

# ■ ECMWF Report on ERS-2 RA for November 2000 ■

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

**By:** Saleh Abdalla

**Date:** 6 December 2000

## **Overview:**

This month around 16691 observations arrived at ECMWF every 6 hours of which 78.29% passed the quality control. Except for relative reduction of data reception during 6-hour time slots centred at 06:00 UTC on 18, 19 and 20 November, the data coverage was quite good (see Figure 1). Note that we are talking about data which have arrived at ECMWF before they were needed for the operational data assimilation.

The positive impact of the change to the altimeter wind speed retrieval mentioned in an earlier report is confirmed for this month as well as can be seen in Figure 26.

## Backscatter:

ESR-2  $\langle \sigma_0 \rangle = 11.04$  dB (with one main peak at 11.1 dB)



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## Wind Speed Comparison with ECMWF wind speeds (bias):

ERS-2 global: 0.091 m/s

ERS-2 northern hemisphere: 0.346 m/s

ERS-2 tropics: 0.012 m/s

ERS-2 southern hemisphere: -0.014 m/s

## Wind Speed Comparison with buoy wind speeds (bias):

ERS-2 global: -0.20 m/s

ERS-2 northern hemisphere: -0.10 m/s

ERS-2 tropics: -1.05 m/s

## Wave Height Comparison with ECMWF wave heights (bias):

ERS-2 global: -0.010 m (lowest waves measured: 0.6m)

ERS-2 northern hemisphere: 0.104 m

ERS-2 tropics: -0.066 m

ERS-2 southern hemisphere: -0.039 m

## Wave Height Comparison with buoy wave heights (bias):

ERS-2 global: -0.18 m

ERS-2 northern hemisphere: -0.16 m

ERS-2 tropics: -0.31



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 Saleh.Abdalla@ecmwf.int

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## Remarks:

- The Altimeter worked normally.
- A bug was found in the computations of some of the means and was corrected. The bug is in effect since May 2000. The table below shows the correct means in between May-October 2000:

| Month     | $\langle \sigma_0 \rangle$<br>(dB) | Alt. $\langle U_{10} \rangle$<br>(m/s) | Model $\langle U_{10} \rangle$<br>(m/s) | Alt. $\langle H_s \rangle$<br>(m) | Model $\langle H_s \rangle$<br>(m) |
|-----------|------------------------------------|----------------------------------------|-----------------------------------------|-----------------------------------|------------------------------------|
| May 2000  | 10.88                              | 8.00                                   | 7.35                                    | 2.53                              | 2.49                               |
| June 2000 | 10.89                              | 7.96                                   | 7.36                                    | 2.46                              | 2.38                               |
| July 2000 | 11.02                              | 7.69                                   | 7.28                                    | 2.42                              | 2.31                               |
| Aug. 2000 | 10.97                              | 7.75                                   | 7.23                                    | 2.45                              | 2.37                               |
| Sep. 2000 | 11.07                              | 7.42                                   | 7.17                                    | 2.43                              | 2.34                               |
| Oct. 2000 | 11.01                              | 7.52                                   | 7.30                                    | 2.47                              | 2.40                               |

- The ECMWF operational forecast model has been upgraded to the TL511 with a horizontal resolution of about 40 km on 21 November 2000. Since then, wind speeds are computed at 40 km horizontal resolution. Although the wave related data are still computed at about 55 km resolution, the spectral resolution has been upgraded to 30 frequency bins and 24 directional bins. Furthermore, wave computations make use of the enhanced resolution of winds.



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## 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 wave model 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.

## **Figure captions:**

Figure 1: Time series of data reception for ERS-2 Altimeter data for November 2000.

Figure 2: Distribution of the ERS-2 Altimeter Backscatter after QC for November 2000.

Figure 3: Distribution of the ERS-2 Altimeter wind speeds after QC for November 2000.

Figure 4: Distribution of the ERS-2 Altimeter wind speeds after along track averaging for November 2000.

Figure 5: Global distribution of ECMWF ocean surface wind speeds for November 2000.

Figure 6: Comparison of ECMWF wind speed results with ERS-2 Altimeter wind speed data for November 2000 (global).

Figure 7: Comparison of ECMWF wind speed results with ERS-2 Altimeter wind speed data for November 2000 (northern hemisphere)



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 Saleh.Abdalla@ecmwf.int

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- Figure 8: Comparison of ECMWF wind speed results with ERS-2 Altimeter wind speed data for November 2000 (tropics)
- Figure 9: Comparison of ECMWF wind speed results with ERS-2 Altimeter wind speed data for November 2000 (southern hemisphere)
- Figure 10: Comparison of buoy wind speed observations with ERS-2 Altimeter wind speed data for November 2000 (global).
- Figure 11: Comparison of buoy wind speed observations with ERS-2 Altimeter wind speed data for November 2000 (northern hemisphere).
- Figure 12: Comparison of buoy wind speed observations with ERS-2 Altimeter wind speed data for November 2000 (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 November 2000.
- Figure 15: Distribution of the ERS-2 Altimeter wave heights after along track averaging for November 2000.
- Figure 16: Global distribution of ECMWF wave heights for November 2000.
- Figure 17: Comparison of ECMWF wave height results with ERS-2 Altimeter wave height data for November 2000 (global).
- Figure 18: Comparison of ECMWF wave height results with ERS-2 Altimeter wave height data for November 2000 (northern hemisphere)
- Figure 19: Comparison of ECMWF wave height results with ERS-2 Altimeter wave height data for November 2000 (tropics)
- Figure 20: Comparison of ECMWF wave height results with ERS-2 Altimeter wave height data for November 2000 (southern hemisphere)
- Figure 21: Comparison of buoy wave height observations with ERS-2 Altimeter wave height data for November 2000 (global).
- Figure 22: Comparison of buoy wave height observations with ERS-2 Altimeter wave height data for November 2000 (northern hemisphere).
- Figure 23: Comparison of buoy wave height observations with ERS-2 Altimeter wave height data for November 2000 (tropics).
- Figure 24: ERS-2 Altimeter wave heights: Timeseries of bias (ERS-2 - model) and scatter index (SI) for November 2000.
- Figure 25: ERS-2 Altimeter wave heights: Timeseries of bias (ERS-2 - model) and scatter index (SI) from December 1996 to November 2000
- Figure 26: ERS-2 Altimeter wind speeds: Timeseries of bias (ERS-2 - model) and scatter index (SI) from December 1996 to November 2000



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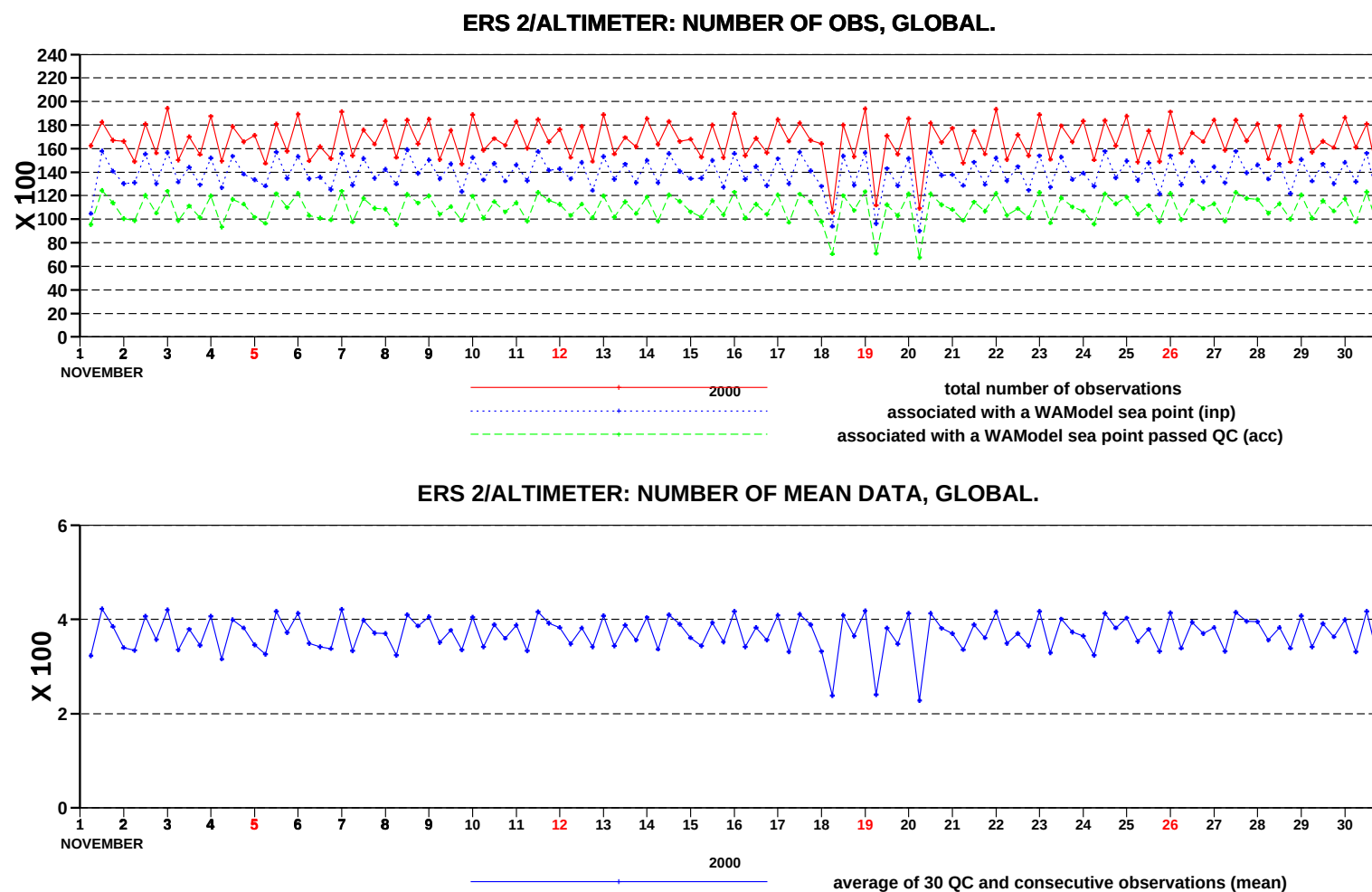


Figure 1: Time series of data reception for ERS-2 Altimeter data for November 2000

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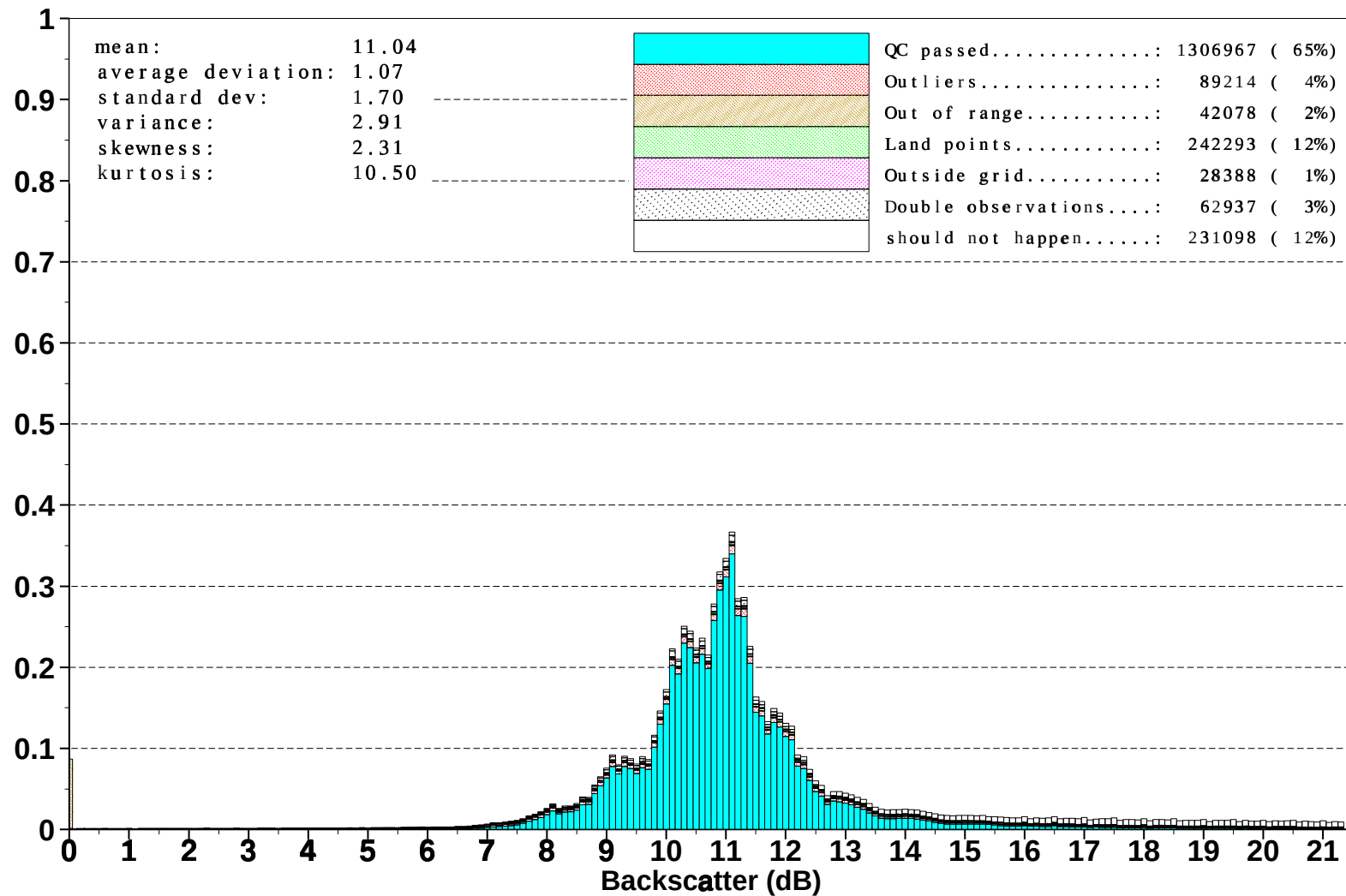


