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

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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 72 monitored at ECMWF. The gyroless ERS-2 scatterometer data was not used in the ECMWF 4D-Var data assimilation system.

During cycle 72, gyroless data was received between 21:01 UTC 4 March 2002 and 20:59 UTC 8 April 2002. Due to an anomaly, no data was received between 02:14 UTC 8 March 2002 and 17:49 UTC 20 March. In addition, no data was received for the 6-hourly periods 18 UTC 2 April 2002 and 12 UTC 6 April 2002.

The quality of the data received during cycle 72 was higher than for the data received during cycle 71. Around the first of April, there was a jump towards improved performance. Since this date, the quality of the data is not much worse than it was during cycle 59, i.e., the last cycle before the on-board failure in January 2001.

The ECMWF assimilation system was not modified during cycle 72.

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ERS-2 STATISTICS FROM 5 MARCH 2002 TO 8 APRIL 2002

The sigma0 bias levels (compared to simulated sigma0's based on ECMWF model first guess winds, see Figure 1) have been reduced for the descending for and aft tracks as compared to the corresponding levels during cycle 71. For the for beam the reduction was 0.1 dB, 0.2 dB and almost zero for respectively lower, mid and high incidence angles. For the aft beam, the corresponding reductions were 0.15 dB, 0.3 dB, and 0.15 dB. Bias levels for the other tracks were almost the same as in cycle 71. As a result, compared to cycle 71, bias levels of the ascending tracks have become more comparable to those for the descending beams. For the aft beam, the bias level of the descending track has become less negative than that of the ascending track. This was the opposite for cycle 71. 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 0.2-0.3 dB more negative than for the aft beam, while for incidence angles larger than 48 degrees it is the aft beam that performs worse (up to 1.0 dB for 57 degrees).

For the higher nodes the distance to the cone history shows several peaks between 21 and 25 March 2002 (see Figure 2). During this period there was some enhanced solar activity (although not visible in the ERS2 altimeter data bias history on the Southern Hemisphere; not shown). A similar coincidence was observed for a peak at 30 March 2002, 06 UTC. 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.

On average, normalized distances are larger than one, and are highest for the last five nodes.

The quality of the UWI winds received during cycle 72 has been improved w.r.t. data received during cycle 71. This is especially true for data received during the last week of cycle 72. The UWI winds now have an average bias of -1.07 m/s, which was -1.22 m/s for cycle 71. The bias is -1.14 m/s for nodes 1-2 (was -1.30 m/

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s) and -1.23 m/s for nodes 15-19 (was -1.36 m/s). Biases are smallest for nodes 8-10 (-0.92 m/s, was -1.08 m/s). The standard deviation is on average 1.77 m/s (was 1.85 m/s), and increases from 1.68 m/s (was 1.76 m/s) for nodes 1-2, to 1.84 m/s for nodes 15-19 (was 1.92 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 53.4 degrees, was 54.1) and between 15 and 25 degrees (average value 21.0, was 20.4) 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 (-1.07 m/s) compared to the plot from cycle 71 (-1.22 m/s). The standard deviation is also smaller (1.78 m/s, was 1.86 m/s). Note that for the gyroless product there is still an amount of low wind data with collocated first-guess winds that are much stronger. The direction scatter plot looks similar to the results from cycle 71 (bias from 1.7 to 1.1 degrees, and standard deviation from 52 to 51 degrees).

In Figures 3-6 there is a signal of a positive jump in performance around the first of April. In order to investigate this, a scatter plot of model 10 m first-guess winds versus UWI wind speeds for data received in the 6-hourly cycles between 0 UTC 1 April 2002 and 18 UTC 8 April 2002 was produced as well. It is displayed in Figure 9, from which it is seen that indeed the data quality has improved considerably. In fact, the quality is almost comparable to that of nominal data, i.e., received before 16 January 2001. A comparison with data acquired during cycle 59 (21 UTC 5 December 2000 to 21 UTC 8 january 2001) shows that the standard deviation is the same (1.62 m/s). Only the bias is somewhat worse (-0.89 m/s, was -0.73 m/s for cycle 59). The amount of low UWI winds collocated with strong ECMWF first-guess winds is much lower, and looks comparable to the situation during cycle 59.

