



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

CW wind lidar measurement campaign at CESAR Observatory

Steven Knoop

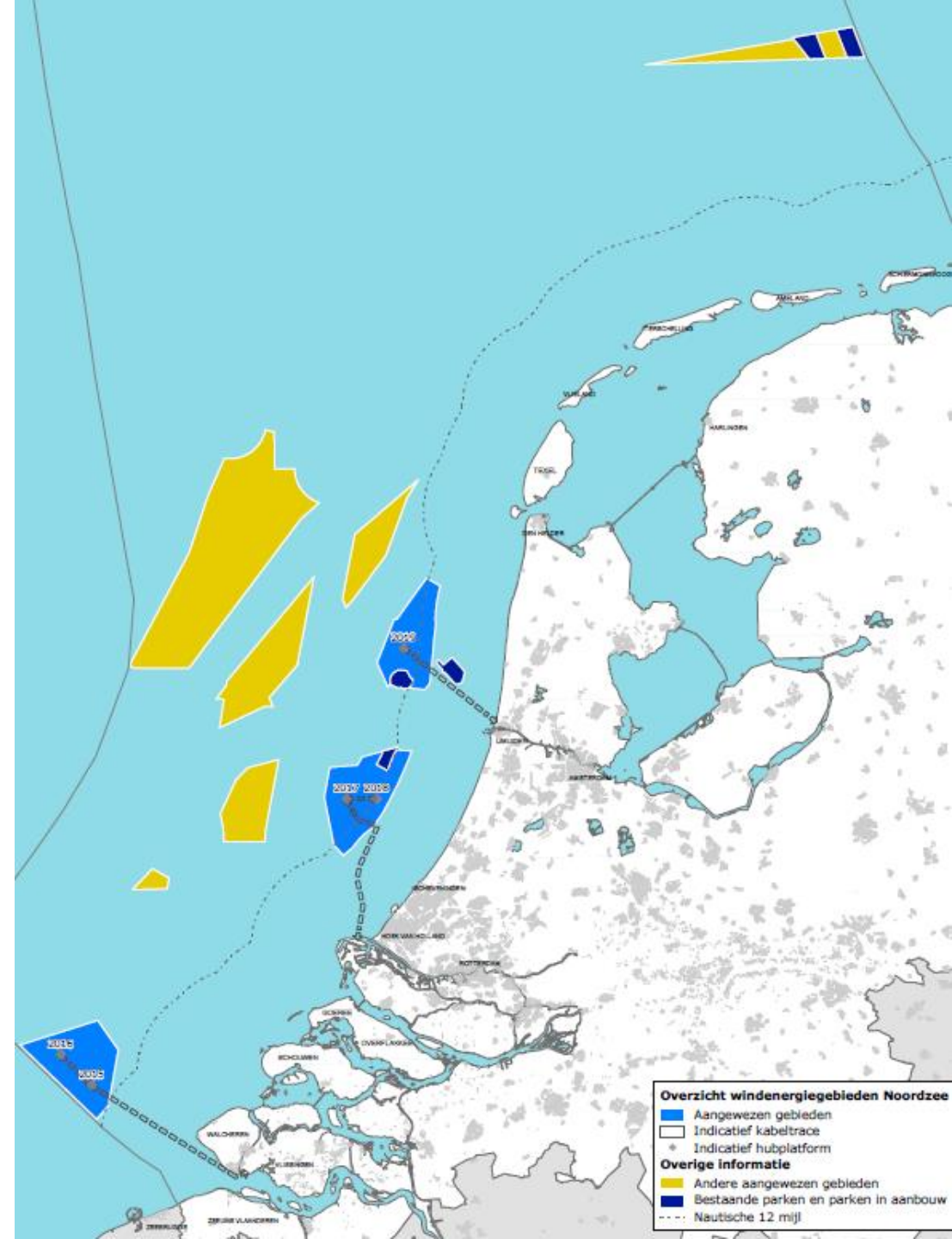
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Background

