

■ ECMWF Report on ERS-2 RA for December 1999 ■

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

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Overview:

This month around 13447 observations arrived at ECMWF every 6 hours of which 81.62% passed the quality control. Data coverage was reduced in six 6 hour time windows centered around the 12th 12UT and 21st 12UT. No data were reported after 31st 12 UT in preparation to the passage to year 2000(see figure 1). Note that we are talking about data which have arrived at ECMWF before they were needed for the operational data assimilation.

Backscatter:

ERS-2 $\langle \sigma_0 \rangle = 10.99\text{dB}$ (one peak: at 11.1dB)

Wind Speed Comparison with ECMWF wind speeds (bias):

ERS-2 global: -0.069 m/s

ERS-2 northern hemisphere: 0.248 m/s

ERS-2 tropics: -0.105 m/s

ERS-2 southern hemisphere: -0.222m/s

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Wind Speed Comparison with buoy wind speeds (bias):

ERS-2 global: -0.10 m/s
ERS-2 northern hemisphere: -0.02 m/s
ERS-2 tropics: -0.51 m/s

Wave Height Comparison with ECMWF wave heights (bias):

ERS-2 global: -0.016 m (lowest waves measured: 0.6m)
ERS-2 northern hemisphere: 0.088 m
ERS-2 tropics: -0.049 m
ERS-2 southern hemisphere: -0.051 m

Wave Height Comparison with buoy wave heights (bias):

ERS-2 global: -0.19 m
ERS-2 northern hemisphere: -0.19 m
ERS-2 tropics: -0.21 m

Remarks:

The Altimeter worked normally.

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.

Figure captions:

Figure 1: Time series of data reception for ERS-2 Altimeter data for December 1999.

Figure 2: Distribution of the ERS-2 Altimeter Backscatter after QC for December 1999.

Figure 3: Distribution of the ERS-2 Altimeter wind speeds after QC for December 1999.

Figure 4: Distribution of the ERS-2 Altimeter wind speeds after along track averaging for December 1999.

Figure 5: Global distribution of ECMWF ocean surface wind speeds for December 1999.

Figure 6: Comparison of ECMWF wind speed results with ERS-2 Altimeter wind speed data for December 1999 (global).

Figure 7: Comparison of ECMWF wind speed results with ERS-2 Altimeter wind speed data for December 1999 (northern hemisphere)

Figure 8: Comparison of ECMWF wind speed results with ERS-2 Altimeter wind speed data for December 1999 (tropics)

Figure 9: Comparison of ECMWF wind speed results with ERS-2 Altimeter wind speed data for December 1999 (southern hemisphere)

Figure 10: Comparison of buoy wind speed observations with ERS-2 Altimeter wind speed data for December 1999 (global).

Figure 11: Comparison of buoy wind speed observations with ERS-2 Altimeter wind speed data for December 1999 (northern hemisphere).

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Figure 12: Comparison of buoy wind speed observations with ERS-2 Altimeter wind speed data for December 1999 (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 December 1999.

Figure 15: Distribution of the ERS-2 Altimeter wave heights after along track averaging for December 1999.

Figure 16: Global distribution of ECMWF wave heights for December 1999.

Figure 17: Comparison of ECMWF wave height results with ERS-2 Altimeter wave height data for December 1999 (global).

Figure 18: Comparison of ECMWF wave height results with ERS-2 Altimeter wave height data for December 1999 (northern hemisphere)

Figure 19: Comparison of ECMWF wave height results with ERS-2 Altimeter wave height data for December 1999 (tropics)

Figure 20: Comparison of ECMWF wave height results with ERS-2 Altimeter wave height data for December 1999 (southern hemisphere)

Figure 21: Comparison of buoy wave height observations with ERS-2 Altimeter wave height data for December 1999 (global).

Figure 22: Comparison of buoy wave height observations with ERS-2 Altimeter wave height data for December 1999 (northern hemisphere).

Figure 23: Comparison of buoy wave height observations with ERS-2 Altimeter wave height data for December 1999 (tropics).

Figure 24: ERS-2 Altimeter wave heights: Timeseries of bias (ERS-2 - model) and scatter index (SI) for December 1999.

Figure 25: ERS-2 Altimeter wave heights: Timeseries of bias (ERS-2 - model) and scatter index (SI) from December 1996 to December 1999

Figure 26: ERS-2 Altimeter wind speeds: Timeseries of bias (ERS-2 - model) and scatter index (SI) from December 1996 to December 1999

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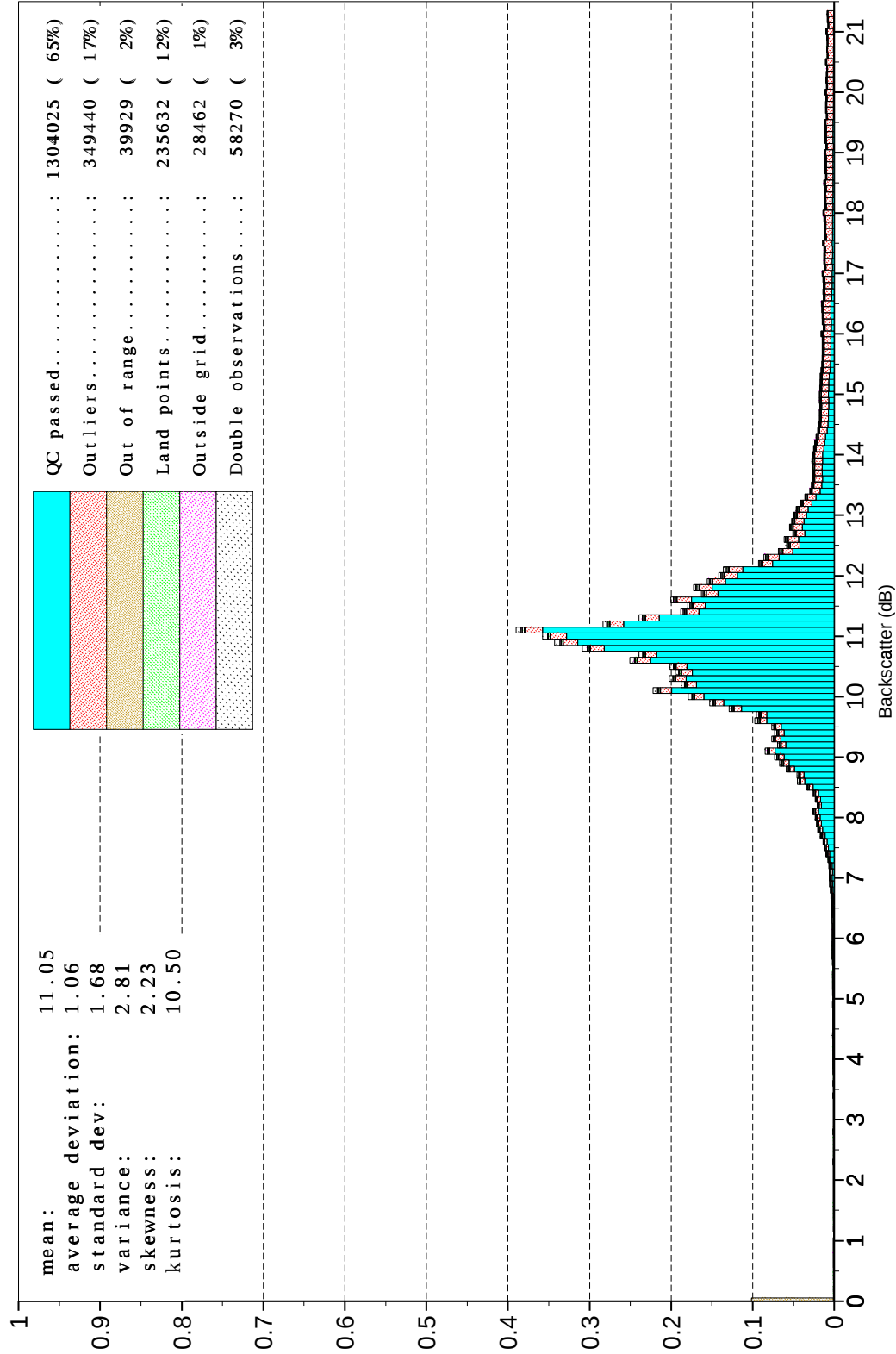


Figure 2: Distribution of the ERS-2 Altimeter backscatter after QC for December 1999

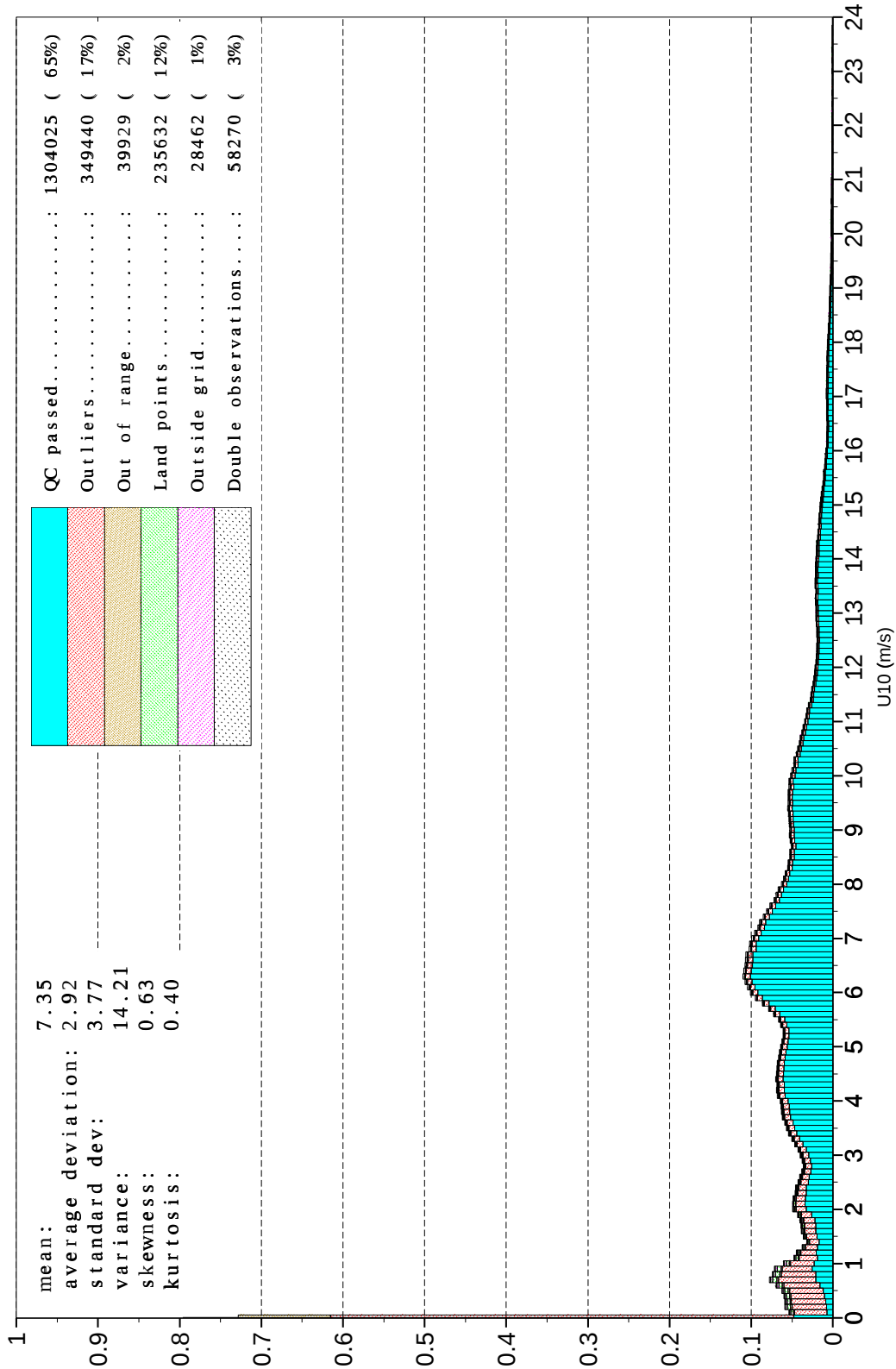


Figure 3: Distribution of the ERS-2 Altimeter wind speeds after QC for December 1999

