

■ ECMWF Report on ERS-2 RA for August 2002 ■

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

By: *Saleh Abdalla*

Date: *13 September 2002*

Overview:

Based on the data received during the full month, on average, 16761 observations arrived at ECMWF every 6 hours of which 13884 observations entered the quality control process. 80.05% of them passed the quality control. The data coverage, which was rather good, can be seen in Figure 1. There was no missing data nor significant reduction during the whole month. Note that we are talking about the raw data which have arrived at ECMWF before they were processed.

The quality of the received data is as good as used to be before January 2000.

Backscatter:

ERS-2 $\langle \sigma_0 \rangle = 11.09$ dB (with double peaks at 10.6 dB and at 11.1 dB)

Wind Speed Comparison with ECMWF wind speeds (bias):

ERS-2 global: -0.012 m/s

ERS-2 northern hemisphere: -0.557 m/s

ERS-2 tropics: -0.045 m/s

ERS-2 southern hemisphere: 0.384 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 August 2002 ■

Wind Speed Comparison with buoy wind speeds (bias):

ERS-2 global: -1.054 m/s

ERS-2 northern hemisphere: -1.078 m/s

ERS-2 tropics: -0.877 m/s

Wave Height Comparison with ECMWF wave heights (bias):

ERS-2 global: -0.017 m (lowest waves measured: 0.6m)

ERS-2 northern hemisphere: 0.048 m

ERS-2 tropics: -0.069 m

ERS-2 southern hemisphere: -0.020 m

Wave Height Comparison with buoy wave heights (bias):

ERS-2 global: 0.049 m

ERS-2 northern hemisphere: 0.064 m

ERS-2 tropics: -0.155 m

Remarks:

- There are few outliers (RA values higher than model) in the scatter plot for the wave heights in the Northern Hemisphere (Figure 18) and Tropics (Figure 19) for this month as it was the case in the previous month. The outliers are due to the tropical cyclones whose locations are not predicted precisely by the high resolution atmospheric model. Of course, few (same number as the wave height outliers) of wind speed outliers can be explained by the same reason as well.



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 August 2002 ■

- Apart from those outliers, the quality of Altimeter wave height and wind speed data are, in general, as good as they used to be.

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 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.



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 August 2002 ■

Figure captions:

Figure 1: Time series of data reception for ERS-2 Altimeter data for August 2002.

Figure 2: Distribution of the ERS-2 Altimeter Backscatter after QC for August 2002.

Figure 3: Distribution of the ERS-2 Altimeter wind speeds after QC for August 2002.

Figure 4: Distribution of the ERS-2 Altimeter wind speeds after along track averaging for August 2002.

Figure 5: Global distribution of ECMWF ocean surface wind speeds for August 2002.

Figure 6: Comparison of ECMWF wind speed results with ERS-2 Altimeter wind speed data for August 2002 (global).

Figure 7: Comparison of ECMWF wind speed results with ERS-2 Altimeter wind speed data for August 2002 (northern hemisphere)

Figure 8: Comparison of ECMWF wind speed results with ERS-2 Altimeter wind speed data for August 2002 (tropics)

Figure 9: Comparison of ECMWF wind speed results with ERS-2 Altimeter wind speed data for August 2002 (southern hemisphere)

Figure 10: Comparison of buoy wind speed observations with ERS-2 Altimeter wind speed data for August 2002 (global).

Figure 11: Comparison of buoy wind speed observations with ERS-2 Altimeter wind speed data for August 2002 (northern hemisphere).

Figure 12: Comparison of buoy wind speed observations with ERS-2 Altimeter wind speed data for August 2002 (tropics).

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 August 2002.

Figure 15: Distribution of the ERS-2 Altimeter wave heights after along track averaging for August 2002.

Figure 16: Global distribution of ECMWF wave heights for August 2002.

Figure 17: Comparison of ECMWF wave height results with ERS-2 Altimeter wave height data for August 2002 (global).

Figure 18: Comparison of ECMWF wave height results with ERS-2 Altimeter wave height data for August 2002 (northern hemisphere)

Figure 19: Comparison of ECMWF wave height results with ERS-2 Altimeter wave height data for August 2002 (tropics)

Figure 20: Comparison of ECMWF wave height results with ERS-2 Altimeter wave height data for August 2002 (southern hemisphere)

Figure 21: Comparison of buoy wave height observations with ERS-2 Altimeter wave height data for August 2002 (global).

Figure 22: Comparison of buoy wave height observations with ERS-2 Altimeter wave height data for August 2002 (northern hemisphere).

Figure 23: Comparison of buoy wave height observations with ERS-2 Altimeter wave height data for August 2002 (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

■ ECMWF Report on ERS-2 RA for August 2002 ■

Figure 24: ERS-2 Altimeter wave heights: Timeseries of bias (ERS-2 - model) and scatter index (SI) for August 2002.

Figure 25: ERS-2 Altimeter wave heights: Timeseries of bias (ERS-2 - model) and scatter index (SI) from December 1996 to August 2002

Figure 26: ERS-2 Altimeter wind speeds: Timeseries of bias (ERS-2 - model) and scatter index (SI) from December 1996 to August 2002



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 August 2002 ■

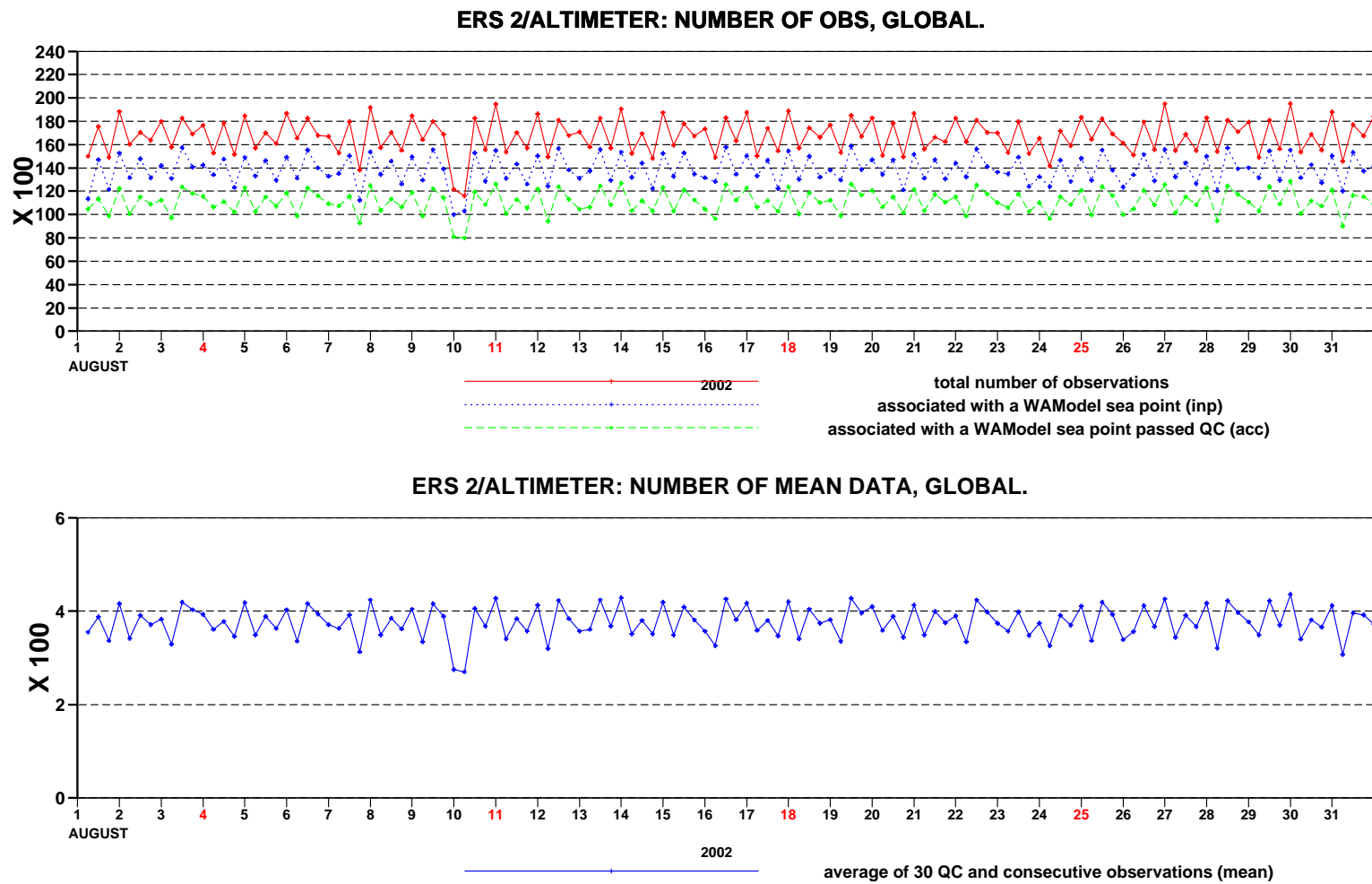
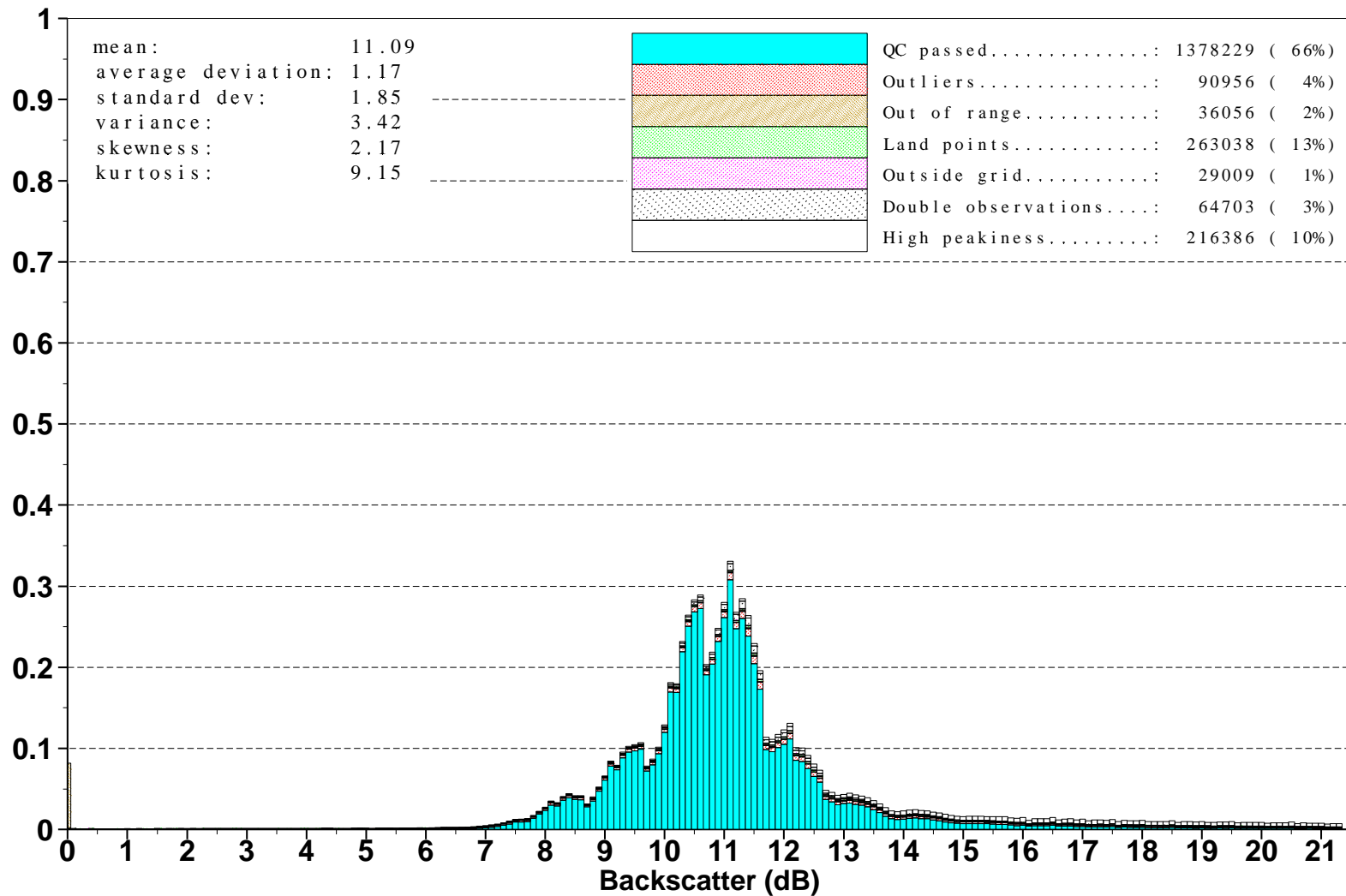


