

■ ECMWF Report on ERS-2 RA for January 2001 ■

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

By: Saleh Abdalla

Date: 8 February 2001

Overview:

Based on the data received during the first 17 days of the month (before the ERS-2 shutdown, see below), on average, 16165 observations arrived at ECMWF every 6 hours of which 82.09% passed the quality control for this month. No data was received after 19:53 UTC on 17 January. This is due to an on-board anomaly which forced all the ERS-2 Payload instruments to be switched off as reported by the ESA Earth Observation Missions Helpdesk Team (EOHelp). During the first 17 days of the month, there were 3 '6-hour' time slots with significant reduction of data reception: 06:00 and 12:00 UTC on the 10th and 12:00 UTC on the 16th of January. The data coverage can be seen in Figure 1. Note that we are talking about the raw data which have arrived at ECMWF before they were processed.

Starting from January 12, the wind speed data started to be of low quality. This was reported at that time. Pierre Femenias pointed out the possible role of the "Sun Blinding Effect". Examination of the along-orbit time series showed that this effect is indeed causing the Altimeter wind speeds to shoot around latitude 40° S (starts at about 35° S and ends at about 45° S with its peak at 40°) compared to the model winds during ascending tracks only (about 80% of the ascending tracks). This situation can be clearly seen in Figure 13 and the scatter of Figure 9. The "Sun Blinding Effect" does not have any impact on wave height data as can be inferred from Figures 20 and 24.



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Backscatter:

ERS-2 $\langle \sigma_0 \rangle = 11.03$ dB (with one main peak at 11.1 dB)

Wind Speed Comparison with ECMWF wind speeds (bias):

ERS-2 global: 0.294 m/s

ERS-2 northern hemisphere: 0.723 m/s

ERS-2 tropics: 0.031 m/s

ERS-2 southern hemisphere: 0.249 m/s

Wind Speed Comparison with buoy wind speeds (bias):

ERS-2 global: 0.153 m/s

ERS-2 northern hemisphere: 0.261 m/s

ERS-2 tropics: -0.980 m/s

Wave Height Comparison with ECMWF wave heights (bias):

ERS-2 global: -0.037 m (lowest waves measured: 0.6m)

ERS-2 northern hemisphere: 0.093 m

ERS-2 tropics: -0.078 m

ERS-2 southern hemisphere: -0.075 m



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Wave Height Comparison with buoy wave heights (bias):

ERS-2 global: -0.15 m

ERS-2 northern hemisphere: -0.15 m

ERS-2 tropics: -0.26 m

Remarks:

- The Altimeter has been switched off since 19:53 UTC on 17 January 2001.
- Compared to the buoy data, the ERS2 wave height showed exceptionally good quality this month as well.
- The “Sun Blinding Effect”, mentioned earlier, is due to a special configuration of the Earth, the satellite, and the Sun in which the DES (Digital Earth Sensor, the active sensor in the computation of the platform attitude) gets directly the sun and blinds it. This occurs around latitude 40° S for the ascending tracks only and for a period going from mid-January to early March. This impact on the data started when since the change from the three-gyro to the single-gyro piloting early 2000.

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.



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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 January 2001.

Figure 2: Distribution of the ERS-2 Altimeter Backscatter after QC for January 2001.

Figure 3: Distribution of the ERS-2 Altimeter wind speeds after QC for January 2001.

Figure 4: Distribution of the ERS-2 Altimeter wind speeds after along track averaging for January 2001.

Figure 5: Global distribution of ECMWF ocean surface wind speeds for January 2001.

Figure 6: Comparison of ECMWF wind speed results with ERS-2 Altimeter wind speed data for January 2001 (global).

Figure 7: Comparison of ECMWF wind speed results with ERS-2 Altimeter wind speed data for January 2001 (northern hemisphere)

Figure 8: Comparison of ECMWF wind speed results with ERS-2 Altimeter wind speed data for January 2001 (tropics)

Figure 9: Comparison of ECMWF wind speed results with ERS-2 Altimeter wind speed data for January 2001 (southern hemisphere)

Figure 10: Comparison of buoy wind speed observations with ERS-2 Altimeter wind speed data for January 2001 (global).

Figure 11: Comparison of buoy wind speed observations with ERS-2 Altimeter wind speed data for January 2001 (northern hemisphere).

Figure 12: Comparison of buoy wind speed observations with ERS-2 Altimeter wind speed data for January 2001 (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 2001.

Figure 15: Distribution of the ERS-2 Altimeter wave heights after along track averaging for January 2001.



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Figure 16: Global distribution of ECMWF wave heights for January 2001.

Figure 17: Comparison of ECMWF wave height results with ERS-2 Altimeter wave height data for January 2001 (global).

Figure 18: Comparison of ECMWF wave height results with ERS-2 Altimeter wave height data for January 2001 (northern hemisphere)

Figure 19: Comparison of ECMWF wave height results with ERS-2 Altimeter wave height data for January 2001 (tropics)

Figure 20: Comparison of ECMWF wave height results with ERS-2 Altimeter wave height data for January 2001 (southern hemisphere)

Figure 21: Comparison of buoy wave height observations with ERS-2 Altimeter wave height data for January 2001 (global).

Figure 22: Comparison of buoy wave height observations with ERS-2 Altimeter wave height data for January 2001 (northern hemisphere).

Figure 23: Comparison of buoy wave height observations with ERS-2 Altimeter wave height data for January 2001 (tropics).

Figure 24: ERS-2 Altimeter wave heights: Timeseries of bias (ERS-2 - model) and scatter index (SI) for January 2001.

Figure 25: ERS-2 Altimeter wave heights: Timeseries of bias (ERS-2 - model) and scatter index (SI) from December 1996 to January 2001

Figure 26: ERS-2 Altimeter wind speeds: Timeseries of bias (ERS-2 - model) and scatter index (SI) from December 1996 to January 2001



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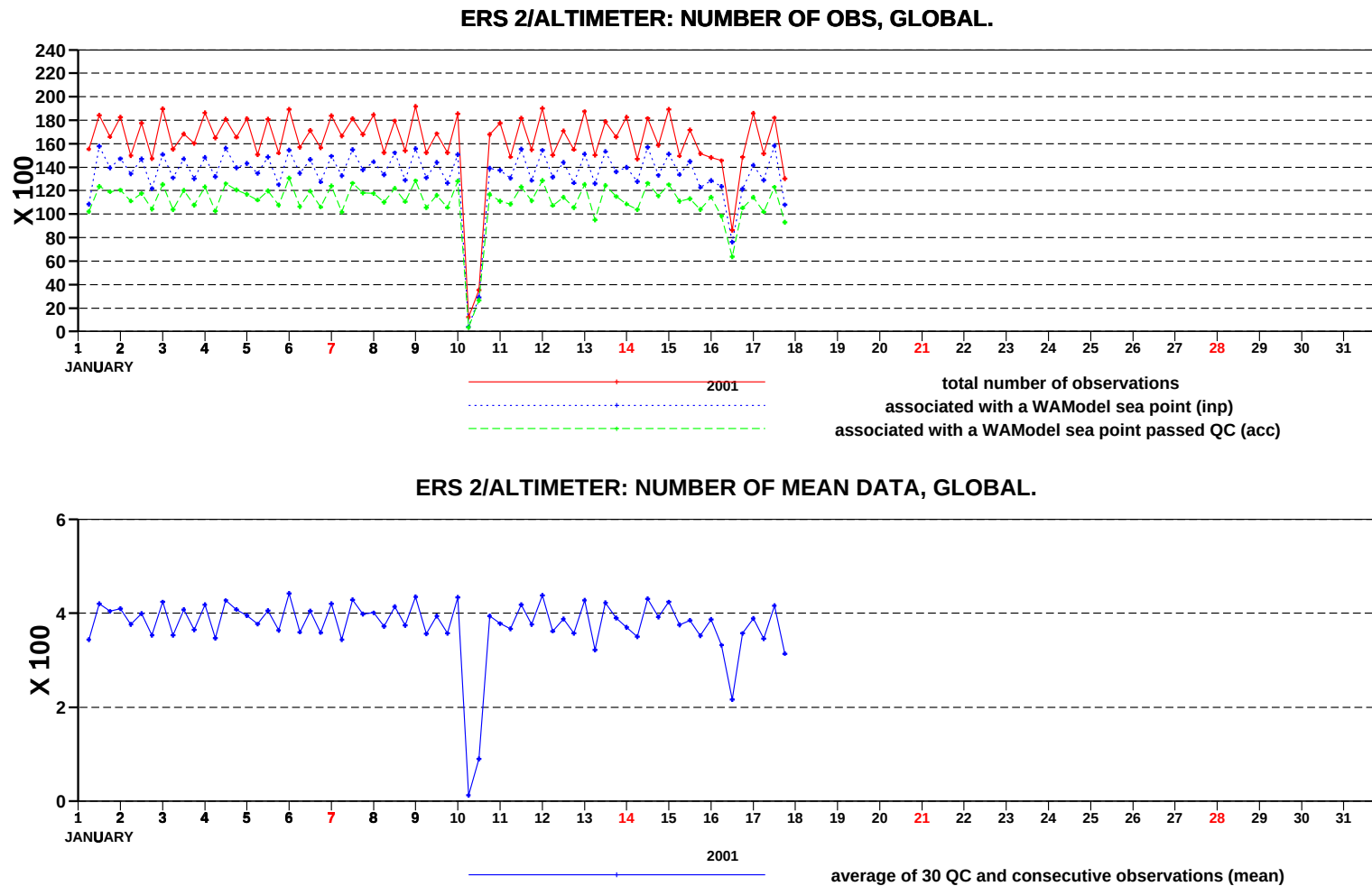


Figure 1: Time series of data reception for ERS-2 Altimeter data for January 2001

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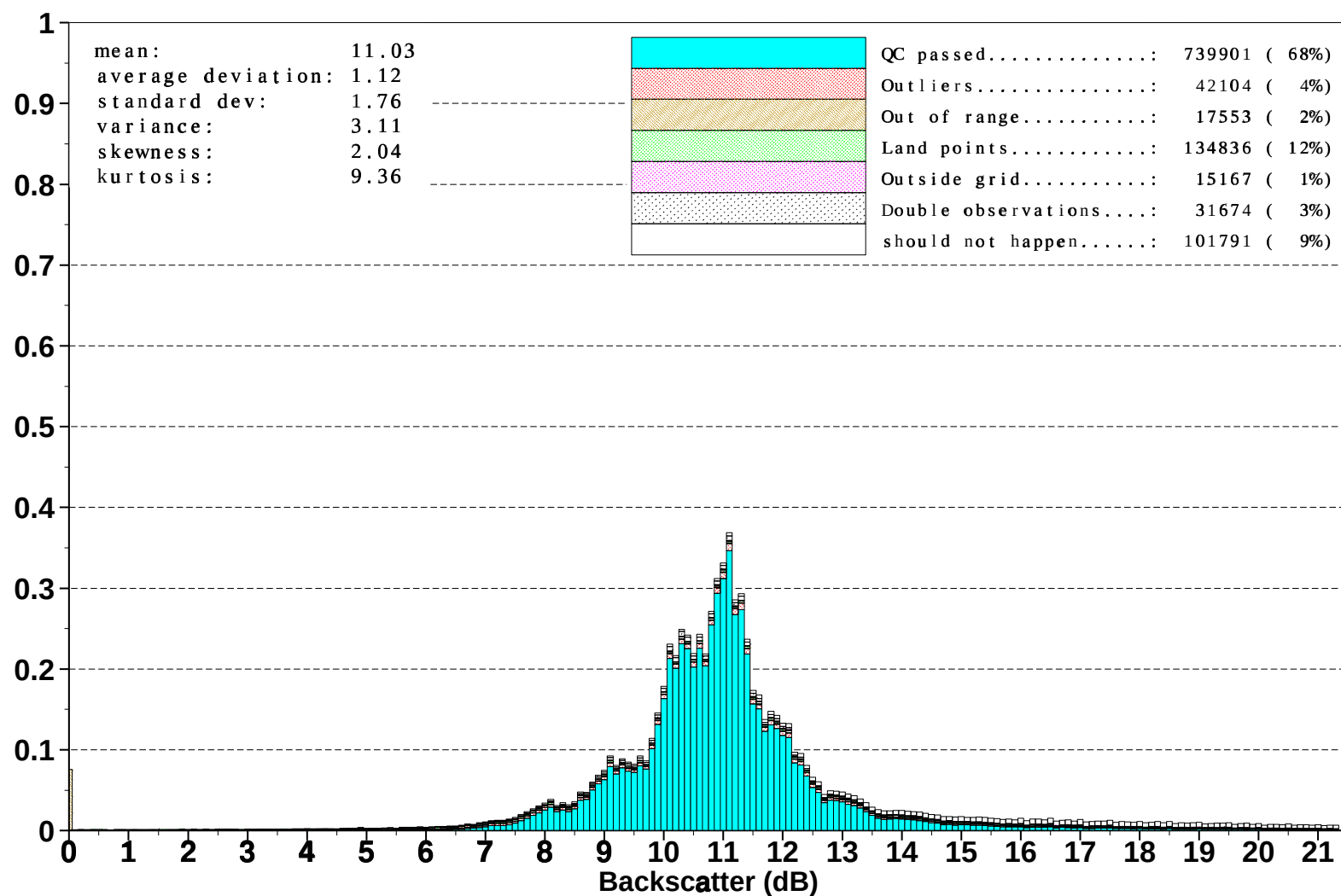


Figure 2: Distribution of the ERS-2 Altimeter backscatter after QC for January 2001



