Sentinel-3 & Jason-3 NRT Wind & Wave Data: Assessment & Assimilation

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Disclaimer

Part of the work presented hereafter is carried out with funding by the European Union. The views expressed herein can in no way be taken to reflect the official opinion of either the European Union or the European Space Agency.

Introduction

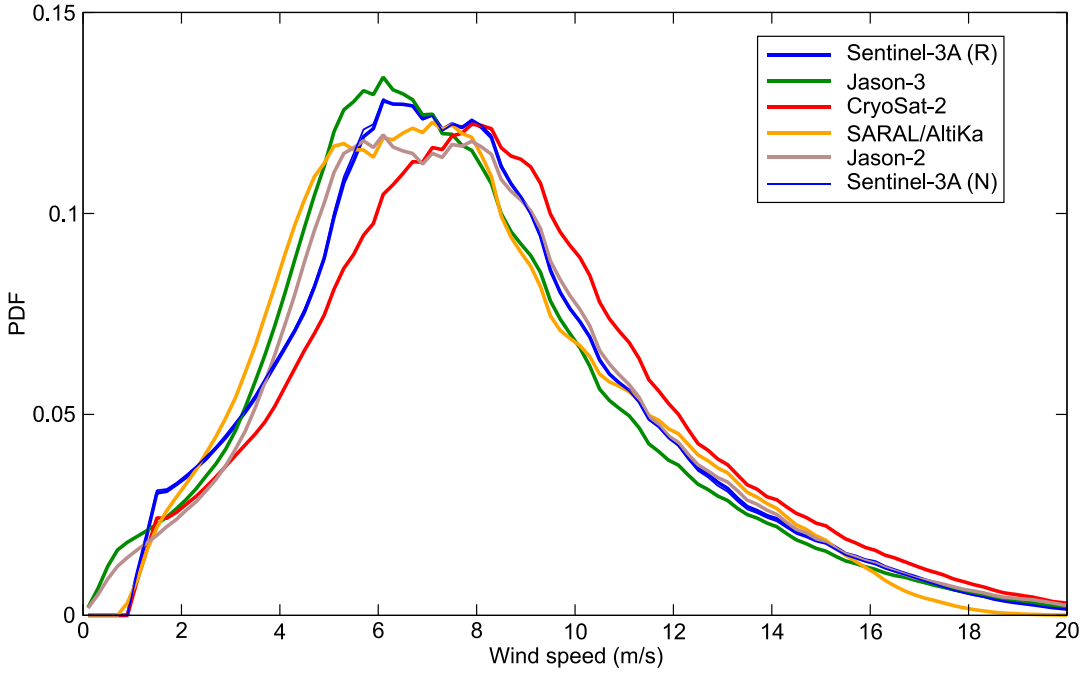
- Sentinel-3A radar altimeter (SRAL) near real time (NRT) Level 2 STM Marine Product (SR_2_WAT) which is routinely obtained from EUMETSAT Copernicus Online Data Access (CODA).
- Jason-3 NRT OGDR wind & wave data are received through GTS.
- Parameters monitored:
  - Backscatter
  - Wind speed
  - Significant wave height (SWH)
- Only 1-Hz data are considered.
- Validation against ECMWF model, other altimeters and in-situ measurements.
- Results reflect the quality of the current Sentinel-3A & Jason-3 NRT products.
- Timeliness Cumulative Occurrence
- Preliminary results from S3B are also shown.

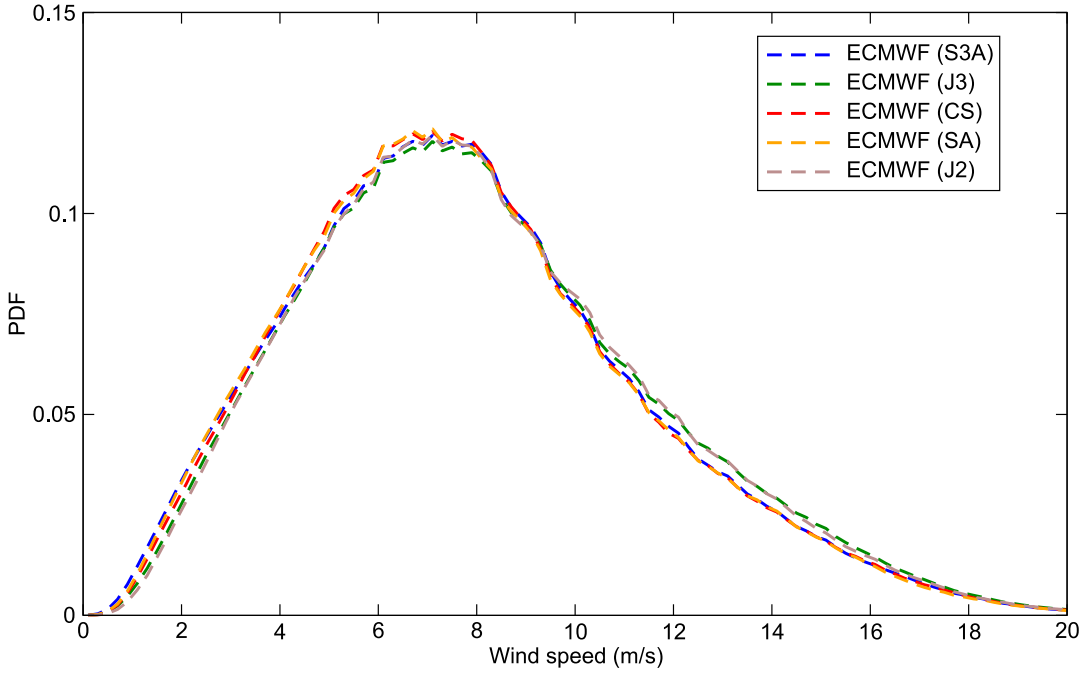
Surface Wind Speed

Sentinel-3A & Jason-3

ECMWF

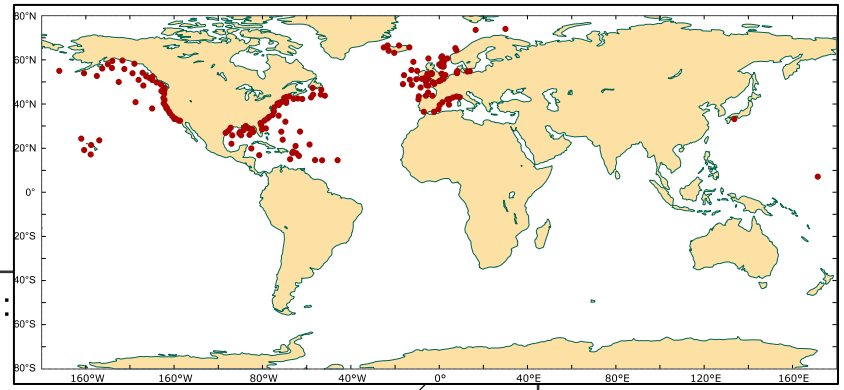
Sentinel-3A & Jason-3 global surface wind speed PDF's (together with other altimeters & model) (13 Dec. 2016 -12 Dec. 2017)

