ECMWF Report on ERS-2 RA for December 2006

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

By: *Saleh Abdalla*

Date: *10 January 2007*

Overview:

Based on the data received at ECMWF during the whole month, on average, 4616 observations arrived at ECMWF every 6 hours of which 69.14% passed the quality control. As can be seen in Figure 1, there was no data during the time window centred at 06:00 UTC on the 26th. of the month. Furthermore, there was significant reduction of data at several time windows. 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 $<\sigma_0>$ = 10.65 dB (with one main peak at 10.6 dB).

Wind Speed Comparison with ECMWF wind speeds (bias):

ERS-2 global: + 0.005 m/s

ERS-2 northern hemisphere: + 0.092 m/s

ERS-2 tropics: - 0.297 m/s

ERS-2 southern hemisphere: - 0.122 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 December 2006

Wind Speed Comparison with buoy wind speeds (bias):

ERS-2 global: - 0.128 m/s

ERS-2 northern hemisphere: - 0.064 m/s

ERS-2 tropics (Hawaii): *missing*

Wave Height Comparison with ECMWF wave heights (bias):

ERS-2 global: - 0.107 m (lowest waves measured: 0.6m)

ERS-2 northern hemisphere: -0.103 m

ERS-2 tropics: - 0.046 m

ERS-2 southern hemisphere: - 0.217 m

Wave Height Comparison with buoy wave heights (bias):

ERS-2 global: - 0.126 m

ERS-2 northern hemisphere: - 0.138 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 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 December 2006

- 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 CY31R1 (since 12 September 2006).

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 December 2006.

Figure 2: Distribution of the ERS-2 Altimeter Backscatter after QC for December 2006.

Figure 3: Distribution of the ERS-2 Altimeter wind speeds after QC for December 2006.

Figure 4: Distribution of the ERS-2 Altimeter wind speeds after along track averaging for December 2006.

Figure 5: Global distribution of ECMWF ocean surface wind speeds for December 2006.

Figure 6: Comparison of ECMWF wind speed results with ERS-2 Altimeter wind speed data for December 2006 (global).

Figure 7: Comparison of ECMWF wind speed results with ERS-2 Altimeter wind speed data for December 2006 (northern hemisphere)

Figure 8: Comparison of ECMWF wind speed results with ERS-2 Altimeter wind speed data for December 2006 (tropics)

Figure 9: Comparison of ECMWF wind speed results with ERS-2 Altimeter wind speed data for December 2006 (southern hemisphere)

Figure 10: Comparison of buoy wind speed observations with ERS-2 Altimeter wind speed data for December 2006 (global).

Figure 11: Comparison of buoy wind speed observations with ERS-2 Altimeter wind speed data for December 2006 (northern hemisphere).

Figure 12: Comparison of buoy wind speed observations with ERS-2 Altimeter wind speed data for December 2006 (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 December 2006.

Figure 15: Distribution of the ERS-2 Altimeter wave heights after along track averaging for December 2006.

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 December 2006.

Figure 17: Comparison of ECMWF wave height results with ERS-2 Altimeter wave height data for December 2006 (global).

Figure 18: Comparison of ECMWF wave height results with ERS-2 Altimeter wave height data for December 2006 (northern hemisphere)

Figure 19: Comparison of ECMWF wave height results with ERS-2 Altimeter wave height data for December 2006 (tropics)

Figure 20: Comparison of ECMWF wave height results with ERS-2 Altimeter wave height data for December 2006 (southern hemisphere)

Figure 21: Comparison of buoy wave height observations with ERS-2 Altimeter wave height data for December 2006 (global).

Figure 22: Comparison of buoy wave height observations with ERS-2 Altimeter wave height data for December 2006 (northern hemisphere).

Figure 23: Comparison of buoy wave height observations with ERS-2 Altimeter wave height data for December 2006 (hawaii).

Figure 24: ERS-2 Altimeter wave heights: Timeseries of bias (ERS-2 - model) and scatter index (SI) for December 2006.

Figure 25: ERS-2 Altimeter wave heights: Timeseries of bias (ERS-2 - model) and scatter index (SI) from December 1996 to December 2006.

Figure 26: ERS-2 Altimeter wind speeds: Timeseries of bias (ERS-2 - model) and scatter index (SI) from December 1996 to December 2006.

Figure 27: Significant wave height: Monthly mean difference of ERS-2 altimeter data minus wave model results for December 2006.

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 December 2006

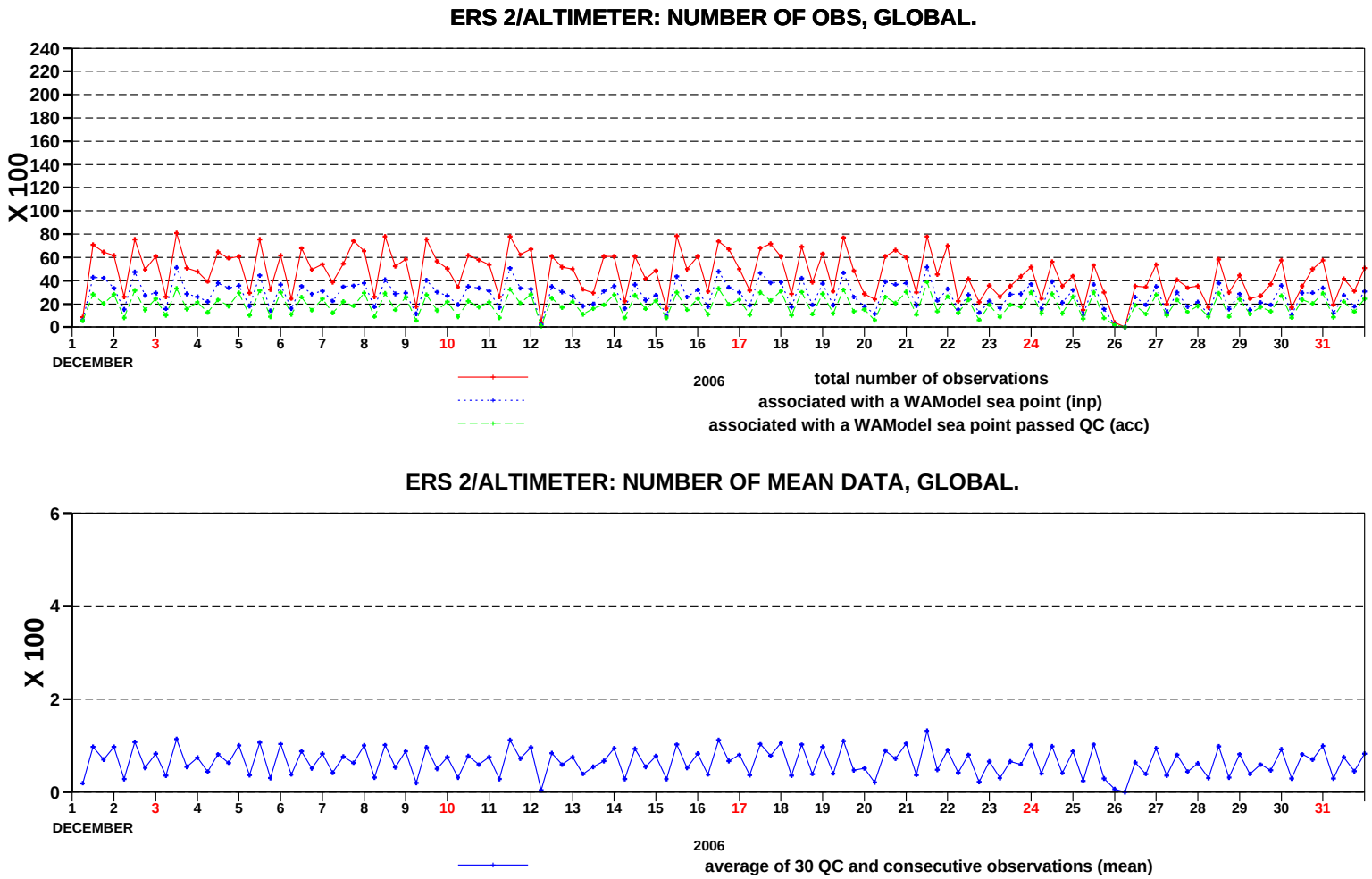


Figure 1:Time series of data reception for ERS-2 Altimeter data for December 2006

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

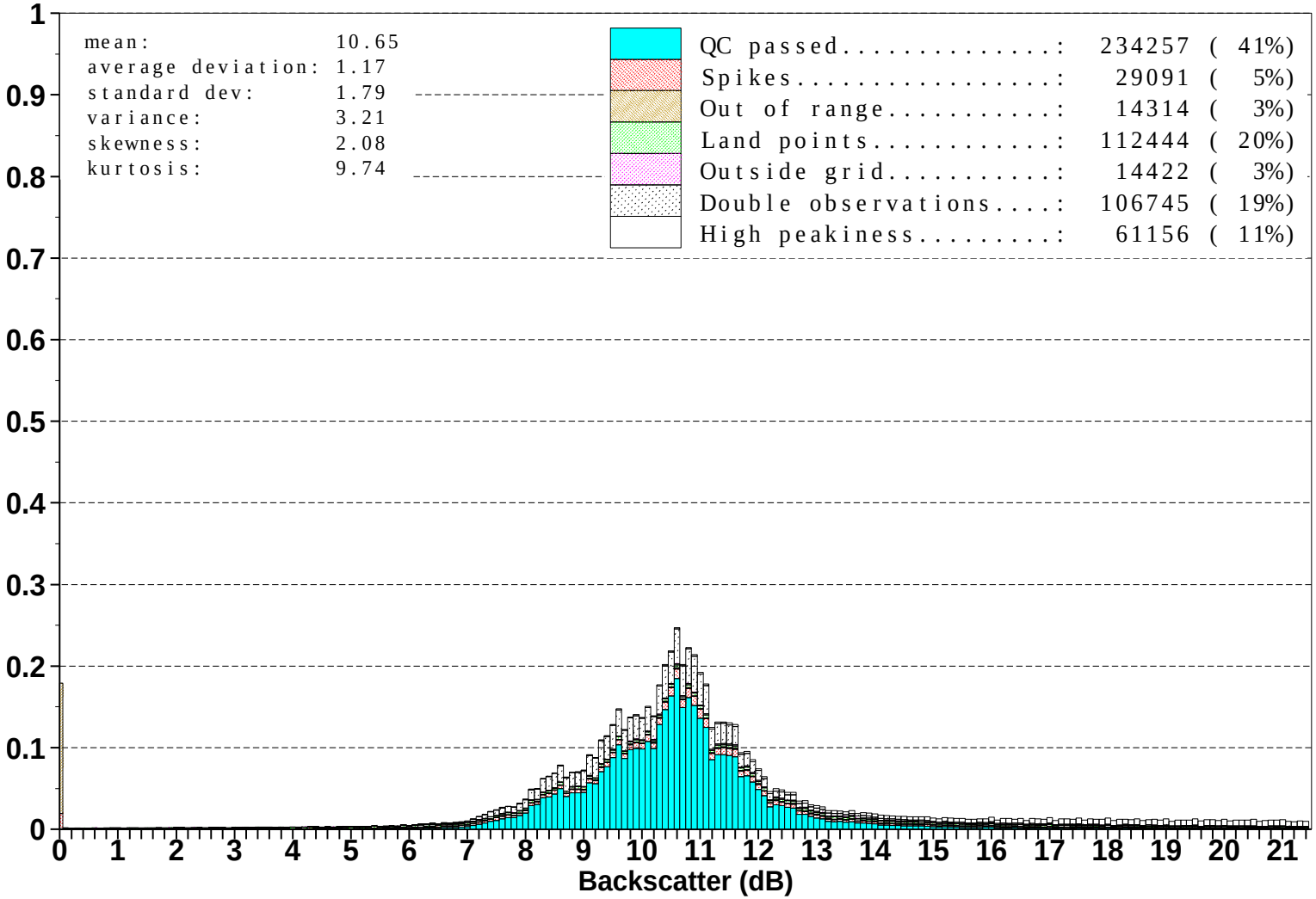


Figure 2: Distribution of the ERS-2 Altimeter backscatter after QC for December 2006

