Calibration/Validation of Jason Wind/Wave data

SWT Jason, New-Orleans Louisiana, USA

21-23 October 2002

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ABSTRACT

Météo-France Marine and Oceanography Division is using data from the ERS2 satellite to improve descriptions of the sea-state. As it travels along its orbit above the earth's surface, the measuring platform's onboard altimeter measures significant wave heights and wind speeds. These parameters are assimilated into Météo-France's VAG sea-state forecasting model. Envisat and Jason, successors of ERS2 and Jason respectively will provide similar and validated data during Fall 2002.Before being assimilated, the data must be validated and calibrated. Results of the Calibration and Validation programme of wind and wave data are presented. Fast delivery OSDR and Offline GDR wind and wave related products are compared with numerical weather/waves prediction model data. results are also compared with the one obtained with Topex data. A particular attention is paid to the geophysical parameters or flags derived by using new algorithms as for the wind speed.

CALVAL PROGRAMME USING NWP, NSSP Models and TOPEX data

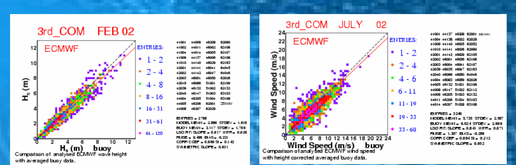
Main Objectives:

To Calibrate/Validate JASON Fast delivery and Offline GDR wind and wave data sets through comparison with Numerical Weather Predictions (NWP) models, Numerical Sea-State Predictions (NSSP) models, buoys data and other satellite data (TOPEX)

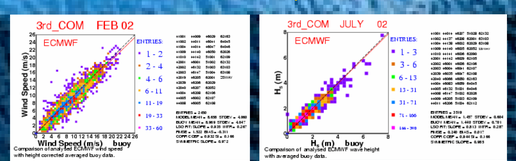
The main advantages of using model data are:

- High number of collocated values compared to buoys (about 15 000 independent data per cycle compared to 50 for buoys).
- Wide range of values (with buoys, values limited to 15 m/s and 5 m), no regional effects.
- Complementary information (buoys, other satellites).

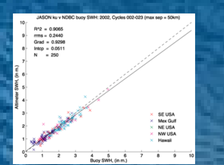
ECMWF winds versus buoys winds



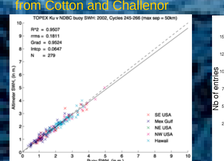
WAM Hs versus buoys Hs



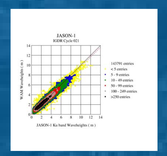
Jason SWH against buoys data from Cotton and Challenor



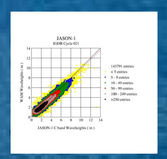
Topex SWH against buoys data



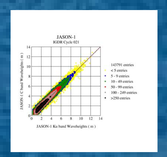
-JASON IGDR



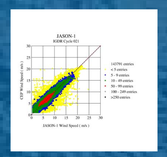
JASON : MEAN = 2.67 STDEV = 1.47
WAM : MEAN = 2.66 STDEV = 1.34
ODR FIT WAM-H(JASON)
SLOPE = 0.91 INTR= 0.22
CORRELATION COEFF = 0.97
BIAS = -0.03
RMS = 0.37
STANDARD DEVIATION = 0.37
SYMMETRIC SLOPE = 0.97



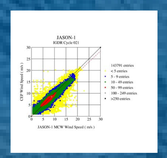
JASON : MEAN = 2.66 STDEV = 1.51
WAM : MEAN = 2.64 STDEV = 1.34
ODR FIT WAM-H(JASON)
SLOPE = 0.97 INTR= 0.71
CORRELATION COEFF = 0.95
BIAS = -0.02
RMS = 0.47
STANDARD DEVIATION = 0.47
SYMMETRIC SLOPE = 0.97



Ku_band : MEAN = 2.67 STDEV = 1.47
C_band : MEAN = 2.66 STDEV = 1.51
OSD FIT C_band=F(Ku_band)
SLOPE = 1.03 INTR= -0.07
CORRELATION COEFF = 0.97
BIAS = 0.00
RMS = 0.34
STANDARD DEVIATION = 0.34
SYMMETRIC SLOPE = 1.00

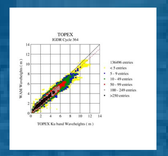


JASON : MEAN = 7.64 STDEV = 3.67
CEP : MEAN = 7.91 STDEV = 3.44
ODR FIT CEP=F(JASON)
SLOPE = 0.93 INTR= 0.71
CORRELATION COEFF = 0.92
BIAS = 0.17
RMS = 1.43
STANDARD DEVIATION = 1.44
SYMMETRIC SLOPE = 1.01

