New developments at CLU

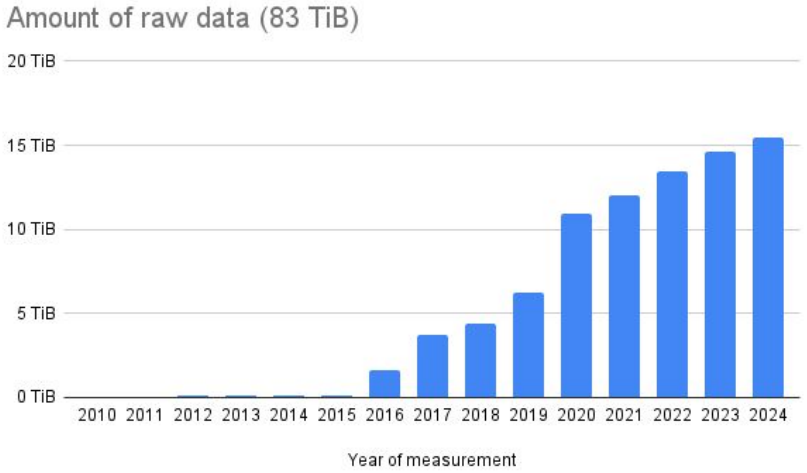
Simo Tukiainen, Ewan O'Connor,
Tuomas Siipola, Niko Leskinen

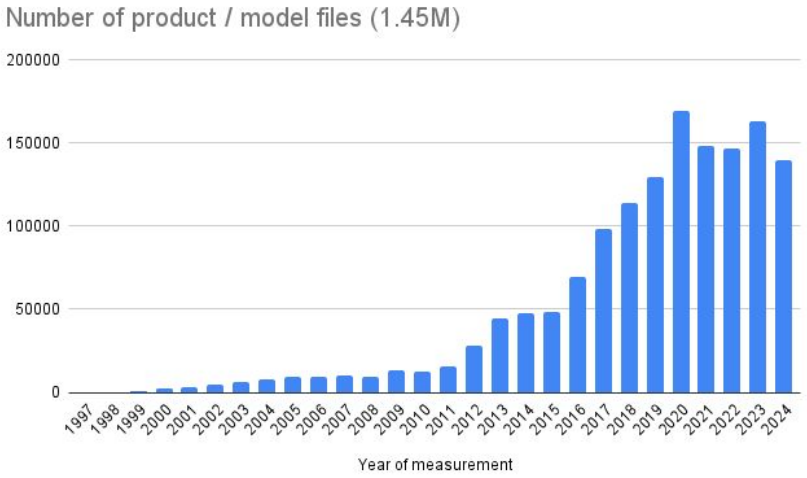
ACTRIS Data Centre – CLU unit
Finnish Meteorological Institute

CCRES workshop 2024-11-07

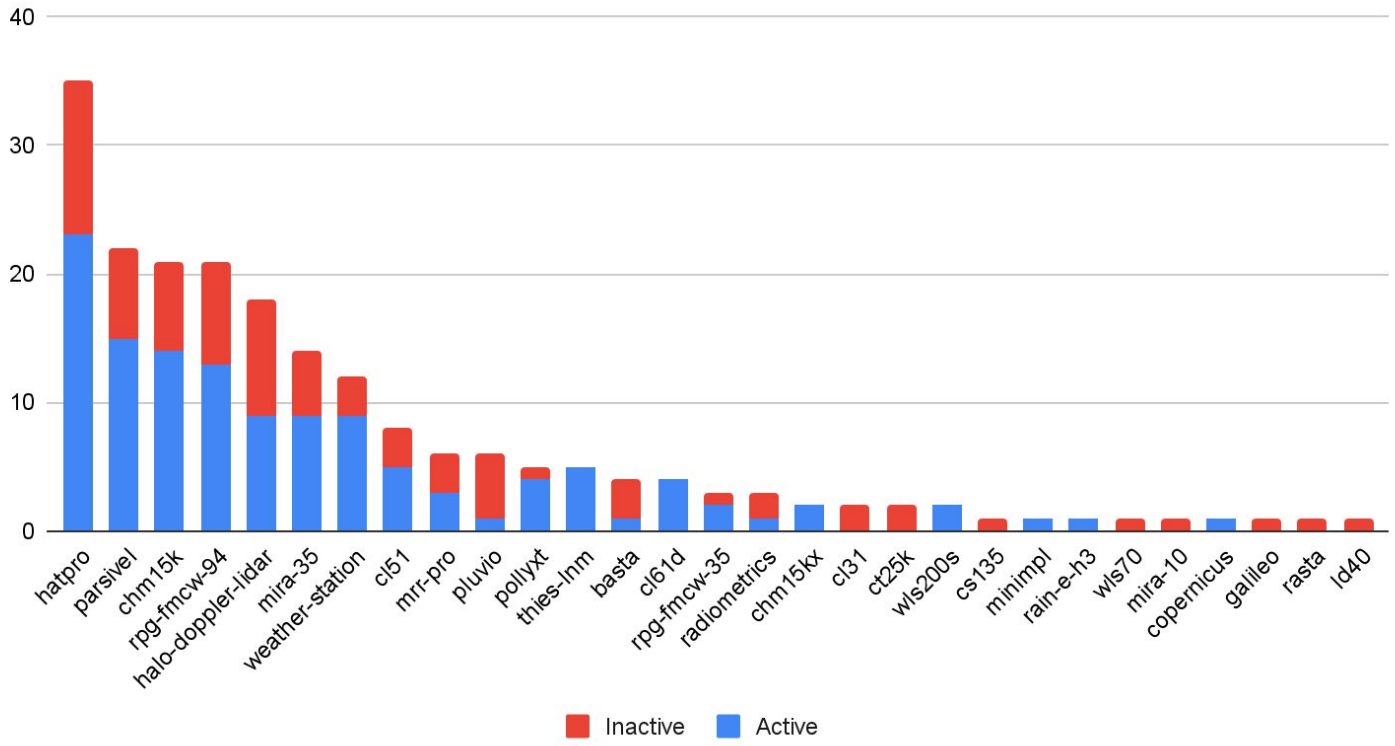
Cloudnet data volume

- ★ 0.8 M product files
- ★ 0.6 M model files
- ★ 15.5 M raw files
- ★ 83 TiB of raw data
  (67 % RPG *.LV0 files)