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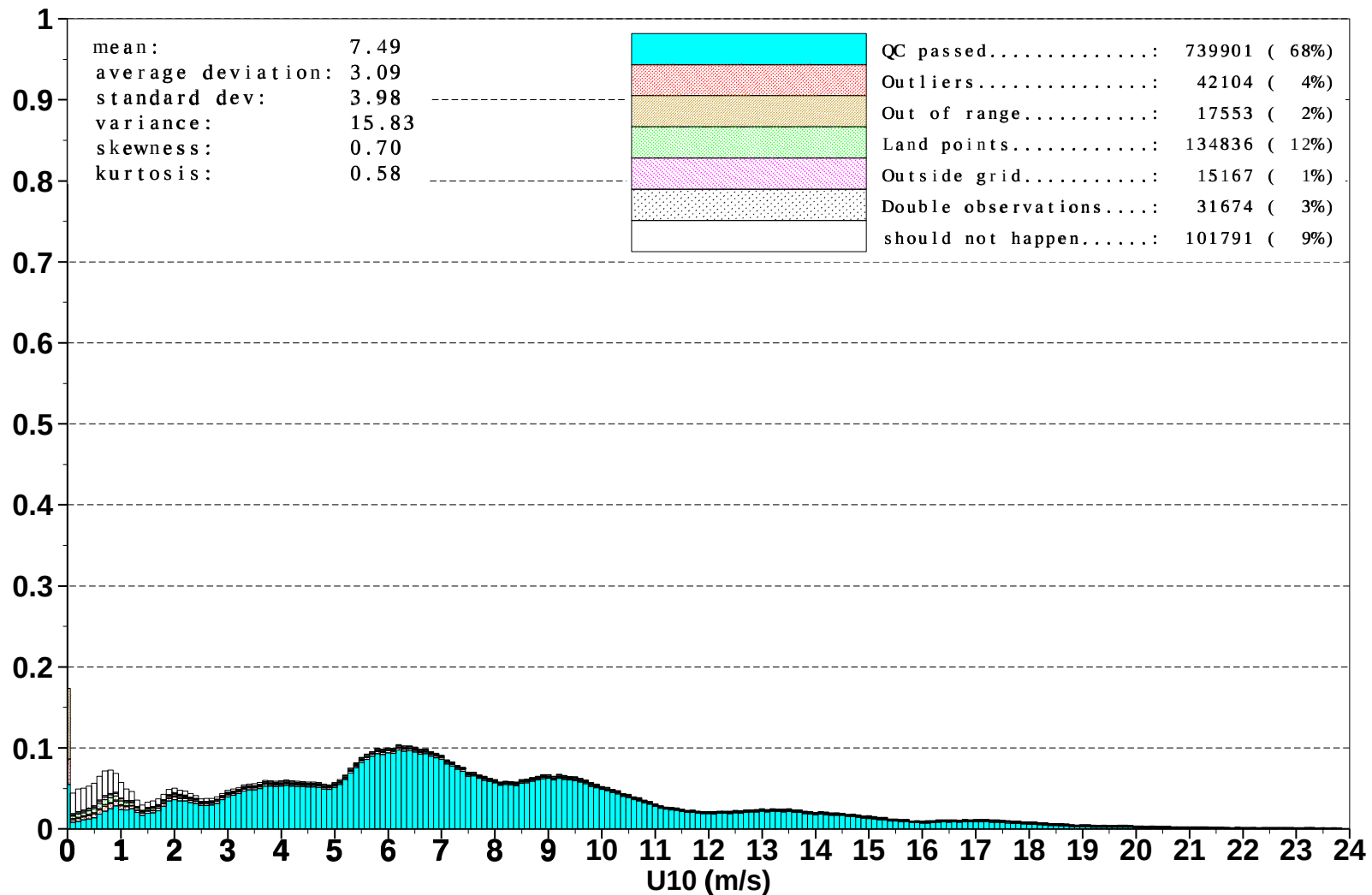


Figure 3: Distribution of the ERS-2 Altimeter wind speeds after QC for January 2001



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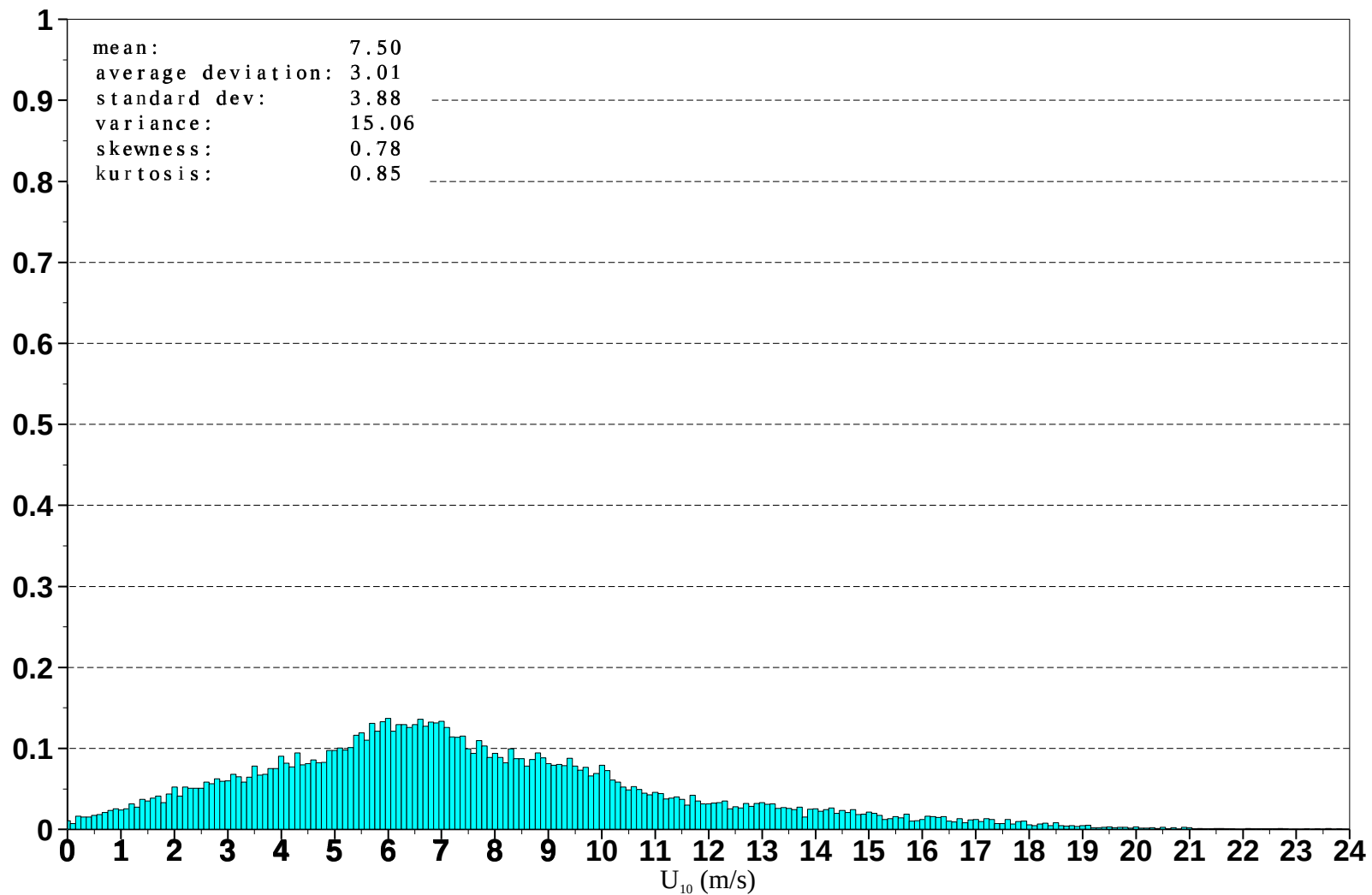


Figure 4: Distribution of ERS-2 Altimeter wind speeds after along track averaging for January 2001



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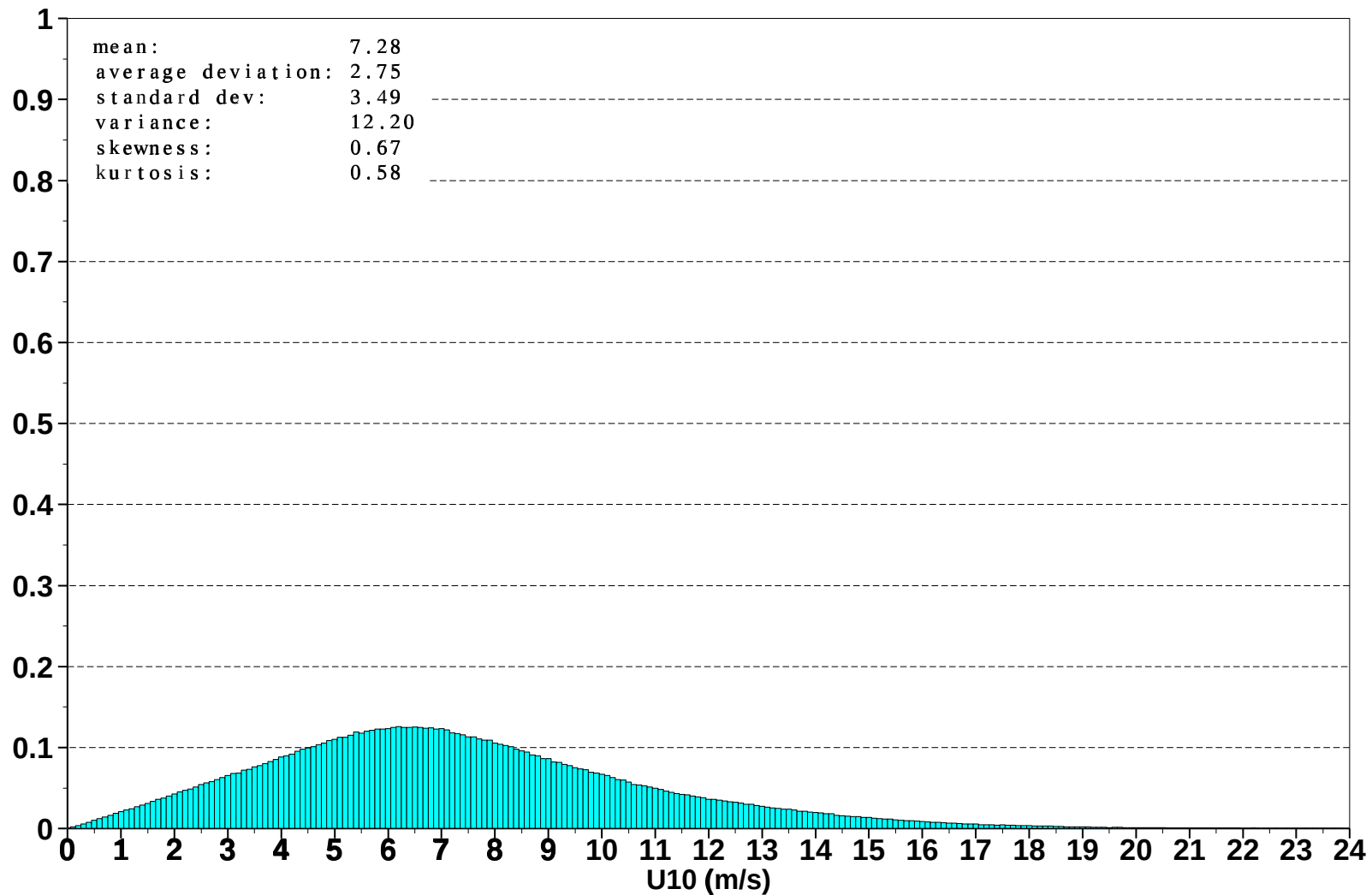


Figure 5: Global distribution of ECMWF ocean surface wind speeds for January 2001

