



Royal Netherlands
Meteorological Institute
*Ministry of Infrastructure
and Water Management*

CW wind lidar measurement campaign at Cabauw

Steven Knoop

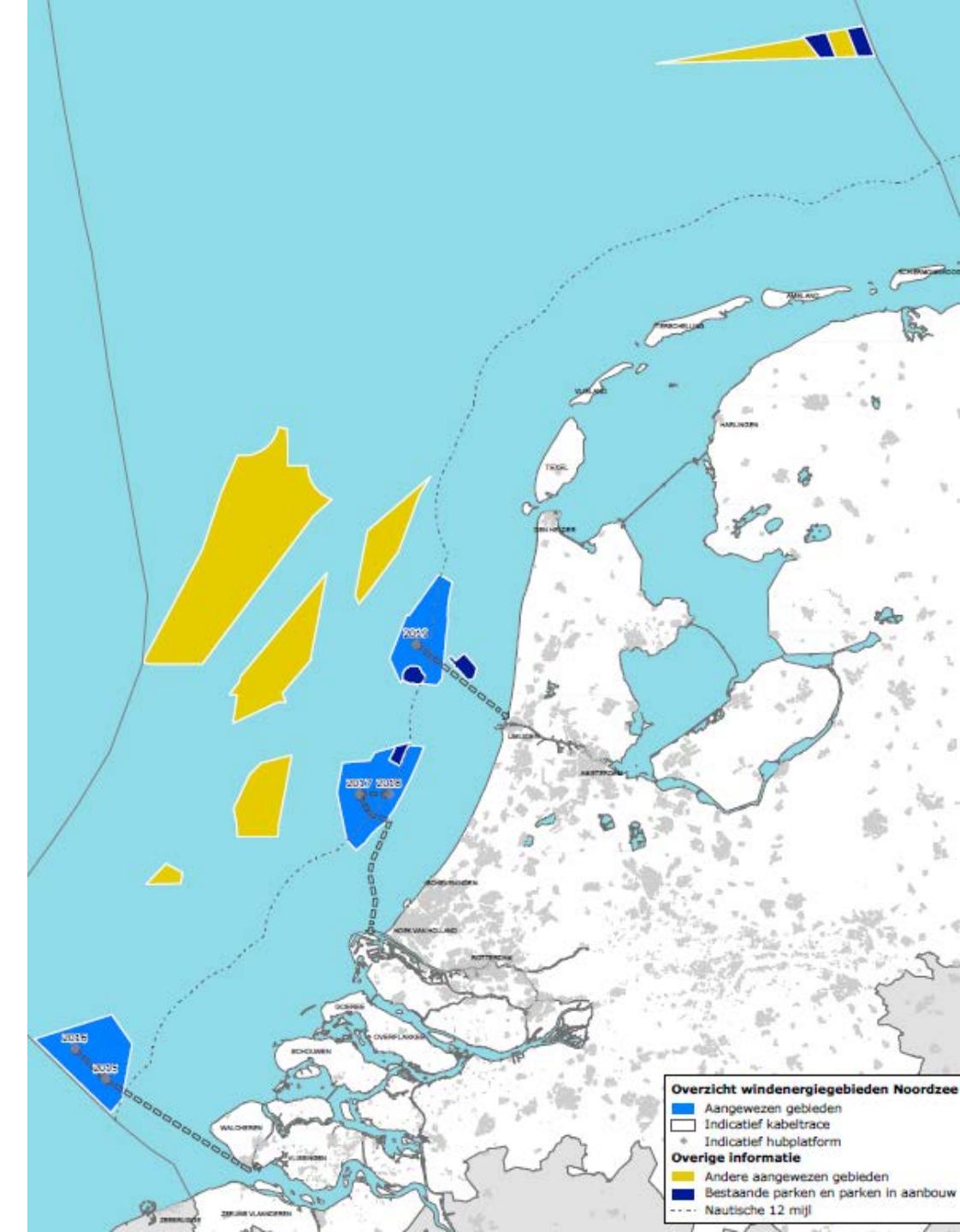
R&D Observations & Data Technology, KNMI

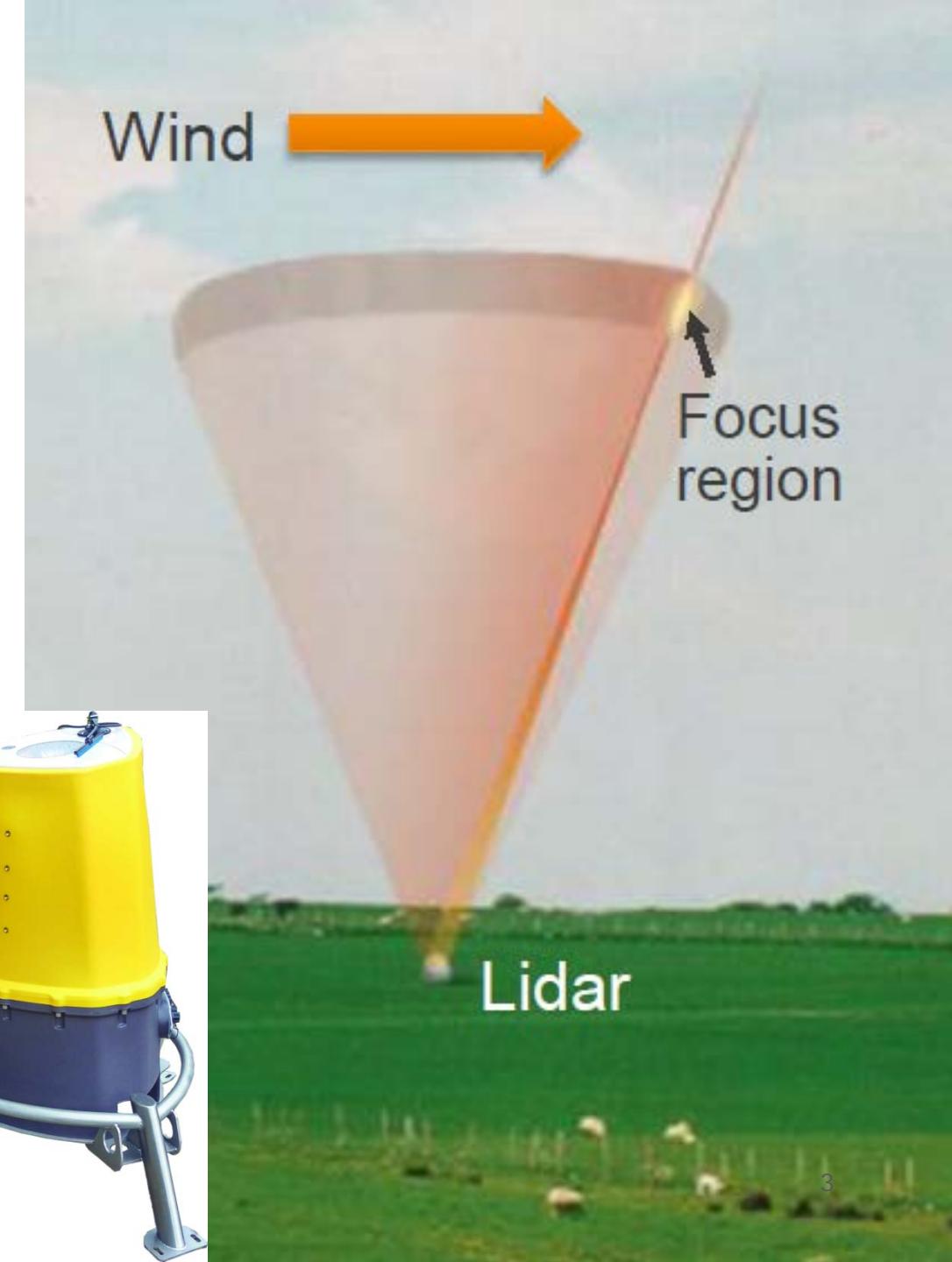
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Background

