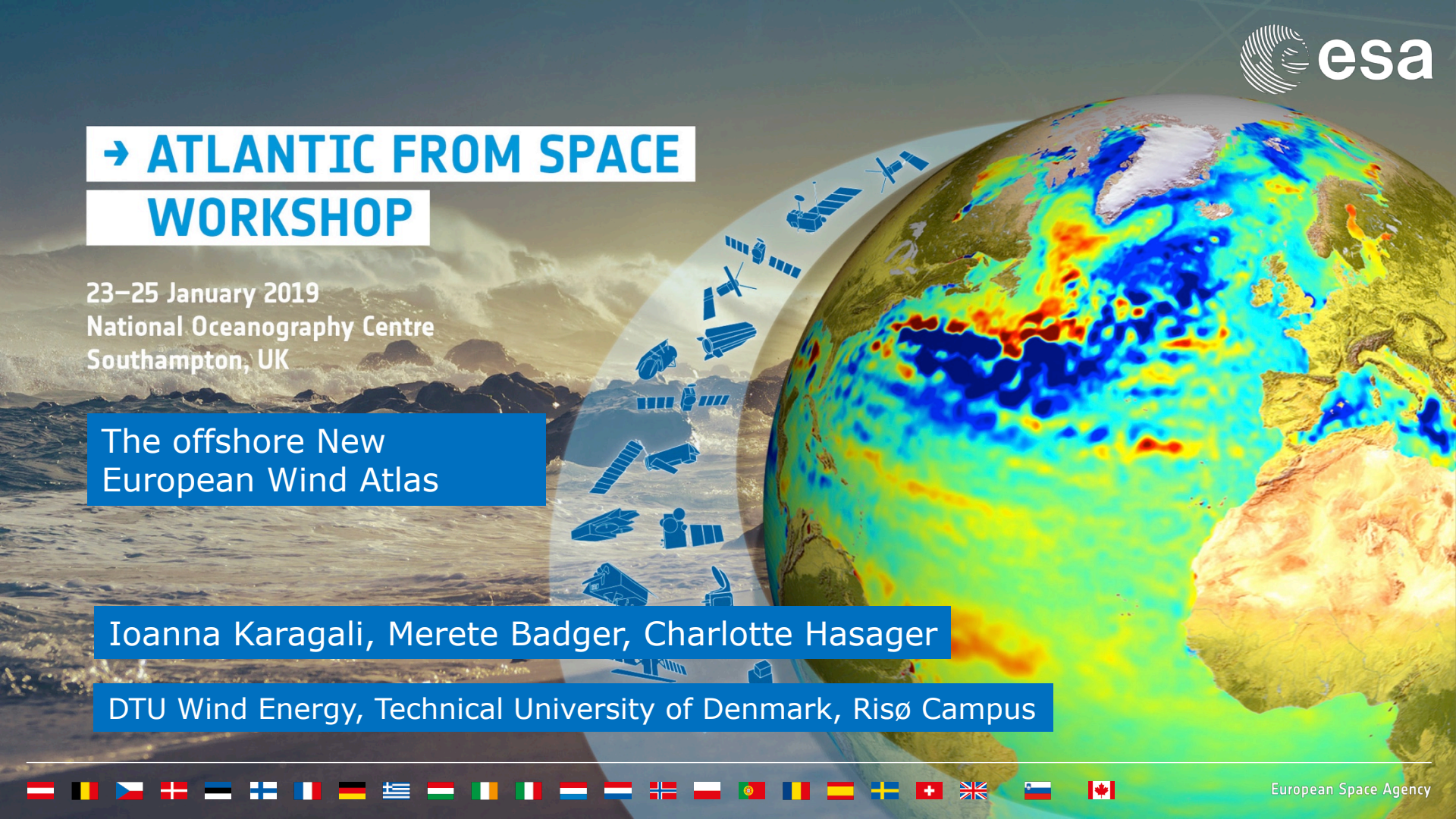
→ ATLANTIC FROM SPACE
WORKSHOP
23–25 January 2019
National Oceanography Centre
Southampton, UK
The offshore New
