Royal Netherlands
Meteorological Institute
Ministry of Infrastructure
and Water Management

Scatterometer-model wind bias statistics for different instruments and other factors

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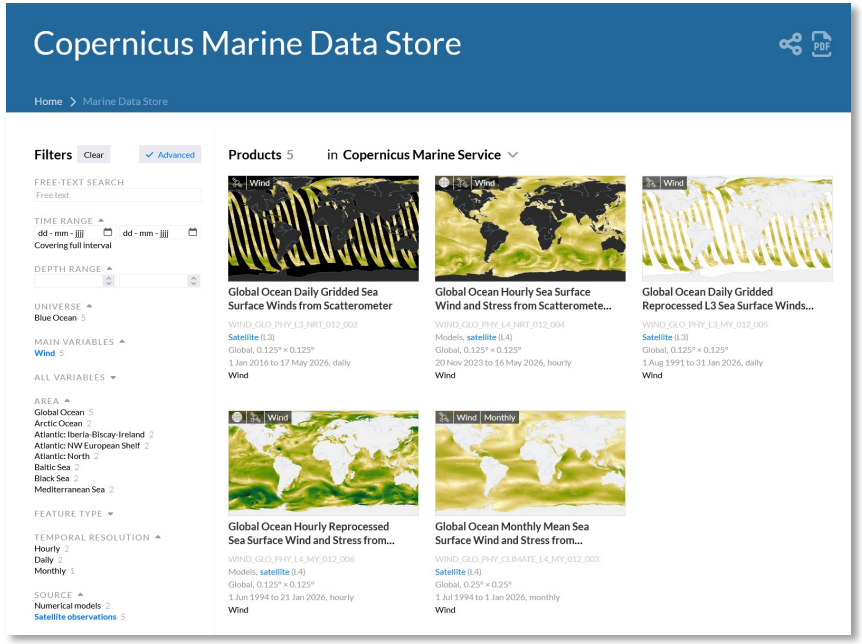
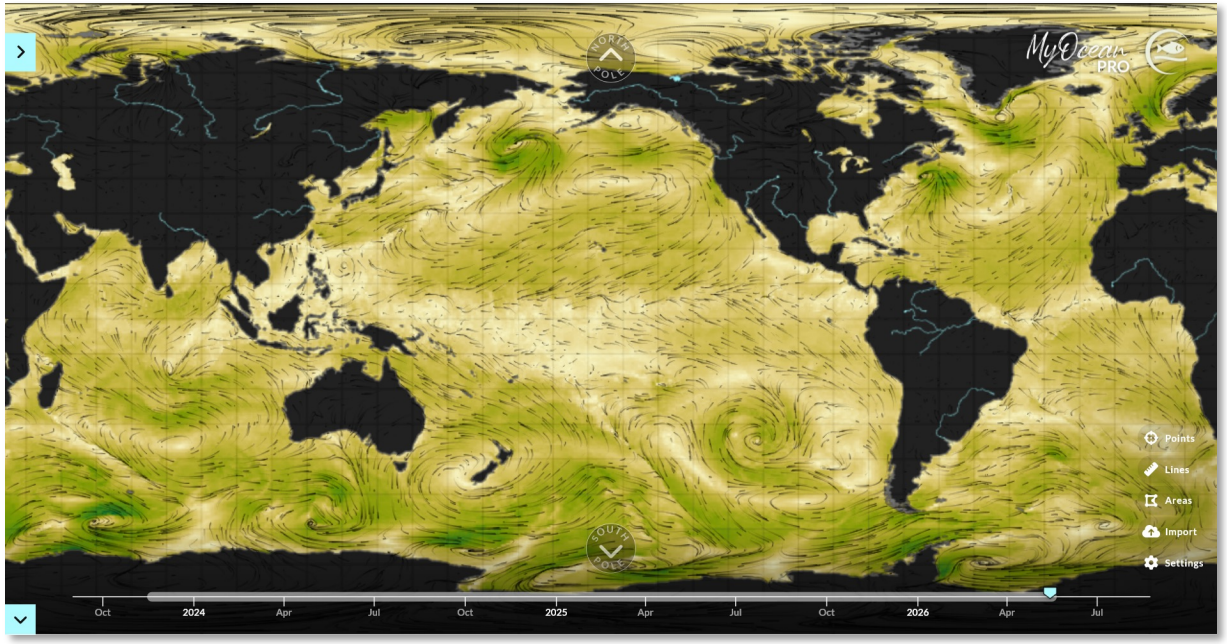
Motivation

