

■ ECMWF Report on ERS-2 RA for January 2003 ■

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

By: Saleh Abdalla

Date: 9 February 2003

Overview:

Based on the data received during the full month, on average, 15495 observations arrived at ECMWF every 6 hours of which 81.4% passed the quality control. The data coverage, which was rather good, can be seen in Figure 1. Data were missed from around 18:00 on the 17th. to around 06:00 on the 19th. and from around 12:00 on the 20th. to around 06:00 on the 21st. of the month (all times are in UTC). Note that we are talking about the raw data which have arrived at ECMWF before they were processed. Apart from the active impact of the DES Sun- Blinding phenomenon, the quality of the received data is as good as usual.

ECMWF atmospheric and wave models have been changed on 13 January 2003.

Backscatter:

ESR-2 $\langle \sigma_0 \rangle = 10.92$ dB (with two peaks at 10.6 and 11.1 dB)

Wind Speed Comparison with ECMWF wind speeds (bias):

ERS-2 global: 0.276 m/s

ERS-2 northern hemisphere: 0.399 m/s

ERS-2 tropics: -0.054 m/s

ERS-2 southern hemisphere: 0.433 m/s



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Wind Speed Comparison with buoy wind speeds (bias):

ERS-2 global: -0.224 m/s

ERS-2 northern hemisphere: -0.138 m/s

ERS-2 tropics: -0.956 m/s

Wave Height Comparison with ECMWF wave heights (bias):

ERS-2 global: -0.055 m (lowest waves measured: 0.6m)

ERS-2 northern hemisphere: 0.028 m

ERS-2 tropics: -0.090 m

ERS-2 southern hemisphere: -0.073 m

Wave Height Comparison with buoy wave heights (bias):

ERS-2 global: -0.17 m

ERS-2 northern hemisphere: -0.17 m

ERS-2 tropics: -0.34 m

Remarks:

- ECMWF atmospheric and wave models have been changed to CY25R3 (en.) on 13 January 2003 (since 18:00 UTC). ERS-2 SAR data are assimilated by the wave model. Other atmospheric changes have been introduced as well.



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- This month there are quite a number of outliers (RA values higher than model) in the scatter plot for the wind speed in the Southern Hemisphere (Figure 9). Most of the outliers can be attributed to the DES sun-blinding phenomenon due to high solar activity. The solar activity was high during the whole of the month.
- There is a couple of outliers in the scatter plots for the wave heights in the Tropics. Those (and same number of the outliers in wind speed) can be attributed due to a tropical storm which was not predicted accurately by the ECMWF meteorological model.
- Apart from that, the quality of Altimeter data is as good as they used to be. Even there is a clear tendency for improved agreement between RA and model data in the Northern Hemisphere after 18 January 2003 (there was no RA on that day). It is not clear if any ESA changes to the RA data or if the ECMWF model changes (on the 13th. of the month) are responsible for this improvement.

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



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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 January 2003.

Figure 2: Distribution of the ERS-2 Altimeter Backscatter after QC for January 2003.

Figure 3: Distribution of the ERS-2 Altimeter wind speeds after QC for January 2003.

Figure 4: Distribution of the ERS-2 Altimeter wind speeds after along track averaging for January 2003.

Figure 5: Global distribution of ECMWF ocean surface wind speeds for January 2003.

Figure 6: Comparison of ECMWF wind speed results with ERS-2 Altimeter wind speed data for January 2003 (global).

Figure 7: Comparison of ECMWF wind speed results with ERS-2 Altimeter wind speed data for January 2003 (northern hemisphere)

Figure 8: Comparison of ECMWF wind speed results with ERS-2 Altimeter wind speed data for January 2003 (tropics)

Figure 9: Comparison of ECMWF wind speed results with ERS-2 Altimeter wind speed data for January 2003 (southern hemisphere)

Figure 10: Comparison of buoy wind speed observations with ERS-2 Altimeter wind speed data for January 2003 (global).

Figure 11: Comparison of buoy wind speed observations with ERS-2 Altimeter wind speed data for January 2003 (northern hemisphere).

Figure 12: Comparison of buoy wind speed observations with ERS-2 Altimeter wind speed data for January 2003 (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 January 2003.

Figure 15: Distribution of the ERS-2 Altimeter wave heights after along track averaging for January 2003.



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Figure 16: Global distribution of ECMWF wave heights for January 2003.

Figure 17: Comparison of ECMWF wave height results with ERS-2 Altimeter wave height data for January 2003 (global).

Figure 18: Comparison of ECMWF wave height results with ERS-2 Altimeter wave height data for January 2003 (northern hemisphere)

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Figure 23: Comparison of buoy wave height observations with ERS-2 Altimeter wave height data for January 2003 (tropics).

Figure 24: ERS-2 Altimeter wave heights: Timeseries of bias (ERS-2 - model) and scatter index (SI) for January 2003.

Figure 25: ERS-2 Altimeter wave heights: Timeseries of bias (ERS-2 - model) and scatter index (SI) from December 1996 to January 2003

Figure 26: ERS-2 Altimeter wind speeds: Timeseries of bias (ERS-2 - model) and scatter index (SI) from December 1996 to January 2003



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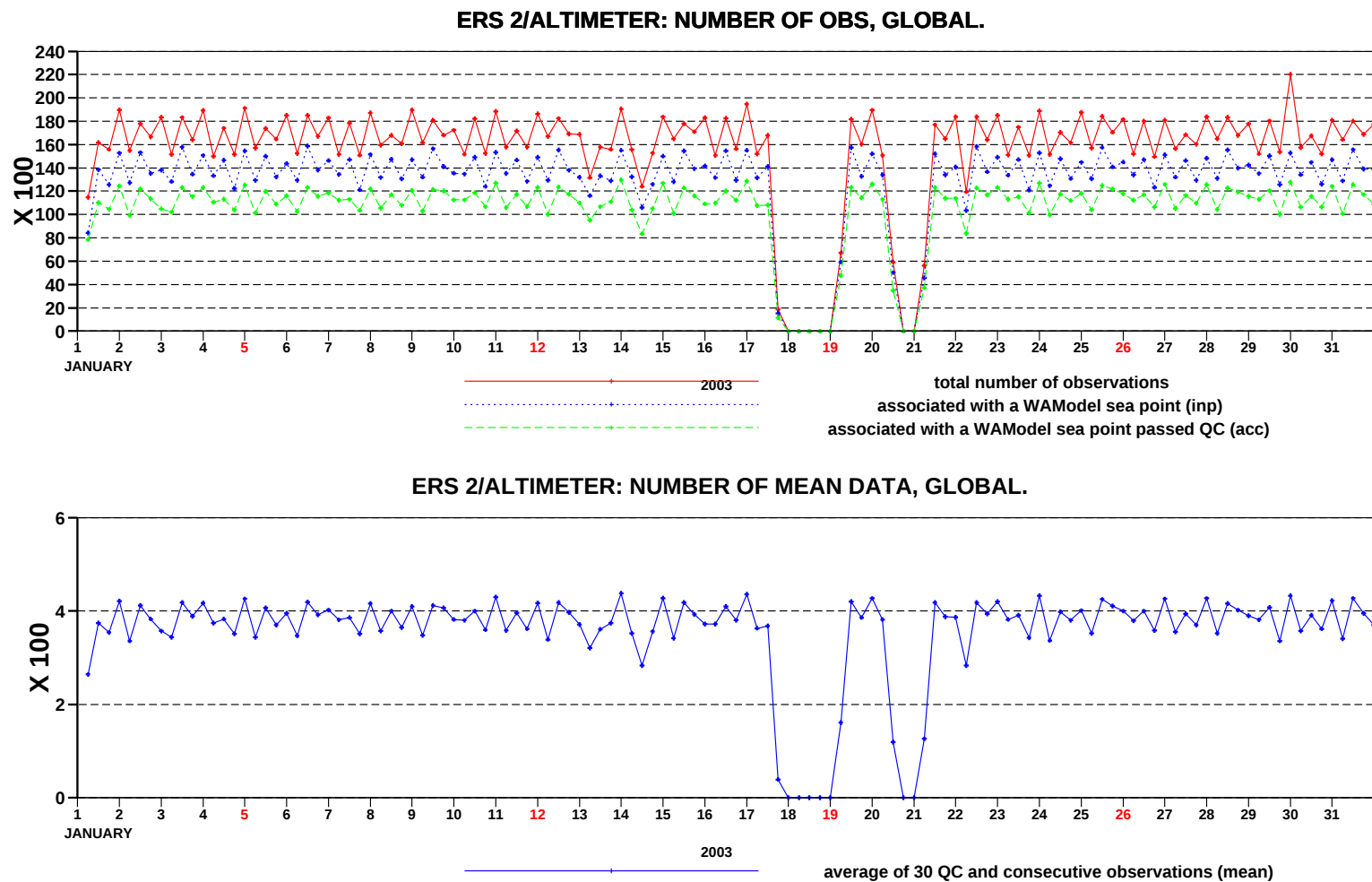


Figure 1: Time series of data reception for ERS-2 Altimeter data for January 2003

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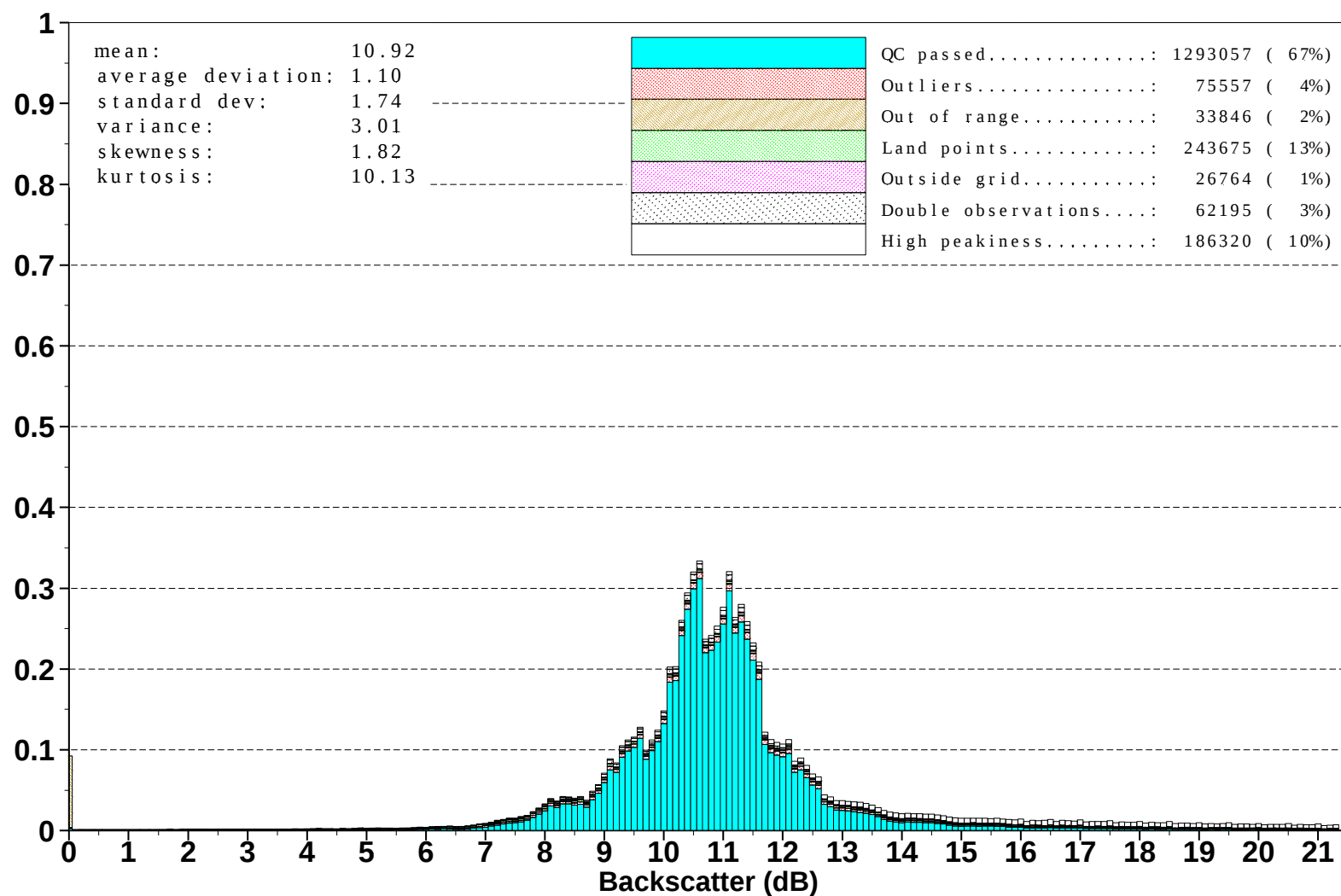


Figure 2: Distribution of the ERS-2 Altimeter backscatter after QC for January 2003