European Wind Atlas
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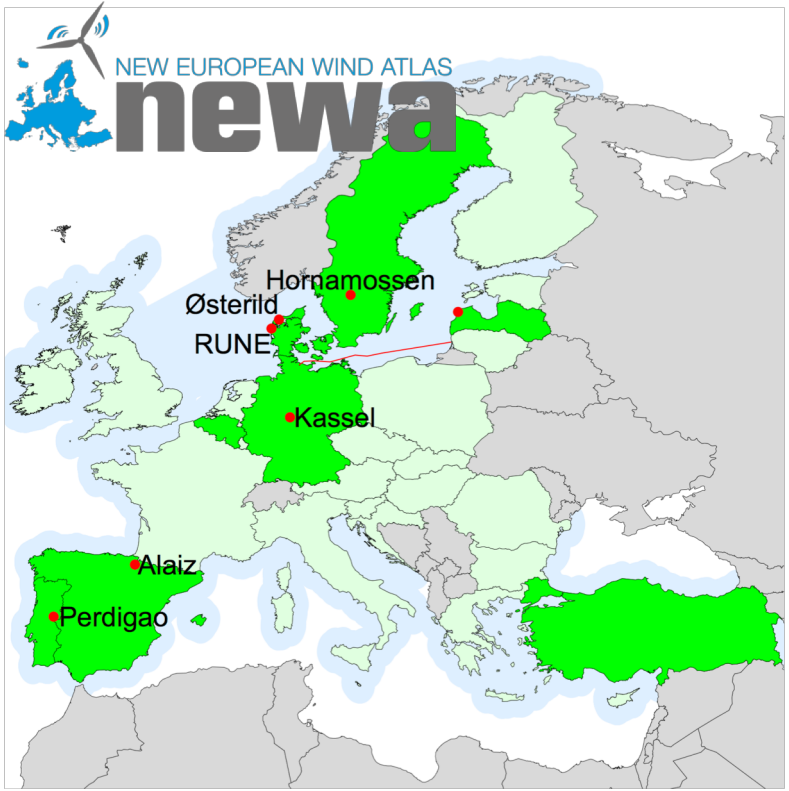
esa
European Space Agency