- KNMI produces L3 and L4 global wind products for the Copernicus Marine Service
- The L4 products provide bias-corrected ECMWF model fields based on scatterometer observations
- Bias corrections in the near real-time product are currently based on Metop-B and Metop-C ASCAT

- **Can we use additional scatterometers to further optimize the L4 NRT product?**

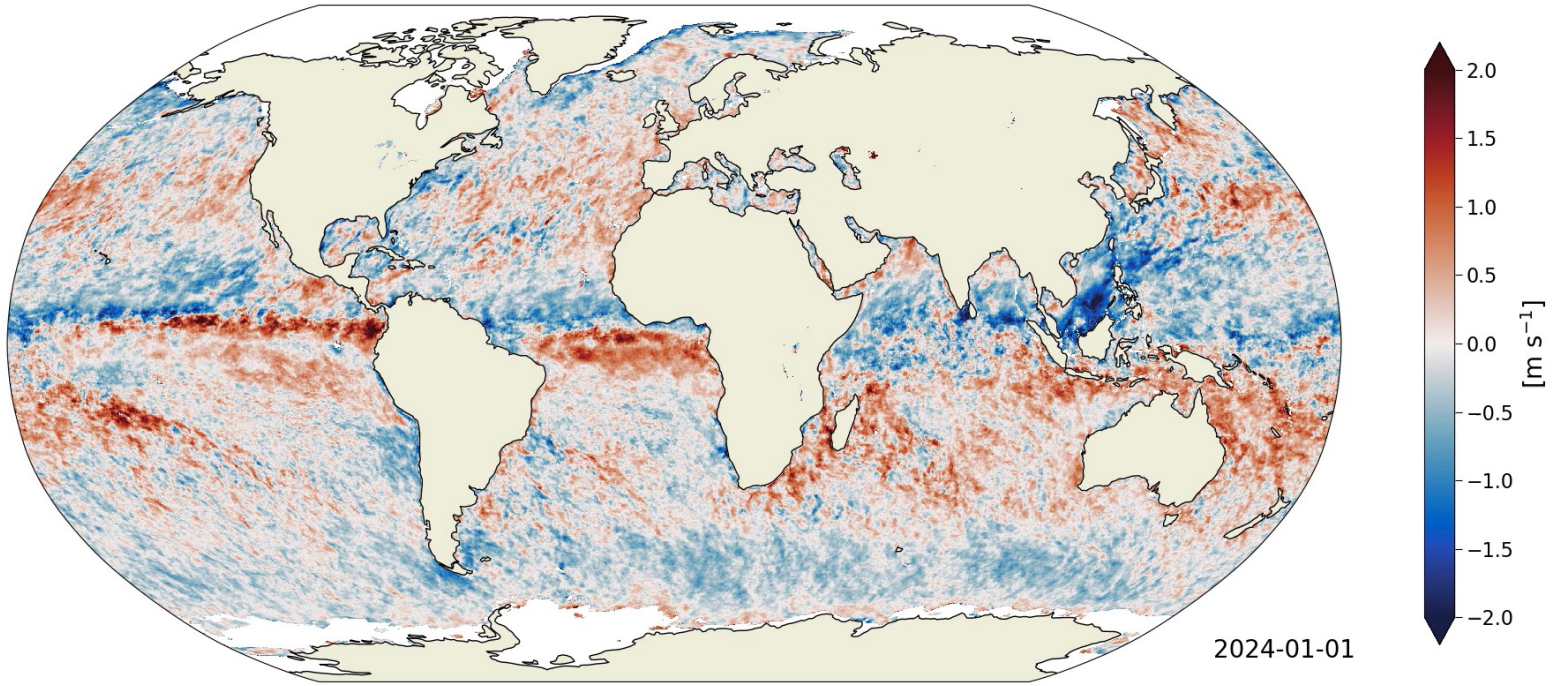




https://marine.copernicus.eu

L4 NRT scatterometer correction

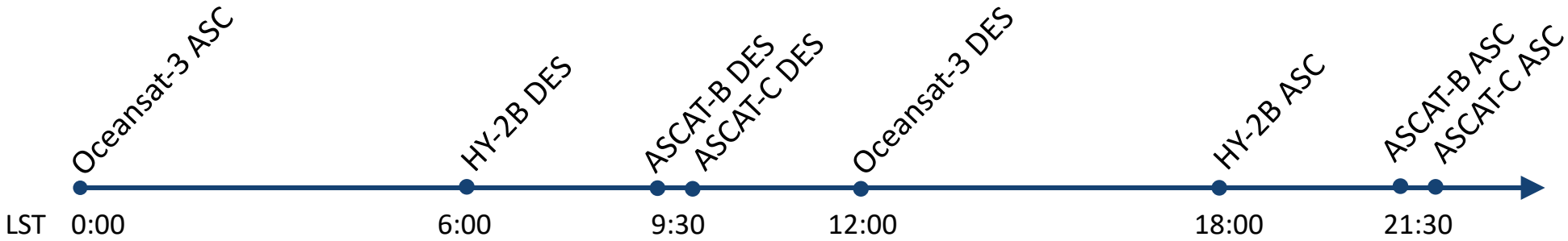