- Dutch North Sea wind farms
- Regulation compensation scheme
- Wind lidars on offshore substations
- Ministry of Infrastructure and Water Management (RWS)
- KNMI
- Measurement campaign



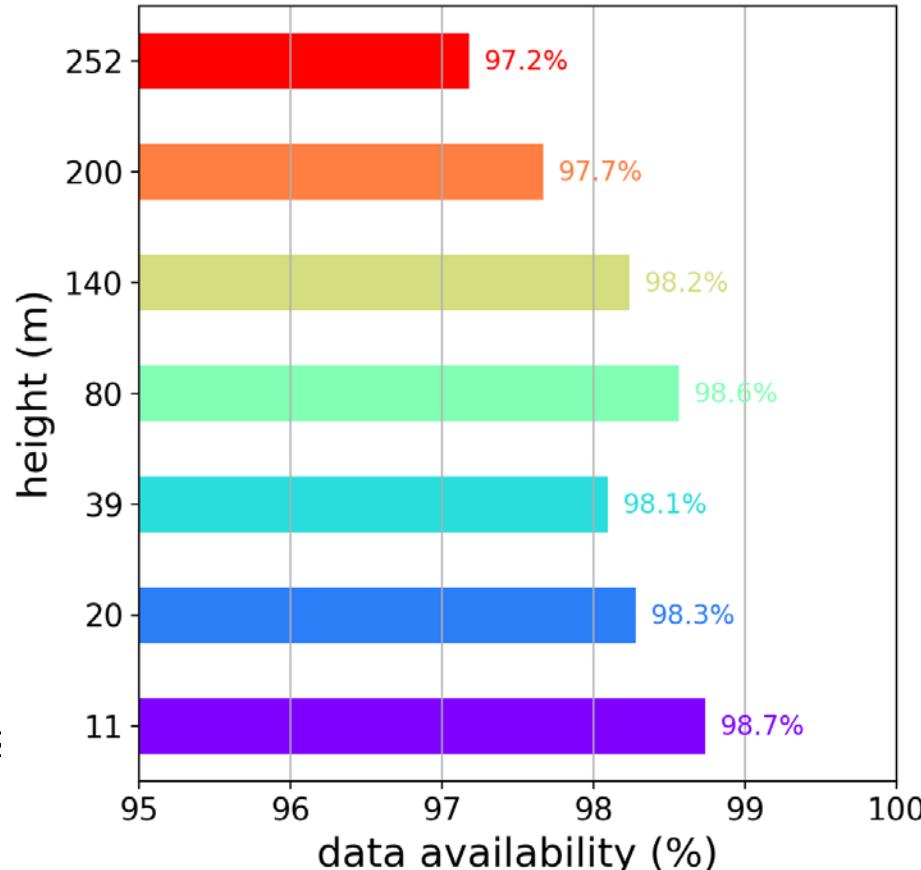


Wind lidar

- Light detection and ranging
- Doppler shift = $2 V_r / \lambda$
- $\lambda = 1.5 \mu\text{m}$
- aerosols
- line-of-sight component only: VAD or DBS for vertical profile of horizontal wind speed/direction
- ranging: pulsed or focused
- ZephIR 300M (ZX Lidars):
 - CW focusing homodyne Doppler lidar
 - VAD scan
 - range: 10 – 200 (300) m
 - probe length height dependent
 - Horizontal wind speed, wind direction, vertical wind speed



2018-02-14 - 2019-06-16



Measurement campaign

Met mast Cabauw

- 213 m
- cup anemometers / wind vanes
 - 10, 20, 40, 80, 140, 200m
- Other in situ and remote sensing instruments
 - cloud base, visibility, precipitation, ...

