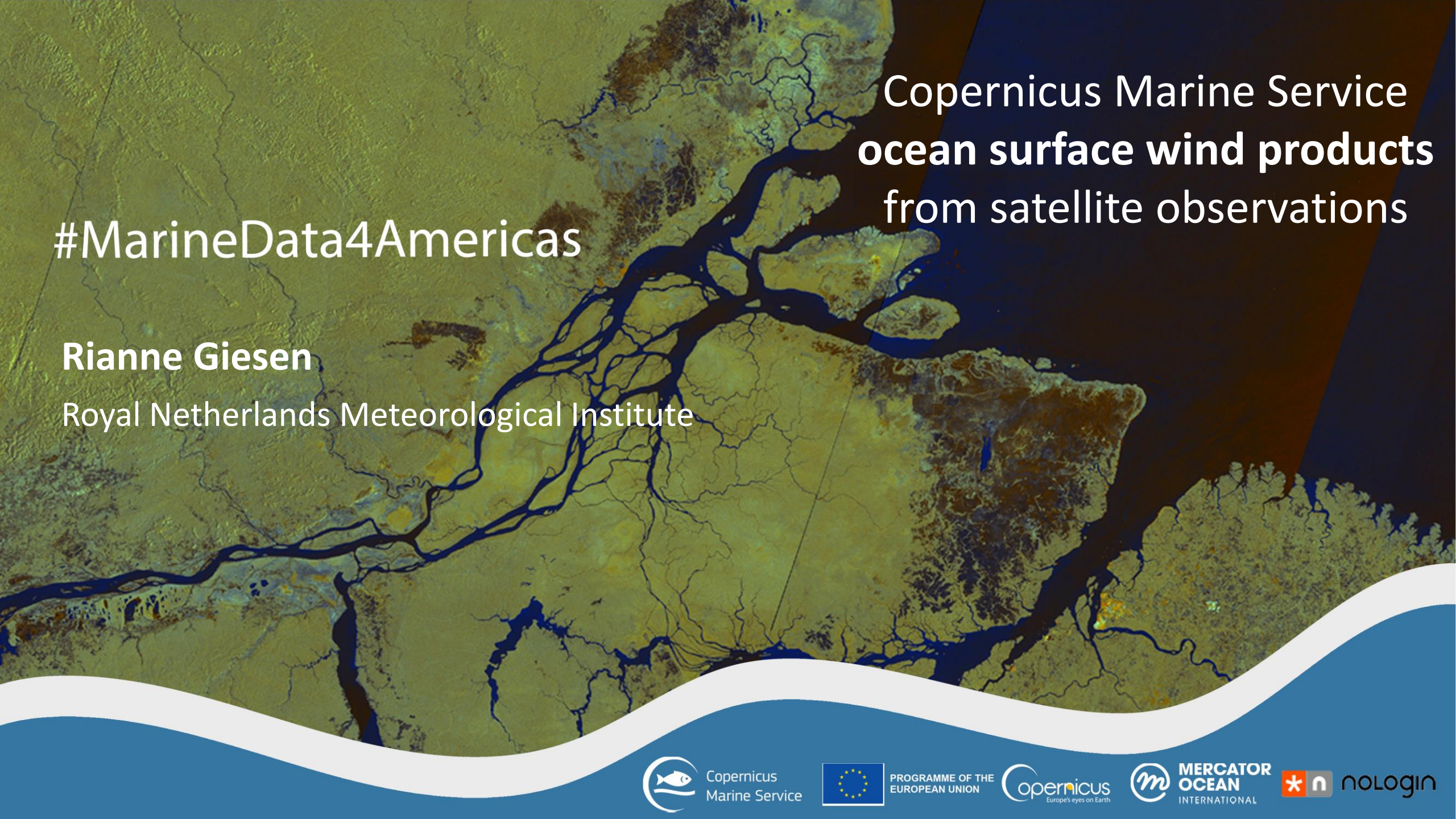

Copernicus Marine Service **ocean surface wind products** from satellite observations

#MarineData4Americas

Rianne Giesen

Royal Netherlands Meteorological Institute

Copernicus Marine Service

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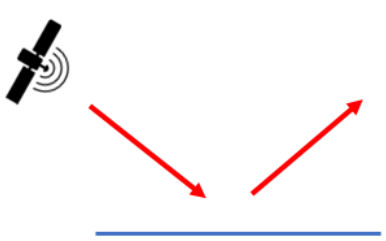
Copernicus Marine Service wind products

Product	Description	Spatial resolution	Temporal coverage	Temporal resolution
L3 NRT	Global Ocean Daily Gridded Sea Surface Winds from Scatterometer	0.125° 0.25° 0.50°	01/01/2016 present	satellite
L3 MY	Global Ocean Daily Gridded Reprocessed Sea Surface Winds from Scatterometer	0.125° 0.25° 0.50°	01/08/1991 -4 months	satellite
L4 NRT	Global Ocean Hourly Sea Surface Wind and Stress from Scatterometer and Model	0.125°	-2 years -1 day	hourly
L4 MY	Global Ocean Hourly Reprocessed Sea Surface Wind and Stress from Scatterometer and Model	0.125° 0.25°	01/08/1999 -4 months	hourly
L4 MY CLIMATE	Global Ocean Monthly Mean Sea Surface Wind and Stress from Scatterometer and Model	0.25°	Aug 1999 -4 months	monthly