- 20-day averaged difference between scatterometer observations and collocated ECMWF model winds
- Combination of Metop-B and Metop-C ASCAT ascending and descending passes
- Collocated ECMWF winds are interpolated in space and time within model forecast lead range [+3, +15]



20-day average meridional wind bias (ASCAT-B+C - ERA5) [Jan-Dec 2024]

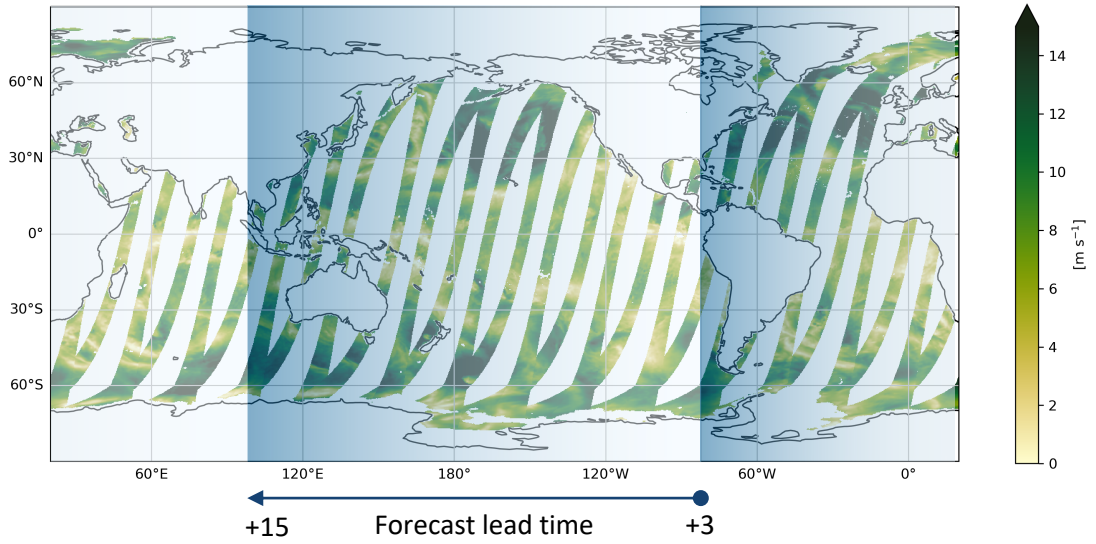
Scatterometer virtual constellation

- Different instruments (e.g. frequency, equator crossing time, orbit type)
- Overpass time determines the local ECMWF model forecast lead time used for bias calculations



