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

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OUTLINE

- **Latency of Wind & Wave Observations.**

- **Quality of 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.**

Latency of Wind & Wave Observations

- **From 10 March to 20 April 2009.**

- **Data reception delay with respect to the major synoptic time at the centre of each 6-hour time window.**

- **Two cut-off times after the end of the 6-hour window:**
  - **Early Delivery (ED): 1 hour.**
  - **Delay Cut-off (DC): 5 hours for 06 and 18 windows, and ~11 hours for 00 and 12 windows.**

- **Availability of Jason-2 OGDR data is quite good.**
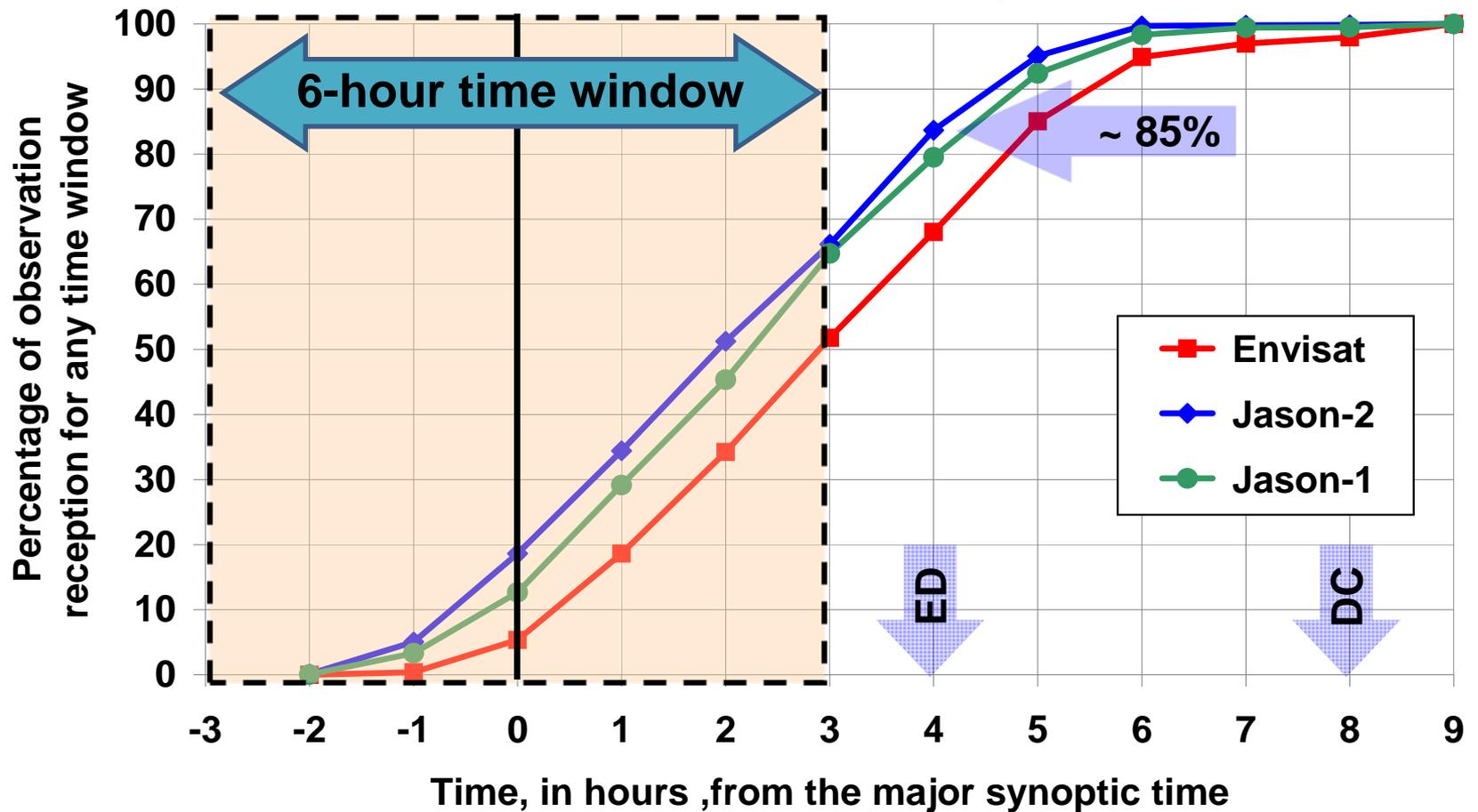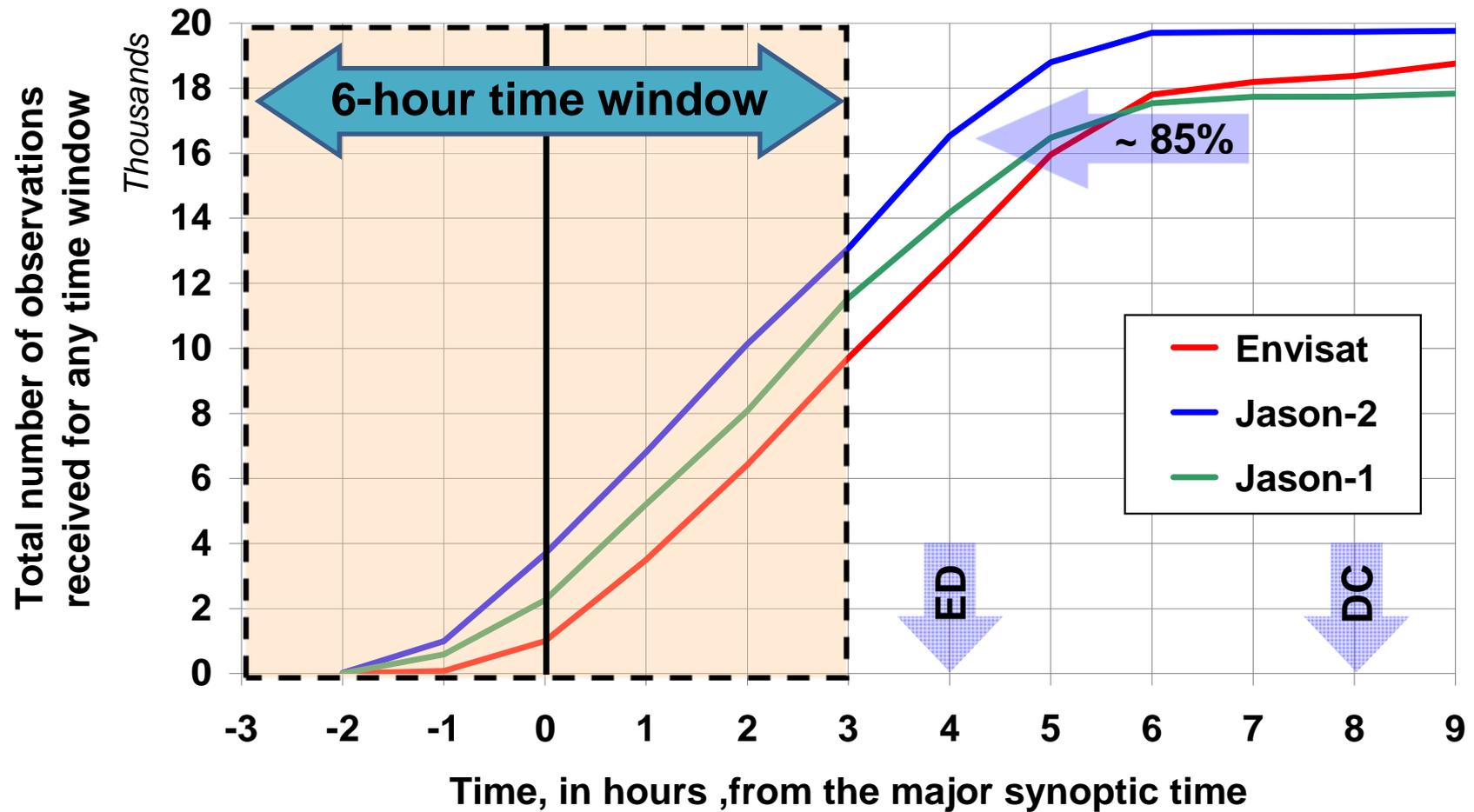
ECMWF System Configuration
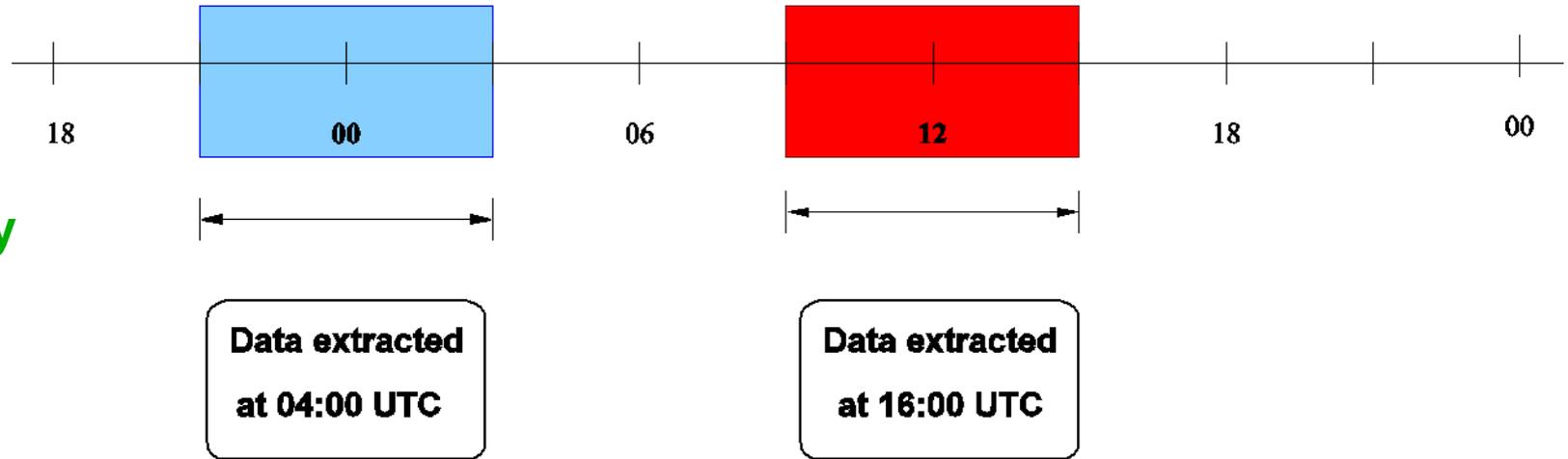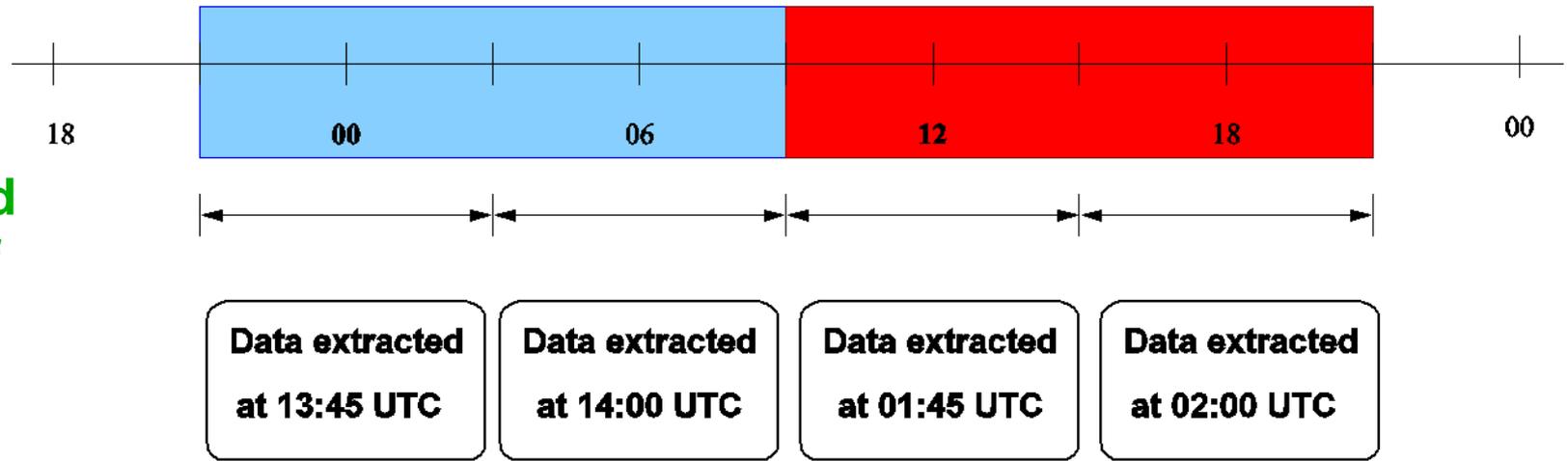
All Time Windows, 10 March - 20 April 2009

