



# New developments at <u>CLU</u>

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#### ACTRIS Data Centre – CLU unit Finnish Meteorological Institute

CCRES workshop 2024-06-11

### Cloudnet data volume

- ★ 1035 years of data
- ★ 1.3 M product files
- ★ 8.9 M raw files
- ★ 72 TiB of raw data (72% RPG \*.LV0 files)

Amount of raw data (72 TiB)



Year of measurement



Year of measurement

#### cloudnet.fmi.fi user statistics

# Monthly unique IPs downloading data





#### Processing queue

Move from cron jobs to queue/worker architecture.

Processing is now more flexible and real-time.



# Site page

New design for site landing page.

→ We need descriptions for the sites! Should focus on the cloud remote sensing component, not the whole station or ACTRIS National Facility.



#### Instrument page

New page in the data portal for each instrument.

Visualise available products and status of submitted raw files.

Will replace PID landing page / InstrumentDB page in the future.



	Search data	Visualise data	Documentation	Sites	Instruments	Products	Contact
UW HALO							
Halo Photonics D	oppler lidar						
		Ove	rview 🗅 Raw files				
Instrument							
PID	take with all to a all a	et/21.12132/3.c82311					
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# Product page

Online documentation on available products in the portal:

- Description
- References
- Dimensions
- Variables

#### Cloudne References Products Instrument products Measurements from an instrument in a harmonised format with some doi.org/10.5194/amt-13-5335-2020 additional processing such as noise screening. >> Disdrometer \* Lidar Dimensions Microwave radiometer ( Model height - Height above mean sea level 🖉 Radar 22 Weather station Dimonsions I Inite Data type float32 Synergetic products Standard name height\_above\_mean\_sea\_level time - Time UTC Cloud properties derived from multiple instruments of different type. Dimensions time Categorize A Classification Units Data type float32 O Drizzle Droplet effective radius Standard name time A lce effective radius A Ice water content Variables ∆ Liquid water content MWR brightness temperature MWR multiple pointing MWR single pointing depending on the source instrument Experimental products altitude - Altitude of site Linite Products based on novel methods or processing software still under Data type float32 development Standard name altitude Sh Categorize (Voodoo) # Classification (Voodoo) ter - Ice effective radius Dimensions time height Oppler lidar Report Doppler lidar wind Units Data type float32 約 Rain radar Description

#### Cloudnet Search data Visualise data Documentation Sites Instruments Products Cont

Ice effective radius

Description

Ice particle effective radius calculated using the Grieche et al. (2020) method which uses Hogan et al. (2006) to estimate ice water content and alpha from Delanoë et al. (2007). In this method, effective radius of ice particles is calculated from attenuated-corrected radar reflectivity and model temperature

Hogan et al. (2008). The Retrieval of Ice Water Content from Radar Reflectivity Factor and Temperature and Its Use in Evaluating a Mesoscale Model. Journal of Applied Meteorology and Climatology, 45(2), 301-317.

Delanoë et al. (2007). The Characterization of Ice Cloud Properties from Doppler Radar Measurements. Journal of Applied Meteorology and Climatology 46(10) 1682-1698 https://doi.org/10.1175(JAM2543.1

Griesche et al. (2020). Application of the shipborne remote sensing supersite OCEANET for profiling of Arctic aerosols and clouds during Polarstern cruise PS106. Atmos. Meas. Tech., 13(10), 5335-5358. https://

hours since 2024-01-01 00:00:00 +00:00

The following variables are available in all products of this type but additional variables may be present

This variable was calculated from the 35.5-GHz radar reflectivity factor after correction for gaseous attenuation, and temperature taken from a forecast model, using the following empirical formula: log10(ier[m]) = (+0.000205 \* Z[dBZ] \* T[degC] + 0.0016 \* Z[dBZ] + +0.0015 \* T[degC] + -1.52) \* 3 / (2 + 917[kg/m3]). In this formula Z is taken to be defined such that all frequencies of radar would measure the same Z in Rayleigh scattering ice. However, the radar is more likely to have been calibrated such that all frequencies would measure the same Z in Rayleigh scattering liquid cloud at 0 degrees C. The measured Z is therefore multiplied by K(liquid,0degC,35.5GHz) ^2/0.93 = 0.944 before applying this formula. The formula has been used where the "categorization" "data has diagnosed that the radar echo is due to ice, but note that in some cases supercooled drizzle will erroneously be identified as ice. Missing data indicates either that ice cloud was present but it was only detected by the lidar so its ice water content could not be estimated, or than there was rain below the ice associated with uncertain attenuation of the reflectivities in the ice.

ier\_error - Random error in ice effective radius



# MWRpy

MWRpy products are now available in 7/20 sites.

→ Sites need to send retrieval coefficients to us!