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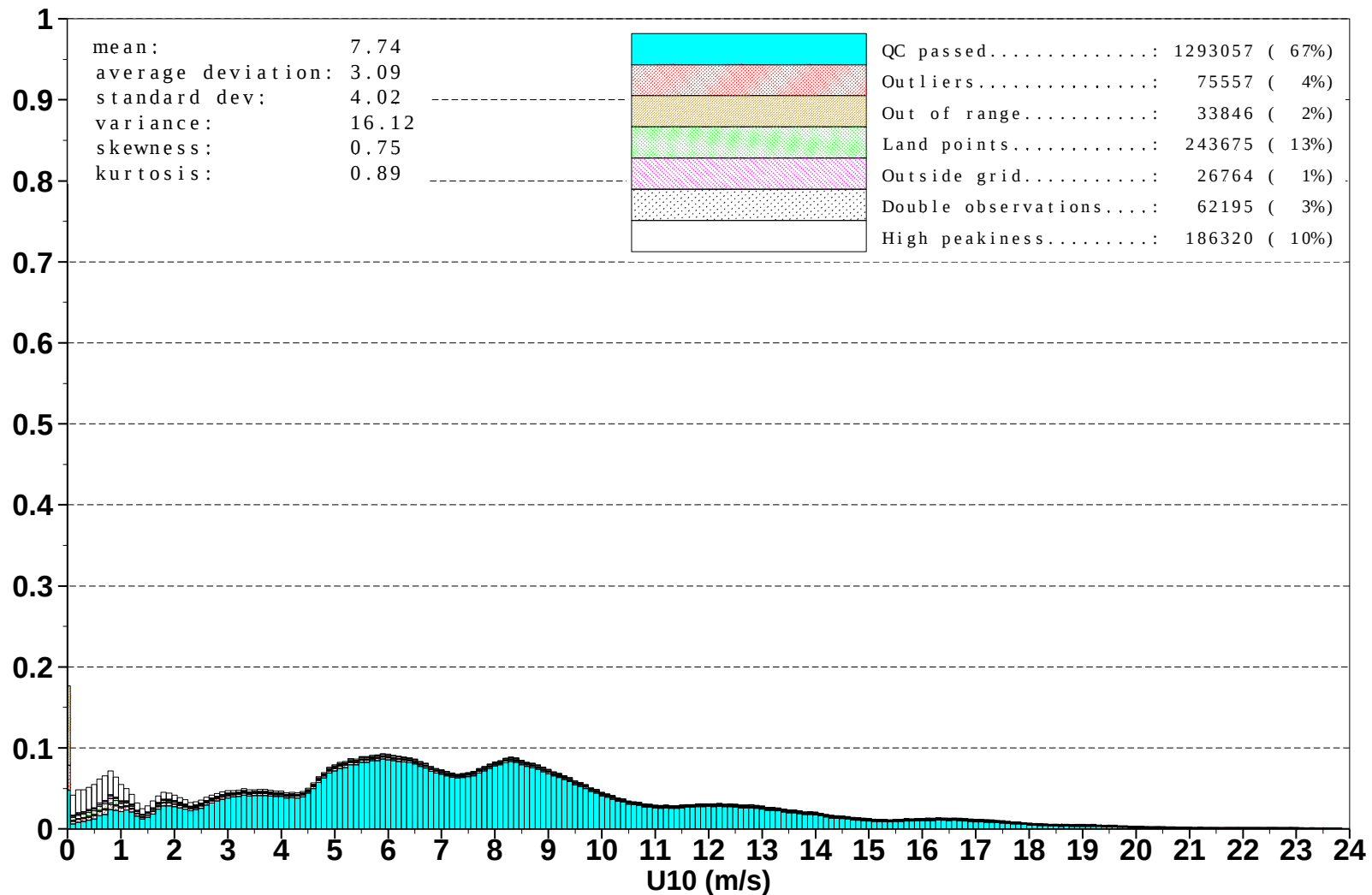


Figure 3: Distribution of the ERS-2 Altimeter wind speeds after QC for January 2003



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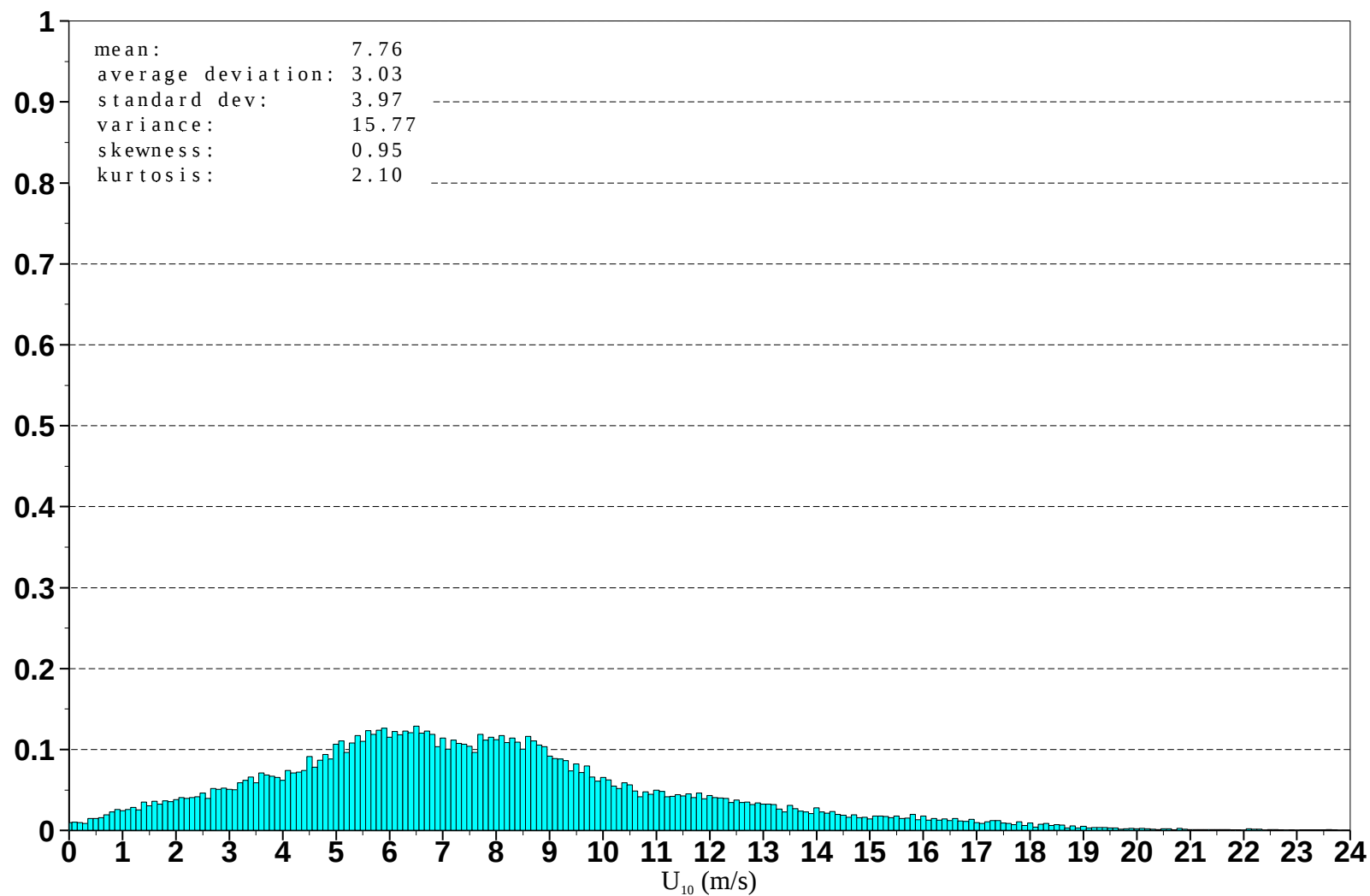


Figure 4: Distribution of ERS-2 Altimeter wind speeds after along track averaging for January 2003

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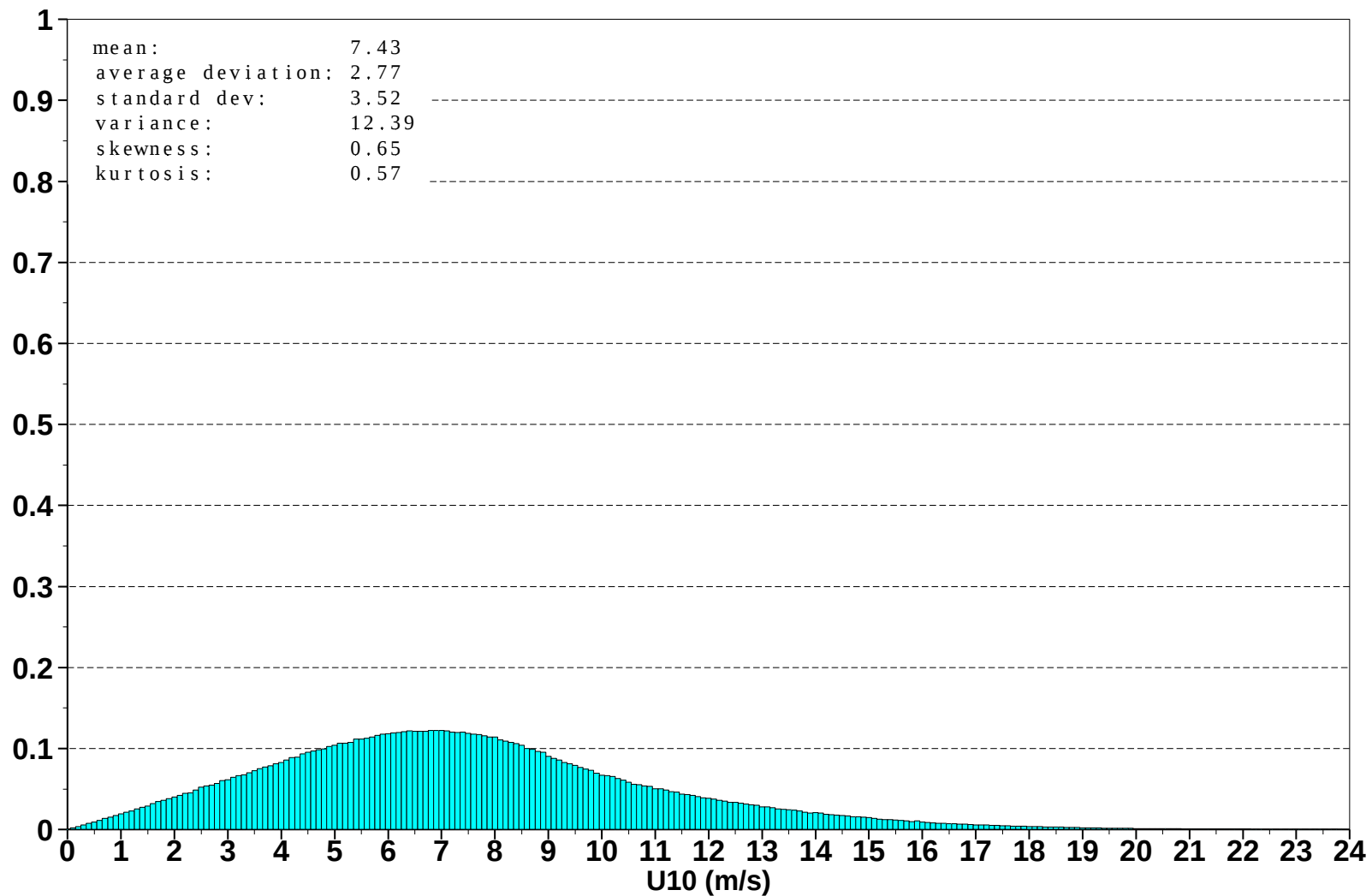


Figure 5: Global distribution of ECMWF ocean surface wind speeds for January 2003

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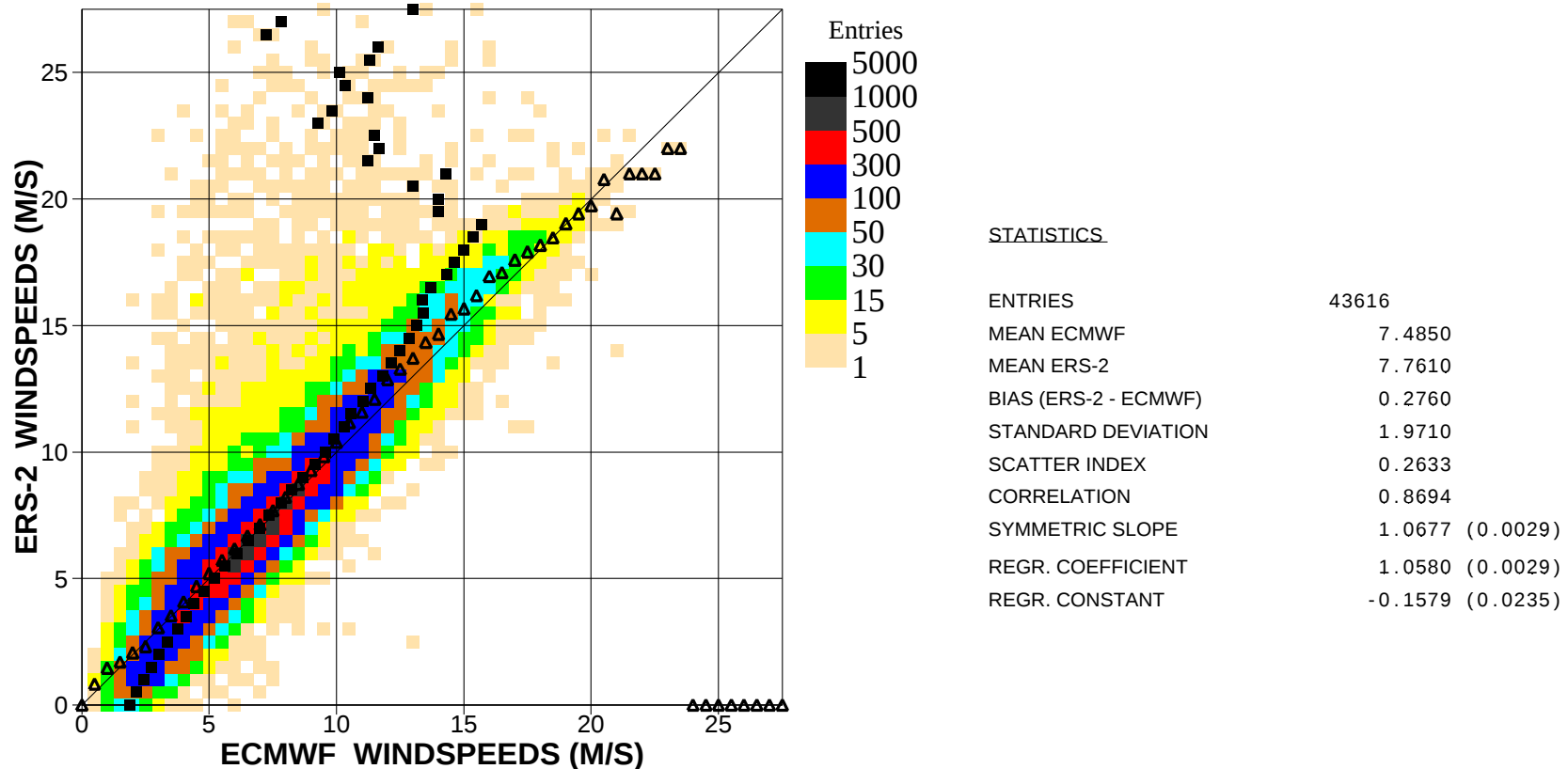


