

■ ECMWF - Report on the ERS-2 Scatterometer ■

MONITORING STATISTICS OF ERS-2 SCATTEROMETER FOR ESA (Project Ref. 12893/98/NL/PR)

- By: Hans Hersbach
- Date: 11 March 2002

1 - INTRODUCTION:

From 12 December 2001 onwards ESRIN has been redistributing ERS-2 scatterometer data to a selected group of users. The quality of this experimental gyroless product was for cycle 71 monitored at ECMWF. The gyroless ERS-2 scatterometer data was not used in the ECMWF 4D-Var data assimilation system.

During cycle 71, gyroless data was received between 21:01 UTC 28 January 2002 and 20:58 UTC 4 March 2002. No data was received for the 6-hourly cycles on 31 January 2002 from 06 UTC to 18 UTC and for 06 UTC 3 March 2002. A volume of less than half the average was received for the 6-hourly cycles for 00 UTC 31 January 2002, 06 UTC 1 February 2002, 12 UTC 7 February 2002, 00 UTC 28 February 2002 and 18 UTC 28 February 2002.

The quality of the data received during cycle 71 was higher than for the data received during cycle 70 and comparable to the quality obtained for cycle 69.

The ECMWF assimilation system was not modified during cycle 71.

■ ECMWF - Report on the ERS-2 Scatterometer ■

ERS-2 STATISTICS FROM 29 JANUARY 2002 TO 4 MARCH 2002

The sigma0 bias levels (compared to simulated sigma0's based on ECMWF model first guess winds) have been reduced for the ascending tracks as compared to the corresponding levels during cycle 70. The reduction was around 0.2 dB for the for and mid beam, and between 0.5 (lower incidence angles) and 0.7 dB (high incidence angles) for the aft beam. Bias levels for the descending tracks were almost the same as in cycle 70. As a result, bias levels of the ascending tracks have become approximately 0.2 dB less negative than those for the descending beams. This is also true for the aft beam, which used to perform much worse for the ascending tracks. The overall behaviour is unchanged: a flat distribution for the mid beam, a gradual increase of negative bias for the for beam towards higher incidence angles, and a rapidly increasing negative bias for the aft beam for incidence angles larger than 42 degrees. Up to incidence angles of 42 degrees, the bias level of the for beam is approximately 0.3 dB more negative than for the aft beam, while for higher incidence angles it is the aft beam that performs worse (up to 0.8 dB for 57 degrees).

For the higher nodes the distance to the cone history shows several peaks (see Figure 2). For the period between 1 February 2002 and 2 February 2002, the distance to the cone is larger than the normalized values. There were also peaks for 18 UTC 5 February 2002, the period between 18 UTC 6 February 2002 and 18 UTC 7 February 2002, for 00 UTC 11 February 2002, 18 UTC 18 February 2002 and for 00 UTC 1 March 2002. The fraction of the data rejected by the ESA quality flag or CMOD4 inversion algorithm is for these periods larger than usual. The peaks do not appear in the cone history for the lower nodes. They do, however, appear in the wind speed bias history (UWI wind compared to ECMWF first guess wind; see Figure 3) for all nodes. Low-quality peaks for ERS2 altimeter data on the Southern Hemisphere (not shown) indicate many events of enhanced solar activity during cycle 71. The periods of low quality scatterometer data indicated above usually occur during such events. On the other hand, there were also periods of enhanced solar activity in which the quality of the scatterometer product was not affected, as e.g. for 21 February 2002. On average, normalized distances are larger than one, and increase towards higher nodes.

■ ECMWF - Report on the ERS-2 Scatterometer ■

The quality of the UWI winds received during cycle 71 has been improved w.r.t. data received during cycle 70. The UWI winds now have an average bias of -1.22 m/s, which was -1.37 m/s for cycle 70. The bias is -1.30 m/s for nodes 1-2 (was -1.40 m/s) and -1.36 m/s for nodes 15-19 (was -1.54 m/s). Biases are smallest for nodes 8-10 (-1.08 m/s, was -1.22 m/s). The standard deviation is on average 1.85 m/s (was 1.97 m/s), and increases from 1.76 m/s (was 1.88 m/s) for nodes 1-2, to 1.92 m/s for nodes 15-19 (was 2.04 m/s). As mentioned above, the peaks in the distance to the cone plots for the higher nodes correspond to low data quality in the wind speed time series for all nodes. Very similar results apply to the de-aliased CMOD4 winds. The (scatterometer - model) direction standard deviations were ranging between 40 and 60 degrees for the UWI data (average value 54.1 degrees, was 56.3) and between 15 and 25 degrees (average value 20.4, was 21.3) for their de-aliased counterparts. The directional bias is close to zero for both UWI and de-aliased CMOD4 products. Therefore, the skill in wind direction has hardly changed.

