Jason-2 Wind and Wave Products: Monitoring, Validation and Assimilation

Saleh Abdalla, Peter Janssen and Jean Bidlot

ECMWF, Reading, UK

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OUTLINE

- **Operational data reception.**

- **Quality of Ku-band significant wave height (SWH) product.**

- **Impact of SWH data assimilation.**

- **Quality of altimeter surface wind speed product.**

- **Quality of Microwave Radiometer (AMR) water vapour content (TCWV) product.**

- **Summary.**

Operational Data Reception Through EUMETCast

- **On average, Jason-2 data received at ECMWF is about 88% of the corresponding Jason-1 data (received through GTS).**

- **The reasons for this are not clear.**

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Operational data reception at ECMWF through EUMETCast of Jason-2 compared to Jason-1

Jason-2 data ~ 88% of Jason-1
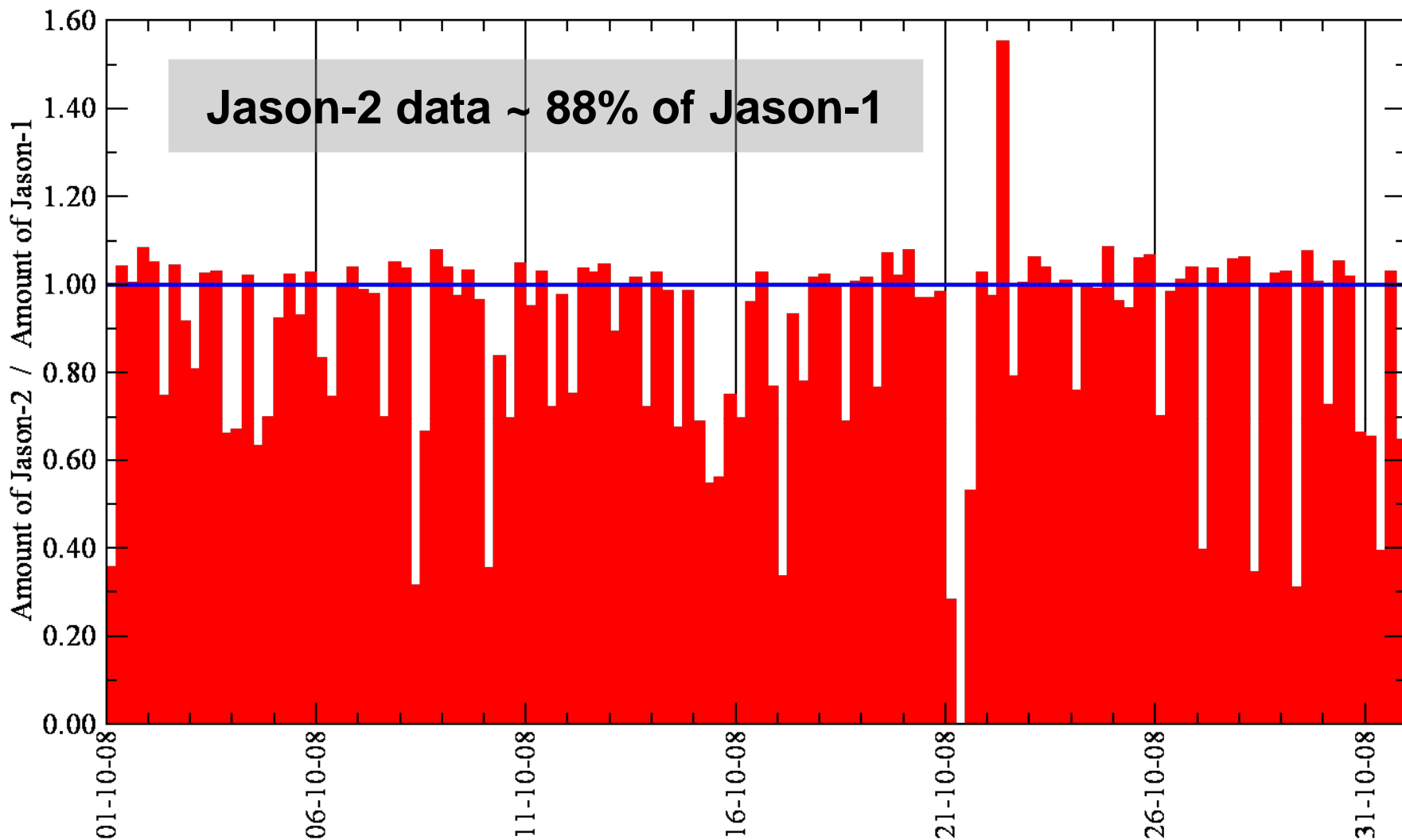
Quality of Ku-Band Significant Wave Height

- **Against: - ECMWF WAM model** first guess
  - GTS in-situ wave measurements

- **Very good in general**   *(as good as Envisat)*.

- **Nominally unbiased** *(unlike Jason-1 & Envisat)*.