Figure 6. Comparison of ECMWF wind speed results with ERS2 Altimeter wind speed data for January 2003 (global)

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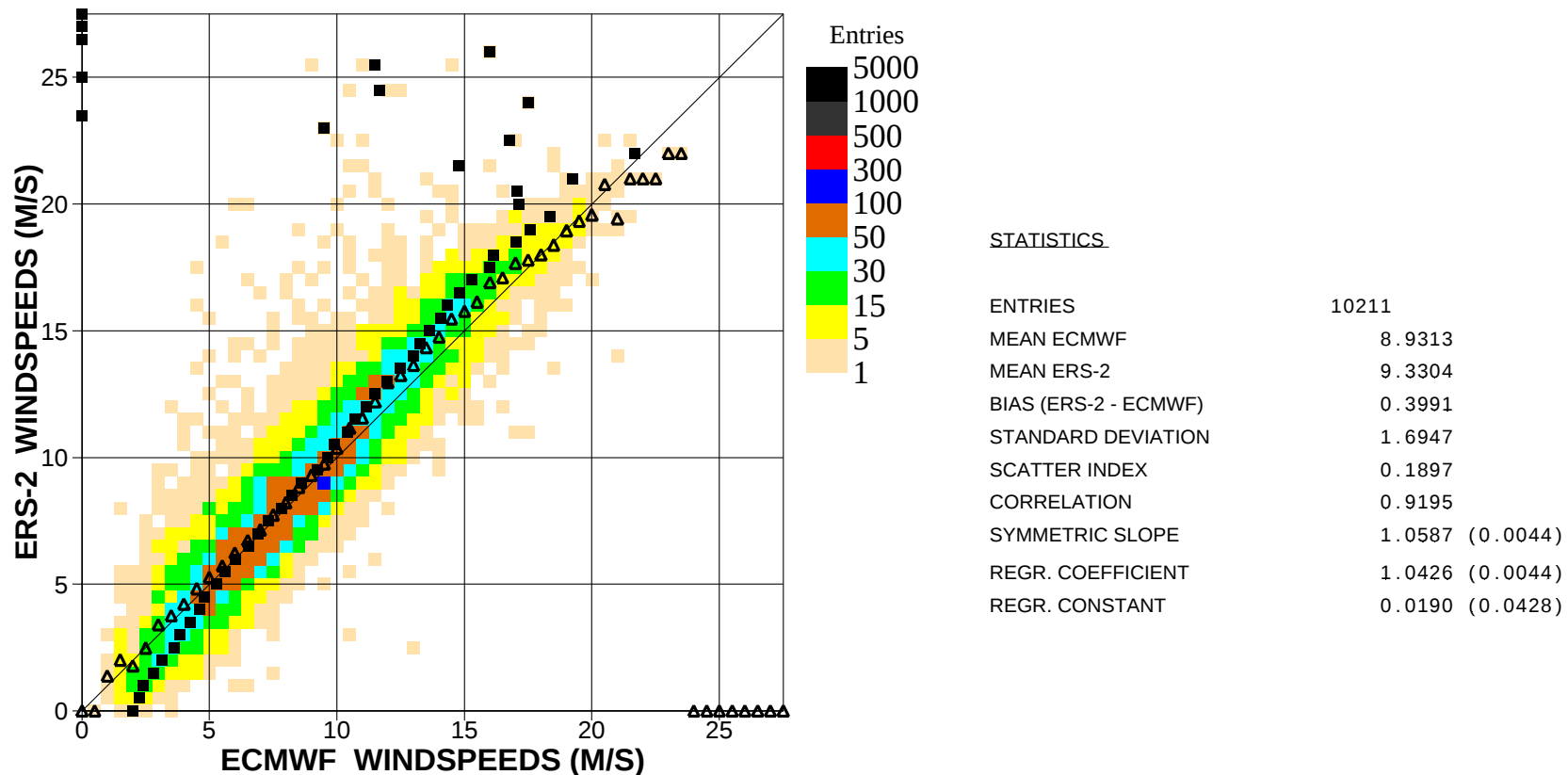


Figure 7. Comparison of ECMWF wind speed results with ERS2 Altimeter wind speed data for January 2003 (n.hem.)

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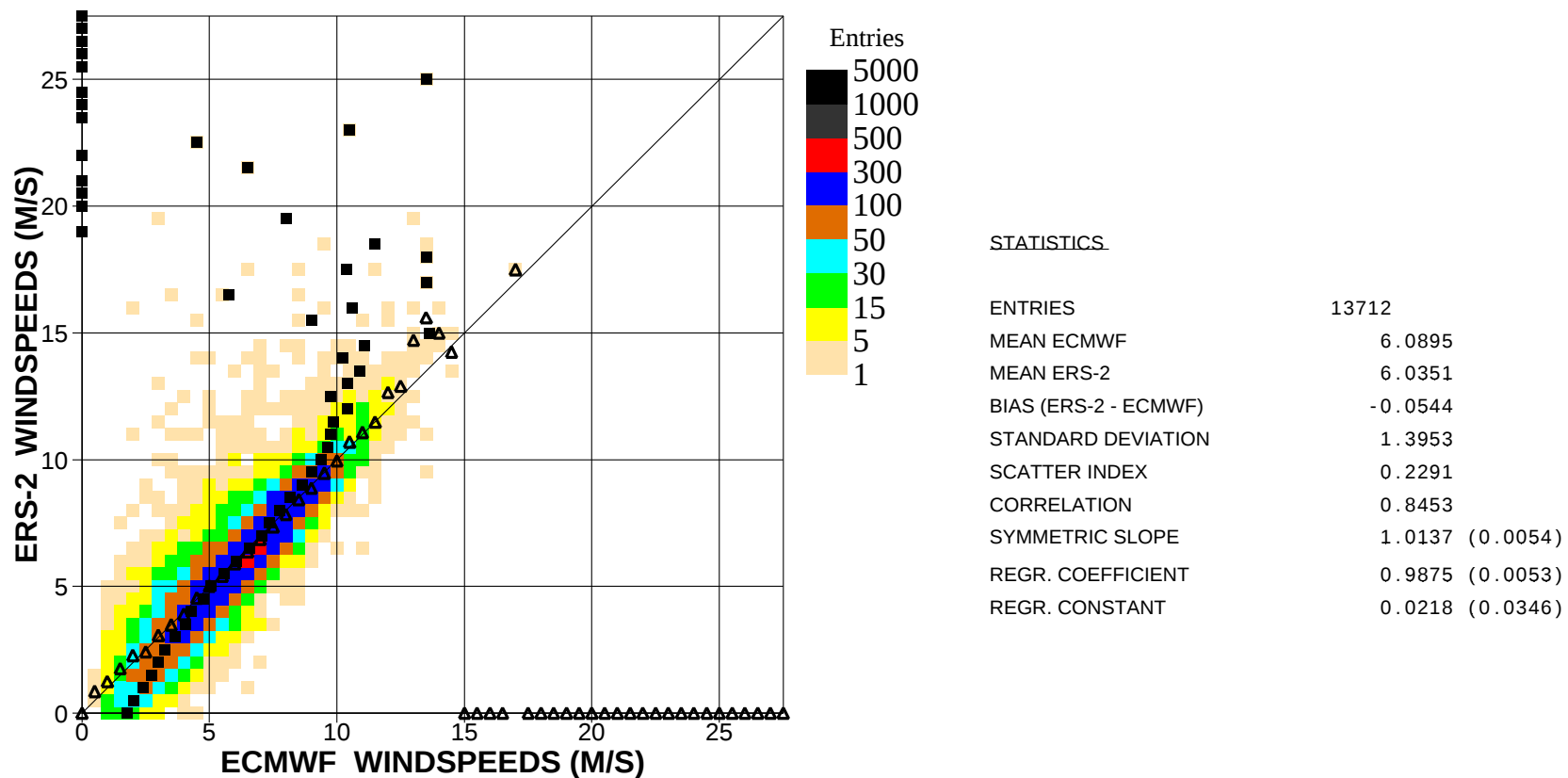


Figure 8. Comparison of ECMWF wind speed results with ERS2 Altimeter wind speed data for January 2003 (tropics)

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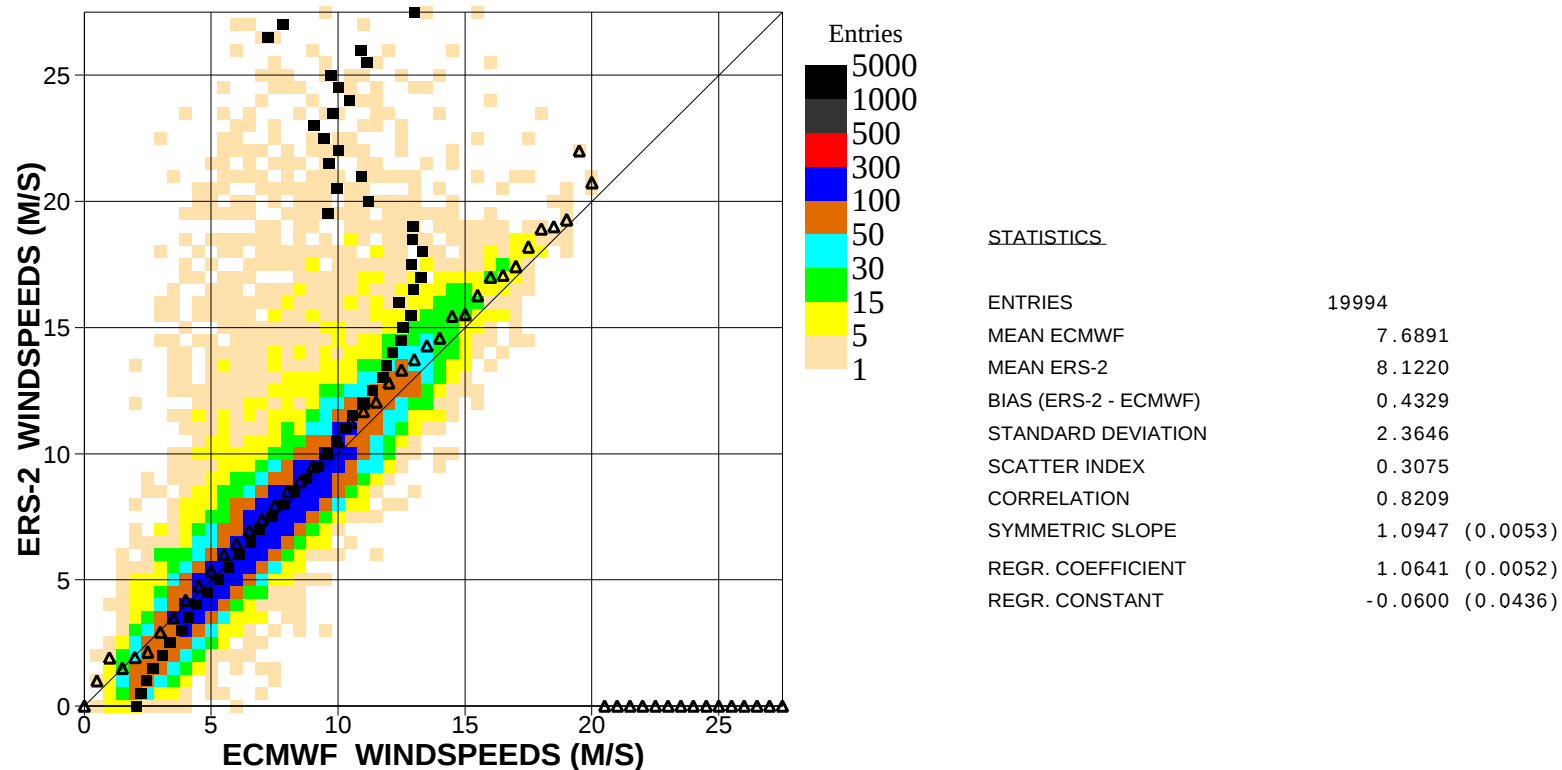


Figure 9. Comparison of ECMWF wind speed results with ERS2 Altimeter wind speed data for January 2003 (s.hem.)