Cloudnet instruments



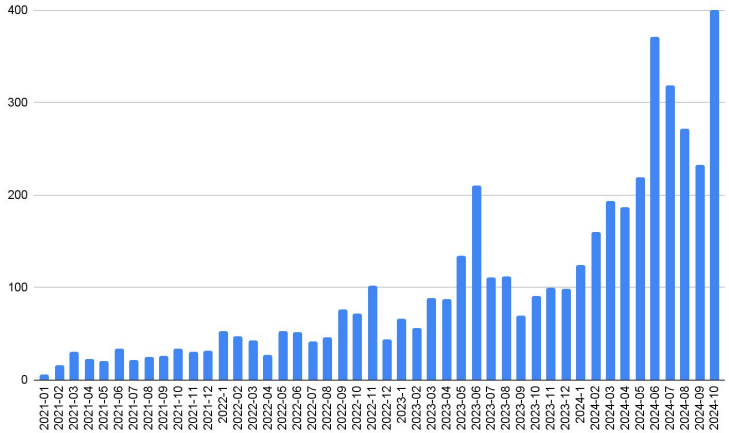
Data submission

- 2-step submission (metadata + data) over HTTP
- Personal credentials
  - Permissions to submit from site X, Y, Z…
  - Contact CLU unit for credentials: actris-cloudnet@fmi.fi
- Recommended tool: cloudnet-submit
  - https://github.com/actris-cloudnet/cloudnet-submit
  - pip install cloudnet-submit

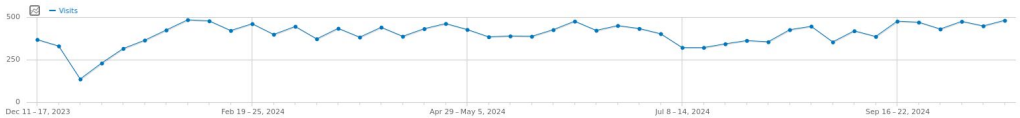
Questions, comments, problems??