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2 - FIGURE CAPTION

Fig. 1: Ratio of < σ0**0.625 > over < CMOD4(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: *T*wo-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.

Fig. 9: Same as Fig. 7, but now for data acquired between 21 UTC 31 March 2002 and 21 UTC 8 April 2002.

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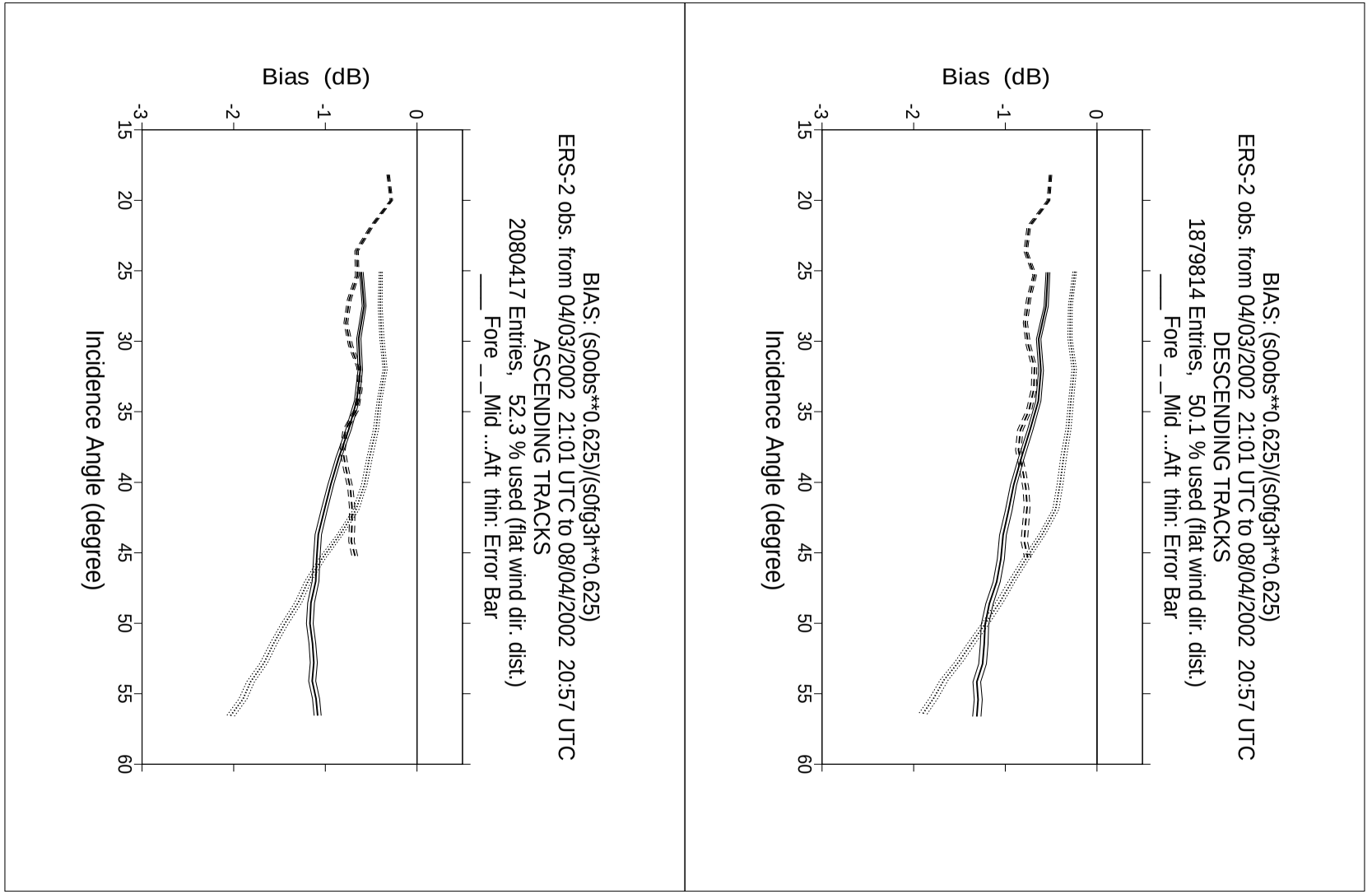