Data quality and availability

- 10-minute (quality controlled) averaged data
- Fog, clouds, precipitation

Period

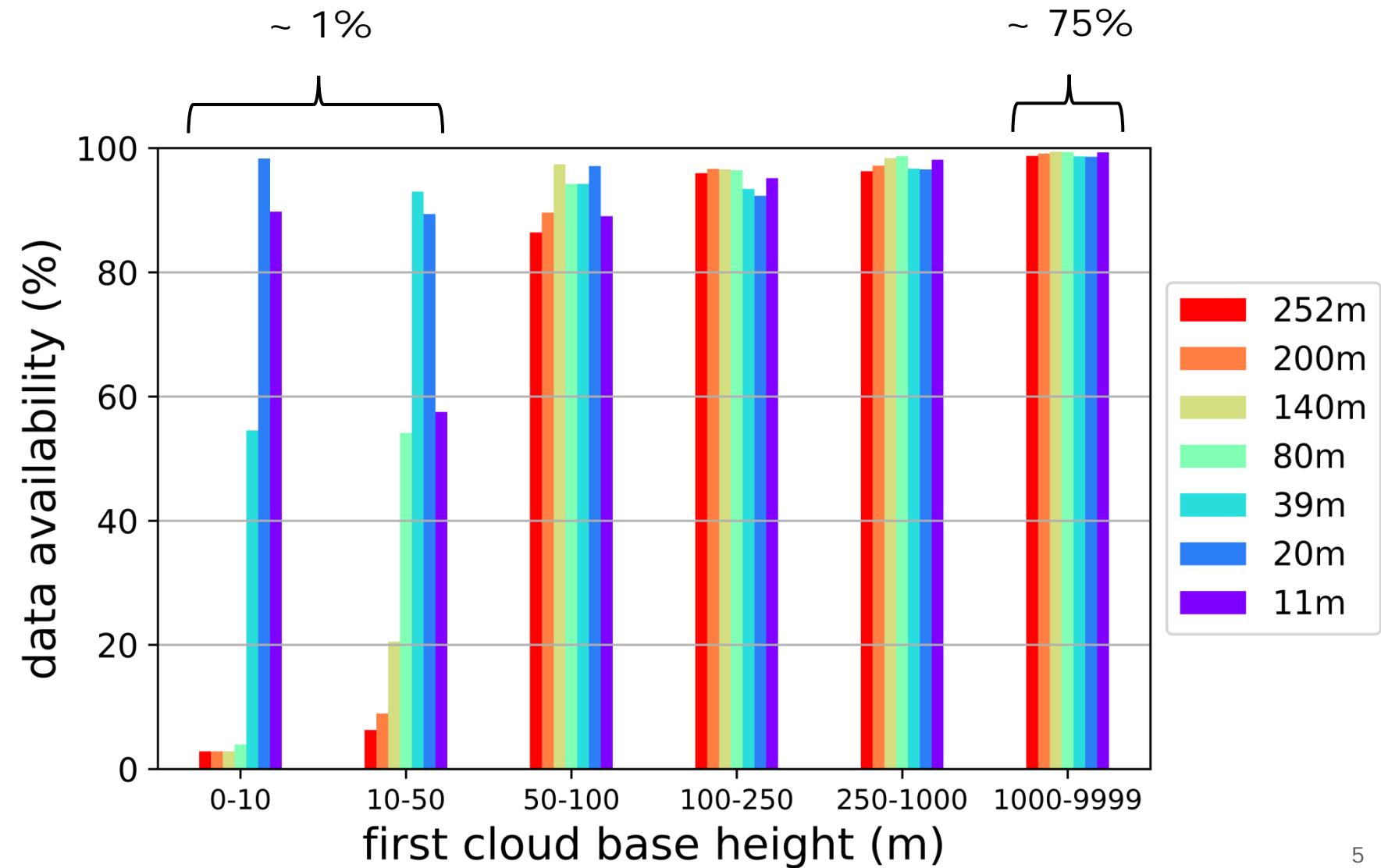
- 2-year (Feb. 2018 – Feb. 2020)



