Gefördert durch:
Bundesministerium für Wirtschaft und Energie
aufgrund eines Beschlusses des Deutschen Bundestages

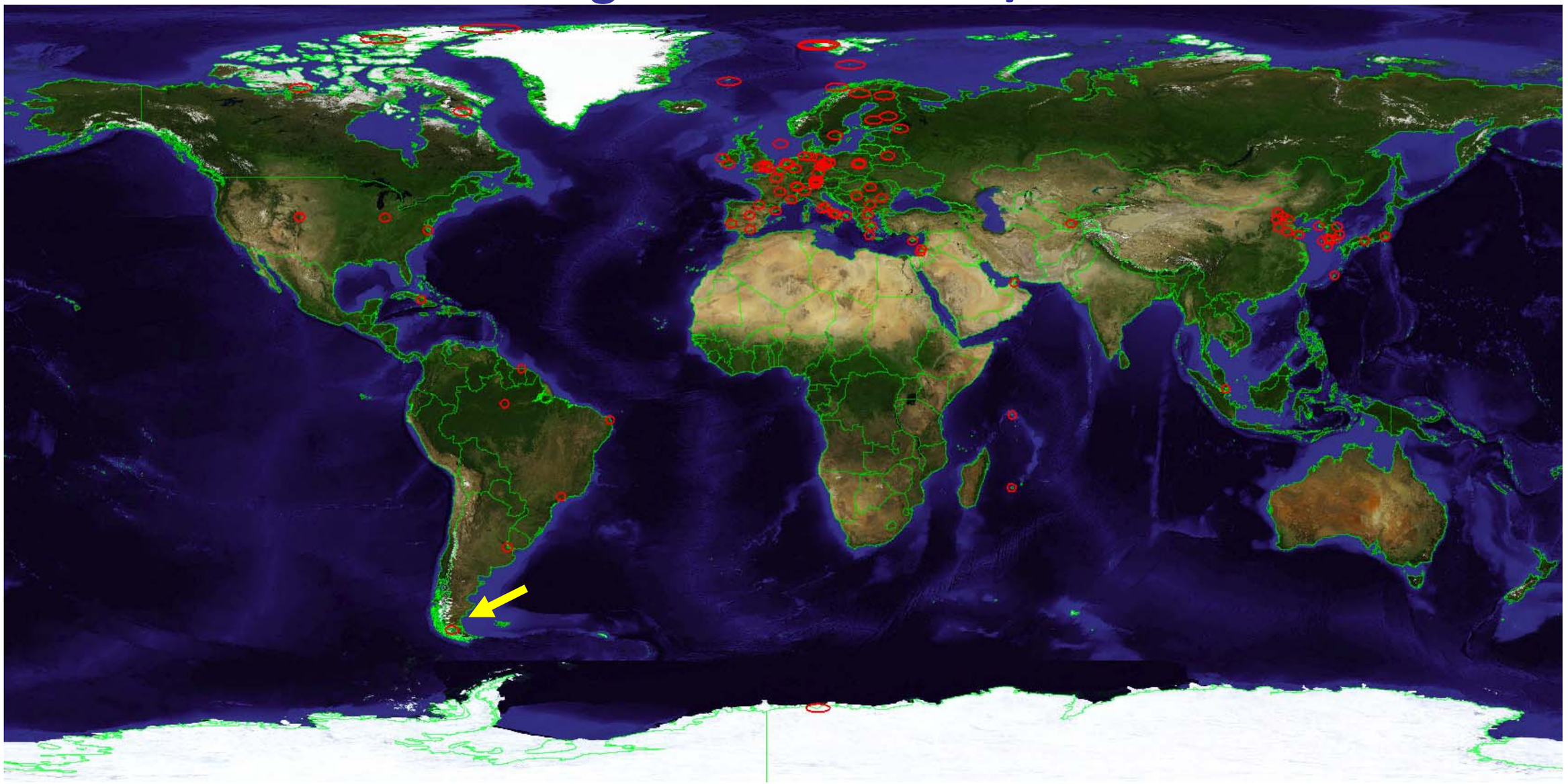
Validation of Aeolus wind products with scanning Doppler cloud radar, wind lidar and radiosondes in the Southern Hemisphere

Holger Baars, Josh Walshester, Elizaveta Basharova, Ronny Engelmann, Johannes Bühl, Martin Radenz, Patric Seifert, Cristofer Jimenez, Inga Dmitrijenko, Tülin Gülbas, Ulla Wandinger and Boris Barja

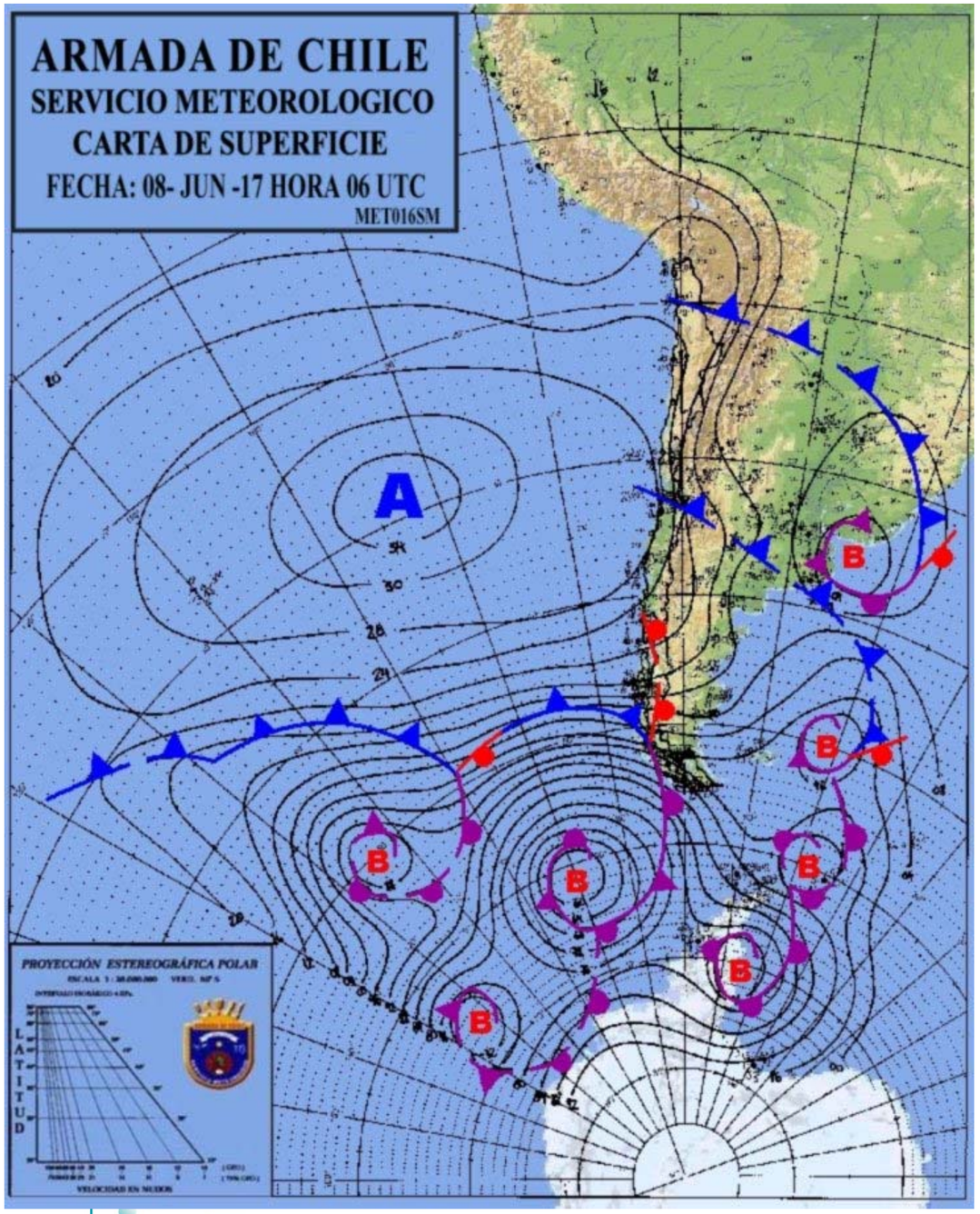
I am sure I forgot someone….sorry.

Thanks to ESA for proving data and material
and especially to **T. Kanitz and S. Bley** for support.