Rationale: New European Wind Atlas

- Resource assessment & spatial planning
- Cover all EU member states & some Associated Countries
- Reduce overall uncertainties in determining wind conditions
- Offshore wind atlas extent: 100 km
  - Mesoscale models
  - Satellite winds
  - Experimental measurements



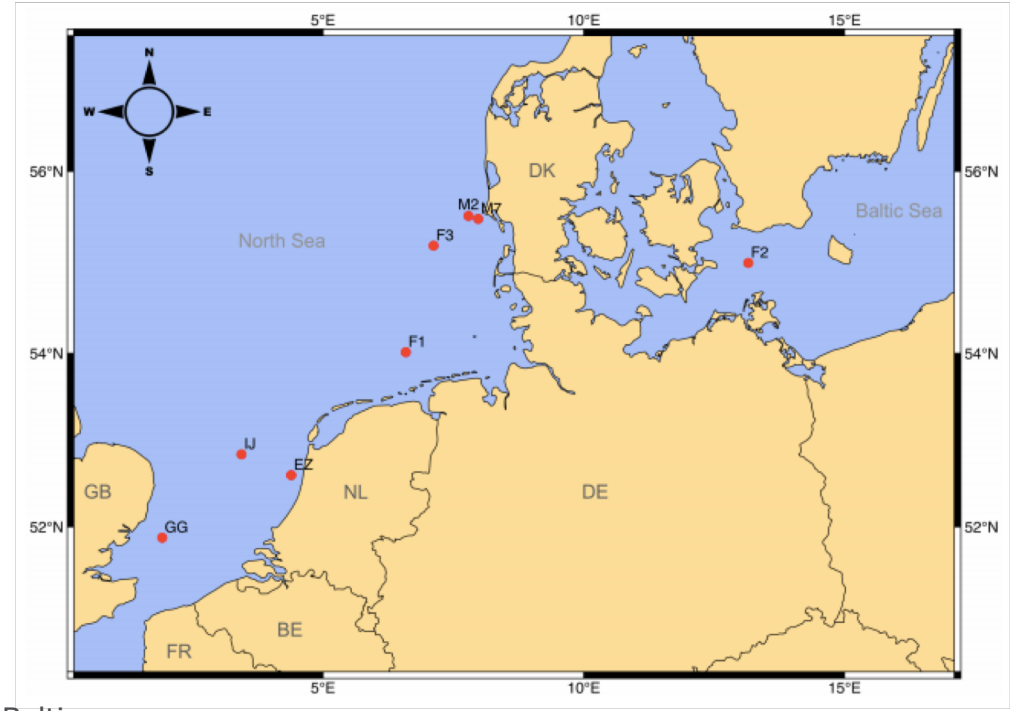
ASCAT Winds

- 12.5 km Stress Equivalent product (CMEMS)
- 2007-2012: reprocessed (012_005), 2013-2016: NRT (012_002)
- 10-year mean wind speed extrapolated using the method of *Badger et al. (2016)*[1]
    - Stability-Dependent-Wind:
        - u_* assuming neutral conditions
        - u_z using long-term stability correction.
    - Equivalent-Neutral-Wind:
        - u_* assuming neutral conditions
        - u_z assuming neutral conditions.

[1] Extrapolating Satellite Winds to Turbine Operating Heights. J. Appl. Meteorol. Clim., 55, 975-991.

In situ measurements

- Meteorological masts
- Wind speed & direction
- Heights 21-100 m
- Temporal availability: 2007-2016
- EZ, M2/M7, GG: 10 m winds (ENW & SDW)[2]
- Filtering for 3-24 m/s, wake-free directions

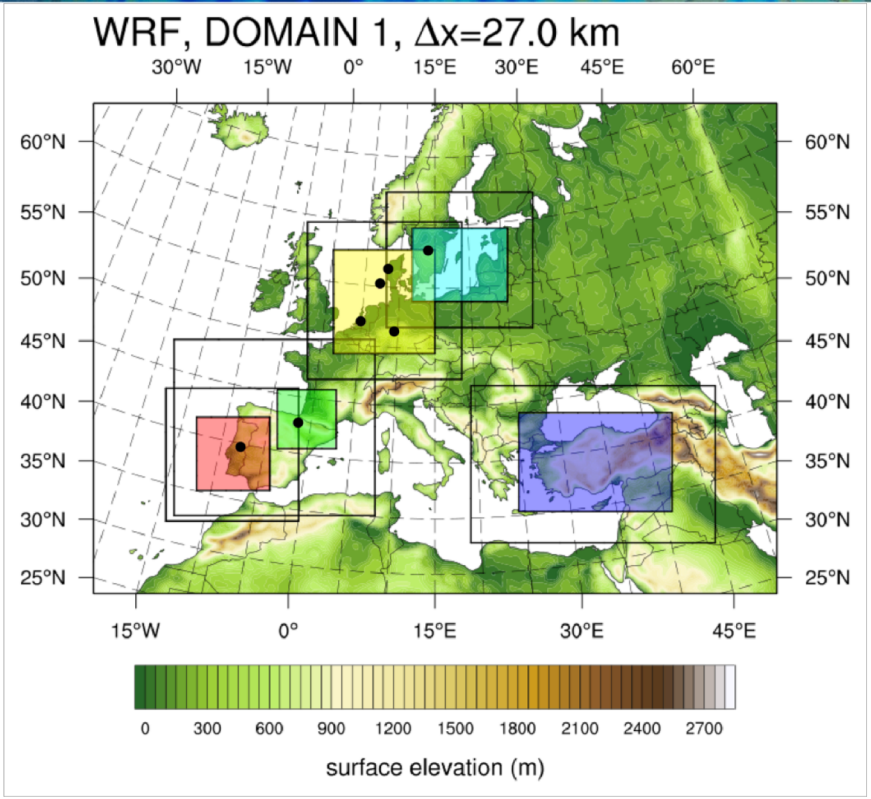


[2]Karagali et al., 2014. Wind Characteristics in the North and Baltic Seas from the QuikSCAT Satellite, Wind Energy 17.1 (2014): 123–140.