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

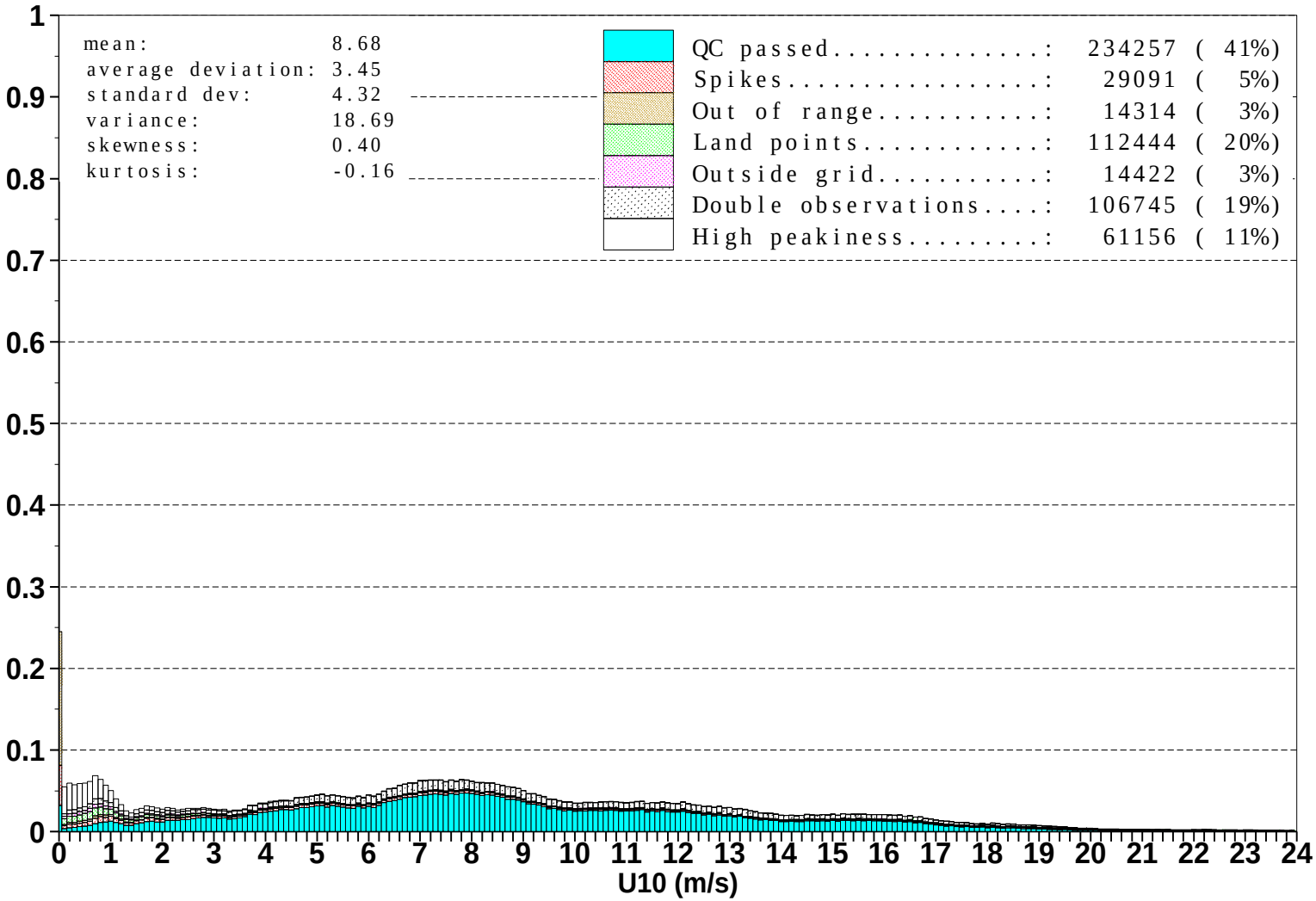


Figure 3: Distribution of the ERS-2 Altimeter wind speeds after QC for December 2006

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

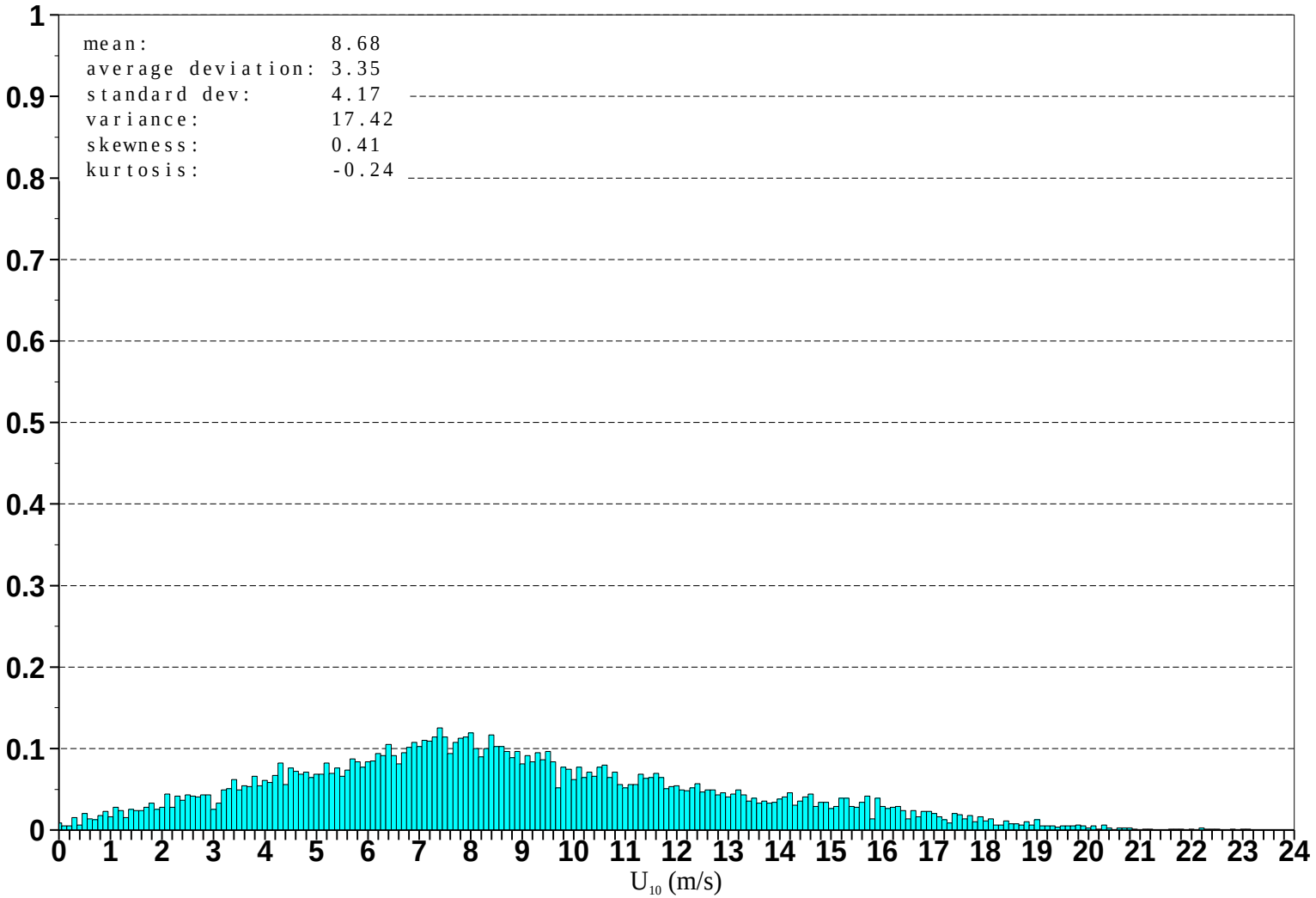


Figure 4: Distribution of ERS-2 Altimeter wind speeds after along track averaging for December 2006

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 December 2006

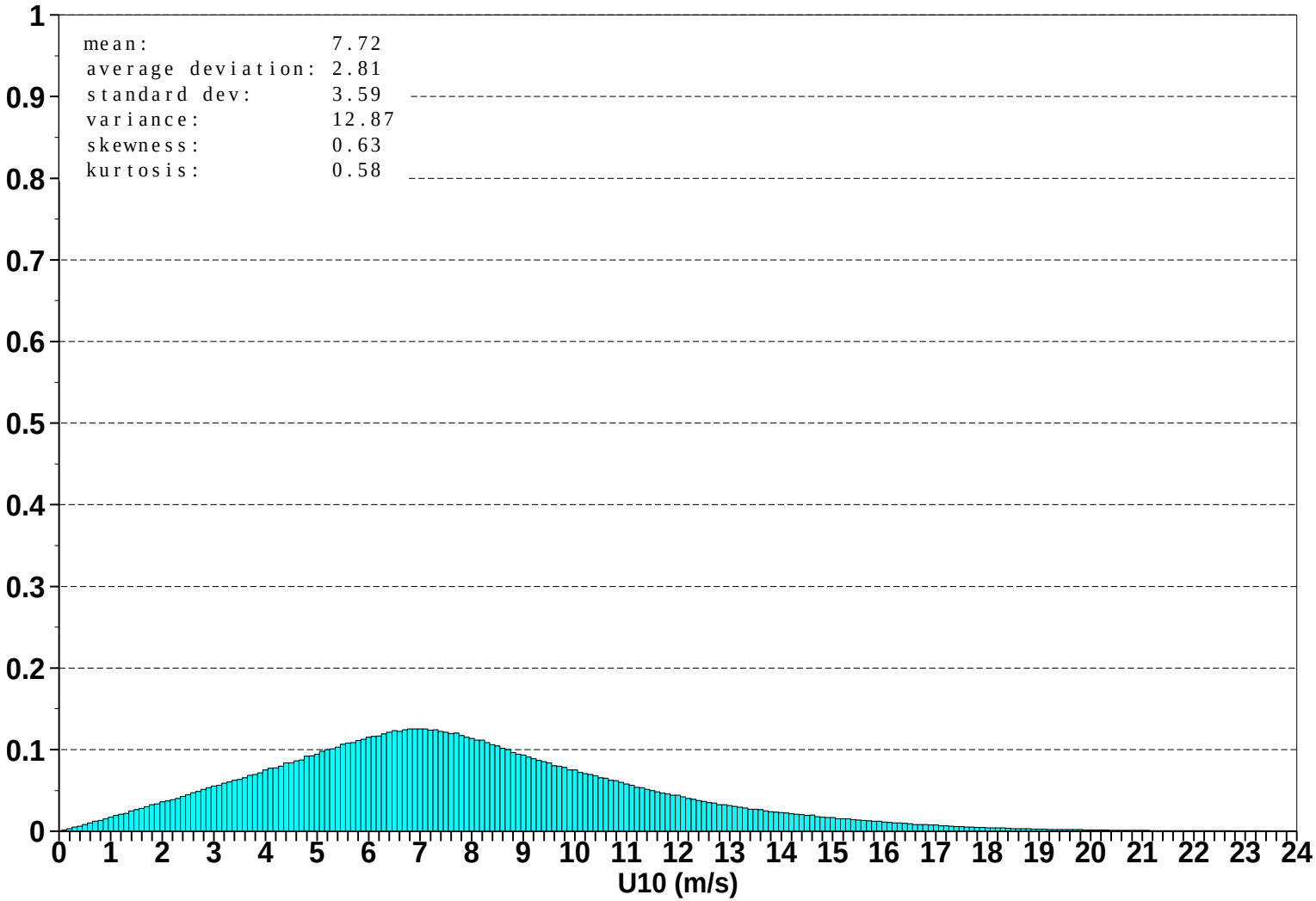
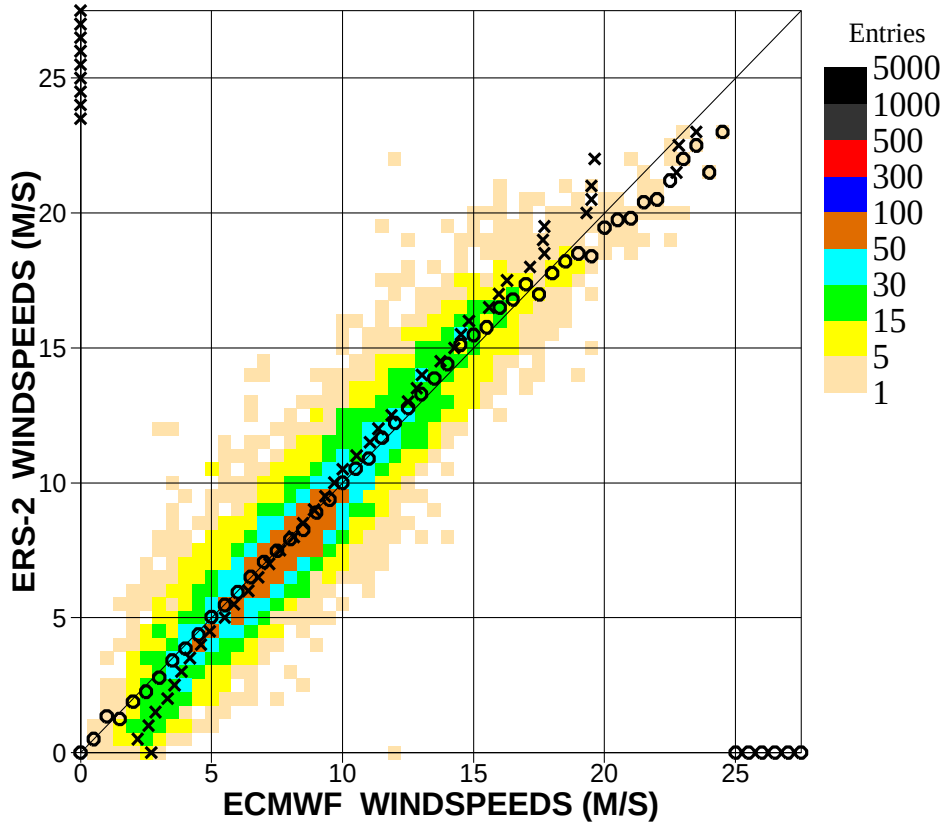