FIGURE 1

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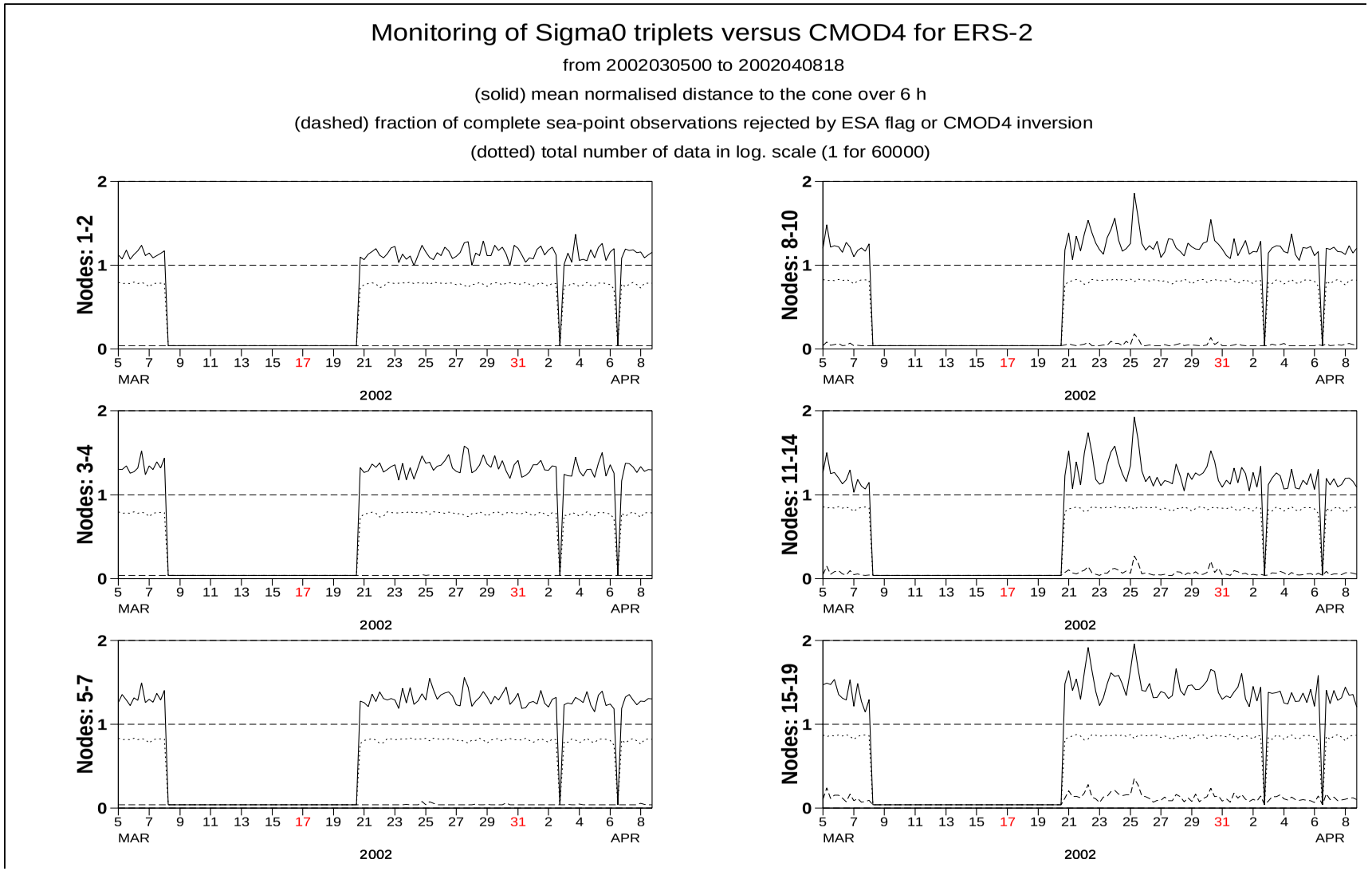