Figure 2: Distribution of the ERS-2 Altimeter backscatter after QC for November 2000

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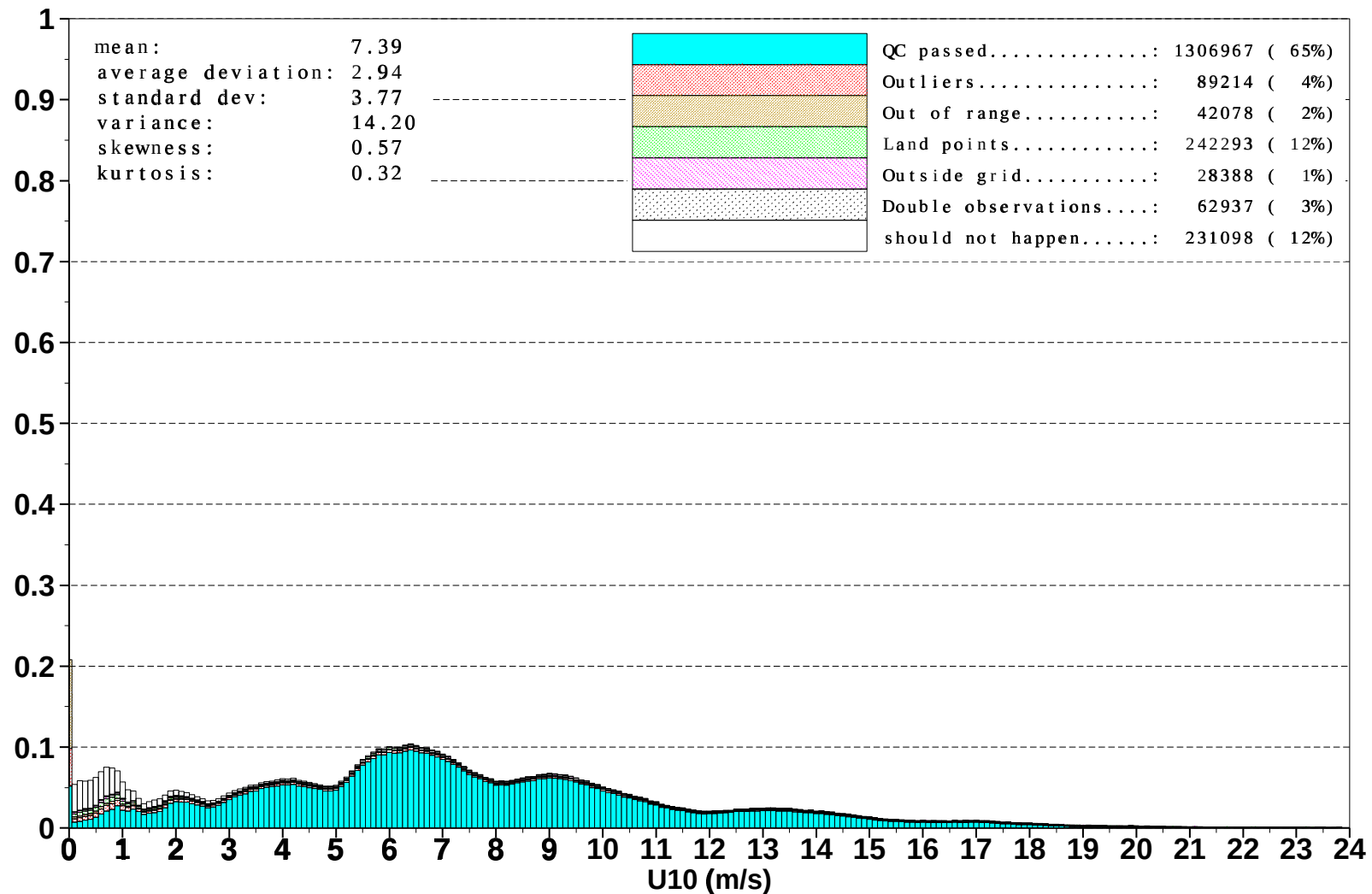


Figure 3: Distribution of the ERS-2 Altimeter wind speeds after QC for November 2000



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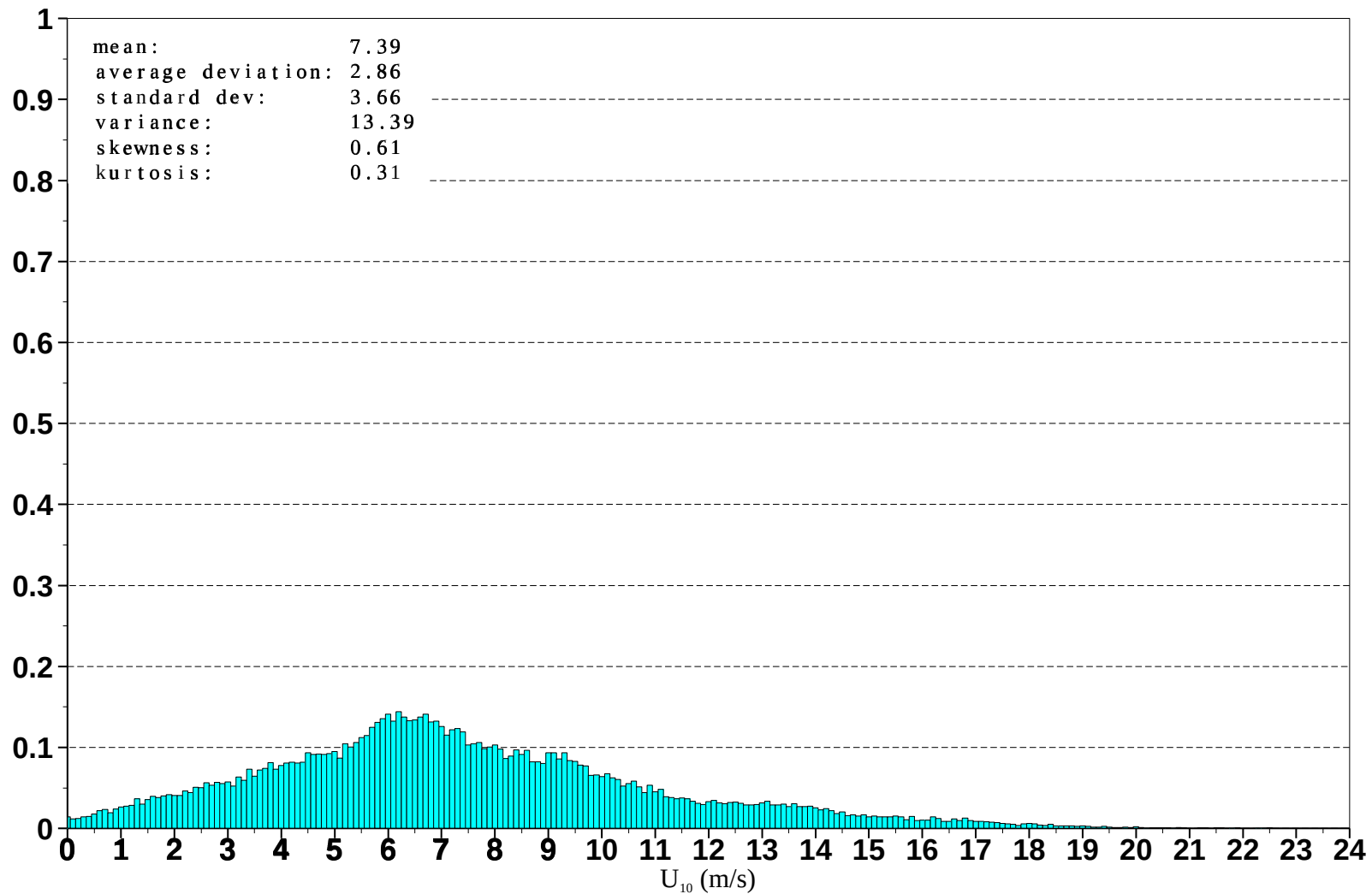


Figure 4: Distribution of ERS-2 Altimeter wind speeds after along track averaging for November 2000



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 Saleh.Abdalla@ecmwf.int

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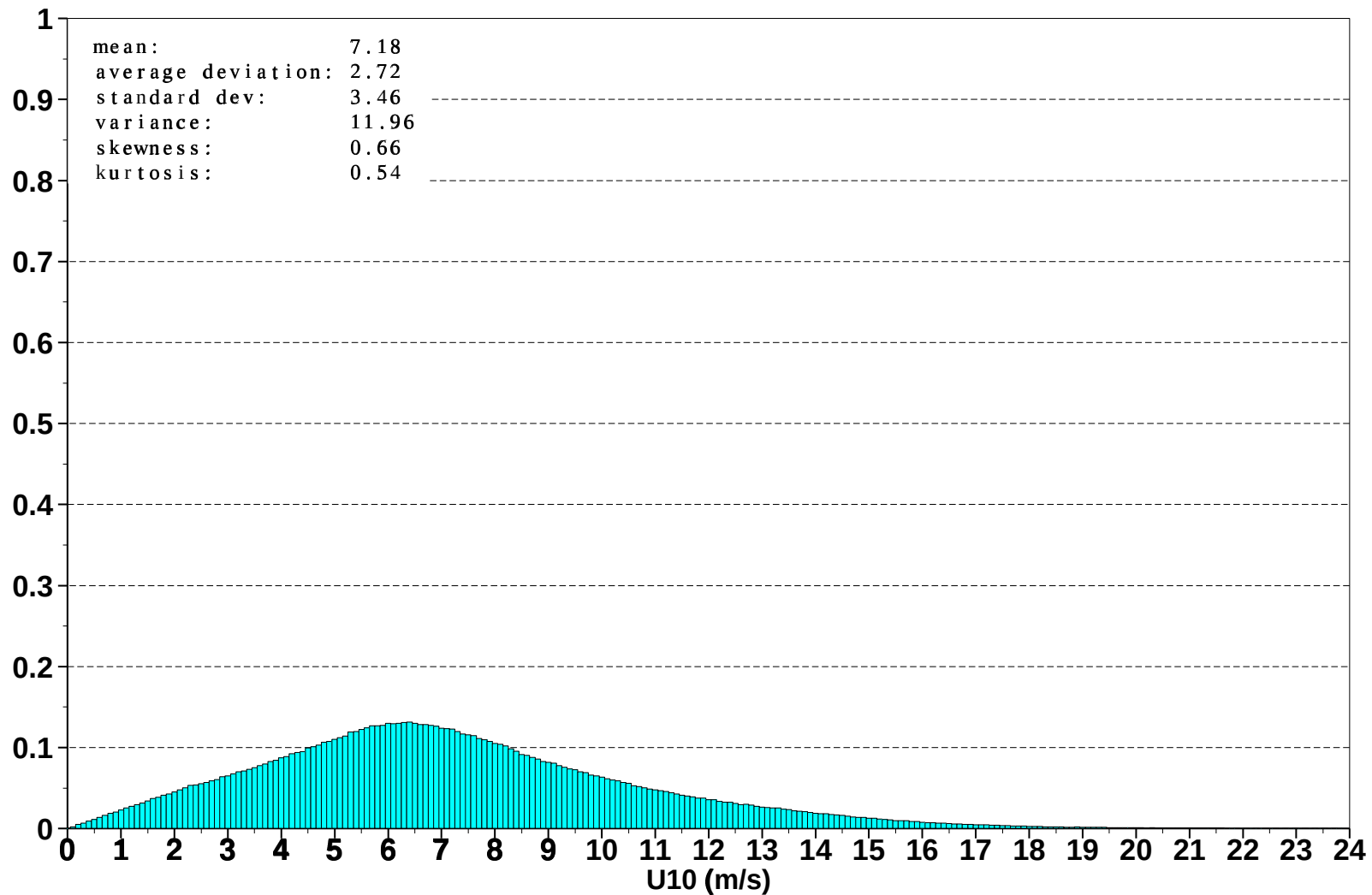


Figure 5: Global distribution of ECMWF ocean surface wind speeds for November 2000



Saleh Abdalla

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Shinfield Park, Reading, Berkshire RG2 9AX, England

