ECMWF Report on ERS-2 RA for October 2007

Title: Report on ERS-2 Radar Altimeter wave height and wind speed data.

By: *Saleh Abdalla*

Date: *23 November 2007*

Overview:

Based on the data received at ECMWF during the whole month, on average, 5161 observations arrived at ECMWF every 6 hours of which 67.62% passed the quality control. As can be seen in Figure 1, there was no data during the 6-hour time window centred at 06:00 UTC on the 26th. of the month. The current coverage of the data covers: the North Atlantic, the western coast of North America, the eastern coast of China and around Korea and Japan, the Southern Ocean and the northeaster parts of the Indian Ocean as can be seen in Figure 27. The quality of the received data is as good as usual.

Backscatter:

ESR-2 $<\sigma_0>$ = 10.98 dB (with two main peaks at 10.6 and 10.8 dB).

Wind Speed Comparison with ECMWF wind speeds (bias):

ERS-2 global: - 0.033 m/s

ERS-2 northern hemisphere: - 0.096 m/s

ERS-2 tropics: - 0.142 m/s

ERS-2 southern hemisphere: + 0.615 m/s

Saleh Abdalla
European Centre for Medium Range Weather Forecasts
Shinfield Park, Reading, Berkshire RG2 9AX, England
Telephone: U.K. (0118) 949 9703, International (+44 118) 949 9703
Telex 984 7908 ECMWF G, Telefax (0118) 986 9450, e-mail: abdalla@ecmwf.int

ECMWF Report on ERS-2 RA for October 2007

Wind Speed Comparison with buoy wind speeds (bias):

ERS-2 global: - 0.597 m/s

ERS-2 northern hemisphere: - 0.626 m/s

ERS-2 tropics (Hawaii): *missing*

Wave Height Comparison with ECMWF wave heights (bias):

ERS-2 global: - 0.059 m (lowest waves measured: 0.6m)

ERS-2 northern hemisphere: - 0.044 m

ERS-2 tropics: - 0.036 m

ERS-2 southern hemisphere: - 0.206 m

Wave Height Comparison with buoy wave heights (bias):

ERS-2 global: - 0.092 m

ERS-2 northern hemisphere: - 0.098 m

ERS-2 tropics (Hawaii): *missing*

Remarks:

- The quality of Altimeter data, both wind speed and significant wave height, is nominal.
- Note that the large fluctuations in the Southern Hemispheric (and Tropical) bias in Figures 13 and 24 are basically due to the limited number of daily measurements.

Saleh Abdalla
European Centre for Medium Range Weather Forecasts
Shinfield Park, Reading, Berkshire RG2 9AX, England
Telephone: U.K. (0118) 949 9703, International (+44 118) 949 9703
Telex 984 7908 ECMWF G, Telefax (0118) 986 9450, e-mail: abdalla@ecmwf.int

ECMWF Report on ERS-2 RA for October 2007

- According to ESA (EOHelp message of 4 July 2003), the recording capabilities of ERS-2 are declared permanently unavailable following the failure of the ERS-2 tape recorder on 22 June 2003. The ERS-2 tape recorders were used to record the ERS-2 Low Rate mission globally for a period of 8 years of continuous acquisition. The global coverage is, therefore, discontinued. The ERS-2 Low Rate mission will be continued within the visibility of ESA ground stations over Europe, North Atlantic, the Arctic and western North America. Coverage extended to include eastern coast of China and around Korea and Japan since 25 June 2005, the Southern Ocean since 4 July 2005 and the north eastern parts of the Indian Ocean since 19 October 2006. Current coverage can be seen in Figure 27.
- Assimilation of ERS-2 RA wave heights into ECMWF wave model was stopped on 21st. of October 2003 and replaced by ENVISAT RA-2 Ku-band wave heights. Both instruments can not be assimilated at the same time as both satellites follow the same track with relatively short time separation (both can be assimilated safely if they were not so close).
- ENVISAT Ku-Band and Jason altimeter significant wave height data and ENVISAT ASAR Wave Mode Level 1b data are assimilated in the ECMWF wave model.
- There was no ECMWF model change during this month. The current operational IFS cycle is CY32R2 (since 05 June 2007).

Comparison Method:

The Altimeter wave height and wind speed data, as received by ECMWF from ESA through GTS, are the so-called fast delivery products. At ECMWF these data are subject to a quality control method, the details of which are described by Janssen et al. (1989) and Bauer et al. (1992). Consequently, superobservations are formed by averaging 30 consecutive data in order to match the spatial scales of the operational WAM model. Therefore, the collocation statistics are based on the comparison between these superobservations and operational wavemodel products.

In addition, since also wave observations from buoys are received through the GTS, the Altimeter products are also compared against buoy observations. Again, in order to have matching scales, the buoy observations are averaged over a

Saleh Abdalla
European Centre for Medium Range Weather Forecasts
Shinfield Park, Reading, Berkshire RG2 9AX, England
Telephone: U.K. (0118) 949 9703, International (+44 118) 949 9703
Telex 984 7908 ECMWF G, Telefax (0118) 986 9450, e-mail: abdalla@ecmwf.int

six hour time window. Apart from this, also a height correction is applied to the wind speed observations, since not all buoys observe the winds at the standard height of 10 m. A default observation height of 5 m is assumed, and when available the actual observation height is used. In order to interpolate from the observation height to the standard height a logarithmic wind profile with a roughness length as given by the Charnock relation is assumed, where the Charnock parameter is given the constant value of 0.018.

Figure captions:

Figure 1: Time series of data reception for ERS-2 Altimeter data for October 2007.

Figure 2: Distribution of the ERS-2 Altimeter Backscatter after QC for October 2007.

Figure 3: Distribution of the ERS-2 Altimeter wind speeds after QC for October 2007.

Figure 4: Distribution of the ERS-2 Altimeter wind speeds after along track averaging for October 2007.

Figure 5: Global distribution of ECMWF ocean surface wind speeds for October 2007.

Figure 6: Comparison of ECMWF wind speed results with ERS-2 Altimeter wind speed data for October 2007 (global).

Figure 7: Comparison of ECMWF wind speed results with ERS-2 Altimeter wind speed data for October 2007 (northern hemisphere)

Figure 8: Comparison of ECMWF wind speed results with ERS-2 Altimeter wind speed data for October 2007 (tropics)

Figure 9: Comparison of ECMWF wind speed results with ERS-2 Altimeter wind speed data for October 2007 (southern hemisphere)

Figure 10: Comparison of buoy wind speed observations with ERS-2 Altimeter wind speed data for October 2007 (global).

Figure 11: Comparison of buoy wind speed observations with ERS-2 Altimeter wind speed data for October 2007 (northern hemisphere).

Figure 12: Comparison of buoy wind speed observations with ERS-2 Altimeter wind speed data for October 2007 (hawaii).

Figure 13: ERS-2 Altimeter wind speeds: Timeseries of bias (ERS-2 - model) and scatter index (SI).

Figure 14: Distribution of the ERS-2 Altimeter wave heights after QC for October 2007.

Figure 15: Distribution of the ERS-2 Altimeter wave heights after along track averaging for October 2007.

Saleh Abdalla
European Centre for Medium Range Weather Forecasts
Shinfield Park, Reading, Berkshire RG2 9AX, England
Telephone: U.K. (0118) 949 9703, International (+44 118) 949 9703
Telex 984 7908 ECMWF G, Telefax (0118) 986 9450, e-mail: abdalla@ecmwf.int

Figure 16: Global distribution of ECMWF wave heights for October 2007.
Figure 17: Comparison of ECMWF wave height results with ERS-2 Altimeter wave height data for October 2007 (global).
Figure 18: Comparison of ECMWF wave height results with ERS-2 Altimeter wave height data for October 2007 (northern hemisphere)
Figure 19: Comparison of ECMWF wave height results with ERS-2 Altimeter wave height data for October 2007 (tropics)
Figure 20: Comparison of ECMWF wave height results with ERS-2 Altimeter wave height data for October 2007 (southern hemisphere)
Figure 21: Comparison of buoy wave height observations with ERS-2 Altimeter wave height data for October 2007 (global).
Figure 22: Comparison of buoy wave height observations with ERS-2 Altimeter wave height data for October 2007 (northern hemisphere).
Figure 23: Comparison of buoy wave height observations with ERS-2 Altimeter wave height data for October 2007 (hawaii).
Figure 24: ERS-2 Altimeter wave heights: Timeseries of bias (ERS-2 - model) and scatter index (SI) for October 2007.
Figure 25: ERS-2 Altimeter wave heights: Timeseries of bias (ERS-2 - model) and scatter index (SI) from December 1996 to October 2007.
Figure 26: ERS-2 Altimeter wind speeds: Timeseries of bias (ERS-2 - model) and scatter index (SI) from December 1996 to October 2007.
Figure 27: Significant wave height: Monthly mean difference of ERS-2 altimeter data minus wave model results for October 2007.

Saleh Abdalla
European Centre for Medium Range Weather Forecasts
Shinfield Park, Reading, Berkshire RG2 9AX, England
Telephone: U.K. (0118) 949 9703, International (+44 118) 949 9703
Telex 984 7908 ECMWF G, Telefax (0118) 986 9450, e-mail: abdalla@ecmwf.int

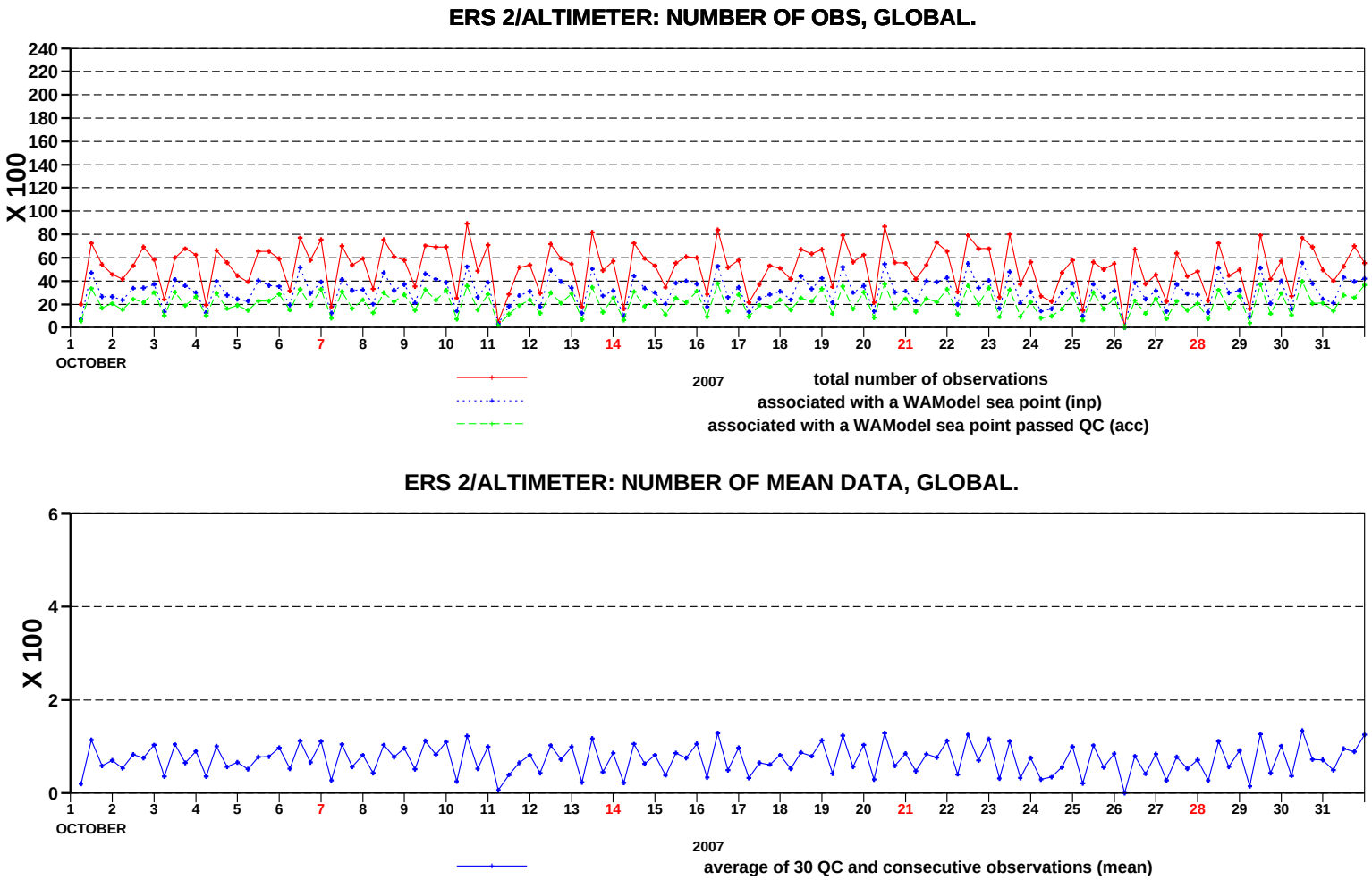


Figure 1:Time series of data reception for ERS-2 Altimeter data for October 2007

Saleh Abdalla
European Centre for Medium Range Weather Forecasts
Shinfield Park, Reading, Berkshire RG2 9AX, England
Telephone: U.K. (0118) 949 9703, International (+44 118) 949 9703
Telex 984 7908 ECMWF G, Telefax (0118) 986 9450, e-mail: abdalla@ecmwf.int

