

The logo for ACTRIS and CCRES. It features a blue arc at the top. A vertical teal line descends from the center of the arc to a teal circle that forms the letter 'O' in 'ACTRIS'. To the right of this line are three teal circles of increasing size. Below the arc, the word 'ACTRIS' is written in teal, and 'CCRES' is written in blue below it.

ACTRIS CCRES

DL Unit – Operational Services

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Pyry Pentikäinen

CCRES Workshop, online – June 11th, 2024



This project receives funding from the European Union's Horizon 2020 research and innovation programme under grant agreements No 871115

DL processing

- Software-based processing and calibration for Doppler lidar
 - SOP (Standard Operation Procedures) documentation
 - Processing Framework incorporating QC and product algorithms
- Tasks
 - Ensure calibration and uncertainty propagation for Doppler lidars in ACTRIS
 - Pointing angle
 - Doppler velocity
 - Winds
 - Signal-to-noise ratio
 - Attenuated backscatter, uncertainties
 - Products
 - Dissipation rate, wind shear, boundary layer classification



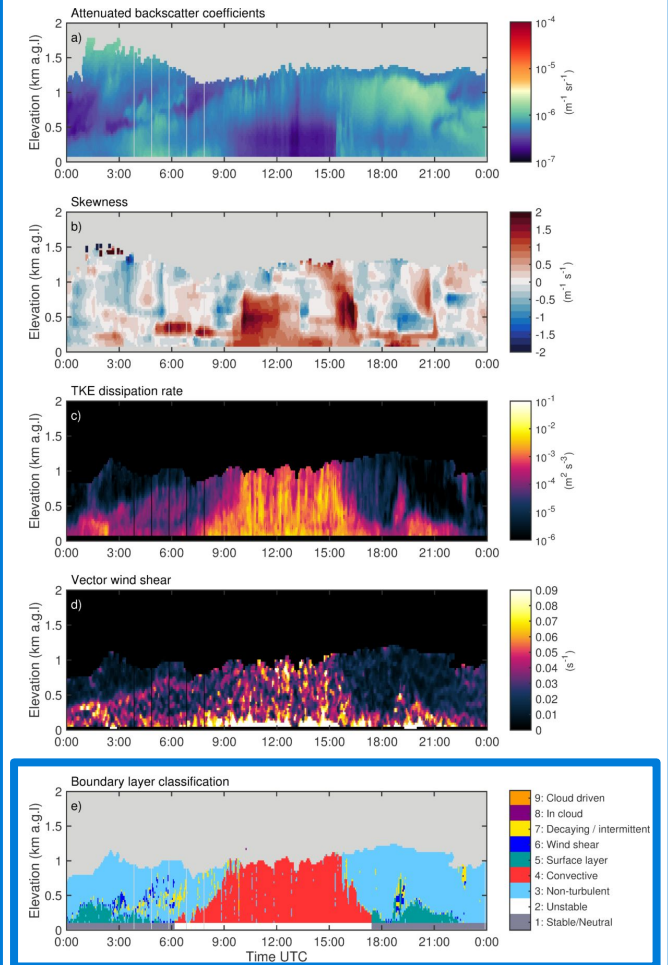
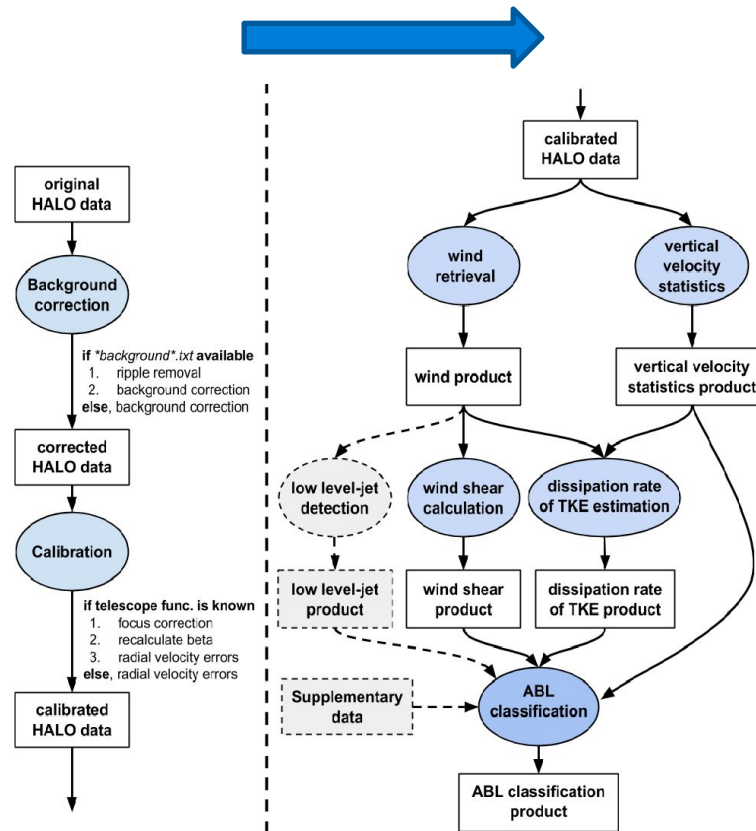
CCRES DL Unit

Doppler lidar: Halo Photonics,
Vaisala



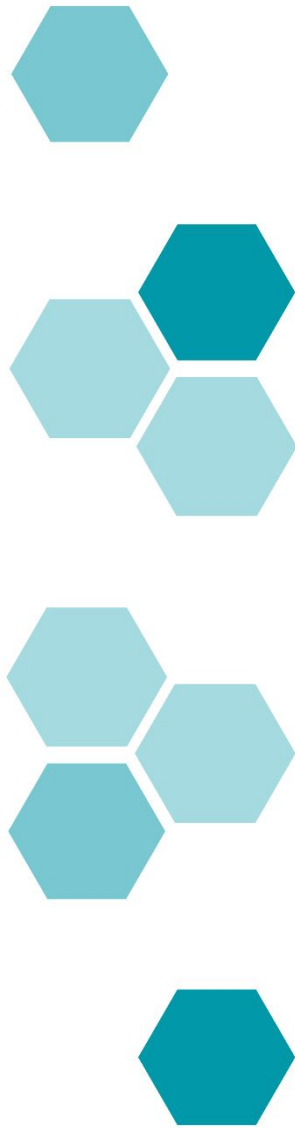
Leosphere

Doppler lidar products:
Winds, wind shear, skewness,
dissipation rate,
BL classification

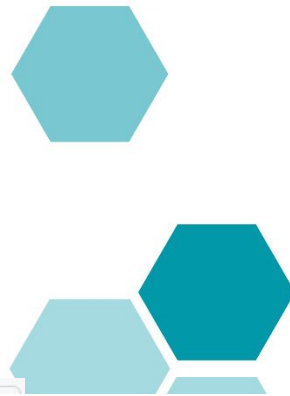


Operational services

- Automated data transmission from NF to DC (together with DC)
- Automated processing and retrieval
 - Horizontal winds are produced in close to real time
 - Continue to develop calibration and QC/monitoring routines
 - Housekeeping DB
 - Supply processing codes on github
 - Both calibration and standard processing
 - Preparing for labelling process



Processing software



- Doppler lidar processing is a Python package (with some Rust)
 - *doppy*: <https://github.com/actris-cloudnet/doppy>

The screenshot shows the GitHub repository page for 'Doppy - Wind doppler lidar p'. The page is divided into two main sections: the left sidebar and the main content area.

Left Sidebar:

- act
- README
- MIT license
- <> Co

Main Content Area:

Doppy - Wind doppler lidar p

CI passing pypi package 0.2.2

Products

- [Stare: Examples](#)
- [Wind: Examples](#)

Instruments

- HALO Photonics Streamline lidars (stare, wind)
- Leosphere WindCube WLS200S (wind)
- Leosphere WindCube WLS70 (wind)

Install

```
pip install doppy
```

Usage

```
import doppy

stare = doppy.product.Stare.from_halo_data(
    data=LIST_OF_STARE_FILE_PATHS,
    data_bg=LIST_OF_BACKGROUND_FILE_PATHS,
    bg_correction_method=doppy.options.BgCorrectionMethod.FIT,
)

(
    doppy.netcdf.Dataset(FILENAME)
    .add_dimension("time")
    .add_dimension("range")
    .add_time(
        name="time",
        dimensions=("time",),
        standard_name="time",
        long_name="Time UTC",
        data=stare.time,
        dtype="f8",
    )
    .add_variable(
        name="range",
        dimensions=("range",),
        units="m",
        data=stare.radial_distance,
        dtype="f4",
    )
)
```



Support for new instruments



ACTRIS Vocabulary

Content language English ▾

Search

Alphabetical

Hierarchy

- data source
- experiment
- instrument
 - instrument model
 - instrument type
 - aerosol particle filter sampler
 - aerosol particle sampler
 - cloud radar
 - electrochemical sensor
 - electron paramagnetic resonance spectrometer
 - gas chromatograph
 - gas sampler
 - gas-phase mass spectrometer
 - high performance liquid chromatograph
 - in situ particle optical parameter instrument
 - inductively coupled plasma spectrometer
 - instrument type unknown
 - ion beam analysis
 - ion chromatograph
 - lidar
 - depolarisation lidar ceilometer
 - differential absorption lidar
 - Doppler lidar**
 - HALO Photonics StreamLine
 - HALO Photonics StreamLine Pro
 - HALO Photonics StreamLine XR
 - HALO Photonics StreamLine XR+
 - Vaisala WindCube 100S
 - Vaisala WindCube 200S
 - Vaisala WindCube 400S
 - Vaisala WindCube WLS70
 - elastic lidar
 - elastic polarization lidar
 - lidar ceilometer
 - multiwavelength Raman lidar
 - multiwavelength Raman polarization lidar
 - Raman lidar
 - Raman polarization lidar

data source > instrument > instrument type > lidar > Doppler lidar

PREFERRED TERM

Doppler lidar

DEFINITION

Active remote sensing instrument operating at near-infrared wavelengths for detecting the scattering and Doppler shift of particles in the atmosphere.