Clouds

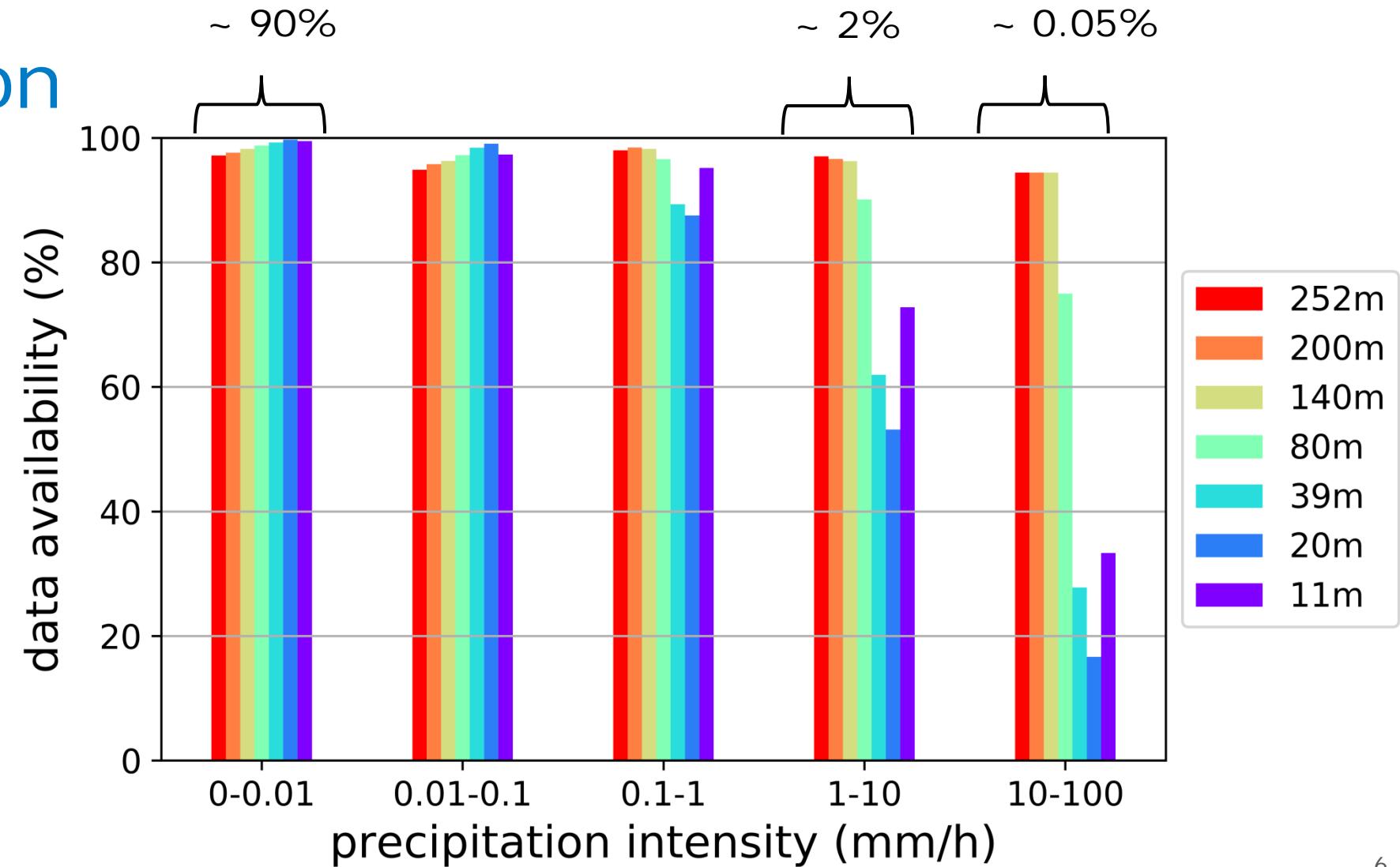


Lufft CHM15K ceilometer