All Time Windows, 10 March - 20 April 2009

# Quality of Ku-Band Significant Wave Height

- **Against: - ECMWF WAM model** first guess

    - GTS in-situ wave measurements

- **Very good in general.**

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

- **Better than Jason-1 by ~ 7%.**
  Not as good as ENVISAT!

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Global comparison between Altimeter and ECMWF wave model (WAM) first-guess SWH values
## (From 01 August 2008 to 28 May 2009)
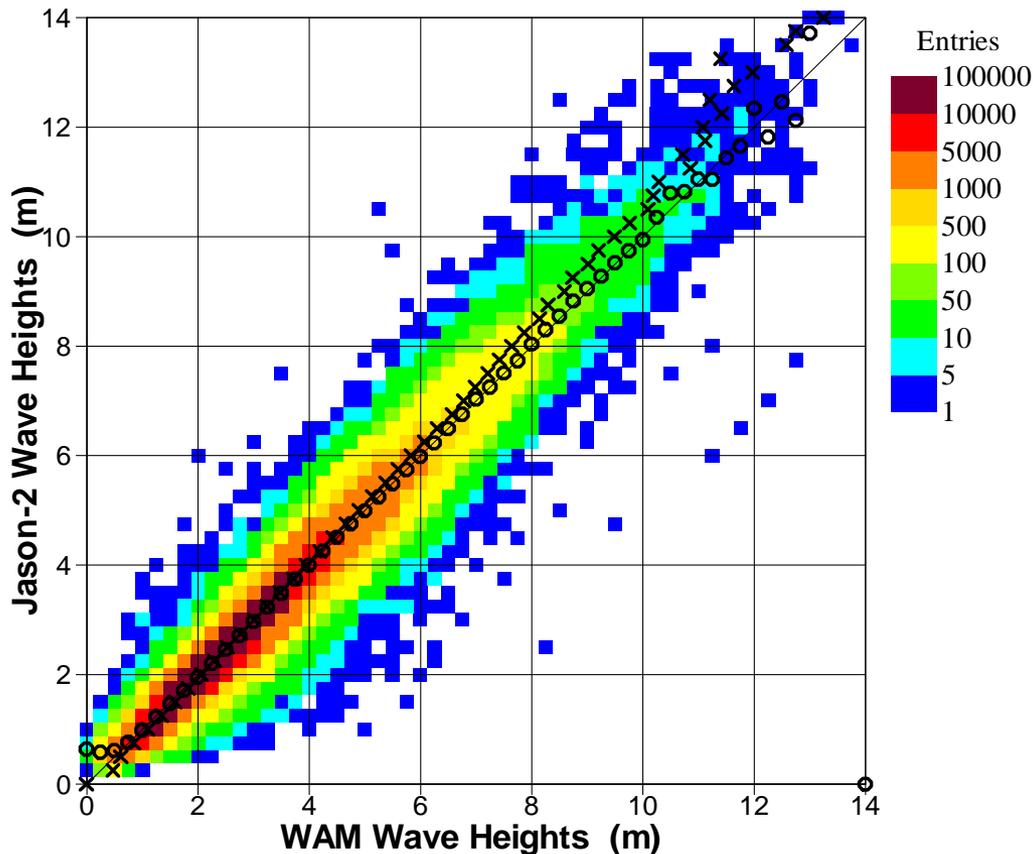
STATISTICS	Jason-2	Jason-1	Envisat
Entries	1117742	1059632	1028484
Mean WAM	2.6752	2.6647	2.5419
Mean Jason-2	2.6501	2.7387	2.6278
Bias (Jason-2 - WAM)	-0.0252	0.0740	0.0859
Standard Deviation	0.2788	0.2990	0.2572
Scatter Index	0.1042	0.1122	0.1012
Correlation	0.9779	0.9761	0.9793
Symmetric Slope	0.9986	1.0342	1.0326
Regr. Coefficient	1.0093	1.0362	1.0063
Regr. Constant	-0.0501	-0.0225	0.0700

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Global comparison between altimeter and ECMWF wave model (WAM) first-guess SWH values

Global Significant Wave Height: _ _ _ _ Bias & _____ St. Dev. Difference (SDD)
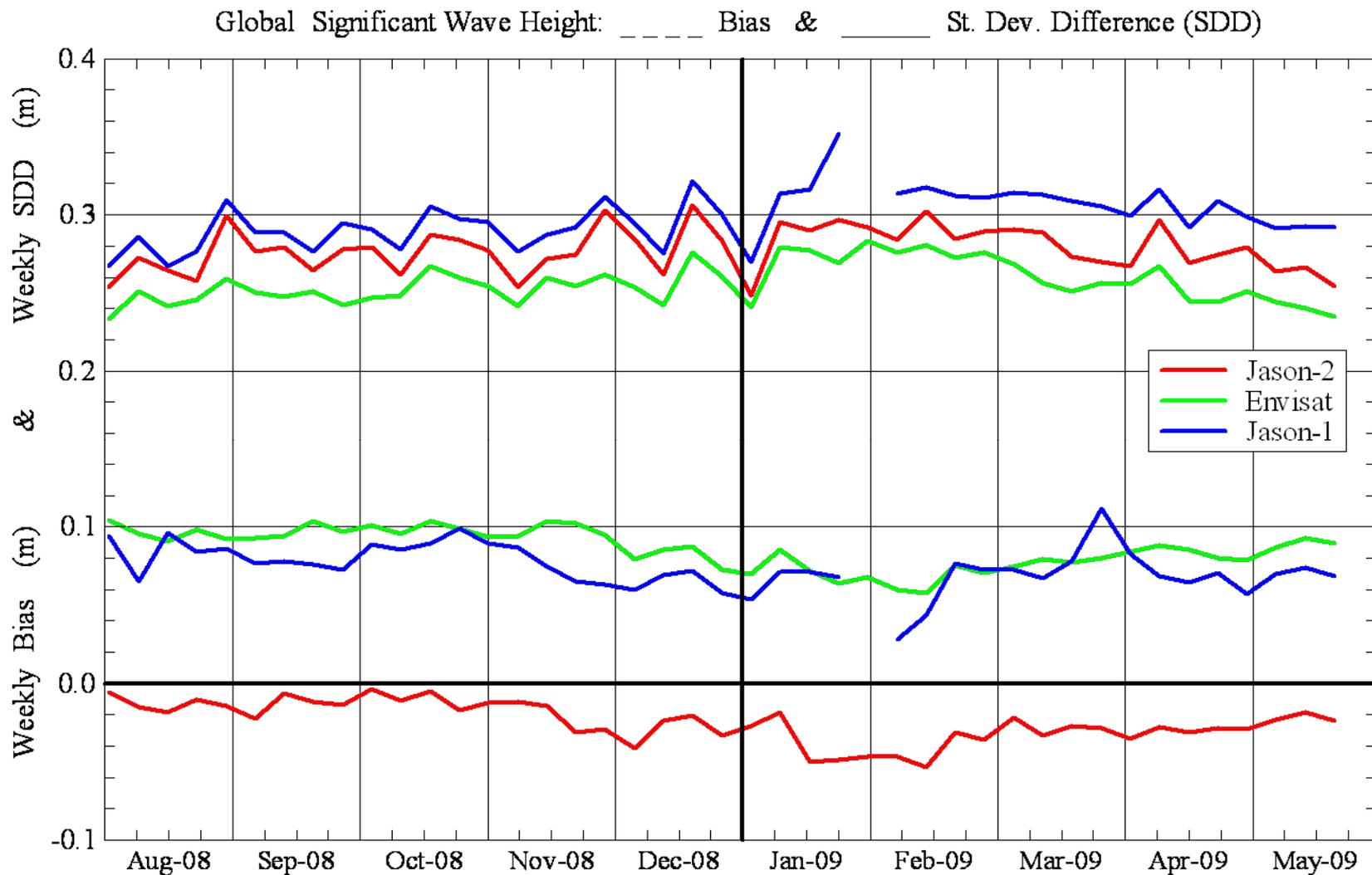
Global comparison between altimeter and in-situ (buoy) SWH values
(From 01 August 2008 to 31 May 2009)
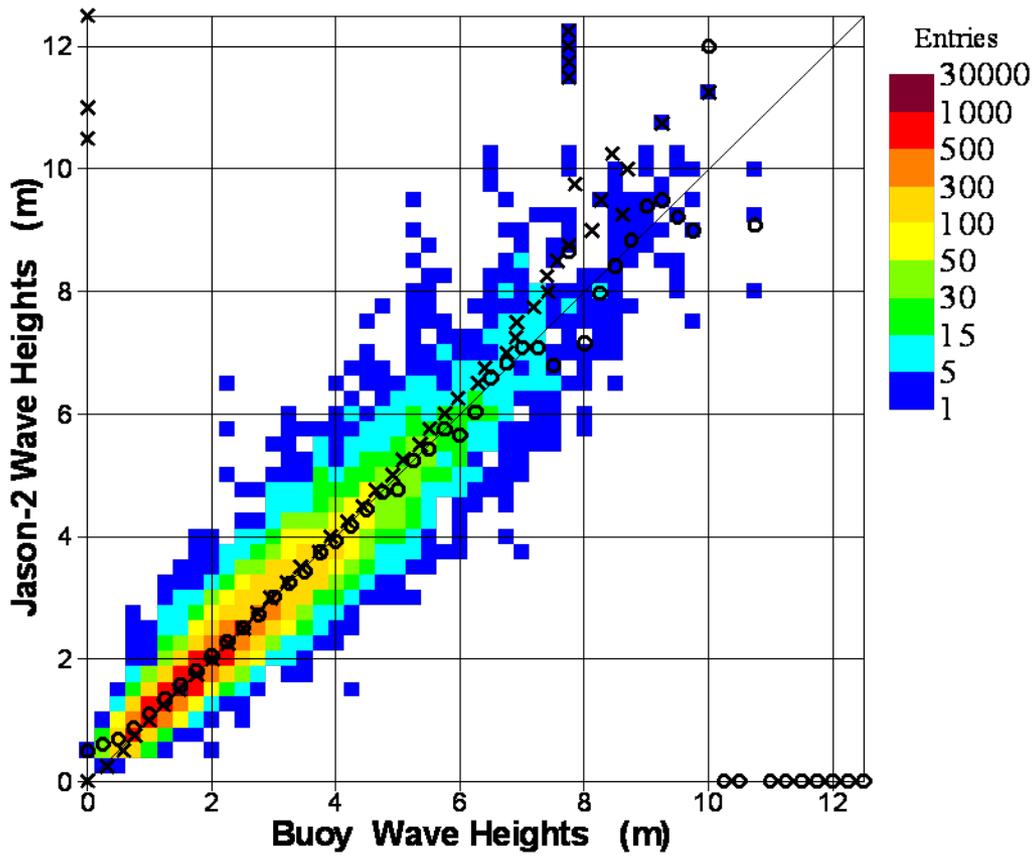
| STATISTICS	Jason-2	Jason-1	Envisat
Entries	24908	14947	20918
Mean Buoy	2.3986	8.5998	2.3893
Mean Jason-2	2.4277	8.7398	2.5277
Bias (Jason-2 - Buoy)	0.0290	0.1400	0.1384
Standard Deviation	0.4119	1.5337	0.3873
Scatter Index	0.1717	0.1783	0.1621
Correlation	0.9544	0.9097	0.9591
Symmetric Slope	1.0107	1.0170	1.0437
Regr. Coefficient	0.9602	0.9293	0.9574
Regr. Constant	0.1244	0.7482	0.2402