- **Better than Jason-1 by ~ 5%.**

Global comparison between Ku-Band and ECMWF wave model (WAM) first-guess SWH values
(From 01 August to 31 October 2008)
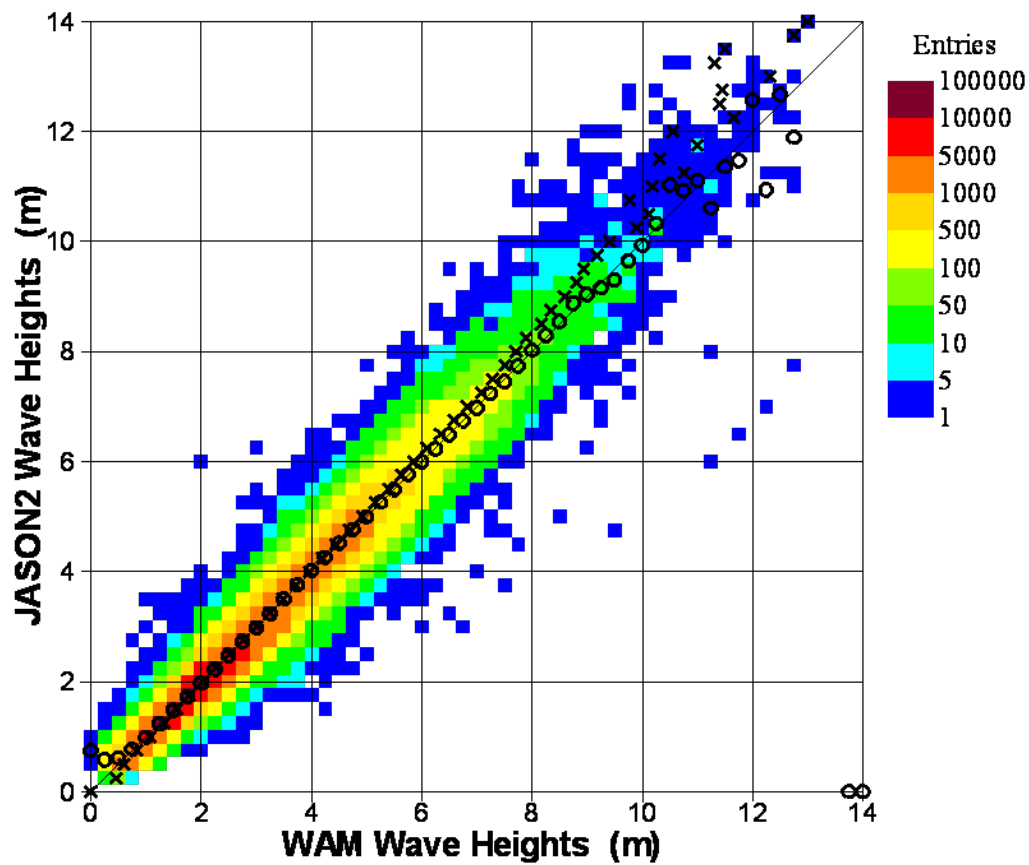
Jason-2   **Jason-1**

STATISTICS	Jason-2	Jason-1
ENTRIES	314585	297269
MEAN WAM	2.6966	2.6851
MEAN JASON2	2.6848	2.7694
BIAS (JASON2 - WAM)	-0.0118	0.0842
STANDARD DEVIATION	0.2741	0.2888
SCATTER INDEX	0.1016	0.1076
CORRELATION	0.9820	0.9810
SYMMETRIC SLOPE	1.0017	1.0350
REGR. COEFFICIENT	1.0050	1.0280
REGR. CONSTANT	-0.0253	0.0089

Global comparison between Ku-Band and in-situ (buoy) SWH values
(From 01 August to 31 October 2008)
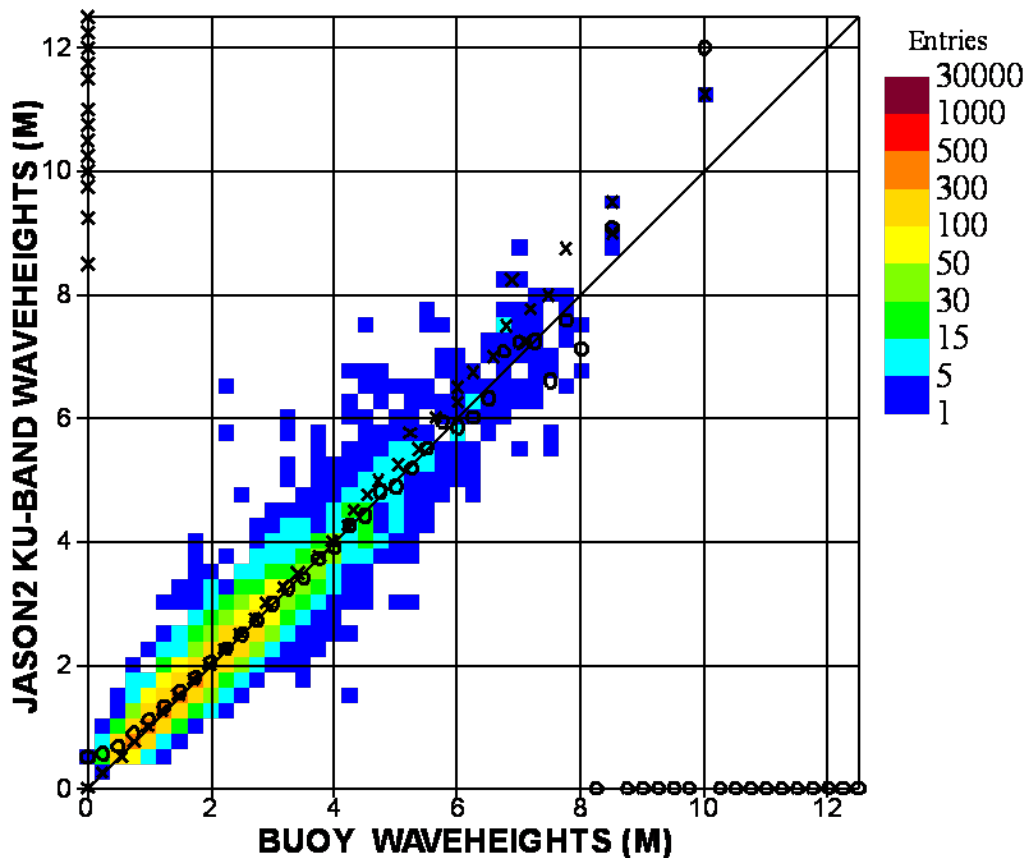
| STATISTICS	Jason-2	Jason-1
ENTRIES	8110	7360
MEAN BUOY	2.0021	2.1089
MEAN JASON2	2.0434	2.2268
BIAS (JASON2 - BUOY)	0.0413	0.1179
STANDARD DEVIATION	0.3461	0.3699
SCATTER INDEX	0.1729	0.1754
CORRELATION	0.9577	0.9559
SYMMETRIC SLOPE	1.0175	1.0485
REGR. COEFFICIENT	0.9659	0.9810
REGR. CONSTANT	0.1095	0.1579