Figure 1: Time series of data reception for ERS-2 Altimeter data for August 2002

■ ECMWF Report on ERS-2 RA for August 2002 ■



■ ECMWF Report on ERS-2 RA for August 2002 ■

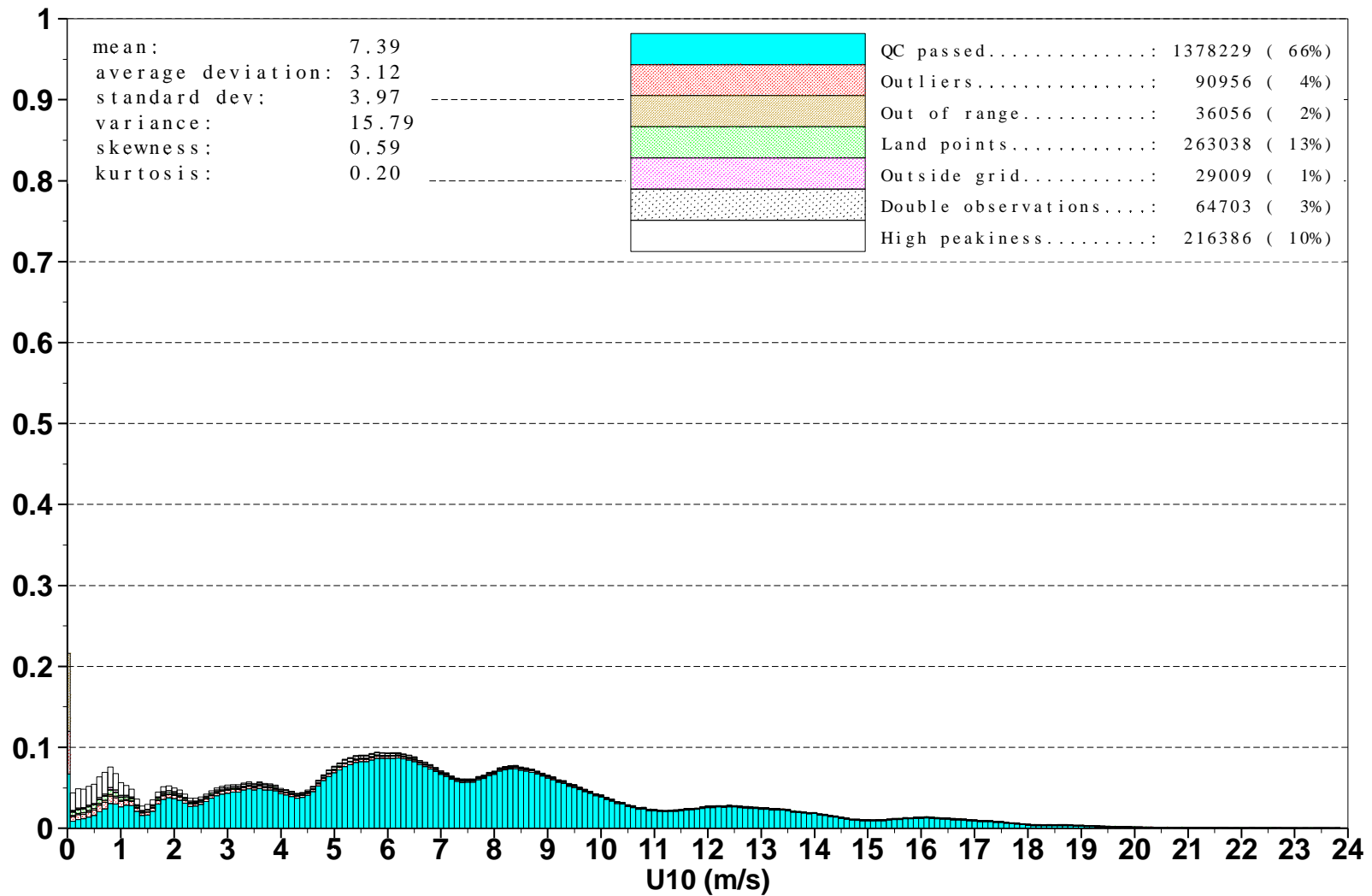


Figure 3: Distribution of the ERS-2 Altimeter wind speeds after QC for August 2002

■
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 August 2002 ■

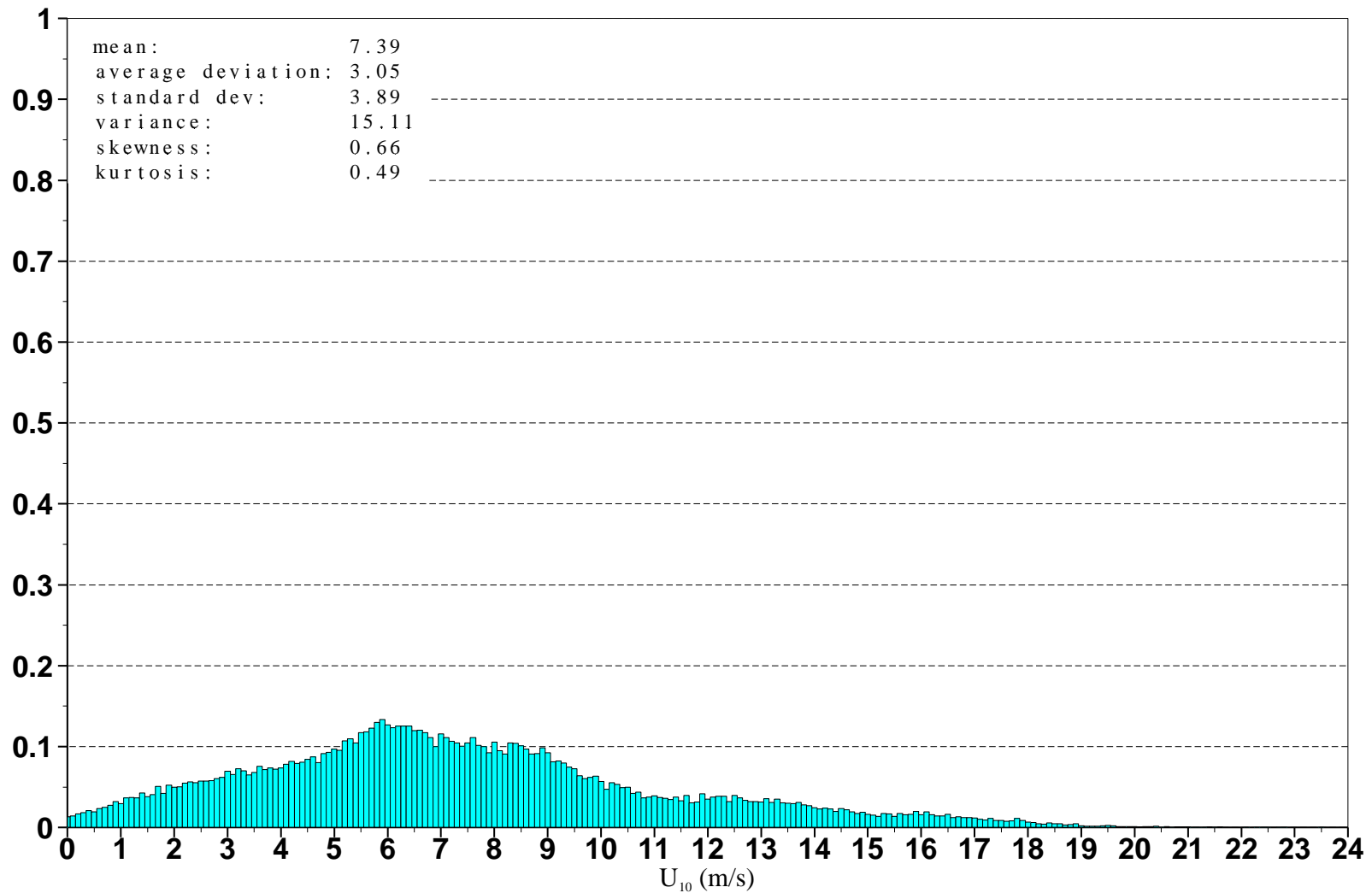
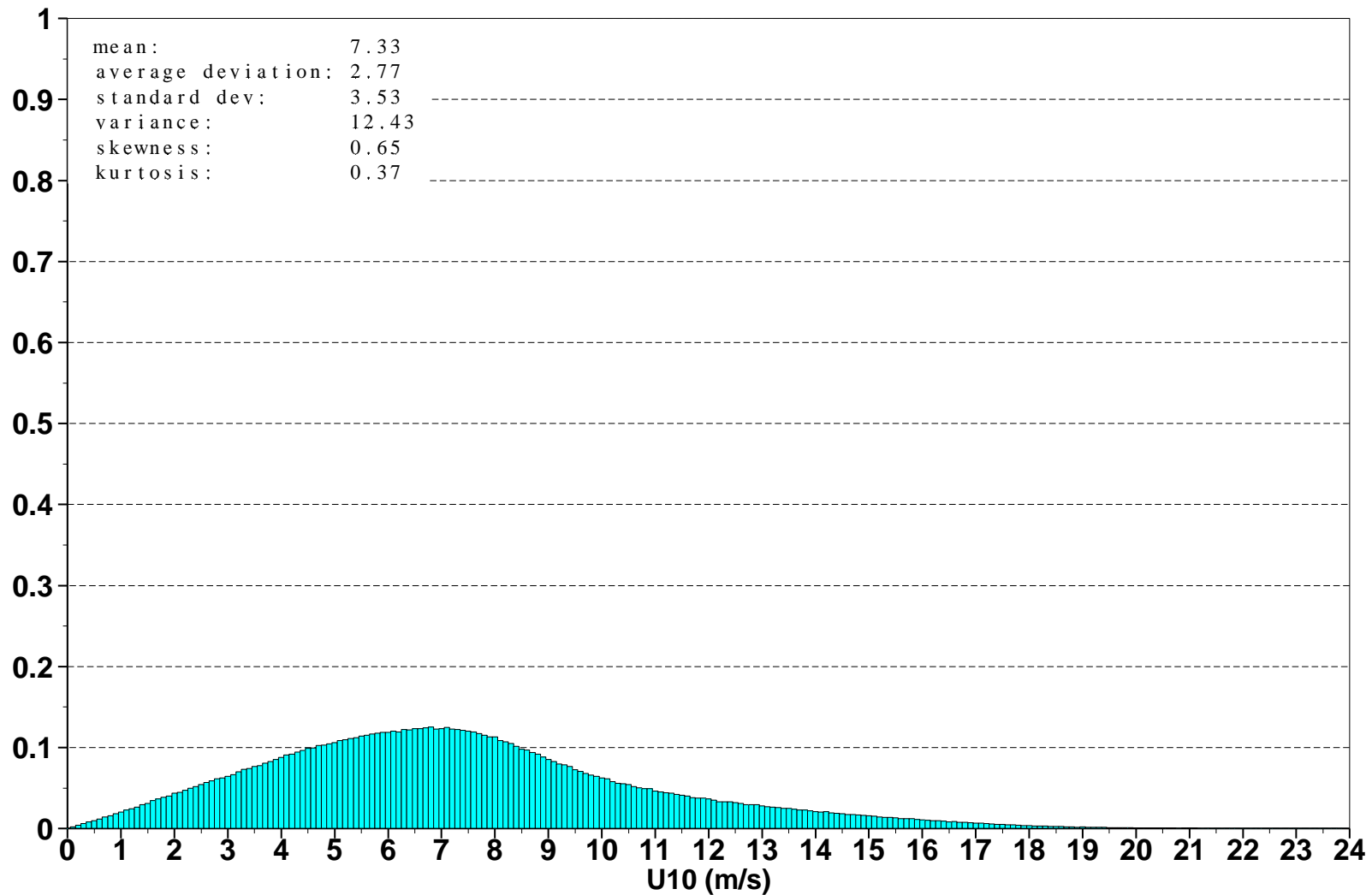


Figure 4: Distribution of ERS-2 Altimeter wind speeds after along track averaging for August 2002

■
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 August 2002 ■



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 August 2002 ■

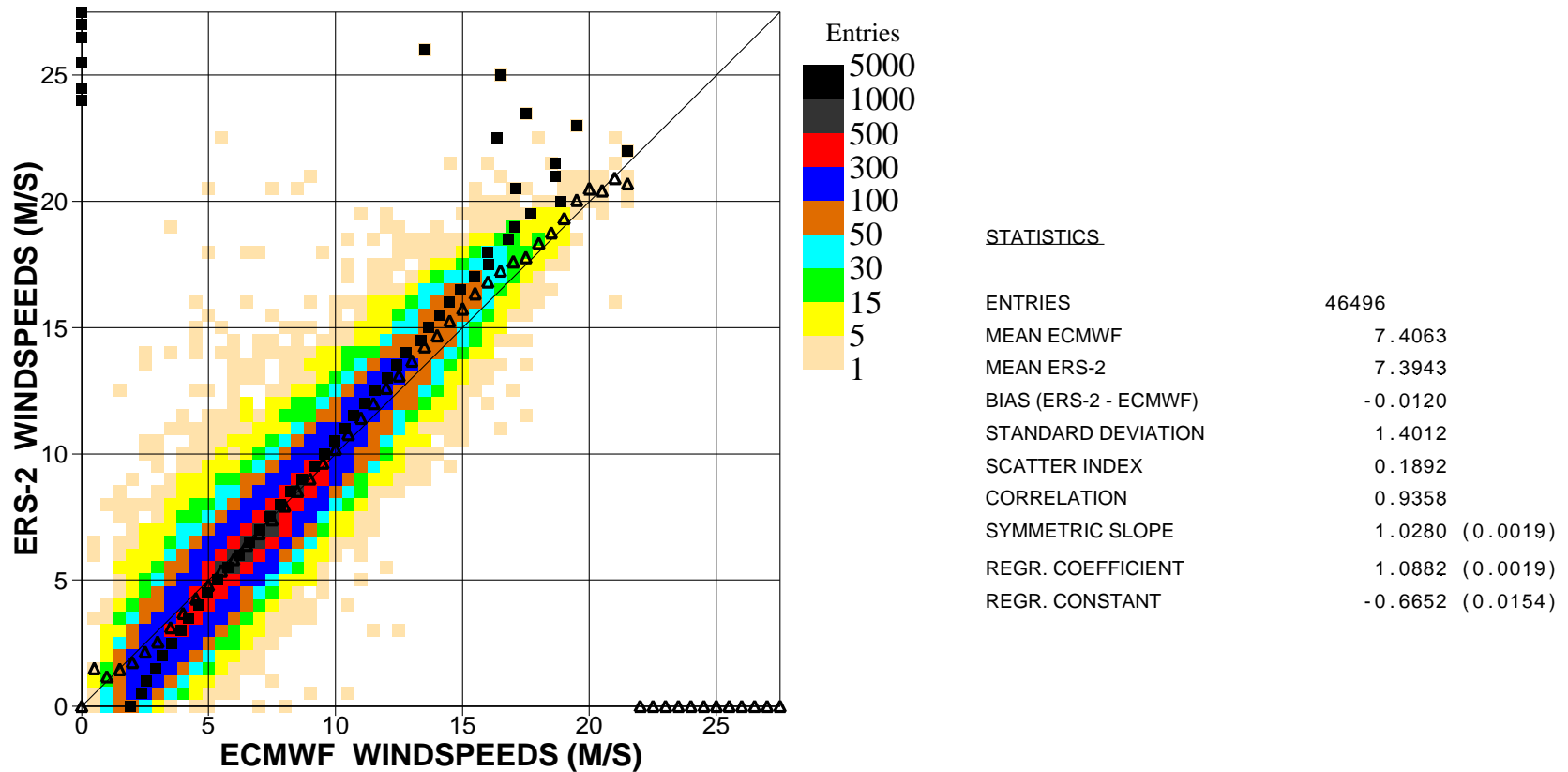


Figure 6. Comparison of ECMWF wind speed results with ERS2 Altimeter wind speed data for August 2002 (global)