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 replaced the corresponding Jason-1 product in the ECMWF system on 10 March 2009.**

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)

———	No data assim.
·········	Jason-2 alone
———	Jason-2 & Envisat
– – –	Jason-1 & Envisat
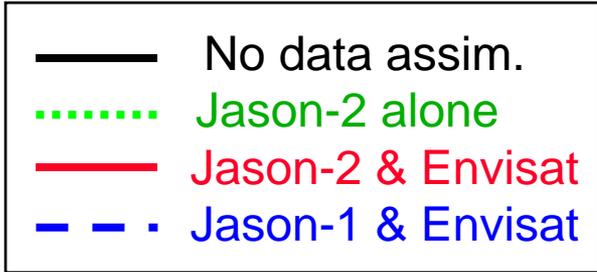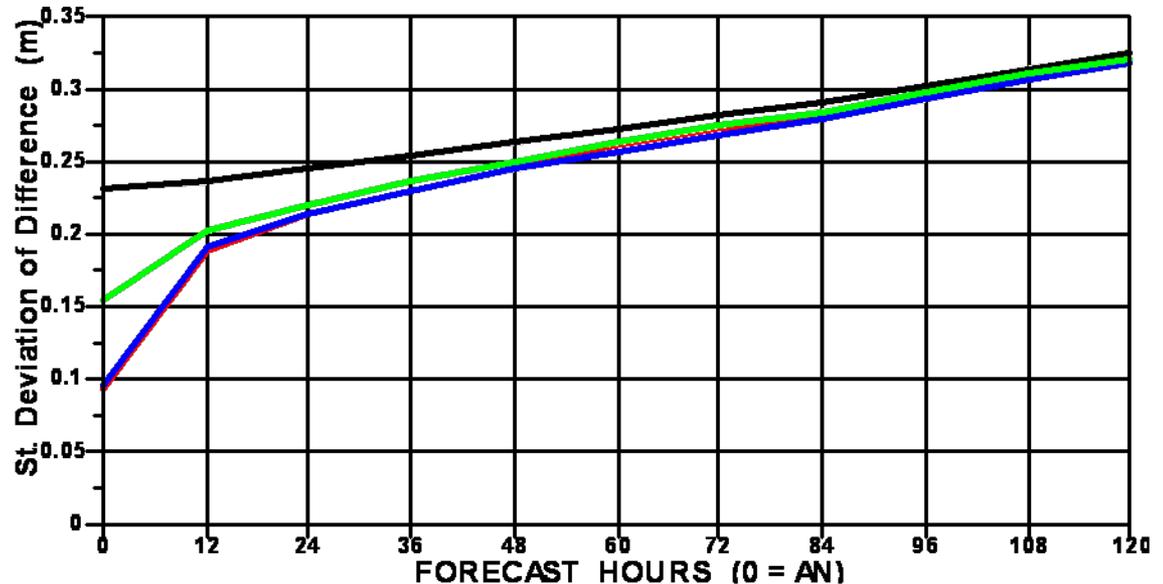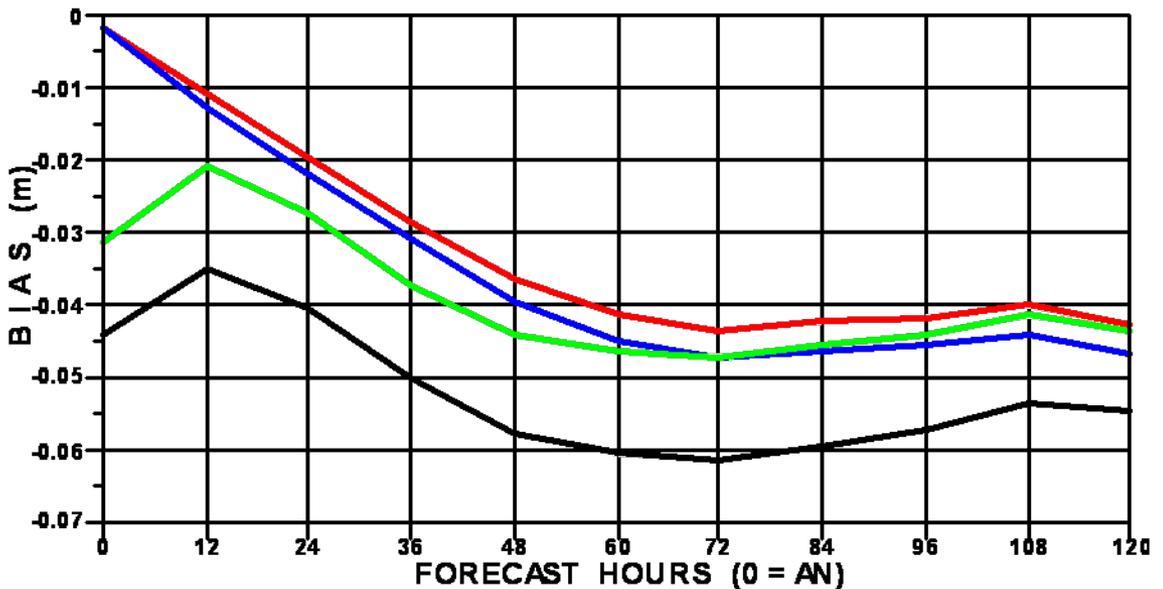