- 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





CESAR

Cabauw Experimental Site for Atmospheric Research

<http://www.cesar-observatory.nl/>



Ruisdael
observatory



<http://ruisdael-observatory.nl/>



Measurement campaign

Met mast Cabauw

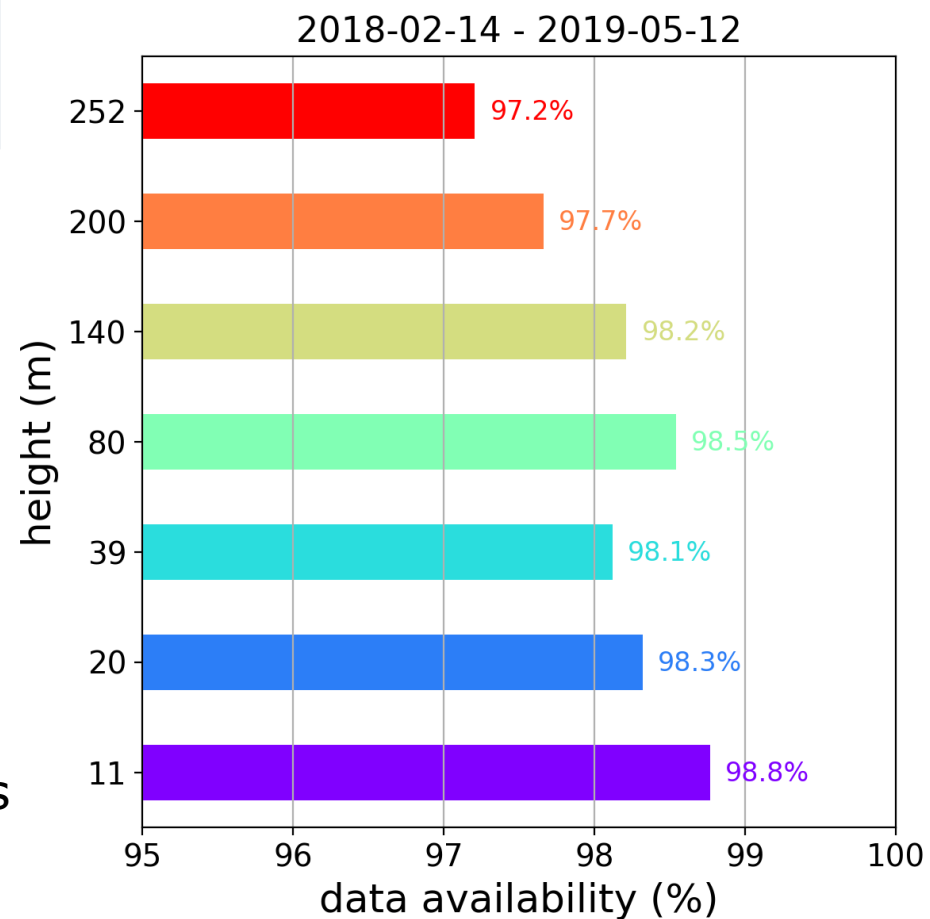
- 213 m
- cup anemometers / wind vanes
 - 10, 20, 40, 80, 140, 200m
- Other in situ and remote sensing instruments
 - cloud base, visibility, precipitation, ...

Data quality and availability

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

Period

- 2-year (Feb. 2018 – Feb. 2020)