Telephone: U.K. (0118) 949 9703, International (+44 118) 949 9703

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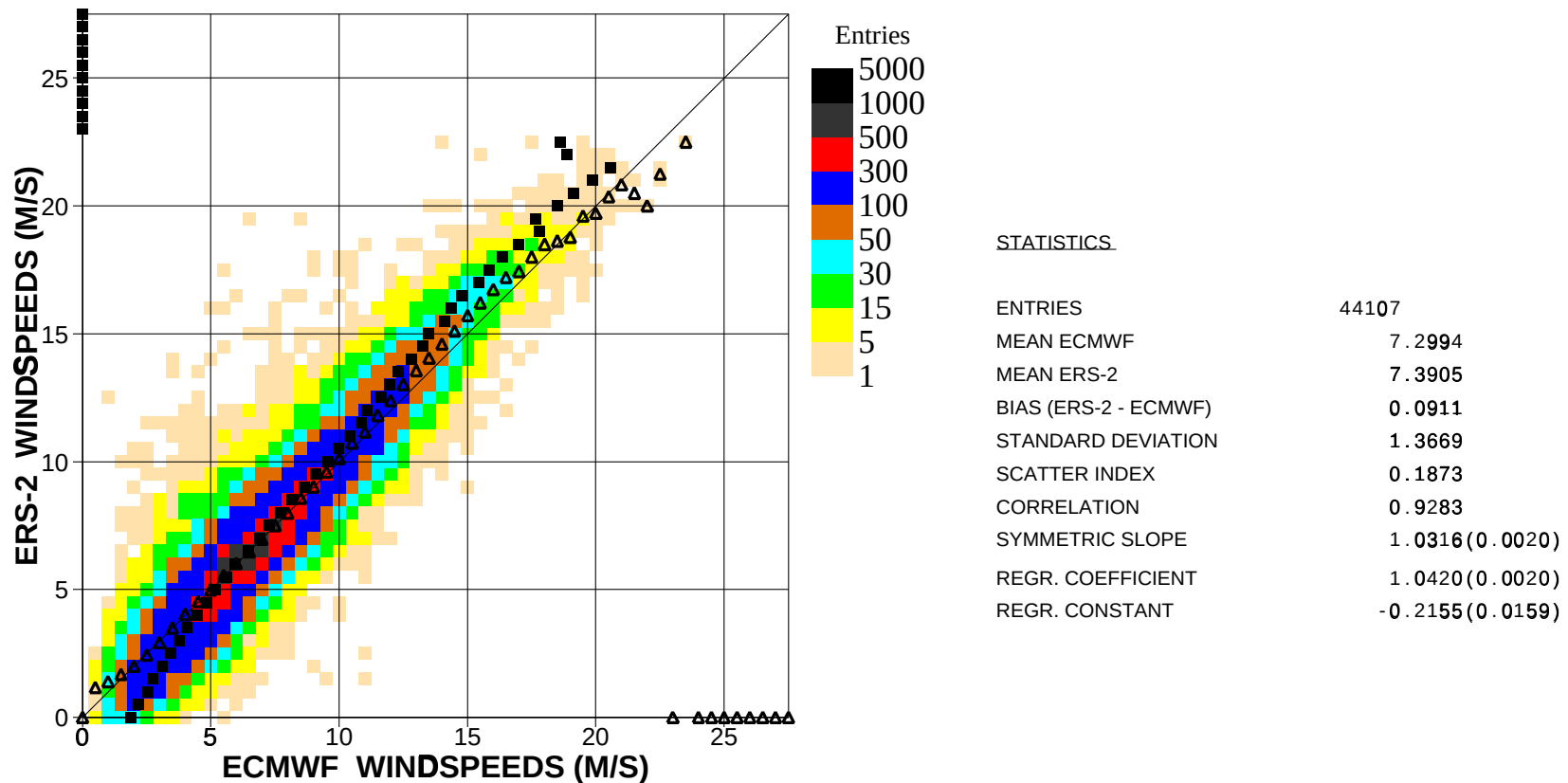


Figure 6. Comparison of ECMWF wind speed results with ERS2 Altimeter wind speed data for November 2000 (global)

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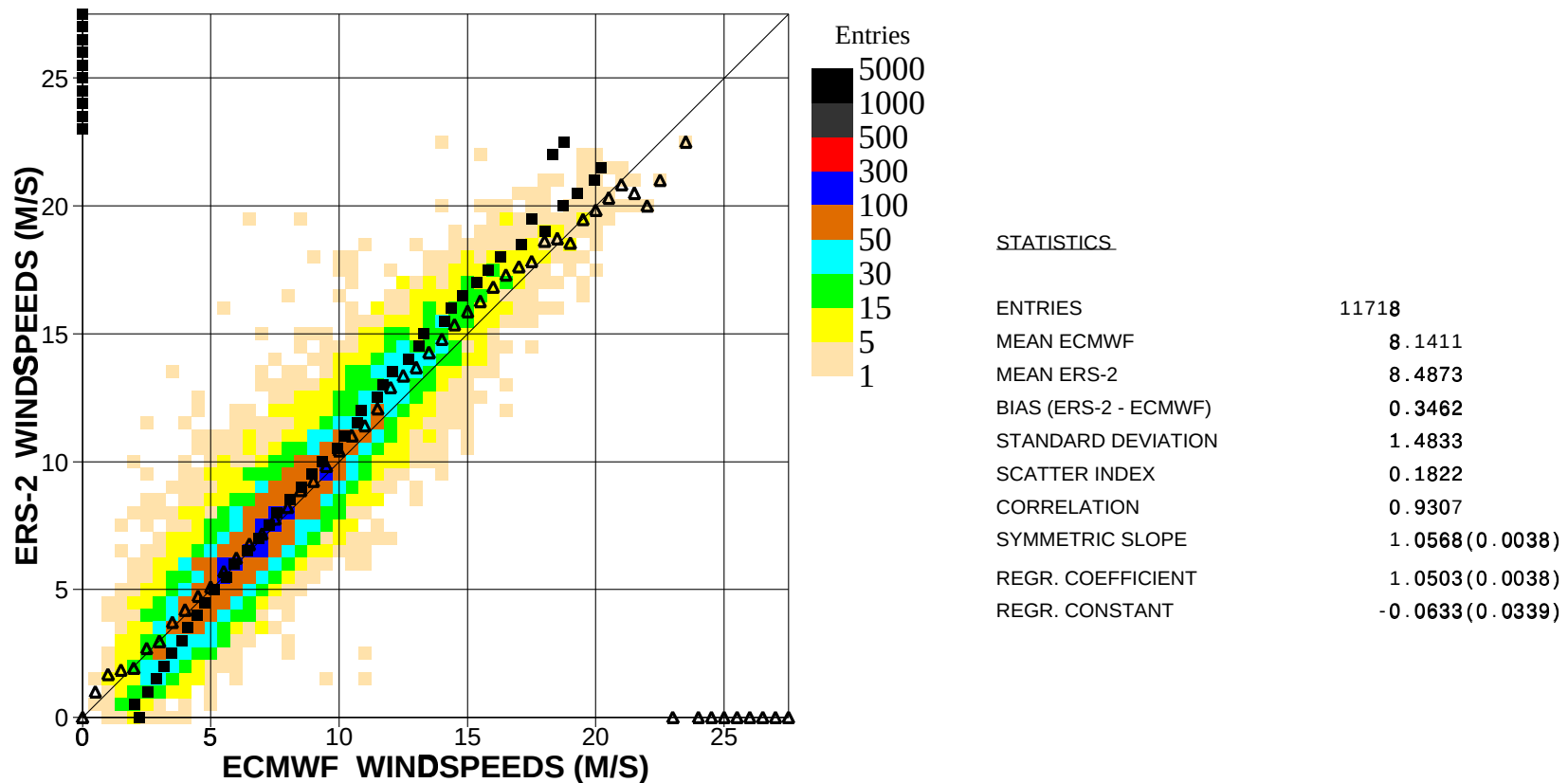


Figure 7. Comparison of ECMWF wind speed results with ERS2 Altimeter wind speed data for November 2000 (n.hem.)

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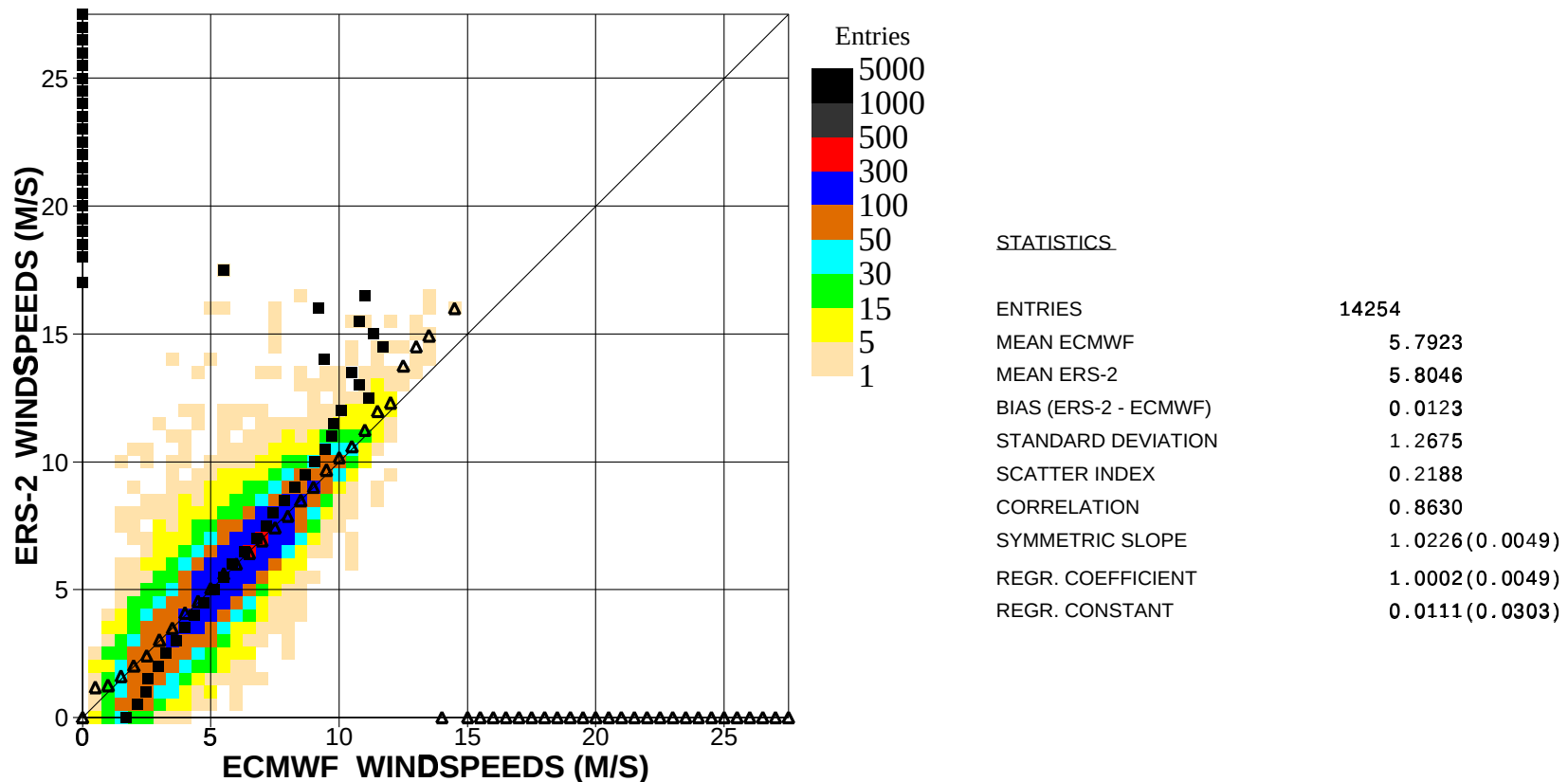


Figure 8. Comparison of ECMWF wind speed results with ERS2 Altimeter wind speed data for November 2000 (tropics)

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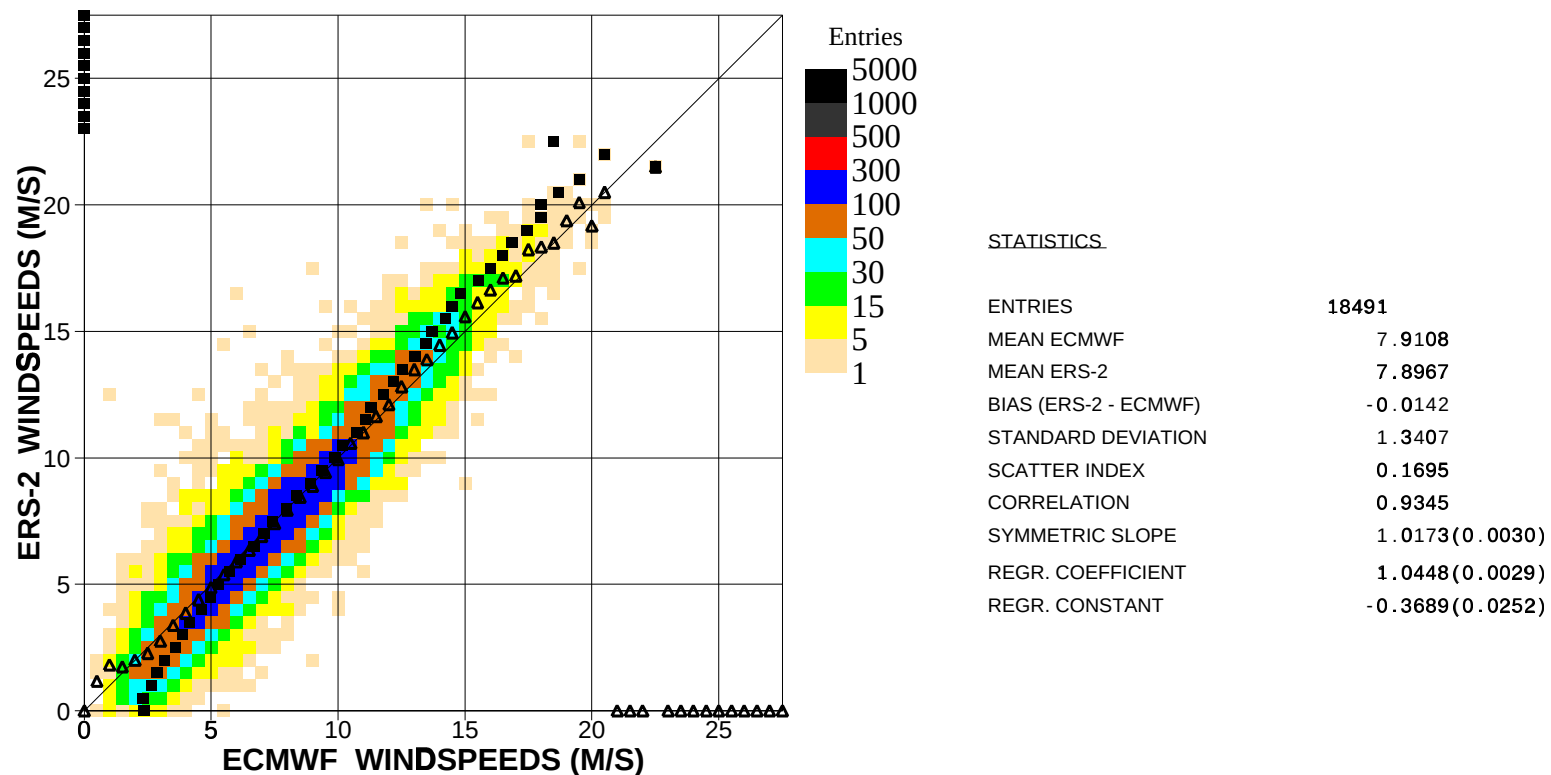


Figure 9. Comparison of ECMWF wind speed results with ERS2 Altimeter wind speed data for November 2000 (s.hem.)

