ACTRiS CCRES

DL Unit – Operational Services

Ewan O'Connor, Niko Leskinen,
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

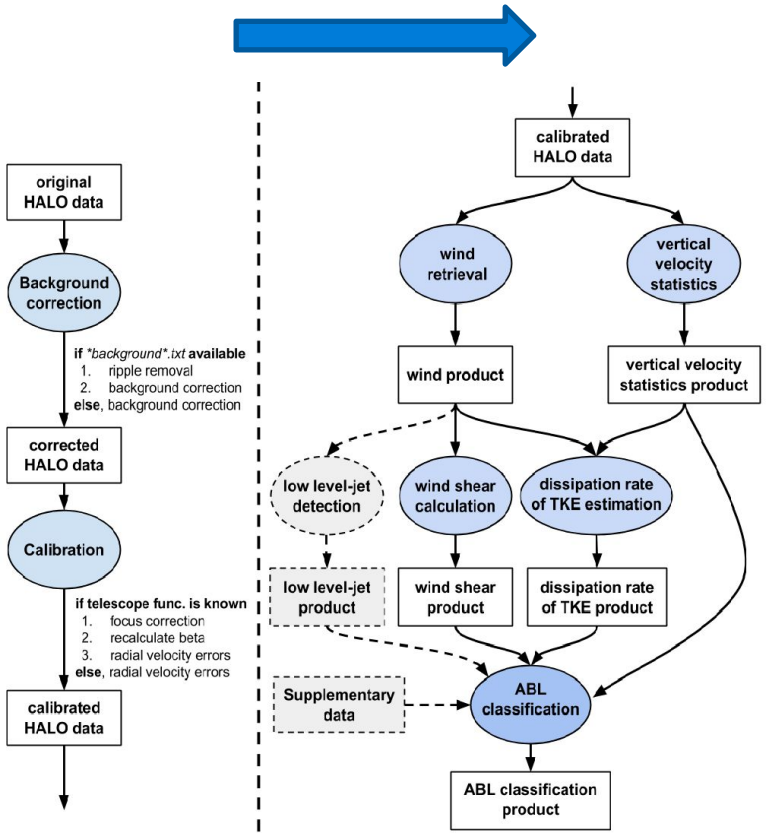
- Software-based processing and calibration for Doppler lidar
  - SOP (Standard Operation Procedures) documentation
  - Processing Framework incorporating QC and product algorithms

- 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

ACTRiS CCRES

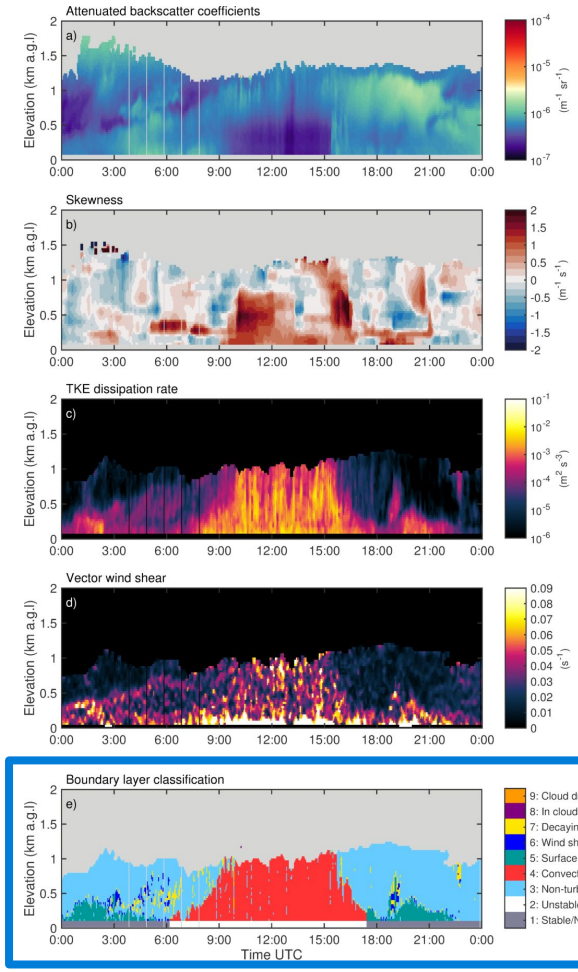
CCRES DL Unit

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

README MIT license

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
```

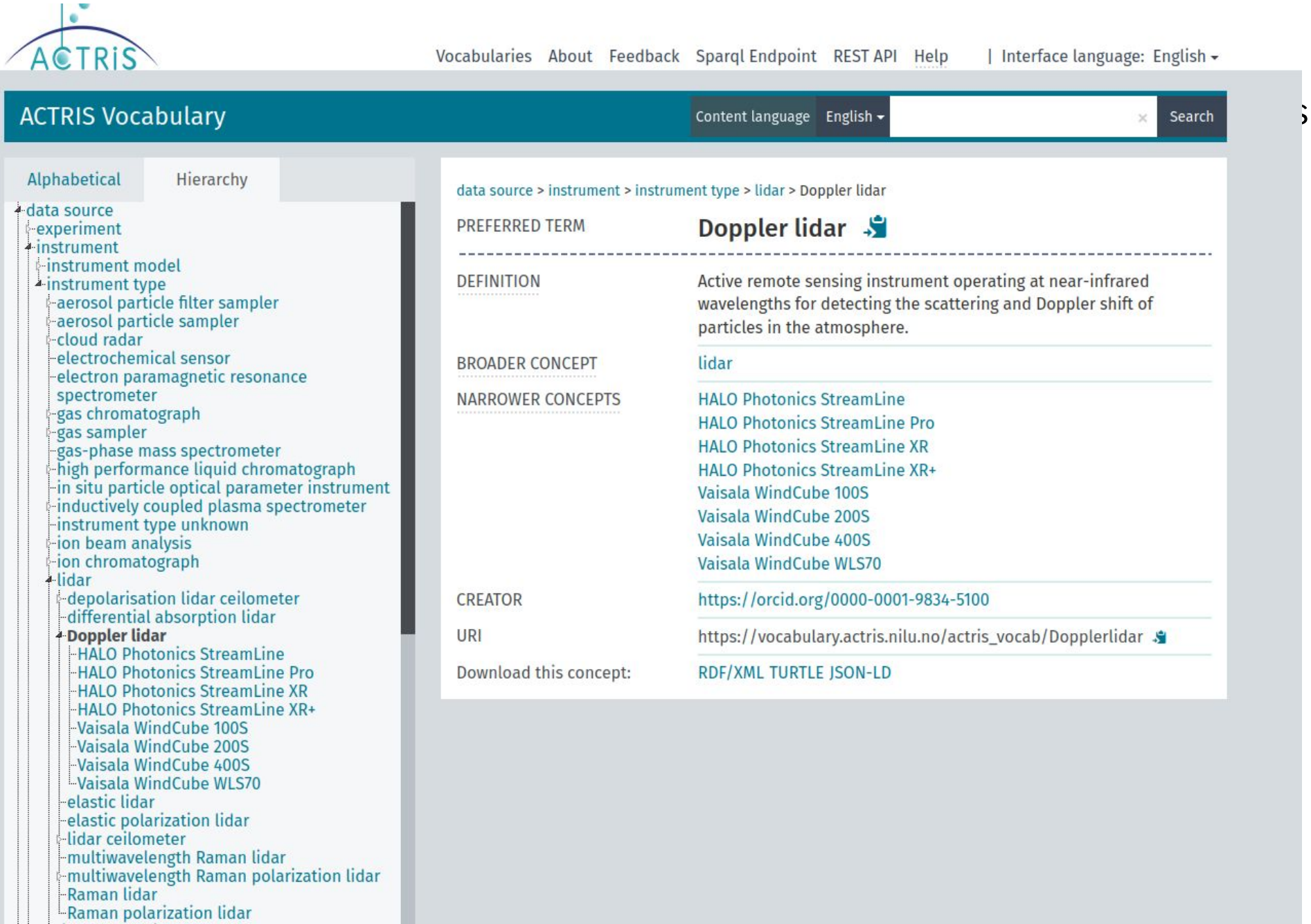
Usage

```
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 CCRES

Cloudnet DATA PORTAL

Search data | Visualise data | Docum

Location

Payerne ×

Show all sites

Date

Current year | Last 30 days | Today

2024-01-01 — 2024-06-10

Show date range

Product

Doppler lidar wind ×

Show experimental products

Instrument model

Results

Found 160 results

volatile experimental

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

« ‹ 1 2 3 › »

Download all

160 files (20.8 MB)

ACTRiS CCRES

Cloudnet DATA PORTAL

Search data | Visualise data | Docum

Location

Palaiseau ×

Show all sites

Date

Current year | Last 30 days | Today

2024-01-01 — 2024-06-10

Show date range

Product

Doppler lidar wind ×

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

« ‹ 1 2 3 › »

Download all

ACTRiS CCRES

Support for new instruments

Cloudnet DATA PORTAL | Search data | Visualise data | Documentation | Sites | Instruments | Products | Contact