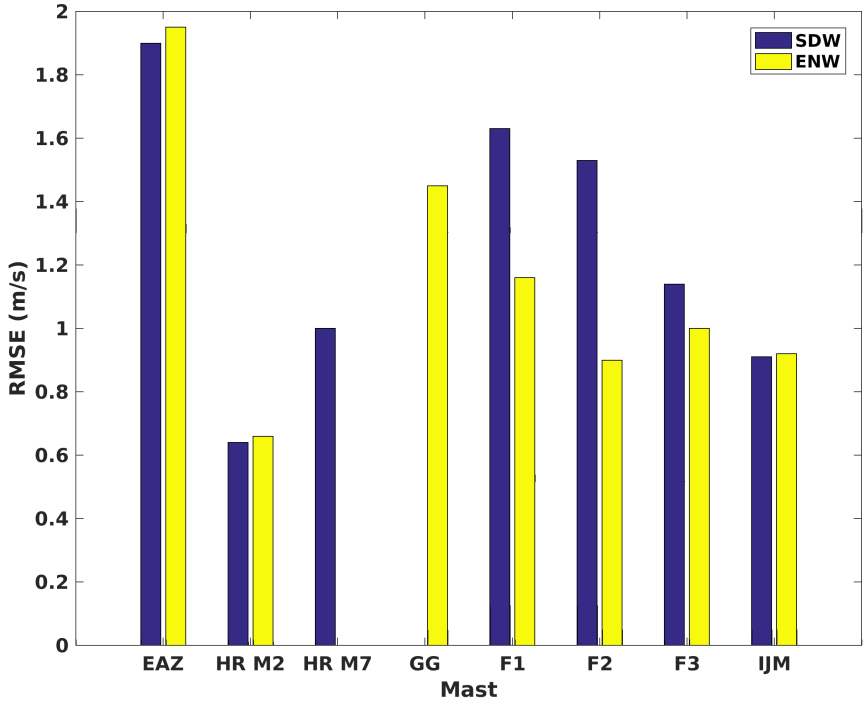
Weather Research & Forecasting (WRF) Model

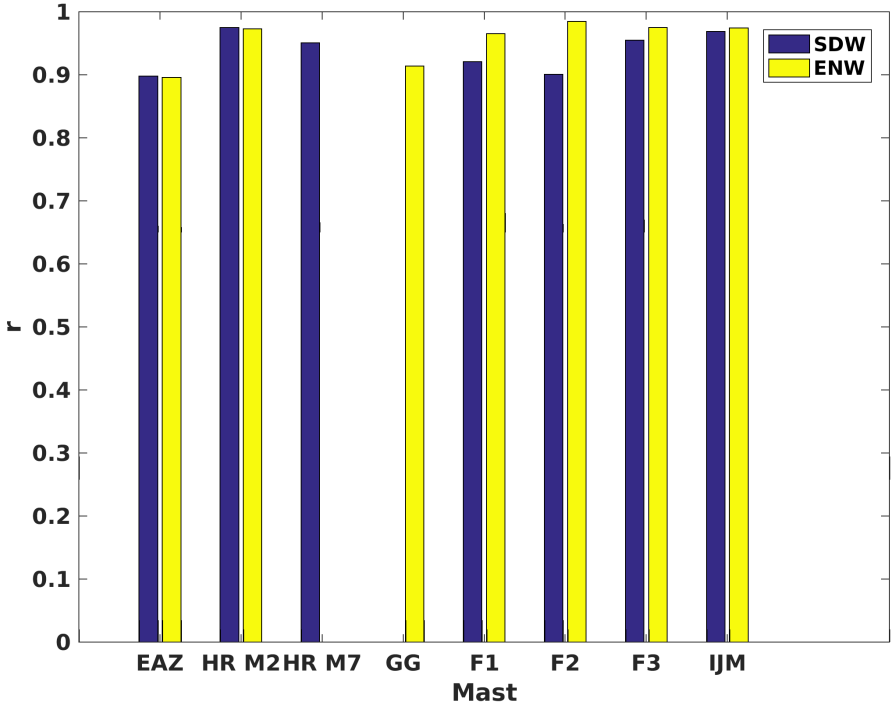
- NEWA Sensitivity experiments (2015)
- 10-year WRF run from *Nuño Martinez et al. (1018)*[3] for long-term stability correction
- Filtering for 3-24 m/s, wake-free directions

[3]Nuño Martinez et al., 2018. Simulation of transcontinental wind and solar PV generation time series, Renewable Energy, 118: 425–436.