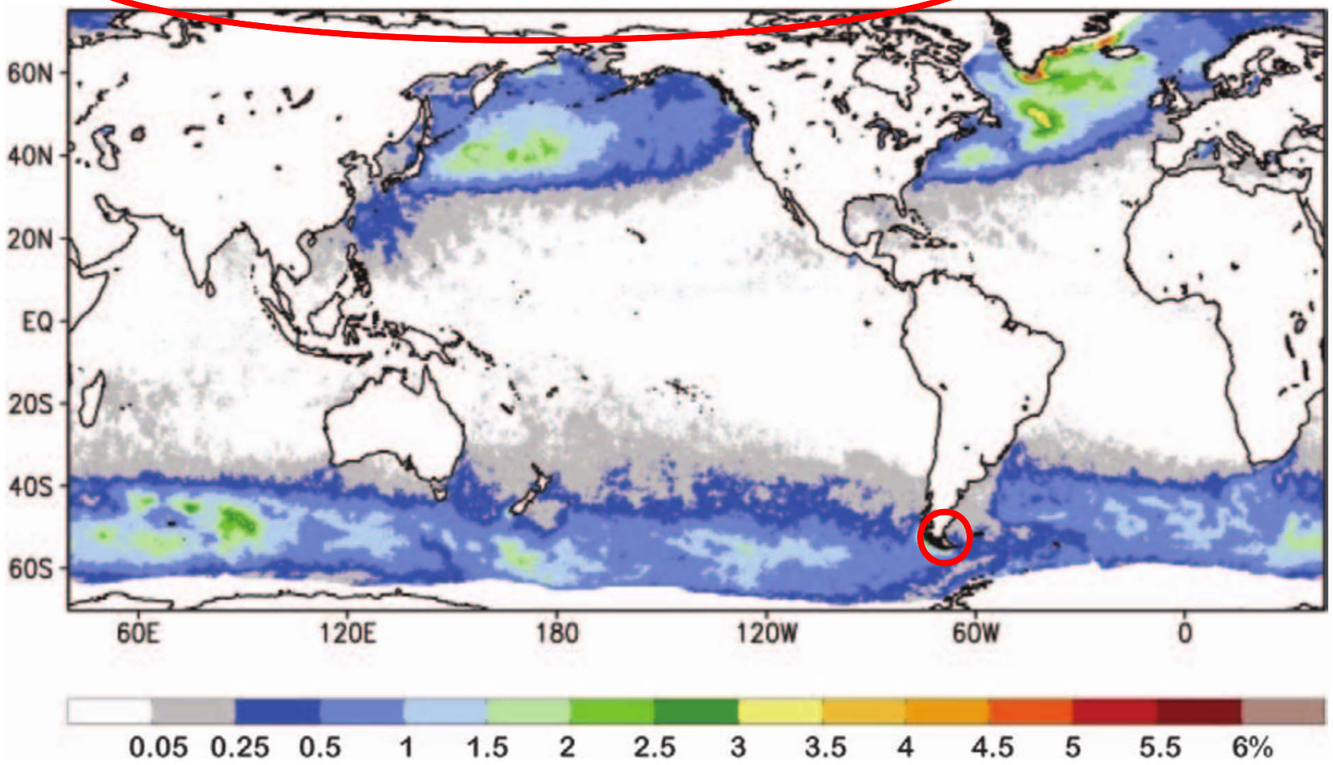
Locations of ground-based Cal/Val activities



The Roaring Forties



Frequency of winds > 25 m/s



[Bourassa 2013 BAMS]

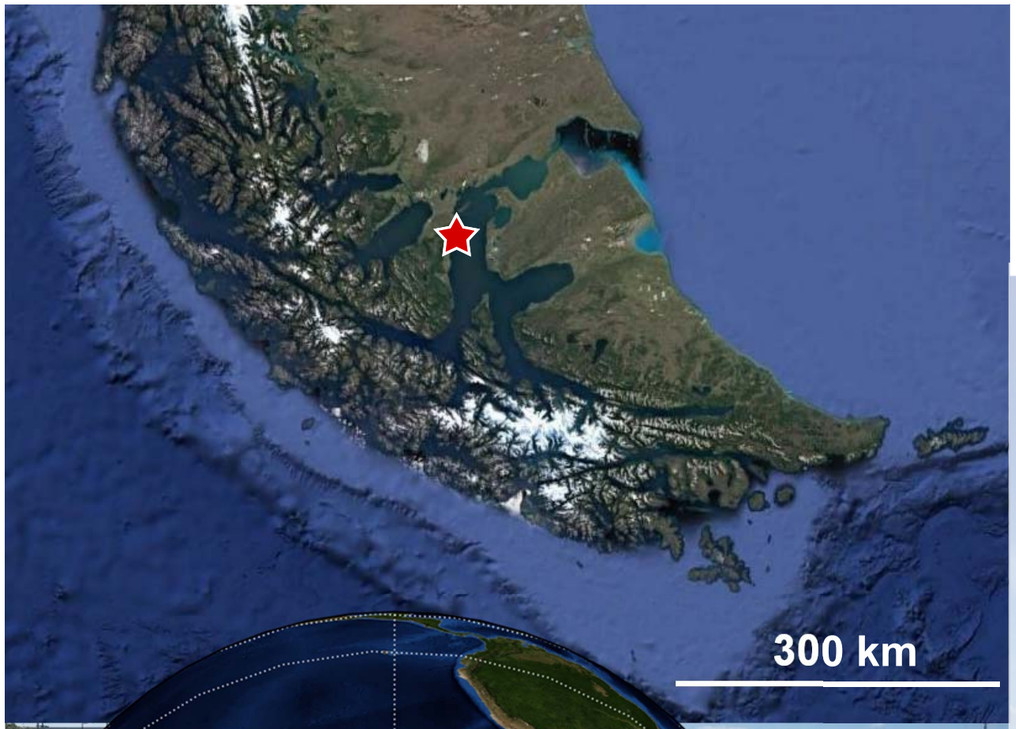
DACAPO PESO

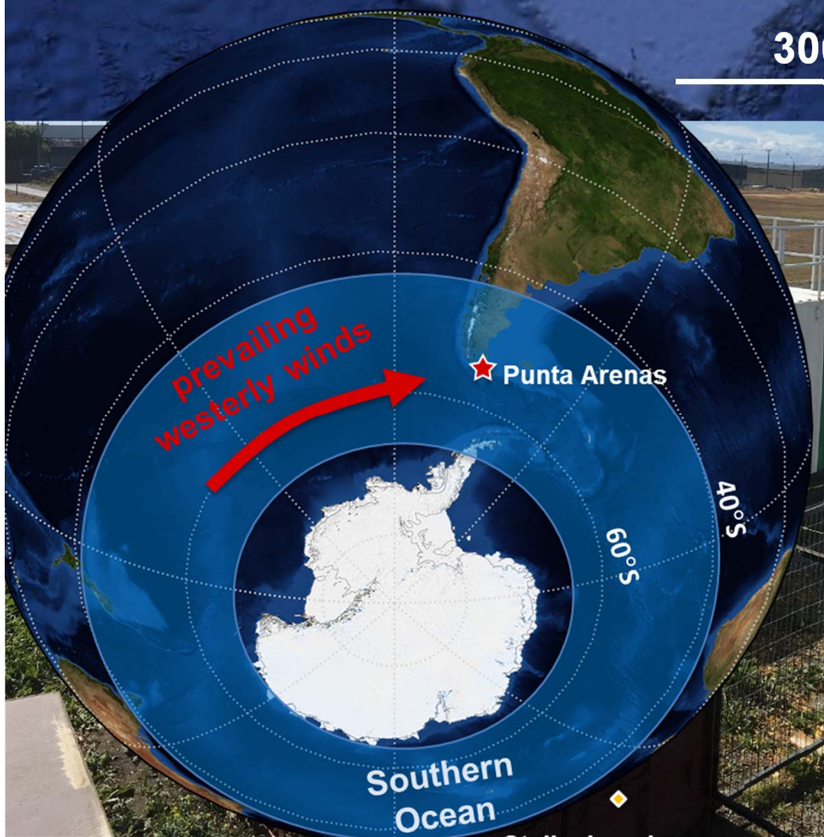
Dynamics, Aerosol, Cloud and Precipitation Observations in the Pristine Environment of the Southern Ocean

TROPOS

LACROS at Punta Arenas: 26 Nov 2018 – 27 Nov 2021

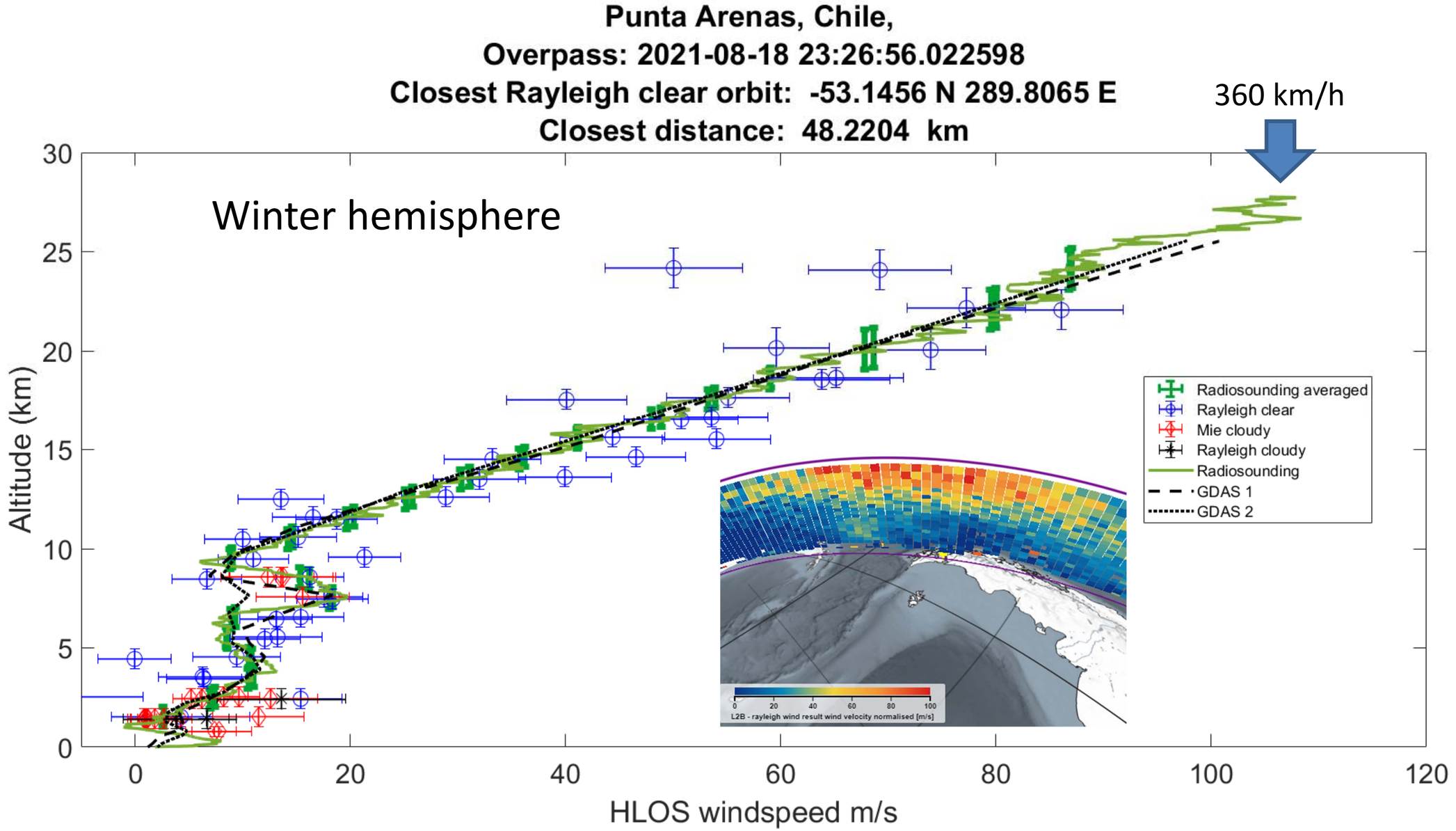
- The (only) campaign positively affected by COVID:
  Extension from 1-year campaign to **3 full years** (anniversary last Friday)
  →two years of remote maintenance and excellent local support
- Occasional dedicated radiosonde launches for Aeolus
- Low aerosol load and difficult Aeolus performance below 2 km
  → Doppler lidar mostly not usable
  →Use of Cloud radar to obtain horizontal wind speed