cloudnet.fmi.fi user statistics

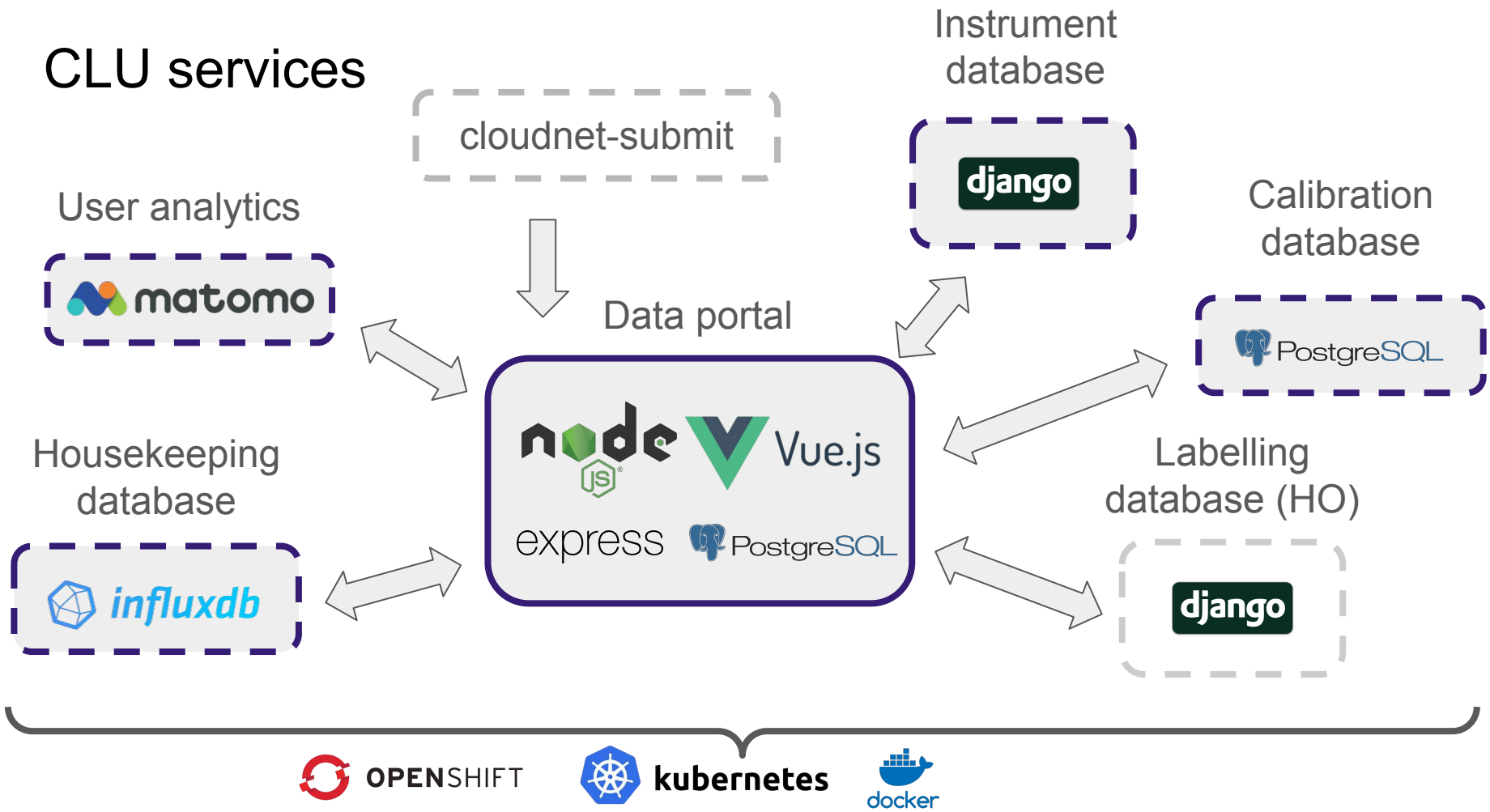
Monthly unique IPs downloading data



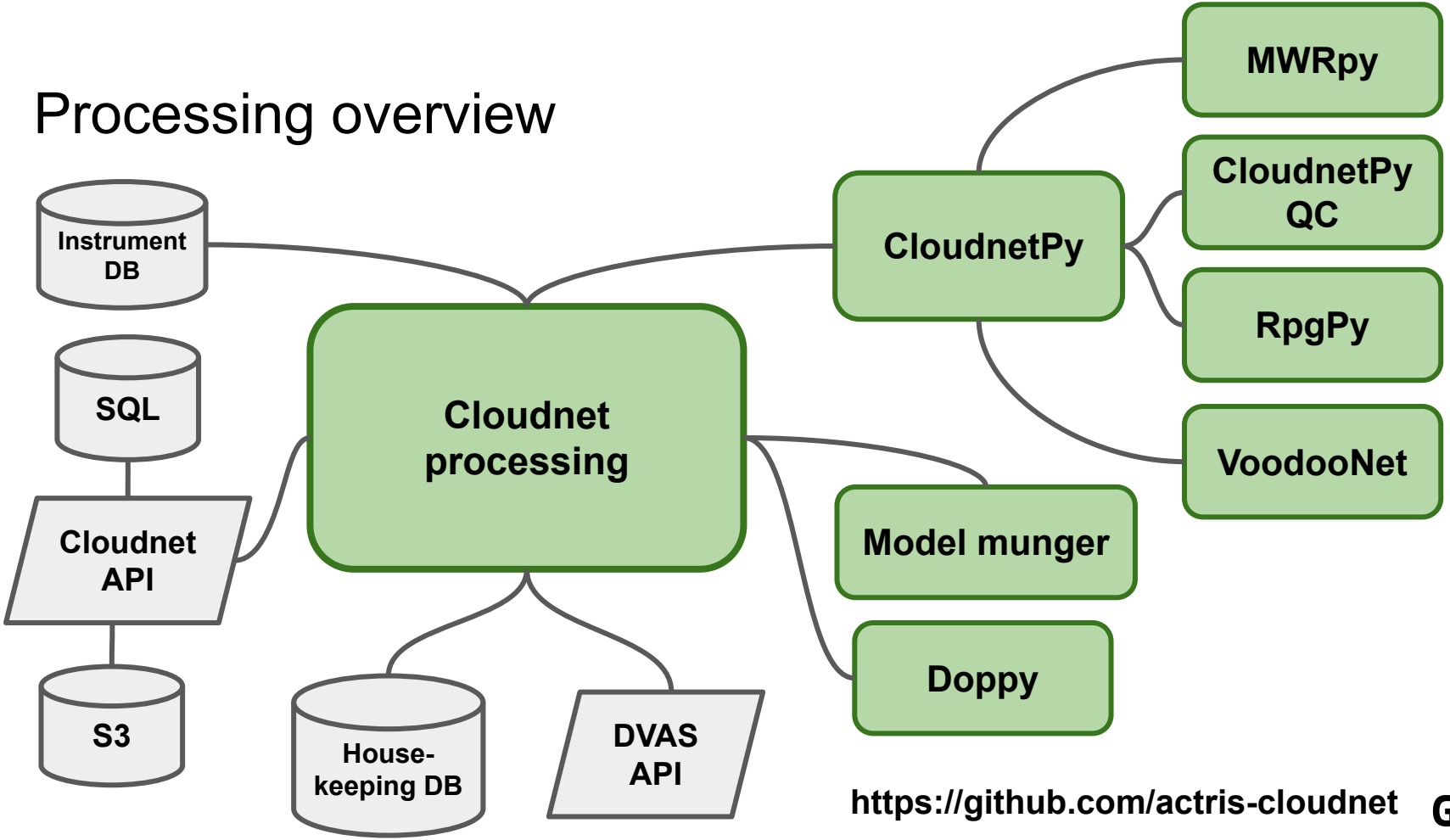
Weekly data portal visits



CLU services



Processing overview



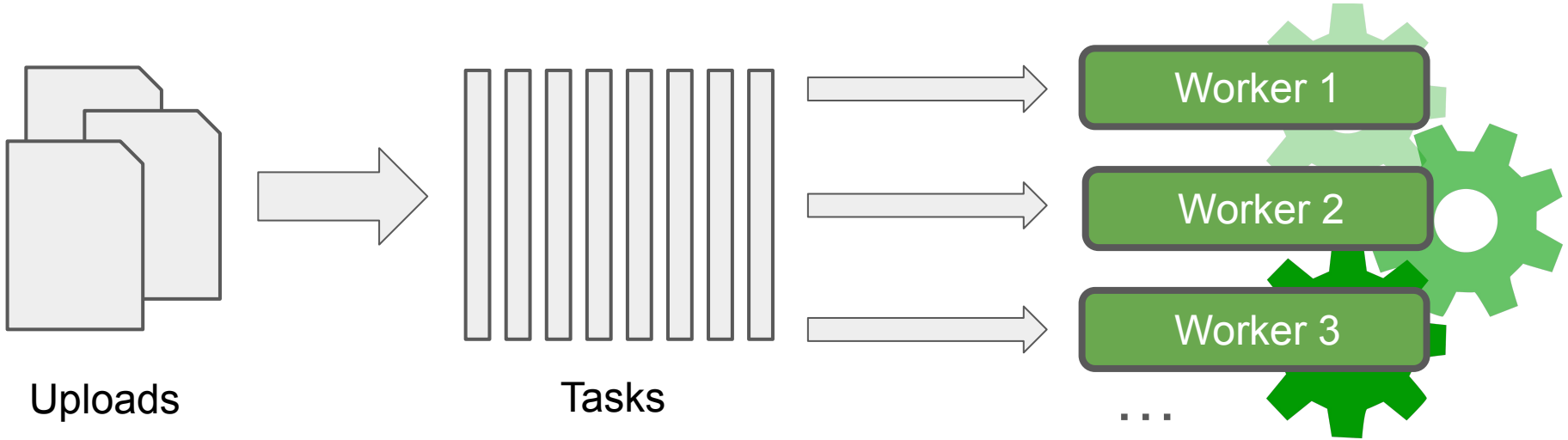
https://github.com/actris-cloudnet

GitHub

Processing queue

Move from traditional cron jobs to modern queue/worker architecture.

Processing is now more flexible, scalable and real-time.