■
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 August 2002 ■

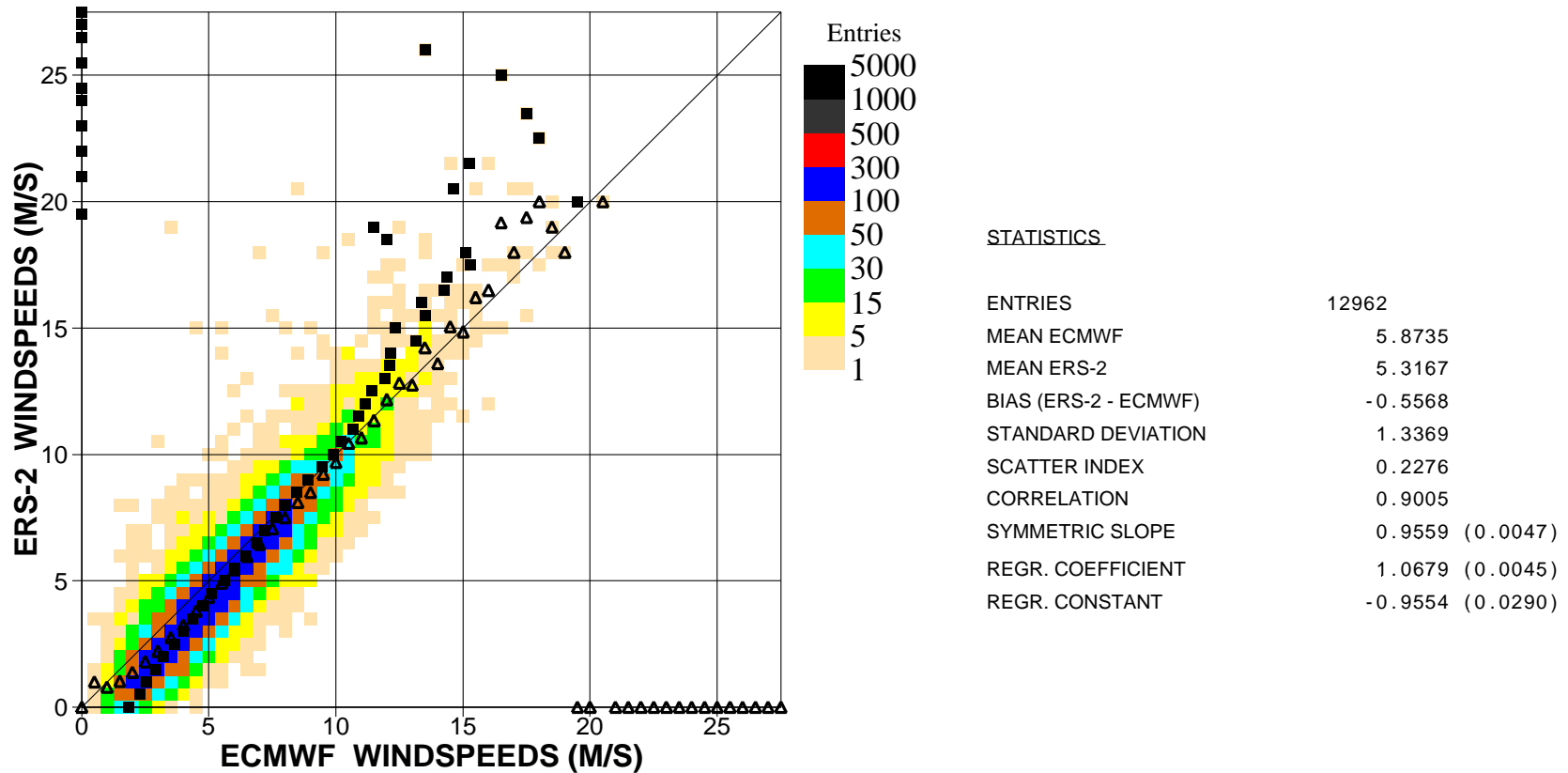


Figure 7. Comparison of ECMWF wind speed results with ERS2 Altimeter wind speed data for August 2002 (n.hem.)

■
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

■ ECMWF Report on ERS-2 RA for August 2002 ■

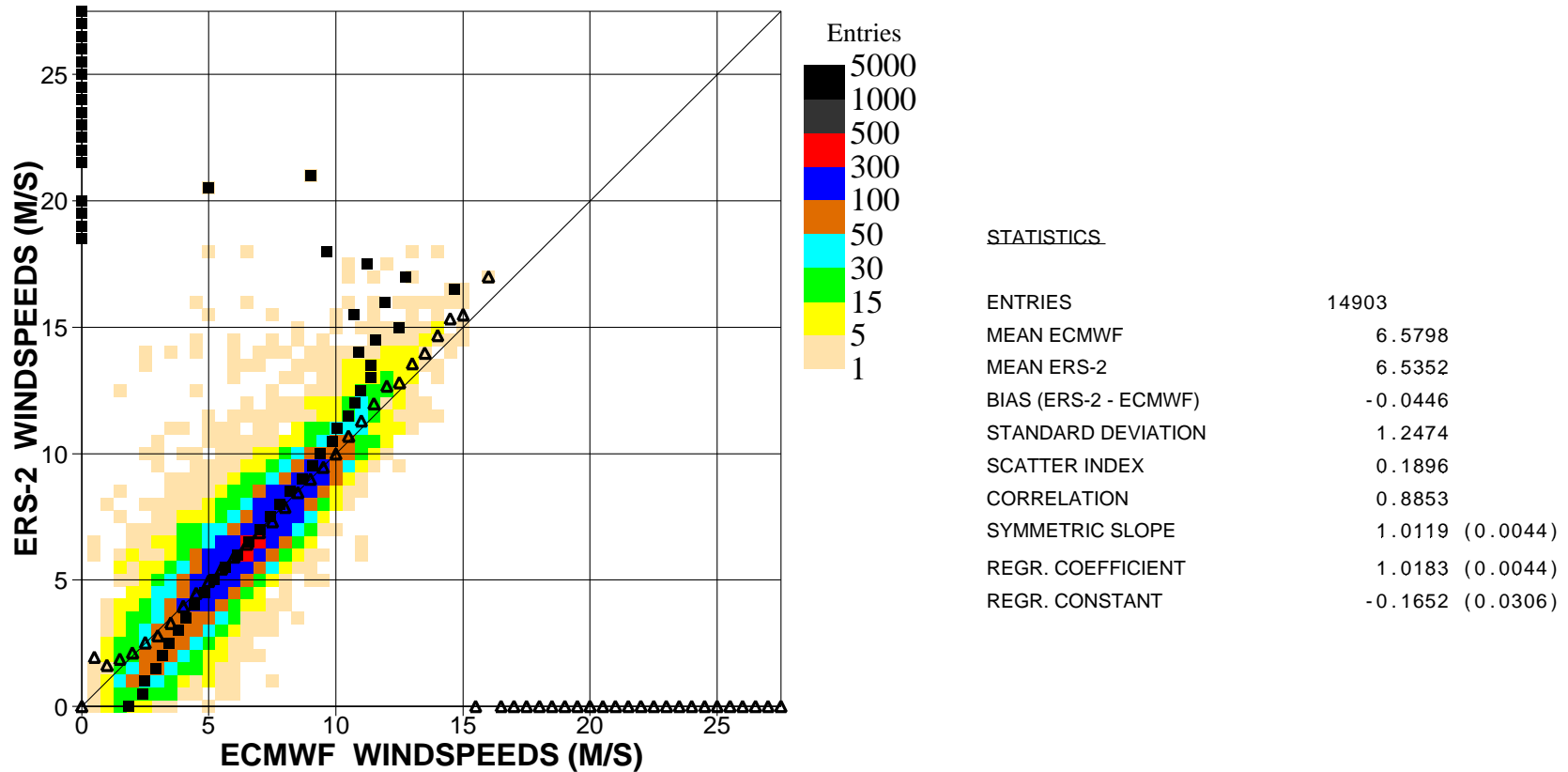


Figure 8. Comparison of ECMWF wind speed results with ERS2 Altimeter wind speed data for August 2002 (tropics)

■
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

■ ECMWF Report on ERS-2 RA for August 2002 ■

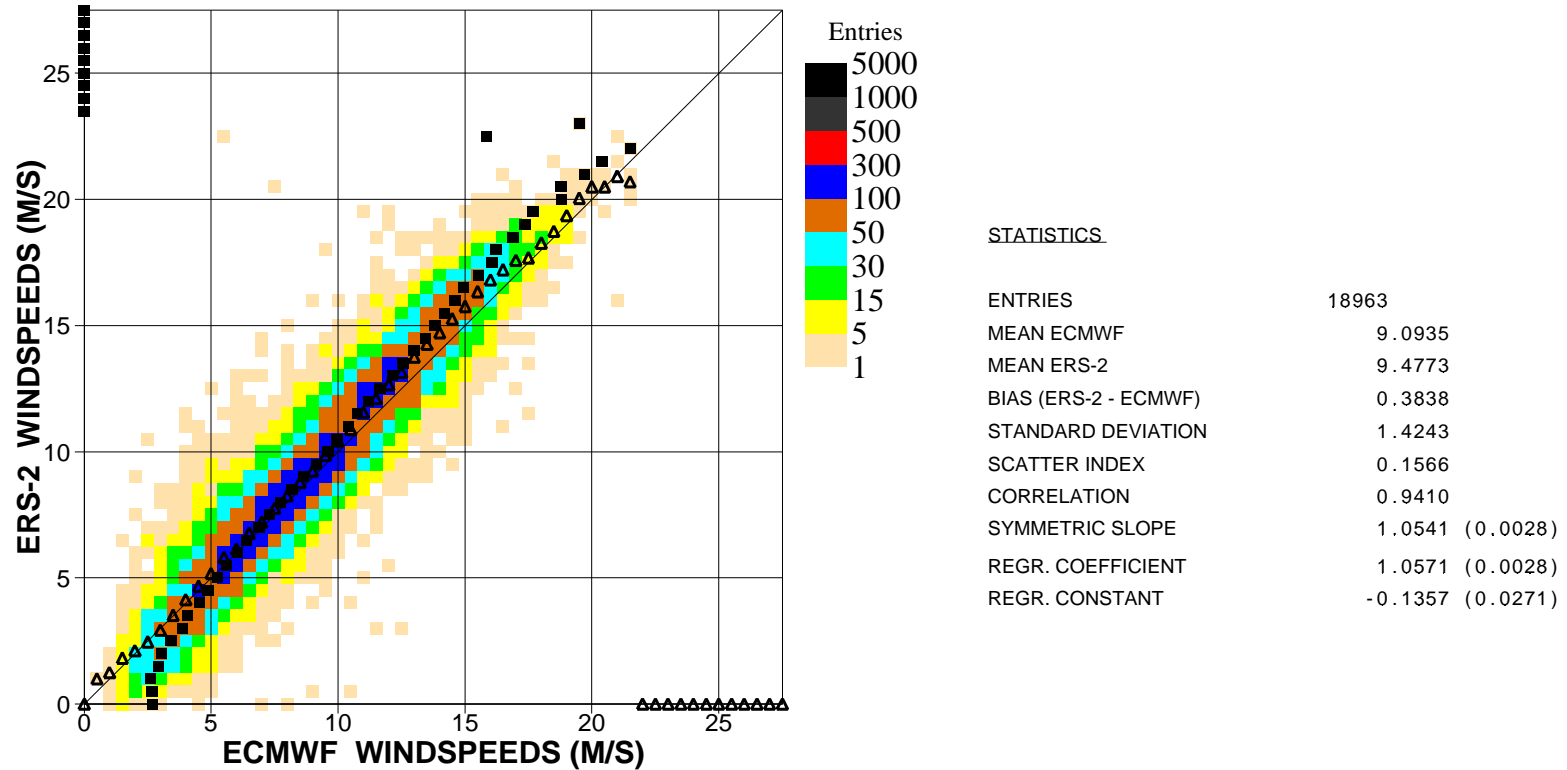


Figure 9. Comparison of ECMWF wind speed results with ERS2 Altimeter wind speed data for August 2002 (s.hem.)