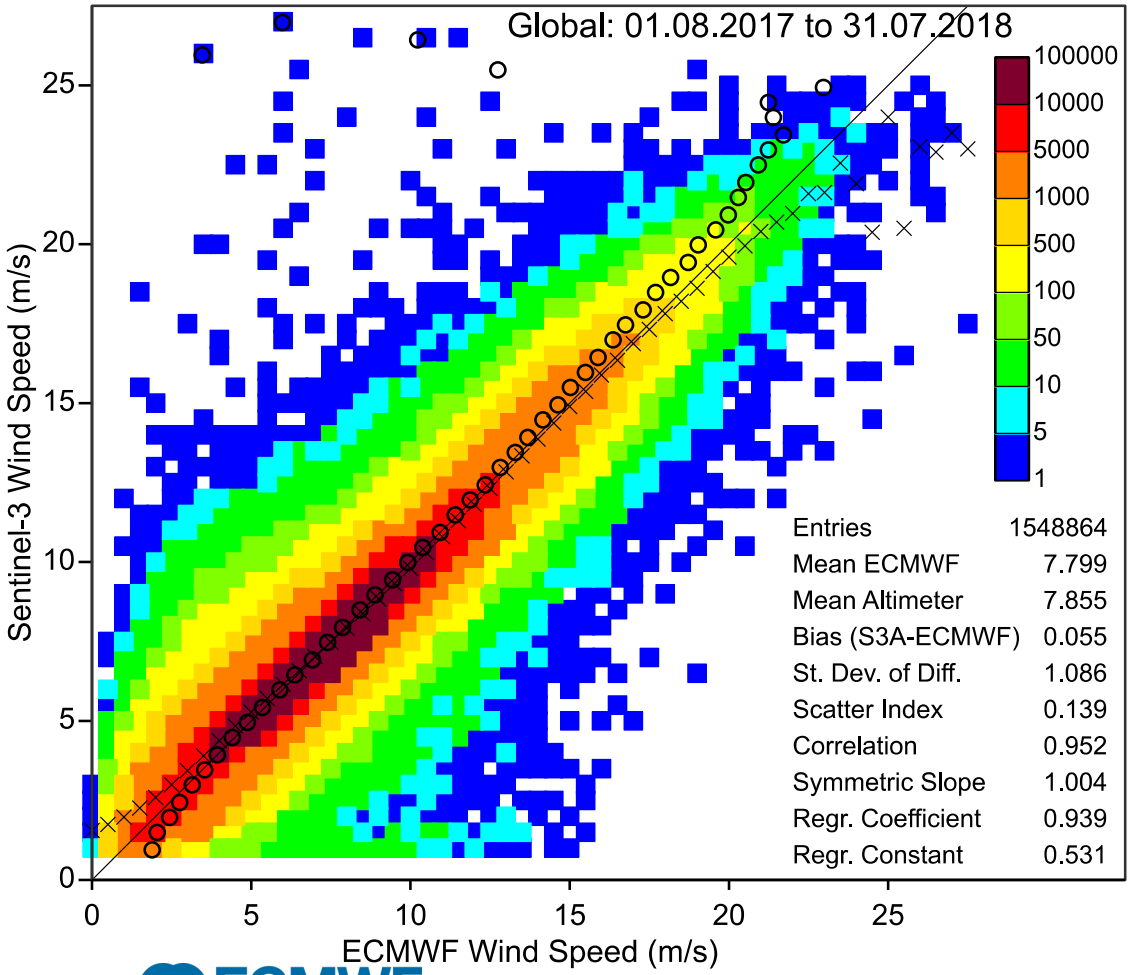


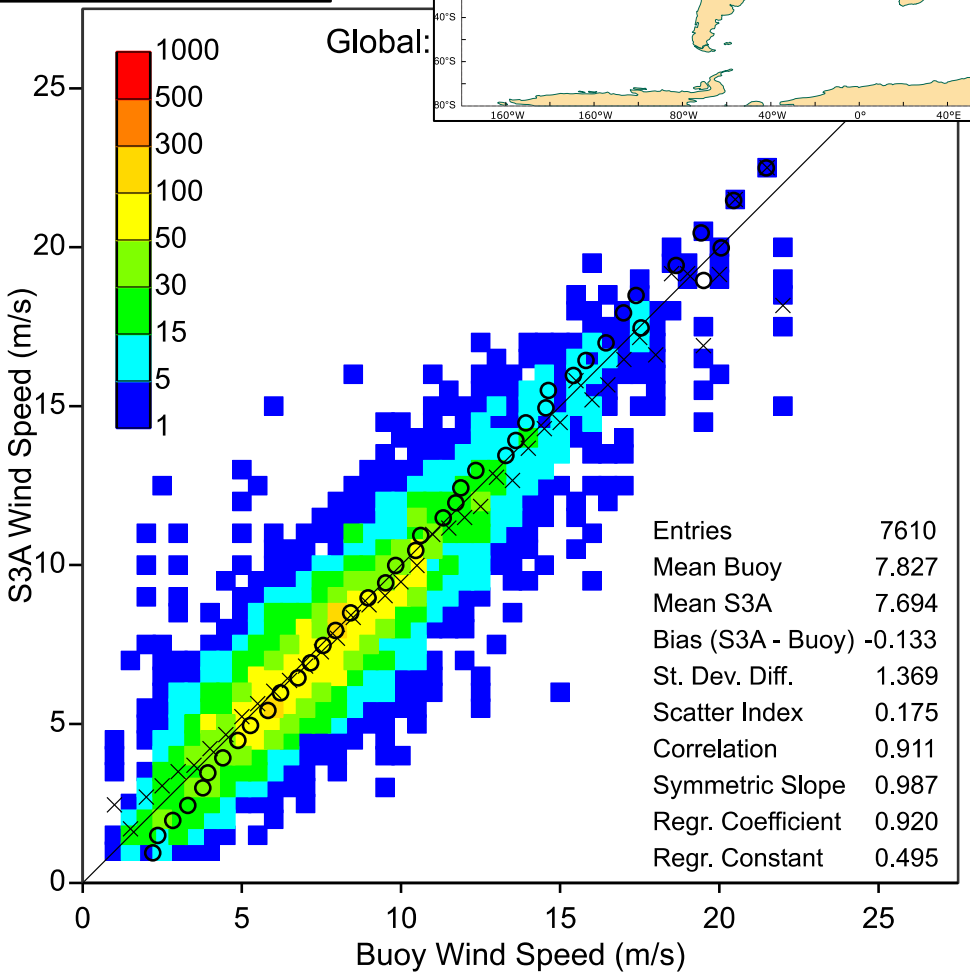


Sentinel-3A SAR wind speed comparison against model & in-situ measurements

1 Aug. 2017 – 31 Jul. 2018

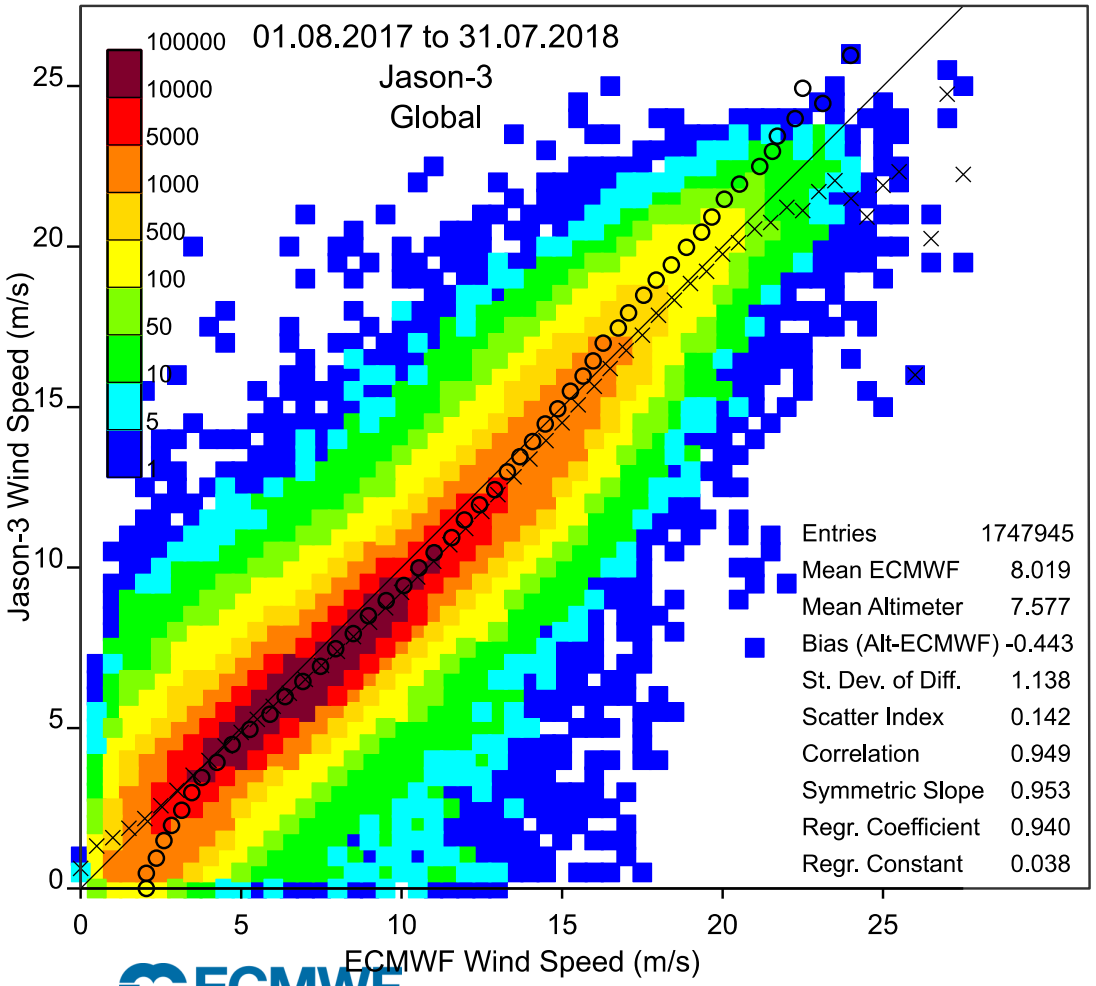


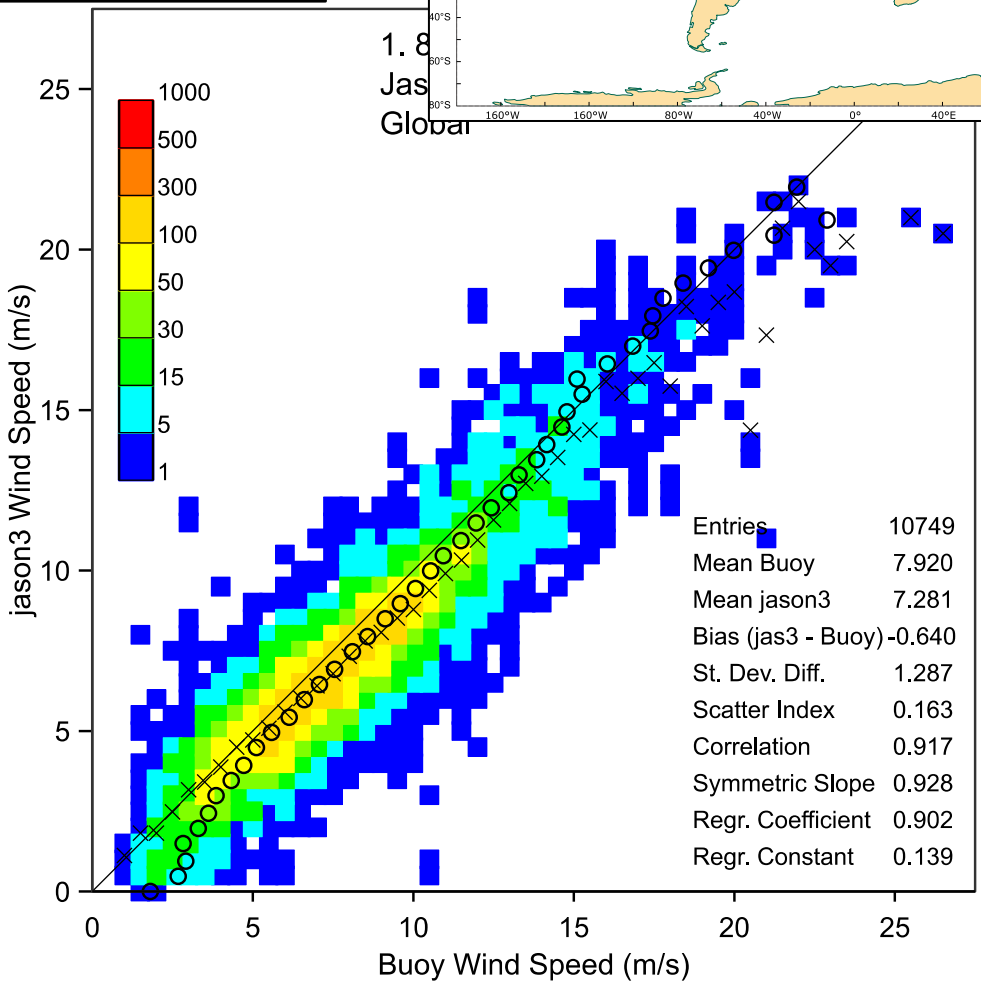


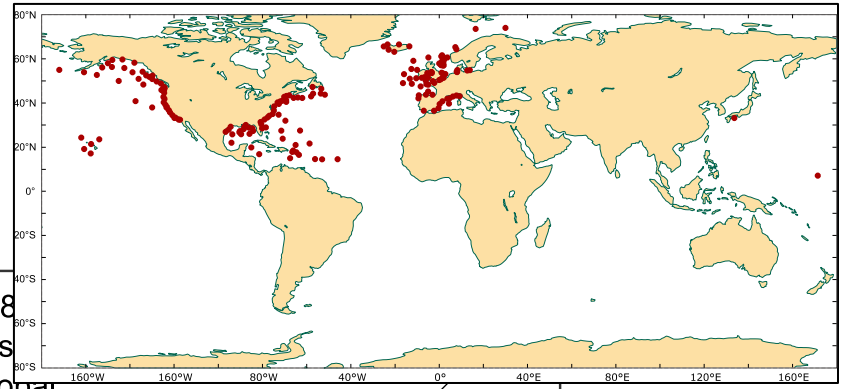


Jason-3 conventional wind speed comparison against model & in-situ measurements

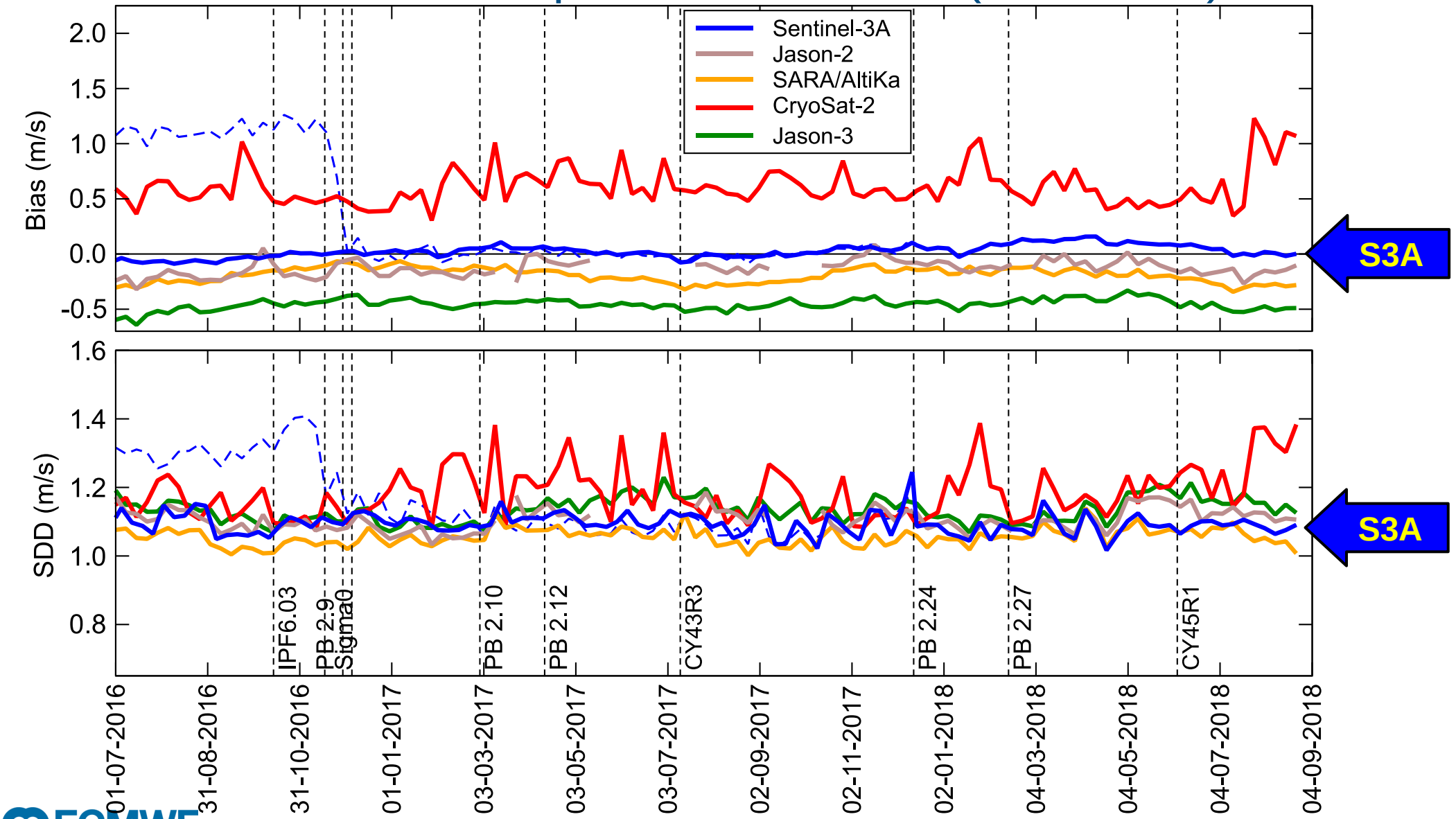
1 Aug. 2017 – 31 Jul. 2018







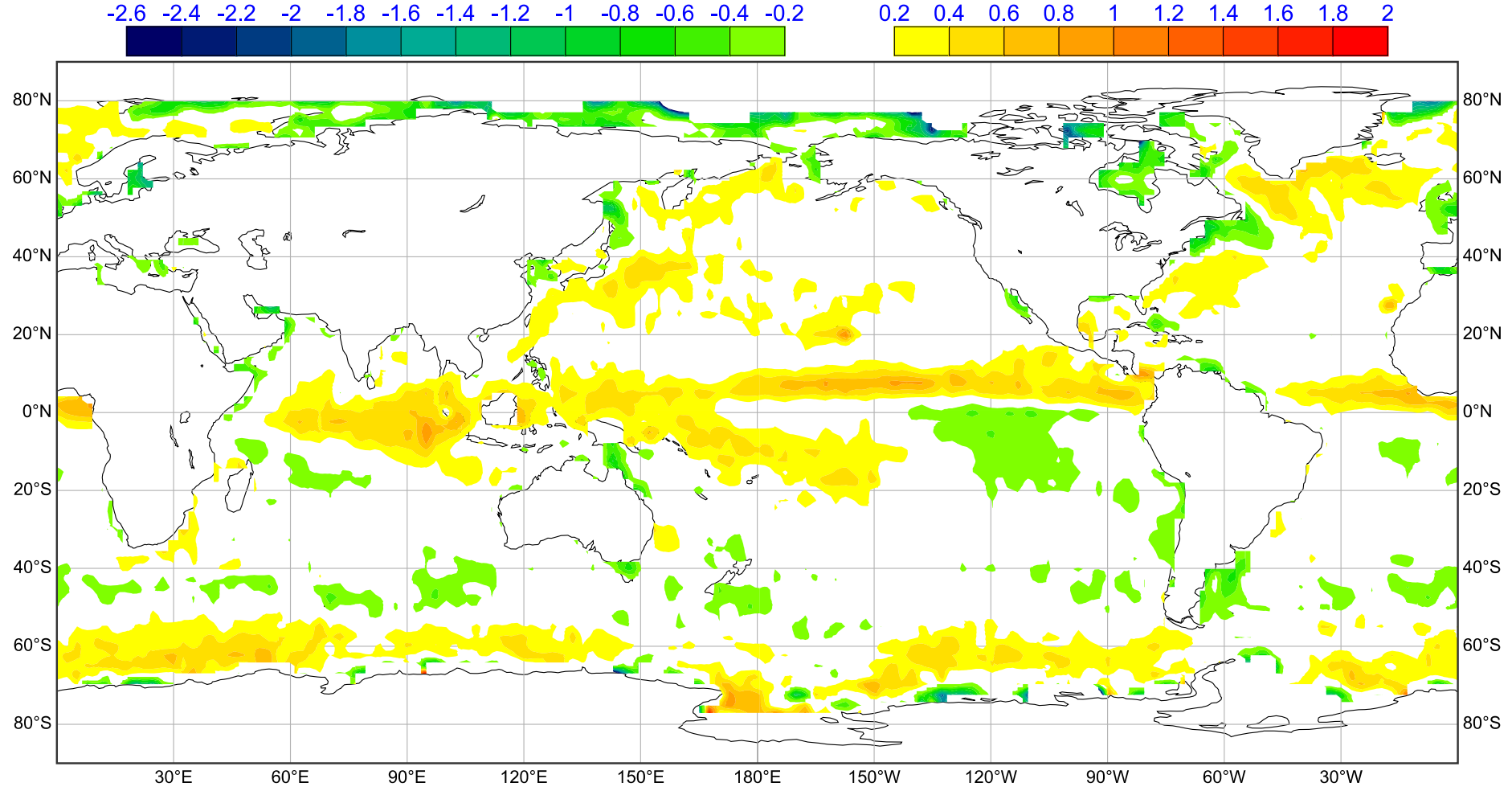
Altimeter surface wind speed bias & SDD (wrt model)



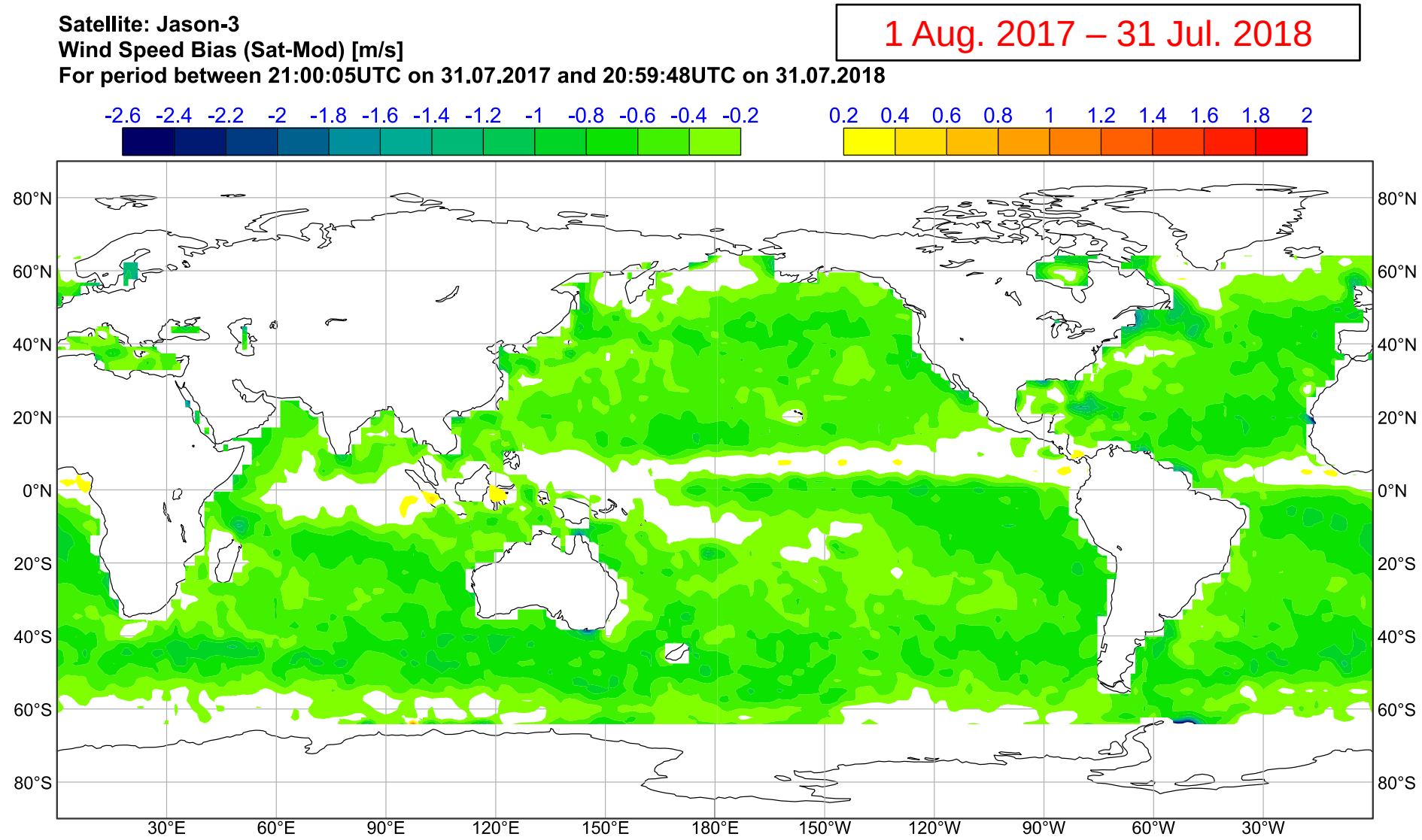
Sentinel-3A SAR wind speed bias (wrt model)

Satellite: Sentinel-3
Wind Speed Bias (Sat-Mod) [m/s]
For period between 21:00:05UTC on 31.07.2017 and 20:56:36UTC on 31.07.2018