Processing queue

Total tasks: 25

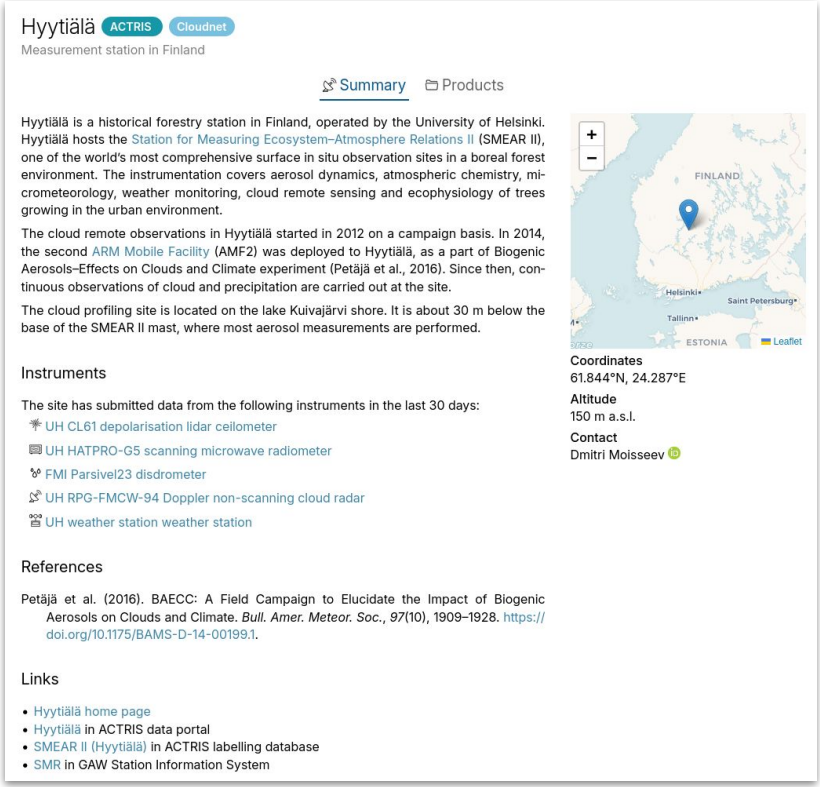
☐ Show failed tasks

Type	Status	Site	Date	Product	Instrument / model	Due in
process	running	payerne	2024-10-25	lidar	MeteoSwiss CHM 15k	
process	running	payerne	2024-10-25	mwr	MeteoSwiss HATPRO-G5	
process	pending	payerne	2024-10-25	mwr-l1c	MeteoSwiss HATPRO-G5	
process	created	kenttarova	2024-10-25	lidar	FMI CL61-B	1 min
process	created	kenttarova	2024-10-25	weather-station	FMI weather station	2 min
process	created	kenttarova	2024-10-24	weather-station	FMI weather station	2 min
process	created	vehmasmaki	2024-10-25	radar	FMI MIRA-35S	2 min
process	created	payerne	2024-10-25	doppler-lidar	MeteoSwiss WLS200S	2 min
process	created	payerne	2024-10-25	doppler-lidar-wind	MeteoSwiss WLS200S	2 min
process	created	chilbolton	2024-10-25	doppler-lidar	UL HALO	2 min
process	created	chilbolton	2024-10-25	doppler-lidar-wind	UL HALO	2 min
process	created	evora	2024-10-25	mwr	UÉ HATPRO-G4	2 min
process	created	evora	2024-10-25	mwr-l1c	UÉ HATPRO-G4	2 min
process	created	hyytiala	2024-10-25	lidar	UH CL61	2 min
process	created	cabauw	2024-10-25	doppler-lidar	KNMI WLS200S	4 min
process	created	cabauw	2024-10-25	doppler-lidar-wind	KNMI WLS200S	4 min
process	created	evora	2024-10-25	lidar	UÉ CHM 15k	4 min
process	created	granada	2024-10-25	categorize		7 min
process	created	kenttarova	2024-10-25	categorize		7 min
process	created	chilbolton	2024-10-25	categorize		7 min
process	created	cabauw	2024-10-25	categorize		8 min
process	created	hyytiala	2024-10-25	categorize		9 min
process	created	evora	2024-10-25	categorize		10 min
process	created	lindenberg	2024-10-25	categorize		12 min
process	created	neumayer	2024-10-25	categorize		13 min

Site page

➔ **Send us an description of your site!**

The description should focus on the cloud remote sensing component, not the whole station or ACTRIS National Facility.



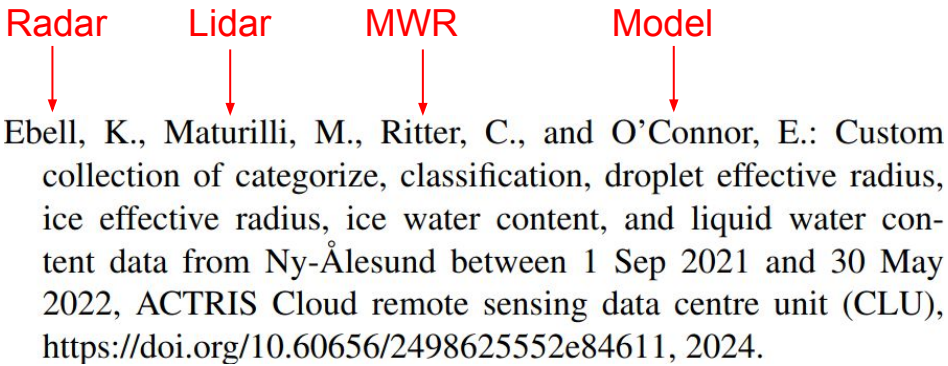
https://cloudnet.fmi.fi/sites

Data citation

Currently the following people are included:

- Instrument PI(s)
- ACTRIS NF PI (from labelling)
- Additional site-specific people

Recent example from the wild:



Ebell, K., Maturilli, M., Ritter, C., and O'Connor, E.: Custom collection of categorize, classification, droplet effective radius, ice effective radius, ice water content, and liquid water content data from Ny-Ålesund between 1 Sep 2021 and 30 May 2022, ACTRIS Cloud remote sensing data centre unit (CLU), https://doi.org/10.60656/2498625552e84611, 2024.

Instrument overview

TROPOS CHM 15k-x (LACROS)

Lufft CHM 15k-x ceilometer

Overview | Raw files | Calibration

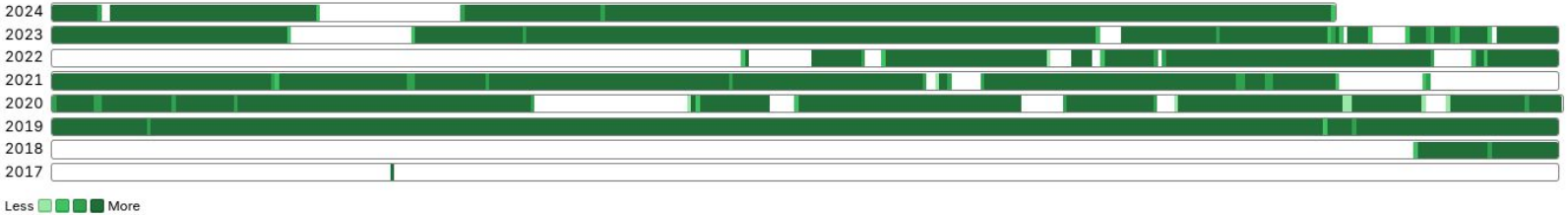
Instrument

PID	https://hdl.handle.net/21.12132/3.cd3578e9f68b42c0
Owner	Leibniz Institute for Tropospheric Research (TROPOS)
Model	Lufft CHM 15k-x
Type	lidar ceilometer
Serial number	CHX090111

Locations

2023-03-29 – now	Leipzig
2022-12-11 – 2024-03-05	Eriswil
2022-06-17 – 2022-12-01	Leipzig
2018-11-27 – 2021-11-30	Punta Arenas
2017-03-24 – 2017-03-24	Limassol

Total size of uploaded raw files



Visualisation: Total size

Year: Select

Raw file status

TROPOS CHM 15k-x (LACROS)