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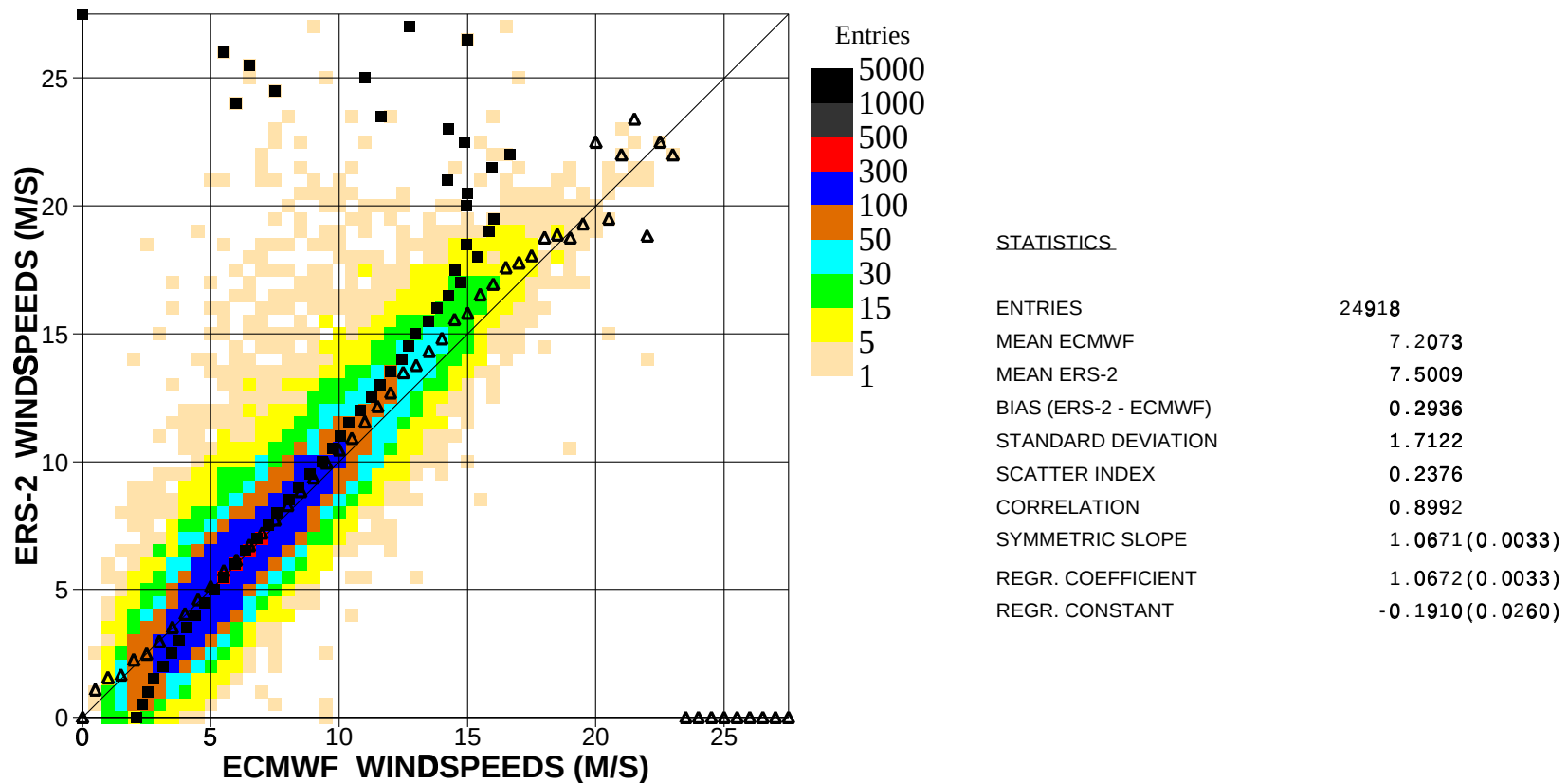


Figure 6. Comparison of ECMWF wind speed results with ERS2 Altimeter wind speed data for January 2001 (global)

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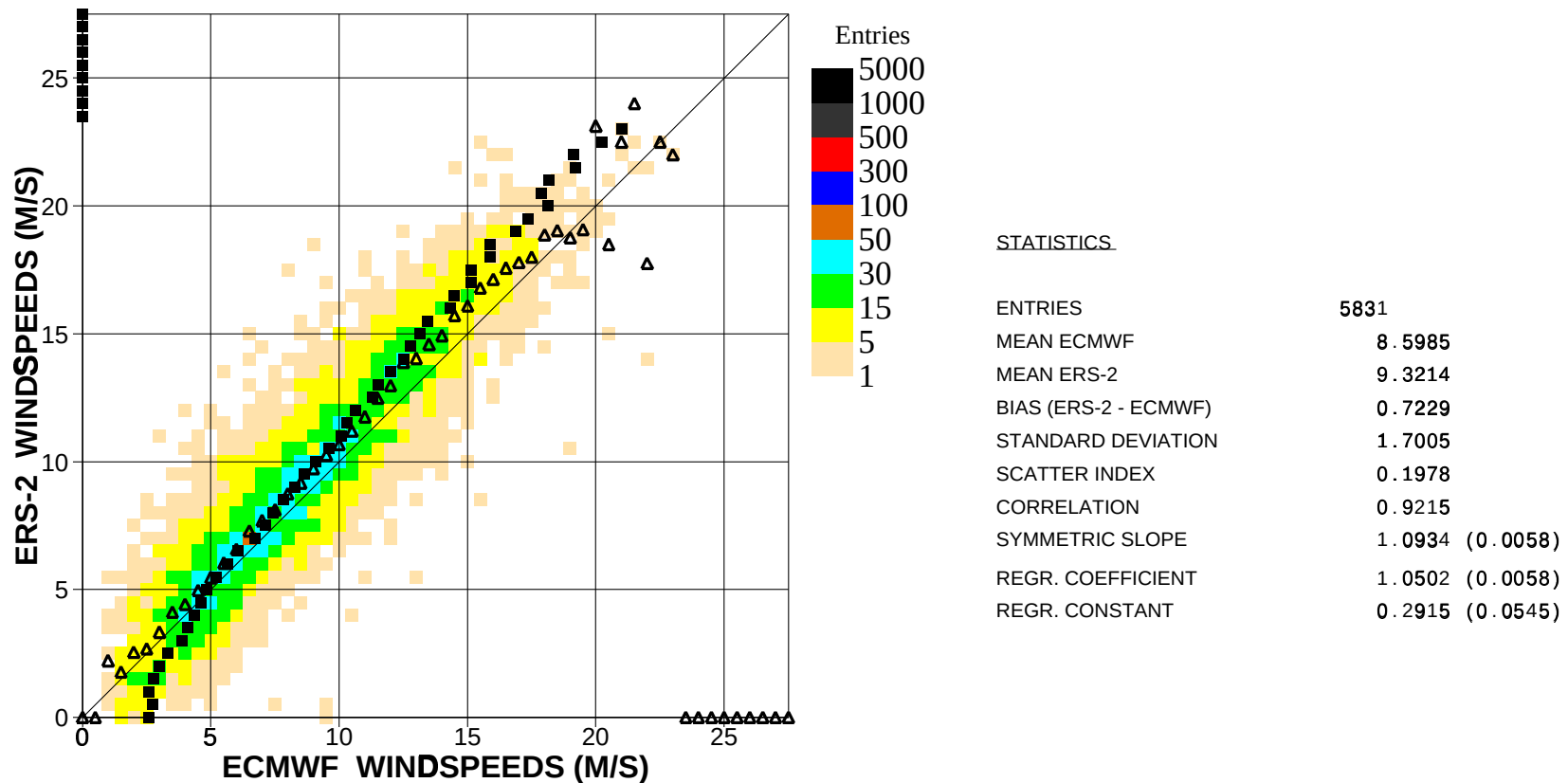


Figure 7. Comparison of ECMWF wind speed results with ERS2 Altimeter wind speed data for January 2001 (n.hem.)

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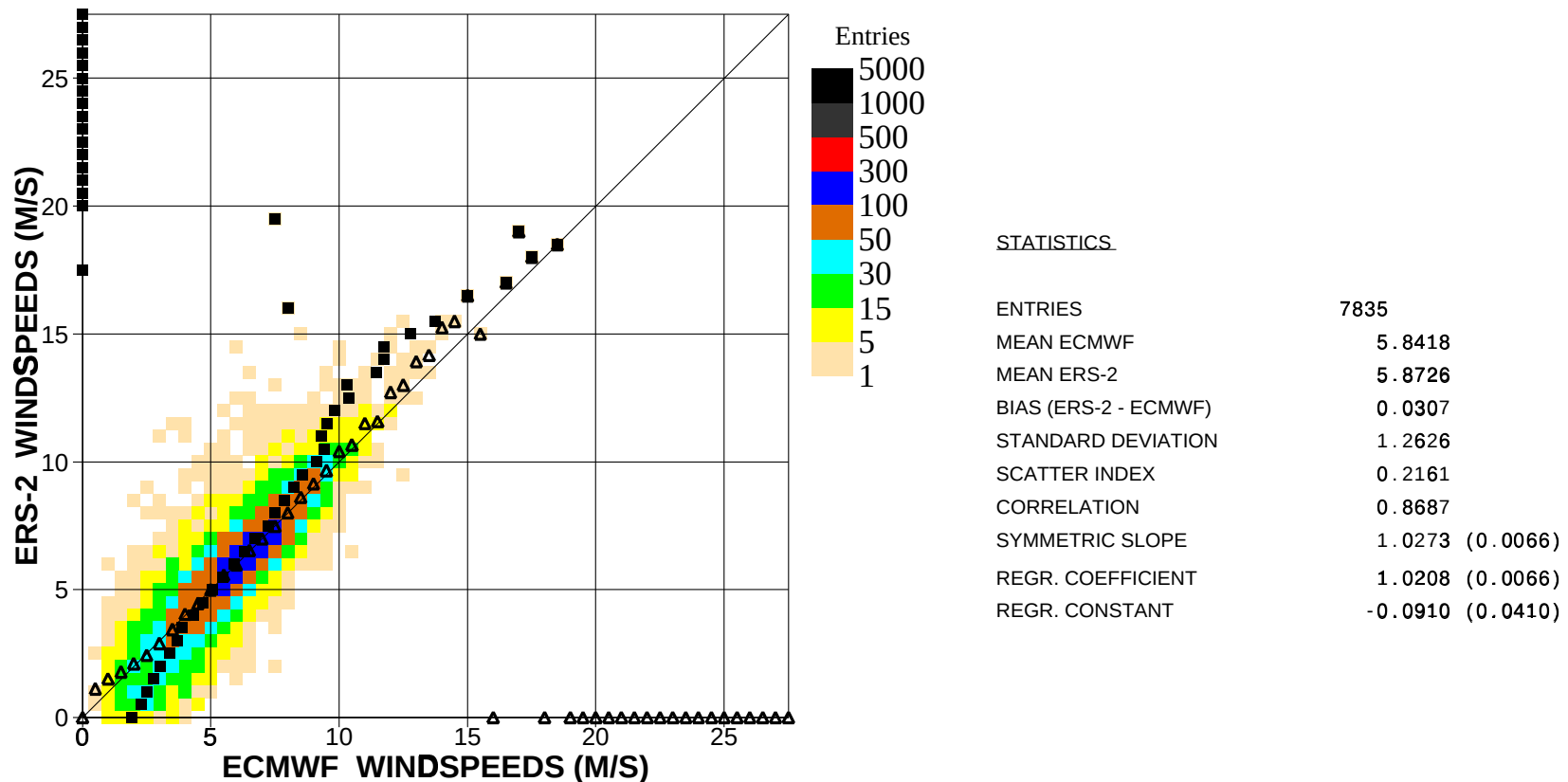


Figure 8. Comparison of ECMWF wind speed results with ERS2 Altimeter wind speed data for January 2001 (tropics)

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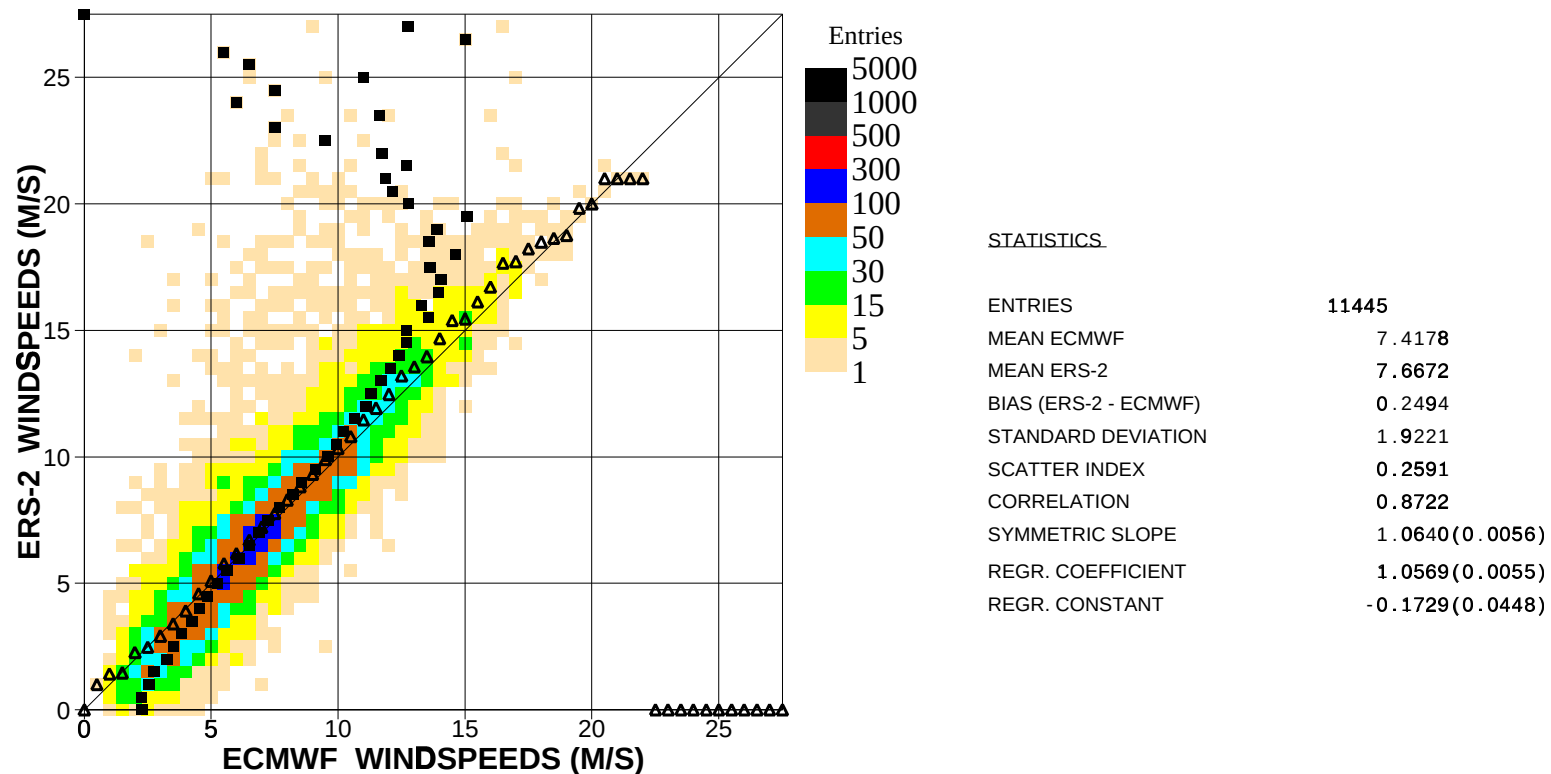


Figure 9. Comparison of ECMWF wind speed results with ERS2 Altimeter wind speed data for January 2001 (s.hem.)