The scatter plot of model 10 m first-guess wind speeds versus UWI wind speeds shows a smaller bias (-1.22 m/s) compared to the plot from cycle 70 (-1.37 m/s). The standard deviation is also smaller (1.86 m/s, was 1.98 m/s). If the lower quality periods would not have been included, both bias and standard deviation would be less. Note that for the gyroless product there is still a fair amount of low wind data with collocated first-guess winds that are much stronger. This trend does not depend on node number and is a general feature observed for data during the whole monitoring period. The direction scatter plot looks similar to the results from cycle 70 (bias from 1.0 to 1.7 degrees, and standard deviation from 55 to 52 degrees).

2 - FIGURE CAPTION

- Fig. 1:* Ratio of $\frac{\sigma_{\text{mid}}}{\sigma_{\text{aft}}} > \text{over} < \text{CMOD4}(\text{First Guess})^{0.625}$ converted in dB for fore beam (solid line), mid beam (dashed line) and aft beam (dotted line) as a function of incidence angle for descending and ascending tracks. The thin lines indicate the error bars on the estimated mean. First Guess winds are based on the in time closest +3h, +6h, +9h, or +12h T511 forecast field, and are bilinearly interpolated in space.
- Fig. 2:* Mean normalised distance to the cone computed every 6 hours for nodes 1-2, 3-4, 5 to 7, 8 to 10, 11 to 14 and 15 to 19 (solid curve close to 1 when no instrumental problems are present). The dotted curve shows the number of incoming triplets in logarithmic scale (1 corresponds to 60000 triplets) and the dashed one indicates the fraction of complete sea-located triplets rejected by the ESA flag, or by the wind inversion algorithm. (0: all data kept, 1: no data kept).
- Fig. 3:* Mean (solid line) and standard deviation (dashed line) of the wind speed difference UWI - First Guess for the data retained by the quality control.
- Fig. 4:* Same as Fig. 3, but for the wind direction difference. Statistics are computed only for wind speeds higher than 4 m/s.
- Fig. 5-6:* Same as Fig. 3 and 4 respectively, but for the de-aliased CMOD4 data.
- Fig. 7:* Two-dimensional histogram of First Guess and UWI wind speeds, for the data kept by the quality control. Circles denote the mean values in the y-direction, and squares those in the x-direction.
- Fig. 8:* Same as Fig. 7, but for wind direction. Only wind speeds higher than 4m/s are taken into account.