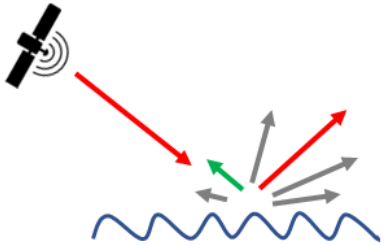
- L3 Level-3
- L4 Level-4
- NRT near real-time
- MY multi-year

Ocean surface wind observations from scatterometers

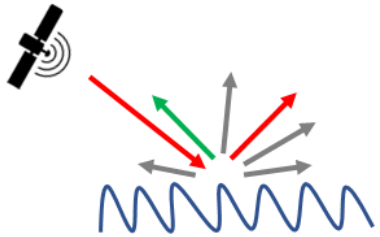
Ocean surface radar scattering and reflection



No wind
Ocean Surface is flat so the satellite signal reflected in a single direction



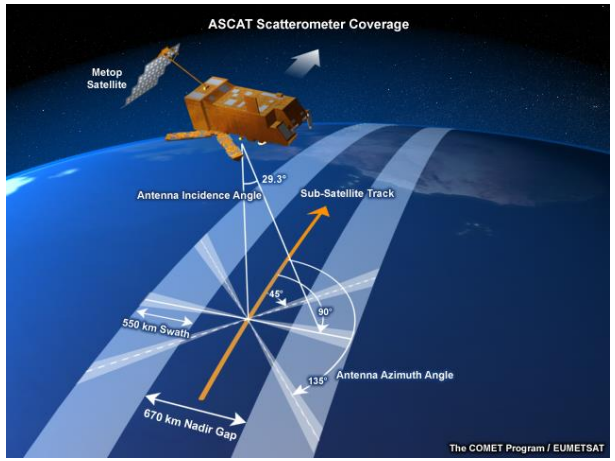
Moderate wind
A bit of roughness on the ocean Surface, some backscatter goes back to the satellite



Intense wind
Ocean Surface is very rough, thus more backscatter reaches the satellite

C-band	**Ku-band**
• 5.3 GHz • 5 cm • Insensitive to rain • Limitations at extreme wind speeds	• 13.4 GHz • 2 cm • Sensitive to rain • Less limitations at extreme wind speeds

Fan-beam scatterometer



Pencil-beam scatterometer

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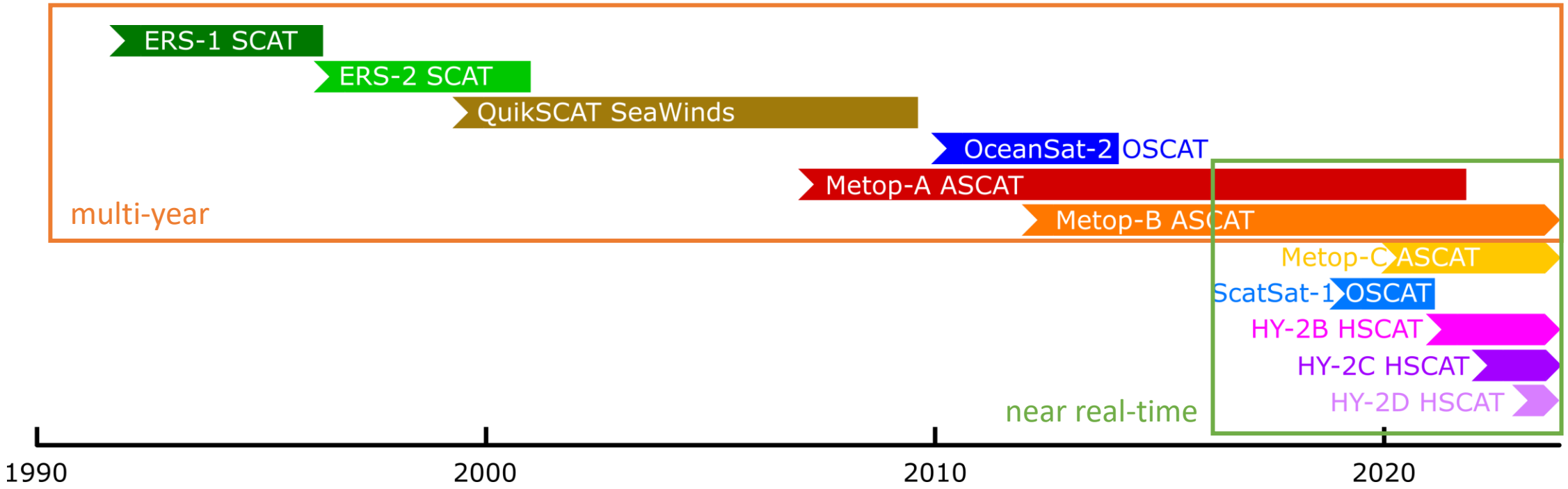
Scatterometer missions

