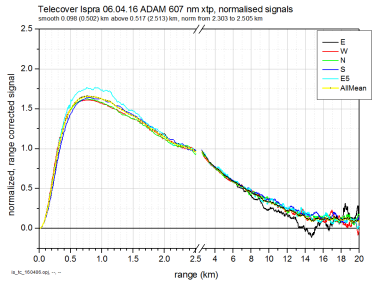
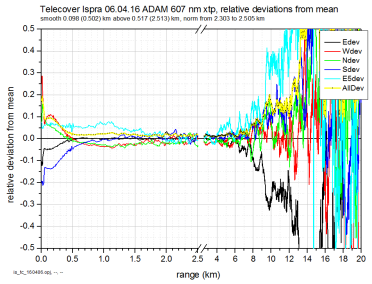
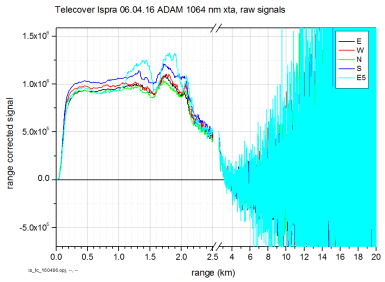
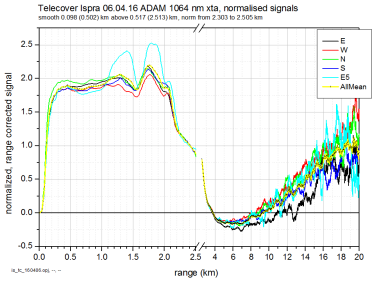
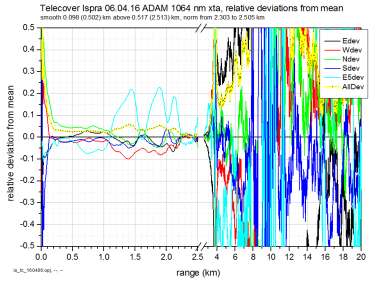

Rayleigh-Fit ISPRA 06.04.16 ADAM 1064 nm xta, normalised signals
smooth 0.002 km above 2.002 km, norm from 5.003 to 6.000 km, RS 16080 160407 0 UT
Rayl
Sig
normalized, range corrected signal
range (km)


Rayleigh-Fit ISPRA 06.04.16 ADAM 1064 nm xta, rel. deviations from Rayleigh
smooth 0.002 km above 2.002 km, norm from 5.003 to 6.000 km, RS 16080 160407 0 UT
SigDev
relative deviation from Rayleigh
range (km)

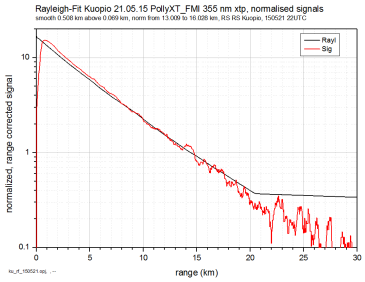
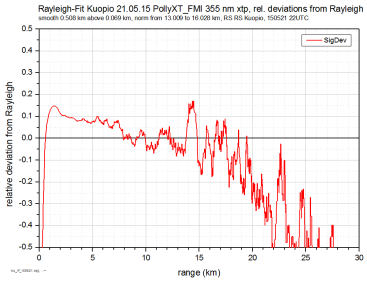
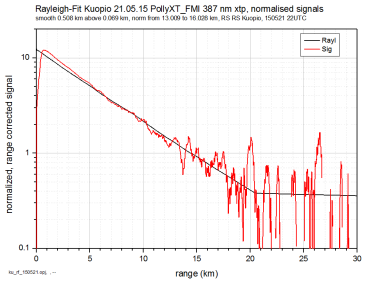
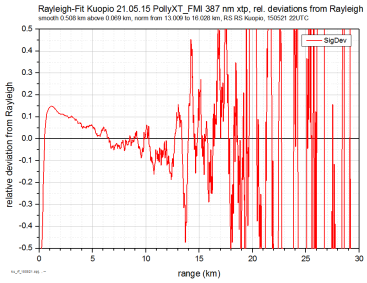
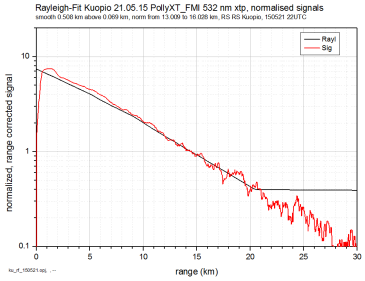
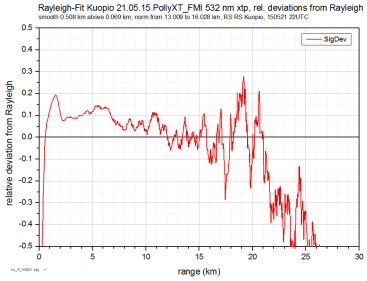
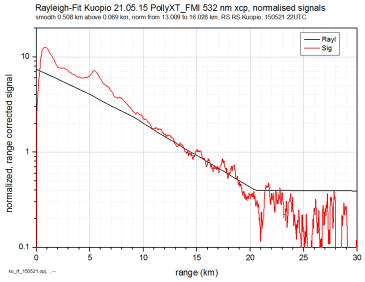
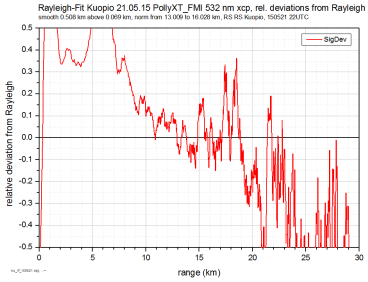
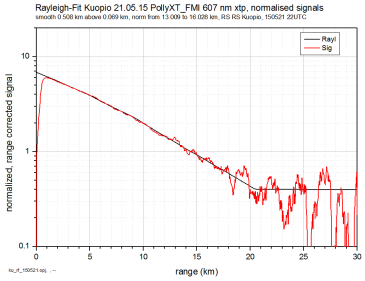
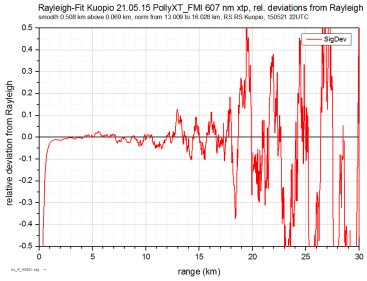
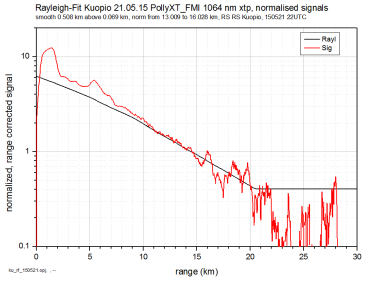
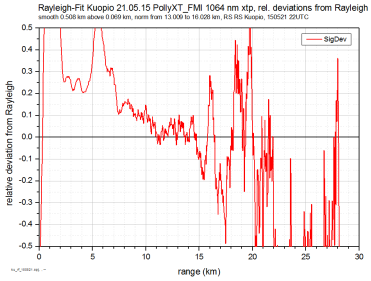
IS Ispra: ADAM – Telecover

Raw signals	Normalised signals	Relative deviations



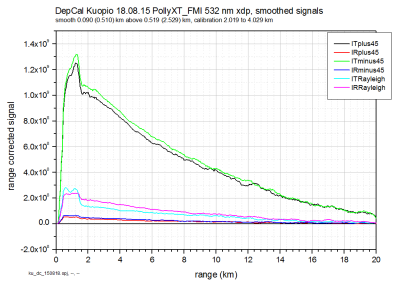
Raw signals	Normalised signals	Relative deviations
		
		
		
		
		

KU Kuopio: POLLY-XT_FMI – Rayleigh fit

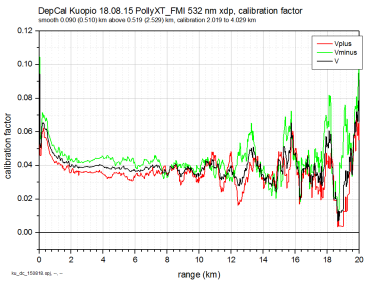
Normalised signals	Relative deviations
	
	
	
	
	
	

KU Kuopio: POLLY-XT_FMI – Polarisation calibration – pol. filter

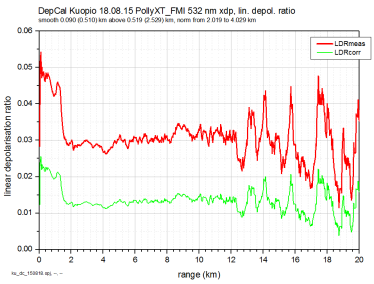
range corrected calibration signals



calibration factor

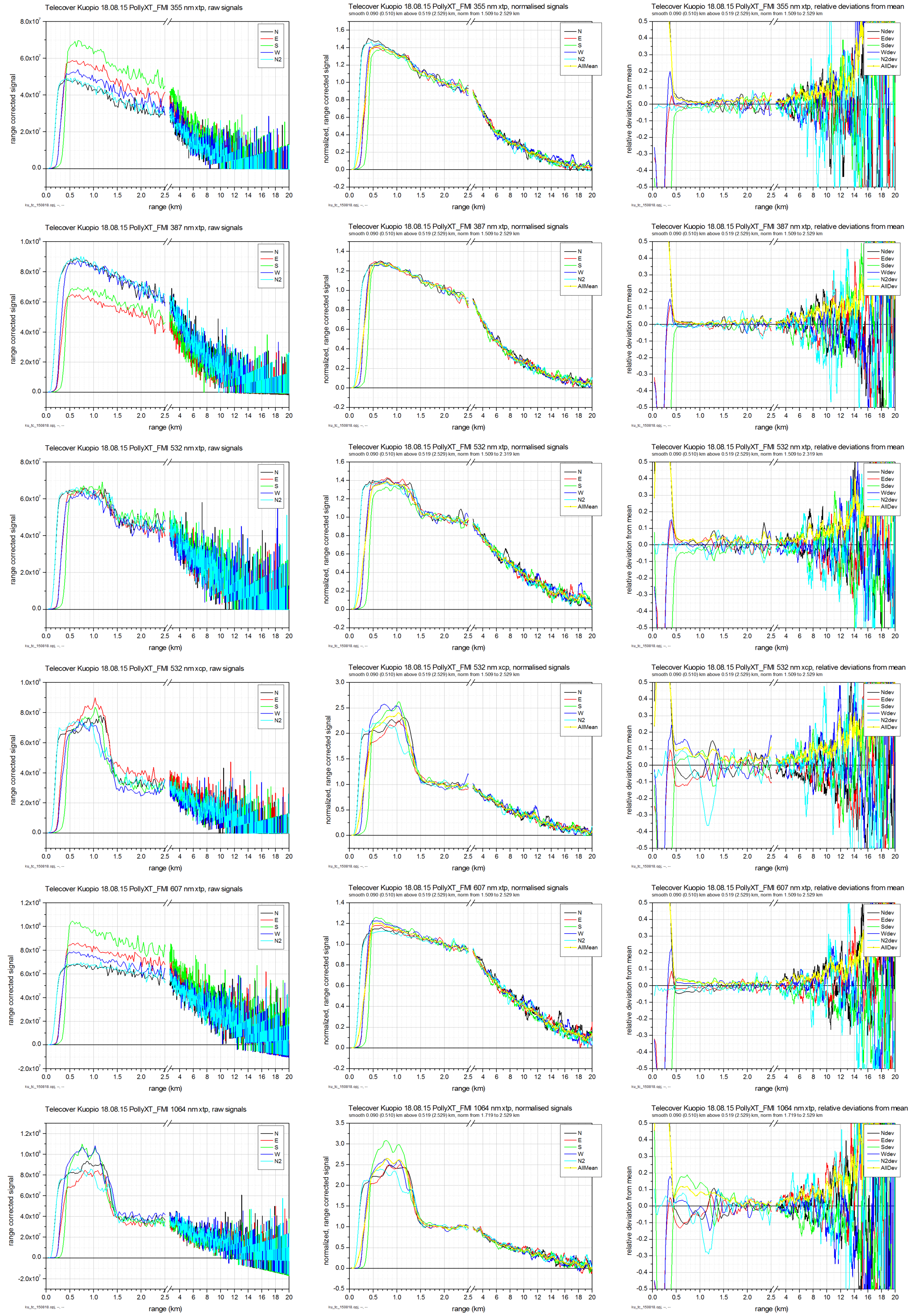


VLDR of Rayleigh data



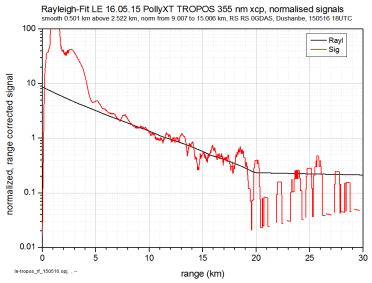
KU Kuopio: POLLY-XT_FMI – Telecover

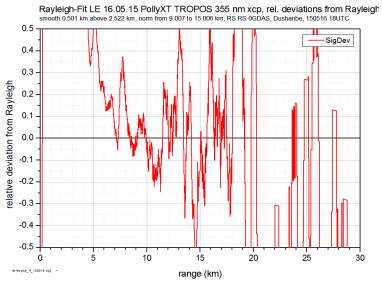
Raw signals	Normalised signals	Relative deviations

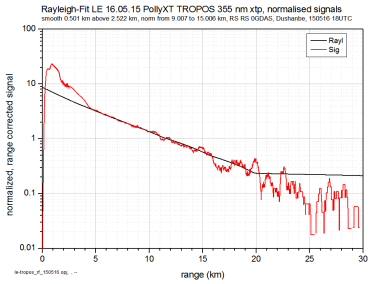


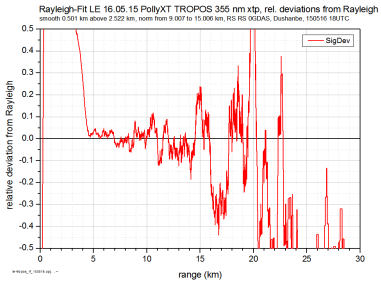
LE Leipzig: POLLY-XT_TROPOS – Rayleigh fit

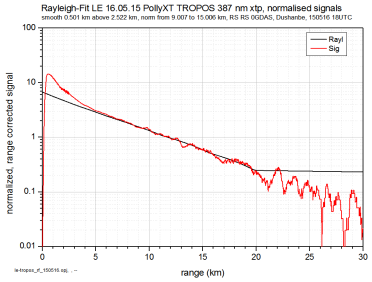
Normalised signals	Relative deviations

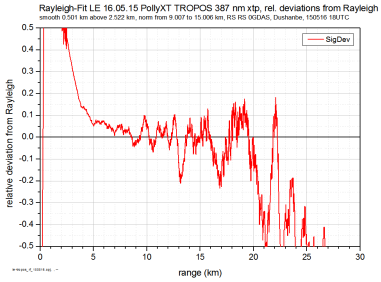


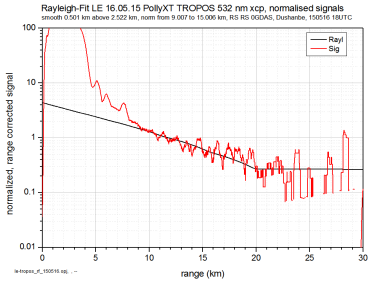


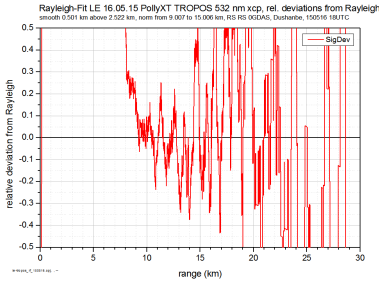


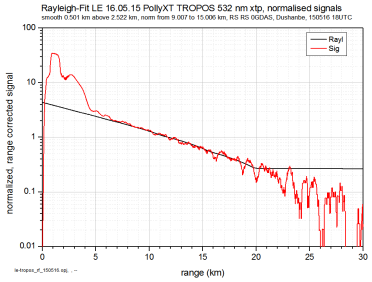


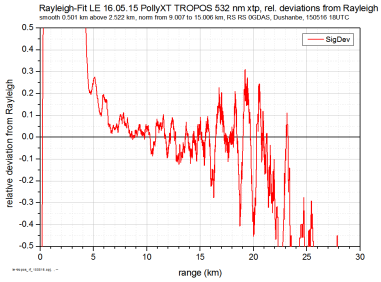


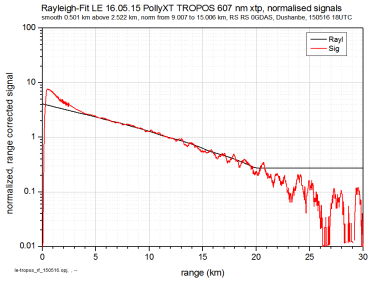


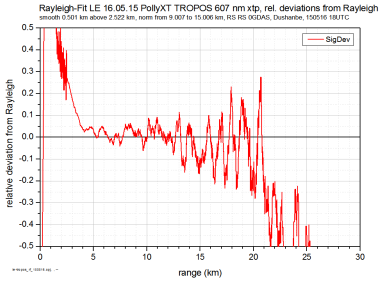


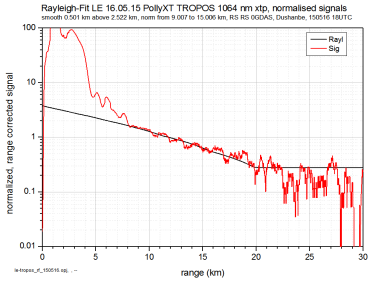


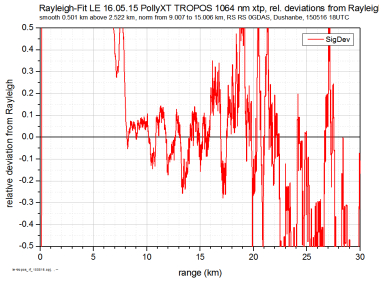






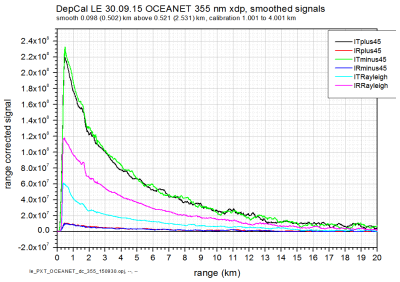




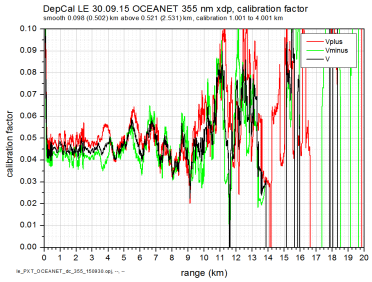


LE Leipzig: POLLY-XT_TROPOS – Polarisation calibration – pol. filter

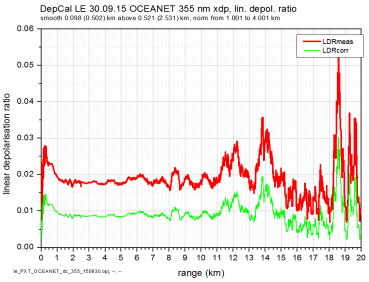
range corrected calibration signals

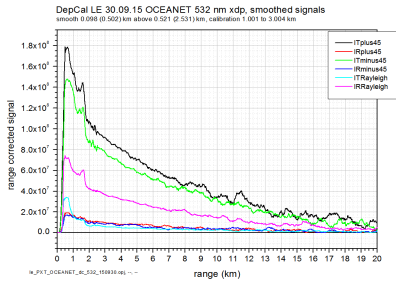


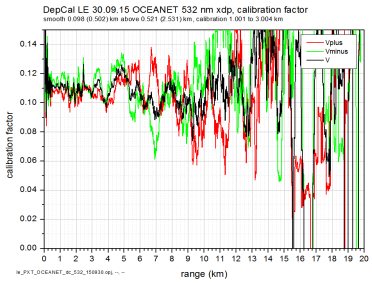
calibration factor

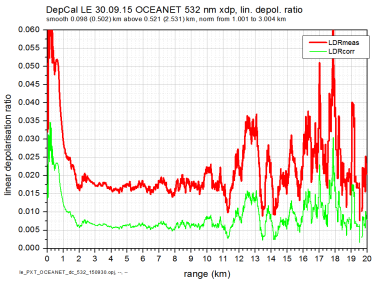


VLDR of Rayleigh data



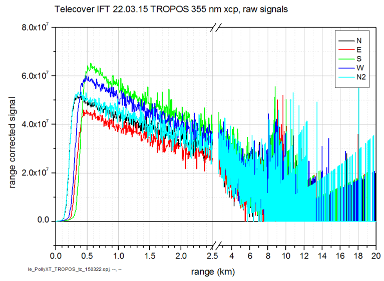


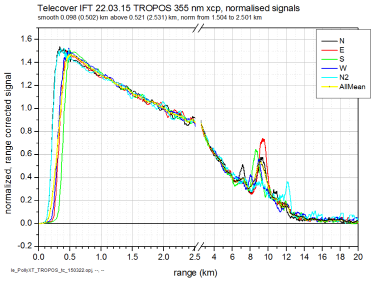


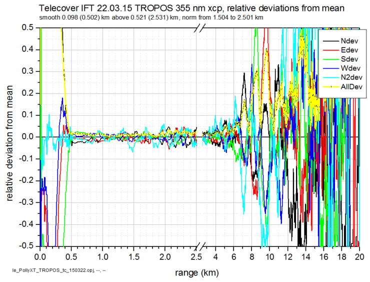


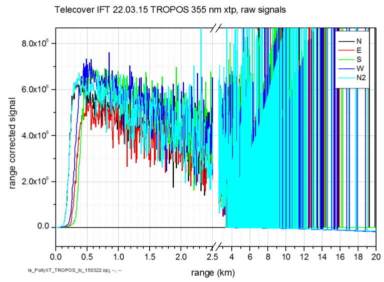
LE Leipzig: POLLY-XT_ TROPOS – Telecover

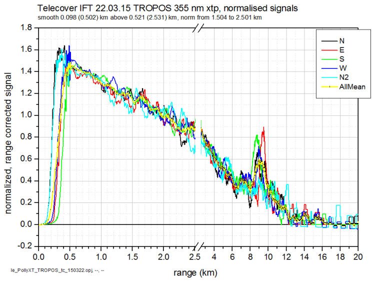
Raw signals	Normalised signals	Relative deviations

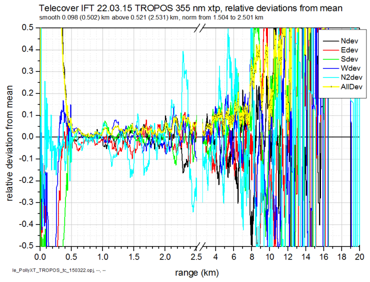


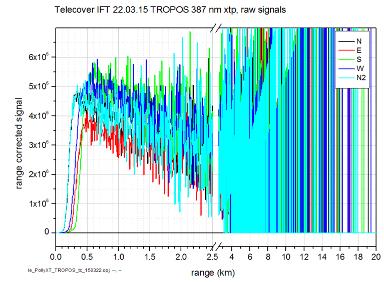


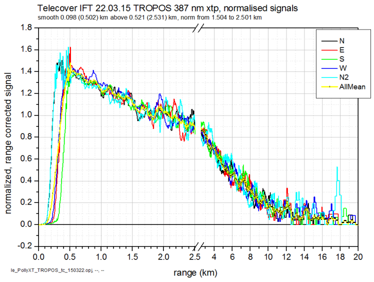


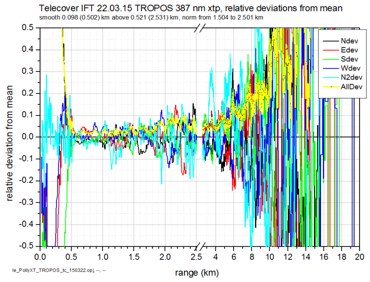


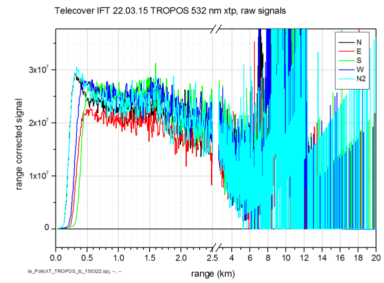


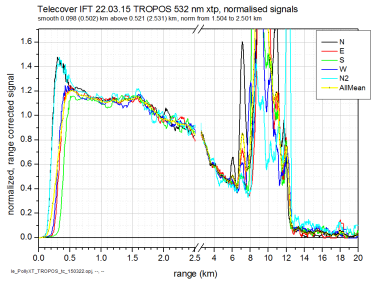


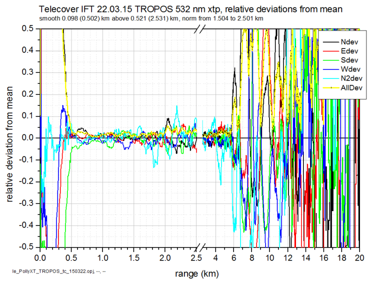


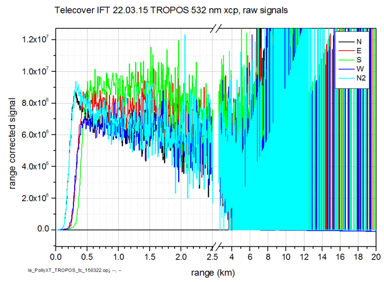


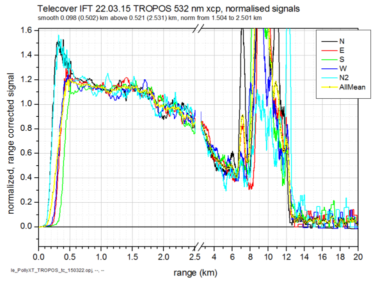


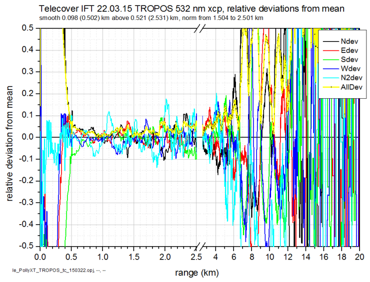


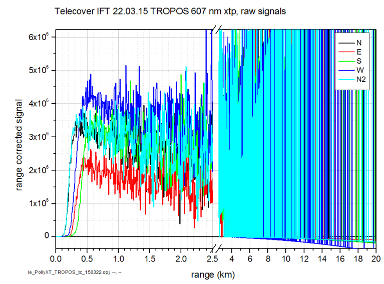


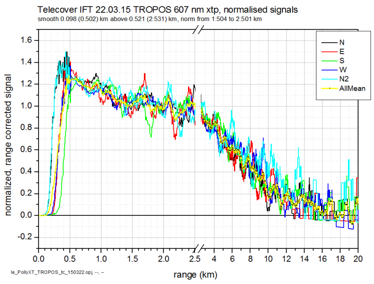


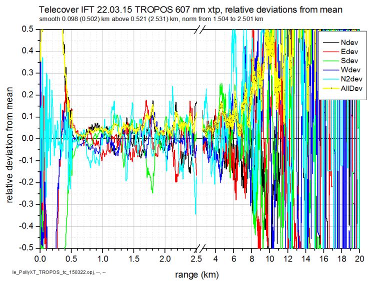


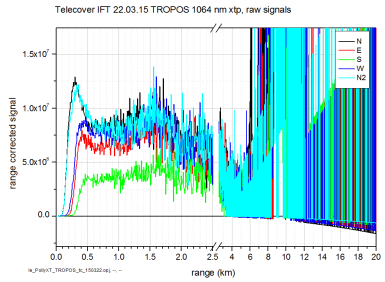


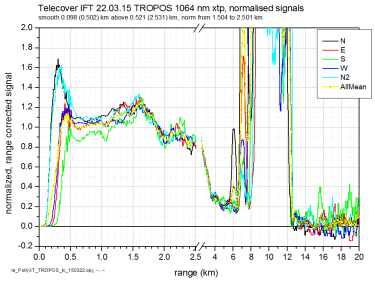


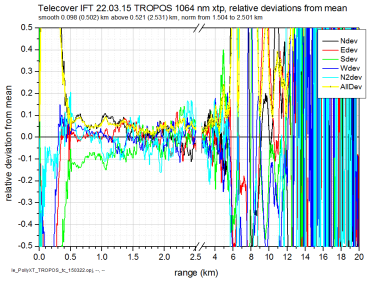







Telecover IFT 22.03.15 TROPOS 1064 nm xtp, raw signals
range corrected signal
range (km)
N
E
S
W
N2