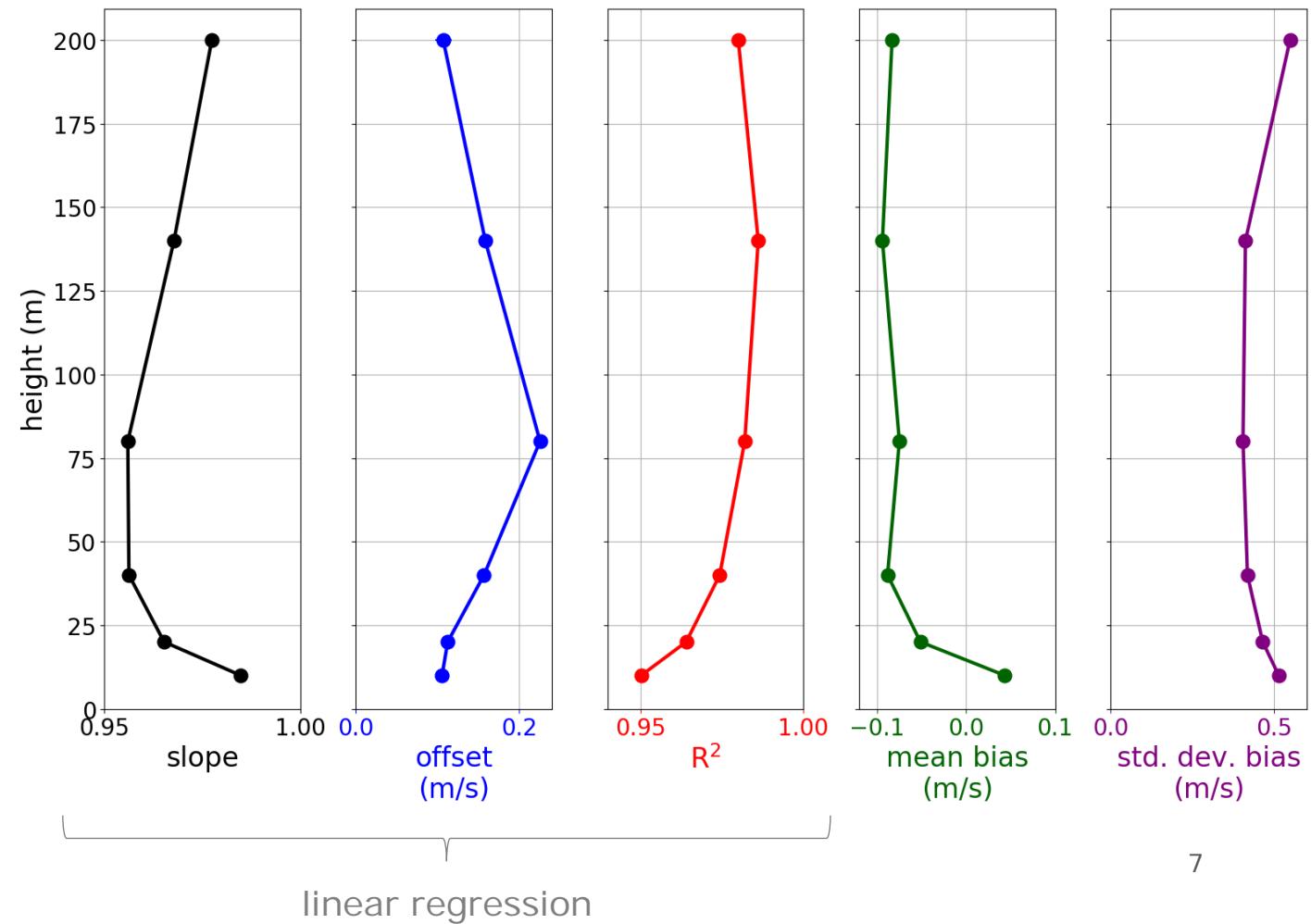
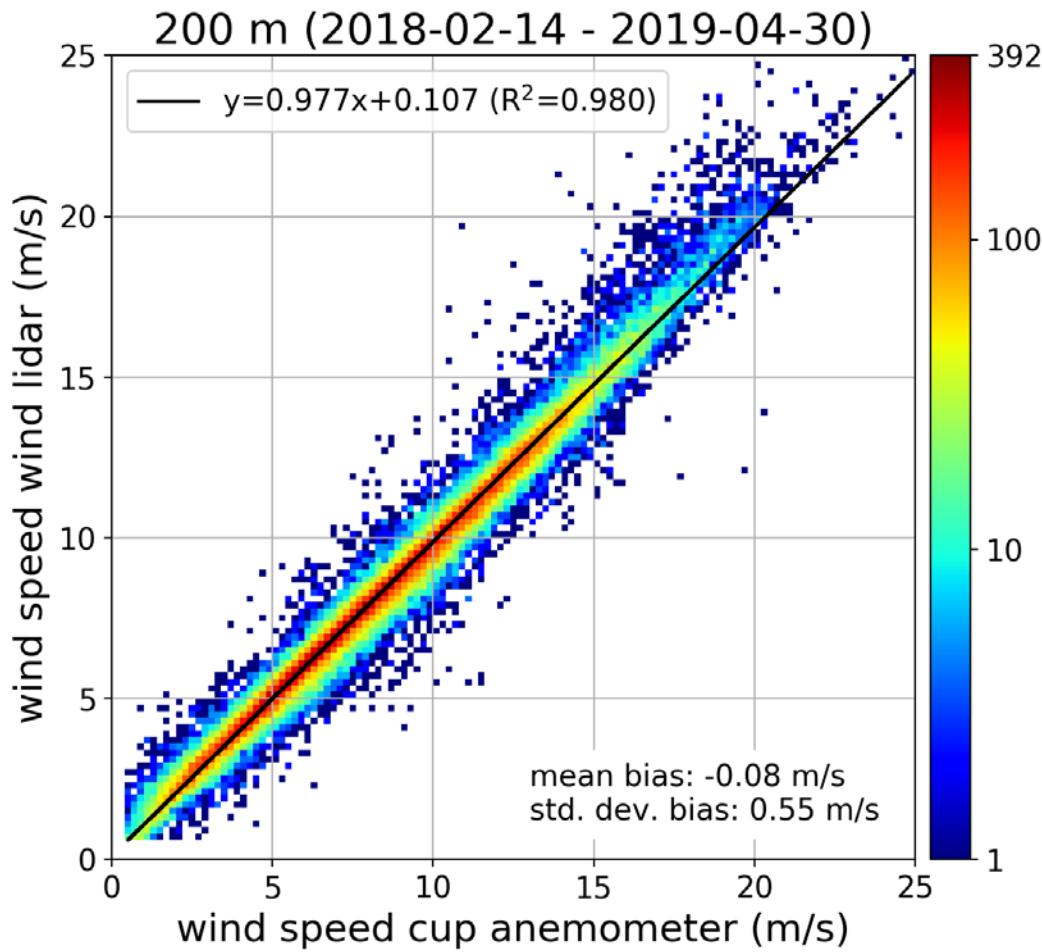