Impact of Jason-2 SWH assimilation on the model peak wave period forecast errors *(at all buoys)*
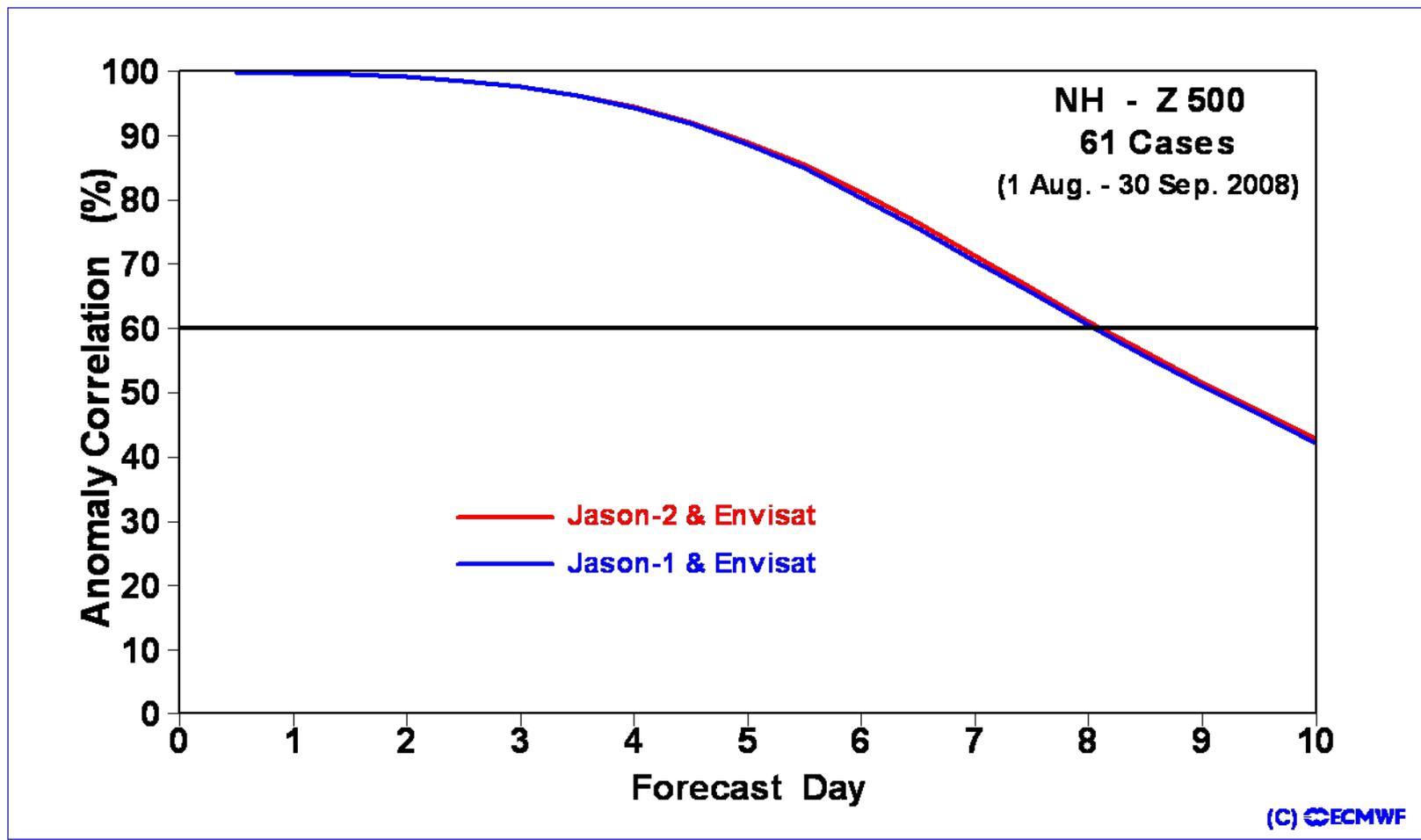## (From 01 August to 21 September 2008)
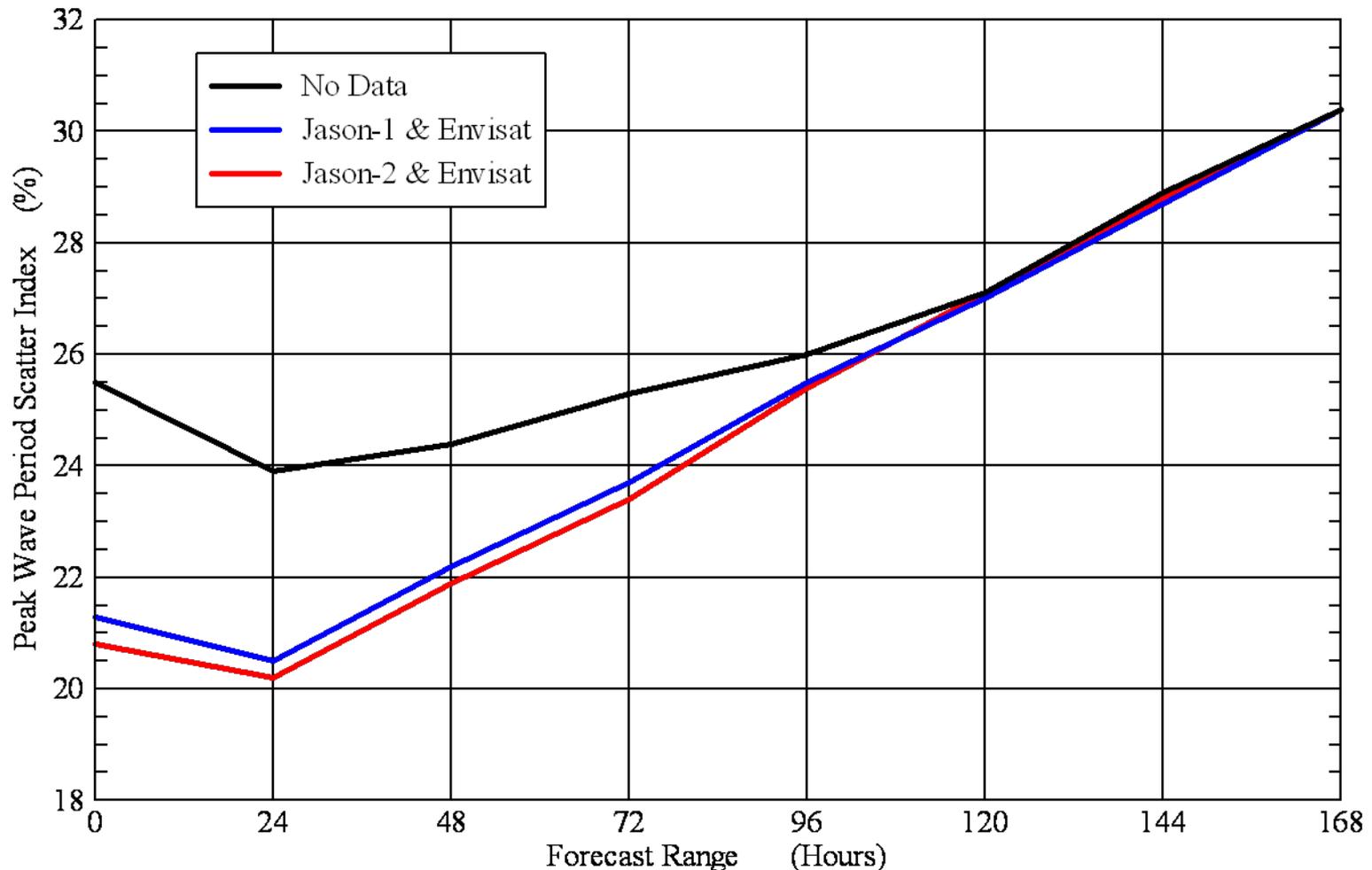
Impact of Jason-2 SWH assimilation on the model 500 hPa Geopotential Height forecast errors in the Northern Hemisphere
(w.r.t. operational analysis, 1 August – 30 September 2008)