BROADER CONCEPT

[lidar](#)

NARROWER CONCEPTS

[HALO Photonics StreamLine](#)
[HALO Photonics StreamLine Pro](#)
[HALO Photonics StreamLine XR](#)
[HALO Photonics StreamLine XR+](#)
[Vaisala WindCube 100S](#)
[Vaisala WindCube 200S](#)
[Vaisala WindCube 400S](#)
[Vaisala WindCube WLS70](#)

CREATOR

<https://orcid.org/0000-0001-9834-5100>

URI

https://vocabulary.actris.nilu.no/actris_vocab/Dopplerlidar

Download this concept:

[RDF/XML](#) [TURTLE](#) [JSON-LD](#)





Location

Show all sites

Date

2024-01-01 — 2024-06-10

Show date range

Product

Show experimental products

Instrument model

Results

Found 160 results

volatile experimental

Data object	Date
Doppler lidar wind from Payerne	<input type="checkbox"/> <input checked="" type="checkbox"/> 2024-06-10
Doppler lidar wind from Payerne	<input type="checkbox"/> <input checked="" type="checkbox"/> 2024-06-09
Doppler lidar wind from Payerne	<input type="checkbox"/> <input checked="" type="checkbox"/> 2024-06-08
Doppler lidar wind from Payerne	<input type="checkbox"/> <input checked="" type="checkbox"/> 2024-06-07
Doppler lidar wind from Payerne	<input type="checkbox"/> <input checked="" type="checkbox"/> 2024-06-06
Doppler lidar wind from Payerne	<input type="checkbox"/> <input checked="" type="checkbox"/> 2024-06-05
Doppler lidar wind from Payerne	<input type="checkbox"/> <input checked="" type="checkbox"/> 2024-06-04
Doppler lidar wind from Payerne	<input type="checkbox"/> <input checked="" type="checkbox"/> 2024-06-03
Doppler lidar wind from Payerne	<input type="checkbox"/> <input checked="" type="checkbox"/> 2024-06-02
Doppler lidar wind from Payerne	<input type="checkbox"/> <input checked="" type="checkbox"/> 2024-06-01
Doppler lidar wind from Payerne	<input type="checkbox"/> <input checked="" type="checkbox"/> 2024-05-31
Doppler lidar wind from Payerne	<input type="checkbox"/> <input checked="" type="checkbox"/> 2024-05-30
Doppler lidar wind from Payerne	<input type="checkbox"/> <input checked="" type="checkbox"/> 2024-05-29



Location
Palaiseau x

Show all sites

Date
Current year Last 30 days Today

2024-01-01 — 2024-06-10

Show date range

Product
Doppler lidar wind x

Show experimental products

Instrument model

Results

Found 86 results

volatile experimental

Data object	Date
Doppler lidar wind from Palaiseau	2024-06-10
Doppler lidar wind from Palaiseau	2024-06-09
Doppler lidar wind from Palaiseau	2024-06-08
Doppler lidar wind from Palaiseau	2024-06-07
Doppler lidar wind from Palaiseau	2024-06-06
Doppler lidar wind from Palaiseau	2024-06-05
Doppler lidar wind from Palaiseau	2024-06-04
Doppler lidar wind from Palaiseau	2024-06-03
Doppler lidar wind from Palaiseau	2024-06-02
Doppler lidar wind from Palaiseau	2024-06-01
Doppler lidar wind from Palaiseau	2024-05-31
Doppler lidar wind from Palaiseau	2024-05-30
Doppler lidar wind from Palaiseau	2024-05-29

Support for new instruments

CEREA WLS70

Leosphere WLS70 WindCube Doppler lidar

[Overview](#)

[Raw files](#)

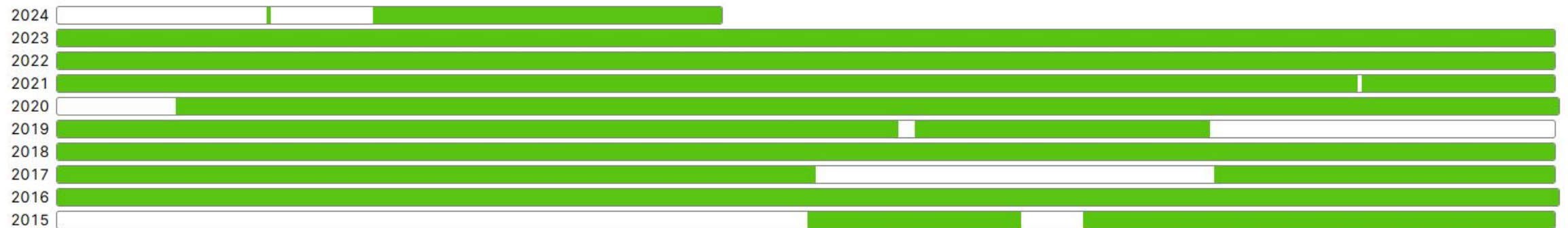
Instrument

PID	https://hdl.handle.net/21.12132/3.d5ee0db6ac964a04
Owner	Centre d'Enseignement et de Recherche en Environnement Atmosphérique (CEREA)
Model	Leosphere WindCube WLS70
Type	Doppler lidar
Serial number	WLS70-10

Locations

2015-07-03 – now [Palaiseau](#)

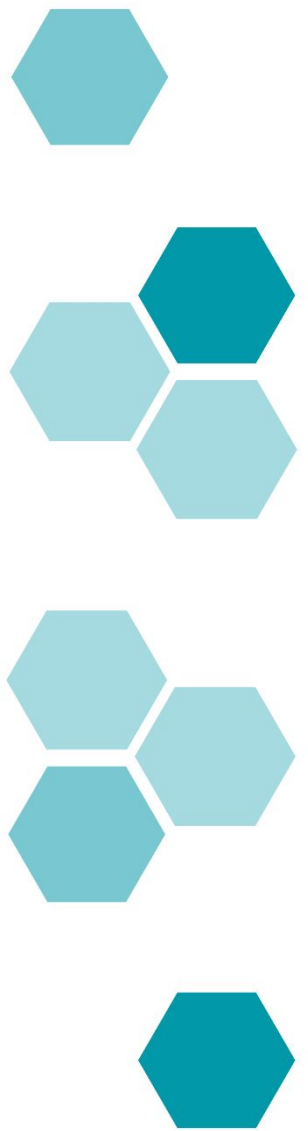
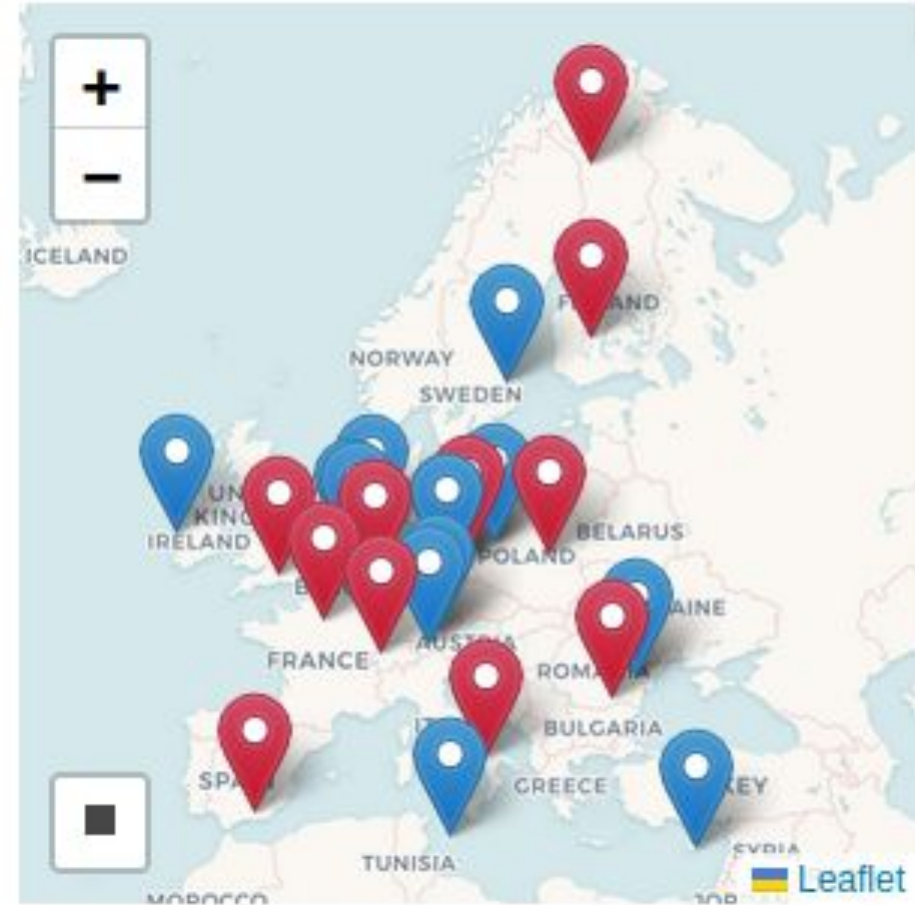
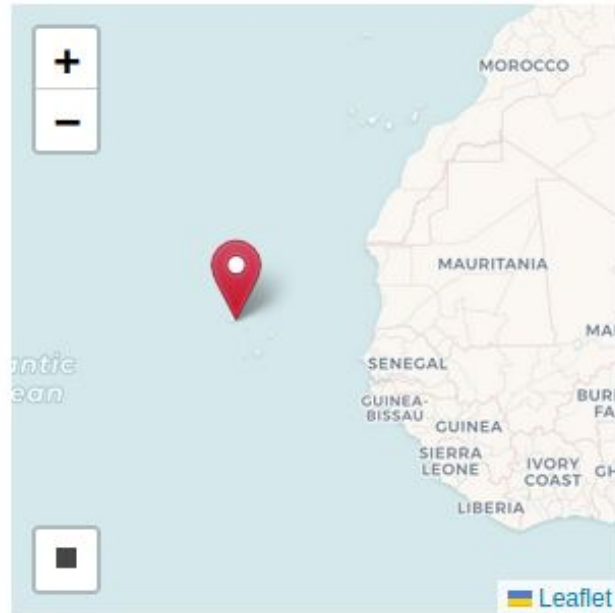
Product availability



All products Some products No products

Doppler lidar instruments

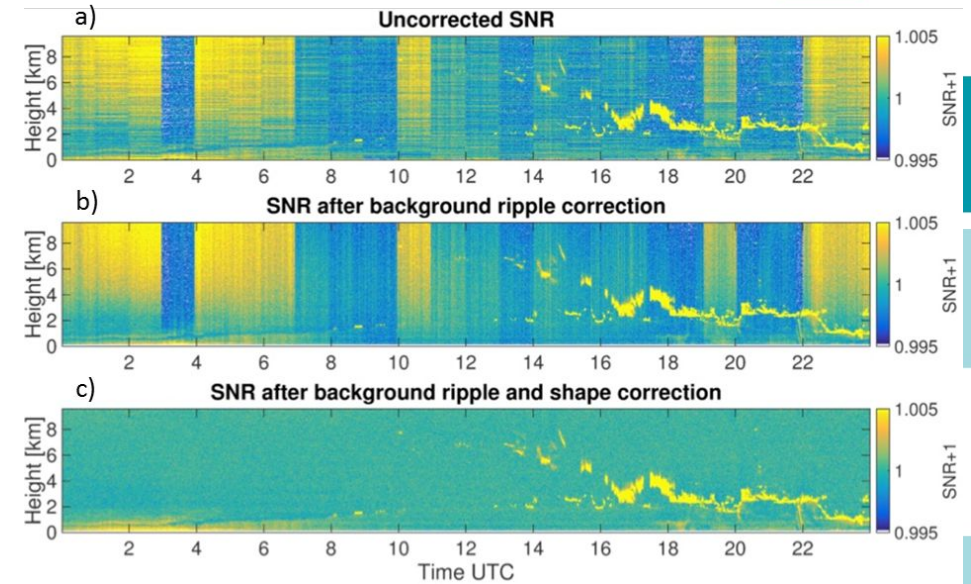
- 13 systems operational
- Another 5 in the database



Automatic calibration procedures

Background correction and uncertainty calculation

- Uncertainty (SNR and v) depends on SNR
- Correct SNR
 - May be temperature dependent
 - [Manninen et al. 2016, Vakkari et al., 2019](#)
- Update SNR and radial velocity uncertainties