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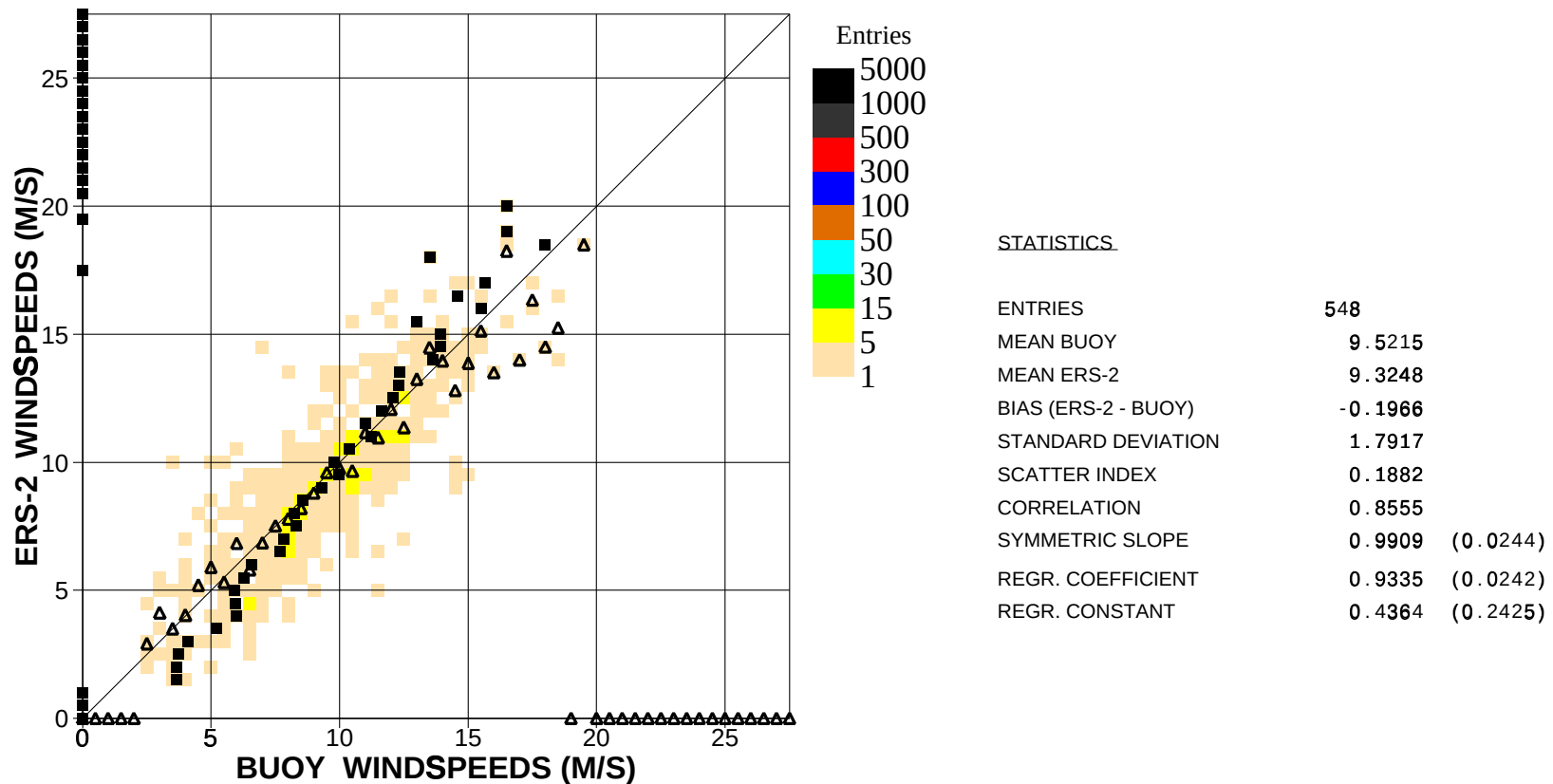


Figure 10. Comparison of buoy wind speed observations with ERS2 Altimeter wind speed data for November 2000 (global)

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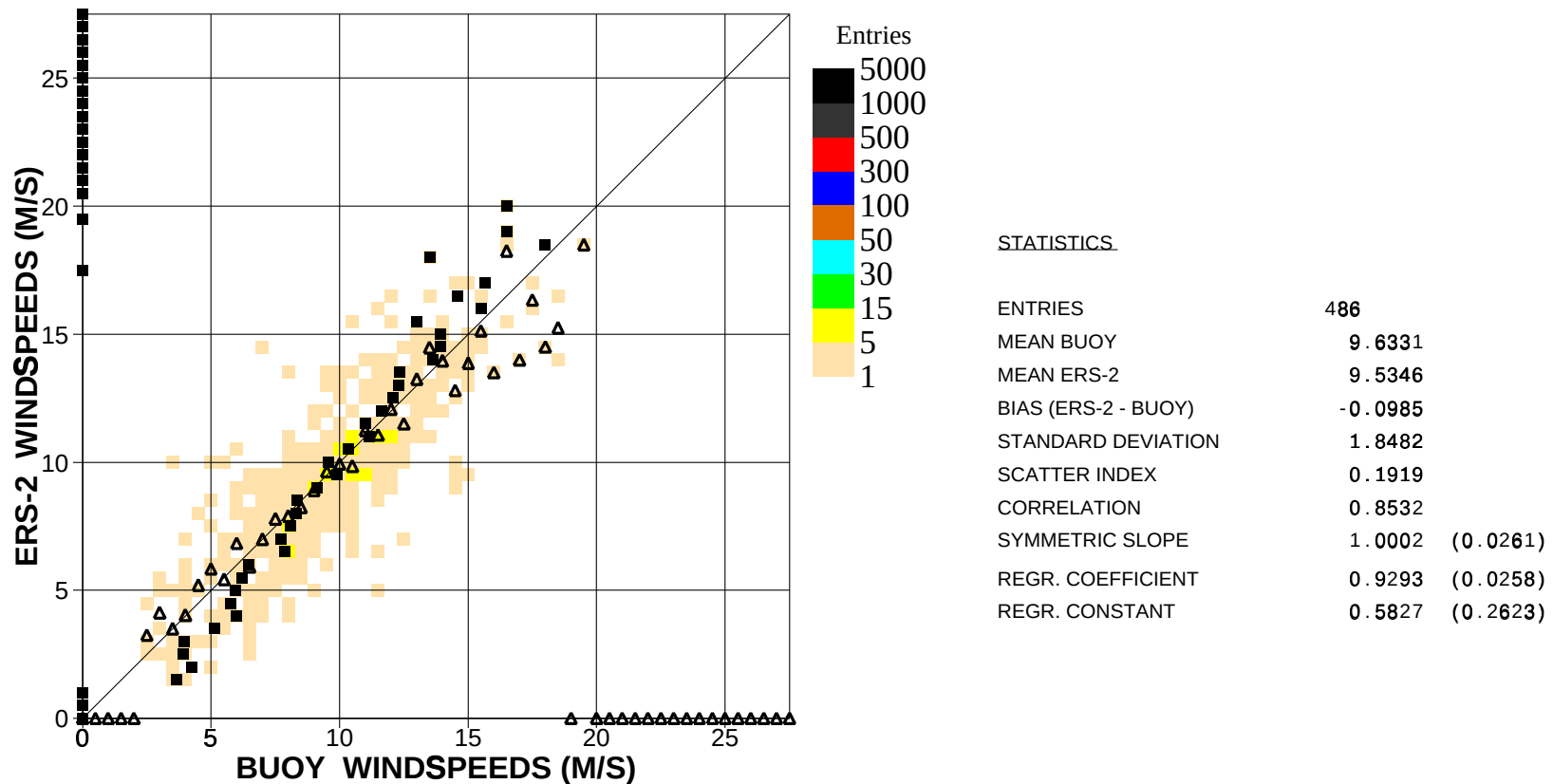


Figure 11. Comparison of buoy wind speed observations with ERS2 Altimeter wind speed data for November 2000 (n.hem.)



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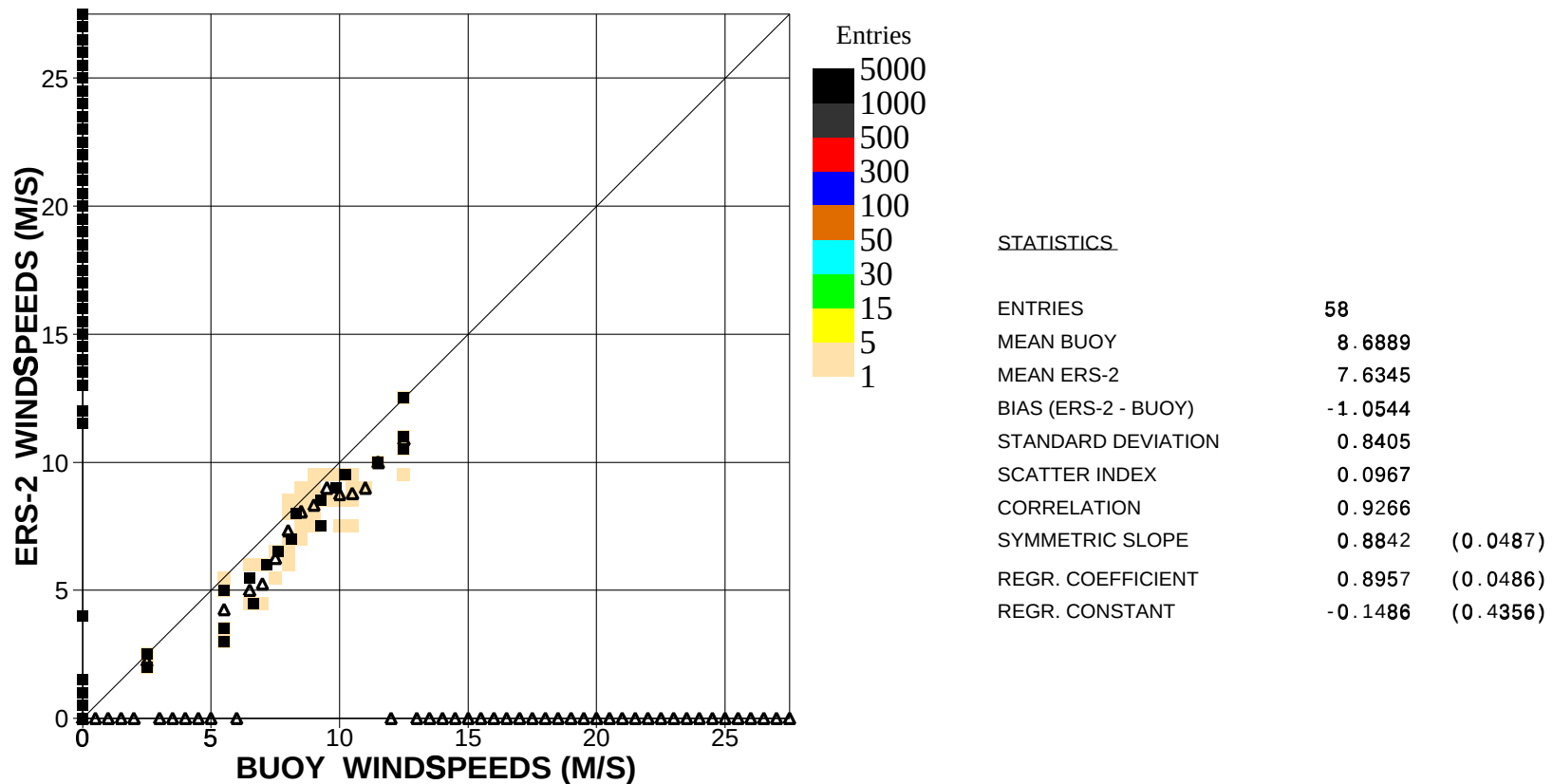


Figure 12. Comparison of buoy wind speed observations with ERS2 Altimeter wind speed data for November 2000 (hawaii)