CEREA WLS70

Leosphere WLS70 WindCube Doppler lidar

Overview | Raw files

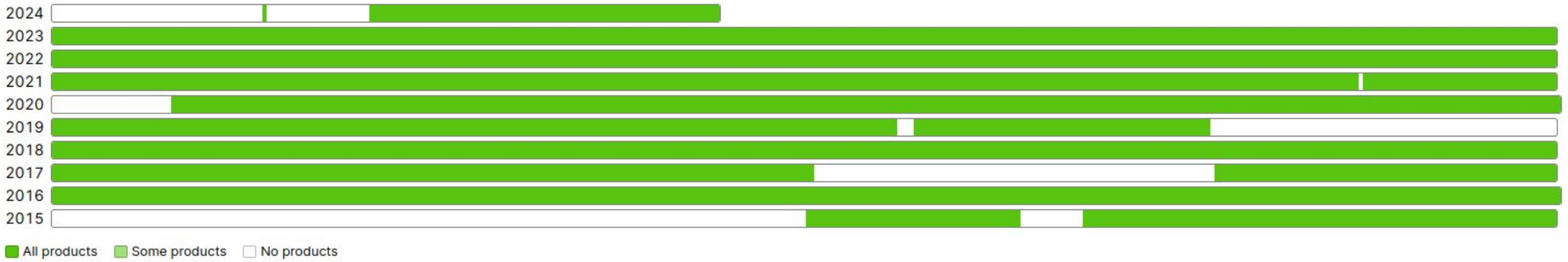
Instrument

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

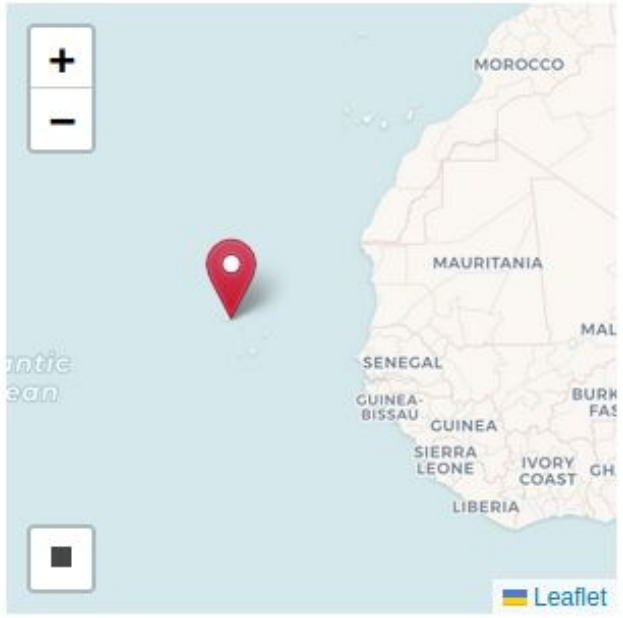
2015-07-03 – now Palaiseau

Product availability



Doppler lidar instruments

- 13 systems operational
- Another 5 in the database

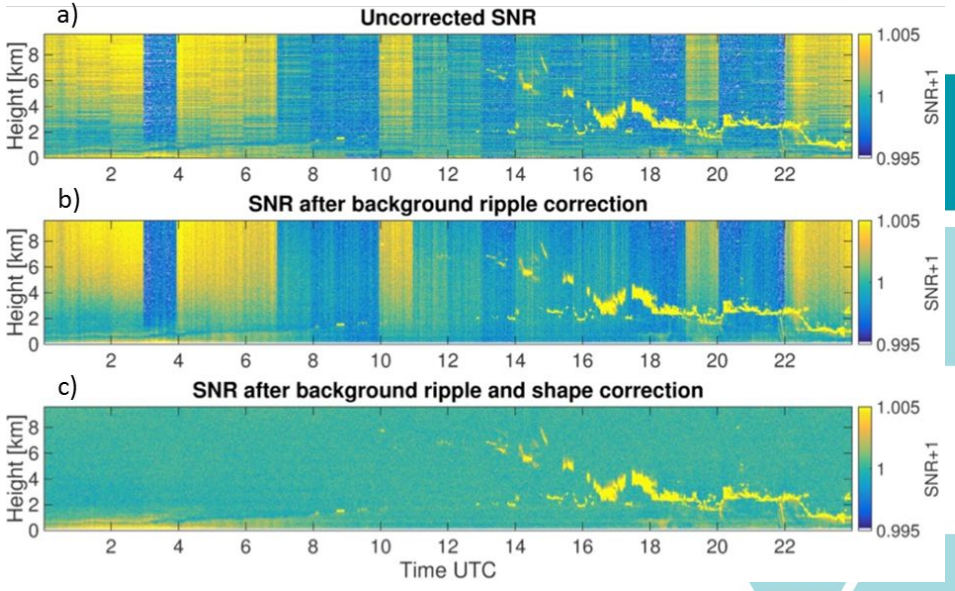


ACTRiS CCRES

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



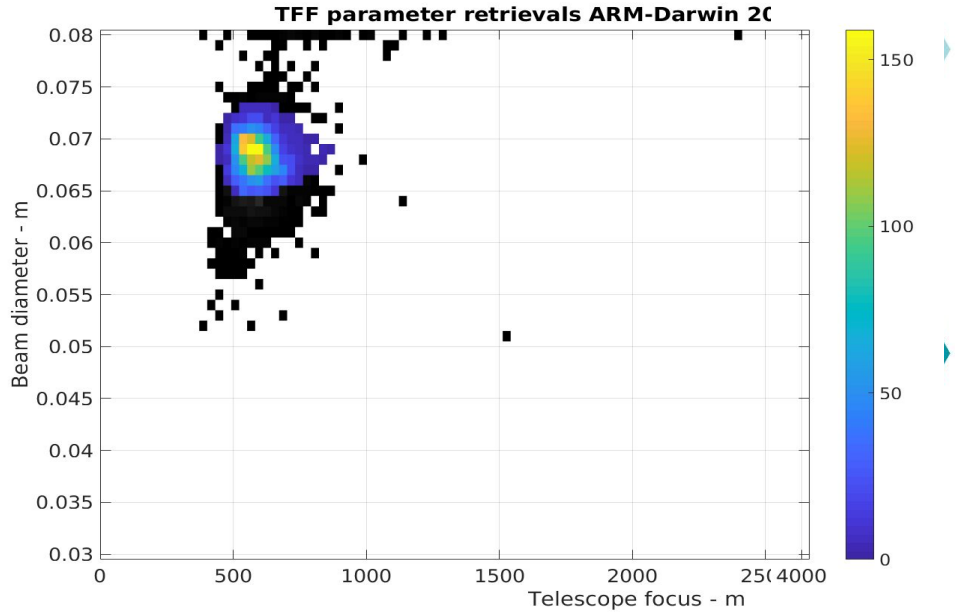
Automatic calibration procedures

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)