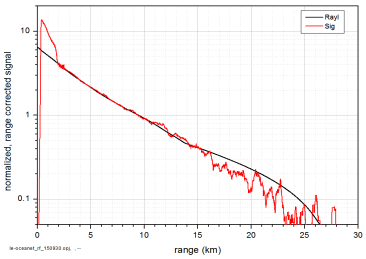

Telecover IFT 22.03.15 TROPOS 1064 nm xtp, normalised signals
smooth 0.098 (0.502) km above 0.521 (2.531) km, norm from 1.504 to 2.501 km
normalized, range corrected signal
range (km)
N
E
S
W
N2
AllMean


Telecover IFT 22.03.15 TROPOS 1064 nm xtp, relative deviations from mean
smooth 0.098 (0.502) km above 0.521 (2.531) km, norm from 1.504 to 2.501 km
relative deviation from mean
range (km)
Ndev
Edev
Sdev
Wdev
N2dev
AllDev

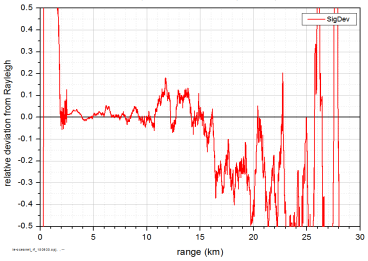
LE Leipzig: POLLY-XT_OCEANET – Rayleigh fit

Normalised signals	Relative deviations

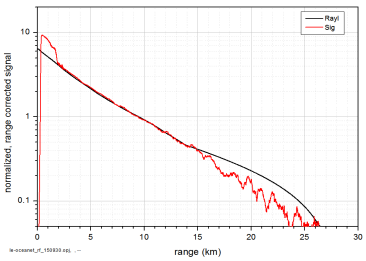
Rayleigh-Fit LE 30.09.15 OCEANET 355 nm xcp, normalised signals



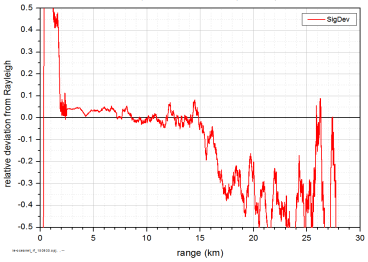
Rayleigh-Fit LE 30.09.15 OCEANET 355 nm xcp, rel. deviations from Rayleigh



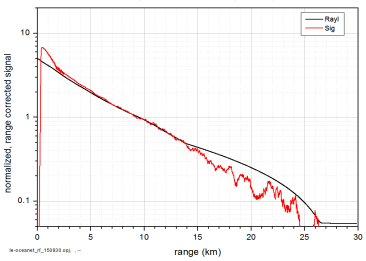
Rayleigh-Fit LE 30.09.15 OCEANET 355 nm xtp, normalised signals



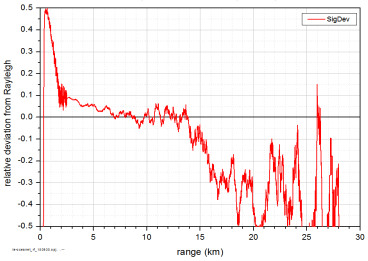
Rayleigh-Fit LE 30.09.15 OCEANET 355 nm xtp, rel. deviations from Rayleigh



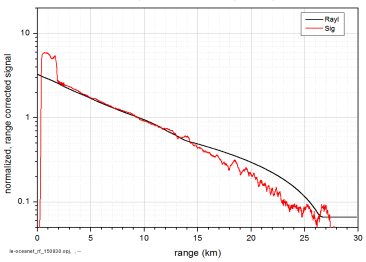
Rayleigh-Fit LE 30.09.15 OCEANET 387 nm xtp, normalised signals



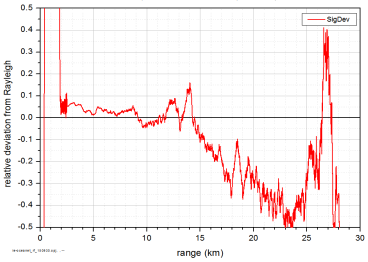
Rayleigh-Fit LE 30.09.15 OCEANET 387 nm xtp, rel. deviations from Rayleigh



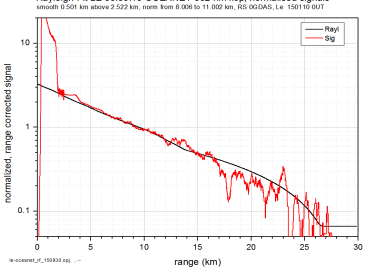
Rayleigh-Fit LE 30.09.15 OCEANET 532 nm xtp, normalised signals



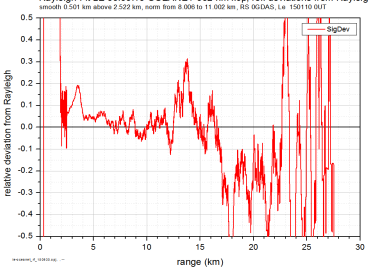
Rayleigh-Fit LE 30.09.15 OCEANET 532 nm xtp, rel. deviations from Rayleigh



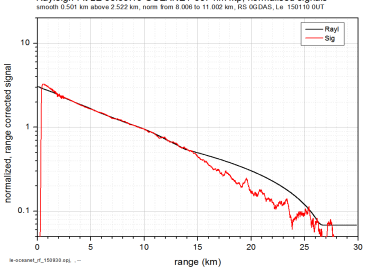
Rayleigh-Fit LE 30.09.15 OCEANET 532 nm xcp, normalised signals



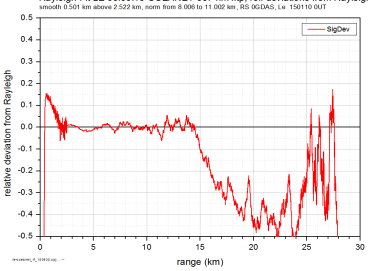
Rayleigh-Fit LE 30.09.15 OCEANET 532 nm xcp, rel. deviations from Rayleigh

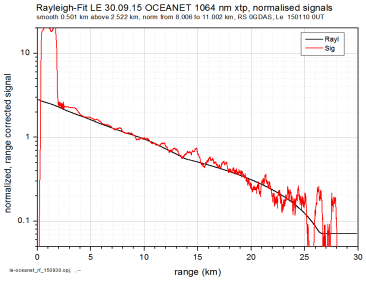


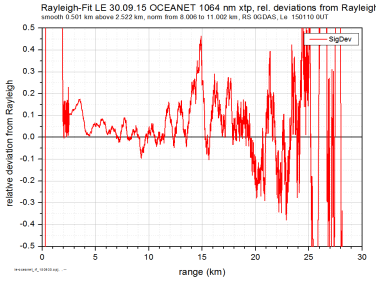
Rayleigh-Fit LE 30.09.15 OCEANET 607 nm xtp, normalised signals



Rayleigh-Fit LE 30.09.15 OCEANET 607 nm xtp, rel. deviations from Rayleigh

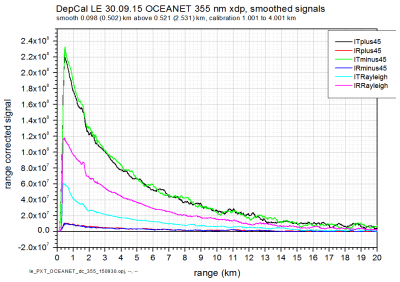




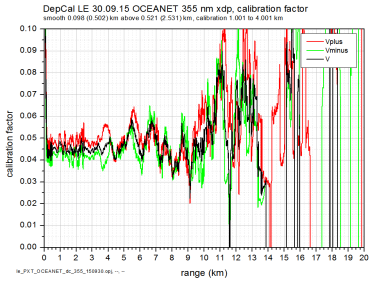


LE Leipzig: POLLY-XT_ OCEANET – Polarisation calibration – pol. filter

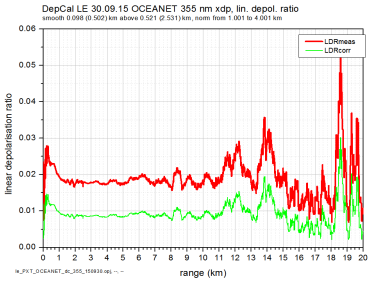
range corrected calibration signals

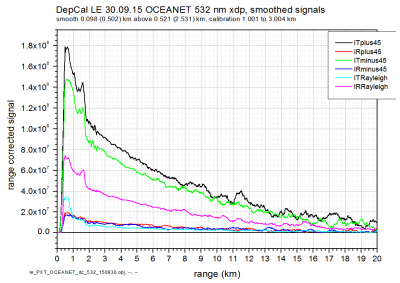


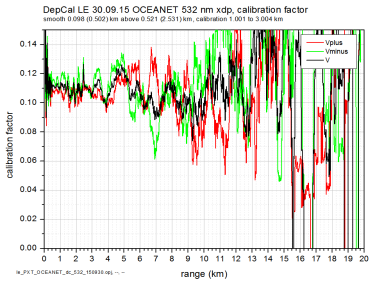
calibration factor

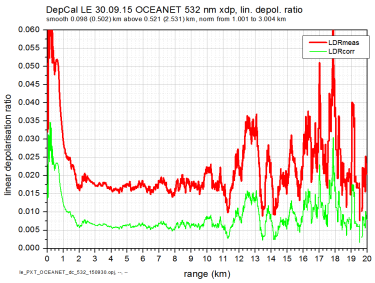


VLDR of Rayleigh data



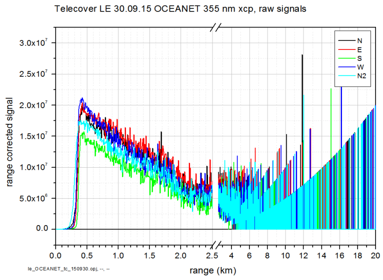


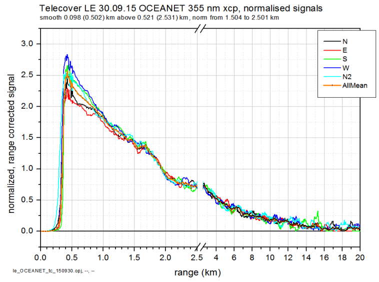


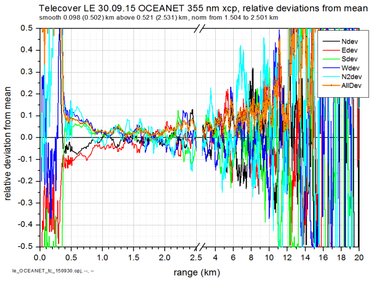


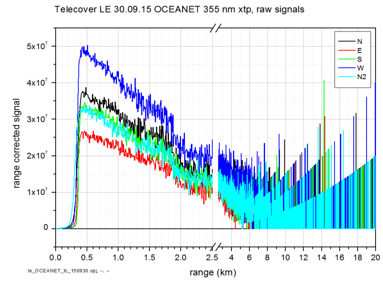
LE Leipzig: POLLY-XT_ OCEANET – Telecover

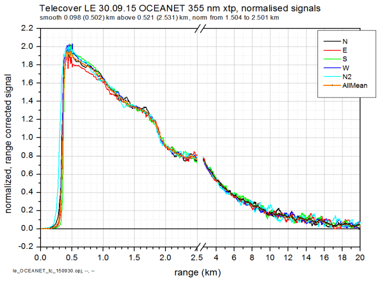
Raw signals	Normalised signals	Relative deviations

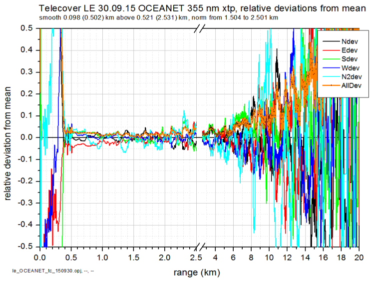


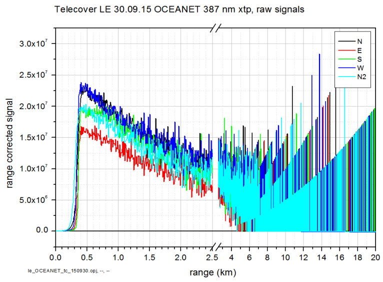


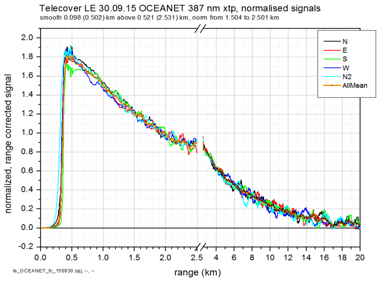


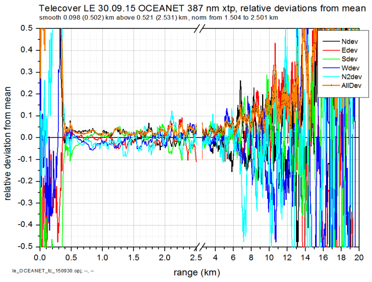


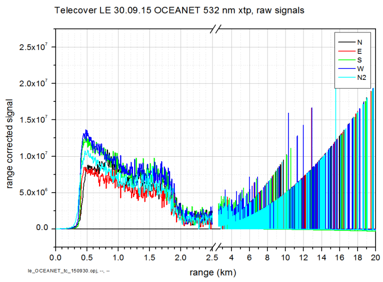


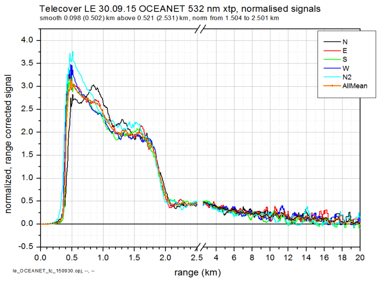


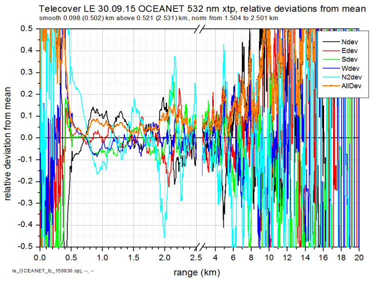


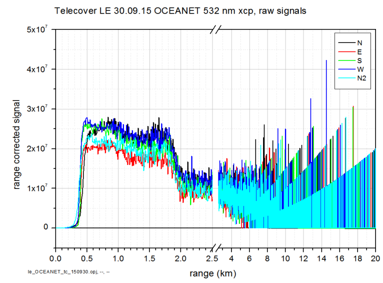


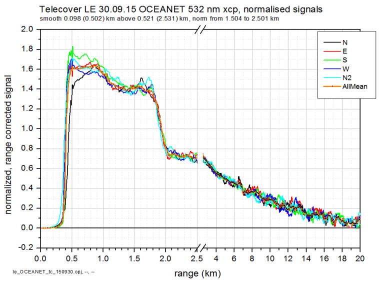


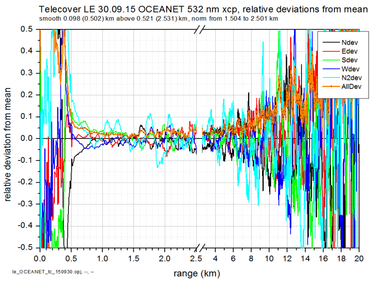


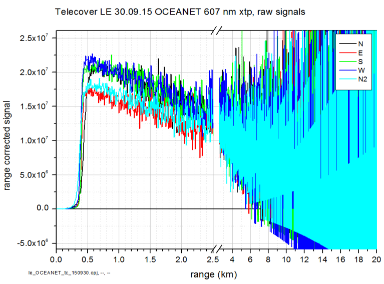


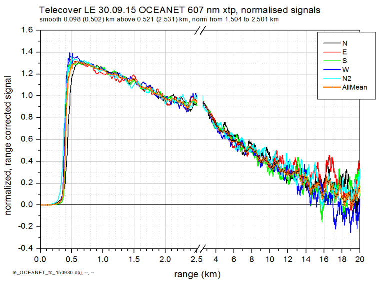


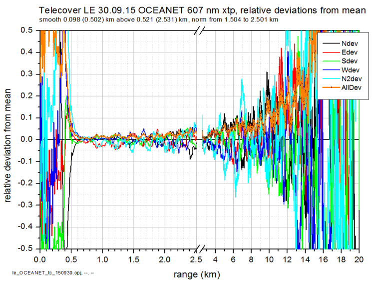


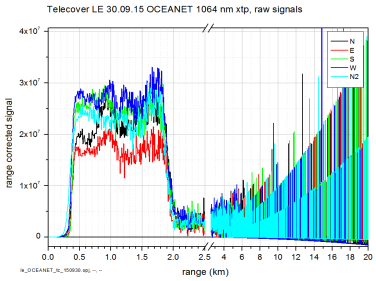


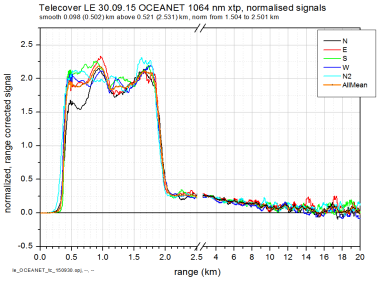


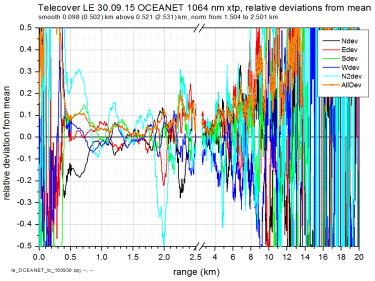






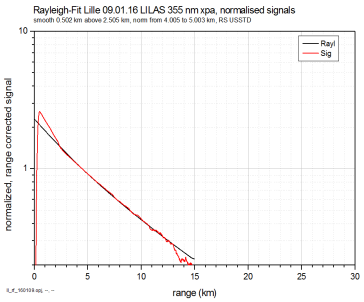

Telecover LE 30.09.15 OCEANET 1064 nm xtp, raw signals
range corrected signal
range (km)
N
E
S
W
NZ

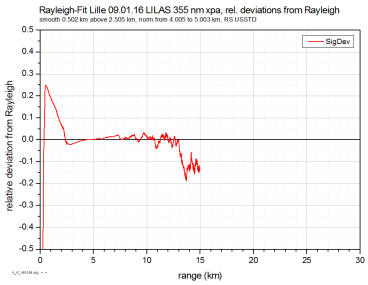

Telecover LE 30.09.15 OCEANET 1064 nm xtp, normalised signals
smooth 0.098 (0.502) km above 0.521 (2.531) km, norm from 1.504 to 2.501 km
normalized, range corrected signal
range (km)
N
E
S
W
NZ
AllMean

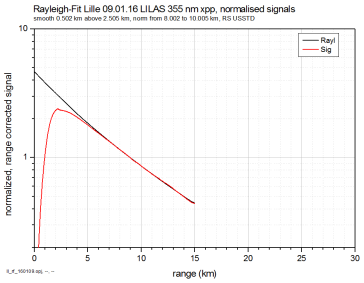

Telecover LE 30.09.15 OCEANET 1064 nm xtp, relative deviations from mean
smooth 0.098 (0.502) km above 0.521 (2.531) km, norm from 1.504 to 2.501 km
relative deviation from mean
range (km)
Ndev
Edev
Sdev
Wdev
NZdev
AllDev

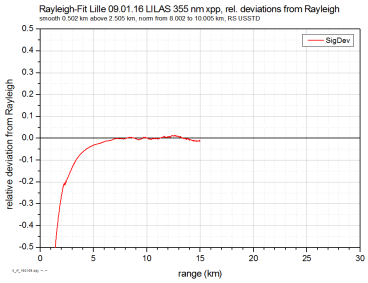
LL Lille (Mbour): LILAS – Rayleigh fit

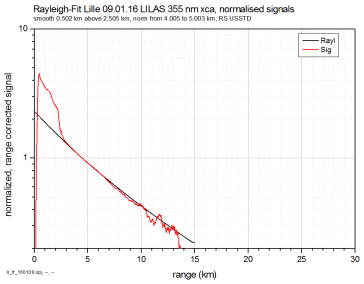
Normalised signals	Relative deviations

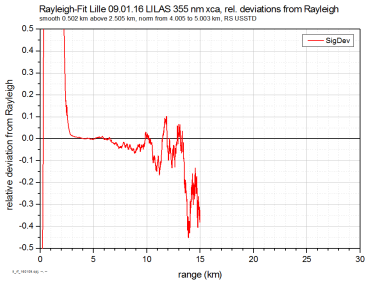


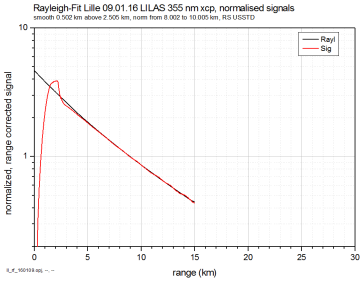


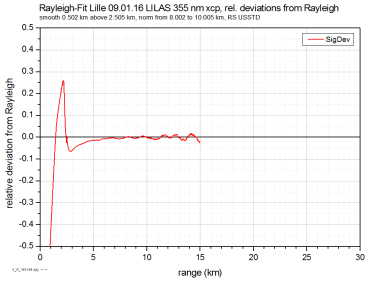


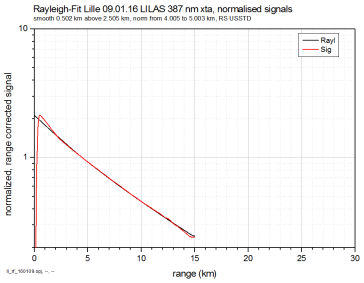


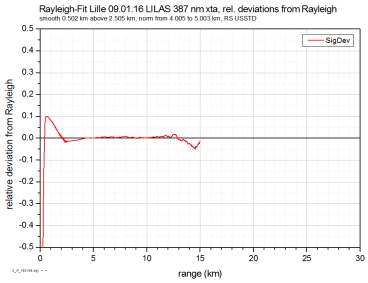


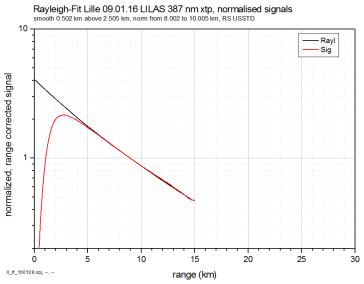


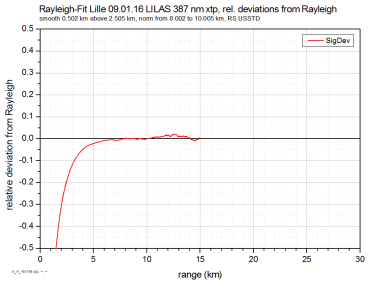


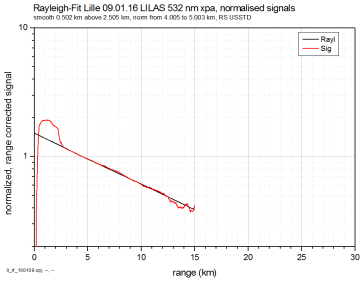


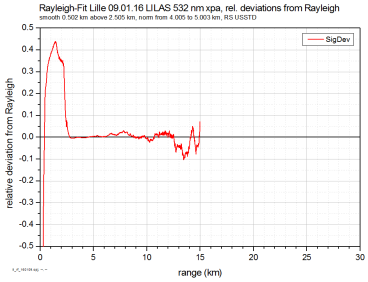


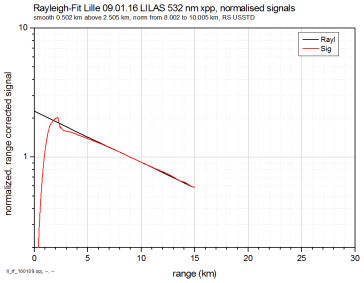


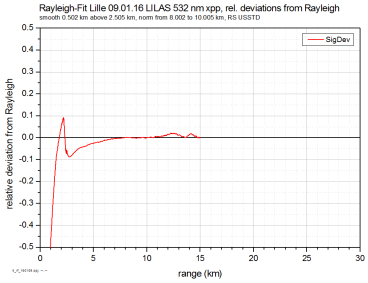


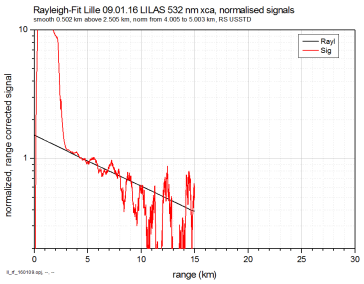


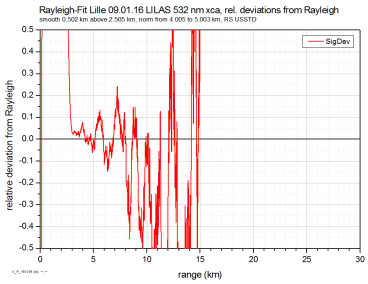

Rayleigh-Fit Lille 09.01.16 LILAS 532 nm xpa, normalised signals
smooth 0.502 km above 2.505 km, norm from 4.005 to 5.003 km, RS USSTD
Rayl
Sig
normalized, range corrected signal
range (km)

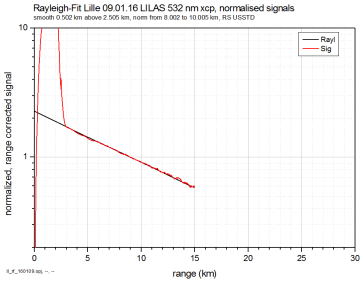

Rayleigh-Fit Lille 09.01.16 LILAS 532 nm xpa, rel. deviations from Rayleigh
smooth 0.502 km above 2.505 km, norm from 4.005 to 5.003 km, RS USSTD
SigDev
relative deviation from Rayleigh
range (km)