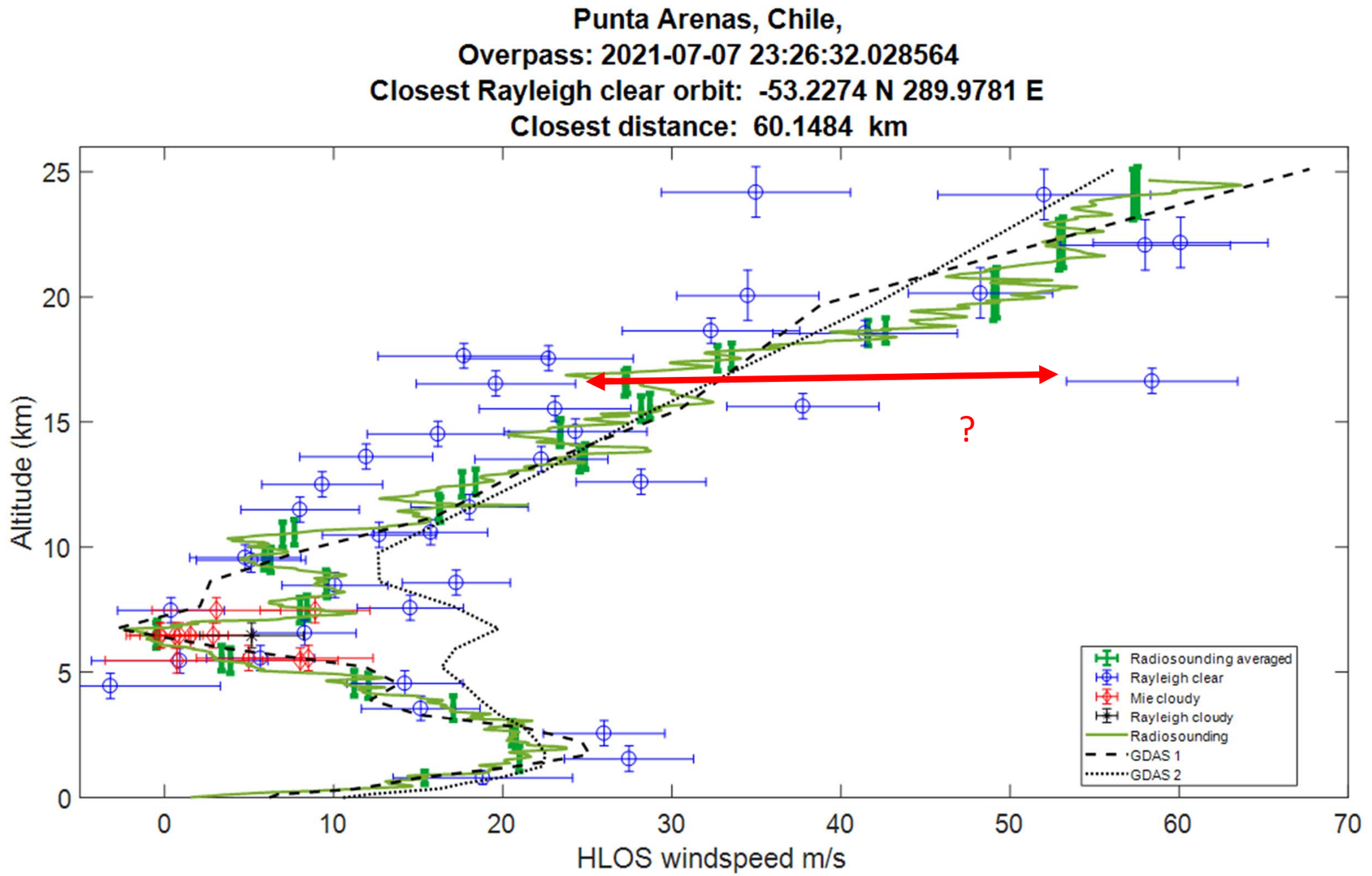


Leipzig Aerosol and Cloud Remote Observations System

Comparison with radiosondes



Comparison with radiosondes

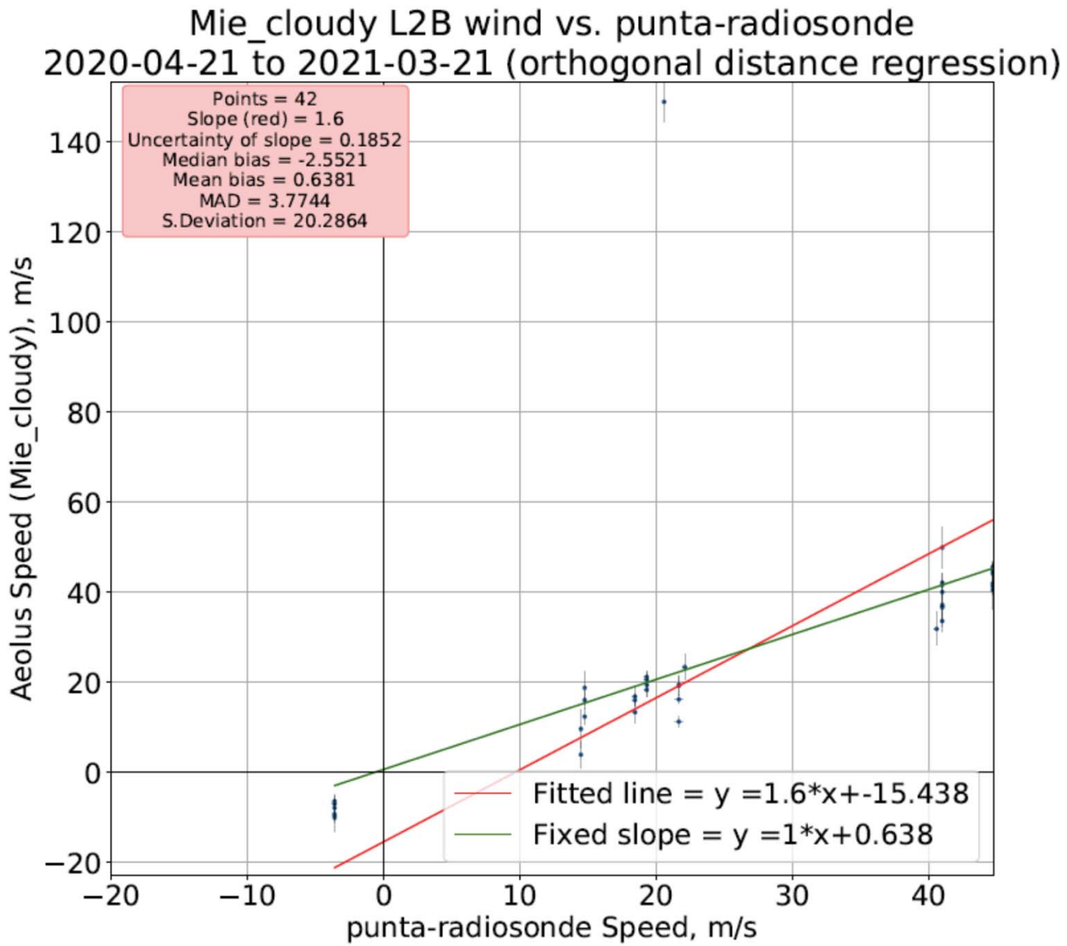


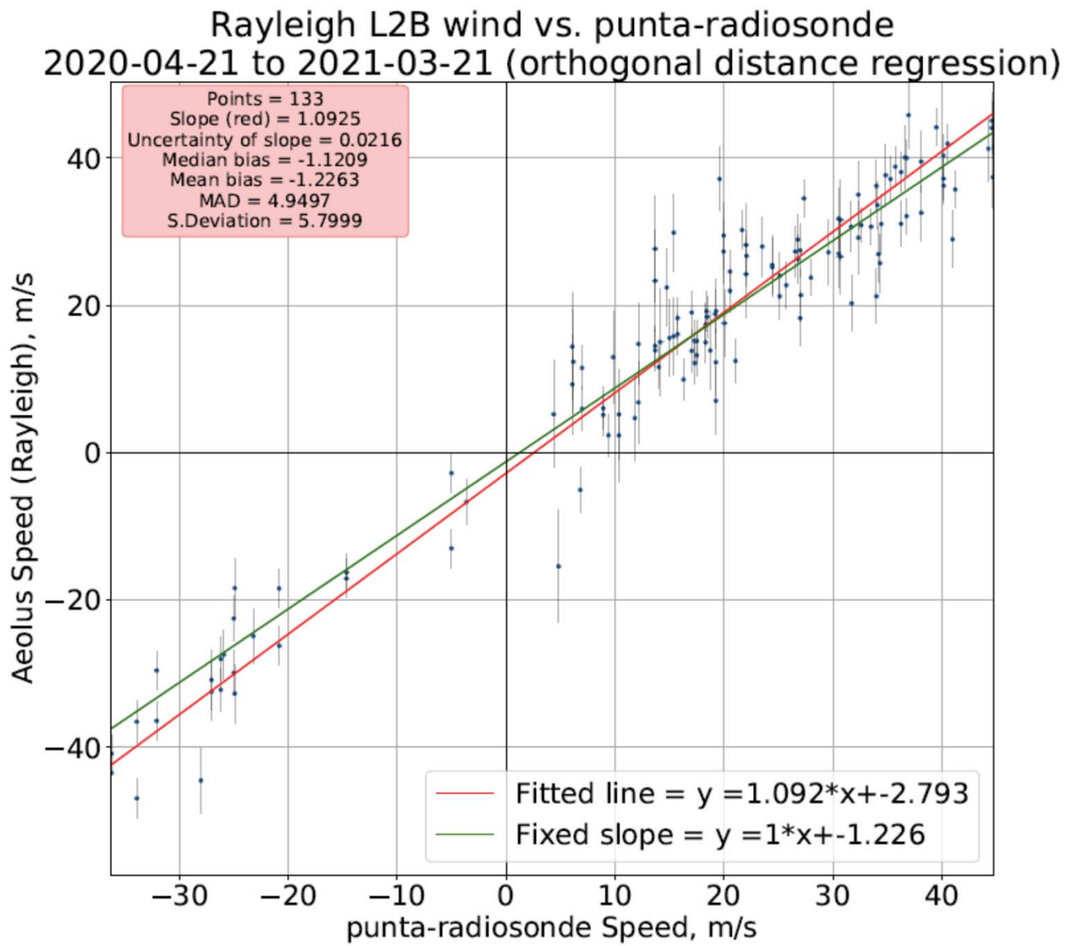
Sometimes large differences between two neighboring Rayleigh winds