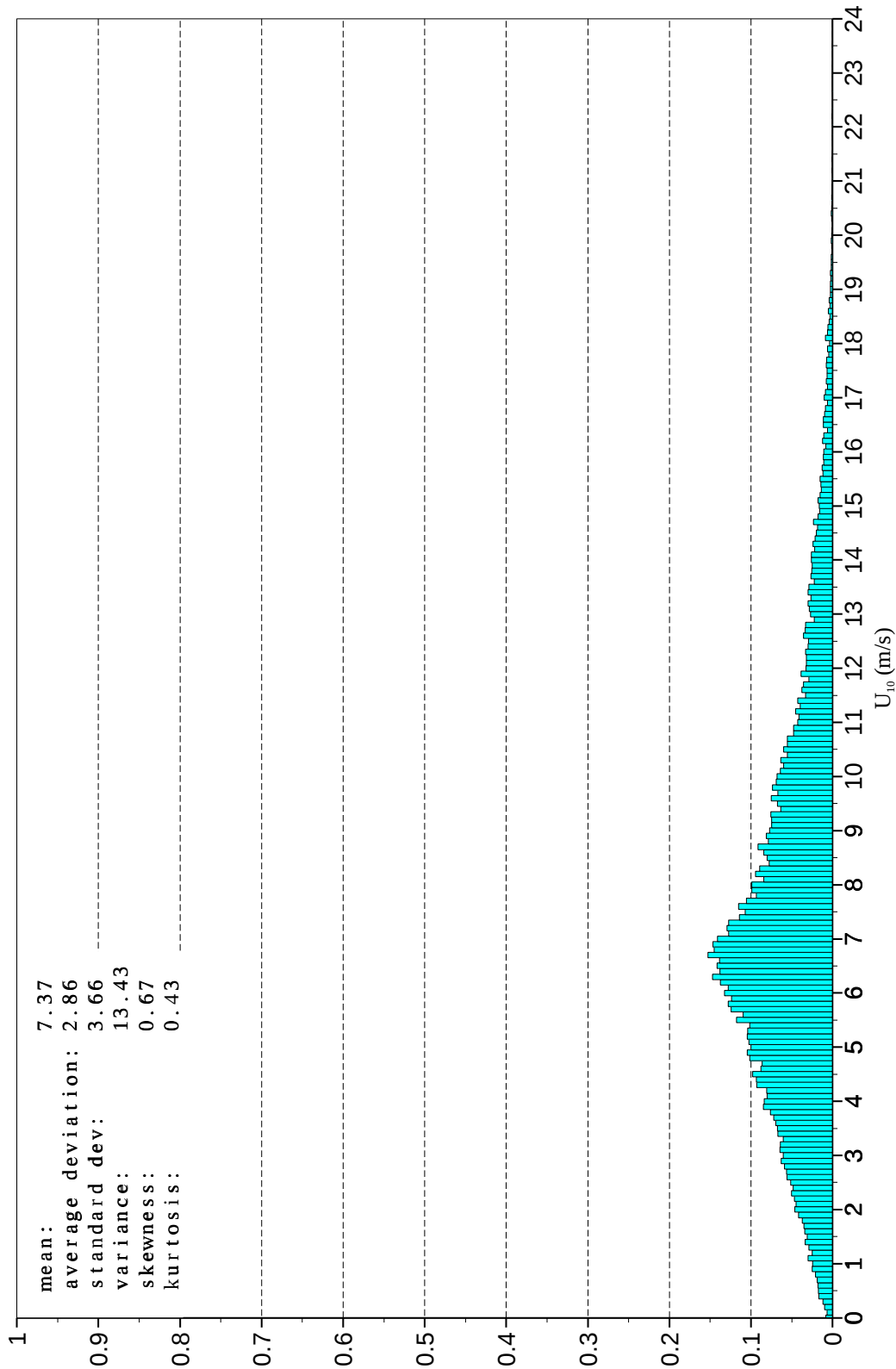


Figure 4: Distribution of ERS-2 Altimeter wind speeds after along track averaging for December 1999

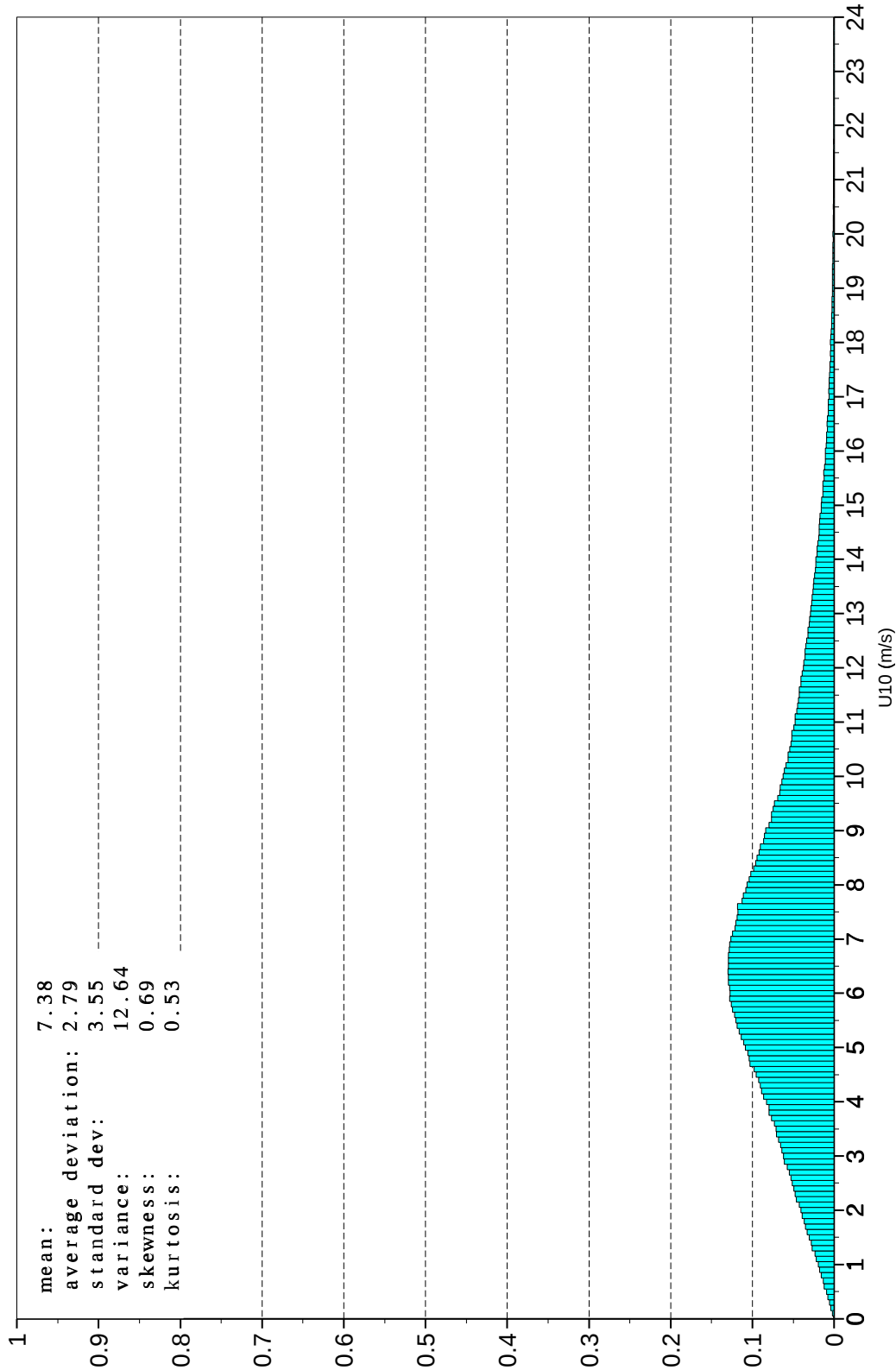


Figure 5: Global distribution of ECMWF ocean surface wind speeds for December 1999

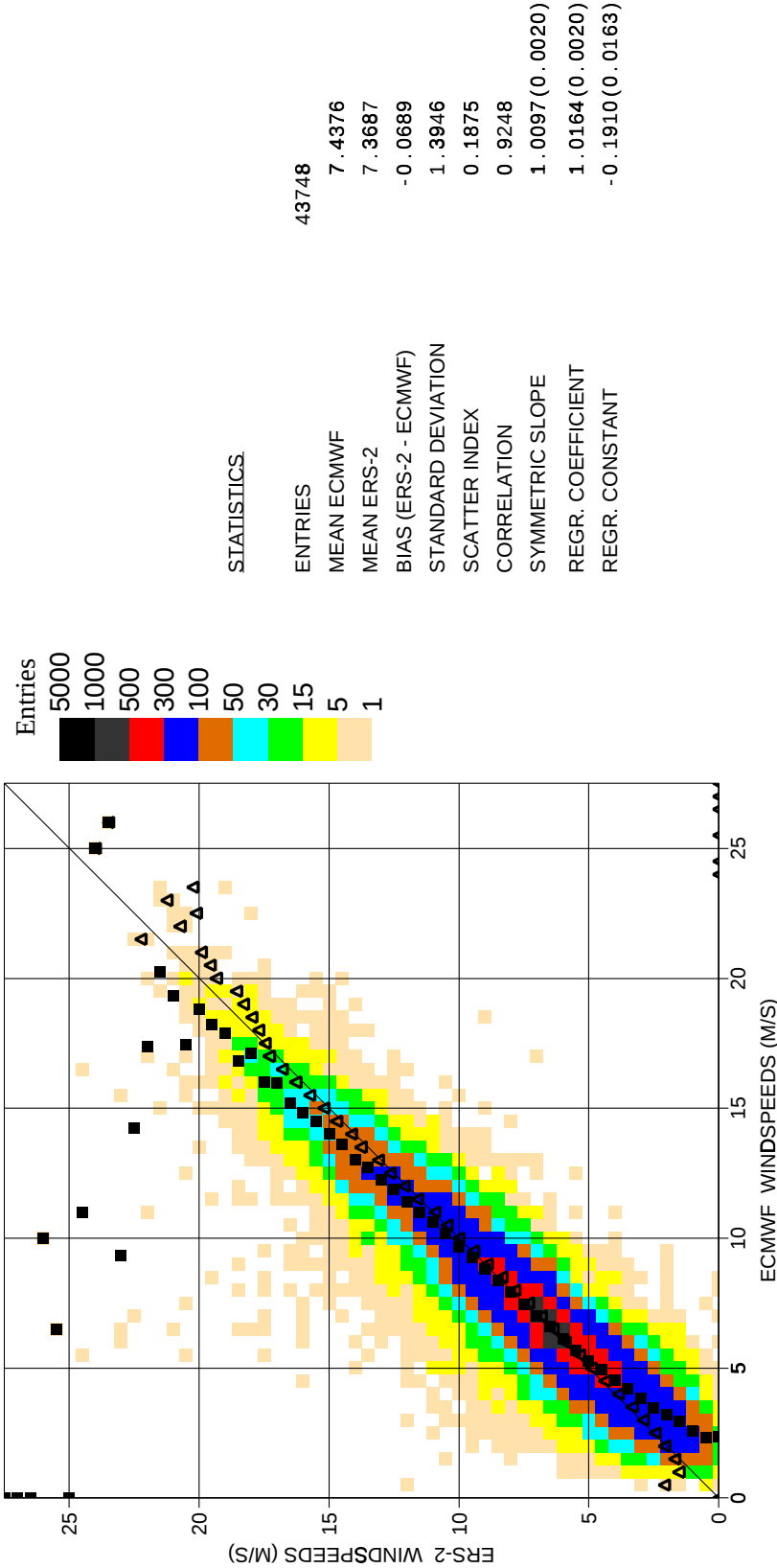


Figure 6. Comparison of ECMWF wind speed results with ERS-2 Altimeter wind speed data for December 1999 (global)