1 Aug. 2017 – 31 Jul. 2018



Jason-3 Surface Wind Speed Bias (wrt model)

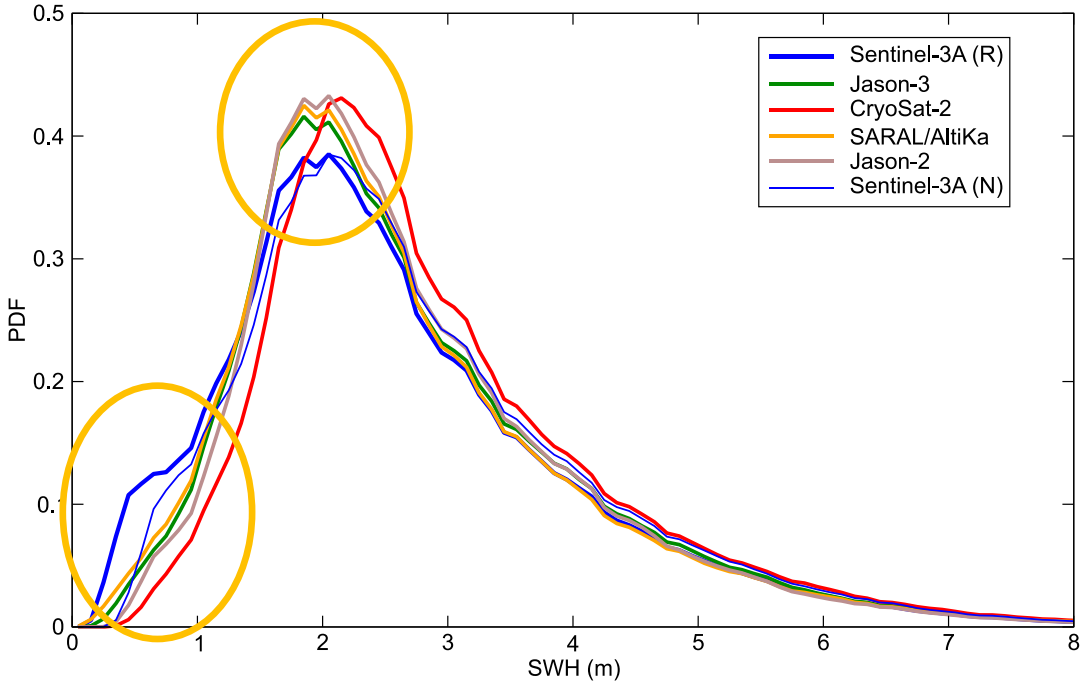


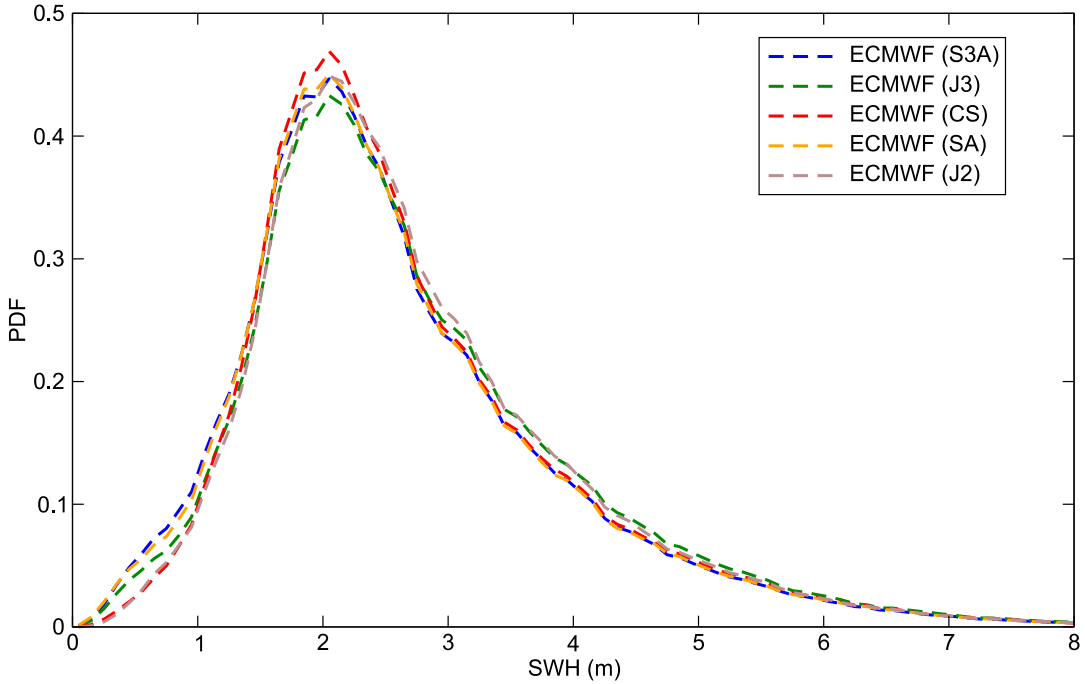
Significant Wave Height (SWH)

Sentinel-3A & Jason-3

ECMWF

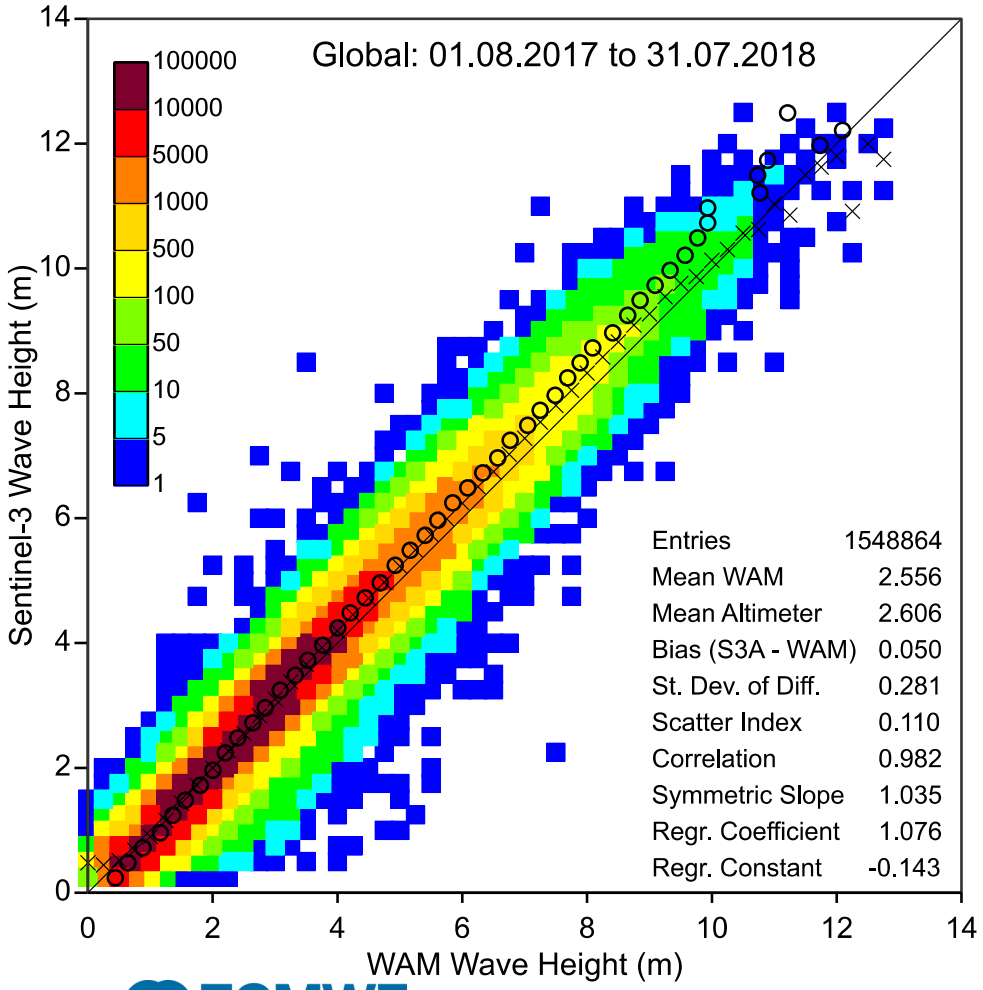
Sentinel-3A & Jason-3 global sig. wave height PDF's (together with other altimeters & model) 13 Dec. 2016 -12 Dec. 2017)