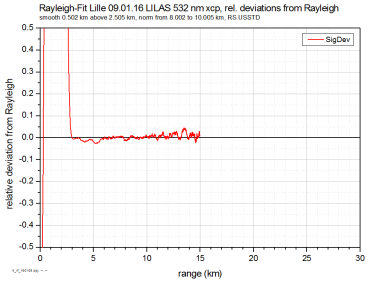

Rayleigh-Fit Lille 09.01.16 LILAS 532 nm xpp, normalised signals
smooth 0.502 km above 2.505 km, norm from 8.002 to 10.005 km, RS USSTD
Rayl
Sig
normalized, range corrected signal
range (km)

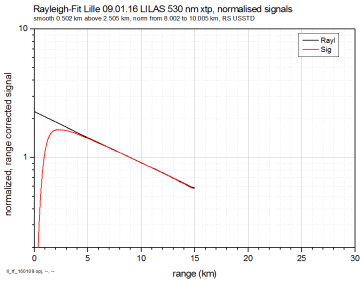

Rayleigh-Fit Lille 09.01.16 LILAS 532 nm xpp, rel. deviations from Rayleigh
smooth 0.502 km above 2.505 km, norm from 8.002 to 10.005 km, RS USSTD
SigDev
relative deviation from Rayleigh
range (km)

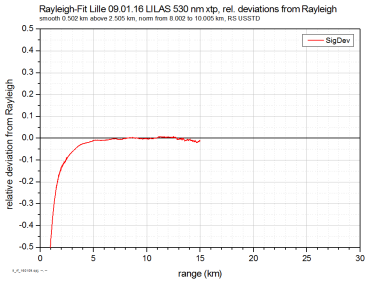

Rayleigh-Fit Lille 09.01.16 LILAS 532 nm xca, normalised signals
smooth 0.502 km above 2.505 km, norm from 4.005 to 5.003 km, RS USSTD
Rayl
Sig
normalized, range corrected signal
range (km)

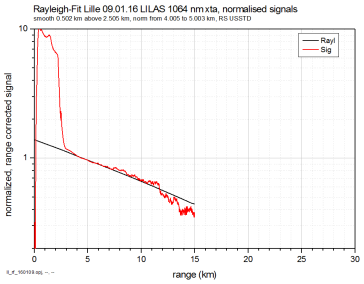

Rayleigh-Fit Lille 09.01.16 LILAS 532 nm xca, rel. deviations from Rayleigh
smooth 0.502 km above 2.505 km, norm from 4.005 to 5.003 km, RS USSTD
SigDev
relative deviation from Rayleigh
range (km)

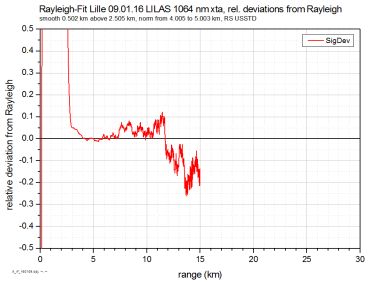

Rayleigh-Fit Lille 09.01.16 LILAS 532 nm xcp, normalised signals
smooth 0.502 km above 2.505 km, norm from 8.002 to 10.005 km, RS USSTD
Rayl
Sig
normalized, range corrected signal
range (km)


Rayleigh-Fit Lille 09.01.16 LILAS 532 nm xcp, rel. deviations from Rayleigh
smooth 0.502 km above 2.505 km, norm from 8.002 to 10.005 km, RS USSTD
SigDev
relative deviation from Rayleigh
range (km)


Rayleigh-Fit Lille 09.01.16 LILAS 530 nm xtp, normalised signals
smooth 0.502 km above 2.505 km, norm from 8.002 to 10.005 km, RS USSTD
Rayl
Sig
normalized, range corrected signal
range (km)

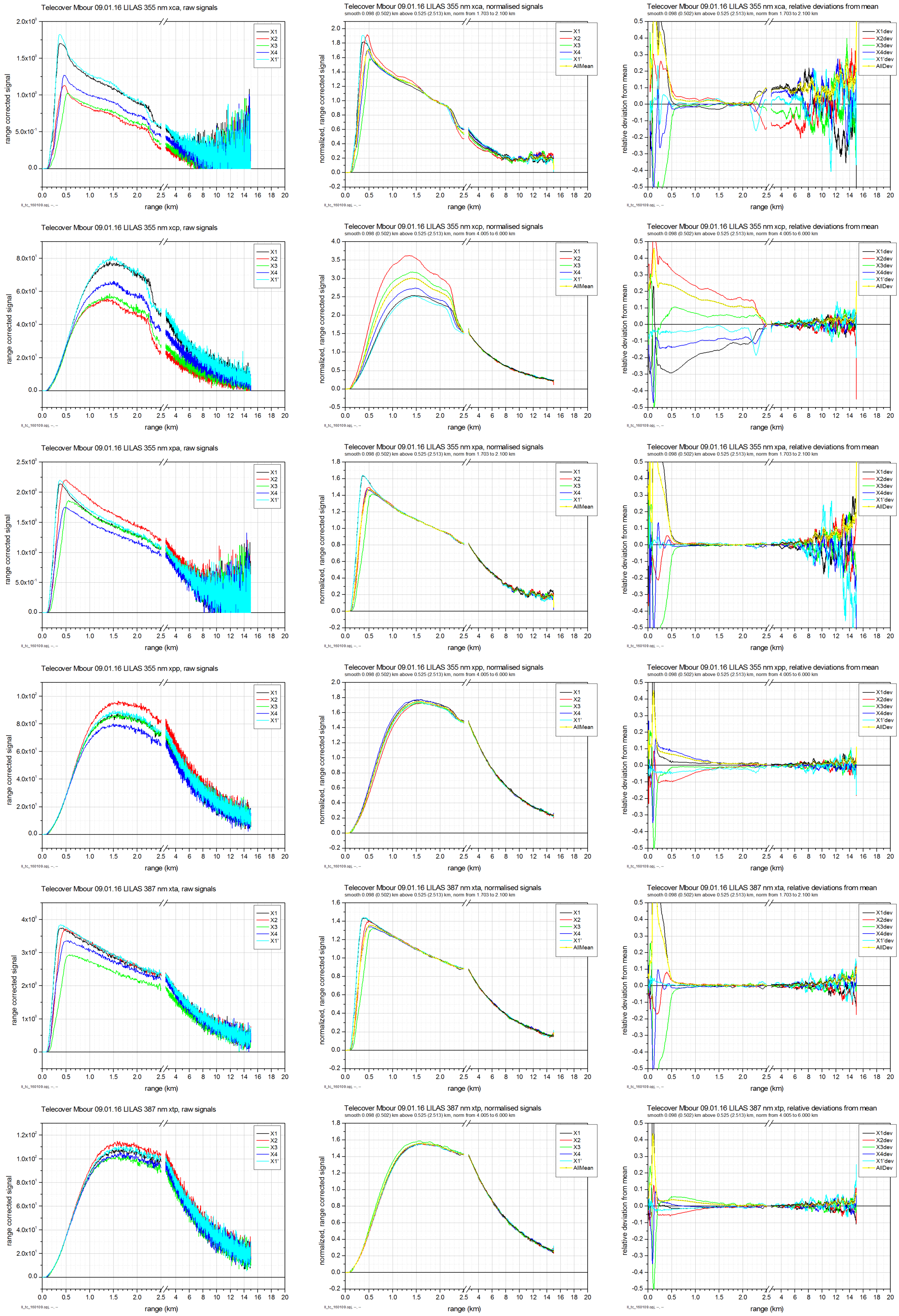

Rayleigh-Fit Lille 09.01.16 LILAS 530 nm xtp, rel. deviations from Rayleigh
smooth 0.502 km above 2.505 km, norm from 8.002 to 10.005 km, RS USSTD
SigDev
relative deviation from Rayleigh
range (km)

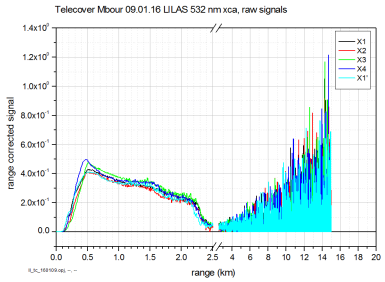

Rayleigh-Fit Lille 09.01.16 LILAS 1064 nm xta, normalised signals
smooth 0.502 km above 2.505 km, norm from 4.005 to 5.003 km, RS USSTD
Rayl
Sig
normalized, range corrected signal
range (km)

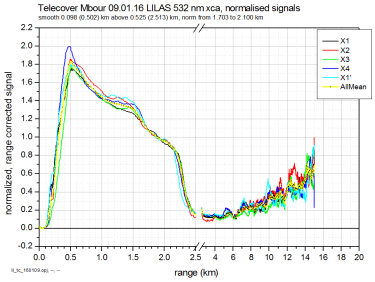

Rayleigh-Fit Lille 09.01.16 LILAS 1064 nm xta, rel. deviations from Rayleigh
smooth 0.502 km above 2.505 km, norm from 4.005 to 5.003 km, RS USSTD
SigDev
relative deviation from Rayleigh
range (km)

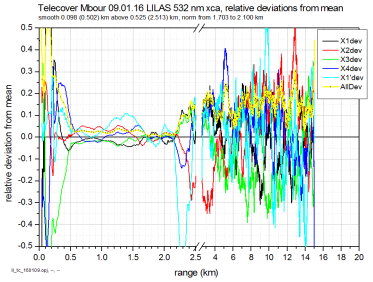
LL Lille (Mbour): LILAS – Telecover

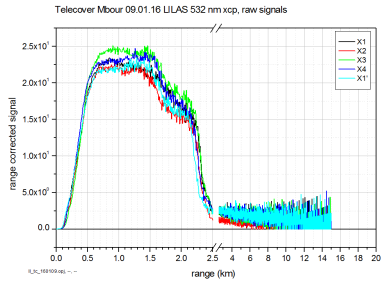
Raw signals	Normalised signals	Relative deviations

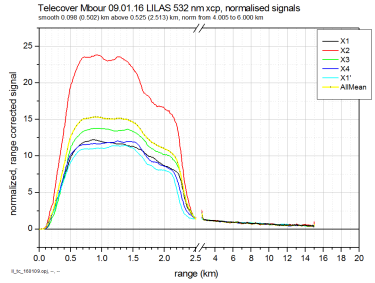


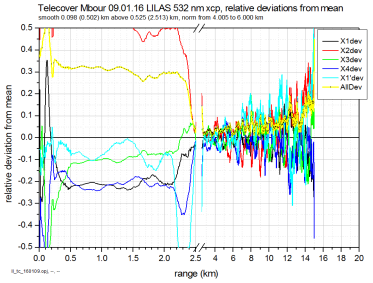

Telecover Mbour 09.01.16 LILAS 532 nm xca, raw signals
range corrected signal
range (km)
X1
X2
X3
X4
X1'

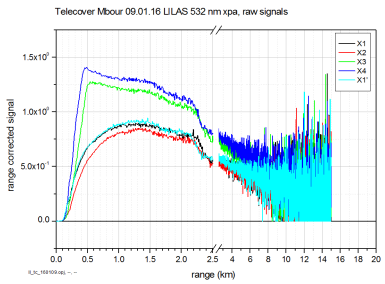

Telecover Mbour 09.01.16 LILAS 532 nm xca, normalised signals
smooth 0.098 (0.502) km above 0.525 (2.513) km, norm from 1.703 to 2.100 km
normalized, range corrected signal
range (km)
X1
X2
X3
X4
X1'
AllMean

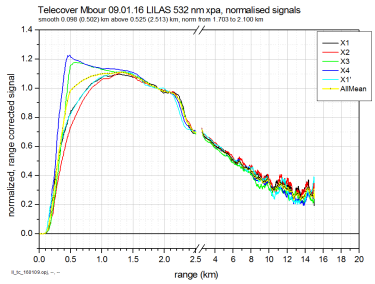

Telecover Mbour 09.01.16 LILAS 532 nm xca, relative deviations from mean
smooth 0.098 (0.502) km above 0.525 (2.513) km, norm from 1.703 to 2.100 km
relative deviation from mean
range (km)
X1dev
X2dev
X3dev
X4dev
X1'dev
AllDev

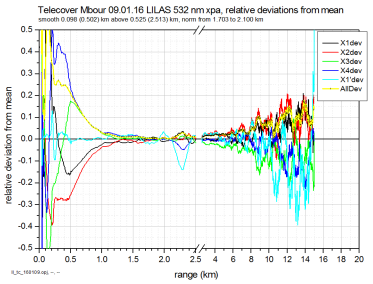

Telecover Mbour 09.01.16 LILAS 532 nm xcp, raw signals
range corrected signal
range (km)
X1
X2
X3
X4
X1'

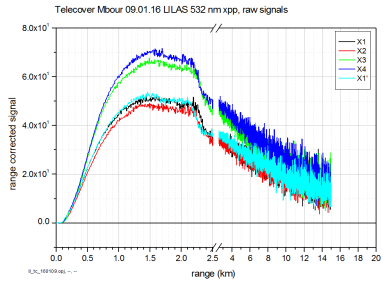

Telecover Mbour 09.01.16 LILAS 532 nm xcp, normalised signals
smooth 0.098 (0.502) km above 0.525 (2.513) km, norm from 4.005 to 6.000 km
normalized, range corrected signal
range (km)
X1
X2
X3
X4
X1'
AllMean

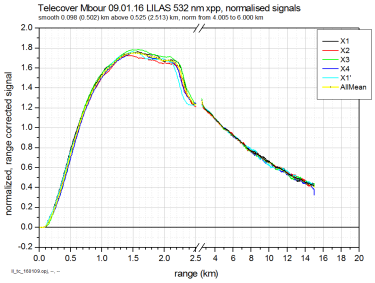

Telecover Mbour 09.01.16 LILAS 532 nm xcp, relative deviations from mean
smooth 0.098 (0.502) km above 0.525 (2.513) km, norm from 4.005 to 6.000 km
relative deviation from mean
range (km)
X1dev
X2dev
X3dev
X4dev
X1'dev
AllDev

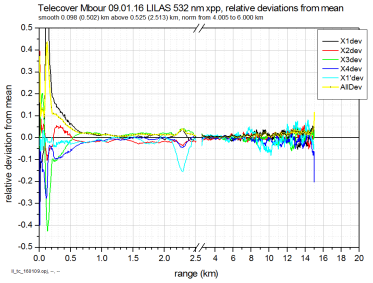

Telecover Mbour 09.01.16 LILAS 532 nm xpa, raw signals
range corrected signal
range (km)
X1
X2
X3
X4
X1'

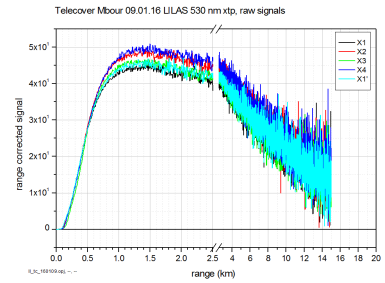

Telecover Mbour 09.01.16 LILAS 532 nm xpa, normalised signals
smooth 0.098 (0.502) km above 0.525 (2.513) km, norm from 1.703 to 2.100 km
normalized, range corrected signal
range (km)
X1
X2
X3
X4
X1'
AllMean

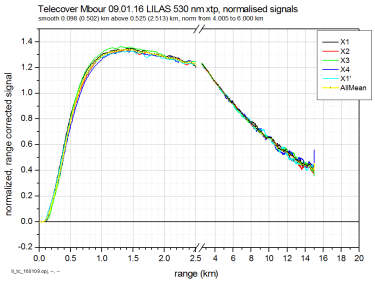

Telecover Mbour 09.01.16 LILAS 532 nm xpa, relative deviations from mean
smooth 0.098 (0.502) km above 0.525 (2.513) km, norm from 1.703 to 2.100 km
relative deviation from mean
range (km)
X1dev
X2dev
X3dev
X4dev
X1'dev
AllDev

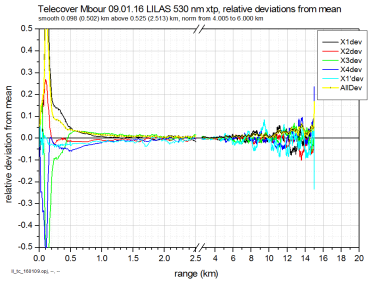

Telecover Mbour 09.01.16 LILAS 532 nm xpp, raw signals
range corrected signal
range (km)
X1
X2
X3
X4
X1'

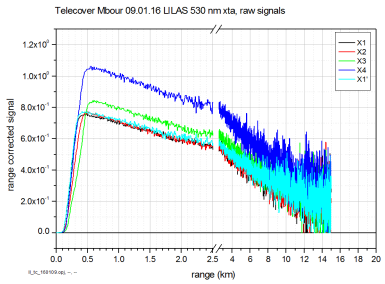

Telecover Mbour 09.01.16 LILAS 532 nm xpp, normalised signals
smooth 0.098 (0.502) km above 0.525 (2.513) km, norm from 4.005 to 6.000 km
normalized, range corrected signal
range (km)
X1
X2
X3
X4
X1'
AllMean

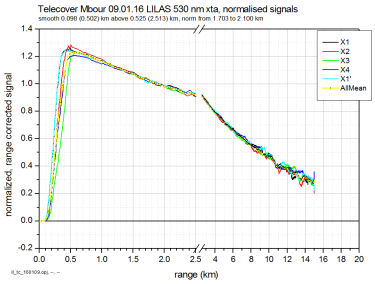

Telecover Mbour 09.01.16 LILAS 532 nm xpp, relative deviations from mean
smooth 0.098 (0.502) km above 0.525 (2.513) km, norm from 4.005 to 6.000 km
relative deviation from mean
range (km)
X1dev
X2dev
X3dev
X4dev
X1'dev
AllDev

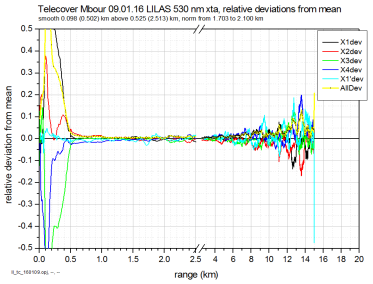

Telecover Mbour 09.01.16 LILAS 530 nm xtp, raw signals
range corrected signal
range (km)
X1
X2
X3
X4
X1'

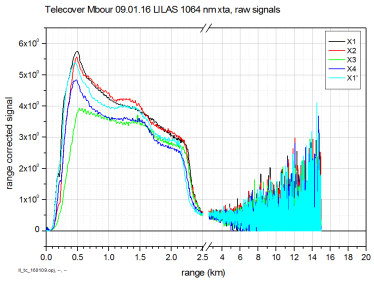

Telecover Mbour 09.01.16 LILAS 530 nm xtp, normalised signals
smooth 0.098 (0.502) km above 0.525 (2.513) km, norm from 4.005 to 6.000 km
normalized, range corrected signal
range (km)
X1
X2
X3
X4
X1'
AllMean

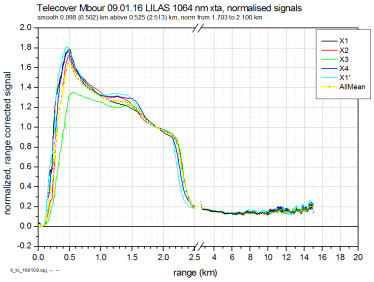

Telecover Mbour 09.01.16 LILAS 530 nm xtp, relative deviations from mean
smooth 0.098 (0.502) km above 0.525 (2.513) km, norm from 4.005 to 6.000 km
relative deviation from mean
range (km)
X1dev
X2dev
X3dev
X4dev
X1'dev
AllDev

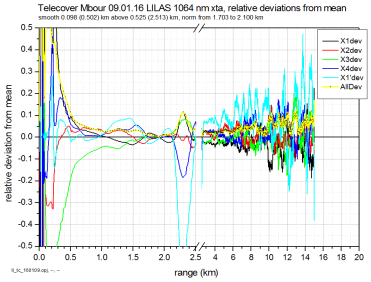

Telecover Mbour 09.01.16 LILAS 530 nm xta, raw signals
range corrected signal
range (km)
X1
X2
X3
X4
X1'


Telecover Mbour 09.01.16 LILAS 530 nm xta, normalised signals
smooth 0.098 (0.502) km above 0.525 (2.513) km, norm from 1.703 to 2.100 km
normalized, range corrected signal
range (km)
X1
X2
X3
X4
X1'
AllMean

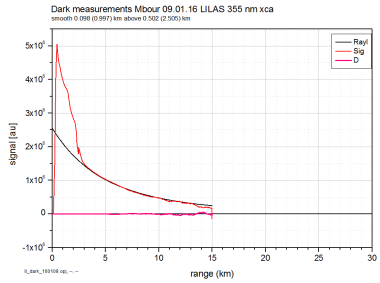

Telecover Mbour 09.01.16 LILAS 530 nm xta, relative deviations from mean
smooth 0.098 (0.502) km above 0.525 (2.513) km, norm from 1.703 to 2.100 km
relative deviation from mean
range (km)
X1dev
X2dev
X3dev
X4dev
X1'dev
AllDev

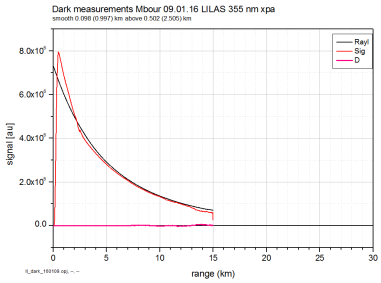


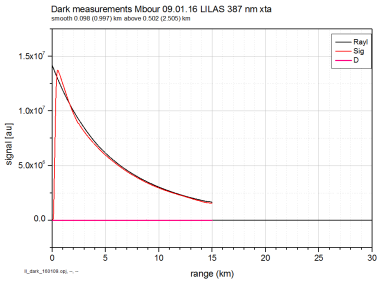


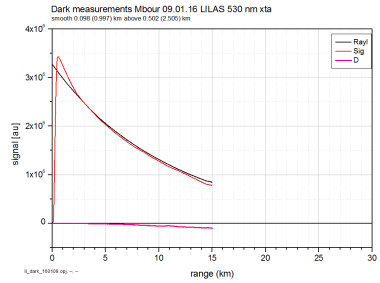


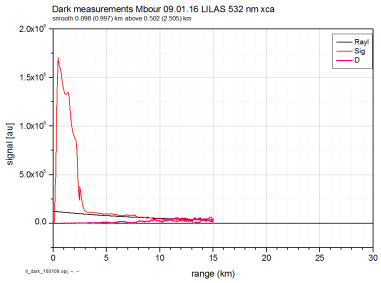
LL Lille (Mbour): LILAS – Dark Measurements

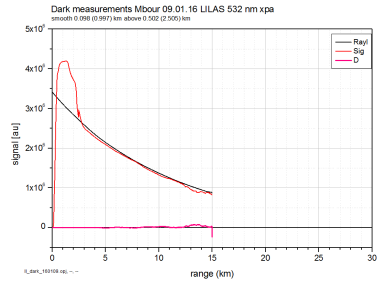


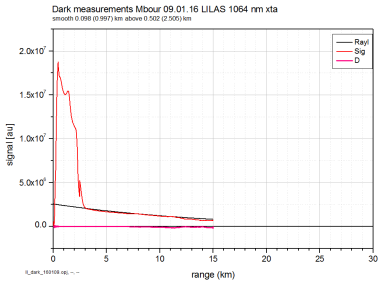






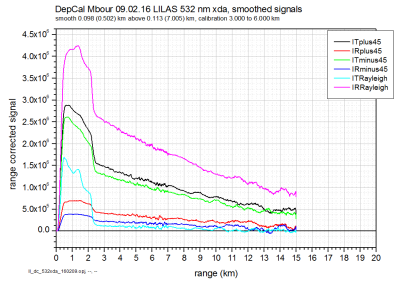


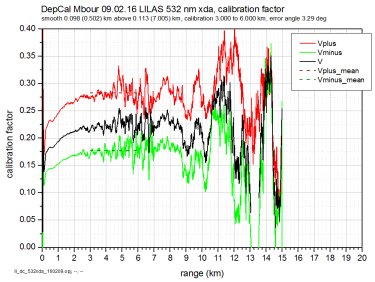


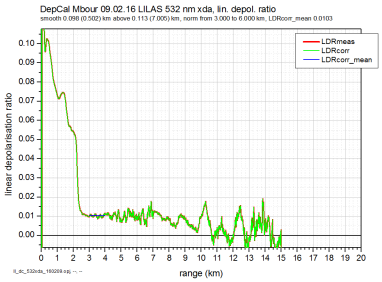


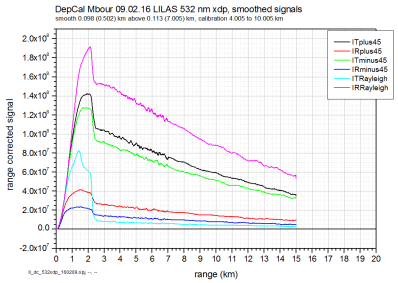
LL Lille (Mbour): LILAS – Polarisation calibration 09.02.16– Linear polarization filter ±45°

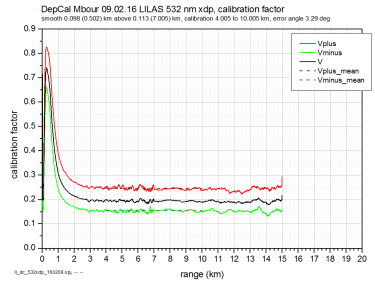
range corrected calibration signals | calibration factor | VLDR of Rayleigh data

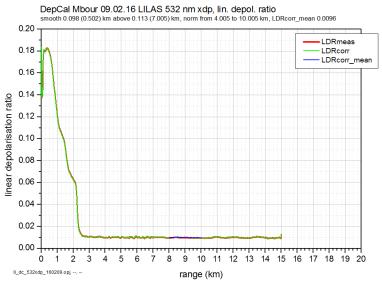




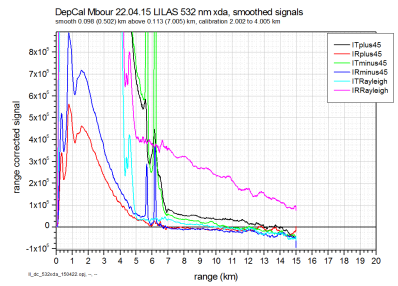


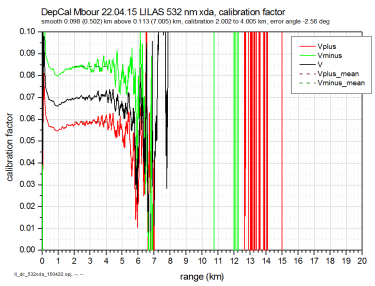


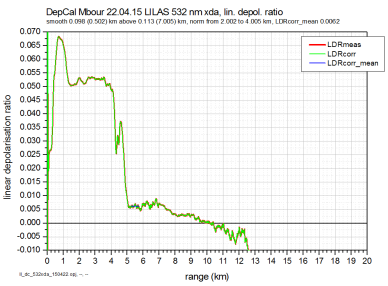


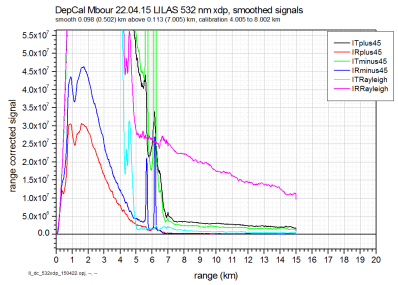


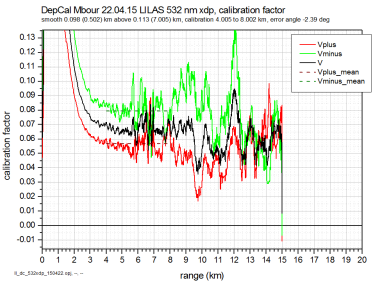
LL Lille (Mbour): LILAS – Polarisation calibration 22.04.15– Linear polarization filter ±45°