Impact of the Assimilation of Significant Wave Height

- **High quality SWH product.**

- **Assimilated without any calibration nor penalisation (i.e. no weight reduction).**

- **The impact is positive.**

- **Jason-2 SWH product will replace the corresponding Jason-1 product in the ECMWF model unless Jason-1 orbit is shifted.**

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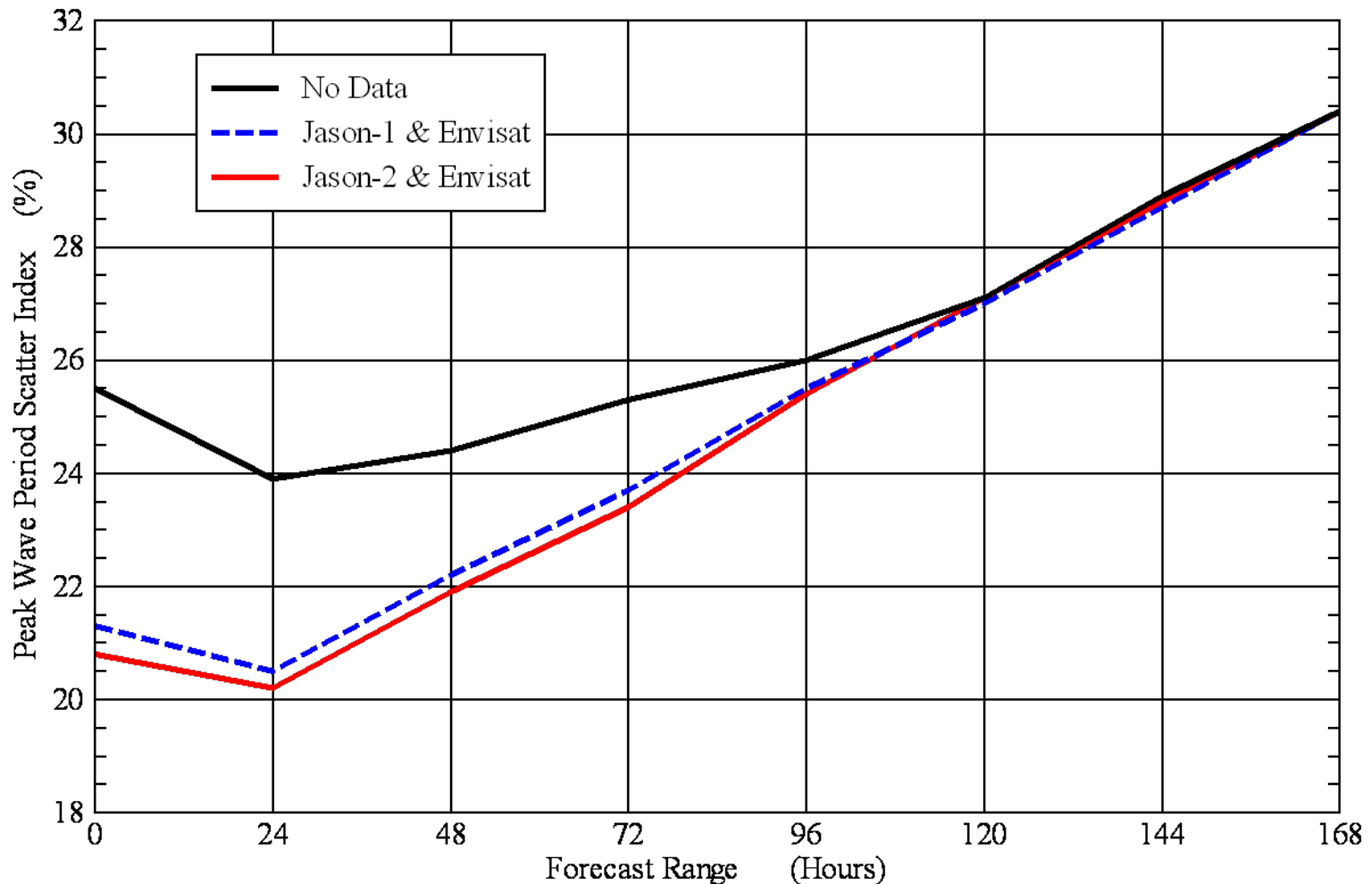# Impact of Jason-2 SWH assimilation on the model SWH forecast errors in the Tropics