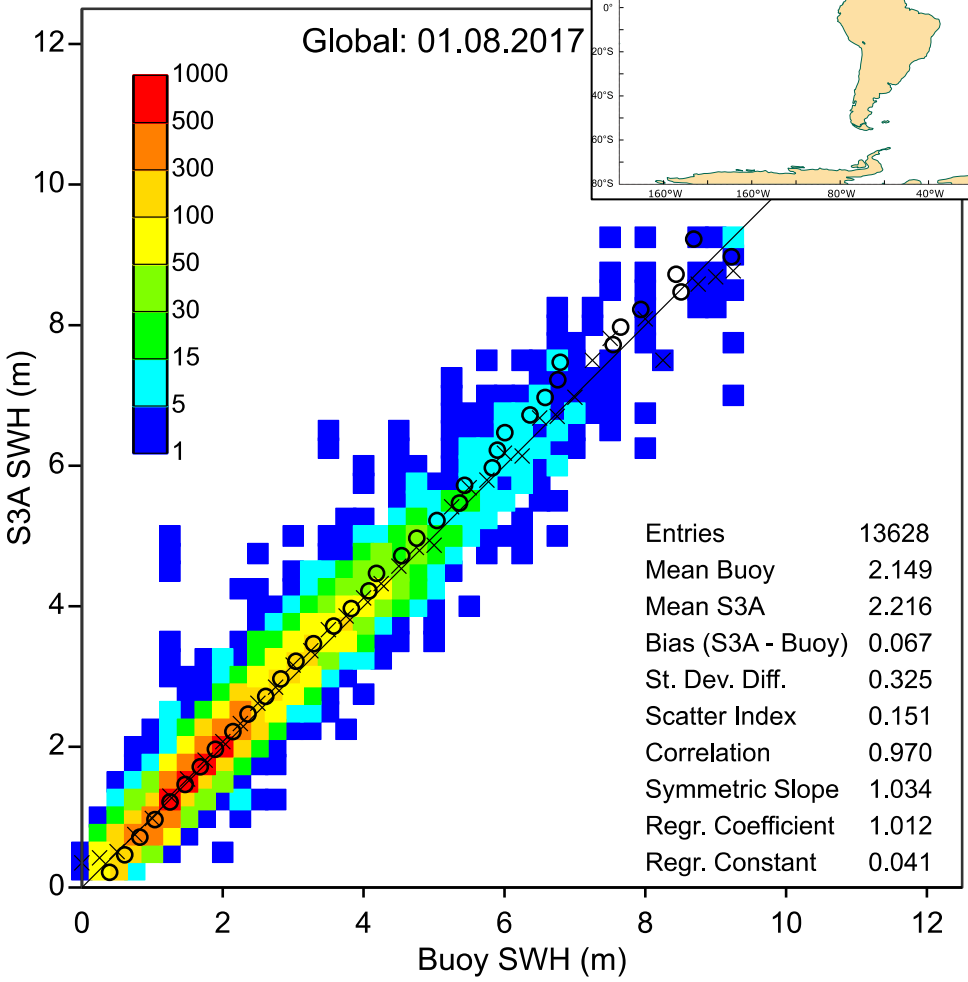


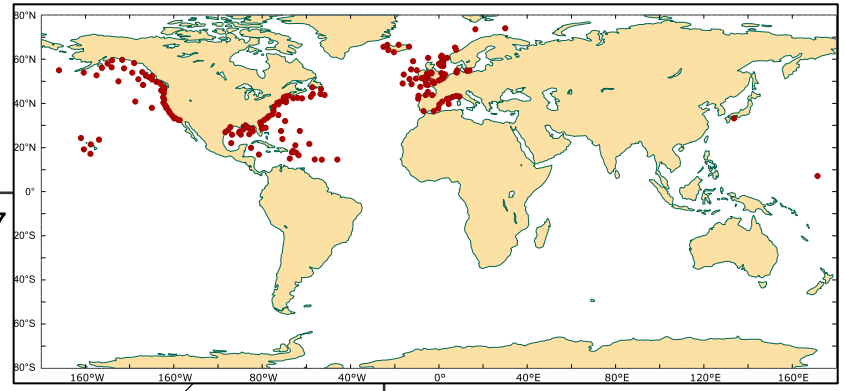


Sentinel-3A SAR SWH comparison against model & in-situ measurements

1 Aug. 2017 – 31 Jul. 2018

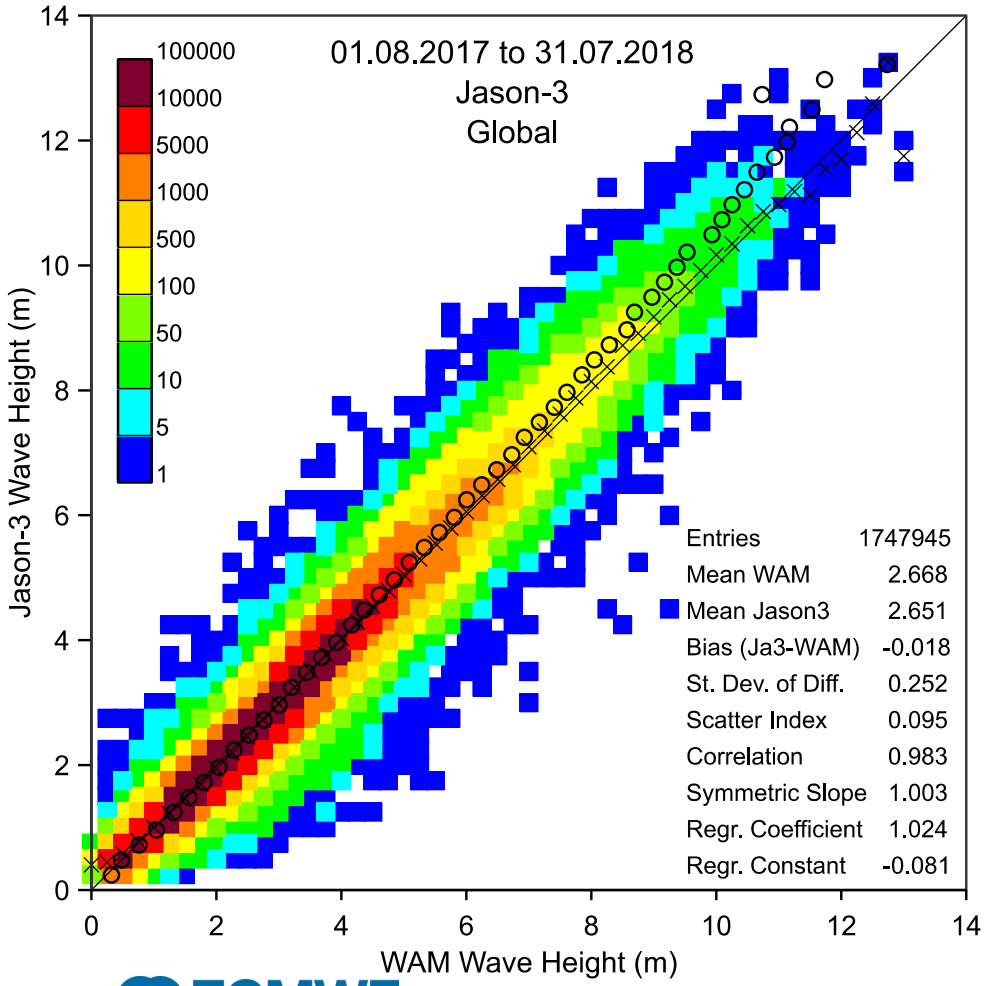


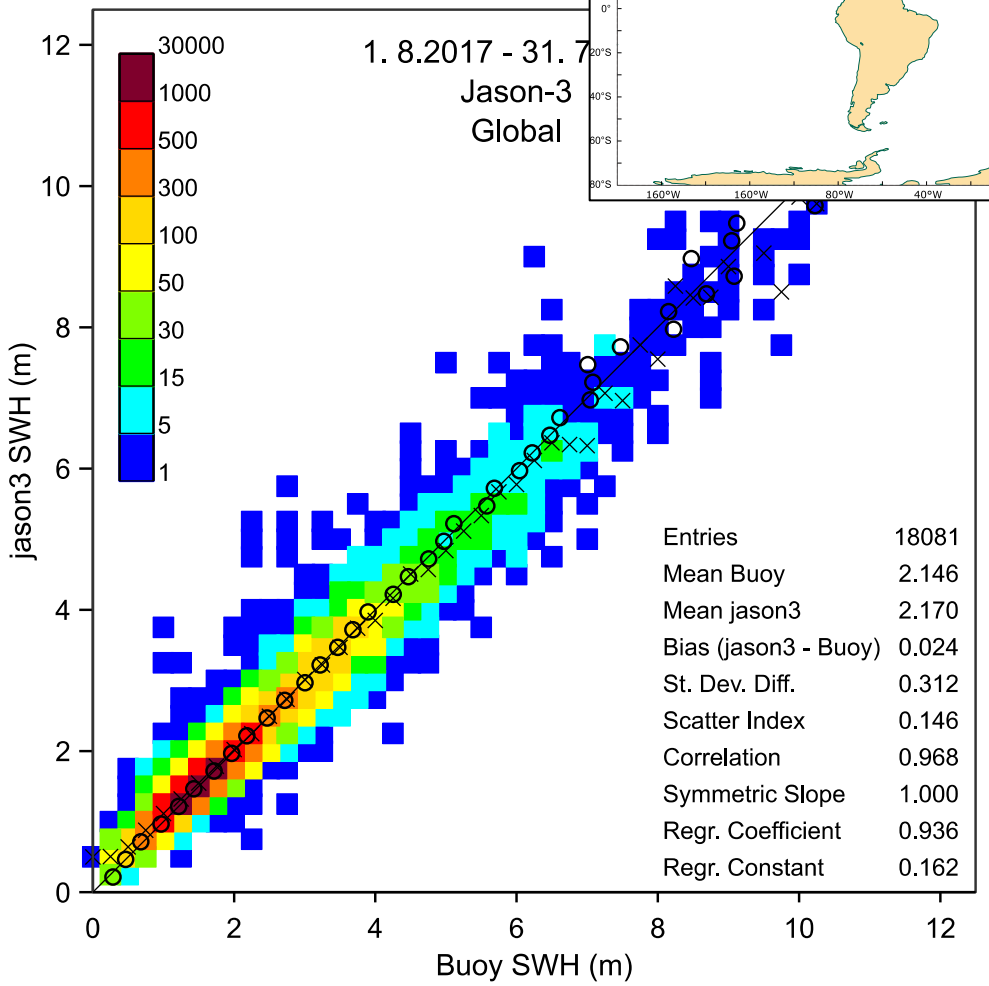


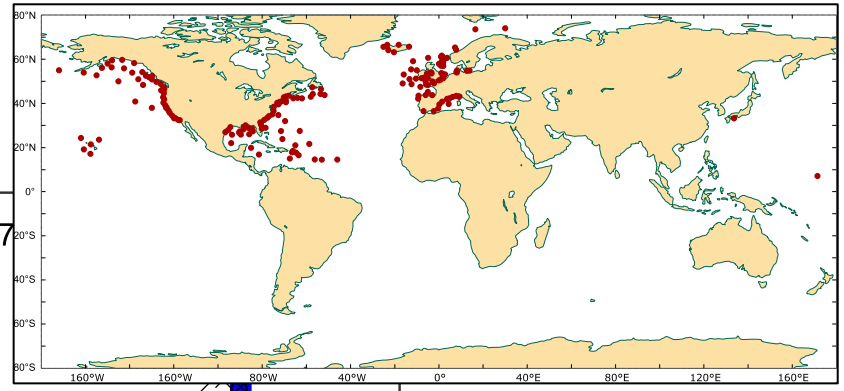


Jason-3 SWH comparison against model & in-situ measurements

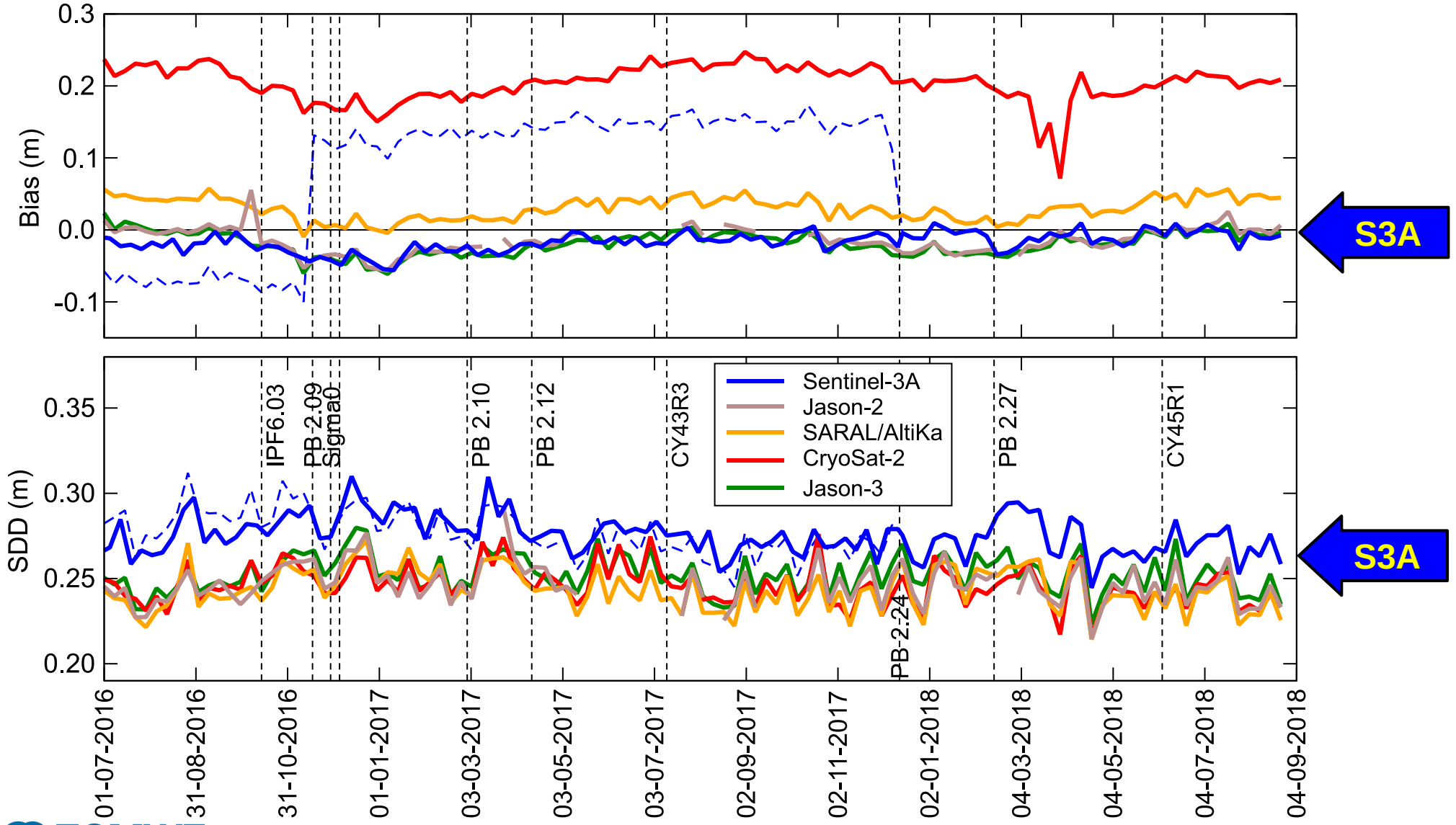
1 Aug. 2017 – 31 Jul. 2018



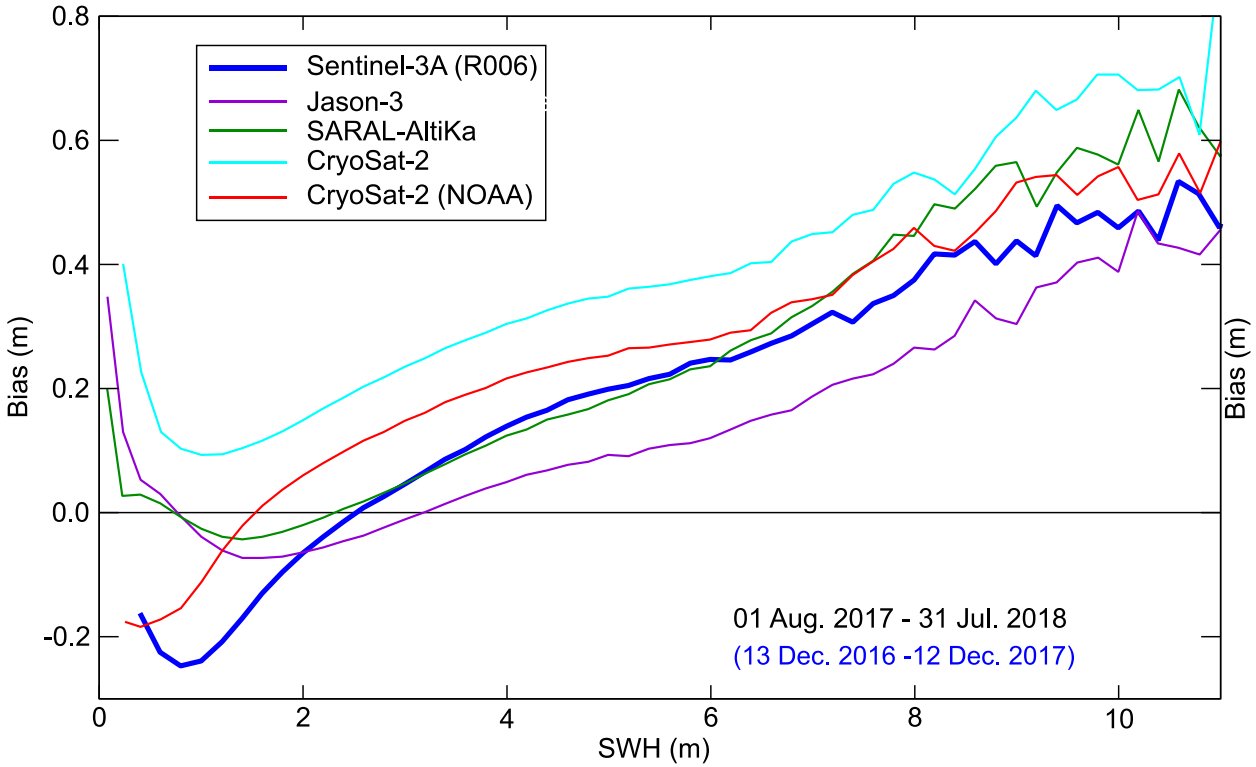


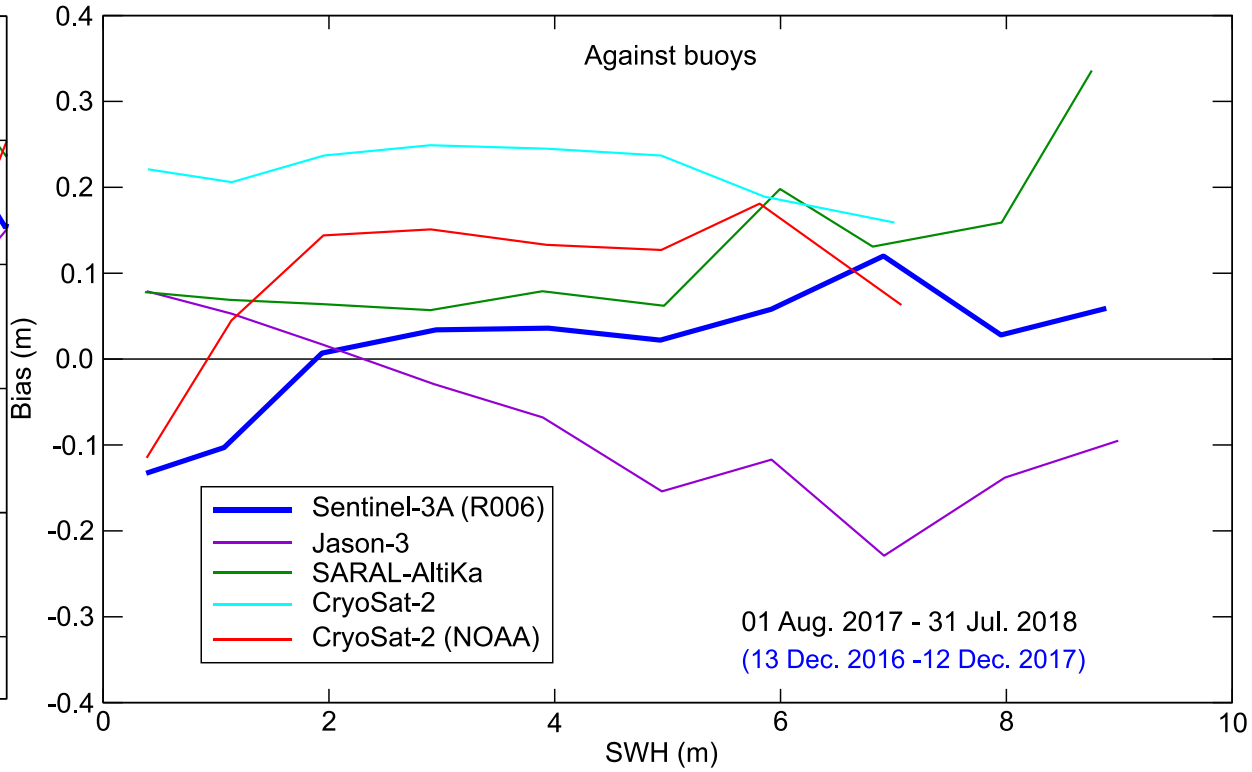


Sentinel-3A SWH bias & SDD (wrt model) – vs other altimeters