Great comparisons, but only once a week and not for the whole period.

Long term analysis – radiosondes

Rayleigh winds (i.e. winds in clear sky) vs. “radar winds”





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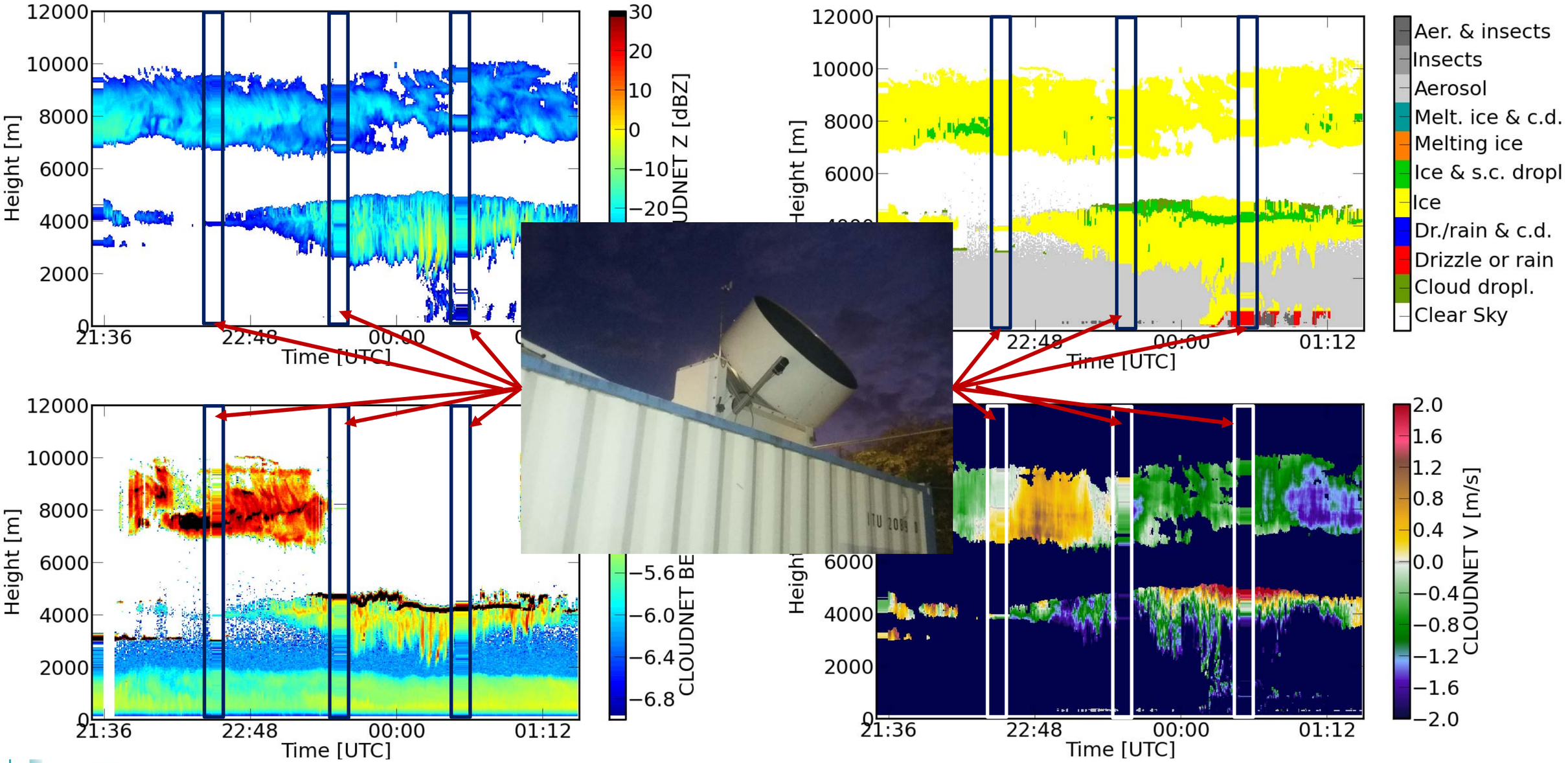
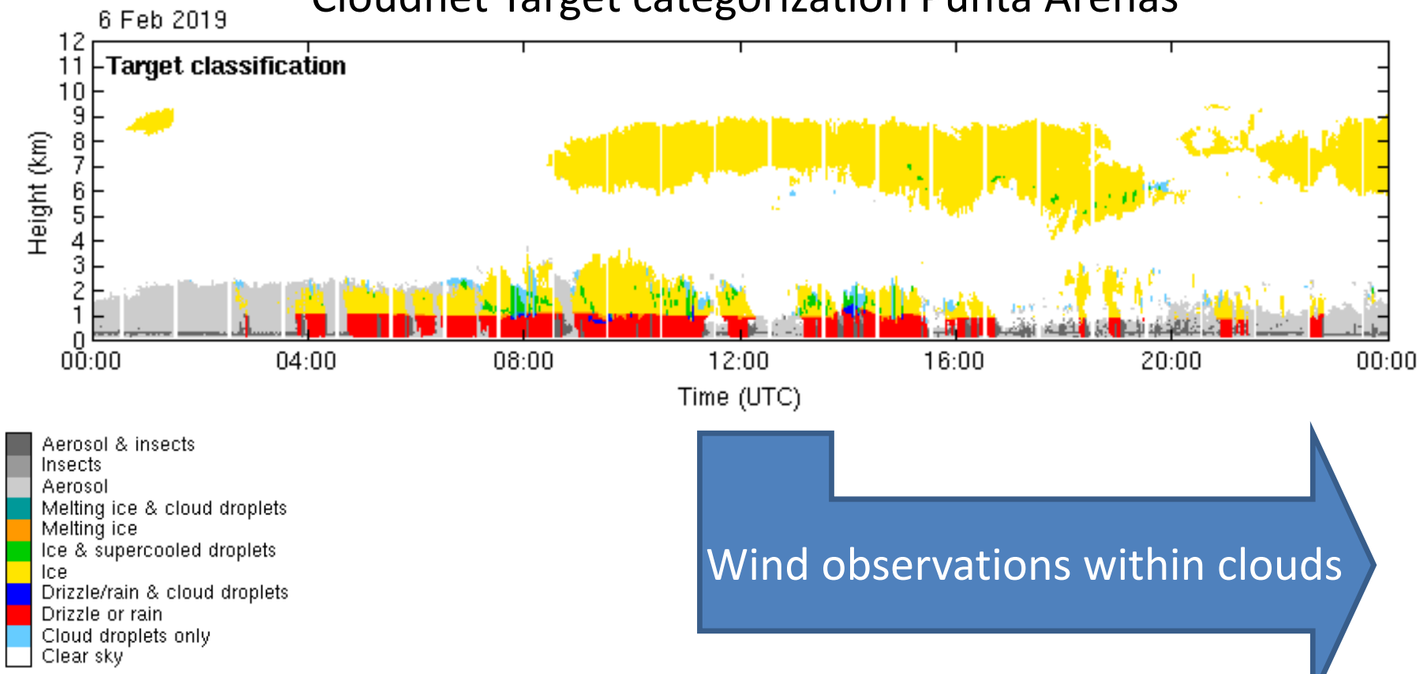
Wind Cal/Val by means of Doppler lidar and cloud radar