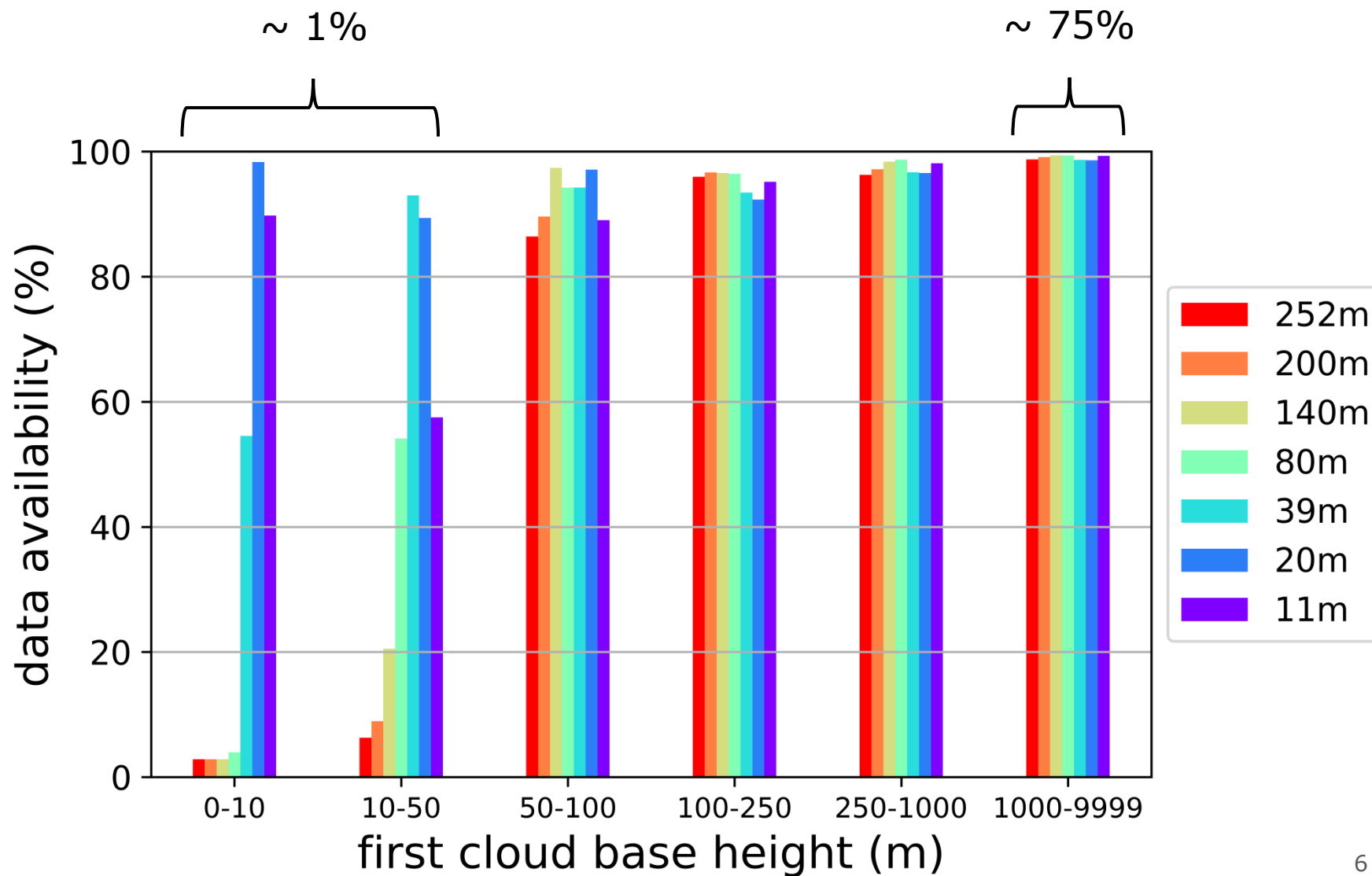




Clouds