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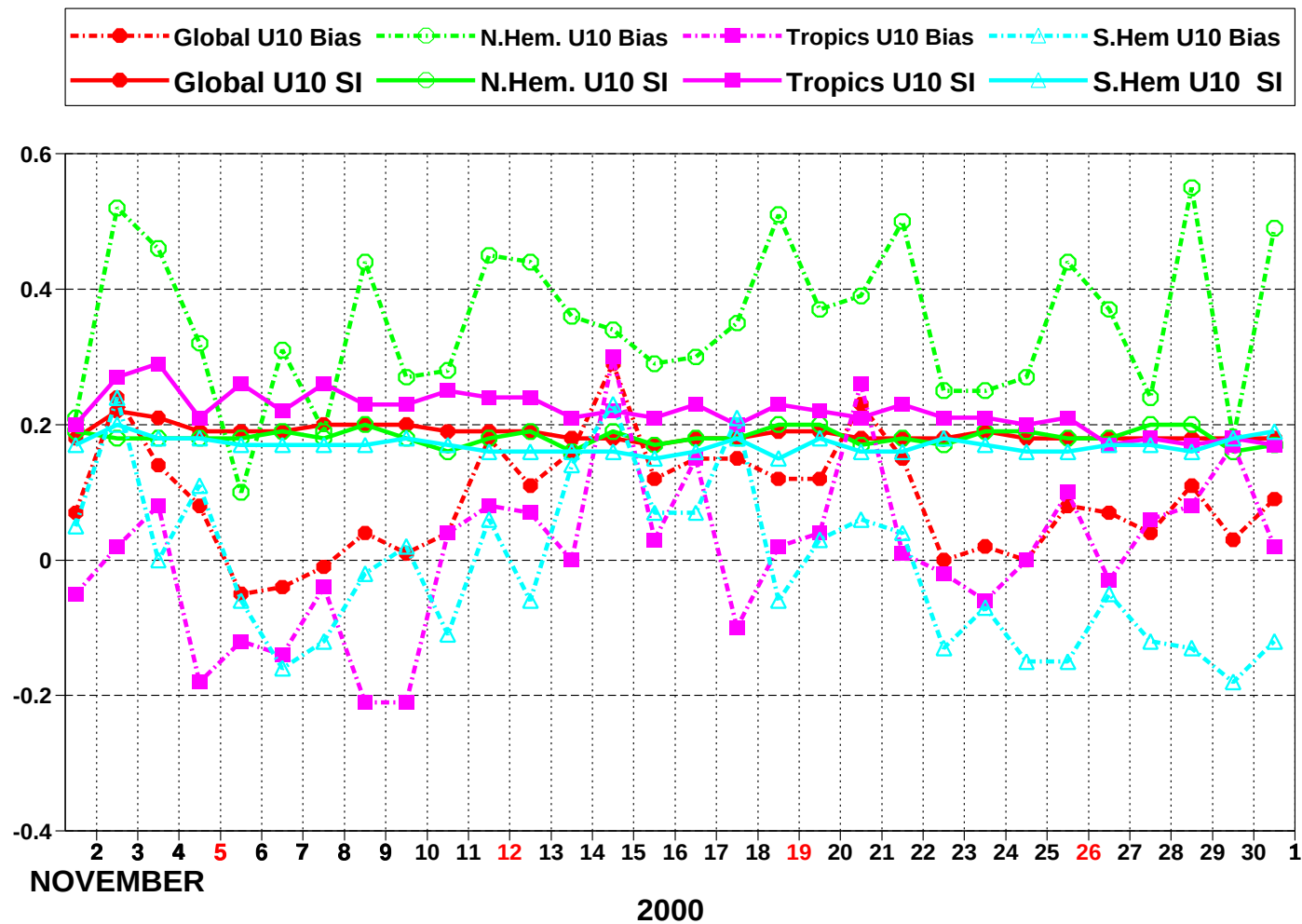


Figure 13: ERS-2 Altimeter wind speeds: Timeseries of bias (ERS-2 - model) and scatter index (SI)



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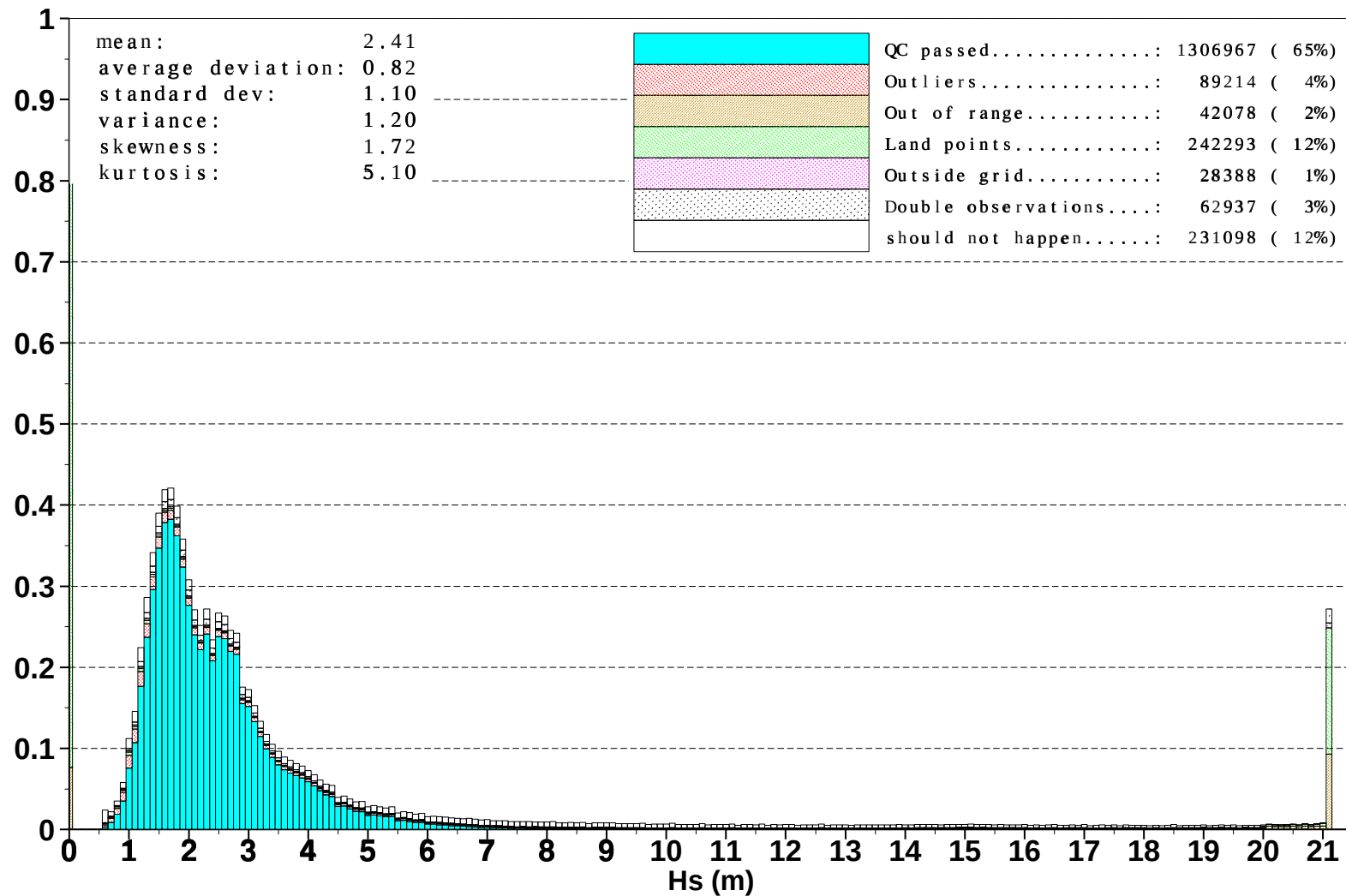


Figure 14: Distribution of the ERS-2 Altimeter wave heights after QC for November 2000

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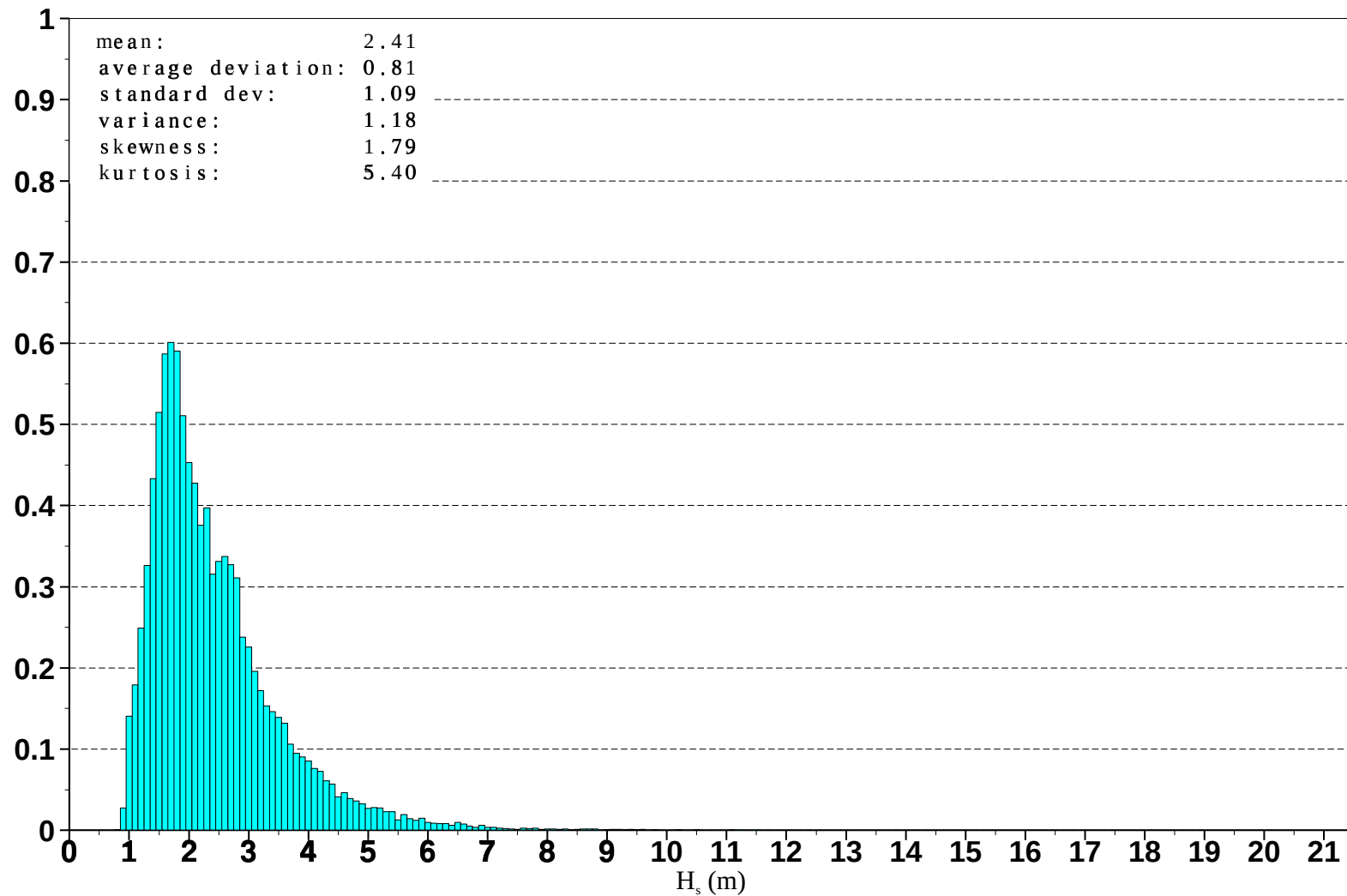


Figure 15: Distribution of ERS-2 Altimeter wave heights after along track averaging for November 2000



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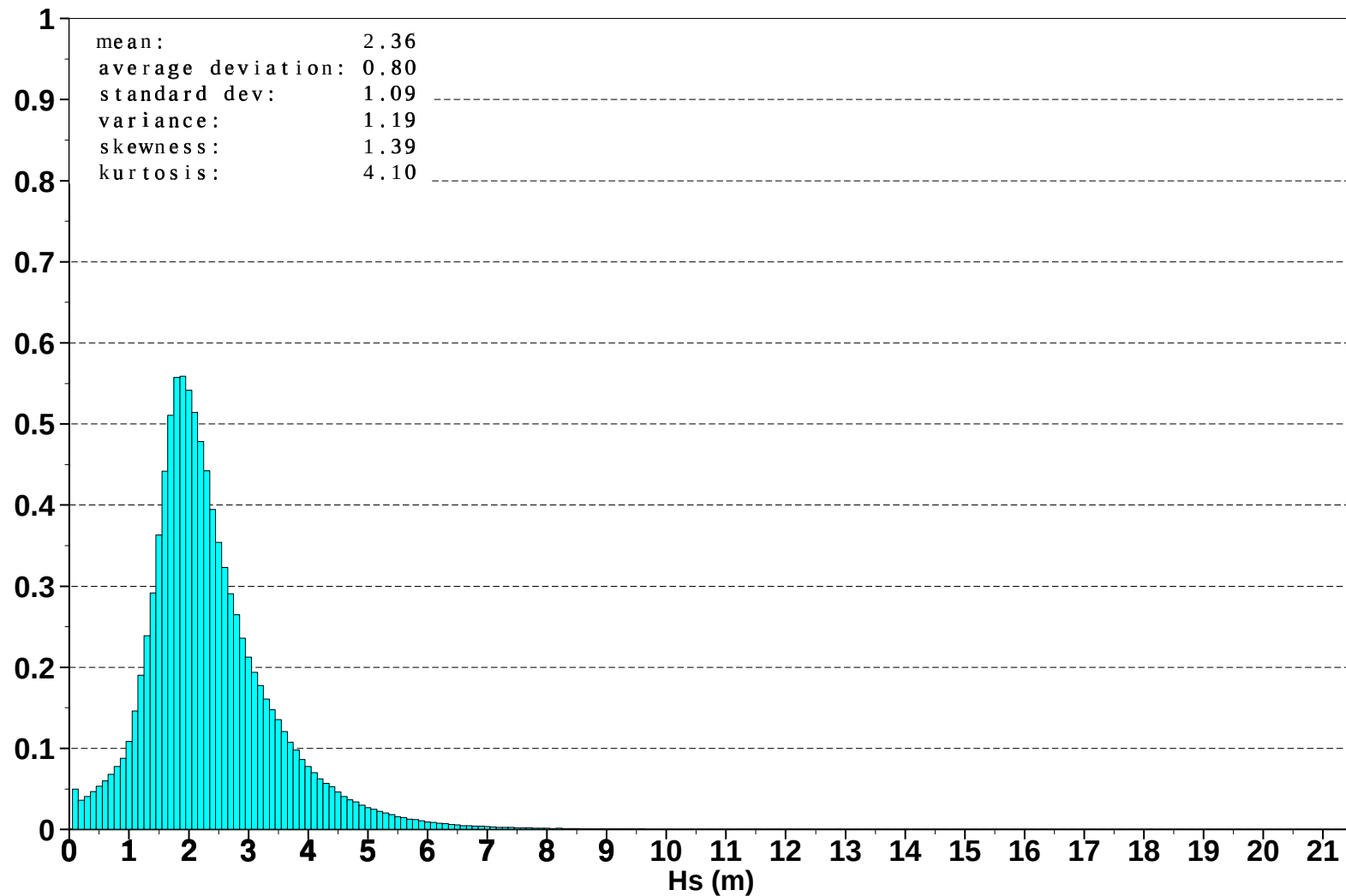