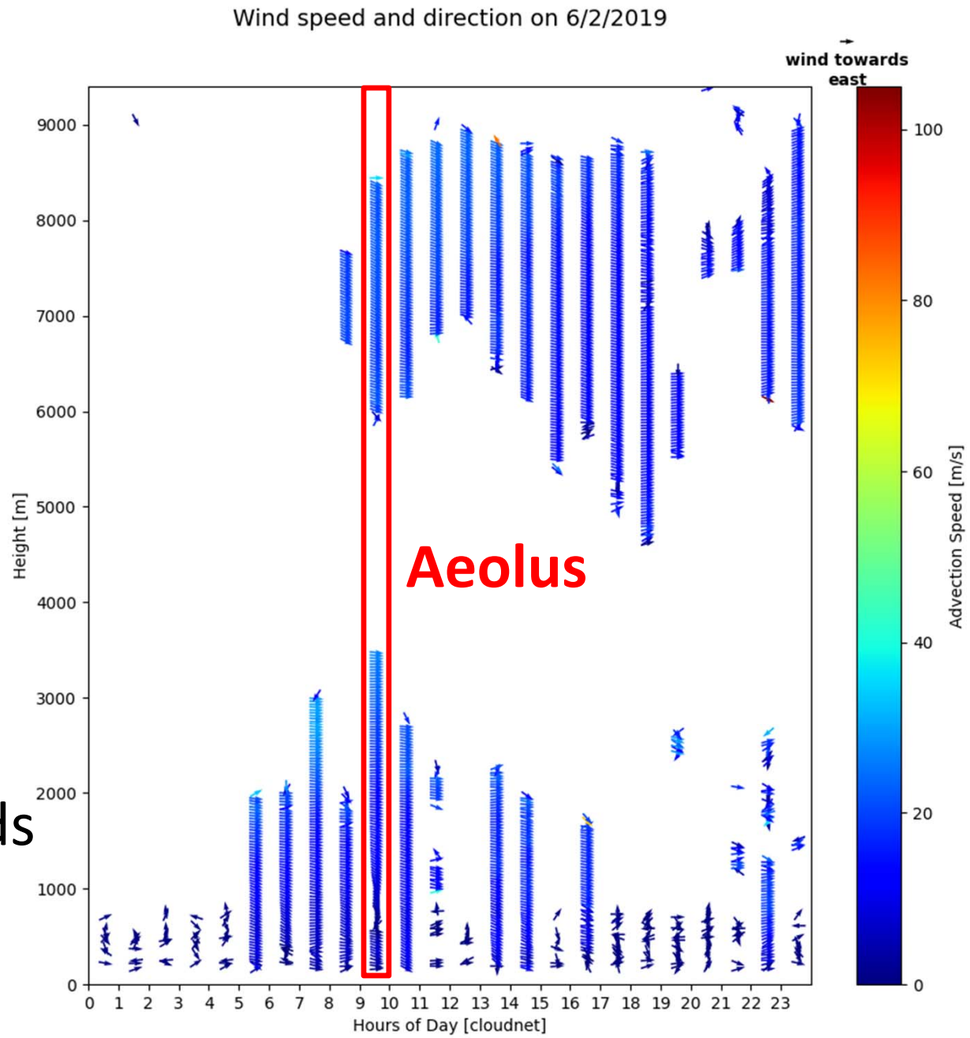


Wind Cal/Val by means of Doppler lidar and cloud radar

Cloudnet Target categorization Punta Arenas



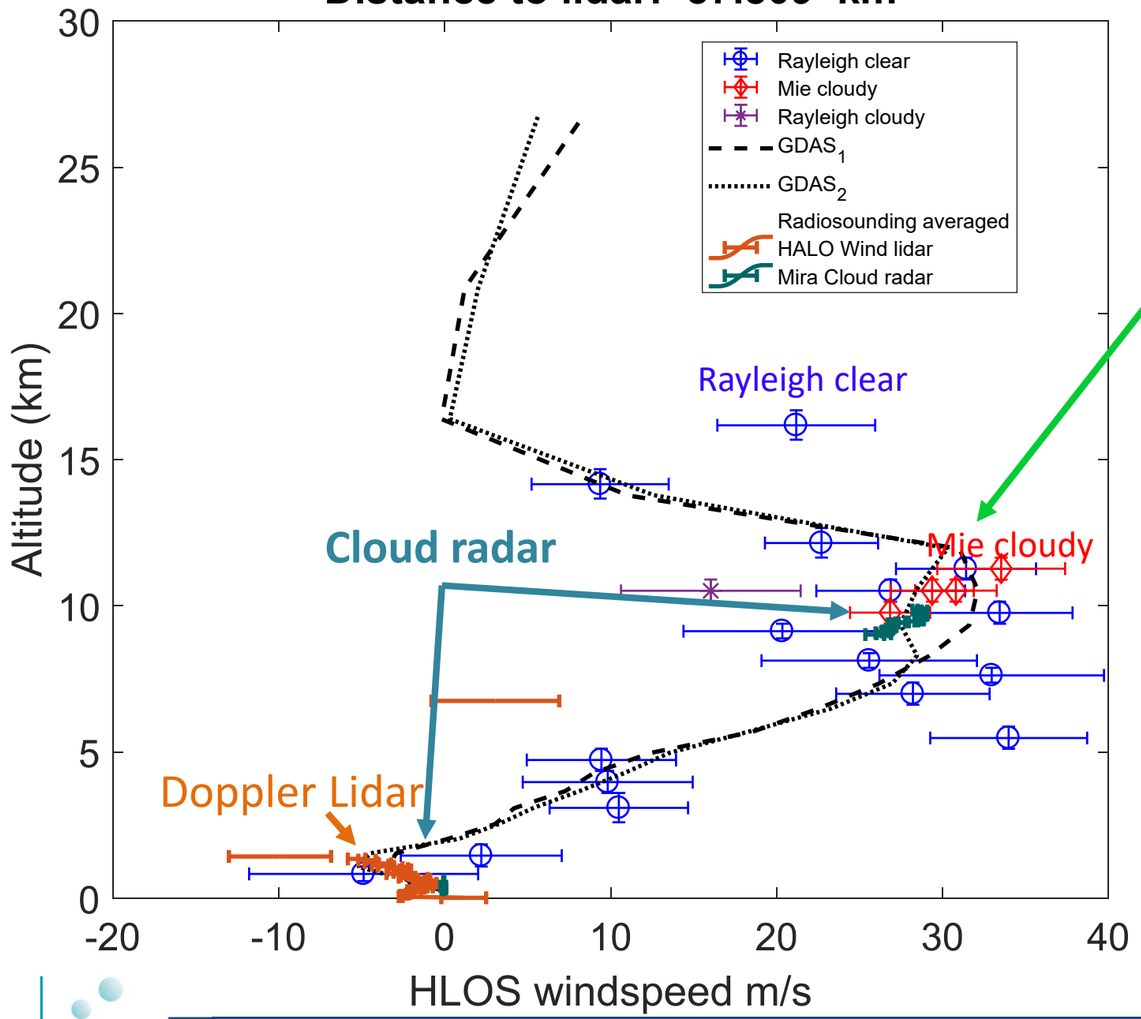
Wind observations within clouds



- Algorithm development finished
- Winds can be obtained in case of homogenous clouds
- Perfect to validate Mie winds

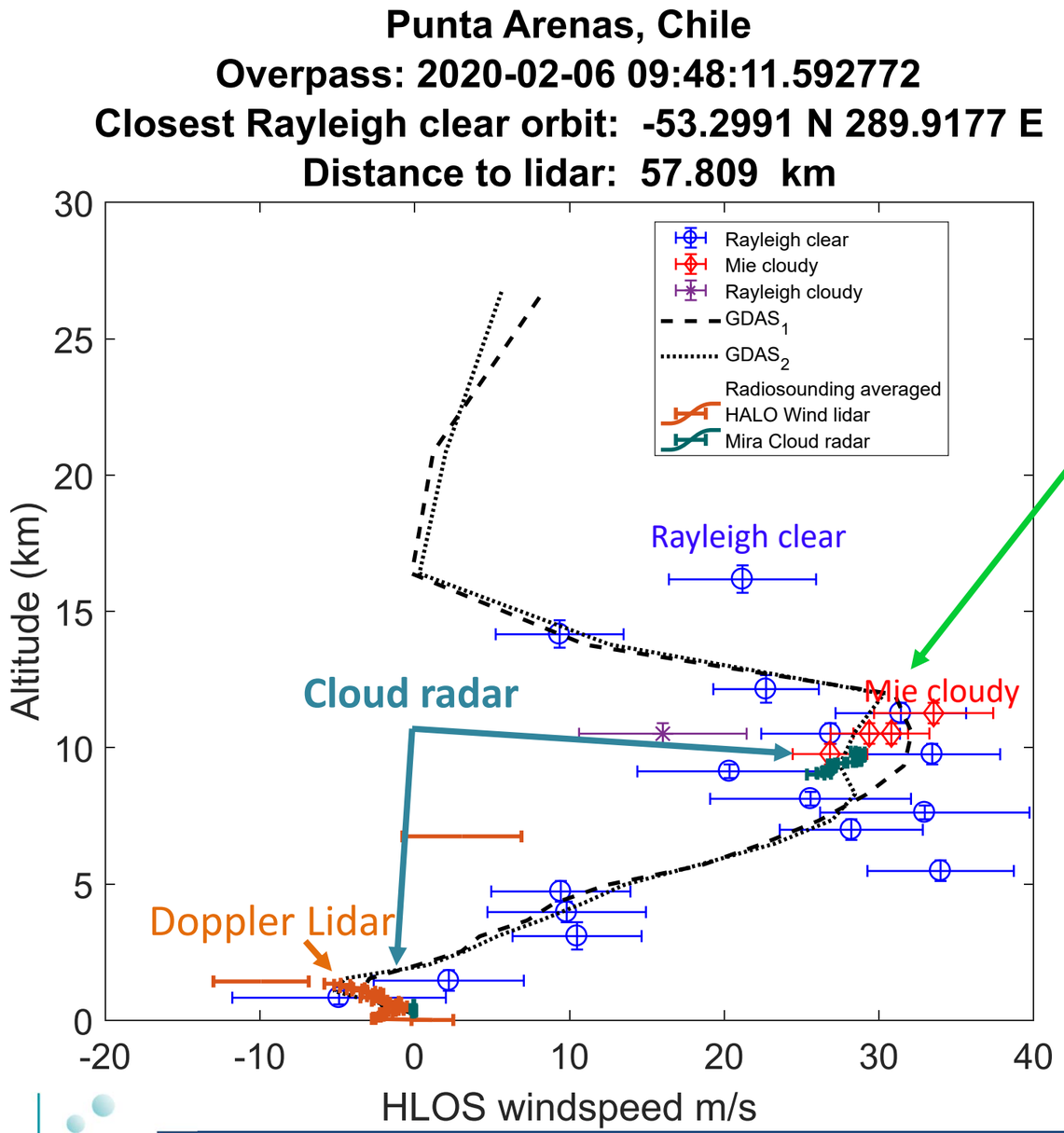
Wind Cal/Val by means of Doppler cloud radar

Punta Arenas, Chile
Overpass: 2020-02-06 09:48:11.592772
Closest Rayleigh clear orbit: -53.2991 N 289.9177 E
Distance to lidar: 57.809 km



Good agreement between
- Mie cloudy,
- Rayleigh clear, and
- ground-based cloud radar observations!