Verified against Envisat & Jason-1

(From 01 August to 21 September 2008)

Legend:
- No data assim.
- Jason-2 alone
- Jason-2 & Envisat
- Jason-1 & Envisat
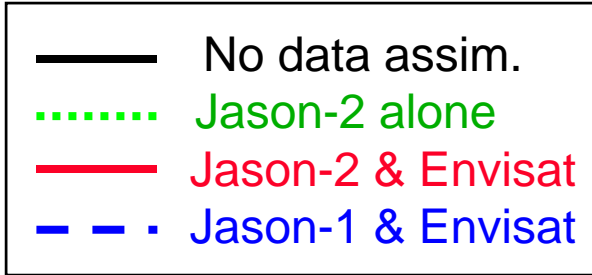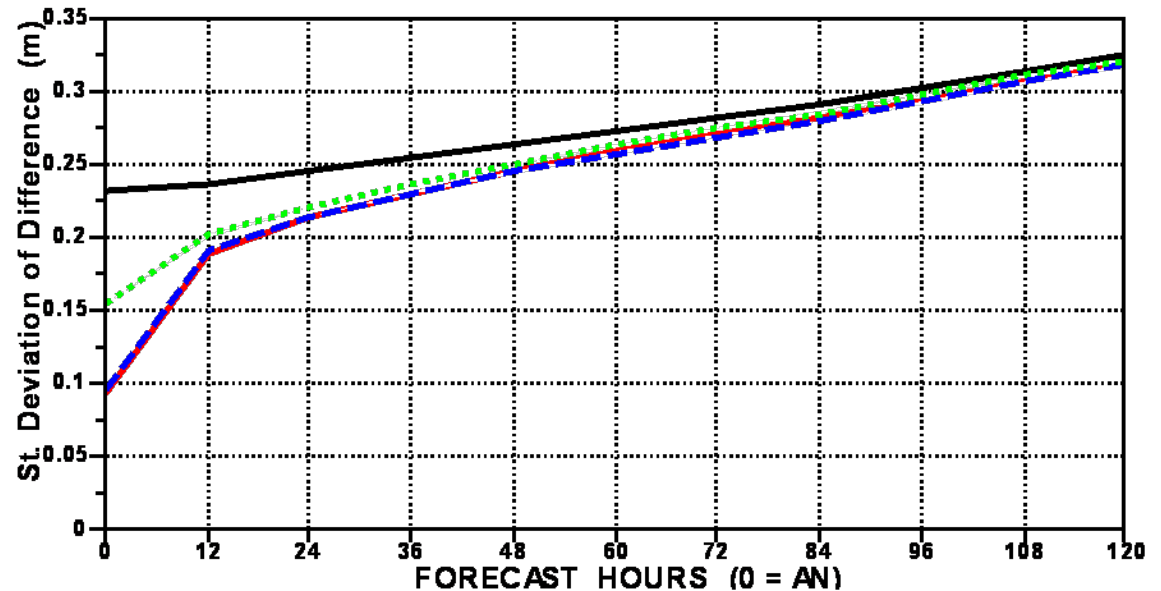