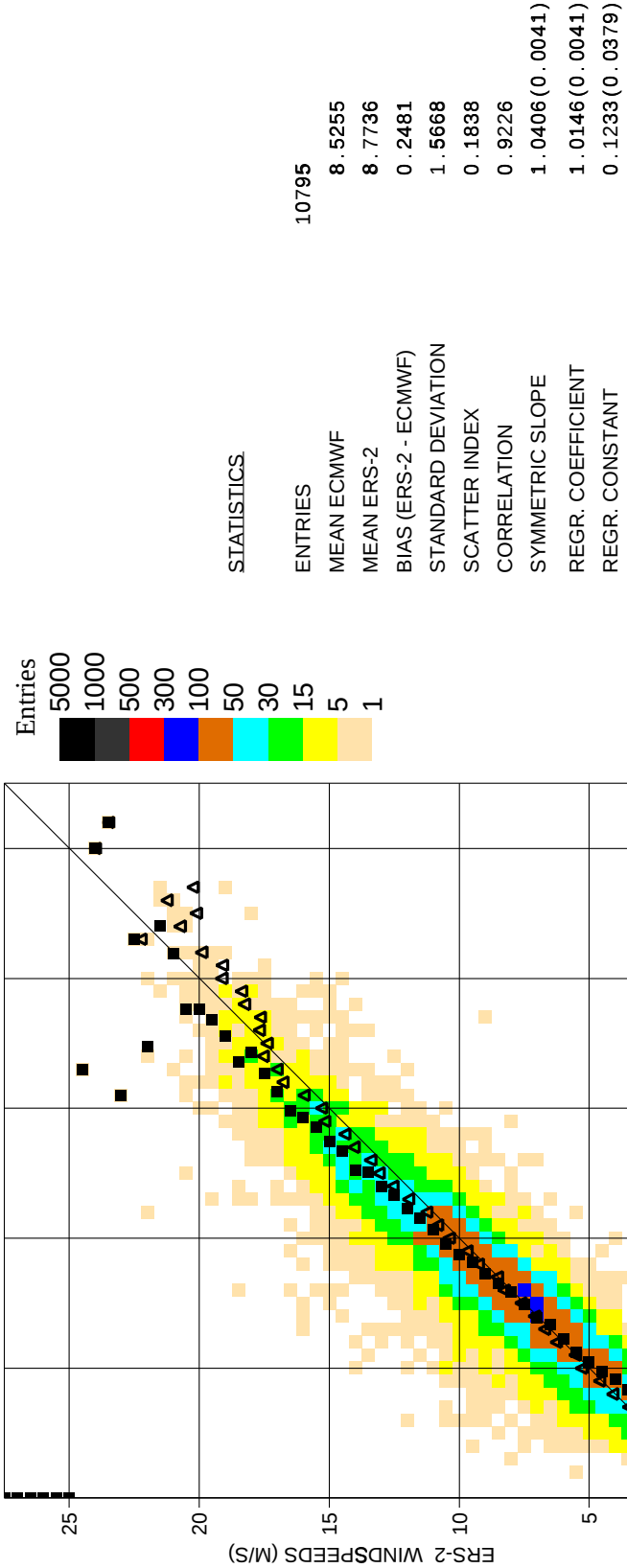


Figure 7. Comparison of ECMWF wind speed results with ERS-2 Altimeter wind speed data for December 1999 (n.hem.)

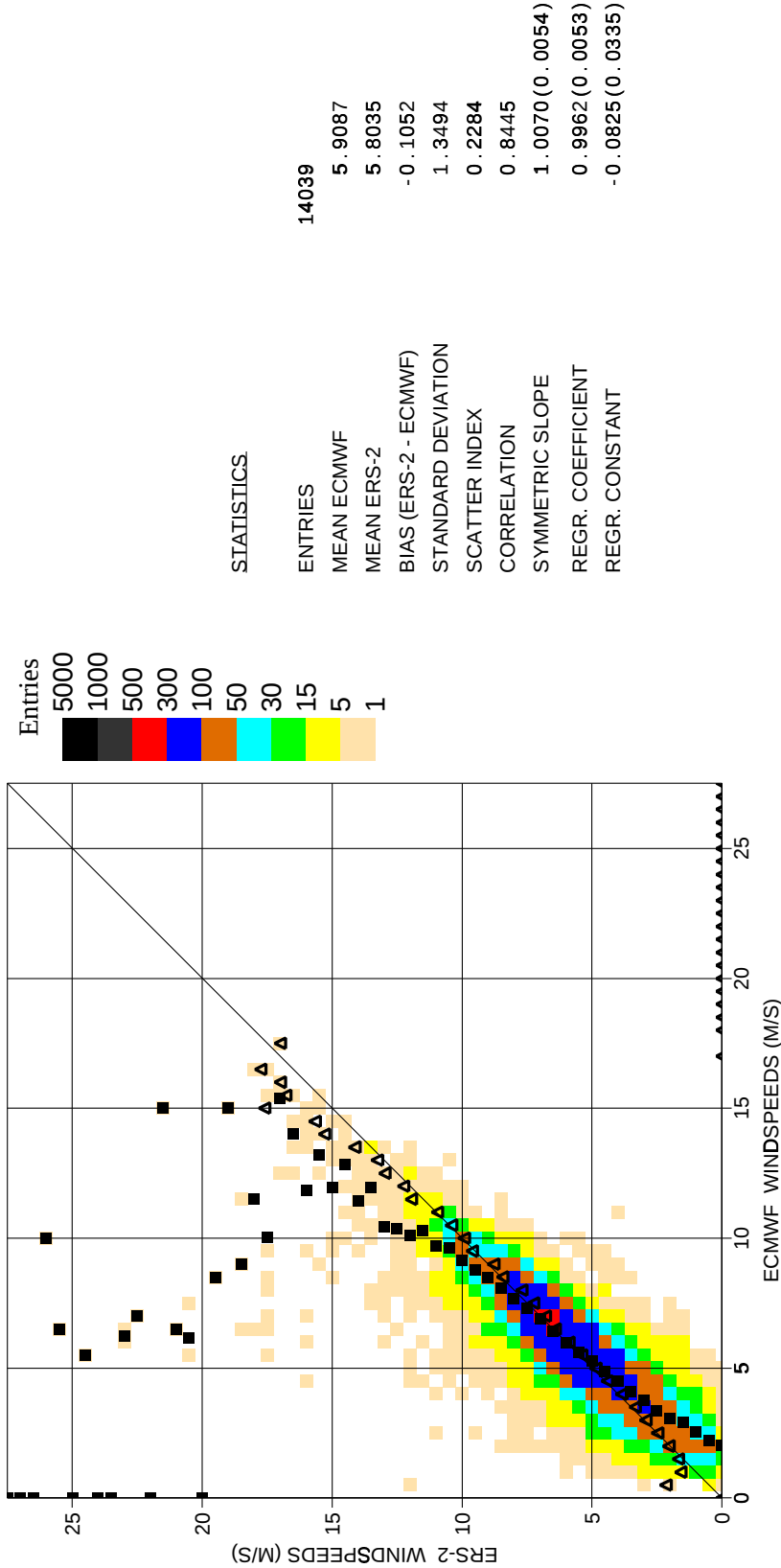


Figure 8. Comparison of ECMWF wind speed results with ERS-2 Altimeter wind speed data for December 1999 (tropics)

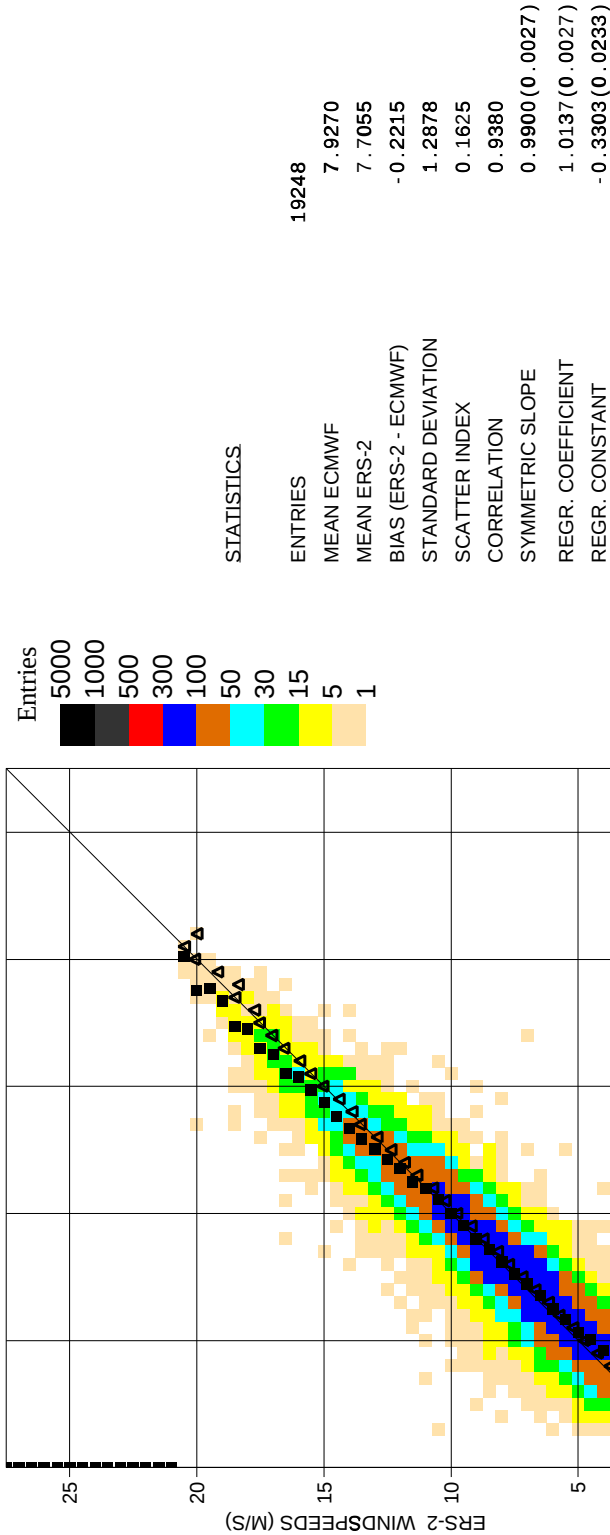


Figure 9. Comparison of ECMWF wind speed results with ERS2 Altimeter wind speed data for December 1999 (s.hem.)

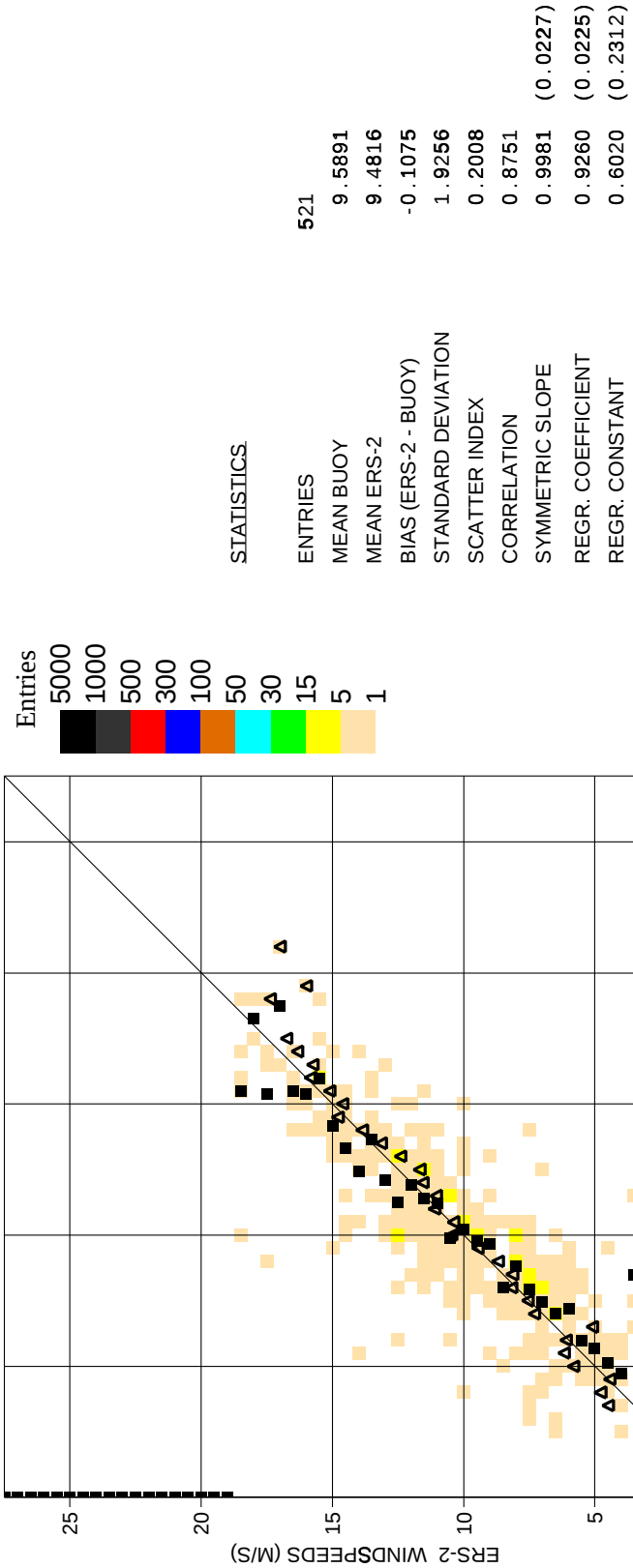


Figure 10. Comparison of buoy wind speed observations with ERS2 Altimeter wind speed data for December 1999 (global)