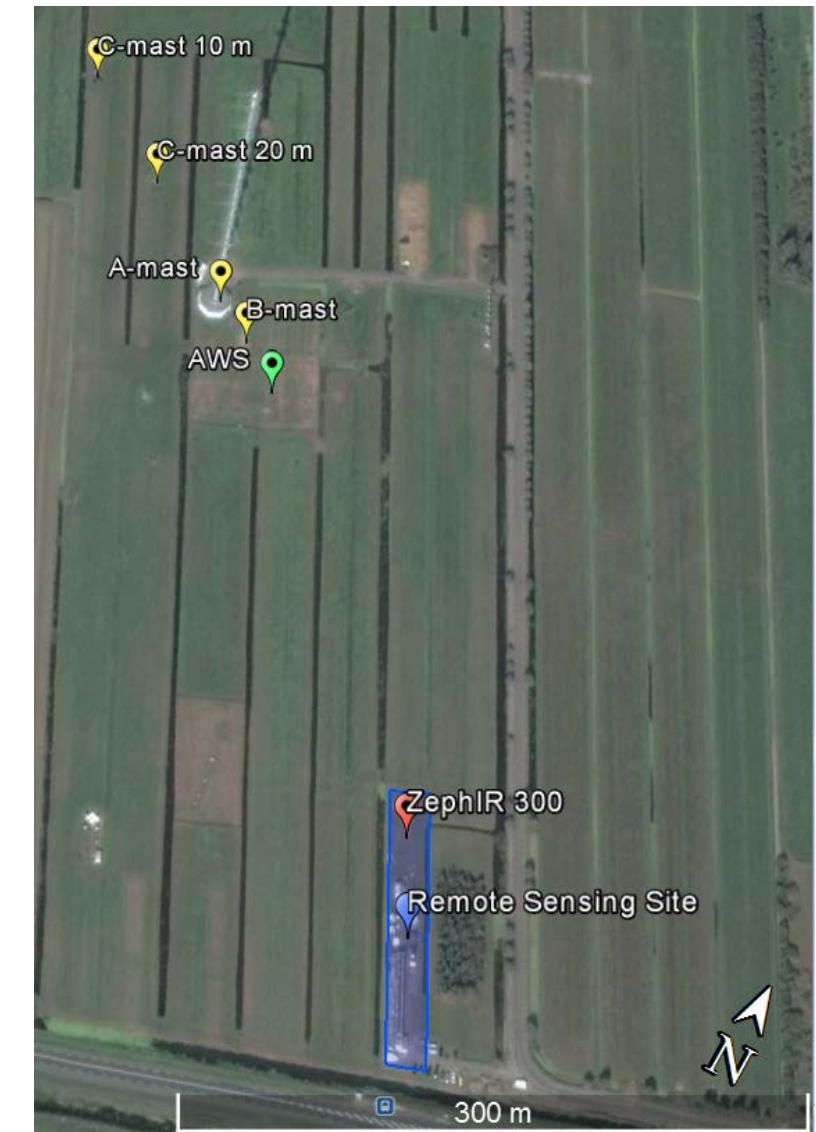
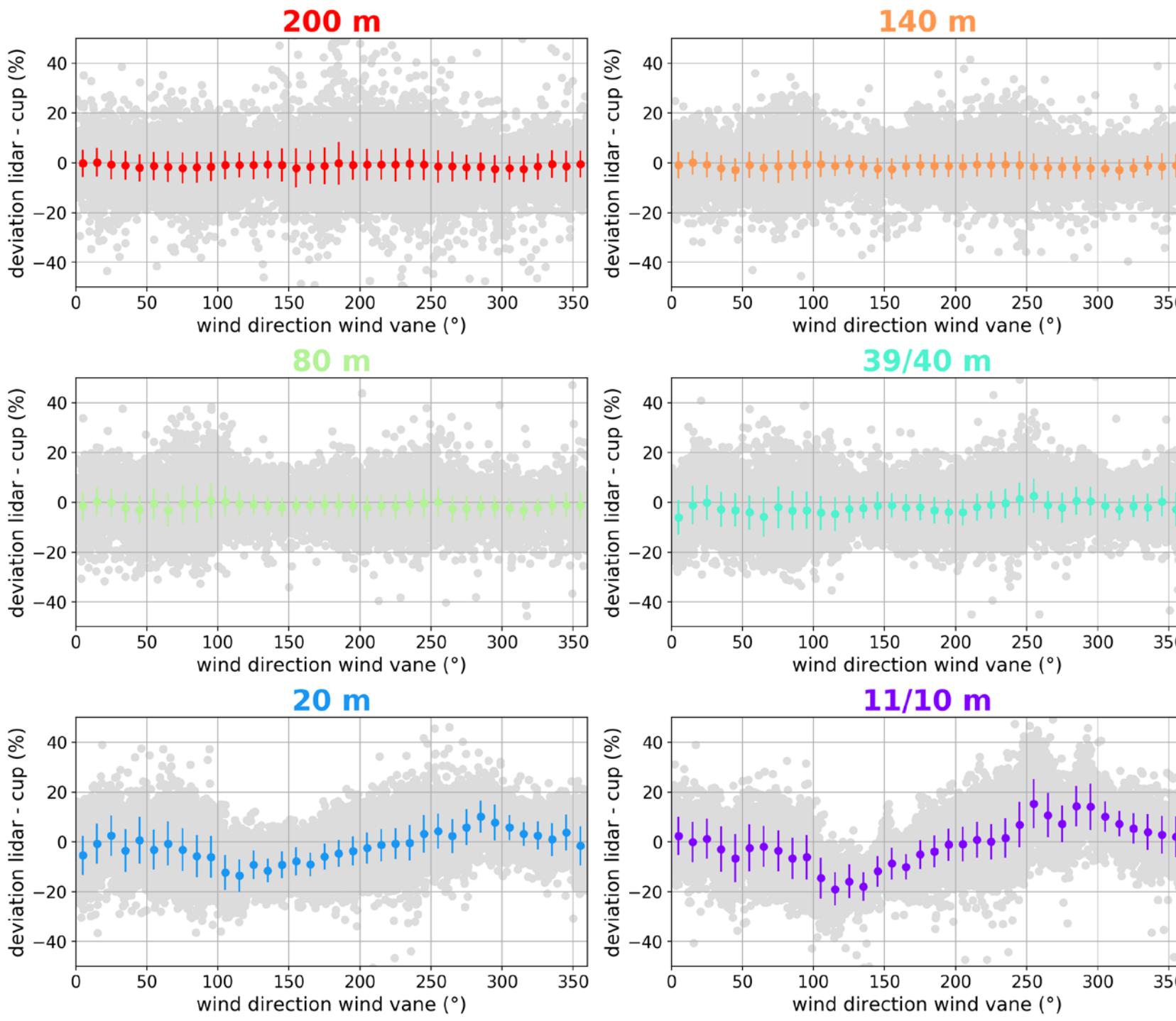
Precipitation