C-band	Ku-band
• ERS-1 SCAT • ERS-2 SCAT • Metop-A ASCAT • Metop-B ASCAT • Metop-C ASCAT	• QuikSCAT SeaWinds • OceanSat-2 OSCAT • ScatSat-1 OSCAT • HY-2B HSCAT • HY-2C HSCAT • HY-2D HSCAT



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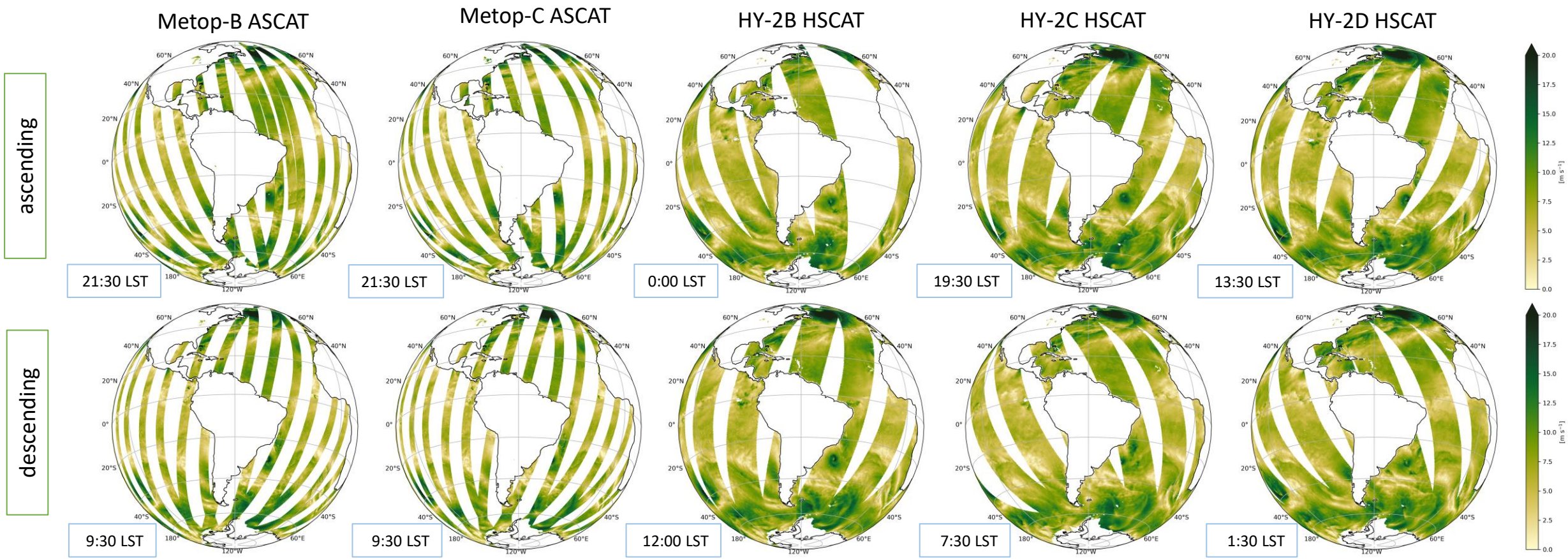
Copernicus Marine Service L3 products - coverage

- Files with orbits aggregated over one day
- Example: NRT scatterometer coverage on 19 February 2024 (wind speed)

Tropical storm Akará



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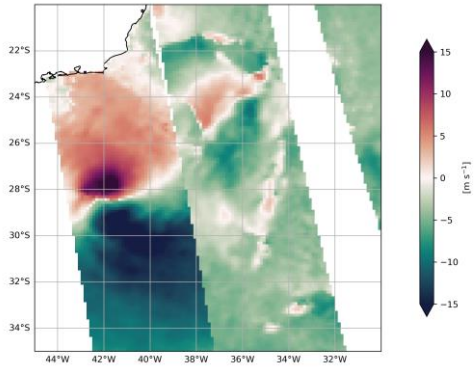
Copernicus Marine Service L3 products - variables

WIND_GLO_PHY_L3_NRT_012_002
WIND_GLO_PHY_L3_MY_012_005

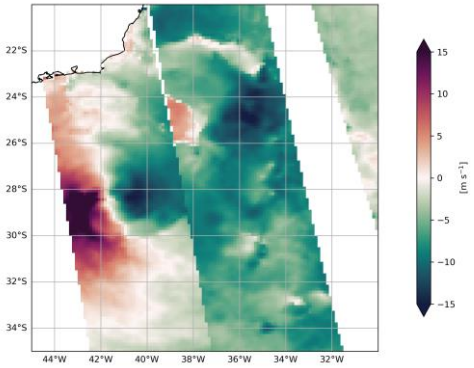
Metop-B ASCAT ascending for 19 February 2024