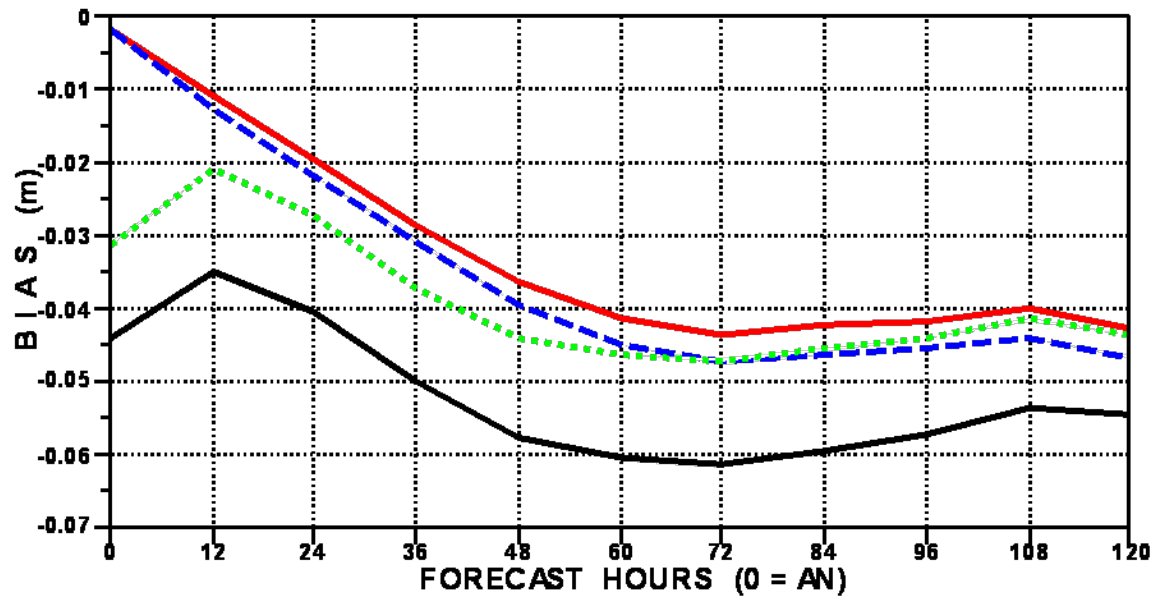
Impact of Jason-2 SWH assimilation on the model peak wave period forecast errors *(at all buoys)*
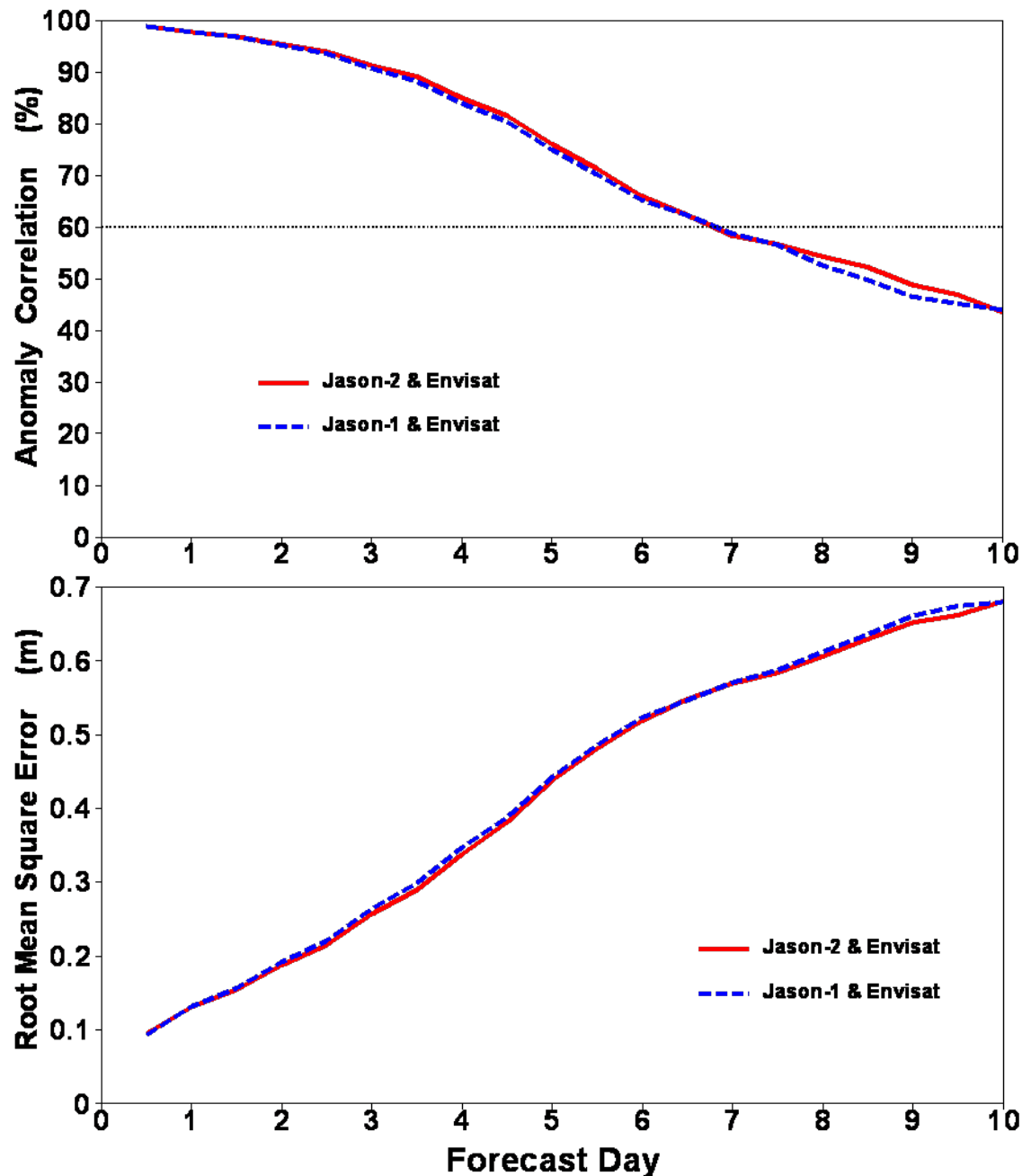## (From 01 August to 21 September 2008)