Wind Cal/Val by means of Doppler cloud radar



Good agreement between
- Mie cloudy,
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- Doppler Cloud Radar Algorithm development finished
  →Winds can be retrieved within clouds
- "Radar" winds available since November 2018
  →Statistics

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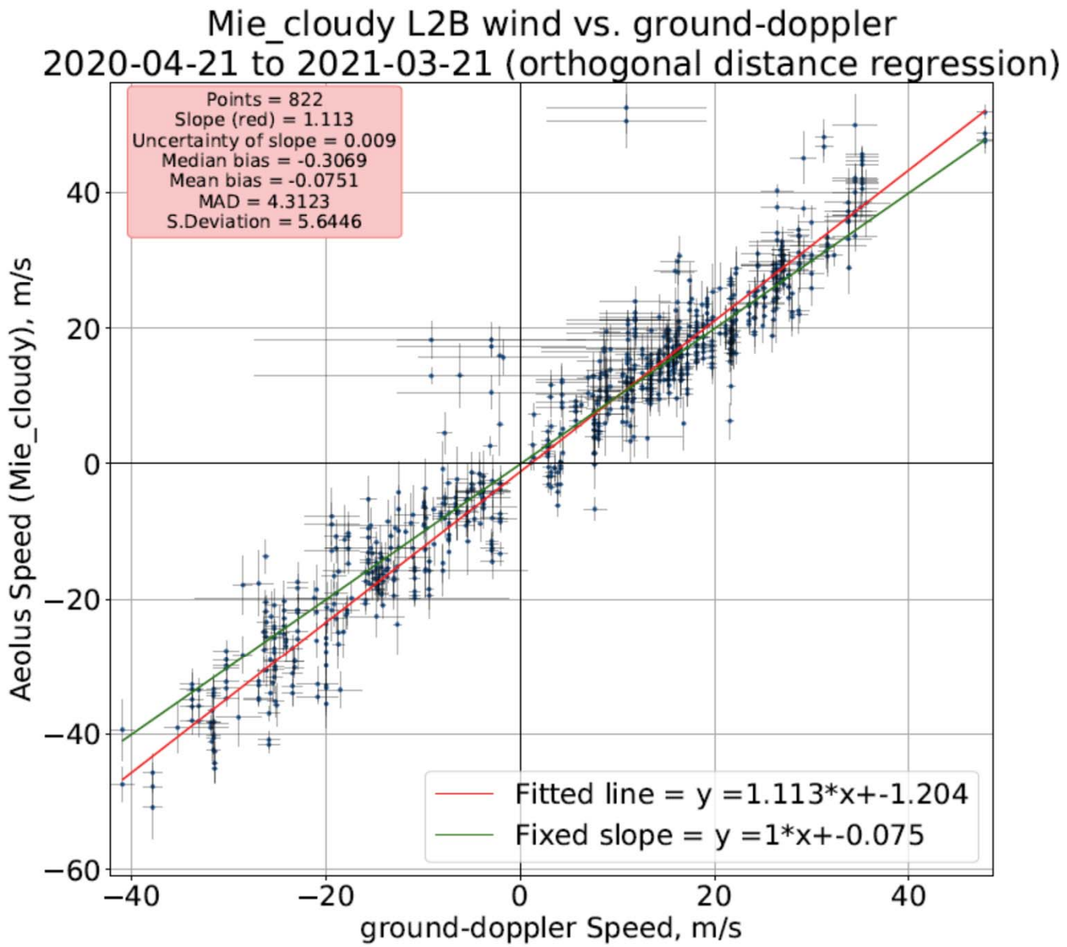
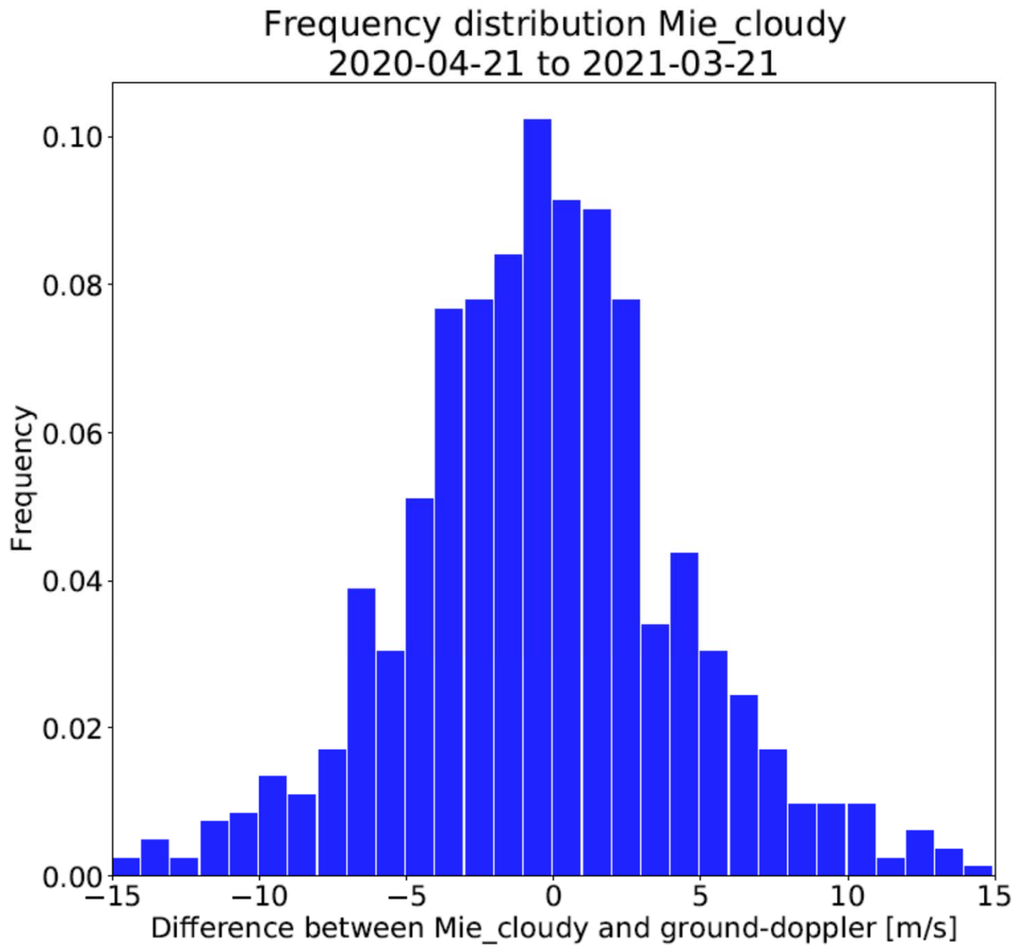
TROPOS

Long term analysis – Mie vs. Cloud radar

Mie winds (i.e. winds at cloud top) vs. “radar winds”





April 2020 – March 2021

Long term analysis – Rayleigh vs. cloud radar

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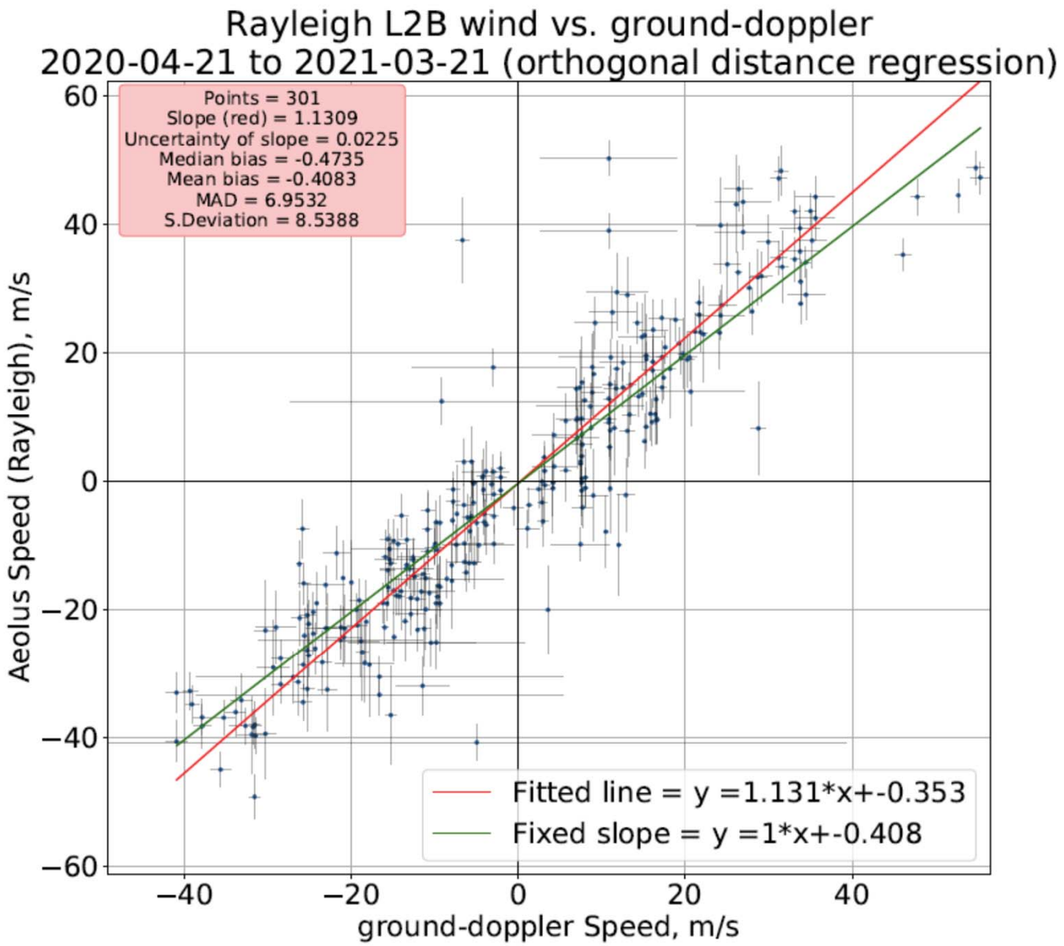