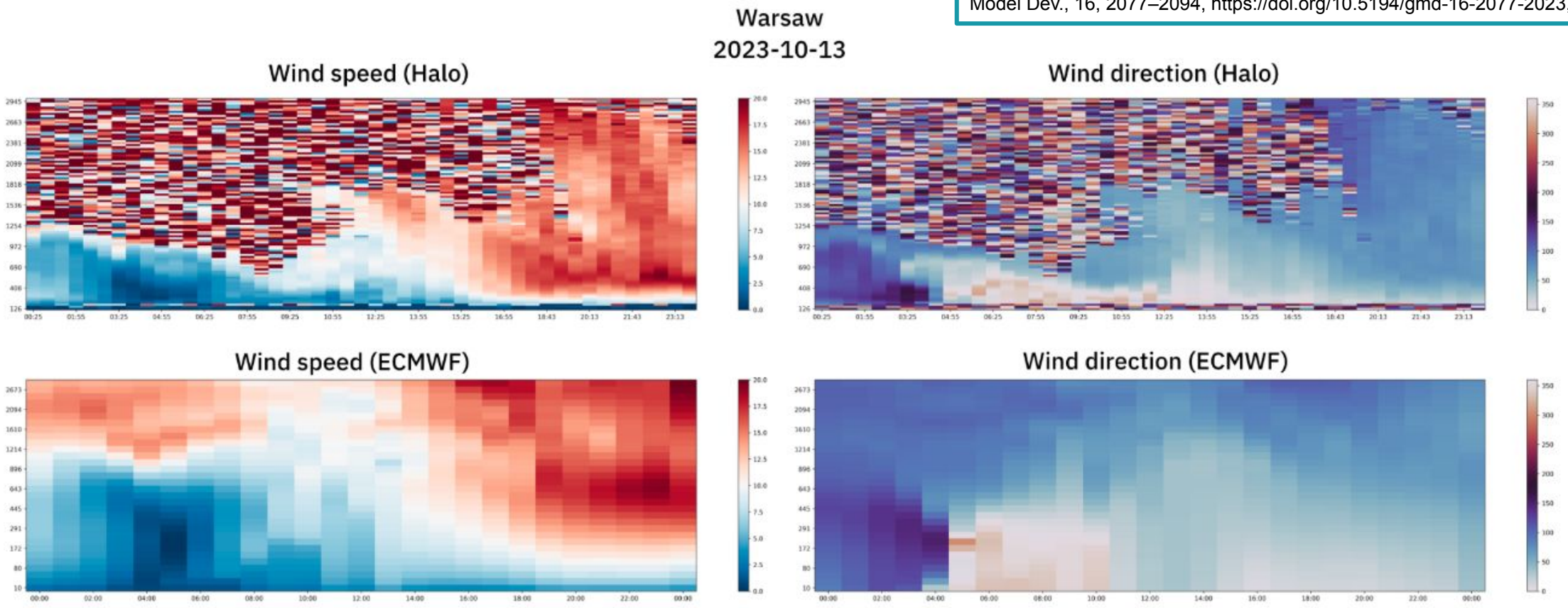


ACTRiS CCRES

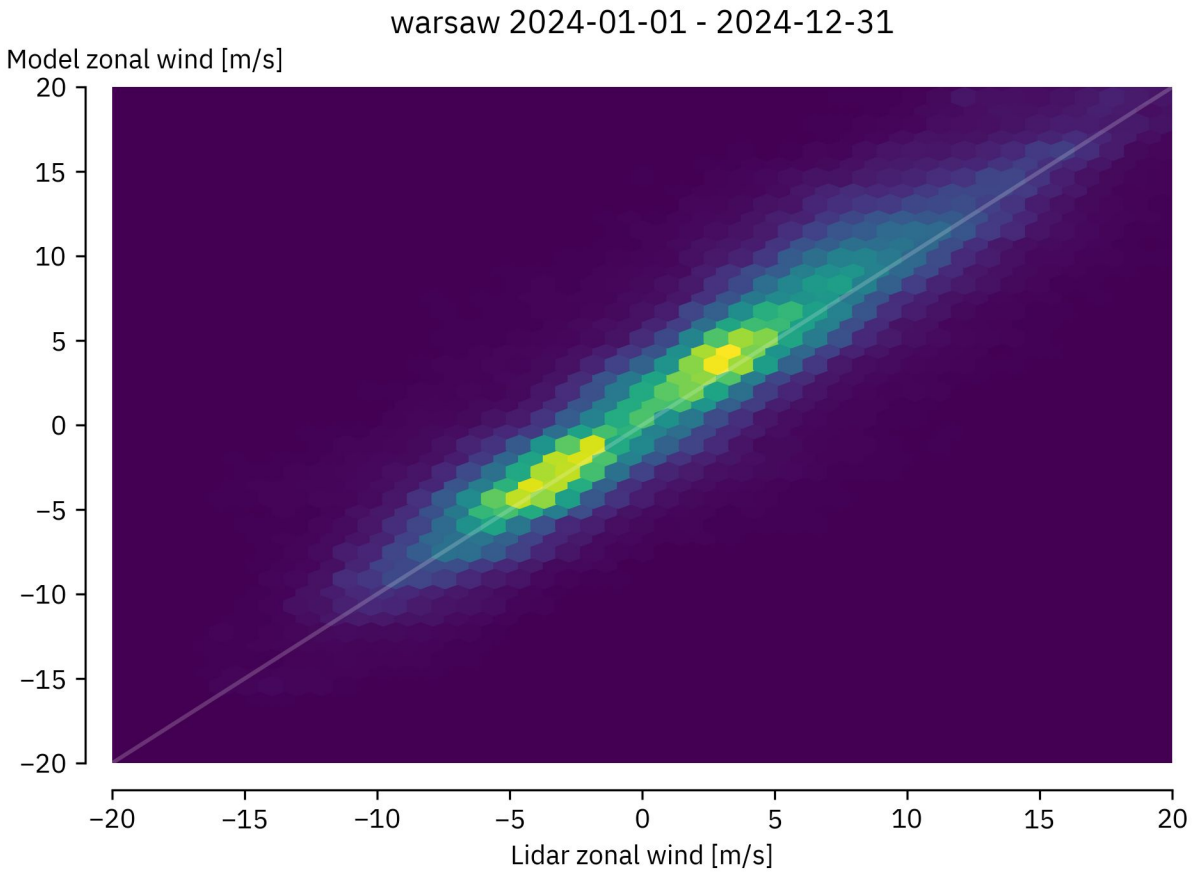
Instrument monitoring - winds

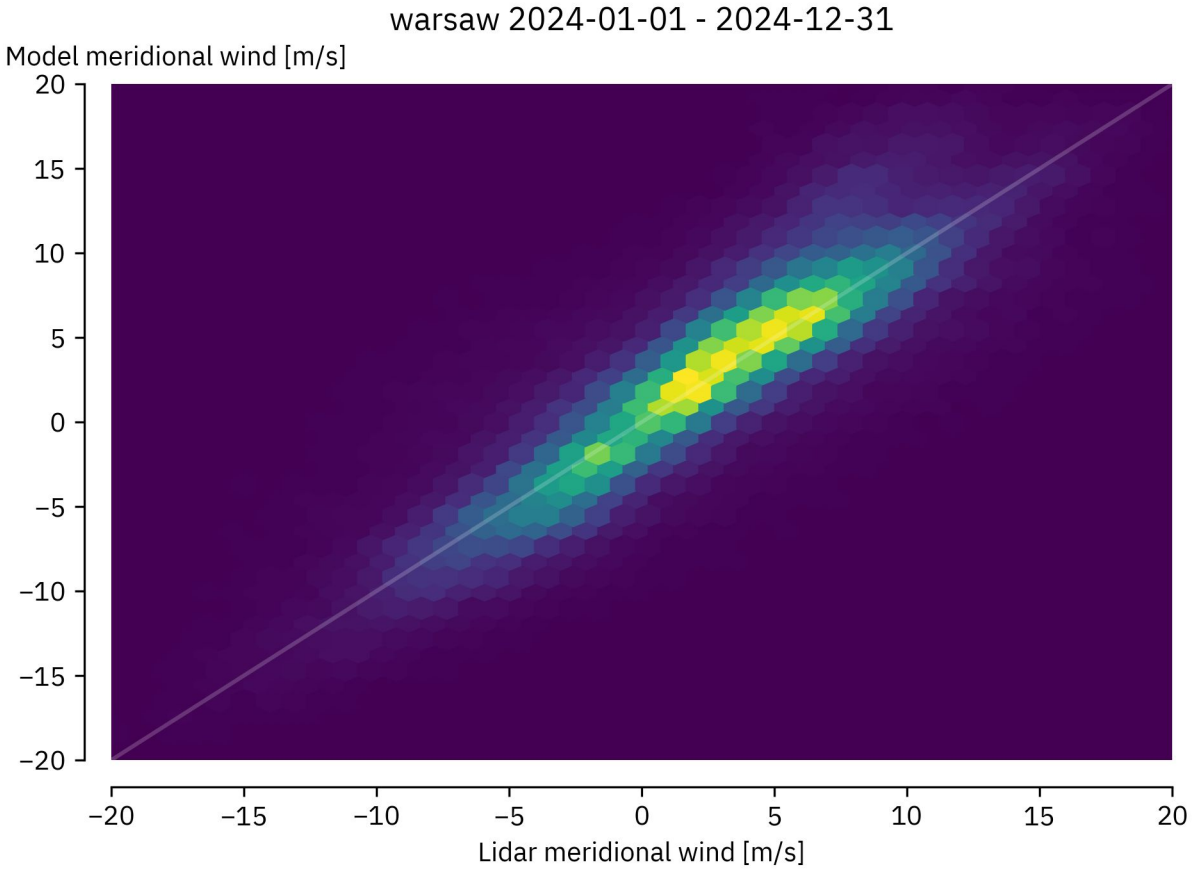
- Start with NWP – will also use weather station, mast, radiosondes where possible
- Model-observation intercomparison

Pentikäinen, P., O'Connor, E. J., and Ortiz-Amezcua, 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.