Ocean surface wind

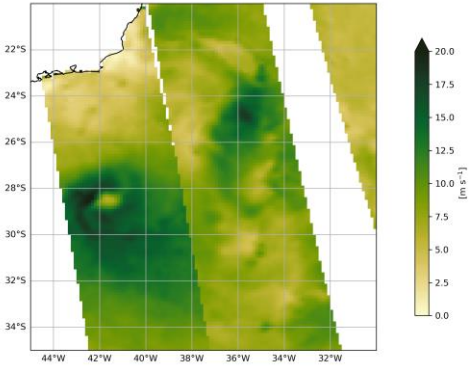
Zonal component



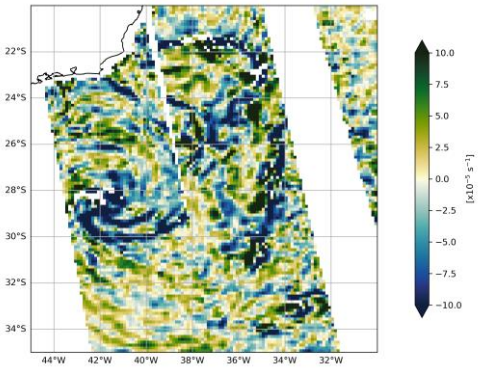
Meridional component



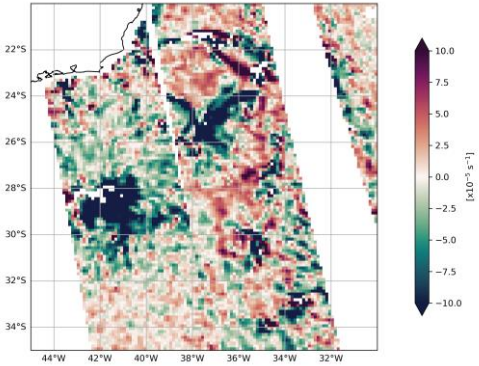
Magnitude (wind speed)



Divergence

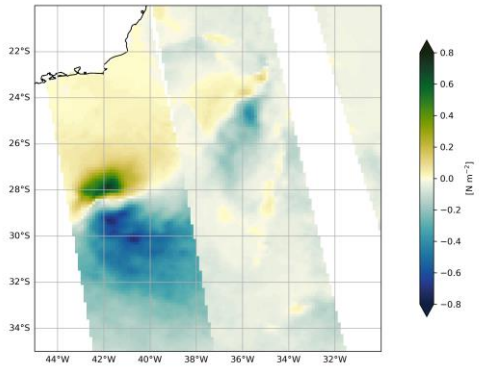


Rotation (curl)

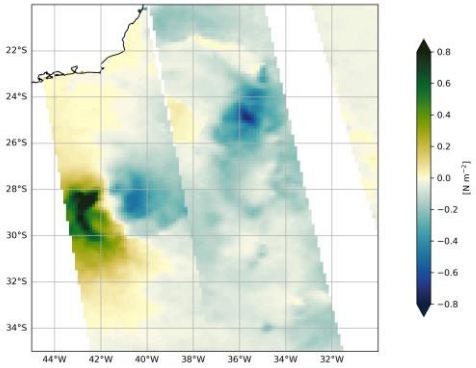


Ocean surface wind stress

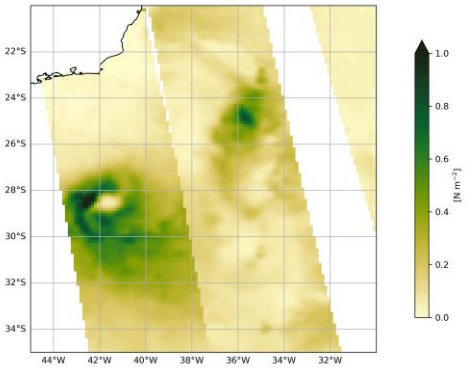
Zonal component



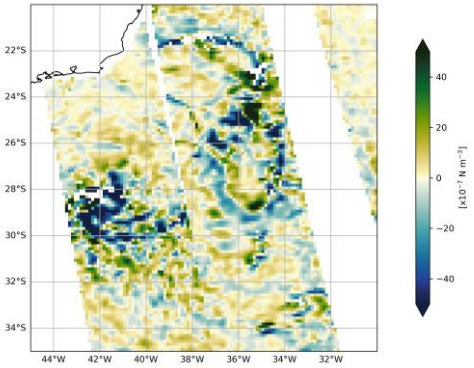
Meridional component



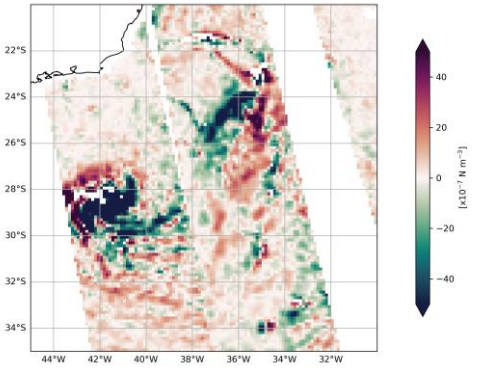
Magnitude



Divergence



Rotation (curl)



In addition to these variables from scatterometer observations, the products contain collocated ECMWF model wind and stress variables

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Scatterometer-model biases

- Persistent biases between scatterometer observations and ECMWF NWP model winds
- Lack of small-scale variability in ECMWF model winds