■
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

■ ECMWF Report on ERS-2 RA for August 2002 ■

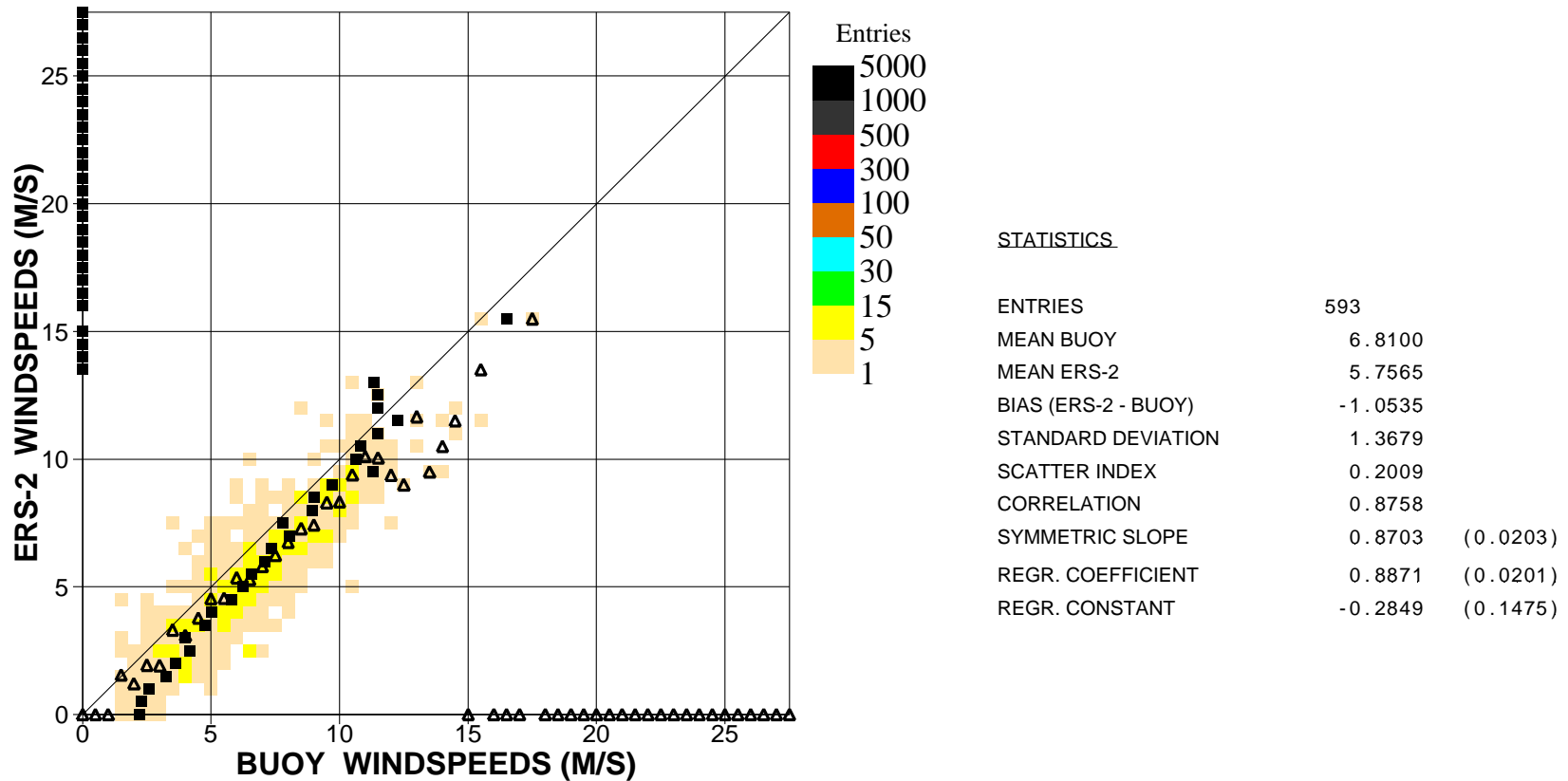


Figure 10. Comparison of buoy wind speed observations with ERS2 Altimeter wind speed data for August 2002 (global)



■ ECMWF Report on ERS-2 RA for August 2002 ■

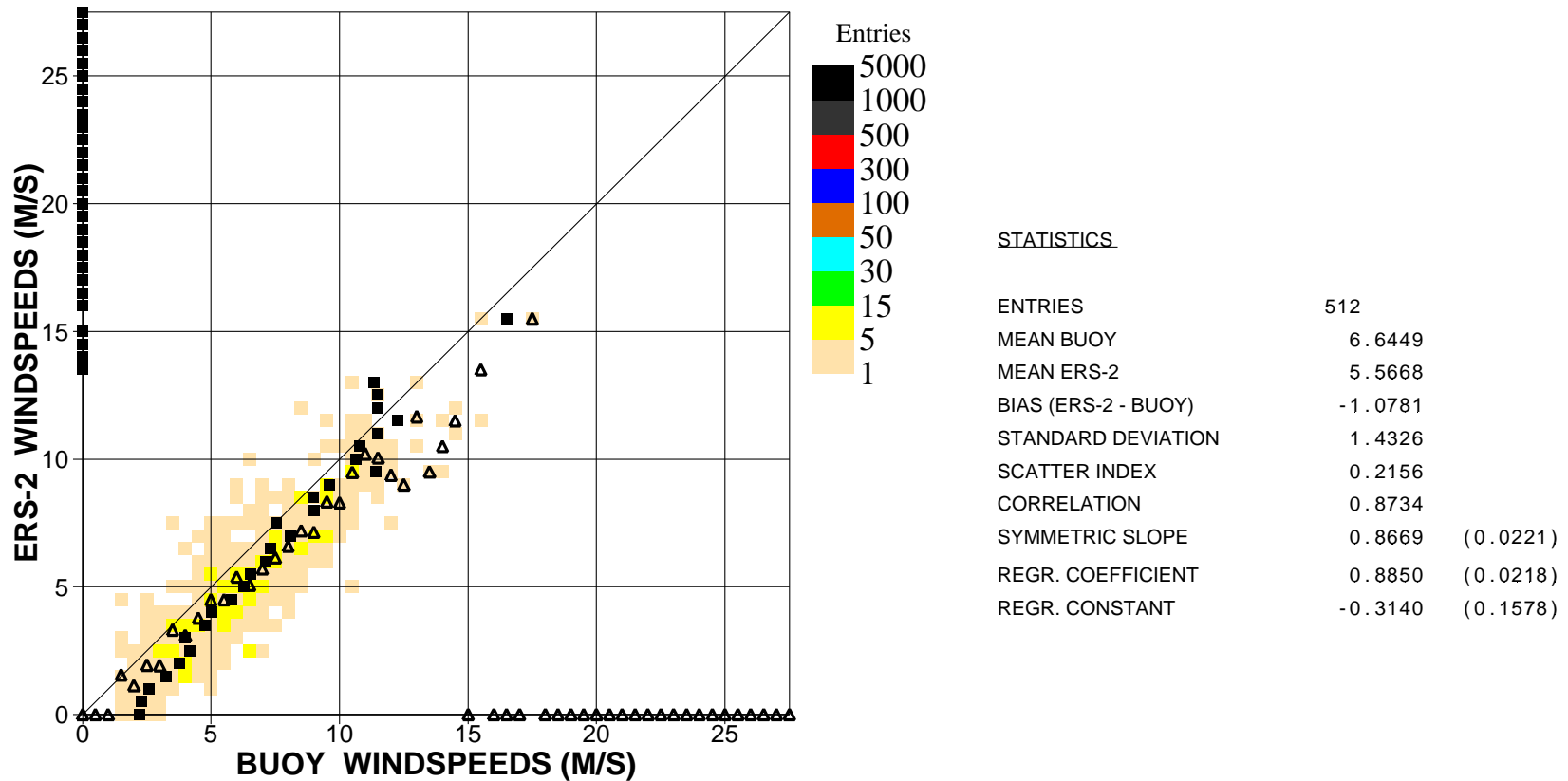


Figure 11. Comparison of buoy wind speed observations with ERS2 Altimeter wind speed data for August 2002 (n.hem.)

■
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

ECMWF Report on ERS-2 RA for August 2002

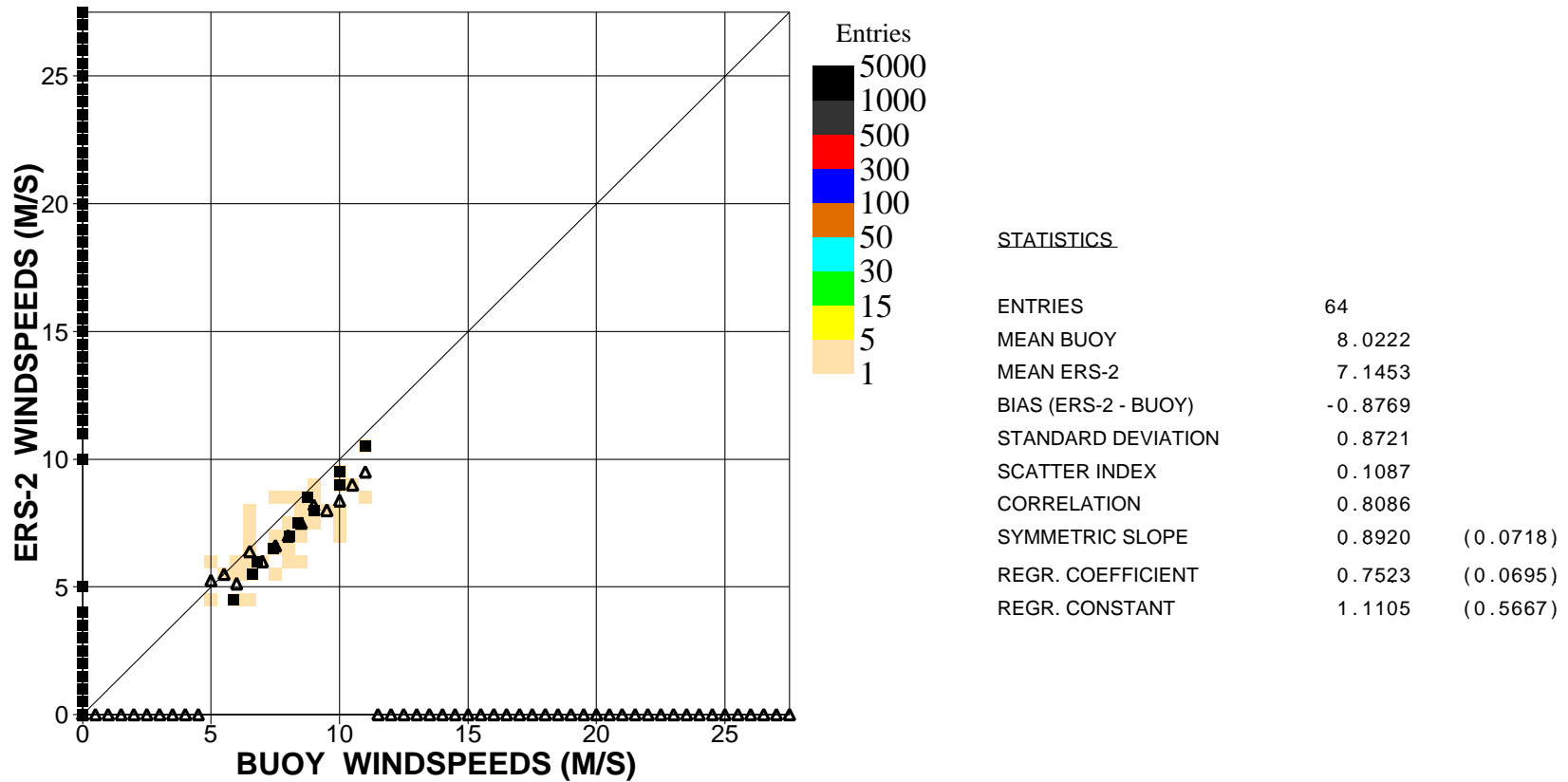


Figure 12. Comparison of buoy wind speed observations with ERS2 Altimeter wind speed data for August 2002 (hawaii)