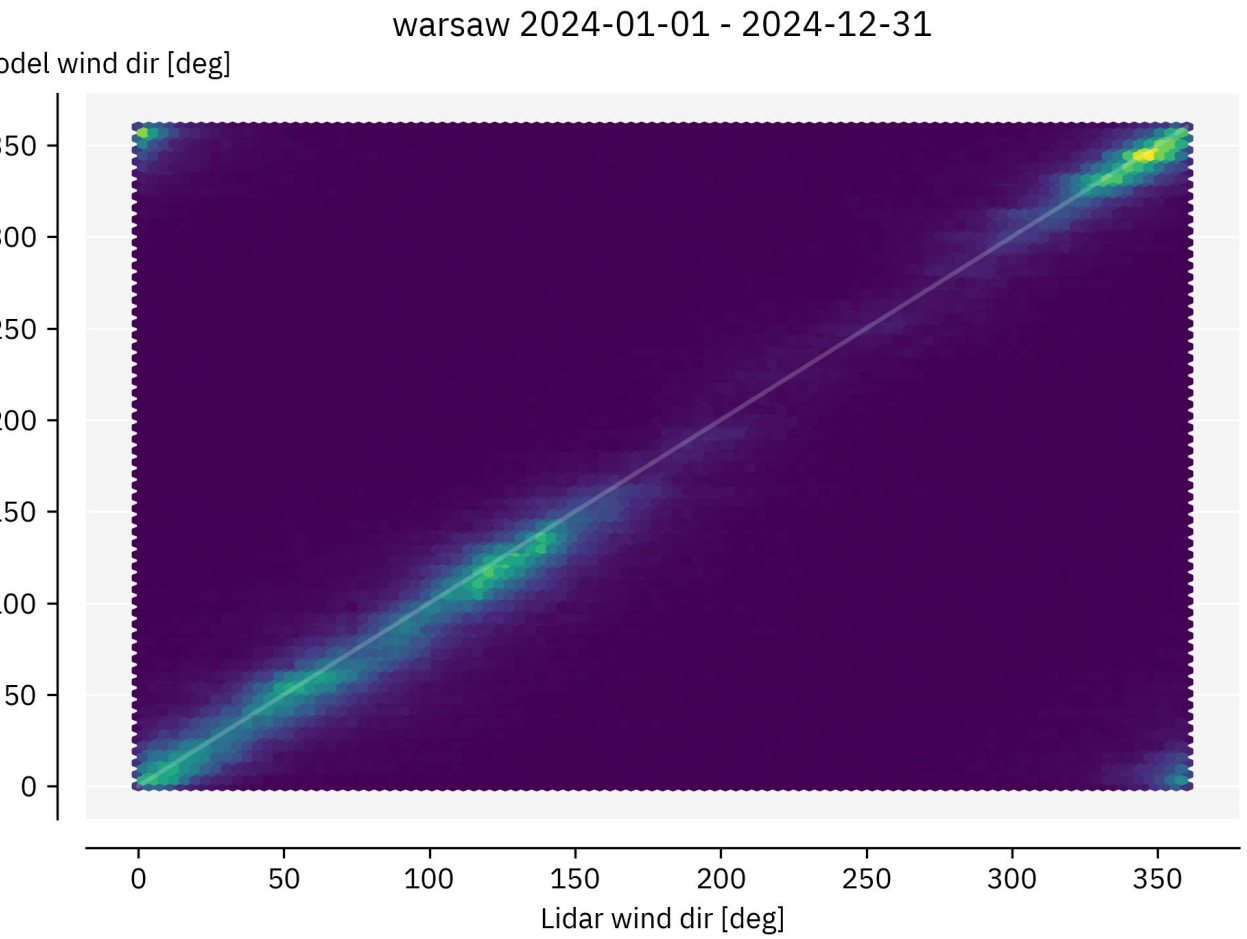
Monitoring with NWP

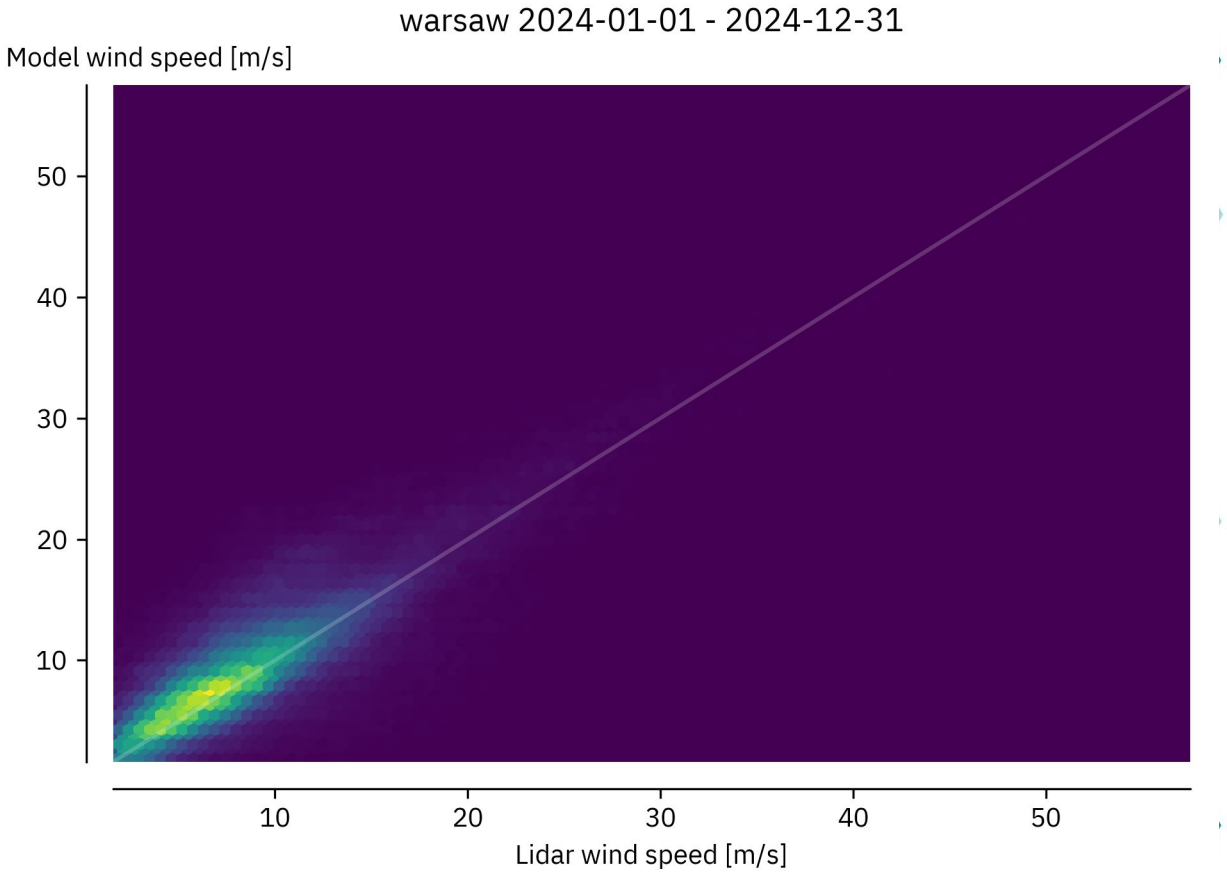




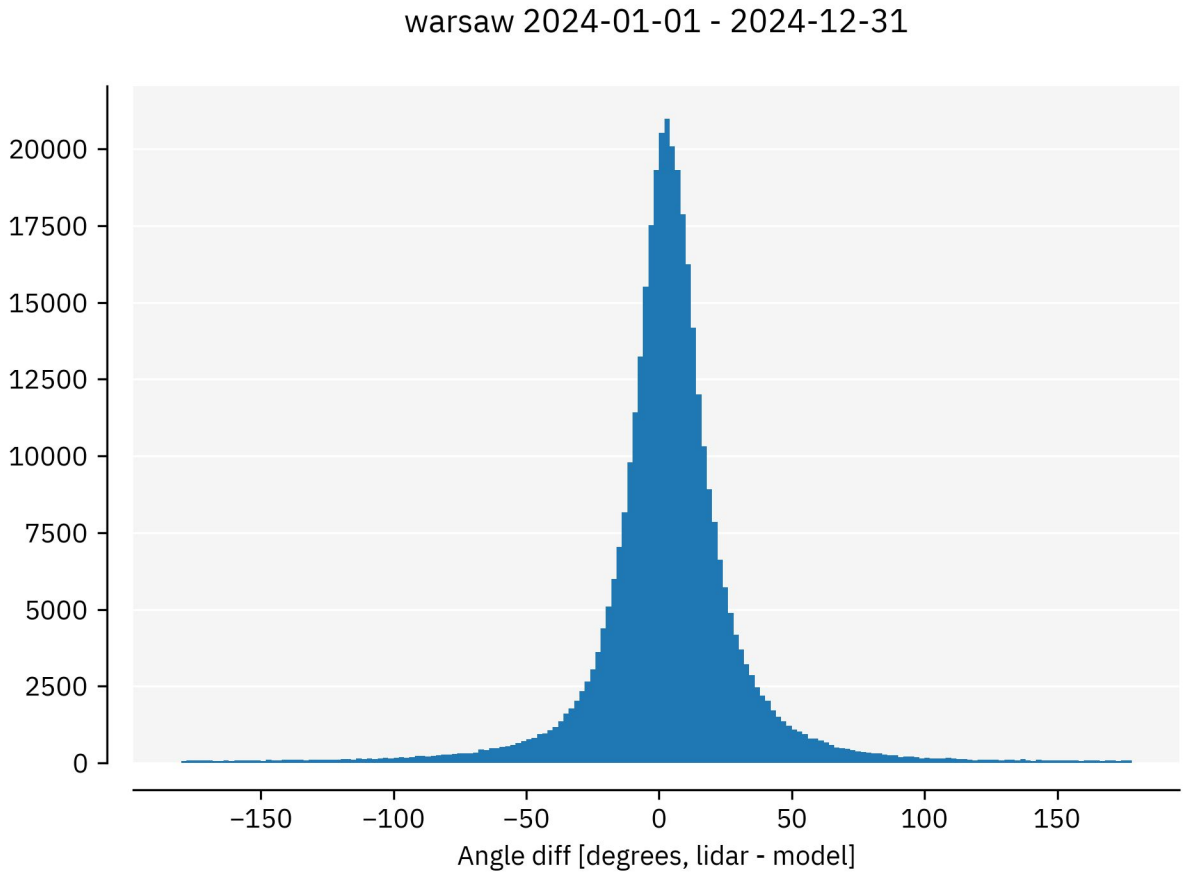
ACTRiS CCRES

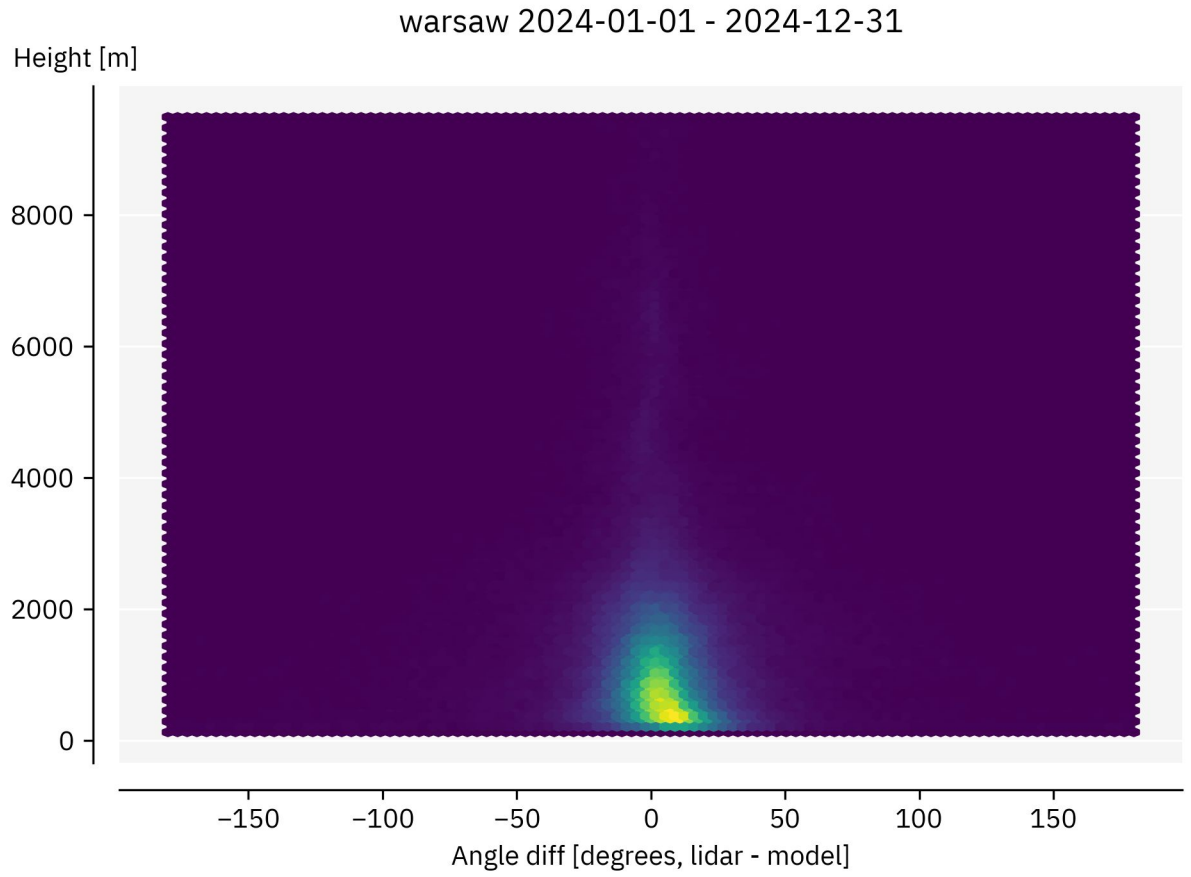
Monitoring with NWP





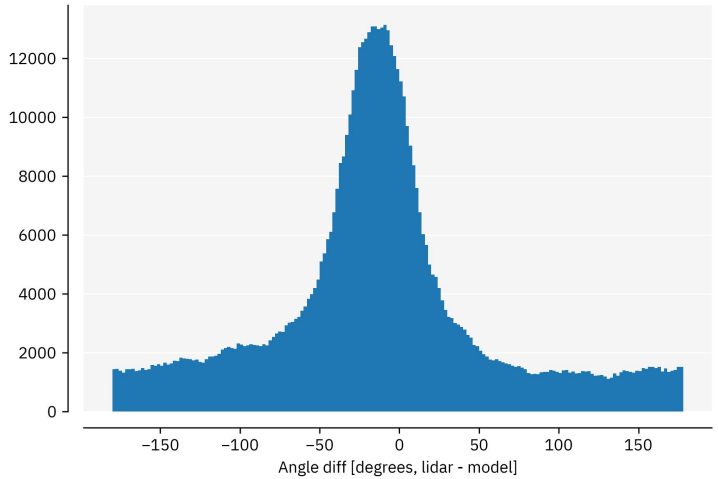
Monitoring with NWP



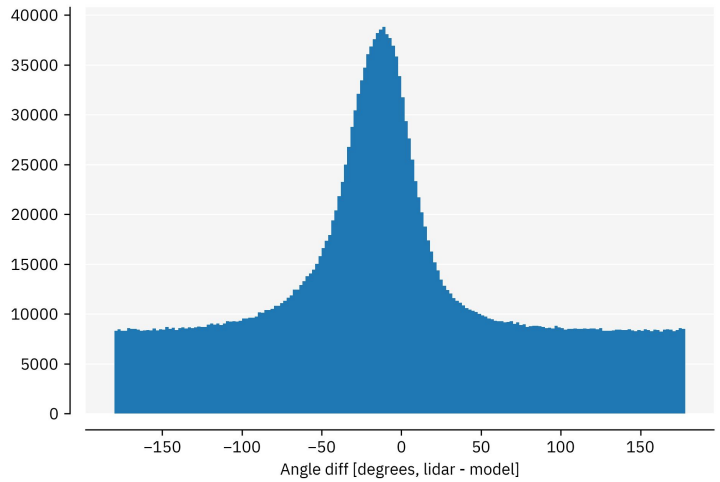


Monitoring with NWP

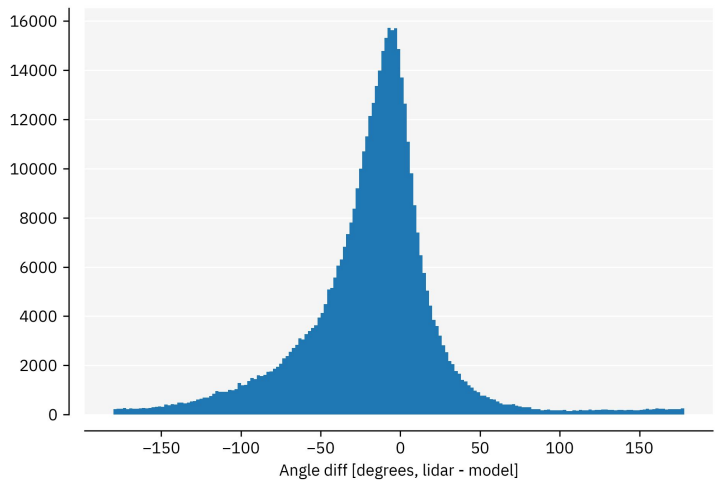
