

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

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Overview:

This month around 11121 observations arrived at ECMWF every 6 hours of which 80.66% passed the quality control imposed on the altimeter wave height. Data coverage was substantially reduced in six 5 hour time windows and no data were reported between the 4th 18UT to the 5th 0UT and between the 7th 12 UT to the 10th 12UT (see figure 1) following operations by ESA. Note that we are talking about data which have arrived at ECMWF before they were needed for the operational data assimilation.

PLEASE SEE REMARKS ON PAGE 3 on the very poor quality of the altimeter wind speeds

Backscatter:

ERS-2 $\langle \sigma_0 \rangle = 10.72\text{dB}$ (one large peak around 11.1dB)

Wind Speed Comparison with ECMWF wind speeds (bias):

ERS-2 global: 0.865 m/s

ERS-2 northern hemisphere: 0.886 m/s

ERS-2 tropics: 0.408 m/s

ERS-2 southern hemisphere: 1.138 m/s

Wind Speed Comparison with buoy wind speeds (bias):

- ERS-2 global: 0.28 m/s
- ERS-2 northern hemisphere: 0.38 m/s
- ERS-2 tropics: -0.34 m/s

Wave Height Comparison with ECMWF wave heights (bias):

- ERS-2 global: -0.014 m (lowest waves measured: 0.6m)
- ERS-2 northern hemisphere: 0.100 m
- ERS-2 tropics: -0.036 m
- ERS-2 southern hemisphere: -0.056 m

Wave Height Comparison with buoy wave heights (bias):

- ERS-2 global: -0.10 m
- ERS-2 northern hemisphere: -0.09 m
- ERS-2 tropics: -0.18 m

Remarks:

The Altimeter DID NOT work normally, at least as far as the wind speed is concerned.

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.

REMARK:

The inspection of the scatter diagrams and time series for the altimeter wind speed reveals that a serious problem occurred with the altimeter wind speed measurements. Figure 13 nicely illustrates the problem. In the report for January, we had already mentioned the unusual positive wind speed bias that had suddenly appeared in the middle of the month. This situation continued into February until the 8th when ESA performs some operations (installation and testing of the mono gyro package) which resulted in a significant deterioration of the data mainly in the southern hemisphere. As indicated by the scatter diagram for the southern hemisphere (figure 9), excessively large altimeter wind speed values were produced. We found by looking at the geographical location of such differences that they were mostly located in a mid-latitude belt around 50°S. In the course of the remaining weeks, it appears that ESA solved part of the problem, however, even at the end of the month and up to now, the bias in all regions seem to be systematically too high when compared to previous months (figure 26) in excess of 0.6 m/s! The comparison with buoys also indicates a larger than usual bias (figure 10). We are concerned by this new trend in the quality of the altimeter wind speed and hope that ESA will soon find a solution to this problem.

The quality of the altimeter wave heights appears to have been largely unaffected by the trouble surrounding the wind speeds.

Figure captions:

- Figure 1: Time series of data reception for ERS-2 Altimeter data for February 2000.
- Figure 2: Distribution of the ERS-2 Altimeter Backscatter after QC for February 2000.
- Figure 3: Distribution of the ERS-2 Altimeter wind speeds after QC for February 2000.
- Figure 4: Distribution of the ERS-2 Altimeter wind speeds after along track averaging for February 2000.
- Figure 5: Global distribution of ECMWF ocean surface wind speeds for February 2000.
- Figure 6: Comparison of ECMWF wind speed results with ERS-2 Altimeter wind speed data for February 2000 (global).
- Figure 7: Comparison of ECMWF wind speed results with ERS-2 Altimeter wind speed data for February 2000 (northern hemisphere)
- Figure 8: Comparison of ECMWF wind speed results with ERS-2 Altimeter wind speed data for February 2000 (tropics)
- Figure 9: Comparison of ECMWF wind speed results with ERS-2 Altimeter wind speed data for February 2000 (southern hemisphere)
- Figure 10: Comparison of buoy wind speed observations with ERS-2 Altimeter wind speed data for February 2000 (global).
- Figure 11: Comparison of buoy wind speed observations with ERS-2 Altimeter wind speed data for February 2000 (northern hemisphere).
- Figure 12: Comparison of buoy wind speed observations with ERS-2 Altimeter wind speed data for February 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 February 2000.
- Figure 15: Distribution of the ERS-2 Altimeter wave heights after along track averaging for February 2000.
- Figure 16: Global distribution of ECMWF wave heights for February 2000.
- Figure 17: Comparison of ECMWF wave height results with ERS-2 Altimeter wave height data for February 2000 (global).
- Figure 18: Comparison of ECMWF wave height results with ERS-2 Altimeter wave height data for February 2000 (northern hemisphere)
- Figure 19: Comparison of ECMWF wave height results with ERS-2 Altimeter wave height data for February 2000 (tropics)
- Figure 20: Comparison of ECMWF wave height results with ERS-2 Altimeter wave height data for February 2000 (southern hemisphere)

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Figure 21: Comparison of buoy wave height observations with ERS-2 Altimeter wave height data for February 2000 (global).

Figure 22: Comparison of buoy wave height observations with ERS-2 Altimeter wave height data for February 2000 (northern hemisphere).

Figure 23: Comparison of buoy wave height observations with ERS-2 Altimeter wave height data for February 2000 (tropics).

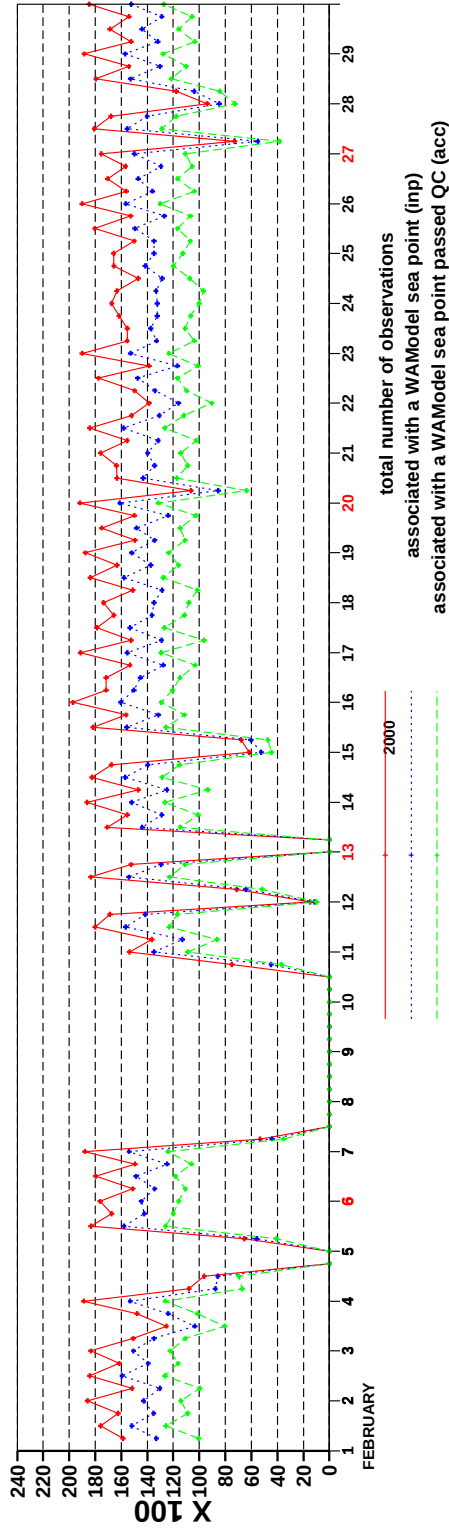
Figure 24: ERS-2 Altimeter wave heights: Timeseries of bias (ERS-2 - model) and scatter index (SI) for February 2000.

Figure 25: ERS-2 Altimeter wave heights: Timeseries of bias (ERS-2 - model) and scatter index (SI) from December 1996 to February 2000

Figure 26: ERS-2 Altimeter wind speeds: Timeseries of bias (ERS-2 - model) and scatter index (SI) from December 1996 to February 2000

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ERS 2/ALTIMETER: NUMBER OF OBS, GLOBAL.



ERS 2/ALTIMETER: NUMBER OF MEAN DATA, GLOBAL.

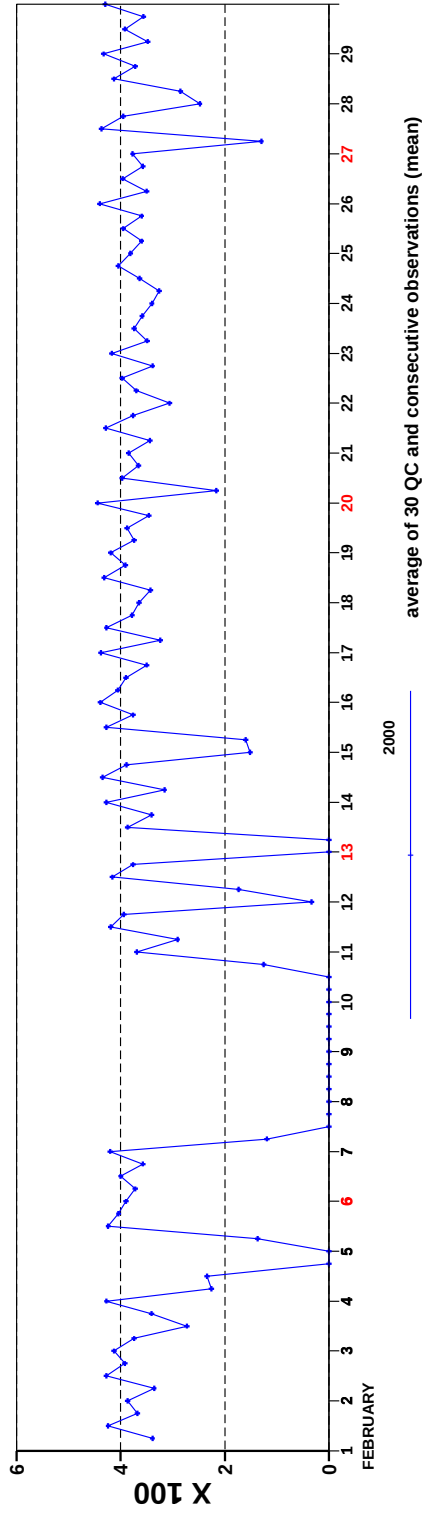


Figure 1: Time series of data reception for ERS-2 Altimeter data for February 2000

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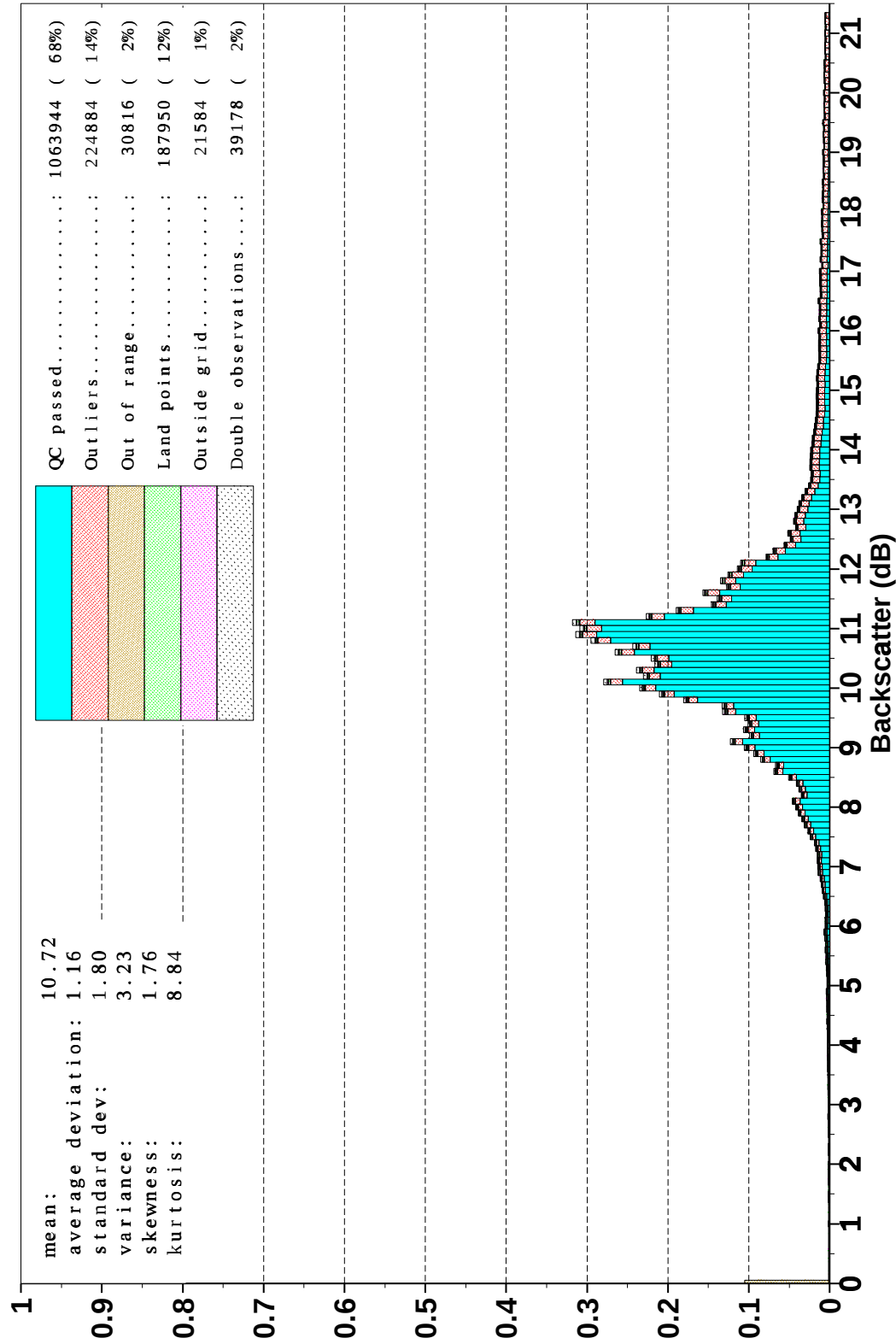