Lufft CHM 15k-x ceilometer

Overview | Raw files | Calibration

Date

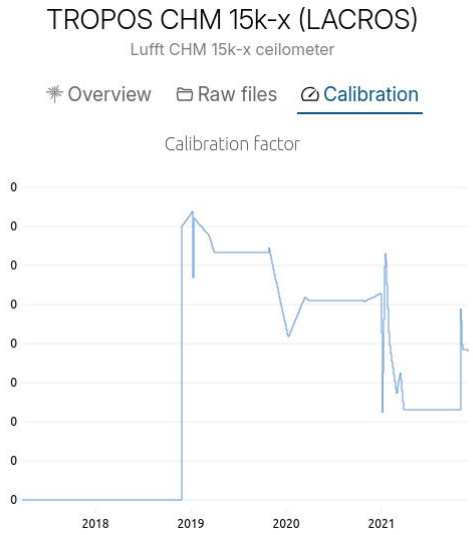
2024-11-06

Uploaded	Processed	Created	Invalid
1	1	0	0

Filename	Size	Status	Created (UTC)	Updated (UTC)
20241106_Leipzig_CHX090111.nc	6.5 MB	processed	2024-11-06 02:05:05	2024-11-06 14:05:15

Calibration

Calibration data is now visible on instrument page:



Uni Köln HATPRO-G5 (JOYHAT)

RPG-Radiometer Physics HATPRO microwave radiometer

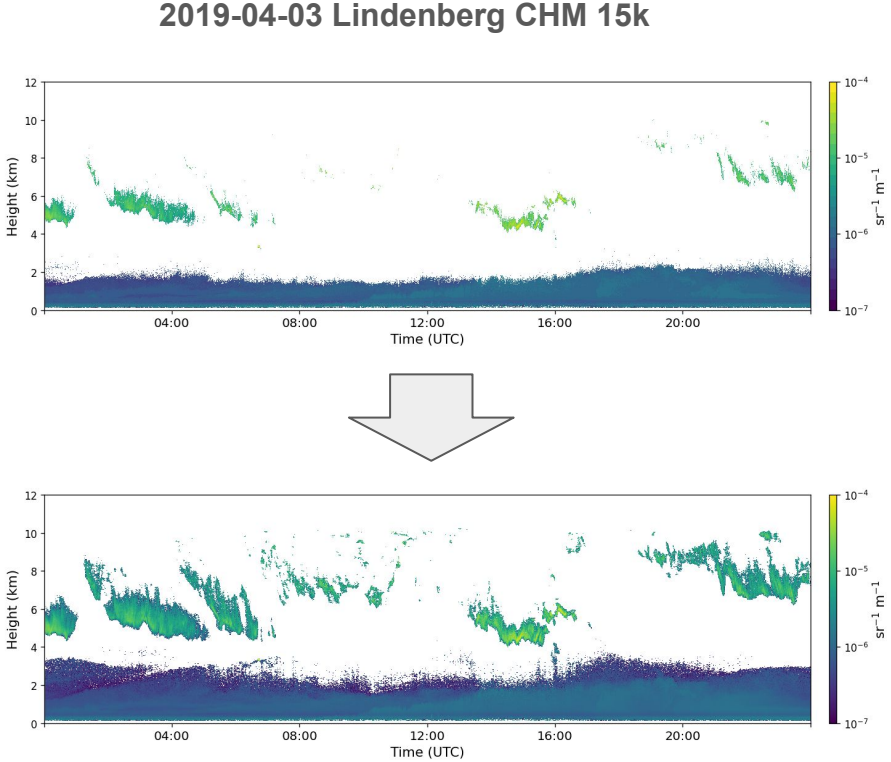
Overview | Raw files | Calibration

Retrieval coefficients

Date	Coefficient files	Updated at
2024-01-01	tbx_deb_rt00_90_00.nc tbx_deb_rt00_90_07.nc tbx_deb_rt00_90_09.nc hpt_deb_rt00_90.nc iwv_deb_rt00_90.nc tbx_deb_rt00_90_08.nc tbx_deb_rt00_90_06.nc tbx_deb_rt00_90_05.nc lwp_deb_rt00_90.nc tbx_deb_rt00_90_02.nc tpt_deb_rt00_90.nc tbx_deb_rt00_90_03.nc tpb_rao_rt03.nc tbx_deb_rt00_90_10.nc tbx_deb_rt00_90_12.nc tbx_deb_rt00_90_11.nc tbx_deb_rt00_90_13.nc tbx_deb_rt00_90_01.nc tbx_deb_rt00_90_04.nc	2024-08-08 13:10:02 UTC

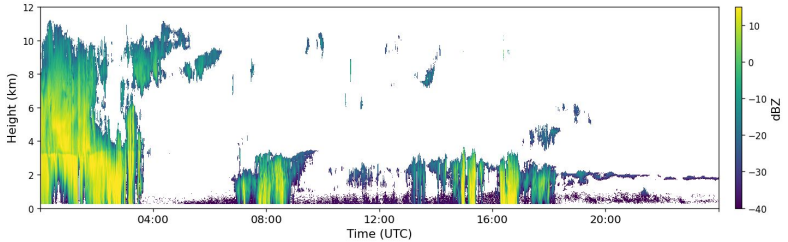
Lidar background screening

Harmonized screening for all ceilometers using improved method first introduced for CL61.

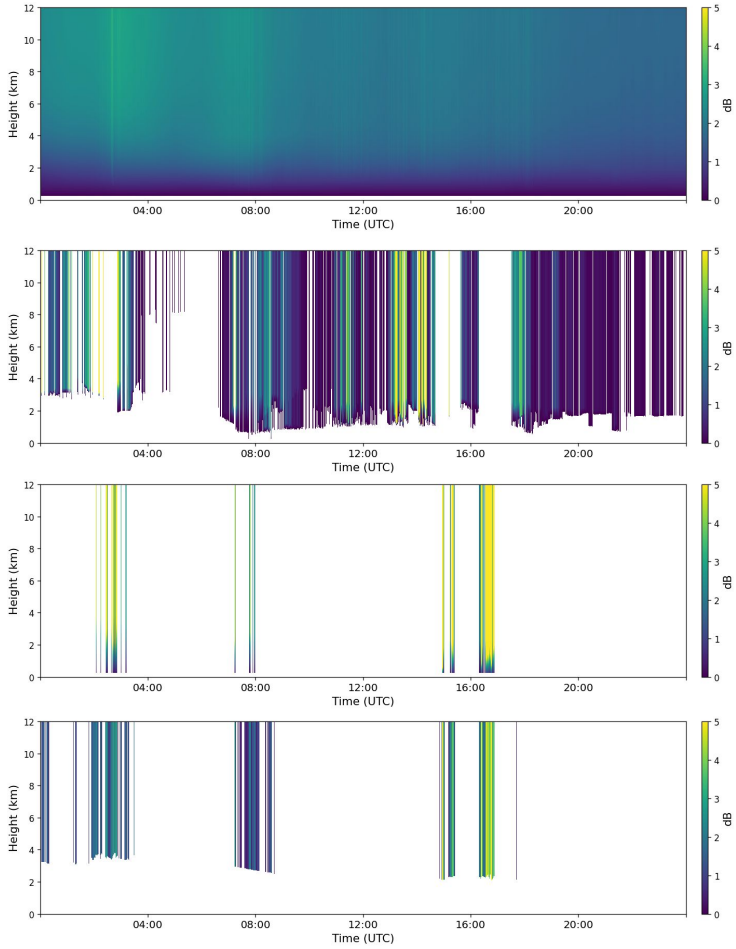


Radar attenuation

- Revised corrections **gas** and **liquid** water attenuation
- Implemented new corrections for **rain** and **melting** layer attenuation