bucharest 2023-01-01 - 2023-12-31



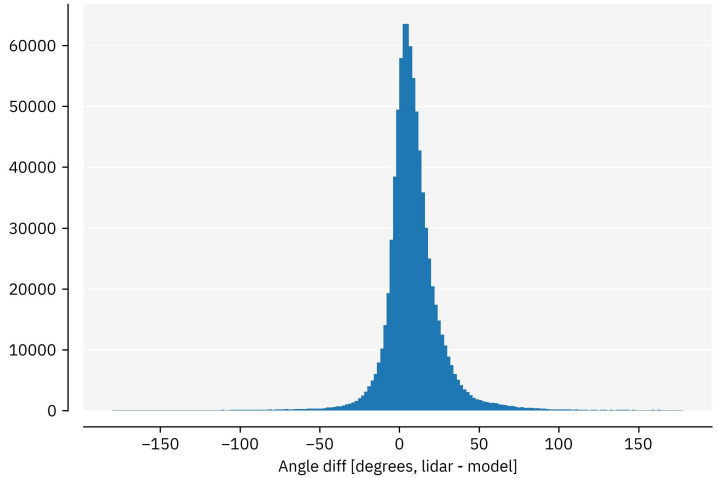
chilbolton 2024-01-01 - 2024-12-31



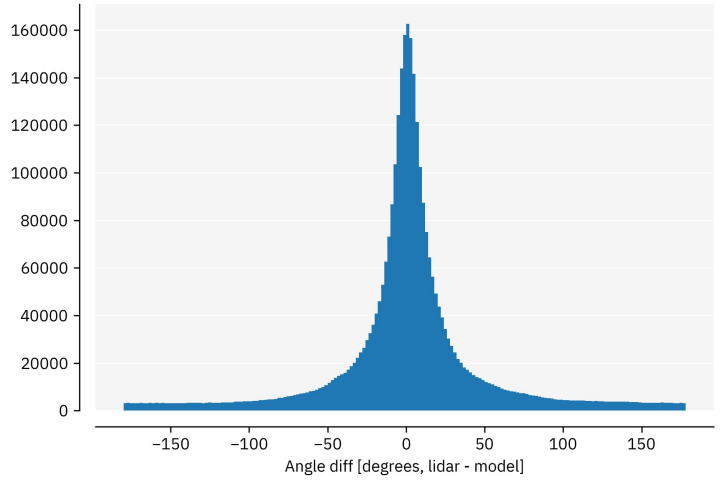
juelich 2024-01-01 - 2024-12-31



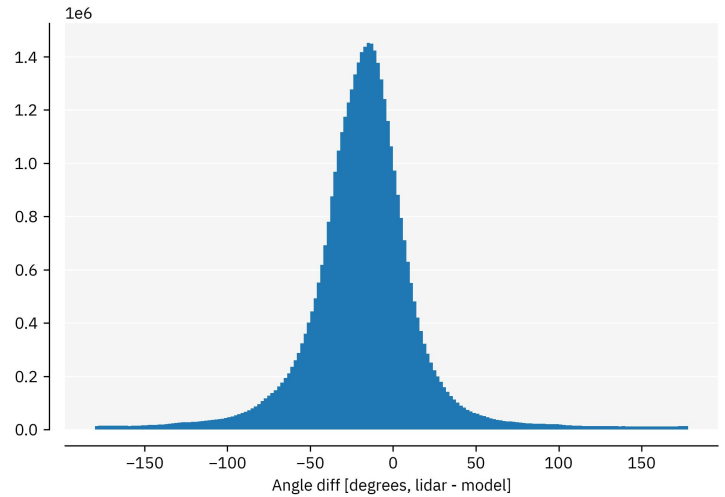
lindenberg 2023-01-01 - 2023-12-31



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

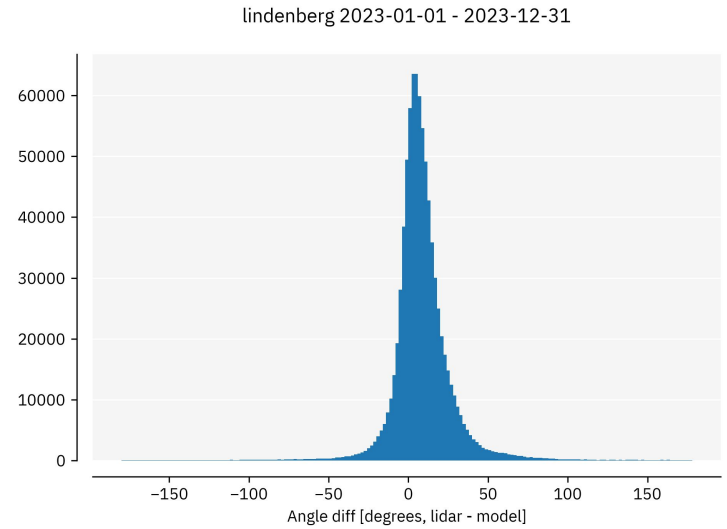


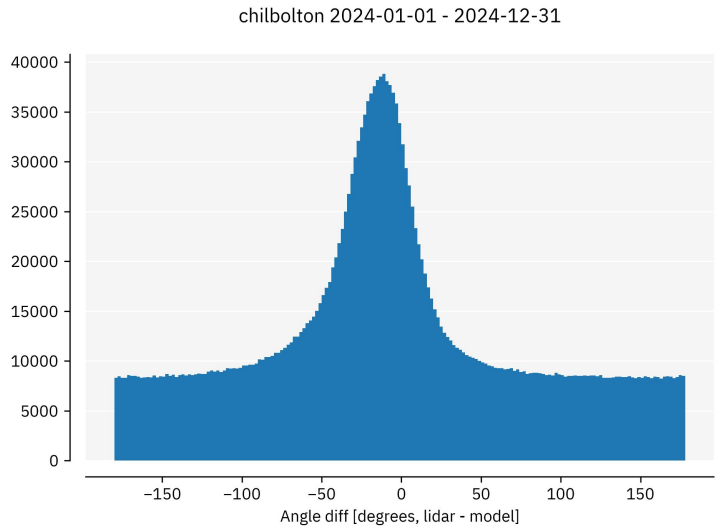