Figure 5: Global distribution of ECMWF ocean surface wind speeds for December 2006

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 December 2006



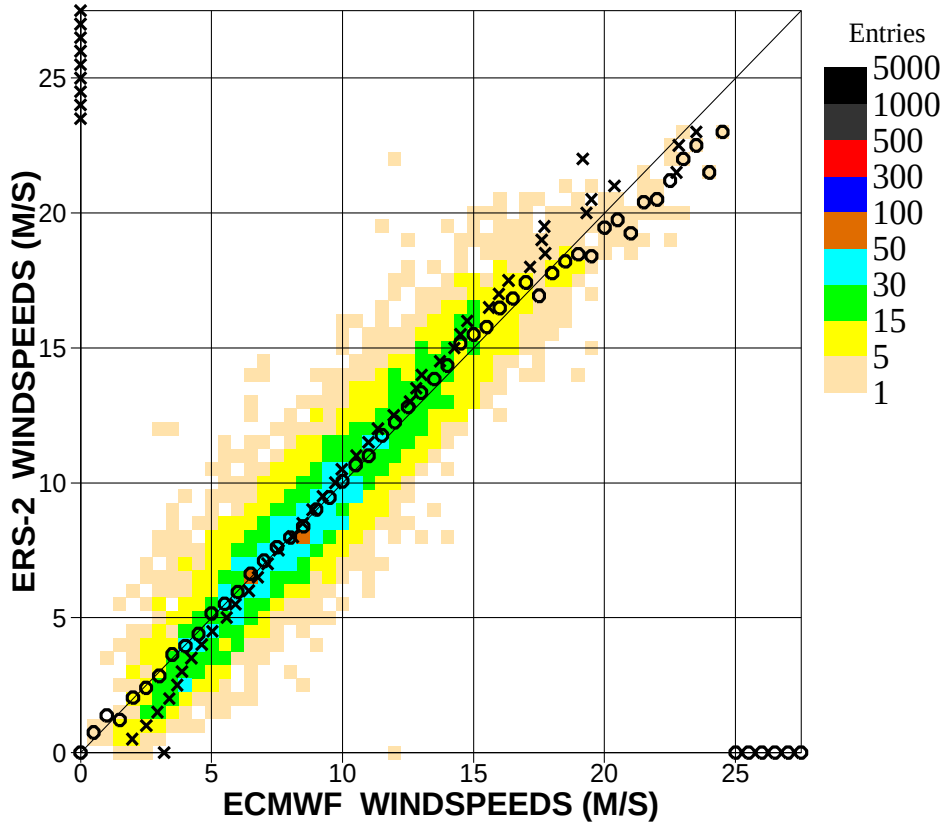
STATISTICS

ENTRIES	7898	
MEAN ECMWF	8.6739	
MEAN ERS-2	8.6787	
BIAS (ERS-2 - ECMWF)	0.0048	
STANDARD DEVIATION	1.4540	
SCATTER INDEX	0.1676	
CORRELATION	0.9377	
SYMMETRIC SLOPE	1.0165	(0.0043)
REGR. COEFFICIENT	1.0271	(0.0043)
REGR. CONSTANT	-0.2304	(0.0406)

Figure 6. Comparison of ECMWF wind speed results with ERS2 Altimeter wind speed data for December 2006 (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

ECMWF Report on ERS-2 RA for December 2006

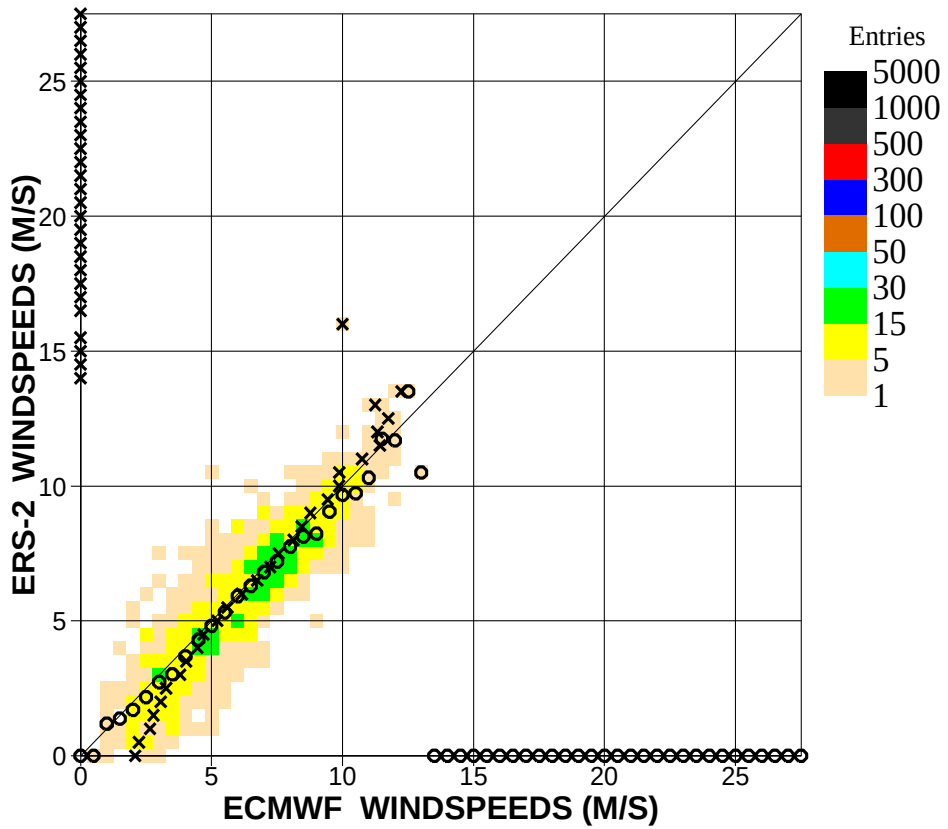


STATISTICS

ENTRIES	5721	
MEAN ECMWF	9.1799	
MEAN ERS-2	9.2720	
BIAS (ERS-2 - ECMWF)	0.0921	
STANDARD DEVIATION	1.5121	
SCATTER INDEX	0.1647	
CORRELATION	0.9352	
SYMMETRIC SLOPE	1.0227	(0.0051)
REGR. COEFFICIENT	1.0193	(0.0051)
REGR. CONSTANT	-0.0854	(0.0509)

Figure 7. Comparison of ECMWF wind speed results with ERS2 Altimeter wind speed data for December 2006 (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

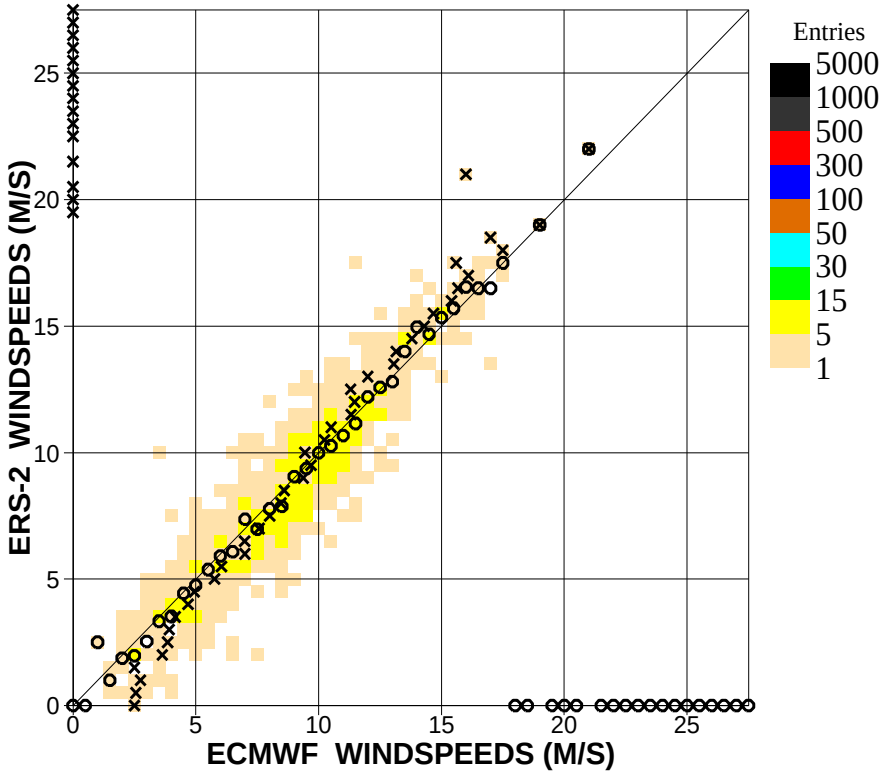


STATISTICS

ENTRIES	1306	
MEAN ECMWF	6.2683	
MEAN ERS-2	5.9717	
BIAS (ERS-2 - ECMWF)	-0.2966	
STANDARD DEVIATION	1.1466	
SCATTER INDEX	0.1829	
CORRELATION	0.9012	
SYMMETRIC SLOPE	0.9709	(0.0131)
REGR. COEFFICIENT	0.9765	(0.0130)
REGR. CONSTANT	-0.1492	(0.0875)

Figure 8. Comparison of ECMWF wind speed results with ERS2 Altimeter wind speed data for December 2006 (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

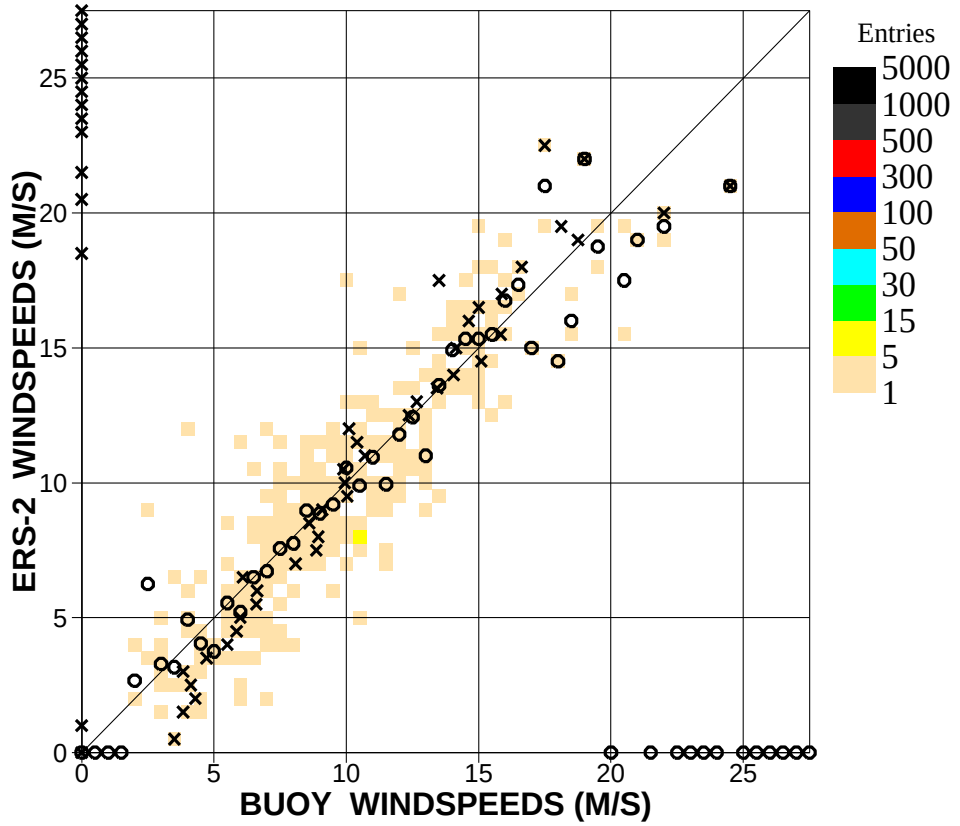


STATISTICS

ENTRIES	906	
MEAN ECMWF	8.9040	
MEAN ERS-2	8.7817	
BIAS (ERS-2 - ECMWF)	-0.1223	
STANDARD DEVIATION	1.4087	
SCATTER INDEX	0.1582	
CORRELATION	0.9303	
SYMMETRIC SLOPE	1.0043	(0.0138)
REGR. COEFFICIENT	1.0417	(0.0137)
REGR. CONSTANT	-0.4940	(0.1302)