FIGURE 1

ECMWF - Report on the ERS-2 Scatterometer

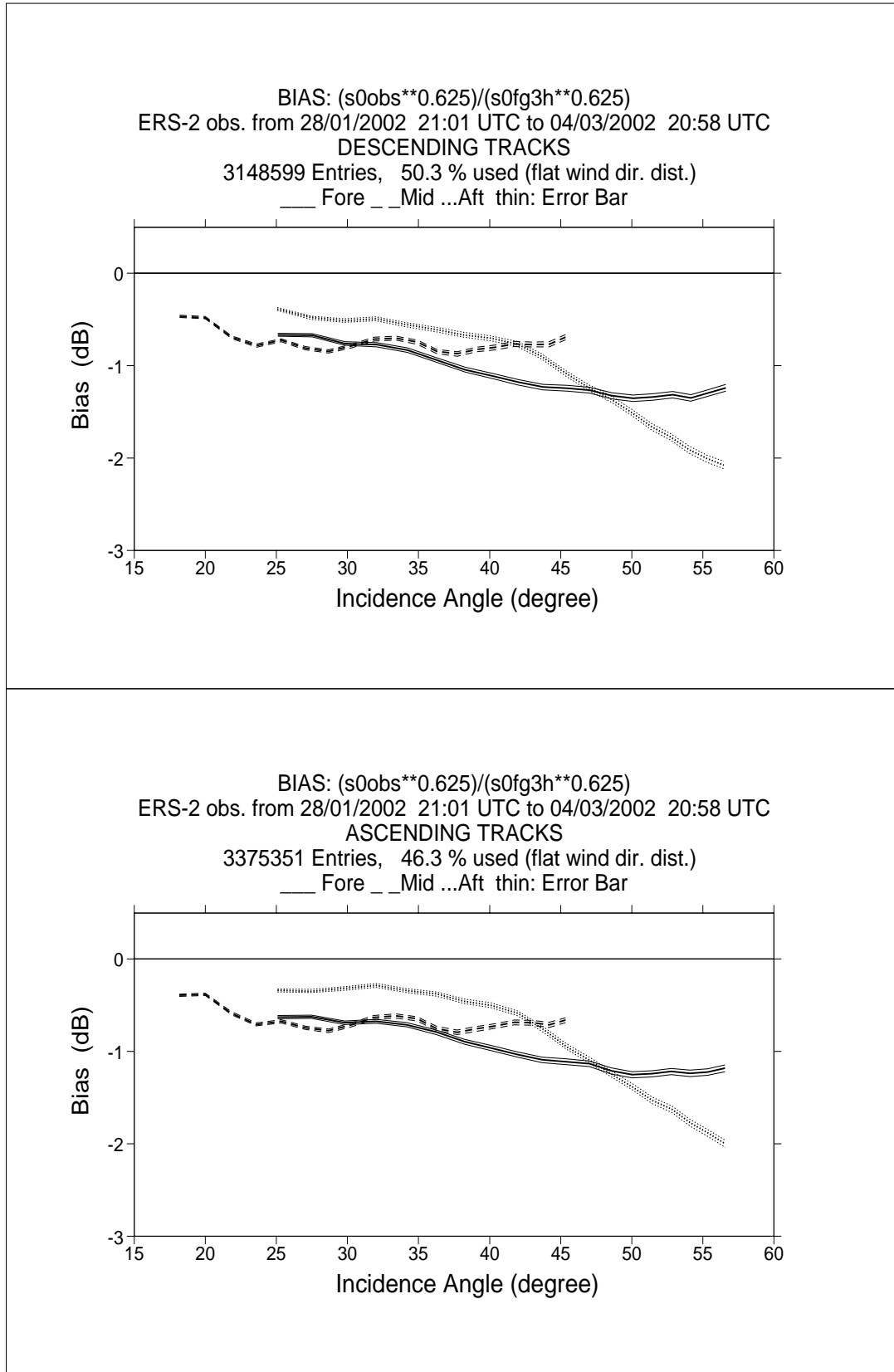


FIGURE 2

ECMWF - Report on the ERS-2 Scatterometer

Monitoring of Sigma0 triplets versus CMOD4 for ERS-2

from 2002012900 to 2002030418

(solid) mean normalised distance to the cone over 6 h
(dashed) fraction of complete sea-point observations rejected by ESA flag or CMOD4 inversion
(dotted) total number of data in log. scale (1 for 60000)