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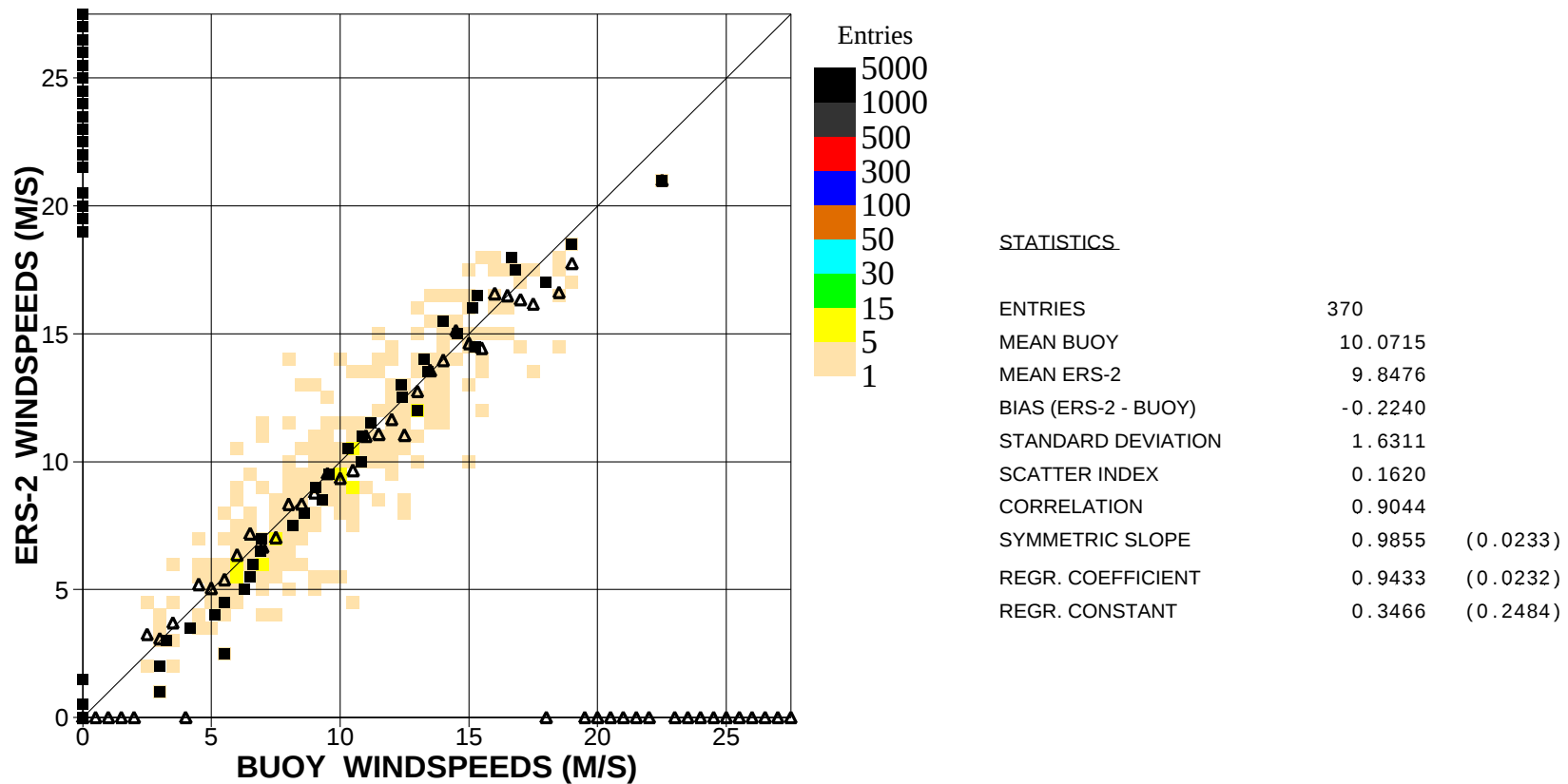


Figure 10. Comparison of buoy wind speed observations with ERS2 Altimeter wind speed data for January 2003 (global)

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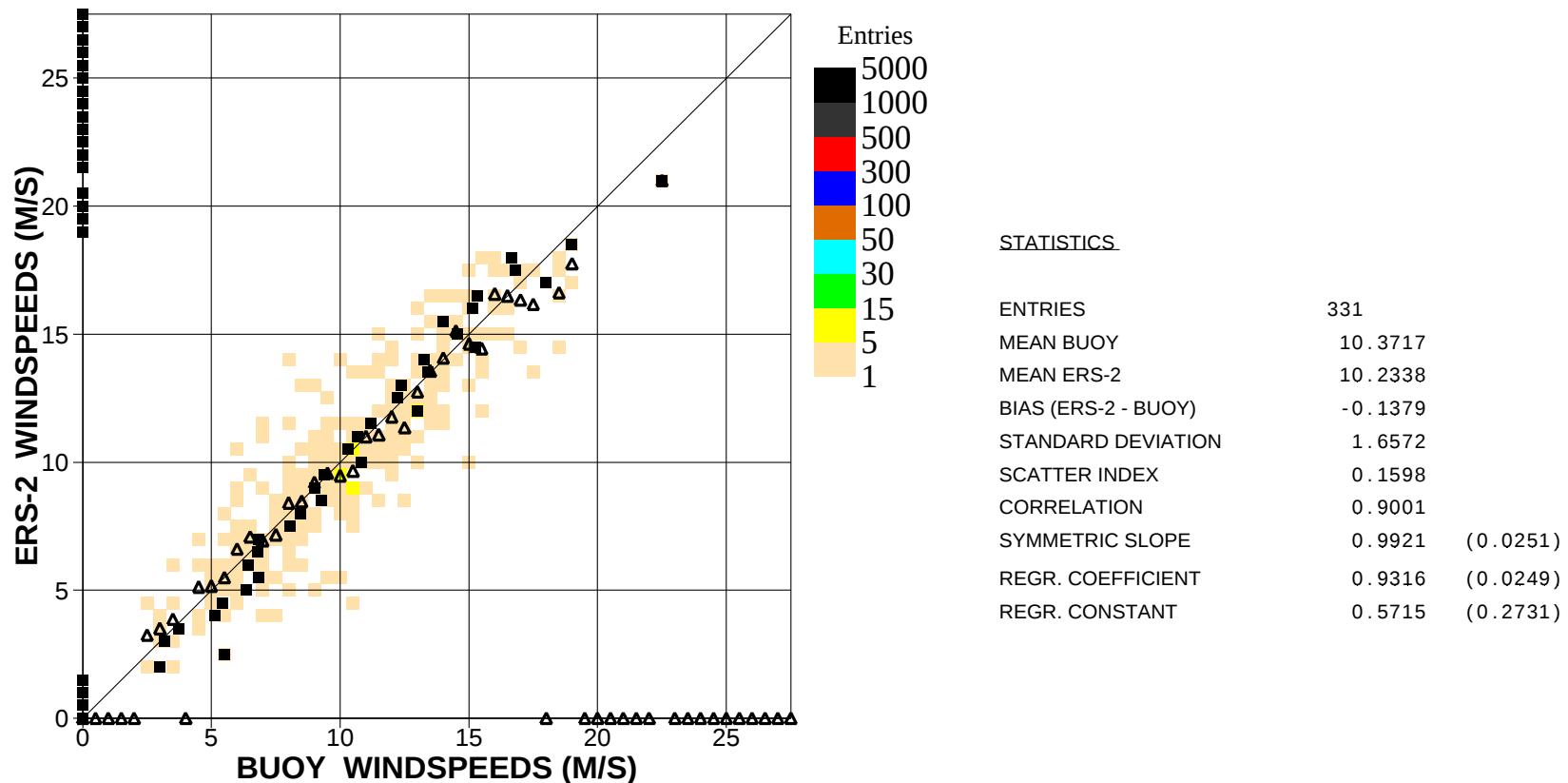


Figure 11. Comparison of buoy wind speed observations with ERS2 Altimeter wind speed data for January 2003 (n.hem.)

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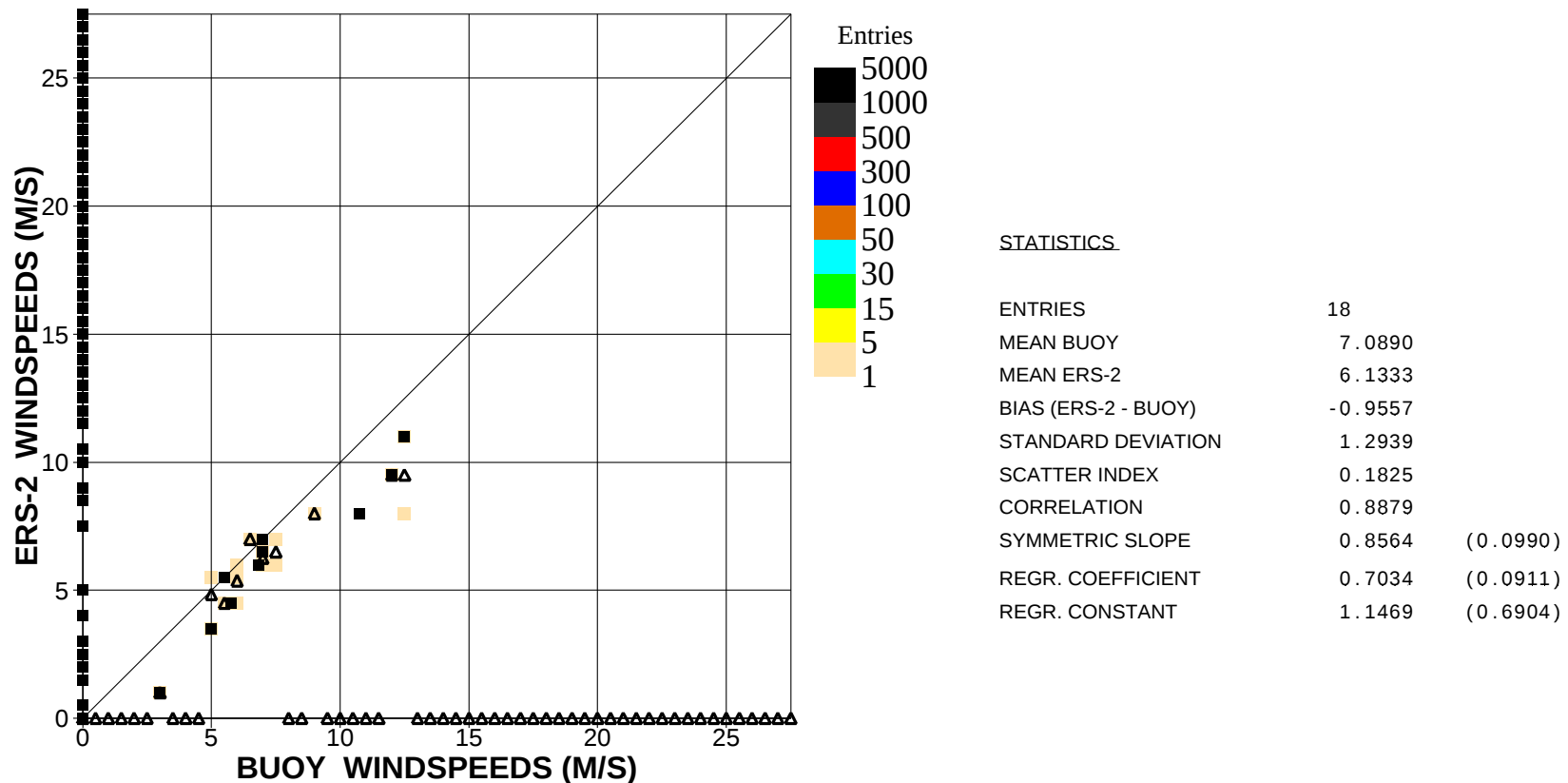


Figure 12. Comparison of buoy wind speed observations with ERS2 Altimeter wind speed data for January 2003 (hawaii)