Figure 2: Distribution of the ERS-2 Altimeter backscatter after QC for February 2000

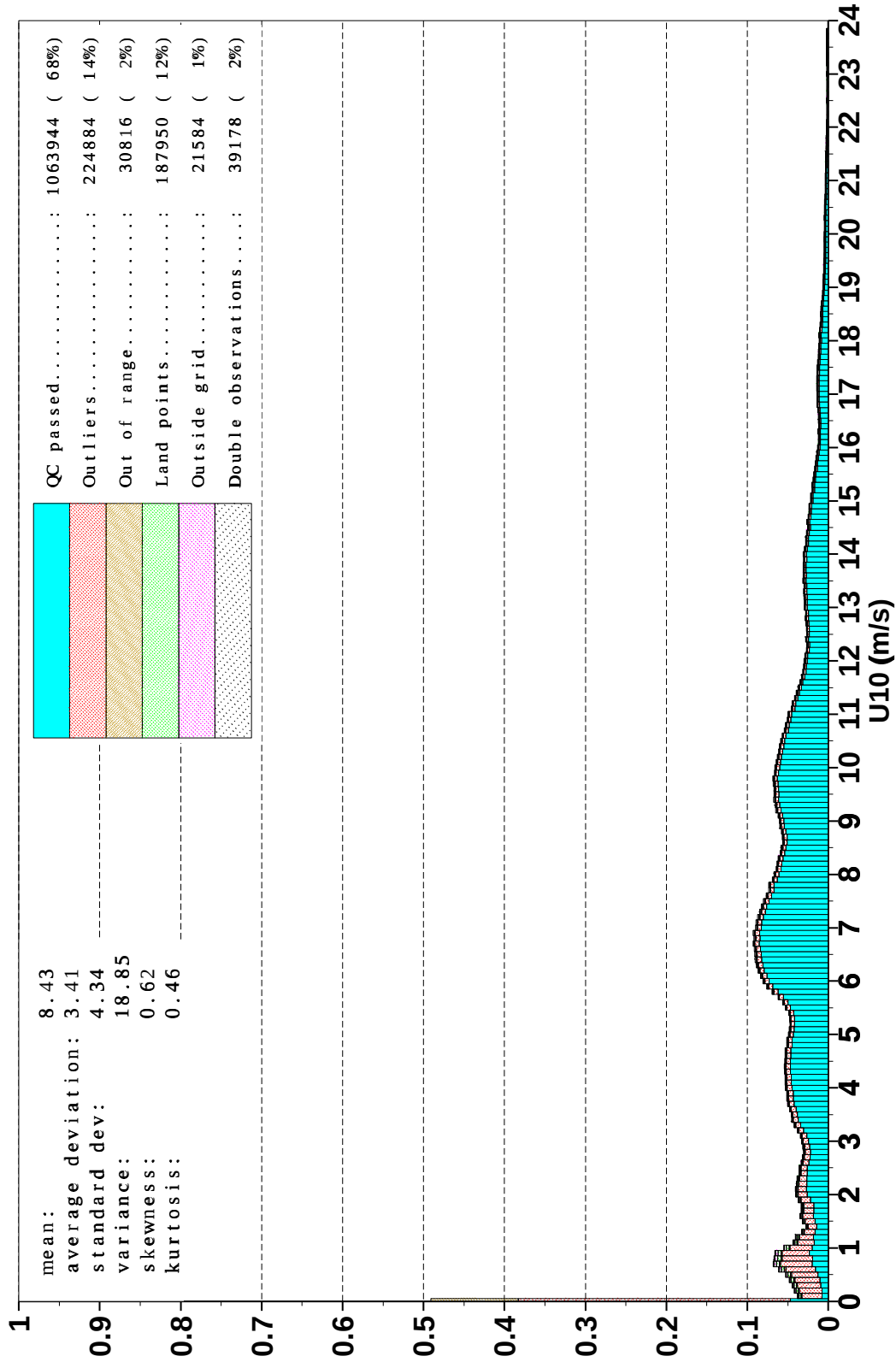


Figure 3: Distribution of the ERS-2 Altimeter wind speeds after QC for February 2000

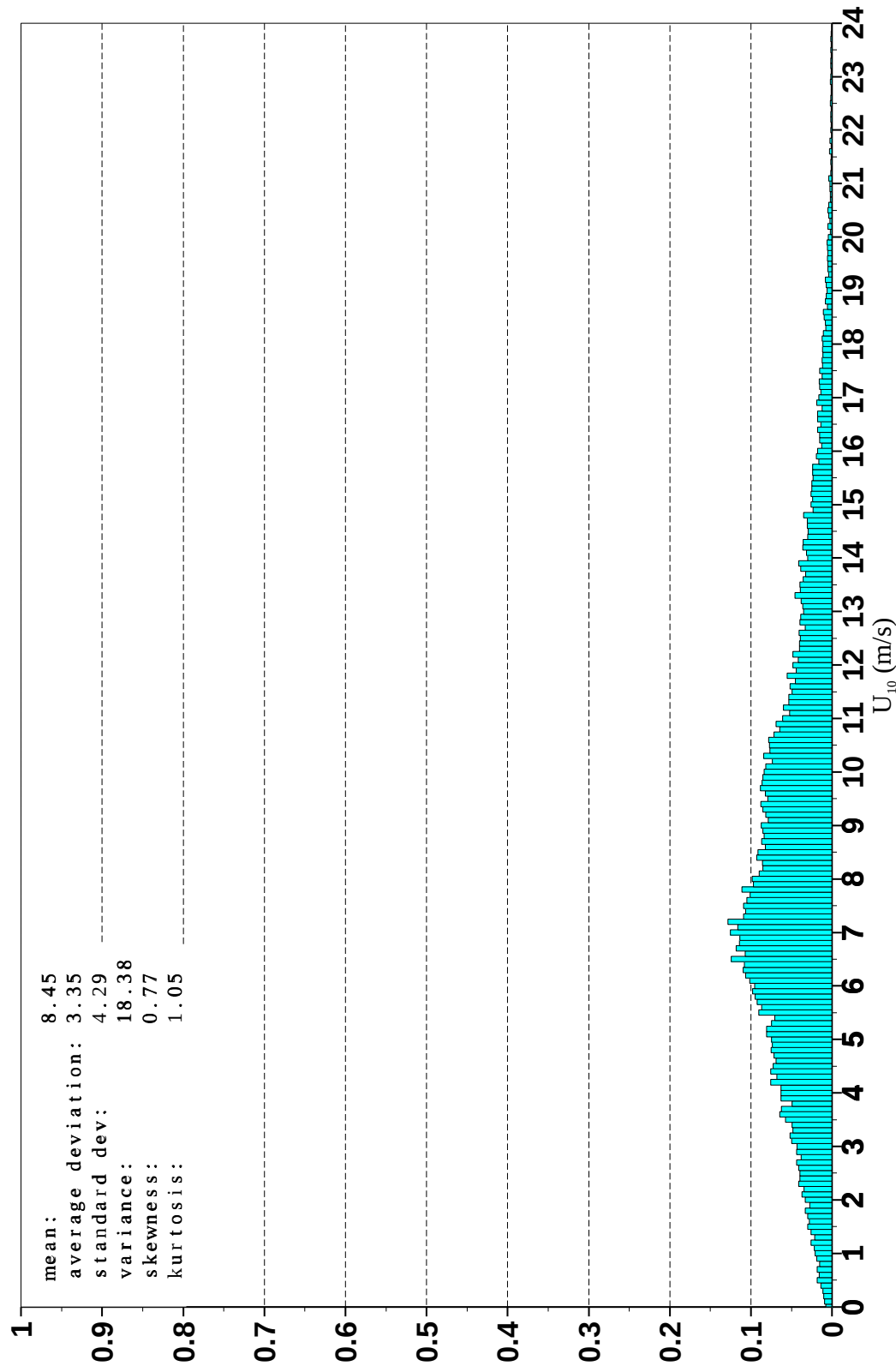


Figure 4: Distribution of ERS-2 Altimeter wind speeds after along track averaging for February 2000

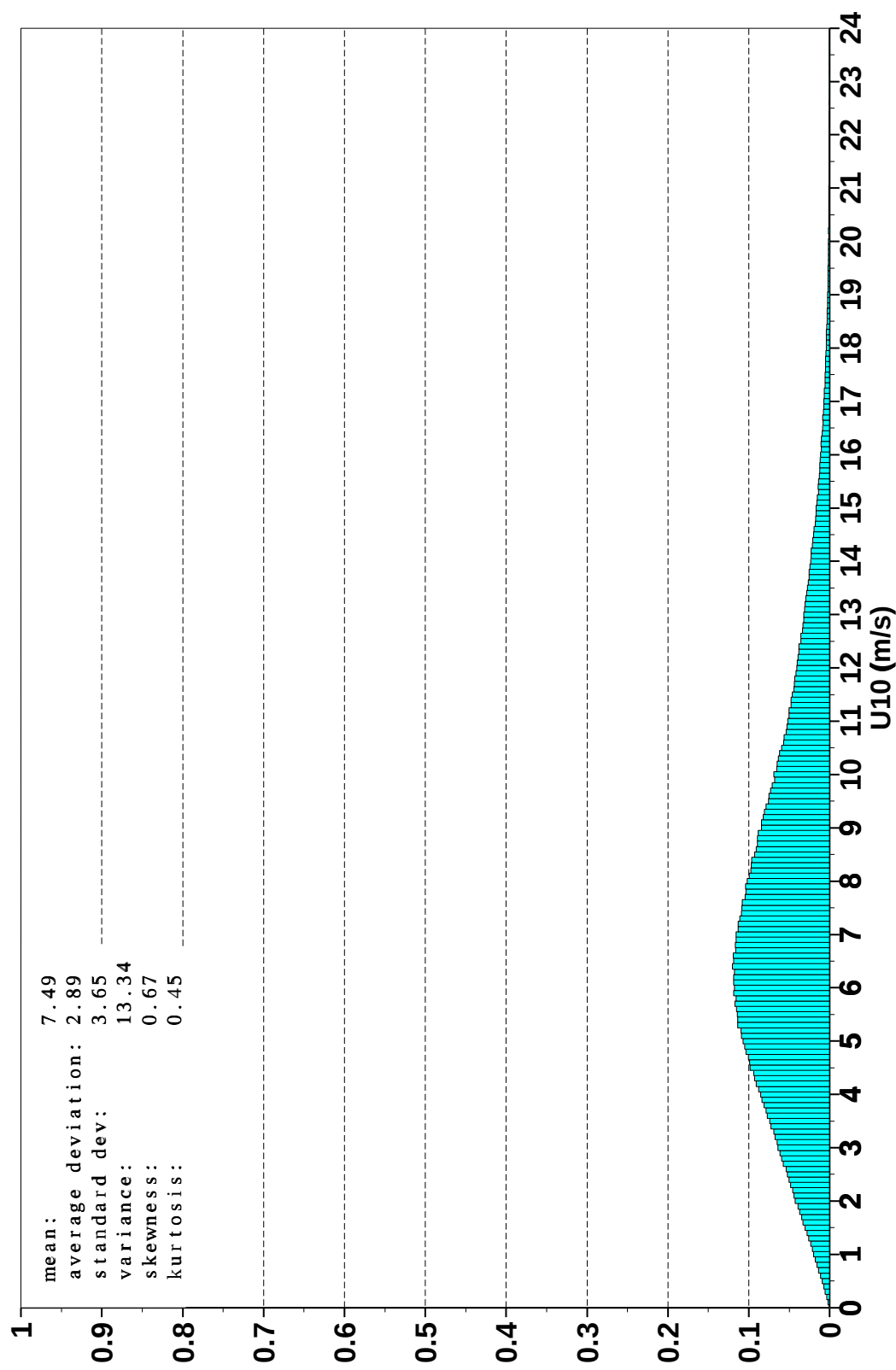


Figure 5: Global distribution of ECMWF ocean surface wind speeds for February 2000