palaiseau 2023-01-01 - 2023-12-31

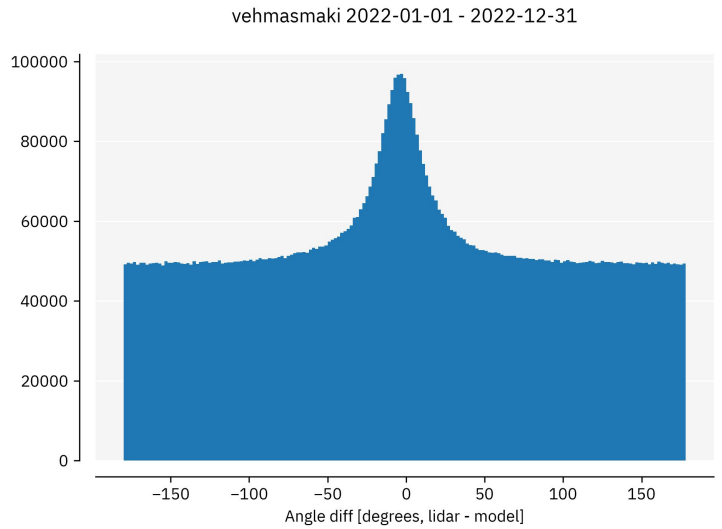


ACTRiS CCRES

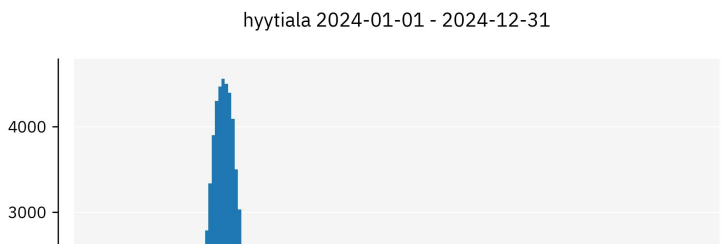
Monitoring with NWP

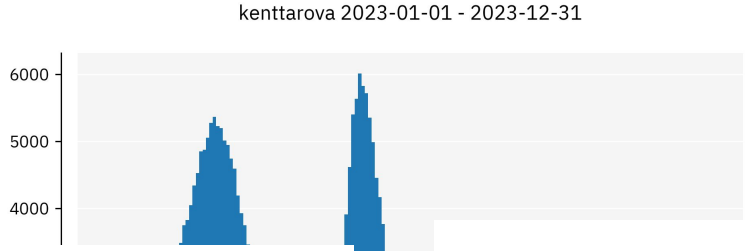


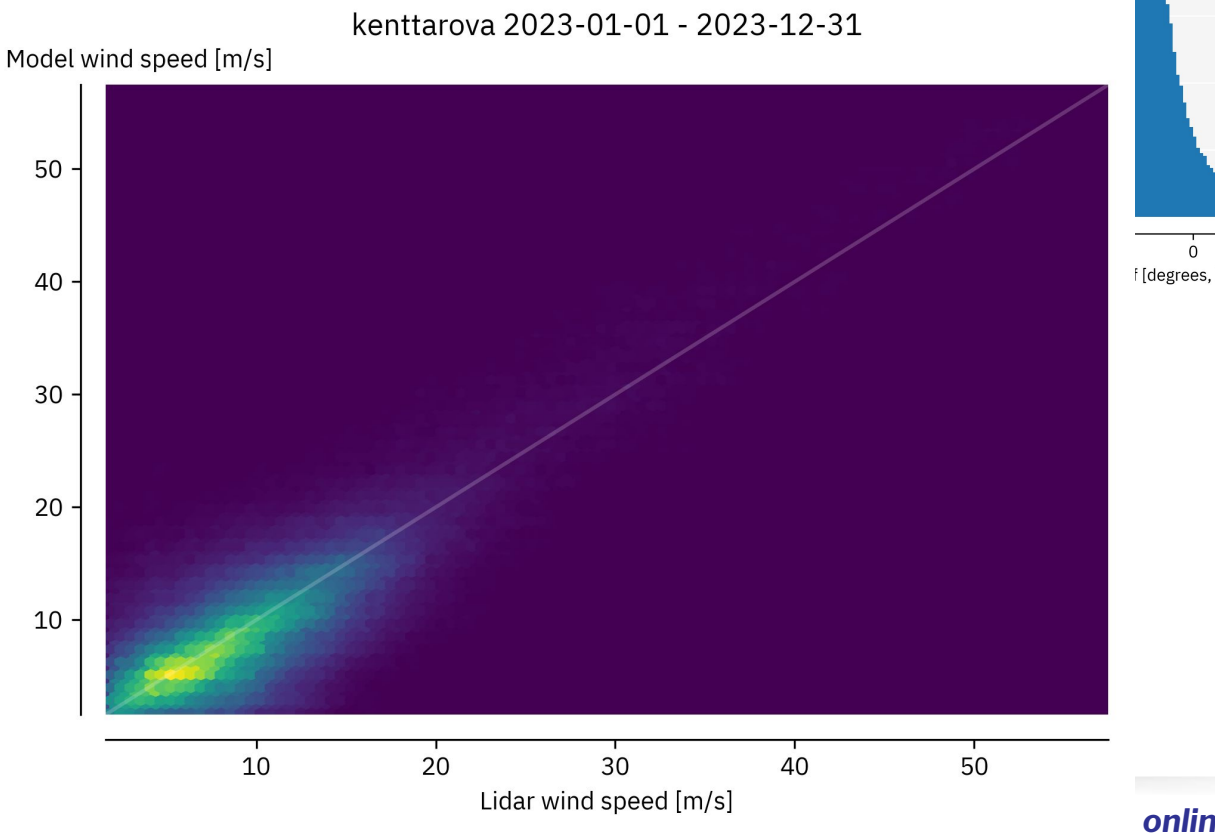


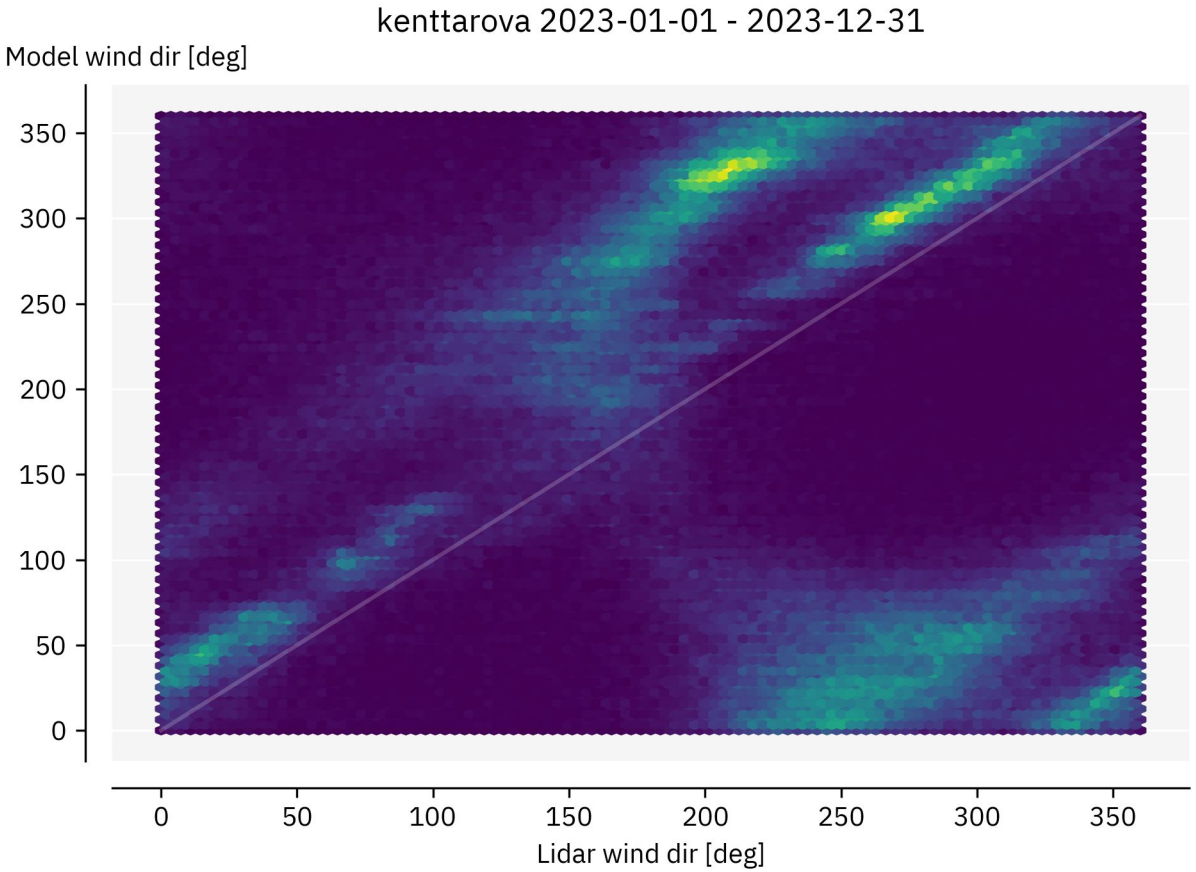


Monitoring with NWP

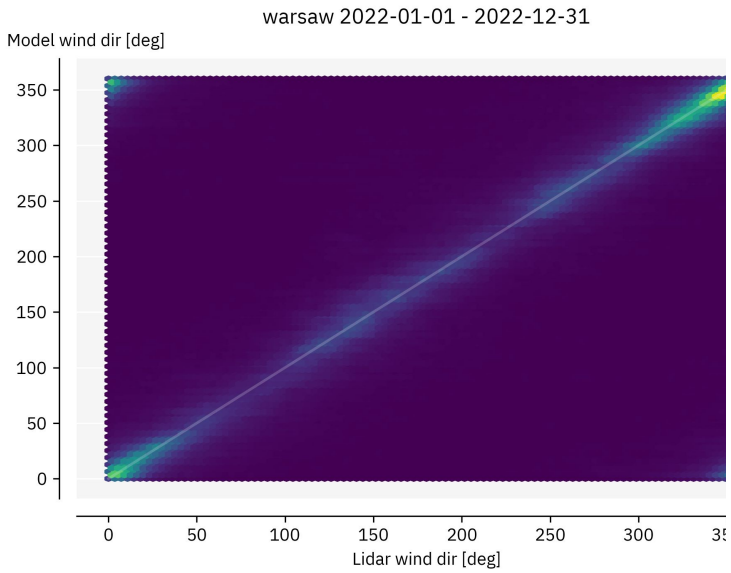


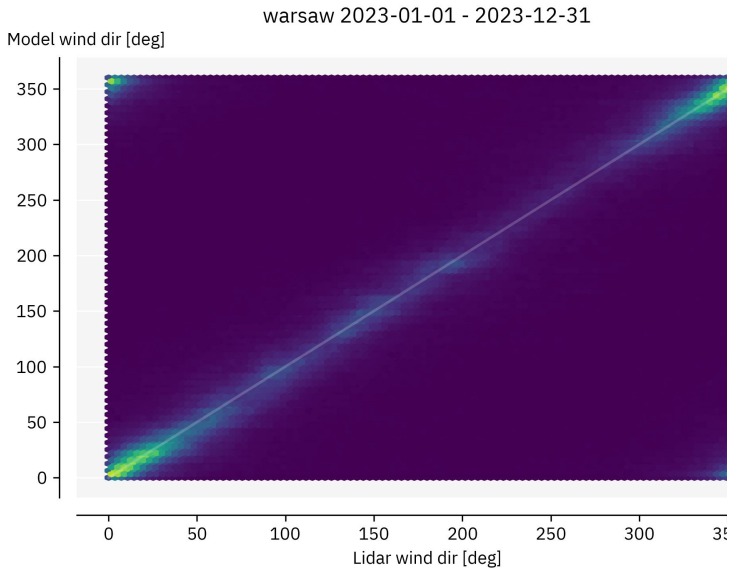