FIGURE 2

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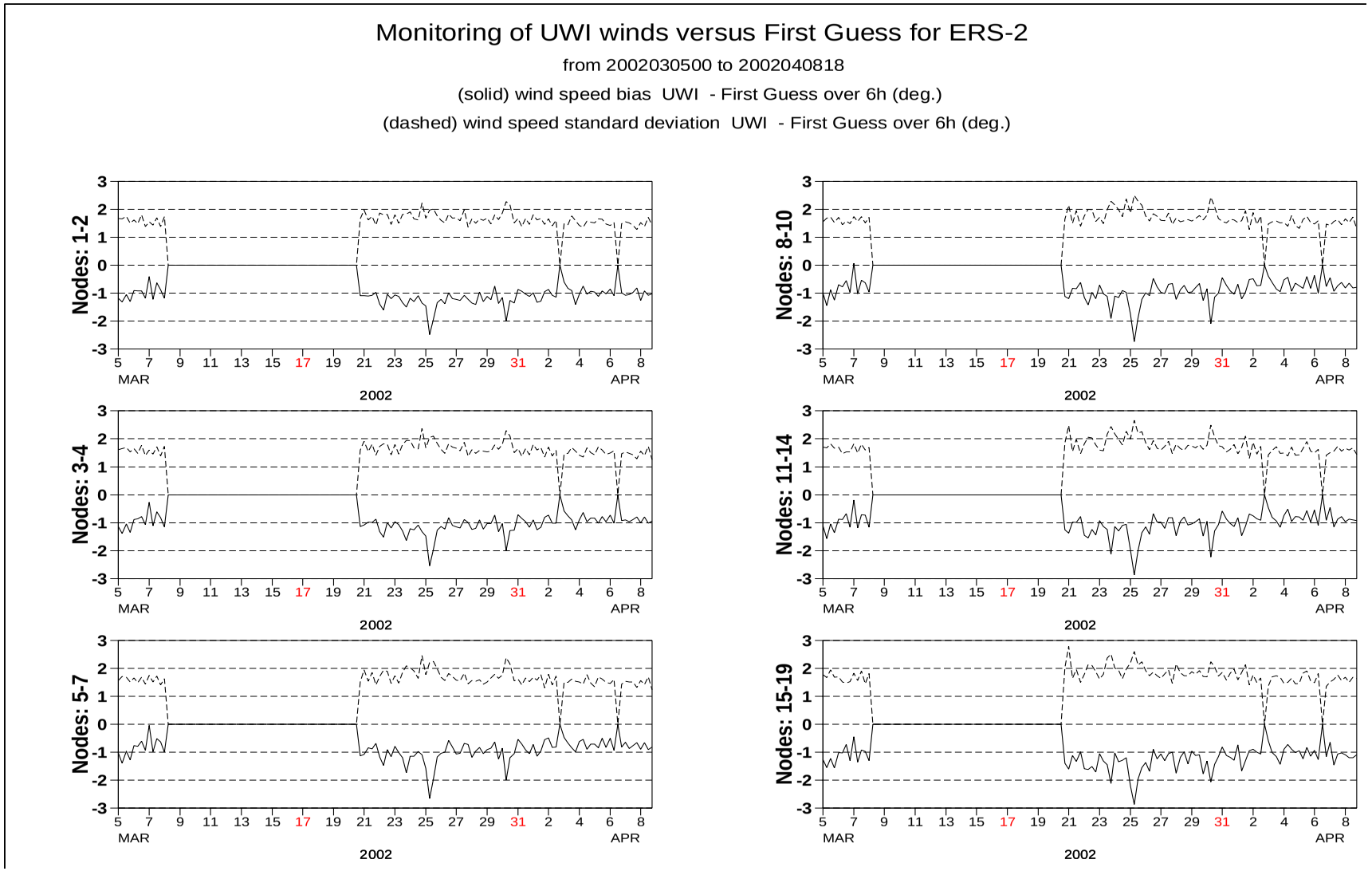