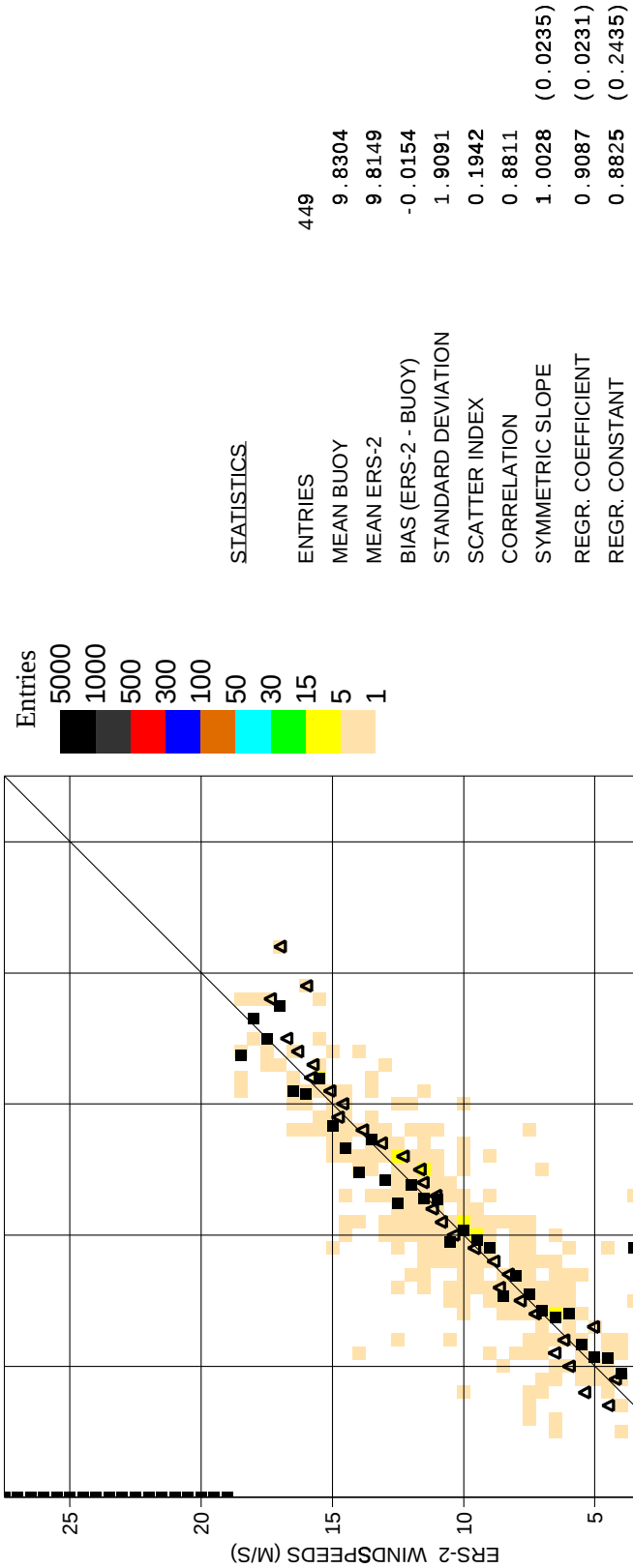


Figure 11. Comparison of buoy wind speed observations with ERS2 Altimeter wind speed data for December 1999 (n.hem.)

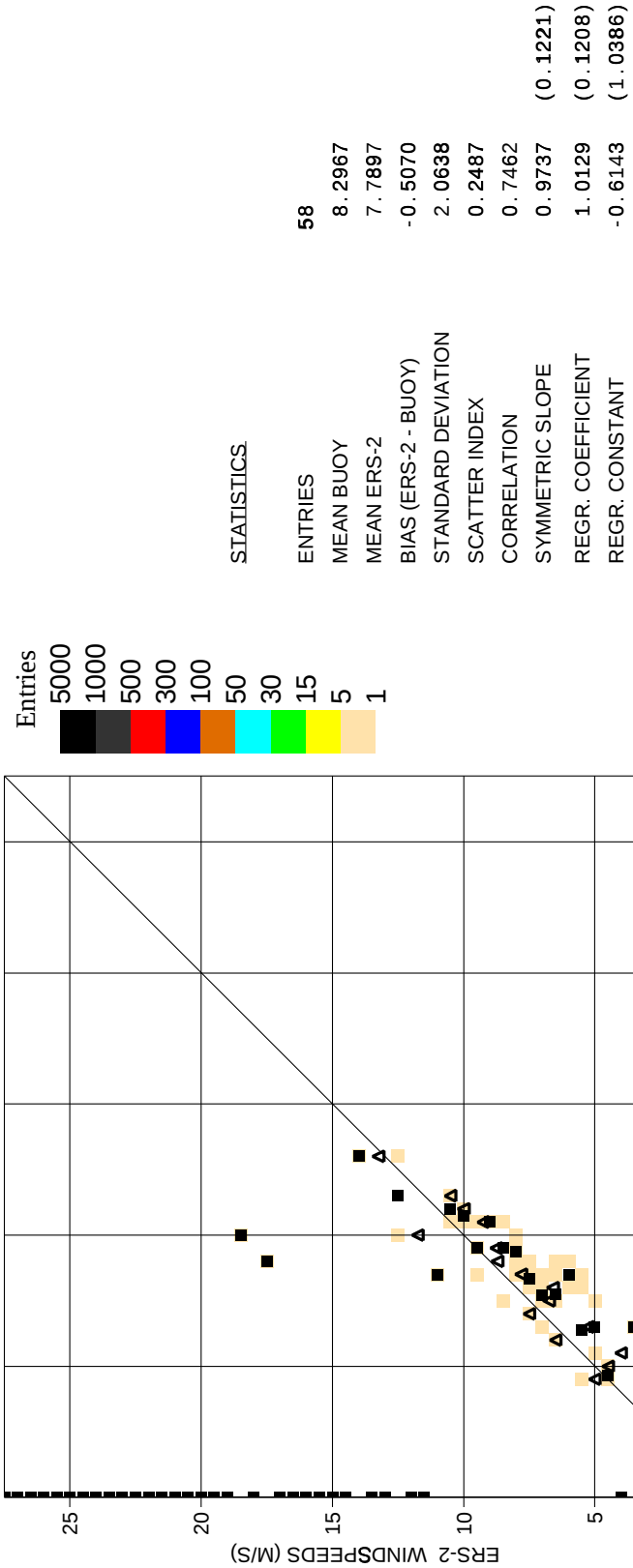


Figure 12. Comparison of buoy wind speed observations with ERS2 Altimeter wind speed data for December 1999 (hawaii)

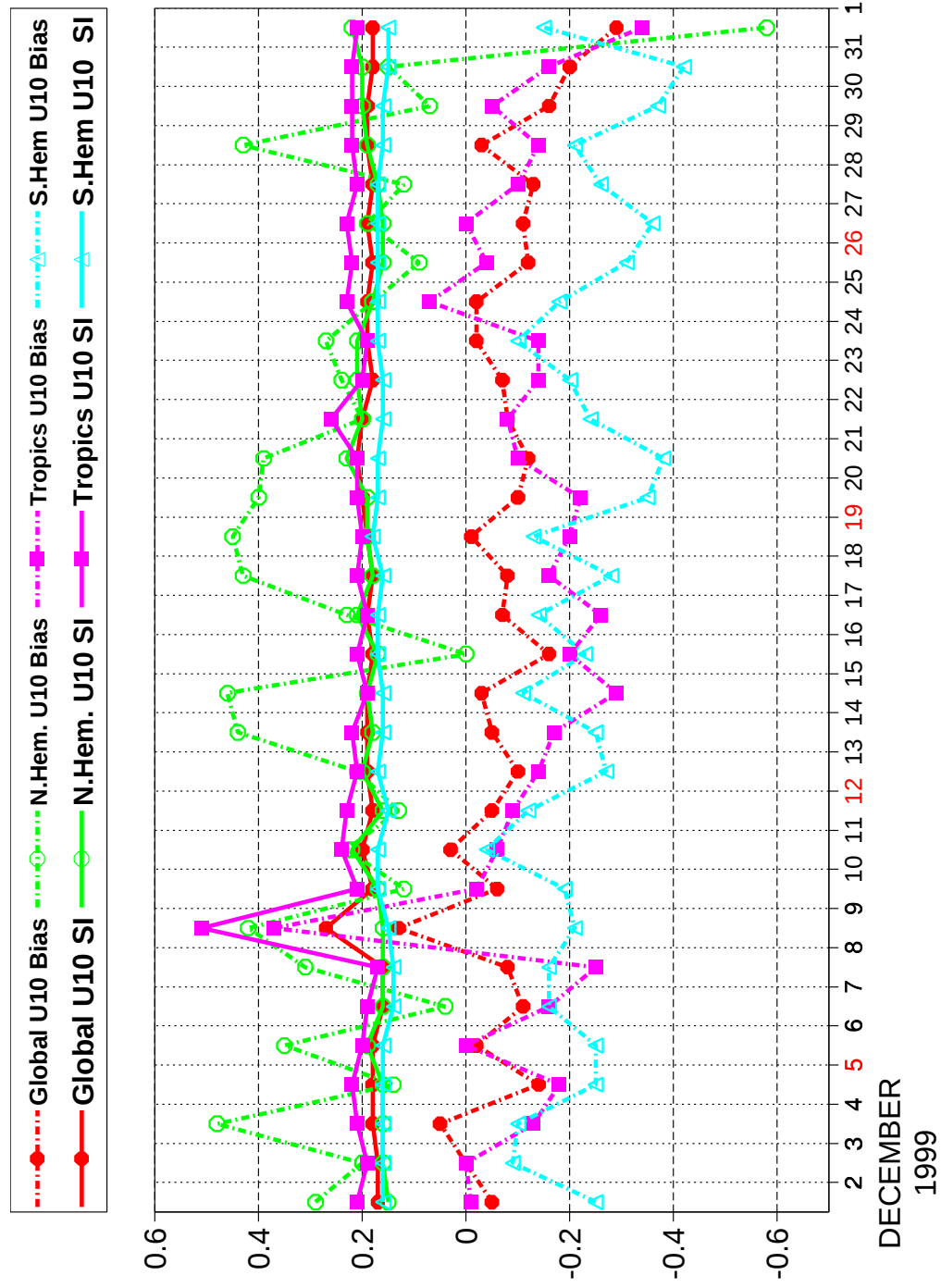


Figure 13: ERS-2 Altimeter wind speeds: Timeseries of bias (ERS-2 - model) and scatter index (SI)