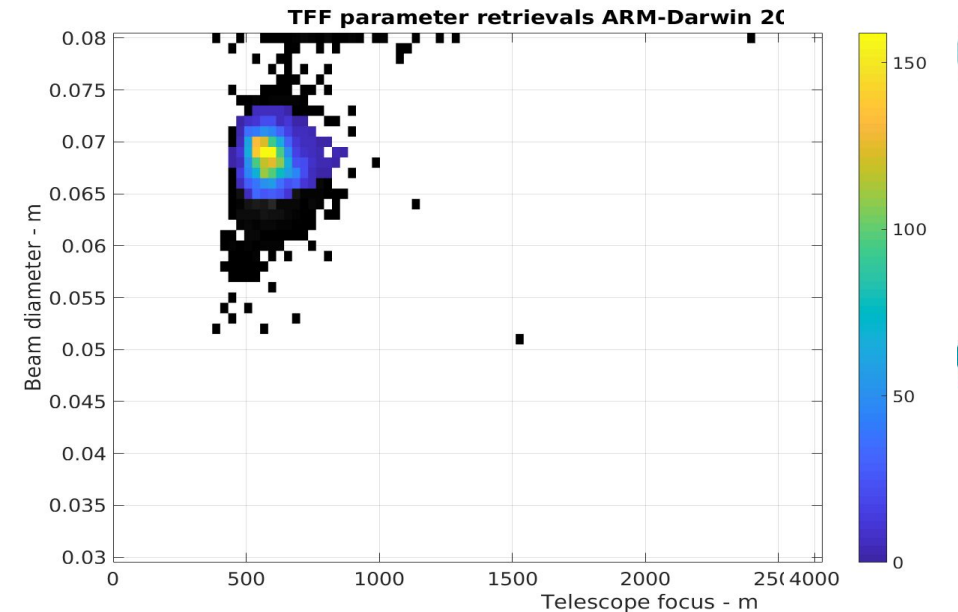
Automatic calibration procedures

Wind calibration – together with PROBE

- Pointing angle check (azimuth and elevation)
- Comparison with in situ if possible
- Uncertainty provision and turbulent impact
 - Scan sequence and retrieval method

Attenuated backscatter calibration

- Liquid cloud calibration ([O'Connor et al. 2004](#), [Hopkin et al. 2019](#))
- Telescope focus function required ([Pentikäinen et al. 2020](#))



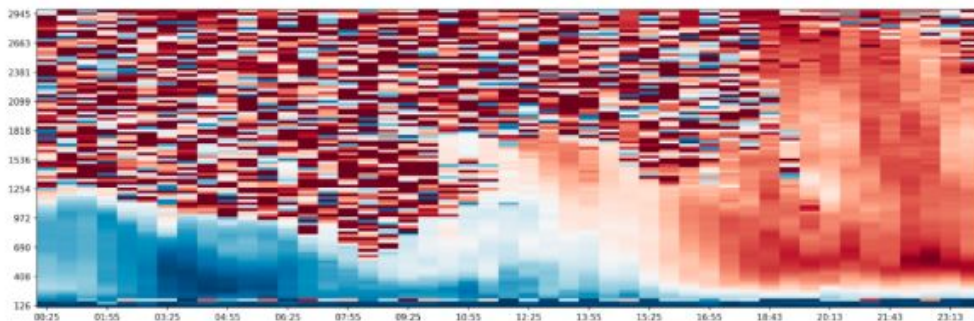
Instrument monitoring - winds

- Start with NWP – will also use weather station, mast, radiosondes where possible
- Model-observation intercomparison

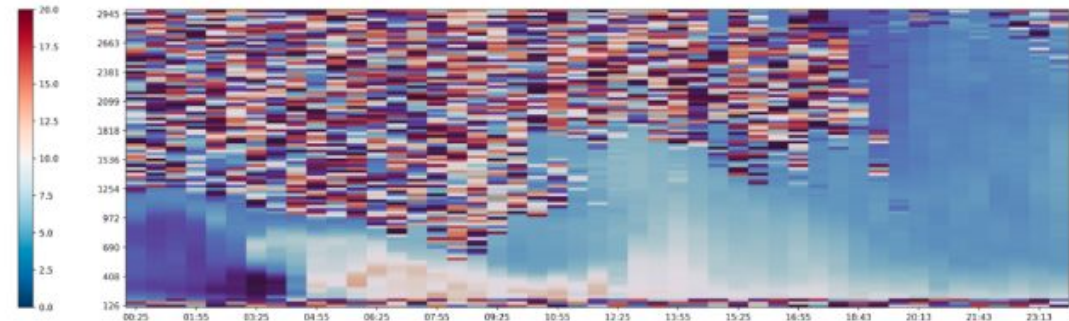
Pentikäinen, P., O'Connor, E. J., and Ortiz-Amezcuca, P.: Evaluating wind profiles in a numerical weather prediction model with Doppler lidar, Geosci. Model Dev., 16, 2077–2094, <https://doi.org/10.5194/gmd-16-2077-2023>, 2023.

Warsaw
2023-10-13

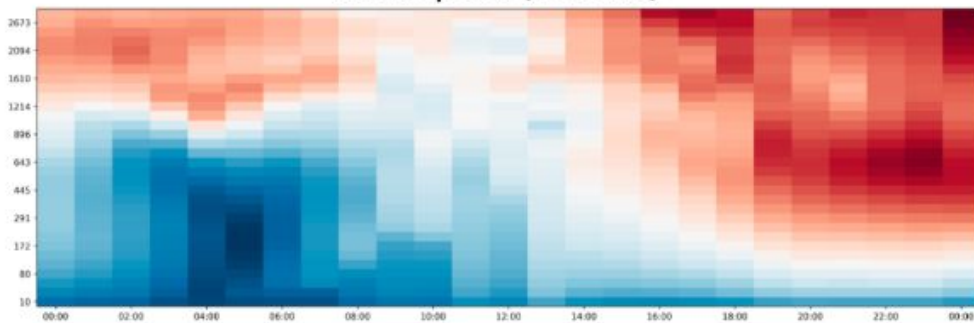
Wind speed (Halo)



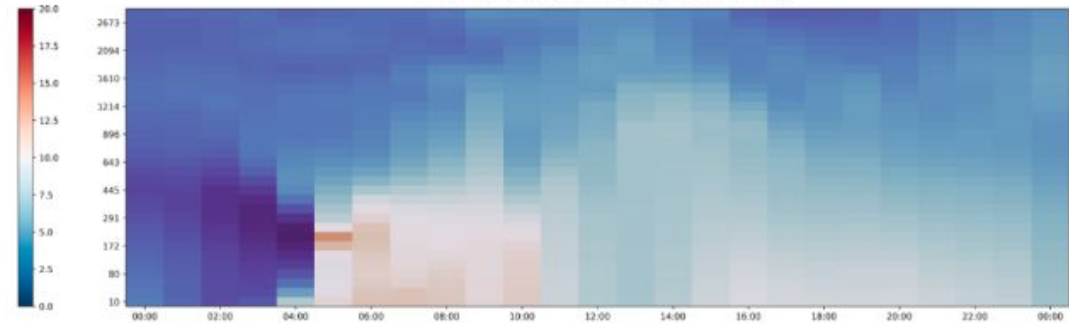
Wind direction (Halo)



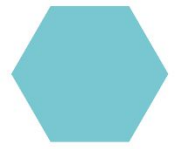
Wind speed (ECMWF)



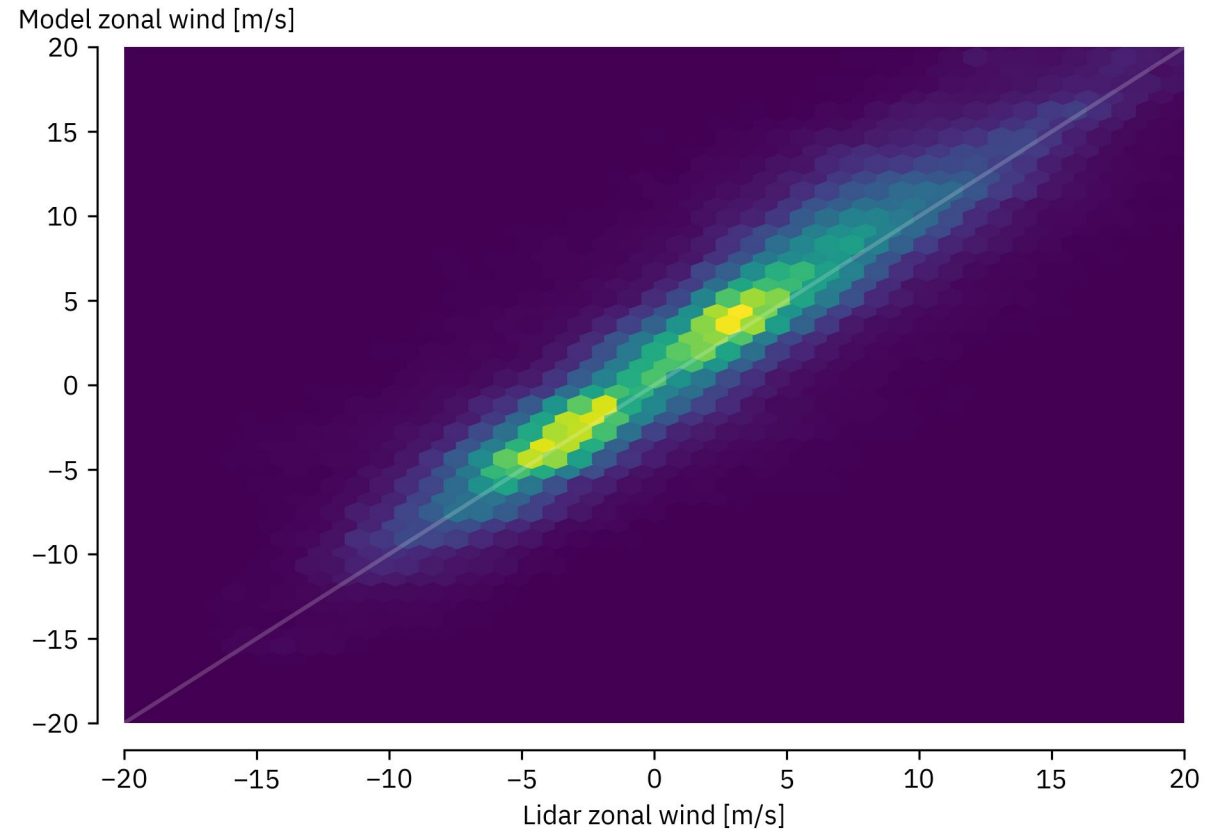
Wind direction (ECMWF)