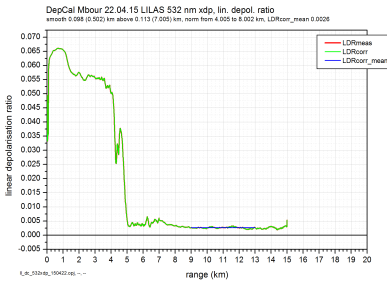






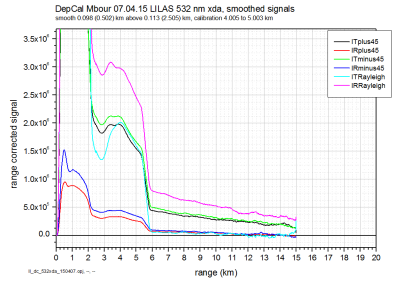


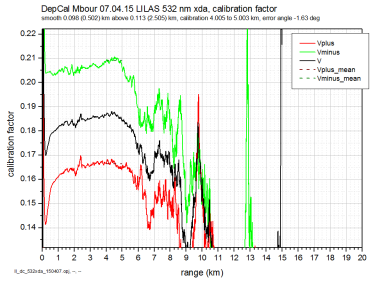


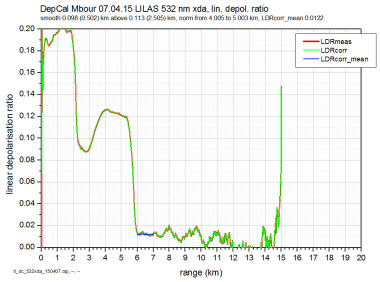


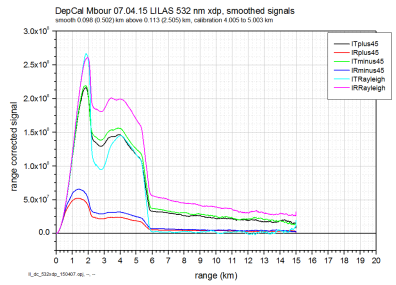
LL Lille (Mbour): LILAS – Polarisation calibration 07.04.15– Linear polarization filter ±45°

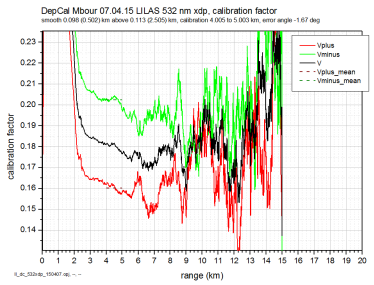
range corrected calibration signals | calibration factor | VLDR of Rayleigh data

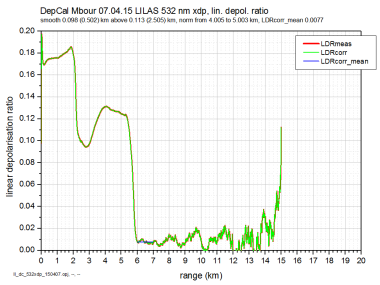




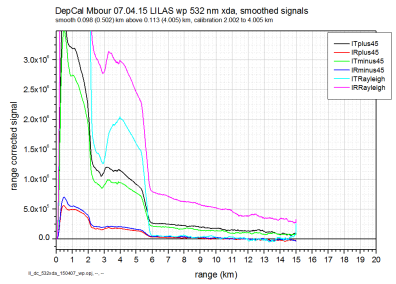


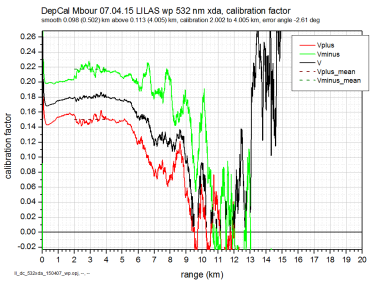


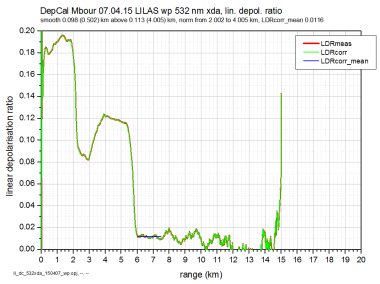


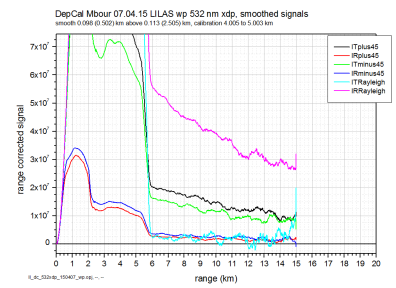


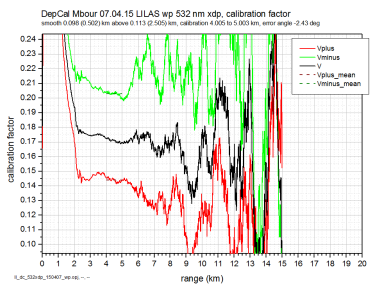
LL Lille (Mbour): LILAS – Polarisation calibration 07.04.15– HWP ±45°

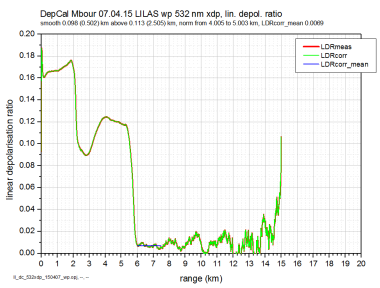






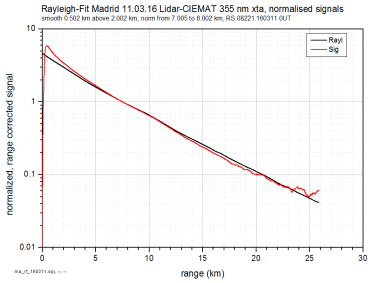


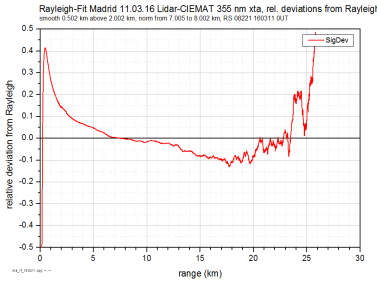


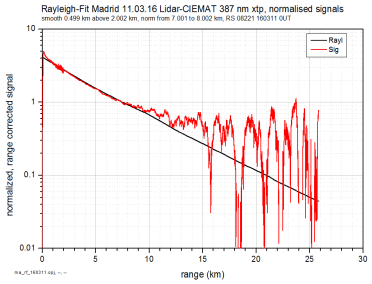


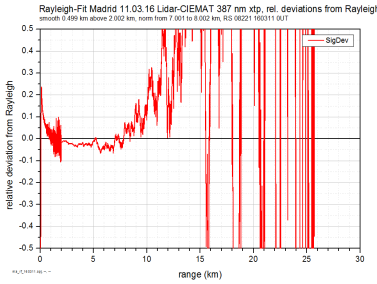
MA Madrid: Lidar-CIEMAT – Rayleigh Fit

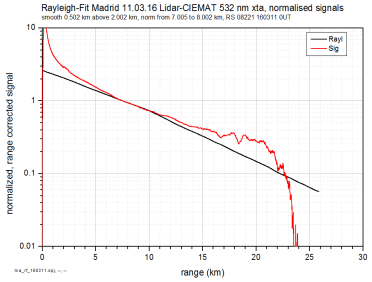
Normalised signals	Relative deviations

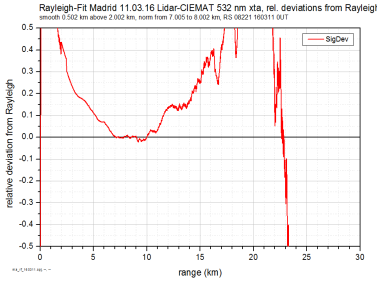


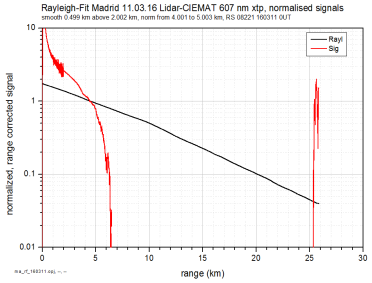


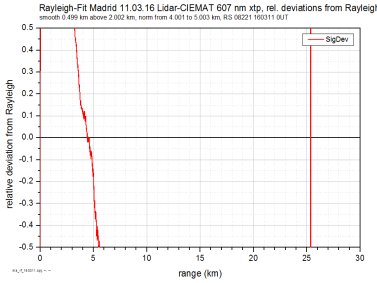


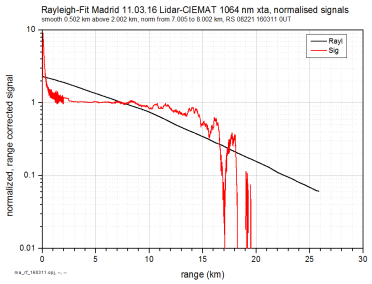


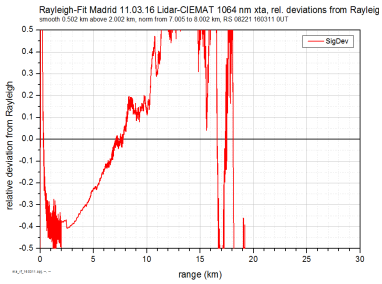




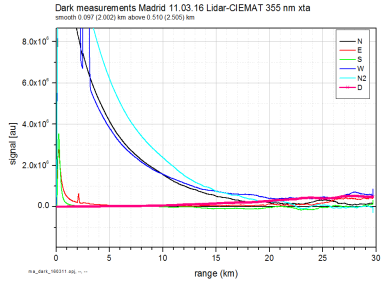


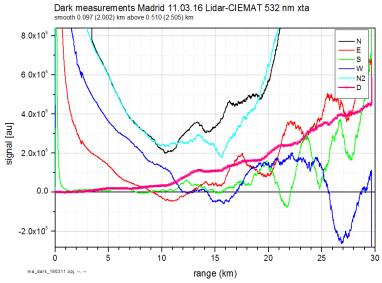


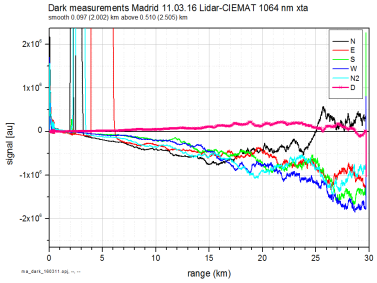




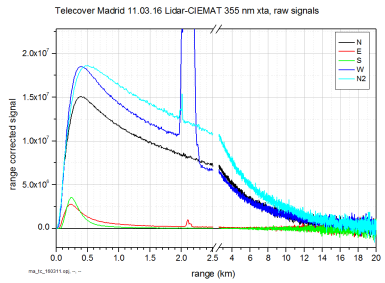
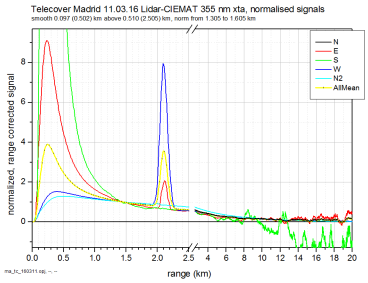
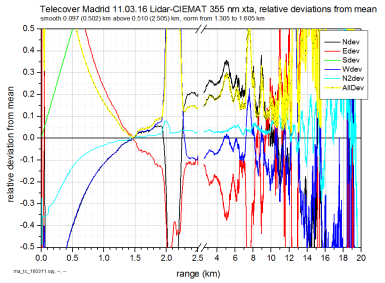
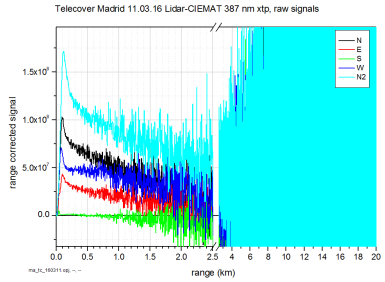
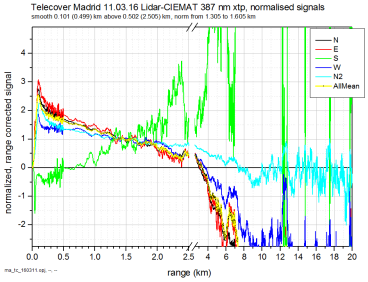
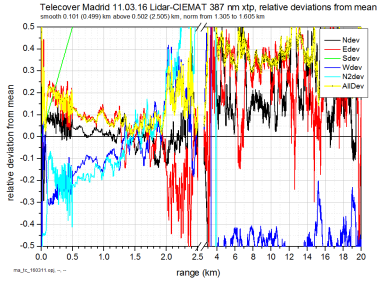
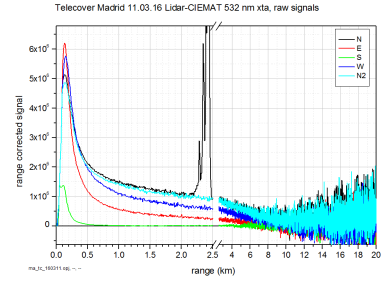
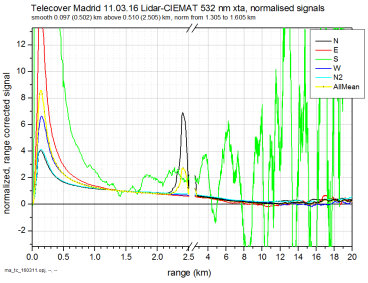
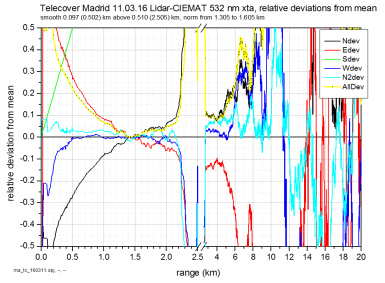
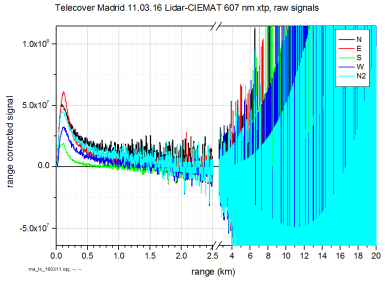
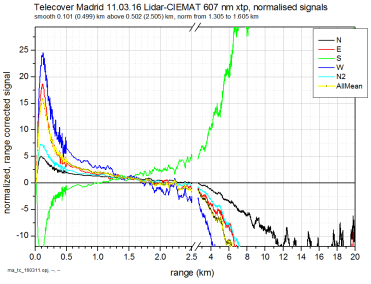
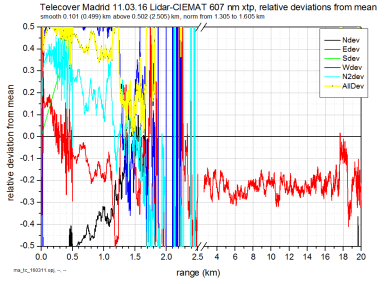
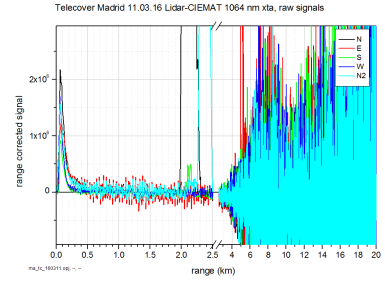
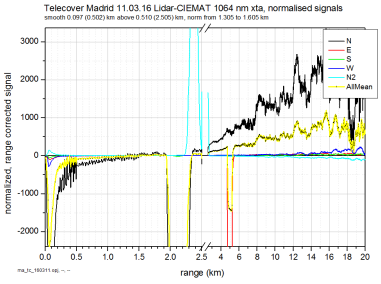
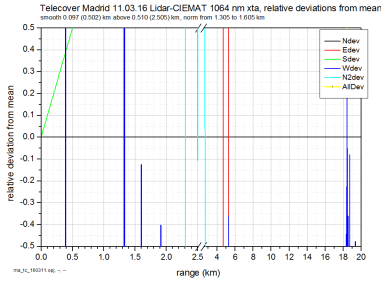
MA Madrid: Lidar-CIEMAT – Dark Measurements





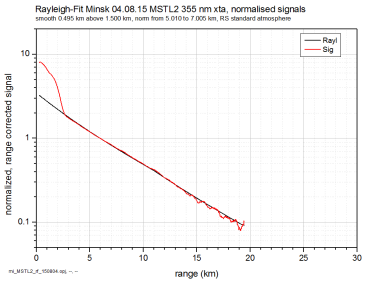


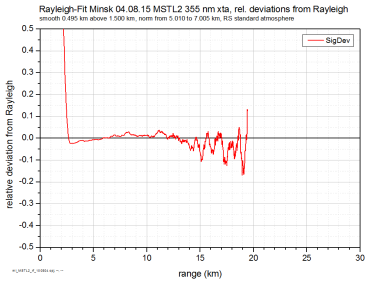
MA Madrid: Lidar-CIEMAT – Telecover

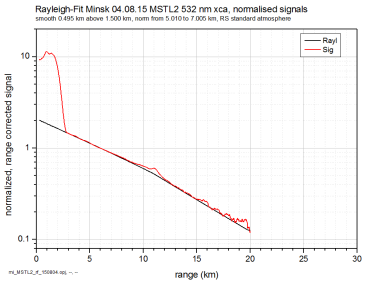
Raw signals	Normalised signals	Relative deviations
		
		
		
		
		

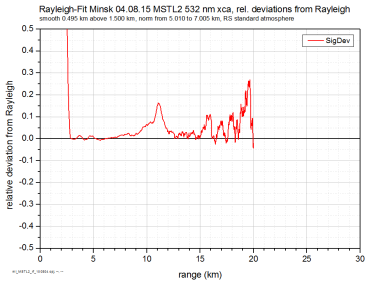
MI Minsk: MSTL-2 – Rayleigh fit

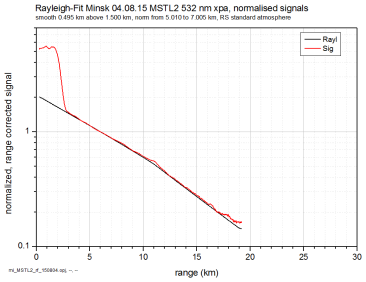
Normalised signals	Relative deviations

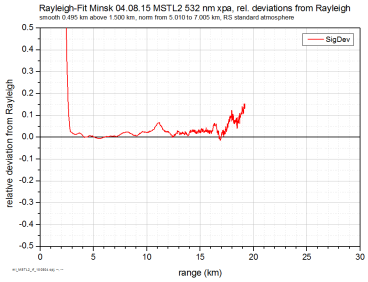


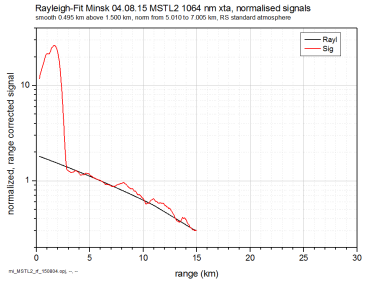


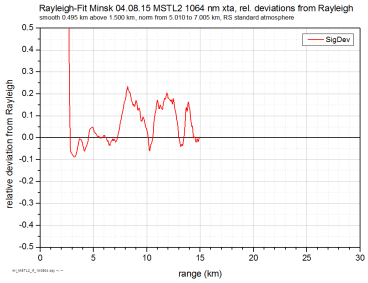




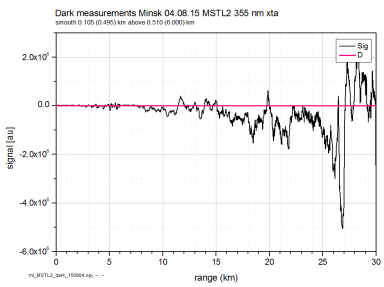


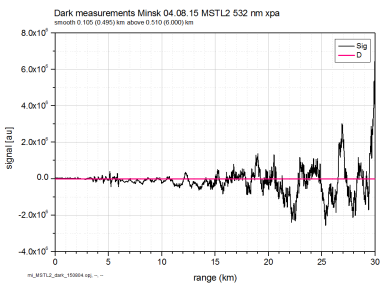


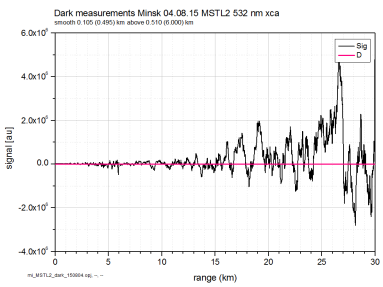


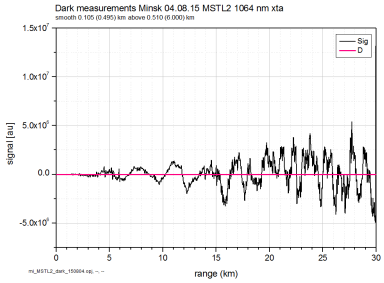


MI Minsk: MSTL-2 – Dark Measurements

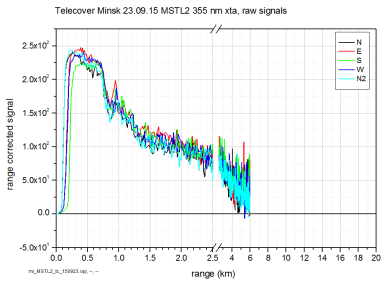
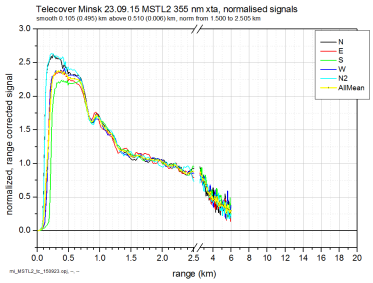
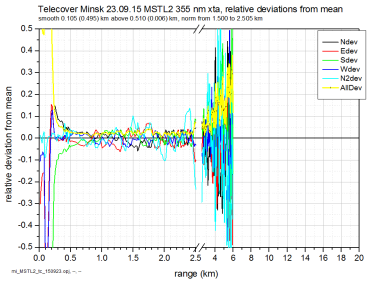
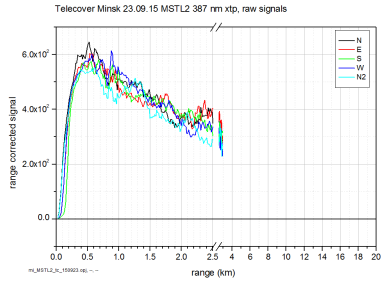
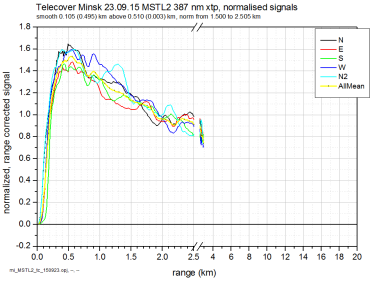
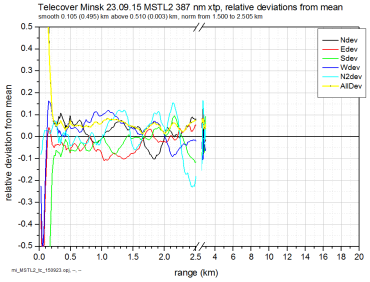
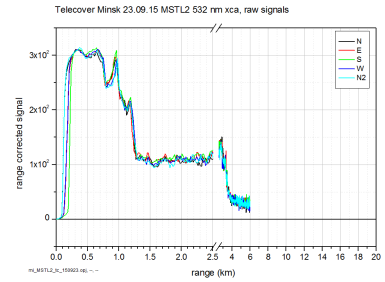
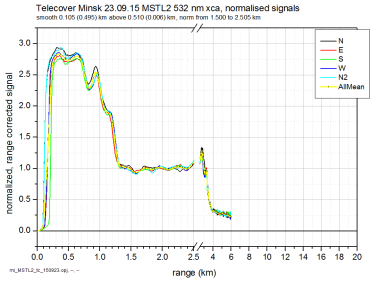
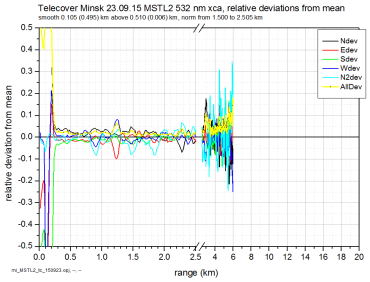
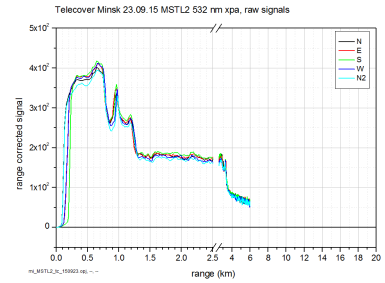
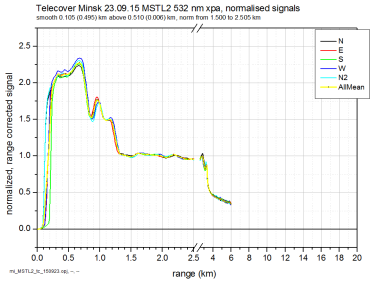
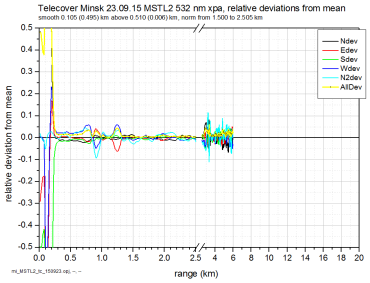
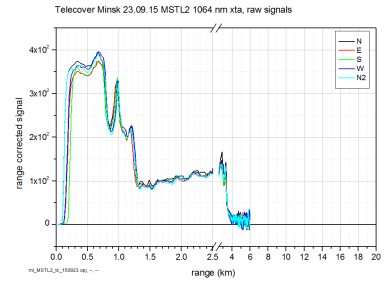
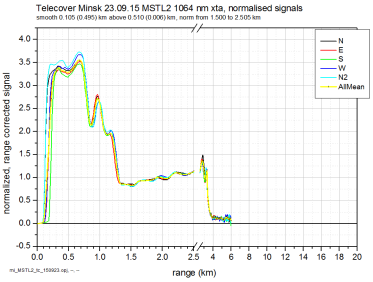
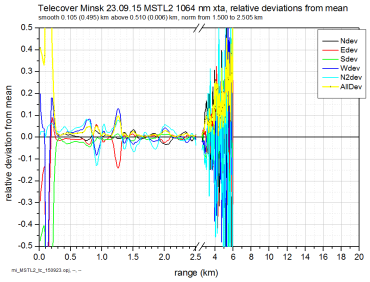