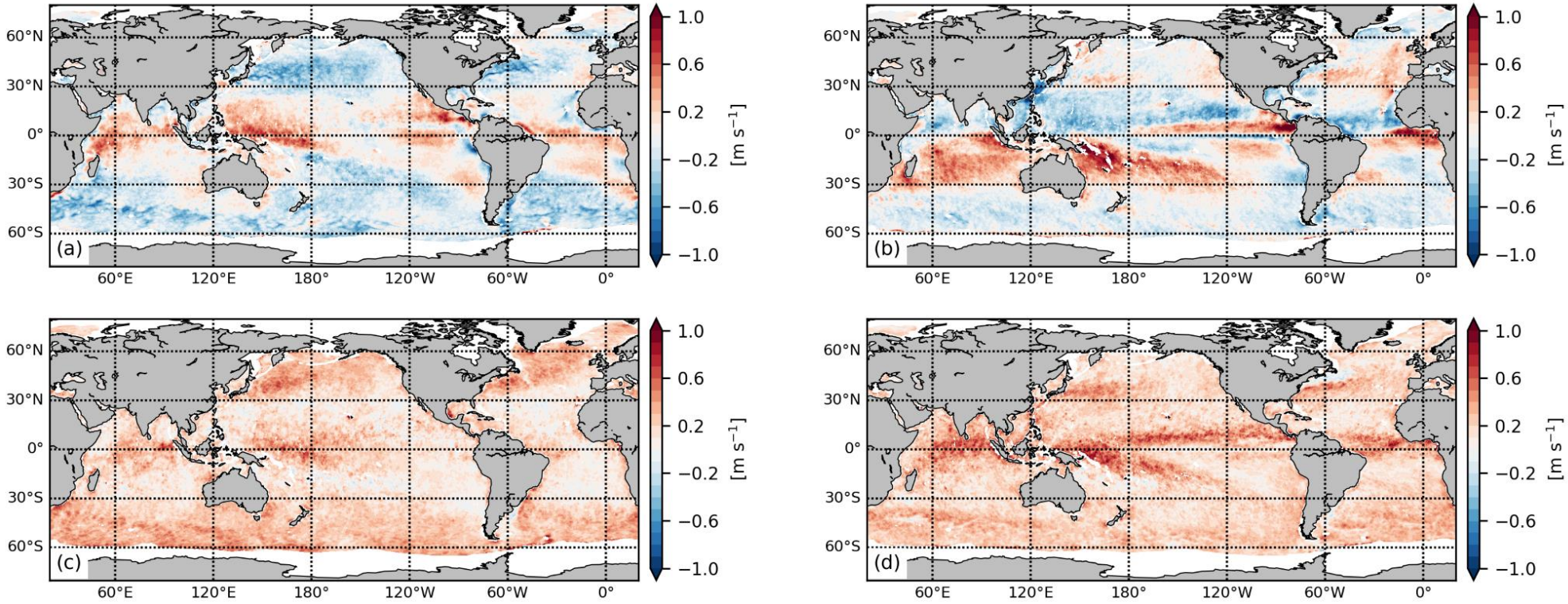
Metop-A ASCAT – ECMWF ERA5 [2019]

Zonal wind bias

Meridional wind bias

Mean wind

Transient wind



Belmonte Rivas, M. and A. Stoffelen (2019): *Characterizing ERA-Interim and ERA5 surface wind biases using ASCAT*, Ocean Sci., 15, 831–852, doi: 10.5194/os-15-831-2019.