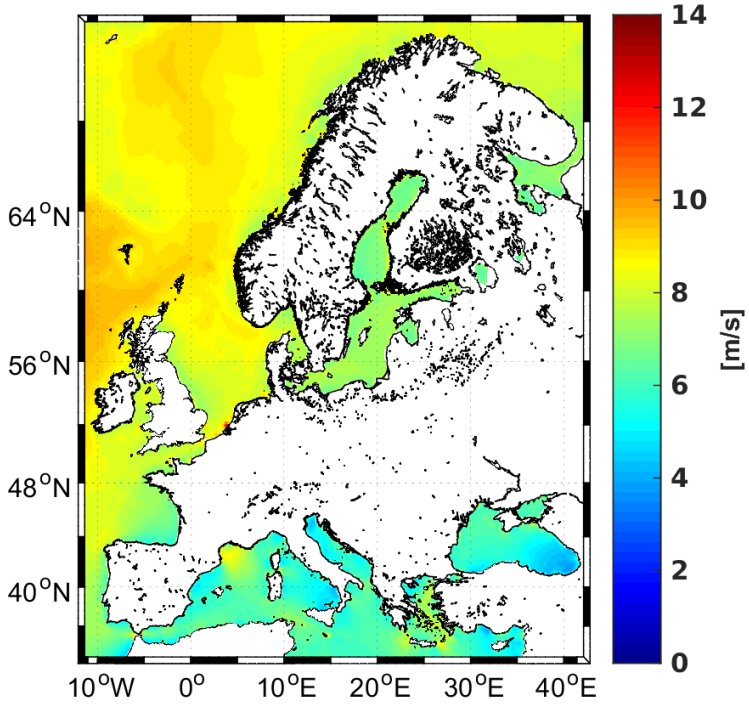
ASCAT vs In Situ at 10-m



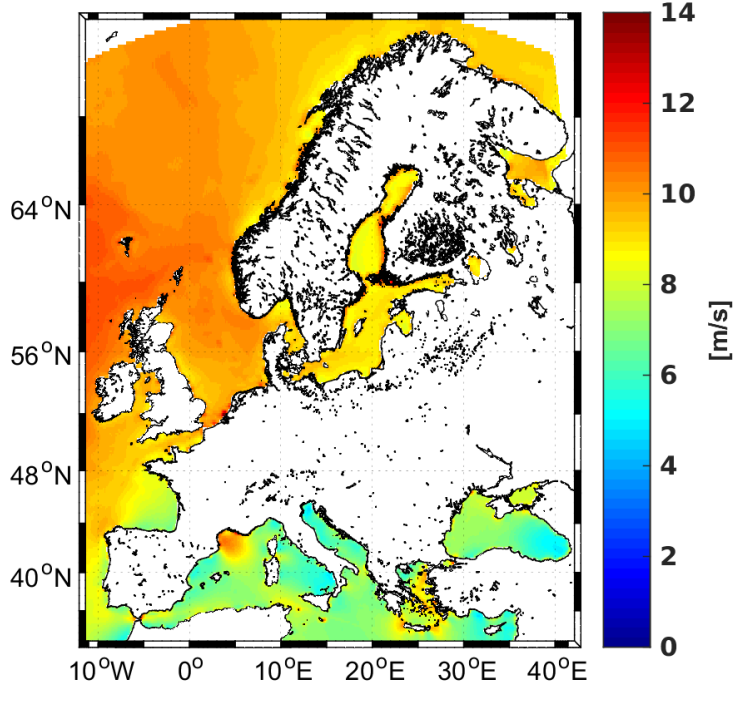


N. of match-ups (SDW/ENW): EAZ 280/285, HR-M2 45, M7 421, GG 59, F1 1038/56, F2 960/27, F3 966/86, IJM 2119/171.

ASCAT Wind Atlas [4]