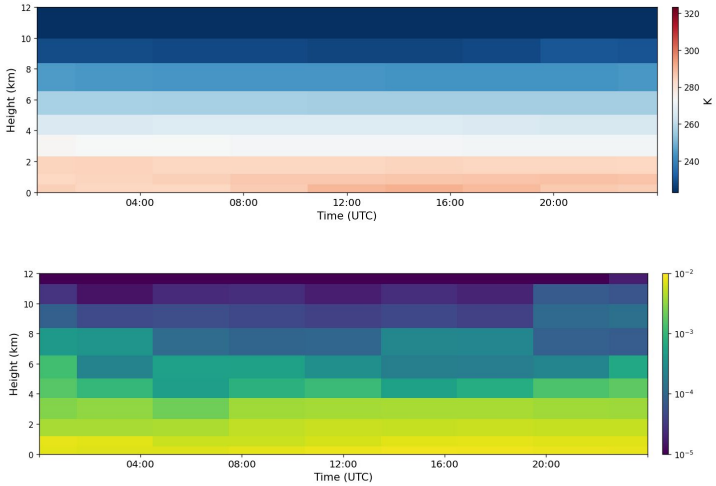
Leipzig 10.10.2024



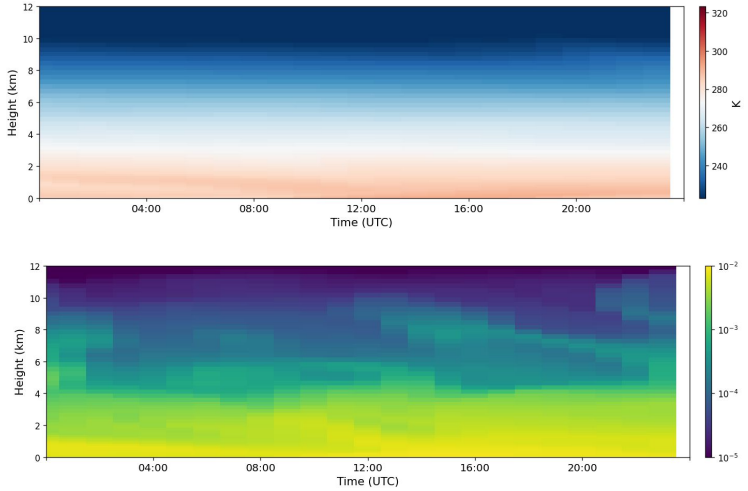
New model processing pipeline “Model munger”

- https://github.com/actris-cloudnet/model-munger/
- ECMWF IFS open implemented as Cloudnet fallback model

IFS Open



IFS full resolution



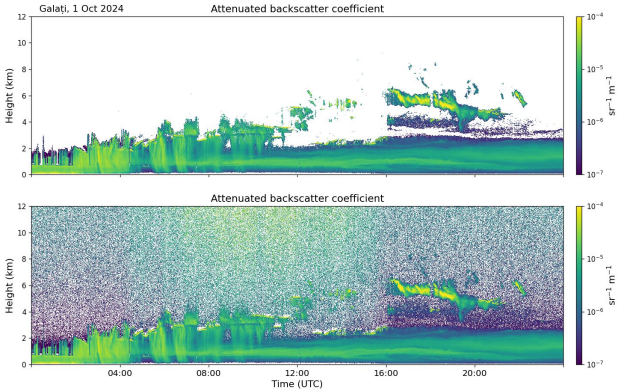
CloudnetPy CLI

- User-friendly interface for trying / debugging CloudnetPy

usage: cloudnetpy [-h] -s SITE -d DATE -p PRODUCTS [--input INPUT] [--output OUTPUT] [--plot | --no-plot] [--show | --no-show] [--dl | --no-dl]

For example:

pip3 install cloudnetpy
cloudnetpy -s galati -p lidar -d 2024-10-01 –show



Multiple instruments of same type

- Which one to use for geophysical products?
- Now possible to define “nominal” instrument for a site (e.g. labelled or otherwise preferred instrument)

Site A (no nominal instrument)

Use MIRA by default

⇨ Radar product ⇨ **Classification + other products**

RPG

⇨ Radar product

Site B (RPG as nominal instrument)