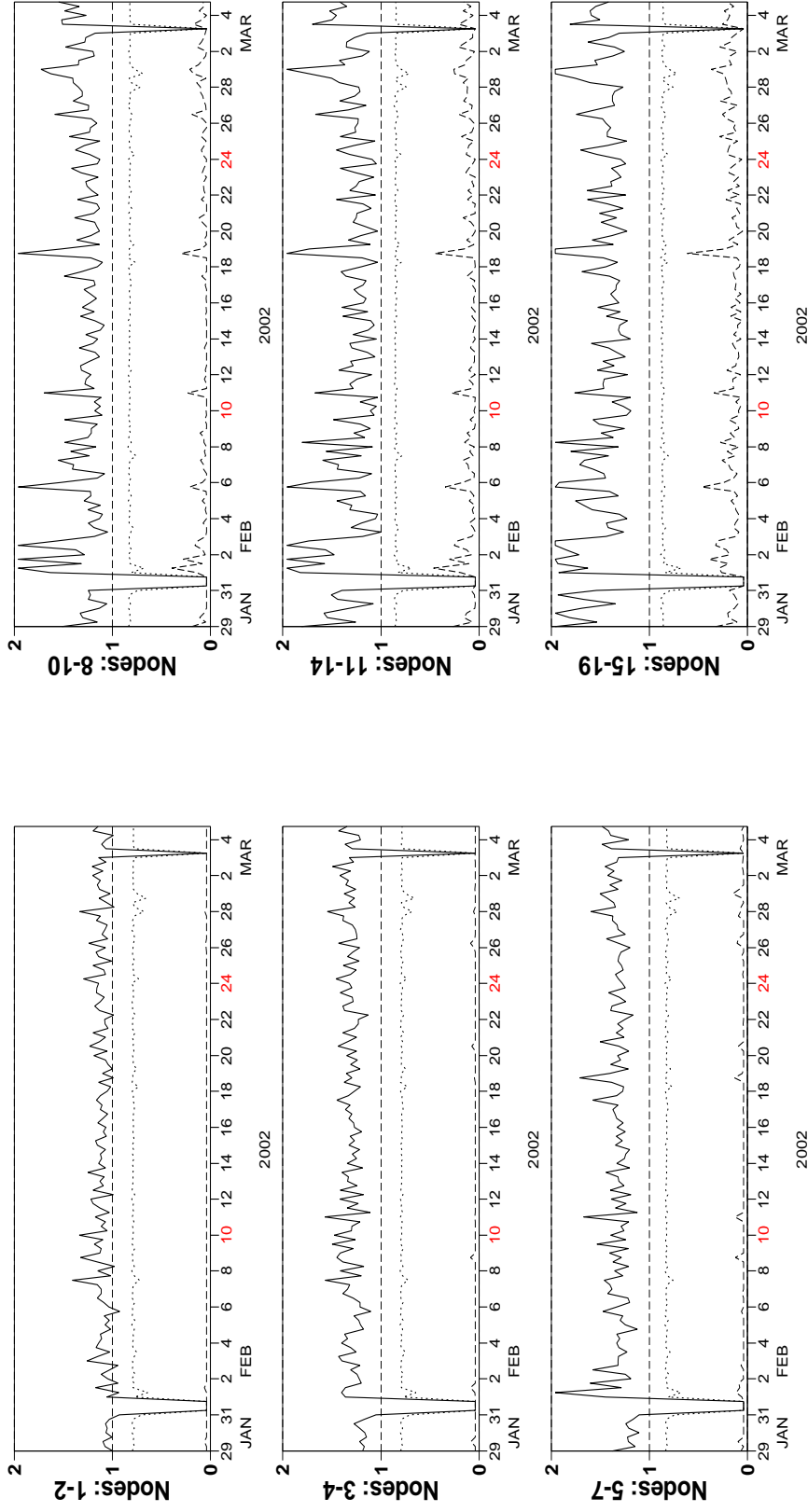


FIGURE 3

ECMWF - Report on the ERS-2 Scatterometer

Monitoring of UWI winds versus First Guess for ERS-2

from 2002012900 to 2002030418

(solid) wind speed bias UWI - First Guess over 6h (deg.)

(dashed) wind speed standard deviation UWI - First Guess over 6h (deg.)