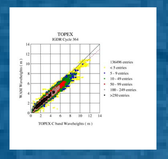


JASON_MCW : MEAN = 8.16 STDEV = 3.83
CEP : MEAN = 7.81 STDEV = 3.44
ODR FIT CEP=F(JASON_MCW)
SLOPE = 0.85 INTR= 0.56
CORRELATION COEFF = 0.92
BIAS = -0.35
RMS = 1.54
STANDARD DEVIATION = 1.49
SYMMETRIC SLOPE = 0.95

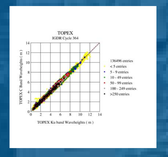
-TOPEX IGDR



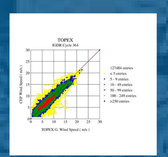
TOPEX : MEAN = 2.83 STDEV = 1.61
WAM : MEAN = 2.69 STDEV = 1.42
ODR WAM=F(TOPEX)
SLOPE = 0.88 INTR= 0.20
CORRELATION COEFF = 0.98
BIAS = -0.14
RMS = 0.38
STANDARD DEVIATION = 0.36
SYMMETRIC SLOPE = 0.94



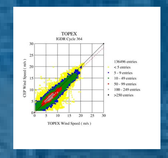
TOPEX : MEAN = 2.87 STDEV = 1.60
WAM : MEAN = 2.69 STDEV = 1.42
ODR FIT WAM-F(TOPEX)
SLOPE = 0.89 INTR= 0.14
CORRELATION COEFF = 0.98
BIAS = -0.18
RMS = 0.41
STANDARD DEVIATION = 0.37
SYMMETRIC SLOPE = 0.93



Ku_band : MEAN = 2.83 STDEV = 1.61
C_band : MEAN = 2.87 STDEV = 1.60
ODR FIT C_band=F(Ku_band)
SLOPE = 0.99 INTR= 0.06
CORRELATION COEFF = 1.00
BIAS = 0.04
RMS = 0.16
STANDARD DEVIATION = 0.16
SYMMETRIC SLOPE = 1.01

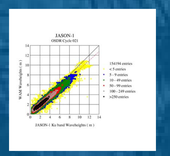


TOPEX_G : MEAN = 7.83 STDEV = 3.65
CEP : MEAN = 7.93 STDEV = 3.50
LSQ FIT CEP=F(TOPEX_G)
SLOPE = 0.90 INTR= 0.90
CORRELATION COEFF = 0.94
BIAS = 0.10
RMS = 1.28
STANDARD DEVIATION = 1.27
SYMMETRIC SLOPE = 1.00

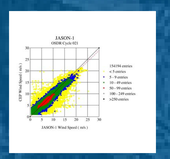


TOPEX : MEAN = 8.29 STDEV = 3.86
CEP : MEAN = 7.93 STDEV = 3.52
ODR FIT CEP=F(TOPEX)
SLOPE = 0.93 INTR= 0.55
CORRELATION COEFF = 0.93
BIAS = -0.43
RMS = 1.49
STANDARD DEVIATION = 1.43
SYMMETRIC SLOPE = 0.94

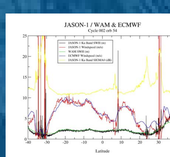
-JASON OSDR



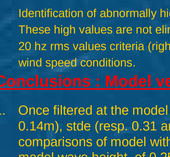
JASON : MEAN = 2.88 STDEV = 1.67
WAM : MEAN = 2.67 STDEV = 1.44
ODR FIT WAM-F(JASON)
SLOPE = 0.85 INTR= 0.21
CORRELATION COEFF = 0.97
BIAS = -0.21
RMS = 0.49
STANDARD DEVIATION = 0.45



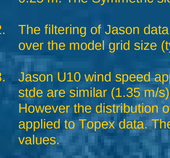
JASON: MEAN = 8.02 STDEV = 3.90
CEP : MEAN = 7.81 STDEV = 3.56
ODR FIT CEP=F(JASON)
SLOPE = 0.91 INTR= 0.53
CORRELATION COEFF = 0.92
BIAS = -0.21
RMS = 1.53
STANDARD DEVIATION = 1.49
SYMMETRIC SLOPE = 0.96



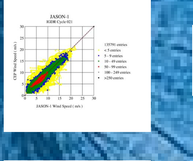
Ku_band : MEAN = 2.83 STDEV = 1.61
C_band : MEAN = 2.87 STDEV = 1.60
ODR FIT C_band=F(Ku_band)
SLOPE = 0.99 INTR= 0.06
CORRELATION COEFF = 1.00
BIAS = 0.04
RMS = 0.16
STANDARD DEVIATION = 0.16
SYMMETRIC SLOPE = 1.01