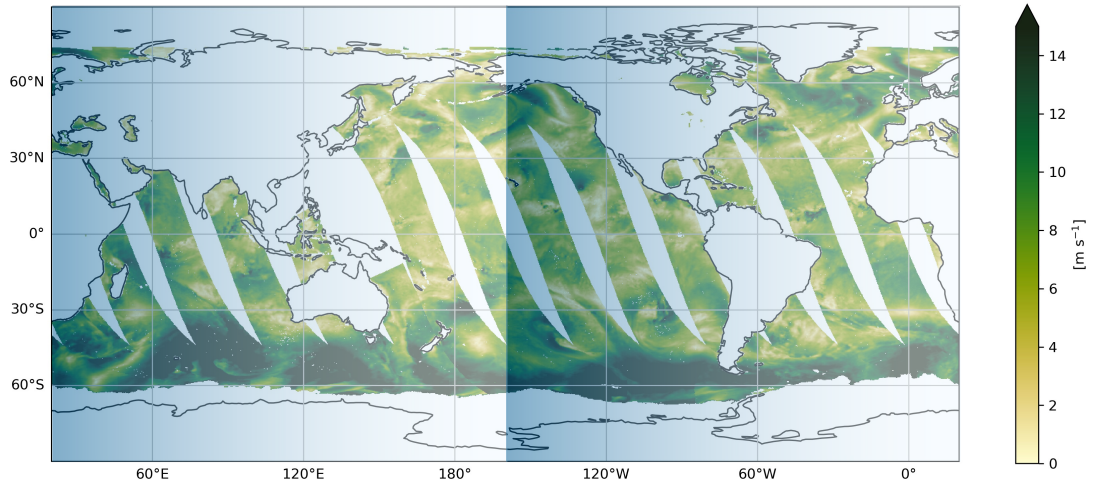
+ HY-2C ASC and DES at varying times (non-sunsynchronous)