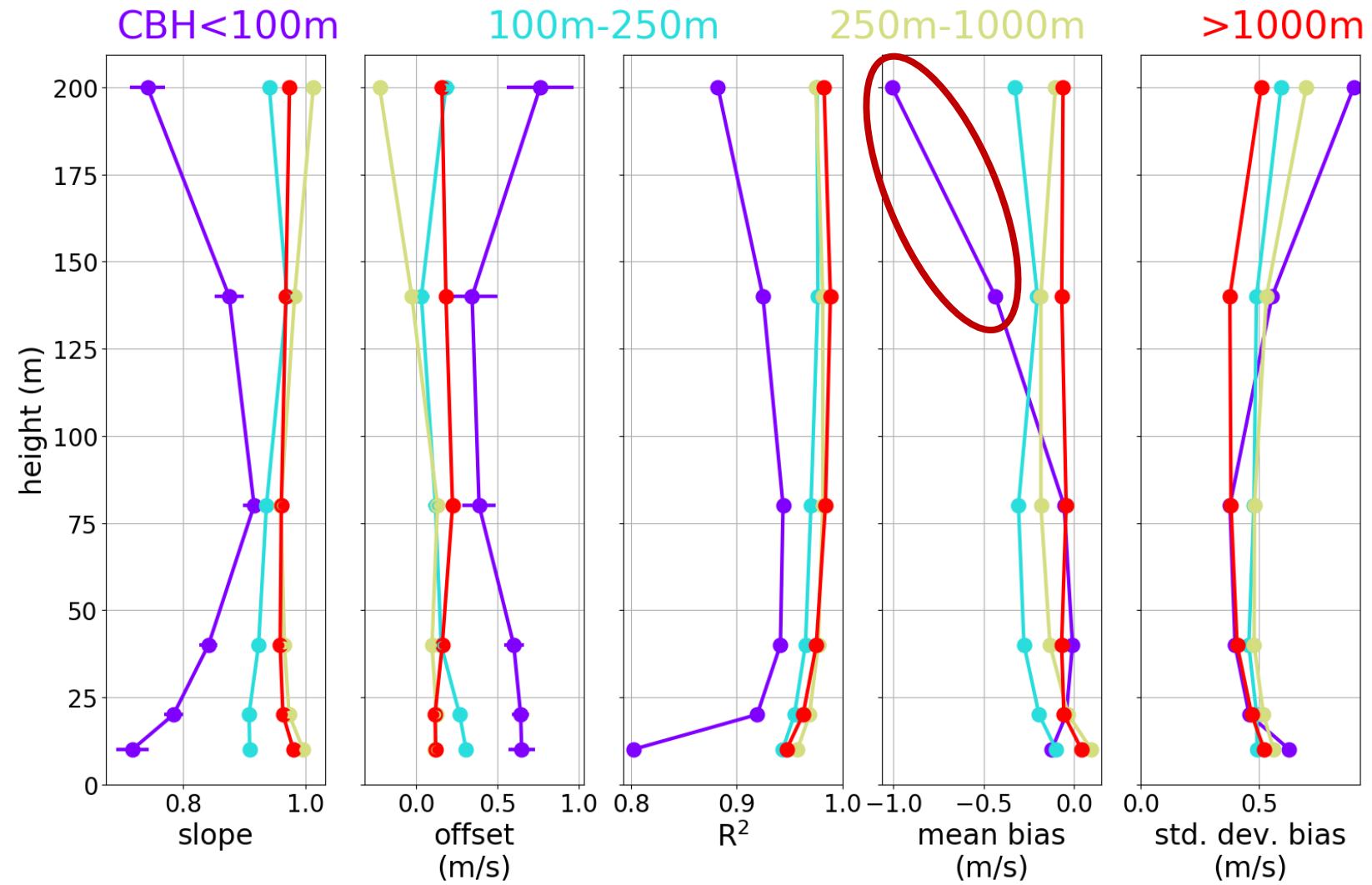
Wind speed correlation





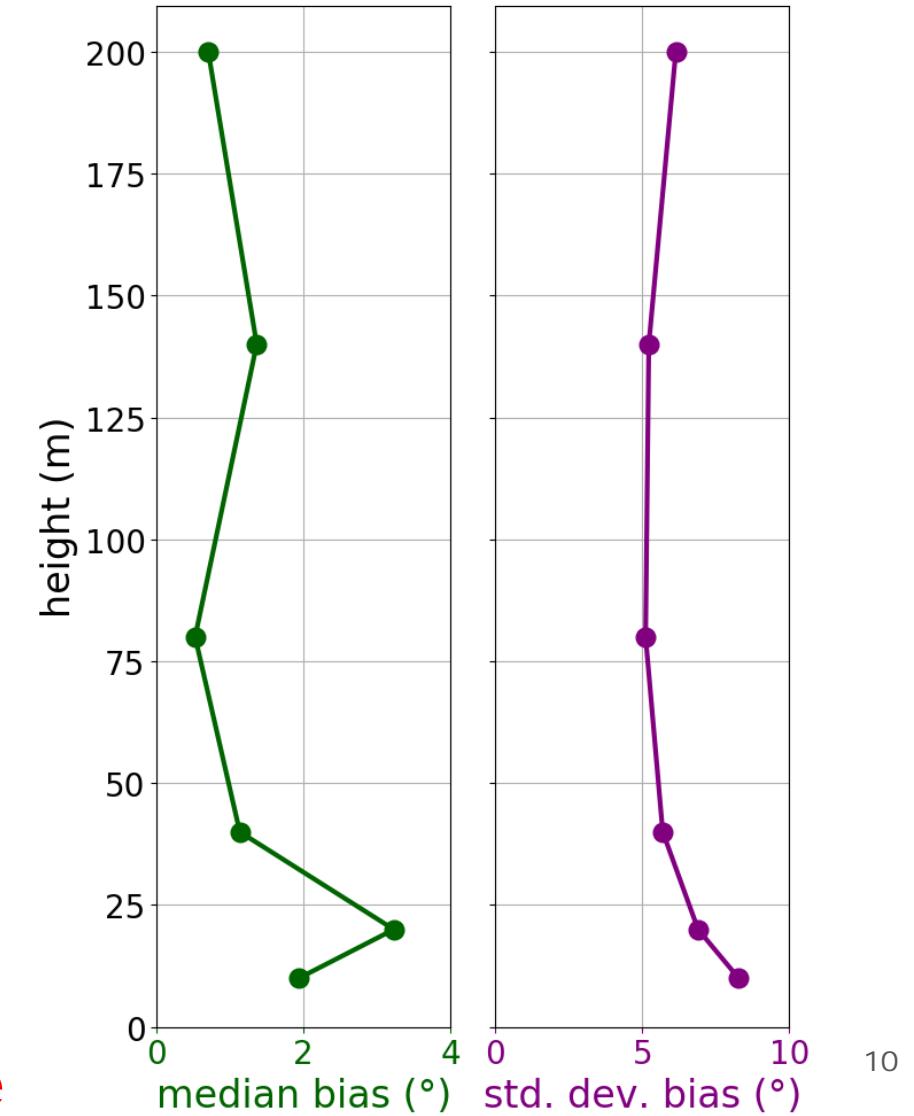
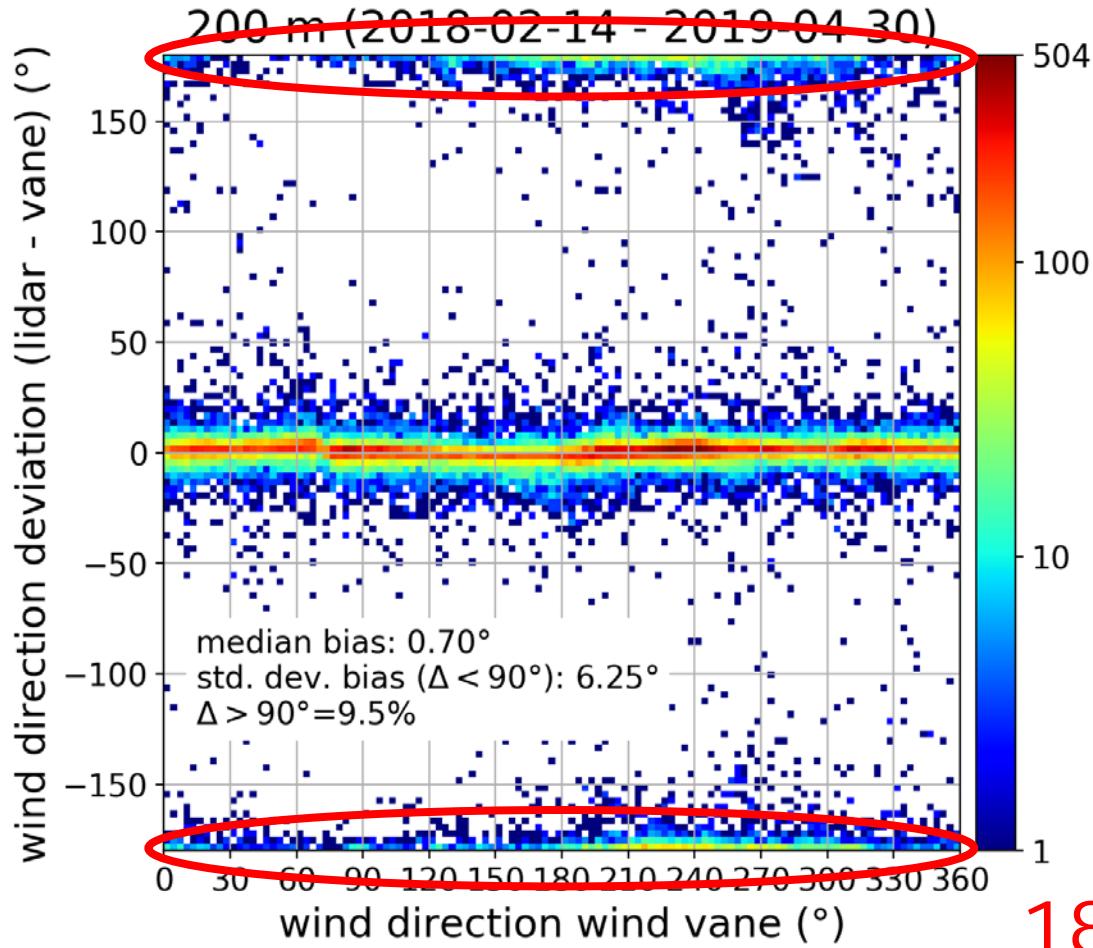