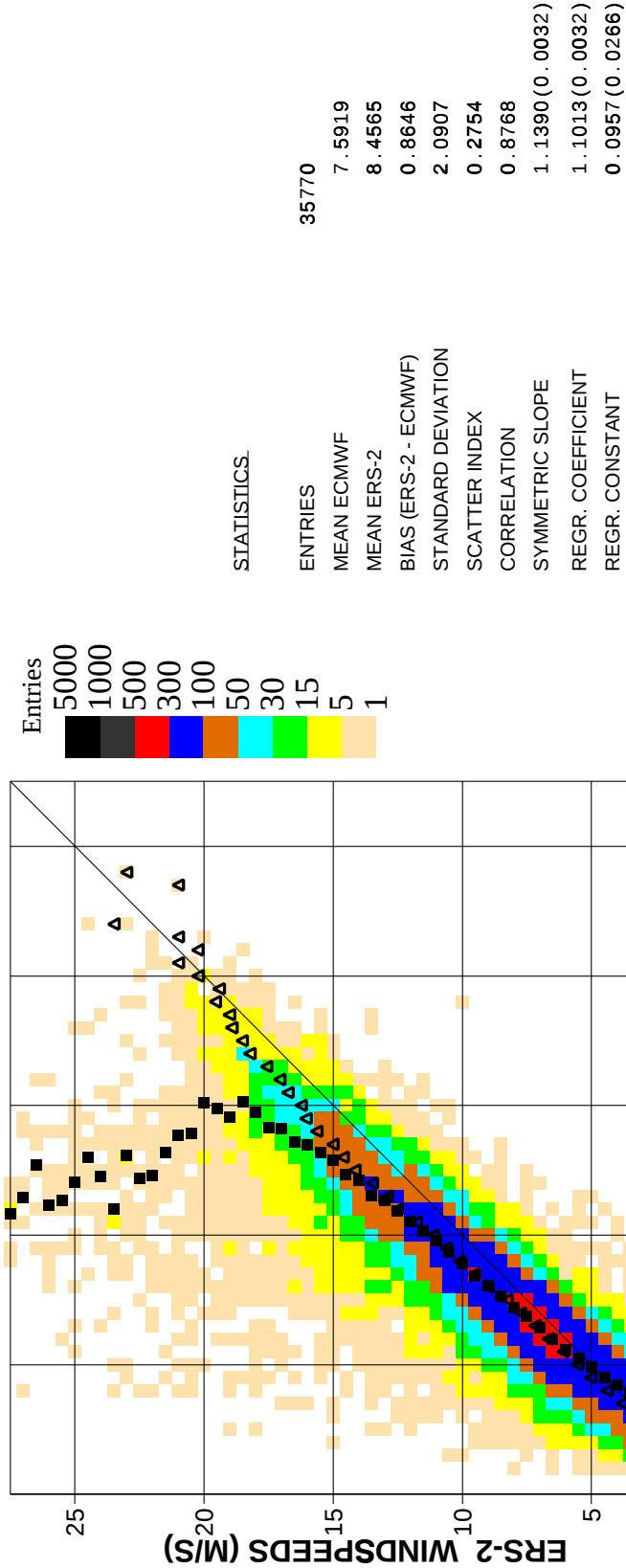


Figure 6. Comparison of ECMWF wind speed results with ERS2 Altimeter wind speed data for February 2000 (global)

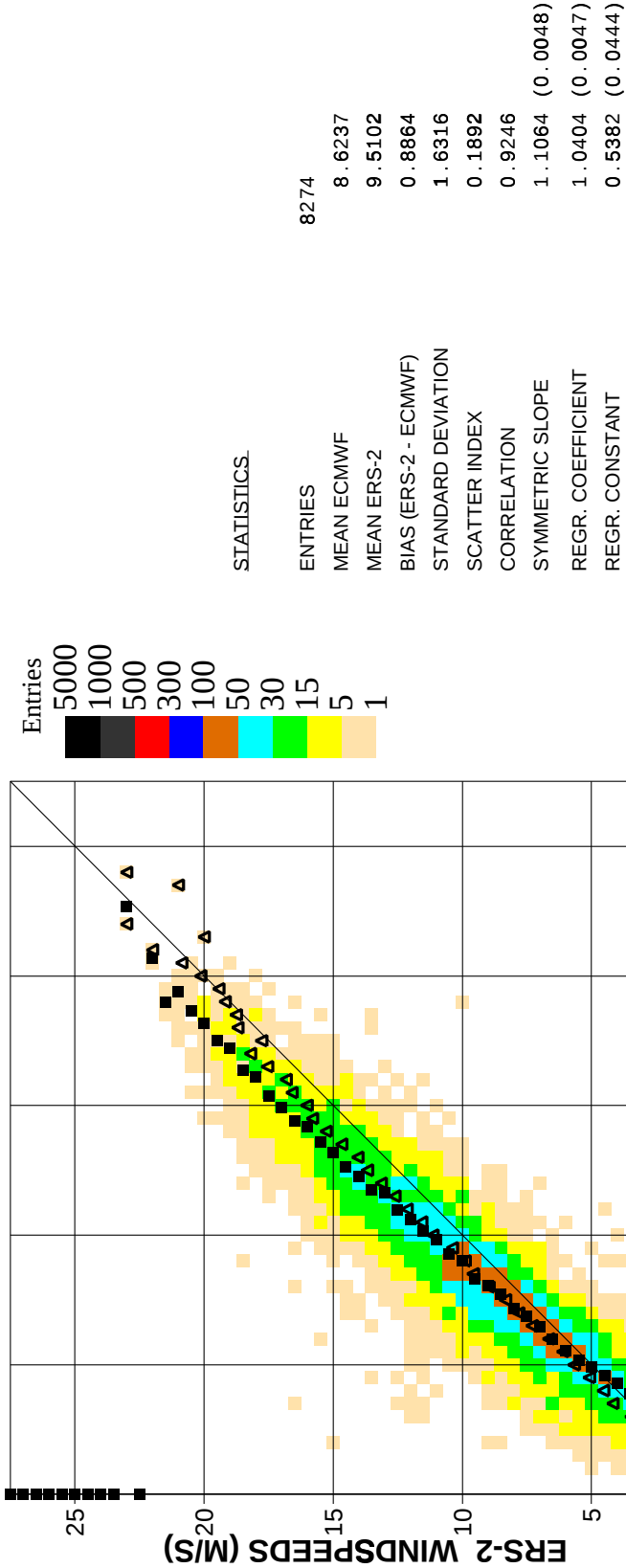


Figure 7. Comparison of ECMWF wind speed results with ERS2 Altimeter wind speed data for February 2000 (n.hem.)

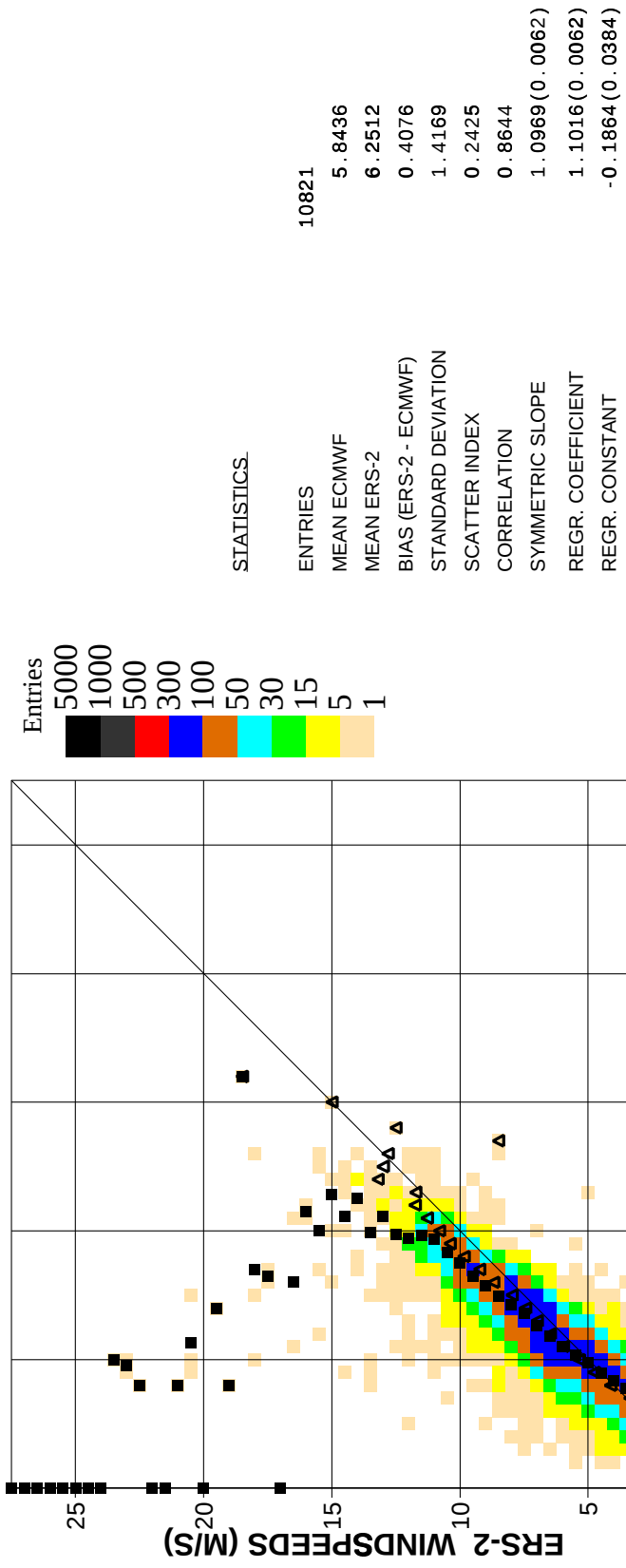


Figure 8. Comparison of ECMWF wind speed results with ERS2 Altimeter wind speed data for February 2000 (tropics)

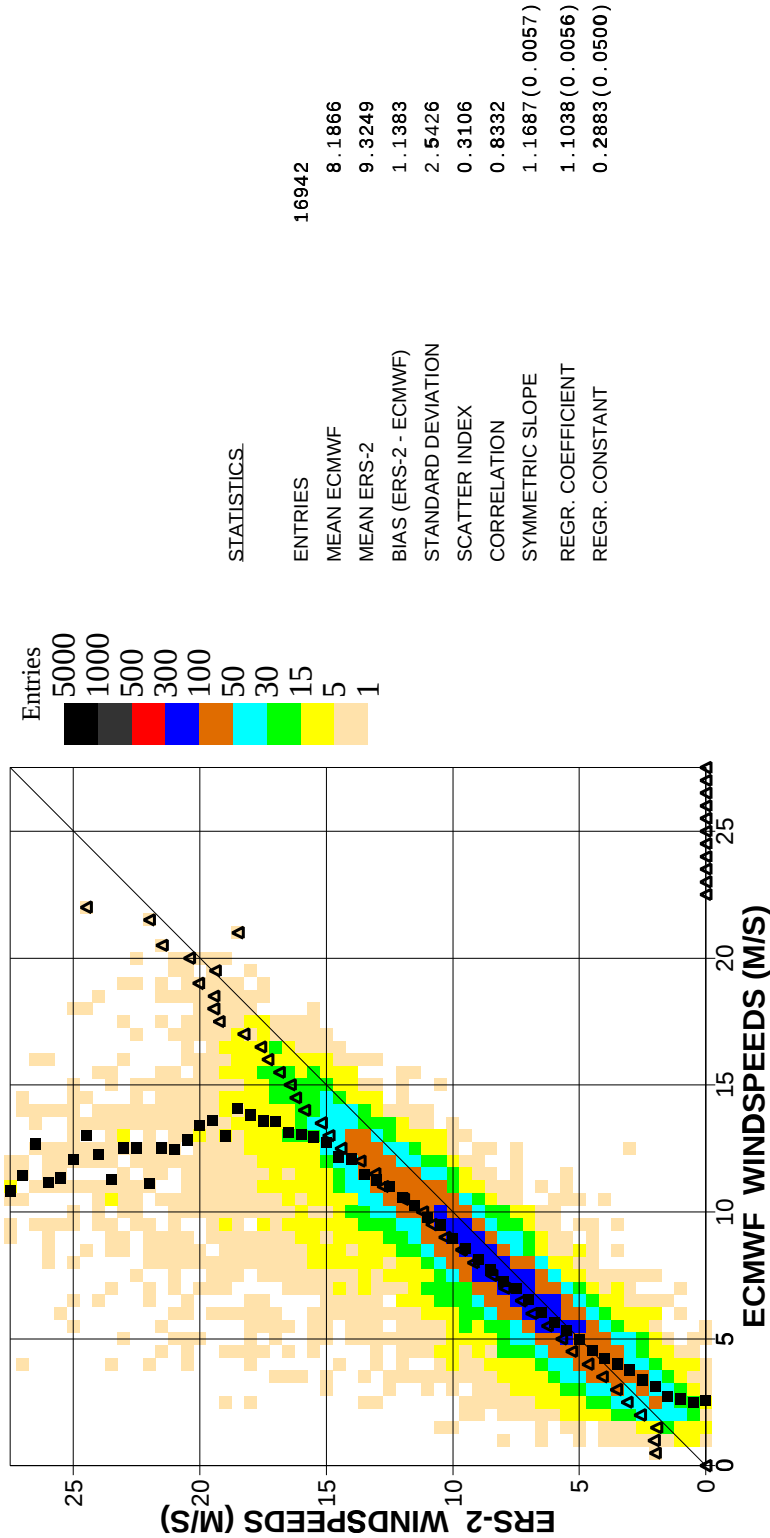


Figure 9. Comparison of ECMWF wind speed results with ERS2 Altimeter wind speed data for February 2000 (s.hem.)