Figure 9. Comparison of ECMWF wind speed results with ERS2 Altimeter wind speed data for December 2006 (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

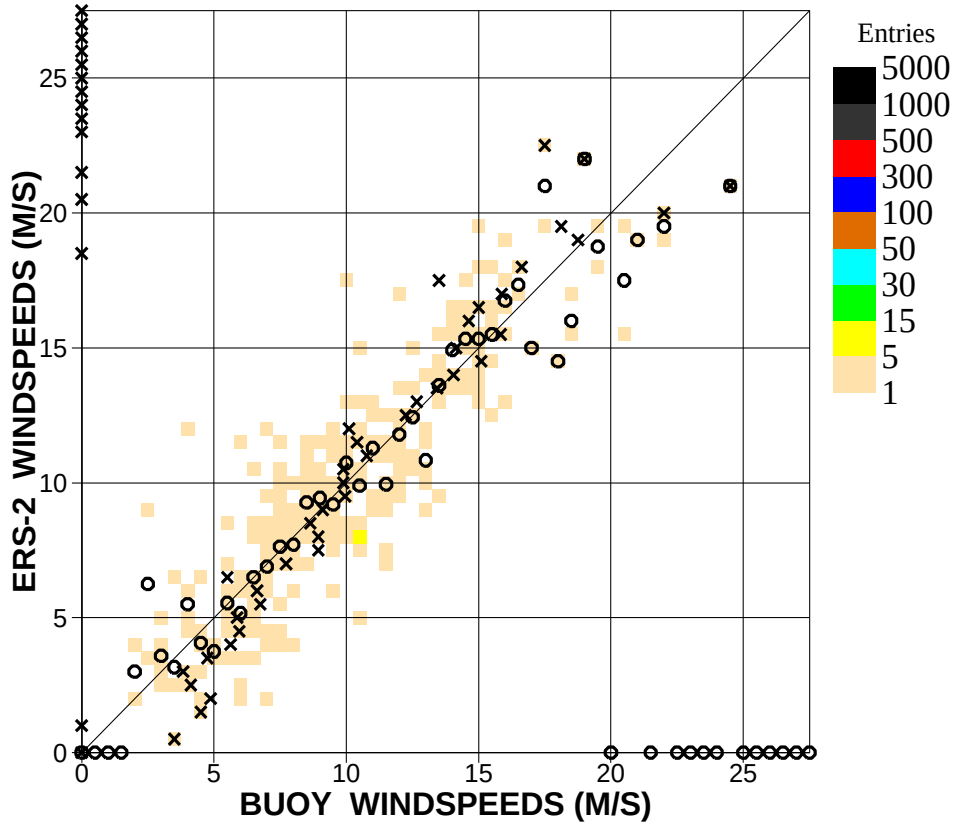


STATISTICS

ENTRIES	335	
MEAN BUOY	9.9601	
MEAN ERS-2	9.8316	
BIAS (ERS-2 - BUOY)	-0.1284	
STANDARD DEVIATION	2.0159	
SCATTER INDEX	0.2024	
CORRELATION	0.8869	
SYMMETRIC SLOPE	1.0003	(0.0275)
REGR. COEFFICIENT	0.9559	(0.0273)
REGR. CONSTANT	0.3107	(0.2931)

Figure 10. Comparison of buoy wind speed observations with ERS2 Altimeter wind speed data for December 2006 (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	304	
MEAN BUOY	10.1693	
MEAN ERS-2	10.1053	
BIAS (ERS-2 - BUOY)	-0.0641	
STANDARD DEVIATION	2.0805	
SCATTER INDEX	0.2046	
CORRELATION	0.8820	
SYMMETRIC SLOPE	1.0048	(0.0293)
REGR. COEFFICIENT	0.9446	(0.0290)
REGR. CONSTANT	0.4990	(0.3183)

Figure 11. Comparison of buoy wind speed observations with ERS2 Altimeter wind speed data for December 2006 (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

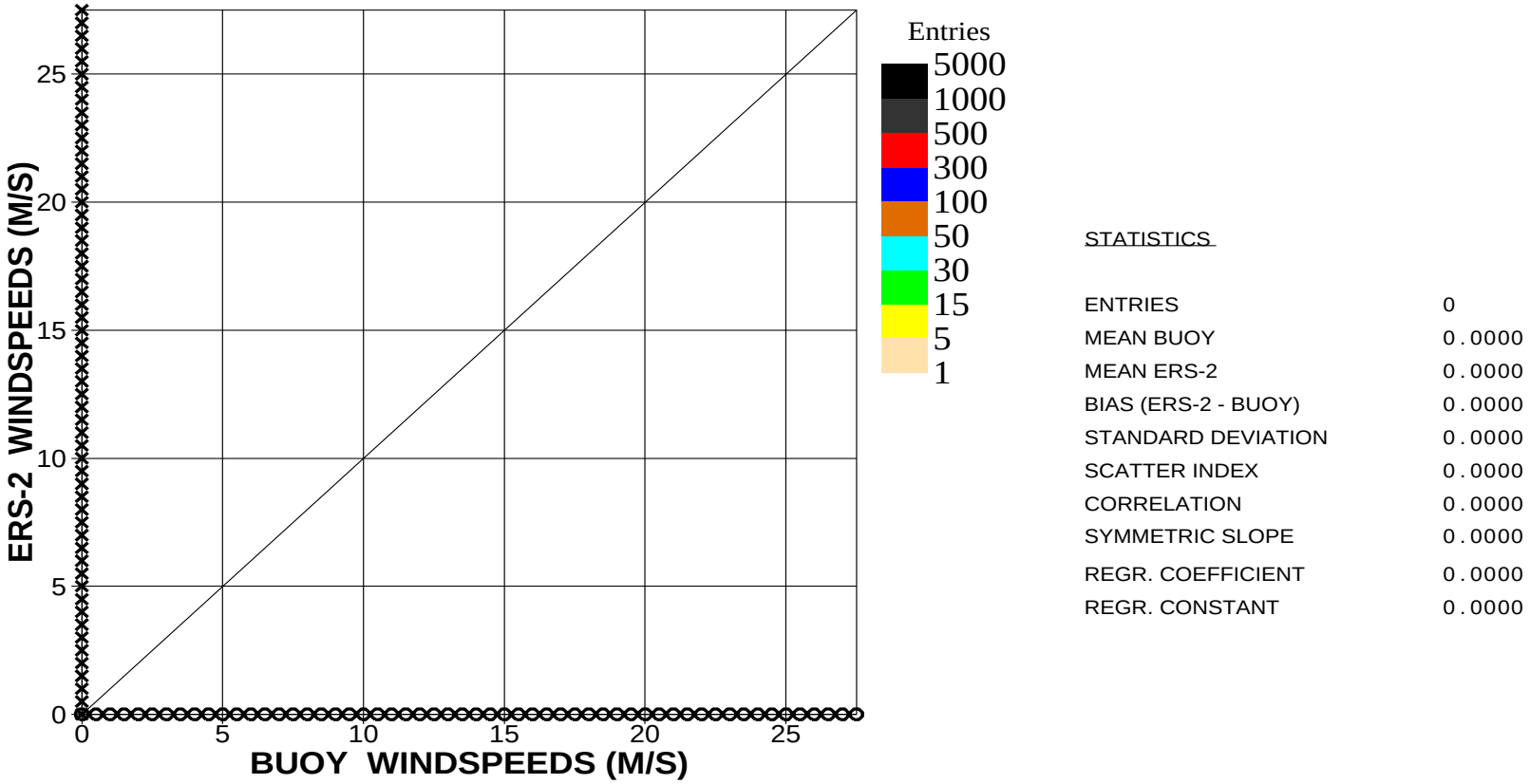


Figure 12. Comparison of buoy wind speed observations with ERS2 Altimeter wind speed data for December 2006 (hawaii)

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

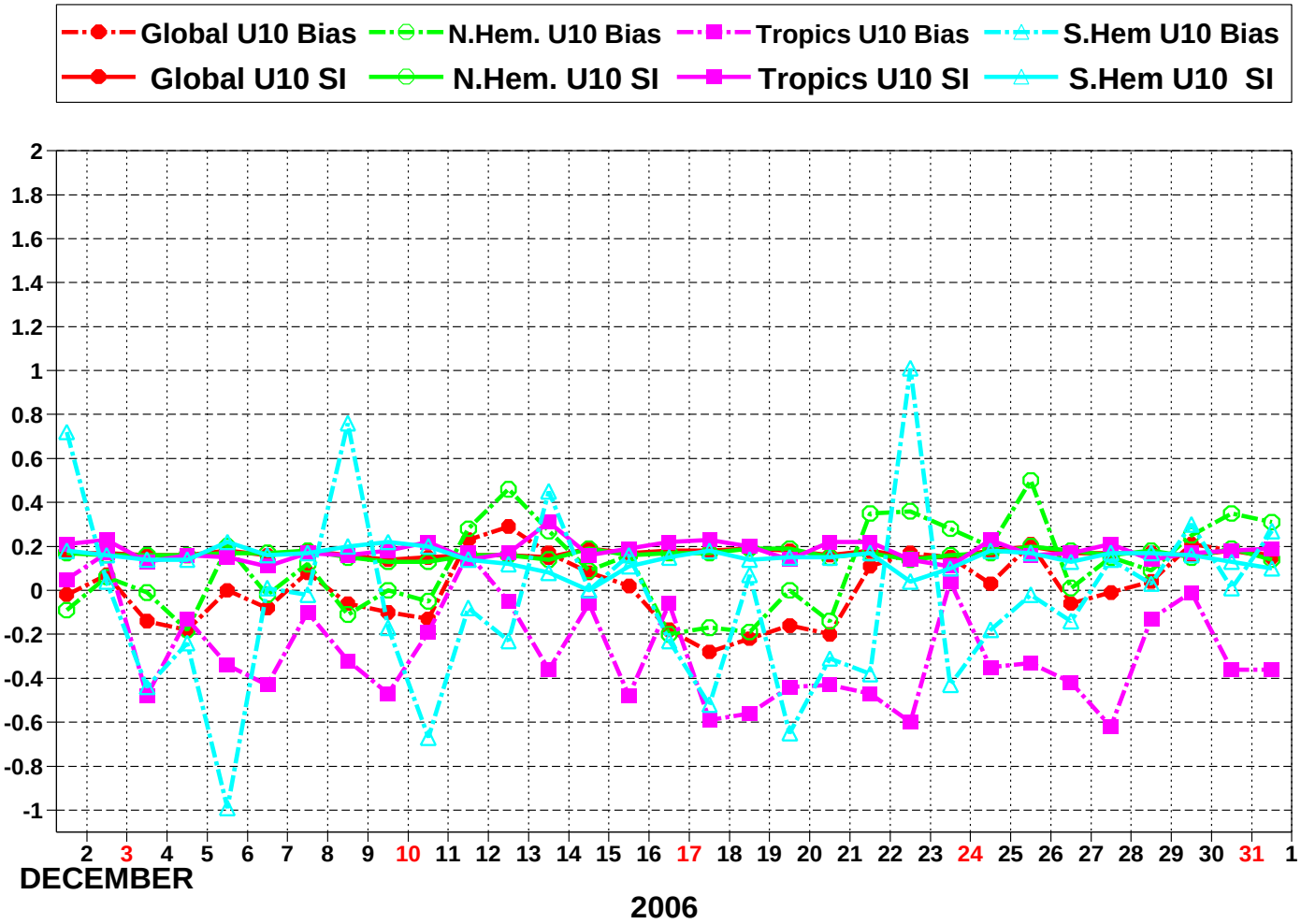


Figure 13: ERS-2 Altimeter wind speeds: Timeseries of bias (ERS-2 - model) and scatter index (SI)