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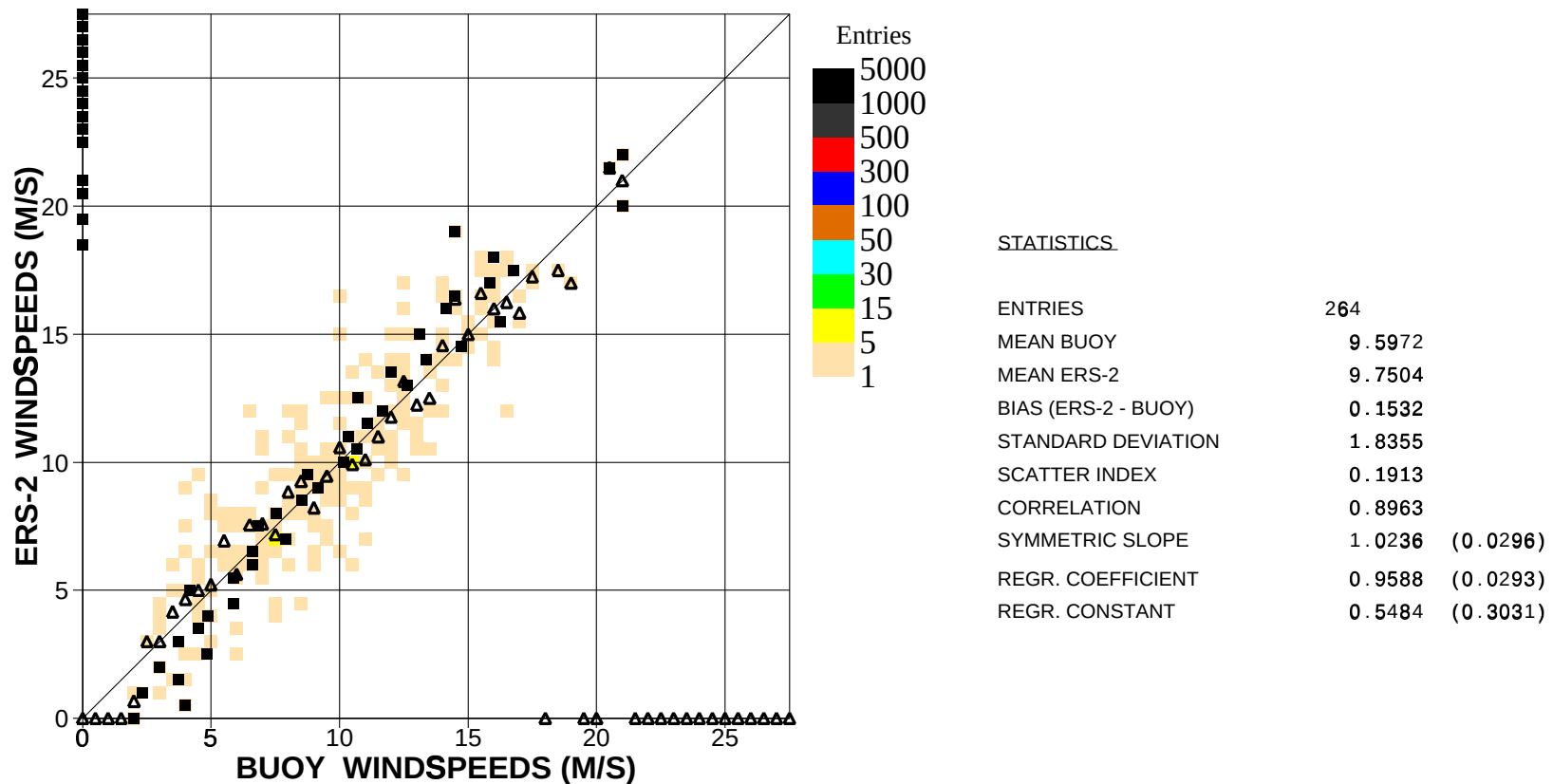


Figure 10. Comparison of buoy wind speed observations with ERS2 Altimeter wind speed data for January 2001 (global)

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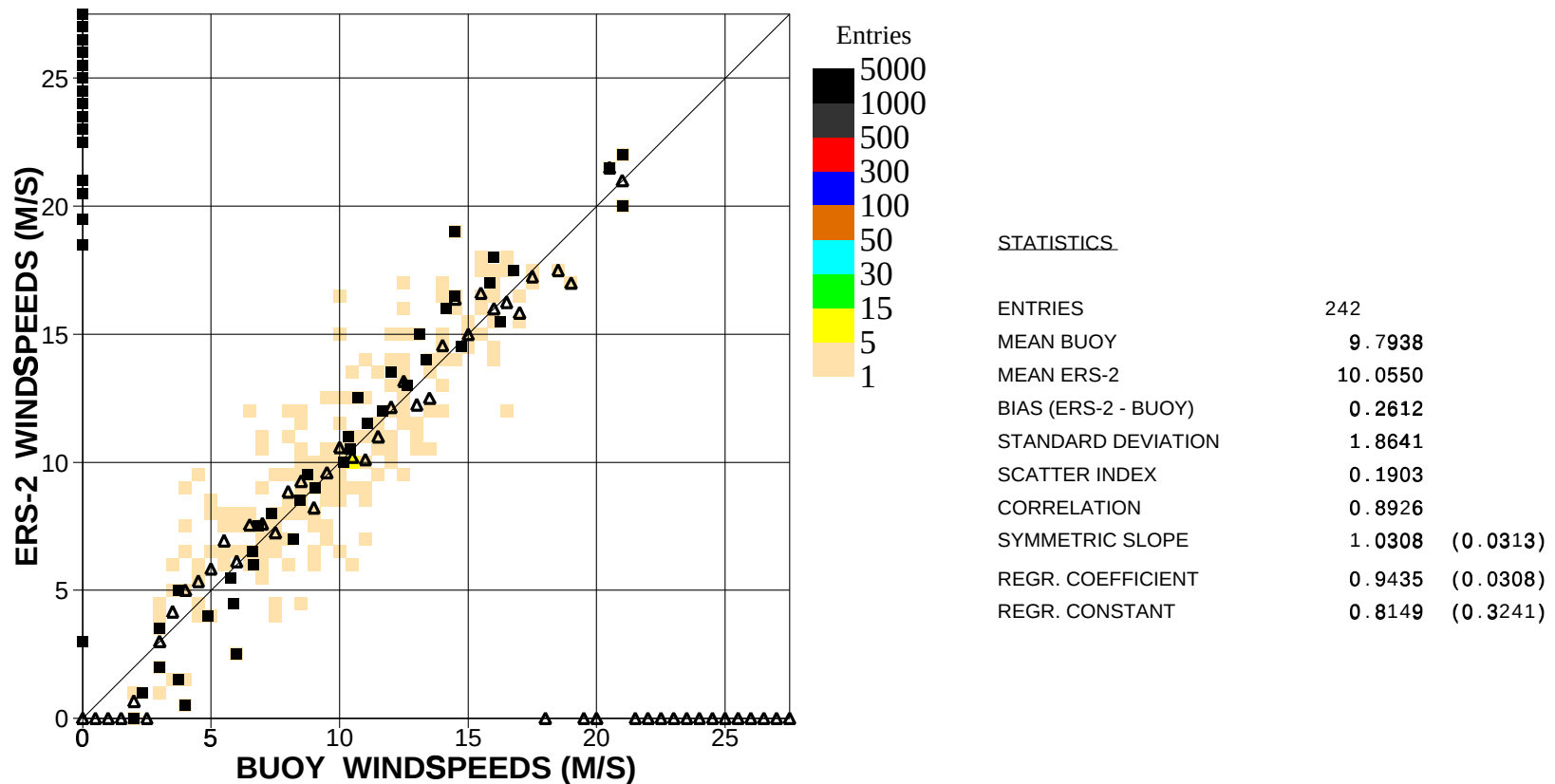


Figure 11. Comparison of buoy wind speed observations with ERS2 Altimeter wind speed data for January 2001 (n.hem.)

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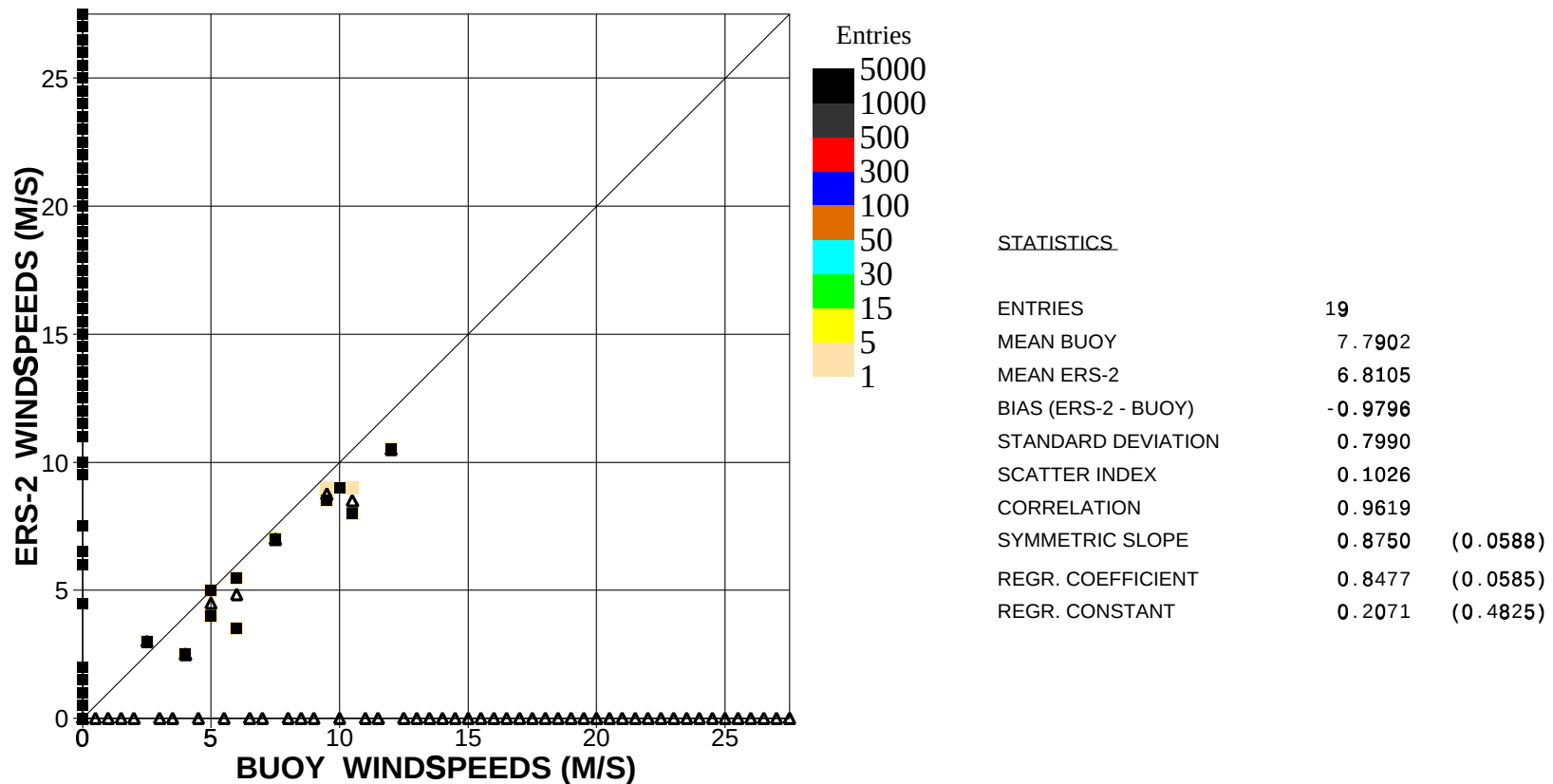


Figure 12. Comparison of buoy wind speed observations with ERS2 Altimeter wind speed data for January 2001 (hawaii)