Impact of the Assimilation of Jason-1 SWH on Top of Jason-2 & ENVISAT

- **Limited impact.**

- **The impact is positive.**

- **Assimilation of Jason-1 SWH product resumed 8 June 2009.**

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Impact of Jason-1 SWH assimilation on top of Jason-2 + ENVISAT *(at all buoys)*
## (From 10 February to 18 May 2009)

(Number of collocations)	SWH (38174)		Mean W. Period, T_z (28986)		Peak W. Period , T_p (23288)	
	Bias (cm)	SI (%)	Bias (s)	SI (%)	Bias (s)	SI (%)
Jason-1 + (Jason-2 + ENVISAT)	- 3.5	14.7	- 0.168	10.8	0.080	15.6
Jason-2 + ENVISAT	- 3.7	15.1	- 0.172	10.9	0.082	15.7

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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 slightly lower than in-situ measurements.**

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

Global comparison between altimeter and ECMWF model analysis surface wind speed values
## (From 01 August 2008 to 28 May 2009)
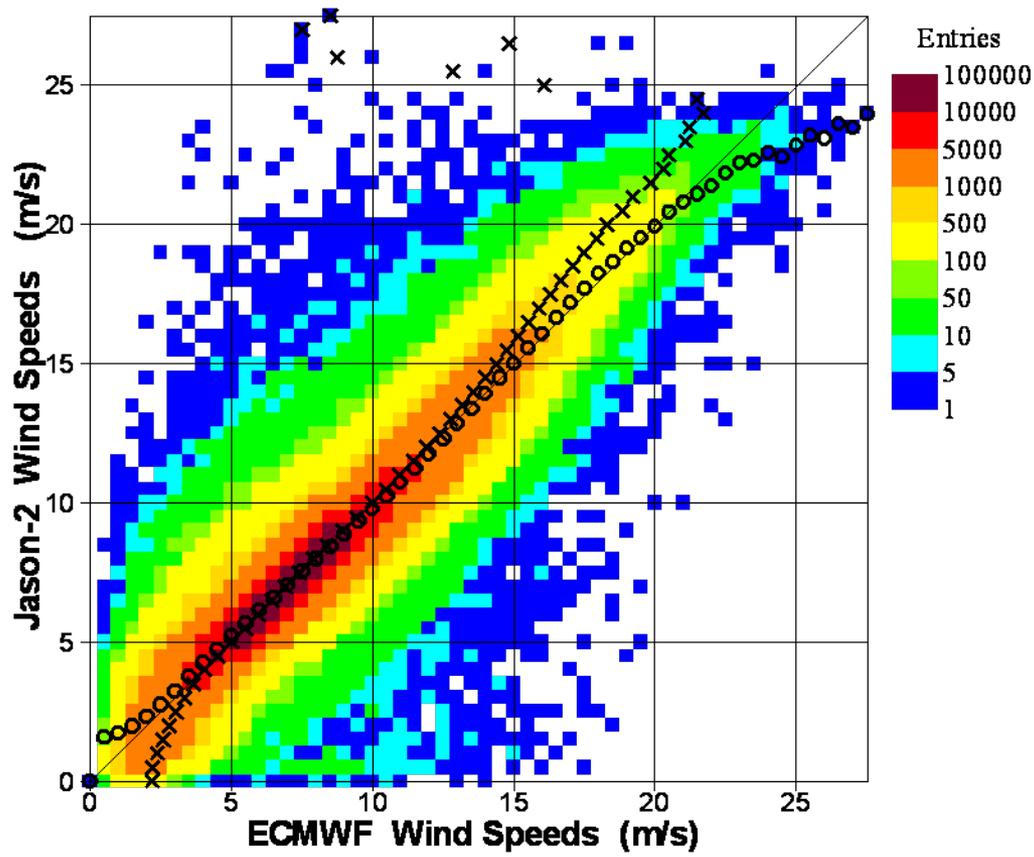
STATISTICS	Jason-2	Jason-1	Envisat
Entries	1109525	1054551	1028484
Mean ECMWF	7.9345	7.9351	7.6800
Mean Jason-2	7.9832	8.2877	7.9378
Bias (Jason-2 - ECMWF)	0.0487	0.3526	0.2577
Standard Deviation	1.2163	1.1984	1.1036
Scatter Index	0.1533	0.1510	0.1437
Correlation	0.9433	0.9454	0.9505
Symmetric Slope	1.0089	1.0436	1.0314
Regr. Coefficient	0.9647	0.9828	0.9704
Regr. Constant	0.3286	0.4888	0.4853

Global comparison between altimeter and ECMWF model analysis surface wind speed values