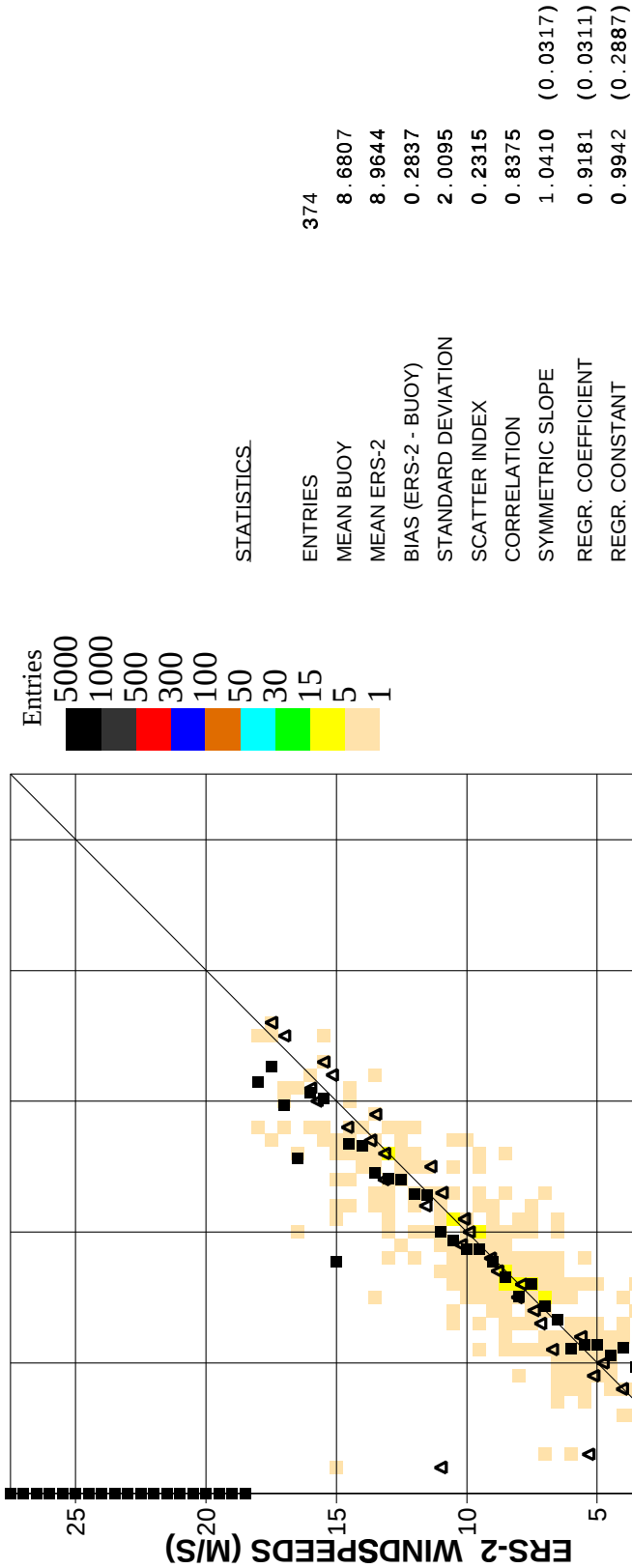


Figure 10. Comparison of buoy wind speed observations with ERS2 Altimeter wind speed data for February 2000 (global)

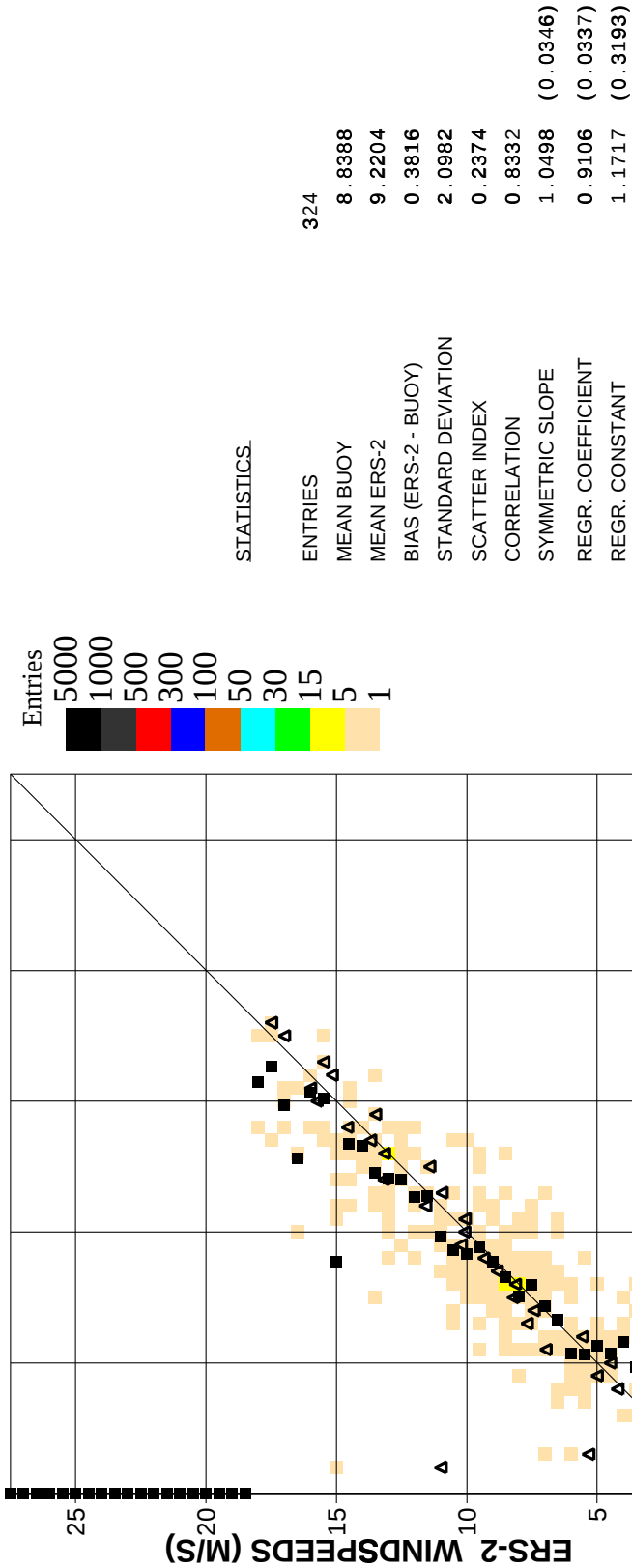


Figure 11. Comparison of buoy wind speed observations with ERS2 Altimeter wind speed data for February 2000 (n.hem.)

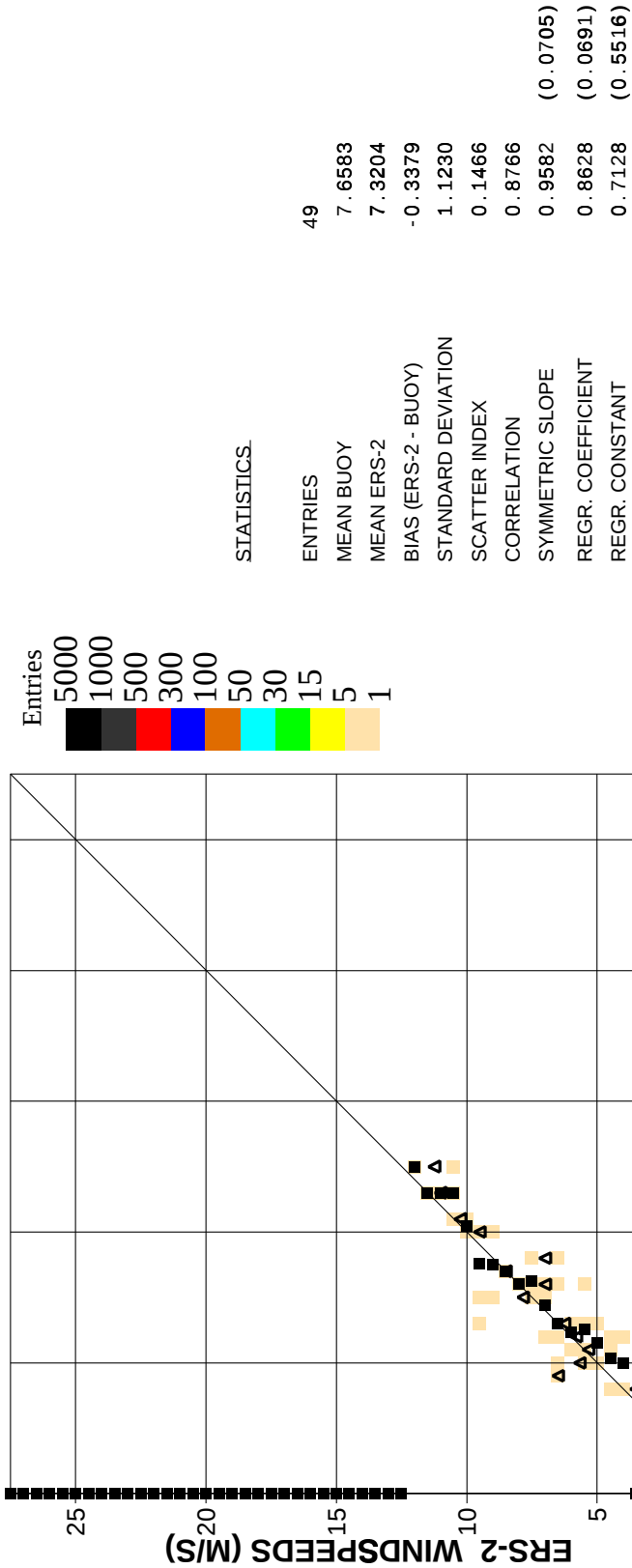


Figure 12. Comparison of buoy wind speed observations with ERS2 Altimeter wind speed data for February 2000 (hawaii)