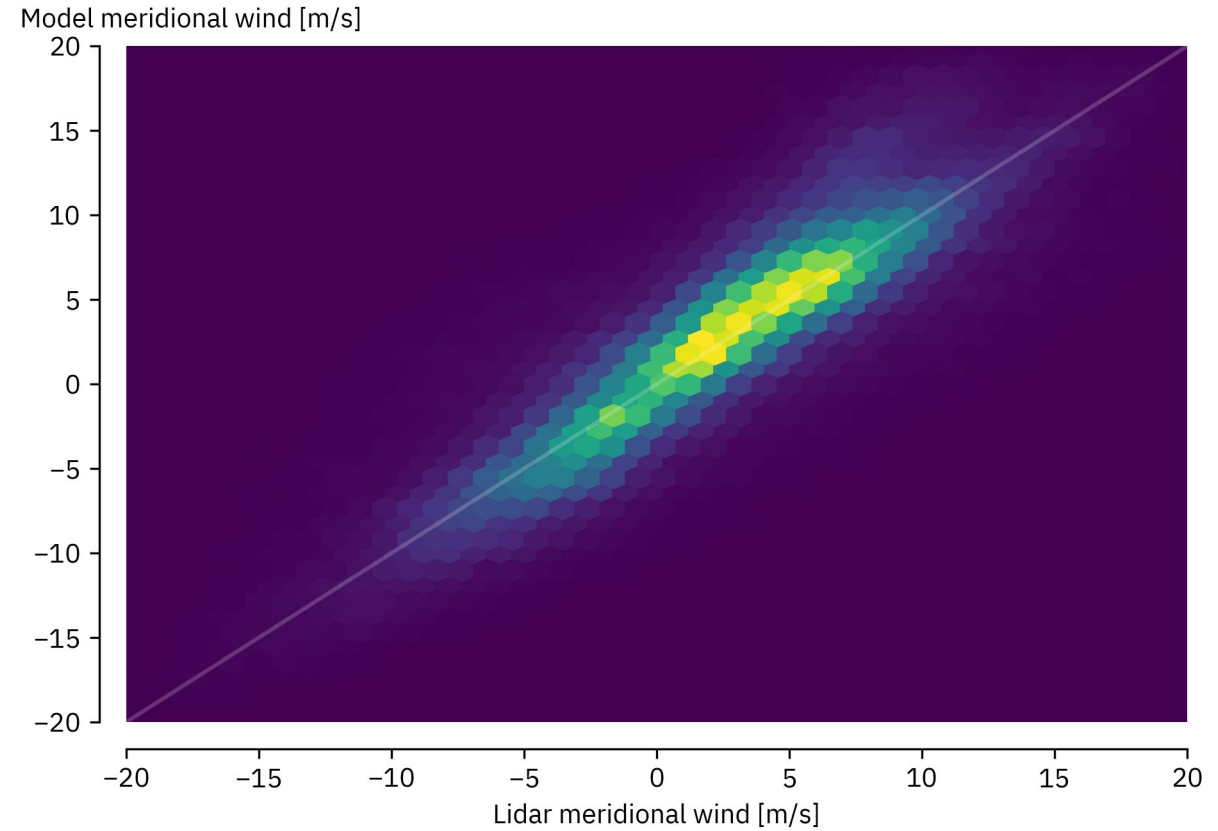
Monitoring with NWP



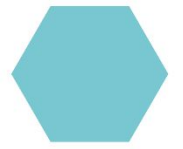
warsaw 2024-01-01 - 2024-12-31



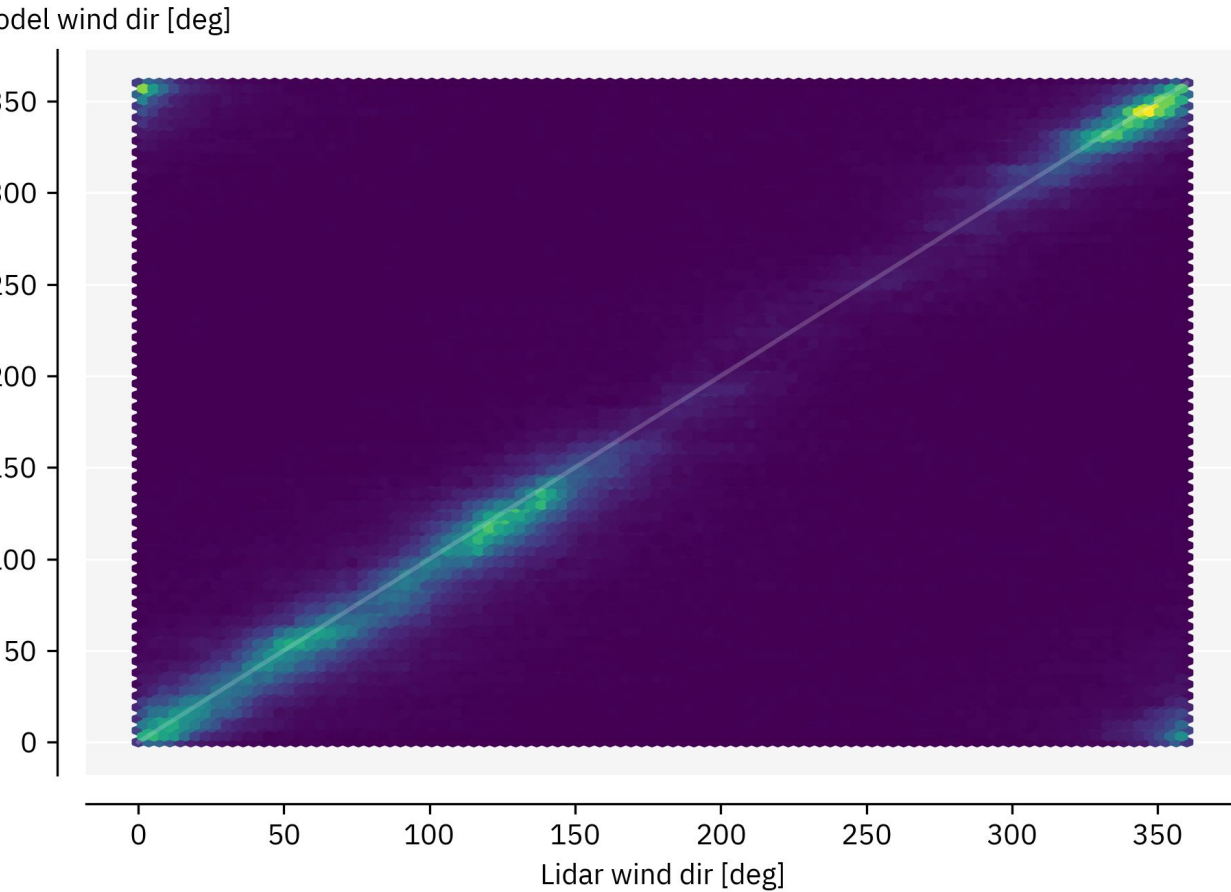
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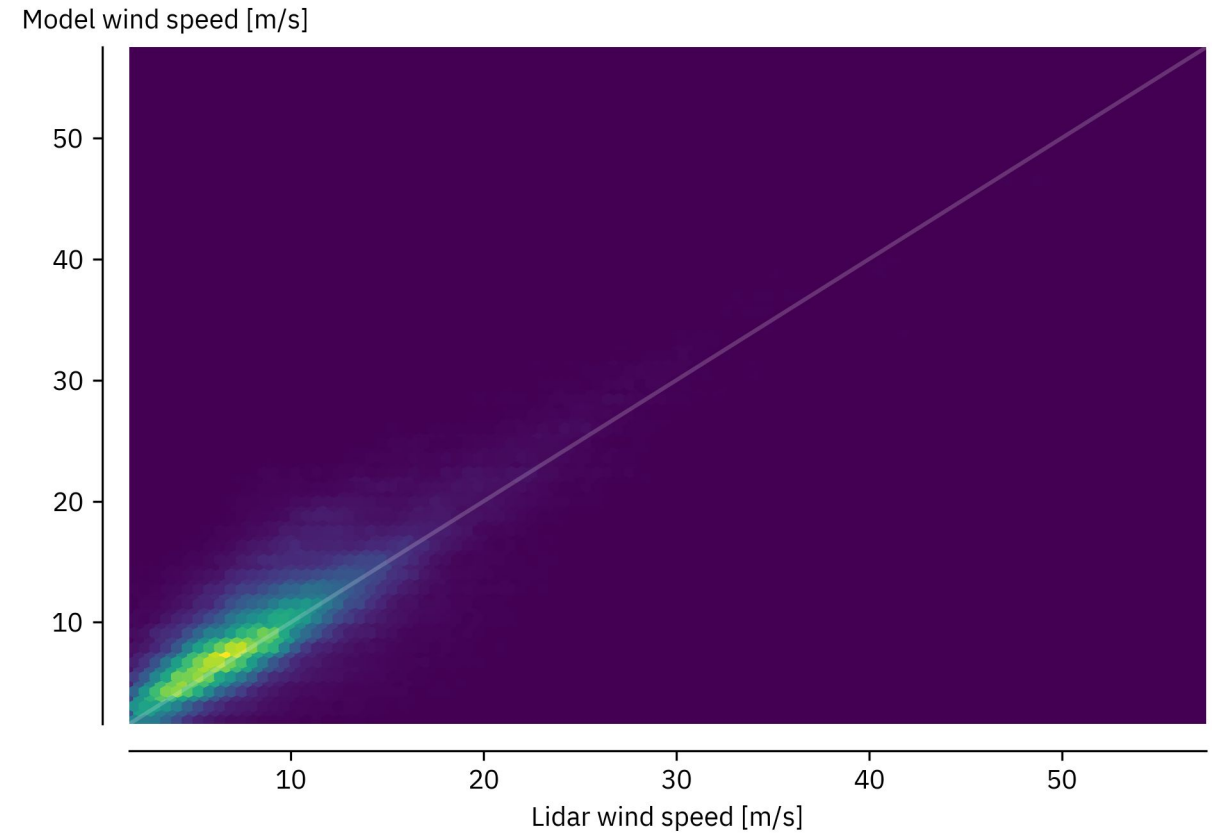
Monitoring with NWP



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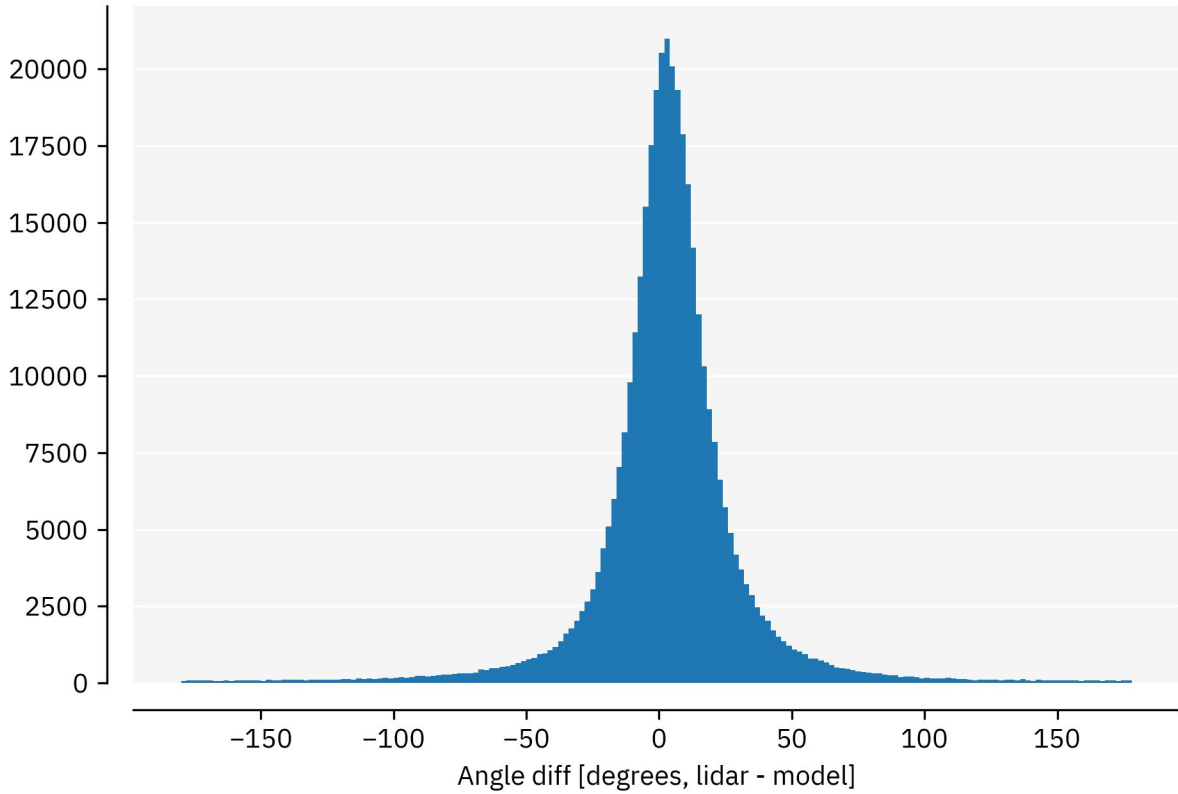
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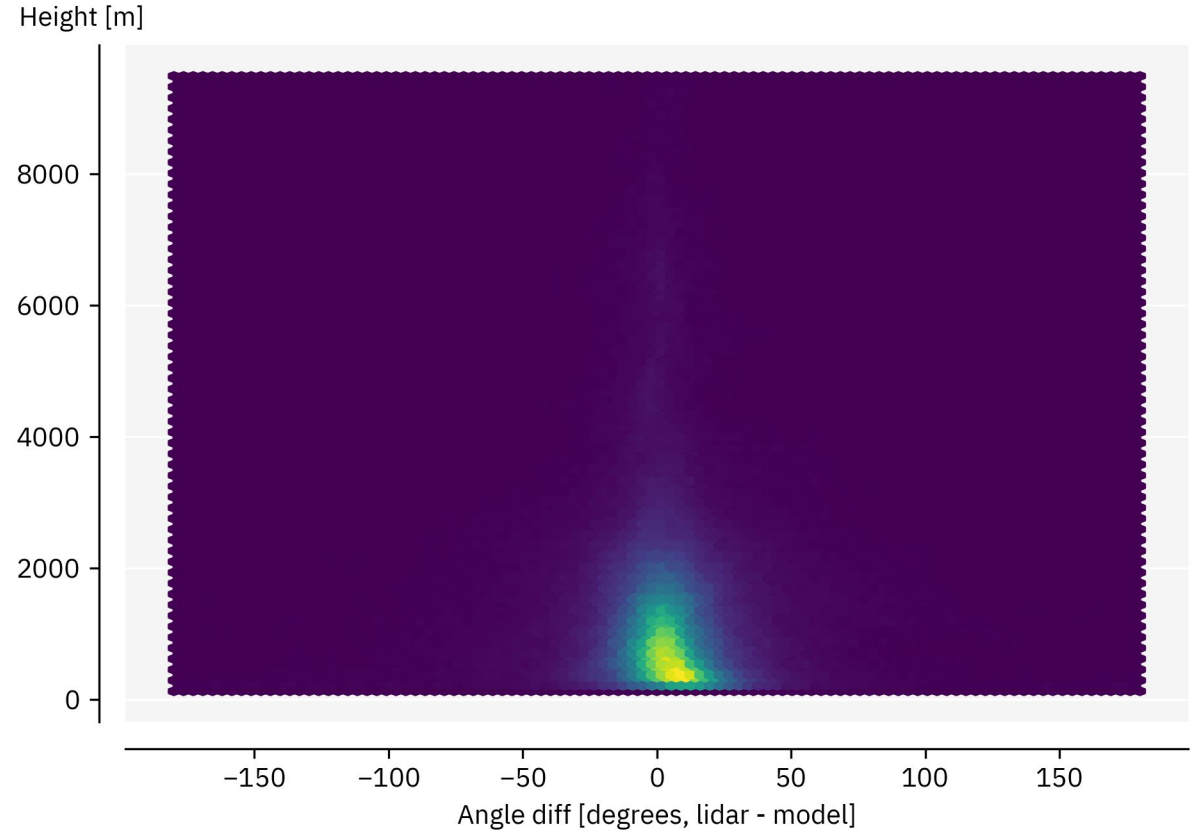
Monitoring with NWP