Global Surface Wind Speed: _ _ _ _ Bias & _____ St. Dev. Difference (SDD)
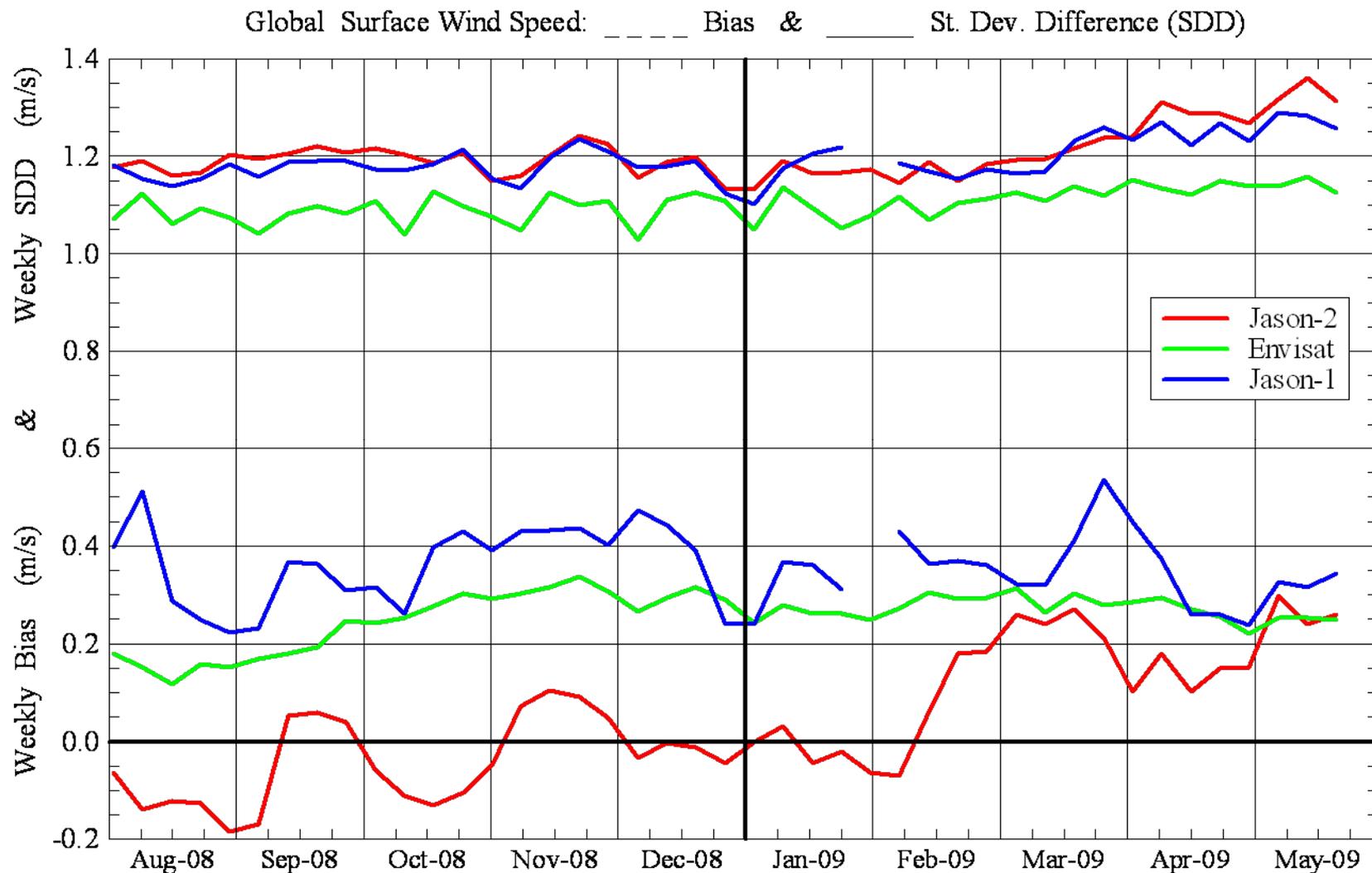
Global comparison between altimeter and in-situ (buoy) surface wind speed values
(From 01 August 2008 to 31 May 2009)
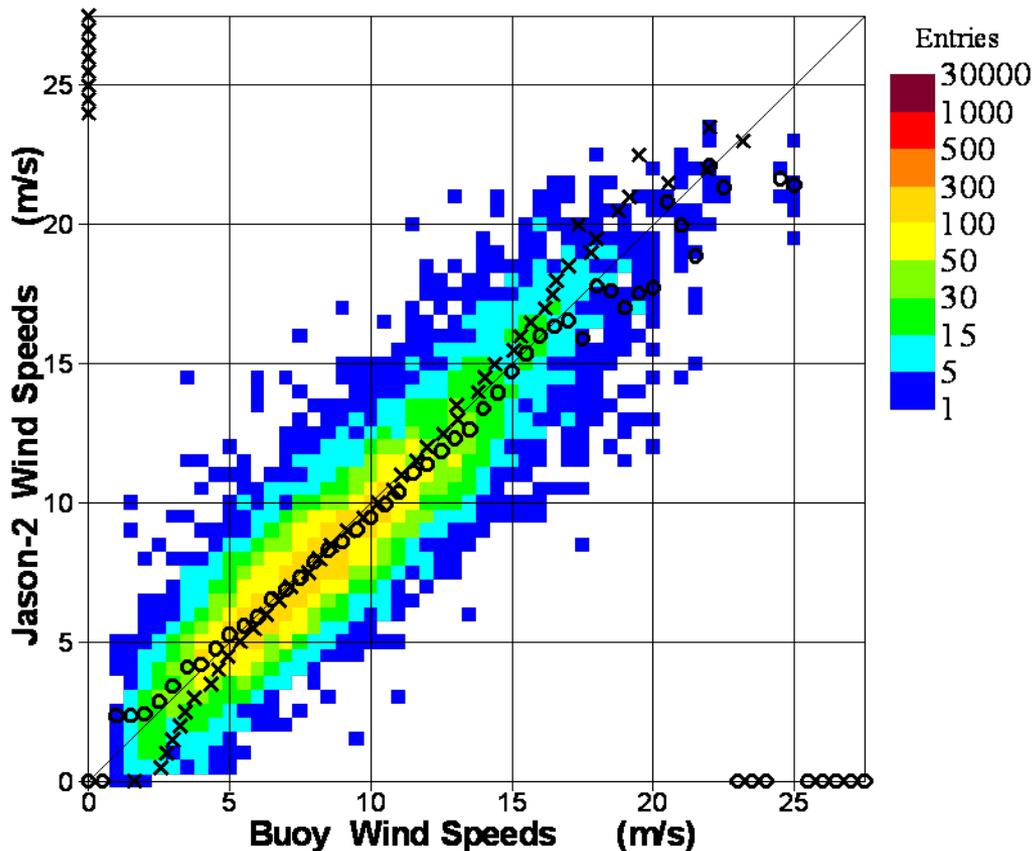
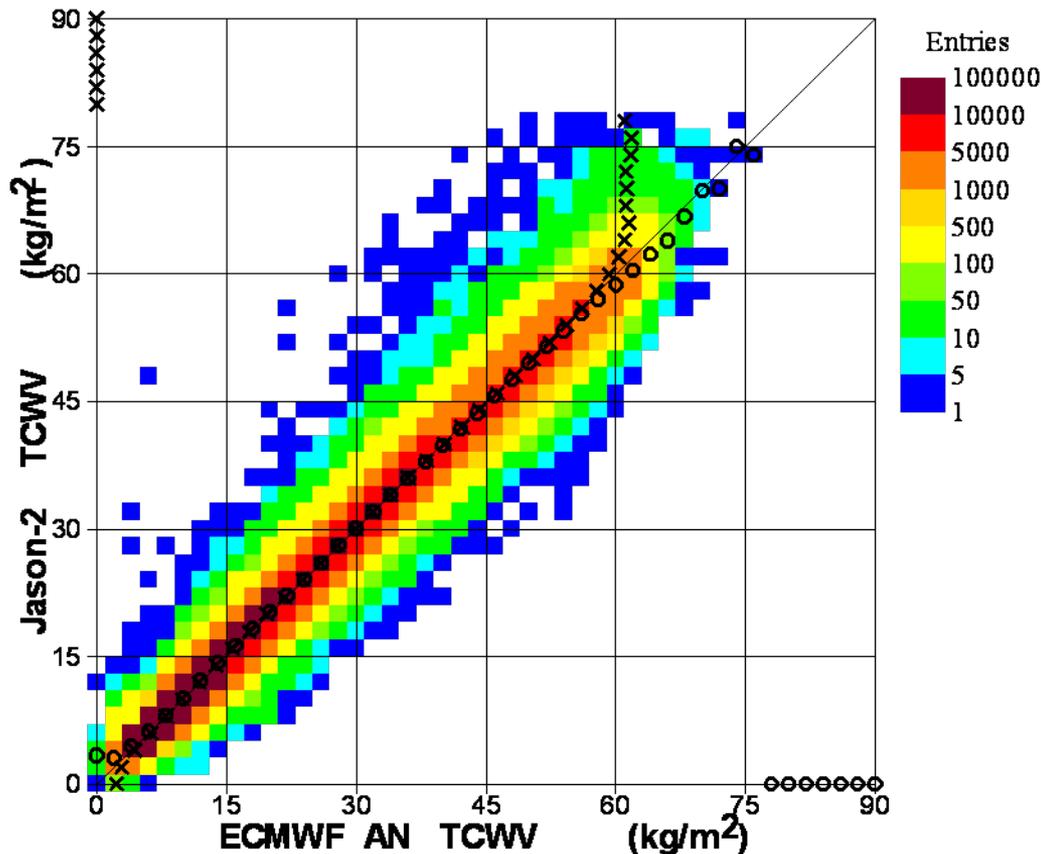| STATISTICS	Jason-2	Jason-1	Envisat
Entries	15774	14947	13436
Mean Buoy	8.5679	8.5998	8.5476
Mean Jason-2	8.3643	8.7398	8.4232
Bias (Jason-2 - Buoy)	-0.2036	0.1400	-0.1244
Standard Deviation	1.5429	1.5337	1.4953
Scatter Index	0.1801	0.1783	0.1749
Correlation	0.9058	0.9097	0.9108
Symmetric Slope	0.9810	1.0170	0.9867
Regr. Coefficient	0.9133	0.9293	0.9050
Regr. Constant	0.5390	0.7482	0.6879