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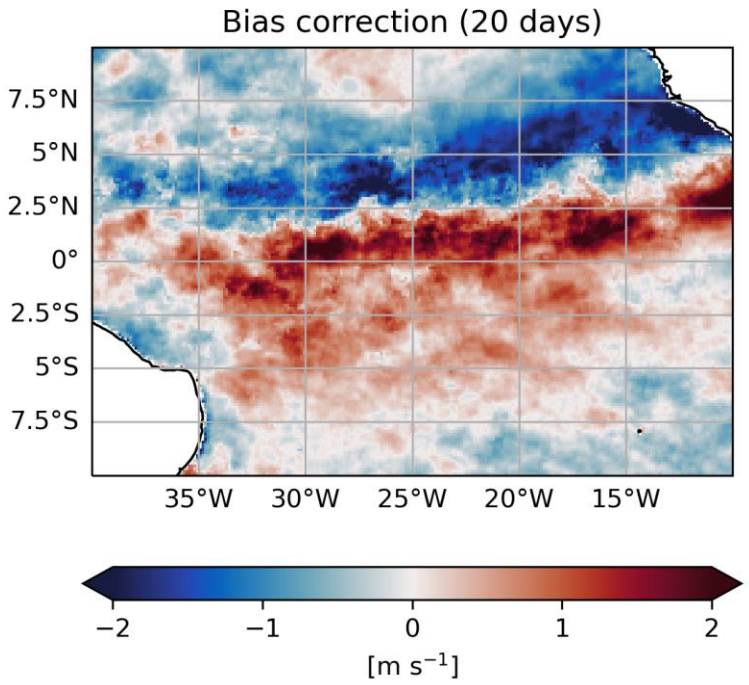
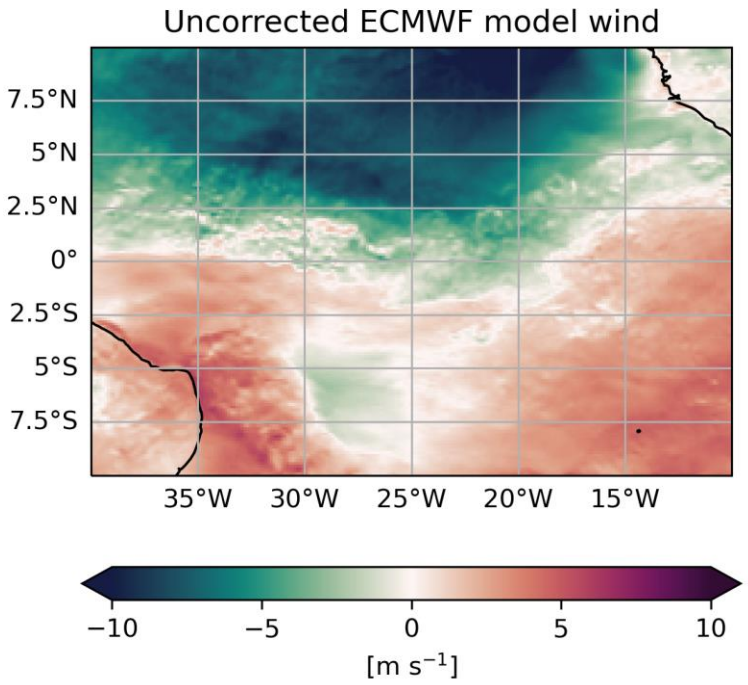
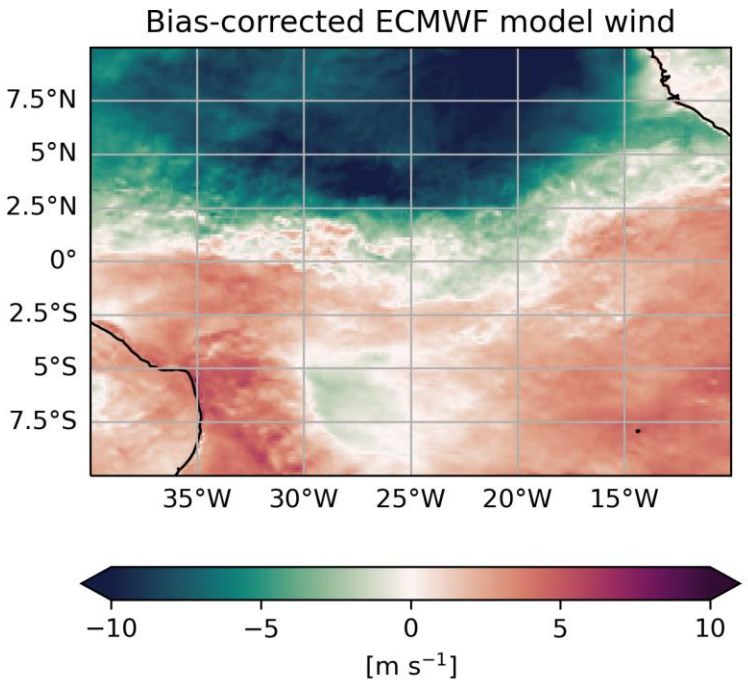
Bias correction method

- Calculate average local difference between all scatterometer observations and collocated ECMWF NWP model winds over a 20-day period
- Add this bias correction field to ECMWF model wind and stress fields

Meridional wind







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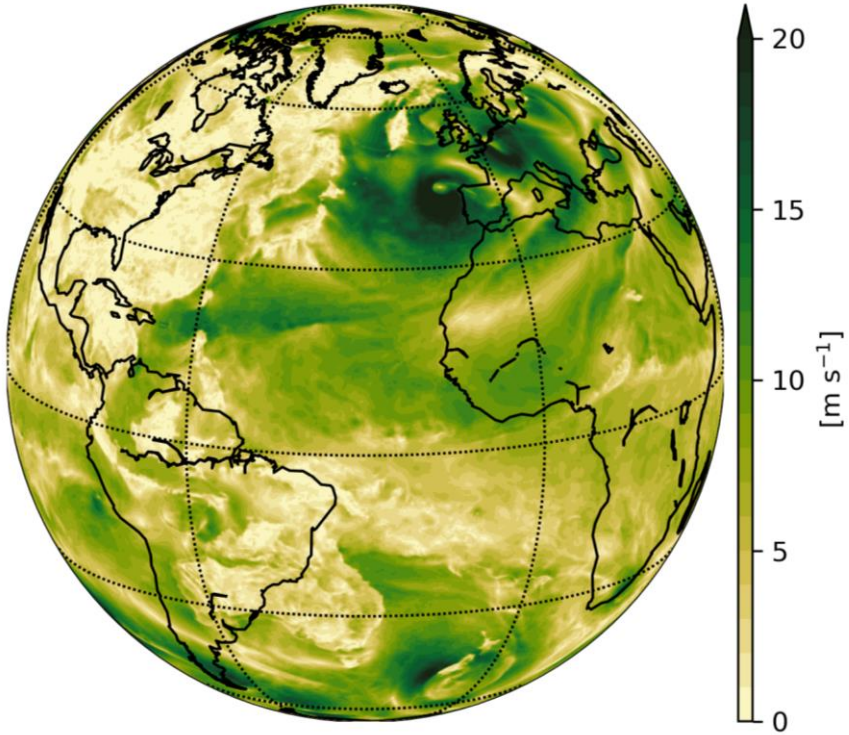
WIND_GLO_PHY_L4_NRT_012_004
WIND_GLO_PHY_L4_MY_012_006