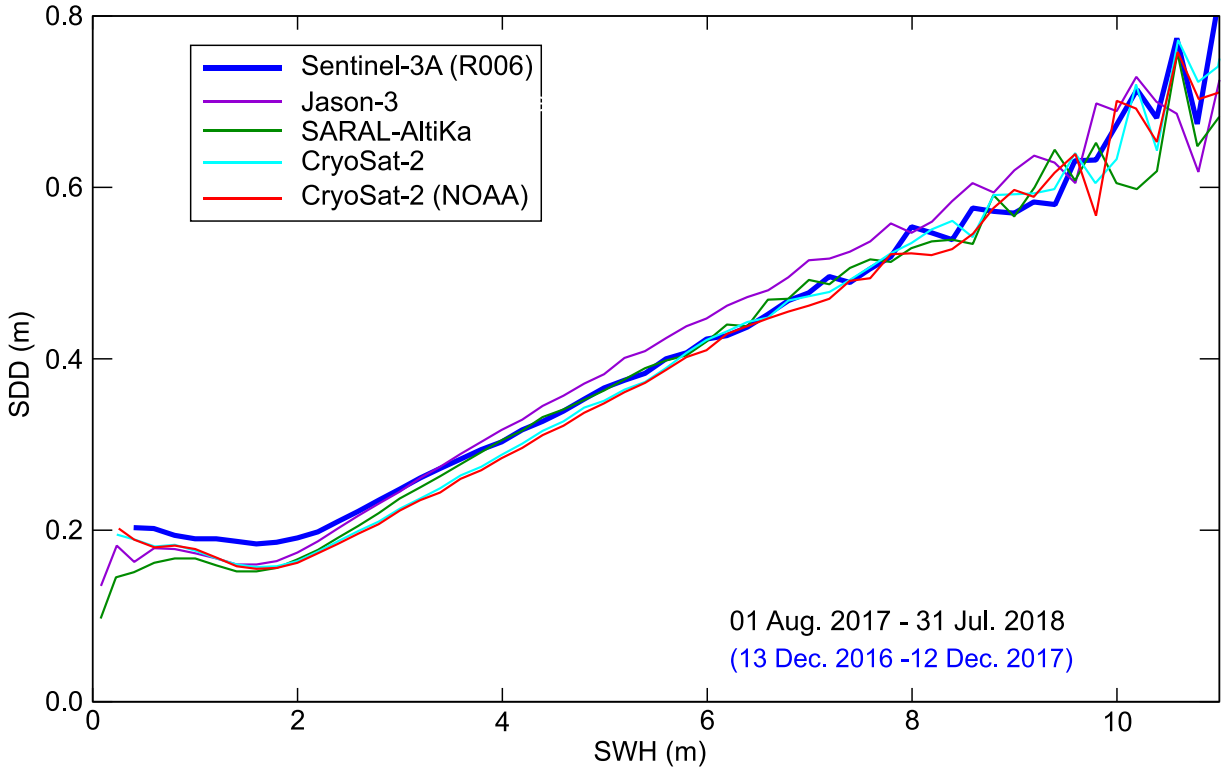


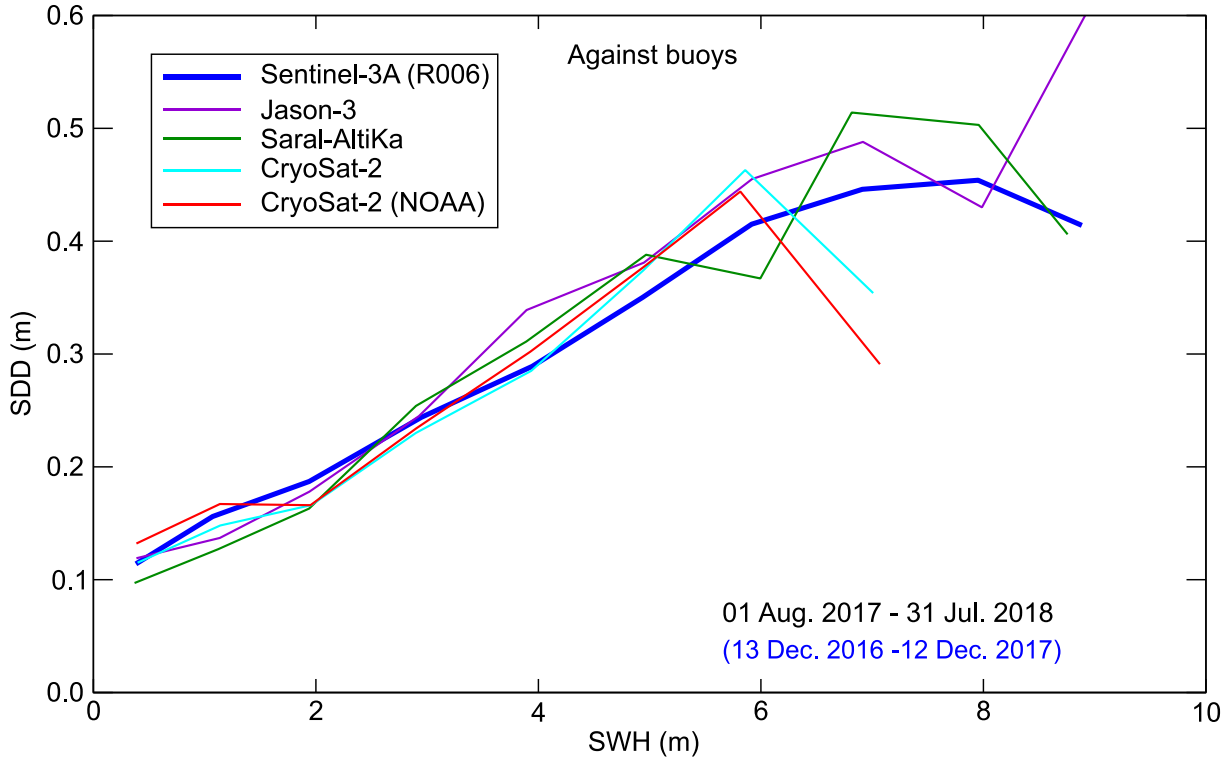
Altimeter SWH Bias (wrt model & buoys)





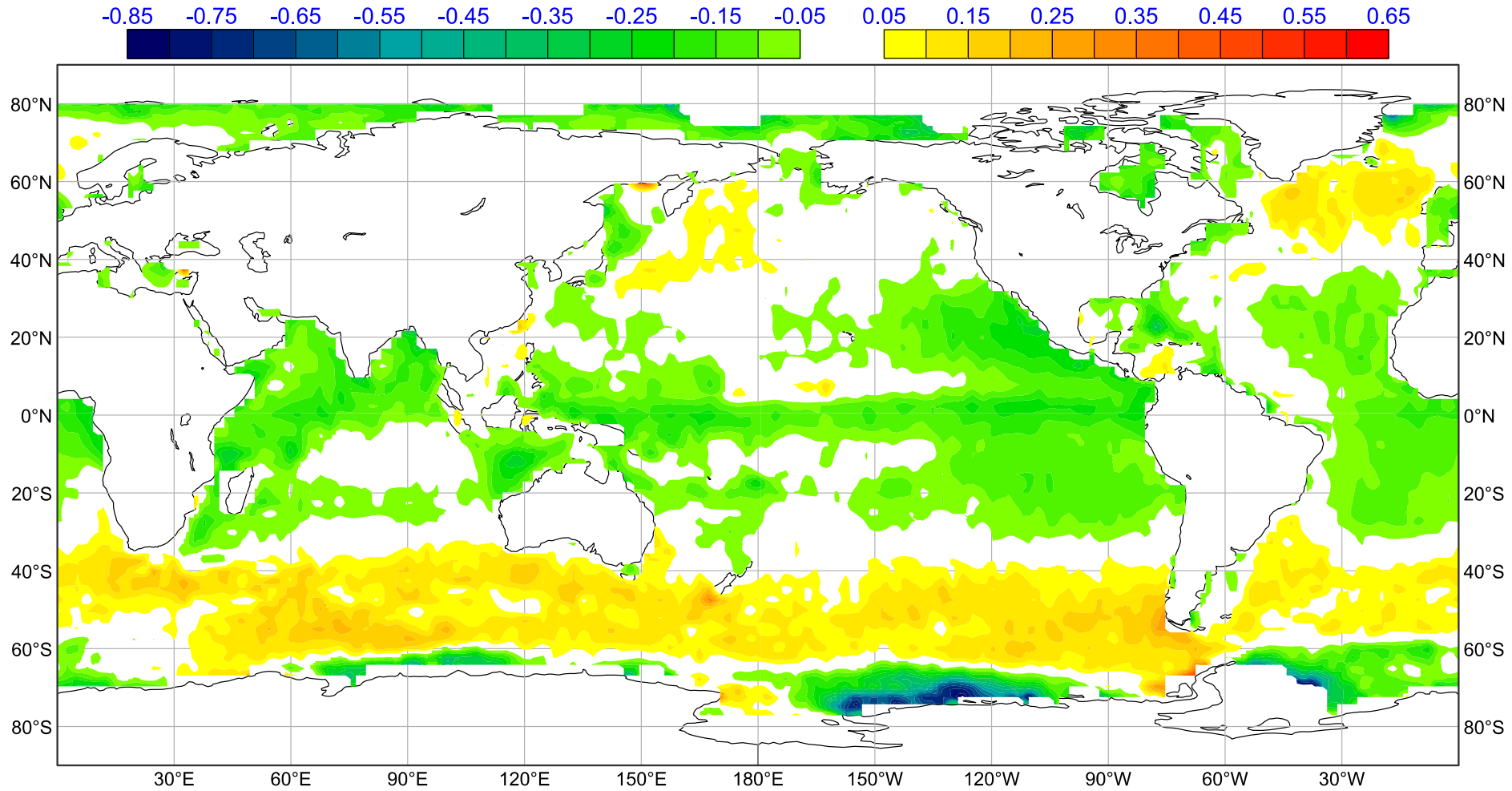
Altimeter SWH SDD (wrt model & buoys)





S3A (Rep. 006) Sig. Wave Height Bias wrt ECMWF model

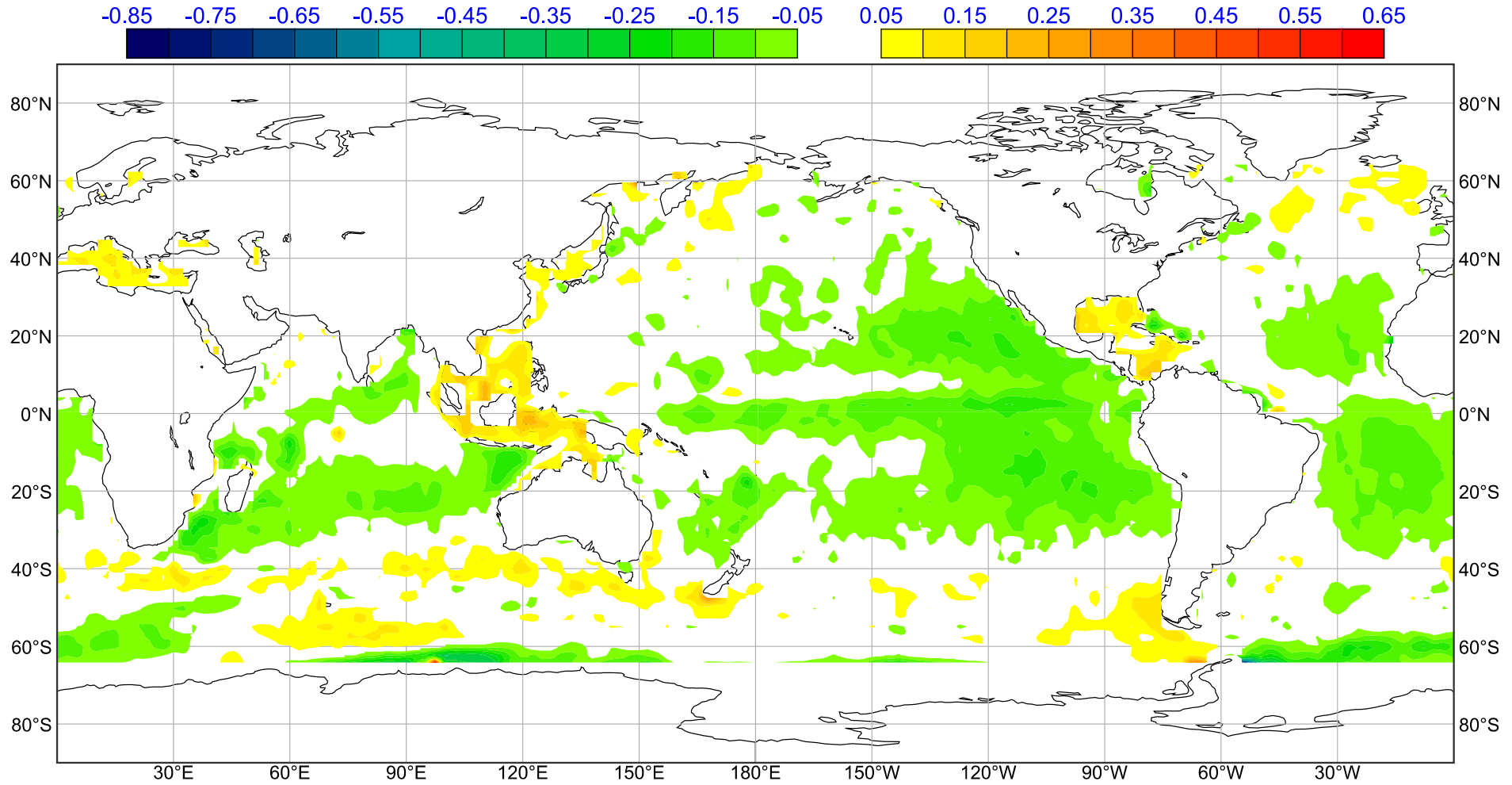
13 Dec. 2016 – 12 Dec. 2017



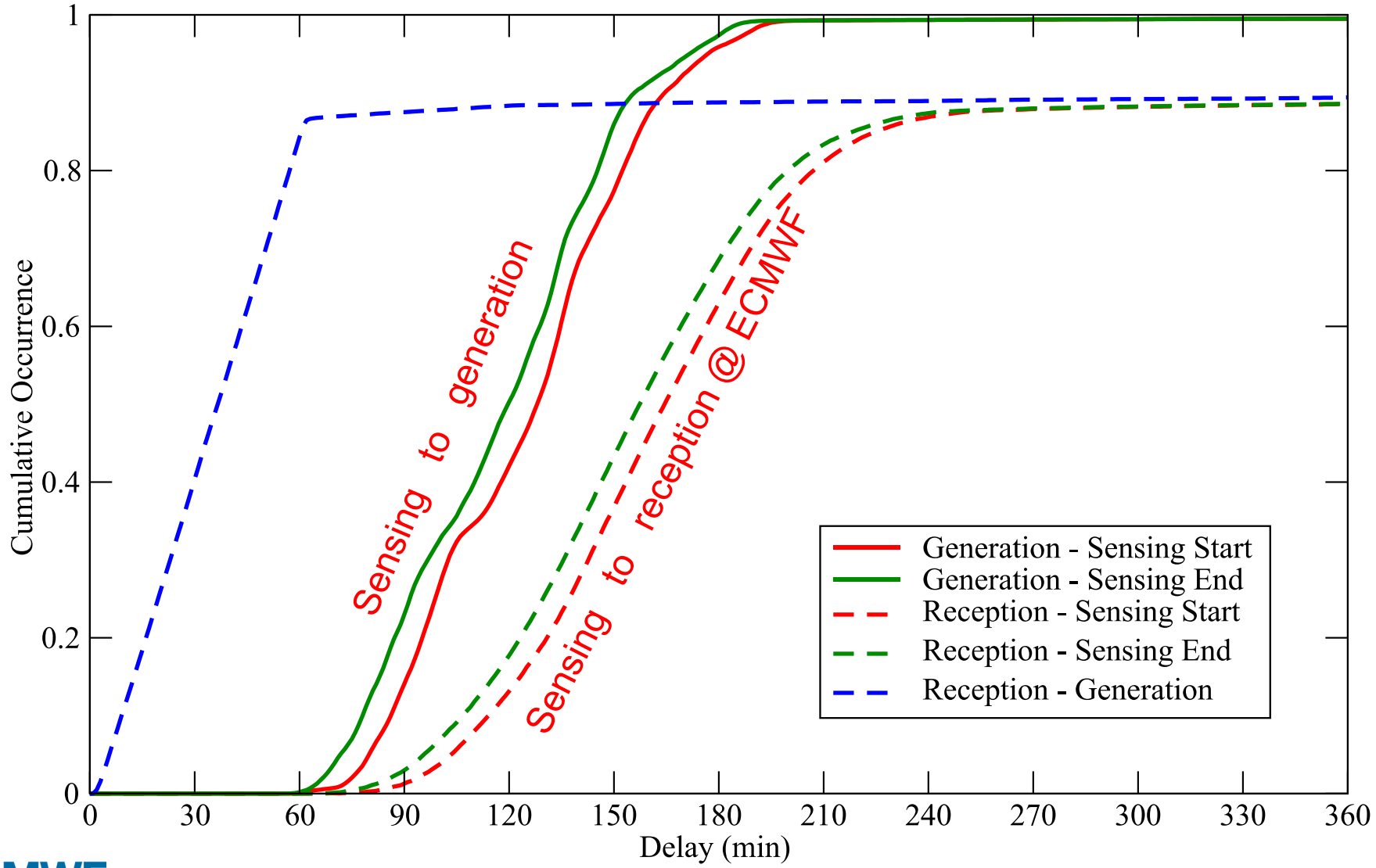
Jason-3 Sig. Wave Height Bias wrt ECMWF model

Satellite: Jason-3
Wave Height Bias (Sat-Mod) [m]
For period between 21:00:06UTC on 12.12.2016 and 20:59:53UTC on 12.12.2017