Metop-C ASCAT DES



+15 Forecast lead time +3

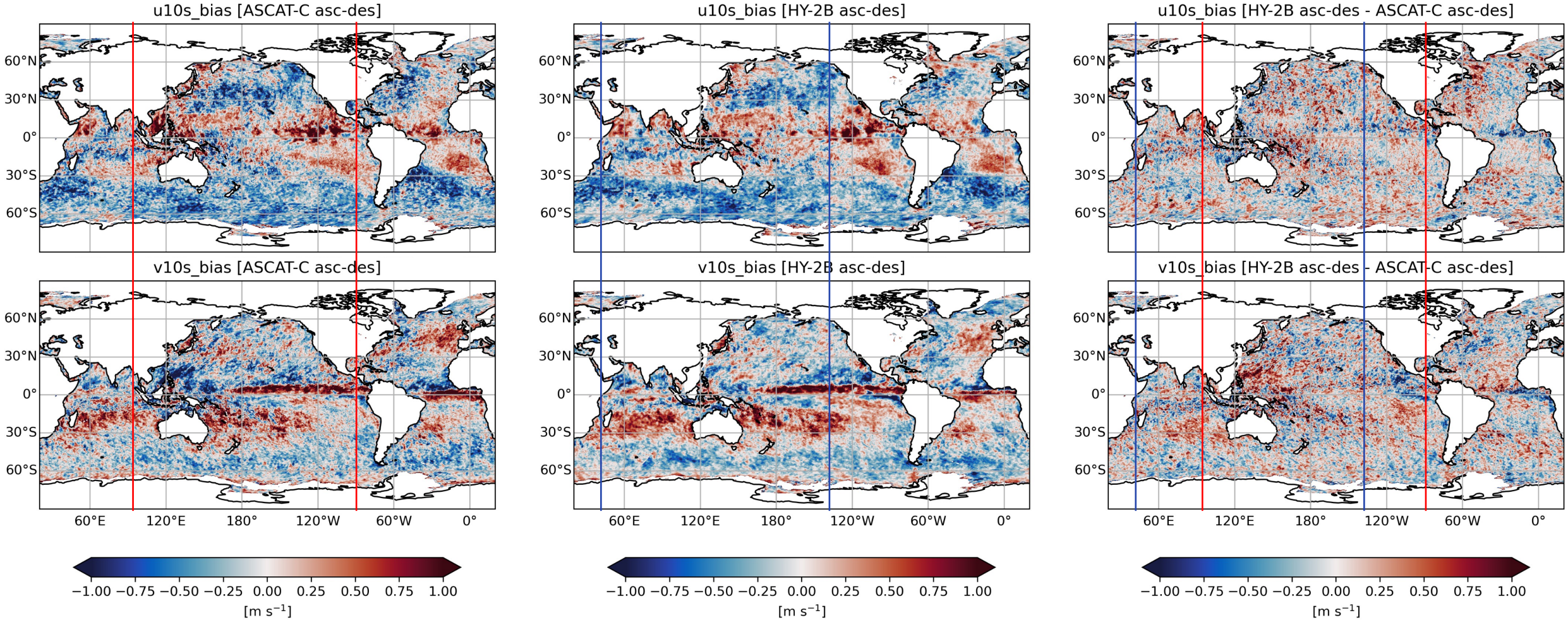
HY-2C HSCAT DES



Spatial bias differences

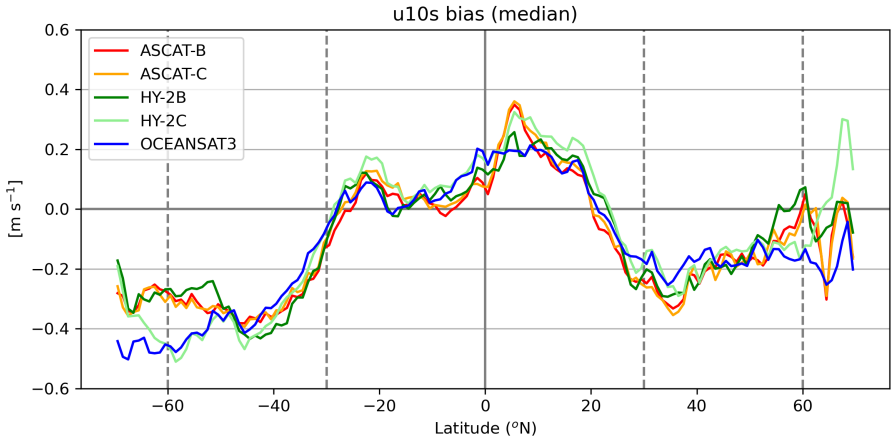
20-day average wind bias
(scat – ECMWF OPS)
[1-20 Jan 2026]

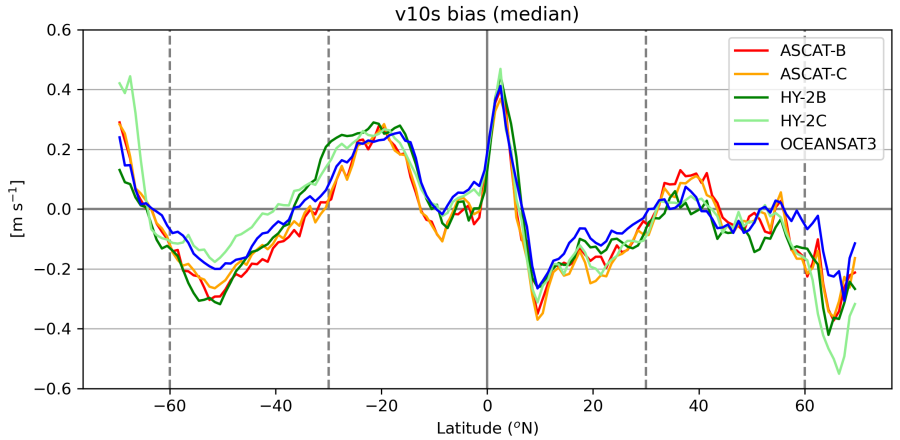
- Bias differences between scatterometers are considerably smaller than the biases themselves