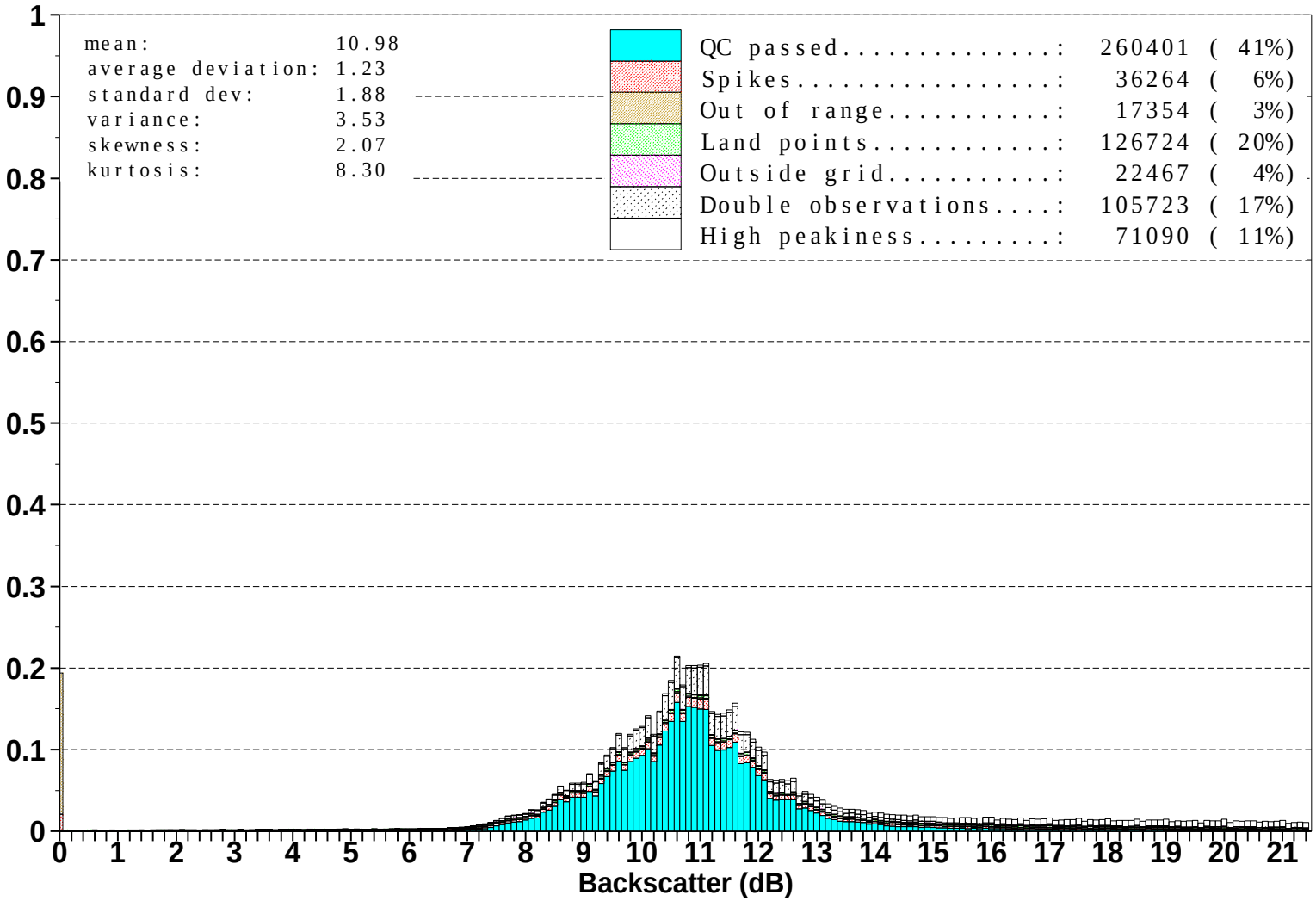


Figure 2: Distribution of the ERS-2 Altimeter backscatter after QC for October 2007

Saleh Abdalla
European Centre for Medium Range Weather Forecasts
Shinfield Park, Reading, Berkshire RG2 9AX, England
Telephone: U.K. (0118) 949 9703, International (+44 118) 949 9703
Telex 984 7908 ECMWF G, Telefax (0118) 986 9450, e-mail: abdalla@ecmwf.int

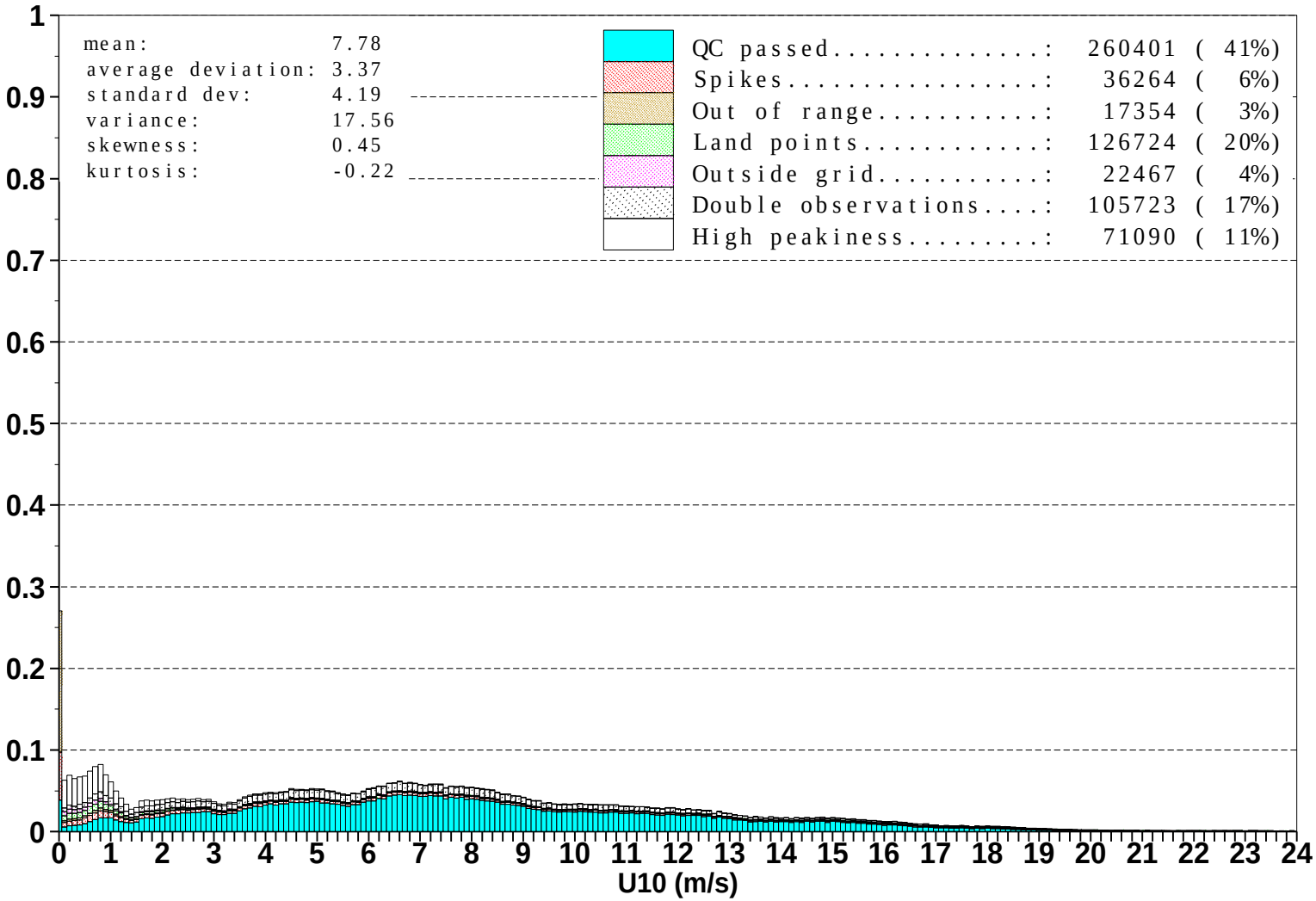


Figure 3: Distribution of the ERS-2 Altimeter wind speeds after QC for October 2007

Saleh Abdalla
European Centre for Medium Range Weather Forecasts
Shinfield Park, Reading, Berkshire RG2 9AX, England
Telephone: U.K. (0118) 949 9703, International (+44 118) 949 9703
Telex 984 7908 ECMWF G, Telefax (0118) 986 9450, e-mail: abdalla@ecmwf.int

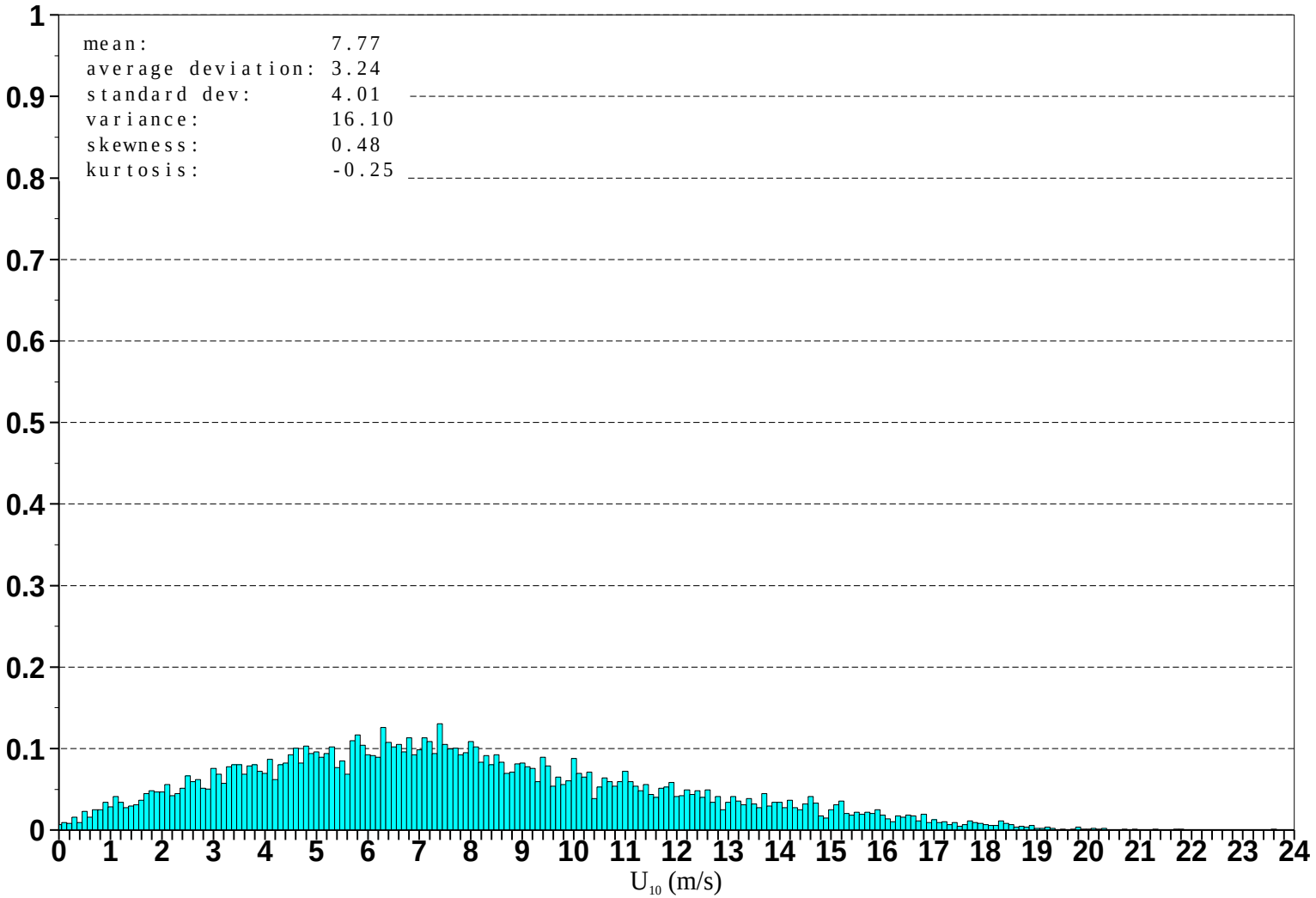


Figure 4: Distribution of ERS-2 Altimeter wind speeds after along track averaging for October 2007

Saleh Abdalla
European Centre for Medium Range Weather Forecasts
Shinfield Park, Reading, Berkshire RG2 9AX, England
Telephone: U.K. (0118) 949 9703, International (+44 118) 949 9703
Telex 984 7908 ECMWF G, Telefax (0118) 986 9450, e-mail: abdalla@ecmwf.int