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

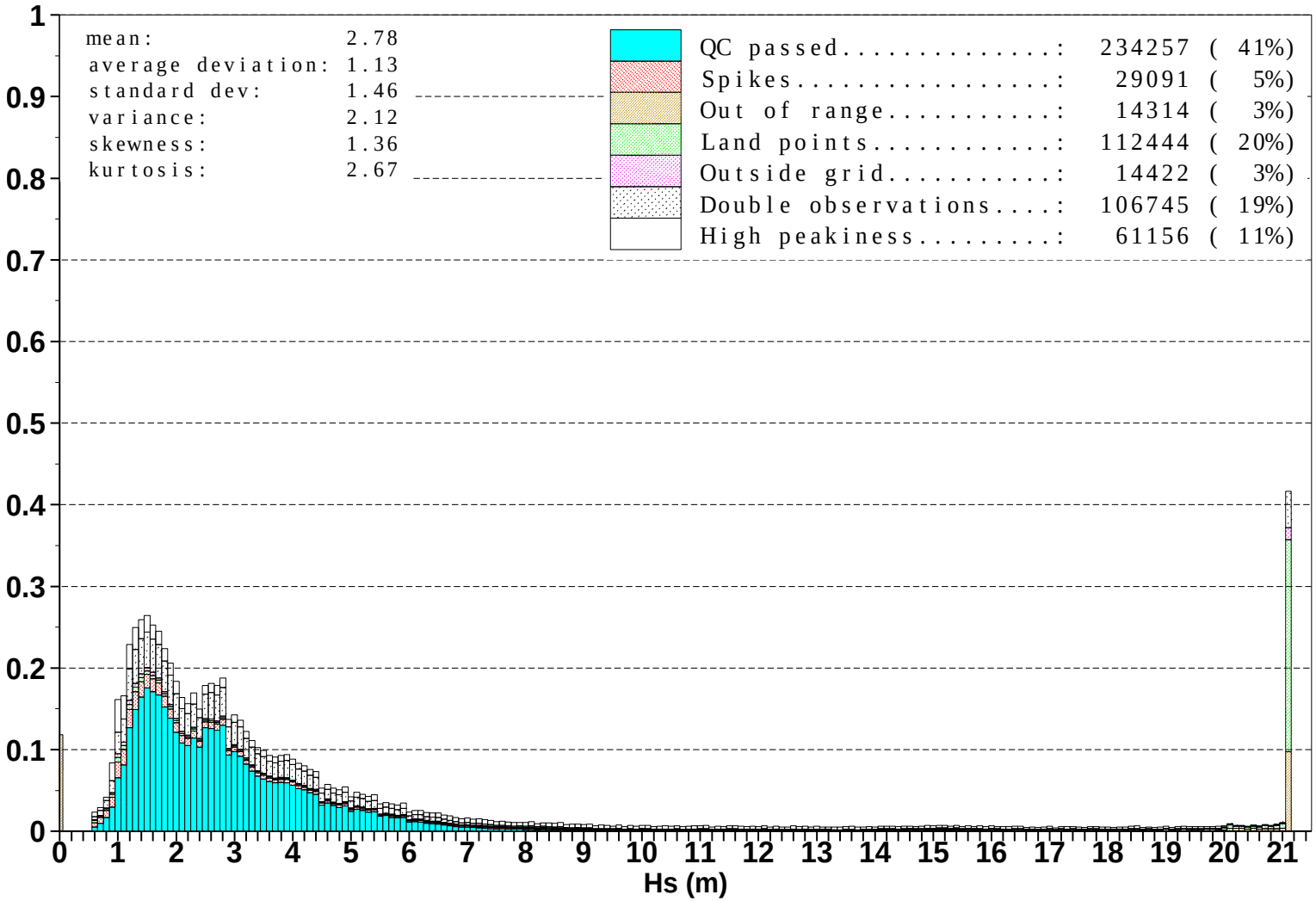


Figure 14: Distribution of the ERS-2 Altimeter wave heights after QC for December 2006

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

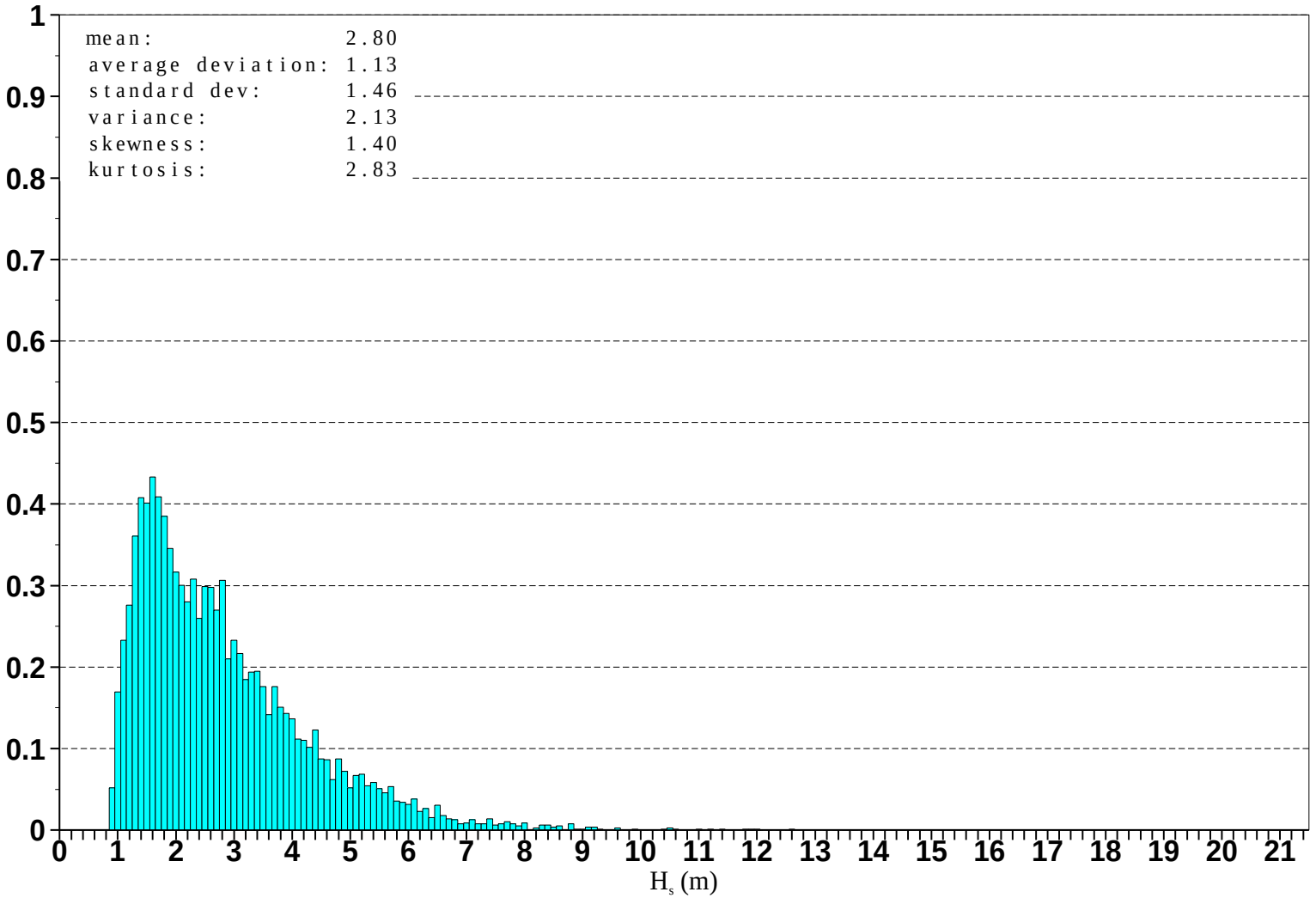


Figure 15: Distribution of ERS-2 Altimeter wave heights after along track averaging for December 2006

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

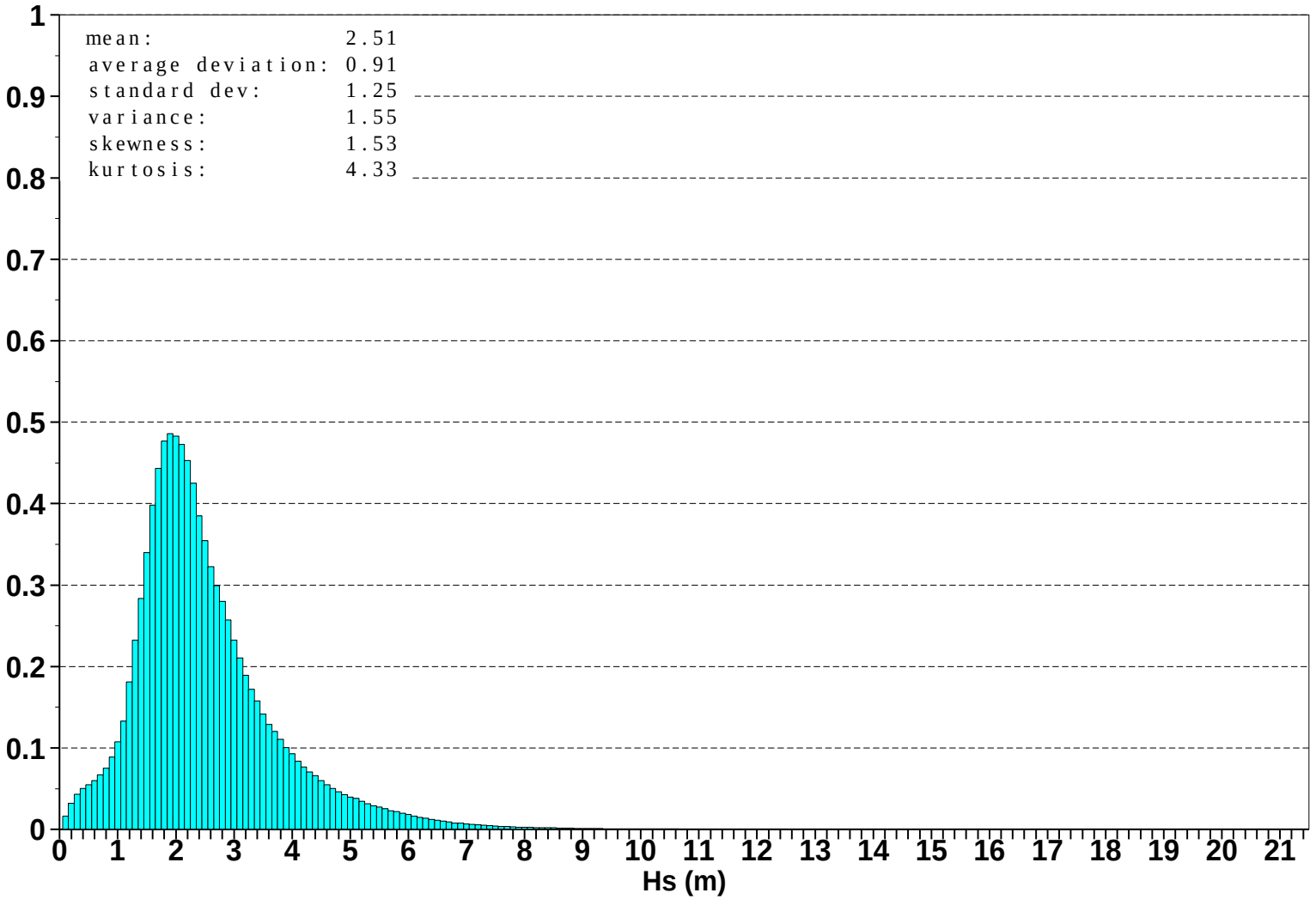
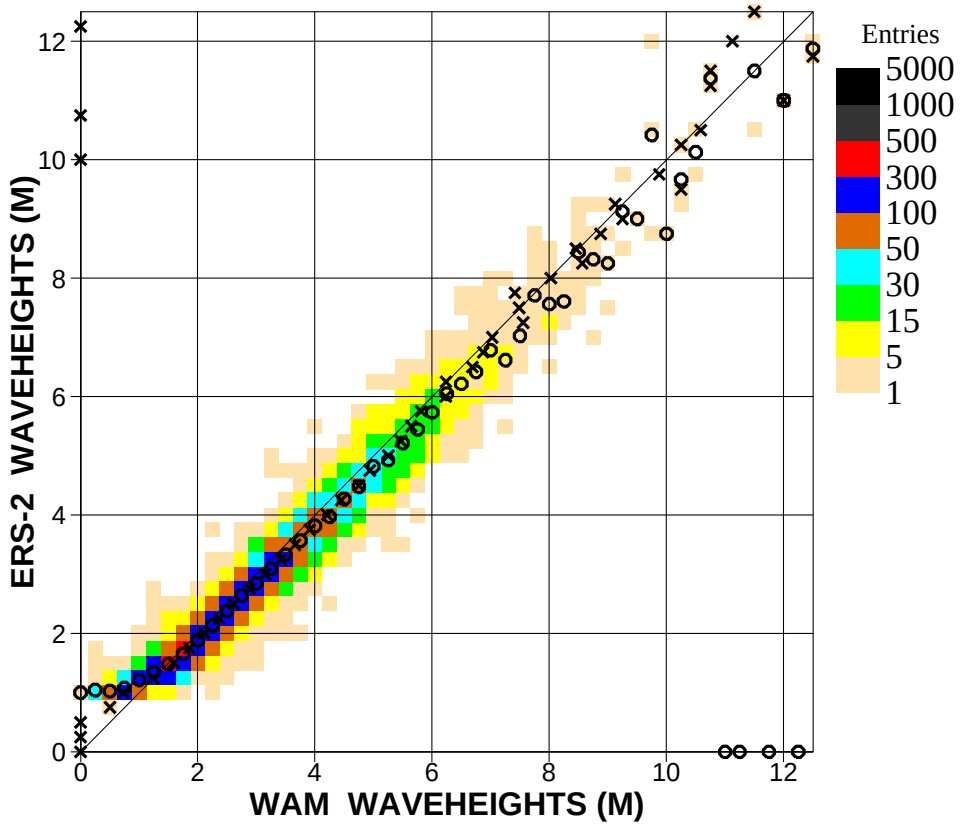