13 Dec. 2016 – 12 Dec. 2017



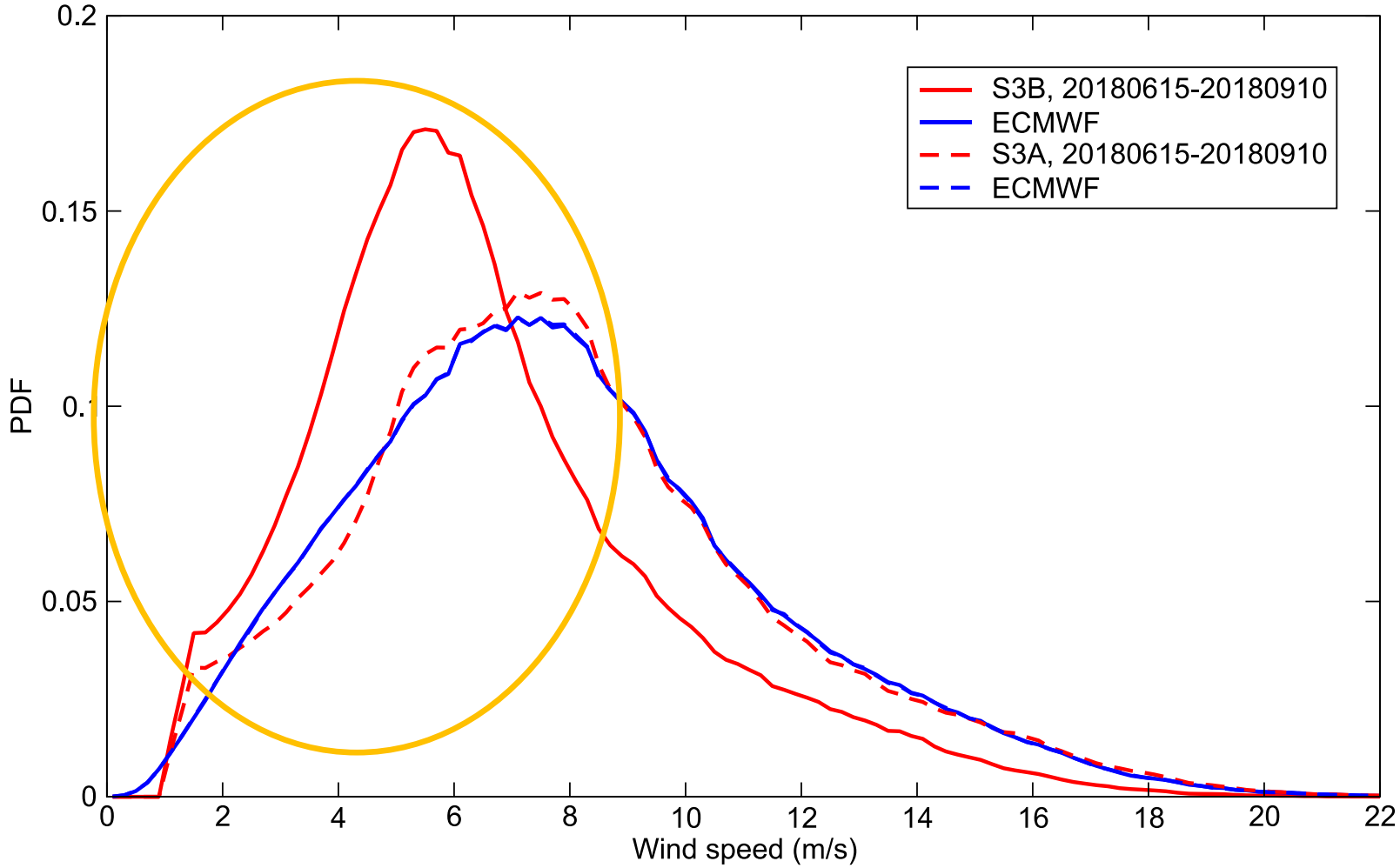
Timeliness of Sentinel-3A *(Unofficial)*



Preliminary results from Sentinel-3B

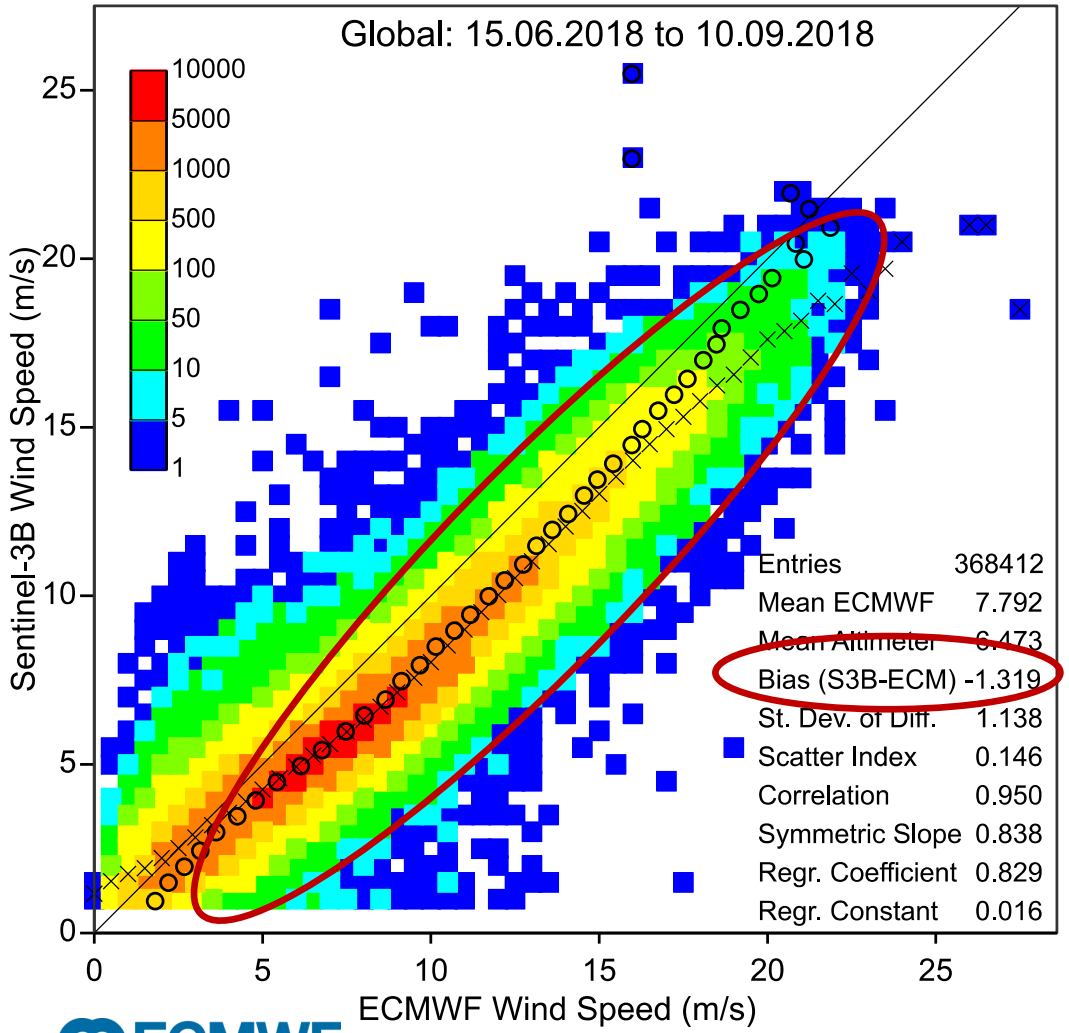
ECMWF

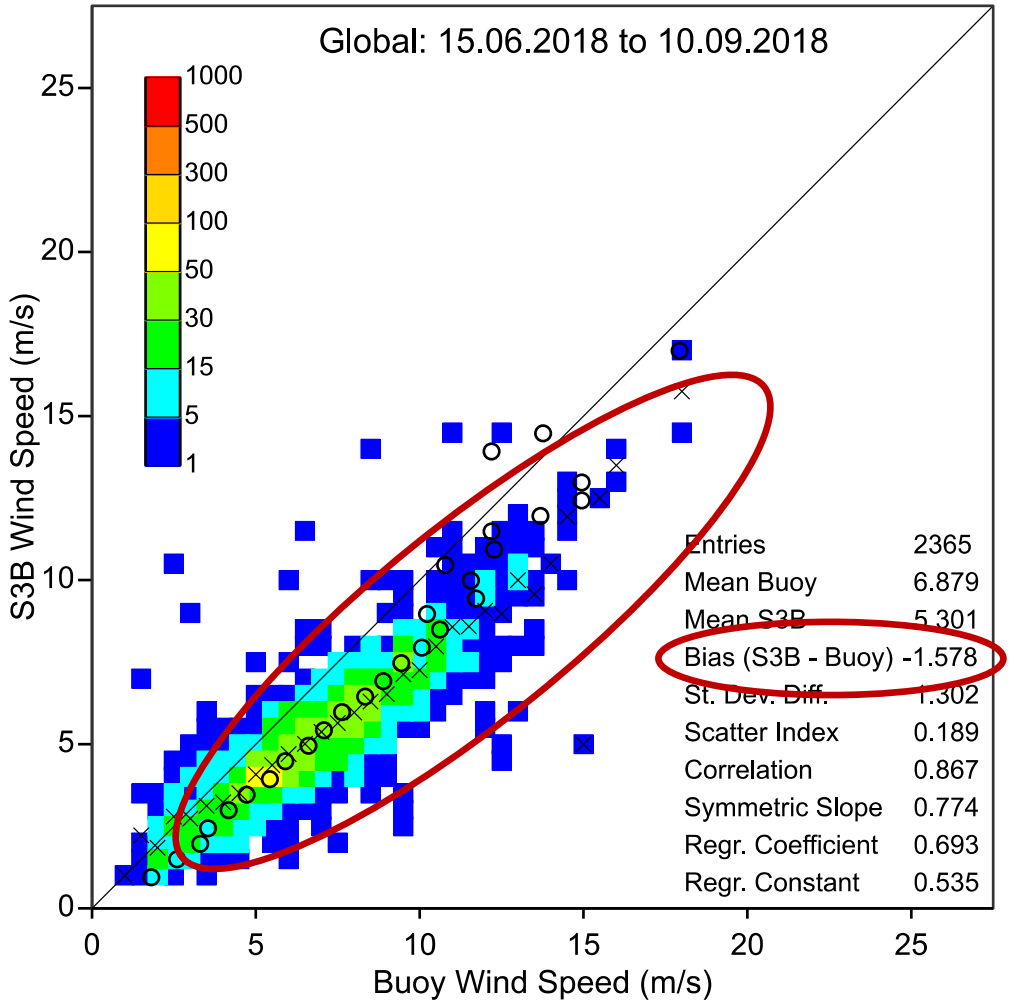
Wind speed histogram



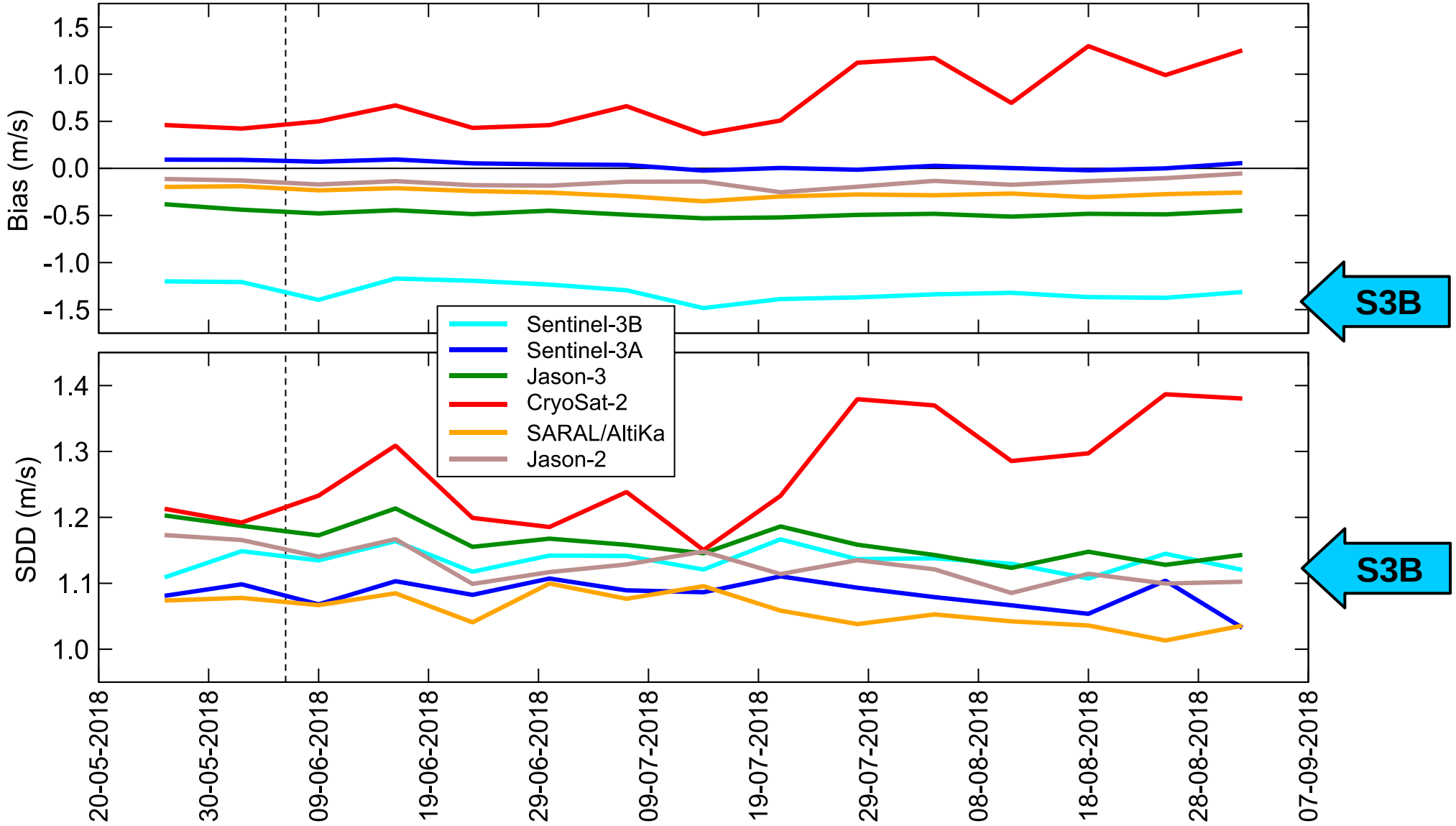
Wind speed comparison against model & in-situ measurements

15 Jun. 2018 – 10 Sep. 2018





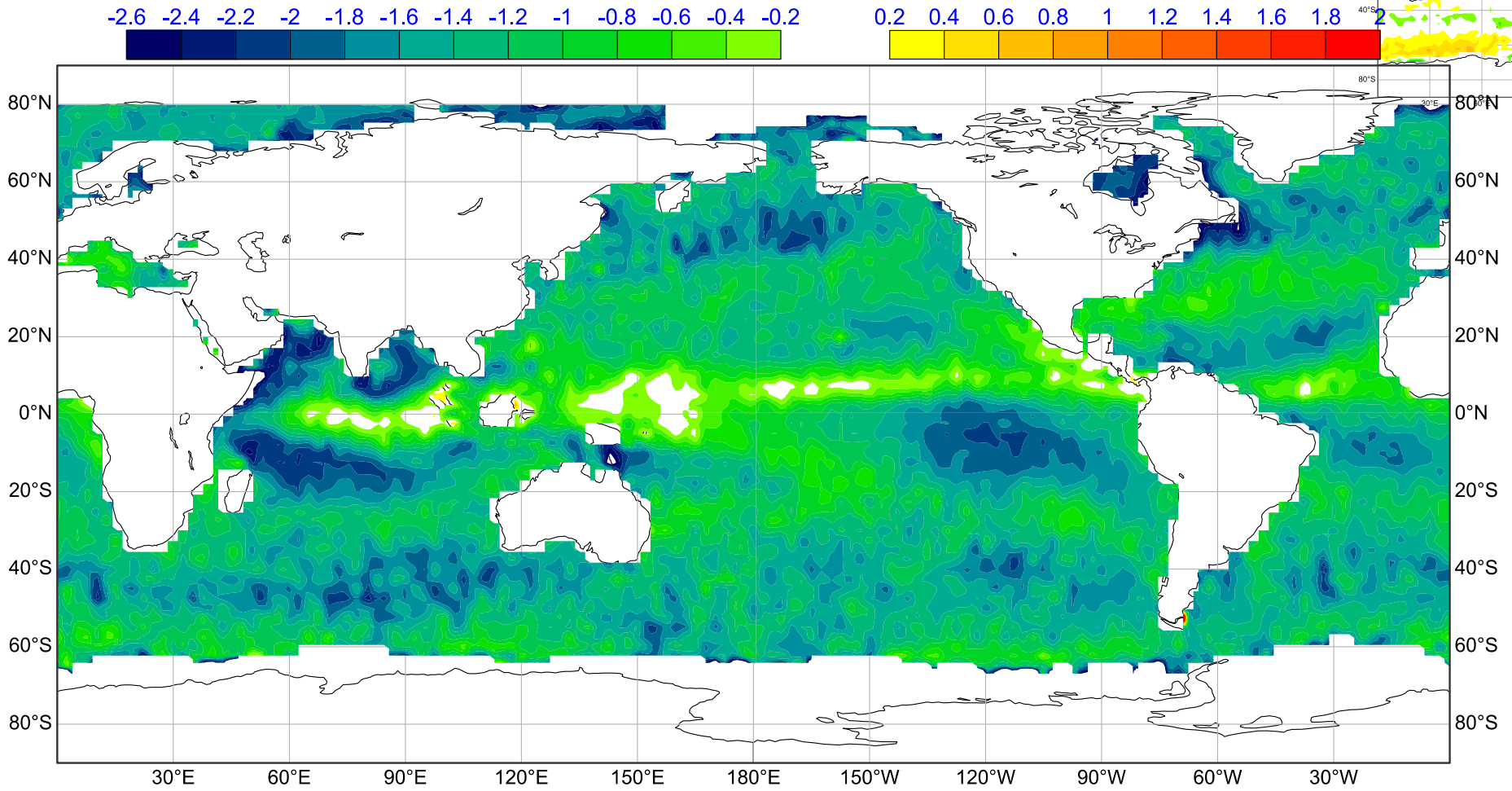
Wind speed bias & SDD (wrt model) – vs other altimeters