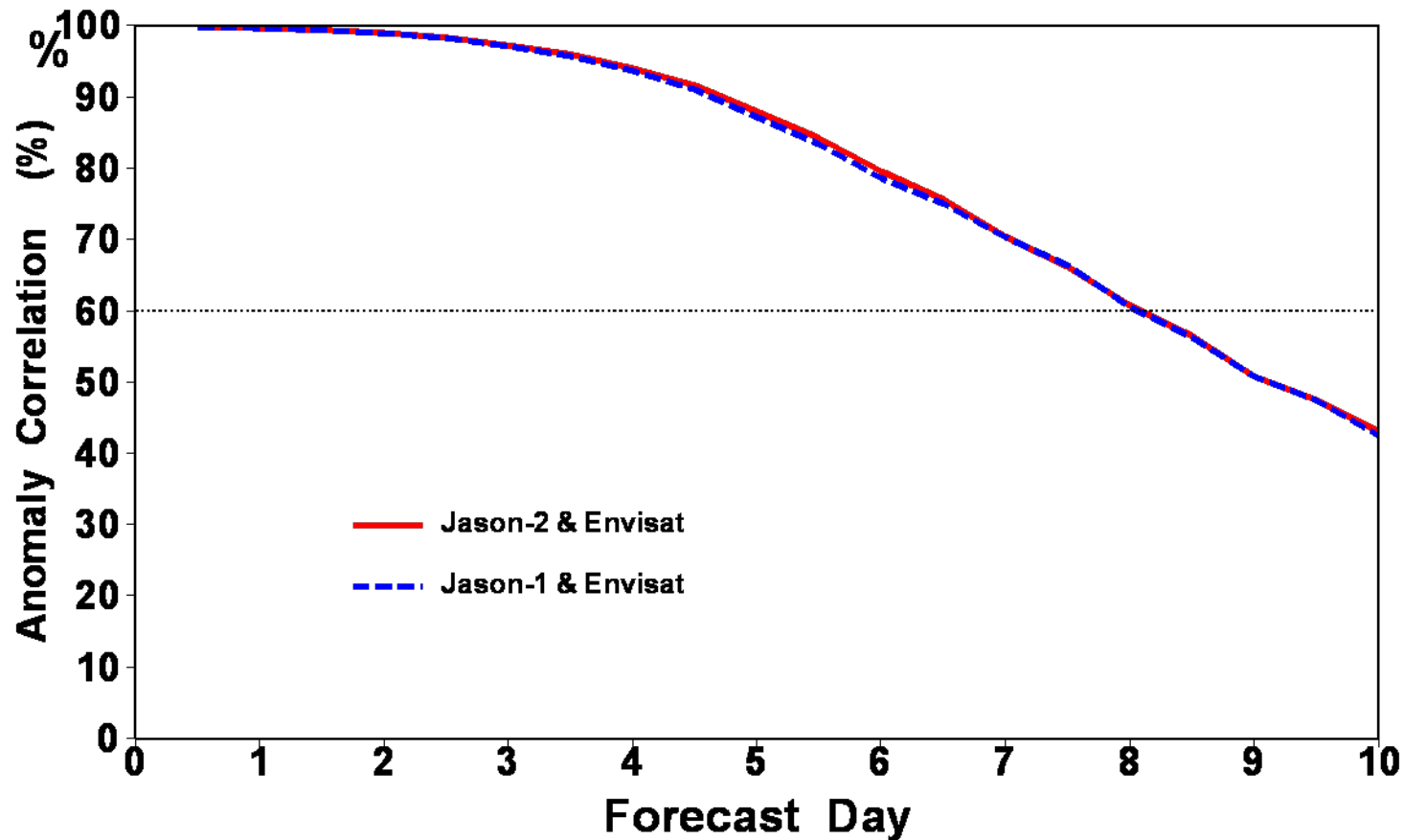**Impact of Jason-2 SWH assimilation on the model SWH forecast errors in the Northern Hemisphere**

(with respect to operational analysis)

(1 - 21 August 2008)

Impact of Jason-2 SWH assimilation on the model 500 hPa Geopotential Height forecast errors in the Northern Hemisphere

### (with respect to operational analysis)
(1 - 21 August 2008)

Quality of Altimeter Surface Wind Speed

- **Against: - ECMWF model** analysis
  - **GTS in-situ wind measurements**

- **Good in general.**

- **Almost unbiased compared to the model; but lower than in-situ measurements by ~5%.**

- **Slightly worse than Jason-1** *and Envisat*
  - **➔ A need for fine tuning!**