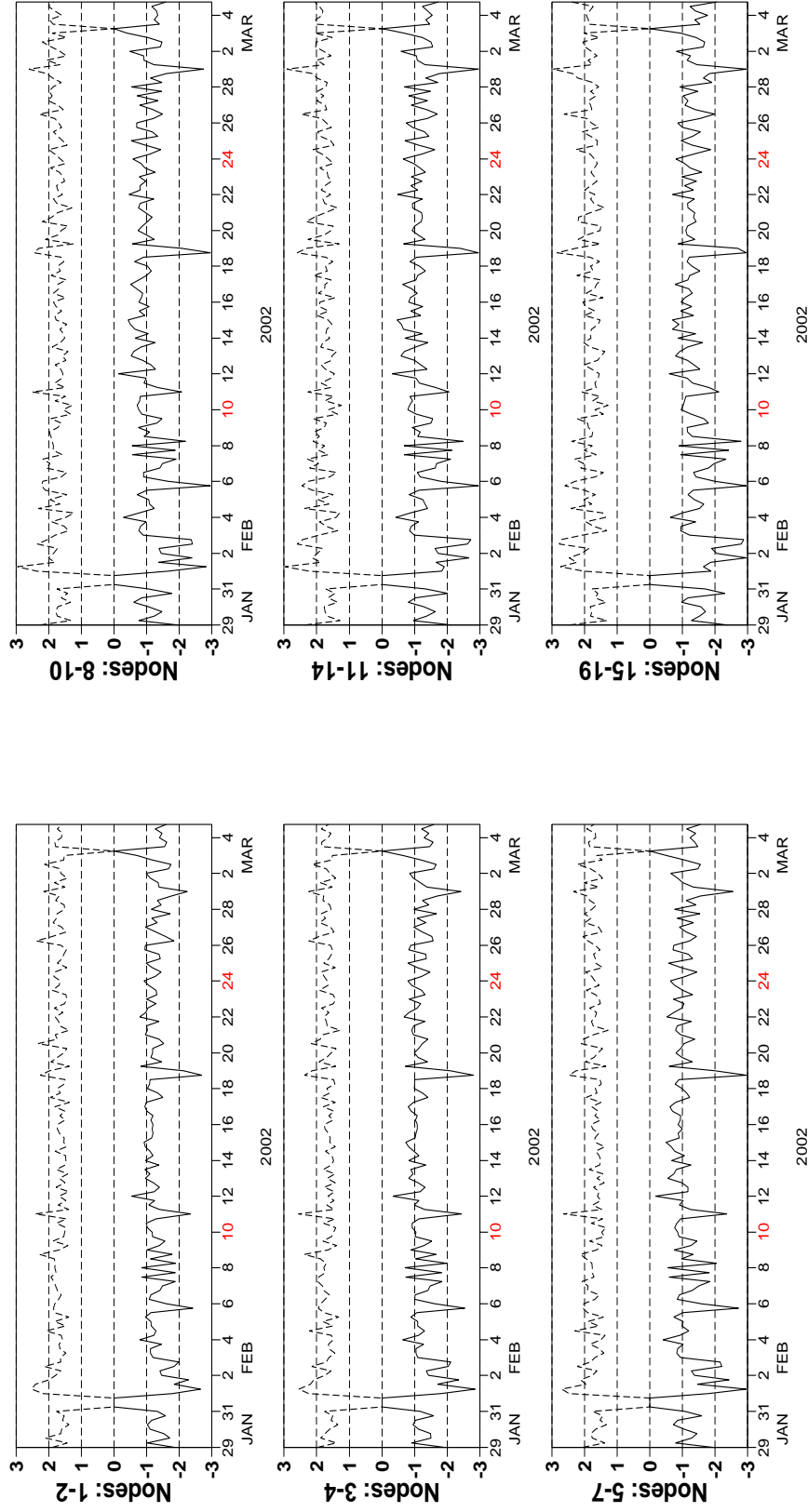


FIGURE 4

Hans Hersbach
European Centre for Medium Range Weather Forecasts
Shinfield Park, Reading, Berkshire RG2 9AX, England
Telephone: U.K. (0118) 9499476, International (+44 118) 9499476
Telex 847908 ECMWF G, Telefax (01189) 869450, e-mail dal@ecmwf.int

ECMWF - Report on the ERS-2 Scatterometer

Monitoring of UWI winds versus First Guess for ERS-2

from 2002012900 to 2002030418

(solid) wind direction bias UWI - First Guess over 6h (deg.)
(dashed) wind direction standard deviation UWI - First Guess over 6h (deg.)