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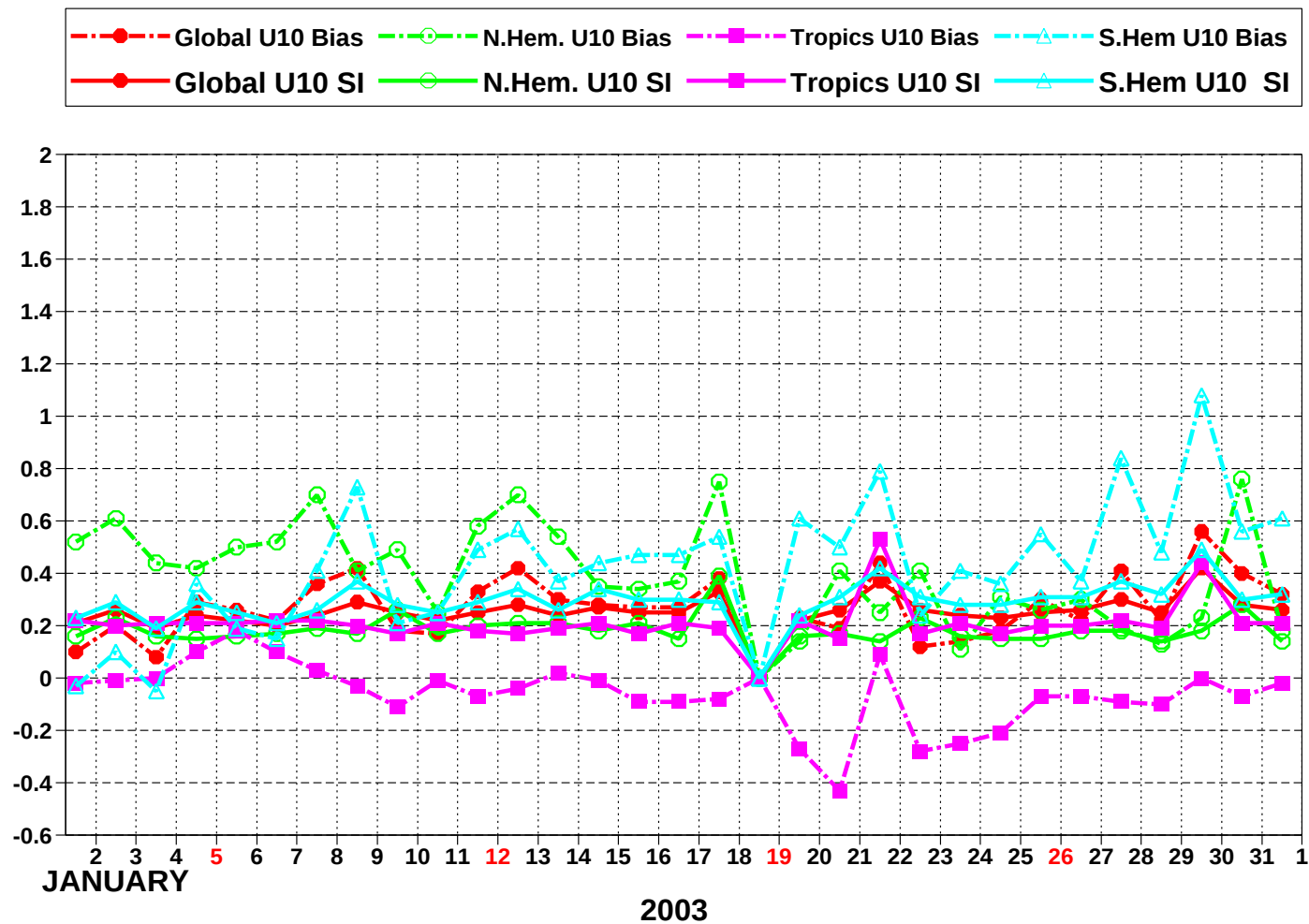


Figure 13: ERS-2 Altimeter wind speeds: Timeseries of bias (ERS-2 - model) and scatter index (SI)

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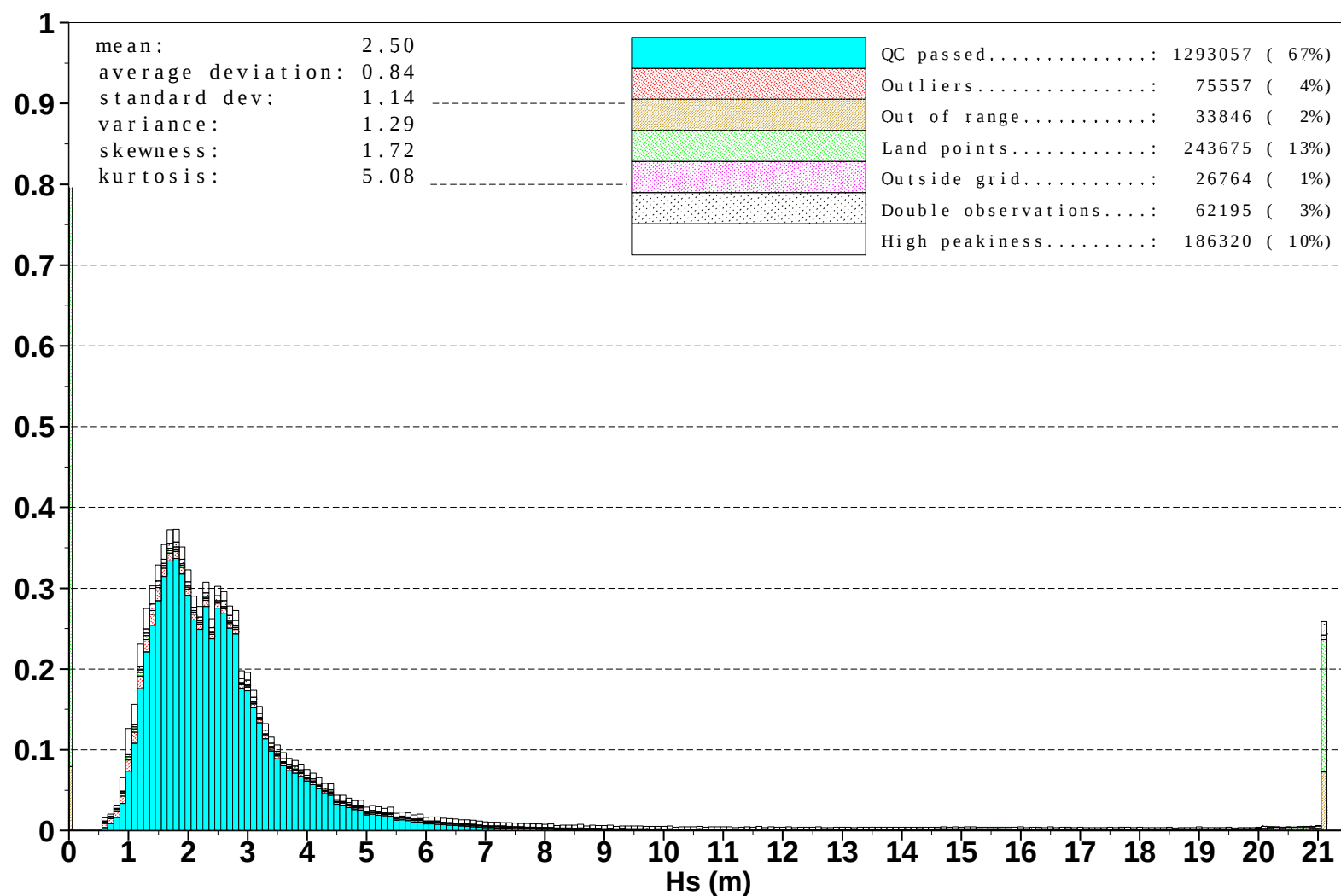
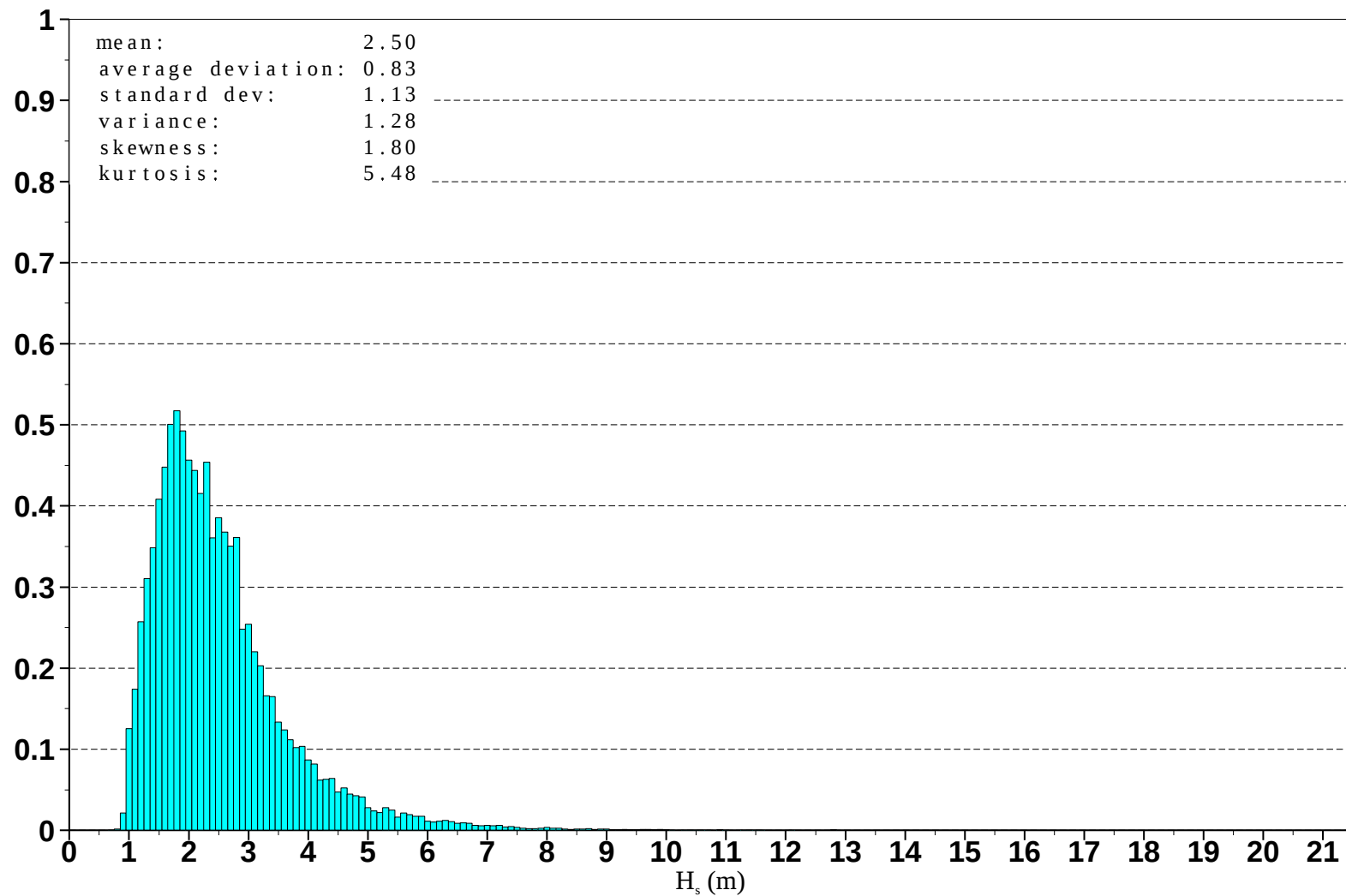


Figure 14: Distribution of the ERS-2 Altimeter wave heights after QC for January 2003

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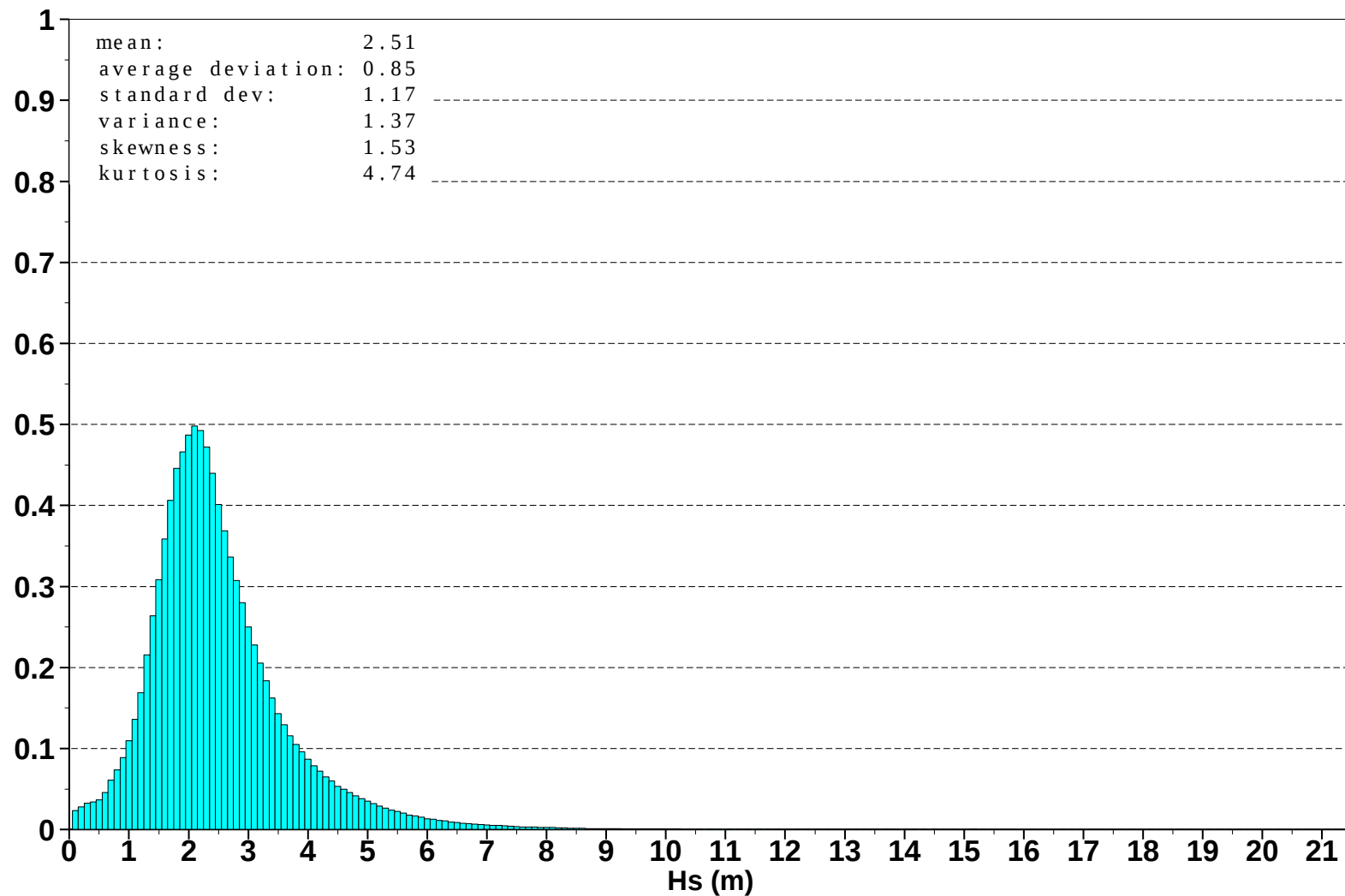