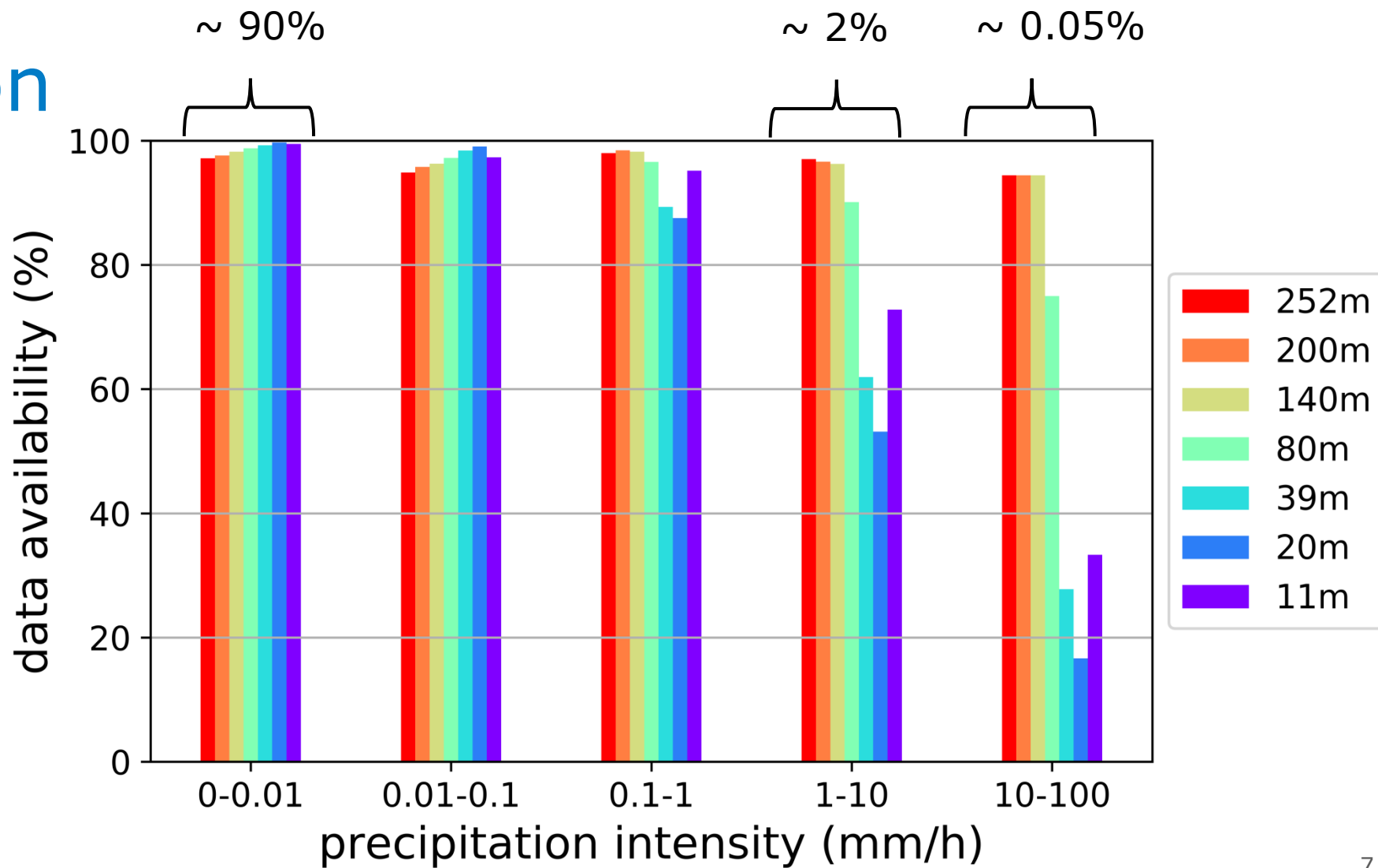


Lufft CHM15K ceilometer