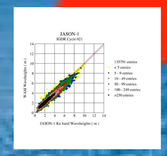
JASON : MEAN = 7.71 STDEV = 3.63
CEP : MEAN = 7.91 STDEV = 3.41
ODR FIT CEP=F(JASON)
SLOPE = 0.93 INTR= 0.62
CORRELATION COEFF = 0.93
BIAS = 0.16
RMS = 1.36
STANDARD DEVIATION = 1.35
SYMMETRIC SLOPE = 1.01



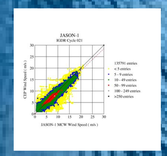
JASON_MCW : MEAN = 8.23 STDEV = 3.79
CEP : MEAN = 7.88 STDEV = 3.41
ODR FIT CEP=F(JASON_MCW)
SLOPE = 0.89 INTR= 0.52
CORRELATION COEFF = 0.93
BIAS = -0.14
RMS = 1.46
STANDARD DEVIATION = 1.42
SYMMETRIC SLOPE = 0.95

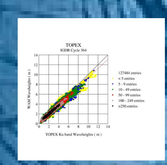


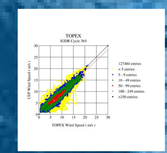
Filtred altimeter data (moving average over 70 km)

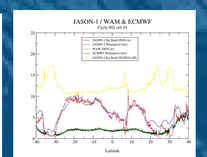


JASON : MEAN = 2.70 STDEV = 1.45
WAM : MEAN = 2.67 STDEV = 1.33
ODR FIT WAM-H(JASON)
SLOPE = 0.92 INTR= 0.20
CORRELATION COEFF = 0.98
BIAS = -0.03
RMS = 0.33
STANDARD DEVIATION = 0.31
SYMMETRIC SLOPE = 0.97





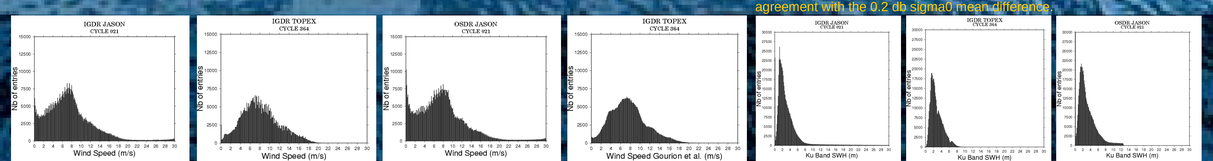




Identification of abnormally high values for Hs from P. Queffeulou.
These high values are not eliminated by quality flags (left figure) but with 20 hz rms values criteria (right figure). They are associated with low wind speed conditions.

Conclusions : Model versus Jason and Topex data

1. Once filtered at the model resolution, Jason appears to give a better measure of Hs than TOPEX, in terms of bias (resp. -0.03m and –0.14m), stde (resp. 0.31 and 0.34) and symmetric slope (resp. 0.97 and 0.93) at high confidence level (>99%). This is deduced from comparisons of model with satellite and model with buoys : comparison of WAM with buoys includes a maximum underestimation of model wave height of 0.25 m in February with a standard deviation error of 0.45 m, in July there is no bias and the the stde is about 0.25 m. The Symmetric slopes varies between 0.93 and 0.97.
2. The filtering of Jason data has reduced the dispersion of the error but not TOPEX. This suggests a strong correlation of the wave height over the model grid size (typically 60 km)
3. Jason U10 wind speed appears to be better than TOPEX in term of bias (resp 0.17 and –0.45) and Slope (resp. 1.01 and 0.94) but the stde are similar (1.35 m/s). However this improvement is mainly due to the new wind speed model function used (Gourrion et all. 2000). However the distribution of low wind speeds is not realistic for Jason. This problems does not arise when the new model function is applied to Topex data. The use of 20 Hz rms values for SWH and WS are recommended in order to eliminate not realistic high SWH values.
4. Jason OSDR Hs and Wind Speed show slightly more scatter than Jason IGDR.
5. OSDR mean Hs value is 0.2 m higher than IGDR one's. The OSDR mean WS value is 0.37 m/s higher than IGRD one's and this is in agreement with the 0.2 db sigma0 mean difference.



Wind speed and SWH Histogrammes for Jason IGR, TOPEX IGDR and Jason OSDR

METEO FRANCE