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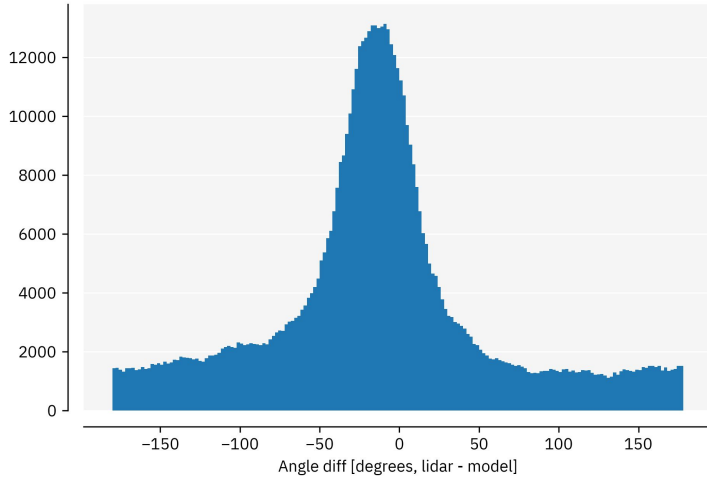


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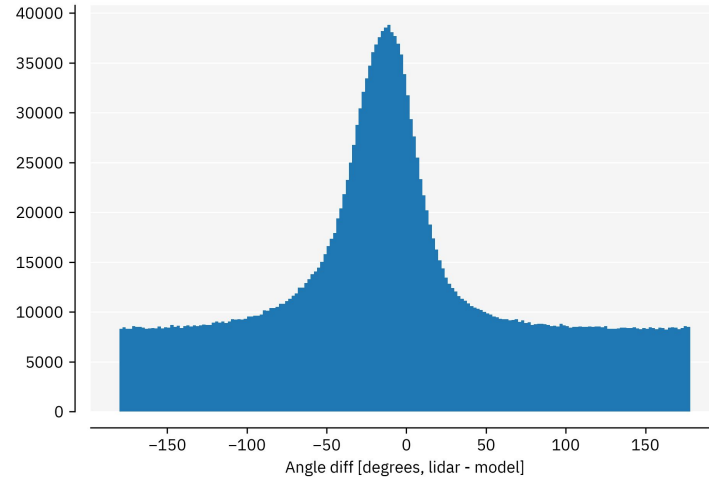


Monitoring with NWP

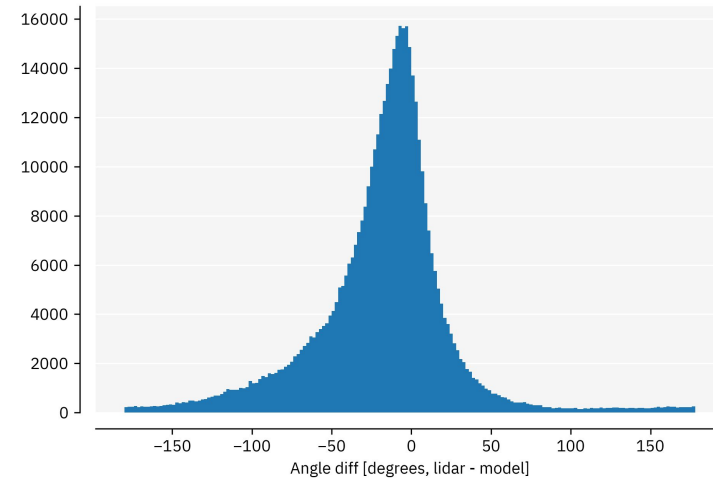
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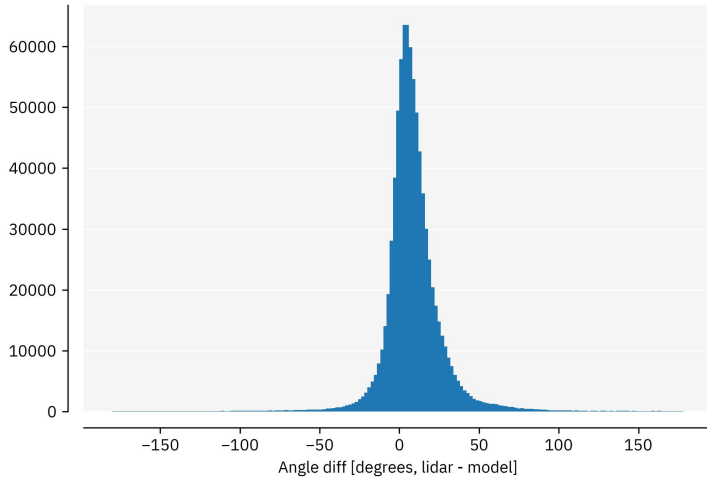
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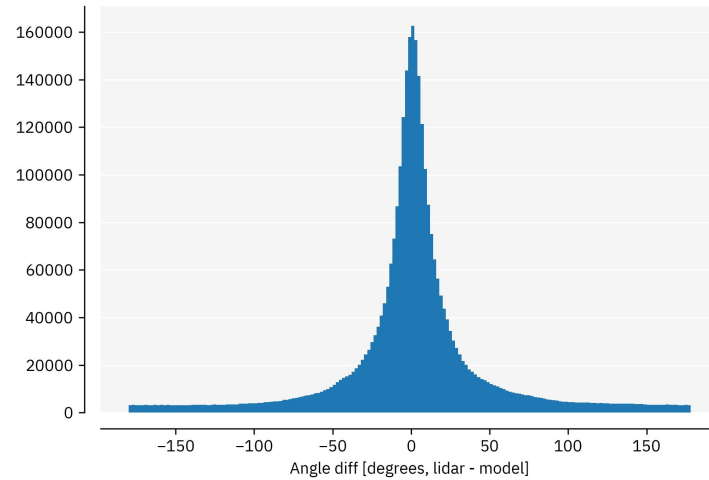
juelich 2024-01-01 - 2024-12-31



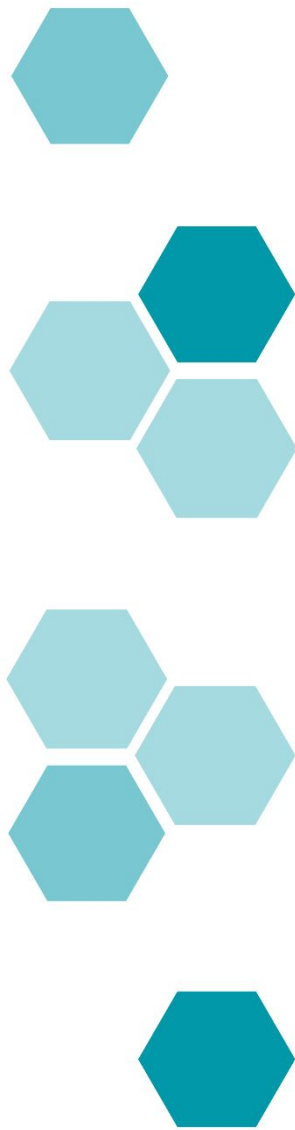
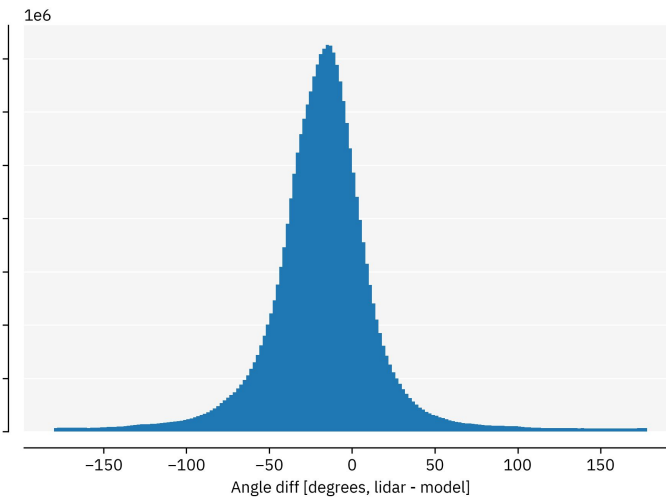
lindenberg 2023-01-01 - 2023-12-31