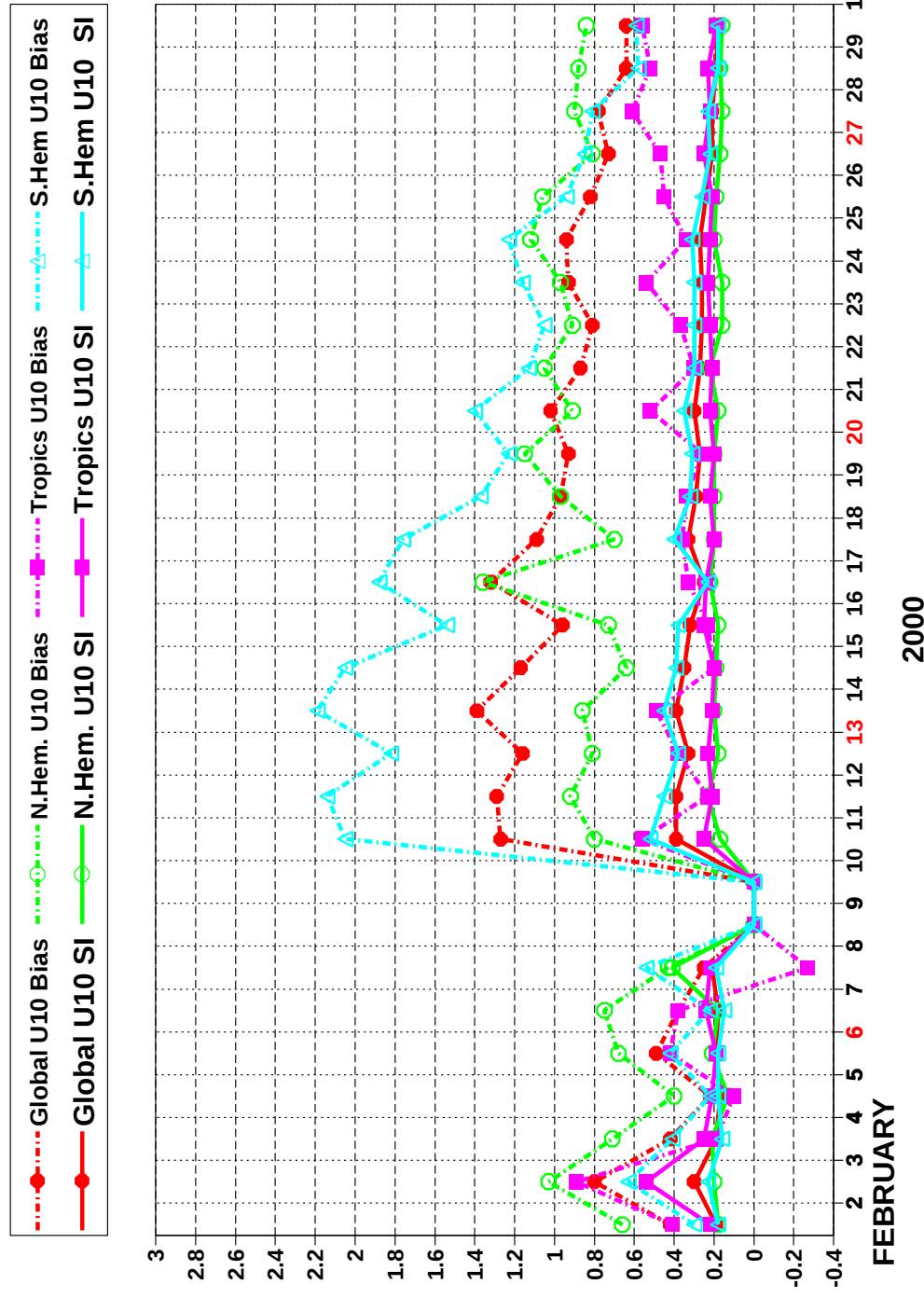


Figure 13: ERS-2 Altimeter wind speeds: Timeseries of bias (ERS-2 - model) and scatter index (SI)

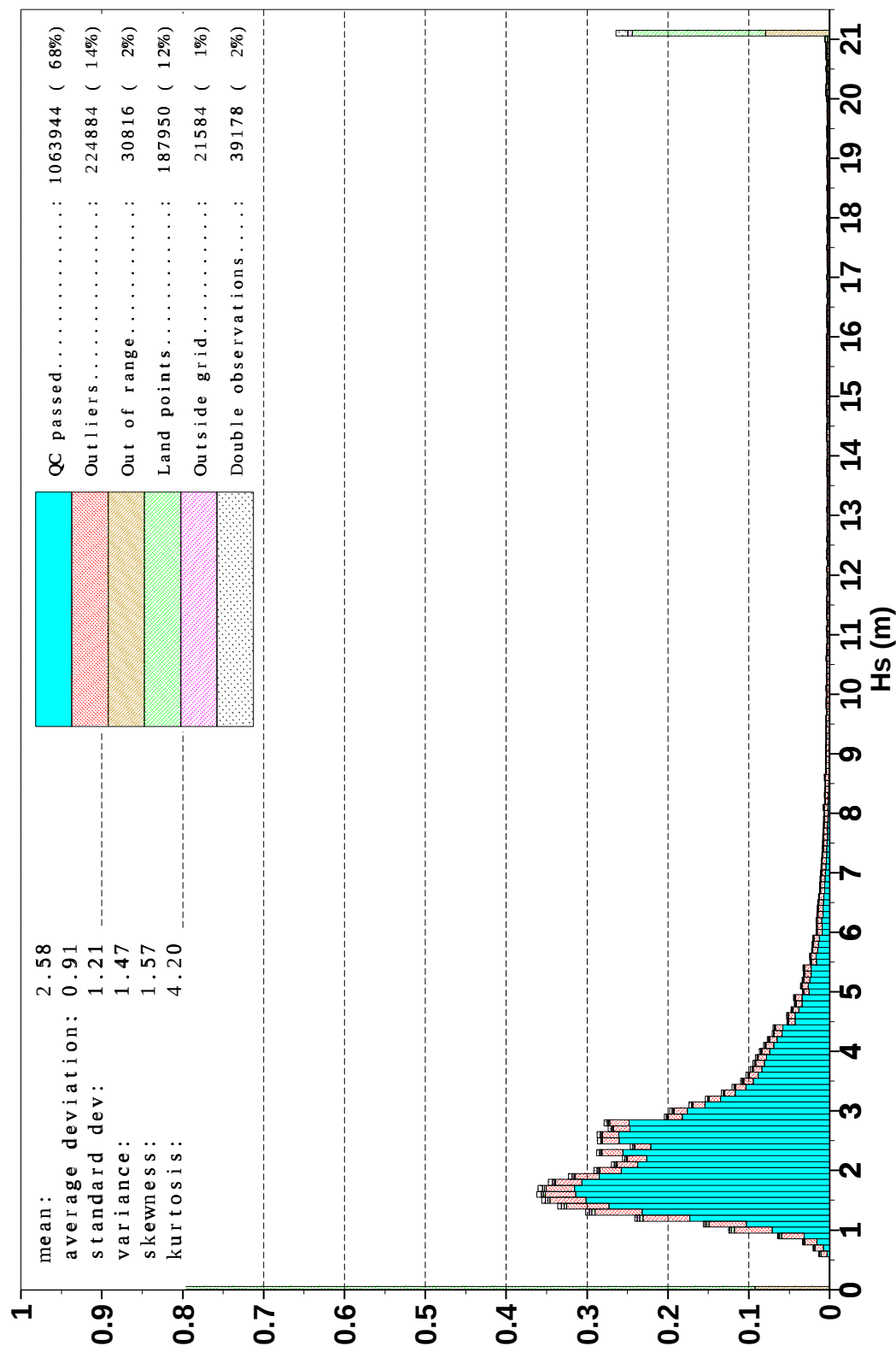


Figure 14: Distribution of the ERS-2 Altimeter wave heights after QC for February 2000

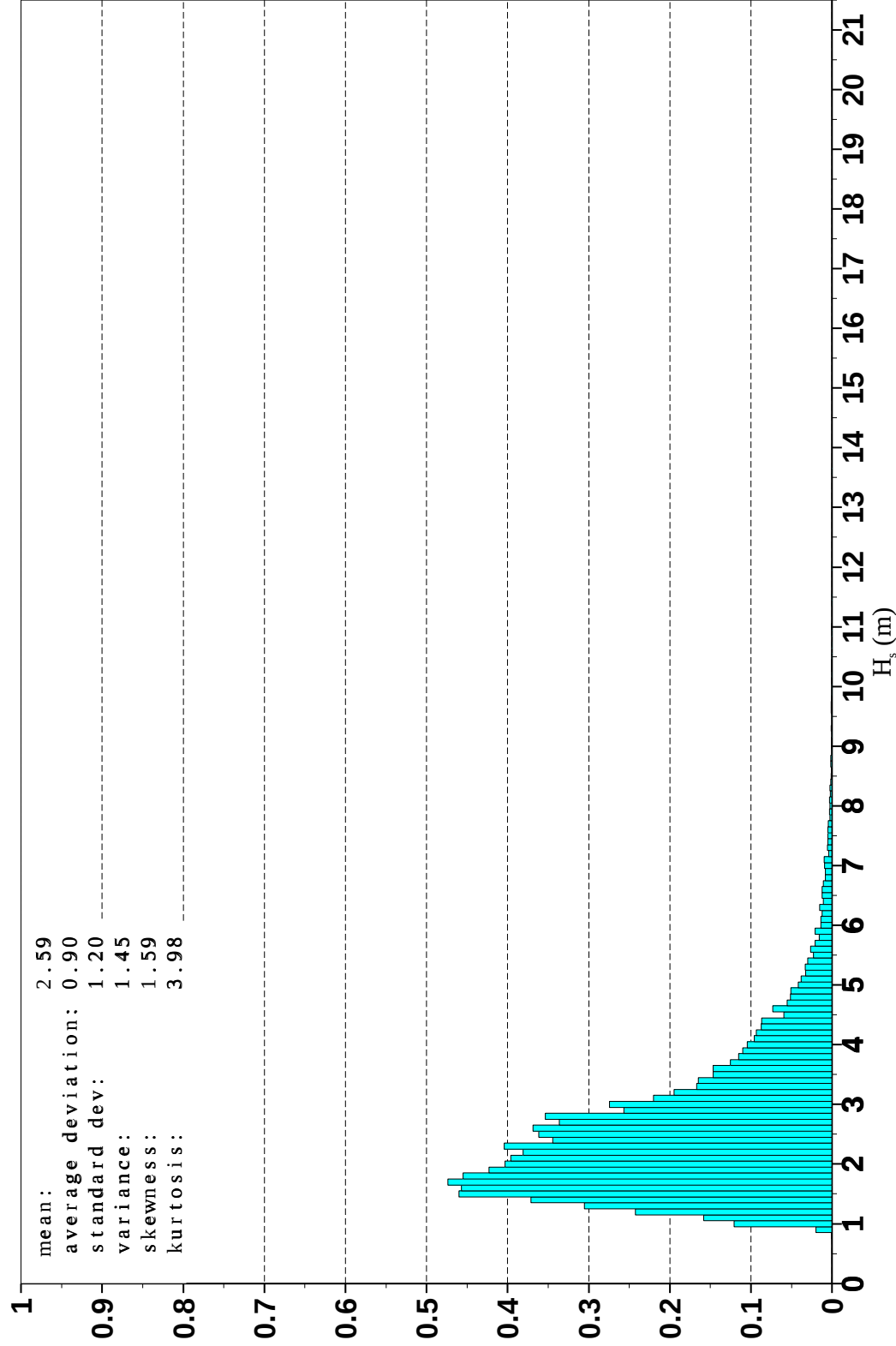


Figure 15: Distribution of ERS-2 Altimeter wave heights after along track averaging for February 2000