Wind speed correlation cloud base height



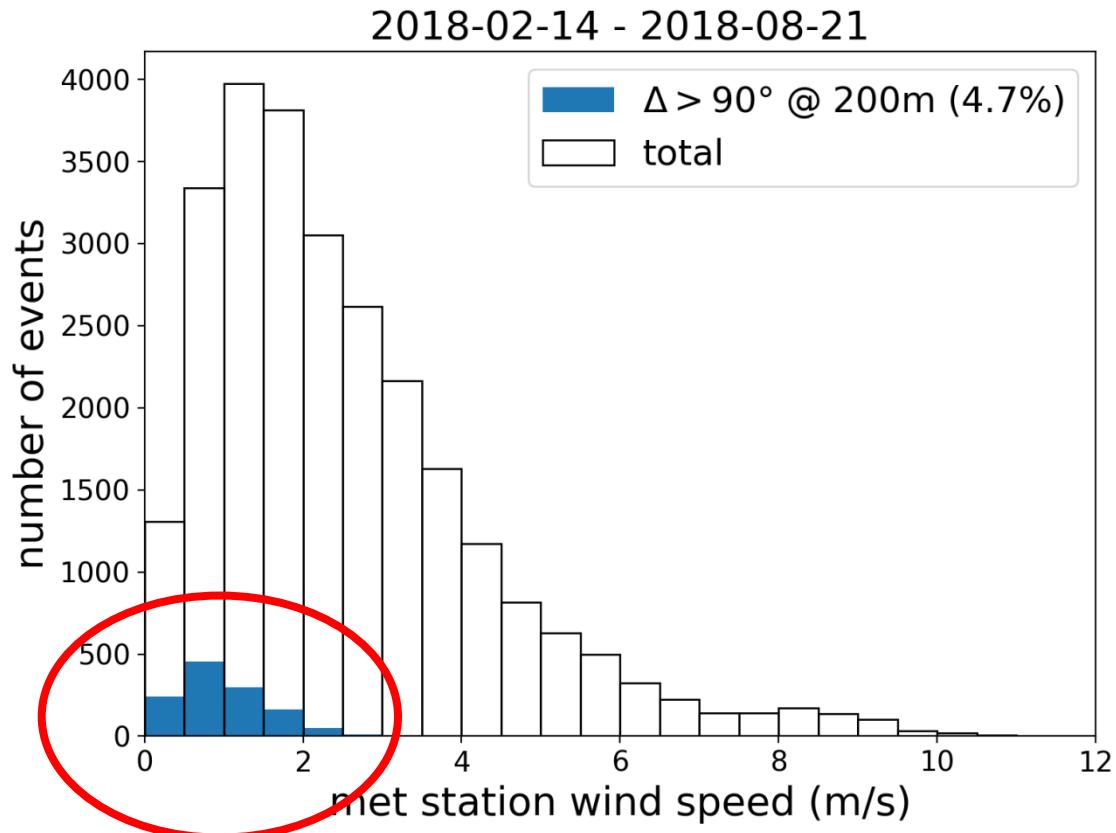


Wind direction correlation





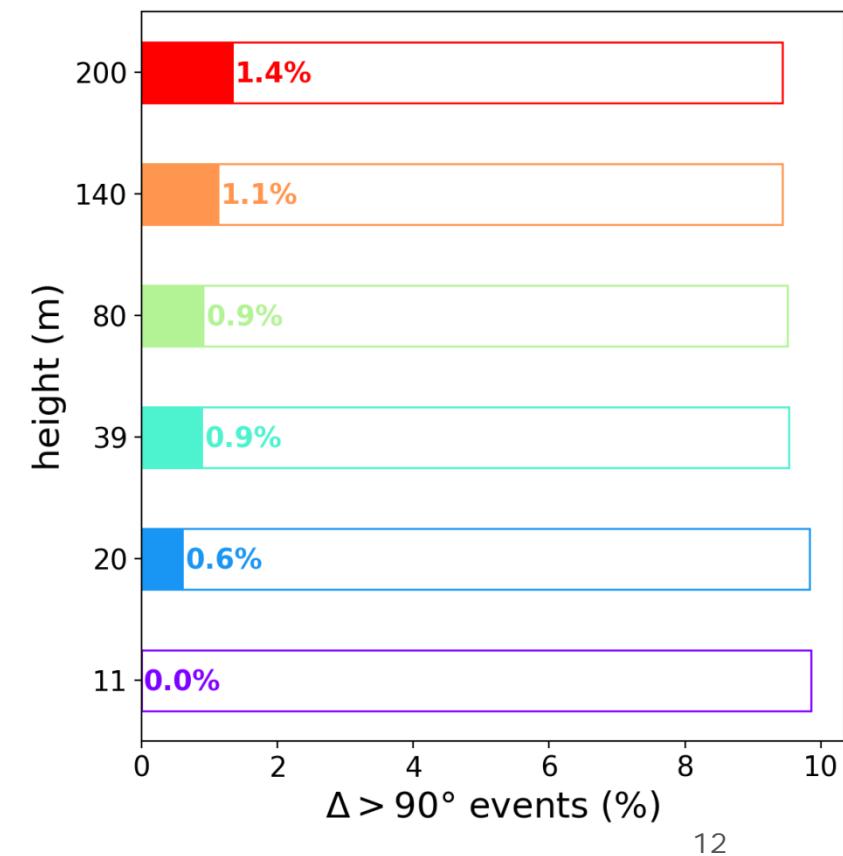
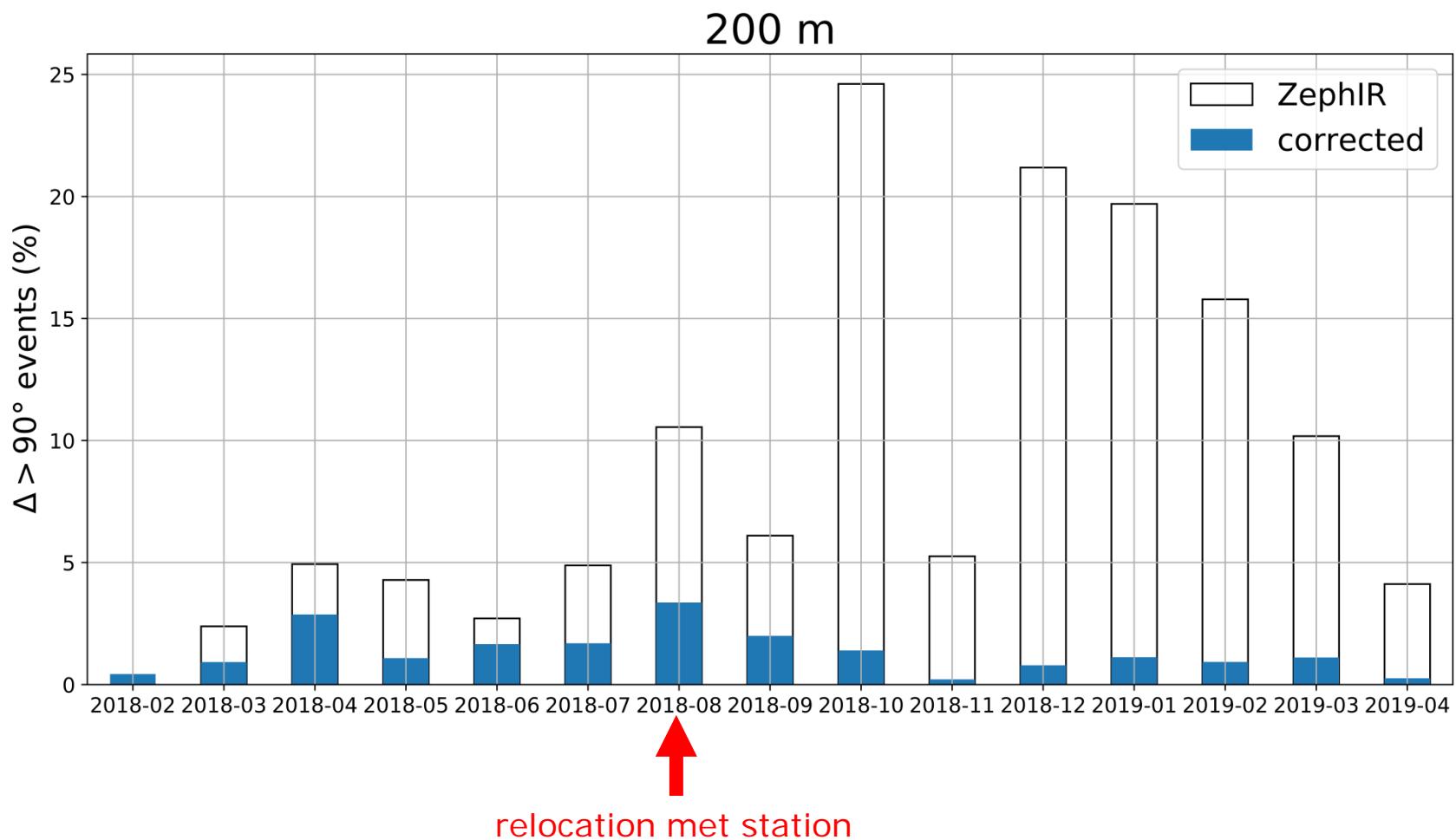
180° issue





Correction on basis of 10-m
mast wind direction

180° correction





Summary and Outlook

- 2-year measurement campaign ZephIR 300M at Cabauw
- Data availability and data quality
 - Clouds, precipitation
- 180° issue
- Since May 29, 2019, 4 additional heights (60, 100, 180, 300)
- Data available





Upcoming Doppler lidar activities

Examples:



@Cabauw:

- 2x long-range Doppler lidar (pulsed)
- Wind fields (all-sky scanning)
 - Vertical pointing

Ruisdael
observatory





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Acknowledgement:

- Rijkswaterstaat (MIVSP)
- KNMI
 - Willem Koetse
 - Fred Bosveld

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