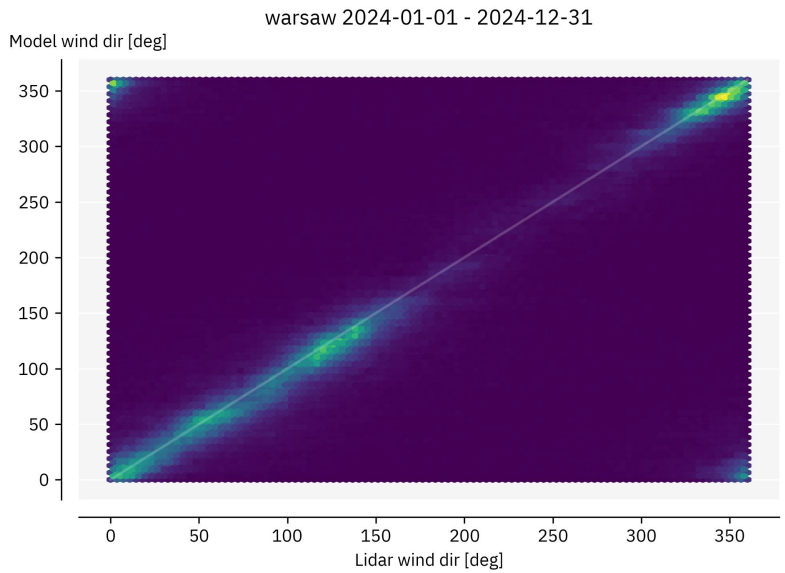




Monitoring with NWP



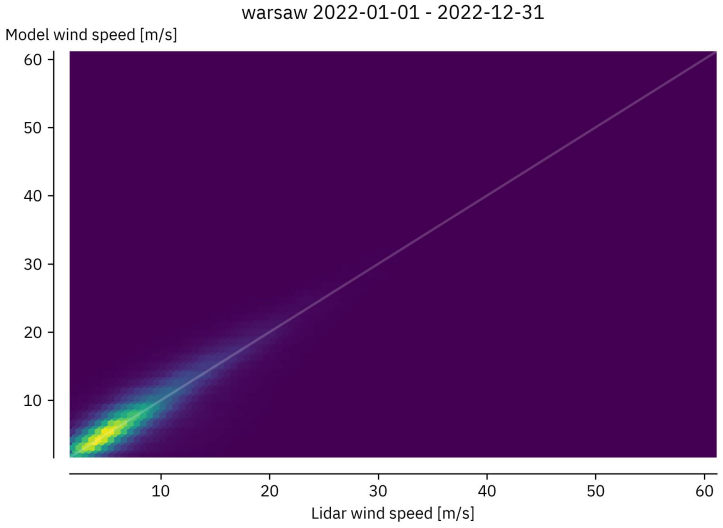


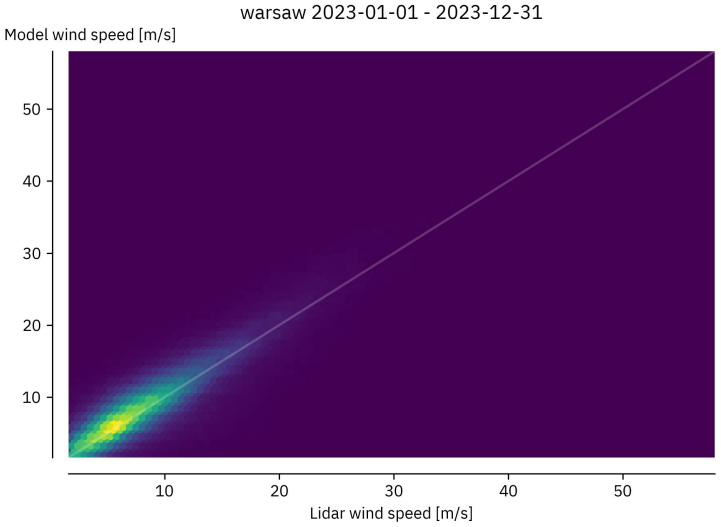


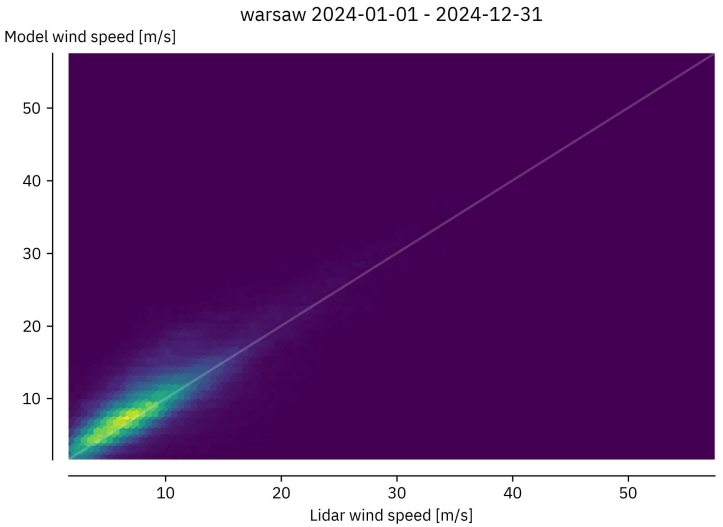
2022

2023

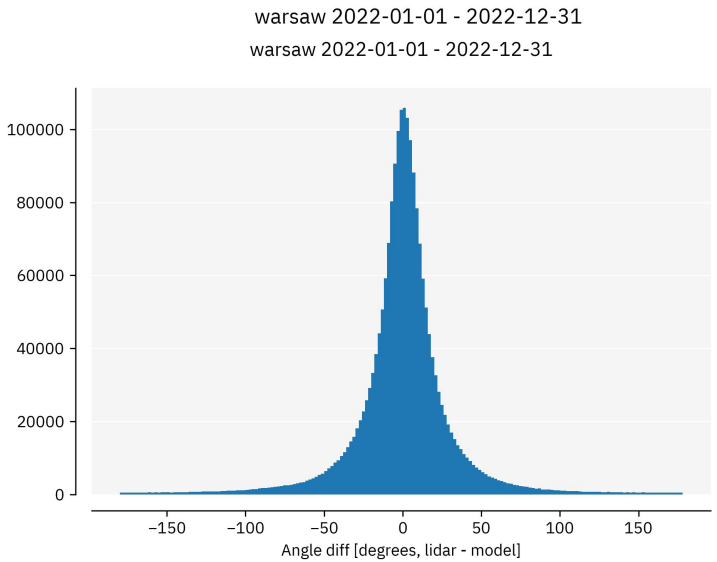
2024

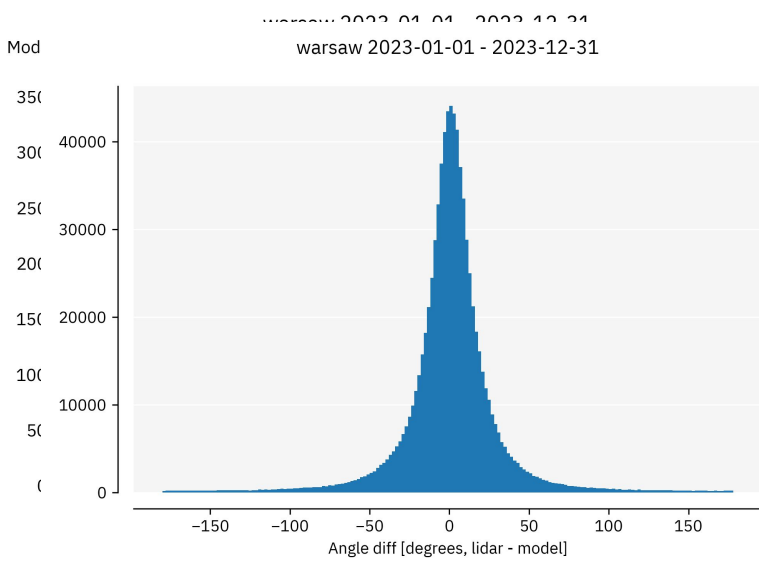


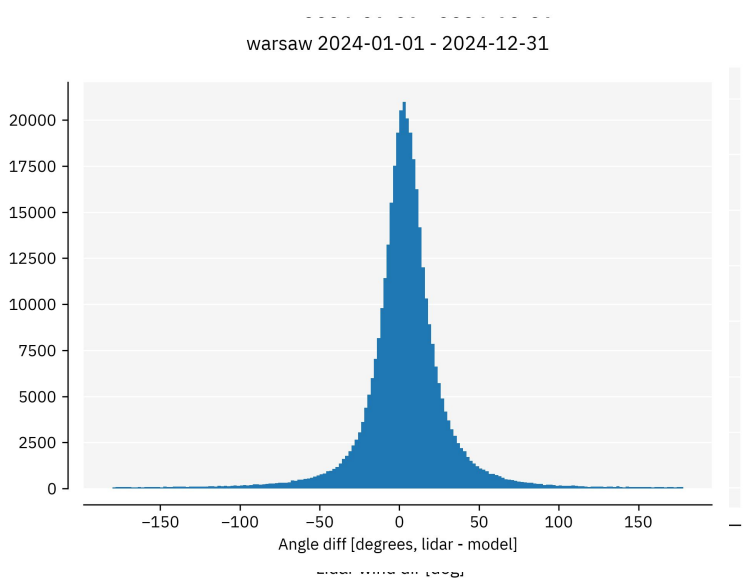




Monitoring with NWP



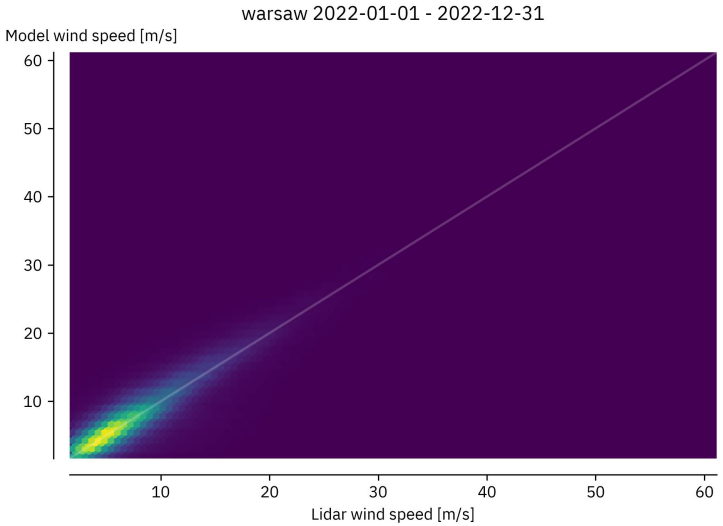