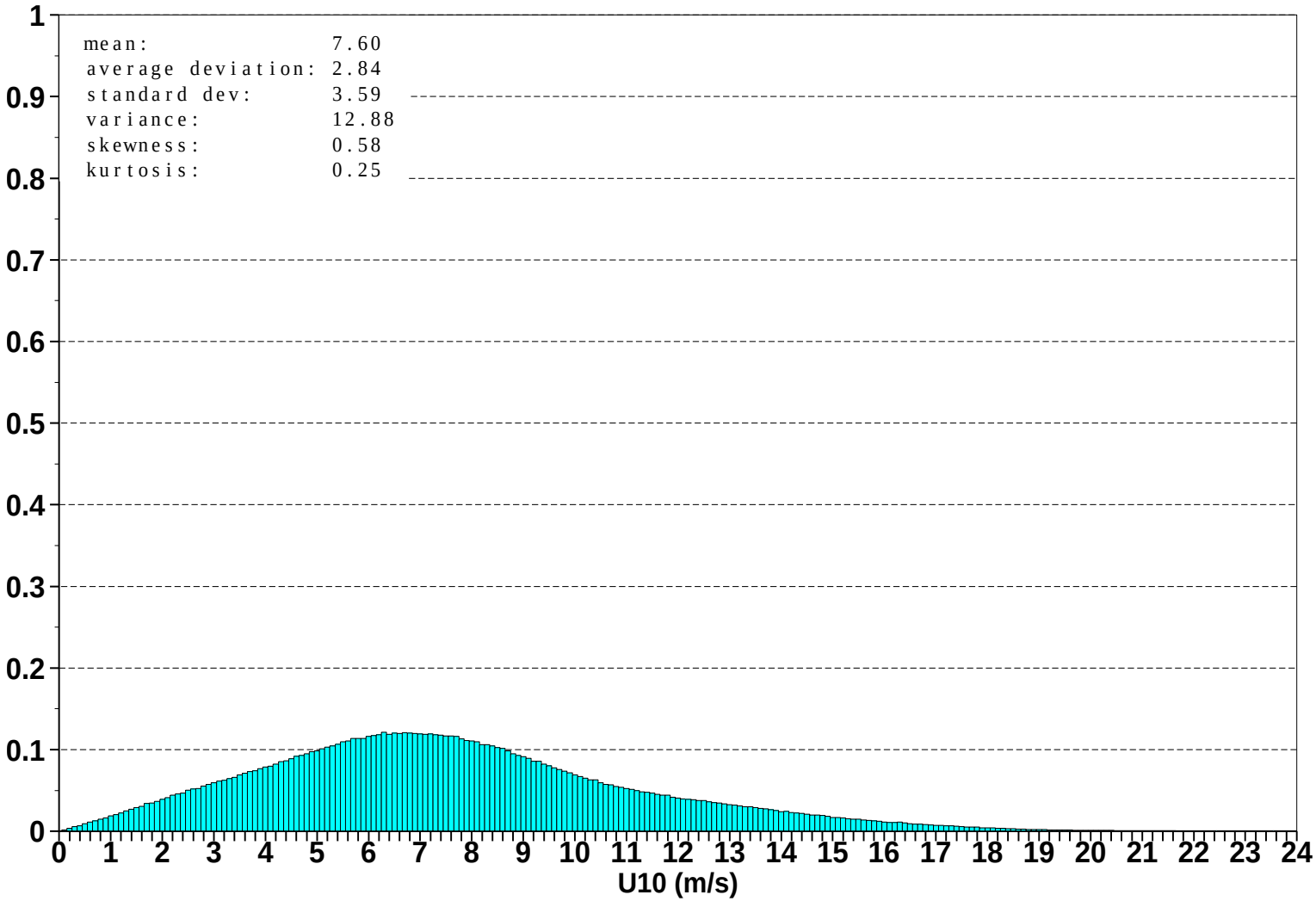
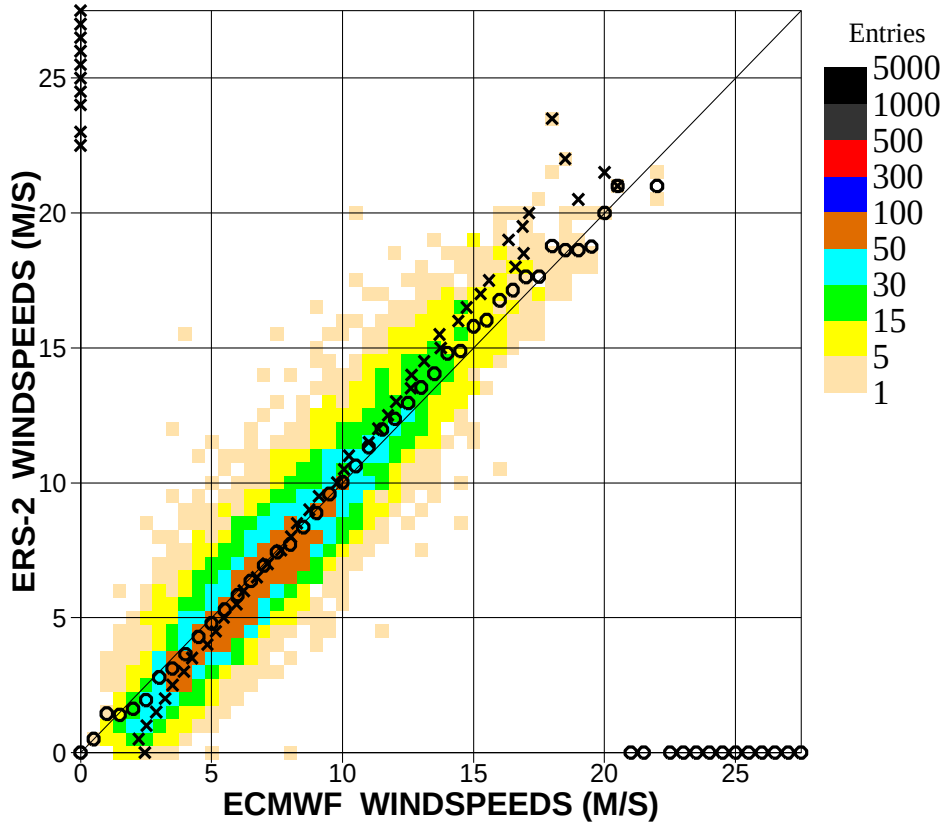


Figure 5: Global distribution of ECMWF ocean surface wind speeds for October 2007

Saleh Abdalla
European Centre for Medium Range Weather Forecasts
Shinfield Park, Reading, Berkshire RG2 9AX, England
Telephone: U.K. (0118) 949 9703, International (+44 118) 949 9703
Telex 984 7908 ECMWF G, Telefax (0118) 986 9450, e-mail: abdalla@ecmwf.int

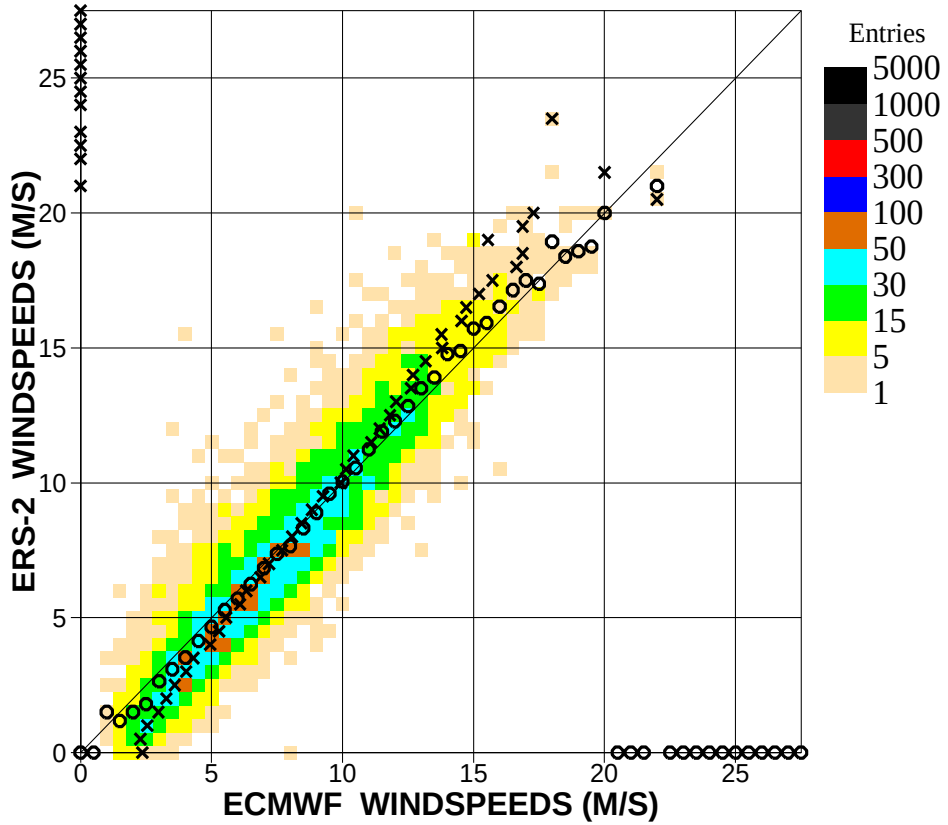


STATISTICS

ENTRIES	8744	
MEAN ECMWF	7.7993	
MEAN ERS-2	7.7660	
BIAS (ERS-2 - ECMWF)	-0.0334	
STANDARD DEVIATION	1.4793	
SCATTER INDEX	0.1897	
CORRELATION	0.9320	
SYMMETRIC SLOPE	1.0239	(0.0046)
REGR. COEFFICIENT	1.0770	(0.0045)
REGR. CONSTANT	-0.6342	(0.0383)

Figure 6. Comparison of ECMWF wind speed results with ERS2 Altimeter wind speed data for October 2007 (global)

Saleh Abdalla
European Centre for Medium Range Weather Forecasts
Shinfield Park, Reading, Berkshire RG2 9AX, England
Telephone: U.K. (0118) 949 9703, International (+44 118) 949 9703
Telex 984 7908 ECMWF G, Telefax (0118) 986 9450, e-mail: abdalla@ecmwf.int

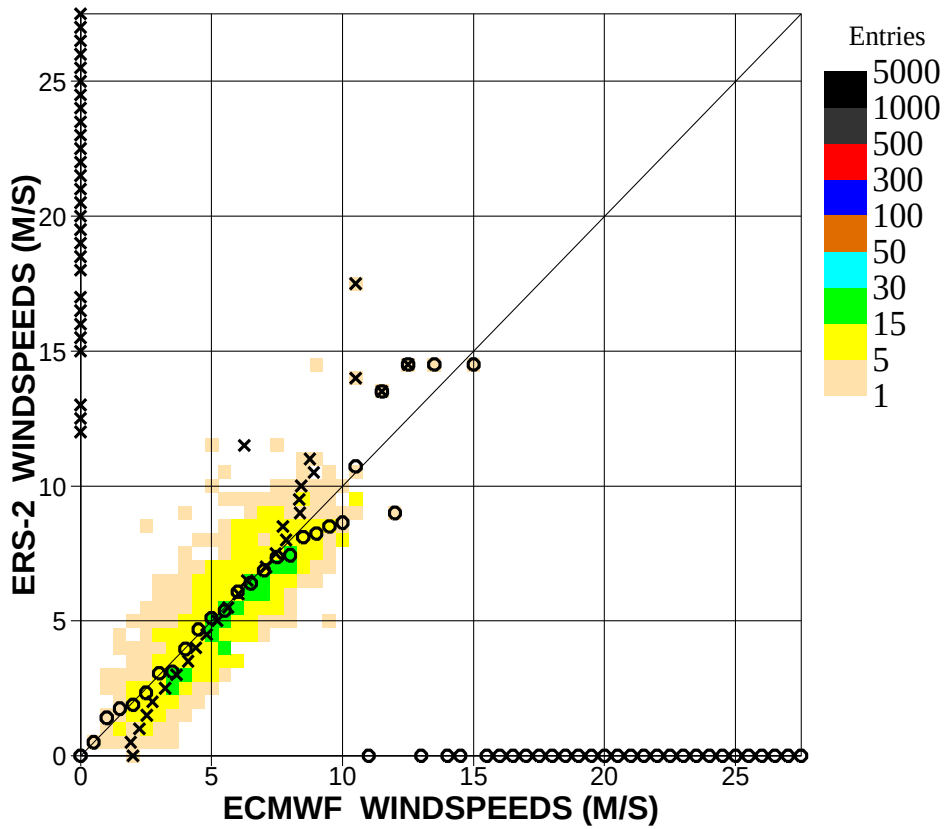


STATISTICS

ENTRIES	6693	
MEAN ECMWF	7.9889	
MEAN ERS-2	7.8933	
BIAS (ERS-2 - ECMWF)	-0.0957	
STANDARD DEVIATION	1.4823	
SCATTER INDEX	0.1855	
CORRELATION	0.9339	
SYMMETRIC SLOPE	1.0177	(0.0052)
REGR. COEFFICIENT	1.0834	(0.0051)
REGR. CONSTANT	-0.7624	(0.0442)

Figure 7. Comparison of ECMWF wind speed results with ERS2 Altimeter wind speed data for October 2007 (n.hem.)

Saleh Abdalla
European Centre for Medium Range Weather Forecasts
Shinfield Park, Reading, Berkshire RG2 9AX, England
Telephone: U.K. (0118) 949 9703, International (+44 118) 949 9703
Telex 984 7908 ECMWF G, Telefax (0118) 986 9450, e-mail: abdalla@ecmwf.int

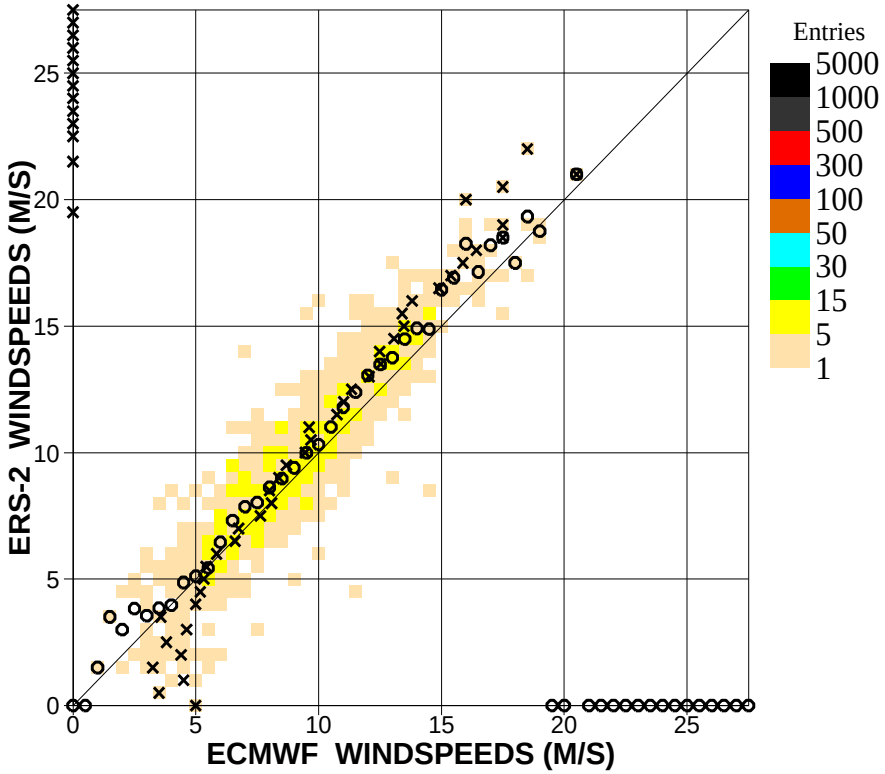


STATISTICS

ENTRIES	1240	
MEAN ECMWF	5.6034	
MEAN ERS-2	5.4613	
BIAS (ERS-2 - ECMWF)	-0.1422	
STANDARD DEVIATION	1.2887	
SCATTER INDEX	0.2300	
CORRELATION	0.8437	
SYMMETRIC SLOPE	0.9929	(0.0170)
REGR. COEFFICIENT	0.9357	(0.0169)
REGR. CONSTANT	0.2182	(0.1015)

Figure 8. Comparison of ECMWF wind speed results with ERS2 Altimeter wind speed data for October 2007 (tropics)

Saleh Abdalla
European Centre for Medium Range Weather Forecasts
Shinfield Park, Reading, Berkshire RG2 9AX, England
Telephone: U.K. (0118) 949 9703, International (+44 118) 949 9703
Telex 984 7908 ECMWF G, Telefax (0118) 986 9450, e-mail: abdalla@ecmwf.int