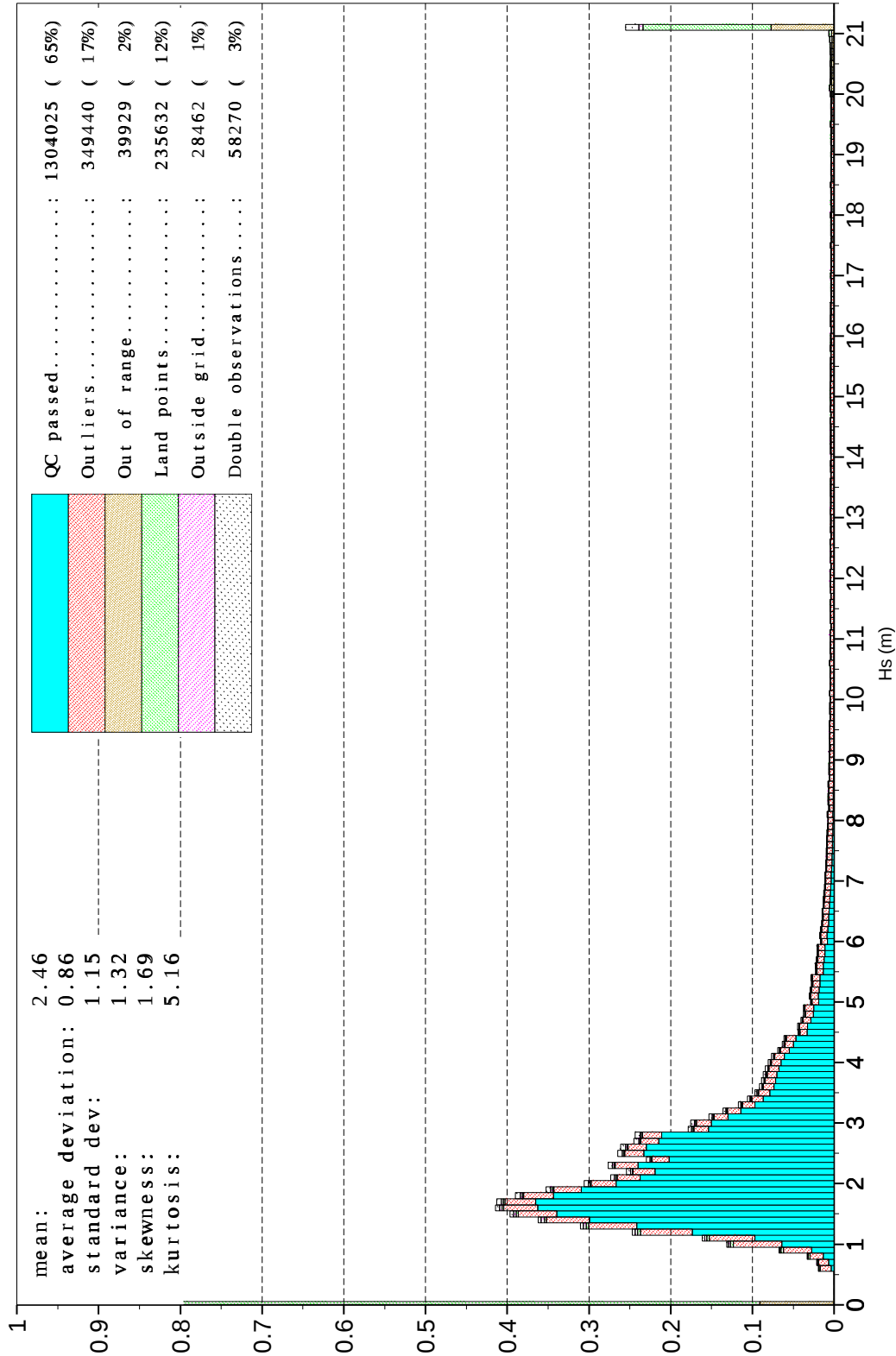


Figure 14: Distribution of the ERS-2 Altimeter wave heights after QC for December 1999

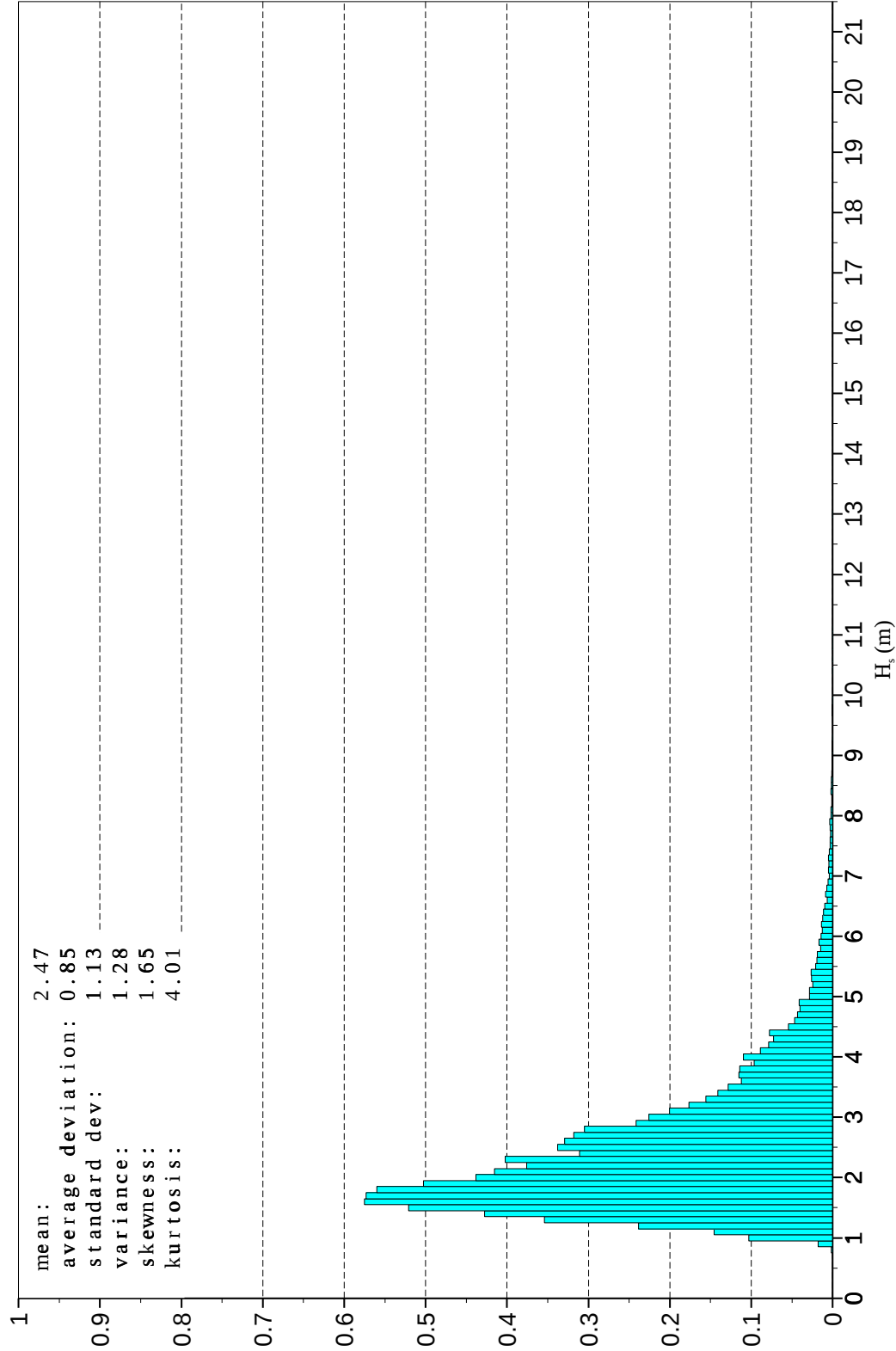


Figure 15: Distribution of ERS-2 Altimeter wave heights after along track averaging for December 1999