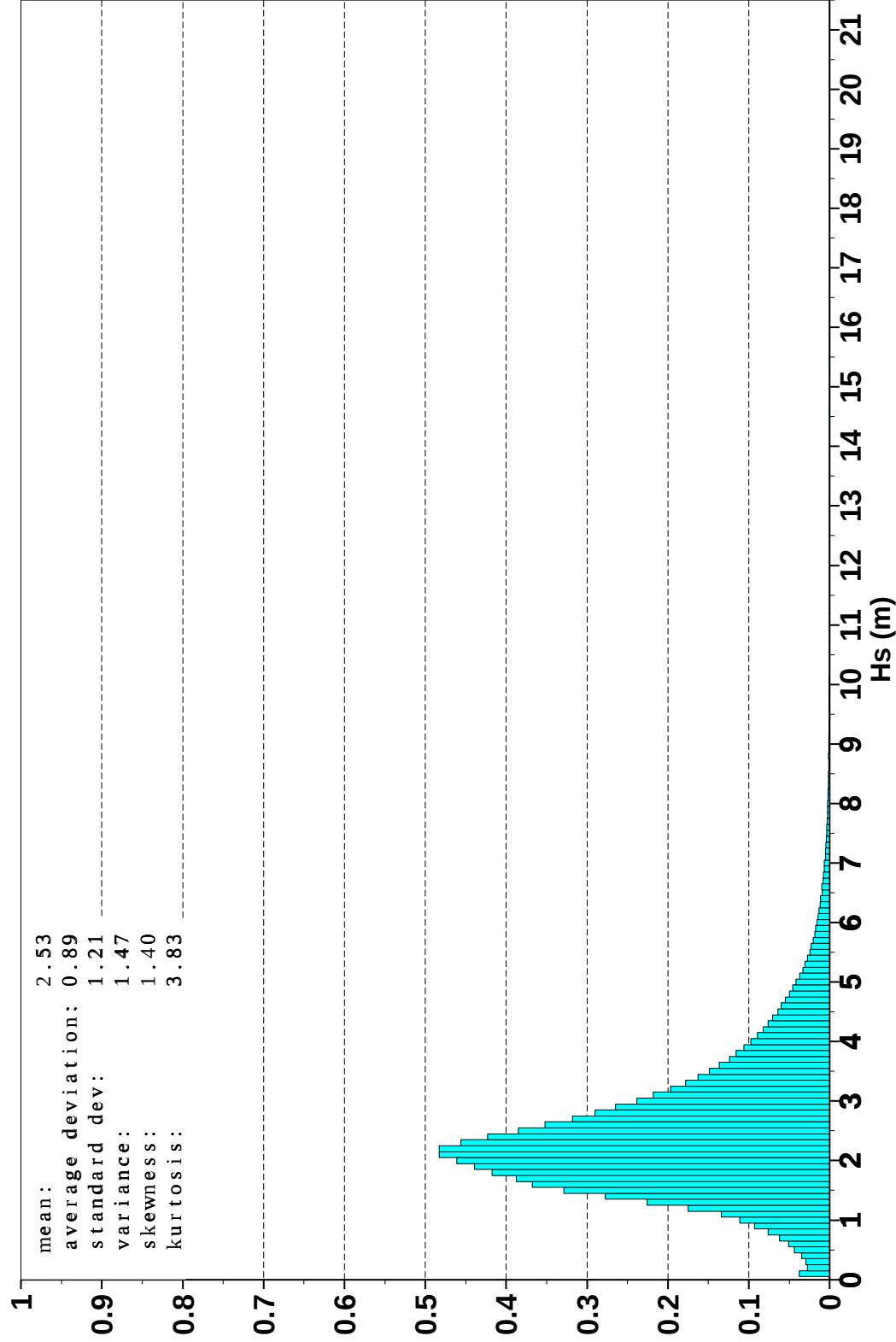


Figure 16: Global distribution of ECMWF wave heights for February 2000

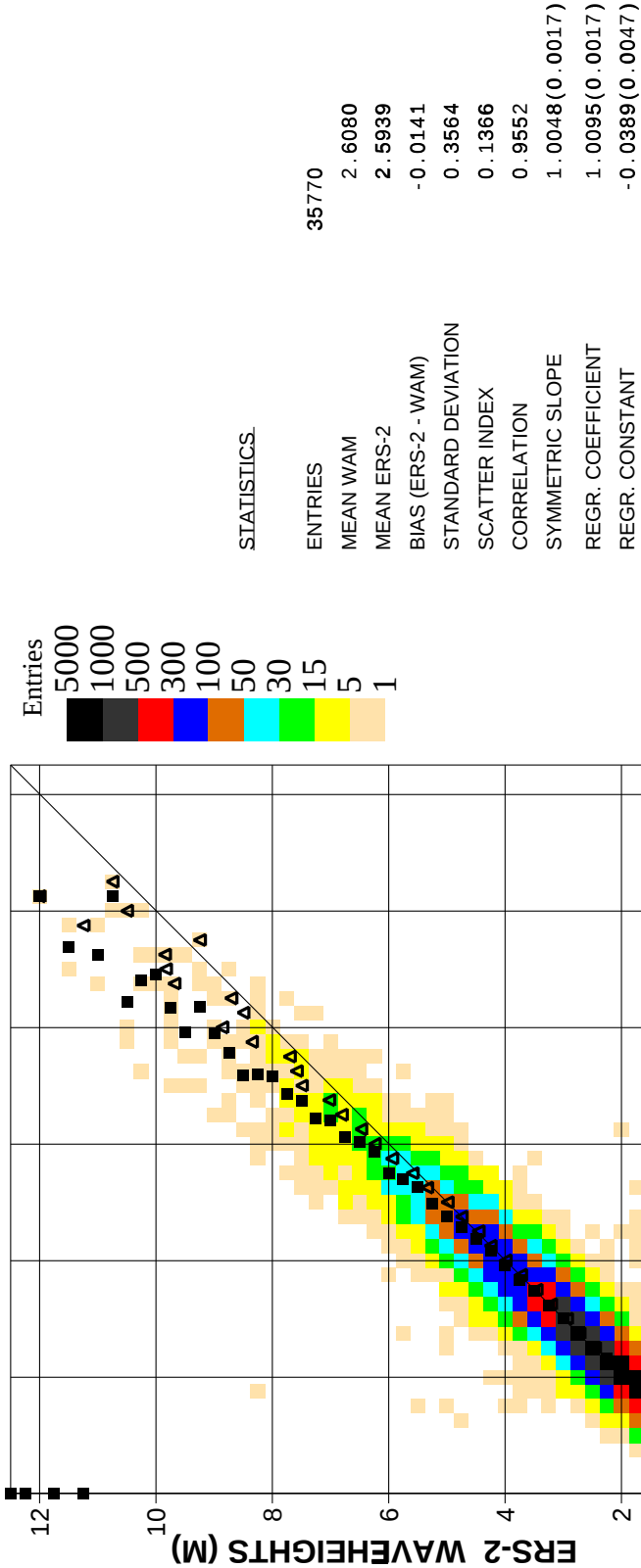


Figure 17. Comparison of ECMWF wave height results with ERS2 Altimeter wave height data for February 2000 (global)

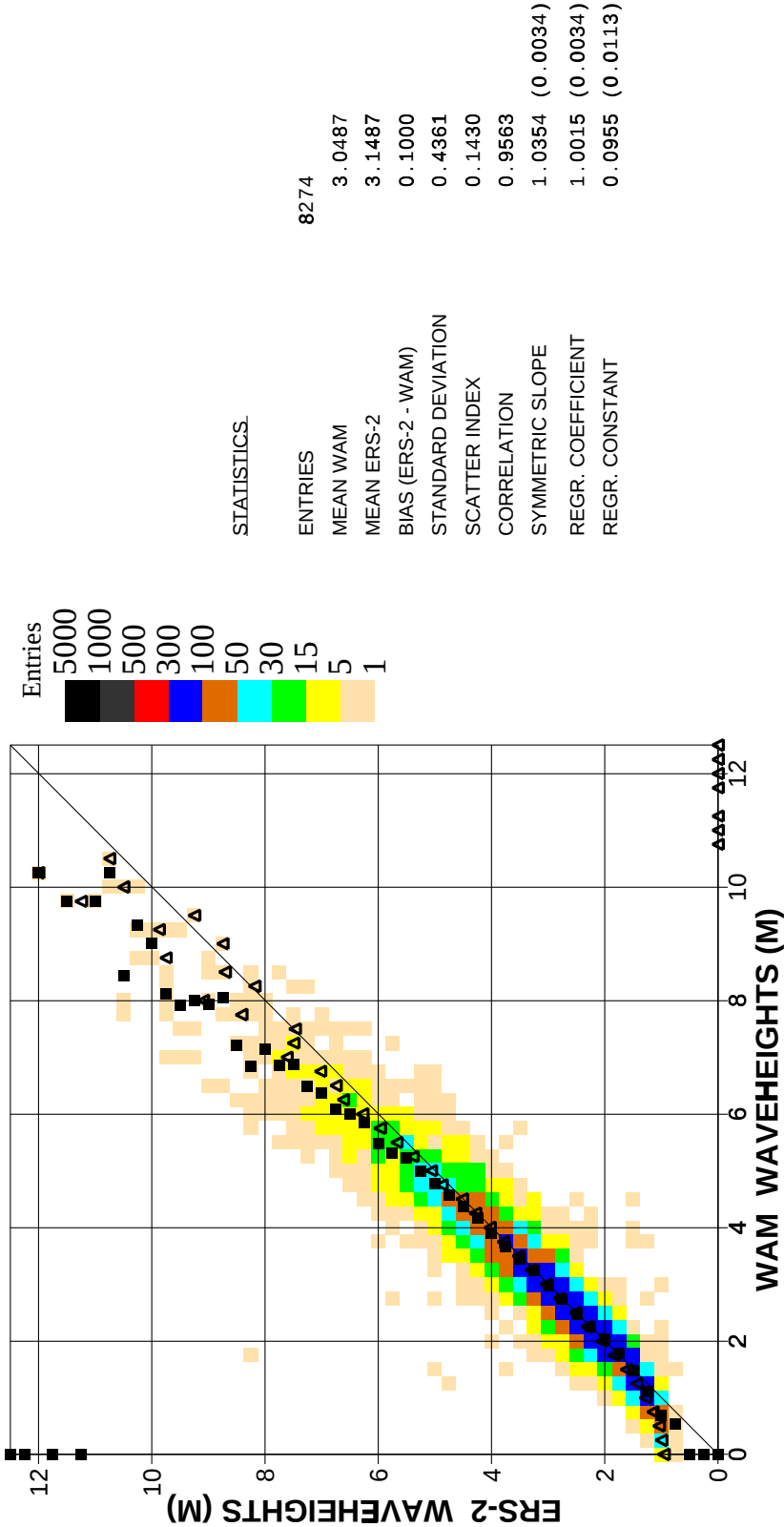


Figure 18. Comparison of ECMWF wave height results with ERS2 Altimeter wave height data for February 2000 (n.hem.)

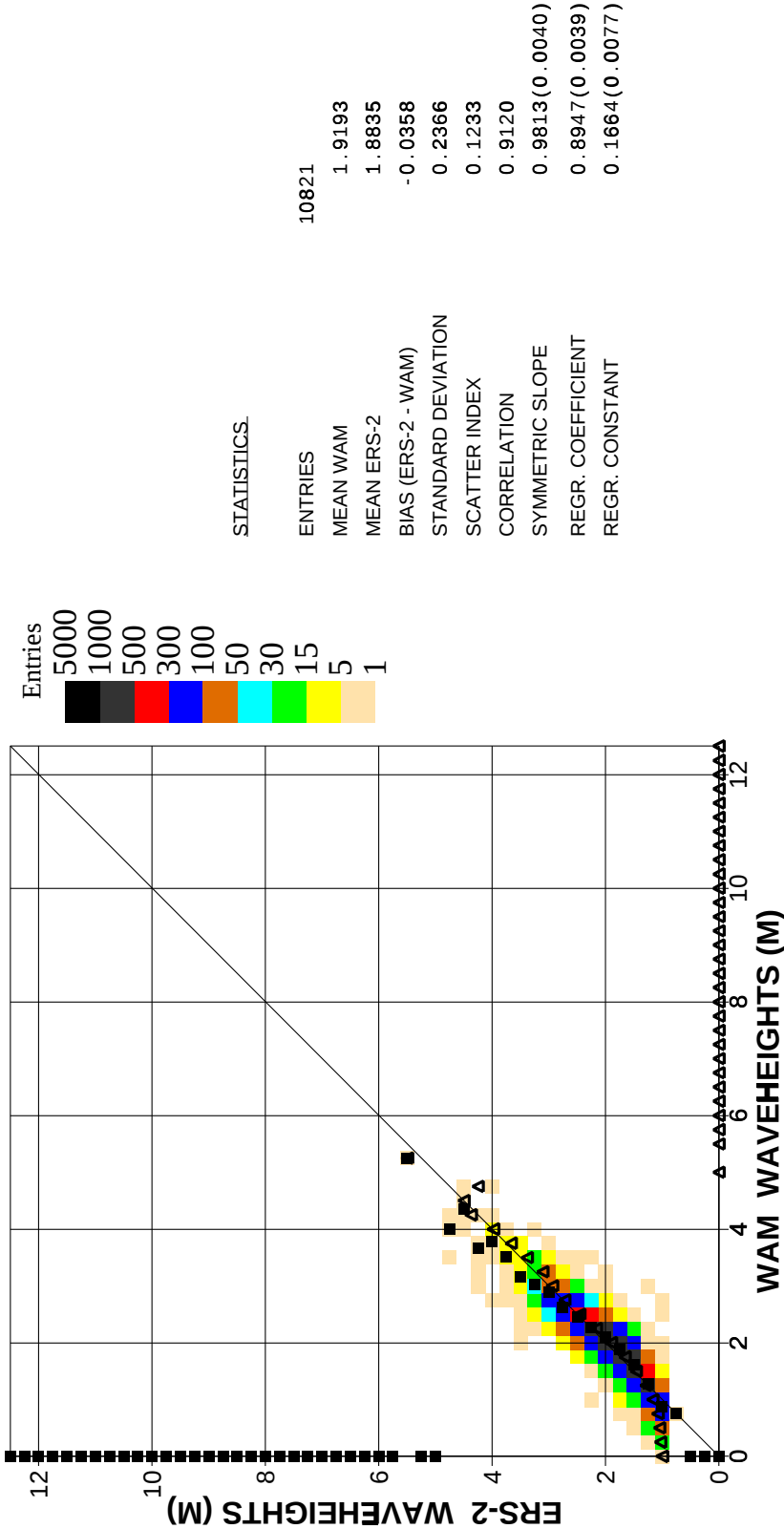


Figure 19. Comparison of ECMWF wave height results with ERS2 Altimeter wave height data for February 2000 (tropics)