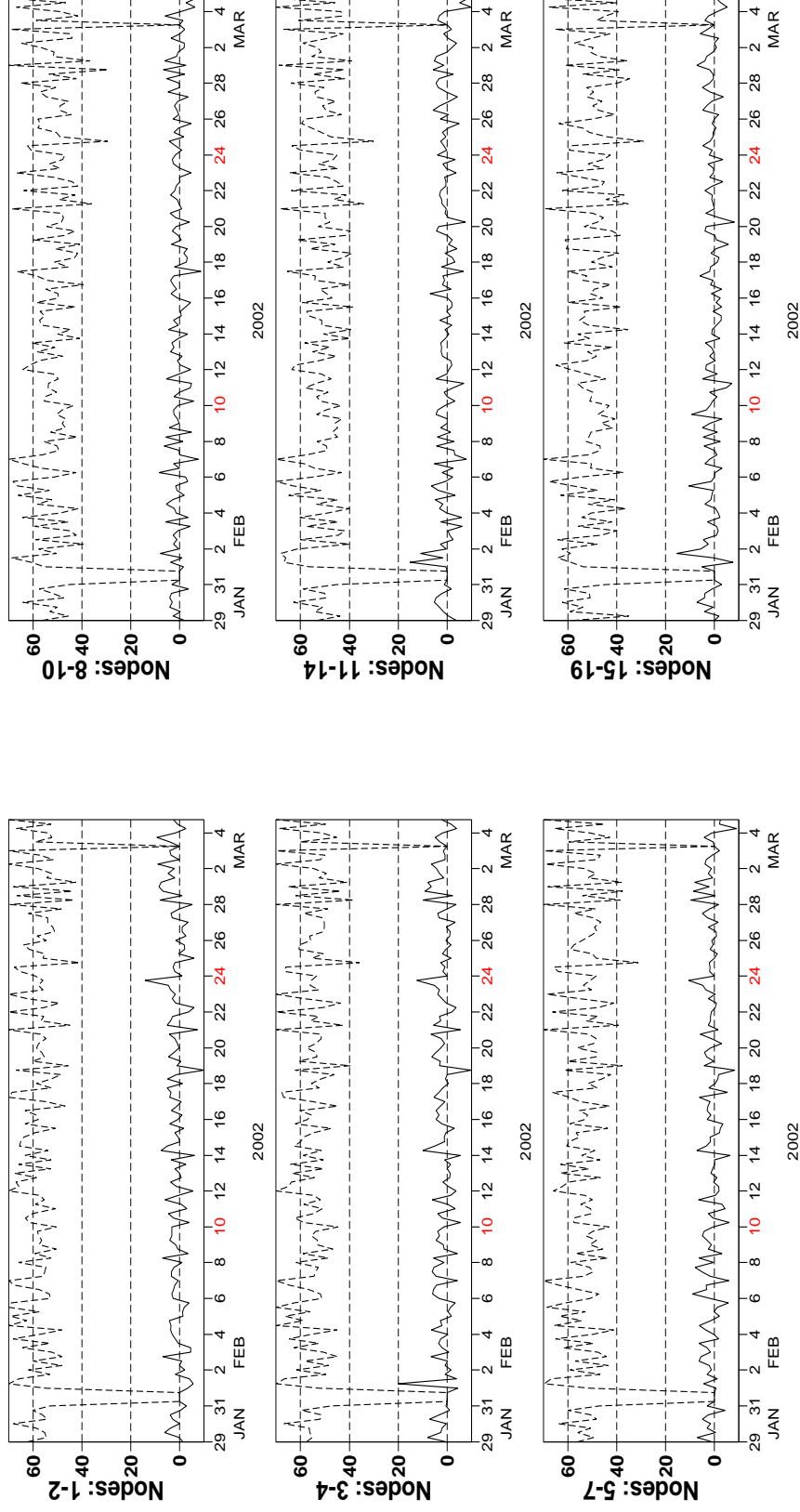


FIGURE 5

Hans Hersbach
European Centre for Medium Range Weather Forecasts
Shinfield Park, Reading, Berkshire RG2 9AX, England
Telephone: U.K. (0118) 9499476, International (+44 118) 9499476
Telex 847908 ECMWF G, Telefax (01189) 869450, e-mail dal@ecmwf.int

ECMWF - Report on the ERS-2 Scatterometer

Monitoring of de-aliased CMOD4 winds versus First Guess for ERS-2

from 2002012900 to 2002030418

(solid) wind speed bias CMOD4 - First Guess over 6h (deg.)

(dashed) wind speed standard deviation CMOD4 - First Guess over 6h (deg.)