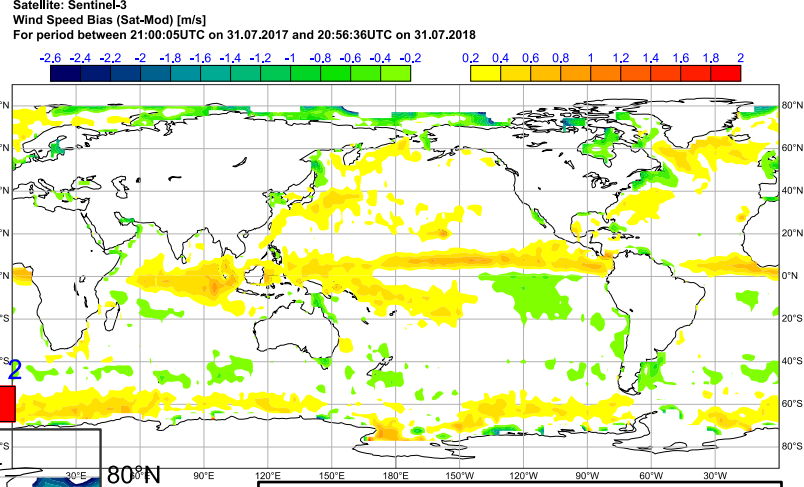


Sentinel-3B wind speed bias (wrt model)

Sentinel-3B: 15 Jun. 2018 – 10 Sep. 2018

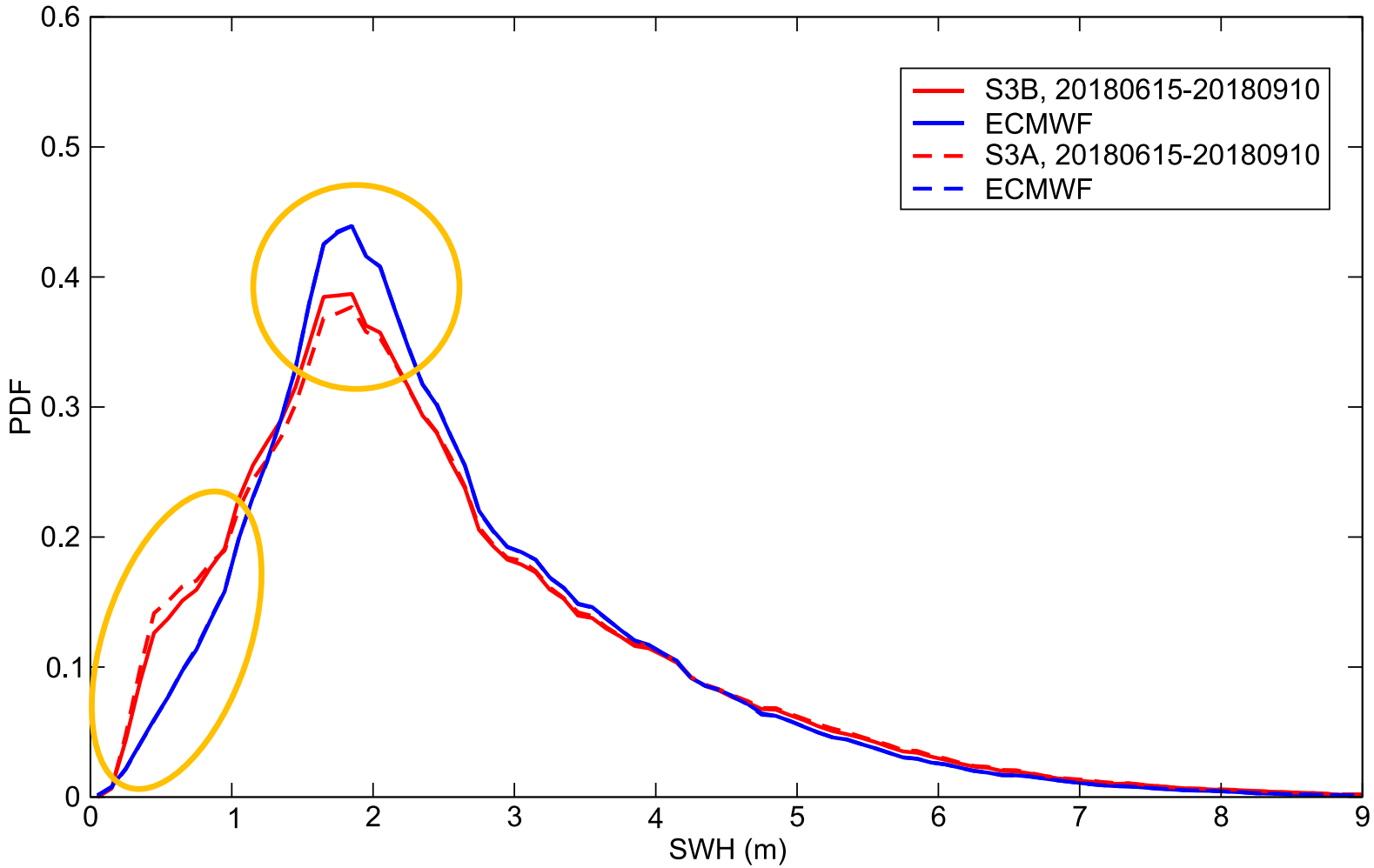
Satellite: Sentinel-3B
Wind Speed Bias (Sat-Mod) [m/s]
For period between 21:04:09UTC on 14.06.2018 and 20:59:56UTC on 10.09.2018





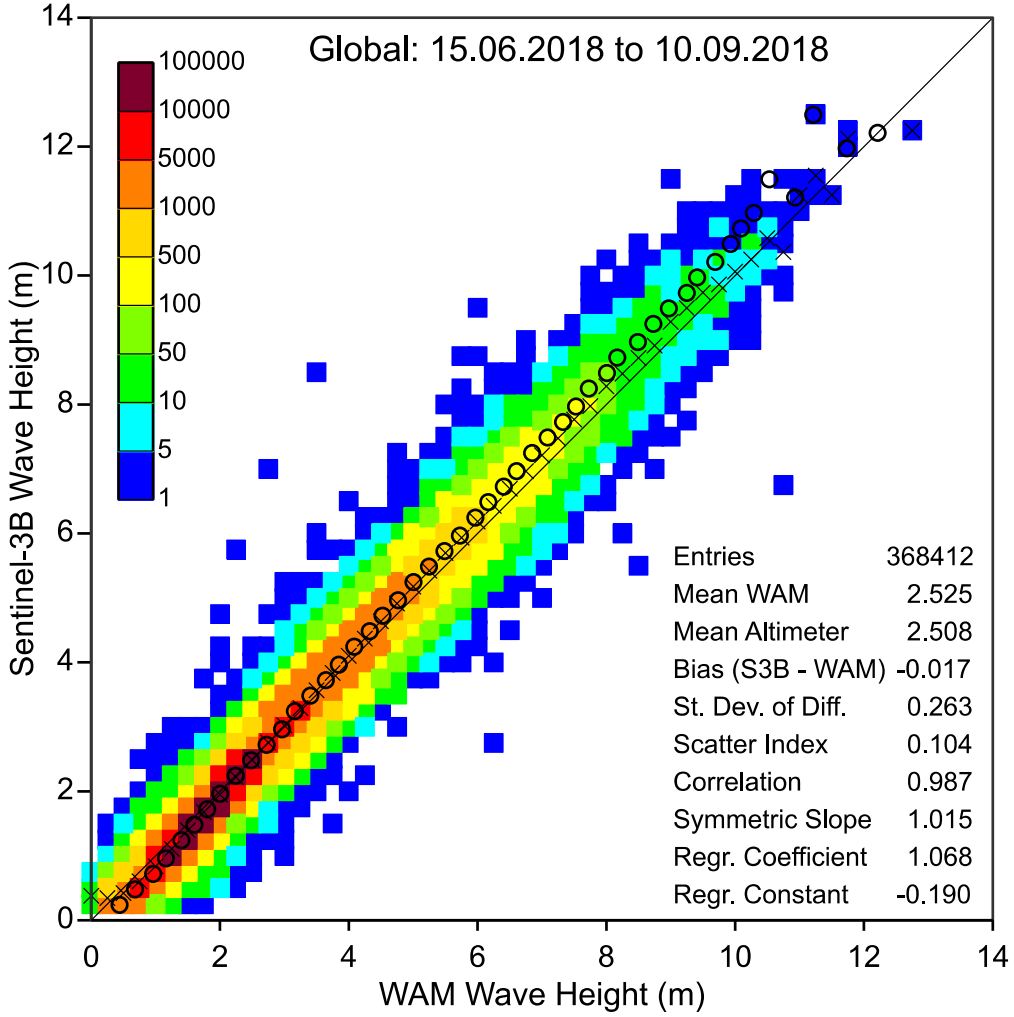
Sentinel-3A:
1 Aug. 2017 – 31 Jul. 2018

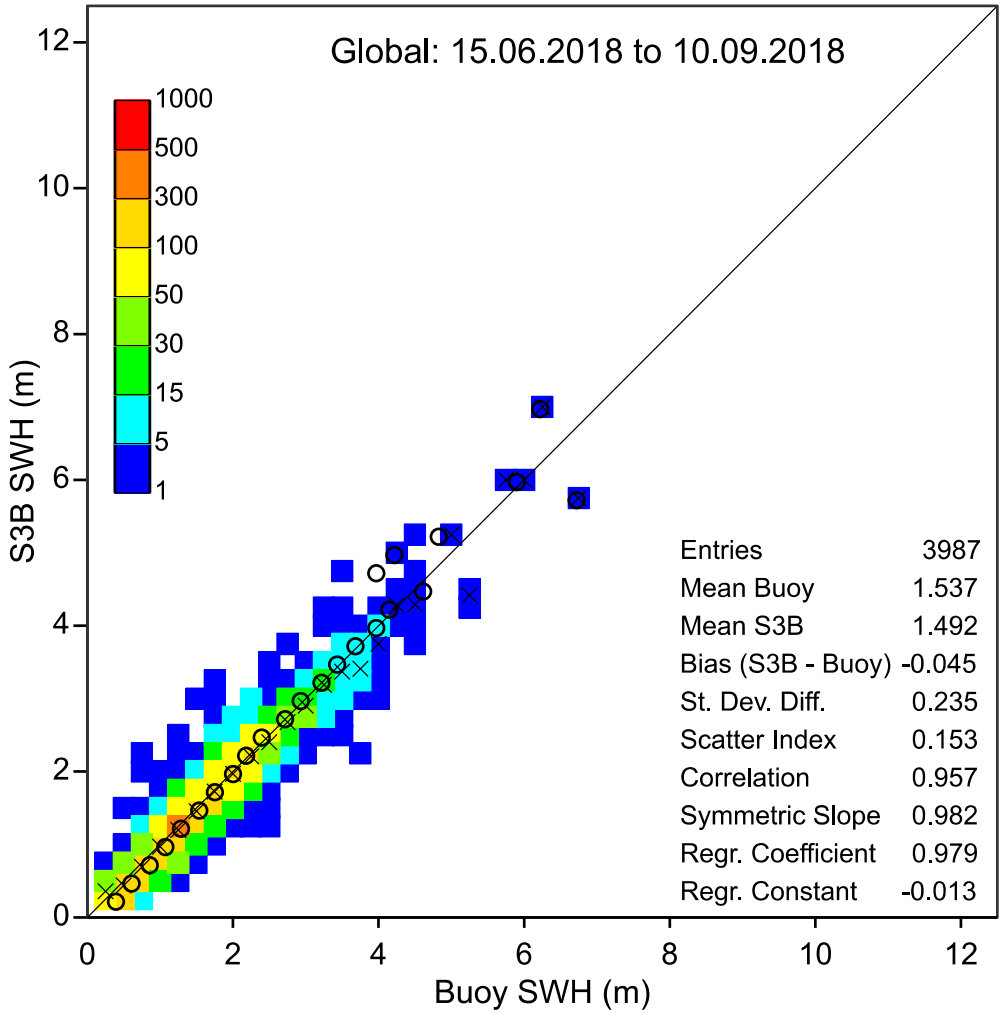
Sentinel-3B significant wave height histogram



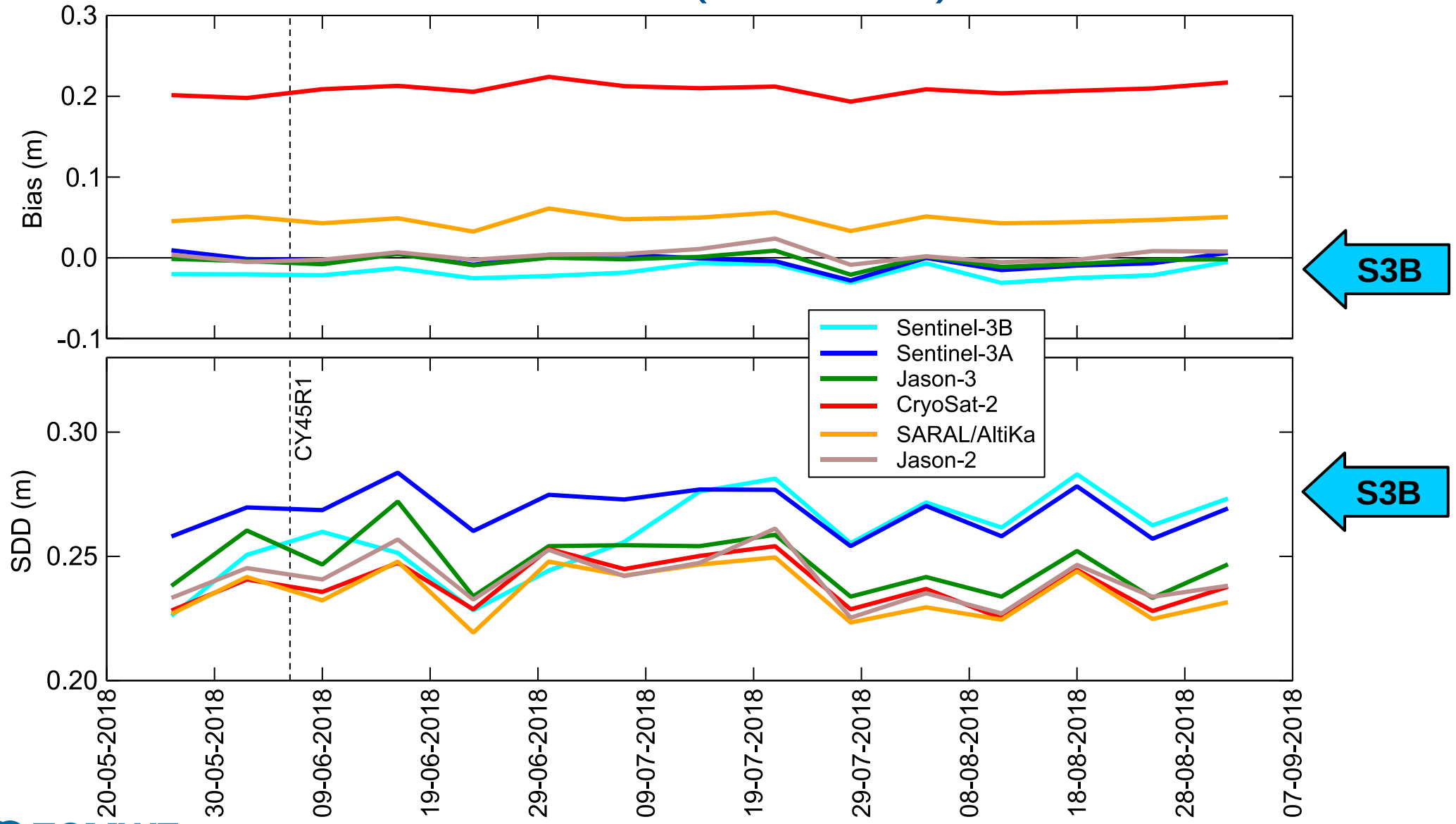
Sentinel-3B significant wave height comparison against model & in-situ measurements