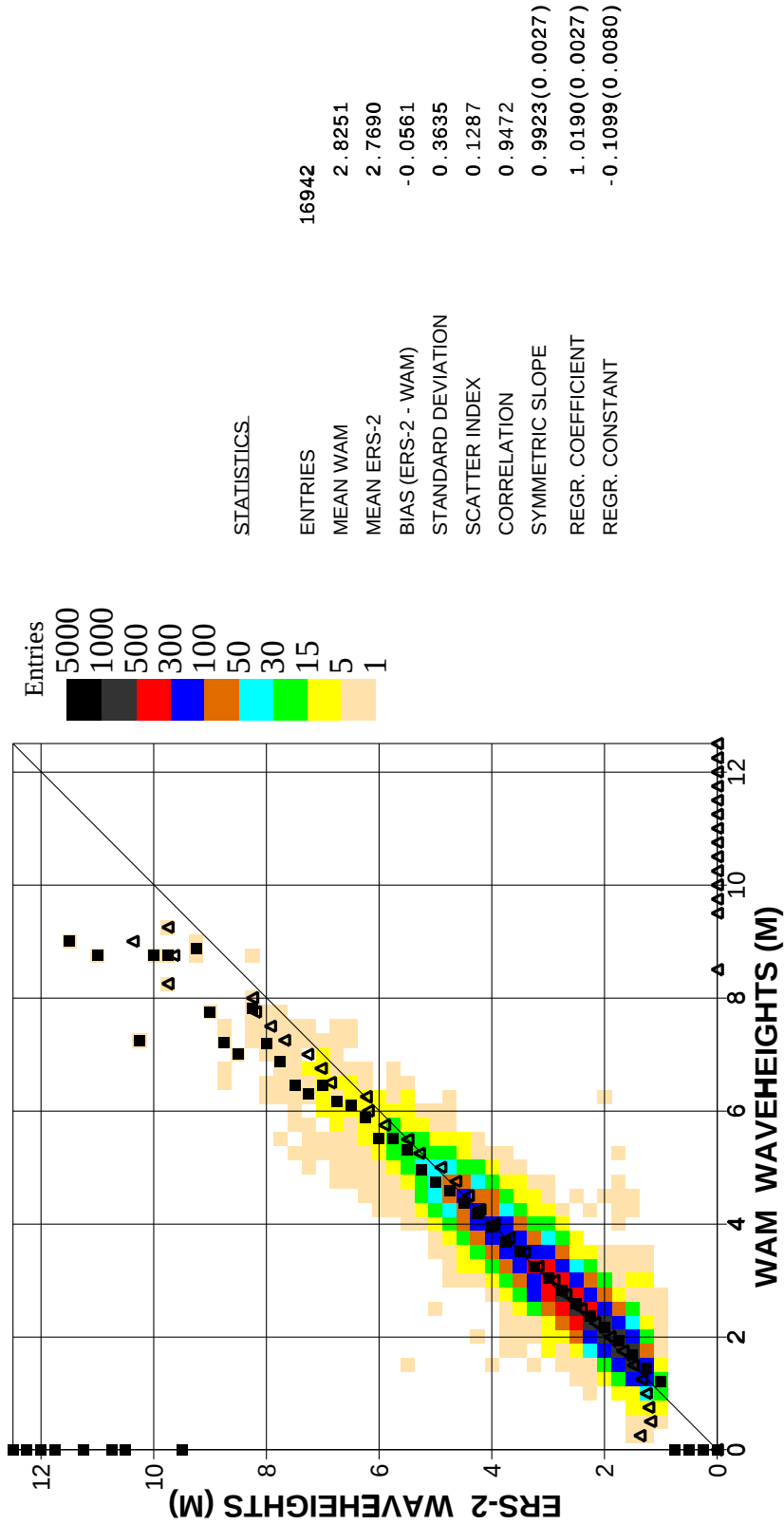


Figure 20. Comparison of ECMWF wave height results with ERS2 Altimeter wave height data for February 2000 (s.hem.)

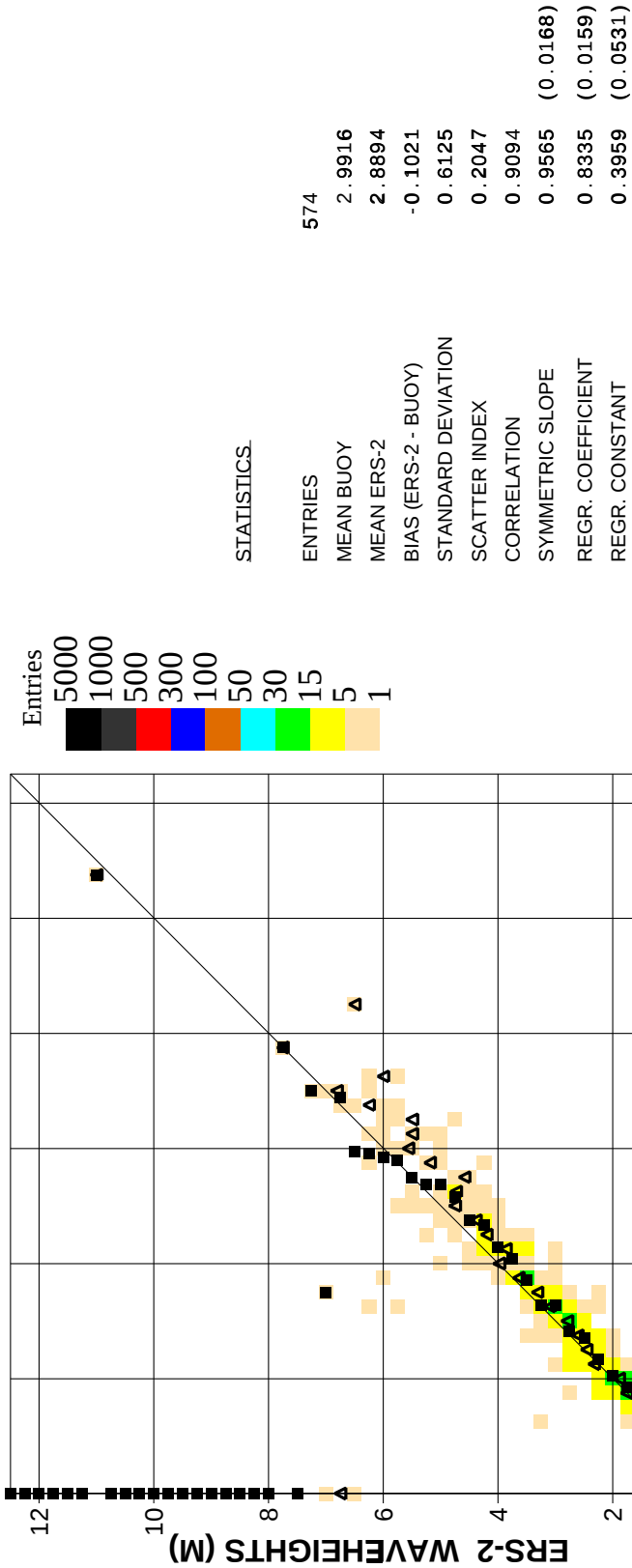


Figure 21. Comparison of buoy wave height observations with ERS2 Altimeter wave height data for February 2000 (global)

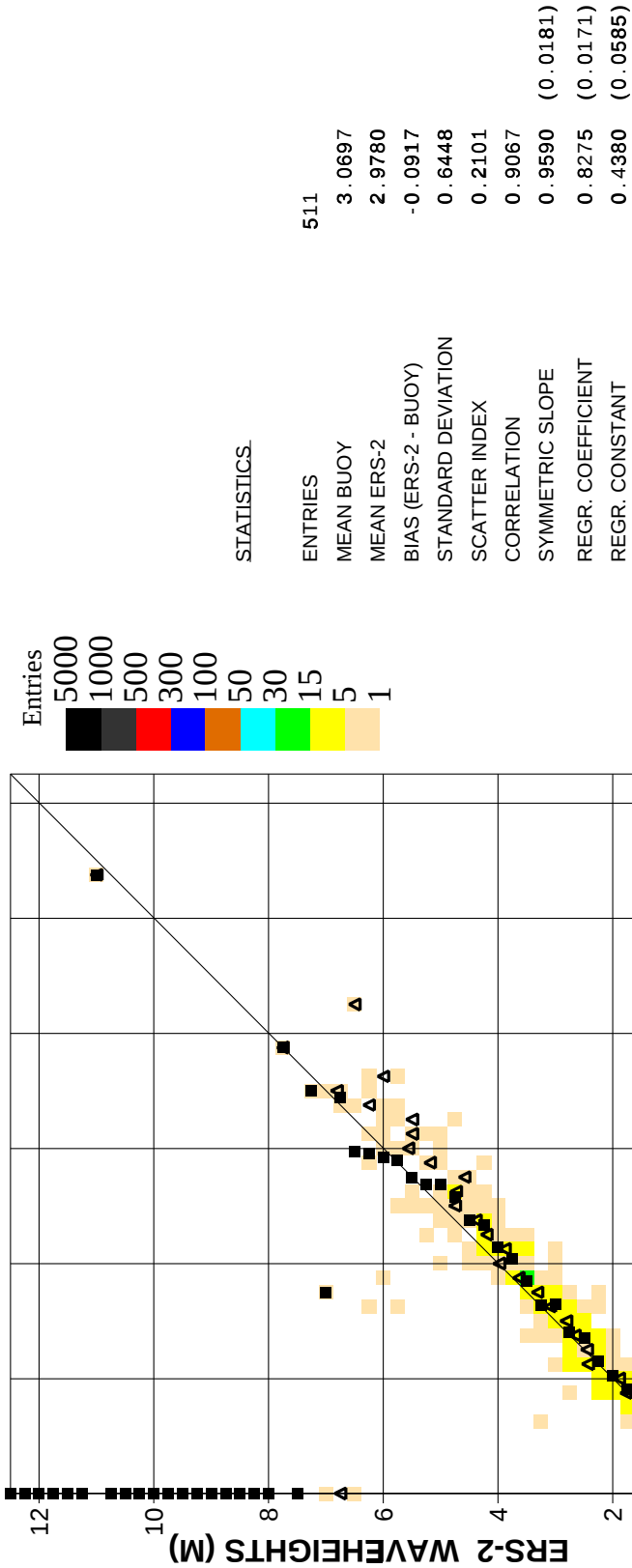


Figure 22. Comparison of buoy wave height observations with ERS2 Altimeter wave height data for February 2000 (n.hem.)

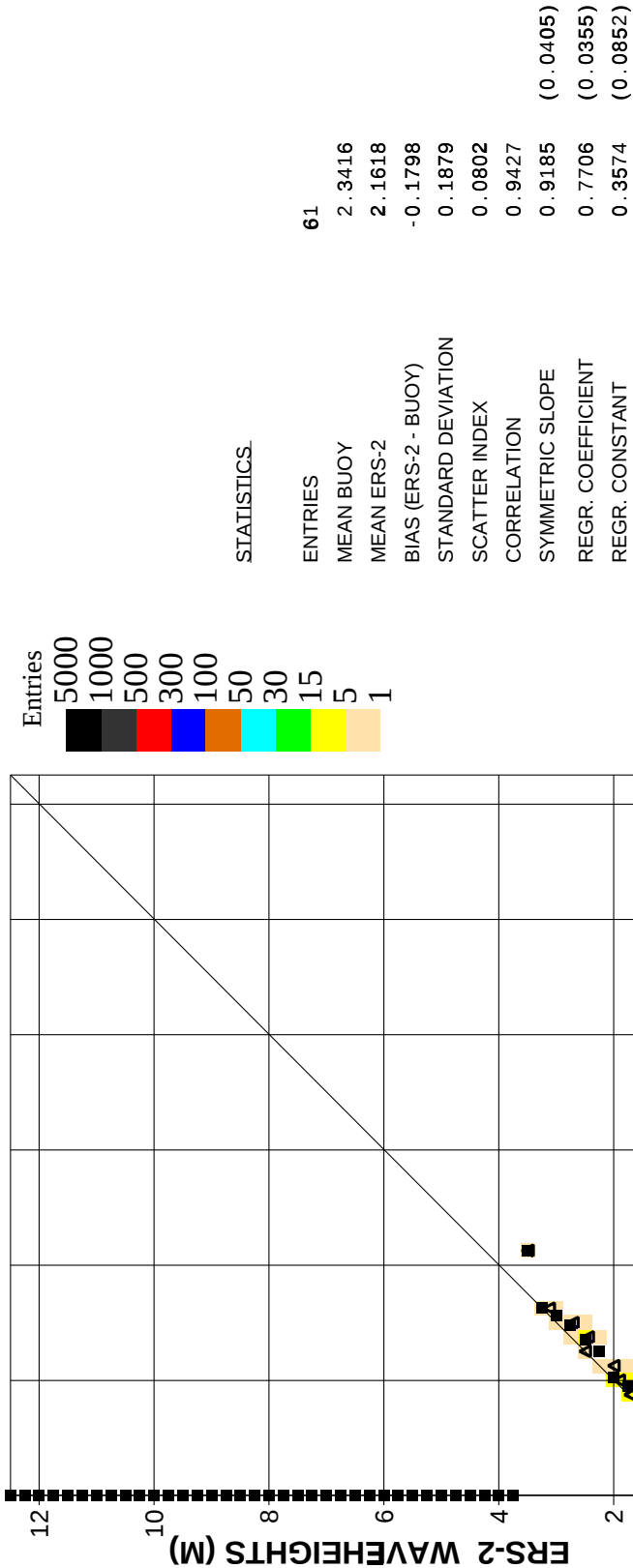


Figure 23. Comparison of buoy wave height observations with ERS2 Altimeter wave height data for February 2000 (hawaii)