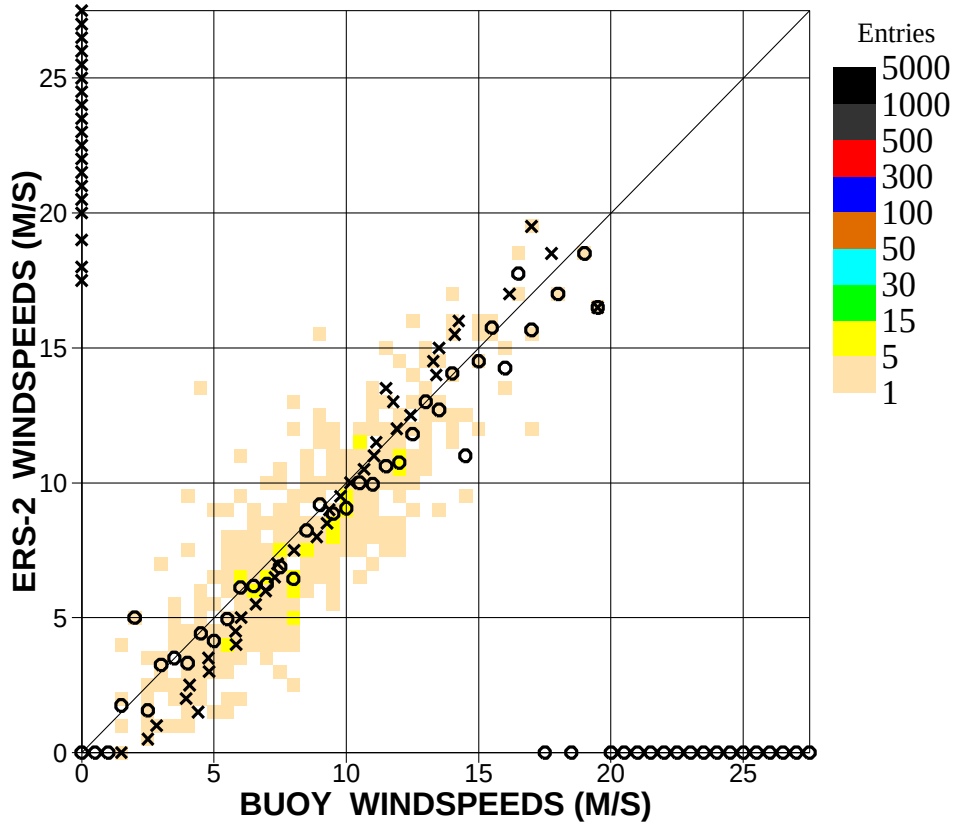


STATISTICS

ENTRIES	838	
MEAN ECMWF	9.4834	
MEAN ERS-2	10.0988	
BIAS (ERS-2 - ECMWF)	0.6154	
STANDARD DEVIATION	1.5512	
SCATTER INDEX	0.1636	
CORRELATION	0.9161	
SYMMETRIC SLOPE	1.0750	(0.0160)
REGR. COEFFICIENT	1.0570	(0.0160)
REGR. CONSTANT	0.0751	(0.1608)

Figure 9. Comparison of ECMWF wind speed results with ERS2 Altimeter wind speed data for October 2007 (s.hem.)

Saleh Abdalla
European Centre for Medium Range Weather Forecasts
Shinfield Park, Reading, Berkshire RG2 9AX, England
Telephone: U.K. (0118) 949 9703, International (+44 118) 949 9703
Telex 984 7908 ECMWF G, Telefax (0118) 986 9450, e-mail: abdalla@ecmwf.int

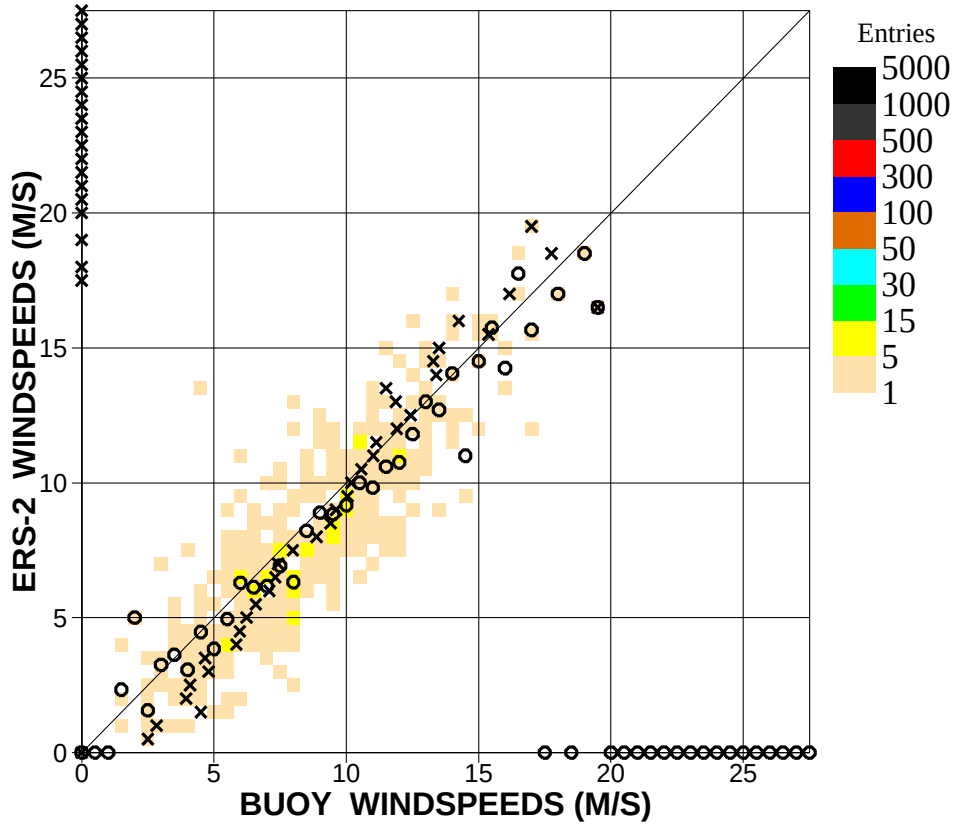


STATISTICS

ENTRIES	538	
MEAN BUOY	8.4140	
MEAN ERS-2	7.8175	
BIAS (ERS-2 - BUOY)	-0.5966	
STANDARD DEVIATION	1.7823	
SCATTER INDEX	0.2118	
CORRELATION	0.8616	
SYMMETRIC SLOPE	0.9526	(0.0244)
REGR. COEFFICIENT	0.9519	(0.0242)
REGR. CONSTANT	-0.1917	(0.2177)

Figure 10. Comparison of buoy wind speed observations with ERS2 Altimeter wind speed data for October 2007 (global)

Saleh Abdalla
European Centre for Medium Range Weather Forecasts
Shinfield Park, Reading, Berkshire RG2 9AX, England
Telephone: U.K. (0118) 949 9703, International (+44 118) 949 9703
Telex 984 7908 ECMWF G, Telefax (0118) 986 9450, e-mail: abdalla@ecmwf.int



STATISTICS

ENTRIES	489	
MEAN BUOY	8.5814	
MEAN ERS-2	7.9556	
BIAS (ERS-2 - BUOY)	-0.6258	
STANDARD DEVIATION	1.7775	
SCATTER INDEX	0.2071	
CORRELATION	0.8640	
SYMMETRIC SLOPE	0.9500	(0.0253)
REGR. COEFFICIENT	0.9521	(0.0251)
REGR. CONSTANT	-0.2147	(0.2302)

Figure 11. Comparison of buoy wind speed observations with ERS2 Altimeter wind speed data for October 2007 (n.hem.)

Saleh Abdalla
European Centre for Medium Range Weather Forecasts
Shinfield Park, Reading, Berkshire RG2 9AX, England
Telephone: U.K. (0118) 949 9703, International (+44 118) 949 9703
Telex 984 7908 ECMWF G, Telefax (0118) 986 9450, e-mail: abdalla@ecmwf.int

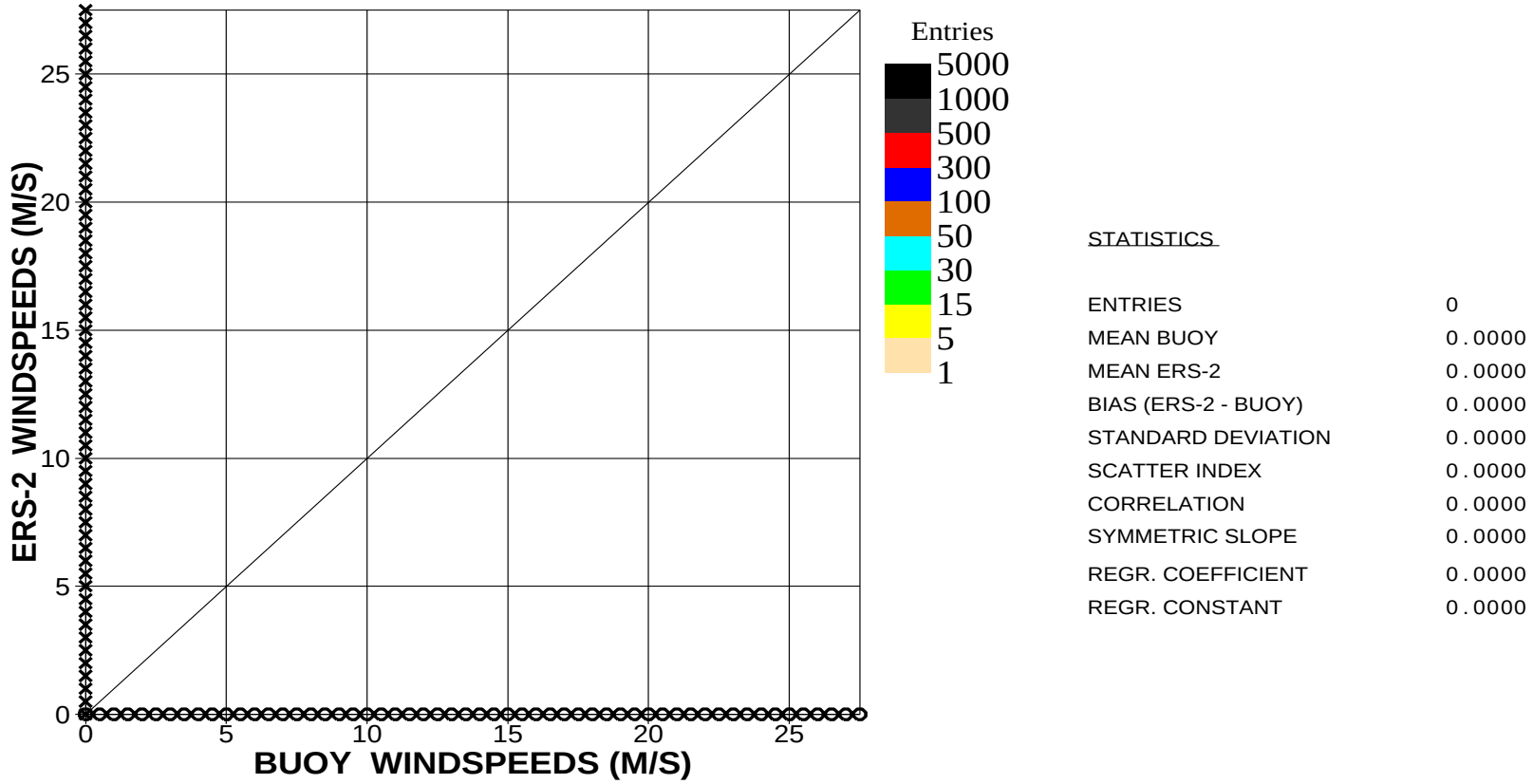


Figure 12. Comparison of buoy wind speed observations with ERS2 Altimeter wind speed data for October 2007 (hawaii)

Saleh Abdalla
European Centre for Medium Range Weather Forecasts
Shinfield Park, Reading, Berkshire RG2 9AX, England
Telephone: U.K. (0118) 949 9703, International (+44 118) 949 9703
Telex 984 7908 ECMWF G, Telefax (0118) 986 9450, e-mail: abdalla@ecmwf.int

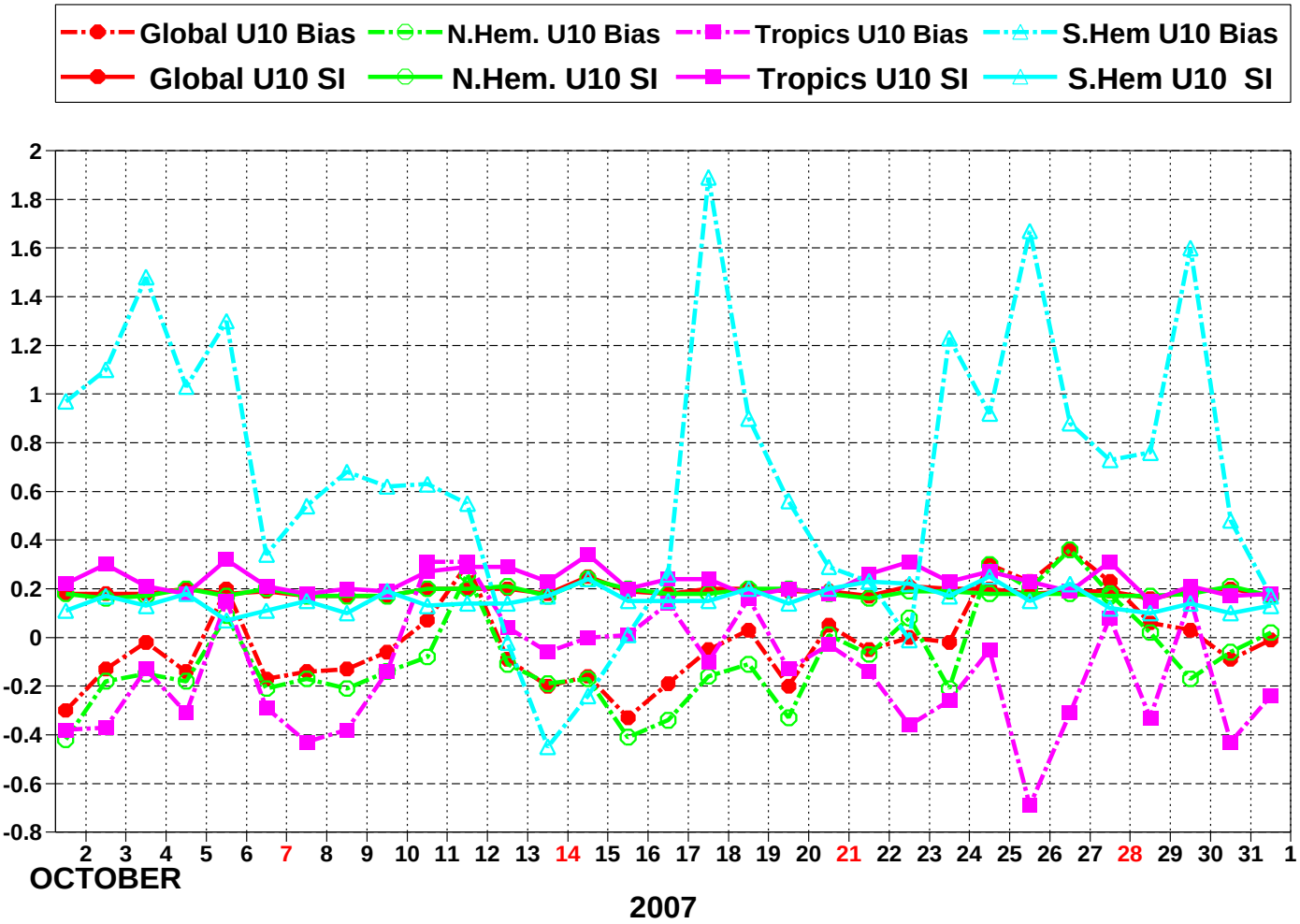


Figure 13: ERS-2 Altimeter wind speeds: Timeseries of bias (ERS-2 - model) and scatter index (SI)