FIGURE 3

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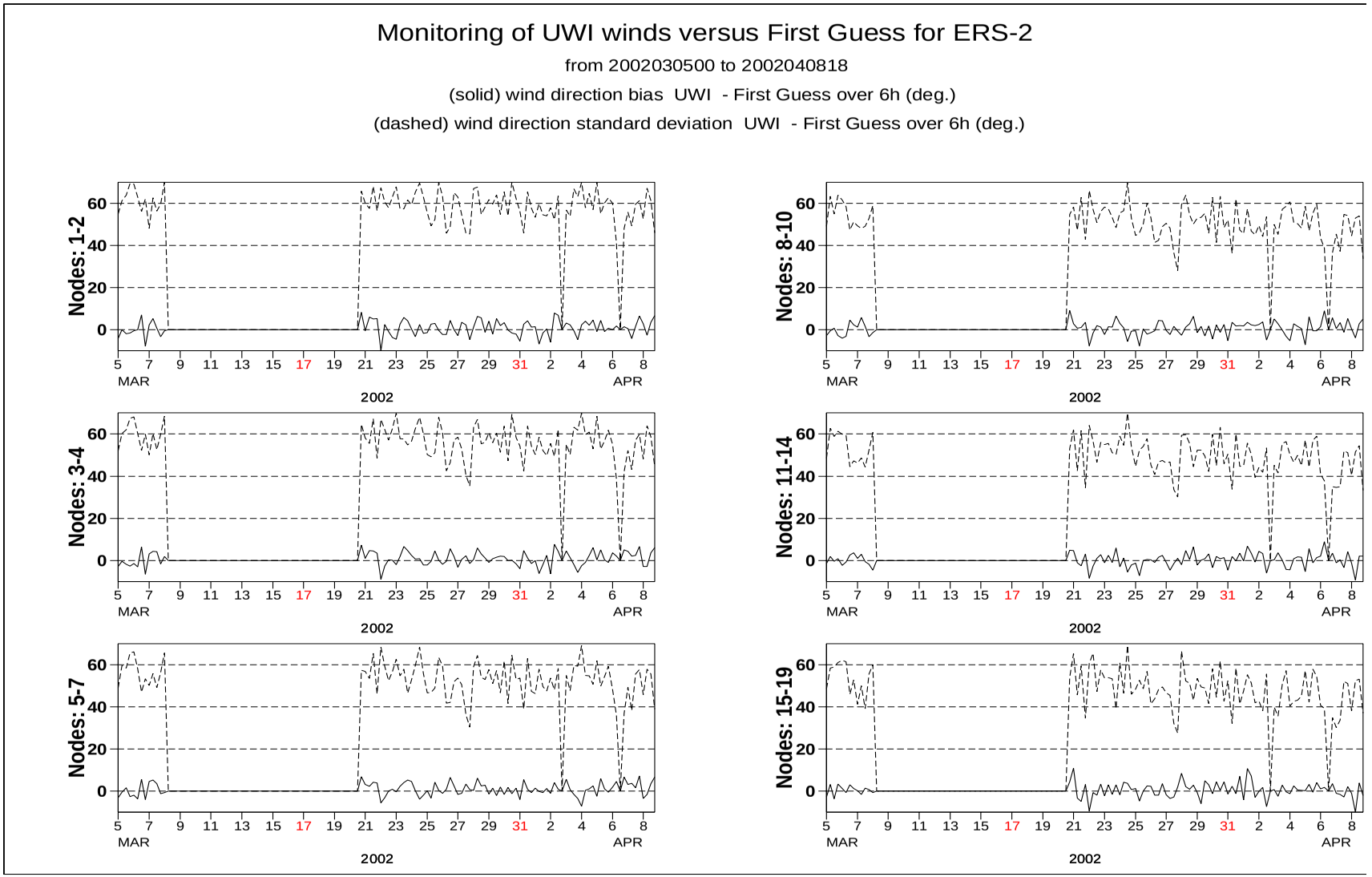