neumayer 2024-01-01 - 2024-12-31

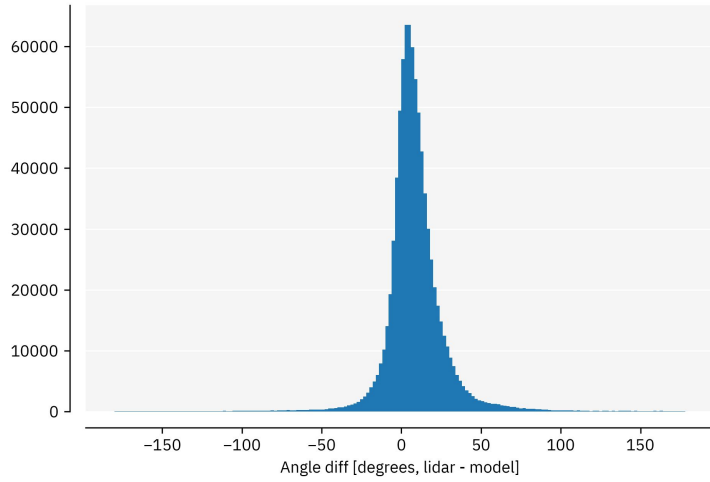


palaiseau 2023-01-01 - 2023-12-31

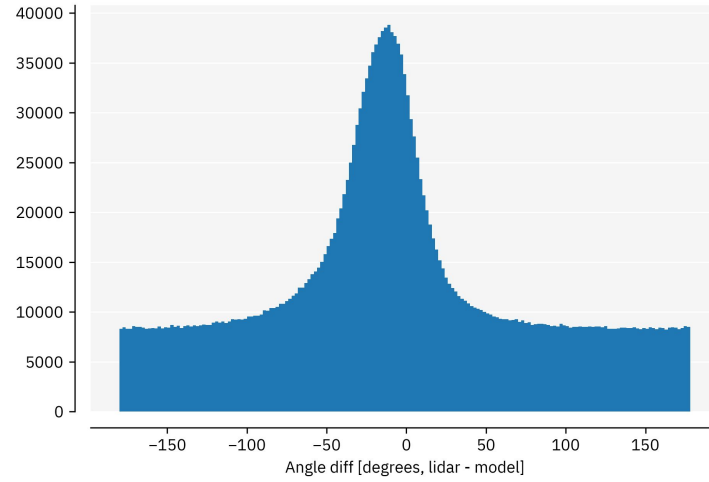


Monitoring with NWP

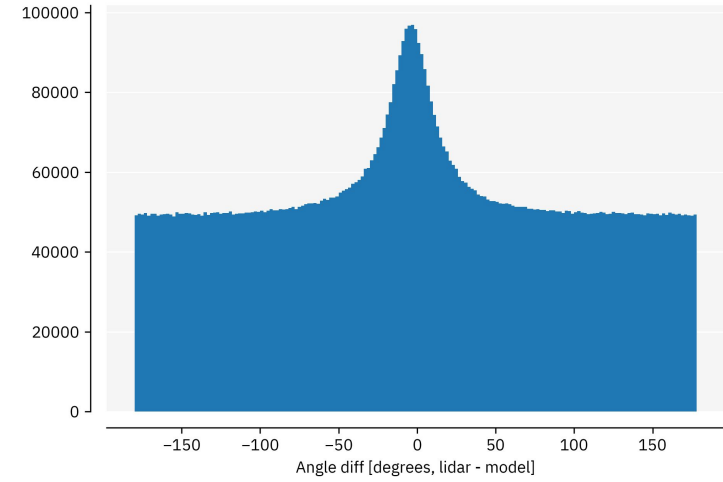
lindenberg 2023-01-01 - 2023-12-31



chilbolton 2024-01-01 - 2024-12-31



vehmasmaki 2022-01-01 - 2022-12-31

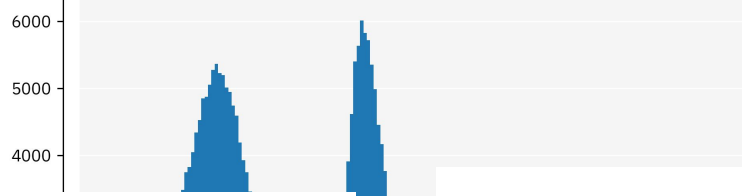


Monitoring with NWP



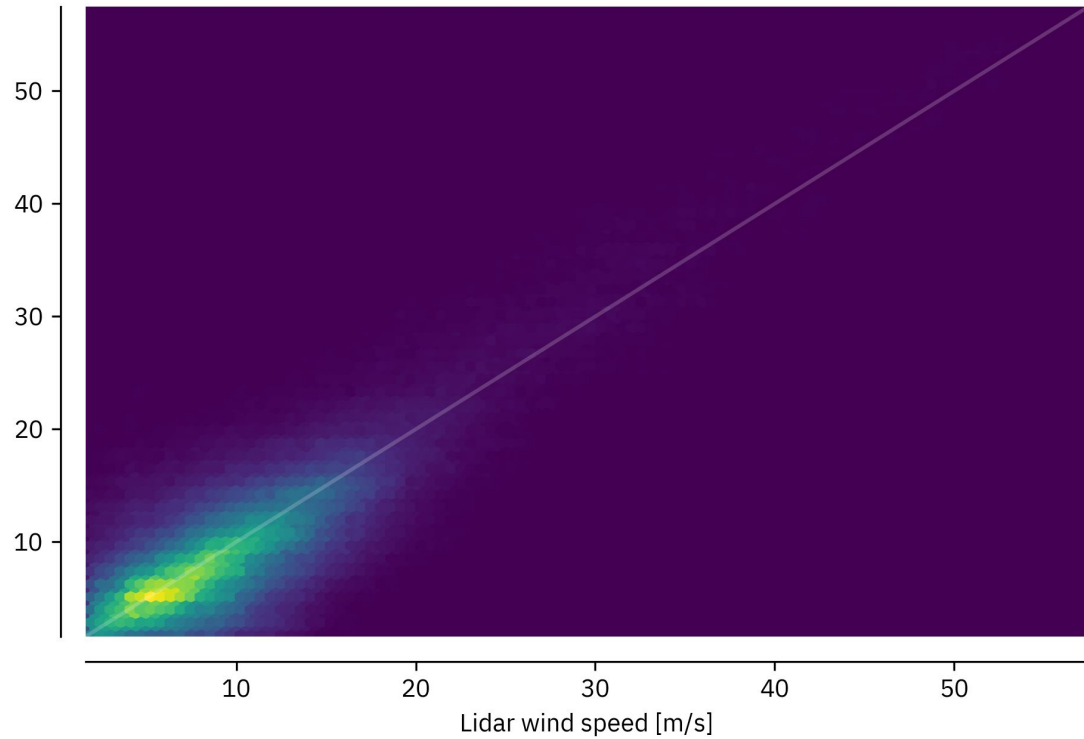
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kenttarova 2023-01-01 - 2023-12-31



kenttarova 2023-01-01 - 2023-12-31

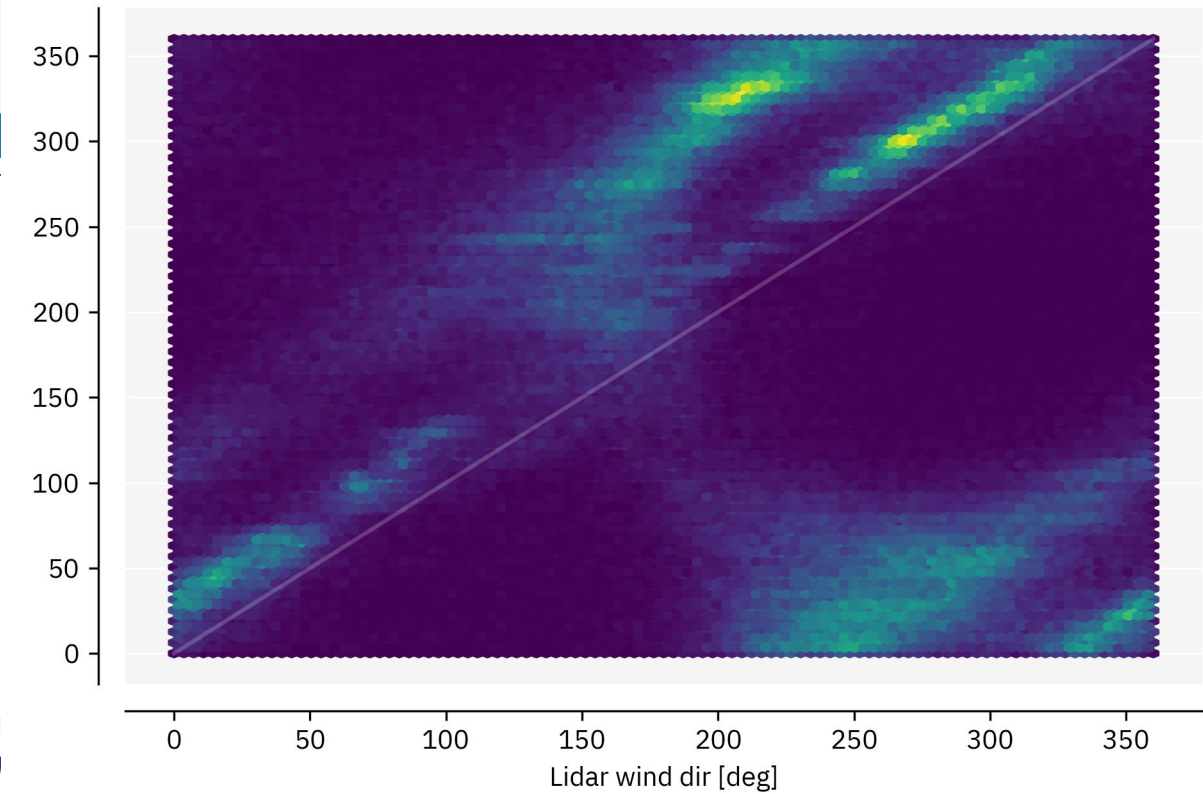
Model wind speed [m/s]



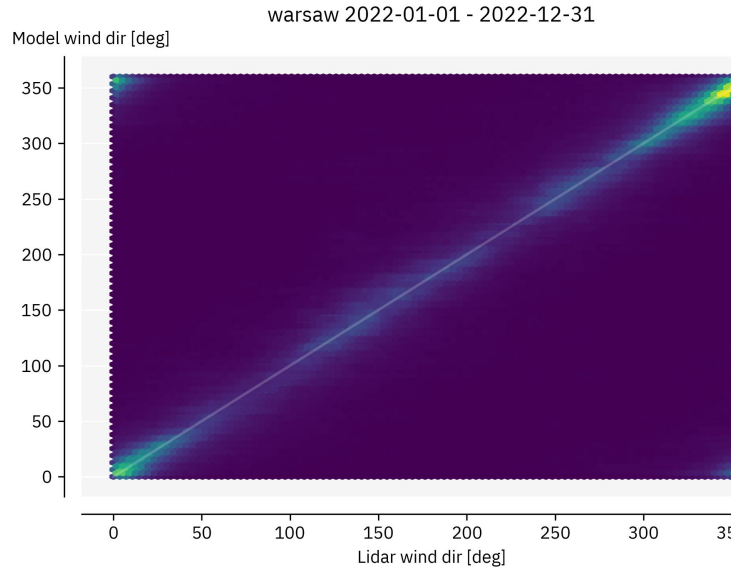
f [degrees,

kenttarova 2023-01-01 - 2023-12-31

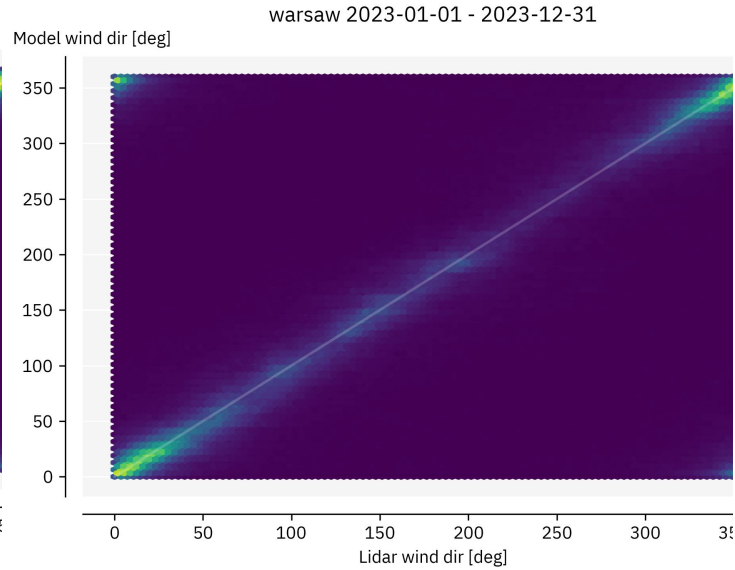
Model wind dir [deg]