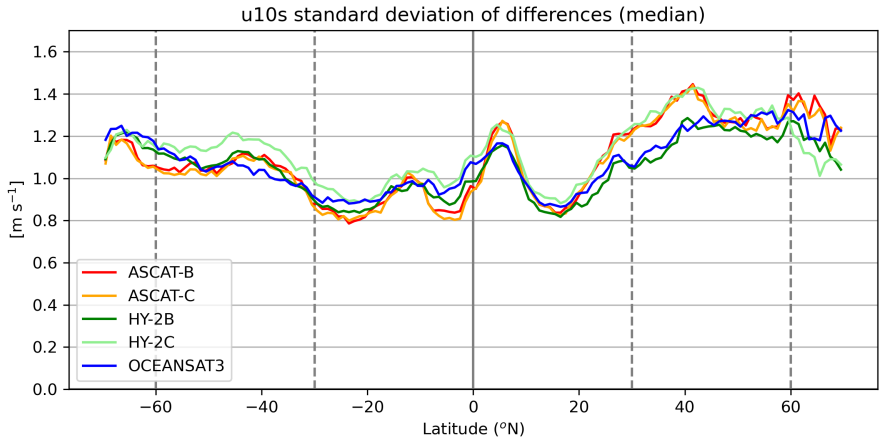


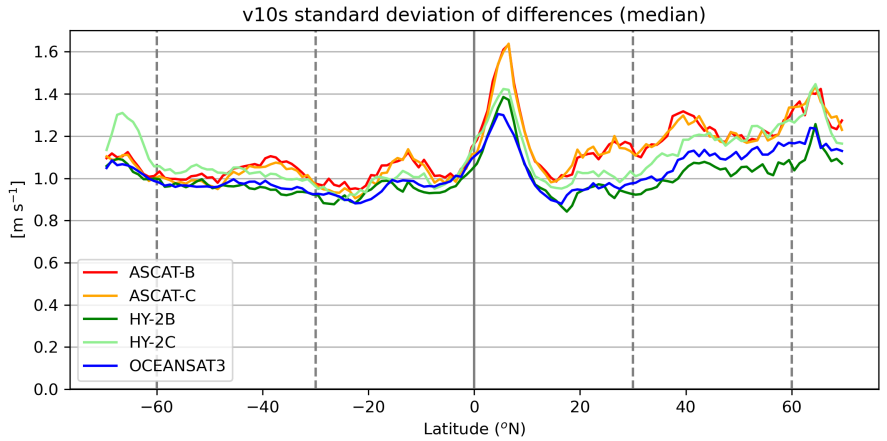
Latitudinal variation of bias differences

- Good bias and standard deviation of differences (SDD) correspondence at most latitudes
- SDD is generally largest for ASCAT and lowest for HY-2B and Oceansat-3