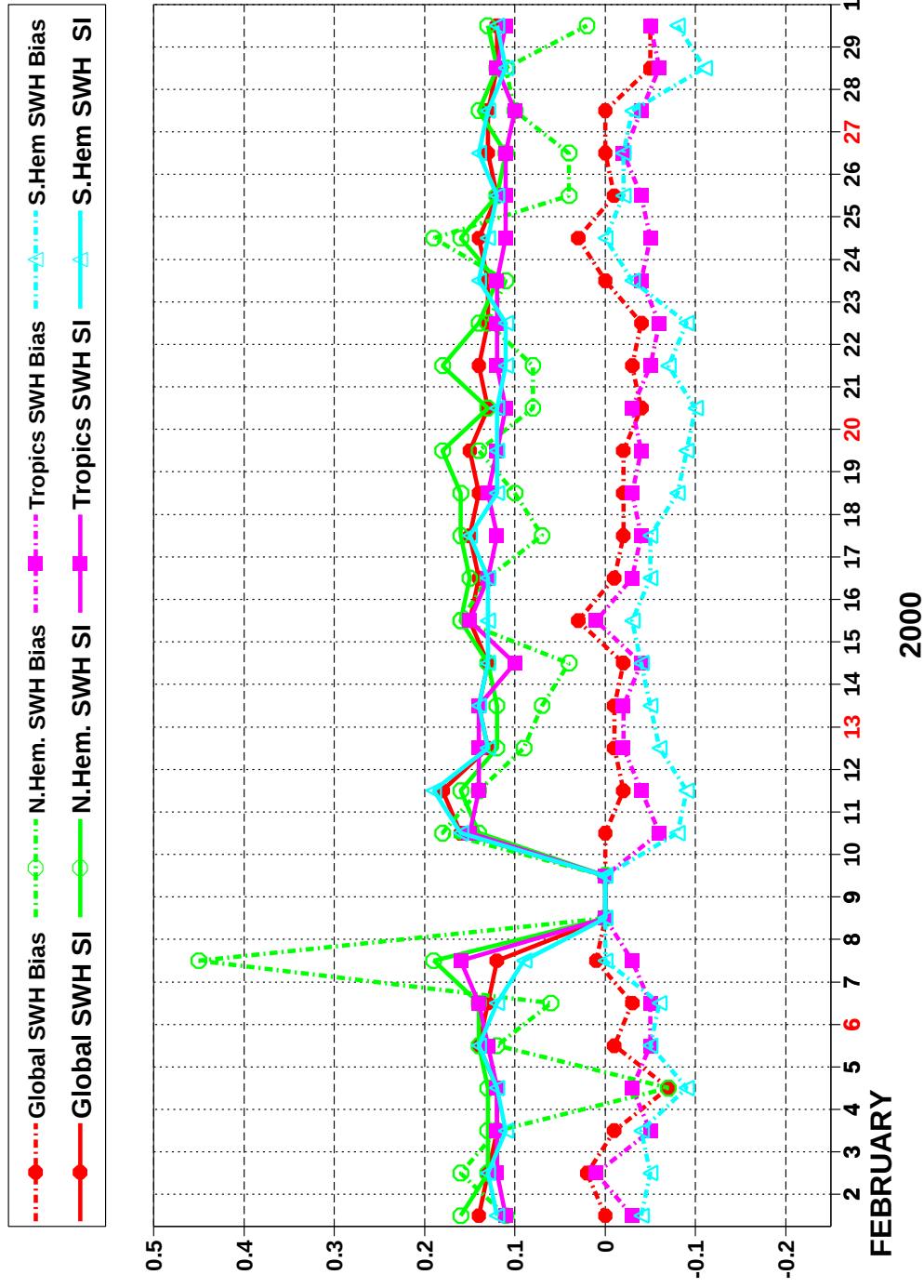


Figure 24: ERS-2 Altimeter wave heights: Timeseries of bias (ERS-2 - model) and scatter index (SI)

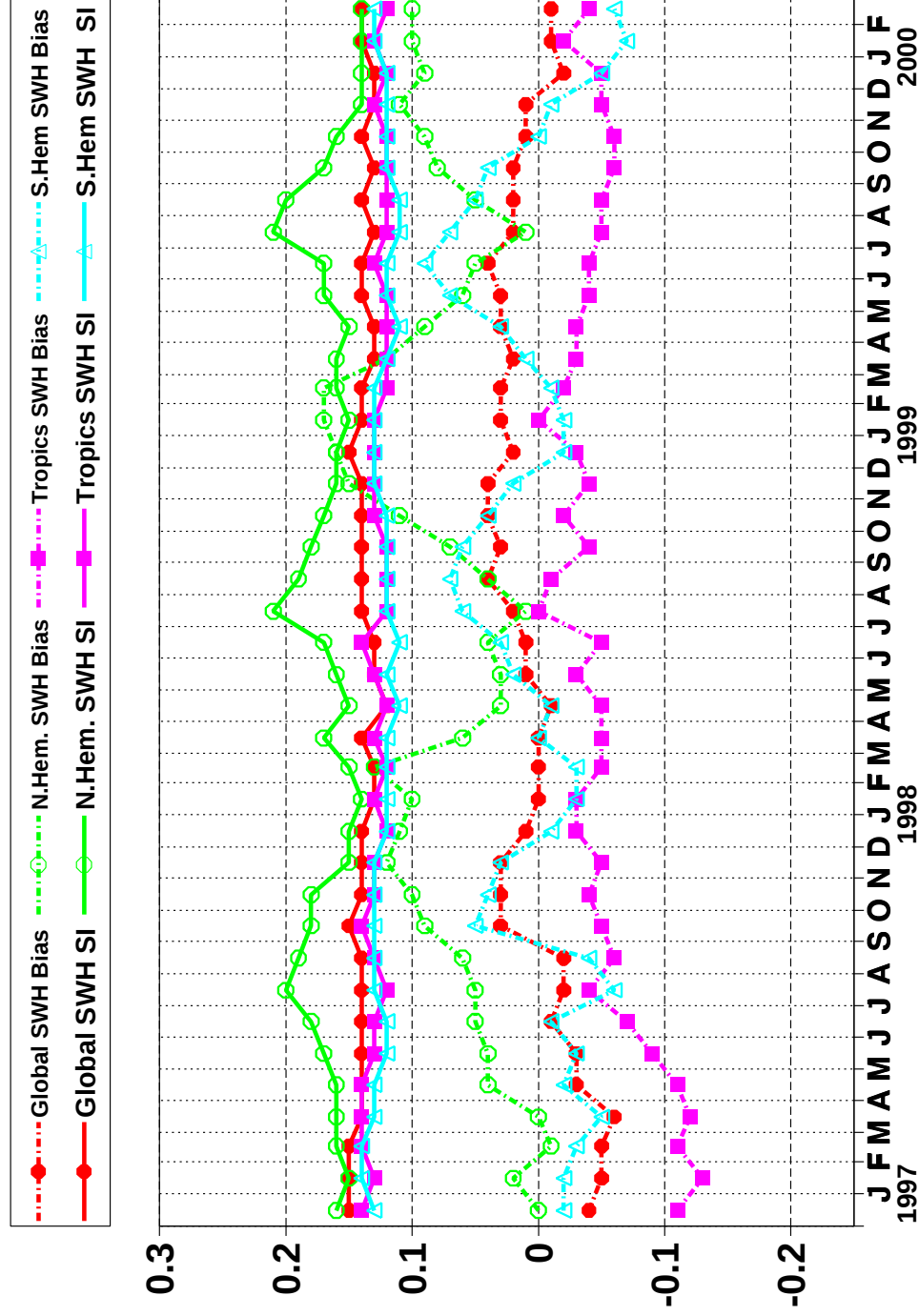


Figure 25: ERS-2 Altimeter wave heights: Timeseries of bias (ERS-2 - model) and scatter index (SI)

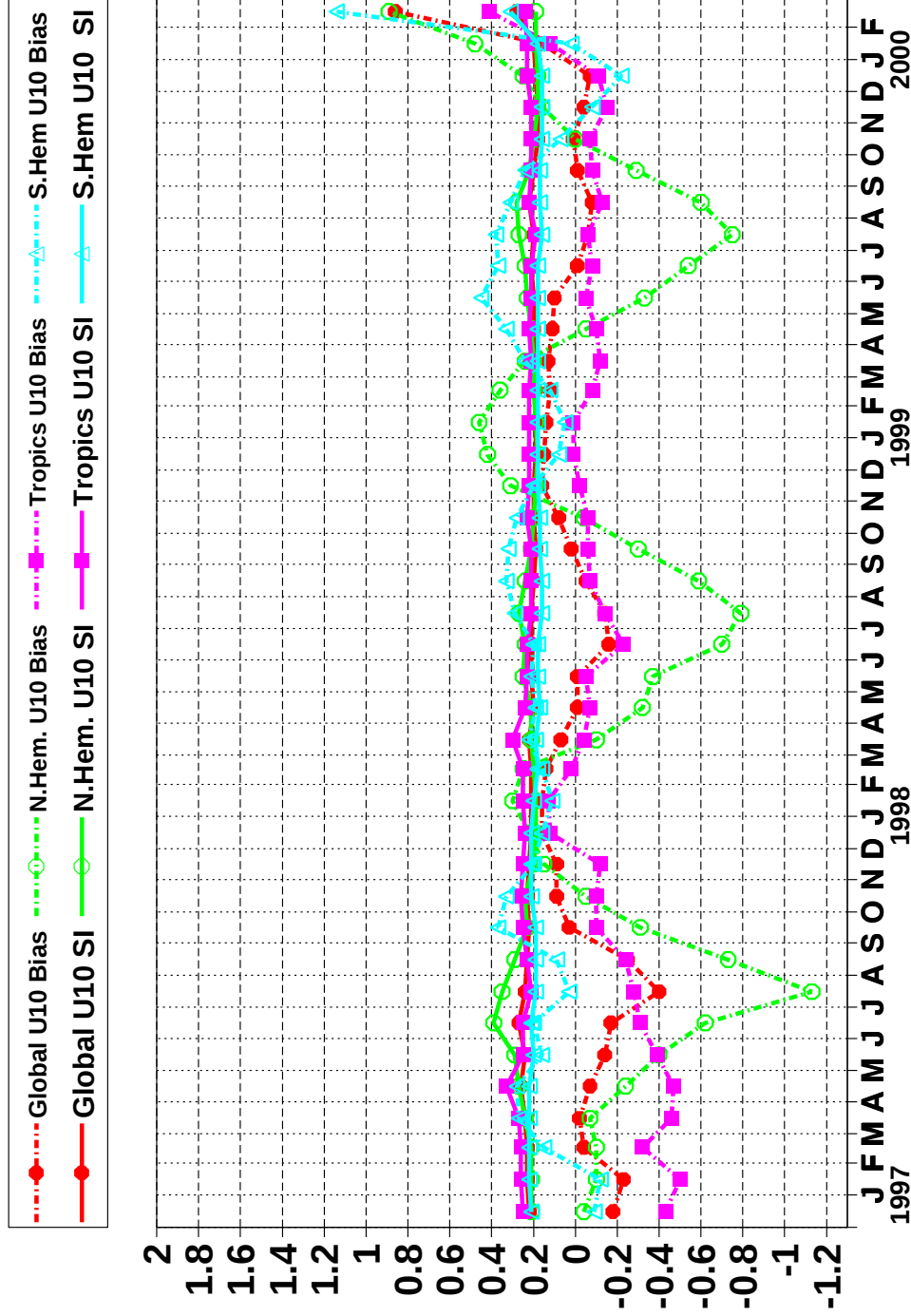


Figure 26: ERS-2 Altimeter wind speeds: Timeseries of bias (ERS-2 - model) and scatter index (SI)