Figure 16: Global distribution of ECMWF wave heights for December 2006

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

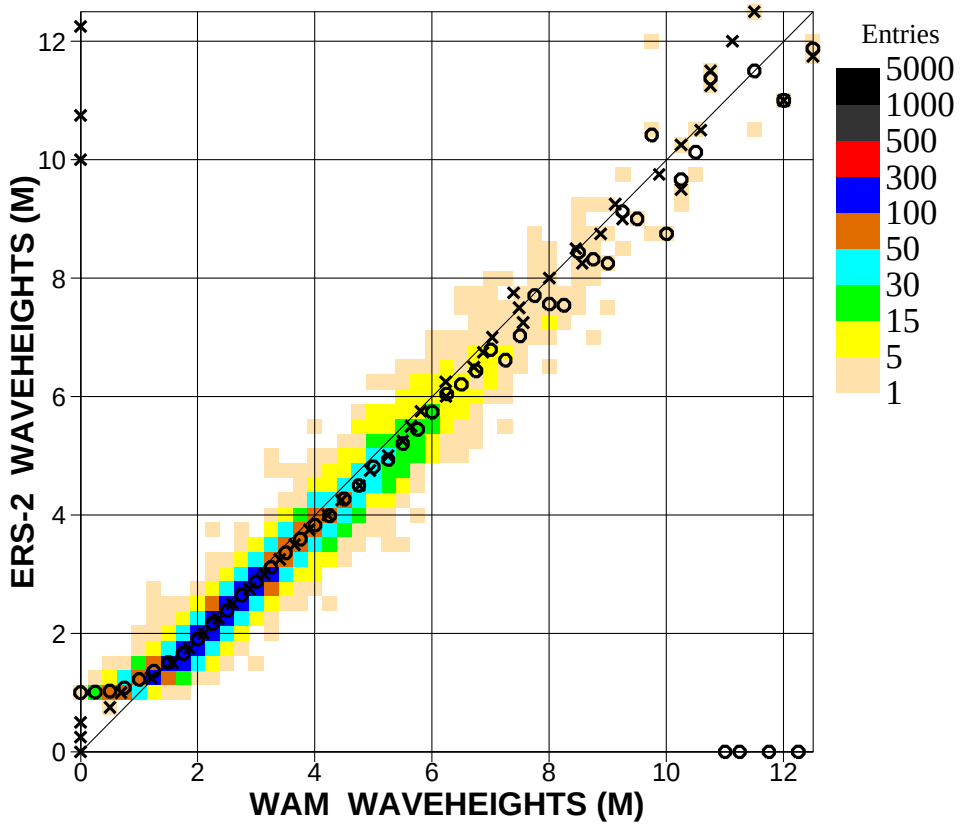


STATISTICS

ENTRIES	7898	
MEAN WAM	2.9070	
MEAN ERS-2	2.8002	
BIAS (ERS-2 - WAM)	-0.1069	
STANDARD DEVIATION	0.3264	
SCATTER INDEX	0.1123	
CORRELATION	0.9779	
SYMMETRIC SLOPE	0.9593	(0.0023)
REGR. COEFFICIENT	0.9244	(0.0022)
REGR. CONSTANT	0.1129	(0.0073)

Figure 17. Comparison of ECMWF wave height results with ERS2 Altimeter wave height data for December 2006 (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

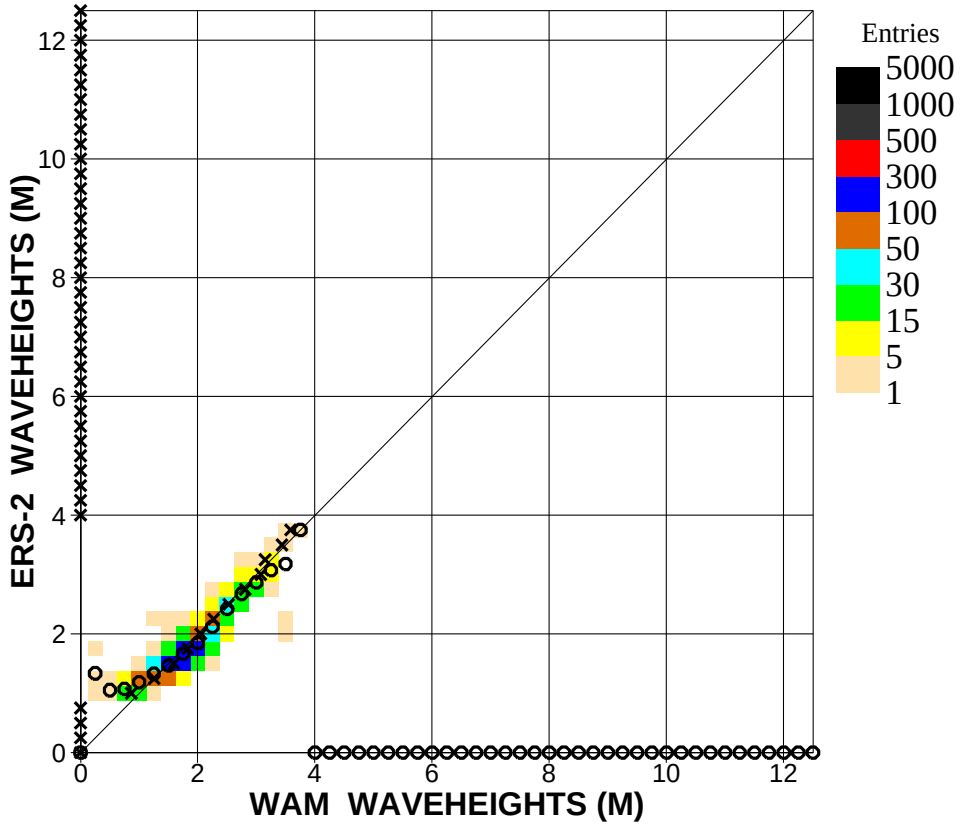


STATISTICS

ENTRIES	5721	
MEAN WAM	3.1379	
MEAN ERS-2	3.0353	
BIAS (ERS-2 - WAM)	-0.1026	
STANDARD DEVIATION	0.3473	
SCATTER INDEX	0.1107	
CORRELATION	0.9782	
SYMMETRIC SLOPE	0.9622	(0.0026)
REGR. COEFFICIENT	0.9228	(0.0026)
REGR. CONSTANT	0.1397	(0.0092)

Figure 18. Comparison of ECMWF wave height results with ERS2 Altimeter wave height data for December 2006 (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

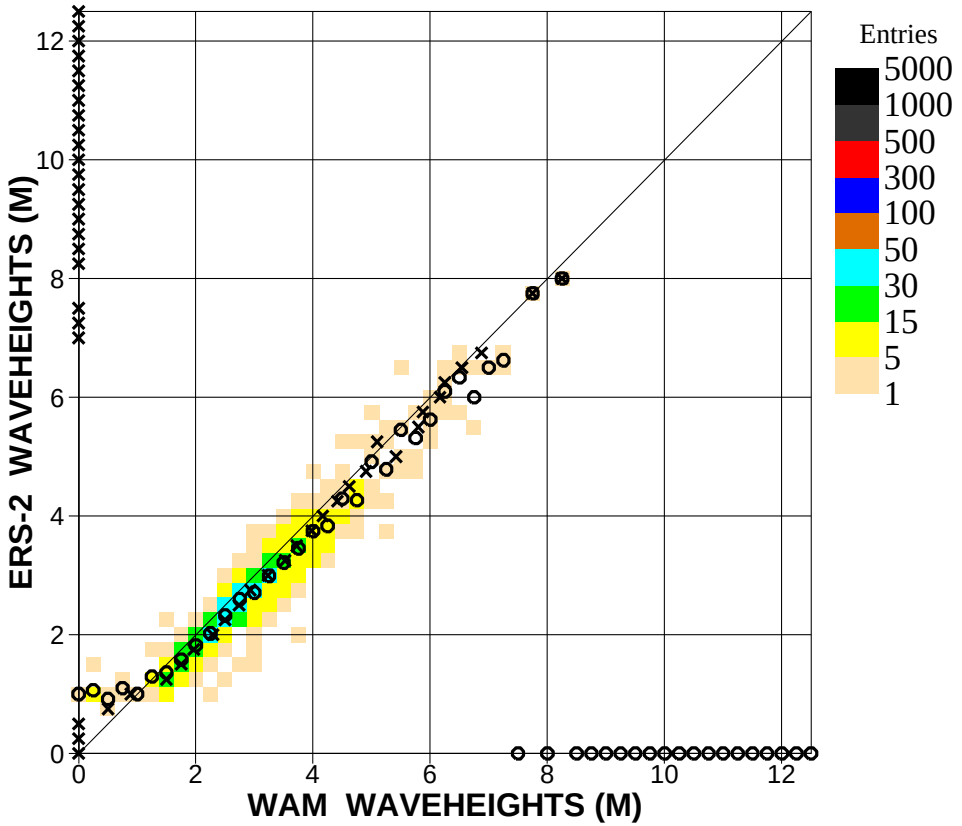


STATISTICS

ENTRIES	1306	
MEAN WAM	1.8216	
MEAN ERS-2	1.7760	
BIAS (ERS-2 - WAM)	-0.0456	
STANDARD DEVIATION	0.1953	
SCATTER INDEX	0.1072	
CORRELATION	0.9334	
SYMMETRIC SLOPE	0.9693	(0.0096)
REGR. COEFFICIENT	0.8433	(0.0090)
REGR. CONSTANT	0.2398	(0.0171)

Figure 19. Comparison of ECMWF wave height results with ERS2 Altimeter wave height data for December 2006 (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