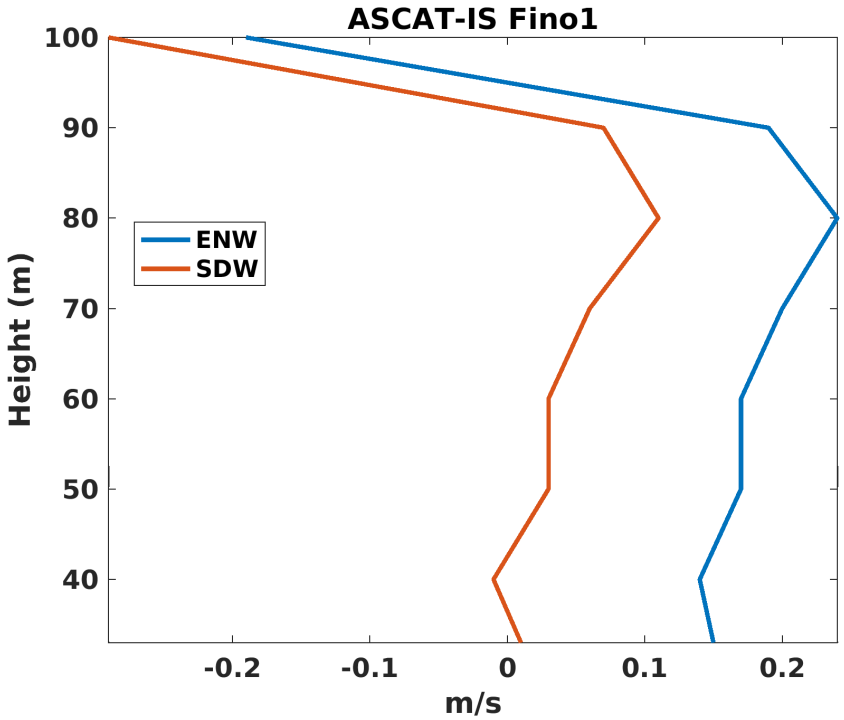
10m

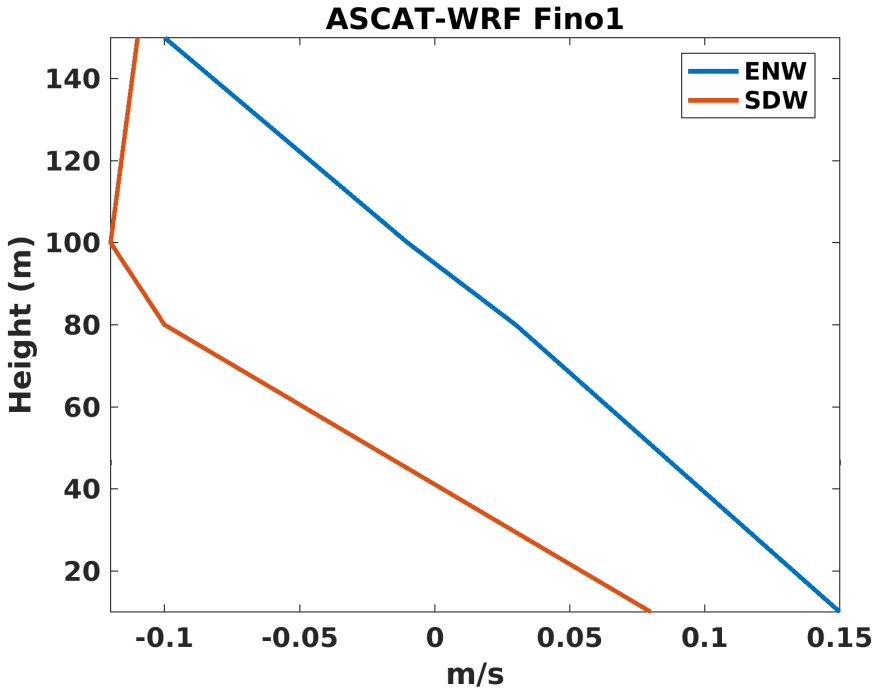


100m

[4] Karagali et al., 2018. New European Wind Atlas offshore, Journal of Physics – Conference Series, 1037 (5).