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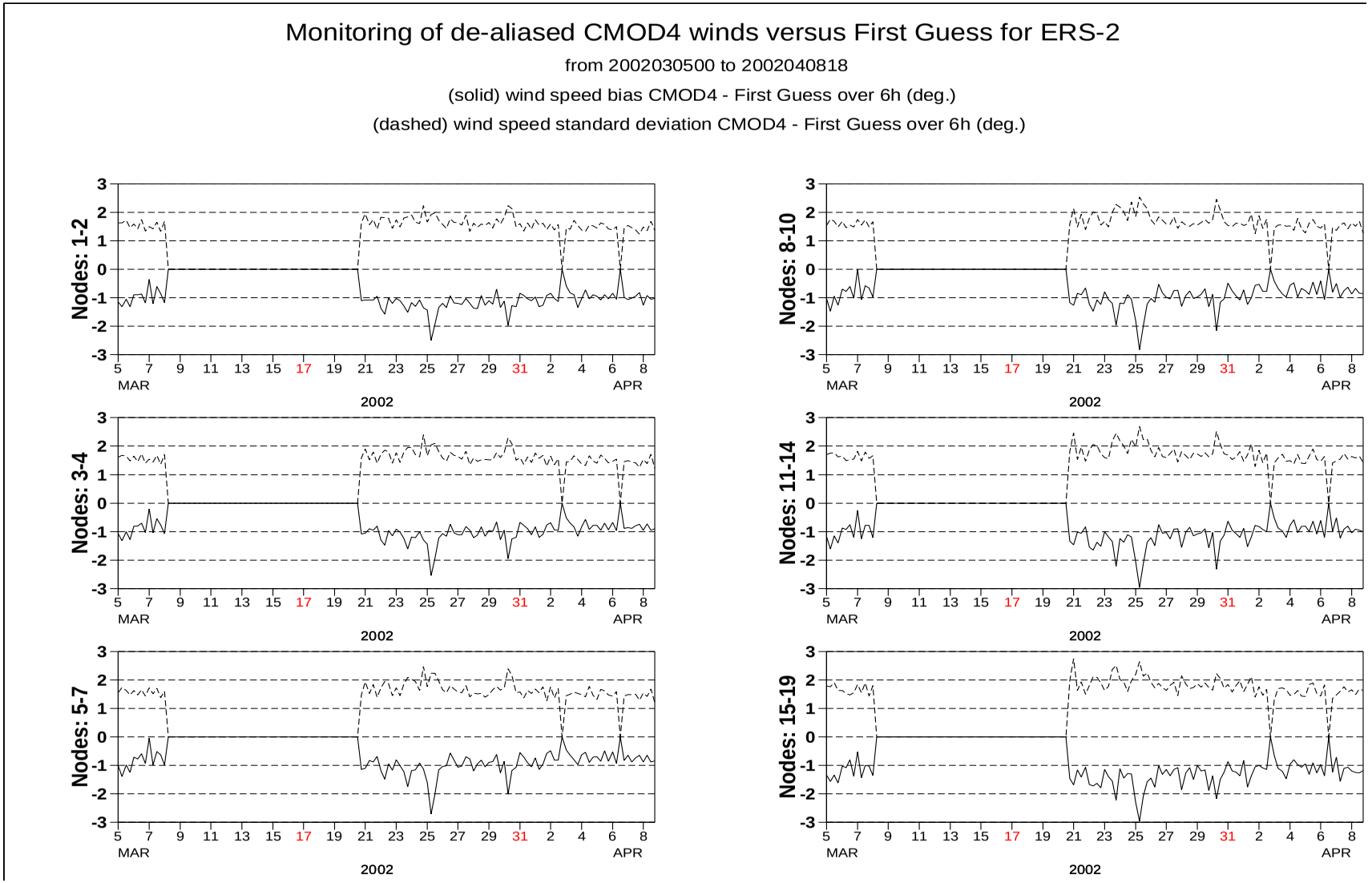