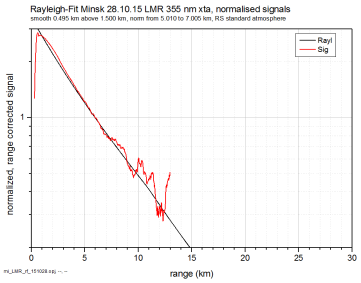

Dark measurements Minsk 04.08.15 MSTL2 1064 nm xta
smooth 0.105 (0.495) km above 0.510 (0.000) km
Sig
D
signals [au]
range (km)
1.5x10^7
1.0x10^7
5.0x10^6
0.0
-5.0x10^6
0
5
10
15
20
25
30

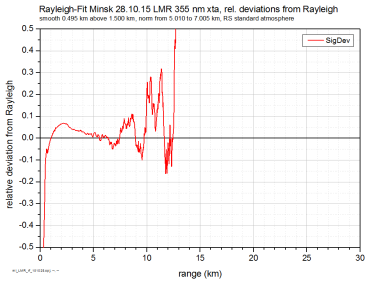
MI Minsk: MSTL-2 – Telecover

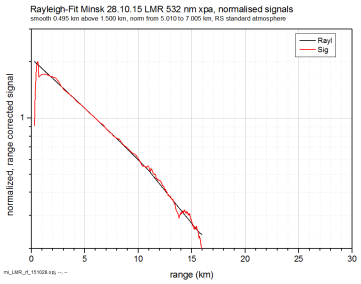
Raw signals	Normalised signals	Relative deviations
		
		
		
		
		

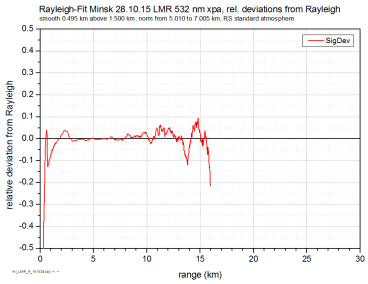
MI Minsk: LMR-mobile – Rayleigh fit

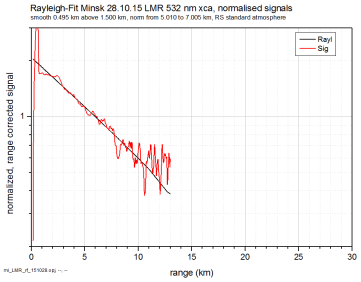
Normalised signals | Relative deviations

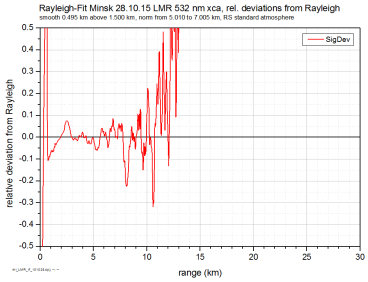


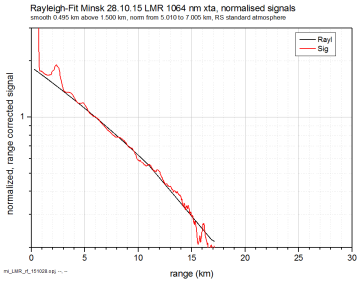


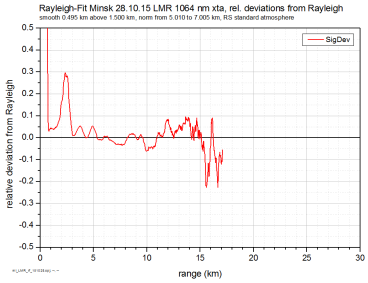




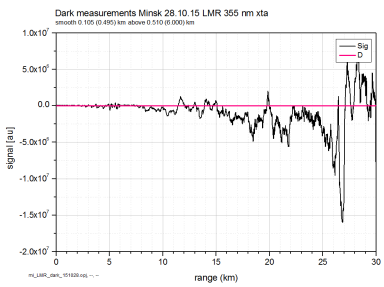


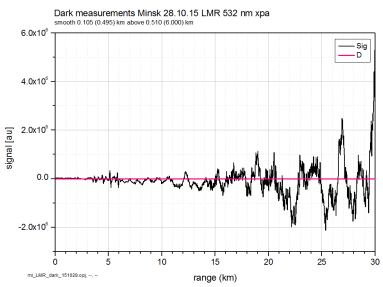


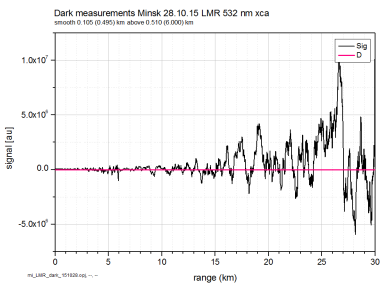


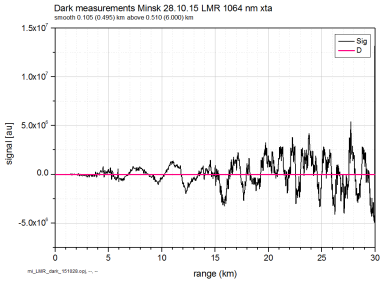


MI Minsk: LMR-mobile – Dark Measurements

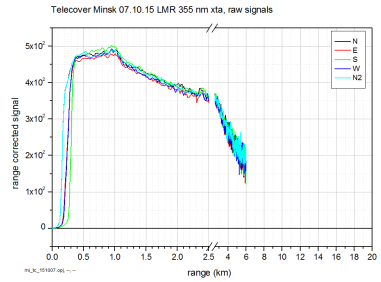
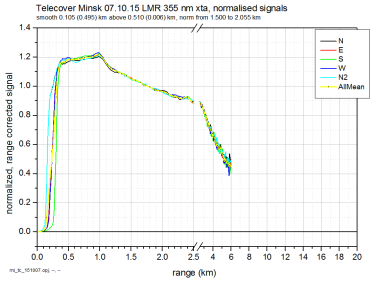
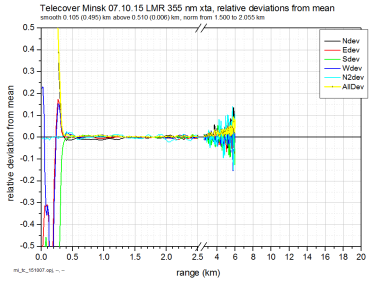
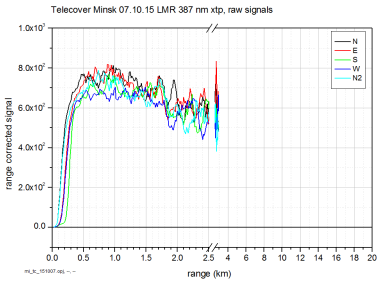
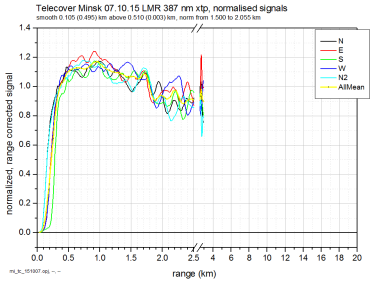
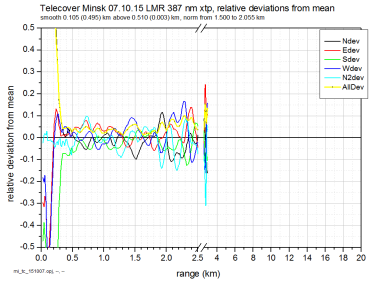
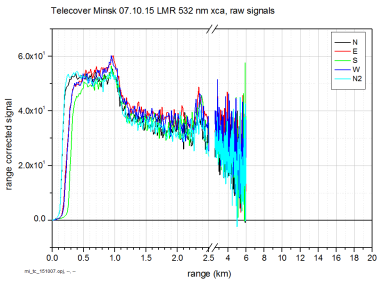
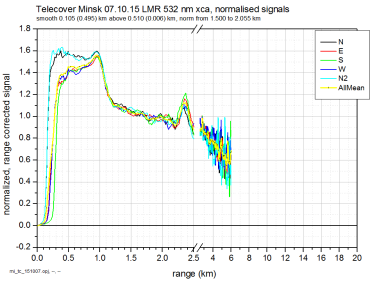
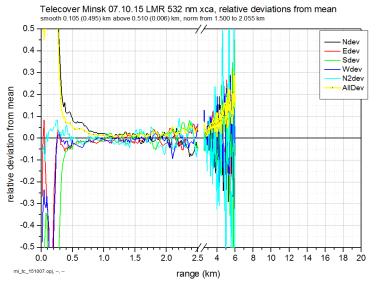
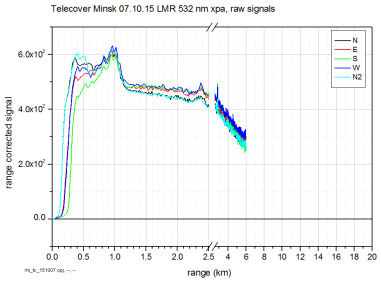
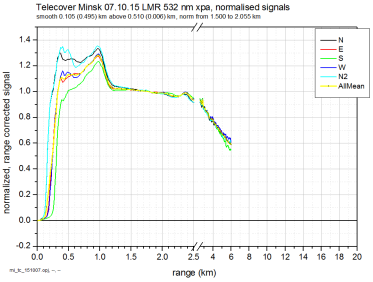
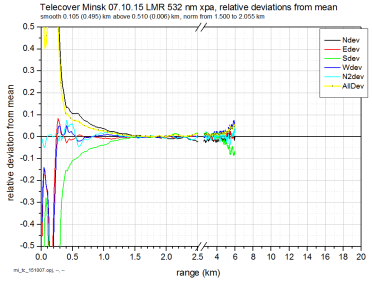
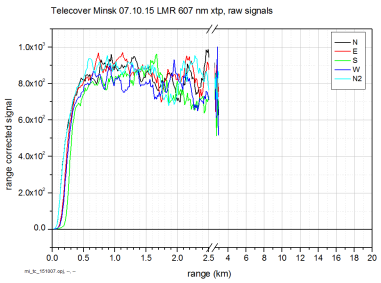
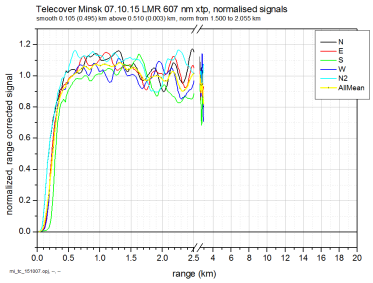
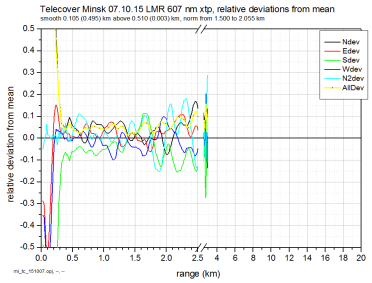


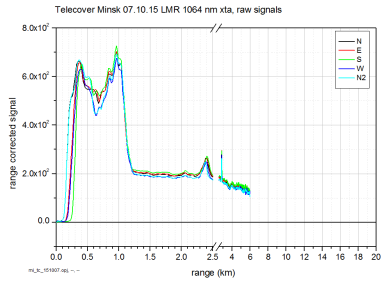


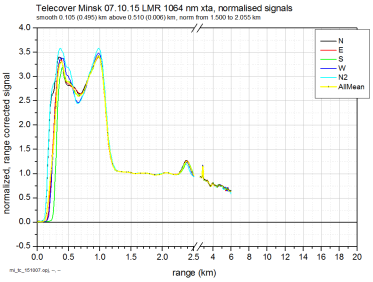


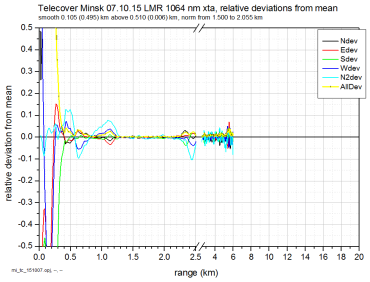


MI Minsk: LMR-mobile – Telecover

Raw signals	Normalised signals	Relative deviations
		
		
		
		
		

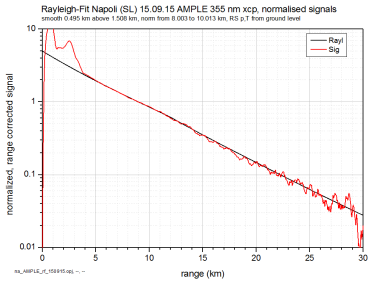

Telecover Minsk 07.10.15 LMR 1064 nm xta, raw signals
range corrected signal
range (km)
N
E
S
W
N2

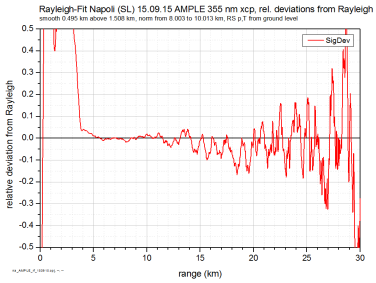

Telecover Minsk 07.10.15 LMR 1064 nm xta, normalised signals
smooth 0.105 (0.495) km above 0.510 (0.006) km, norm from 1.500 to 2.055 km
normalized, range corrected signal
range (km)
N
E
S
W
N2
AllMean

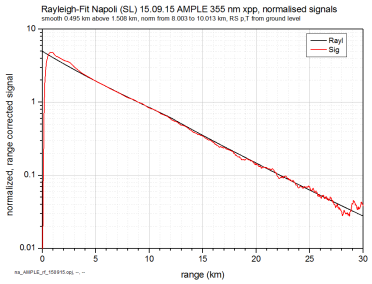

Telecover Minsk 07.10.15 LMR 1064 nm xta, relative deviations from mean
smooth 0.105 (0.495) km above 0.510 (0.006) km, norm from 1.500 to 2.055 km
relative deviation from mean
range (km)
Ndev
Edev
Sdev
Wdev
N2dev
AllDev

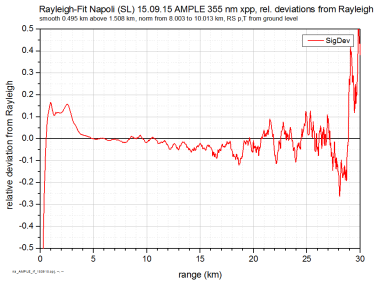
NA Napoli: AMPLE – Rayleigh Fit

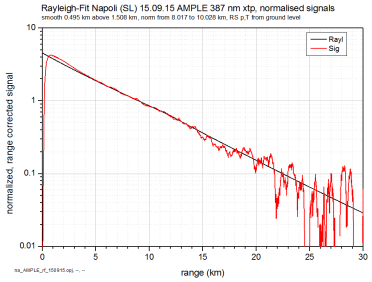
Normalised signals	Relative deviations

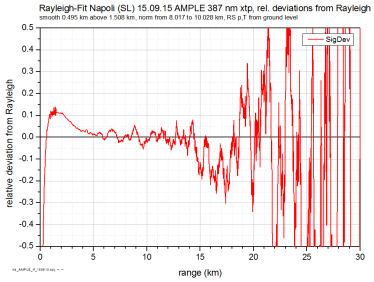






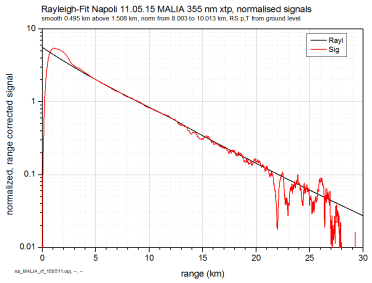


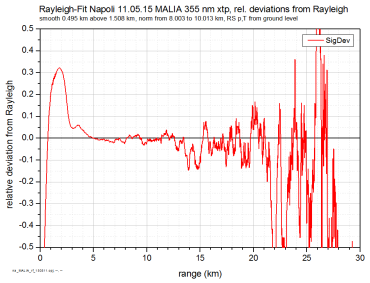


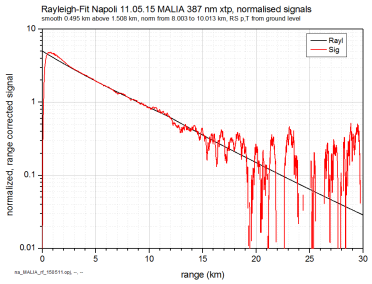


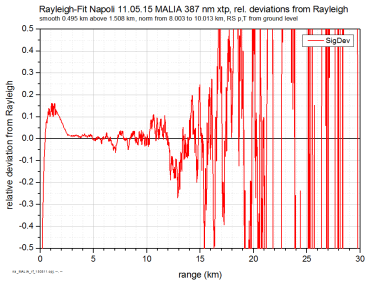
NA Napoli: MALIA – Rayleigh Fit

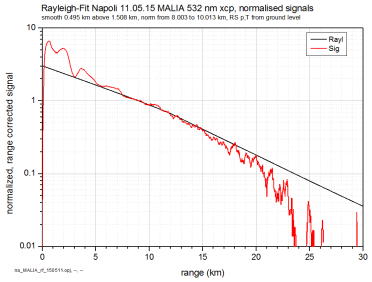
Normalised signals	Relative deviations

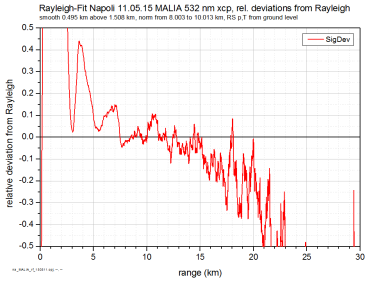


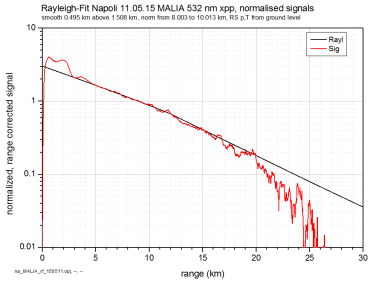


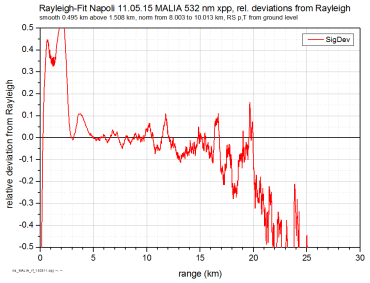


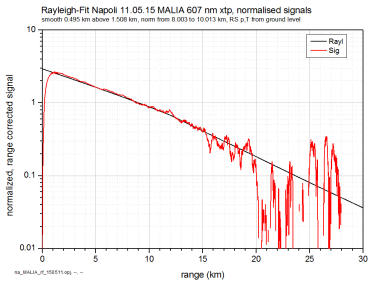


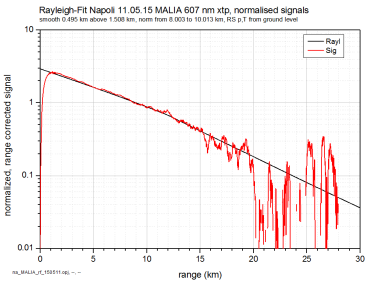






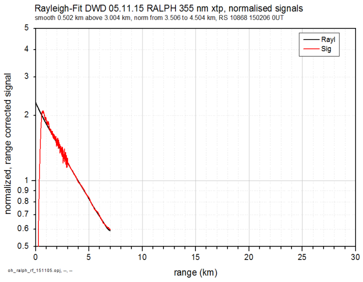


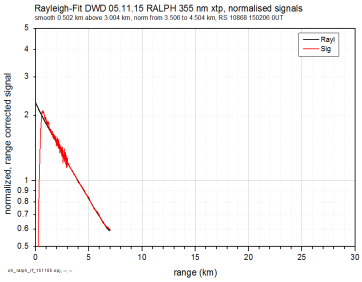


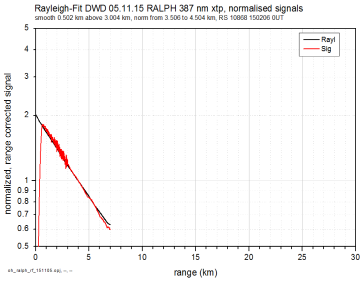


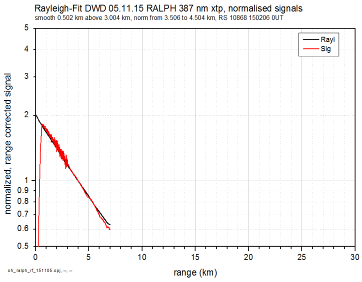
OH DWD-OHP: RALPH – Rayleigh Fit

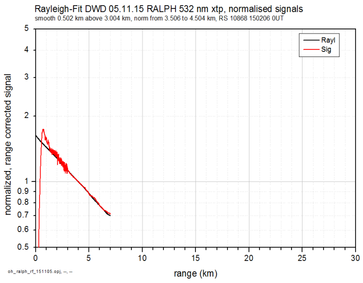
Normalised signals	Relative deviations

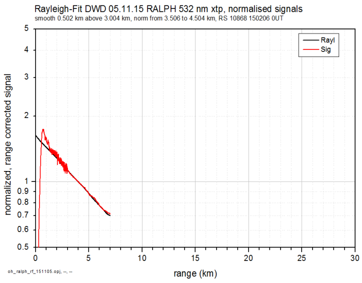


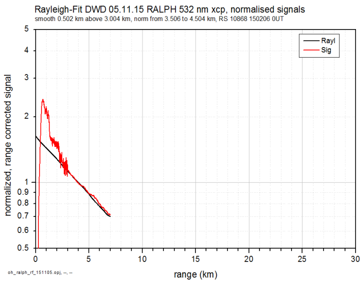


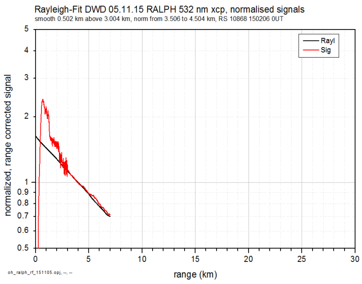


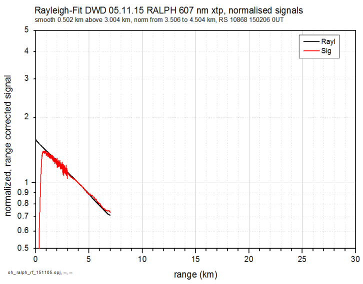


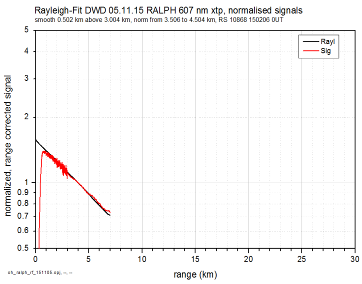


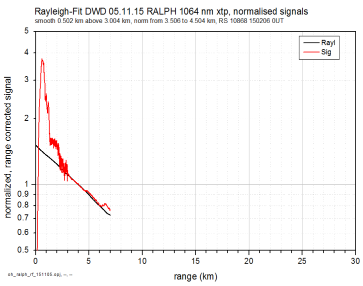


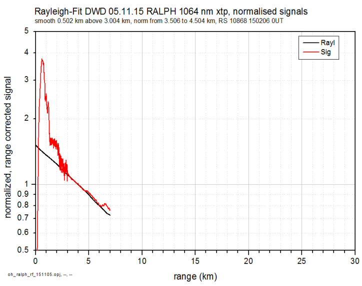




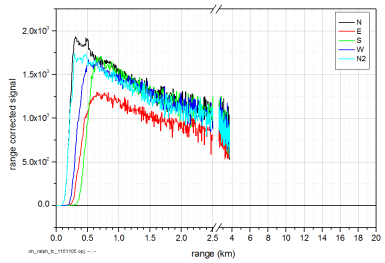
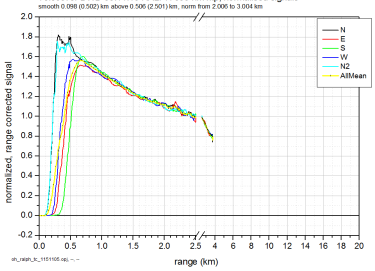
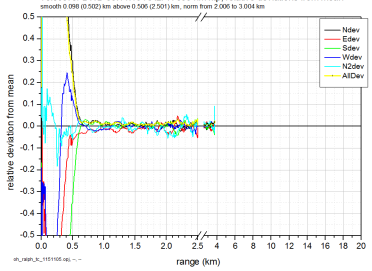
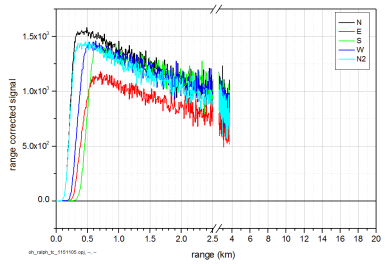
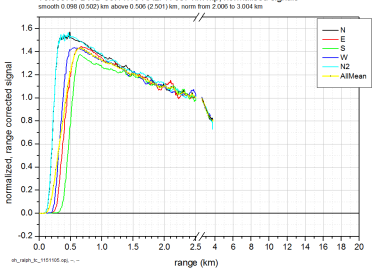
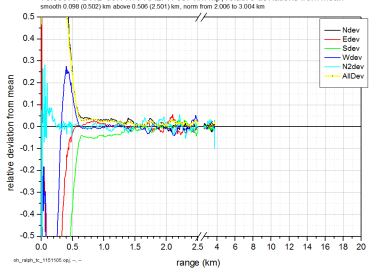
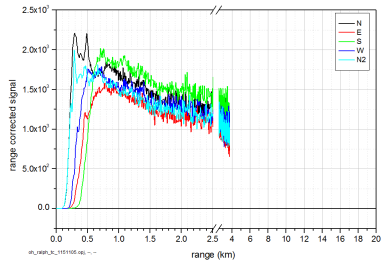
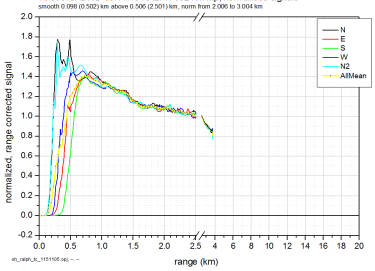
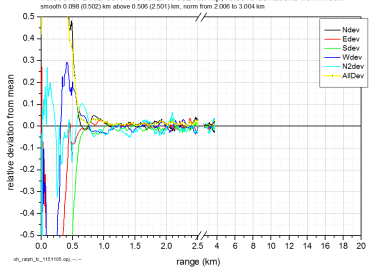
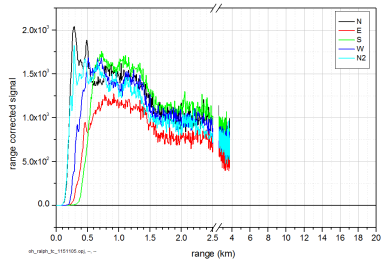
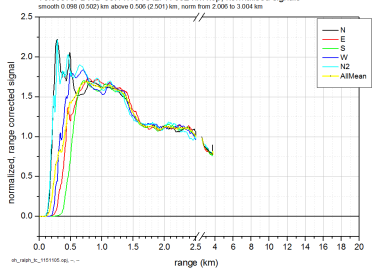
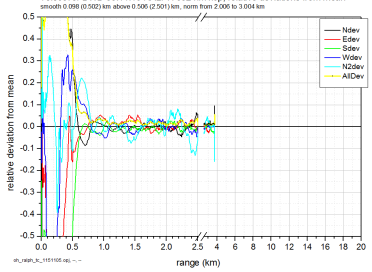
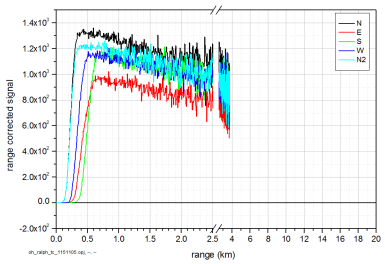
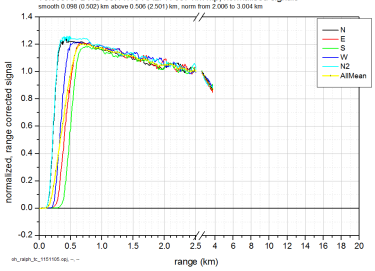
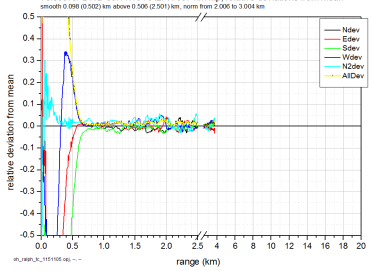
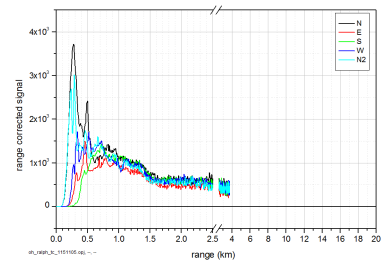
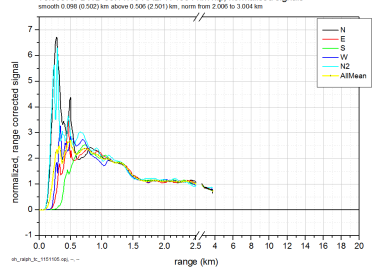
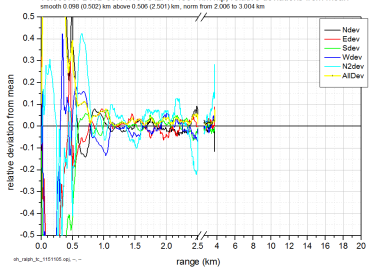