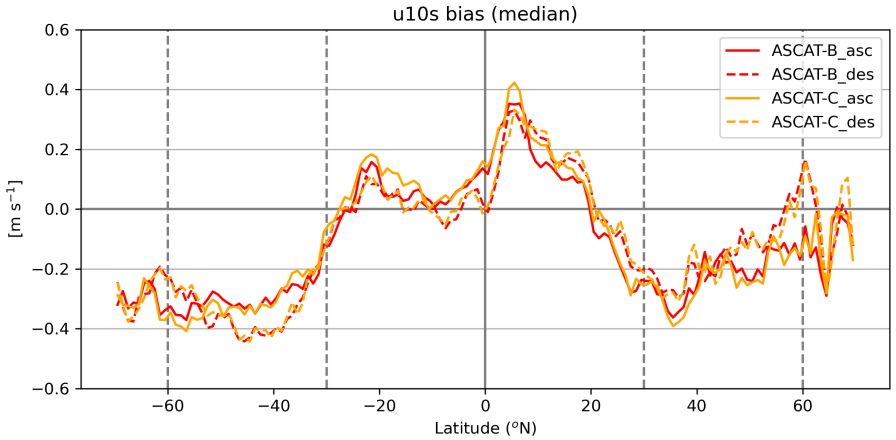


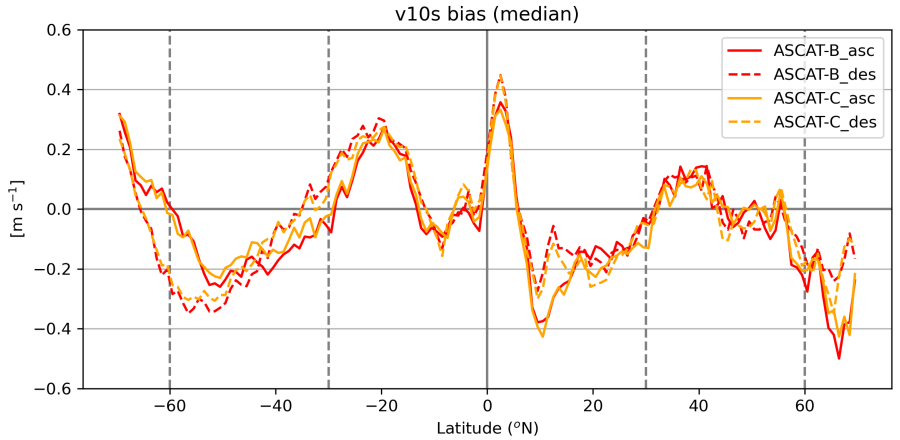


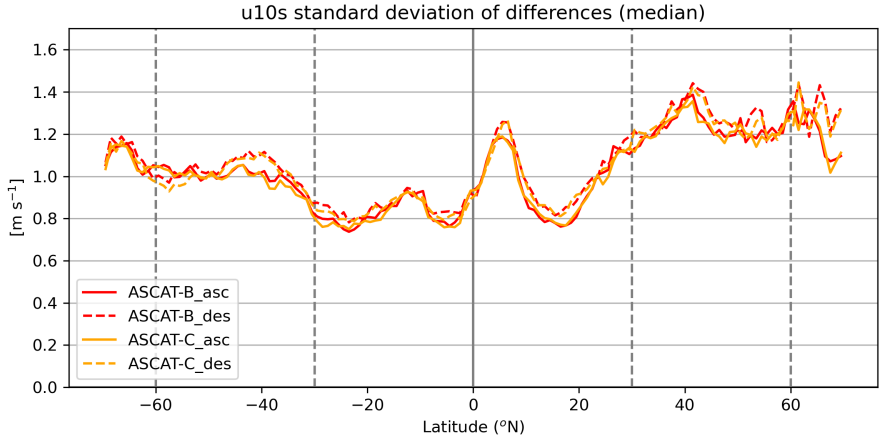
20-day average wind bias (scat – ECMWF OPS) [1-20 Jan 2026]

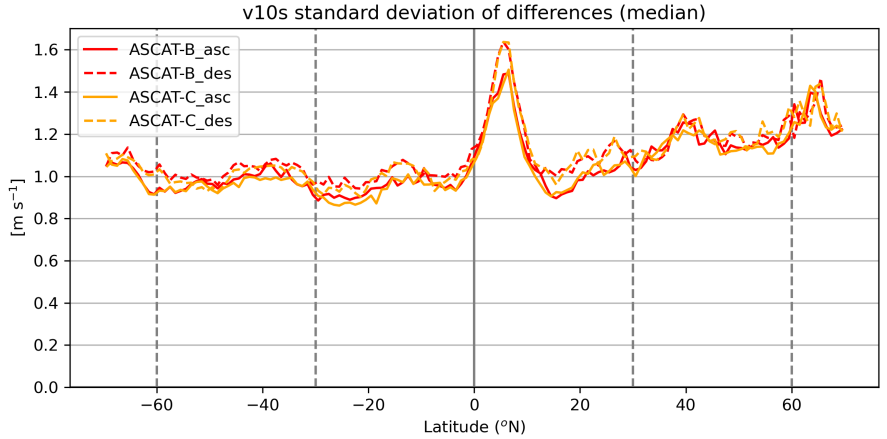
Effect of the daily cycle

- Bias differences between ascending and descending passes of similar magnitude as between different instruments
- SDD is generally larger for descending (morning) than for ascending (evening) passes