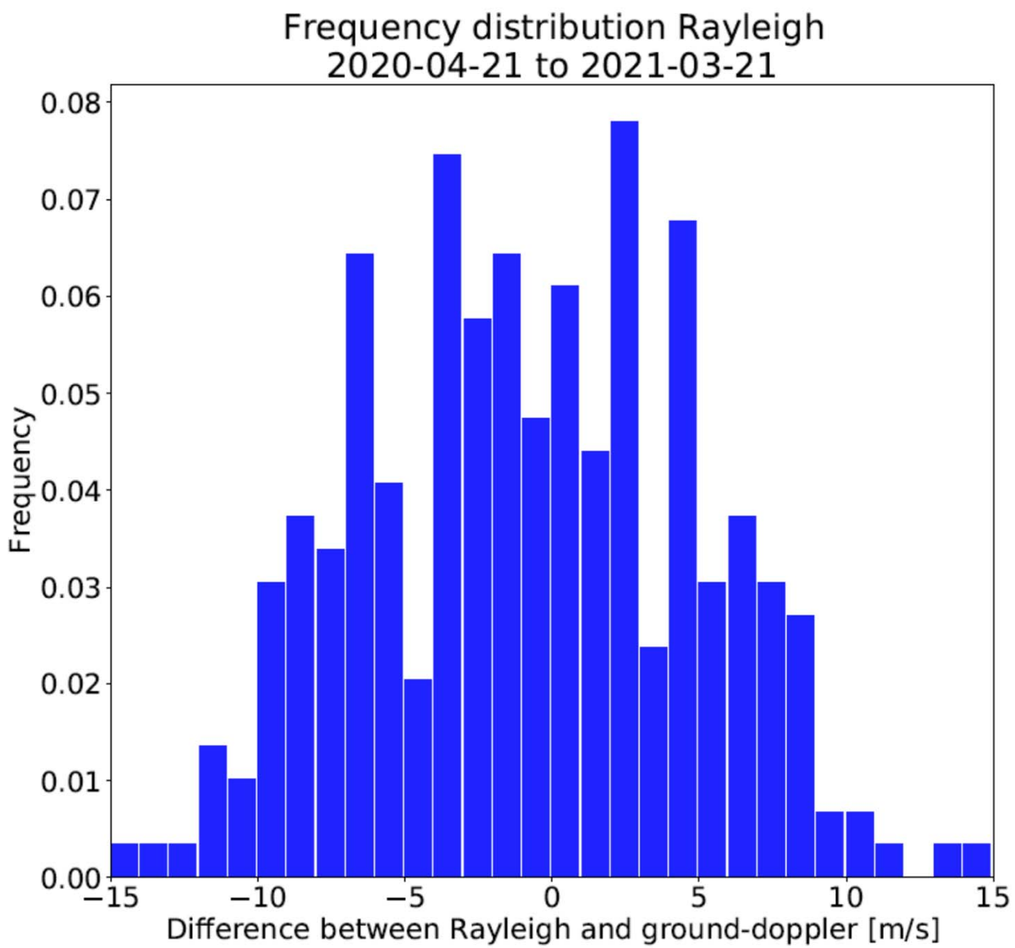

April 2020 – March 2021

Summary Punta Arenas

Aeolus vs. Radiosoundings

	Rayleigh	Mie
Number of points	133	42
Slope (m/s)	1.09+-0.02	1.6+-0.19
Median bias (m/s)	-1.12	-2.55
Mean bias (m/s)	-1.22	0.64
Scaled MAD (m/s)	4.95	3.77
Standard deviation (m/s)	5.8	20.2

Aeolus vs. Cloud Radar/Doppler lidar

	Rayleigh	Mie
Number of points	301	822
Slope (m/s)	1.13+-0.02	1.11+-0.01
Median bias (m/s)	-0.47	-0.31
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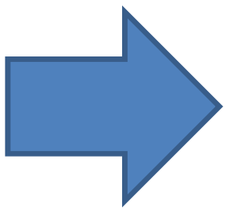
April 2020 – March 2021

- In principle available for whole 3 year period.
- Nov 2018 – April 2020
- Some outliers still need to be investigated
- Any recommendation/request for certain periods?



	Rayleigh	Mie
Number of points	832	1266
Slope (m/s)	2.55+-0.02	1.06+-0.02
Median bias (m/s)	-1.13	1.03
Mean bias (m/s)	-9.31	1.35
Scaled MAD (m/s)	16.13	5.56
Standard deviation (m/s)	52.2	13.4

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Conclusion + Outlook

Gefördert durch:
Bundesministerium für Wirtschaft und Energie
aufgrund eines Beschlusses des Deutschen Bundestages

- 3 years campaign in Punta Arenas
- Excellent place for validation of Aeolus wind products
- Radiosondes provide valuable information
- Doppler cloud radar very promising for the validation for the Mie winds
- Wind lidar does often only capture the PBL and thus difficult for comparison

→intense validation efforts

- Outlook
  - Punta Arenas campaign is over now ☹
  - Full 3 year data set will be analyzed soon

    → any desired periods for validation?
  - Radiosonde launches at Leipzig continue

Thanks to the Punta Arenas Team!!!!

Impressions from the last launch last Wednesday!