Figure 16: Global distribution of ECMWF wave heights for January 2003



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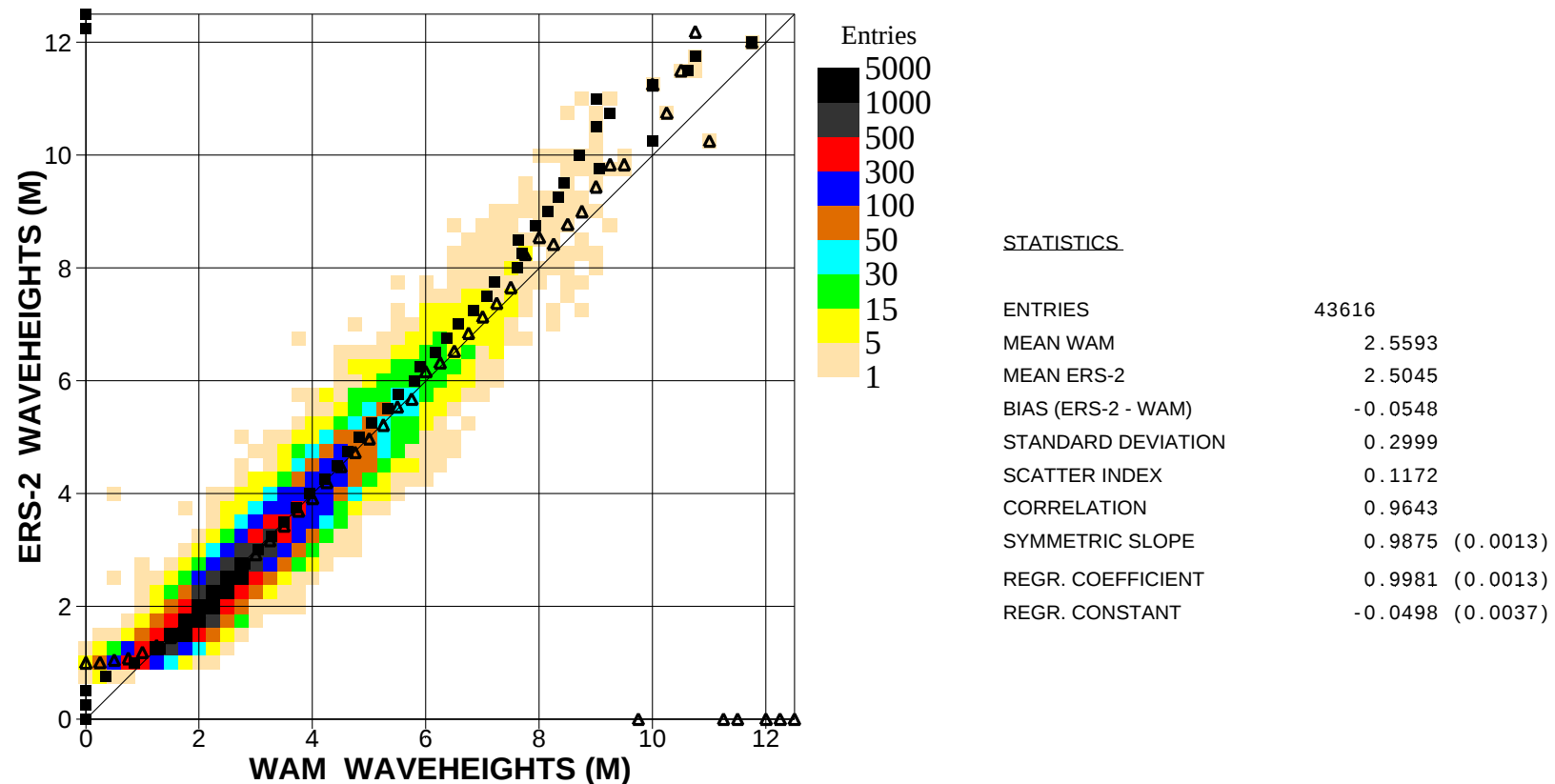


Figure 17. Comparison of ECMWF wave height results with ERS2 Altimeter wave height data for January 2003 (global)

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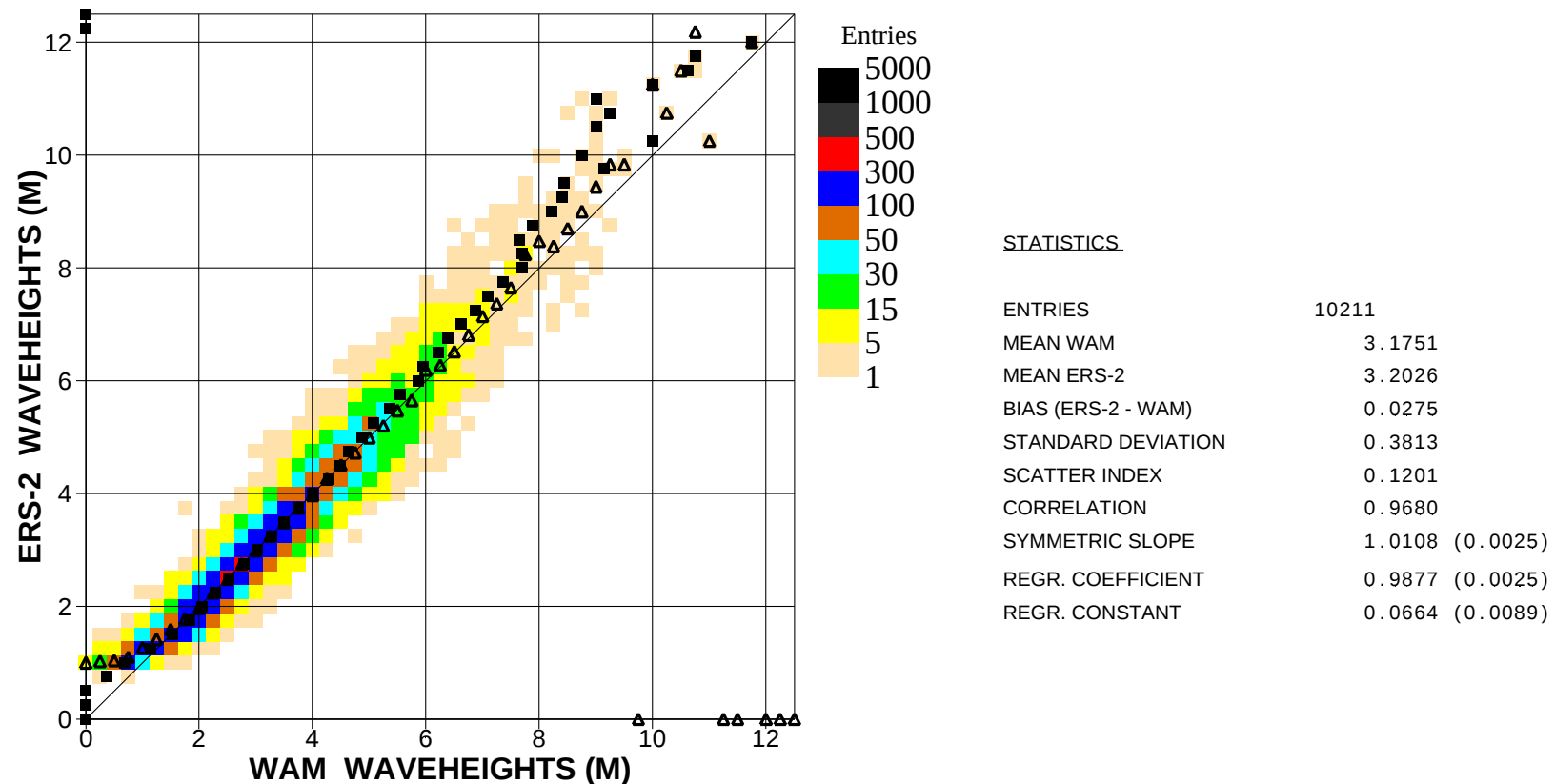


Figure 18. Comparison of ECMWF wave height results with ERS2 Altimeter wave height data for January 2003 (n.hem.)

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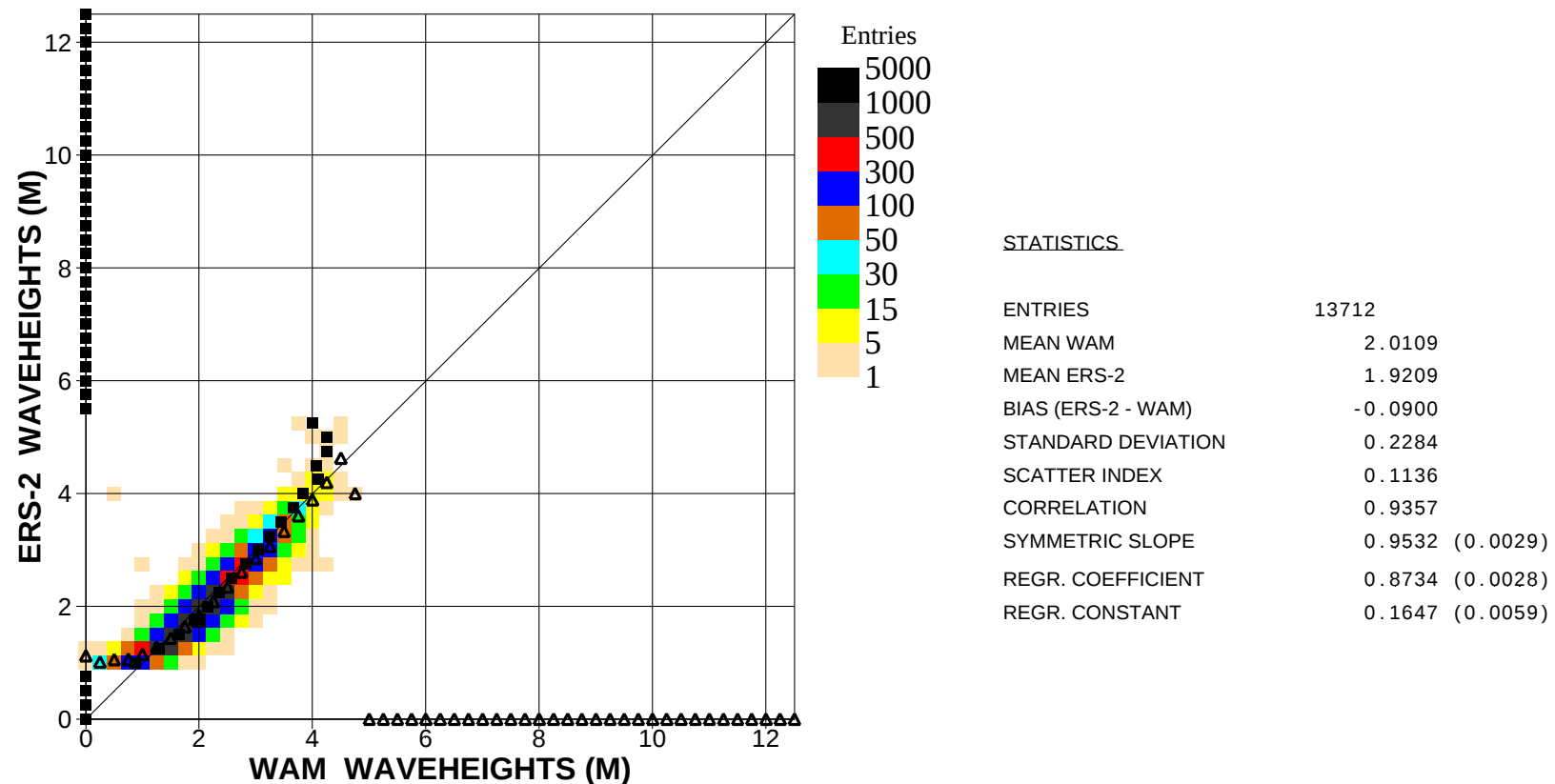


Figure 19. Comparison of ECMWF wave height results with ERS2 Altimeter wave height data for January 2003 (tropics)