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Global comparison between altimeter and ECMWF model analysis wind speed values
(From 01 August to 31 October 2008)
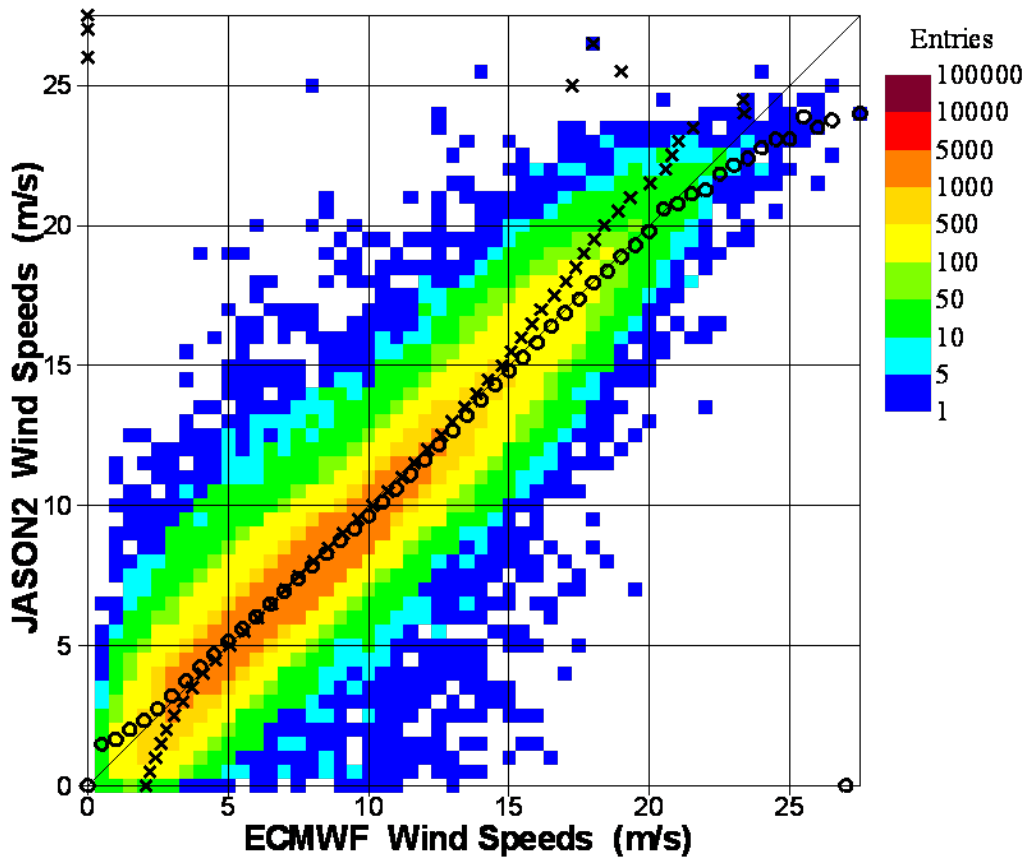
STATISTICS	Jason-2	Jason-1
ENTRIES	312211	295896
MEAN ECMWF	8.0462	8.0279
MEAN JASON2	7.9659	8.3499
BIAS (JASON2 - ECMWF)	-0.0803	0.3220
STANDARD DEVIATION	1.1971	1.1811
SCATTER INDEX	0.1488	0.1471
CORRELATION	0.9466	0.9492
SYMMETRIC SLOPE	0.9929	1.0392
REGR. COEFFICIENT	0.9530	0.9820
REGR. CONSTANT	0.2977	0.4669

Global comparison between altimeter and in-situ (buoy) surface wind speed values
(From 01 August to 31 October 2008)
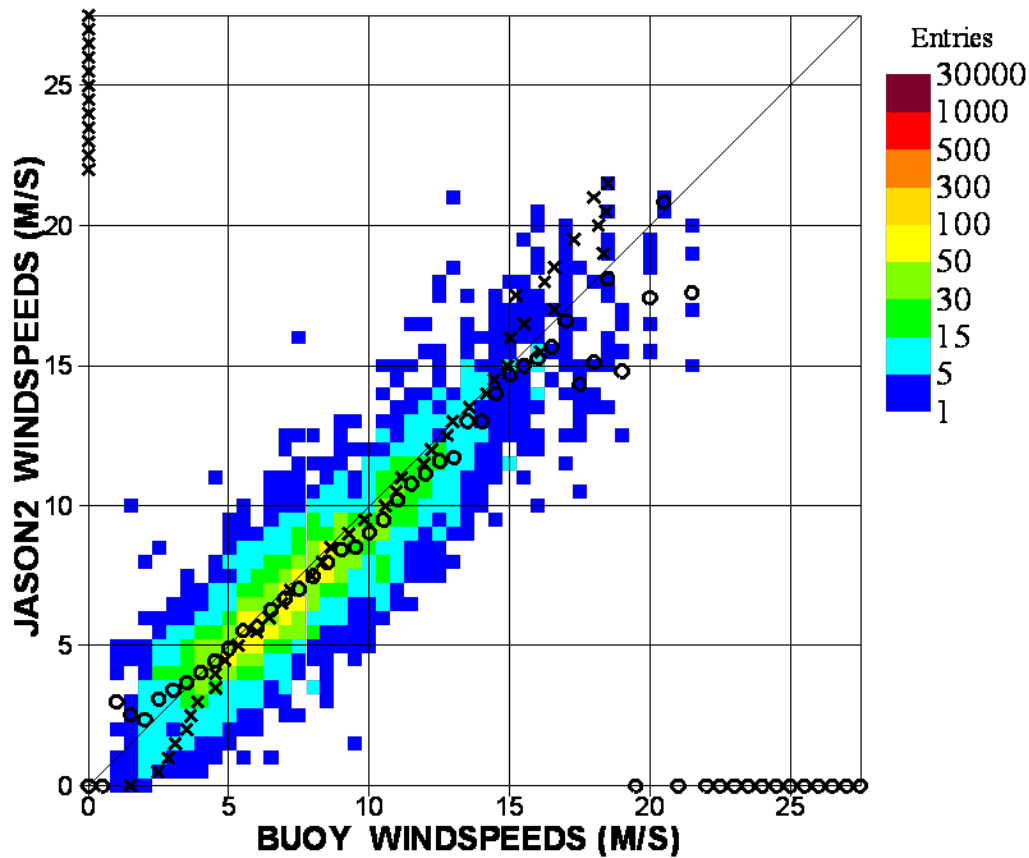
STATISTICS	Jason-2	Jason-1
ENTRIES	5266	4889
MEAN BUOY	7.7545	7.9386
MEAN JASON2	7.3563	7.9536
BIAS (JASON2 - BUOY)	-0.3982	0.0150
STANDARD DEVIATION	1.4806	1.4865
SCATTER INDEX	0.1909	0.1873
CORRELATION	0.8969	0.9019
SYMMETRIC SLOPE	0.9544	1.0025
REGR. COEFFICIENT	0.8840	0.9075
REGR. CONSTANT	0.5017	0.7494

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Quality of Jason-2 AMR Water Vapour Content

- **Against ECMWF model** analysis.