Figure 16: Global distribution of ECMWF wave heights for November 2000



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

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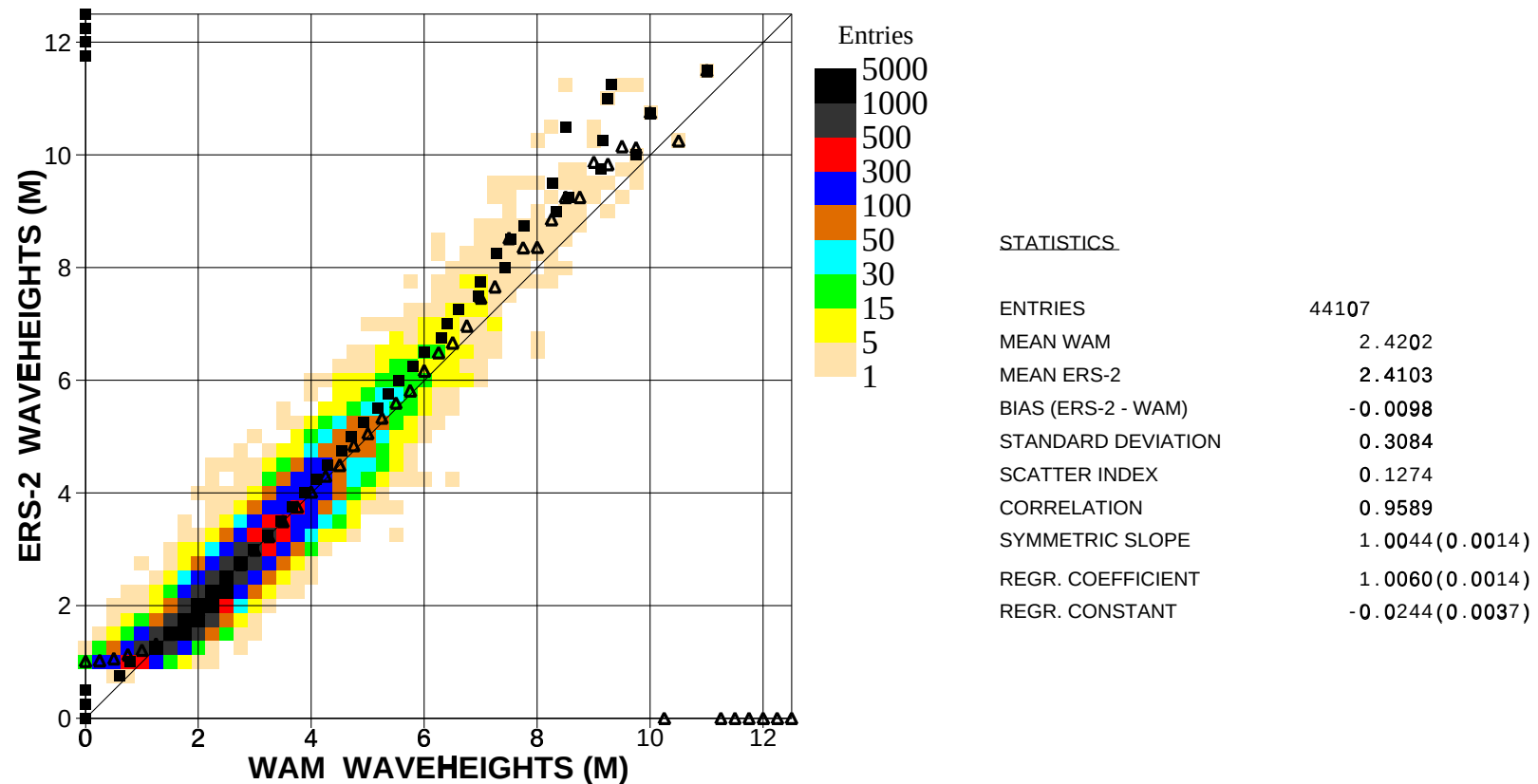


Figure 17. Comparison of ECMWF wave height results with ERS2 Altimeter wave height data for November 2000 (global)

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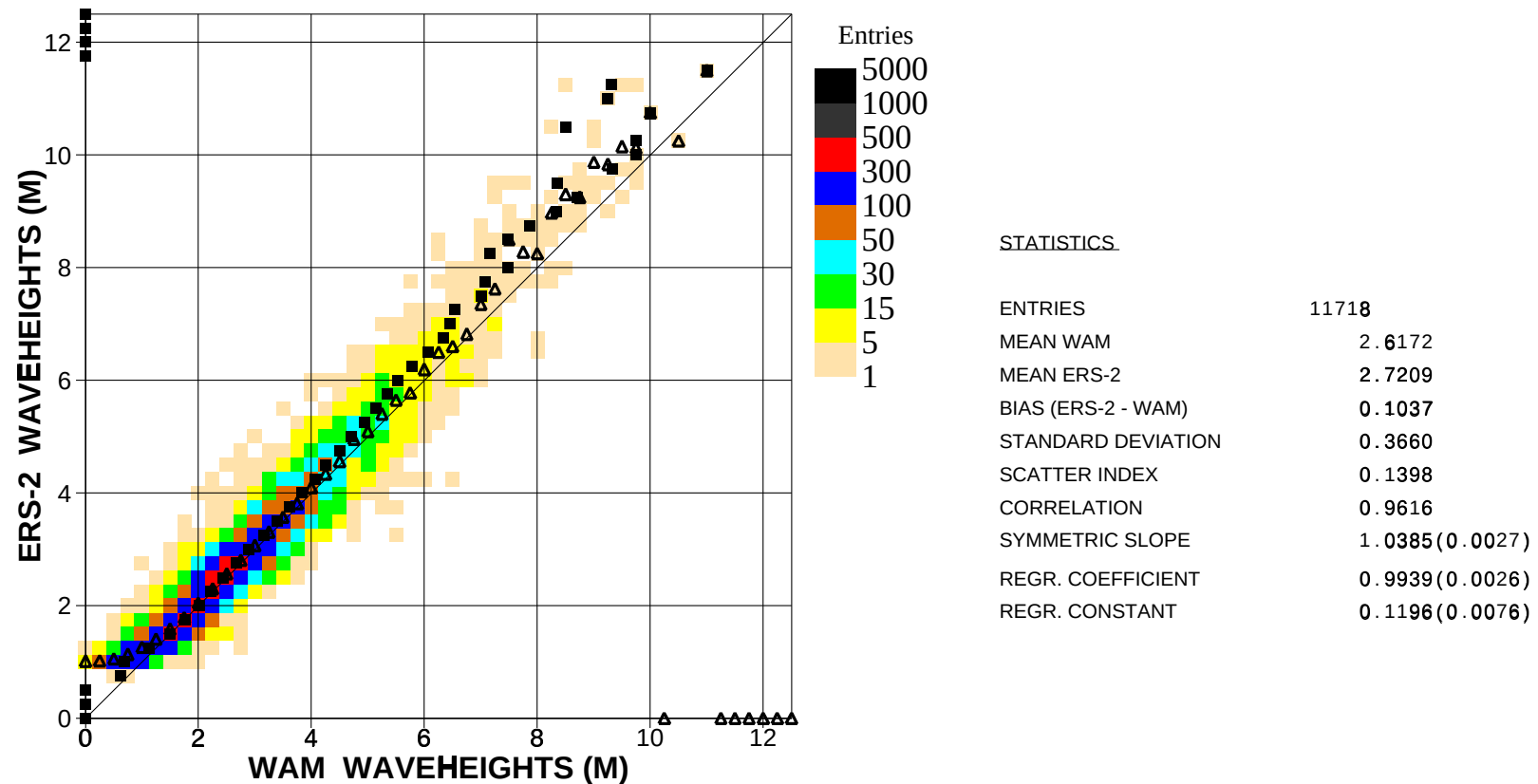


Figure 18. Comparison of ECMWF wave height results with ERS2 Altimeter wave height data for November 2000 (n.hem.)

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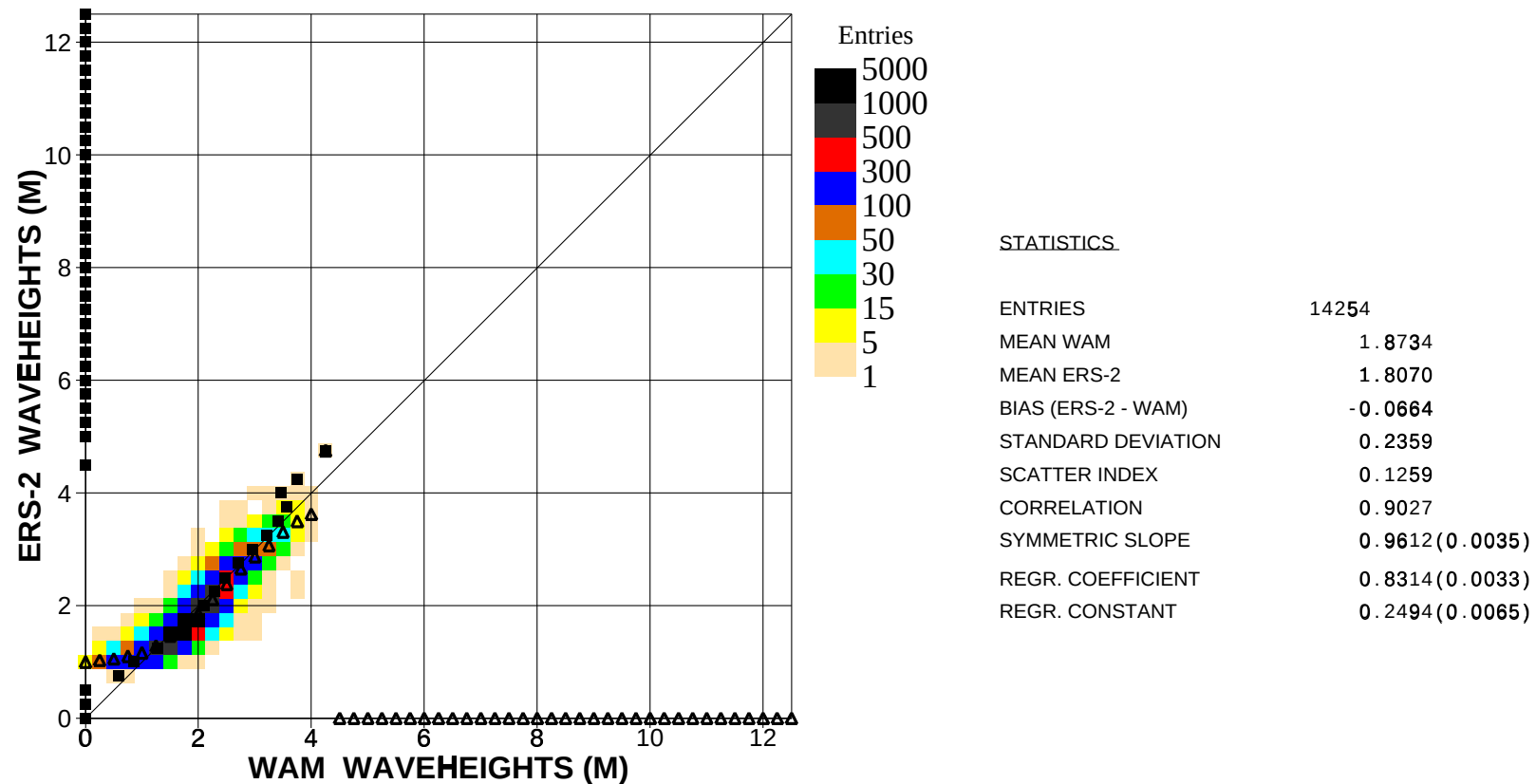


Figure 19. Comparison of ECMWF wave height results with ERS2 Altimeter wave height data for November 2000 (tropics)

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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 Saleh.Abdalla@ecmwf.int