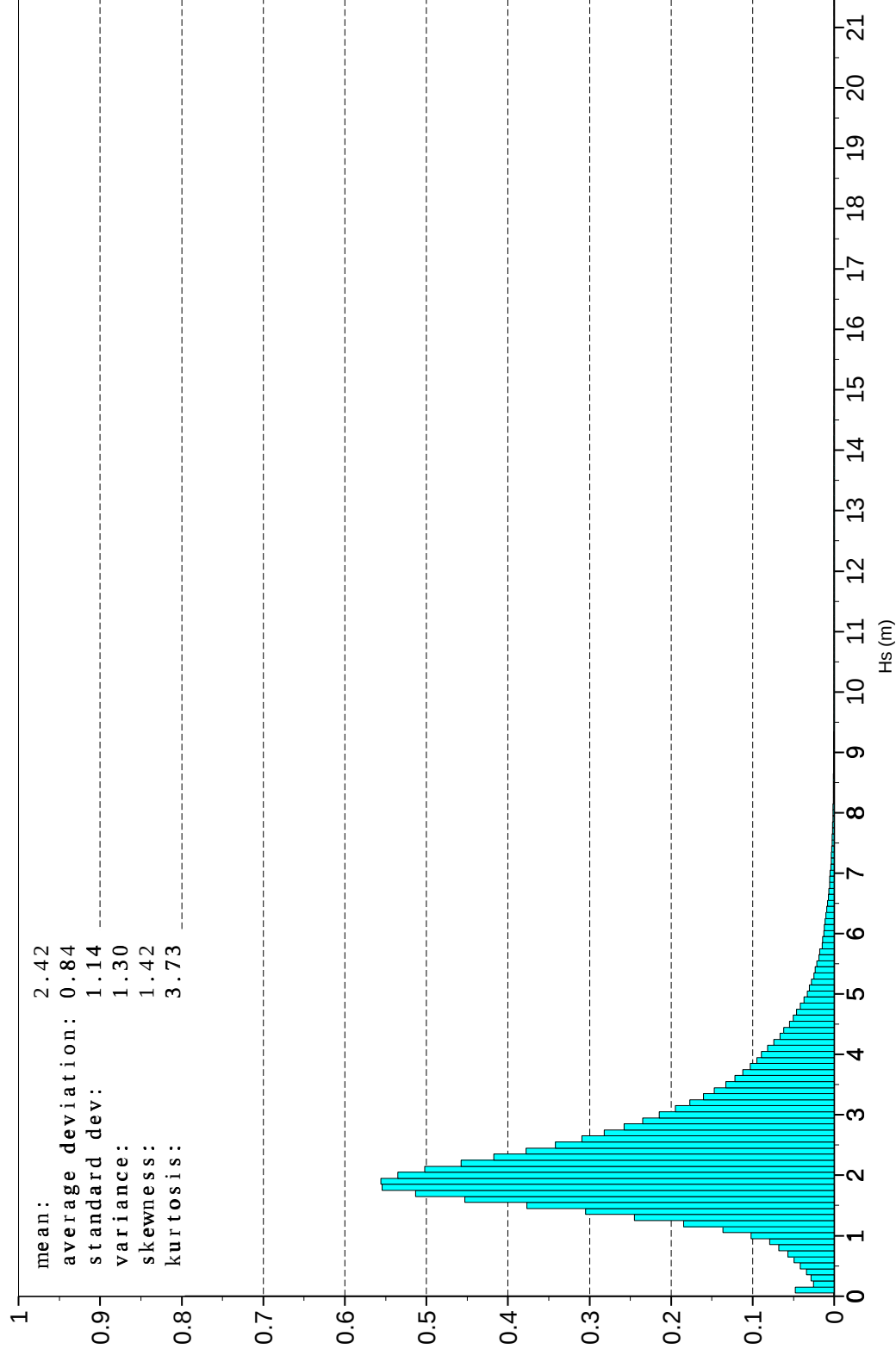


Figure 16: Global distribution of ECMWF wave heights for December 1999

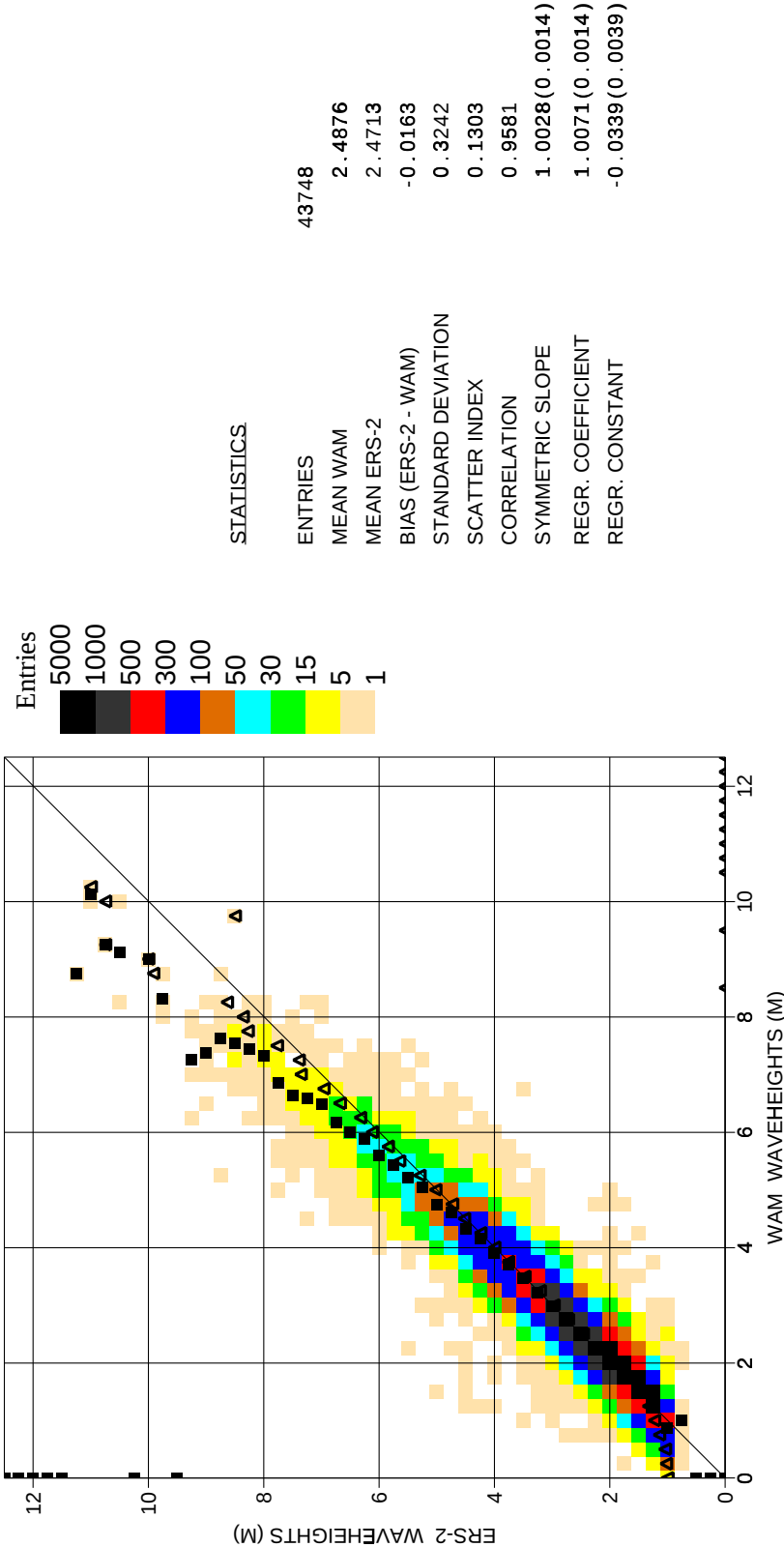


Figure 17. Comparison of ECMWF wave height results with ERS2 Altimeter wave height data for December 1999 (global)

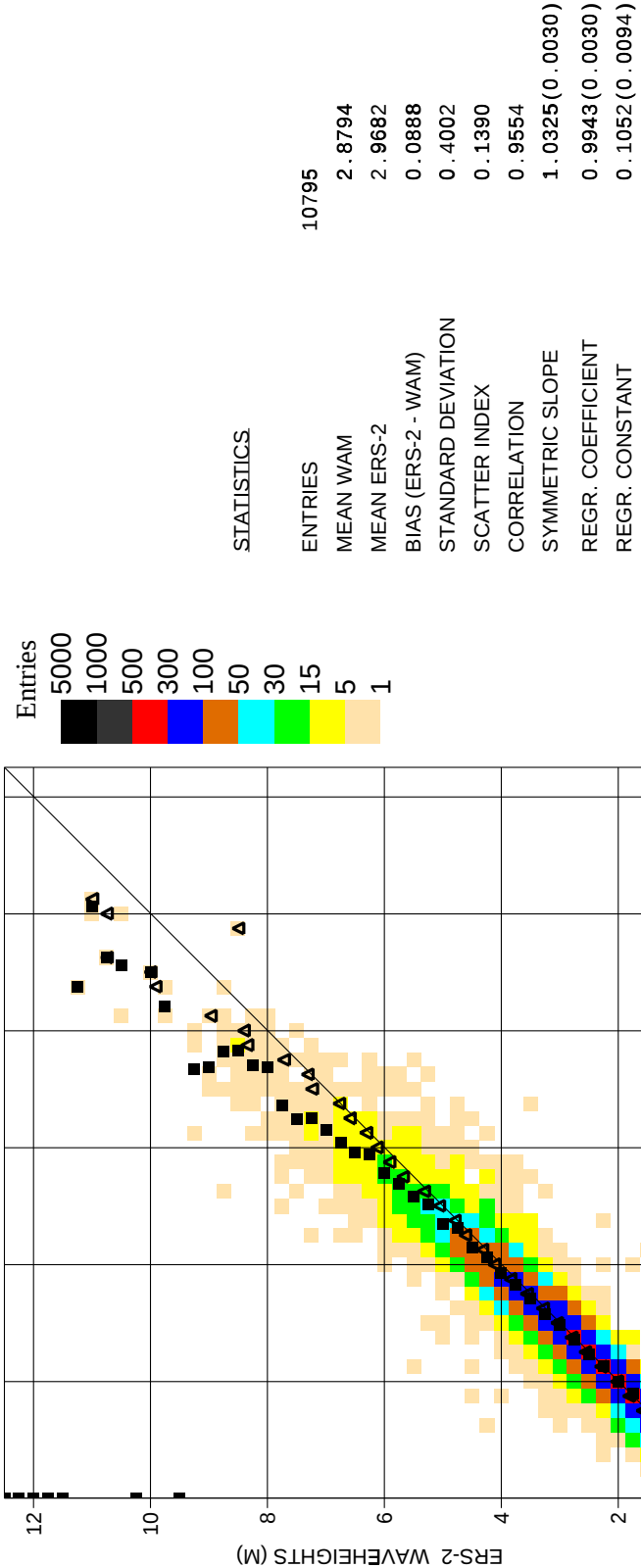


Figure 18. Comparison of ECMWF wave height results with ERS2 Altimeter wave height data for December 1999 (n.hem.)

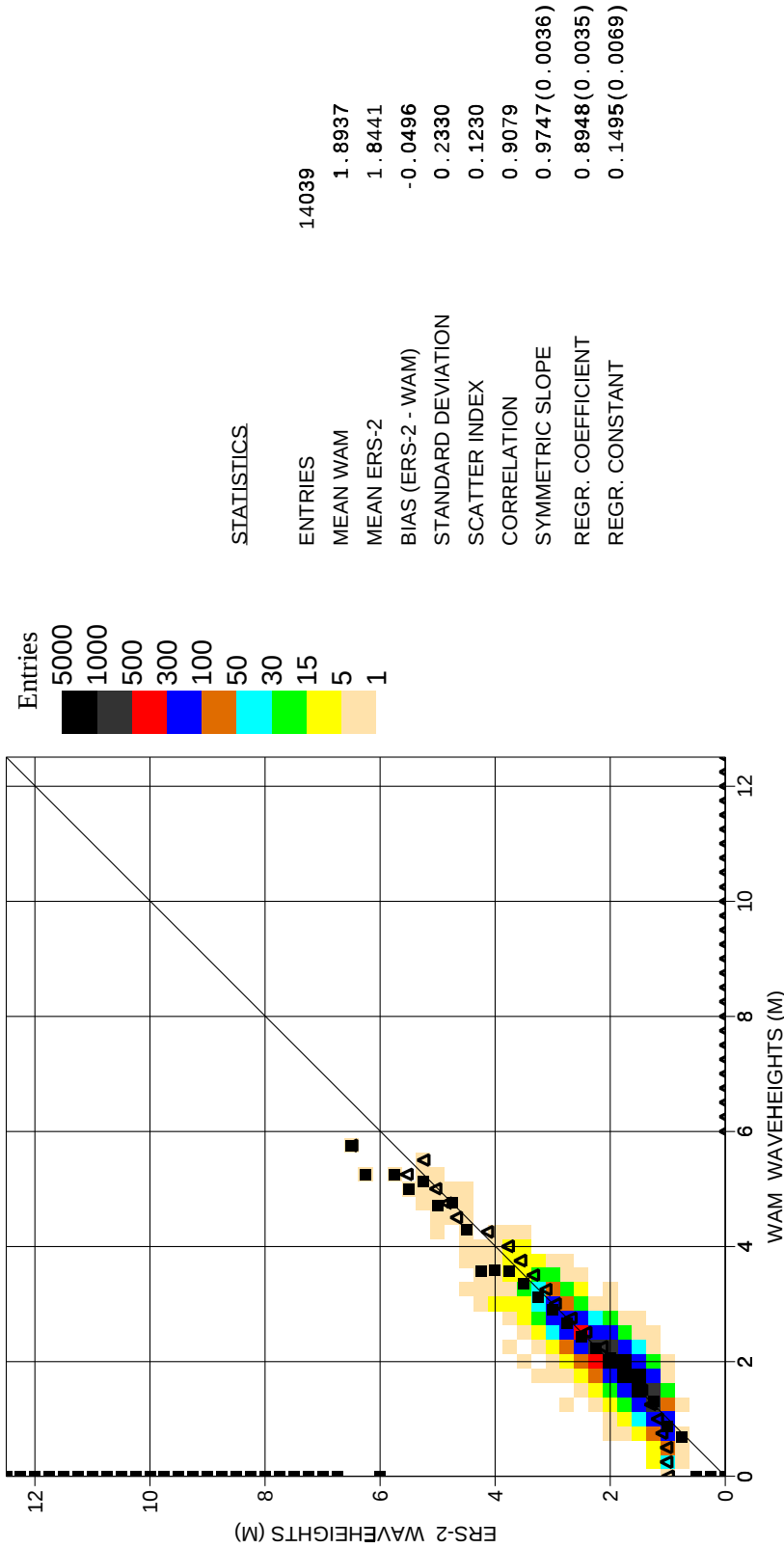


Figure 19. Comparison of ECMWF wave height results with ERS2 Altimeter wave height data for December 1999 (tropics)