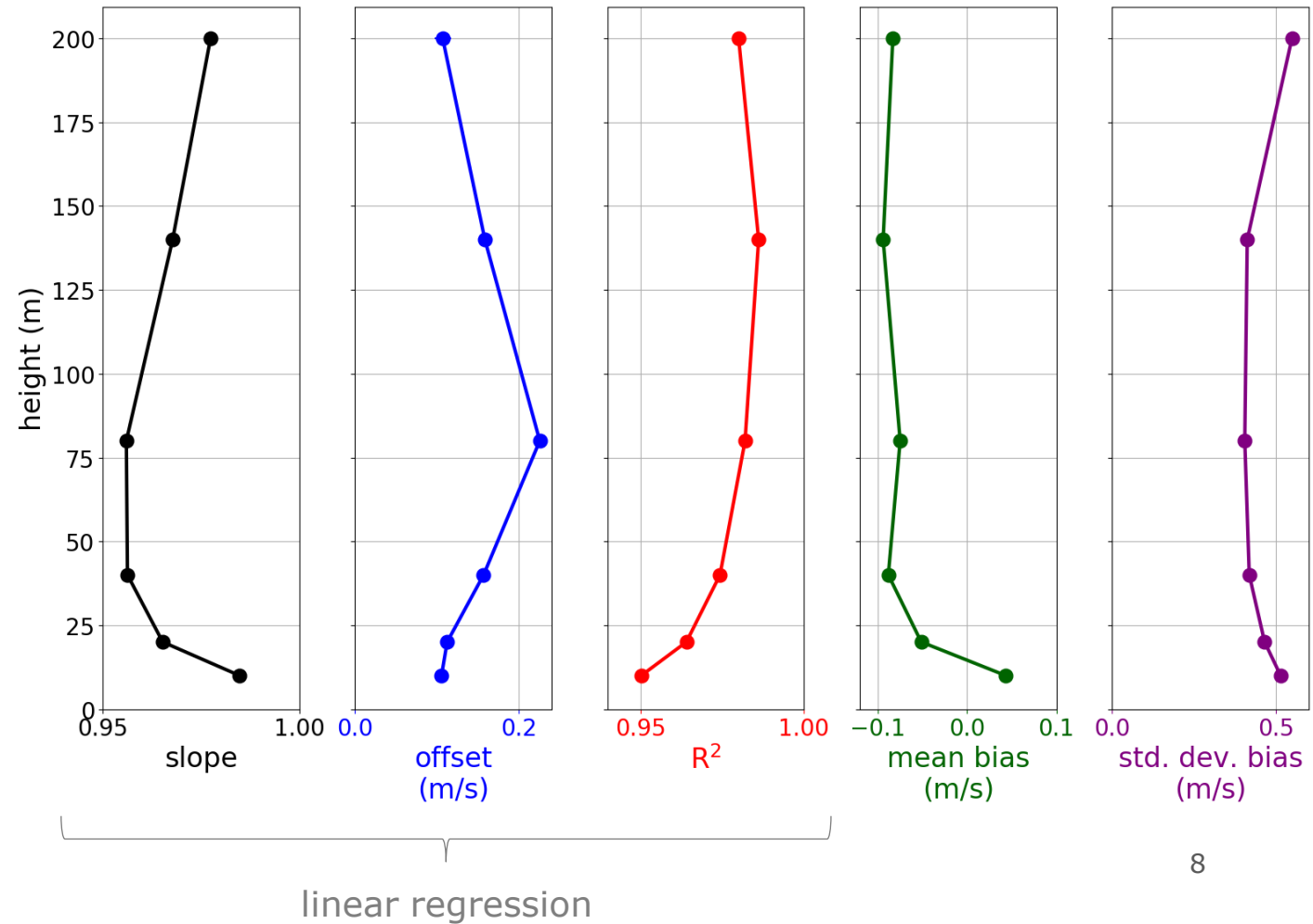
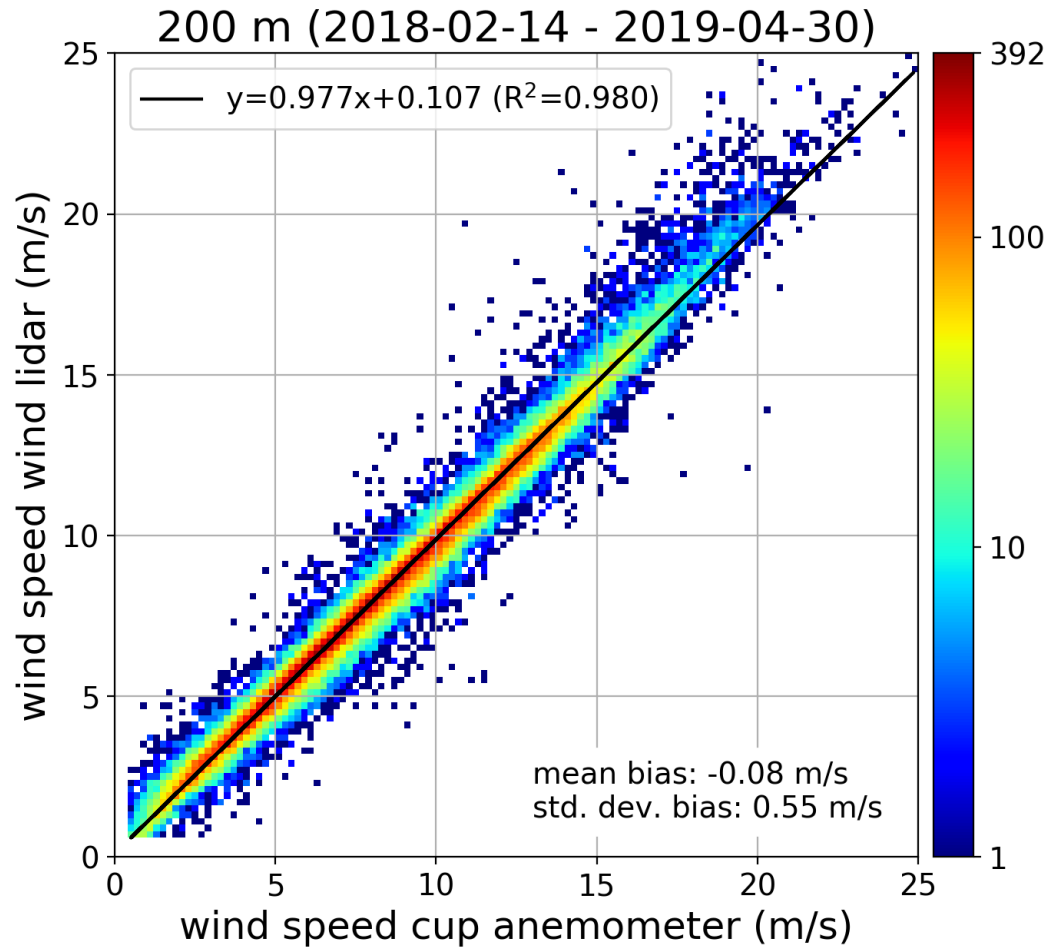