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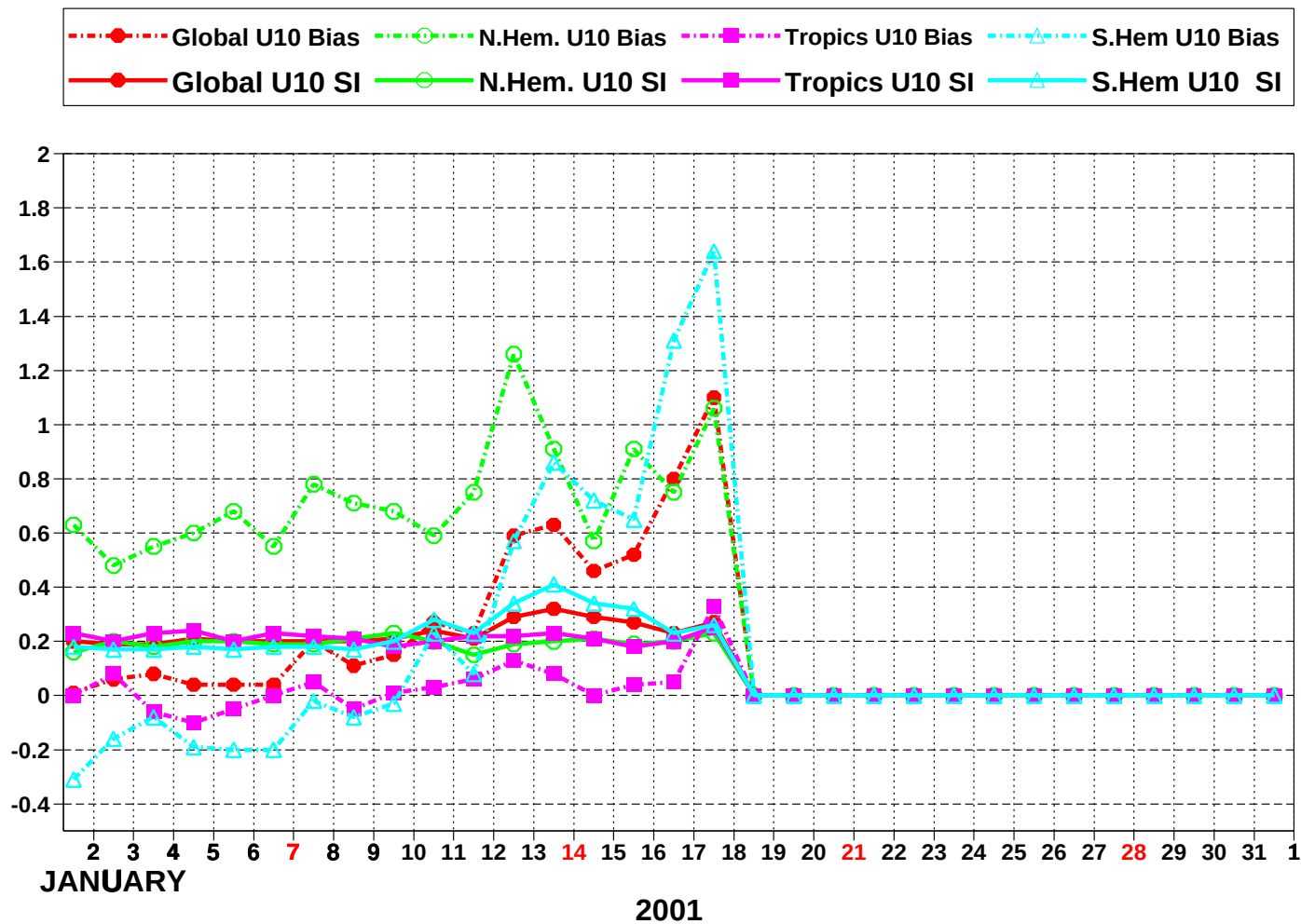


Figure 13: ERS-2 Altimeter wind speeds: Timeseries of bias (ERS-2 - model) and scatter index (SI)

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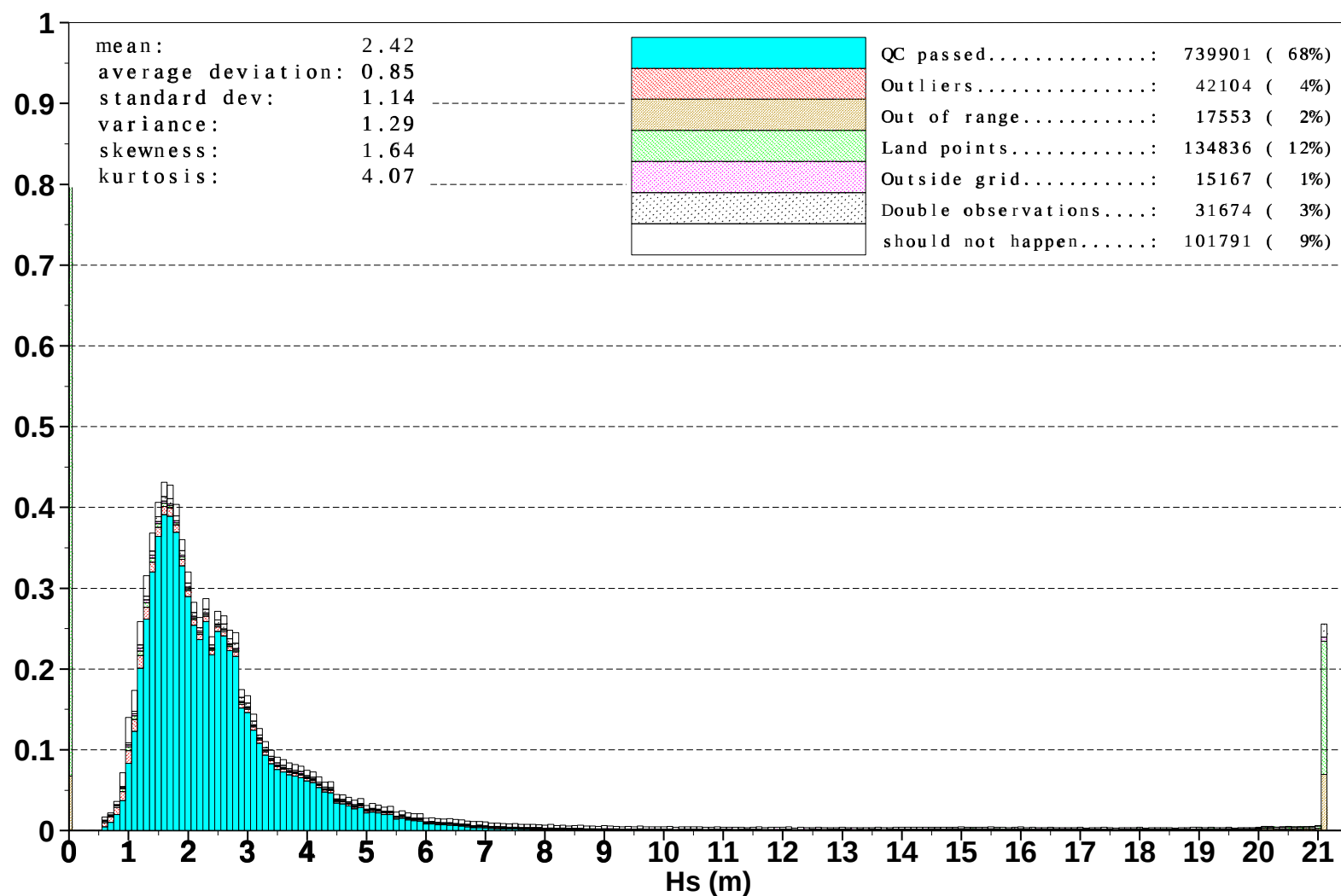


Figure 14: Distribution of the ERS-2 Altimeter wave heights after QC for January 2001

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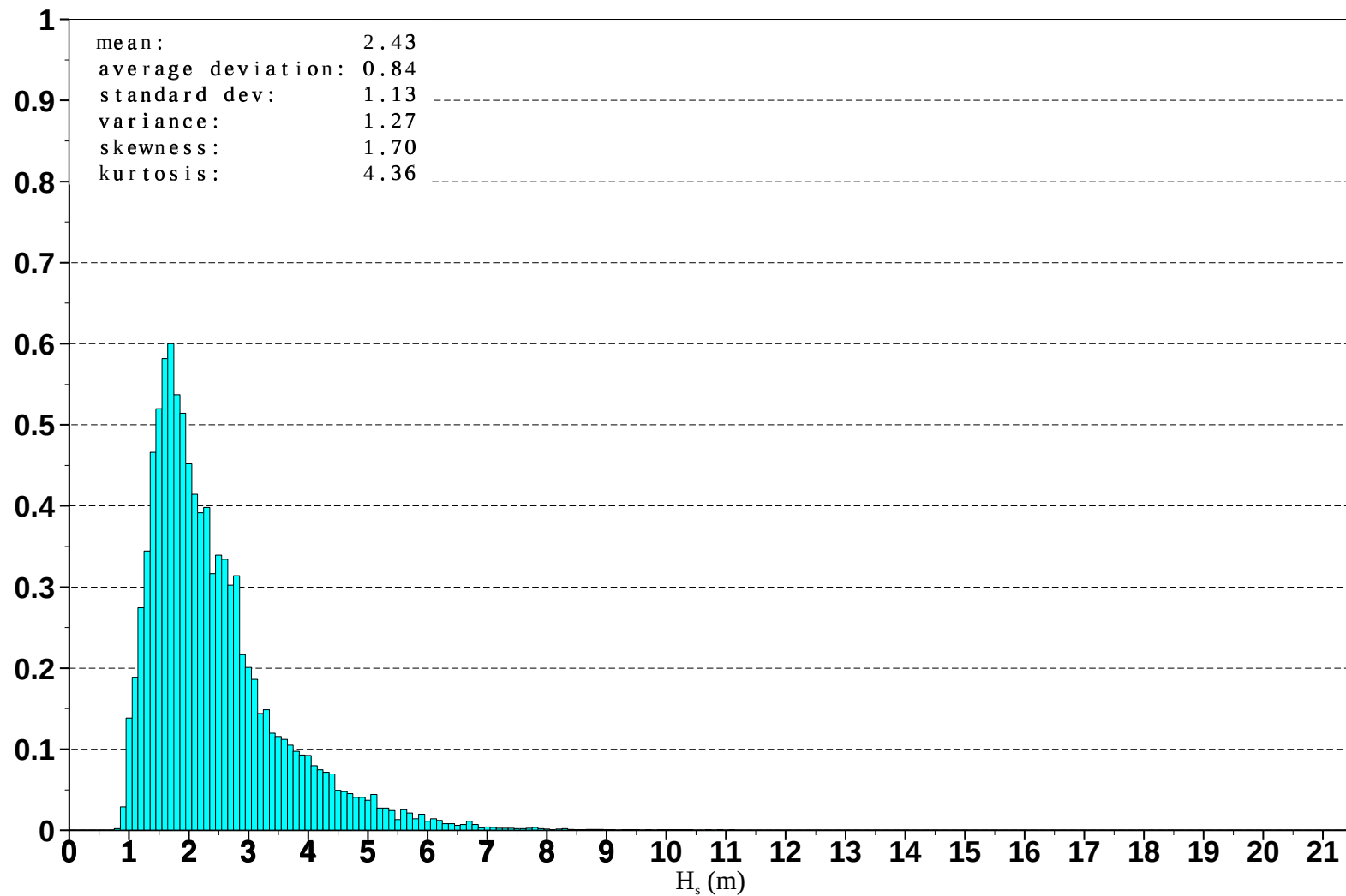


Figure 15: Distribution of ERS-2 Altimeter wave heights after along track averaging for January 2001

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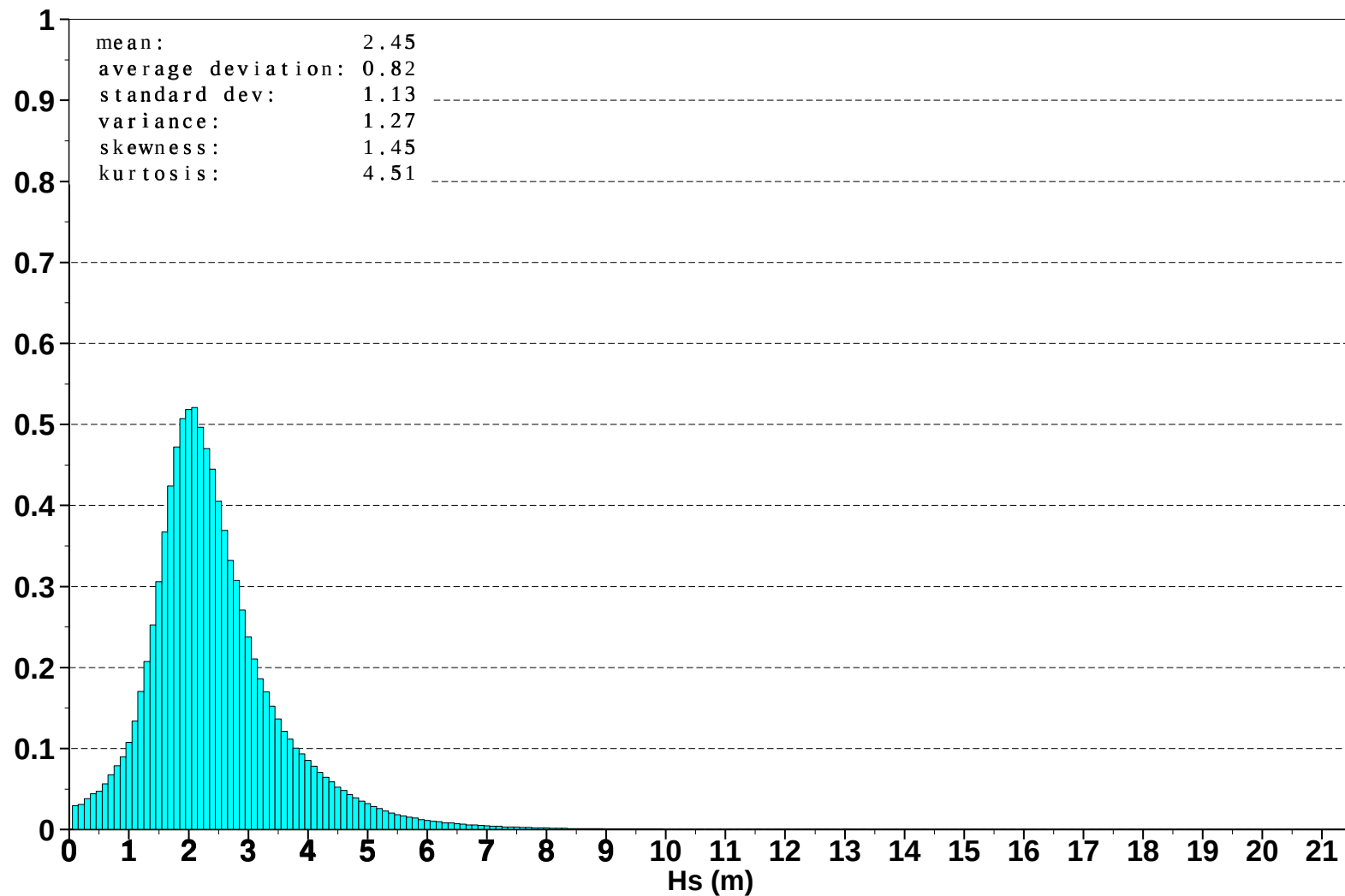