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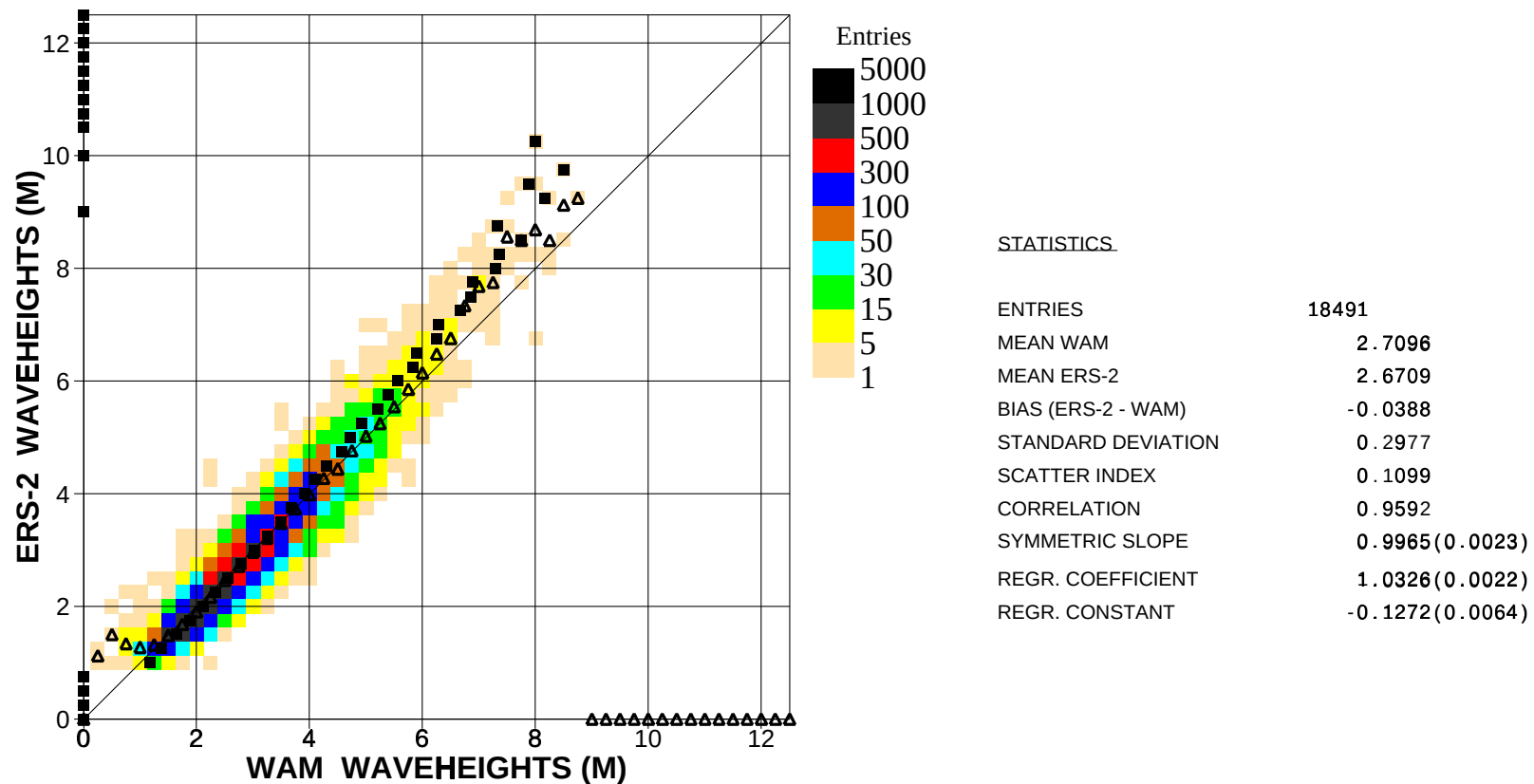


Figure 20. Comparison of ECMWF wave height results with ERS2 Altimeter wave height data for November 2000 (s.hem.)

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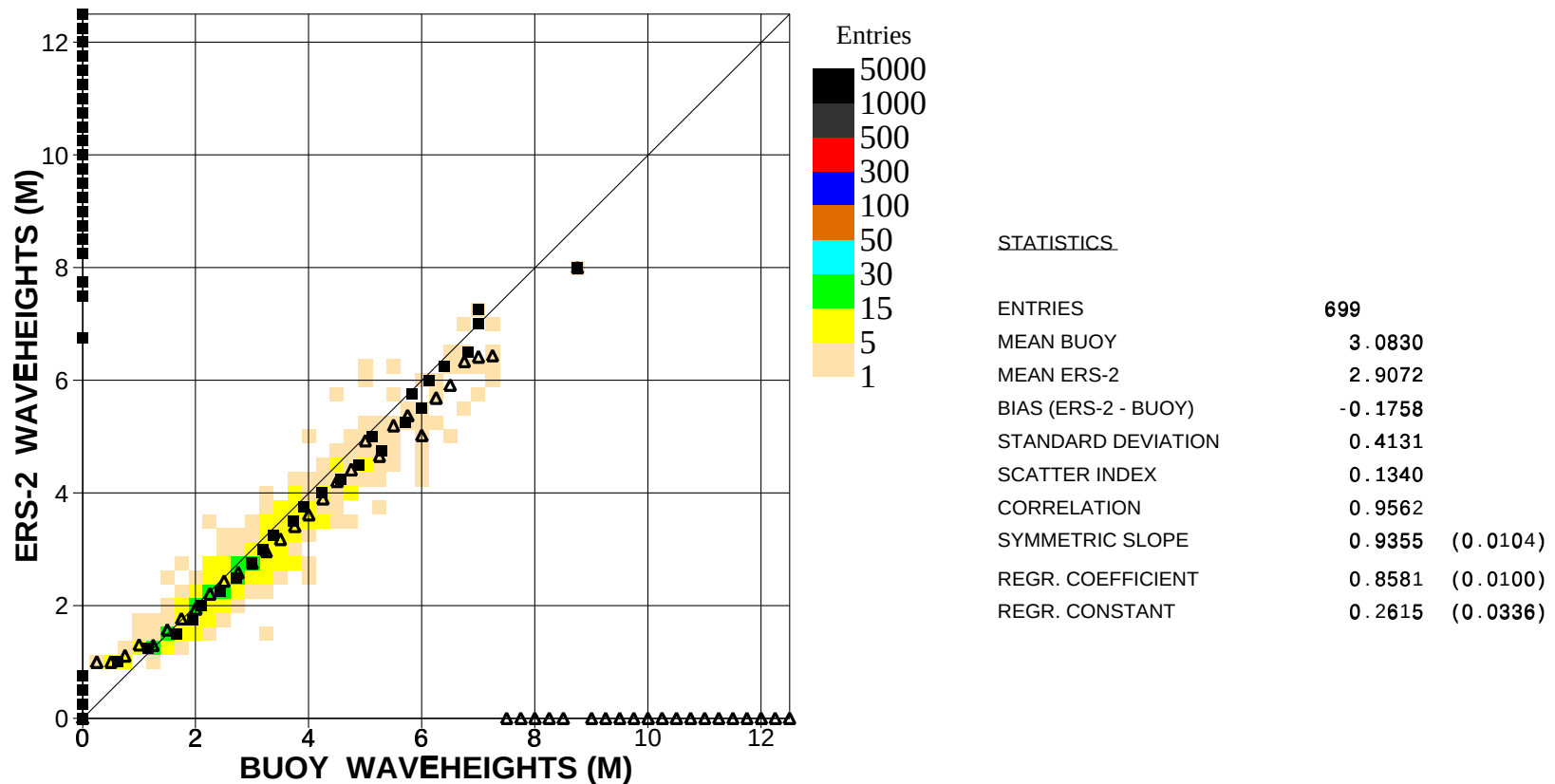


Figure 21. Comparison of buoy wave height observations with ERS2 Altimeter wave height data for November 2000 (global)

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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  
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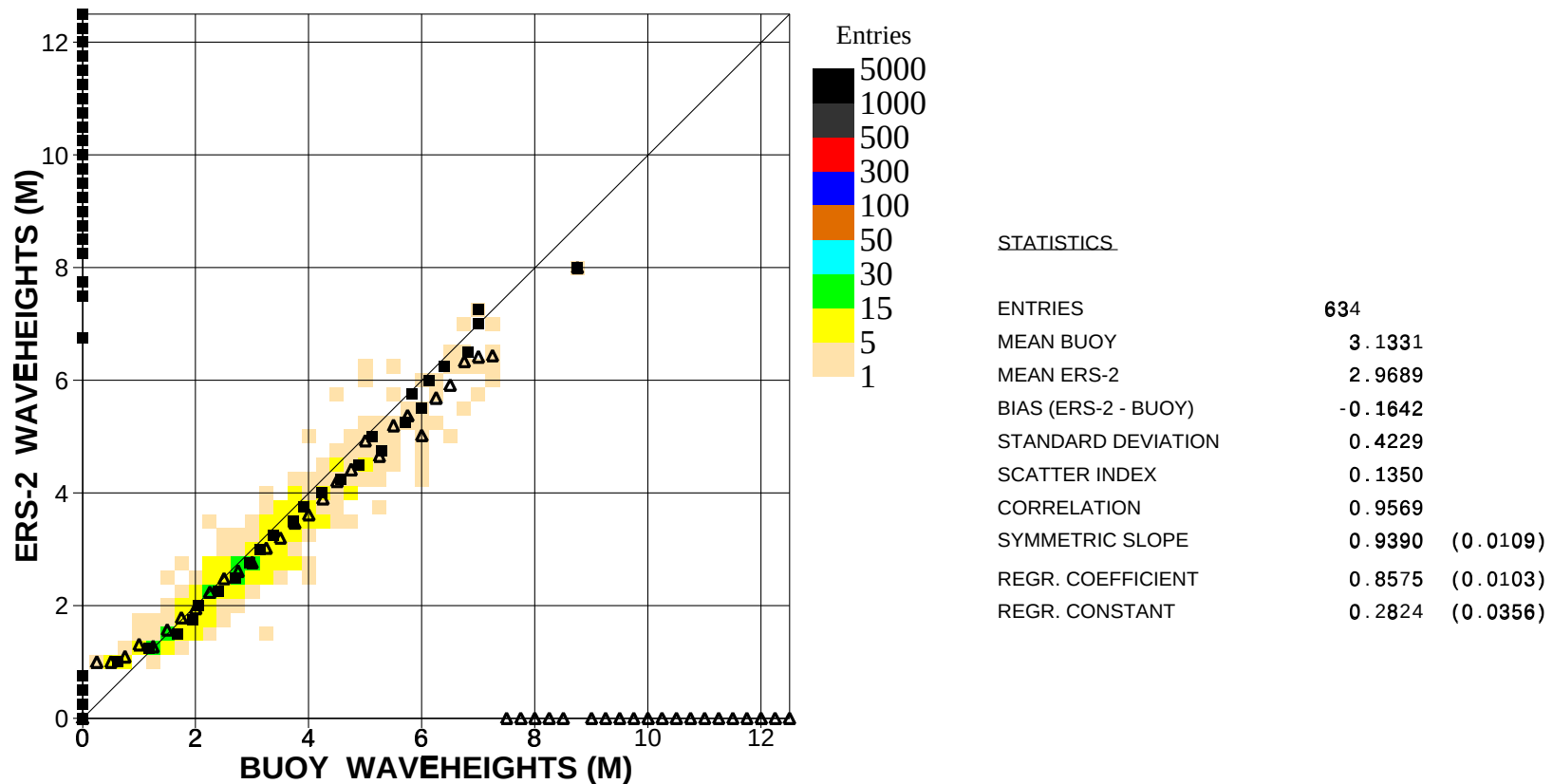


Figure 22. Comparison of buoy wave height observations with ERS2 Altimeter wave height data for November 2000 (n.hem.)

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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 Saleh.Abdalla@ecmwf.int

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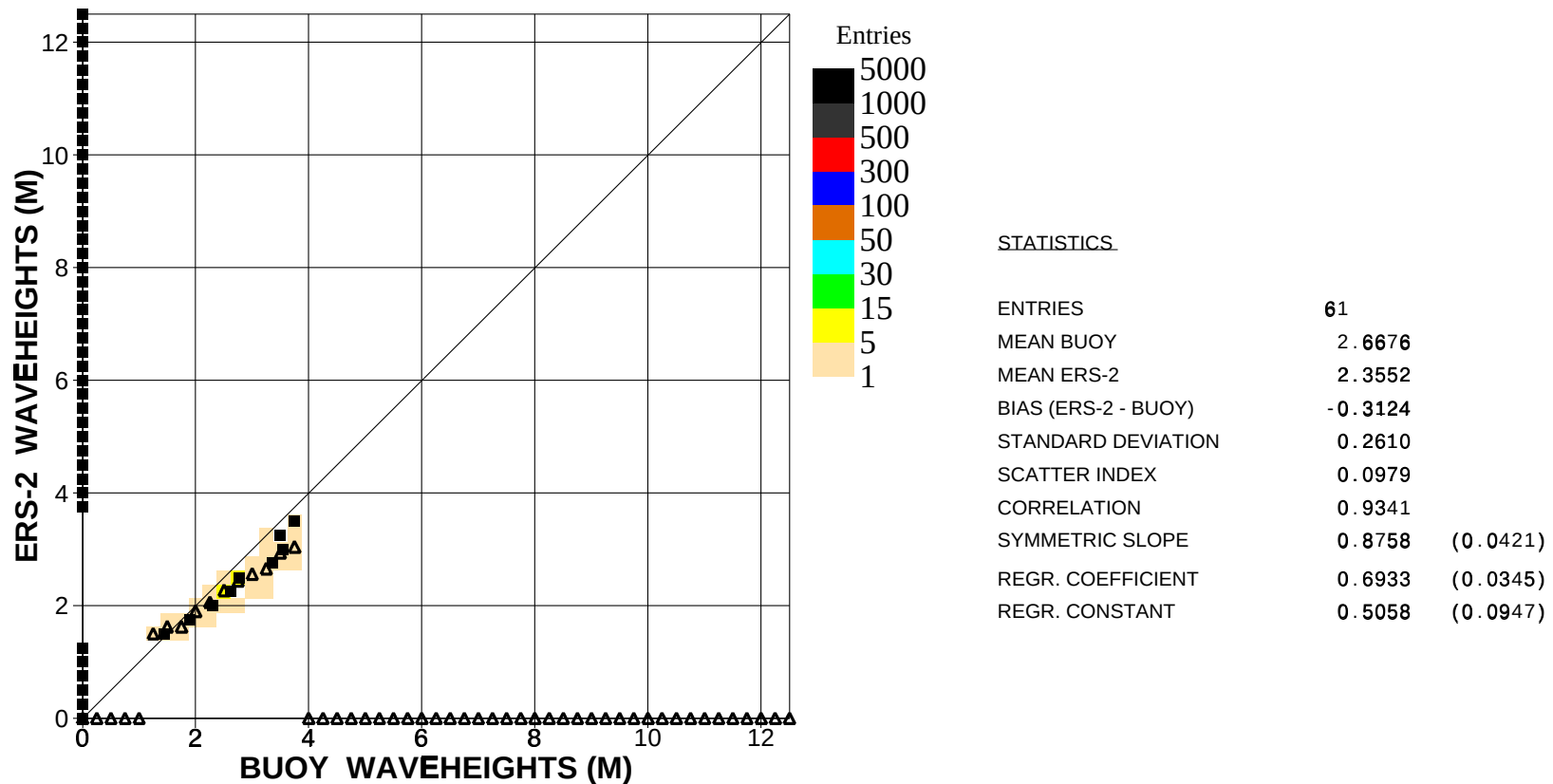