Precipitation



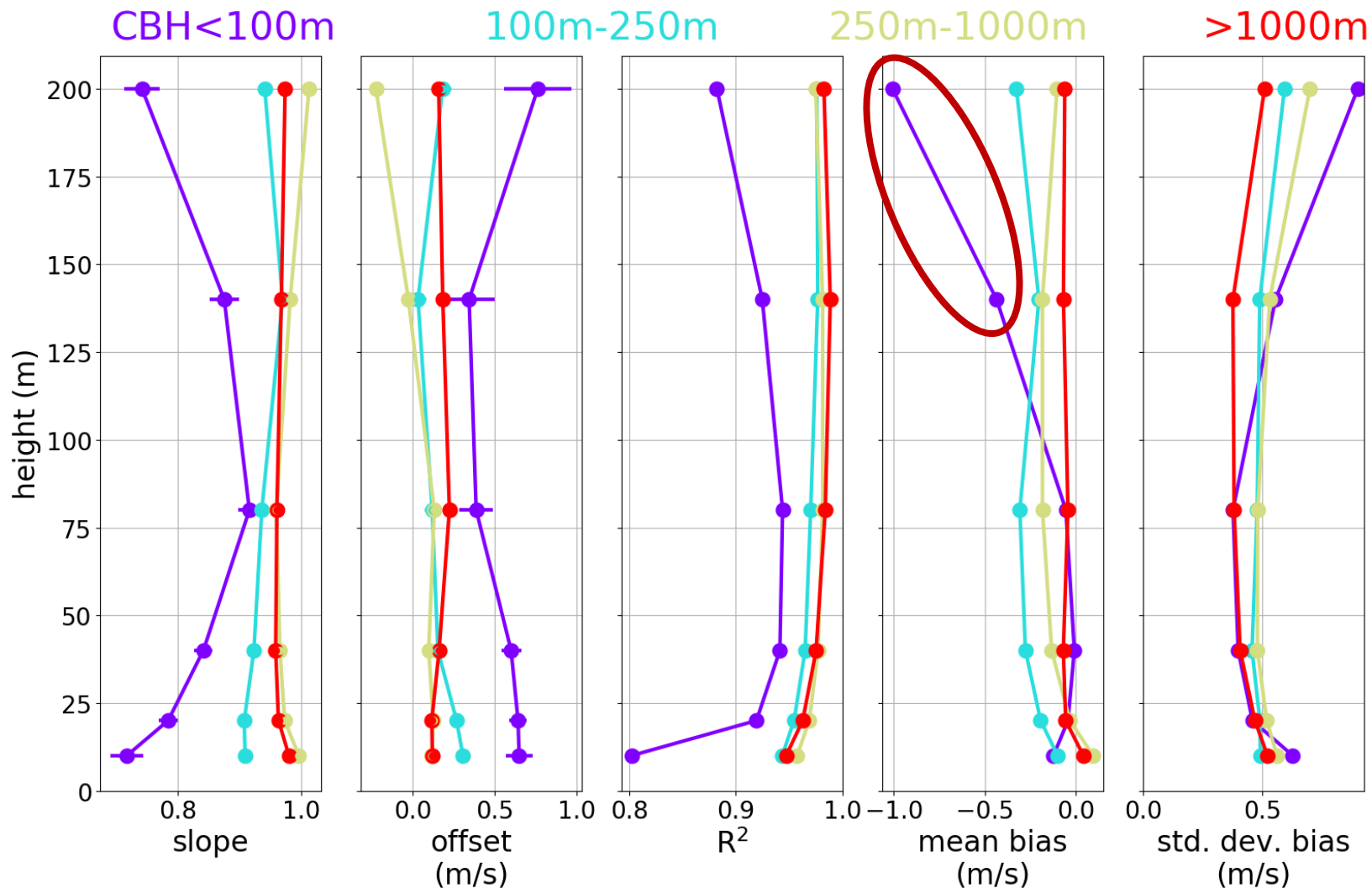


Wind speed correlation



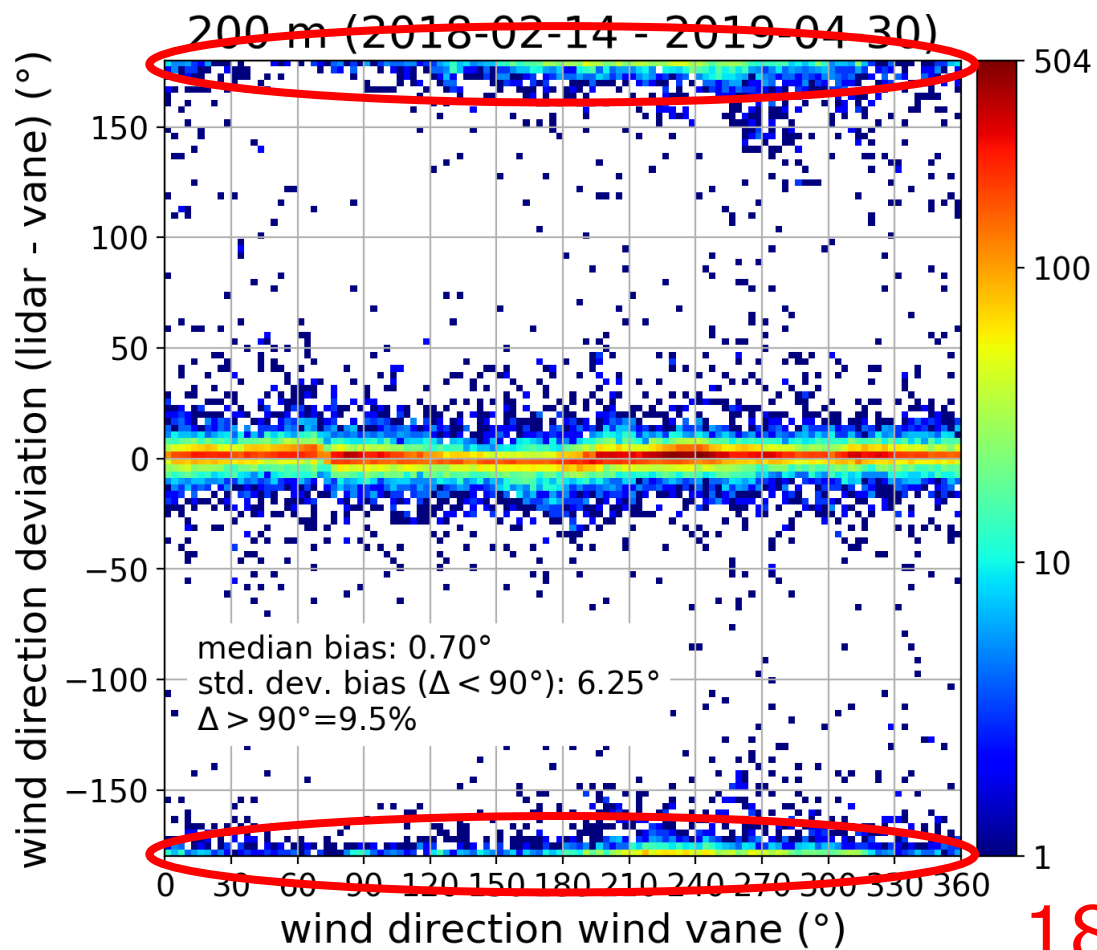


Wind speed correlation cloud base height

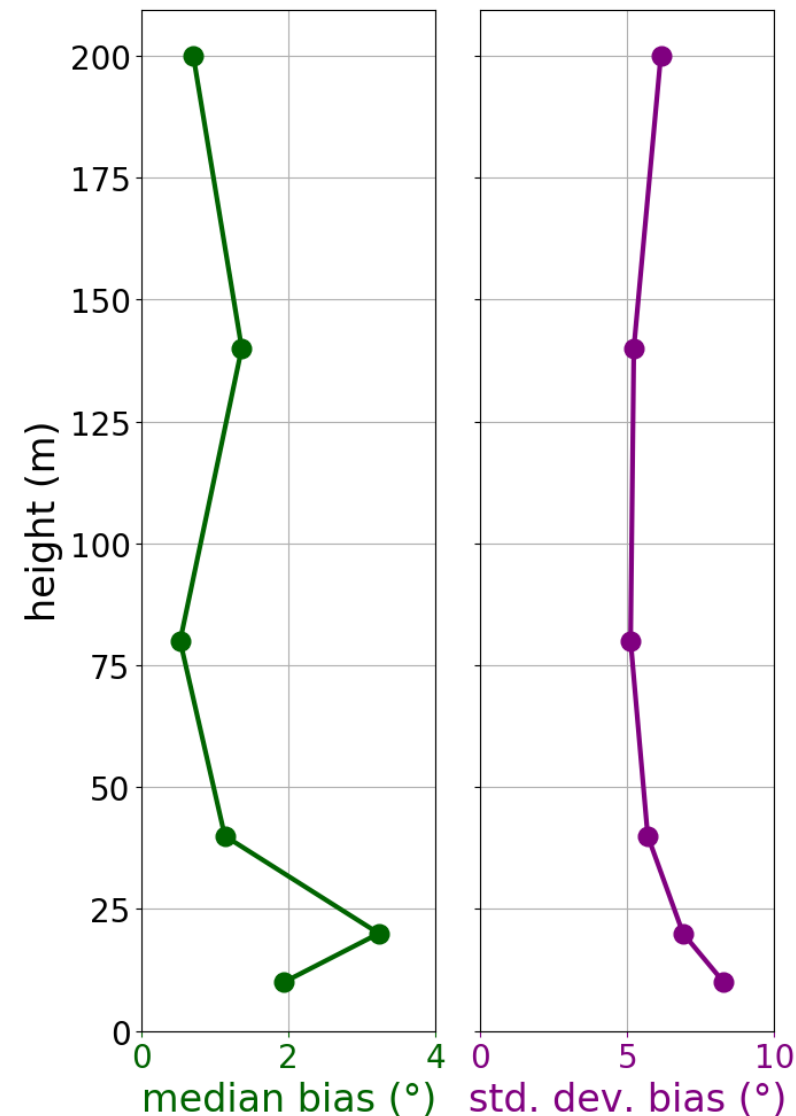




Wind direction correlation

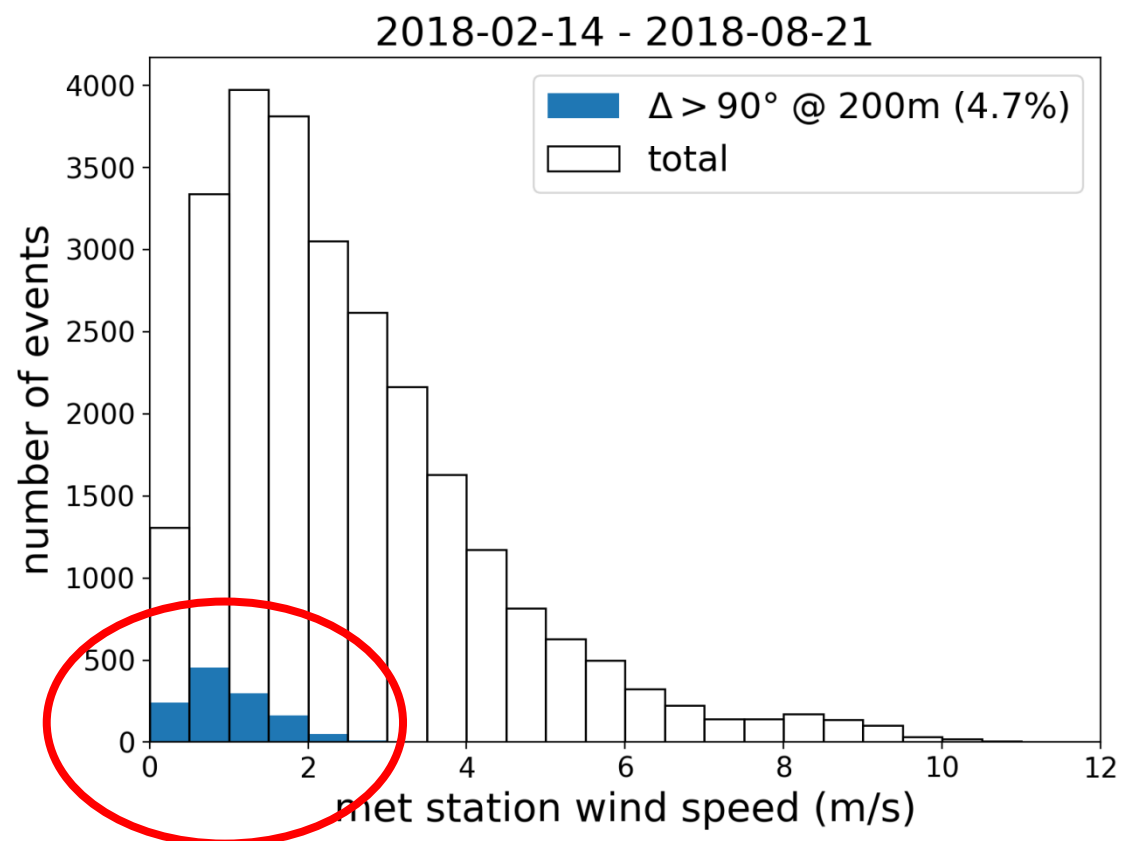


180° issue