Figure 16: Global distribution of ECMWF wave heights for January 2001



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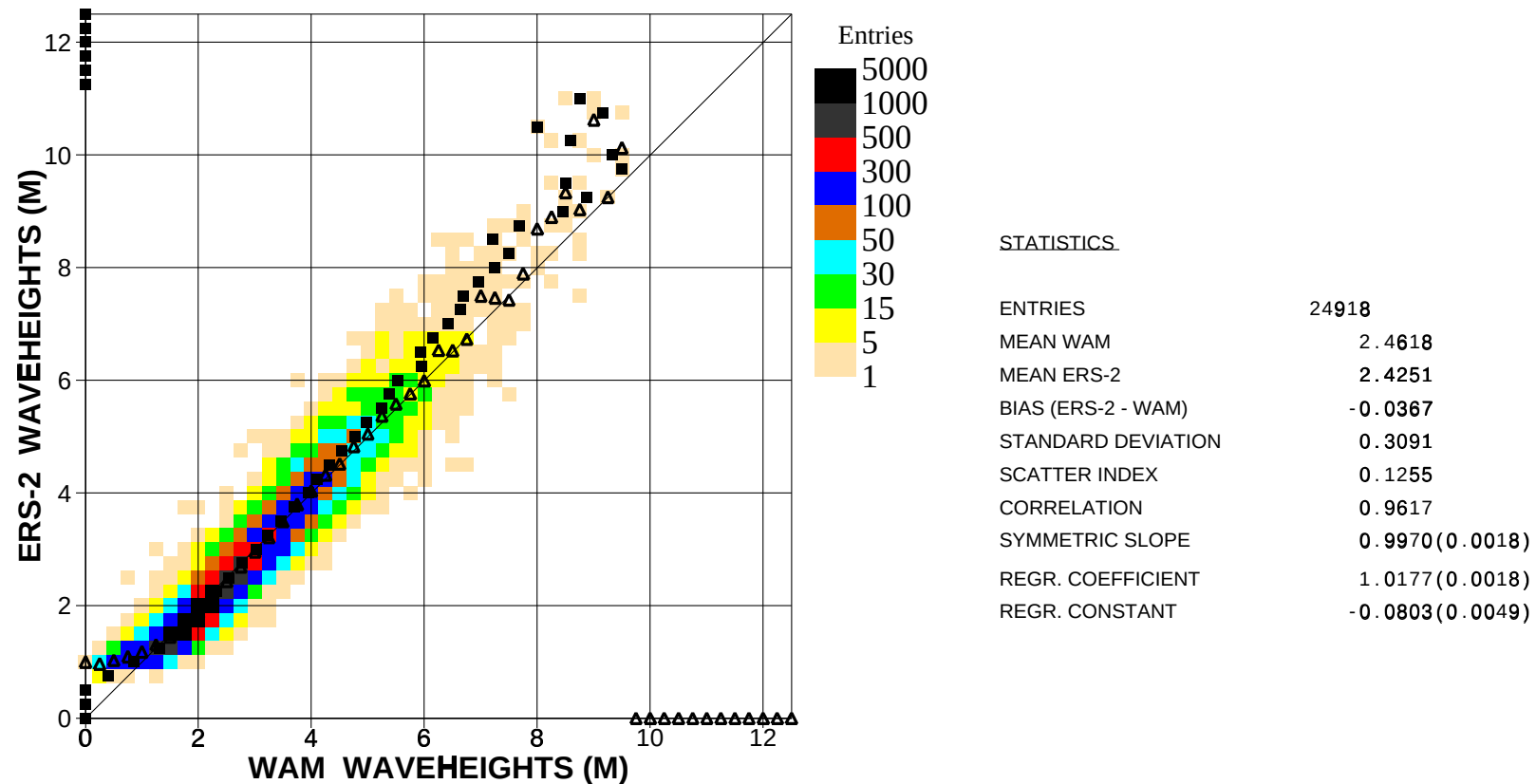


Figure 17. Comparison of ECMWF wave height results with ERS2 Altimeter wave height data for January 2001 (global)

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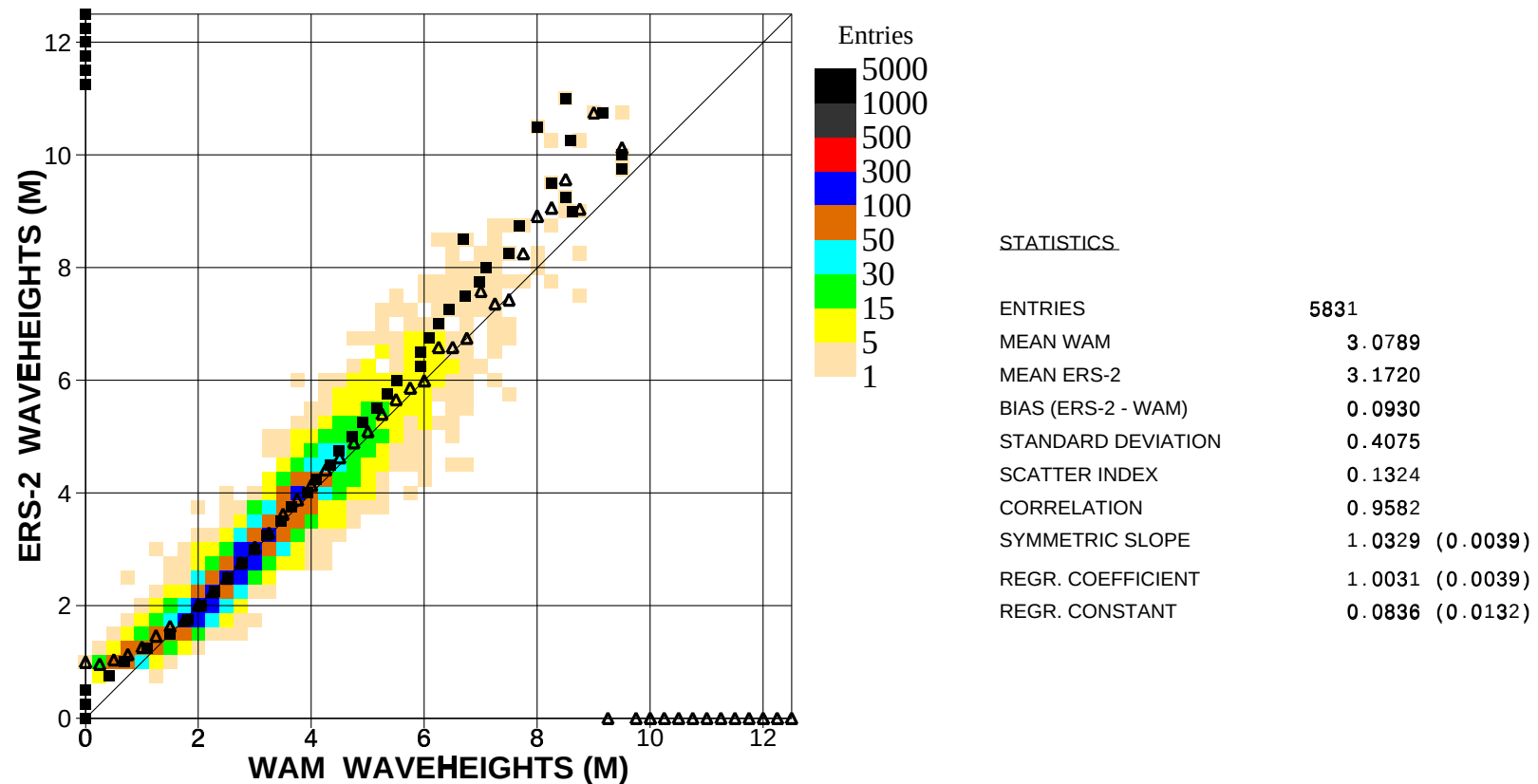


Figure 18. Comparison of ECMWF wave height results with ERS2 Altimeter wave height data for January 2001 (n.hem.)

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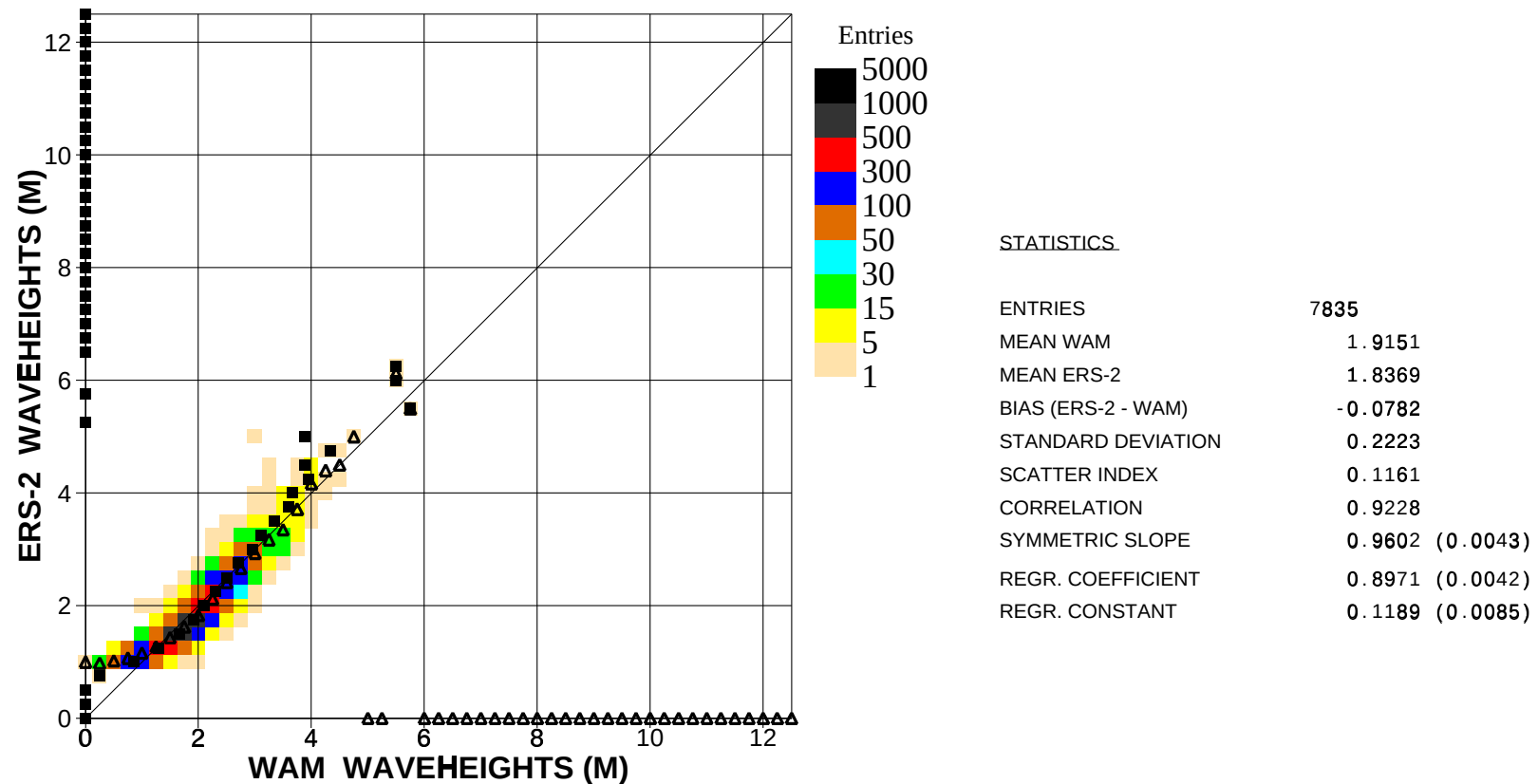


Figure 19. Comparison of ECMWF wave height results with ERS2 Altimeter wave height data for January 2001 (tropics)