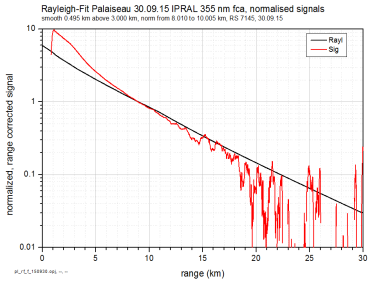


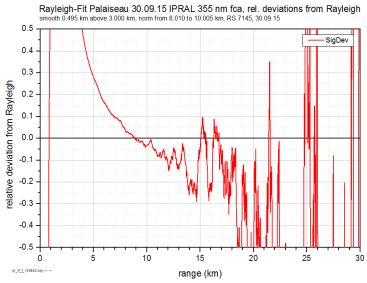
OH DWD-OHP: RALPH – Telecover

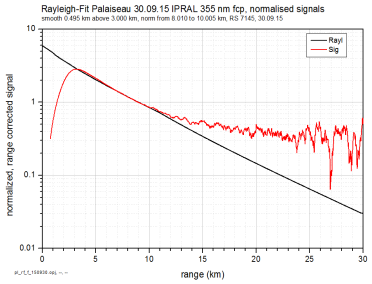
Raw signals	Normalised signals	Relative deviations
Telecover DWD 05.11.15 RALPH 355 nm xtp, raw signals	Telecover DWD 05.11.15 RALPH 355 nm xtp, normalised signals	Telecover DWD 05.11.15 RALPH 355 nm xtp, relative deviations from mean
		
Telecover DWD 05.11.15 RALPH 387 nm xtp, raw signals	Telecover DWD 05.11.15 RALPH 387 nm xtp, normalised signals	Telecover DWD 05.11.15 RALPH 387 nm xtp, relative deviations from mean
		
Telecover DWD 05.11.15 RALPH 532 nm xtp, raw signals	Telecover DWD 05.11.15 RALPH 532 nm xtp, normalised signals	Telecover DWD 05.11.15 RALPH 532 nm xtp, relative deviations from mean
		
Telecover DWD 05.11.15 RALPH 532 nm xcp, raw signals	Telecover DWD 05.11.15 RALPH 532 nm xcp, normalised signals	Telecover DWD 05.11.15 RALPH 532 nm xcp, relative deviations from mean
		
Telecover DWD 05.11.15 RALPH 607 nm xtp, raw signals	Telecover DWD 05.11.15 RALPH 607 nm xtp, normalised signals	Telecover DWD 05.11.15 RALPH 607 nm xtp, relative deviations from mean
		
Telecover DWD 05.11.15 RALPH 1064 nm xtp, raw signals	Telecover DWD 05.11.15 RALPH 1064 nm xtp, normalised signals	Telecover DWD 05.11.15 RALPH 1064 nm xtp, relative deviations from mean
		

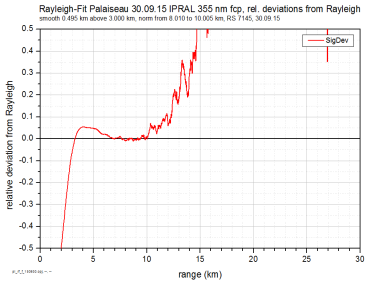
PL Palaiseau: IPRAL far – Rayleigh fit

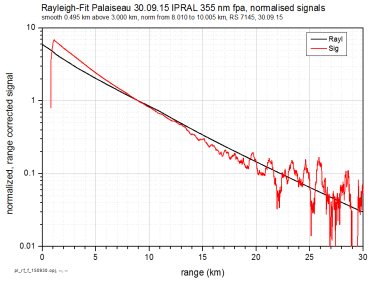
Normalised signals	Relative deviations

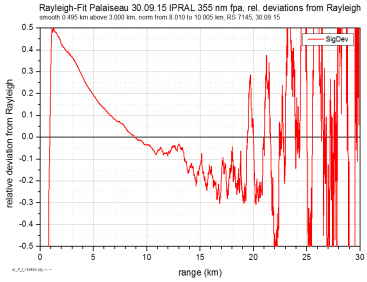


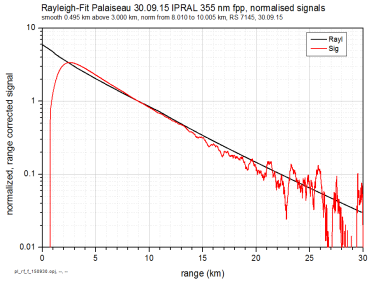


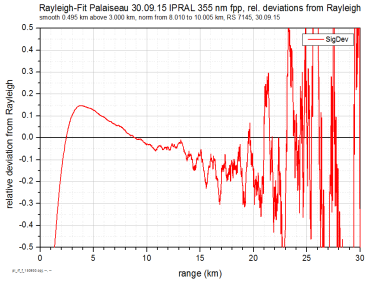


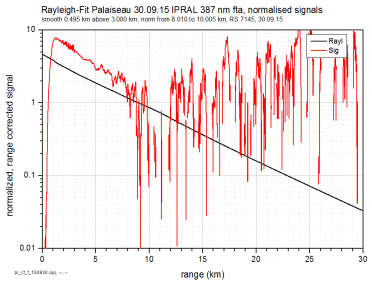


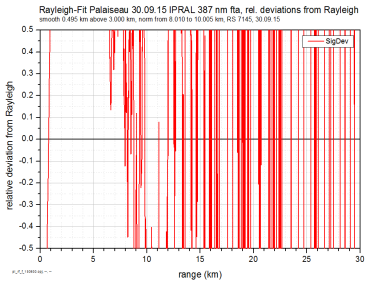


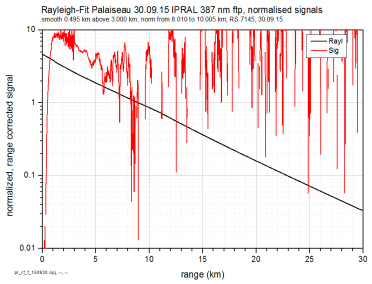


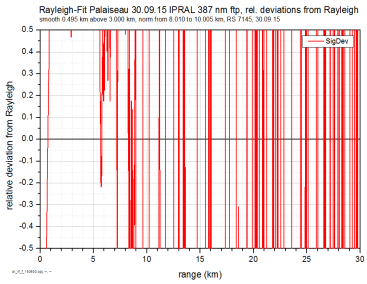


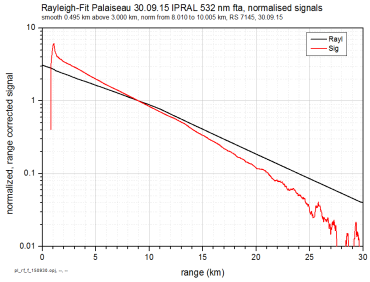


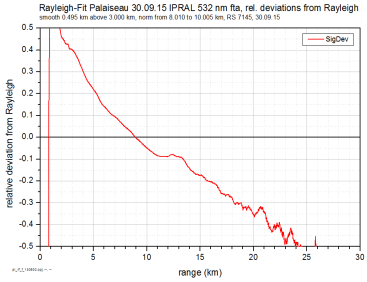


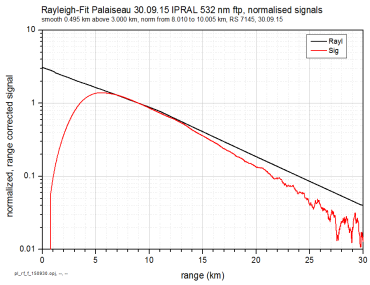


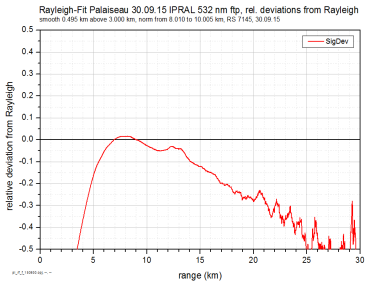


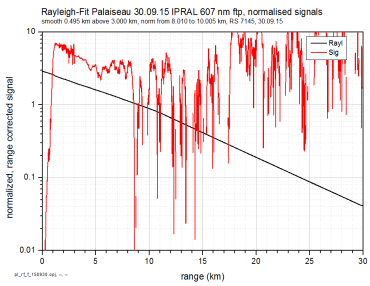


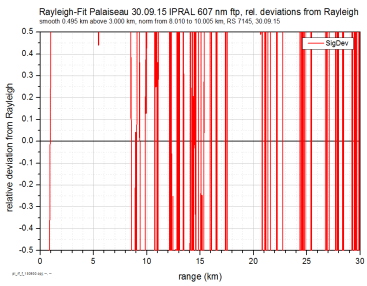

Rayleigh-Fit Palaiseau 30.09.15 IPRAL 532 nm fta, normalised signals
smooth 0.495 km above 3.000 km, norm from 8.010 to 10.005 km, RS 7145, 30.09.15
Rayl
Sig
normalized, range corrected signal
range (km)

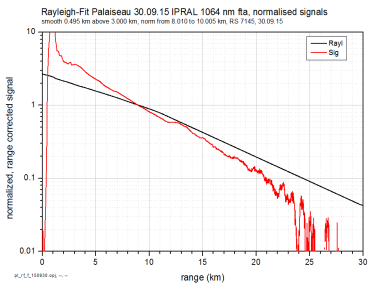

Rayleigh-Fit Palaiseau 30.09.15 IPRAL 532 nm fta, rel. deviations from Rayleigh
smooth 0.495 km above 3.000 km, norm from 8.010 to 10.005 km, RS 7145, 30.09.15
SigDev
relative deviation from Rayleigh
range (km)

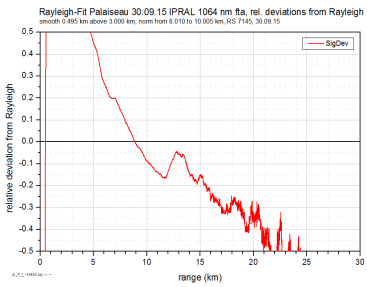

Rayleigh-Fit Palaiseau 30.09.15 IPRAL 532 nm ftp, normalised signals
smooth 0.495 km above 3.000 km, norm from 8.010 to 10.005 km, RS 7145, 30.09.15
Rayl
Sig
normalized, range corrected signal
range (km)


Rayleigh-Fit Palaiseau 30.09.15 IPRAL 532 nm ftp, rel. deviations from Rayleigh
smooth 0.495 km above 3.000 km, norm from 8.010 to 10.005 km, RS 7145, 30.09.15
SigDev
relative deviation from Rayleigh
range (km)

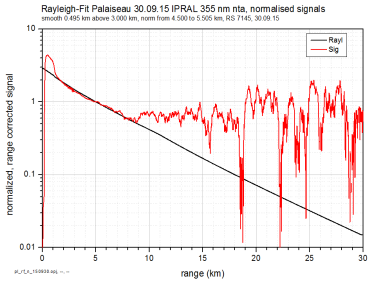
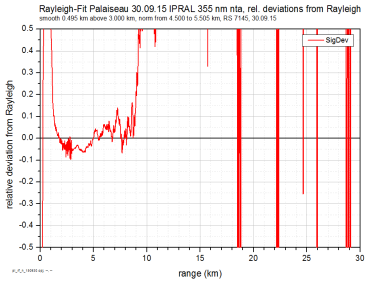
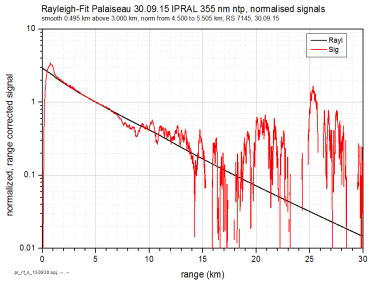
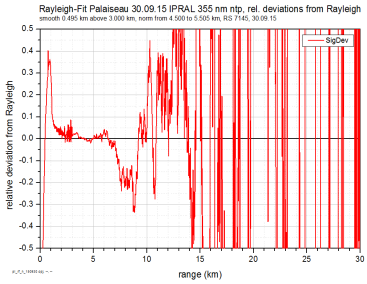
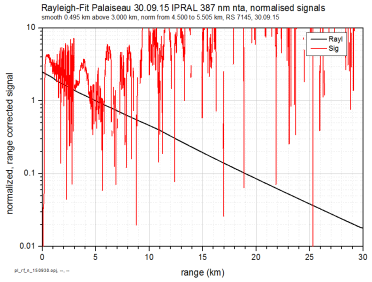
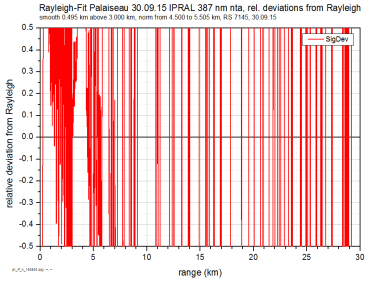
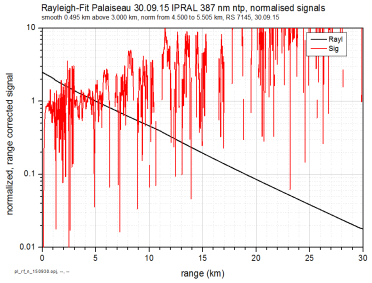
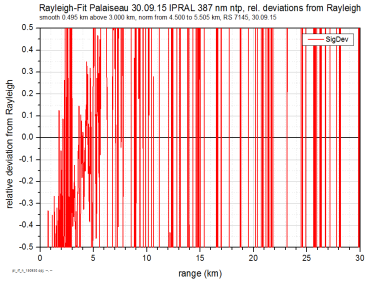
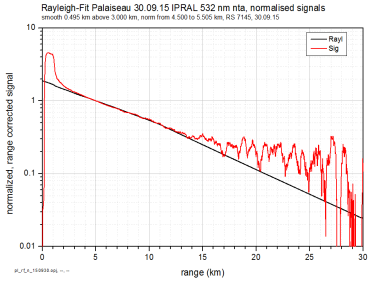
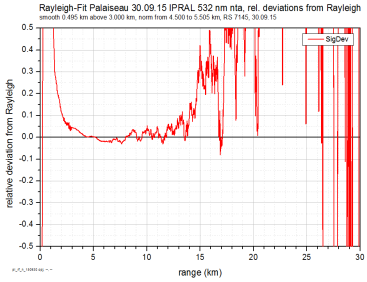
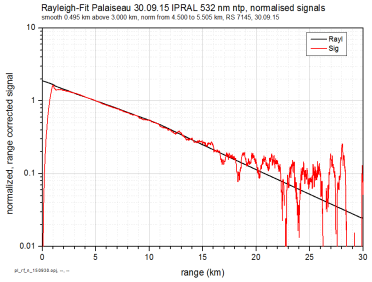
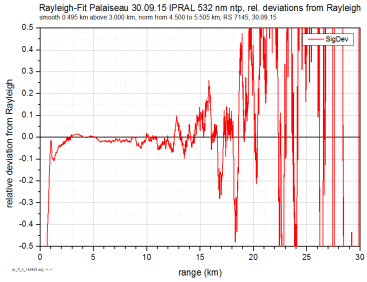

Rayleigh-Fit Palaiseau 30.09.15 IPRAL 607 nm ftp, normalised signals
smooth 0.495 km above 3.000 km, norm from 8.010 to 10.005 km, RS 7145, 30.09.15
Rayl
Sig
normalized, range corrected signal
range (km)


Rayleigh-Fit Palaiseau 30.09.15 IPRAL 607 nm ftp, rel. deviations from Rayleigh
smooth 0.495 km above 3.000 km, norm from 8.010 to 10.005 km, RS 7145, 30.09.15
SigDev
relative deviation from Rayleigh
range (km)


Rayleigh-Fit Palaiseau 30.09.15 IPRAL 1064 nm fta, normalised signals
smooth 0.495 km above 3.000 km, norm from 8.010 to 10.005 km, RS 7145, 30.09.15
Rayl
Sig
normalized, range corrected signal
range (km)

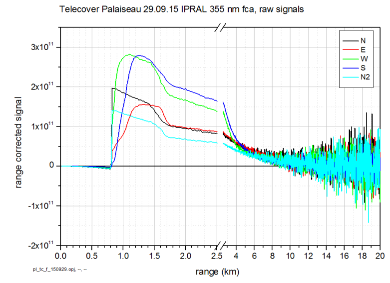

Rayleigh-Fit Palaiseau 30.09.15 IPRAL 1064 nm fta, rel. deviations from Rayleigh
smooth 0.495 km above 3.000 km, norm from 8.010 to 10.005 km, RS 7145, 30.09.15
SigDev
relative deviation from Rayleigh
range (km)

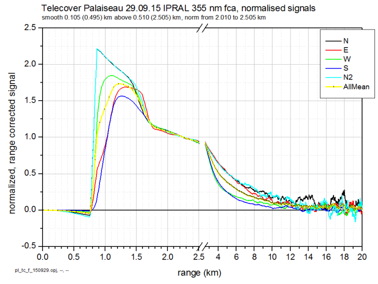
PL Palaiseau: IPRAL near – Rayleigh fit

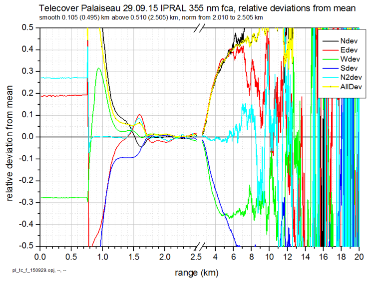
Normalised signals	Relative deviations
	
	
	
	
	
	

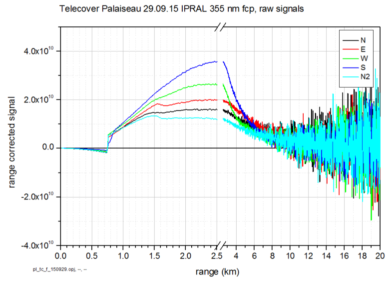
PL Palaiseau: IPRAL far – Telecover

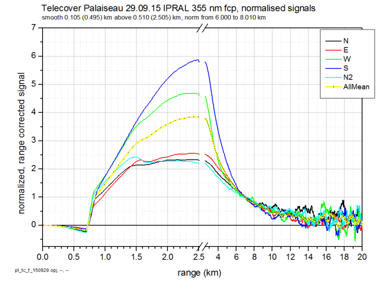
Raw signals	Normalised signals	Relative deviations

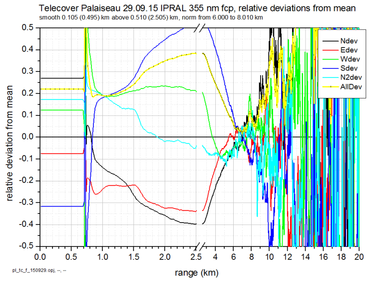


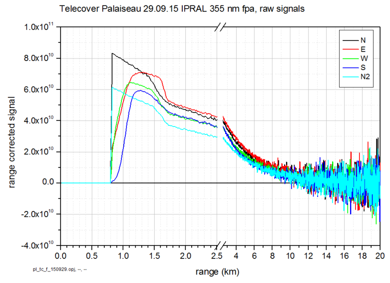


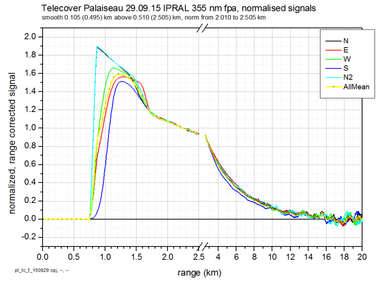


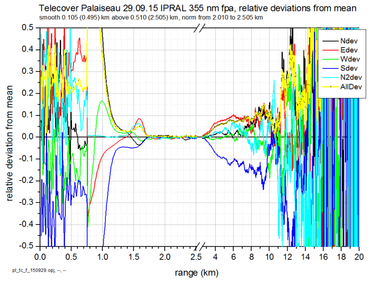


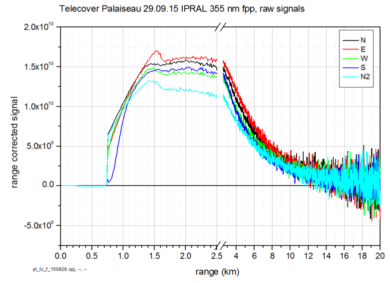


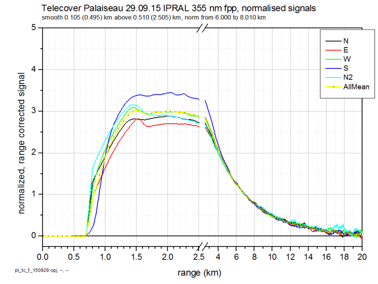


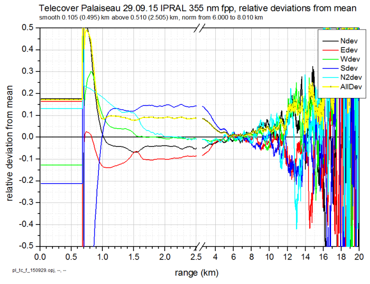


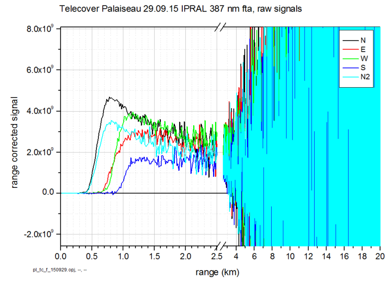


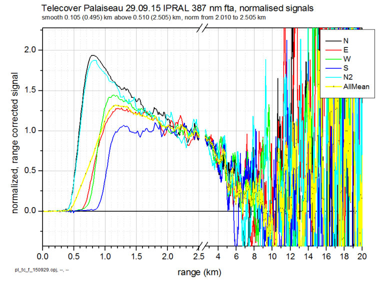


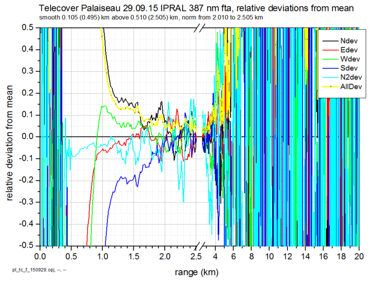


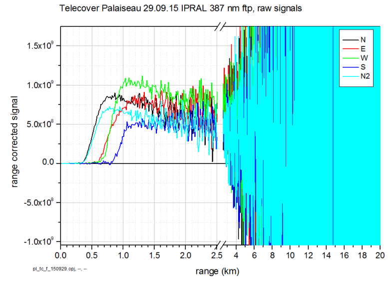


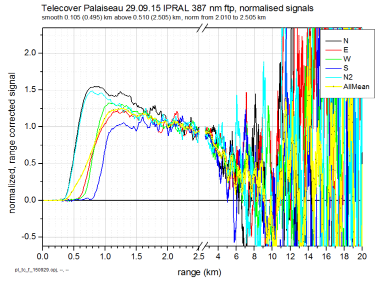


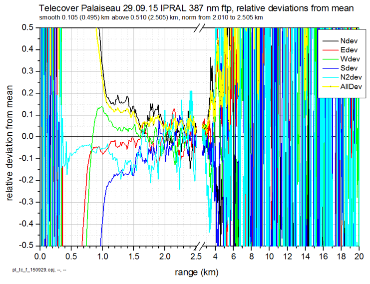


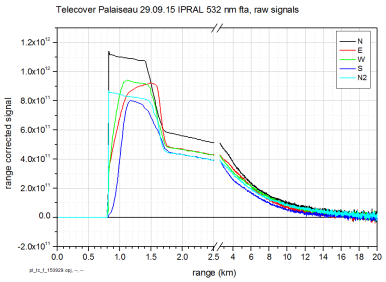


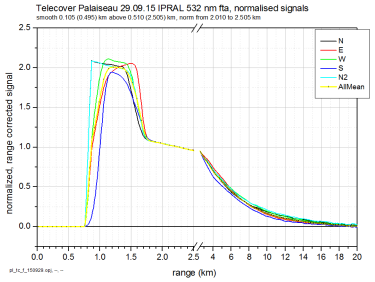


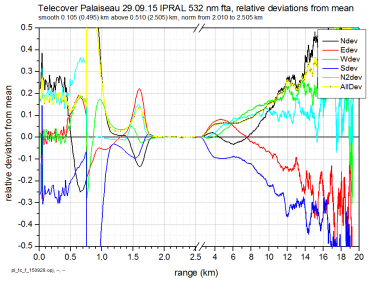


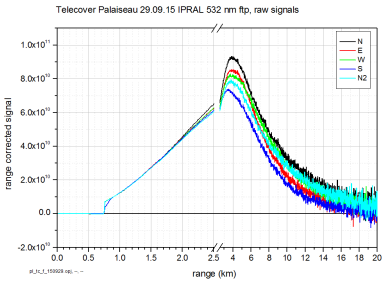


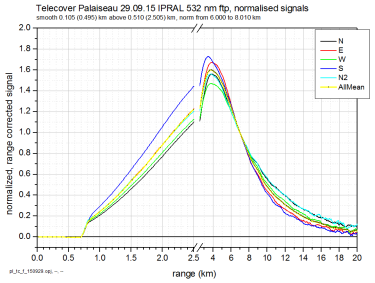


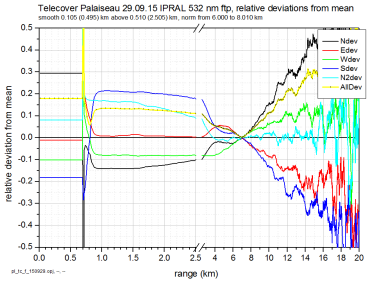

Telecover Palaiseau 29.09.15 IPRAL 532 nm fta, raw signals
range corrected signal
range (km)
N
E
W
S
N2