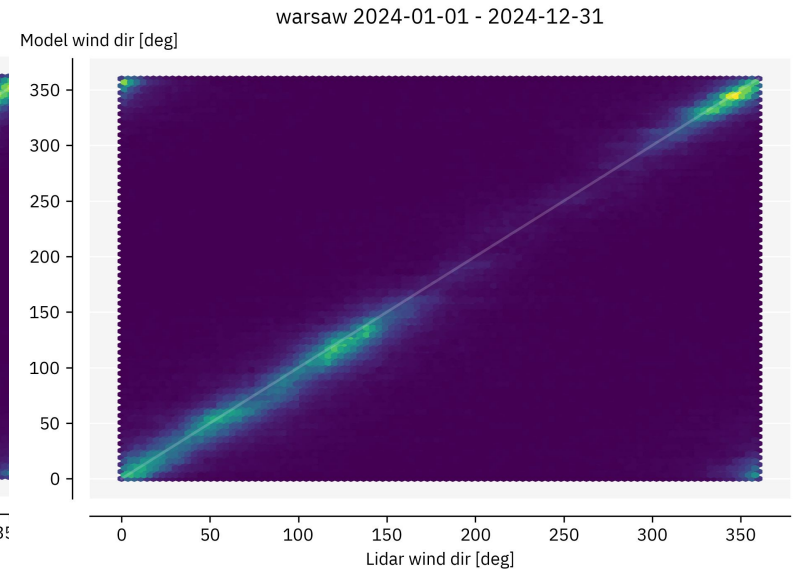
Monitoring with NWP



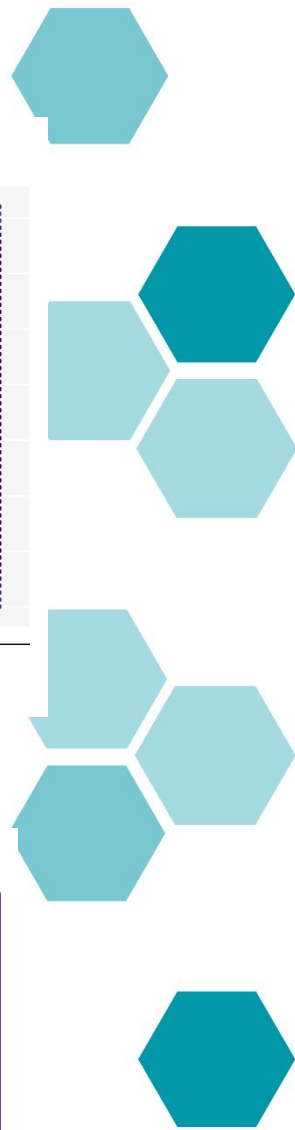
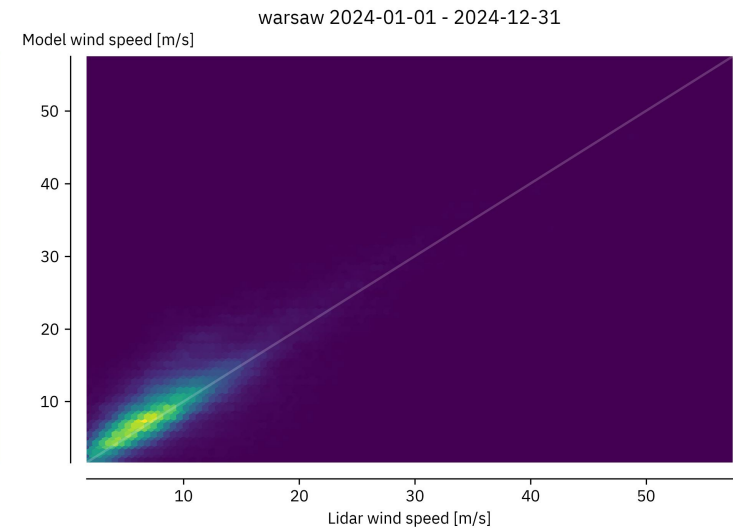
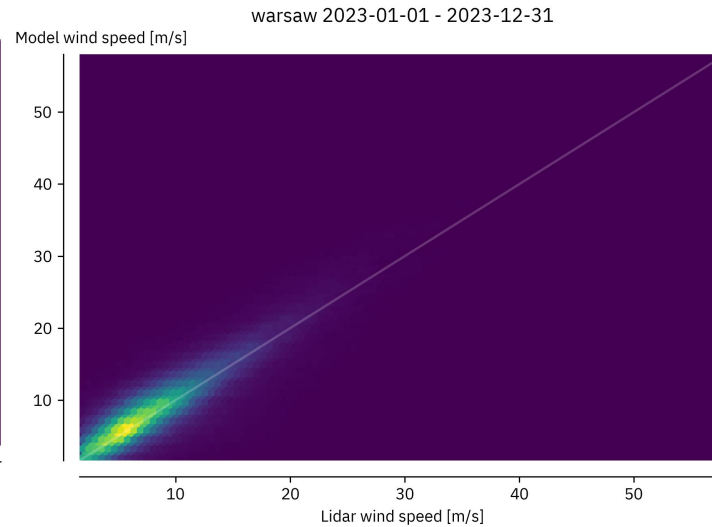
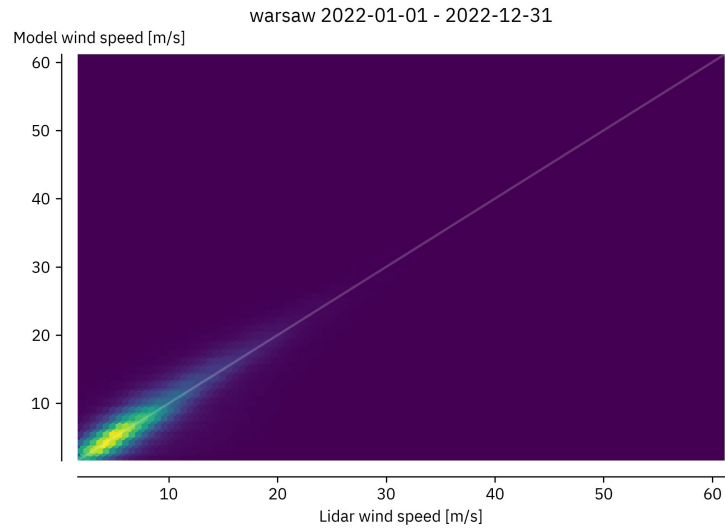
2022



2023

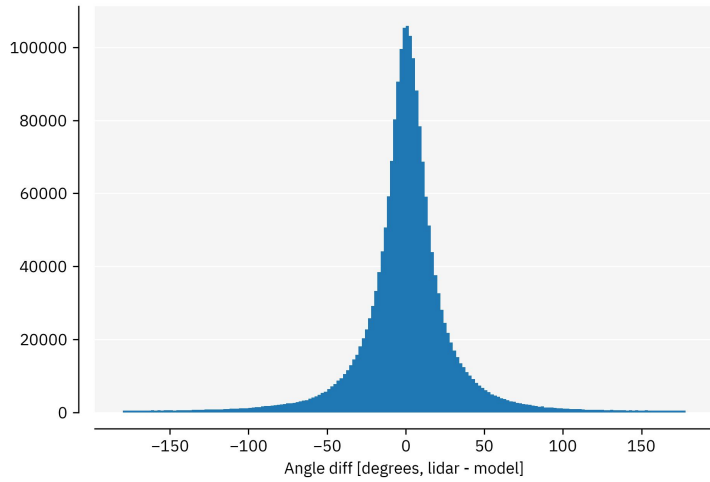


2024



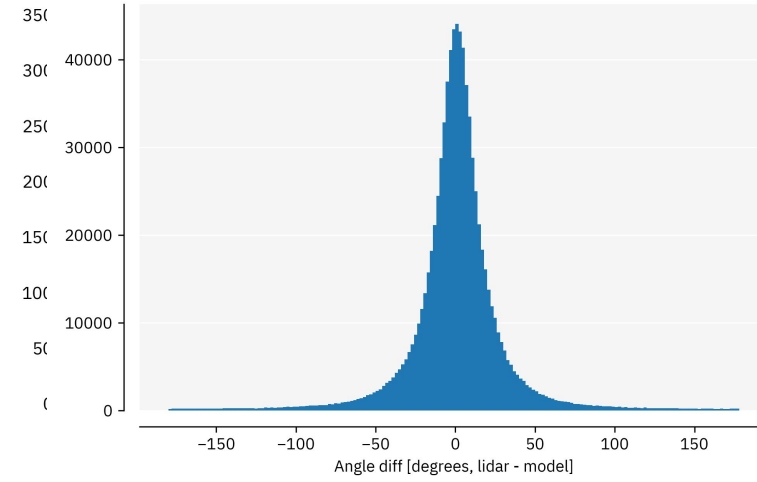
Monitoring with NWP

warsaw 2022-01-01 - 2022-12-31
warsaw 2022-01-01 - 2022-12-31



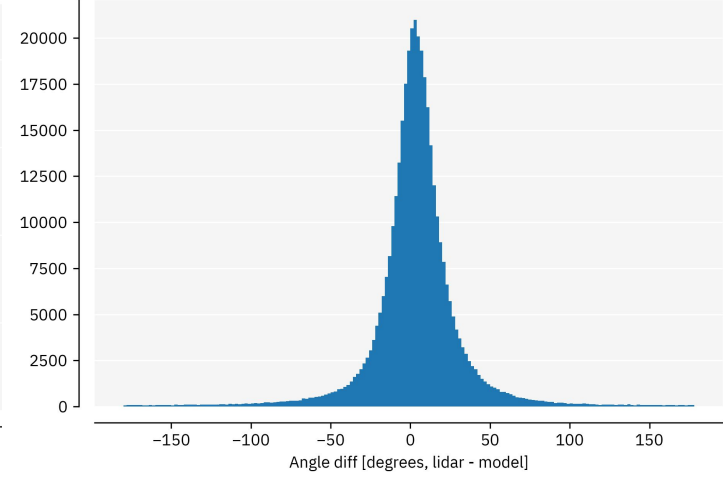
2022

warsaw 2023-01-01 - 2023-12-31
warsaw 2023-01-01 - 2023-12-31



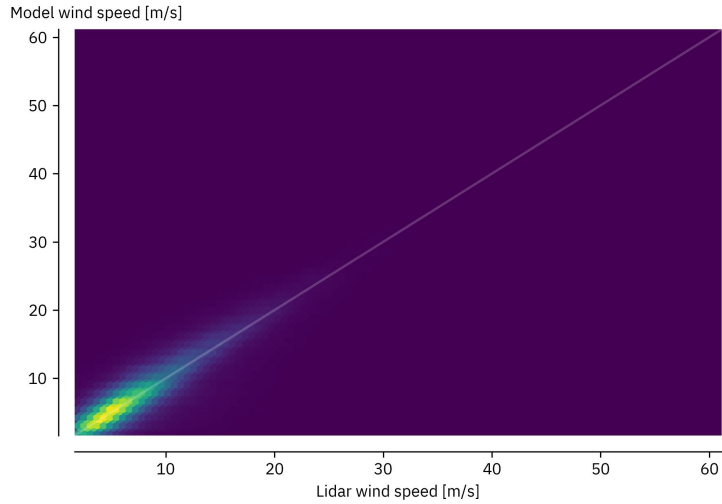
2023

warsaw 2024-01-01 - 2024-12-31
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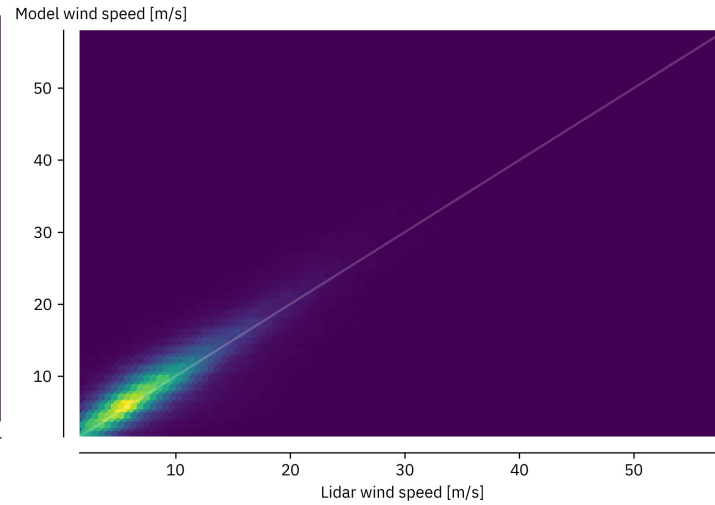