Saleh Abdalla
European Centre for Medium Range Weather Forecasts
Shinfield Park, Reading, Berkshire RG2 9AX, England
Telephone: U.K. (0118) 949 9703, International (+44 118) 949 9703
Telex 984 7908 ECMWF G, Telefax (0118) 986 9450, e-mail: abdalla@ecmwf.int

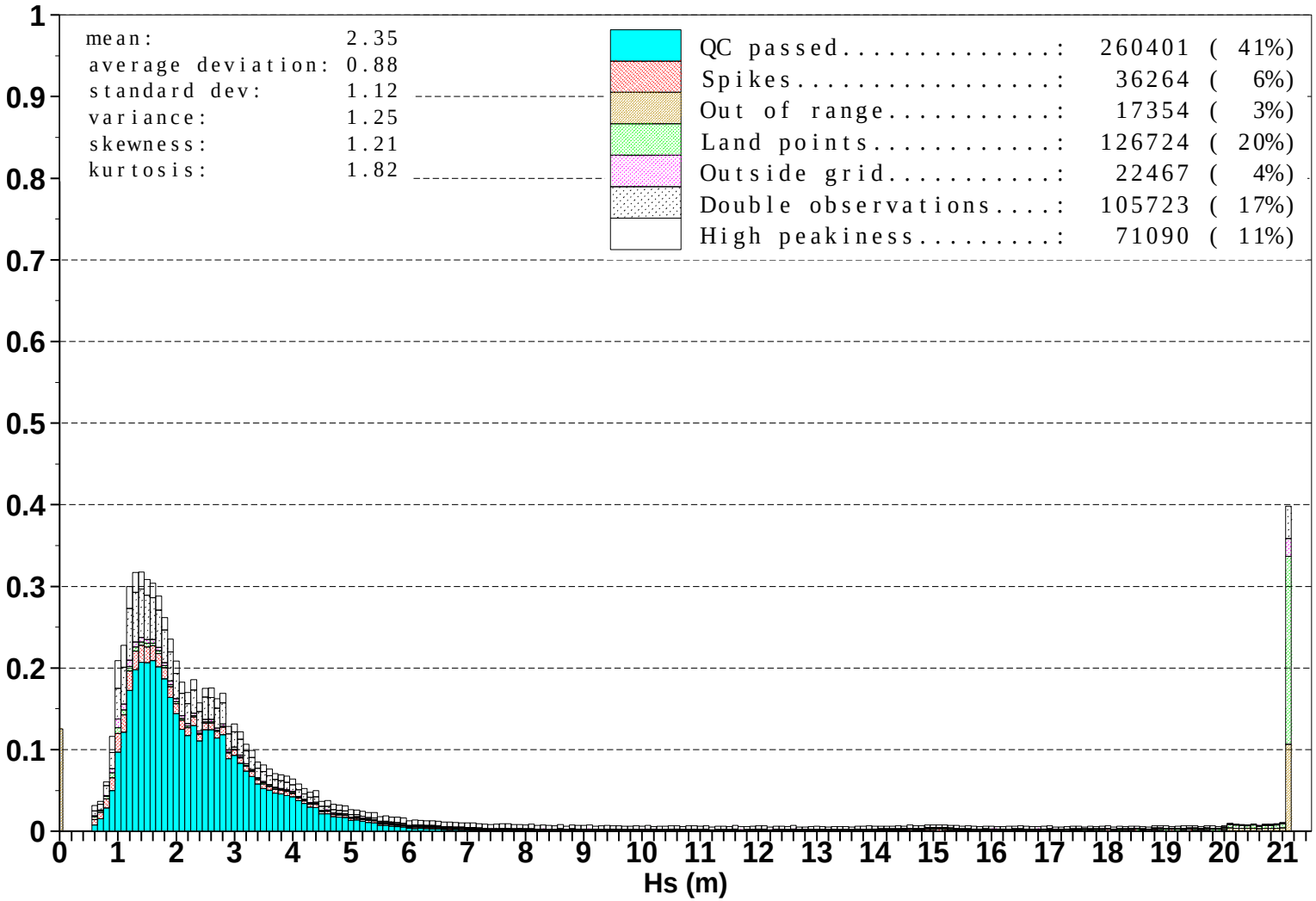


Figure 14: Distribution of the ERS-2 Altimeter wave heights after QC for October 2007

Saleh Abdalla
European Centre for Medium Range Weather Forecasts
Shinfield Park, Reading, Berkshire RG2 9AX, England
Telephone: U.K. (0118) 949 9703, International (+44 118) 949 9703
Telex 984 7908 ECMWF G, Telefax (0118) 986 9450, e-mail: abdalla@ecmwf.int

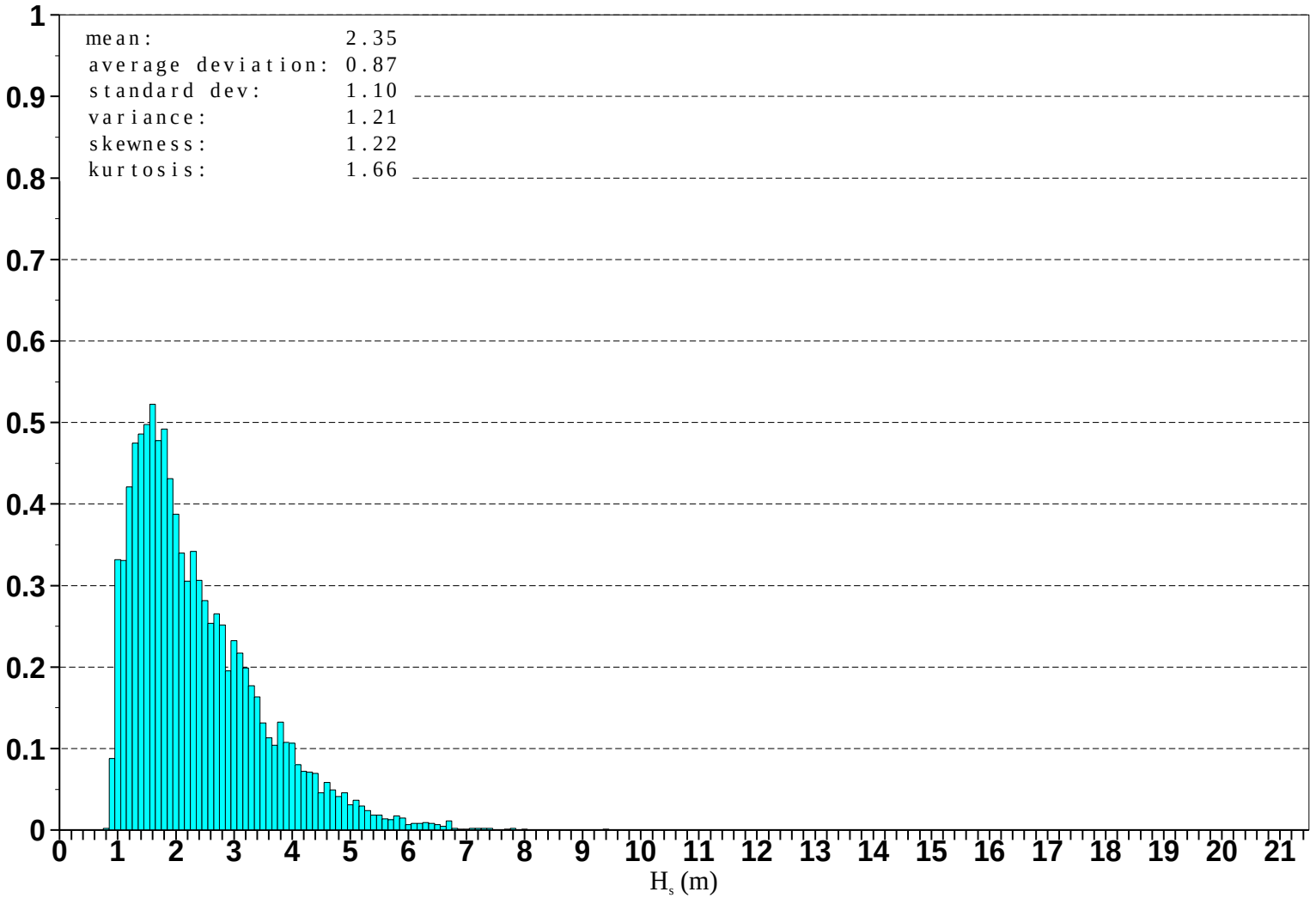


Figure 15: Distribution of ERS-2 Altimeter wave heights after along track averaging for October 2007

Saleh Abdalla
European Centre for Medium Range Weather Forecasts
Shinfield Park, Reading, Berkshire RG2 9AX, England
Telephone: U.K. (0118) 949 9703, International (+44 118) 949 9703
Telex 984 7908 ECMWF G, Telefax (0118) 986 9450, e-mail: abdalla@ecmwf.int

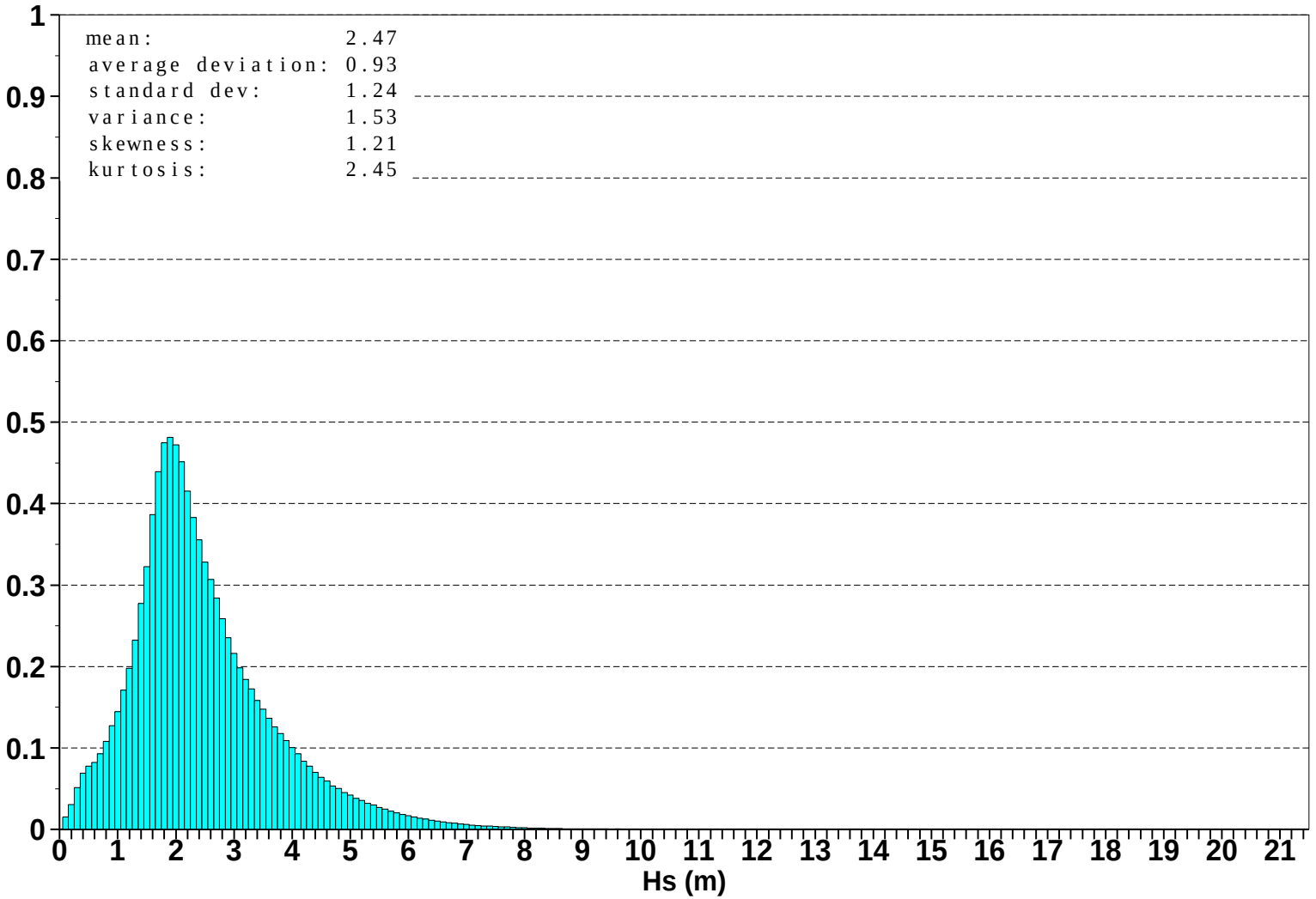
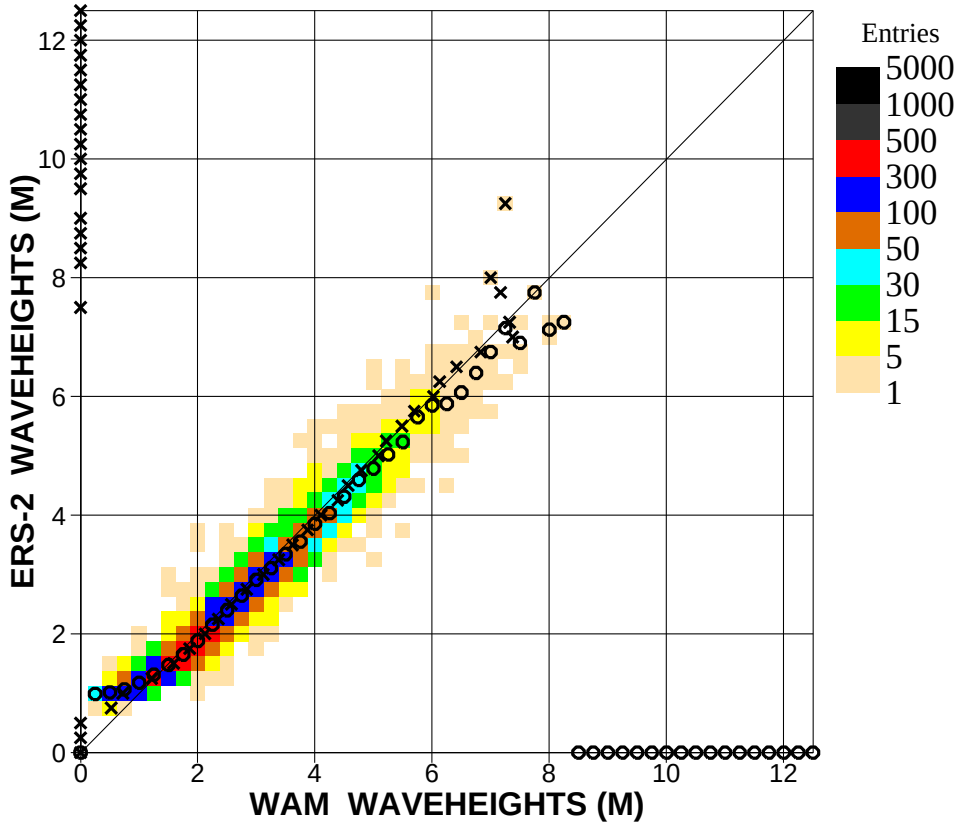