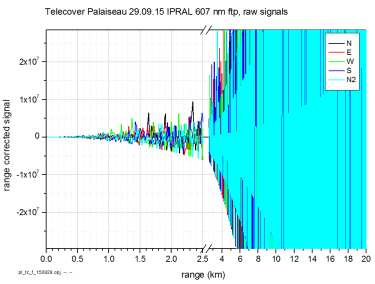

Telecover Palaiseau 29.09.15 IPRAL 532 nm fta, normalised signals
smooth 0.105 (0.495) km above 0.510 (2.505) km, norm from 2.010 to 2.505 km
normalized, range corrected signal
range (km)
N
E
W
S
N2
AllMean

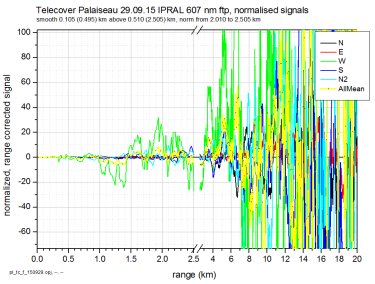

Telecover Palaiseau 29.09.15 IPRAL 532 nm fta, relative deviations from mean
smooth 0.105 (0.495) km above 0.510 (2.505) km, norm from 2.010 to 2.505 km
relative deviation from mean
range (km)
Ndev
Edev
Wdev
Sdev
N2dev
AllDev

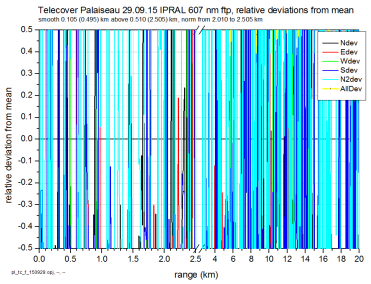

Telecover Palaiseau 29.09.15 IPRAL 532 nm ftp, raw signals
range corrected signal
range (km)
N
E
W
S
N2

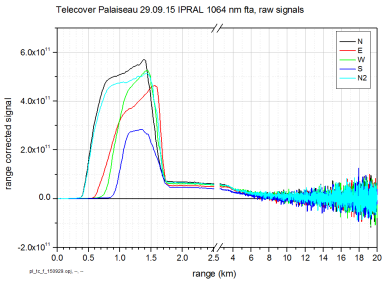

Telecover Palaiseau 29.09.15 IPRAL 532 nm ftp, normalised signals
smooth 0.105 (0.495) km above 0.510 (2.505) km, norm from 6.000 to 8.010 km
normalized, range corrected signal
range (km)
N
E
W
S
N2
AllMean

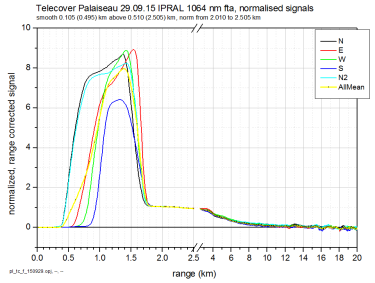

Telecover Palaiseau 29.09.15 IPRAL 532 nm ftp, relative deviations from mean
smooth 0.105 (0.495) km above 0.510 (2.505) km, norm from 6.000 to 8.010 km
relative deviation from mean
range (km)
Ndev
Edev
Wdev
Sdev
N2dev
AllDev

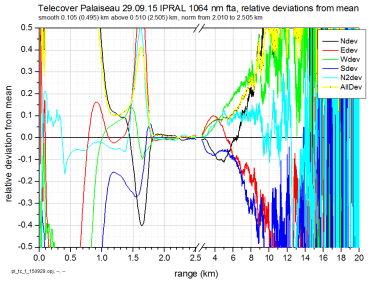

Telecover Palaiseau 29.09.15 IPRAL 607 nm ftp, raw signals
range corrected signal
range (km)
N
E
W
S
N2


Telecover Palaiseau 29.09.15 IPRAL 607 nm ftp, normalised signals
smooth 0.105 (0.495) km above 0.510 (2.505) km, norm from 2.010 to 2.505 km
normalized, range corrected signal
range (km)
N
E
W
S
N2
AllMean


Telecover Palaiseau 29.09.15 IPRAL 607 nm ftp, relative deviations from mean
smooth 0.105 (0.495) km above 0.510 (2.505) km, norm from 2.010 to 2.505 km
relative deviation from mean
range (km)
Ndev
Edev
Wdev
Sdev
N2dev
AllDev

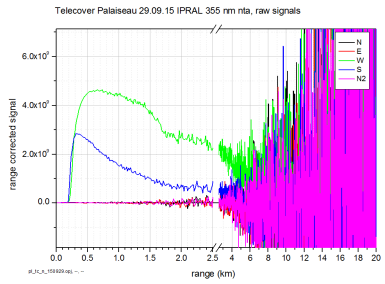

Telecover Palaiseau 29.09.15 IPRAL 1064 nm fta, raw signals
range corrected signal
range (km)
N
E
W
S
N2

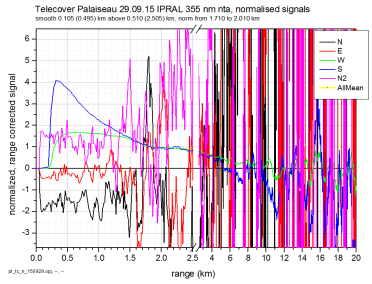

Telecover Palaiseau 29.09.15 IPRAL 1064 nm fta, normalised signals
smooth 0.105 (0.495) km above 0.510 (2.505) km, norm from 2.010 to 2.505 km
normalized, range corrected signal
range (km)
N
E
W
S
N2
AllMean

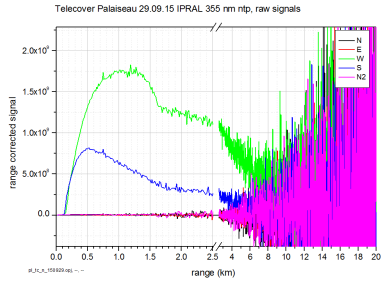

Telecover Palaiseau 29.09.15 IPRAL 1064 nm fta, relative deviations from mean
smooth 0.105 (0.495) km above 0.510 (2.505) km, norm from 2.010 to 2.505 km
relative deviation from mean
range (km)
Ndev
Edev
Wdev
Sdev
N2dev
AllDev

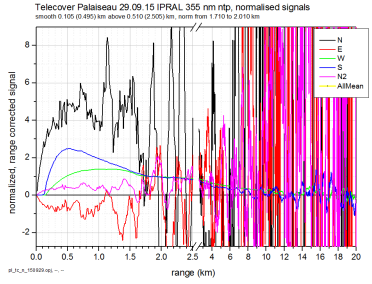
PL Palaiseau: IPRAL near – Telecover

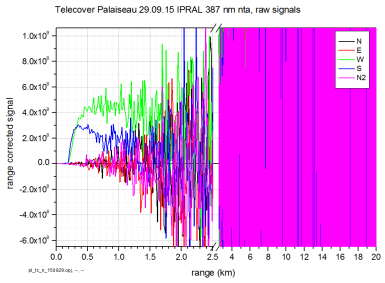
Normalised signals	Relative deviations

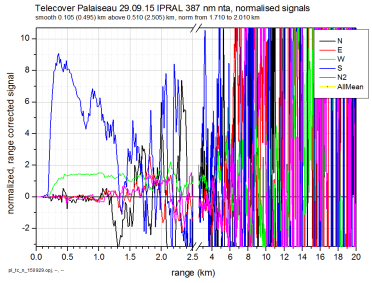


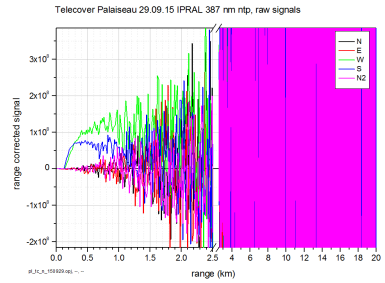


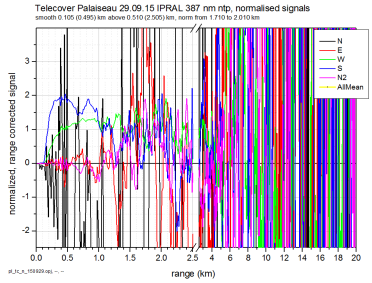


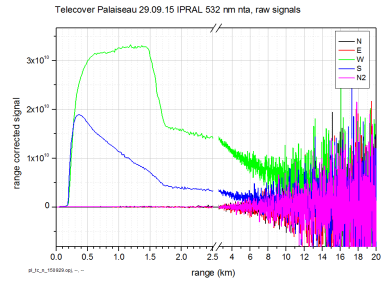


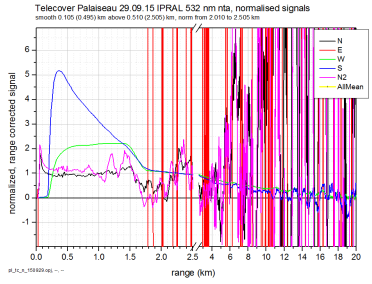


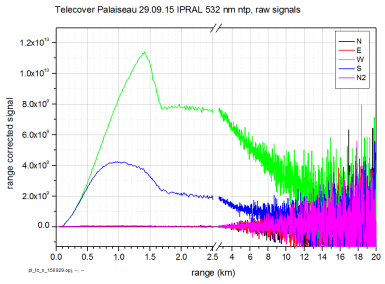


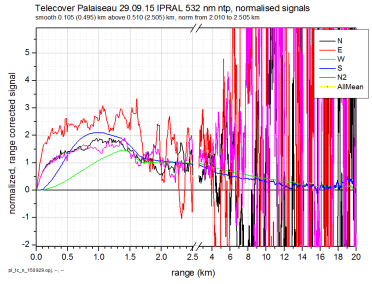












EARLINET Trigger Delays Report

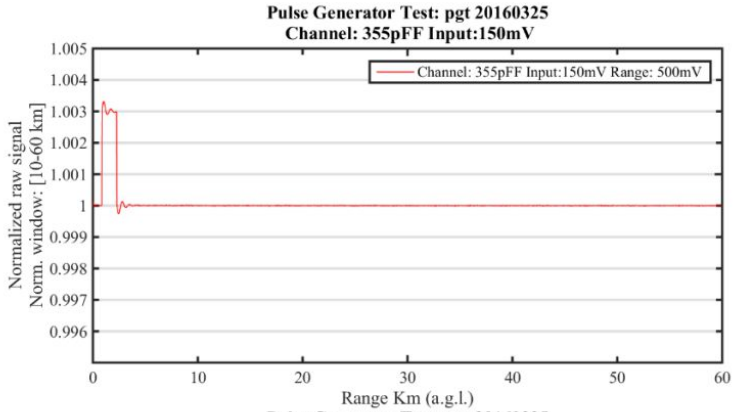
Lidar site / ID	Palaiseau / pl
Lidar system	IPRAL
Date	29.03.2016
Measured by	Juan Antonio Bravo-Aranda
Comments	Despite X1 and X2 are the unknown photon-counting trigger delays, it has been determined that the trigger delay is the same for several channels. The behaviour of Raman channels were not yet determined.

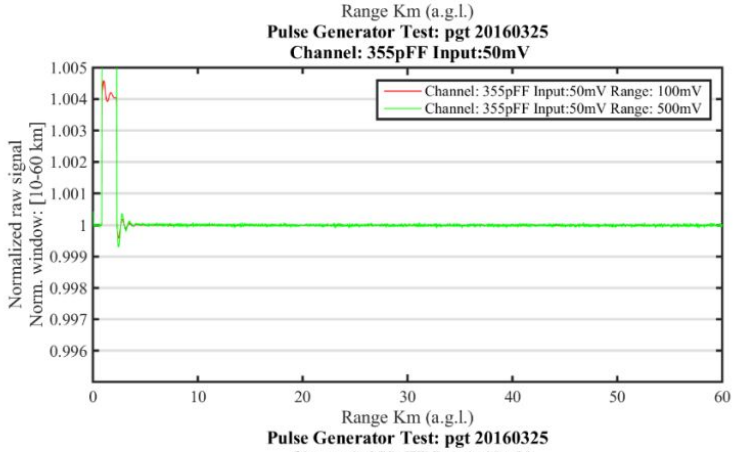
Channel	DA-mode (pc, analogue)	Trigger delay [rangebin]	Resolution [m/rb]	Methode	Comment
1064 fta	Analogue	X1* – 4	15	Signal correlation	Using 1064 and 532 nm channels (i.e, 1064fta Vs 532fta)
607 ftp	Photoncounting	X1			1064fta Vs 532fta
355 fpa	Analogue	X1 – 4			355fpa Vs 355fpp
355 fpp	Photoncounting	X1			355fpa Vs 532ftp
355 fsa	Analogue	X1 - 4			355fsa Vs 355fsp
355 fsp	Photoncounting	X1			355fpa Vs 355fsp
387 fta	Analogue	X2 - 4			387fsa Vs 387fsp
387 ftp	Photoncounting	X2			unknown
408 fta	Analogue	unknown			-
408 ftp	Photoncounting	unknown			-
532 fta	Analogue	X1 - 4			532fta Vs 532ftp
532 ftp	Photoncounting	X1			unknown
355 nta	Analogue	X1 – 4			355nta Vs 355ntp
355 ntp	Photoncounting	X1			355fpp Vs 355ntp
387 nta	Analogue	unknown			-
387 ntp	Photoncounting	unknown			-
532 nta	Analogue	X1 - 4			532nta Vs 532ntp
532 ntp	Photoncounting	X1			532ftp Vs 532ntp

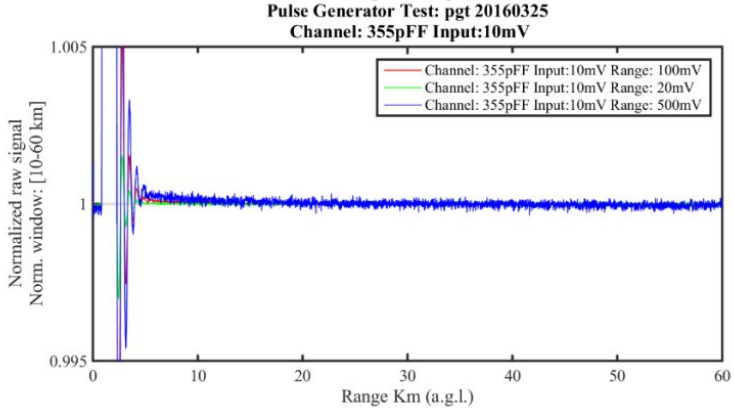
EARLINET Pulse Generator Report

Lidar site / ID	Palaiseau / pl
Lidar system	IPRAL
Date	29.03.2016
Measured by	Juan Antonio Bravo-Aranda
Comments	Results show that the combination of 50mV inputs and 100mV voltage range provides the smallest ringing effect and the most stable baseline.

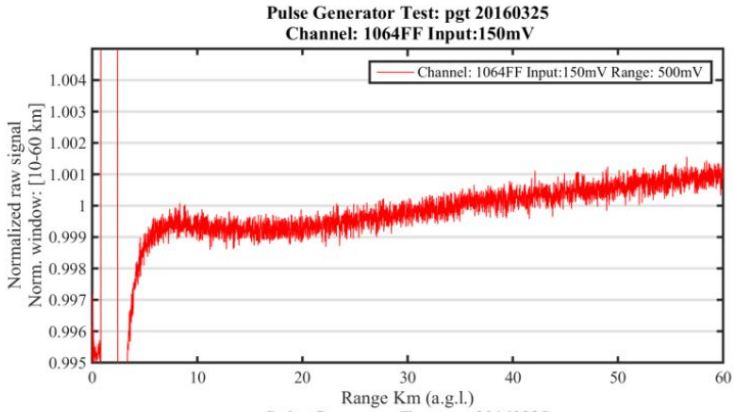
Channel 355fpa:

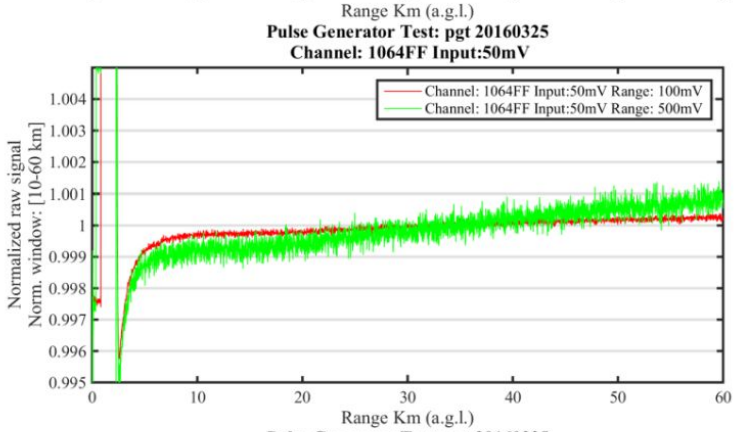


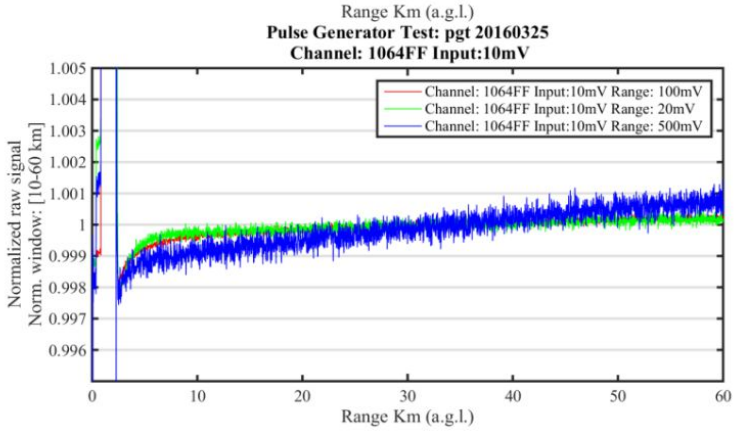




Channel 1064fta:

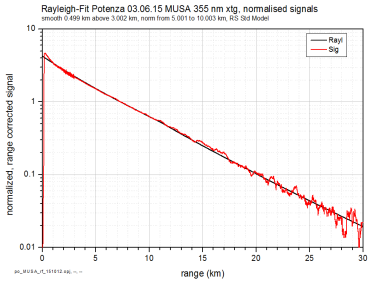


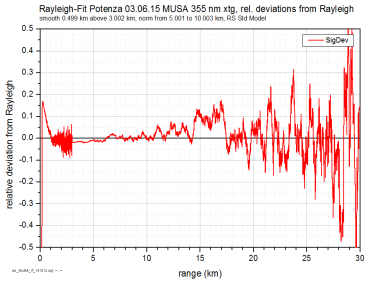


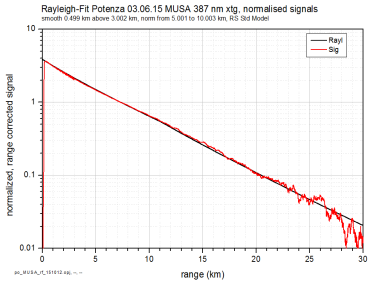


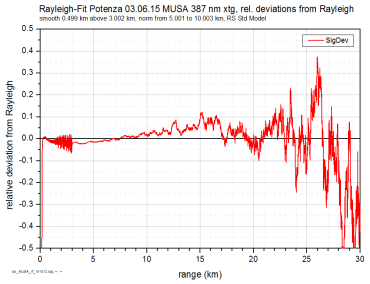
PO Potenza: MUSA – Rayleigh fit

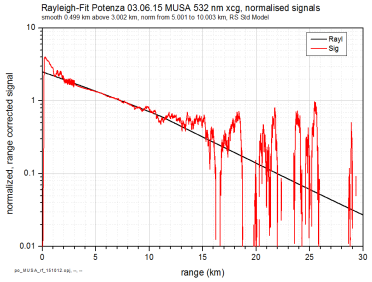
Normalised signals	Relative deviations

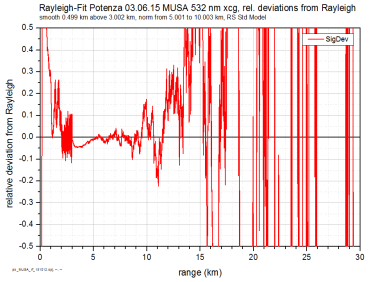


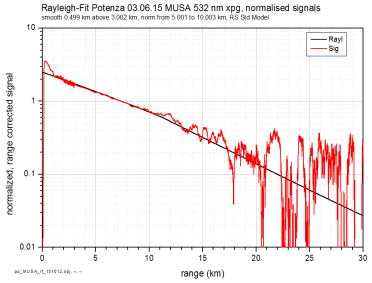


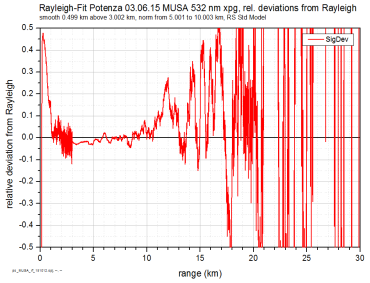


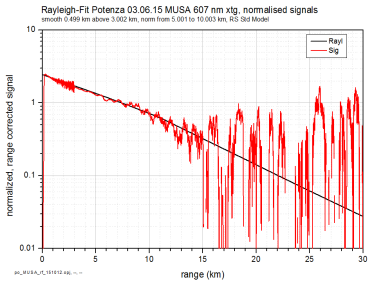


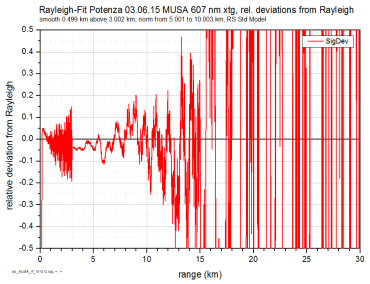


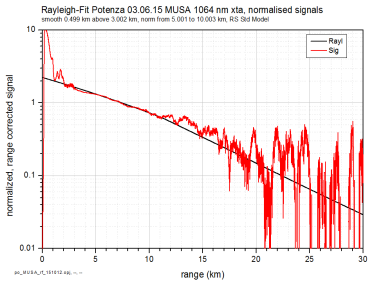


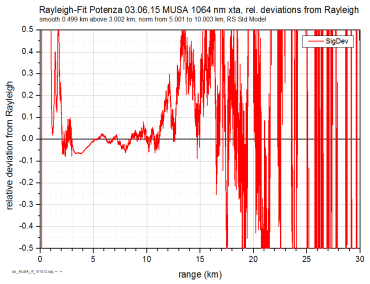






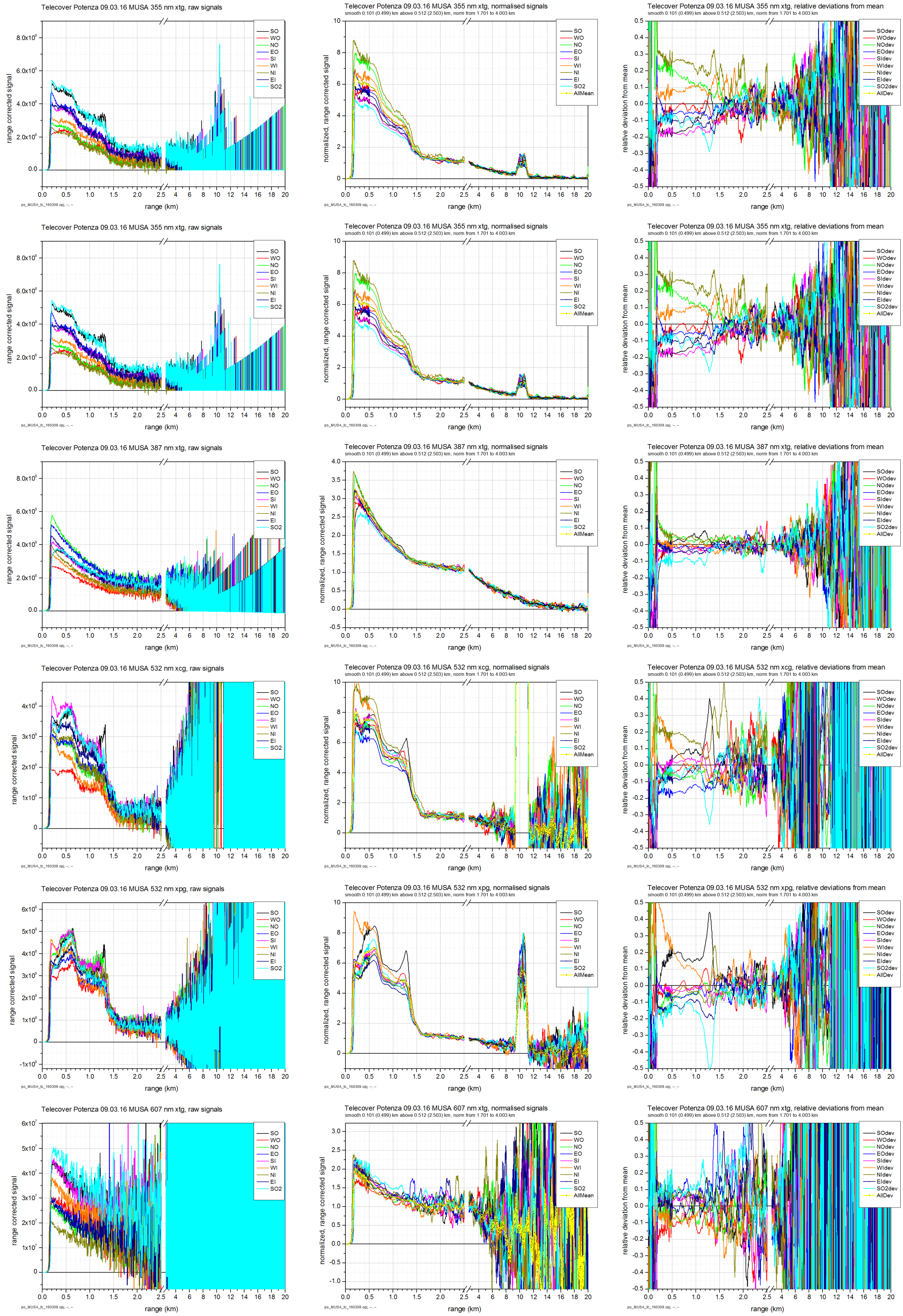


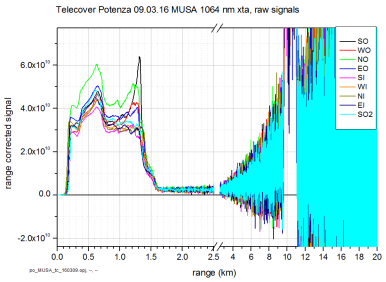


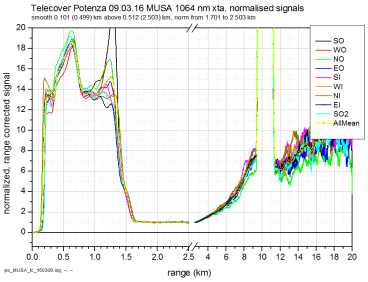


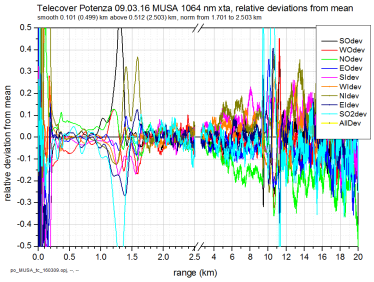
PO Potenza: MUSA – Telecover

Raw signals	Normalised signals	Relative deviations



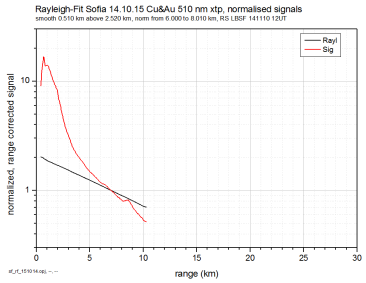

Telecover Potenza 09.03.16 MUSA 1064 nm xta, raw signals
range corrected signal
range (km)
SO
WO
NO
EO
SI
WI
NI
EI
SO2