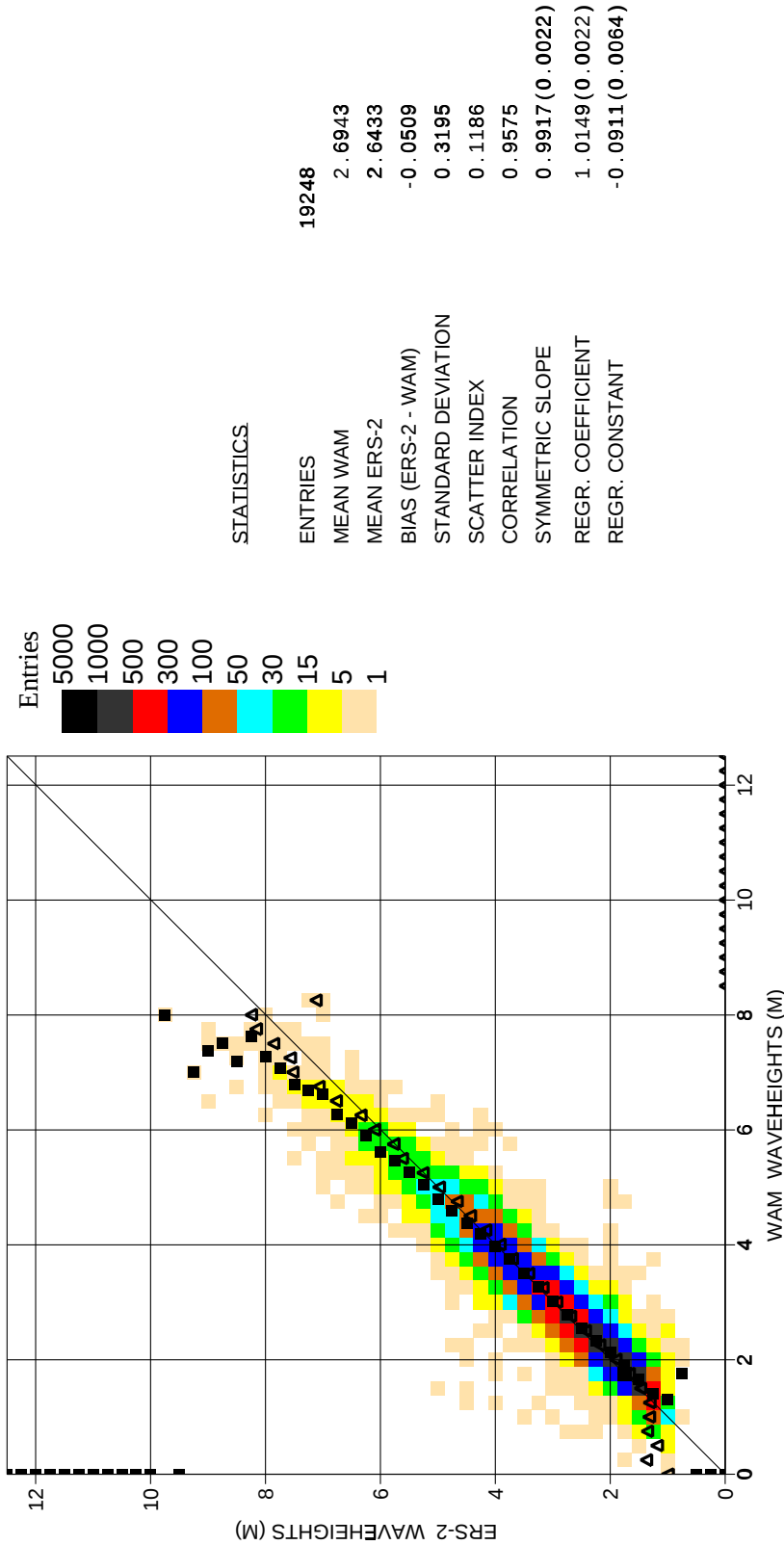


Figure 20. Comparison of ECMWF wave height results with ERS2 Altimeter wave height data for December 1999 (s.hem.)

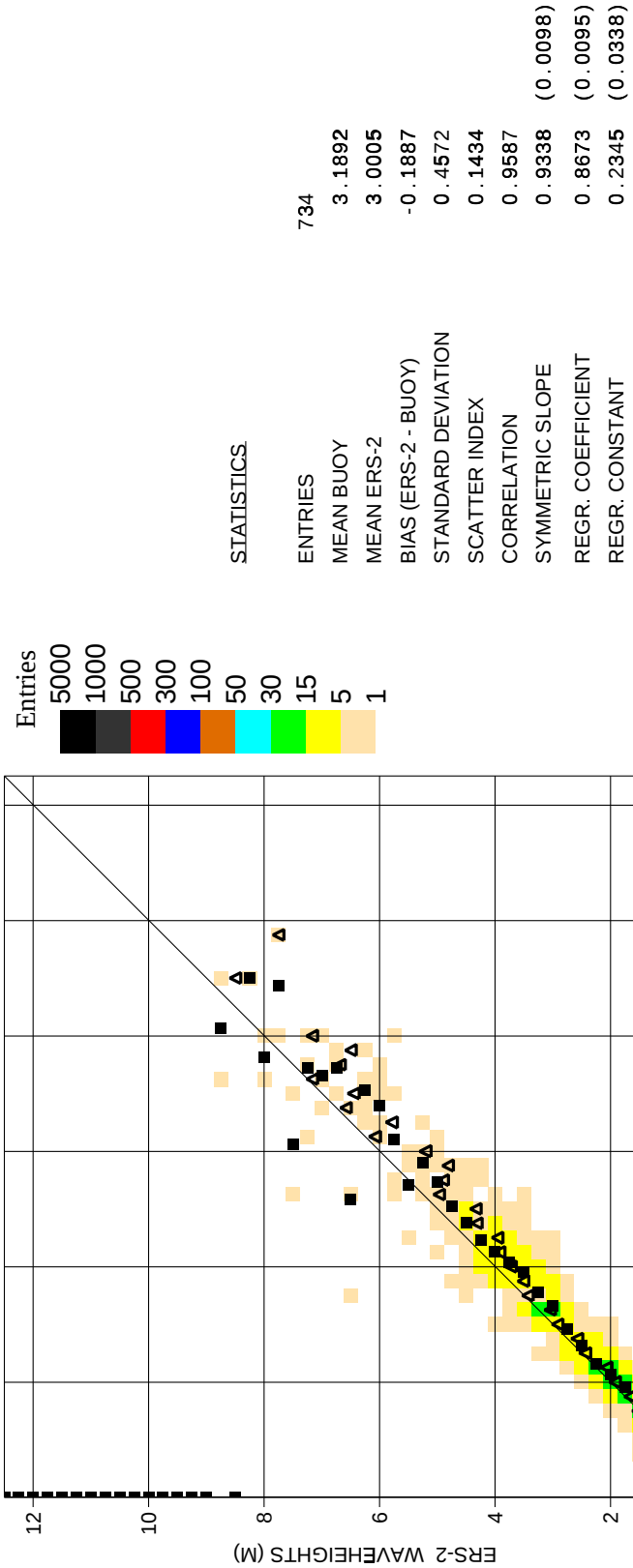


Figure 21. Comparison of buoy wave height observations with ERS2 Altimeter wave height data for December 1999 (global)

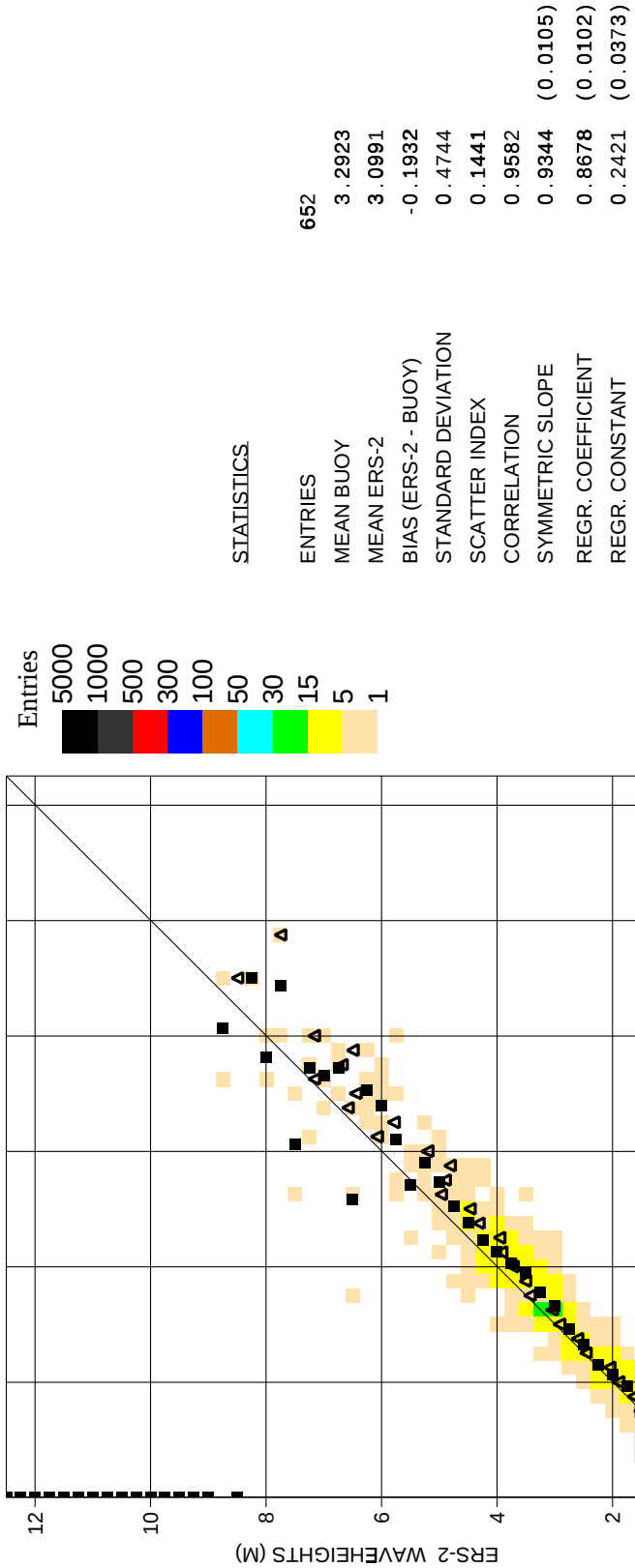


Figure 22. Comparison of buoy wave height observations with ERS2 Altimeter wave height data for December 1999 (n.hem.)

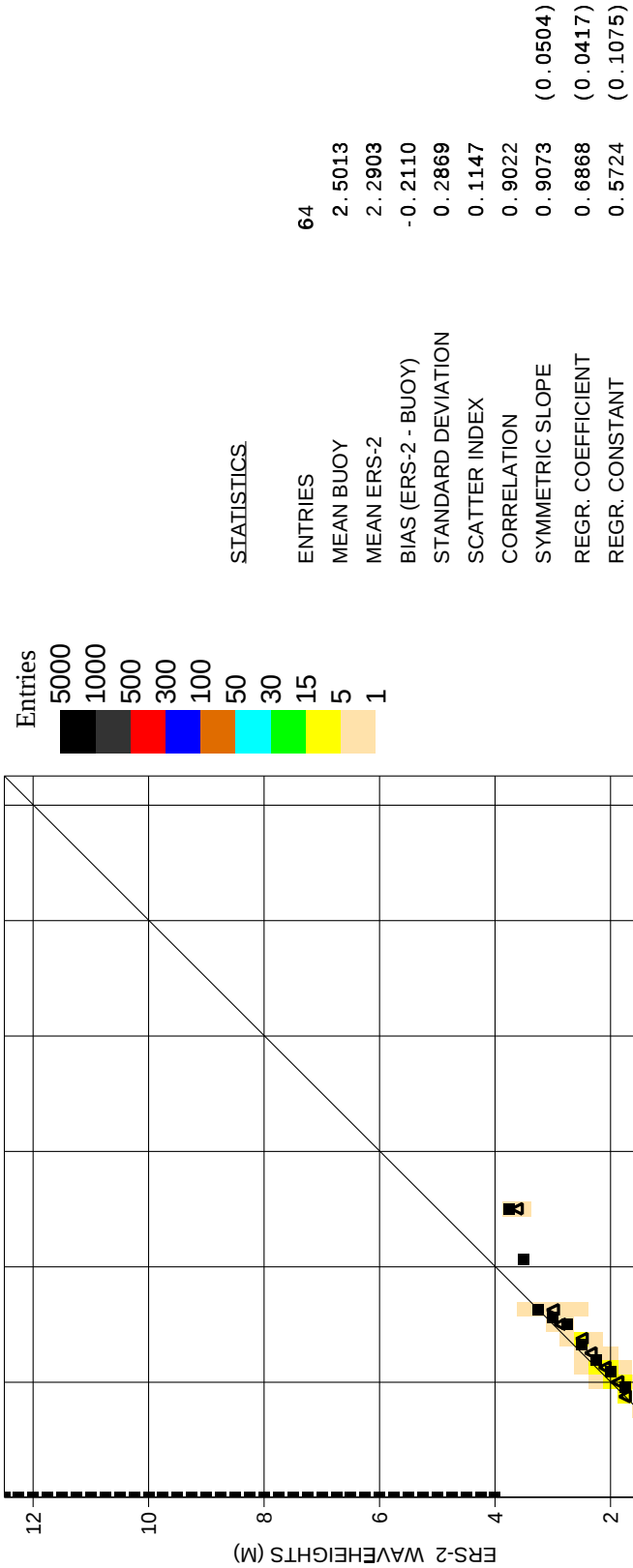


Figure 23. Comparison of buoy wave height observations with ERS2 Altimeter wave height data for December 1999 (hawaii)