Figure 16: Global distribution of ECMWF wave heights for October 2007

Saleh Abdalla
European Centre for Medium Range Weather Forecasts
Shinfield Park, Reading, Berkshire RG2 9AX, England
Telephone: U.K. (0118) 949 9703, International (+44 118) 949 9703
Telex 984 7908 ECMWF G, Telefax (0118) 986 9450, e-mail: abdalla@ecmwf.int

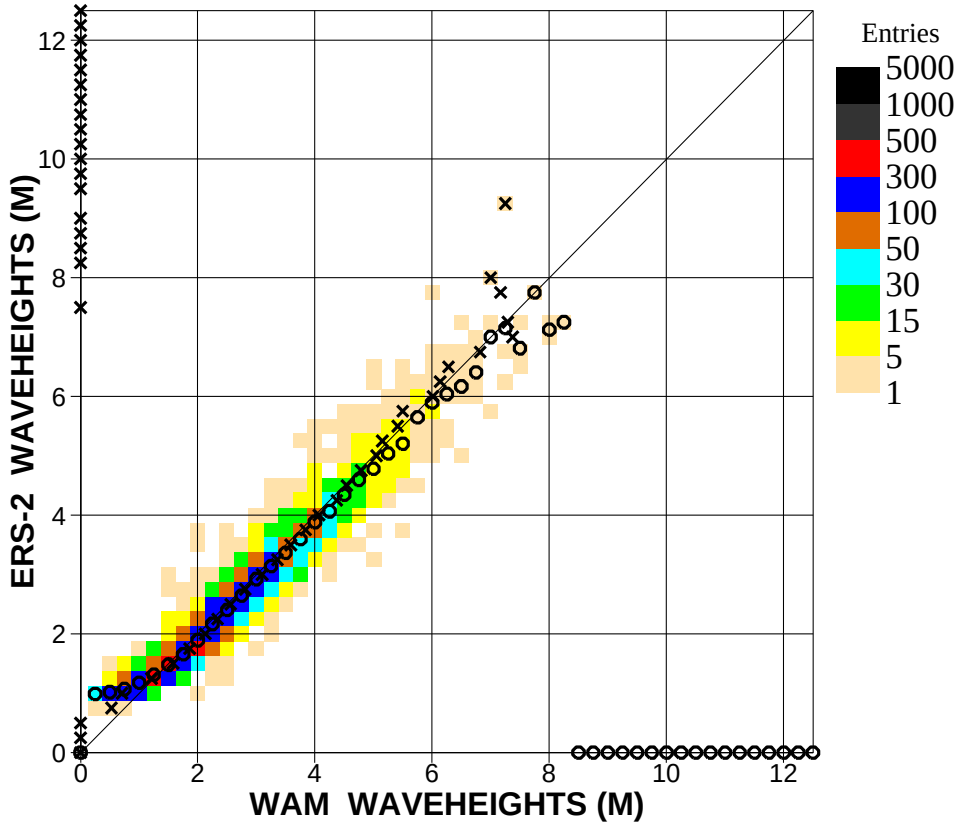


STATISTICS

ENTRIES	8744	
MEAN WAM	2.4085	
MEAN ERS-2	2.3500	
BIAS (ERS-2 - WAM)	-0.0585	
STANDARD DEVIATION	0.2847	
SCATTER INDEX	0.1182	
CORRELATION	0.9708	
SYMMETRIC SLOPE	0.9683	(0.0025)
REGR. COEFFICIENT	0.9092	(0.0024)
REGR. CONSTANT	0.1603	(0.0064)

Figure 17. Comparison of ECMWF wave height results with ERS2 Altimeter wave height data for October 2007 (global)

Saleh Abdalla
European Centre for Medium Range Weather Forecasts
Shinfield Park, Reading, Berkshire RG2 9AX, England
Telephone: U.K. (0118) 949 9703, International (+44 118) 949 9703
Telex 984 7908 ECMWF G, Telefax (0118) 986 9450, e-mail: abdalla@ecmwf.int

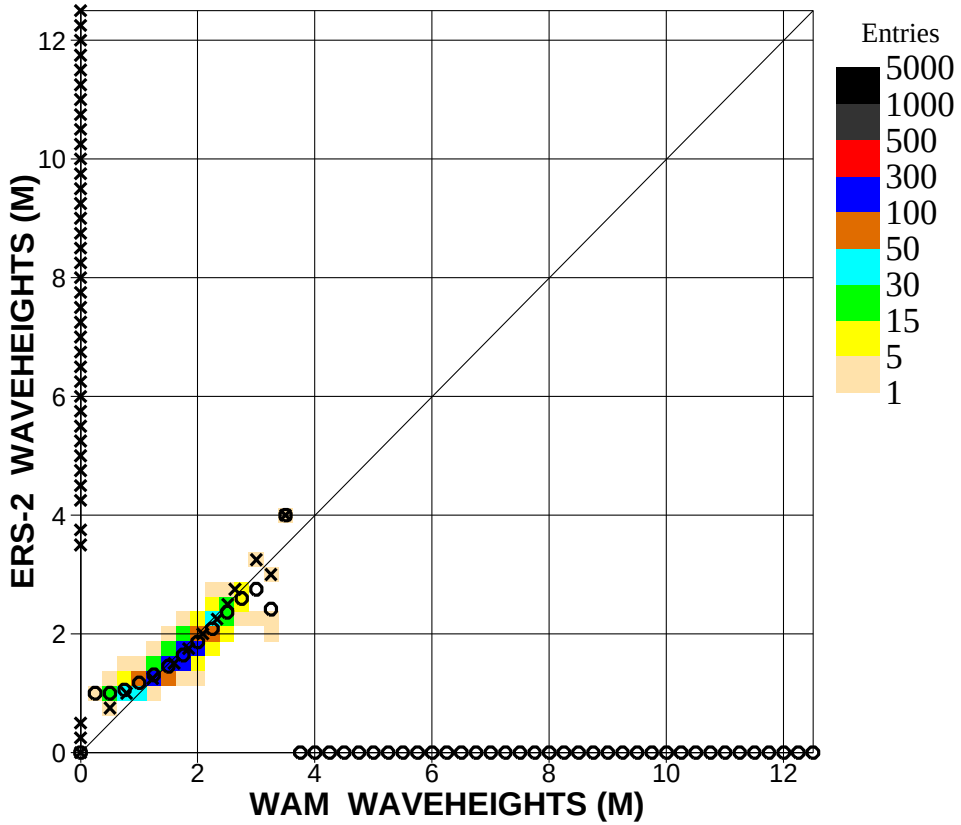


STATISTICS

ENTRIES	6693	
MEAN WAM	2.4035	
MEAN ERS-2	2.3595	
BIAS (ERS-2 - WAM)	-0.0440	
STANDARD DEVIATION	0.2927	
SCATTER INDEX	0.1218	
CORRELATION	0.9687	
SYMMETRIC SLOPE	0.9741	(0.0030)
REGR. COEFFICIENT	0.9119	(0.0029)
REGR. CONSTANT	0.1677	(0.0076)

Figure 18. Comparison of ECMWF wave height results with ERS2 Altimeter wave height data for October 2007 (n.hem.)

Saleh Abdalla
European Centre for Medium Range Weather Forecasts
Shinfield Park, Reading, Berkshire RG2 9AX, England
Telephone: U.K. (0118) 949 9703, International (+44 118) 949 9703
Telex 984 7908 ECMWF G, Telefax (0118) 986 9450, e-mail: abdalla@ecmwf.int

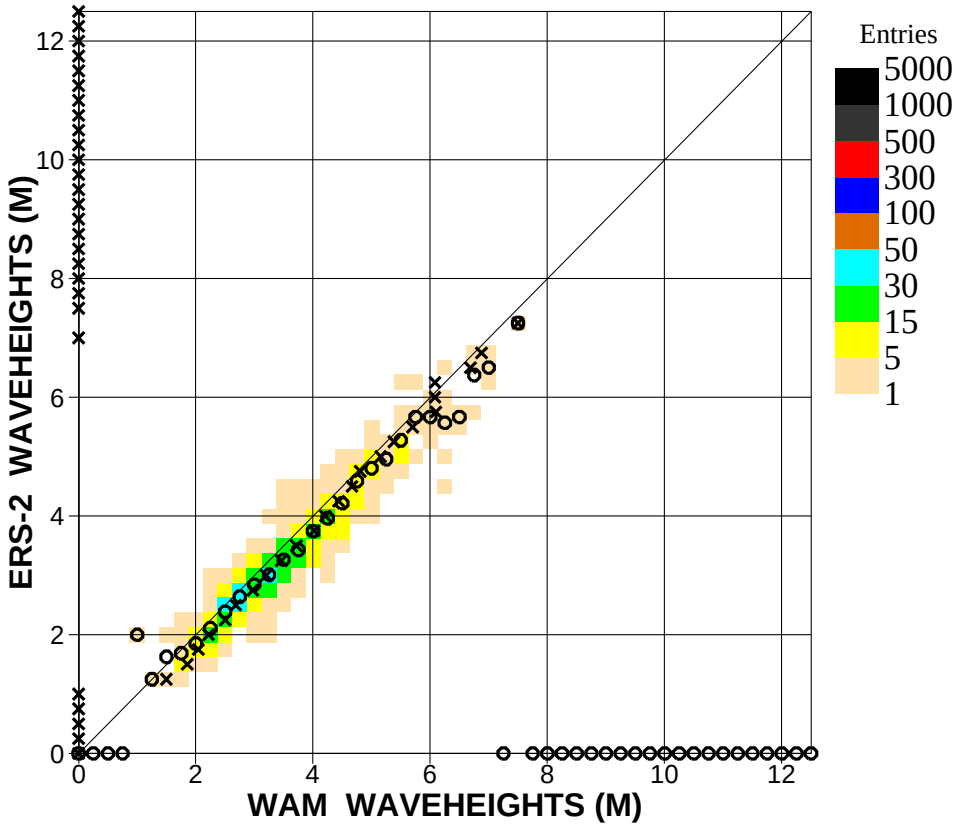


STATISTICS

ENTRIES	1240	
MEAN WAM	1.6748	
MEAN ERS-2	1.6383	
BIAS (ERS-2 - WAM)	-0.0364	
STANDARD DEVIATION	0.1894	
SCATTER INDEX	0.1131	
CORRELATION	0.9280	
SYMMETRIC SLOPE	0.9657	(0.0107)
REGR. COEFFICIENT	0.7389	(0.0084)
REGR. CONSTANT	0.4009	(0.0147)

Figure 19. Comparison of ECMWF wave height results with ERS2 Altimeter wave height data for October 2007 (tropics)

Saleh Abdalla
European Centre for Medium Range Weather Forecasts
Shinfield Park, Reading, Berkshire RG2 9AX, England
Telephone: U.K. (0118) 949 9703, International (+44 118) 949 9703
Telex 984 7908 ECMWF G, Telefax (0118) 986 9450, e-mail: abdalla@ecmwf.int