- **Very good in general.**

- **Slightly wetter than the model (and Jason-1).**

- **Has (slightly) more outliers than the corresponding Jason-1 product.**

Global comparison between Jason-2 and ECMWF model analysis water vapour content (TCWV) values
(From 01 August to 31 October 2008)
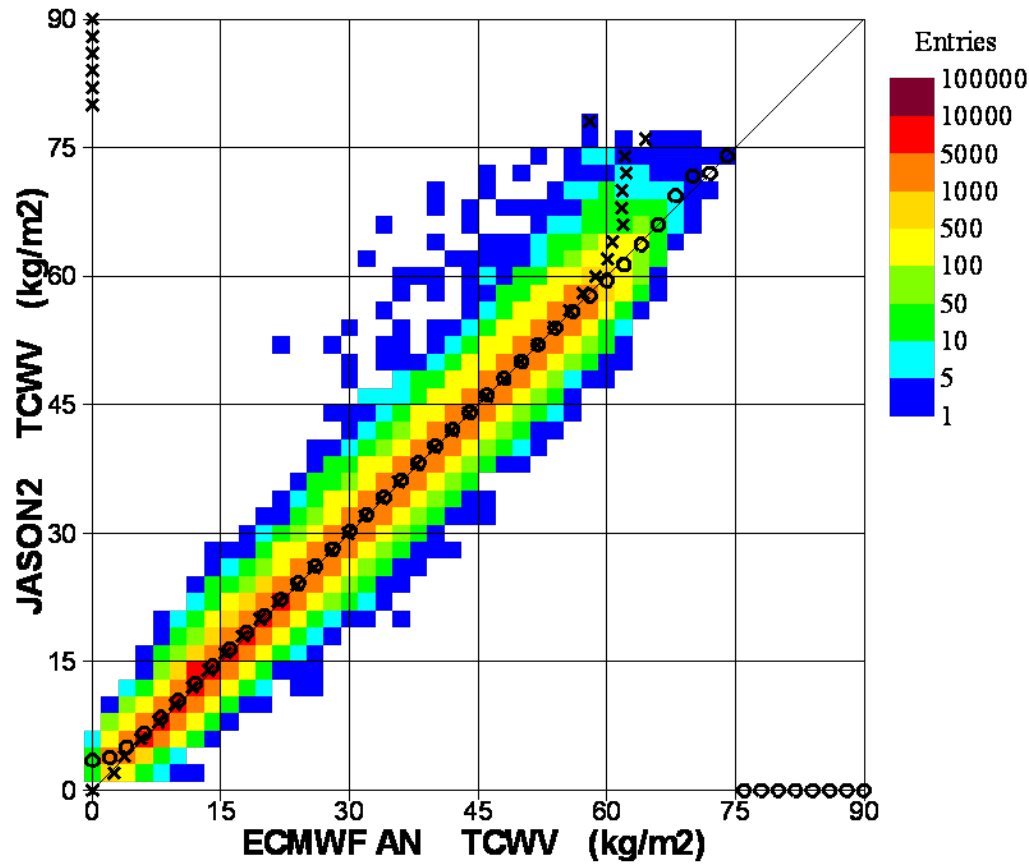
STATISTICS	Jason-2	Jason-1
ENTRIES	271675	298810
MEAN ECMWF	25.9728	24.4807
MEAN JASON2	26.2045	24.2788
BIAS (JASON2 - ECMWF)	0.2317	-0.2019
STANDARD DEVIATION	1.8281	1.7640
SCATTER INDEX	0.0704	0.0721
CORRELATION	0.9935	0.9940
SYMMETRIC SLOPE	1.0046	0.9873
REGR. COEFFICIENT	0.9868	0.9710
REGR. CONSTANT	0.5753	0.5073

<u>Summary</u>

- **Jason-2 NRT OGDR-BUFR wind and wave products have been monitored and verified at ECMWF since early August 2008.**

- **The amount of received data through EUMETCast at ECMWF is ~ 88% of those from Jason-1.**

- **Wave height parameter is in very good agreement with the model and in-situ data. It is better than that of Jason-1.**

<u>Summary</u> *(Cont'd)*

- **Wind speed parameter agrees very well with the model and in-situ data. However, it is slightly worse than Jason-1.**

- **Although slightly wetter, the AMR water vapour content product is in very good agreement with the corresponding product from ECMWF model. However, there are slightly more outliers compared to Jason-1.**

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<u>Summary</u> *(Cont'd)*

- **Assimilation of Jason-2 significant wave heights in the ECMWF model has a positive impact on the model forecasts.**

- **Operational assimilation of the data is planned to take place soon.**

- **If Jason-1 and Jason-2 are not shifted apart, we will not be able to make use of both data streams and therefore Jason-2 data will be favoured by ECMWF.**

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