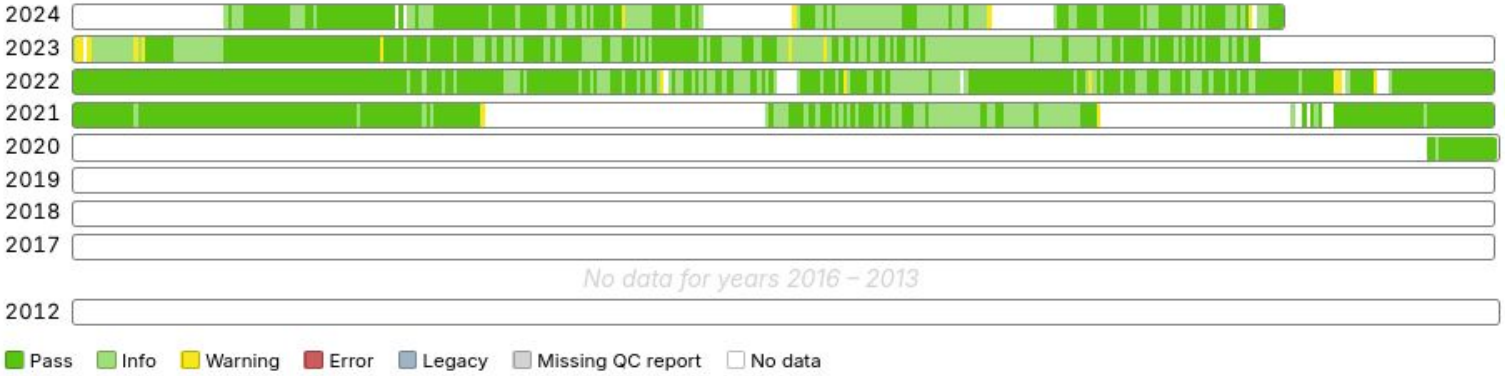
MIRA

⇨ Radar product

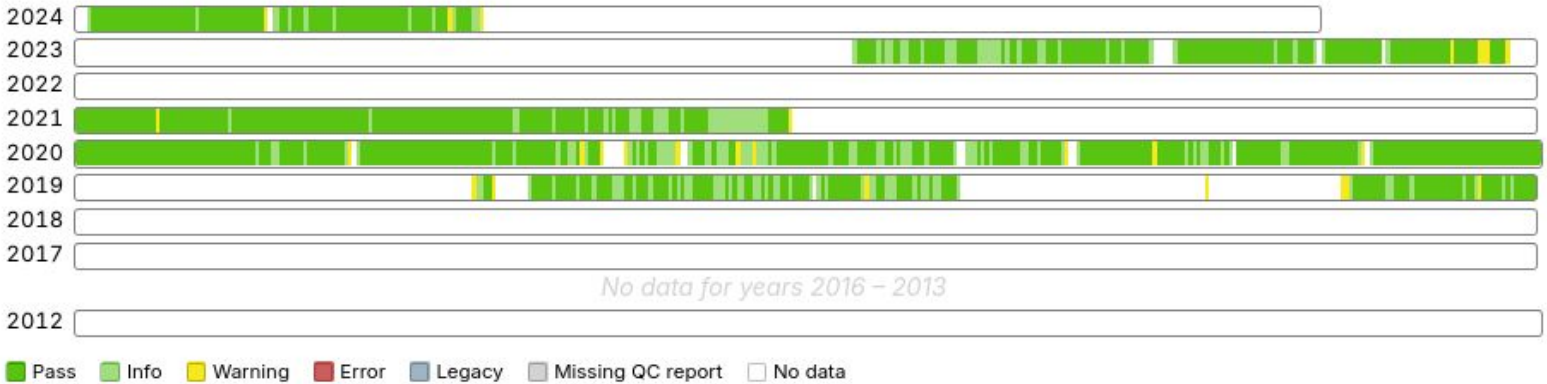
Use RPG (if available)

⇨ Radar product ⇨ **Classification + other products**

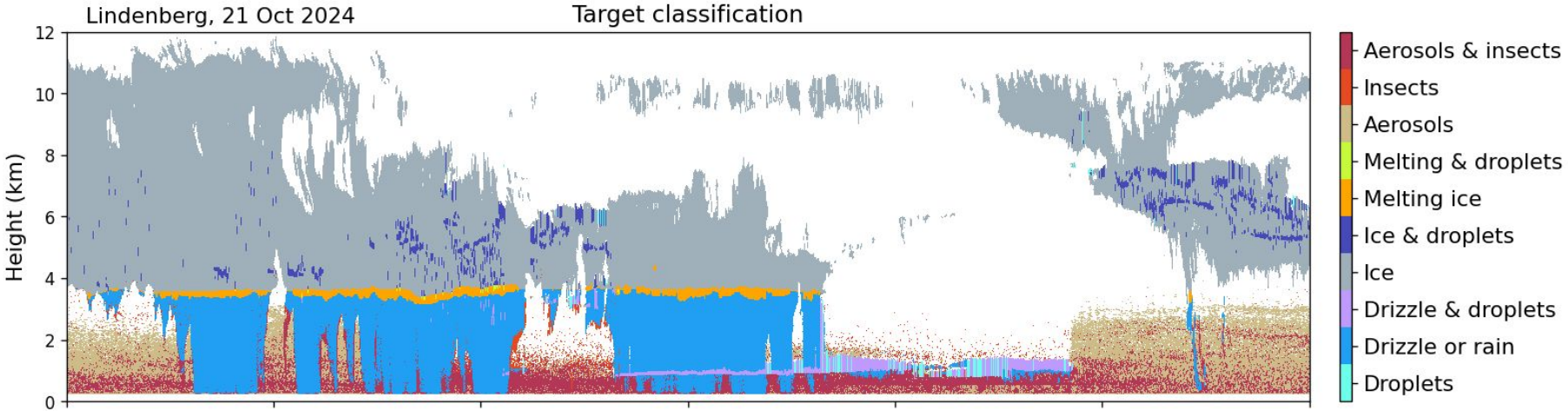
Product quality / availability - Radar (INOE MIRA-35S)



Product quality / availability - Radar (ESA RPG-FMCW-94-DP)



Instrument configuration example



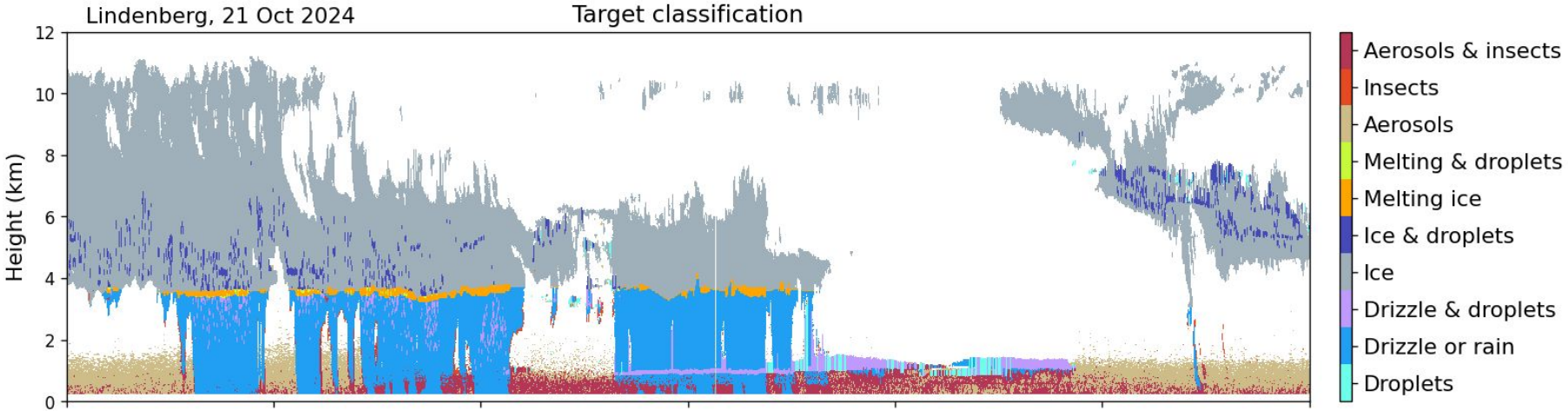
Lidar
- **Lufft CHM 15k**
- Vaisala CL61
- HALO StreamLine