Copernicus Marine Service hourly L4 products

- Hourly bias-corrected ECMWF model wind variables
- NRT product:
  - ECMWF operational wind fields
  - 0.125° horizontal grid
    - Metop-B+C (-2 years until -1 day)
- MY product:
  - ECMWF ERA5 reanalysis wind fields
  - 0.125° horizontal grid dataset:
    - Metop-A ASCAT (2007-2011)
    - Metop-A+B ASCAT (2011-2021)
    - Metop-B+C (2021- -4 months)
  - 0.25° horizontal grid dataset:
    - QuikSCAT Seawinds (1999-2009)
    - ERS-1 (1991-1996) and ERS-2 SCAT (1996-1999) will be added in 2024

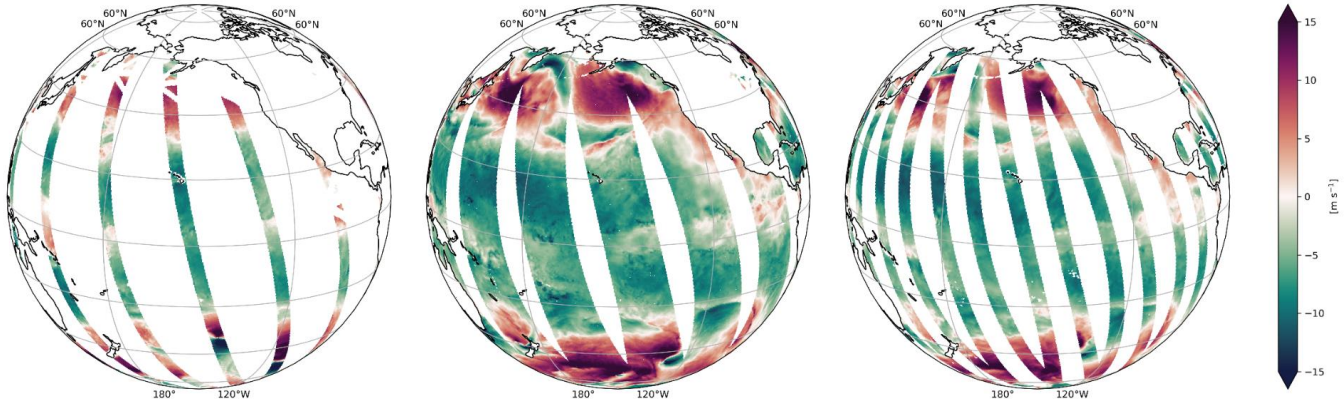


L4 MY hourly product – changes in scatterometer coverage

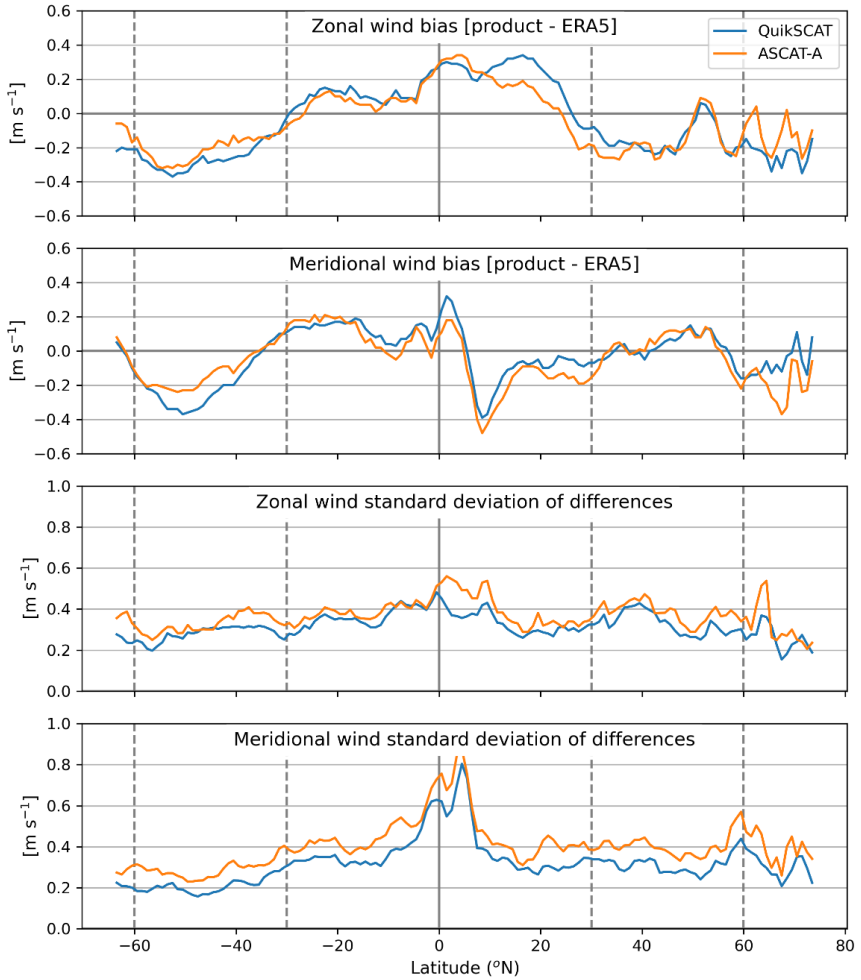
- Daily spatial coverage varies largely between ERS, QuikSCAT and Metop scatterometer instruments
- ERS requires longer averaging window length (90 days) and special treatment of data gaps