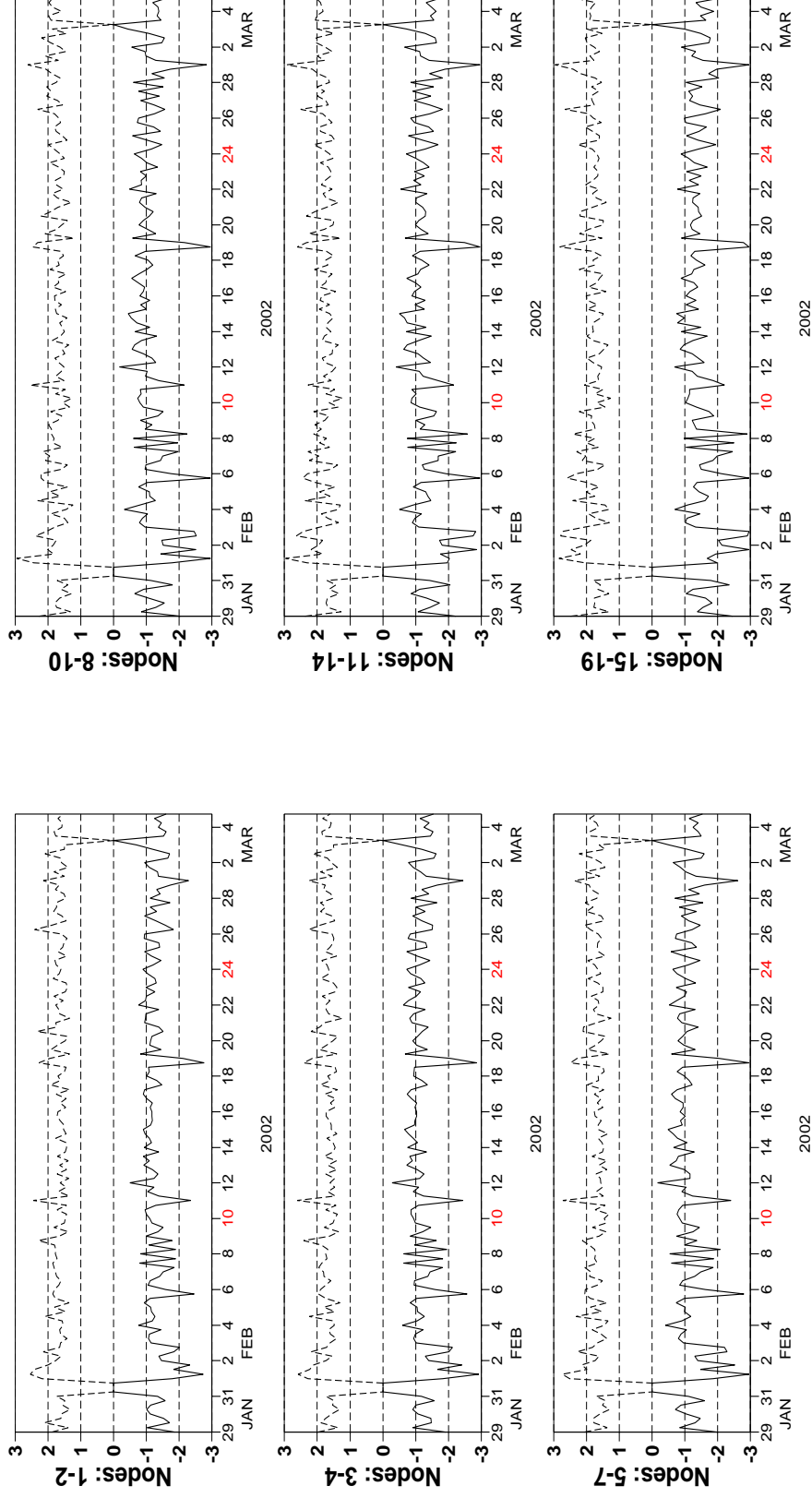


FIGURE 6

ECMWF - Report on the ERS-2 Scatterometer

Monitoring of de-aliased CMOD4 winds versus First Guess for ERS-2

from 2002012900 to 2002030418

(solid) wind direction bias CMOD4 - First Guess over 6h (deg.)

(dashed) wind direction standard deviation CMOD4 - First Guess over 6h (deg.)