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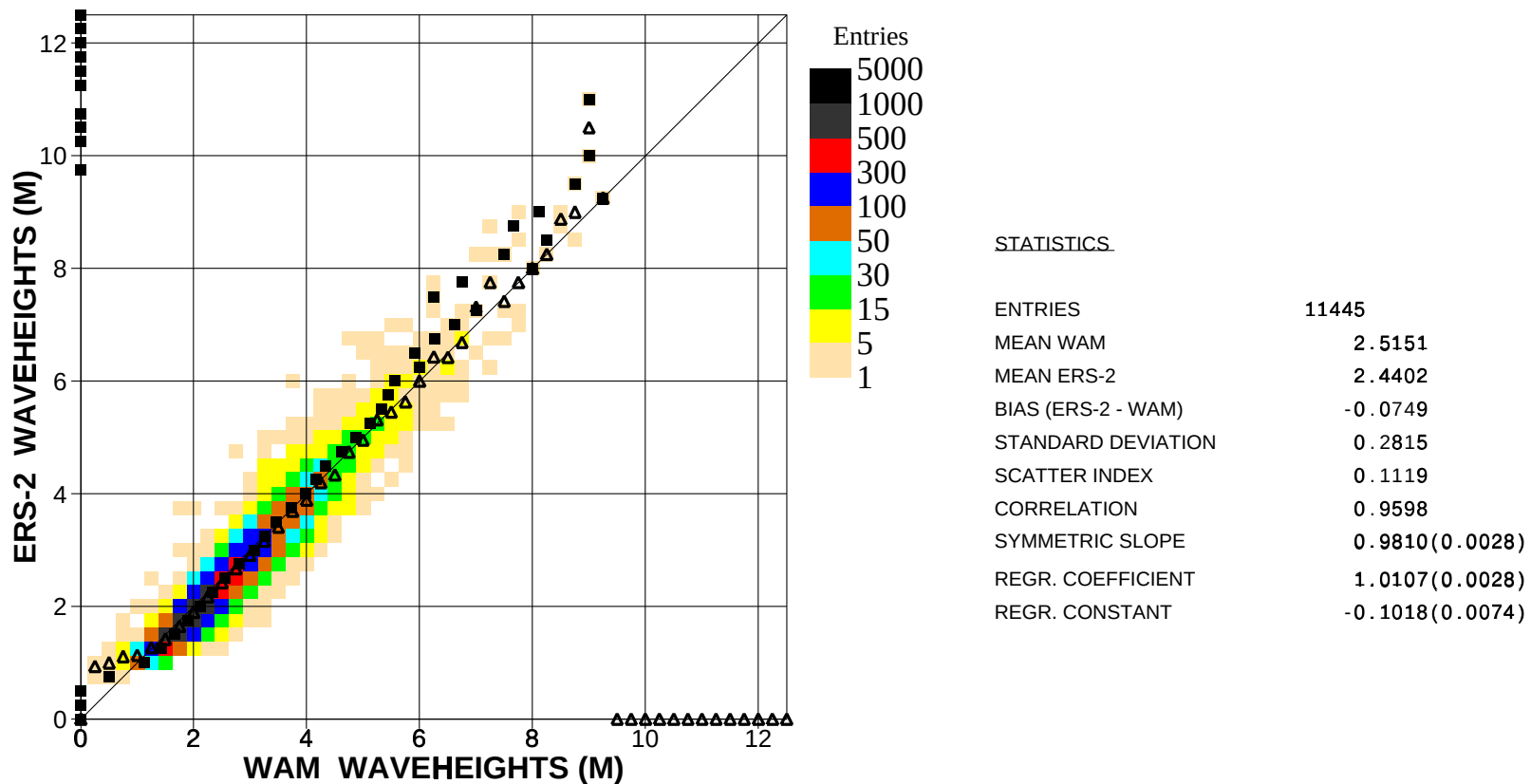


Figure 20. Comparison of ECMWF wave height results with ERS2 Altimeter wave height data for January 2001 (s.hem.)

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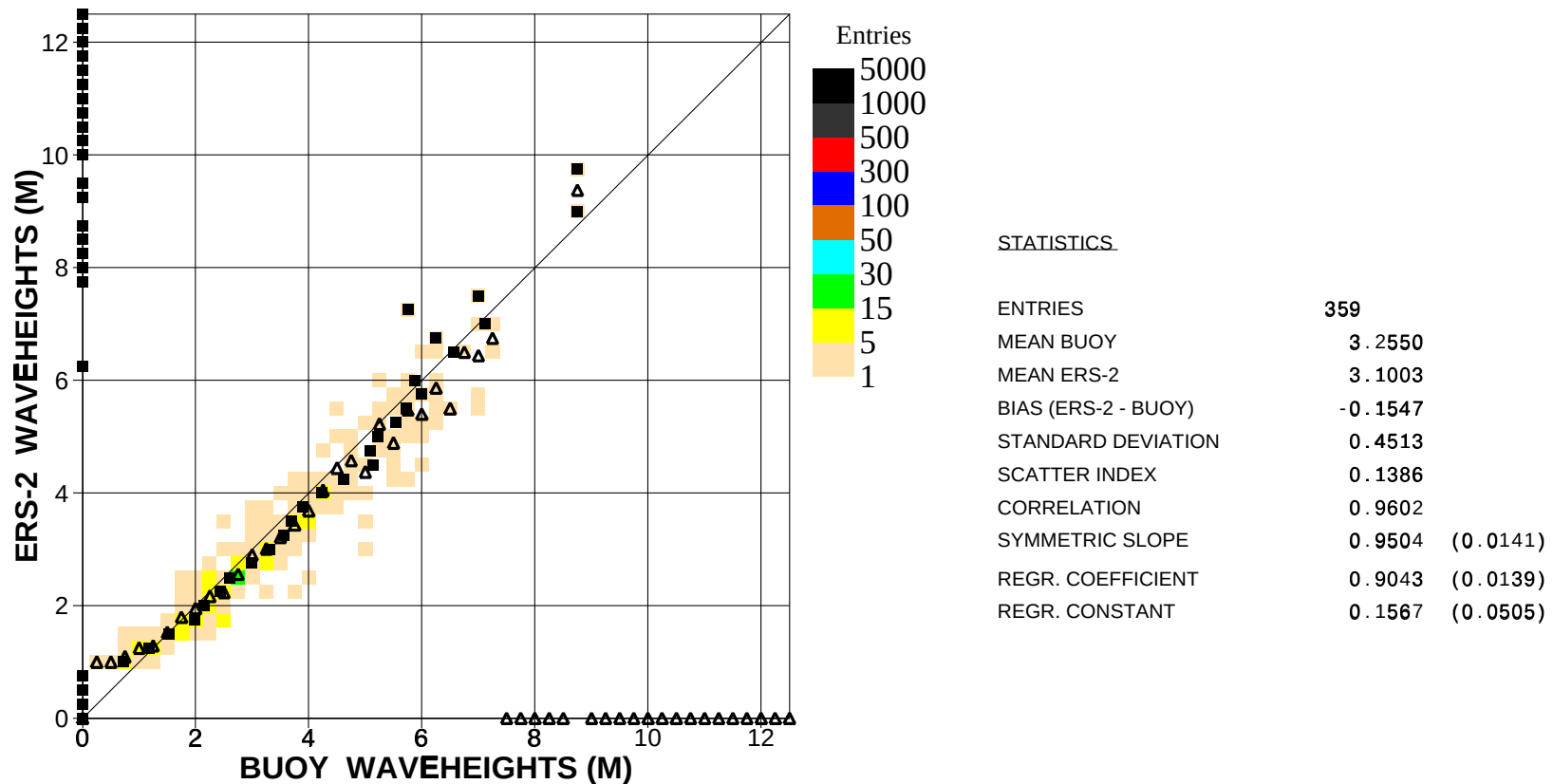


Figure 21. Comparison of buoy wave height observations with ERS2 Altimeter wave height data for January 2001 (global)

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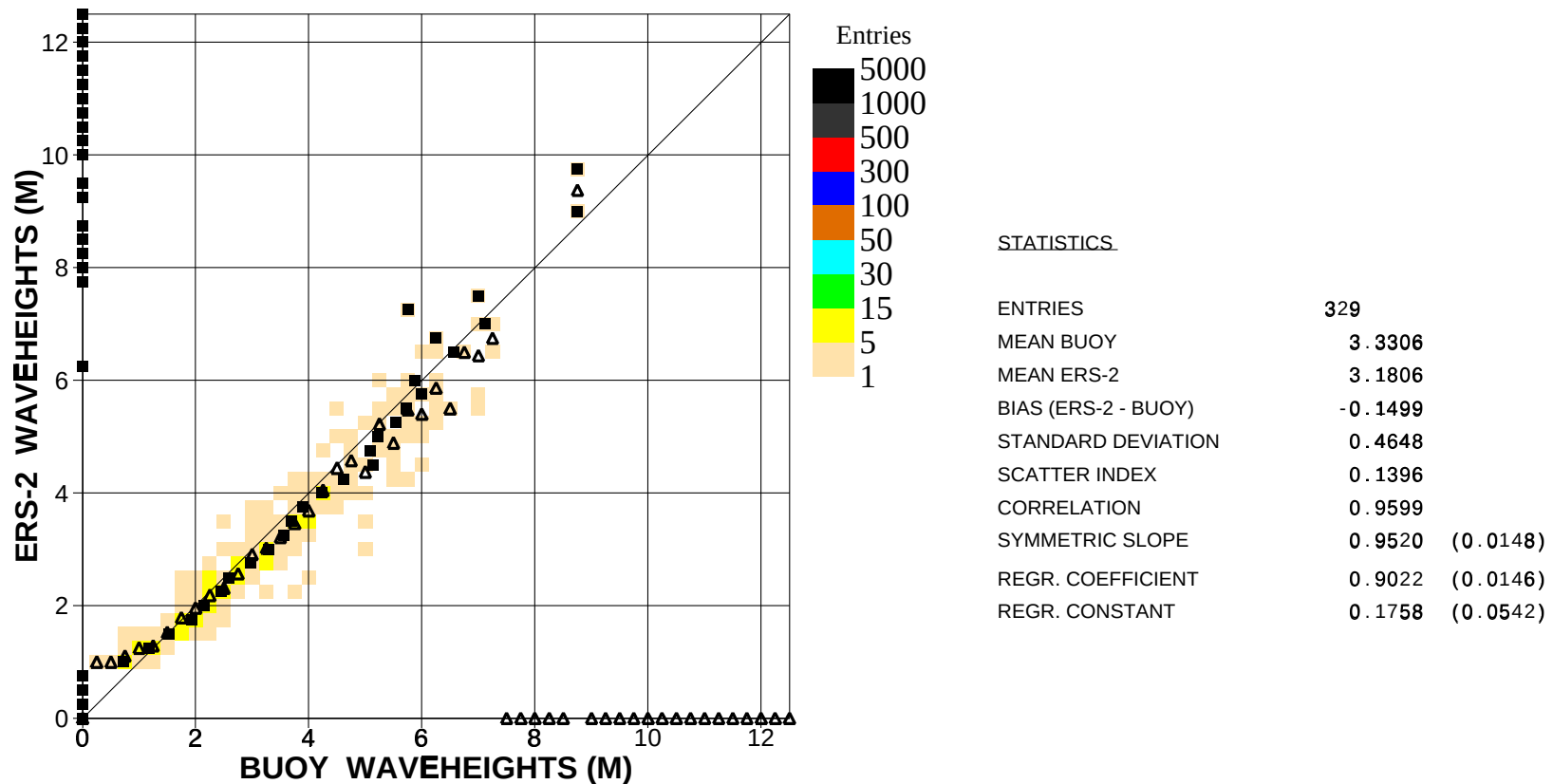


Figure 22. Comparison of buoy wave height observations with ERS2 Altimeter wave height data for January 2001 (n.hem.)

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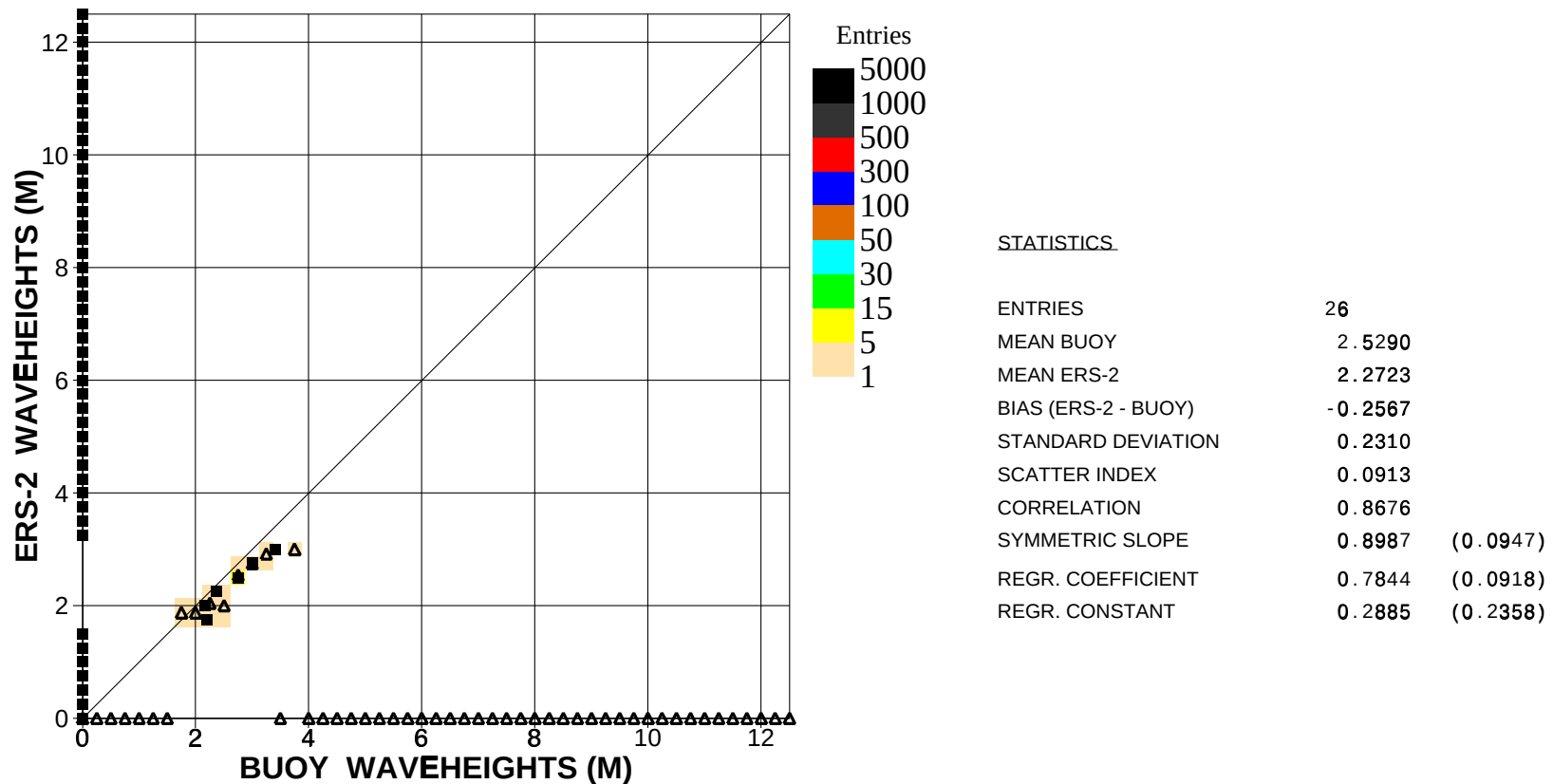