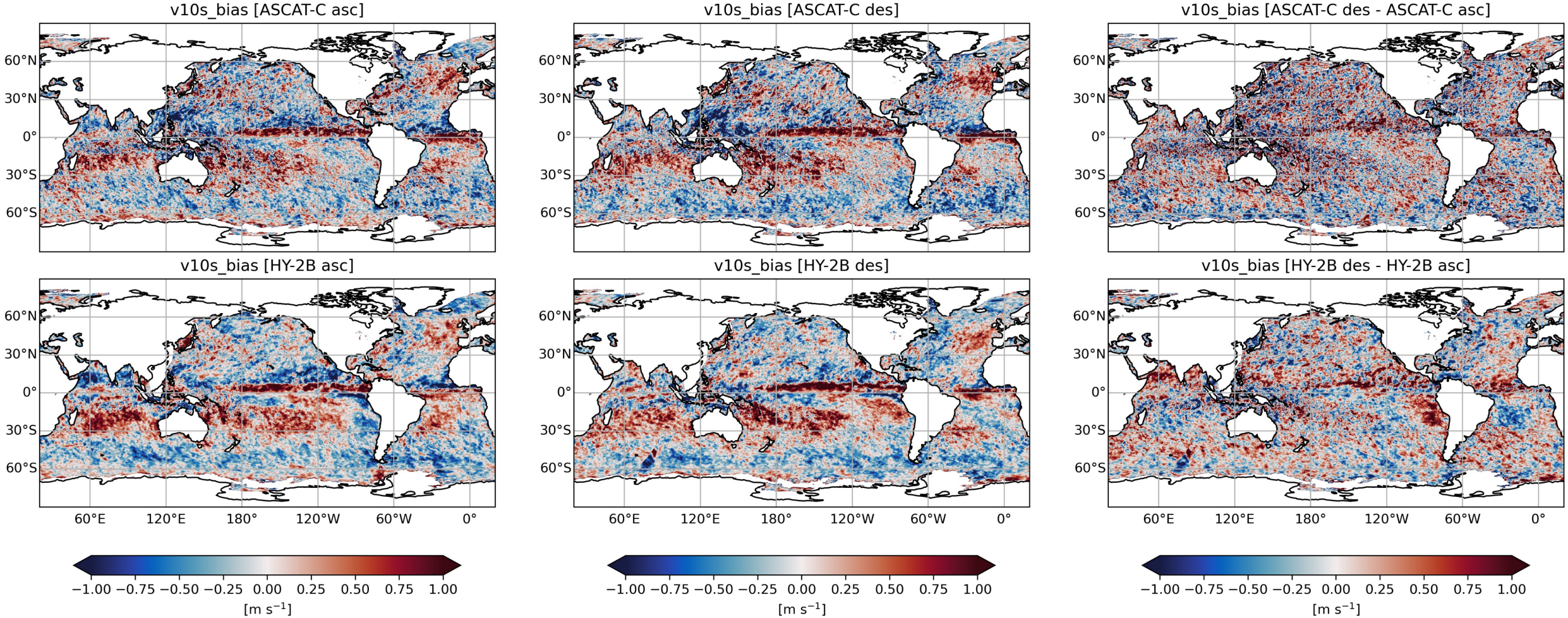


20-day average wind bias (scat – ECMWF OPS) [1-20 Jan 2026]

Effect of the daily cycle

20-day average wind bias
(scat – ECMWF OPS)
[1-20 Jan 2026]

- Locally, bias differences between ascending and descending passes are as large as the biases themselves



Summary

- Today, bias corrections can be calculated based on observations from various complementary scatterometers
- Overall, bias patterns correspond well between different scatterometer types
- Bias differences between ascending and descending passes are locally substantial
- There is no visible indication that the bias depends on the forecast lead time

Outlook

- Analyse bias differences over a longer period than 20 days
- Analyse bias differences between scatterometers for different averaging windows
- Exploit HY-2C and harmonic analysis to better understand the errors in the modelled daily cycle