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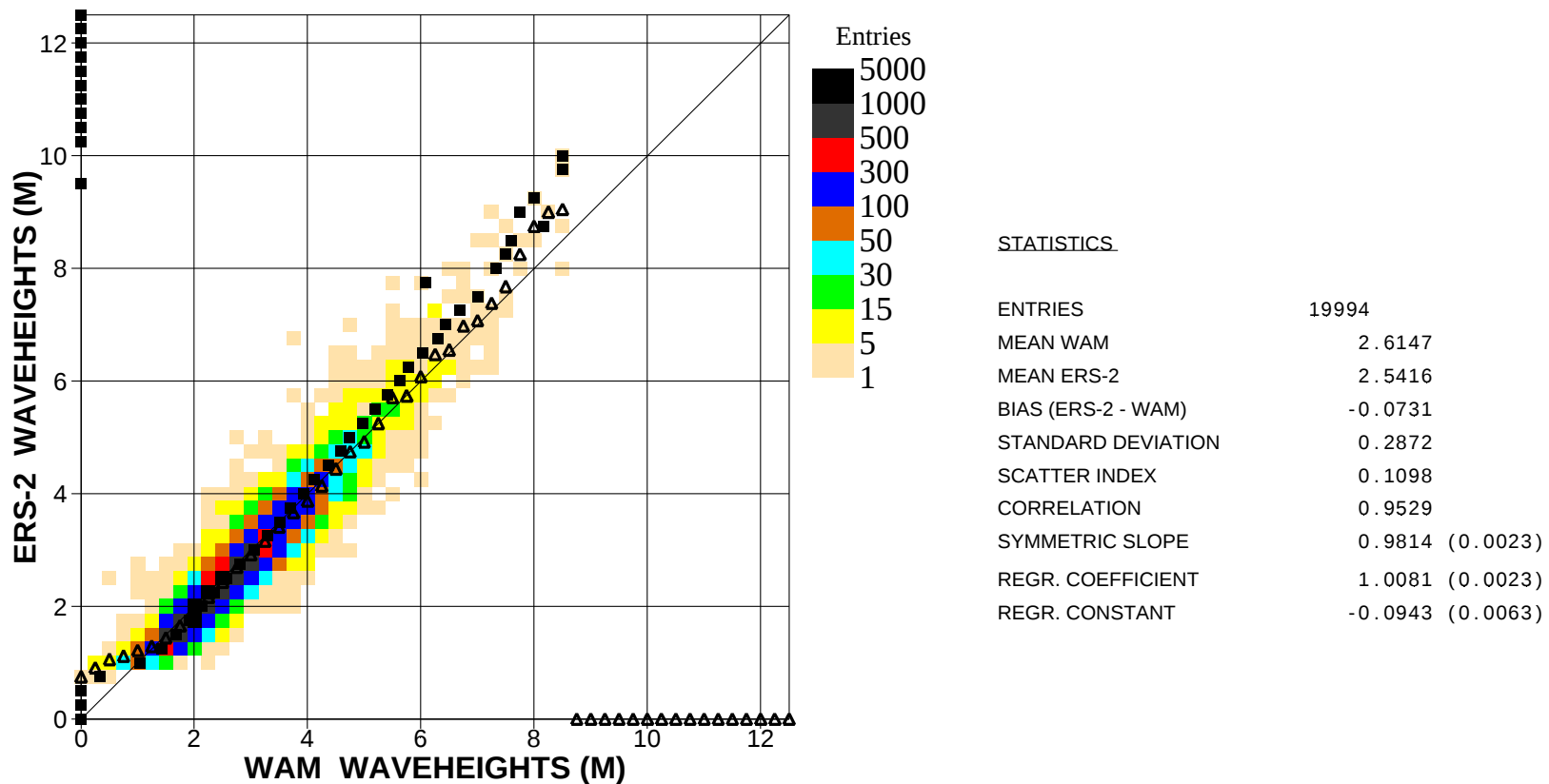


Figure 20. Comparison of ECMWF wave height results with ERS2 Altimeter wave height data for January 2003 (s.hem.)

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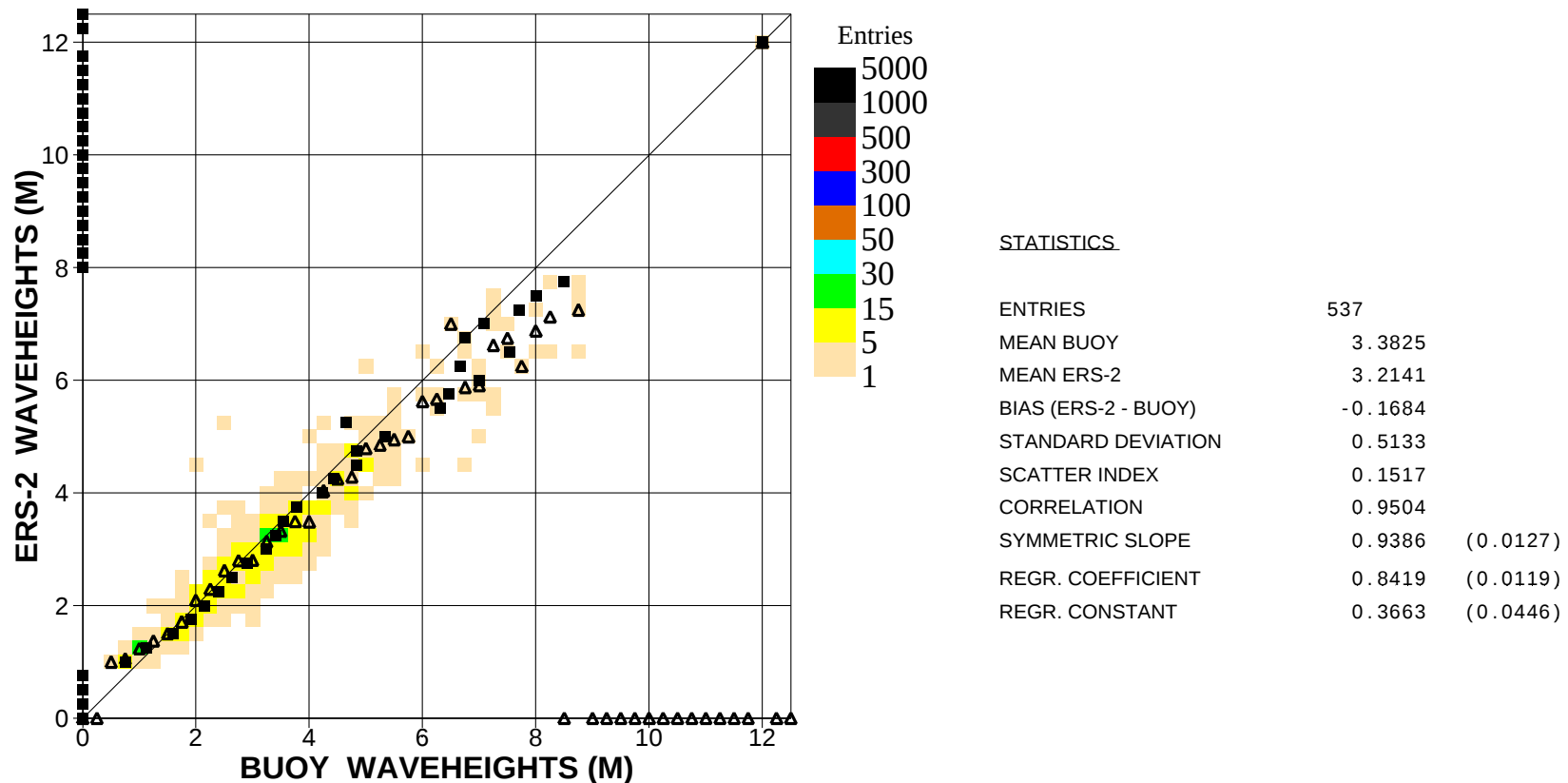


Figure 21. Comparison of buoy wave height observations with ERS2 Altimeter wave height data for January 2003 (global)

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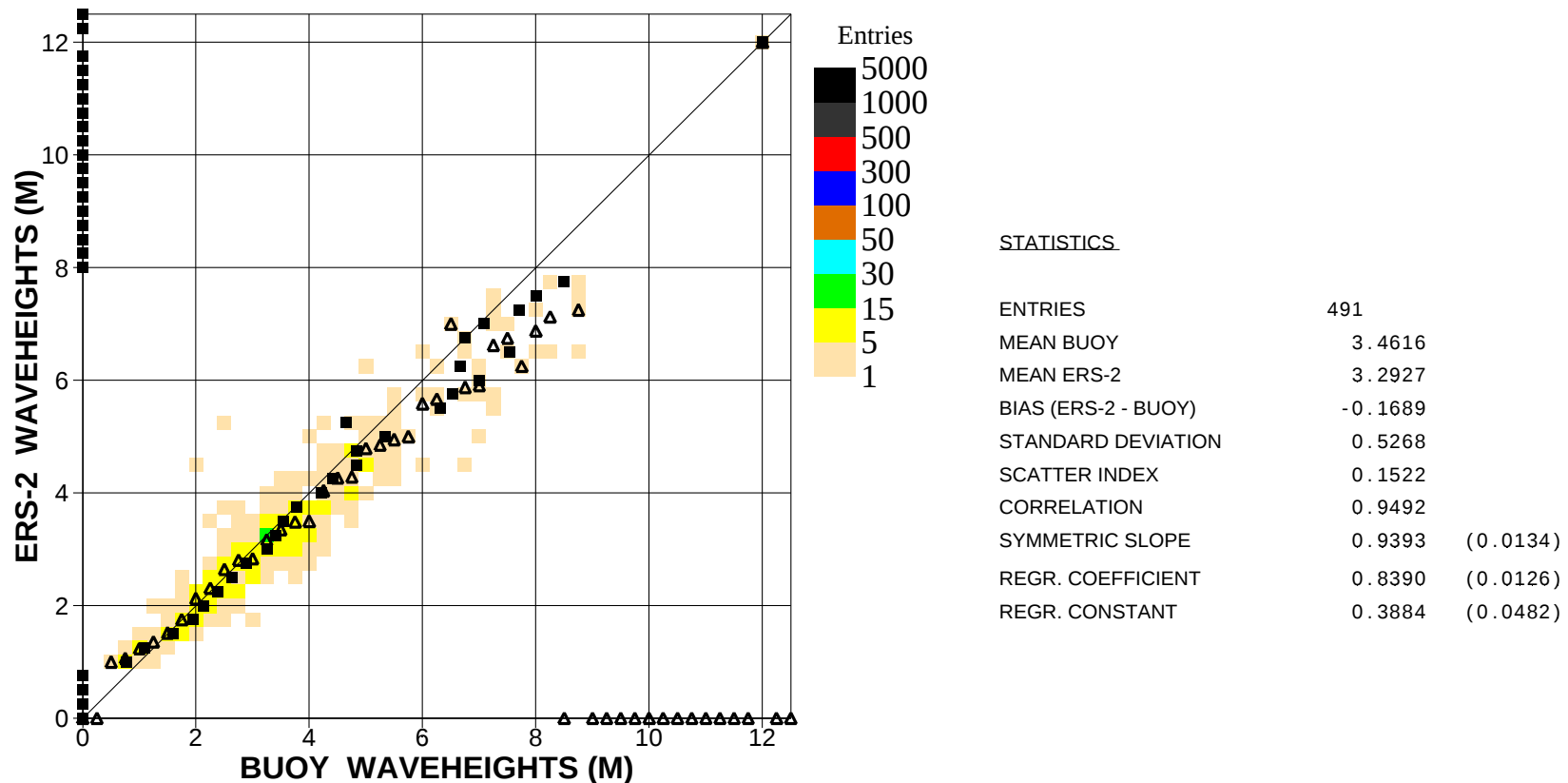


Figure 22. Comparison of buoy wave height observations with ERS2 Altimeter wave height data for January 2003 (n.hem.)

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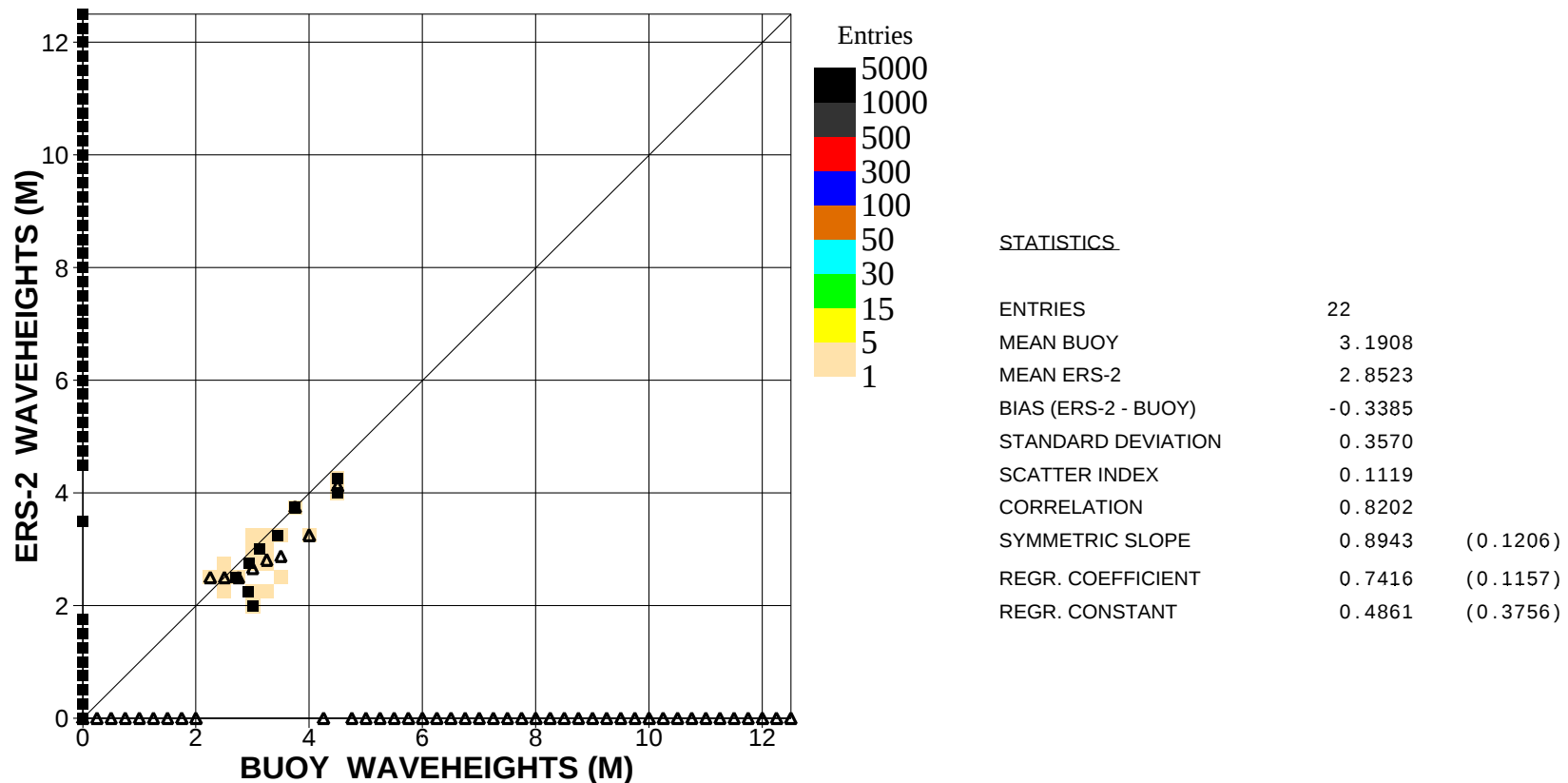