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

■ ECMWF Report on ERS-2 RA for August 2002 ■

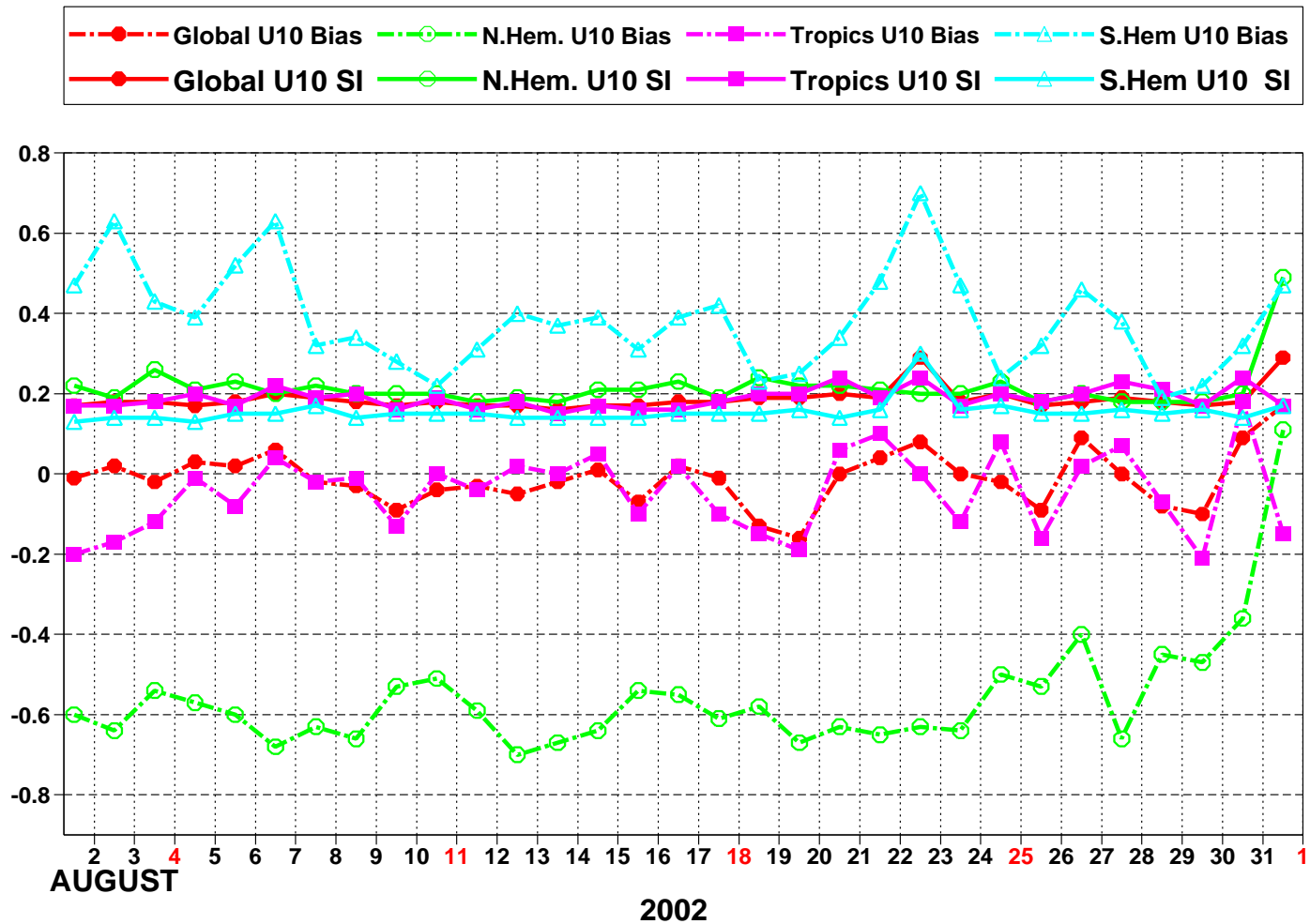


Figure 13: ERS-2 Altimeter wind speeds: Timeseries of bias (ERS-2 - model) and scatter index (SI)

■ ECMWF Report on ERS-2 RA for August 2002 ■

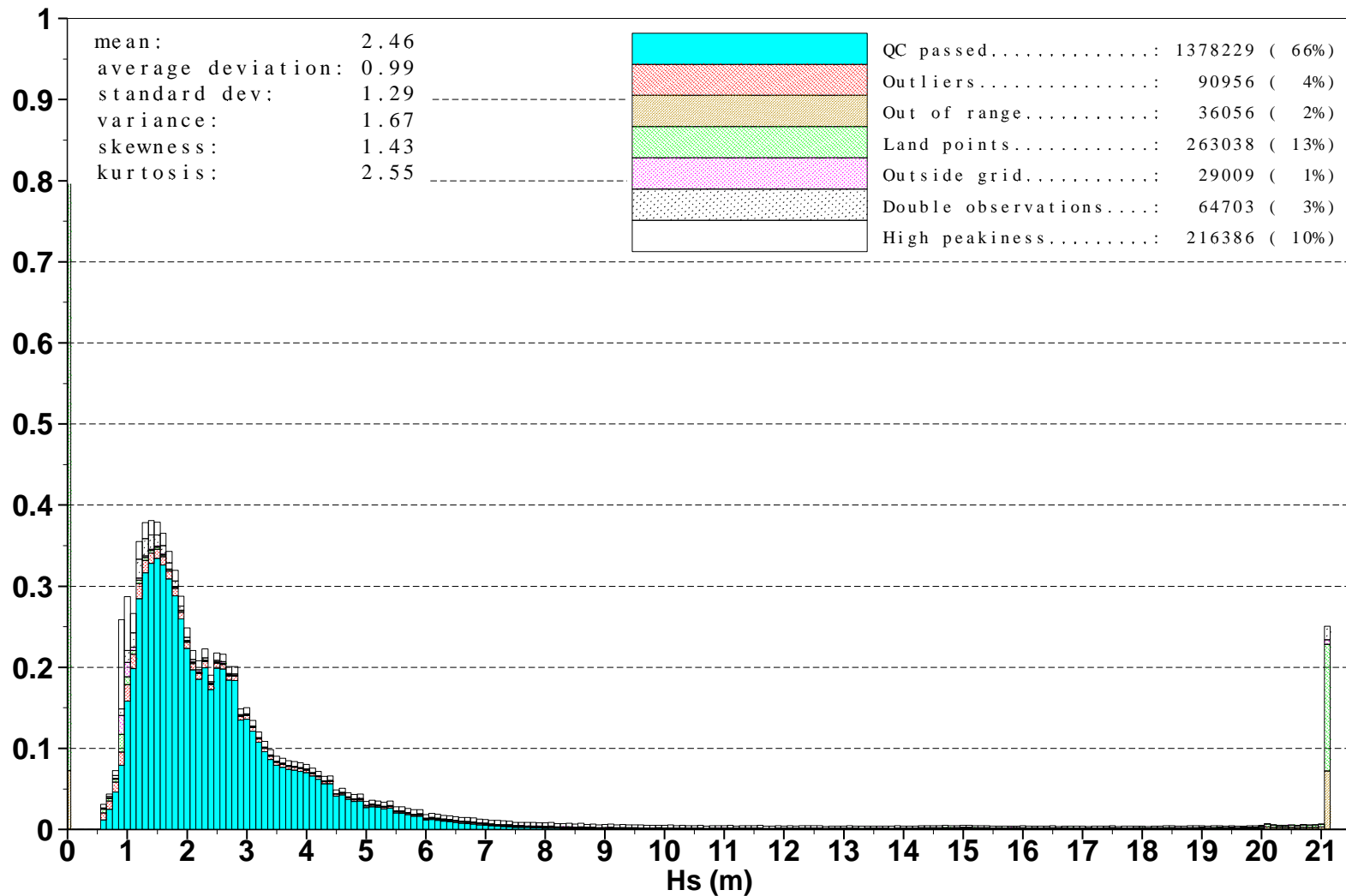


Figure 14: Distribution of the ERS-2 Altimeter wave heights after QC for August 2002



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 August 2002 ■

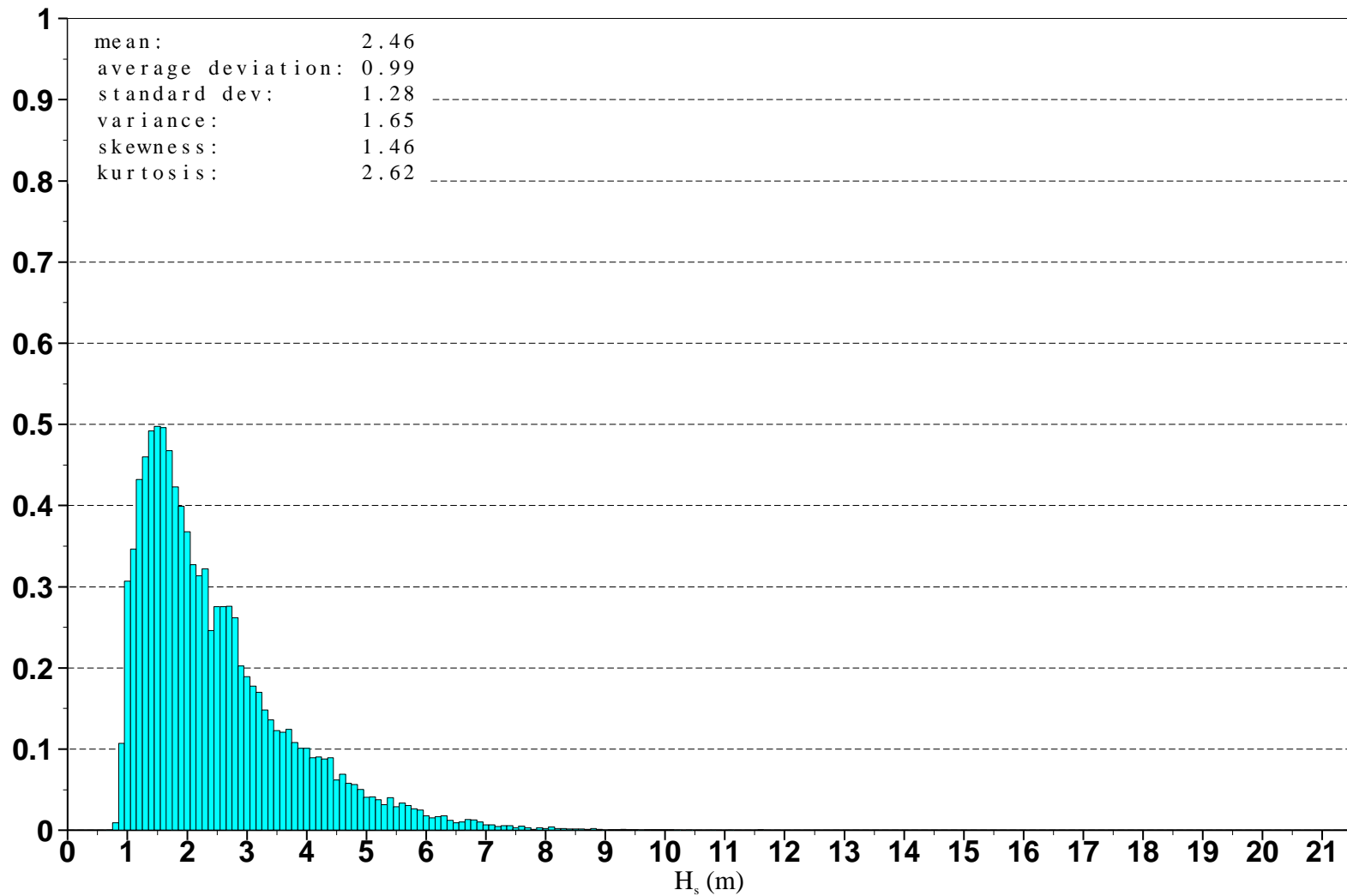


Figure 15: Distribution of ERS-2 Altimeter wave heights after along track averaging for August 2002