Telecover Potenza 09.03.16 MUSA 1064 nm xta, normalised signals
smooth 0.101 (0.499) km above 0.512 (2.503) km, norm from 1.701 to 2.503 km
normalized, range corrected signal
range (km)
SO
WO
NO
EO
SI
WI
NI
EI
SO2
AllMean

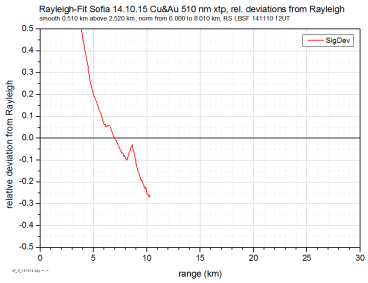

Telecover Potenza 09.03.16 MUSA 1064 nm xta, relative deviations from mean
smooth 0.101 (0.499) km above 0.512 (2.503) km, norm from 1.701 to 2.503 km
relative deviation from mean
range (km)
SOdev
WOdev
NOdev
EOdev
SIdev
WIdev
NIdev
EIdev
SO2dev
AllDev

SF Sofia: CuBr – Rayleigh Fit

Normalised signals

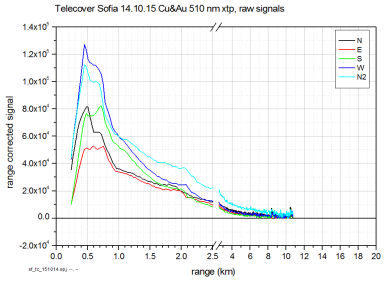


Relative deviations

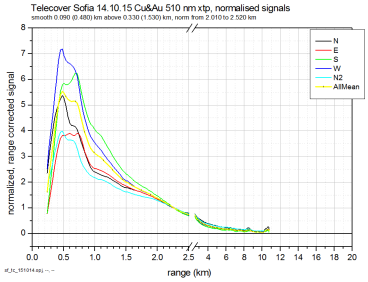


SF Sofia: CuBr – Telecover

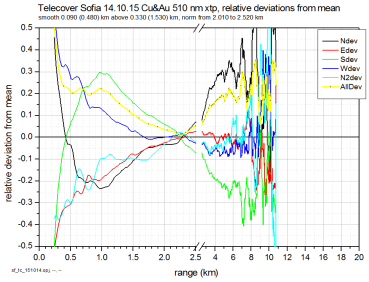
Raw signals



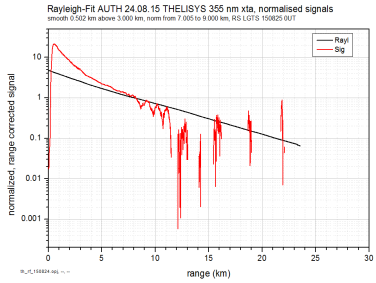
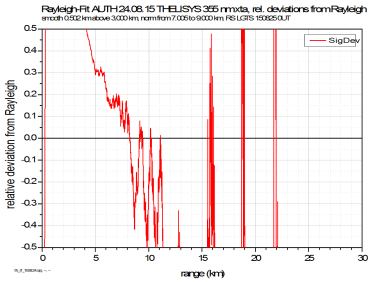
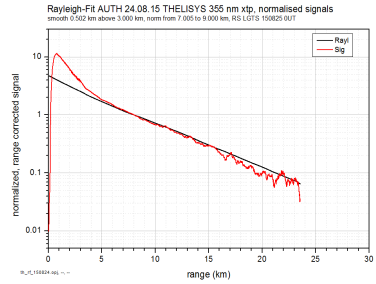
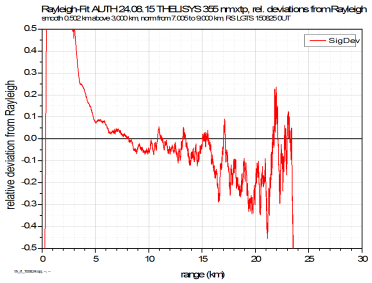
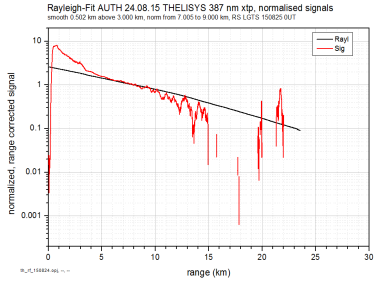
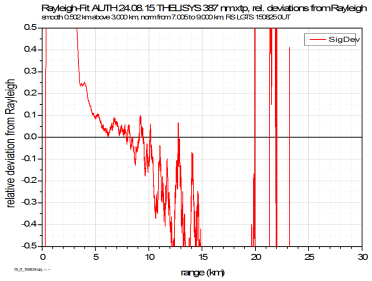
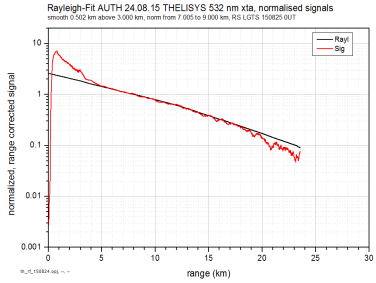
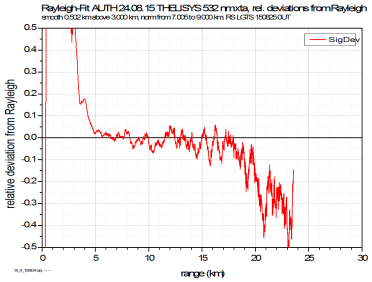
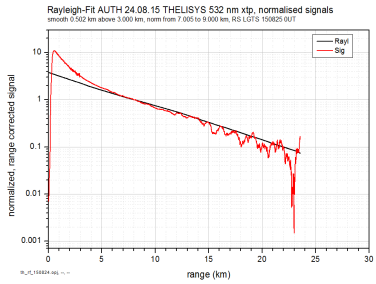
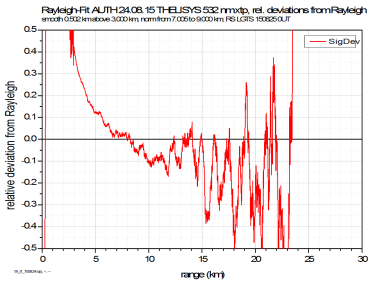
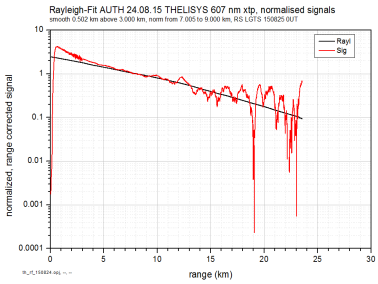
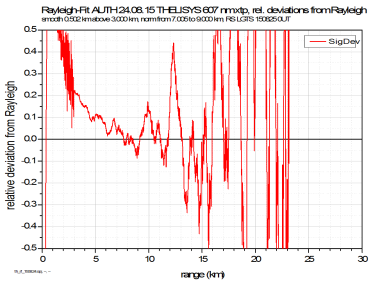
Normalised signals

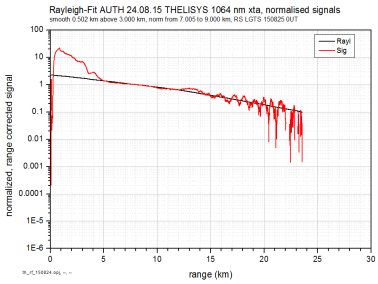


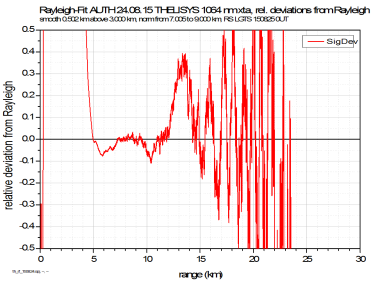
Relative deviations



TH Thessaloniki: THELISYS – Rayleigh fit

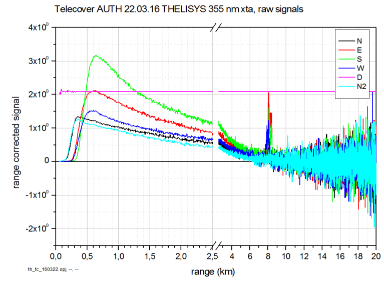
Normalised signals	Relative deviations
	
	
	
	
	
	

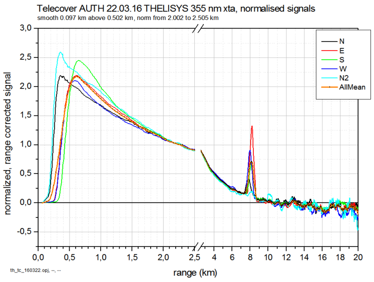

Rayleigh-Fit AUTH 24.08.15 THELISYS 1064 nm xta, normalised signals
smooth 0.502 km above 3.000 km, norm from 7.005 to 9.000 km, RS LGTS 150825.DAT
Rayl
Sig
normalized, range corrected signal
range (km)

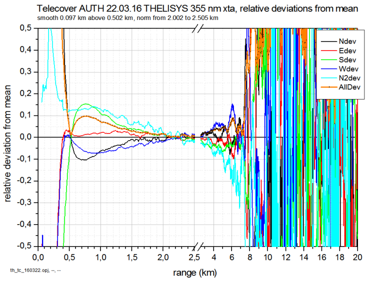

Rayleigh-Fit AUTH 24.08.15 THELISYS 1064 nm xta, rel. deviations from Rayleigh
smooth 0.502 km above 3.000 km, norm from 7.005 to 9.000 km, RS LGTS 150825.DAT
SigDev
relative deviation from Rayleigh
range (km)

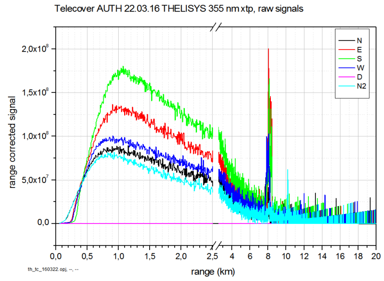
TH Thessaloniki: THELISYS – Telecover

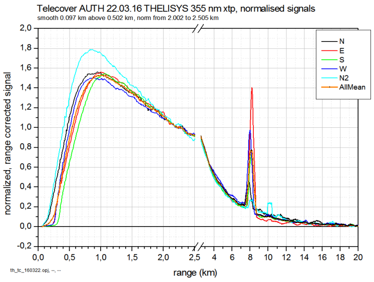
Raw signals	Normalised signals	Relative deviations

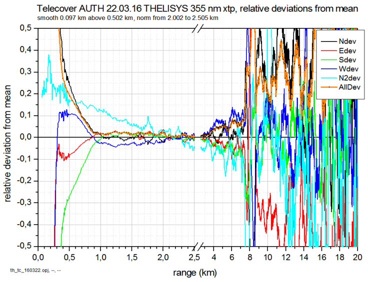


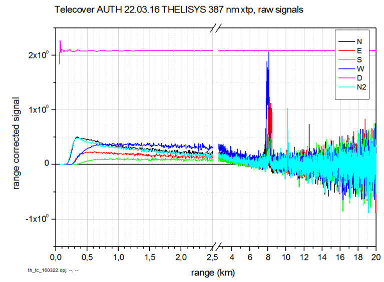


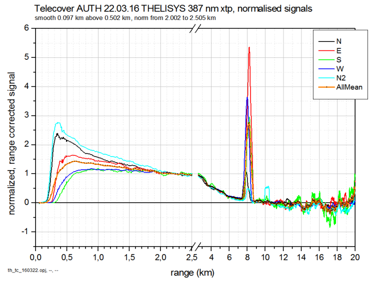


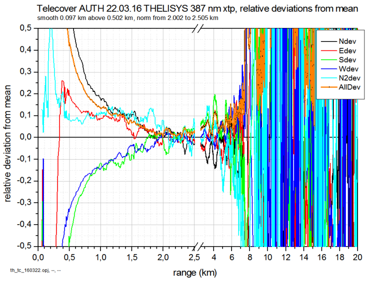


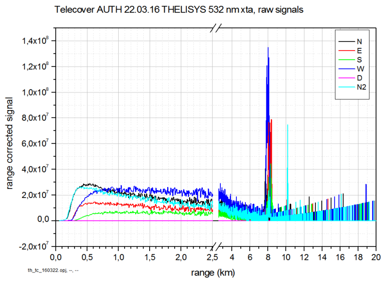


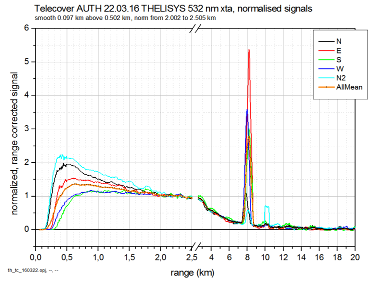


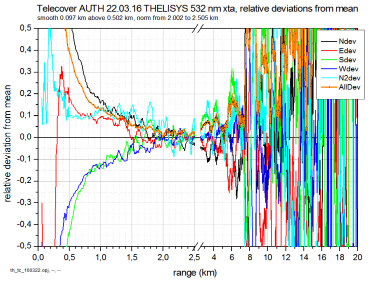


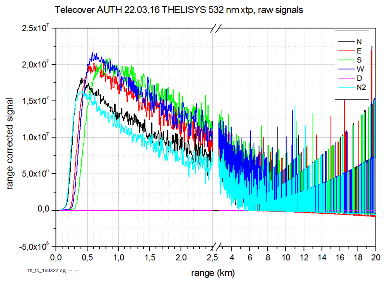


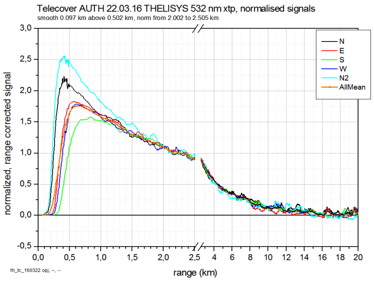


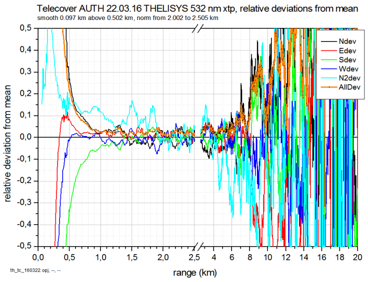


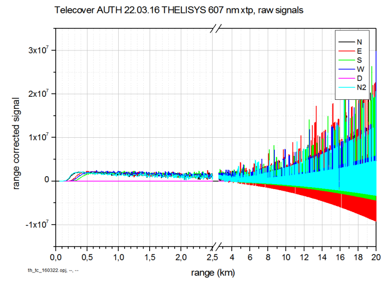


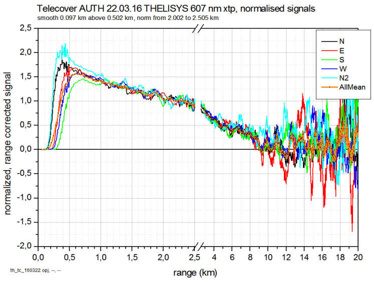


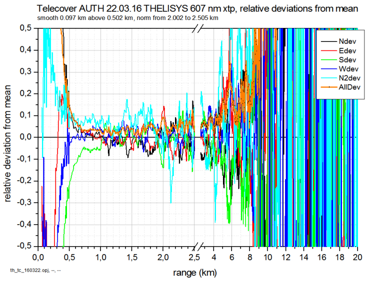


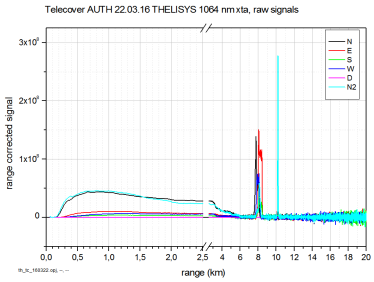


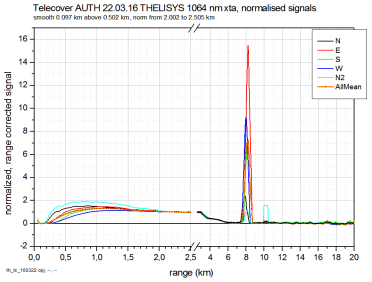


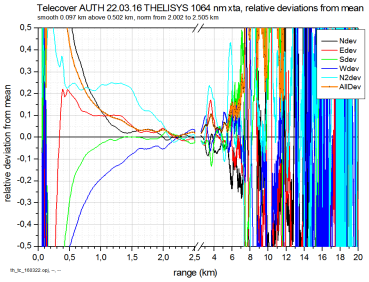






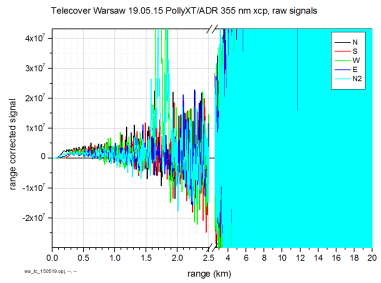

Telecover AUTH 22.03.16 THELISYS 1064 nm xta, raw signals
range corrected signal
range (km)
N
E
S
W
D
N2

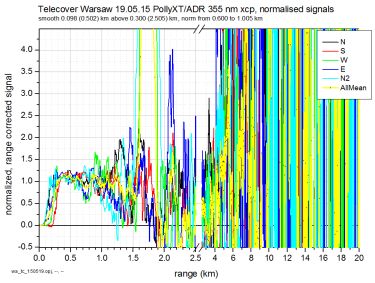

Telecover AUTH 22.03.16 THELISYS 1064 nm xta, normalised signals
smooth 0.097 km above 0.502 km, norm from 2.002 to 2.505 km
normalized, range-corrected signal
range (km)
N
E
S
W
N2
AllMean

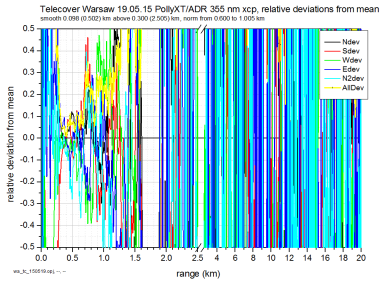

Telecover AUTH 22.03.16 THELISYS 1064 nm xta, relative deviations from mean
smooth 0.097 km above 0.502 km, norm from 2.002 to 2.505 km
relative deviation from mean
range (km)
Ndev
Edev
Sdev
Wdev
N2dev
AllDev

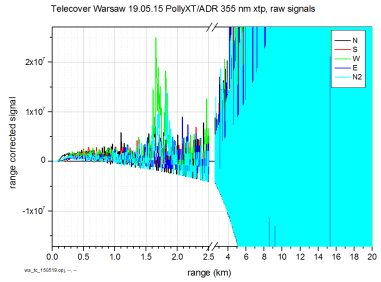
WA Warsaw: POLLY-XT_ADR – Telecover

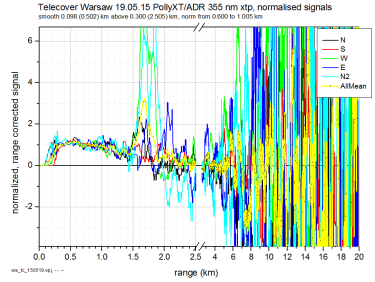
Raw signals	Normalised signals	Relative deviations

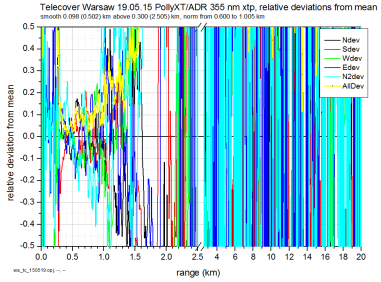


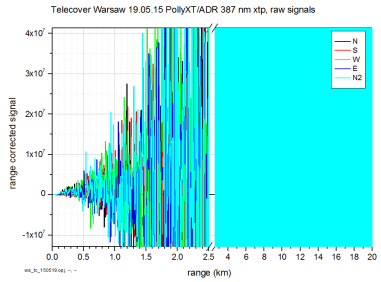


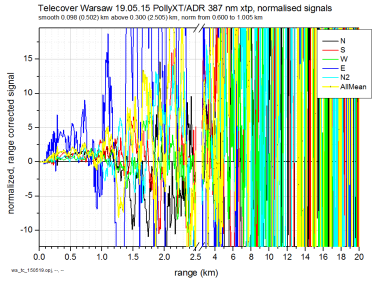


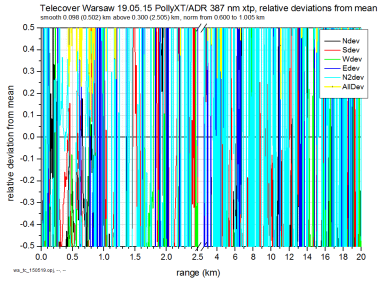


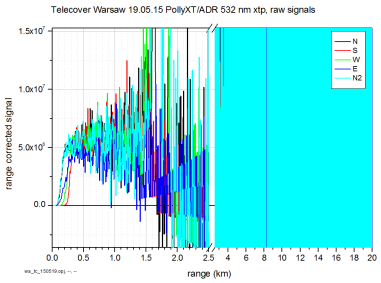


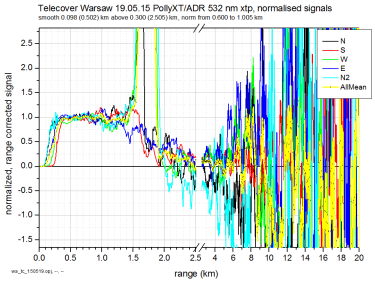


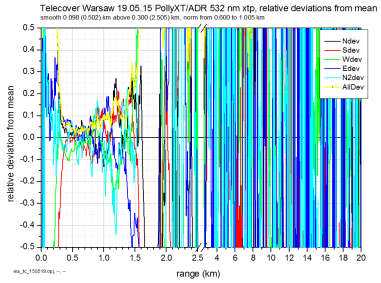


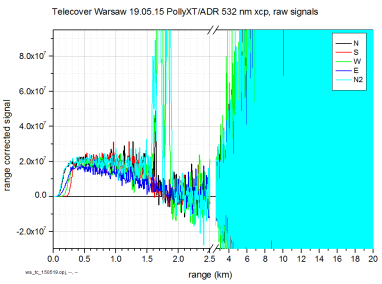


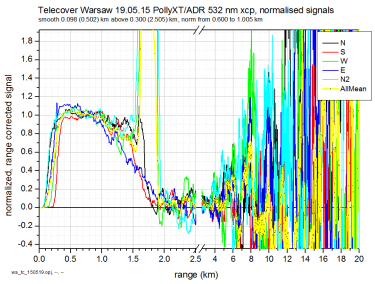


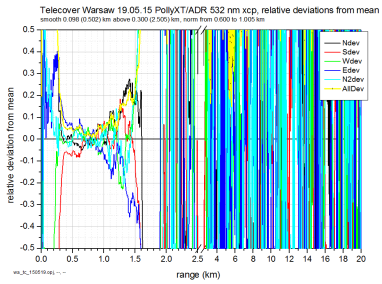


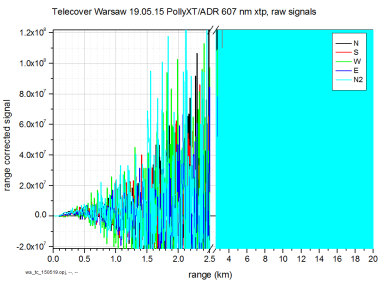


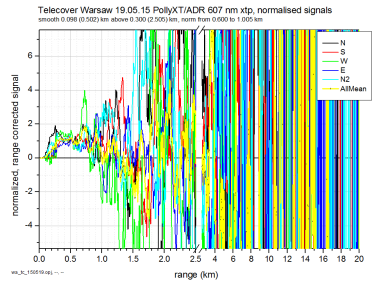


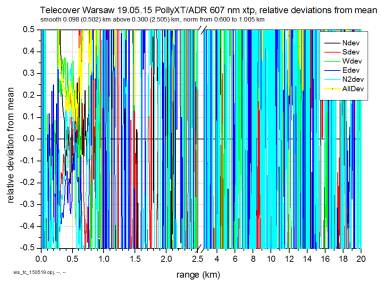


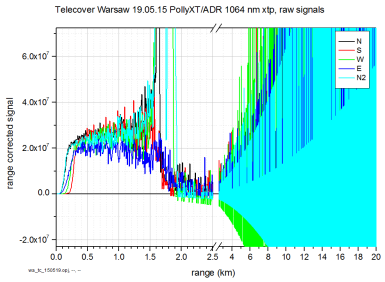


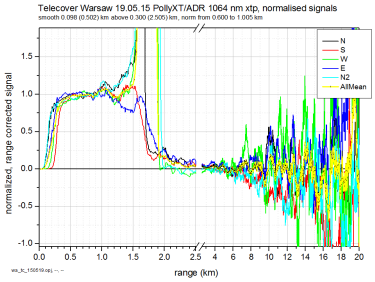


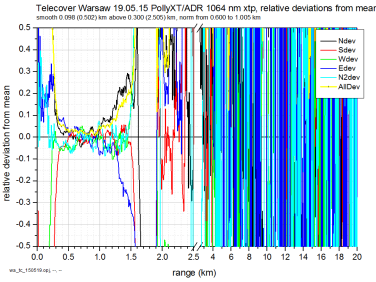







Telecover Warsaw 19.05.15 PollyXT/ADR 1064 nm xtp, raw signals
range corrected signal
range (km)
N
S
W
E
N2


Telecover Warsaw 19.05.15 PollyXT/ADR 1064 nm xtp, normalised signals
smooth 0.098 (0.502) km above 0.300 (2.505) km, norm from 0.600 to 1.005 km
normalized, range corrected signal
range (km)
N
S
W
E
N2
AllMean


Telecover Warsaw 19.05.15 PollyXT/ADR 1064 nm xtp, relative deviations from mear
smooth 0.098 (0.502) km above 0.300 (2.505) km, norm from 0.600 to 1.005 km
relative deviation from mean
range (km)
Ndev
Sdev
Wdev
Edev
N2dev
AllDev

3.4 References

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