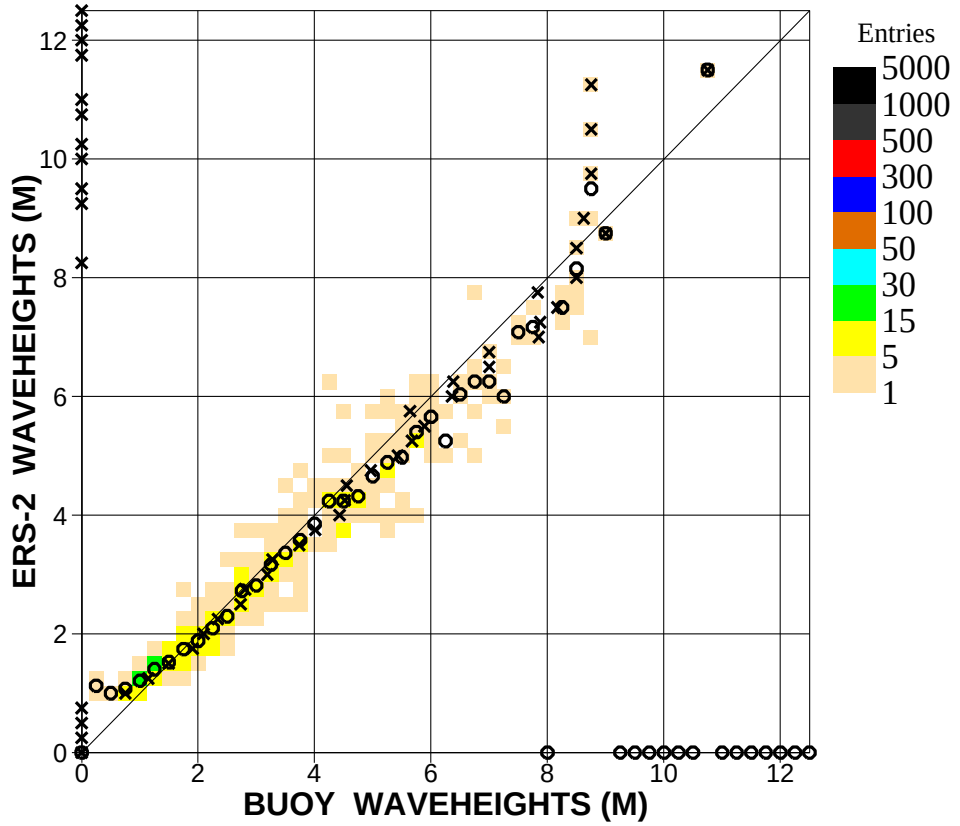


STATISTICS

ENTRIES	906	
MEAN WAM	2.9783	
MEAN ERS-2	2.7615	
BIAS (ERS-2 - WAM)	-0.2169	
STANDARD DEVIATION	0.3133	
SCATTER INDEX	0.1052	
CORRELATION	0.9573	
SYMMETRIC SLOPE	0.9316	(0.0093)
REGR. COEFFICIENT	0.9235	(0.0093)
REGR. CONSTANT	0.0109	(0.0294)

Figure 20. Comparison of ECMWF wave height results with ERS2 Altimeter wave height data for December 2006 (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

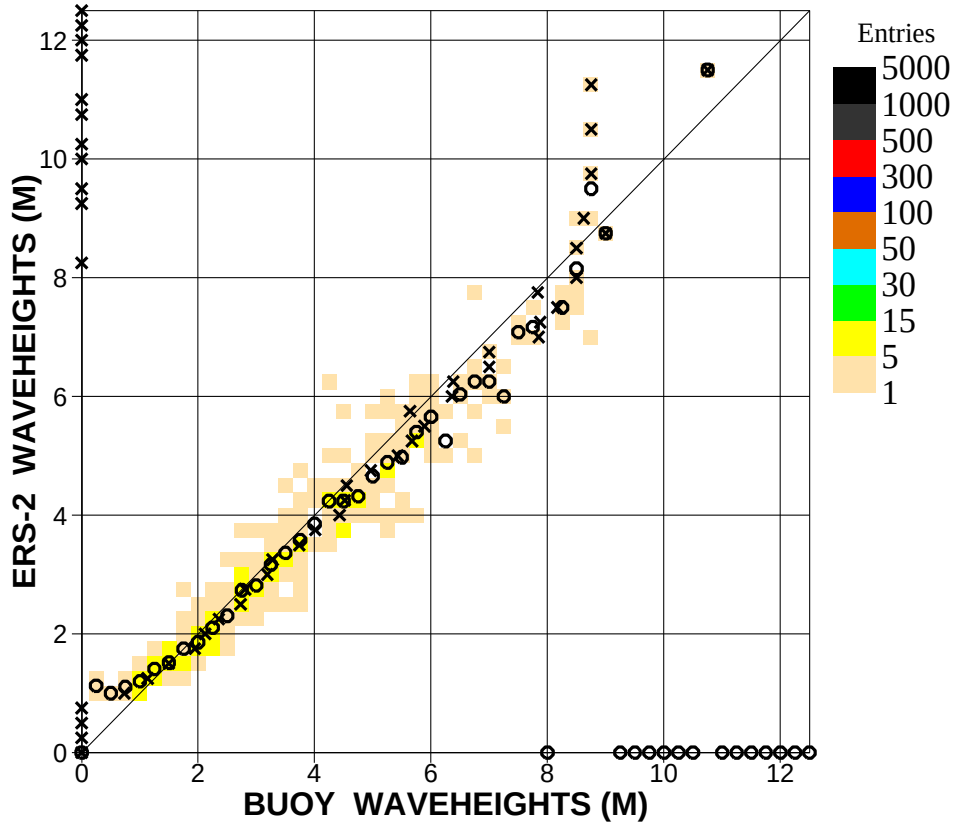


STATISTICS

ENTRIES	472	
MEAN BUOY	3.4238	
MEAN ERS-2	3.2983	
BIAS (ERS-2 - BUOY)	-0.1255	
STANDARD DEVIATION	0.4672	
SCATTER INDEX	0.1365	
CORRELATION	0.9722	
SYMMETRIC SLOPE	0.9576	(0.0104)
REGR. COEFFICIENT	0.9139	(0.0101)
REGR. CONSTANT	0.1692	(0.0401)

Figure 21. Comparison of buoy wave height observations with ERS2 Altimeter wave height data for December 2006 (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

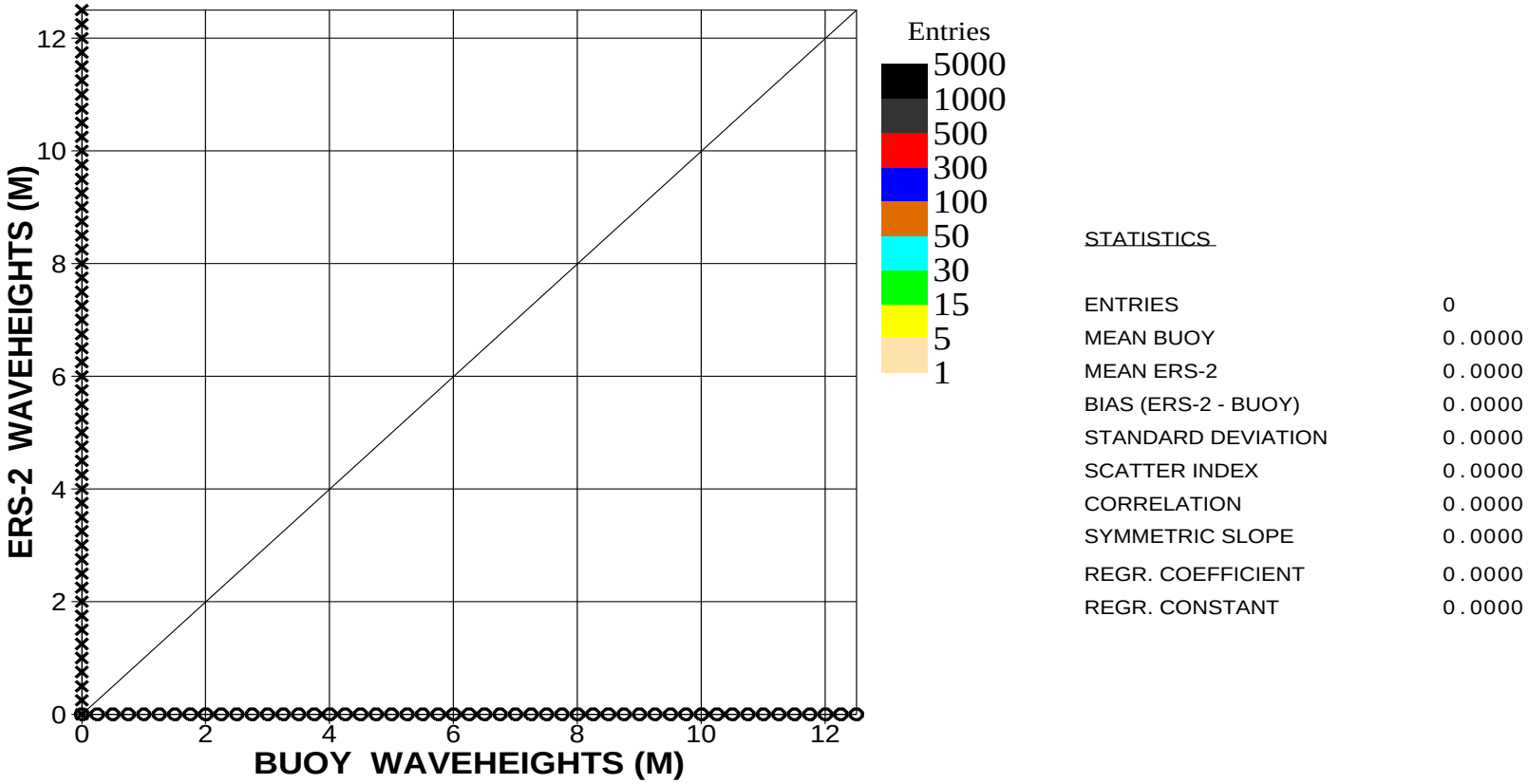


STATISTICS

ENTRIES	440	
MEAN BUOY	3.5562	
MEAN ERS-2	3.4178	
BIAS (ERS-2 - BUOY)	-0.1384	
STANDARD DEVIATION	0.4786	
SCATTER INDEX	0.1346	
CORRELATION	0.9707	
SYMMETRIC SLOPE	0.9569	(0.0110)
REGR. COEFFICIENT	0.9155	(0.0108)
REGR. CONSTANT	0.1621	(0.0441)

Figure 22. Comparison of buoy wave height observations with ERS2 Altimeter wave height data for December 2006 (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 December 2006 (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

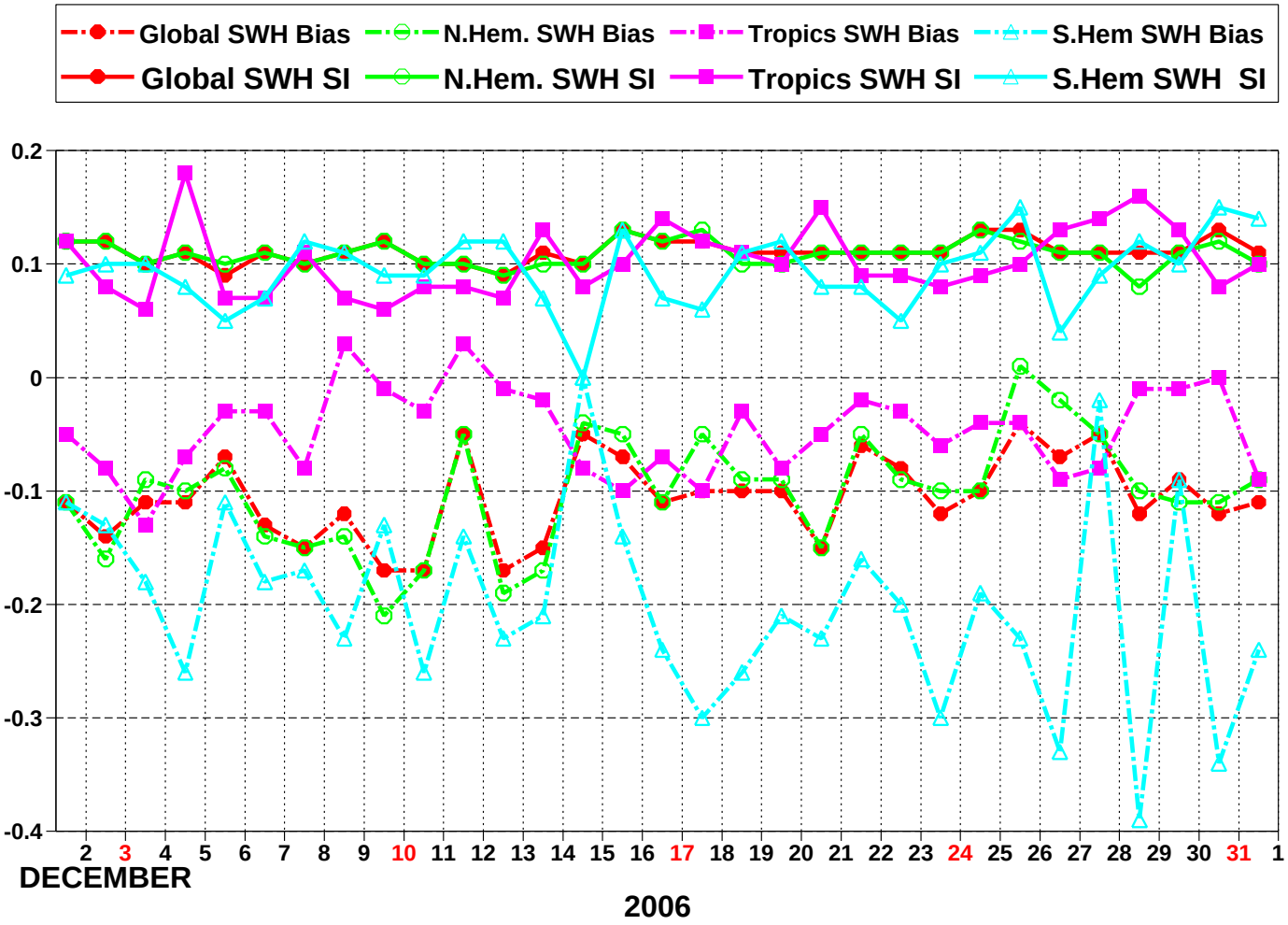


Figure 24: ERS-2 Altimeter wave heights: Timeseries of bias (ERS-2 - model) and scatter index (SI)