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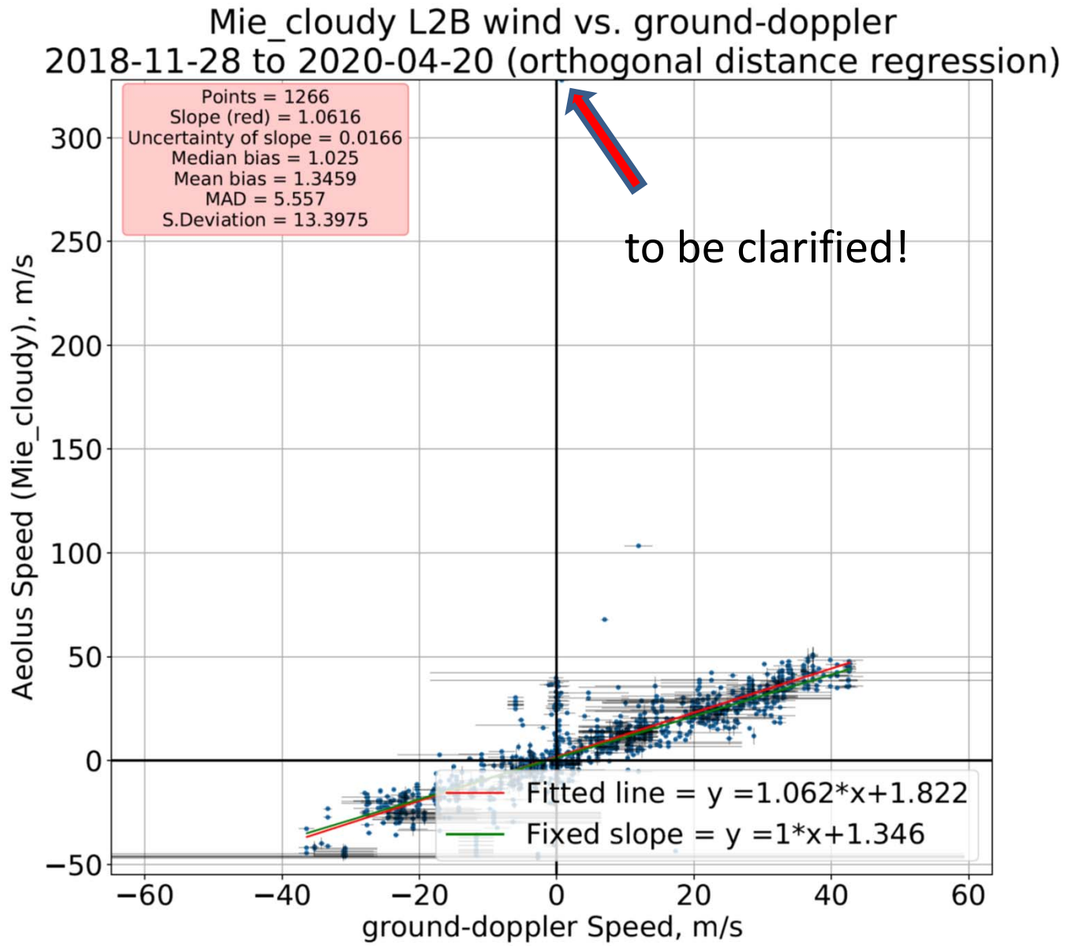
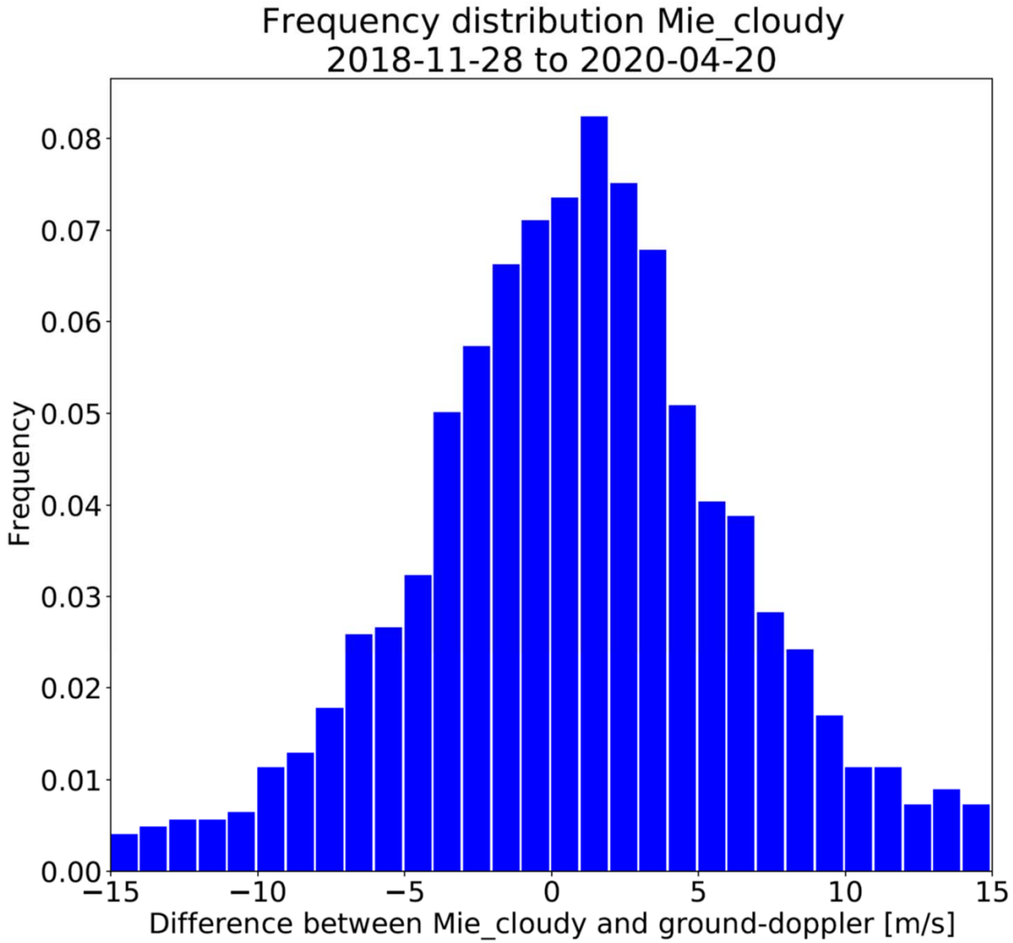
Backup slides

Long term analysis – Mie vs. Cloud radar

Mie winds (i.e. winds at cloud top) vs. “radar winds”





Nov 2018 – 20 April 2020

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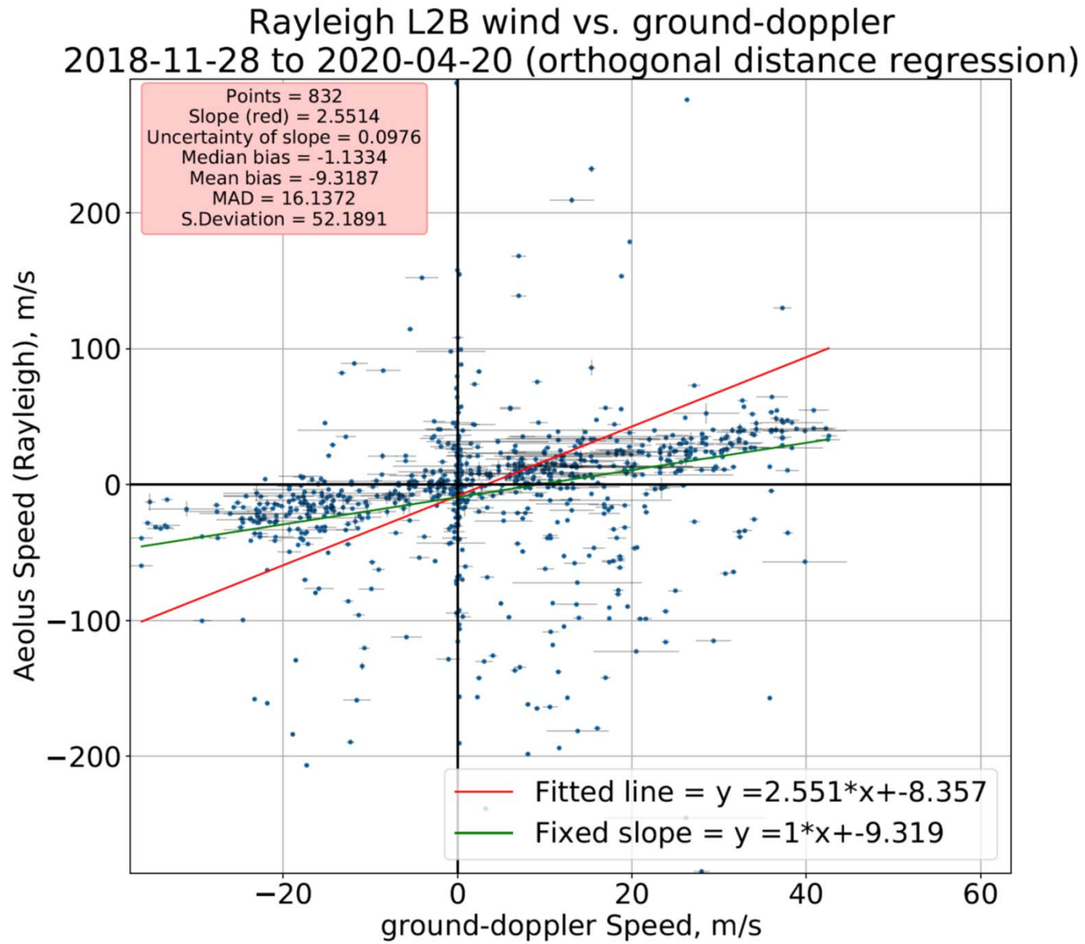

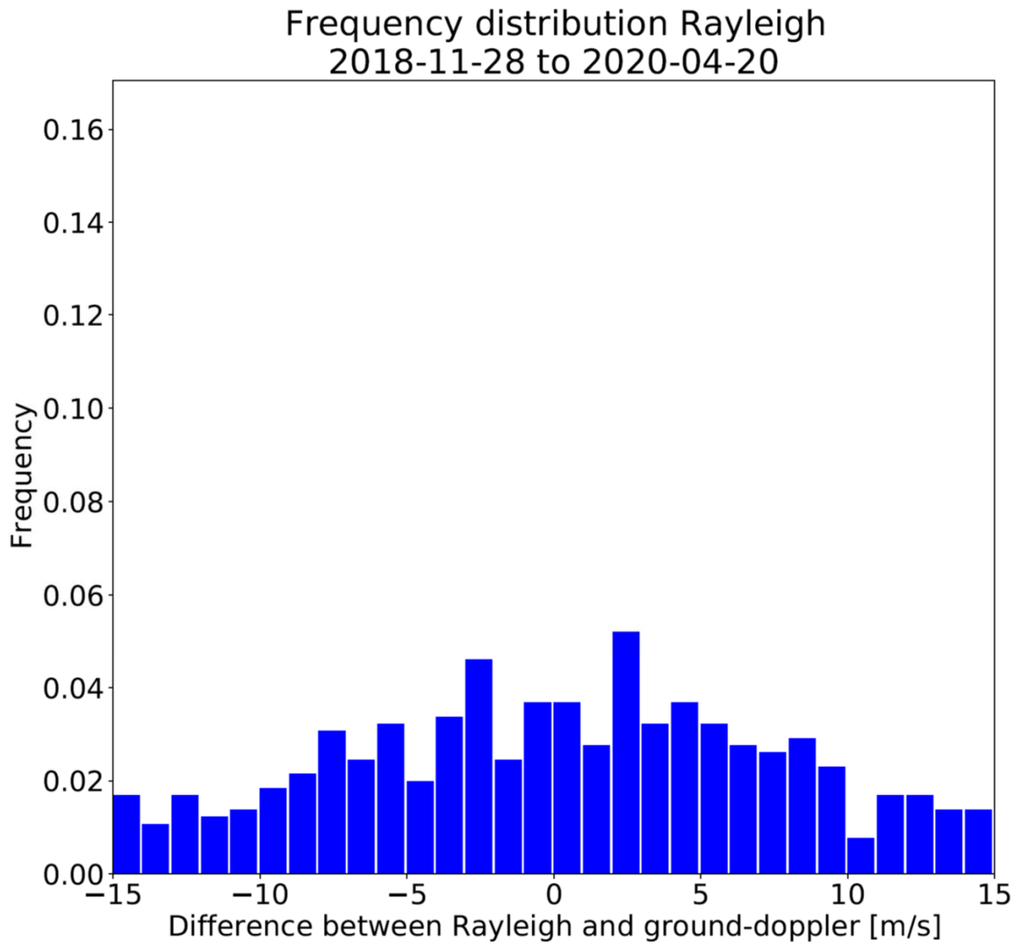

Nov 2018 – 20 April 2020