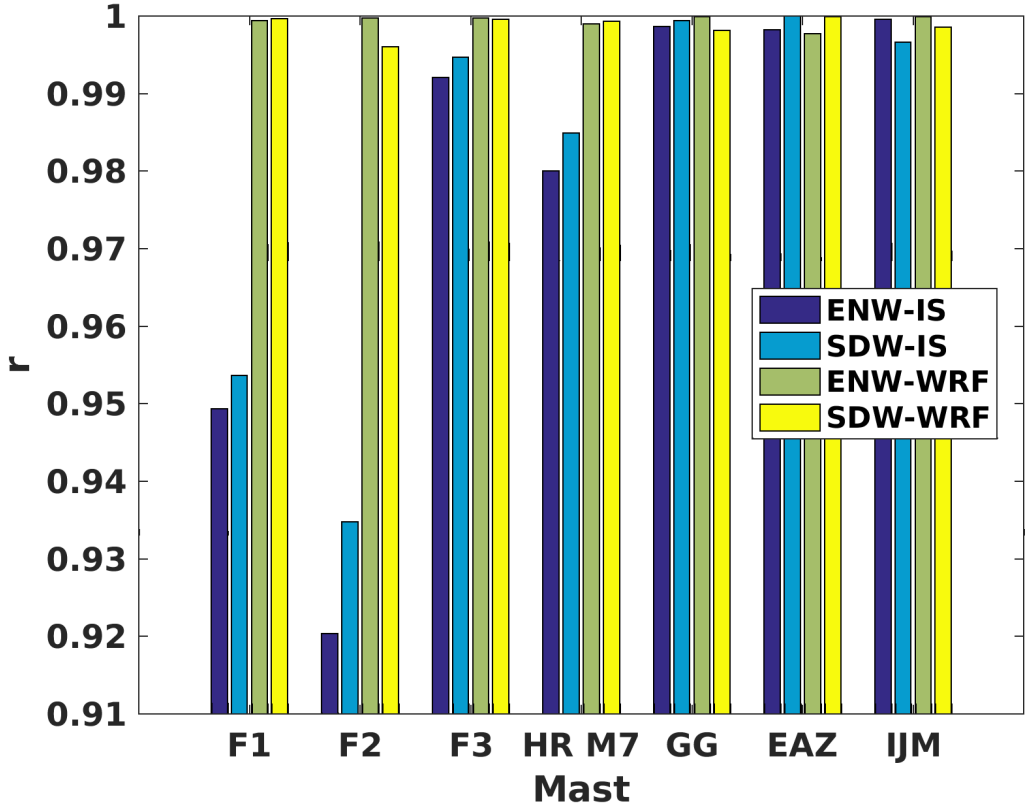
ASCAT "profiles"





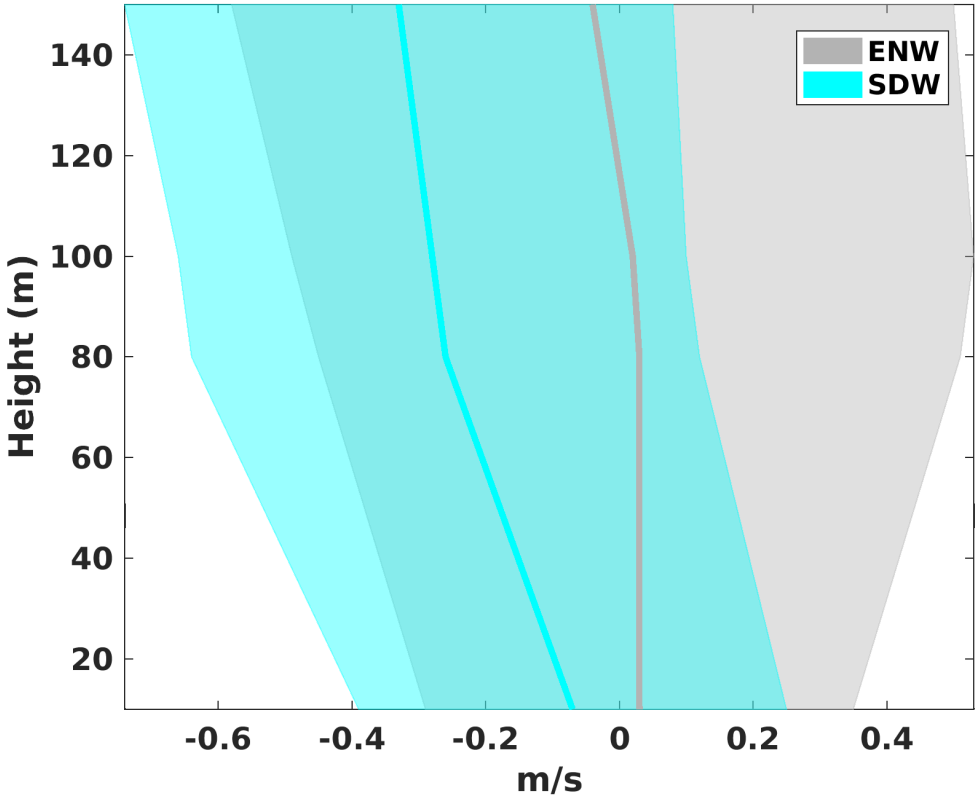
Overall mean wind speed bias at different heights for ASCAT - In Situ (left) and ASCAT - WRF (right). Fino 1 data used for 2015-2016.