#### Weather station?



#### 5 weather stations, 5 file formats $\Box$ 26+ sites, 26+ formats?

• Unclear fields, wrong units, typos, local time, different resolutions, measurements at multiple heights, multiple rain gauges, ...

#### What fields are needed? Can we agree on a common file format?

"TOA5","CR1000XSeries","CR1000X","23644","CR1000X.Std.05.01","CPU:AGORA\_UGR.CR1X","54351","meteo" "TIMESTAMP","RECORD","air\_t\_Avg","rh\_Avg","pressure\_Avg","wind\_speed\_avg","wind\_dir\_avg","wind\_dir\_std"," rain\_Tot" "TS","RN,"degC","%","hPa","m/s","Deg","Deg","mm"

"","","Avg","Avg","Avg","WVc","WVc","WVc","Tot" "2024-04-21 00:00:00",5319,12.7,100,937.7554,0,0,0,0

 # y m d
 minute AaRNRT/mm AaNRT/mm BaRT/mm BaNRT/mm AbRNRT/mm AbNRT/mm BbNRT/mm

 Pa/kPa Ta/dsC RH/pcnt WD/ds WS/(m/s)
 2024 5 23 0
 0.000
 0.000
 477.938 477.945
 0.000
 0.000
 984.585
 984.596 100.86

2024 5 23 0 0.000 0.000 477.938 477.945 0.000 0.000 984.585 984.596 100.86 5.50 87.00 155.35 0.39

"Read time (UTC+2)", "Temp 2m (C)", "Humidity 2m (%)", "Temp 10m (C)", "Temp 20m (C)", "Temp -5cm (C)", "Dew point temp (C)", "Wind speed max/3h (m/s)", "Wind speed Tomin (m/s)", "Wind dir (deg)", "Wind dir 10min (deg)", "Perssure (hPa)", "Perssure s.I. (hPa)", "PPFD (umol/m2s)", "Error code 1 (code)", "Error code 2 (code)", "Snow depth (cm)", "Humidity 20.6m (%)", "Cloud base height (10m)", "Cloud layer1 height (10m)", "Layer2 cloudiness (1/8)", "Cloud layer3 height (10m)", "Layer3 cloudiness (1/8)", "Precipitation (?)"

<pre># File contains 1-min average standard ground weather data calculated from 5s wind data (speed and direction) at 10 m AGL # and from 5s weather data (temperature, humidity, pressure, precipitation) all at 2 m AGL from meteoairsol station # Location : SIRTA (48.7N, 2.2E), zone 1 # Created by : Christophe Boitel # For information concerning those files, contact email : sirtascience (at) ipsl.polytechnique.fr # Col. 1 : Date Time (yyyy-mm-ddThh:mm:ssZ) # Col. 2 : Wind speed (m/s) # Col. 3 : Wind direction (degres) # Col. 3 : Wind direction (degres) # Col. 5 : Relative humidity (%) # Col. 5 : Relative humidity (%) # Col. 6 : Pressure (hPa) # Col. 7 : Precipitation rate (mm/min) # Col. 8 : 24-hr cumulated precipitation since 00UT (mm) # # 01 02 03 04 05 06 07 08 # 2024-05-27T00:00:00Z 0.00 nan 13.04 86.69 999.940.00 0.00</pre>	# Date create # Version : 01		28							
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# Multiple instruments

Which instruments to select in synergetic products?

- Prioritise ACTRIS labelled instruments?
- How to choose between instruments of same type?
- What if data is missing?

#### Example from Lindenberg:

Lidar

- Lufft CHM 15k
- Vaisala CL61
- HALO StreamLine

Microwave radiometer

- RPG HATPRO-G5
- Radiometrics MP-3000A

Cloud radar

- METEK MIRA-35
- RPG-FMCW-94-DP

Disdrometer

- OTT Parsivel<sup>2</sup>
- Thies LPM

## Upcoming ACTRIS data portal

Developed by <u>NILU</u>.

Search Cloudnet data alongside other ACTRIS data.

Release is scheduled Autumn 2024.

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#### Roadmap for future developments

• Level 3 / model evaluation





Mean ice water content also compares quite well at all levels, if snow and graupel included.



### Roadmap for future developments

- Improved methods
  - Target categorization updates
  - ML target categorization
- New classification 'bits' for attenuation
  - Rain
    - disdrometer at surface and rain-reflectivity retrieval (Mom and Moisseev)
  - Melting level
    - retrieval in testing (Li and Moisseev, 2019)
  - Radome
    - blower, sky noise
  - Flag complete attenuation







### Roadmap for future developments

- Level 3 / model evaluation
- Improved methods (e.g. ML classification)
- New products (e.g. Doppler lidar)
- New instruments (e.g. MiniMPL)
- Instrument calibration in production
- Landing pages for campaigns? Now we only have "campaign sites".
- Multiple instrument combinations on the same site (e.g. to generate multiple classification products)