■
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 August 2002 ■

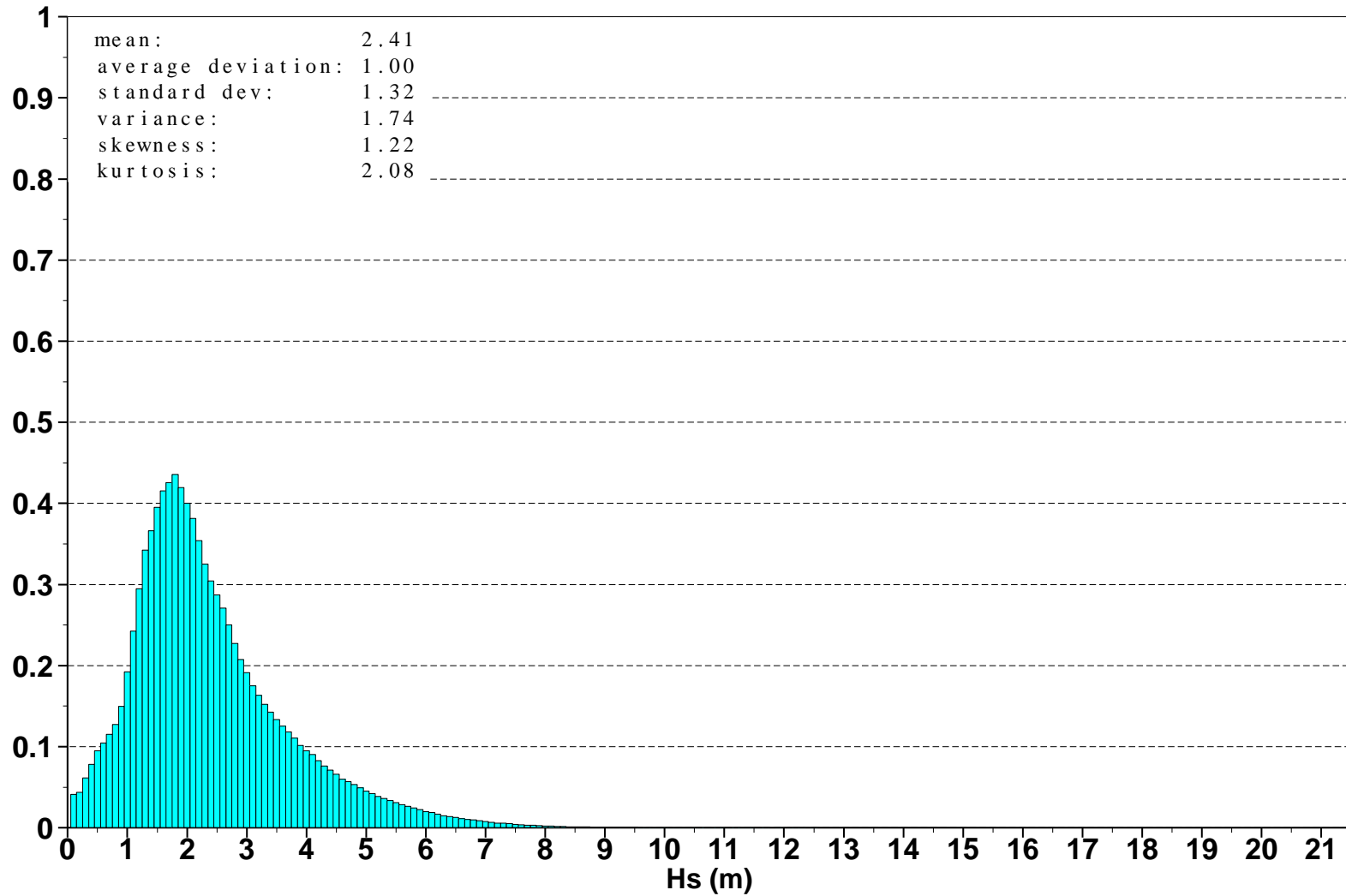


Figure 16: Global distribution of ECMWF wave heights for August 2002



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 August 2002 ■

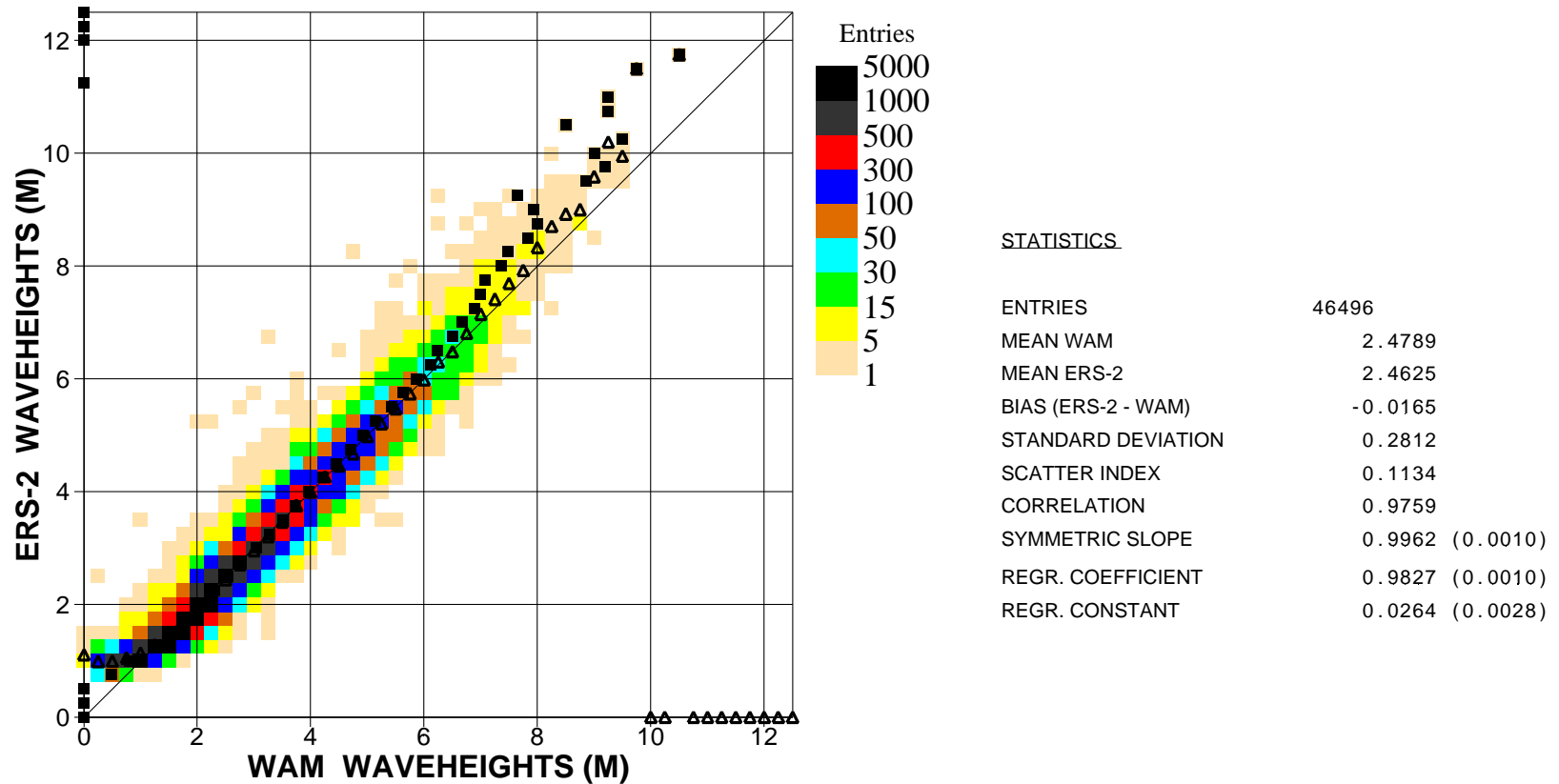


Figure 17. Comparison of ECMWF wave height results with ERS2 Altimeter wave height data for August 2002 (global)

ECMWF Report on ERS-2 RA for August 2002

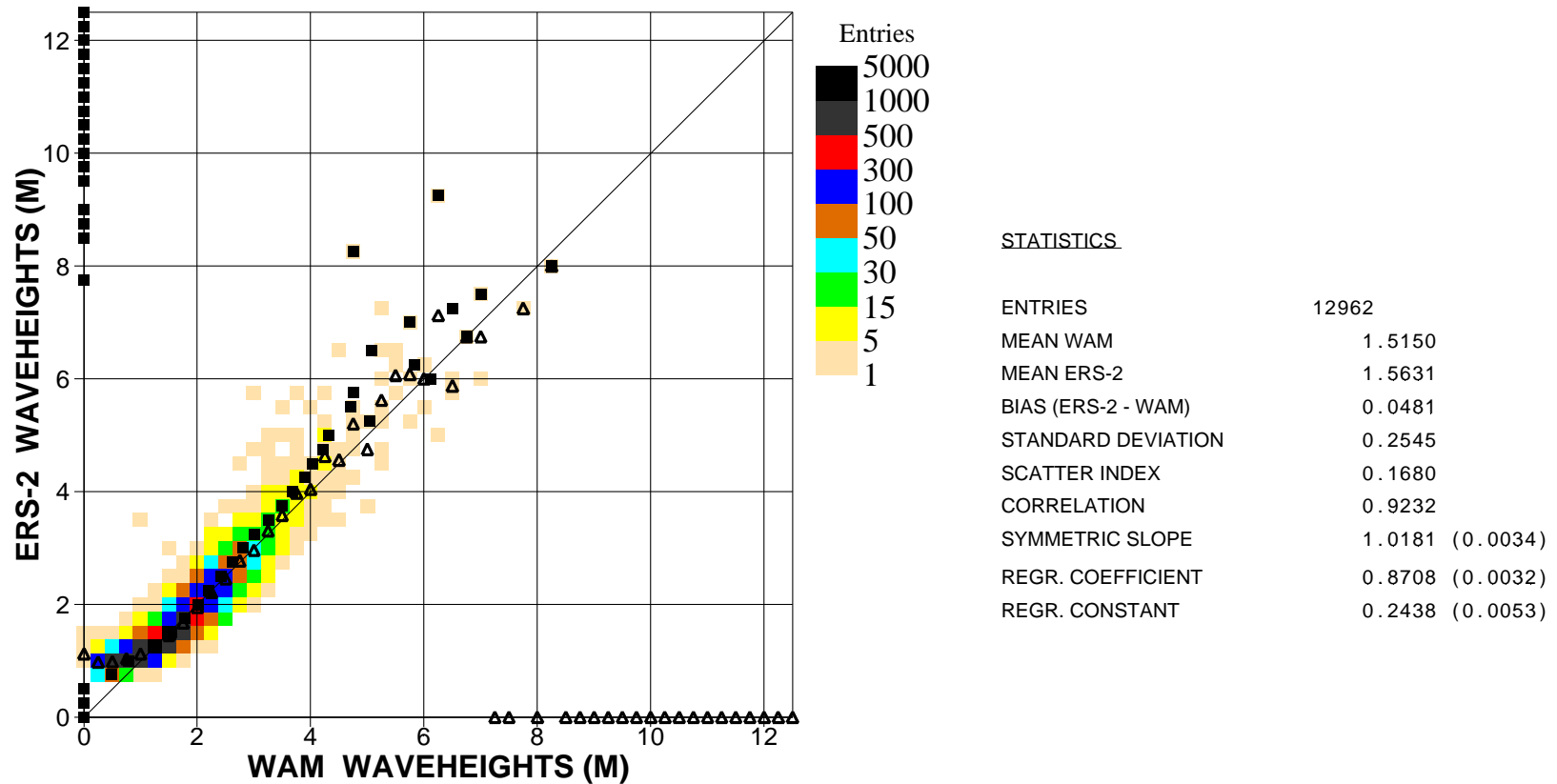


Figure 18. Comparison of ECMWF wave height results with ERS2 Altimeter wave height data for August 2002 (n.hem.)

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

■ ECMWF Report on ERS-2 RA for August 2002 ■

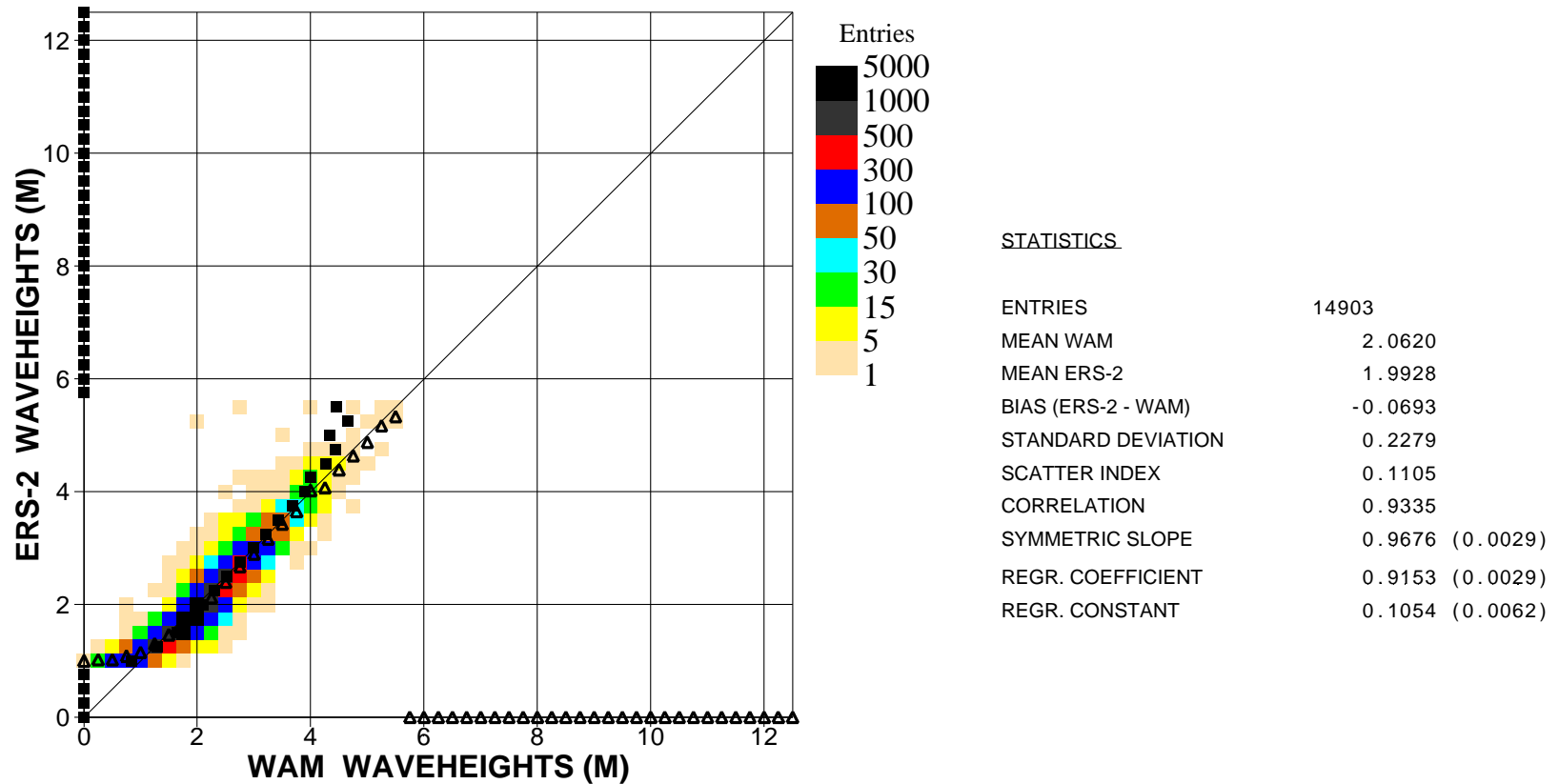


Figure 19. Comparison of ECMWF wave height results with ERS2 Altimeter wave height data for August 2002 (tropics)