2024

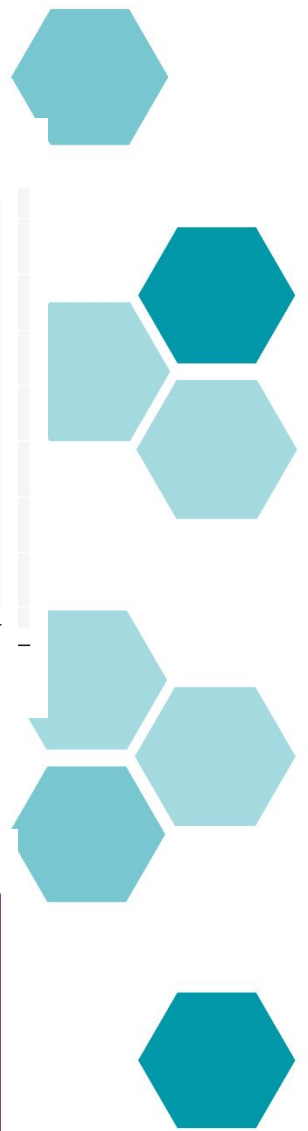
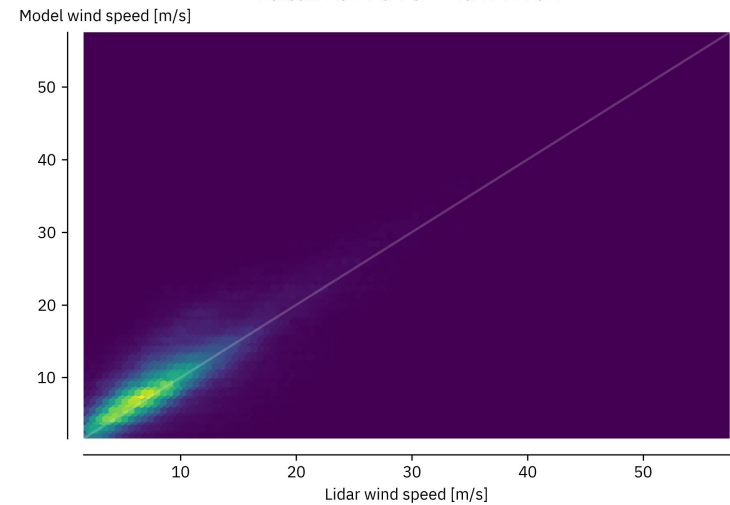
warsaw 2022-01-01 - 2022-12-31



warsaw 2023-01-01 - 2023-12-31



warsaw 2024-01-01 - 2024-12-31

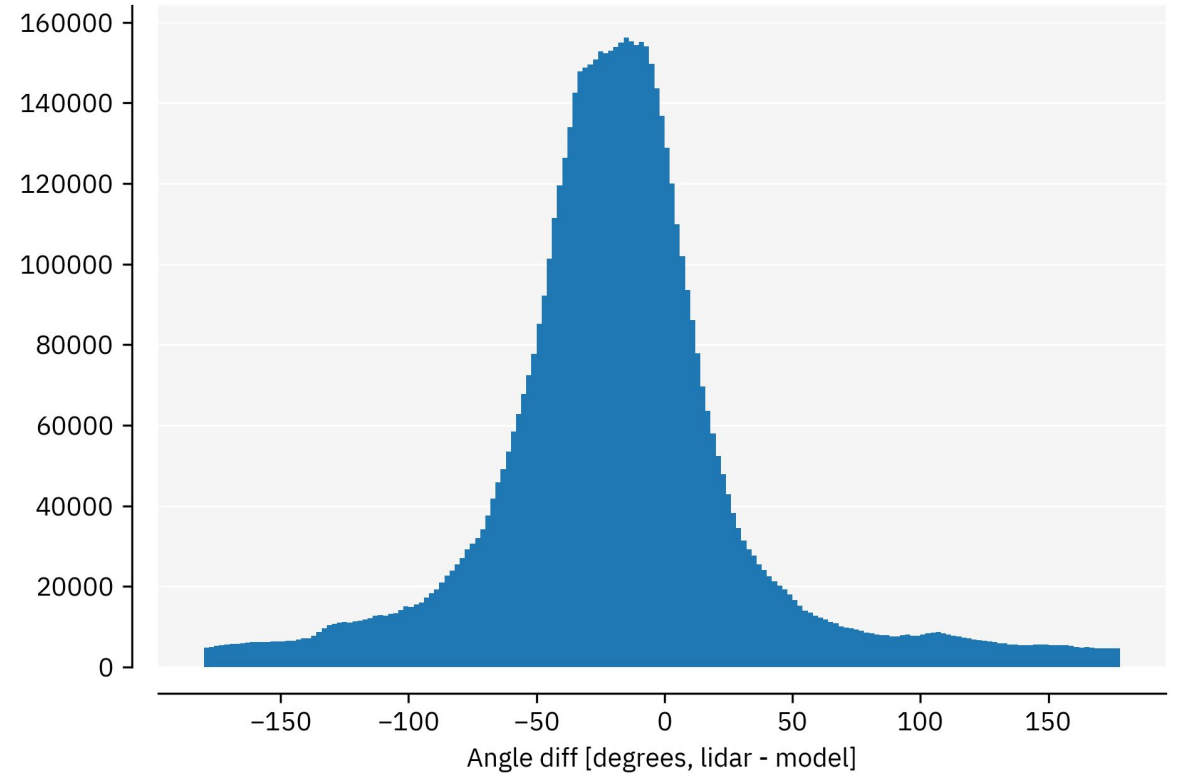
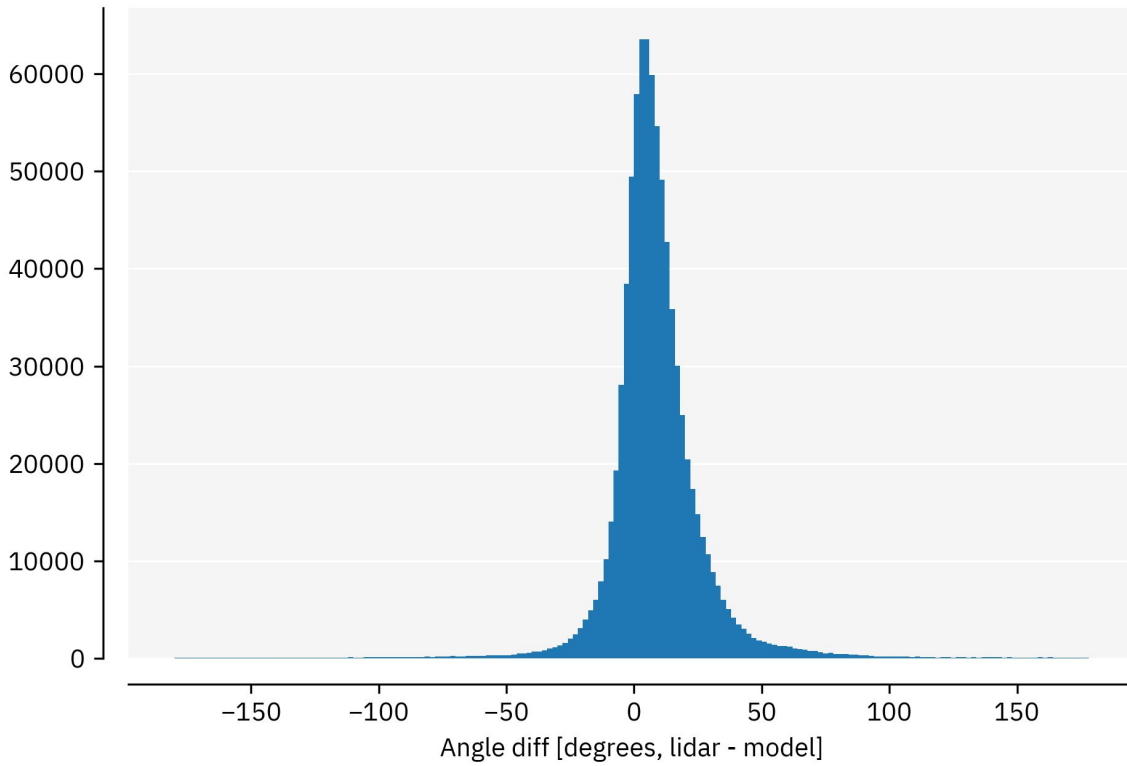


Monitoring with NWP



lindenberg 2023-01-01 - 2023-12-31

lindenberg 2024-01-01 - 2024-12-31



Monitoring pages

Integrate across instruments

UL HALO

HALO Photonics StreamLine Doppler lidar

[Overview](#) [Raw files](#)

Instrument

PID <https://hdl.handle.net/21.12132/3.1e2e7ddeeda641e5>
Owner University of Leeds
Model StreamLine Pro
Type Doppler lidar
Serial number 0616-118

Locations

2016-05-10 – now [Chilbolton](#)

Product availability



■ All products ■ Some products □ No products

Visualisation

Products

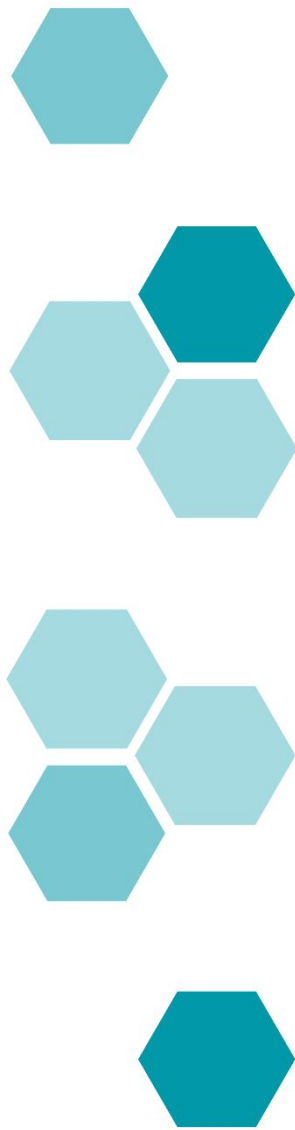
Year

Select



Roadmap

- This year
 - Monitoring
 - Background and horizontal winds (azimuth correction)
 - Housekeeping data (to Grafana dashboards)
- Next year
 - Focus correction
 - Calibration
 - Attenuated backscatter coefficient
 - Extend products
 - Turbulent classification
 - Low level jets
 - Level 3 (climatologies and model evaluation)





Thank you