Quality of Jason-2 AMR Water Vapour Content

- **Against ECMWF model** analysis.

- **Good in general.**

- **Compared to the model:**
  Until mid February 2009: slightly wetter; afterwards: slightly drier.

- **Now: AMR is as dry as JMR (Jason-1) and MWR (ENVISAT).**

- **On 4-5 Dec. 2008, it was 10X higher than usual.**

Global comparison between Jason-2 and ECMWF model analysis water vapour content (TCWV) values
(From 01 August 2008 to 28 May 2009)

STATISTICS	Jason-2	Jason-1	Envisat
Entries	1052615	1066978	974305
Mean ECMWF	24.1423	23.6622	24.5330
Mean Jason-2	24.1385	23.3083	23.6834
Bias (Jason-2 - ECMWF)	-0.0038	-0.3539	-0.8496
Standard Deviation	1.9671	1.8360	2.0280
Scatter Index	0.0815	0.0776	0.0827
Correlation	0.9923	0.9932	0.9918
Symmetric Slope	0.9971	0.9848	0.9802
Regr. Coefficient	0.9831	0.9775	1.0075
Regr. Constant	0.4051	0.1780	-1.0330

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Global comparison between Jason-2 and ECMWF model analysis water vapour content (TCWV) values

Global Total Column Water Vapour: _ _ _ _ Bias & _____ St. Dev. Difference (SDD)
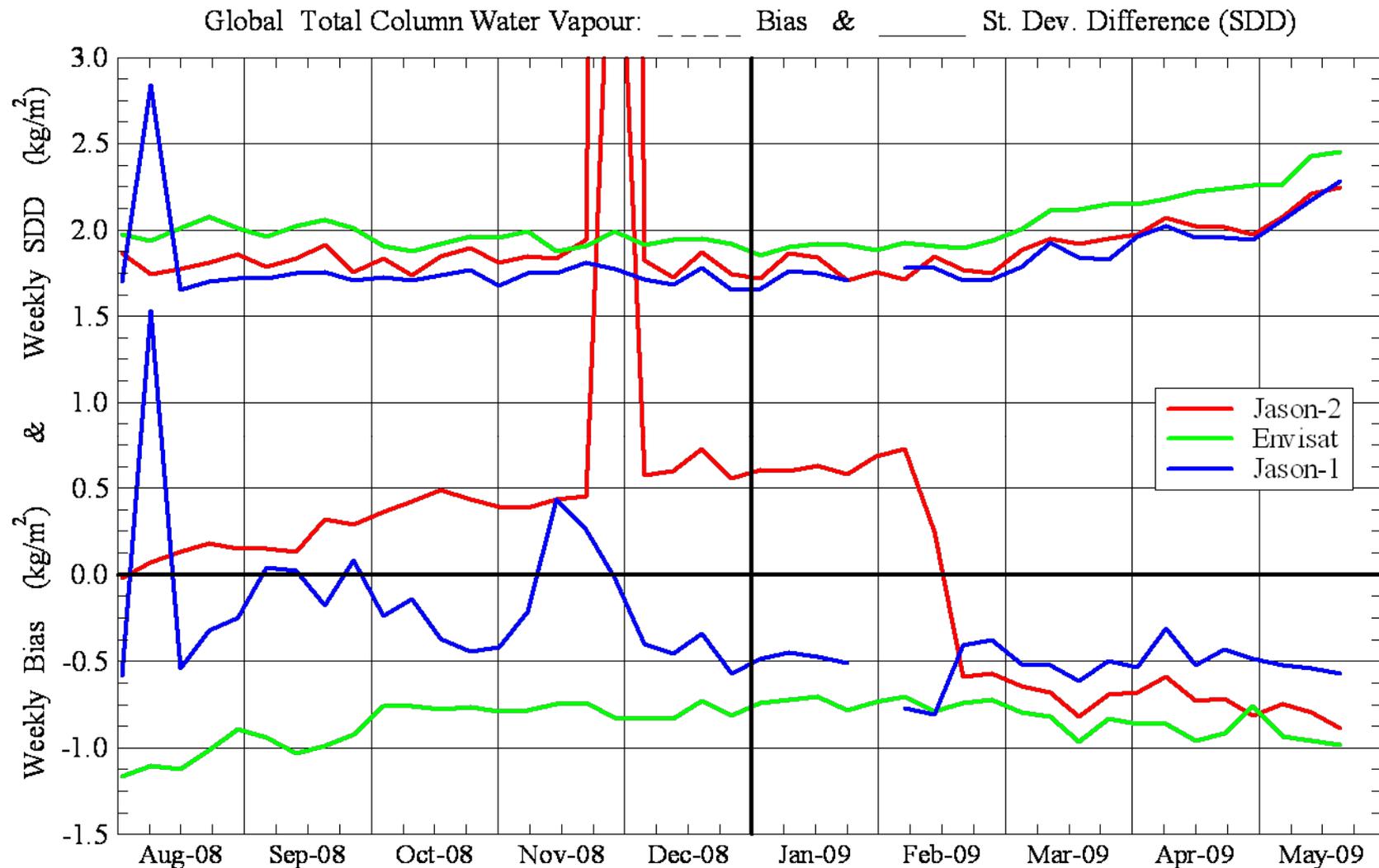
<u>Summary</u>

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

- **The rate of data reception is quite good.**

- **Significant wave height product is in very good agreement with the model and in-situ data. Although it is better than Jason-1 counterpart, it is not as good as ENVISAT.**

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Summary (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 started on 10 March 2009 replacing Jason-1.**

- **Assimilating Jason-1 SWH on top of Jason-2 and ENVISAT adds a little positive impact.**

- **Assimilation of Jason-1 SWH resumed on 8 June 2009.**

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Summary *(Cont'd)*

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

- **AMR water vapour product was slightly wetter than the ECMWF model until mid February 2009, when it started to be slightly drier. Otherwise, it is in good agreement with the corresponding product from ECMWF model.**

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END

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