■
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

■ ECMWF Report on ERS-2 RA for August 2002 ■

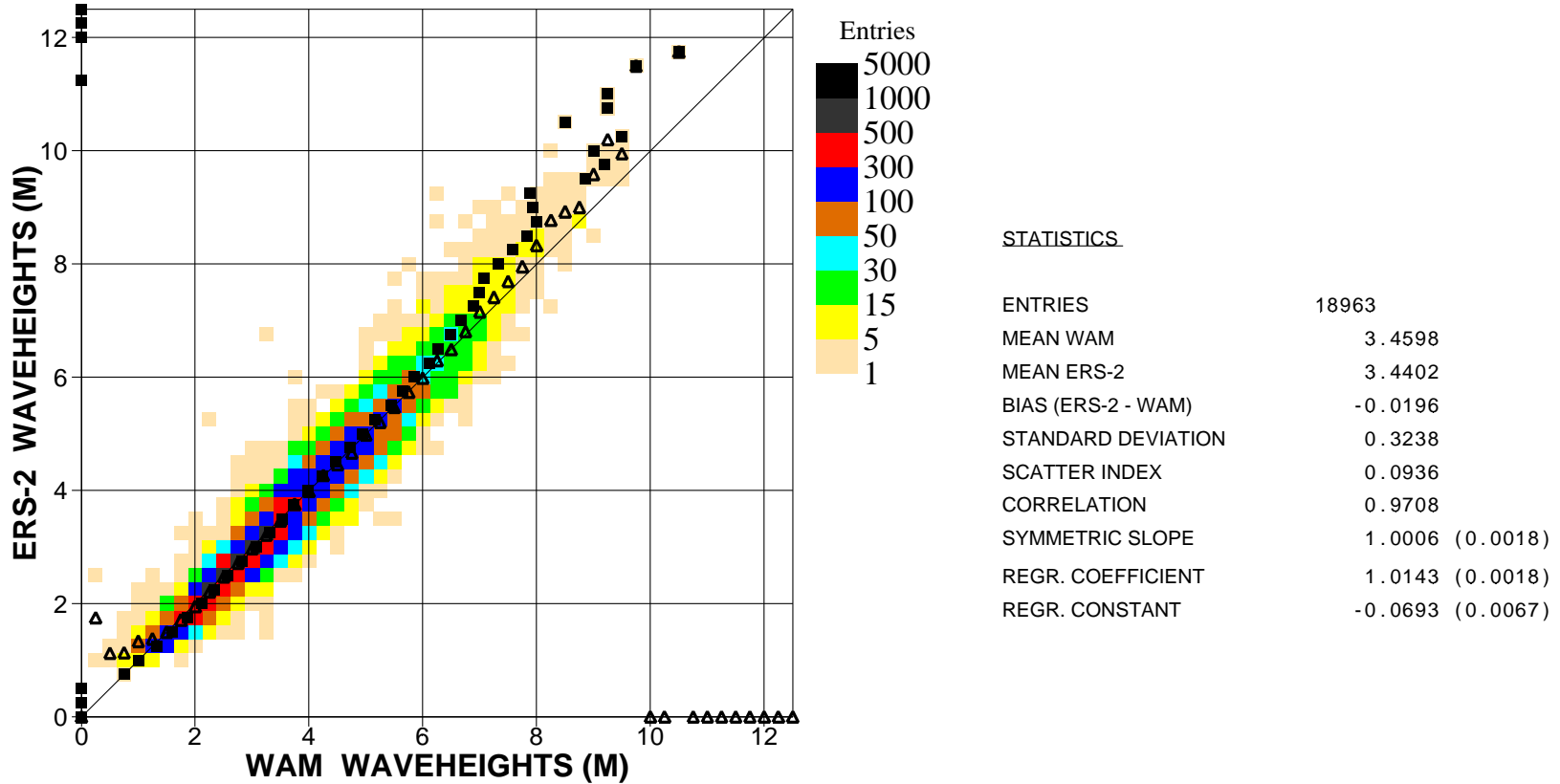


Figure 20. Comparison of ECMWF wave height results with ERS2 Altimeter wave height data for August 2002 (s.hem.)

■
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

ECMWF Report on ERS-2 RA for August 2002

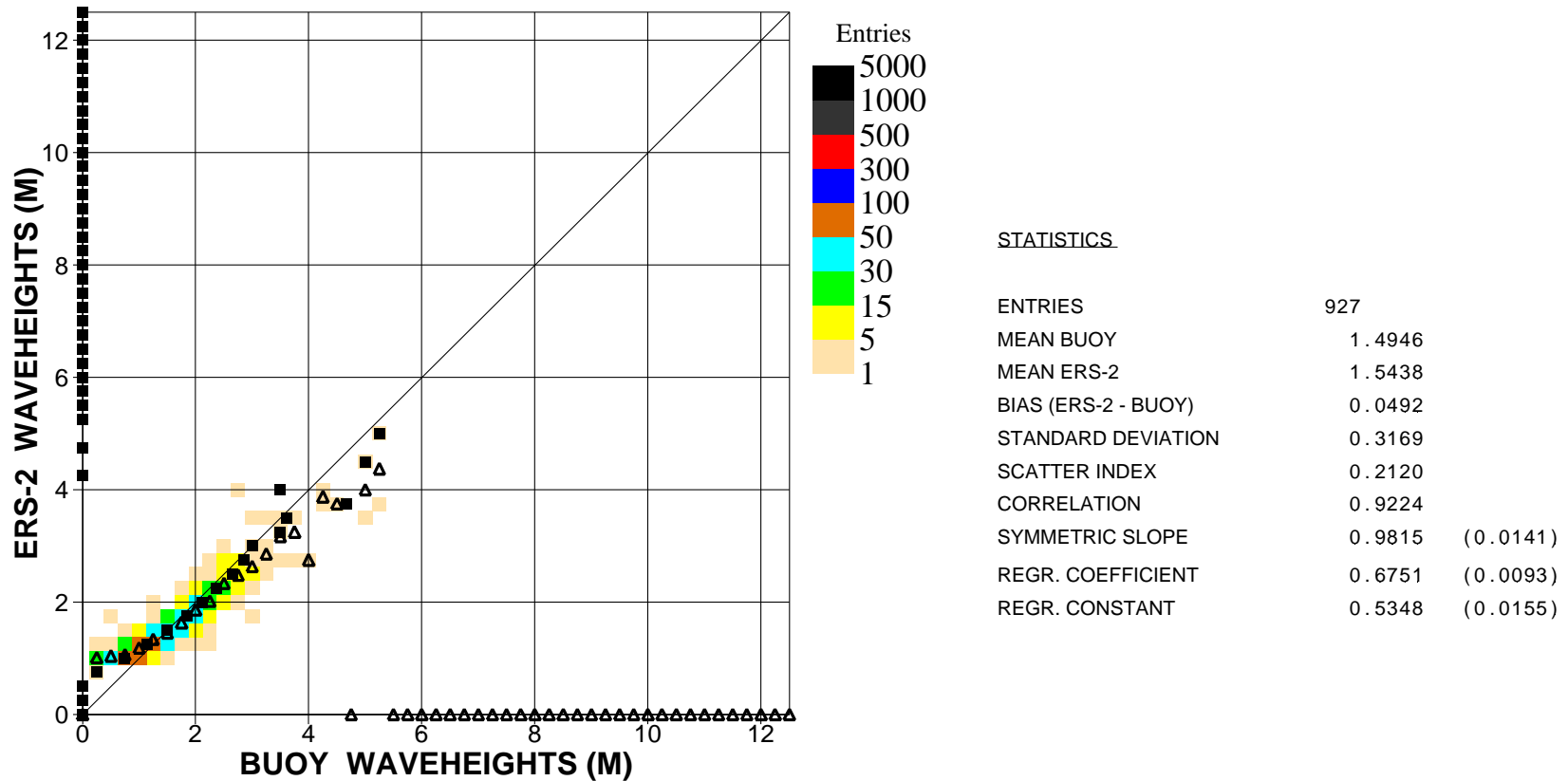


Figure 21. Comparison of buoy wave height observations with ERS2 Altimeter wave height data for August 2002 (global)

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 August 2002

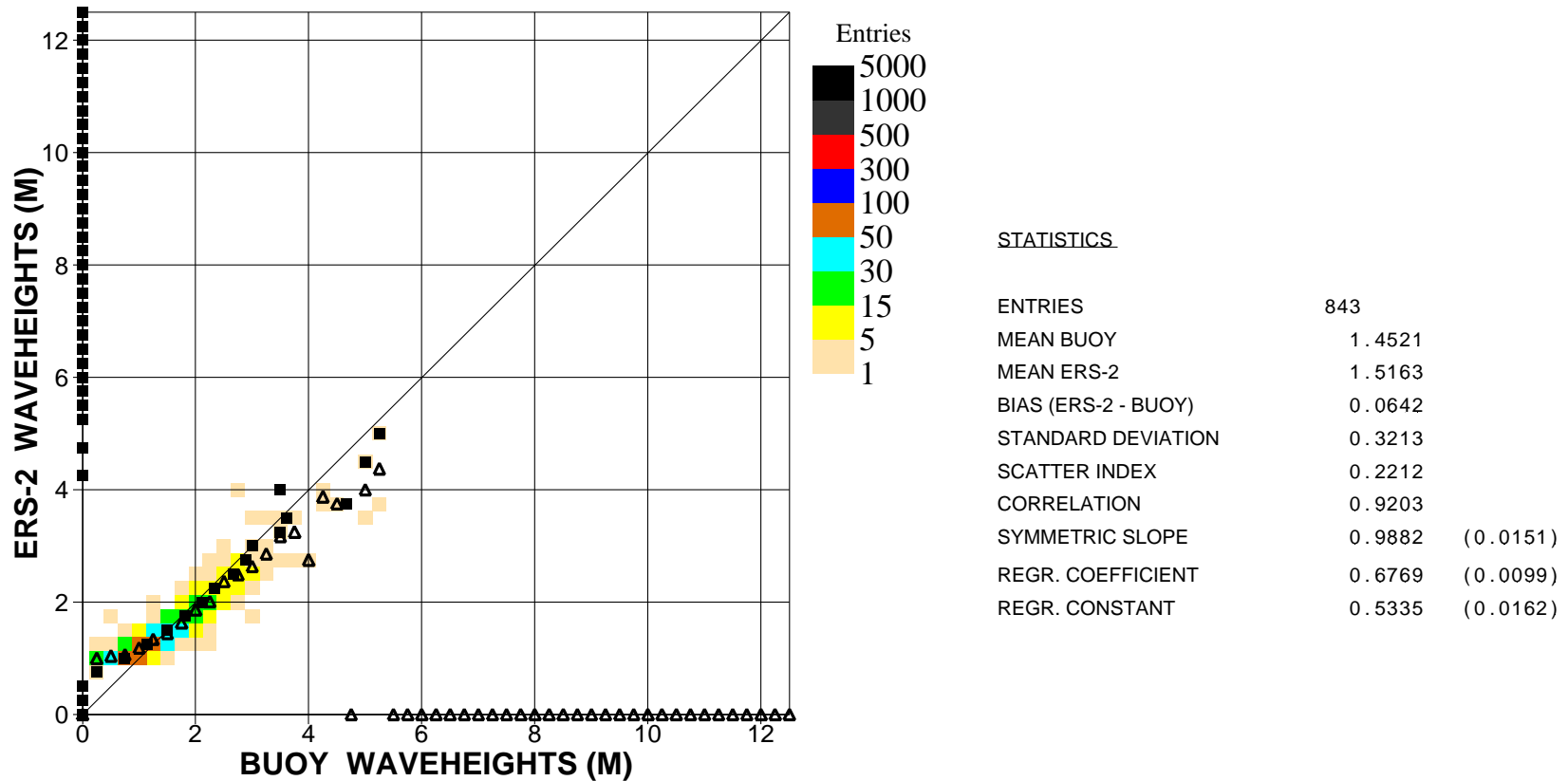


Figure 22. Comparison of buoy wave height observations with ERS2 Altimeter wave height data for August 2002 (n.hem.)

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

■ ECMWF Report on ERS-2 RA for August 2002 ■

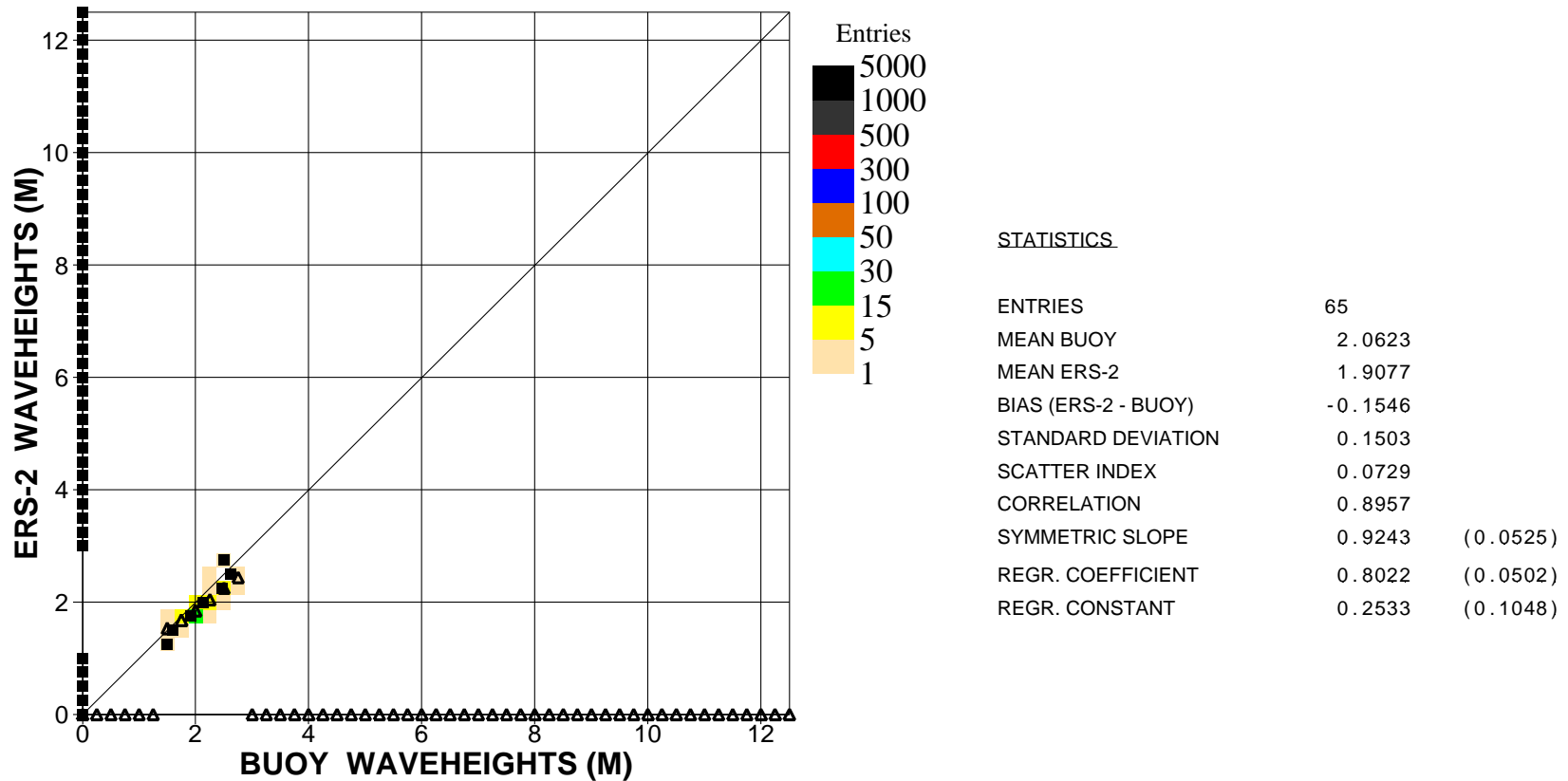


Figure 23. Comparison of buoy wave height observations with ERS2 Altimeter wave height data for August 2002 (hawaii)