Zonal wind

ERS-2 | QuikSCAT | Metop-A



Wind bias and standard deviation for QuikSCAT and Metop-A for January 2008



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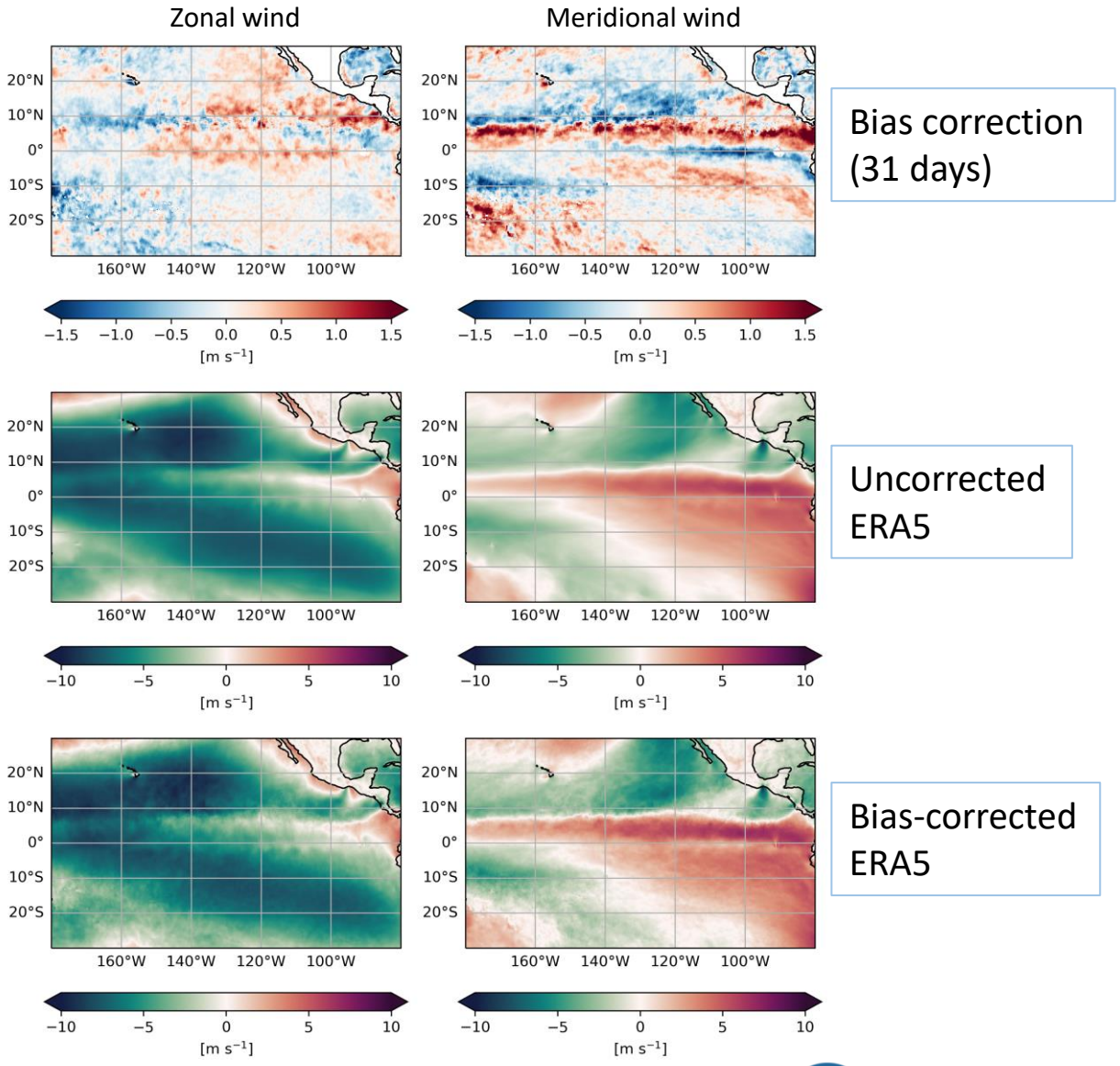
WIND_GLO_PHY_CLIMATE_L4_MY_012_003

Copernicus Marine Service monthly L4 product

December 2020



- Monthly bias-corrected ERA5 reanalysis wind fields
- 0.25° horizontal grid dataset:
  - Metop-B+C (2021- -4 months)
  - Metop-A+B ASCAT (2011-2021)
  - Metop-A ASCAT (2007-2011)
  - QuikSCAT Seawinds (1999-2007)
  - ERS-1 (1991-1996) and ERS-2 SCAT (1996-1999) will be added in 2024
- Scalar-averaged monthly wind speed will be added as a variable in 2024

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