Figure 23. Comparison of buoy wave height observations with ERS2 Altimeter wave height data for November 2000 (hawaii)

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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  
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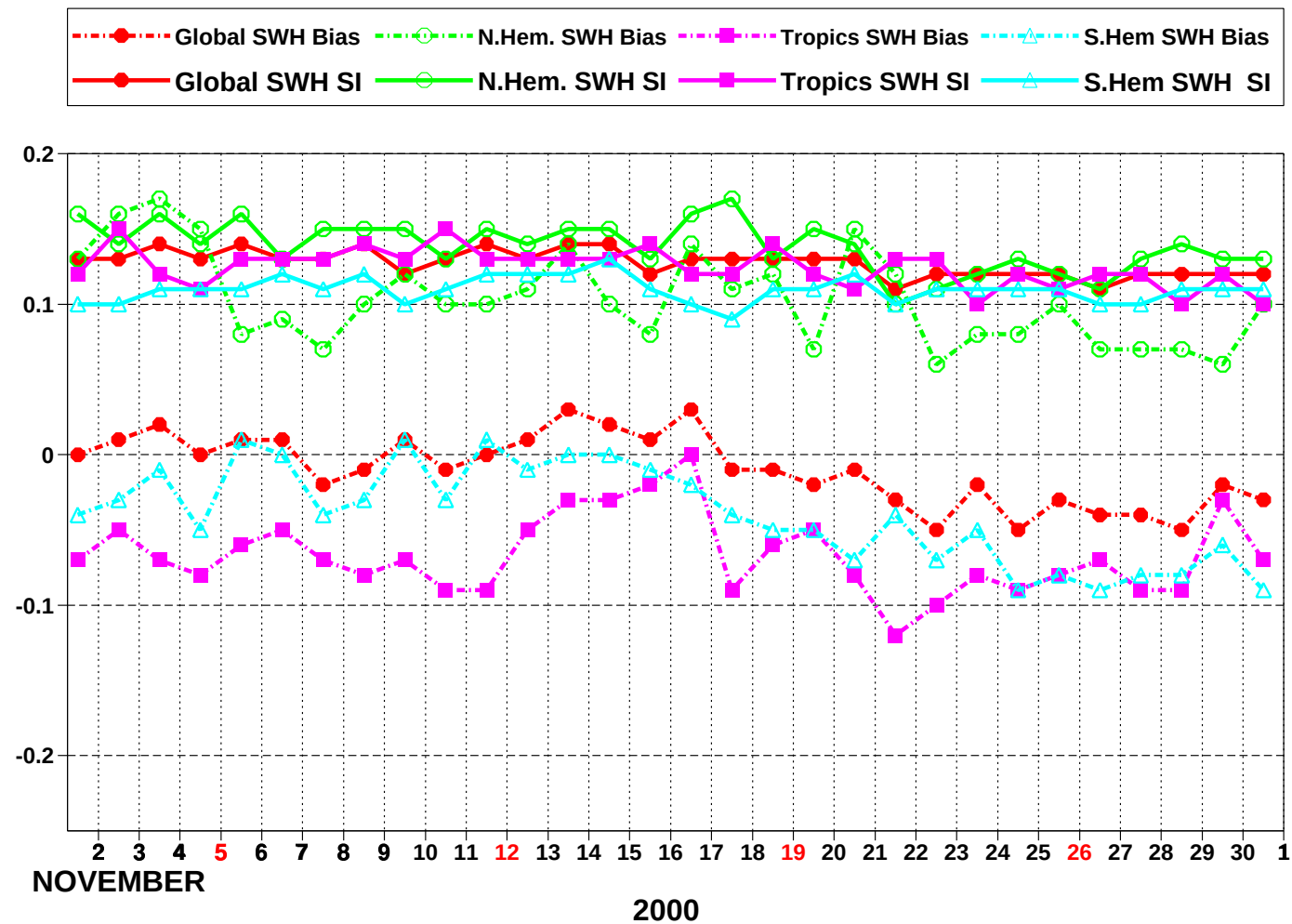


Figure 24: ERS-2 Altimeter wave heights: Timeseries of bias (ERS-2 - model) and scatter index (SI)

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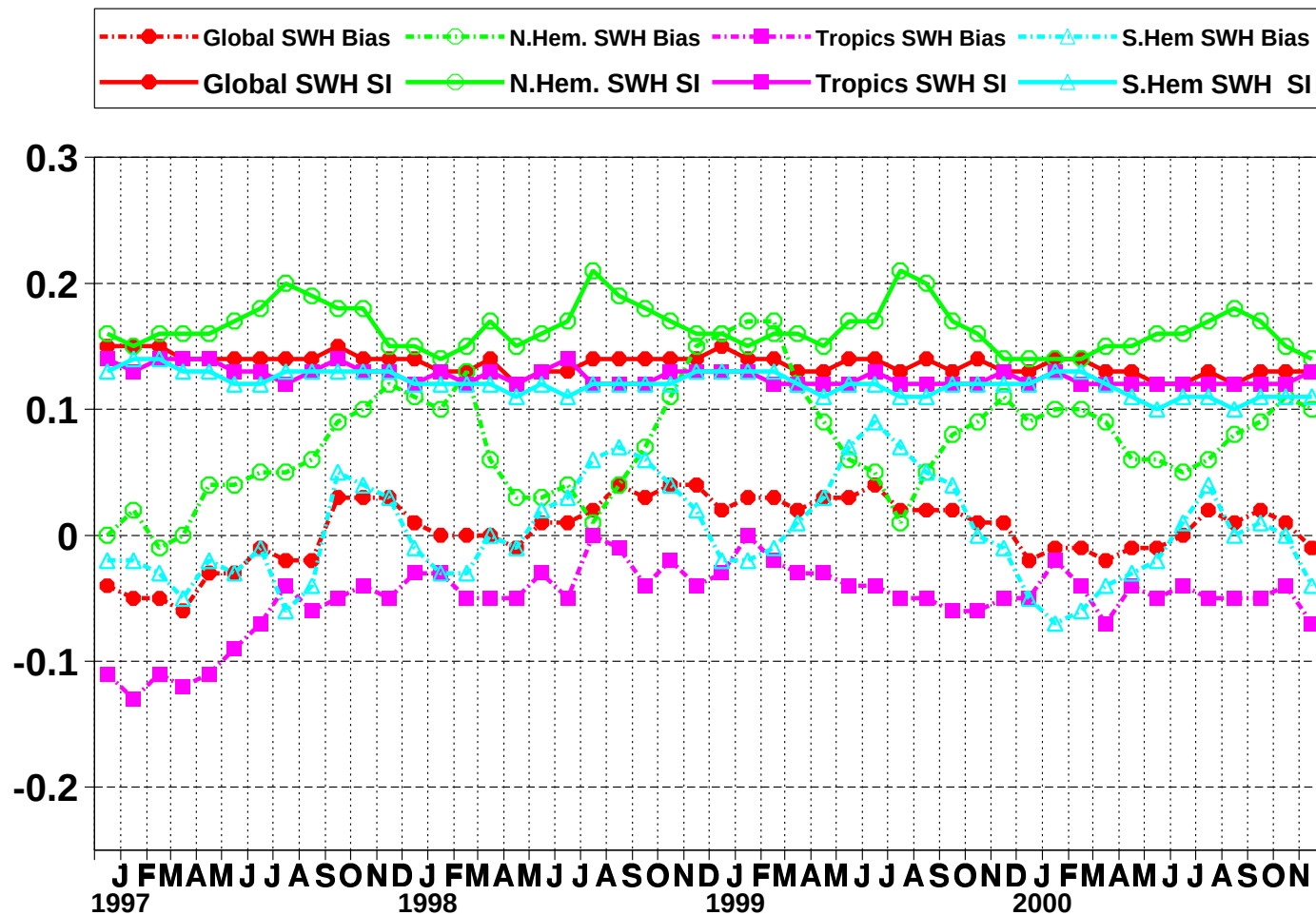


Figure 25: ERS-2 Altimeter wave heights: Timeseries of bias (ERS-2 - model) and scatter index (SI)

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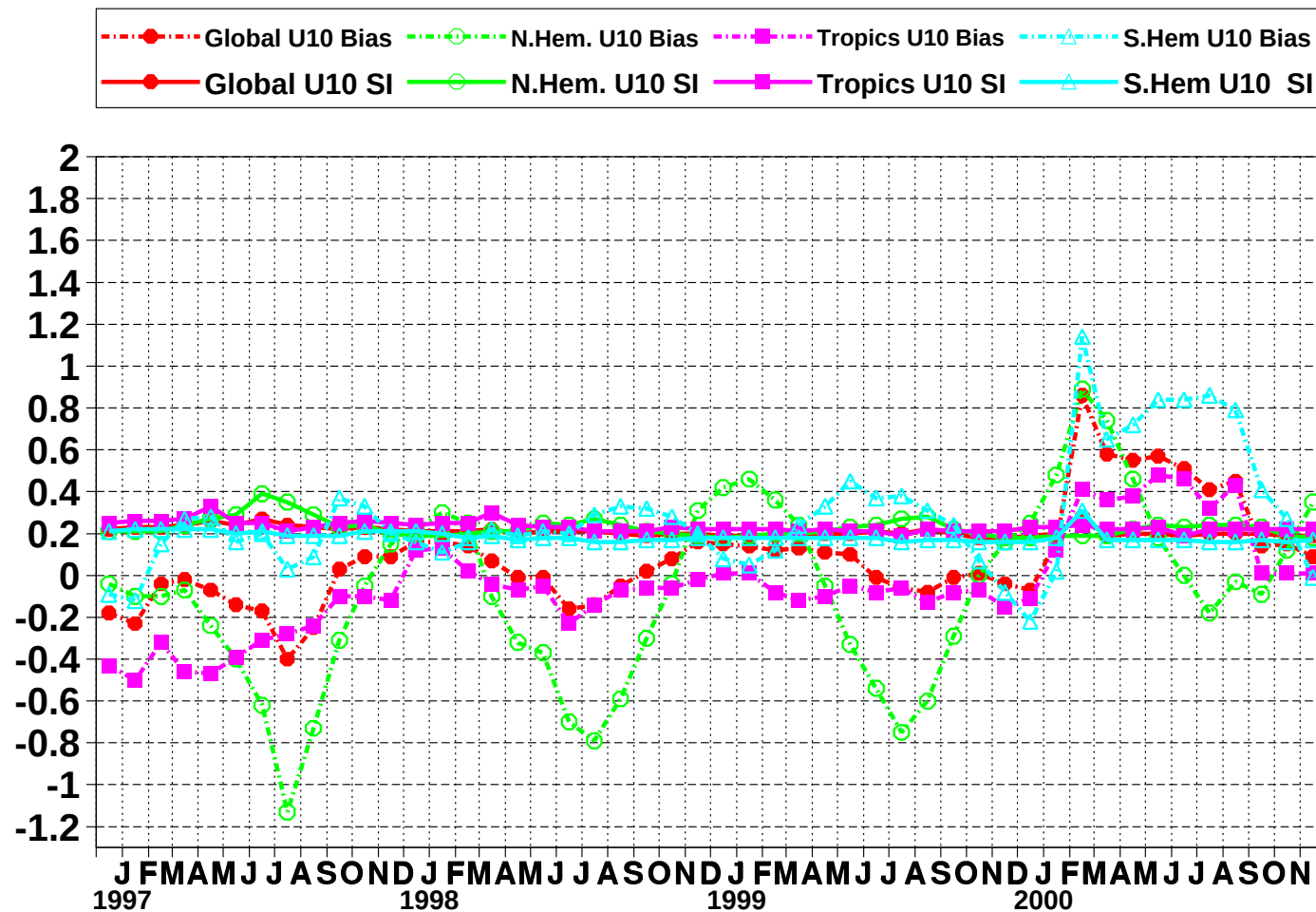


Figure 26: ERS-2 Altimeter wind speeds: Timeseries of bias (ERS-2 - model) and scatter index (SI)