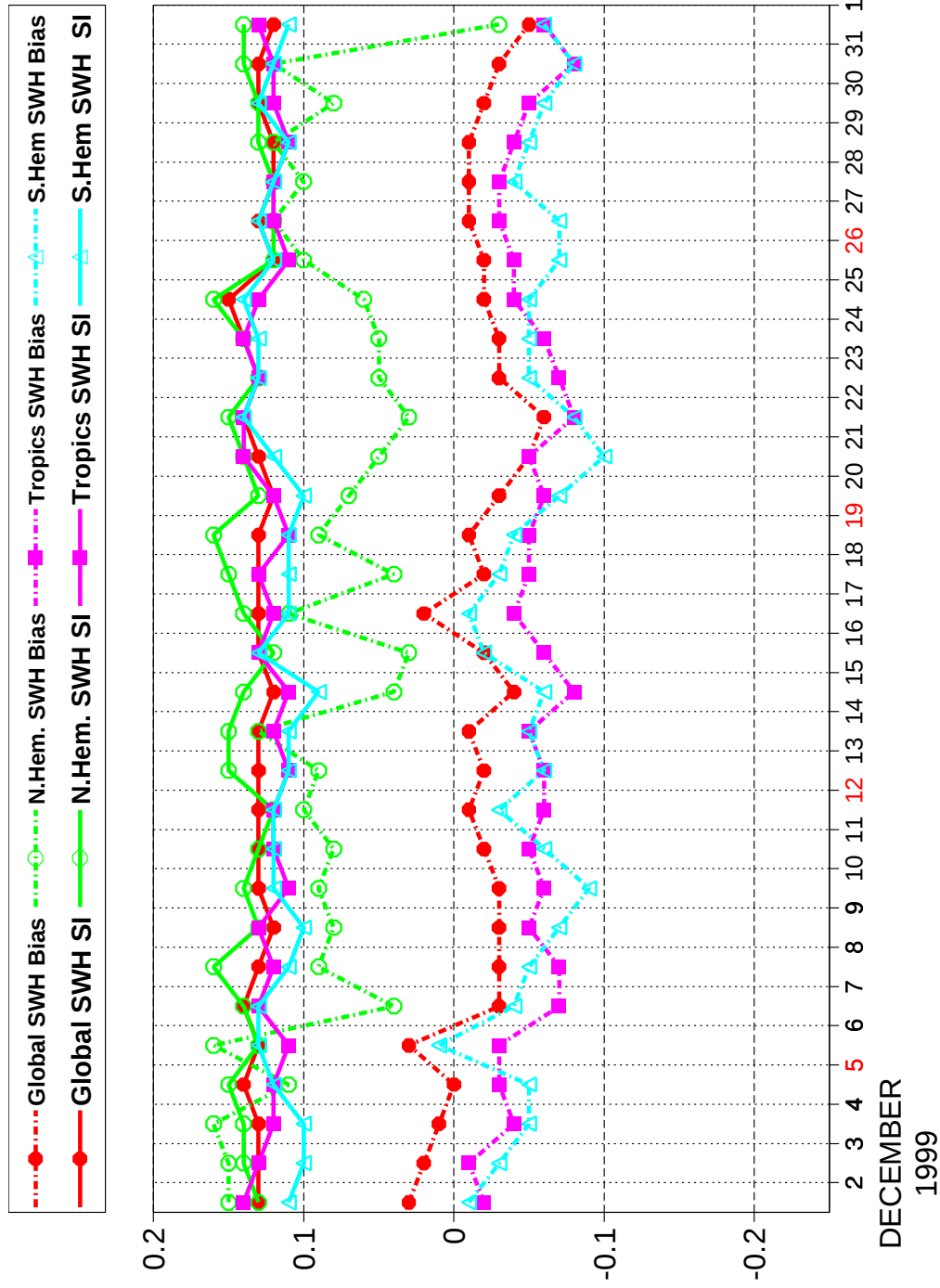


Figure 24: ERS-2 Altimeter wave heights: Timeseries of bias (ERS-2 - model) and scatter index (SI)

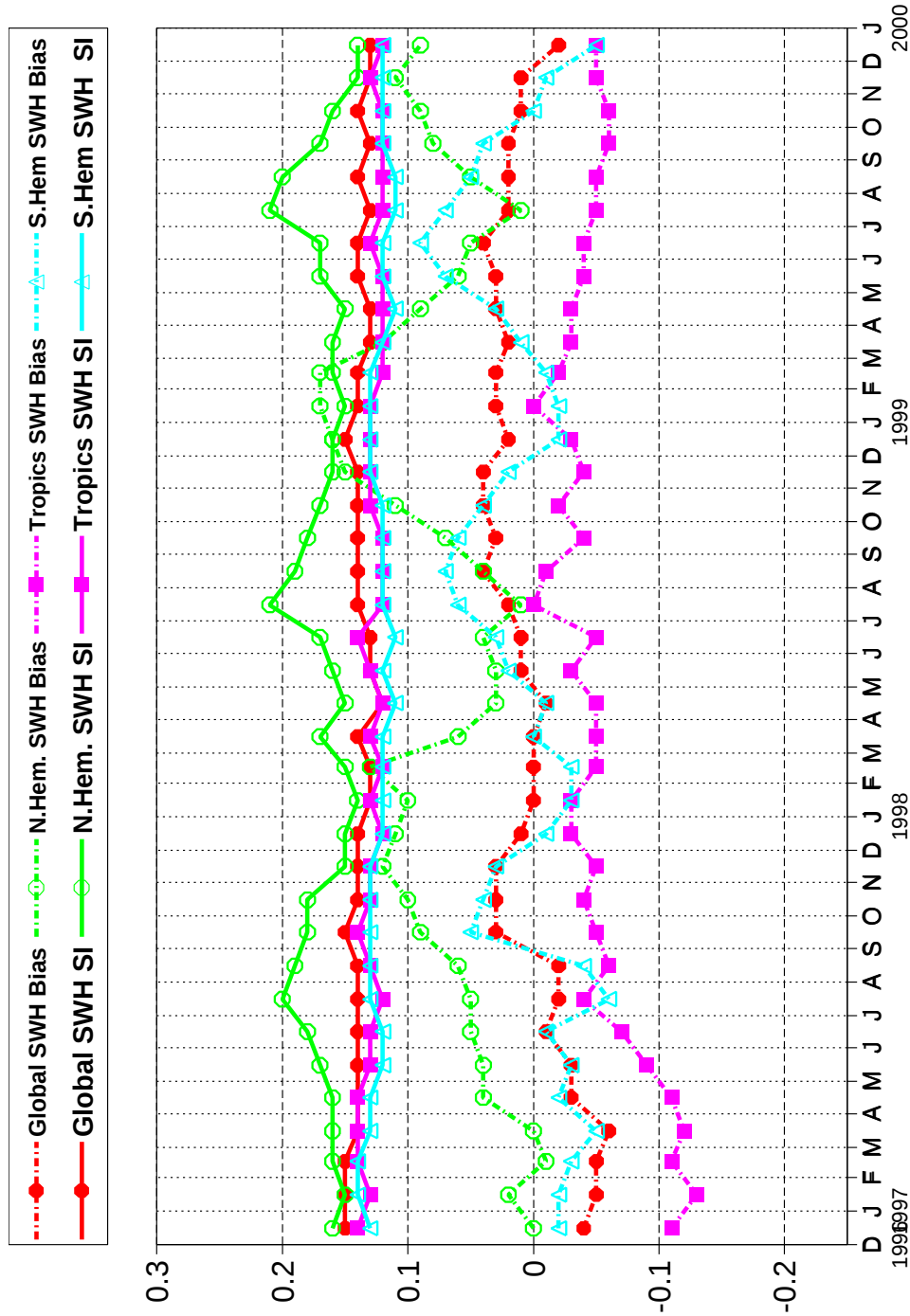


Figure 25: ERS-2 Altimeter wave heights: Timeseries of bias (ERS-2 - model) and scatter index (SI)

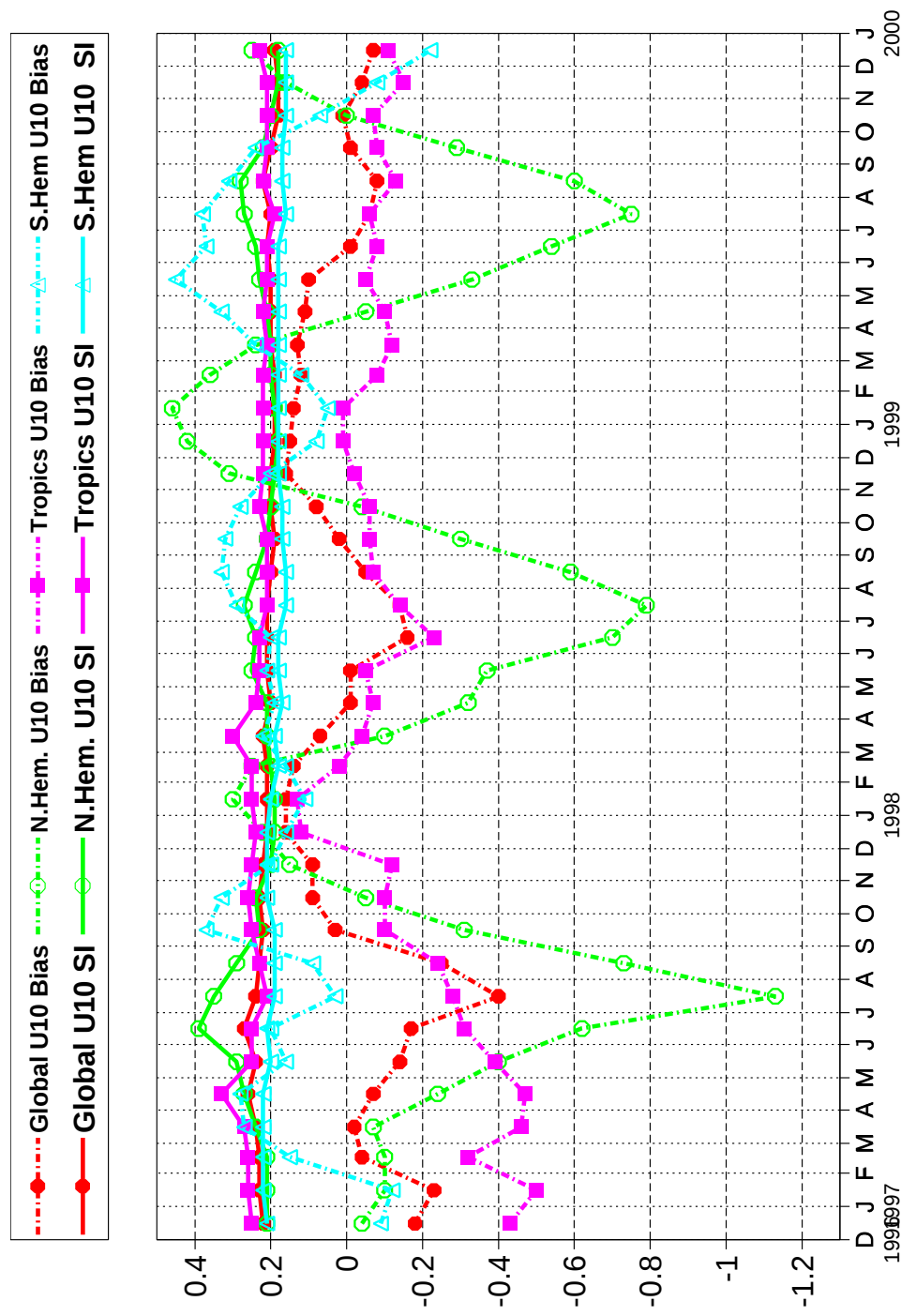


Figure 26: ERS-2 Altimeter wind speeds: Timeseries of bias (ERS-2 - model) and scatter index (SI)