Microwave radiometer
- **RPG HATPRO-G5**
- Radiometrics MP-3000A

Cloud radar
- **METEK MIRA-35**
- RPG-FMCW-94-DP

Disdrometer
- **OTT Parsivel²**
- Thies LPM

Instrument configuration example



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**

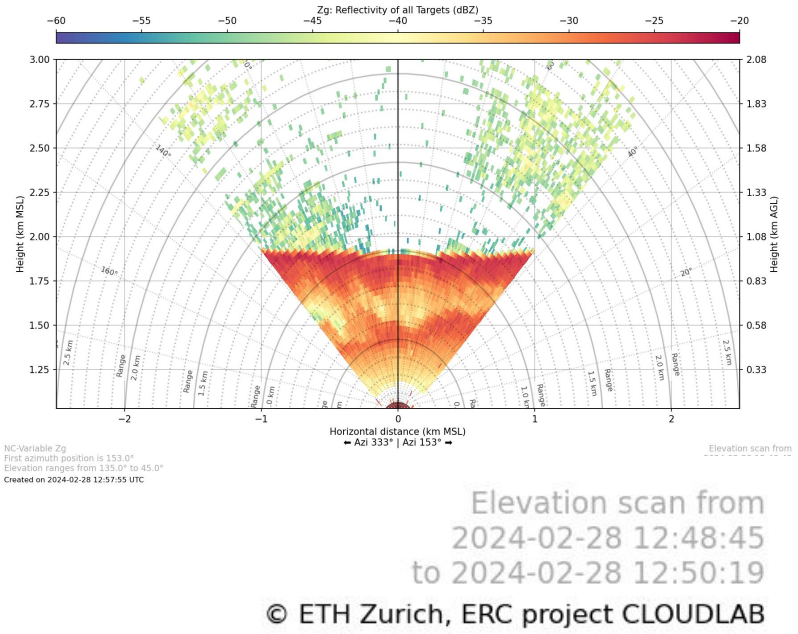
Disdrometer
- OTT Parsivel²
- **Thies LPM**

Radar scanning products

Currently only zenith-pointing radar product.

Planning to receive radar scan data from sites:

- Calculate winds (similarly to Doppler lidar wind product)
- Merged product with Doppler lidar?
- File format? (CfRadial2 or Cloudnet convention)
- Which other products are possible and wanted from scan data?

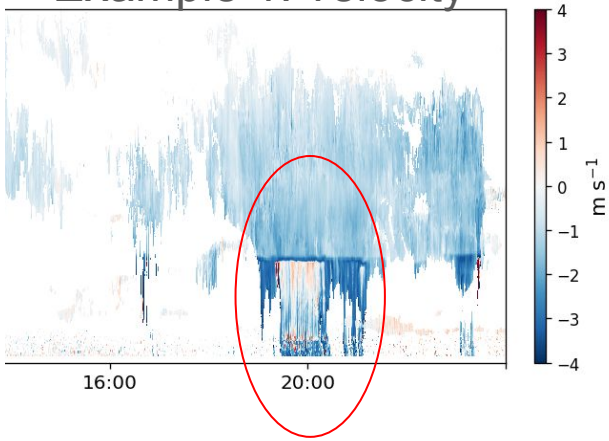


Radar spectra dealiasing

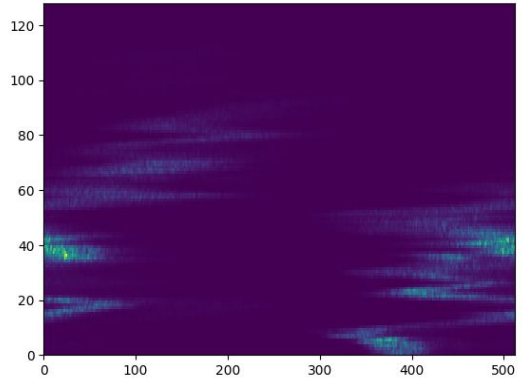
Folding is a common problem especially with RPG cloud radars.

➔ Investigating operational methods for dealiasing cloud radar spectra.

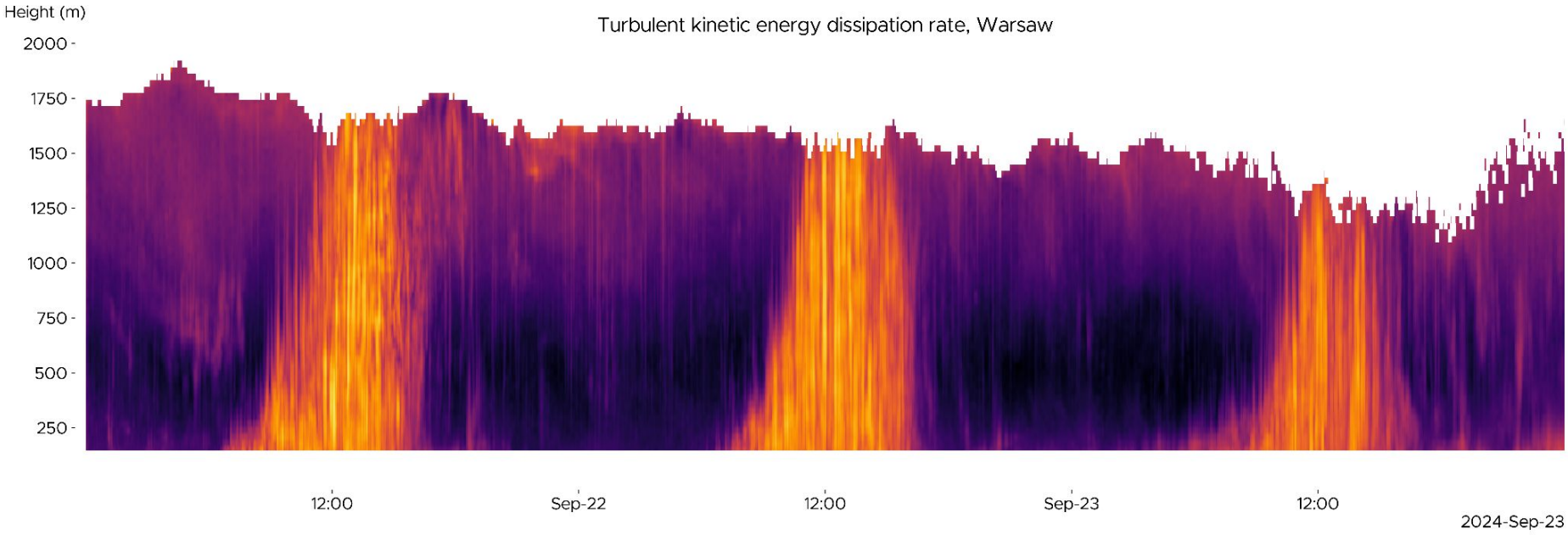
Example 1: velocity



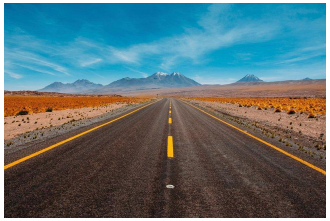
Example 2: spectra



Doppler lidar winds / turbulence, work in progress



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 and monitoring
- Landing pages for campaigns? Now we only have “campaign sites”
- ARM data ??