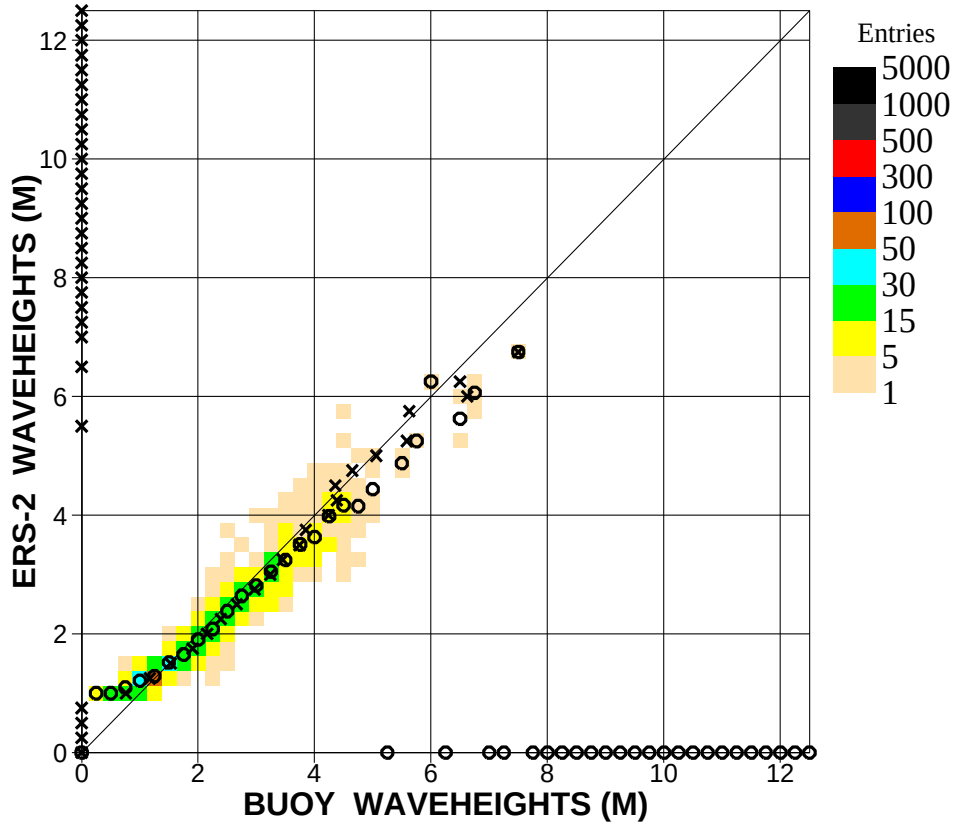


STATISTICS

ENTRIES	838	
MEAN WAM	3.5103	
MEAN ERS-2	3.3041	
BIAS (ERS-2 - WAM)	-0.2062	
STANDARD DEVIATION	0.2947	
SCATTER INDEX	0.0840	
CORRELATION	0.9602	
SYMMETRIC SLOPE	0.9442	(0.0094)
REGR. COEFFICIENT	0.9378	(0.0094)
REGR. CONSTANT	0.0121	(0.0346)

Figure 20. Comparison of ECMWF wave height results with ERS2 Altimeter wave height data for October 2007 (s.hem.)

Saleh Abdalla
European Centre for Medium Range Weather Forecasts
Shinfield Park, Reading, Berkshire RG2 9AX, England
Telephone: U.K. (0118) 949 9703, International (+44 118) 949 9703
Telex 984 7908 ECMWF G, Telefax (0118) 986 9450, e-mail: abdalla@ecmwf.int

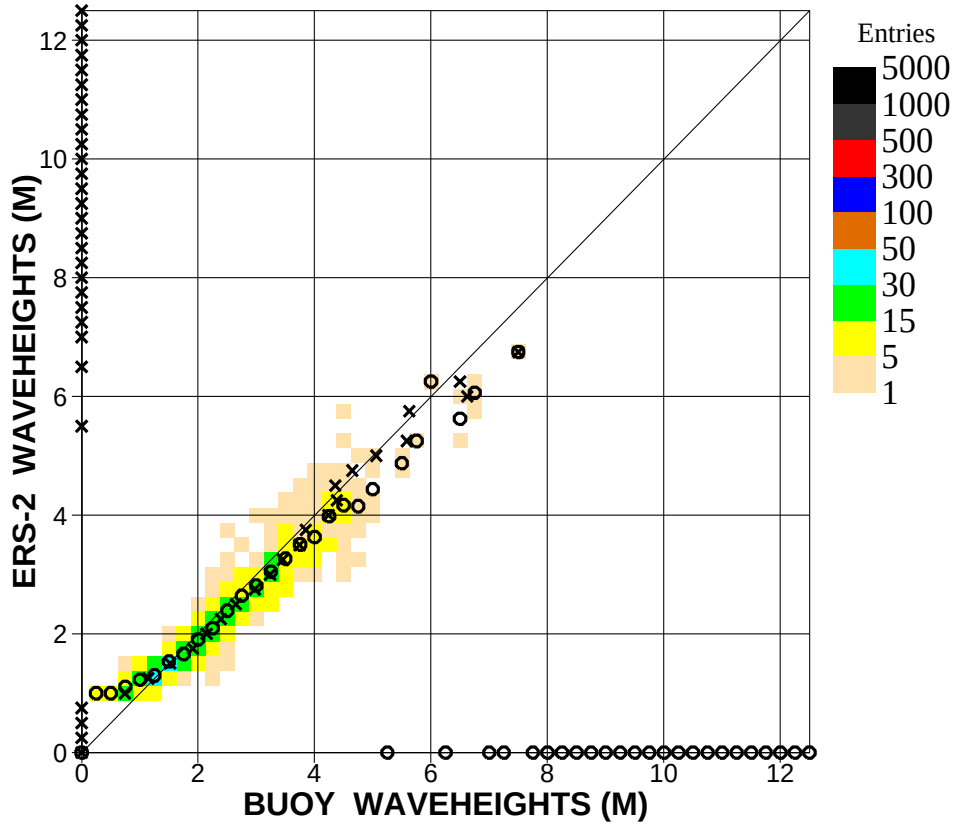


STATISTICS

ENTRIES	826	
MEAN BUOY	2.4378	
MEAN ERS-2	2.3458	
BIAS (ERS-2 - BUOY)	-0.0919	
STANDARD DEVIATION	0.3508	
SCATTER INDEX	0.1439	
CORRELATION	0.9605	
SYMMETRIC SLOPE	0.9452	(0.0093)
REGR. COEFFICIENT	0.8366	(0.0084)
REGR. CONSTANT	0.3064	(0.0229)

Figure 21. Comparison of buoy wave height observations with ERS2 Altimeter wave height data for October 2007 (global)

Saleh Abdalla
European Centre for Medium Range Weather Forecasts
Shinfield Park, Reading, Berkshire RG2 9AX, England
Telephone: U.K. (0118) 949 9703, International (+44 118) 949 9703
Telex 984 7908 ECMWF G, Telefax (0118) 986 9450, e-mail: abdalla@ecmwf.int

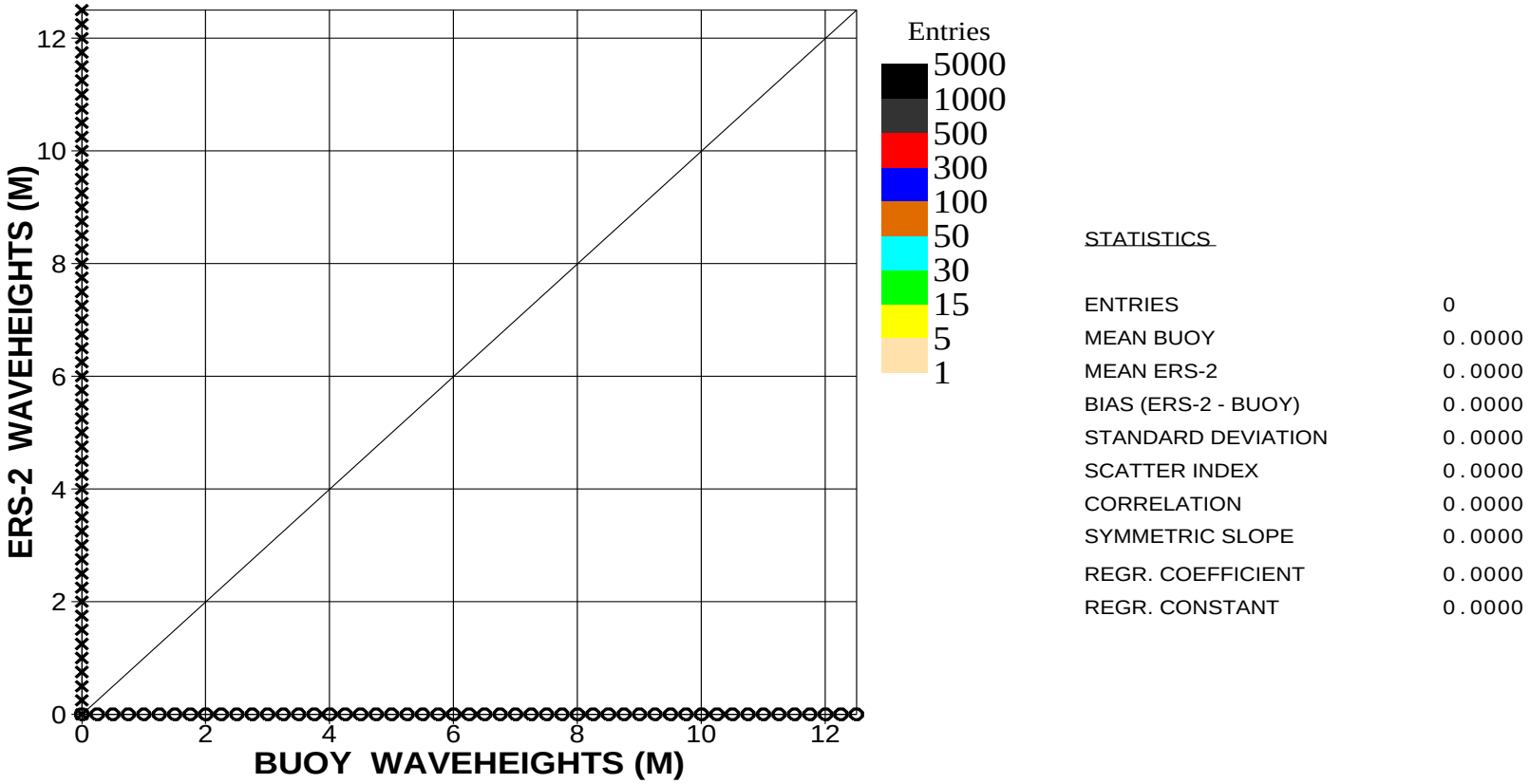


STATISTICS

ENTRIES	767	
MEAN BUOY	2.5107	
MEAN ERS-2	2.4128	
BIAS (ERS-2 - BUOY)	-0.0979	
STANDARD DEVIATION	0.3565	
SCATTER INDEX	0.1420	
CORRELATION	0.9589	
SYMMETRIC SLOPE	0.9450	(0.0098)
REGR. COEFFICIENT	0.8358	(0.0089)
REGR. CONSTANT	0.3144	(0.0249)

Figure 22. Comparison of buoy wave height observations with ERS2 Altimeter wave height data for October 2007 (n.hem.)

Saleh Abdalla
European Centre for Medium Range Weather Forecasts
Shinfield Park, Reading, Berkshire RG2 9AX, England
Telephone: U.K. (0118) 949 9703, International (+44 118) 949 9703
Telex 984 7908 ECMWF G, Telefax (0118) 986 9450, e-mail: abdalla@ecmwf.int



STATISTICS

ENTRIES	0
MEAN BUOY	0.0000
MEAN ERS-2	0.0000
BIAS (ERS-2 - BUOY)	0.0000
STANDARD DEVIATION	0.0000
SCATTER INDEX	0.0000
CORRELATION	0.0000
SYMMETRIC SLOPE	0.0000
REGR. COEFFICIENT	0.0000
REGR. CONSTANT	0.0000

Figure 23. Comparison of buoy wave height observations with ERS2 Altimeter wave height data for October 2007 (hawaii)

Saleh Abdalla
European Centre for Medium Range Weather Forecasts
Shinfield Park, Reading, Berkshire RG2 9AX, England
Telephone: U.K. (0118) 949 9703, International (+44 118) 949 9703
Telex 984 7908 ECMWF G, Telefax (0118) 986 9450, e-mail: abdalla@ecmwf.int

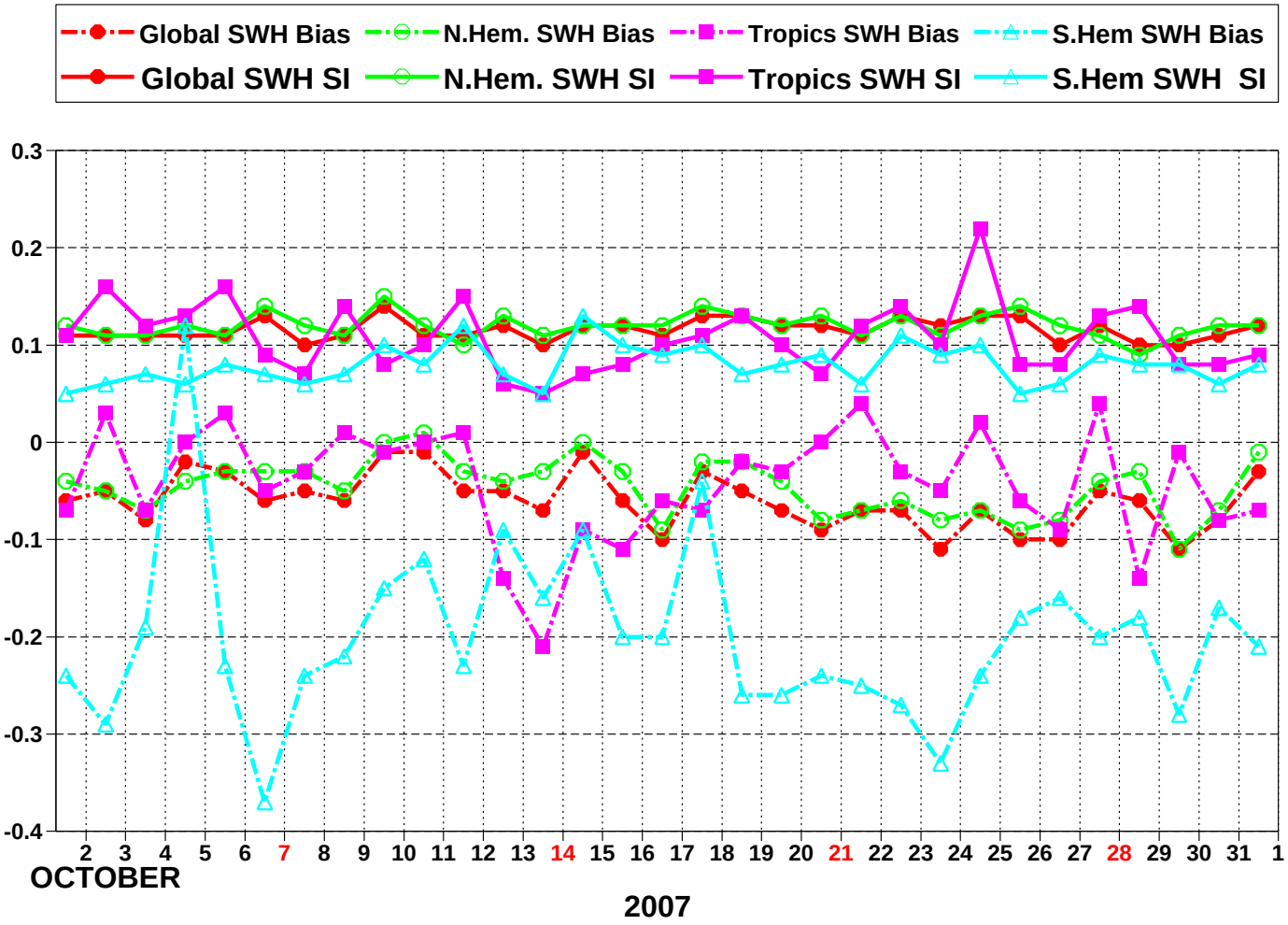


Figure 24: ERS-2 Altimeter wave heights: Timeseries of bias (ERS-2 - model) and scatter index (SI)