15 Jun. 2018 – 10 Sep. 2018

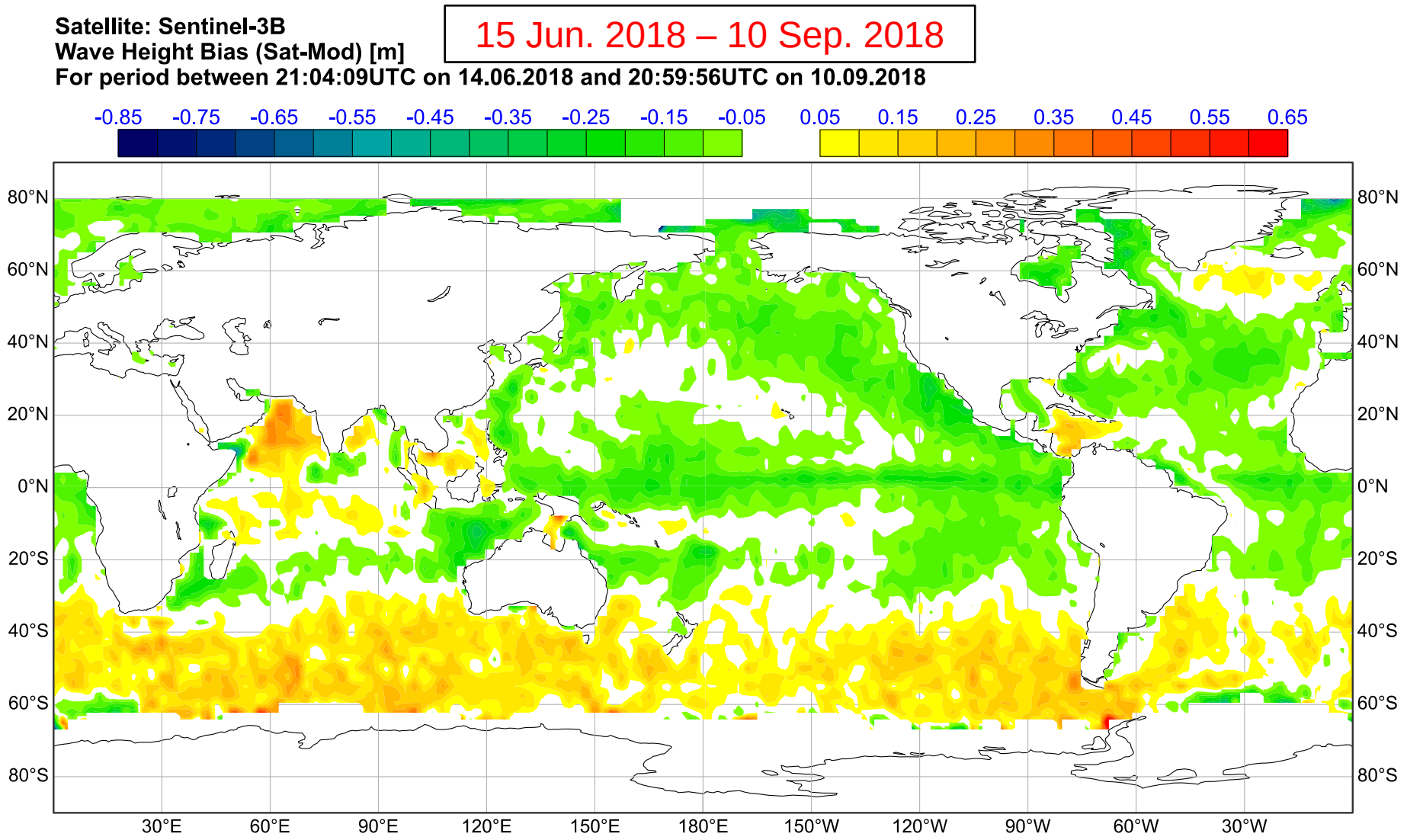




Sentinel-3B SWH bias & SDD (wrt model) – vs other altimeters



Sentinel-3B significant wave height (wrt model)



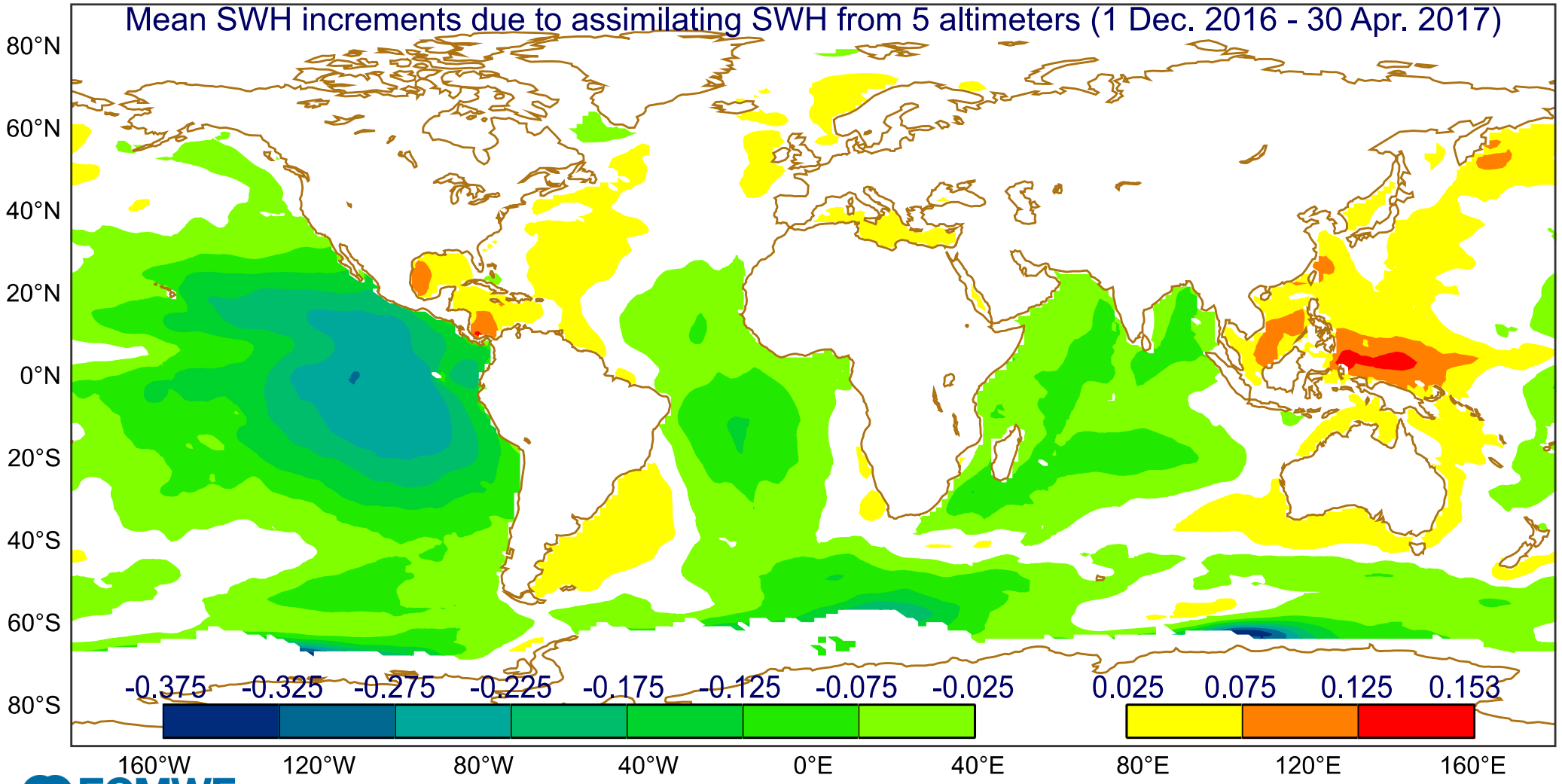
Assimilation of SWH

ECMWF

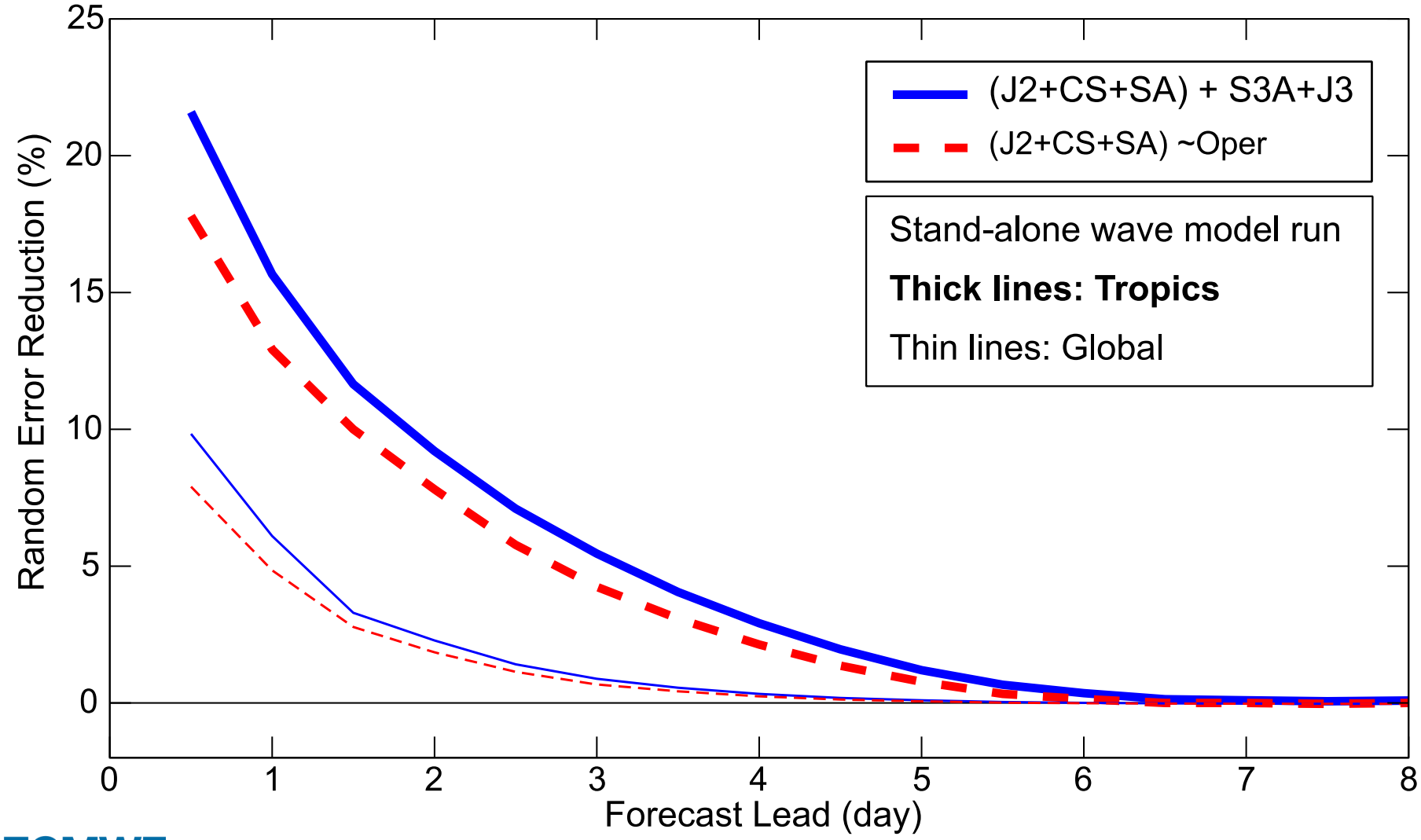
Assimilation of Sentinel-3A SRAL SAR and Jason-3 SWH

- ECMWF wave model (ECWAM) which is part of Integrated Forecasting System (IFS).
- Both stand-alone (not coupled with the atmosphere) and coupled runs.
- Assimilation of SWH at a scale of ~70-80 km (super-observations).
- Based on Optimum Interpolation (OI).
- Current in operation: Jason-2, CryoSat-2 and SARAL/AltiKa.
- Impact:
  - Improvement of model analysis
  - Improvement of model forecast.
  - Improvement of the robustness of the wave data assimilation system.
- Jason-3 and Sentinel-3A SAR SWH products are assimilated operationally since June 2018.

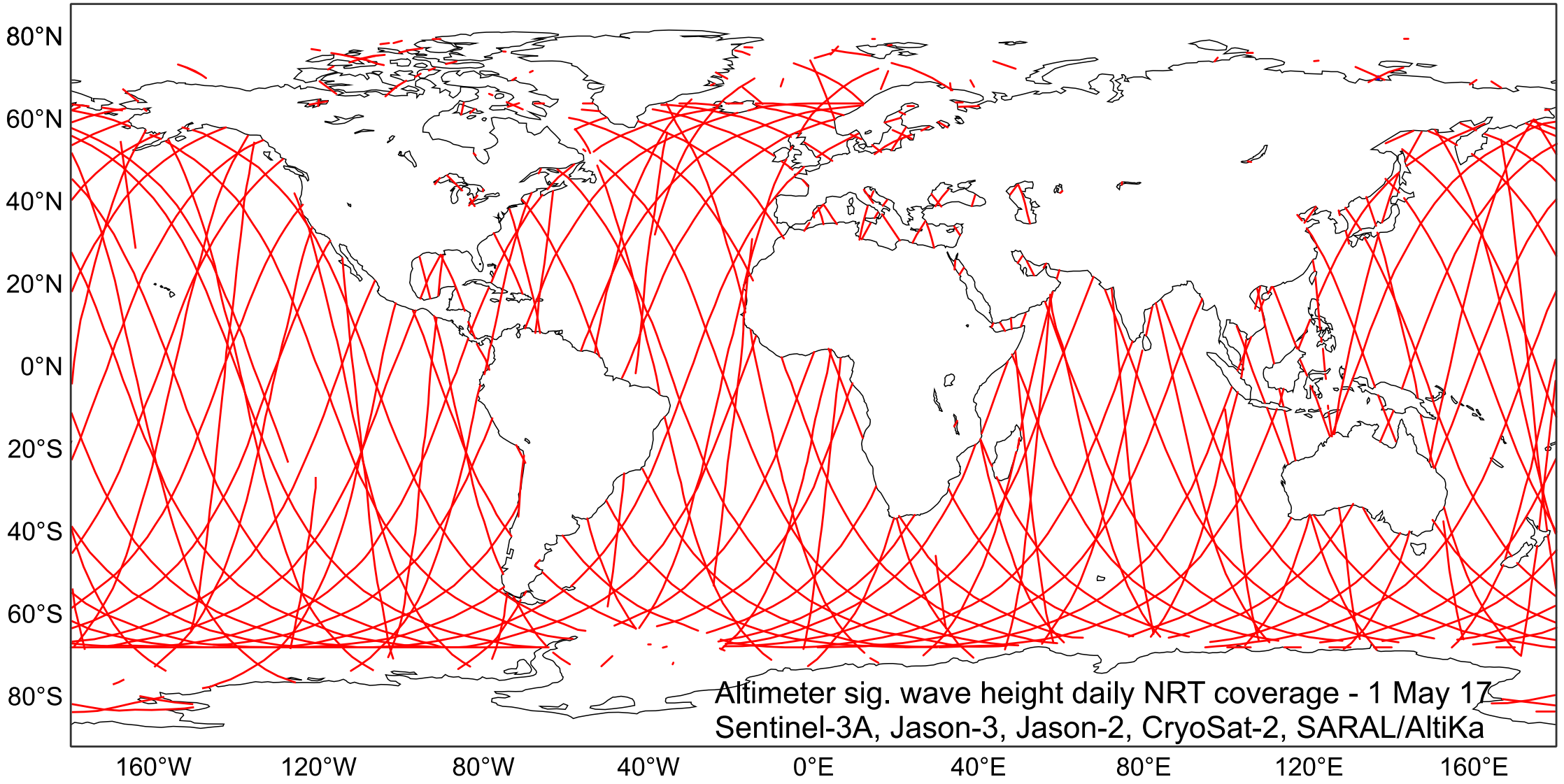
Impact of altimeter SWH data (from 5 altimeters) assimilation on model analysis (1 Dec. 2016 – 30 Apr. 2017)



Impact of altimeter SWH data (from 5 altimeters) assimilation on model forecasts (1 Dec. 2016 – 30 Apr. 2017)



Daily Coverage of NRT Altimeter SWH (1 May 2017)



Concluding Remarks

ECMWF

Concluding Remarks

Surface Wind Speed (both SAR & PLRM):

- SAR wind is stable and very good (one of the best).
- Although the PLRM wind is good it is not as good as SAR wind.

Significant Wave Height (SWH):

- Stable but not as good as other altimeters.
- SWH needs fine tuning:
  - Shows slightly higher deviations from the model compared to other altimeters.
  - Underestimates low SWH (< ~1 m).

Preliminary S3B Data:

- Wind speed is biased low.
- SWH is quite good with features similar to those of S3A.

Assimilation of SWH data into ECMWF wave model (ECWAM):

- Positive impact.
- More robust observed system for data assimilation..