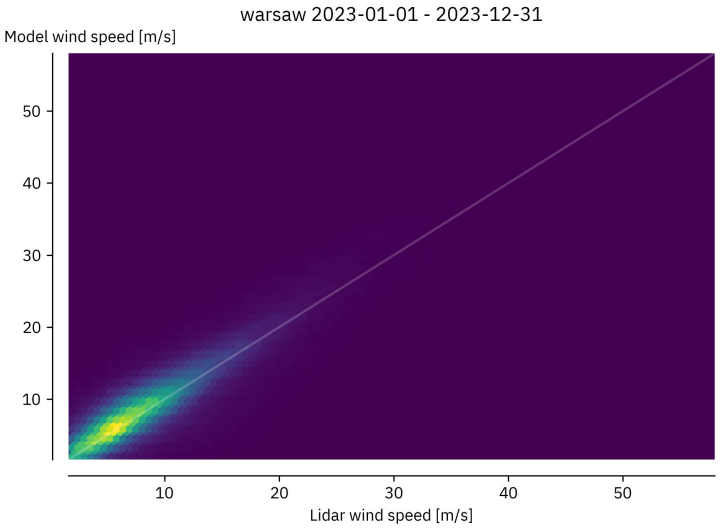


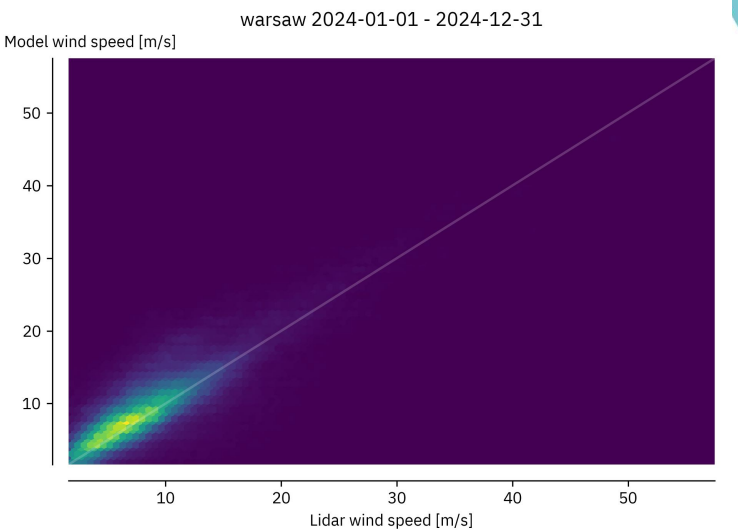
2022

2023

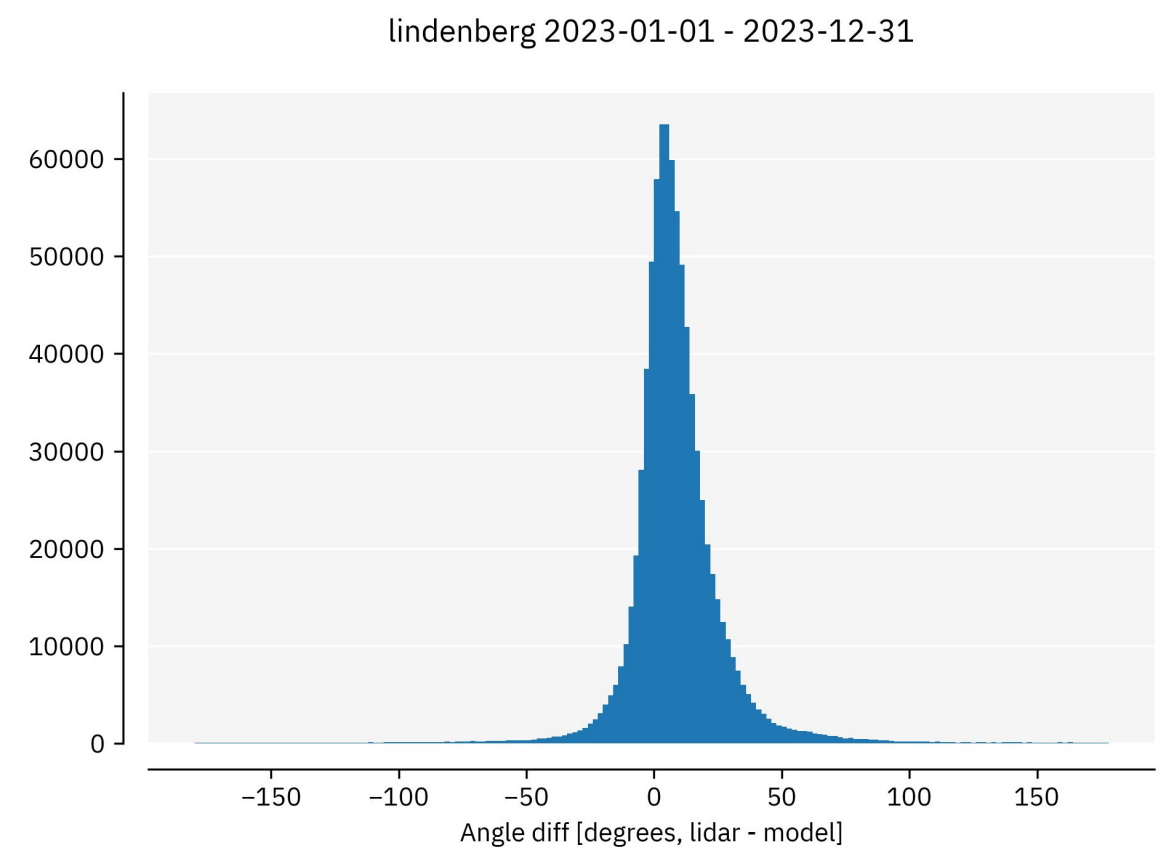
2024

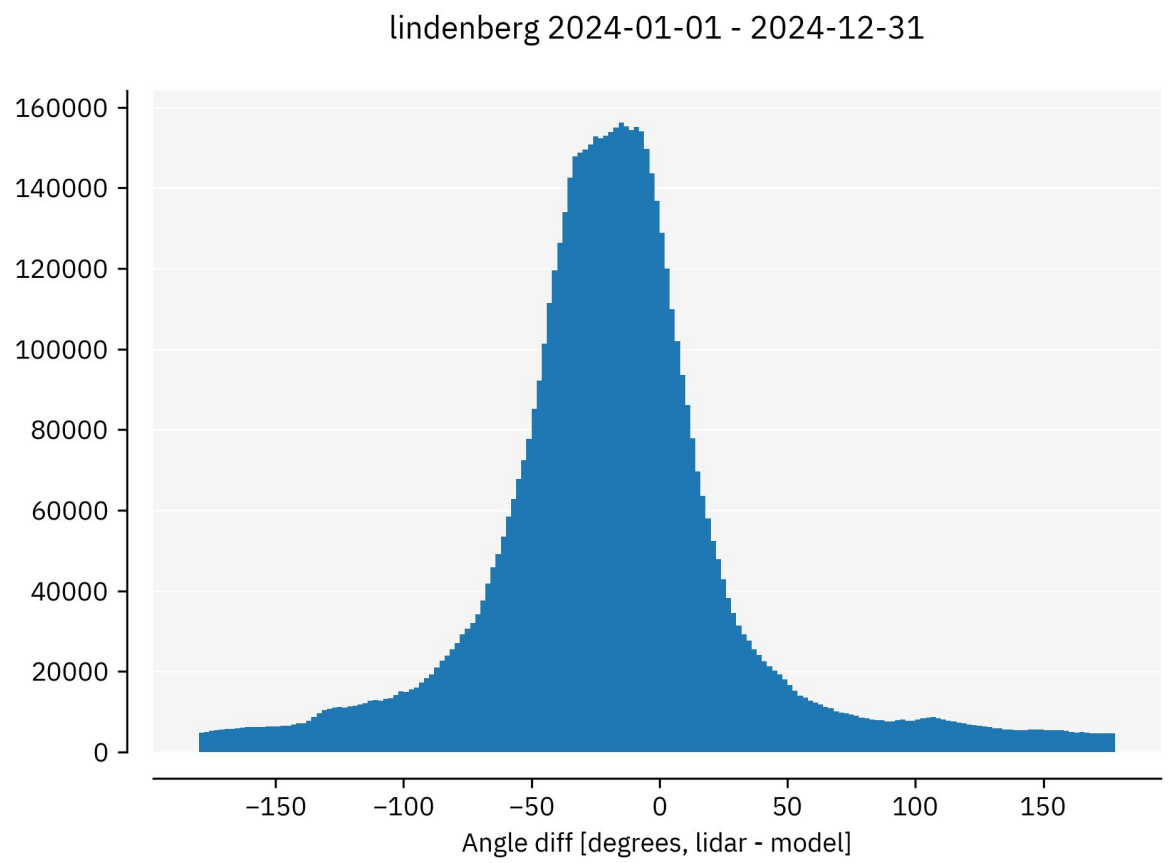






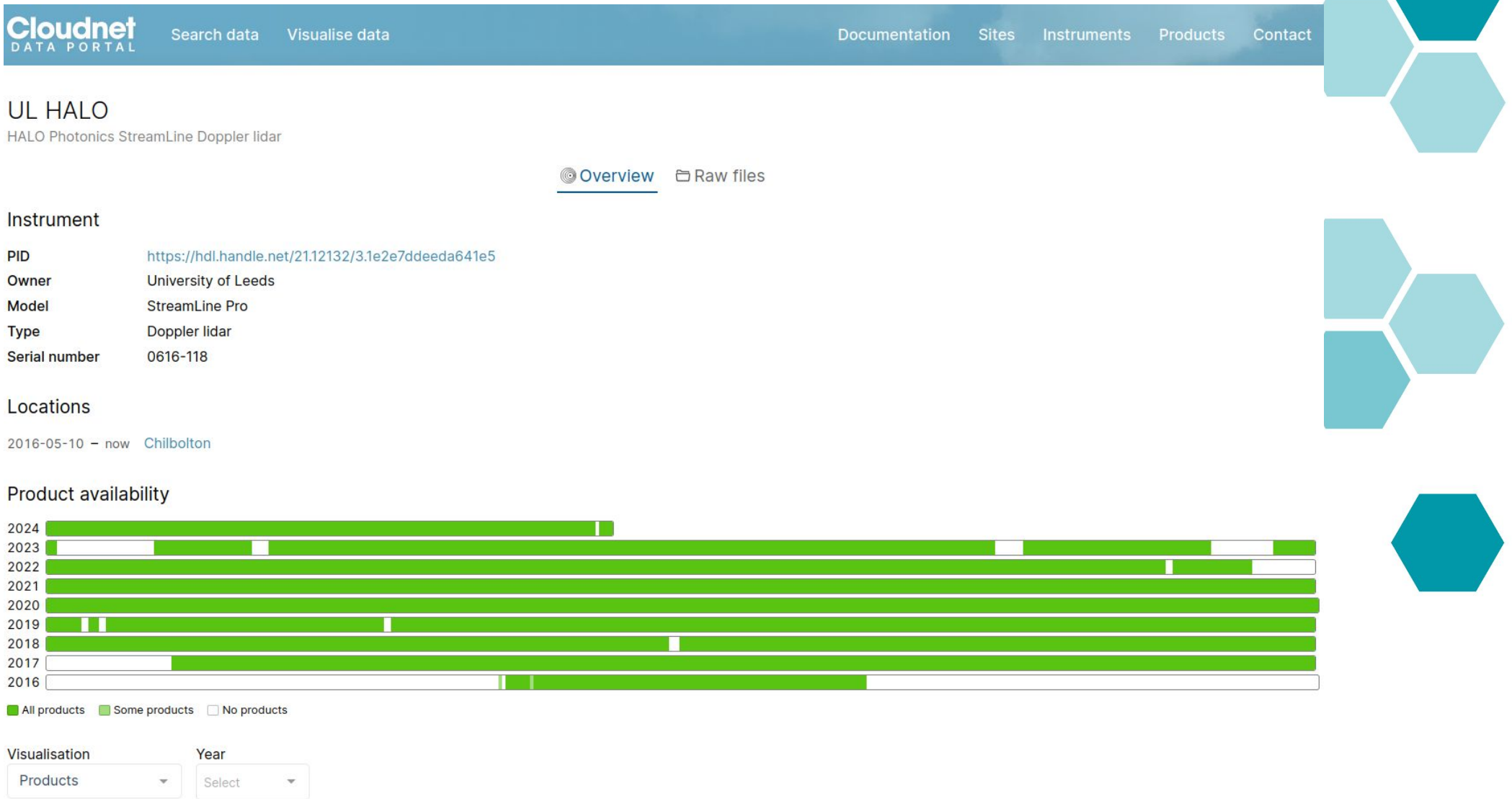
Monitoring with NWP





Monitoring pages

Integrate across instruments



ACTRiS CCRES

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)

ACTRiS CCRES

Thank you