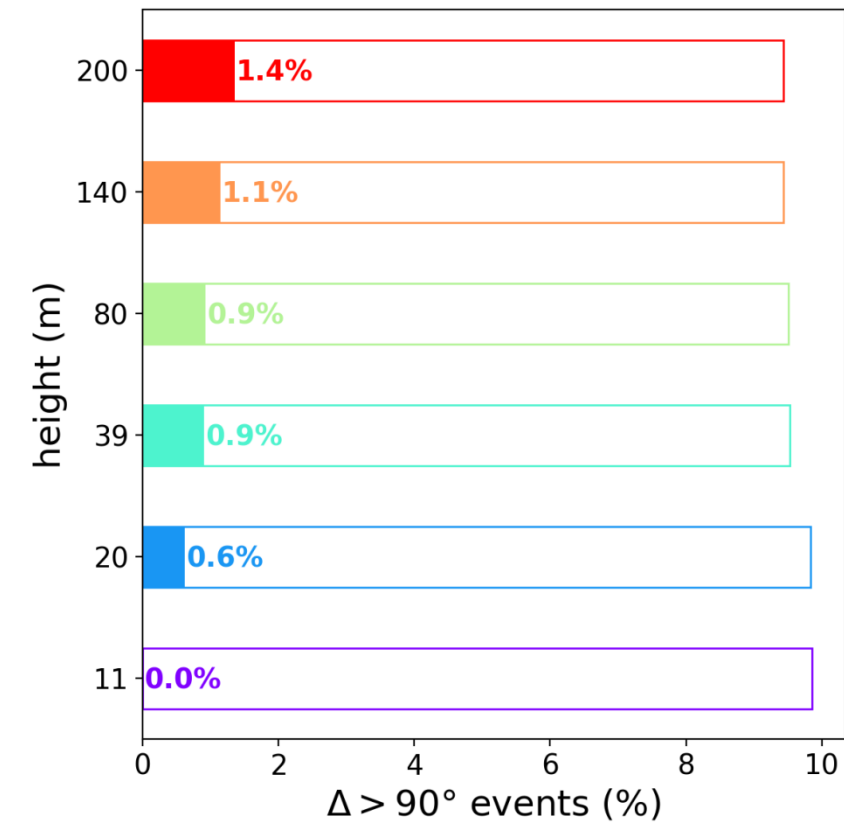
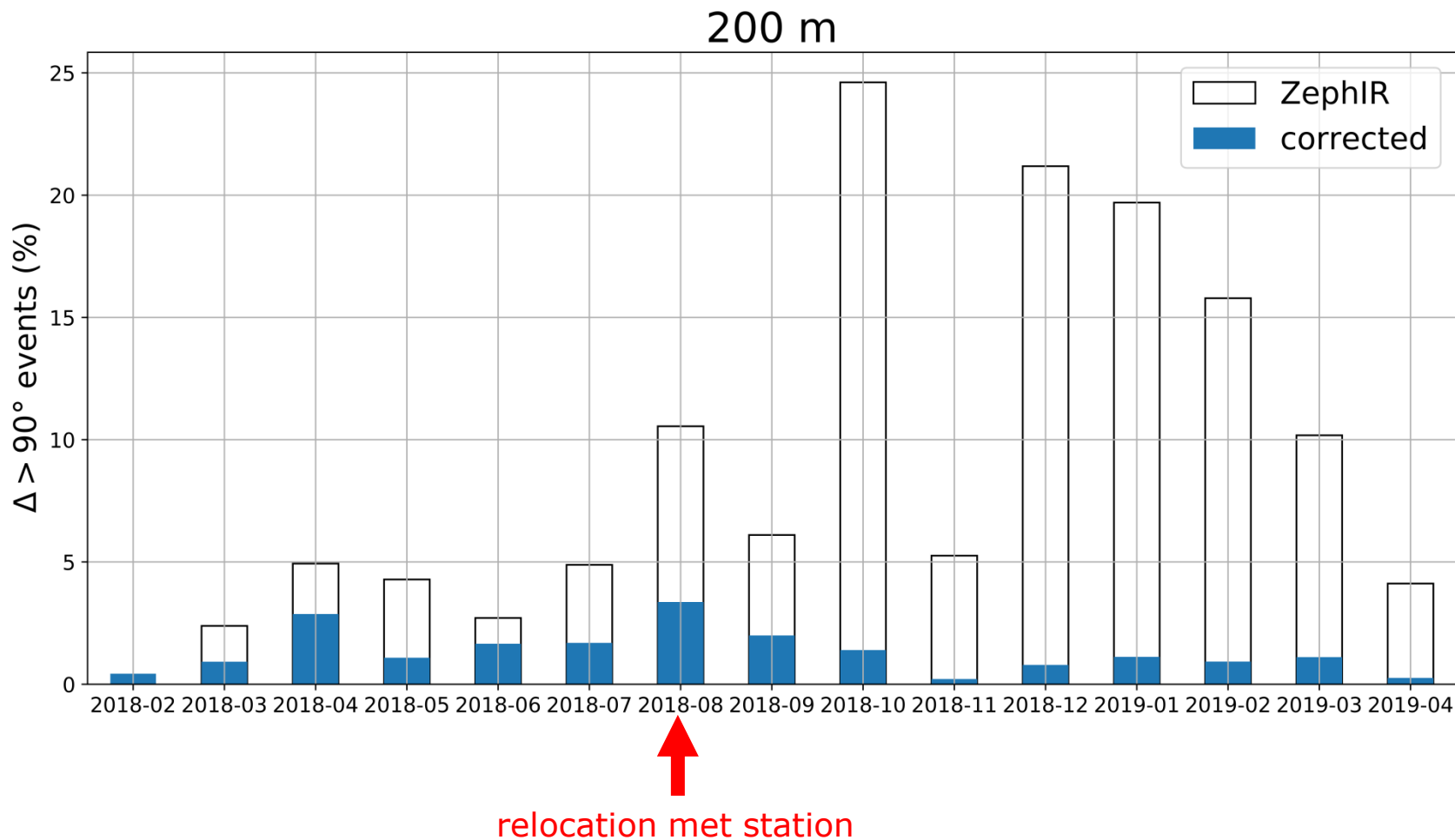
180° issue





Correction on basis of 10-m
mast wind direction

180° correction





Summary and Outlook

- 2-year measurement campaign ZephIR 300M at CESAR Observatory (Cabauw)
- Intercomparison 10-200m
- Data availability and data quality
 - Clouds, precipitation
- 180° issue
- Offshore deployment





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Acknowledge:

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- KNMI/CESAR Observatory

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