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

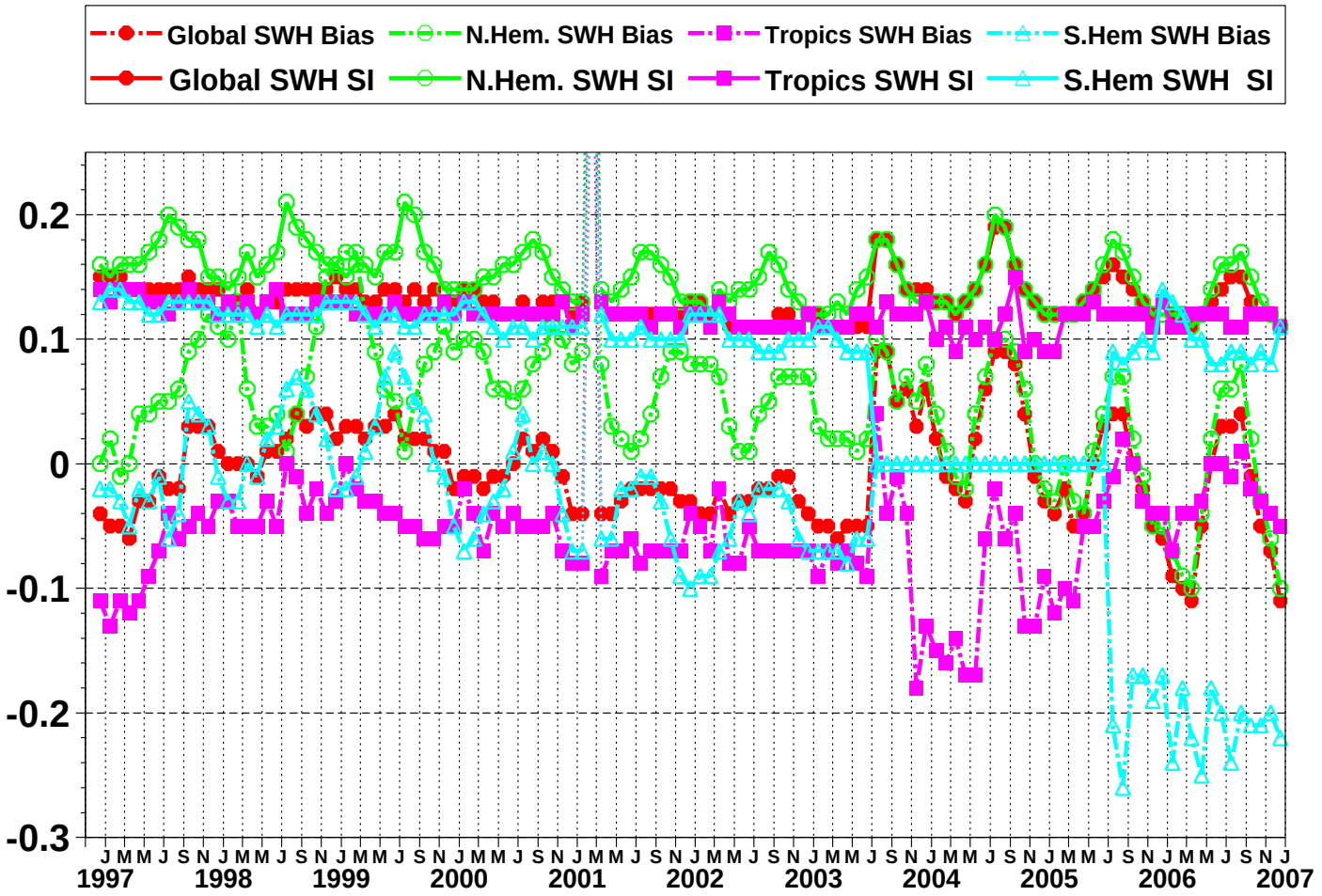


Figure 25: ERS-2 Altimeter wave heights: Timeseries of bias (ERS-2 - model) and scatter index (SI)

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

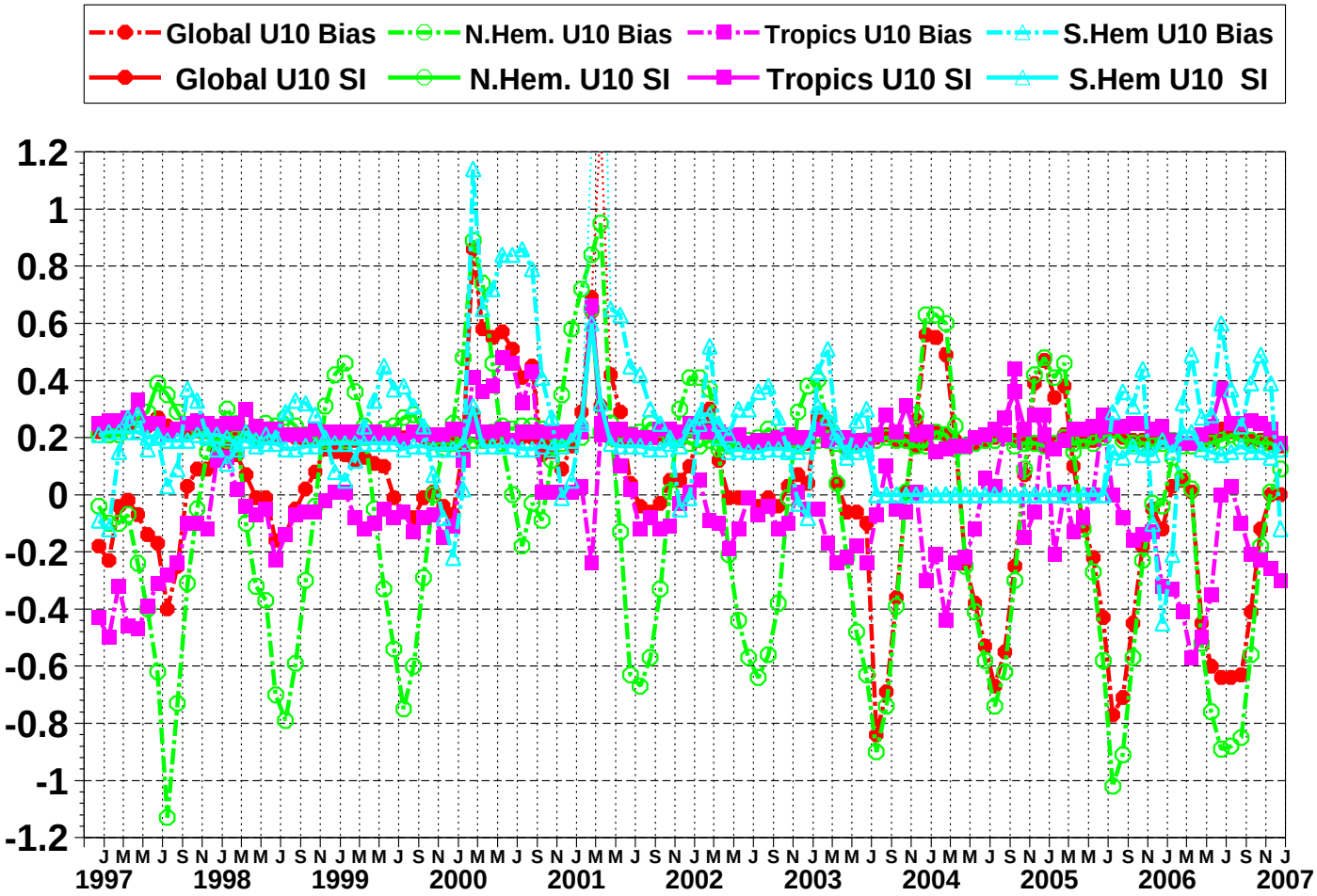


Figure 26: ERS-2 Altimeter wind speeds: Timeseries of bias (ERS-2 - model) and scatter index (SI)

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

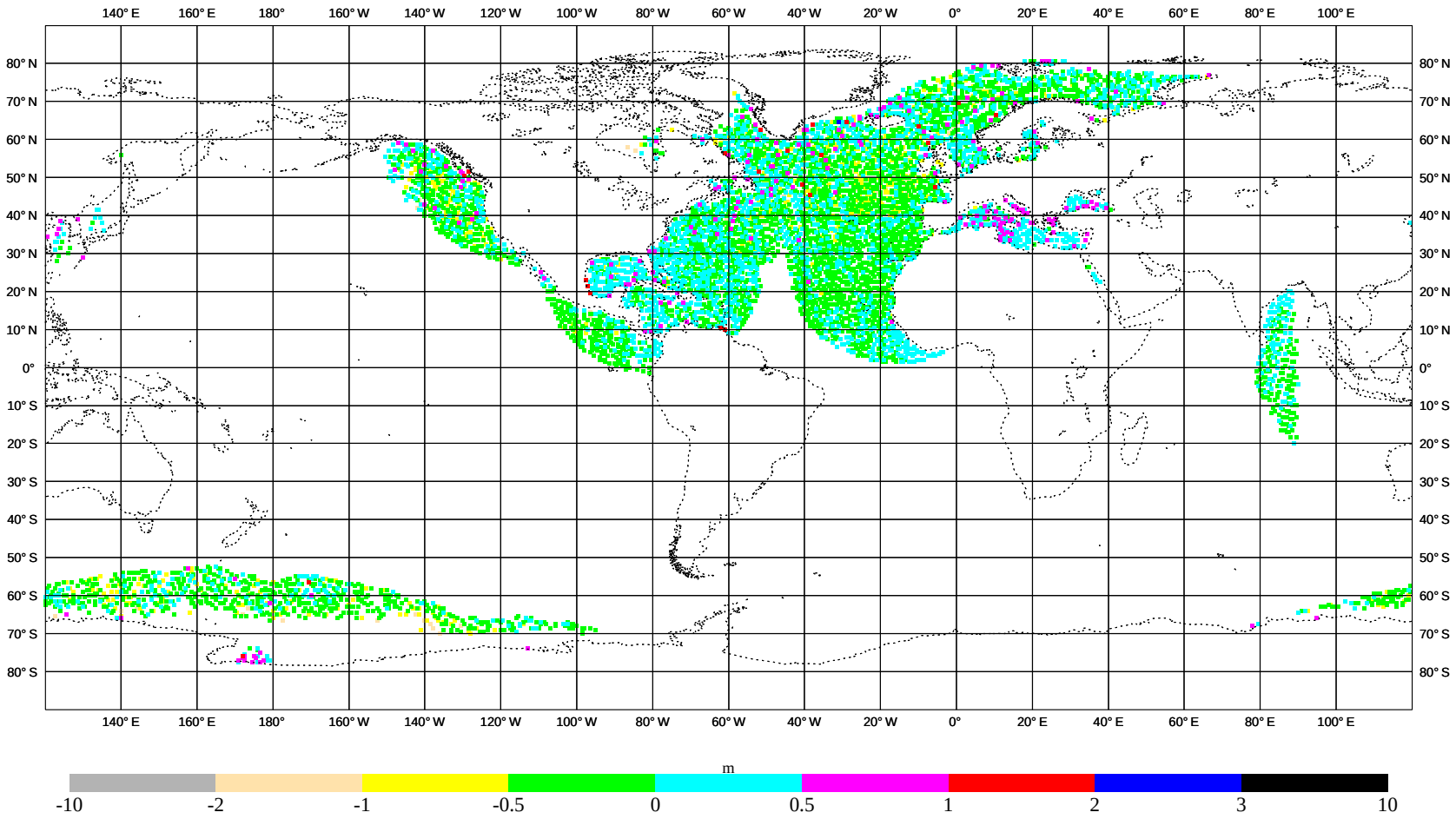


Figure 27: Significant wave height: Monthly mean difference of ERS-2 altimeter data minus wave model results for December 2006.

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