ASCAT – In situ – WRF correlation



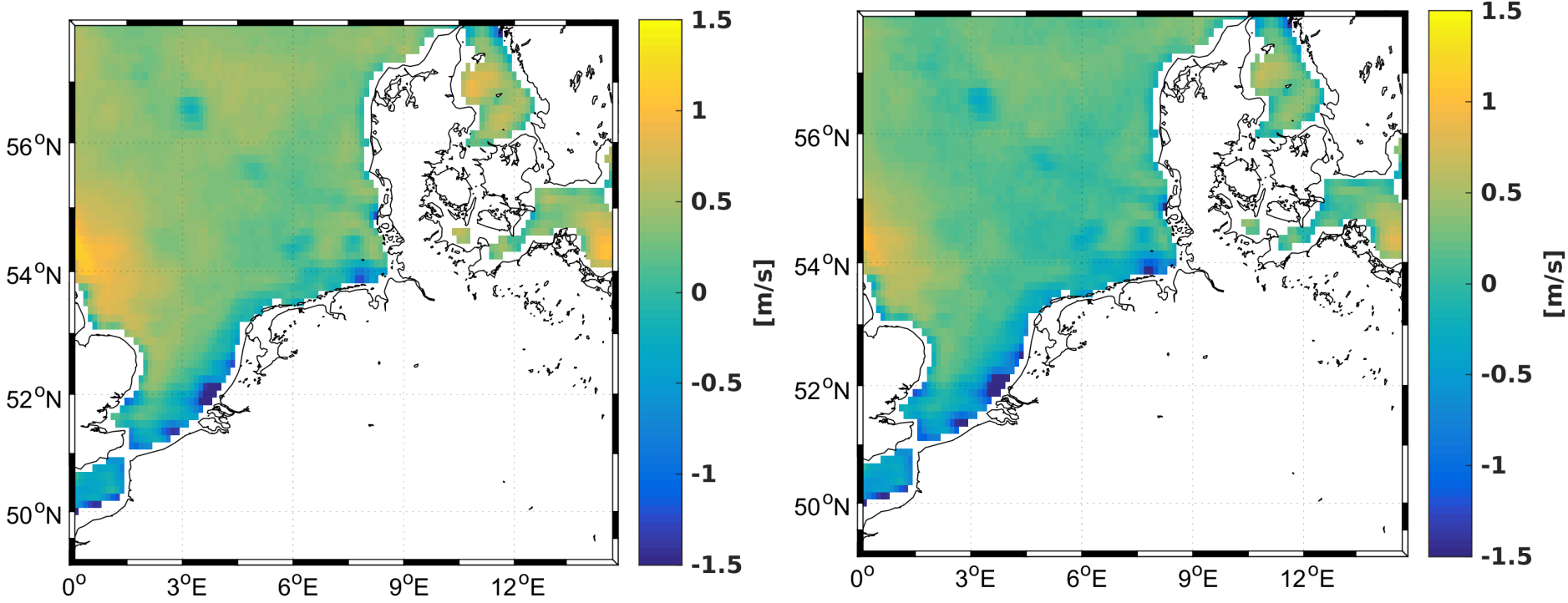
Overall correlation of mean wind speeds
at all available heights.

ASCAT vs WRF long-term profiles



ASCAT-WRF 10-year mean wind speed difference (solid) and standard deviation (shaded) at various heights (all grid points).

WRF - ASCAT 2015



10m wind speed difference using 2 different WRF PBL schemes: MYJ (left), YSU (right).

Summary

- Comparison of ASCAT 10m winds with in situ data RMSE < 2 m/s, r>0.9
- Satellite surface winds extrapolated to hub-height relevant levels
- Mean biases in ASCAT-In Situ profiles up to 0.25 m/s in most cases
- Overall ASCAT - WRF profiles, neutral up to 100 m, stable up to 150 m
- Increased spatial variability in the ASCAT 10 m winds compared to WRF
- WRF-ASCAT mean biases up to 0.5 m/s and for most of the North Sea

Recommendations

- More platforms → more observations.
- Improving the network of in situ locations for validation.
- Standardization on processing methodologies for offshore wind energy.
    - Hard targets, shipping routes, etc.
    - Including bias estimates depending on physical conditions (e.g. SST).
- Merged ocean winds: scat, SAR, passive microwave.