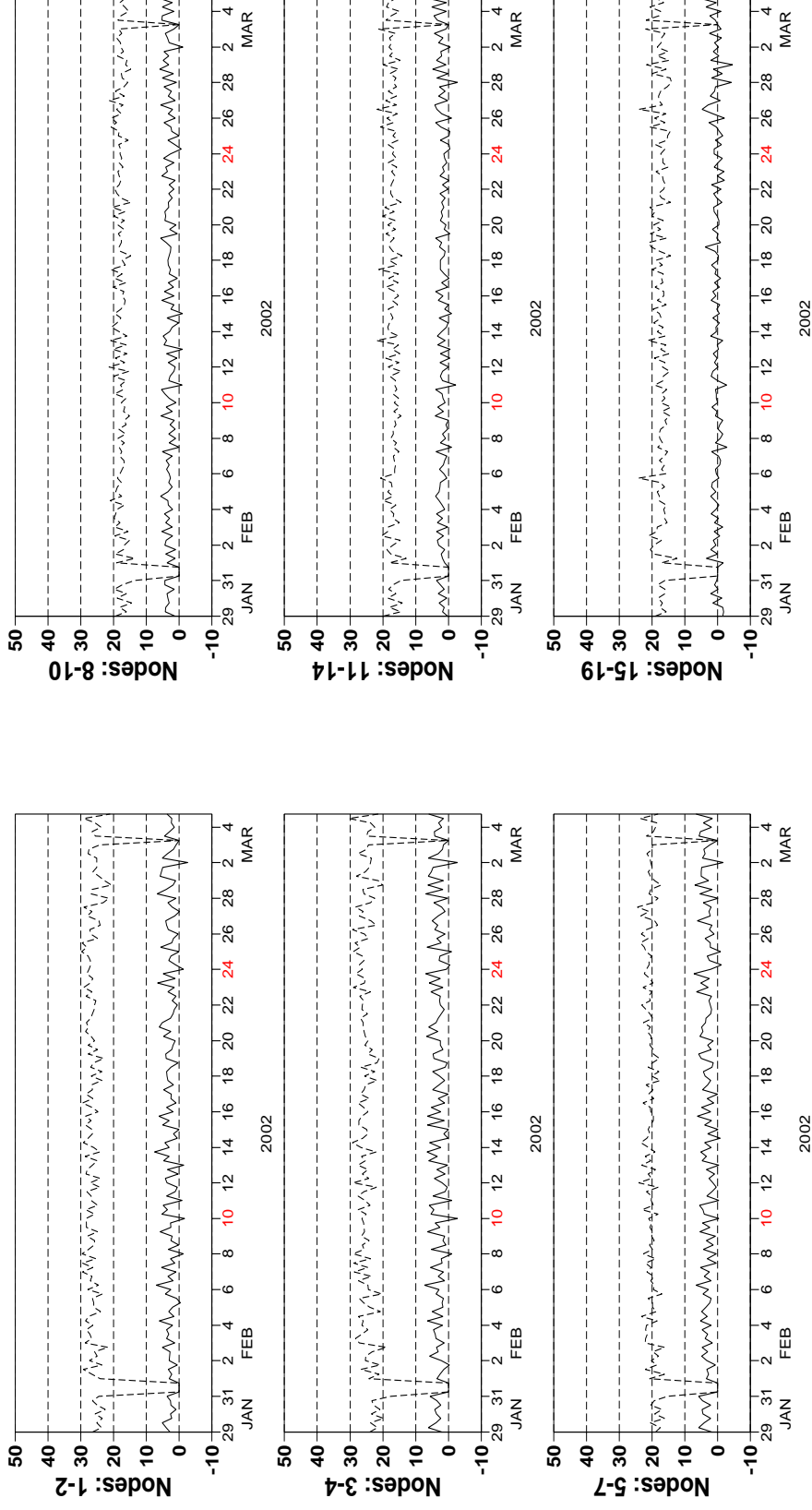
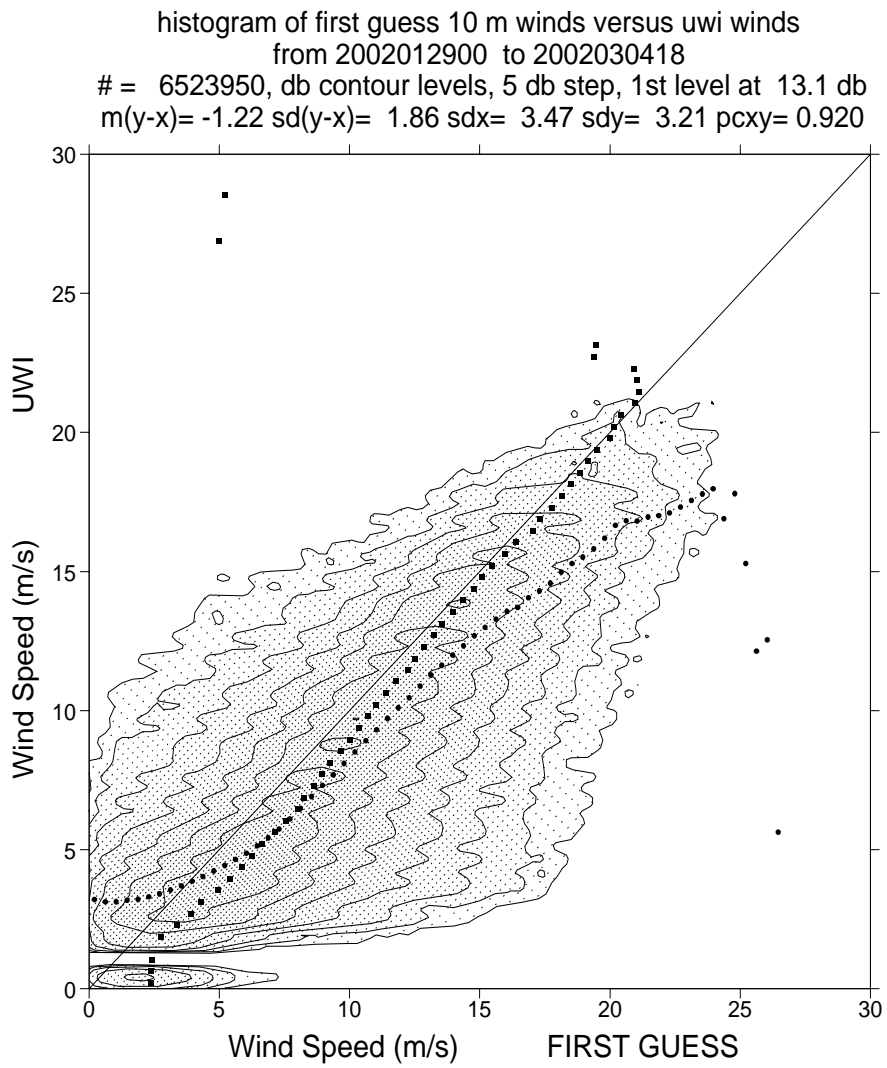


FIGURE 7



■ **FIGURE 8**