Saleh Abdalla
European Centre for Medium Range Weather Forecasts
Shinfield Park, Reading, Berkshire RG2 9AX, England
Telephone: U.K. (0118) 949 9703, International (+44 118) 949 9703
Telex 984 7908 ECMWF G, Telefax (0118) 986 9450, e-mail: abdalla@ecmwf.int

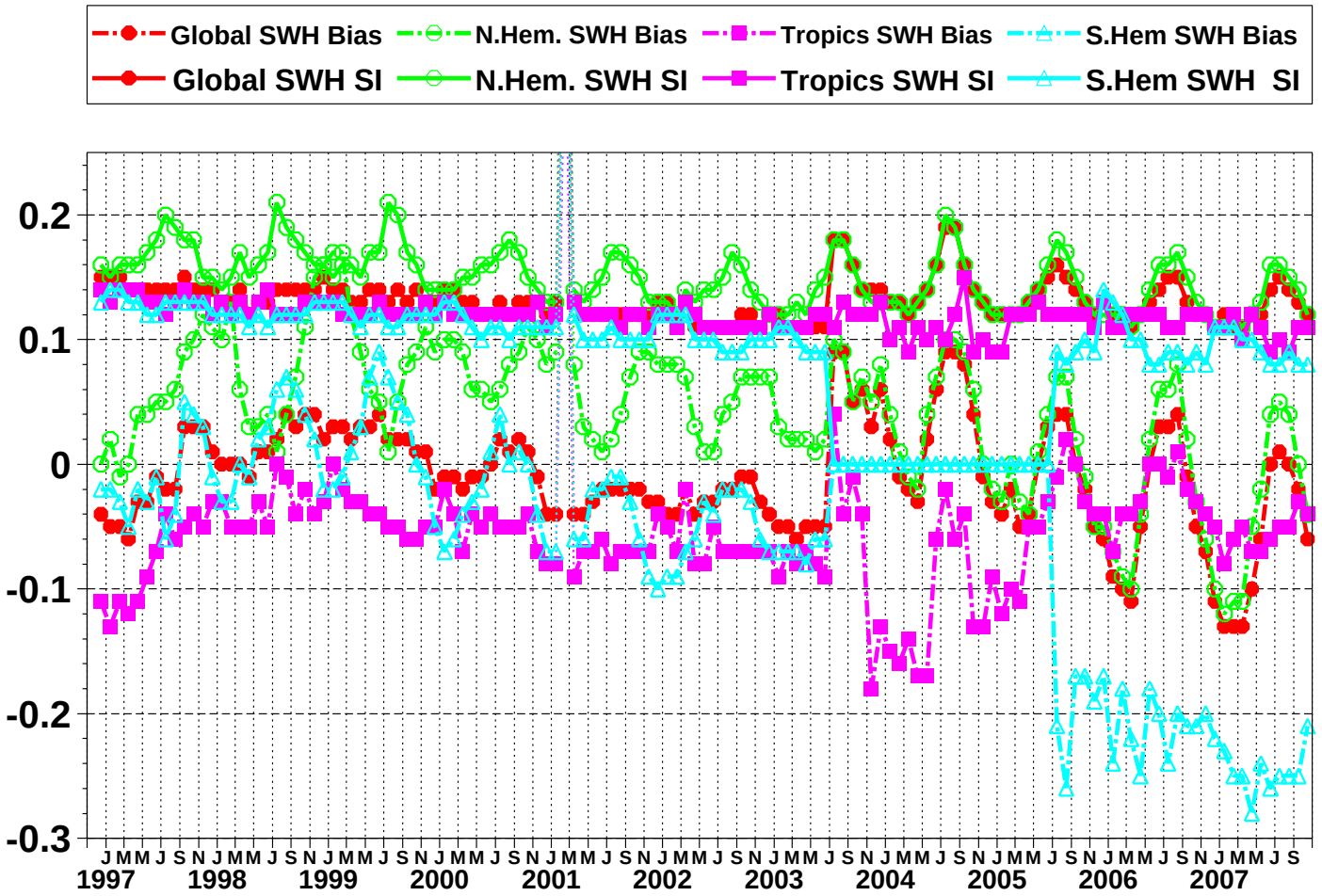


Figure 25: ERS-2 Altimeter wave heights: Timeseries of bias (ERS-2 - model) and scatter index (SI)

Saleh Abdalla
European Centre for Medium Range Weather Forecasts
Shinfield Park, Reading, Berkshire RG2 9AX, England
Telephone: U.K. (0118) 949 9703, International (+44 118) 949 9703
Telex 984 7908 ECMWF G, Telefax (0118) 986 9450, e-mail: abdalla@ecmwf.int

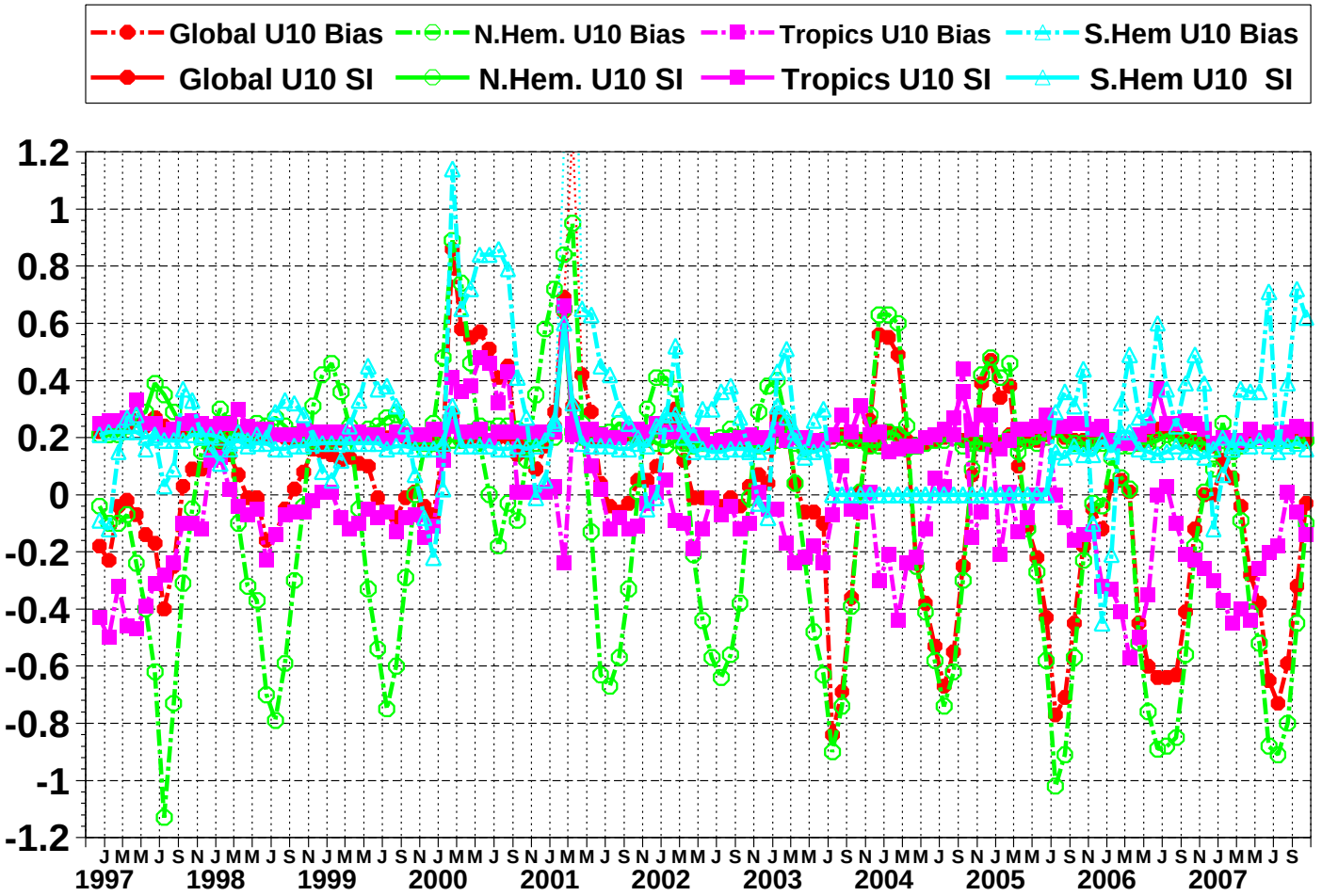


Figure 26: ERS-2 Altimeter wind speeds: Timeseries of bias (ERS-2 - model) and scatter index (SI)

Saleh Abdalla
European Centre for Medium Range Weather Forecasts
Shinfield Park, Reading, Berkshire RG2 9AX, England
Telephone: U.K. (0118) 949 9703, International (+44 118) 949 9703
Telex 984 7908 ECMWF G, Telefax (0118) 986 9450, e-mail: abdalla@ecmwf.int

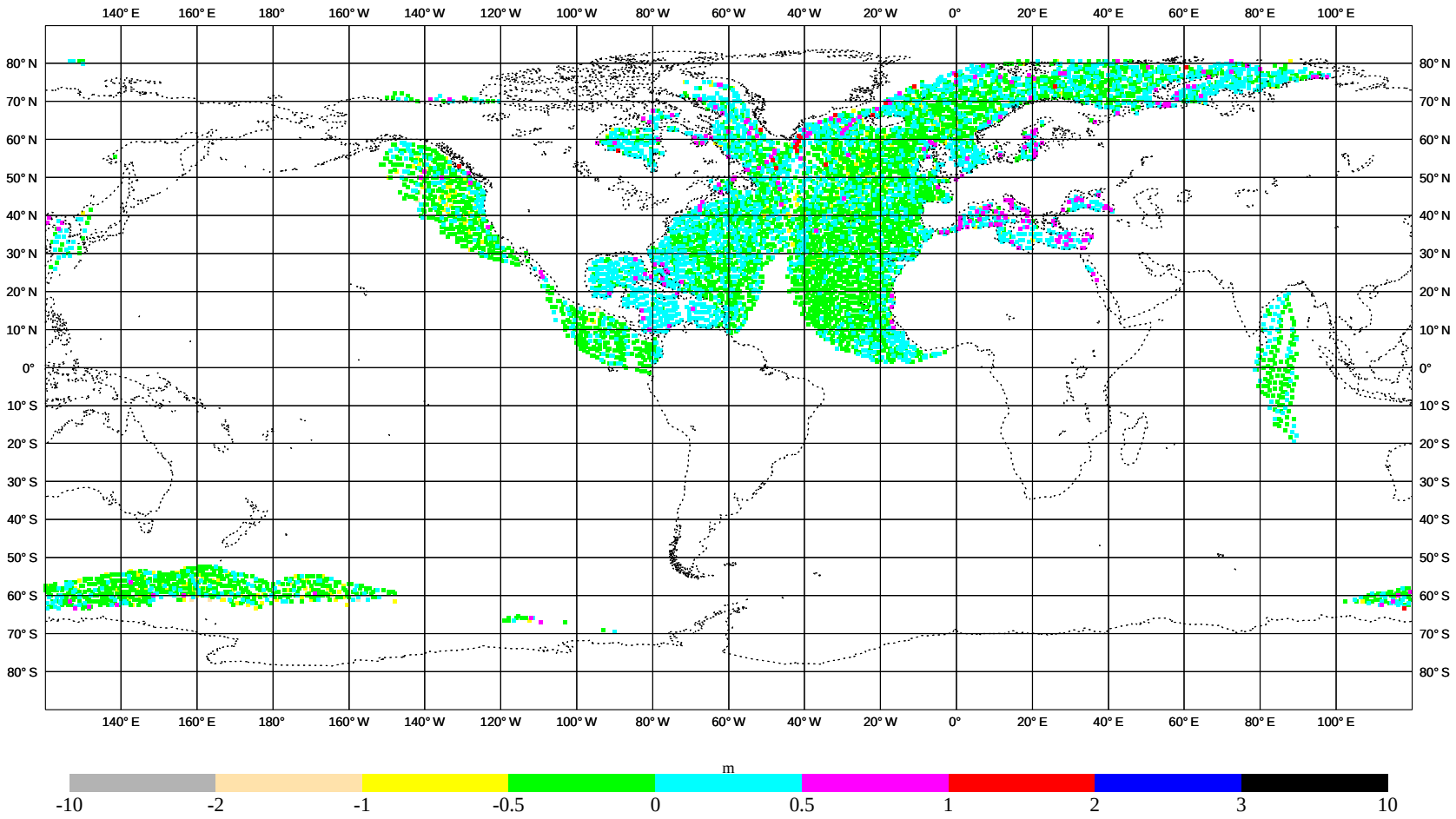


Figure 27: Significant wave height: Monthly mean difference of ERS-2 altimeter data minus wave model results for October 2007

Saleh Abdalla
European Centre for Medium Range Weather Forecasts
Shinfield Park, Reading, Berkshire RG2 9AX, England
Telephone: U.K. (0118) 949 9703, International (+44 118) 949 9703
Telex 984 7908 ECMWF G, Telefax (0118) 986 9450, e-mail: abdalla@ecmwf.int