Figure 23. Comparison of buoy wave height observations with ERS2 Altimeter wave height data for January 2003 (hawaii)

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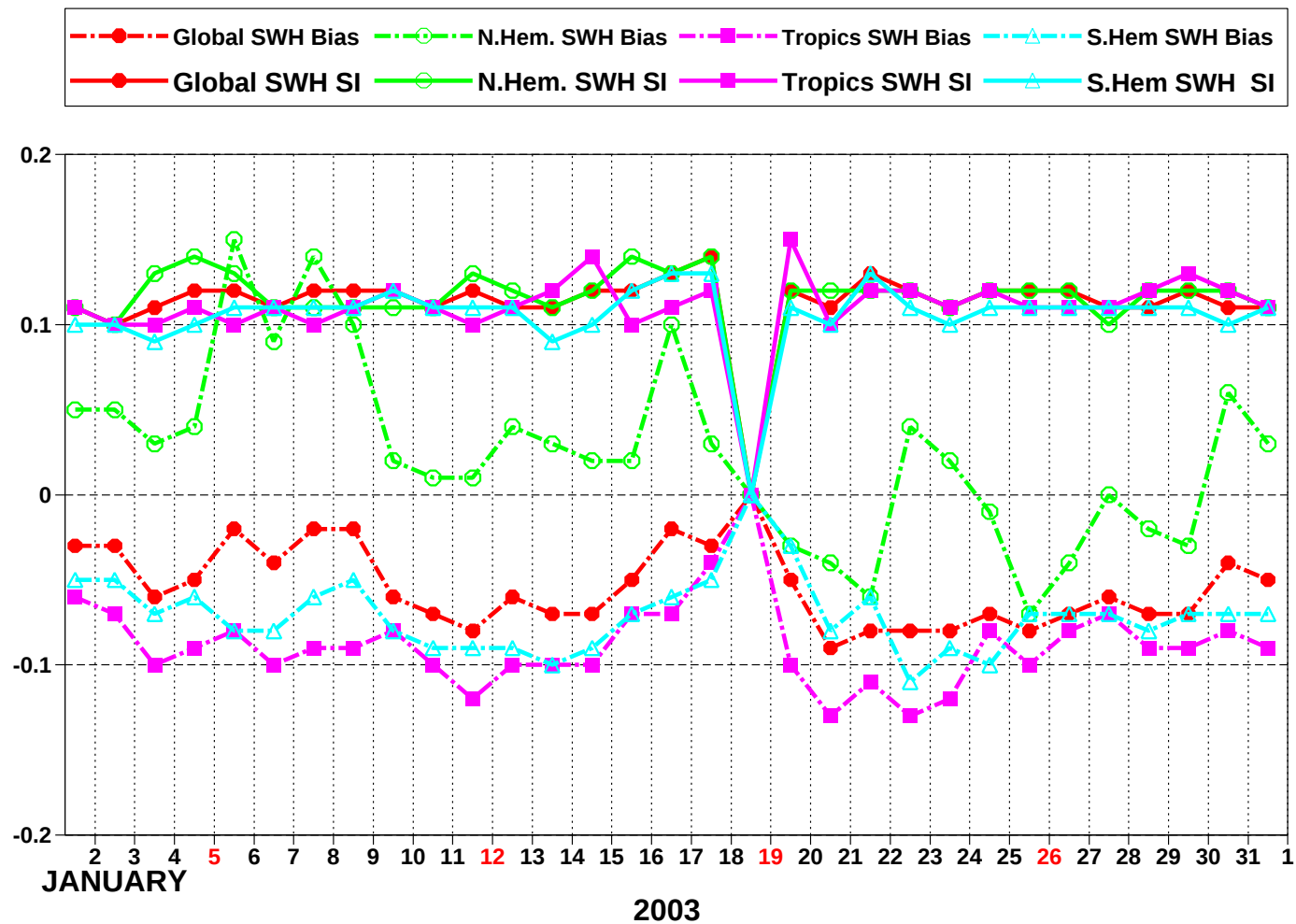


Figure 24: ERS-2 Altimeter wave heights: Timeseries of bias (ERS-2 - model) and scatter index (SI)

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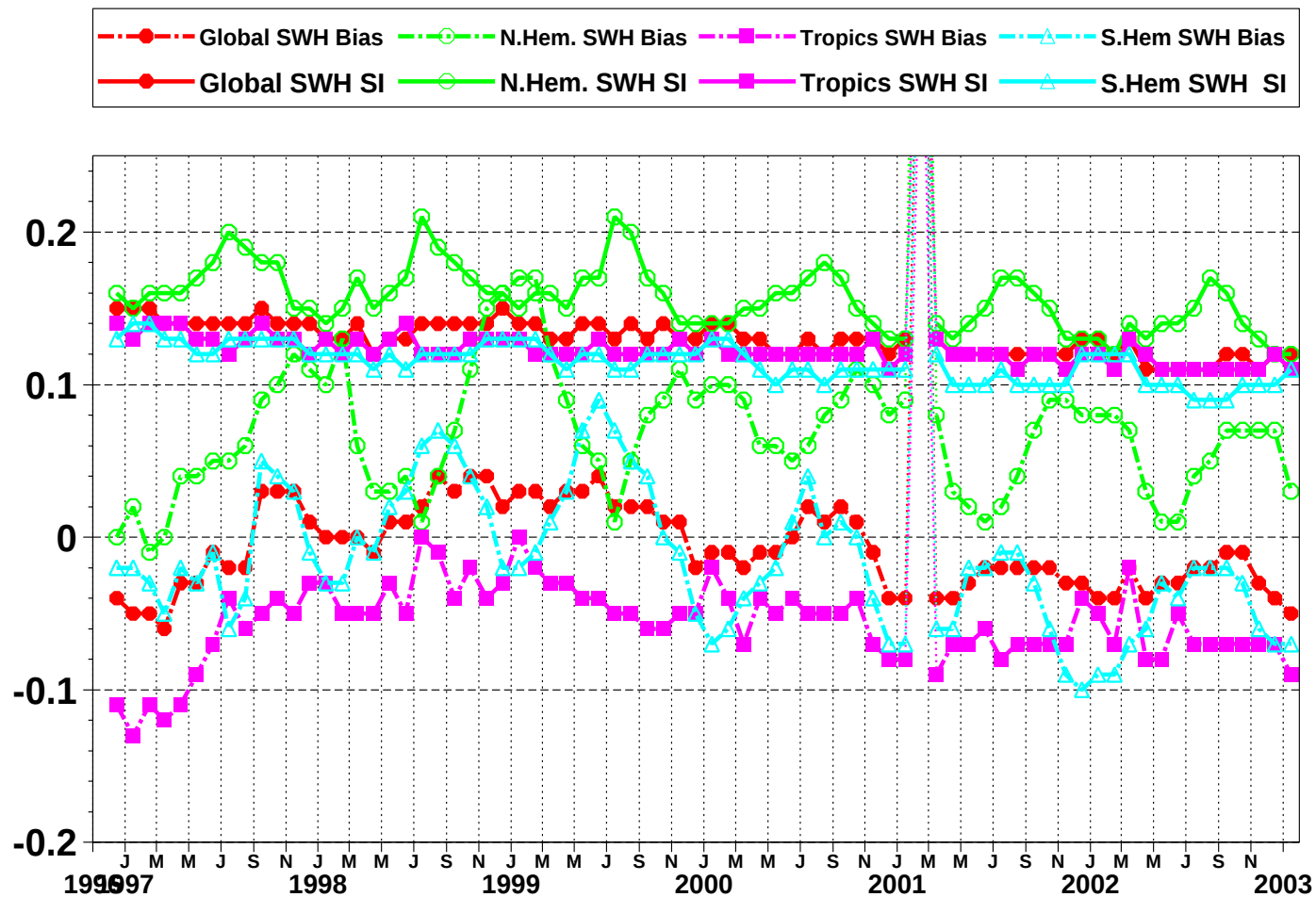


Figure 25: ERS-2 Altimeter wave heights: Timeseries of bias (ERS-2 - model) and scatter index (SI)

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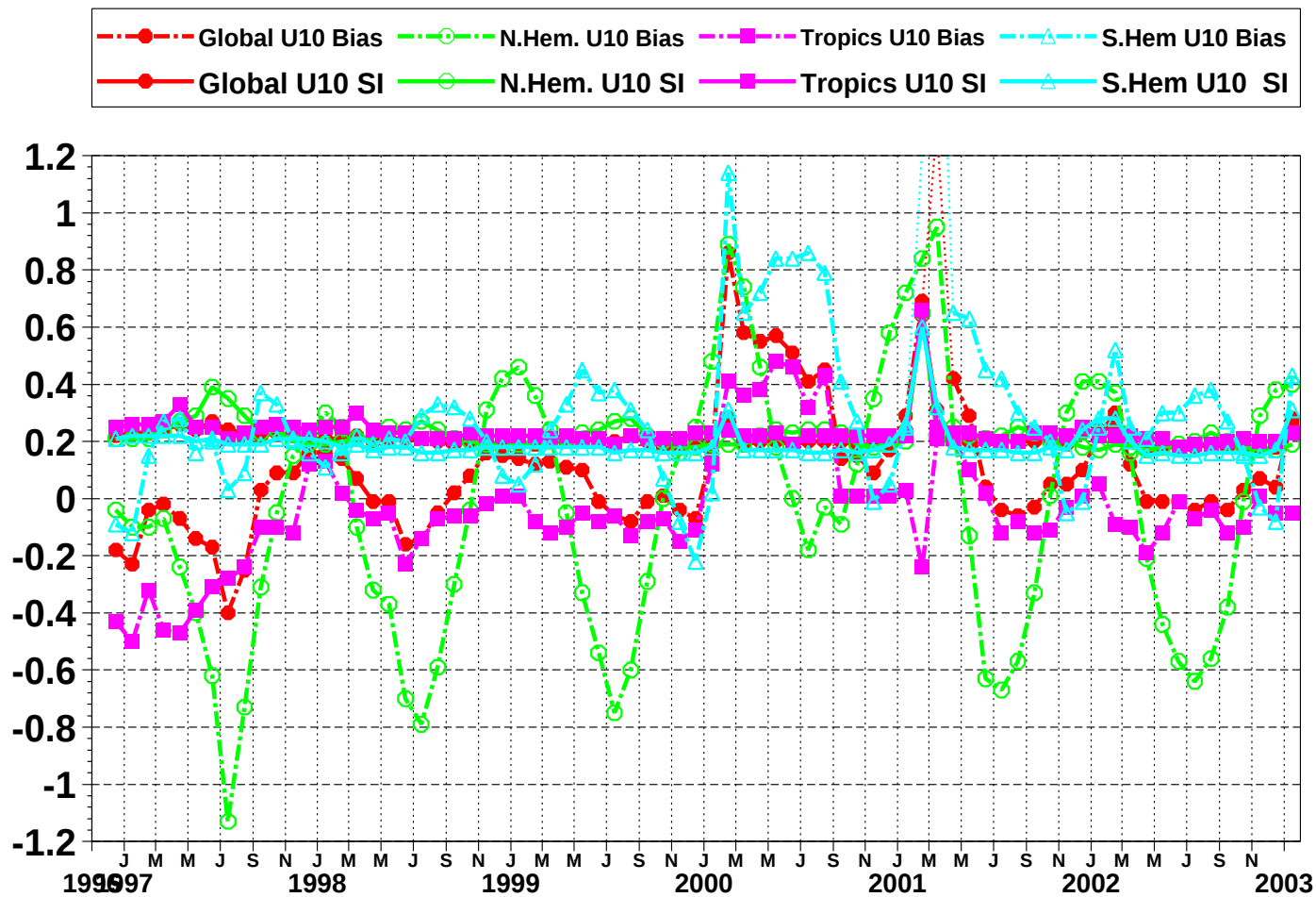


Figure 26: ERS-2 Altimeter wind speeds: Timeseries of bias (ERS-2 - model) and scatter index (SI)