Figure 23. Comparison of buoy wave height observations with ERS2 Altimeter wave height data for January 2001 (hawaii)

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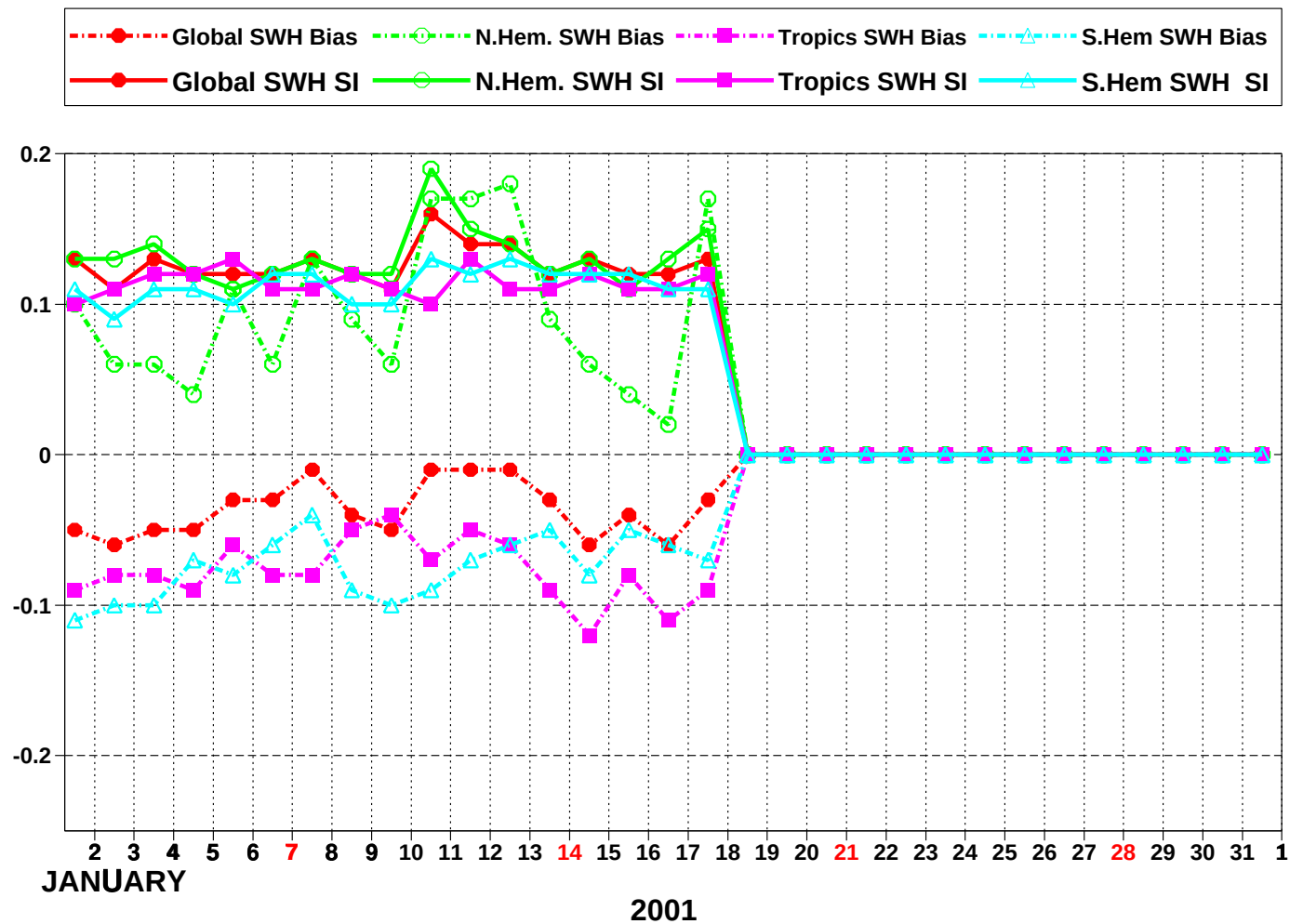


Figure 24: ERS-2 Altimeter wave heights: Timeseries of bias (ERS-2 - model) and scatter index (SI)

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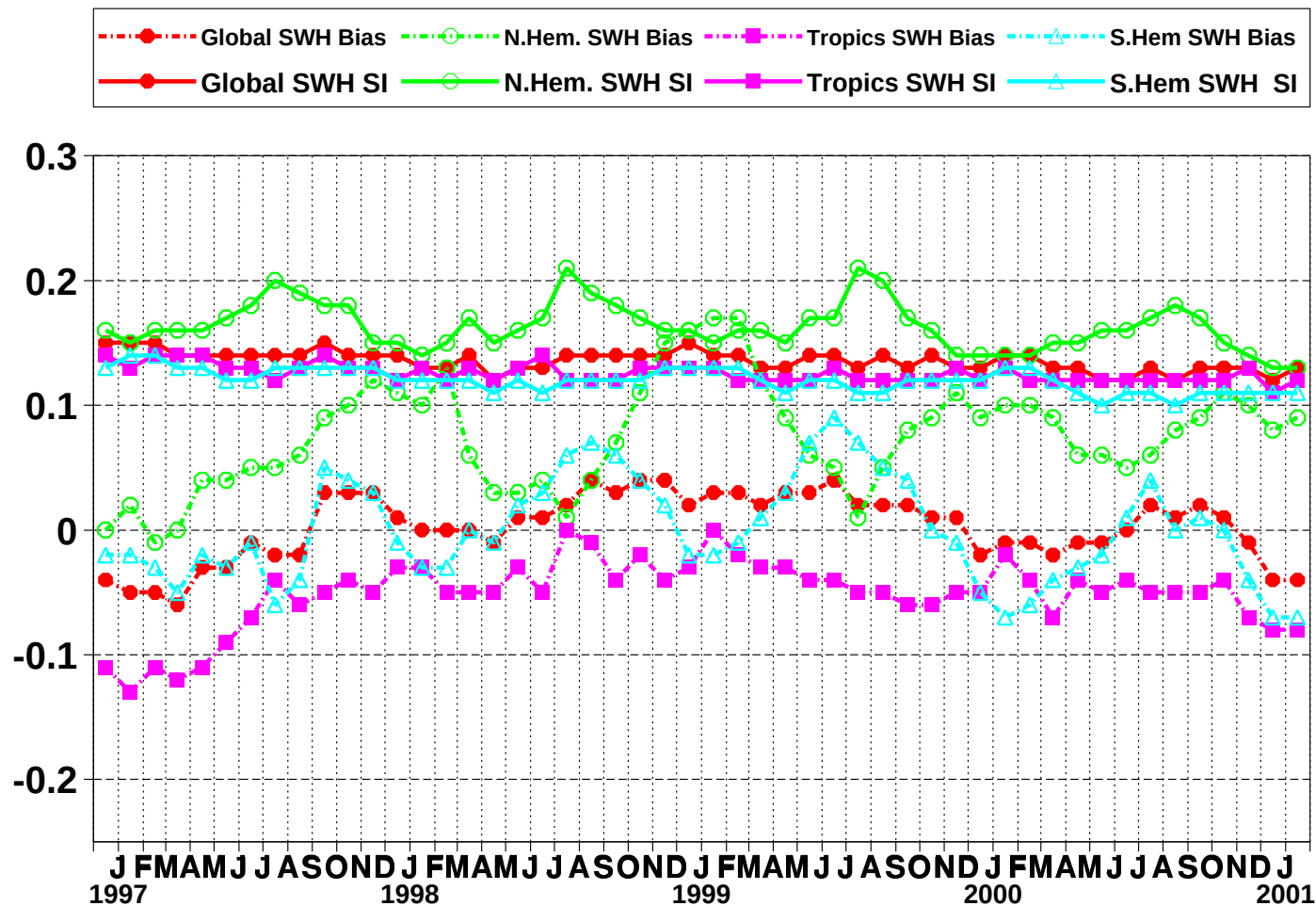


Figure 25: ERS-2 Altimeter wave heights: Timeseries of bias (ERS-2 - model) and scatter index (SI)



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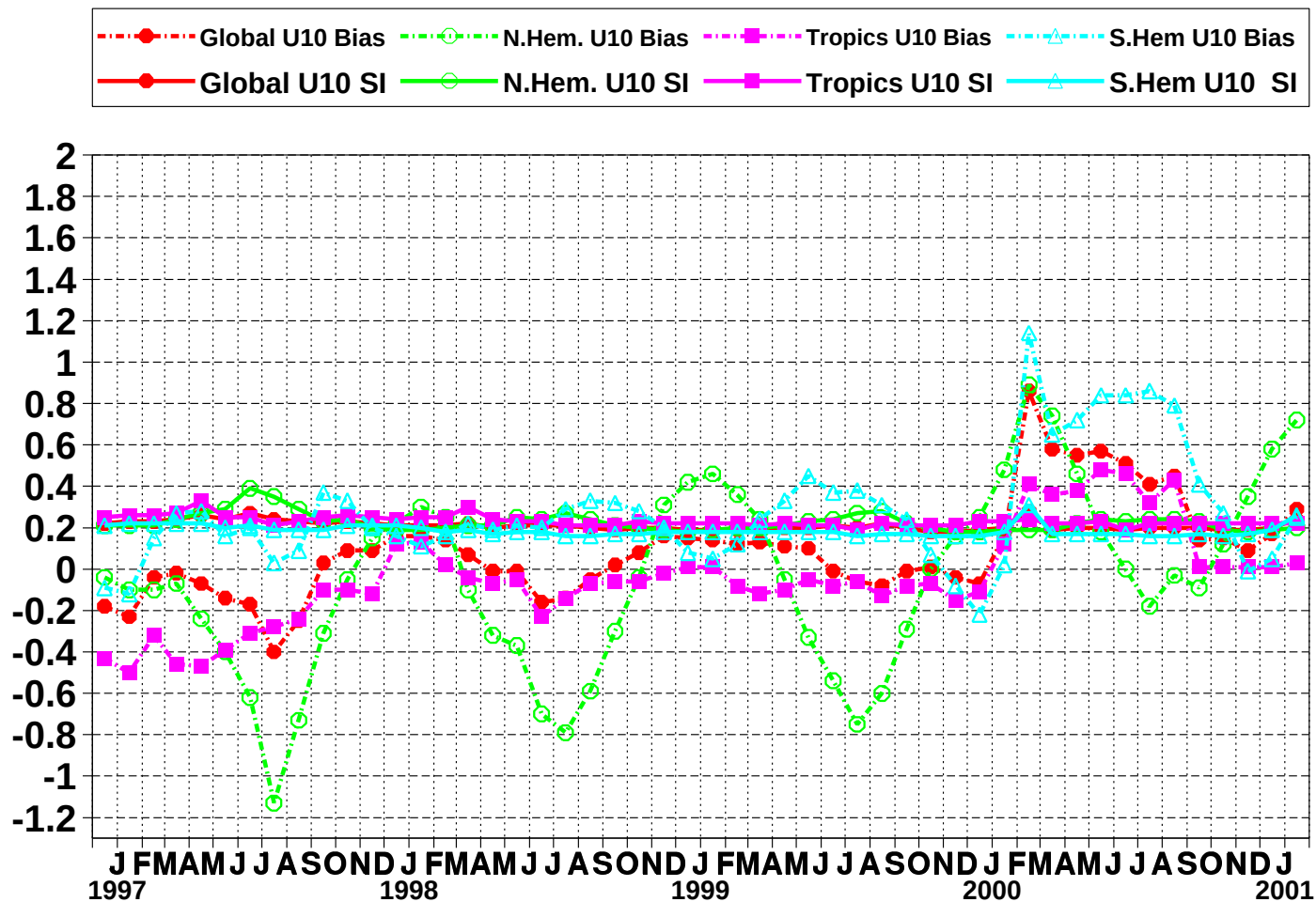


Figure 26: ERS-2 Altimeter wind speeds: Timeseries of bias (ERS-2 - model) and scatter index (SI)

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