■
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

ECMWF Report on ERS-2 RA for August 2002

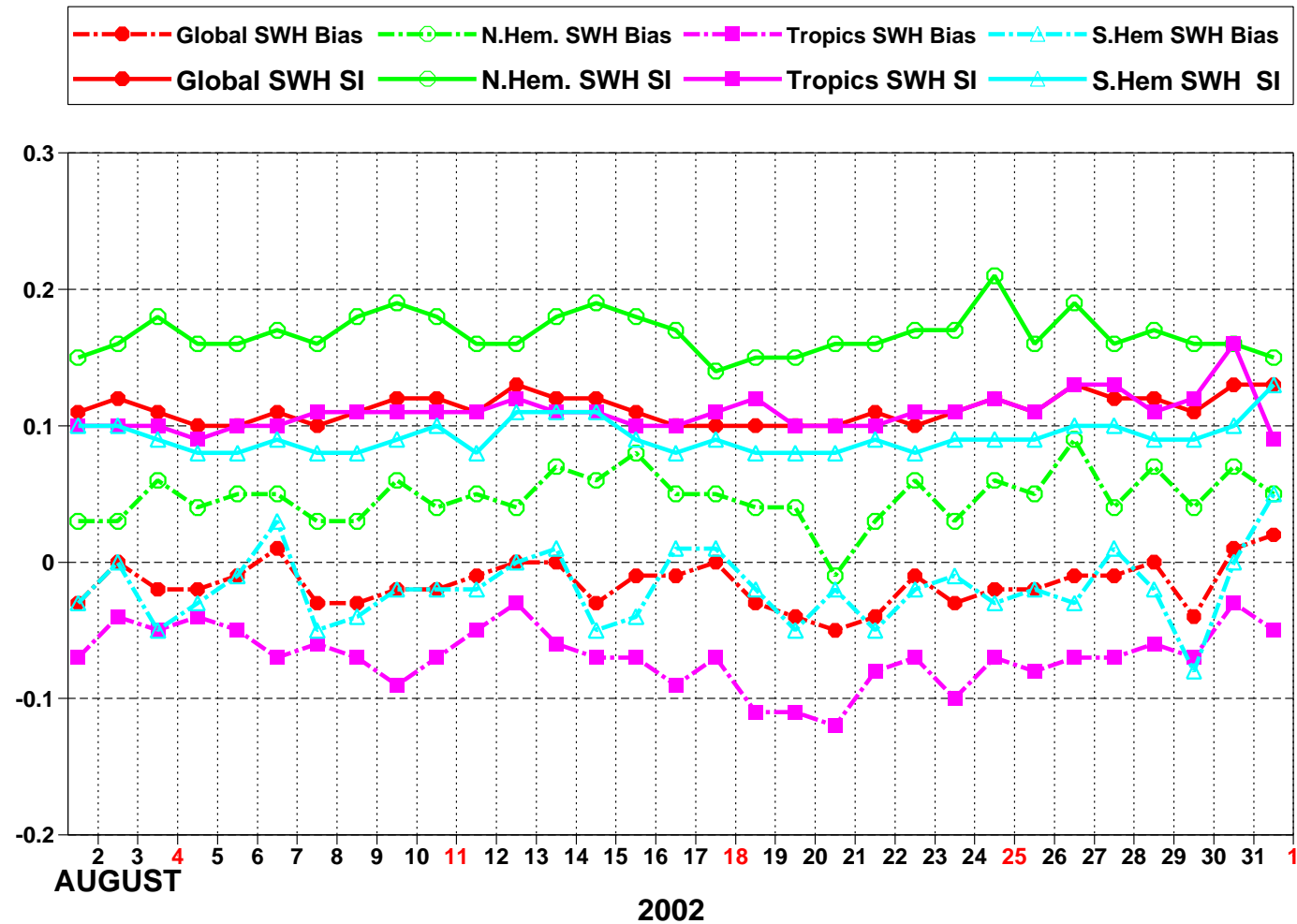


Figure 24: ERS-2 Altimeter wave heights: Timeseries of bias (ERS-2 - model) and scatter index (SI)

ECMWF Report on ERS-2 RA for August 2002

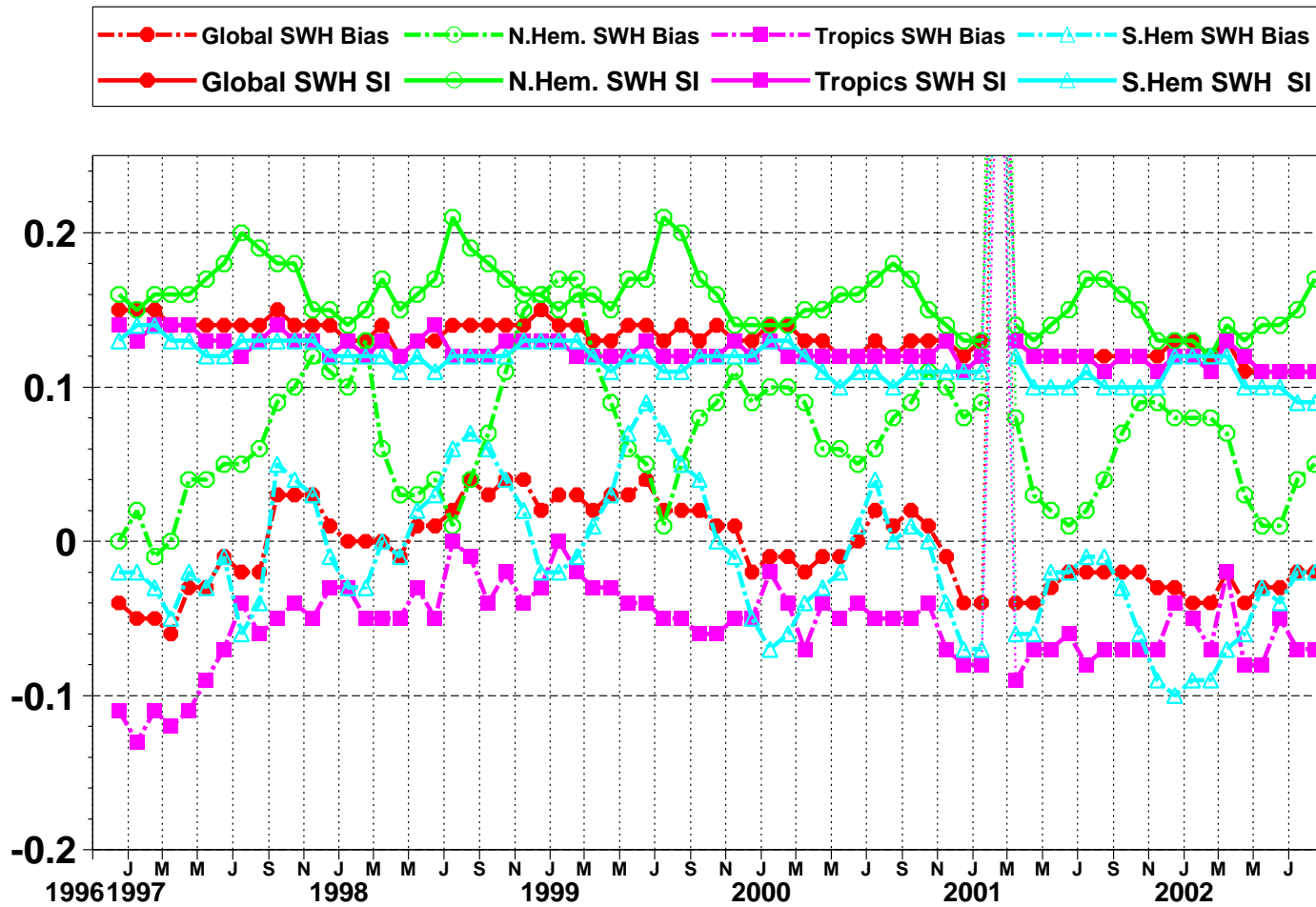


Figure 25: ERS-2 Altimeter wave heights: Timeseries of bias (ERS-2 - model) and scatter index (SI)

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

■ ECMWF Report on ERS-2 RA for August 2002 ■

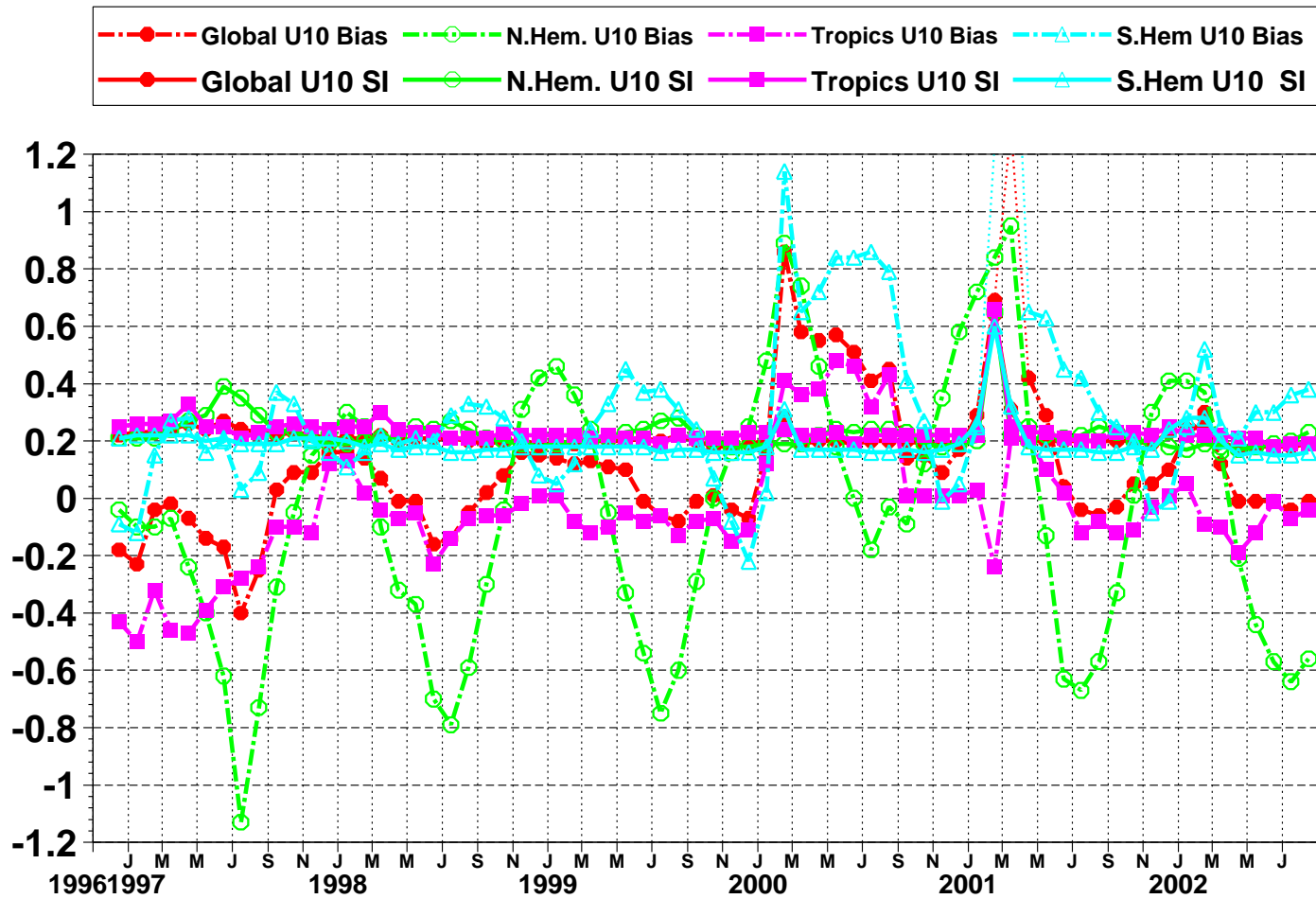


Figure 26: ERS-2 Altimeter wind speeds: Timeseries of bias (ERS-2 - model) and scatter index (SI)

■
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