FIGURE 5

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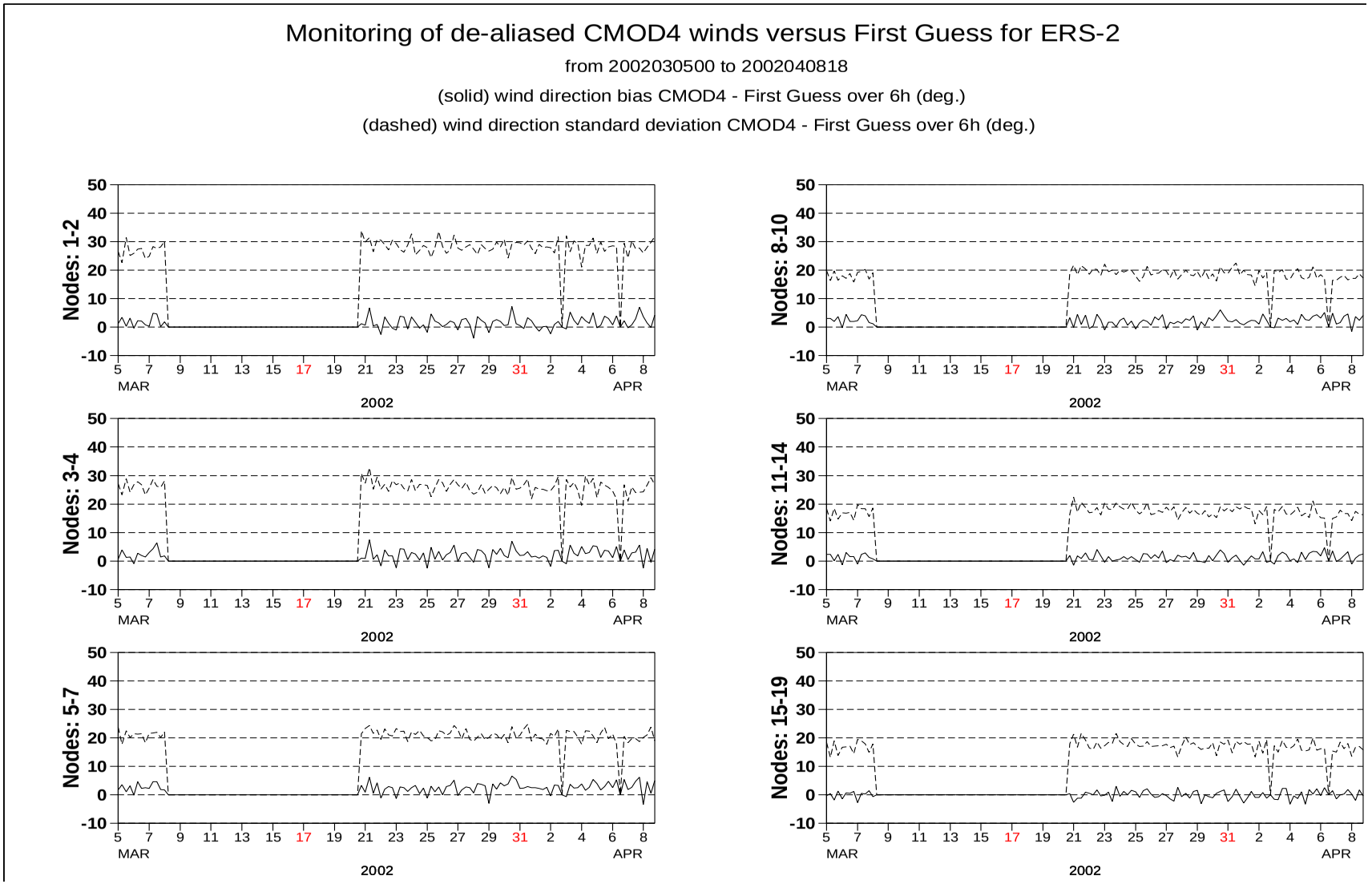

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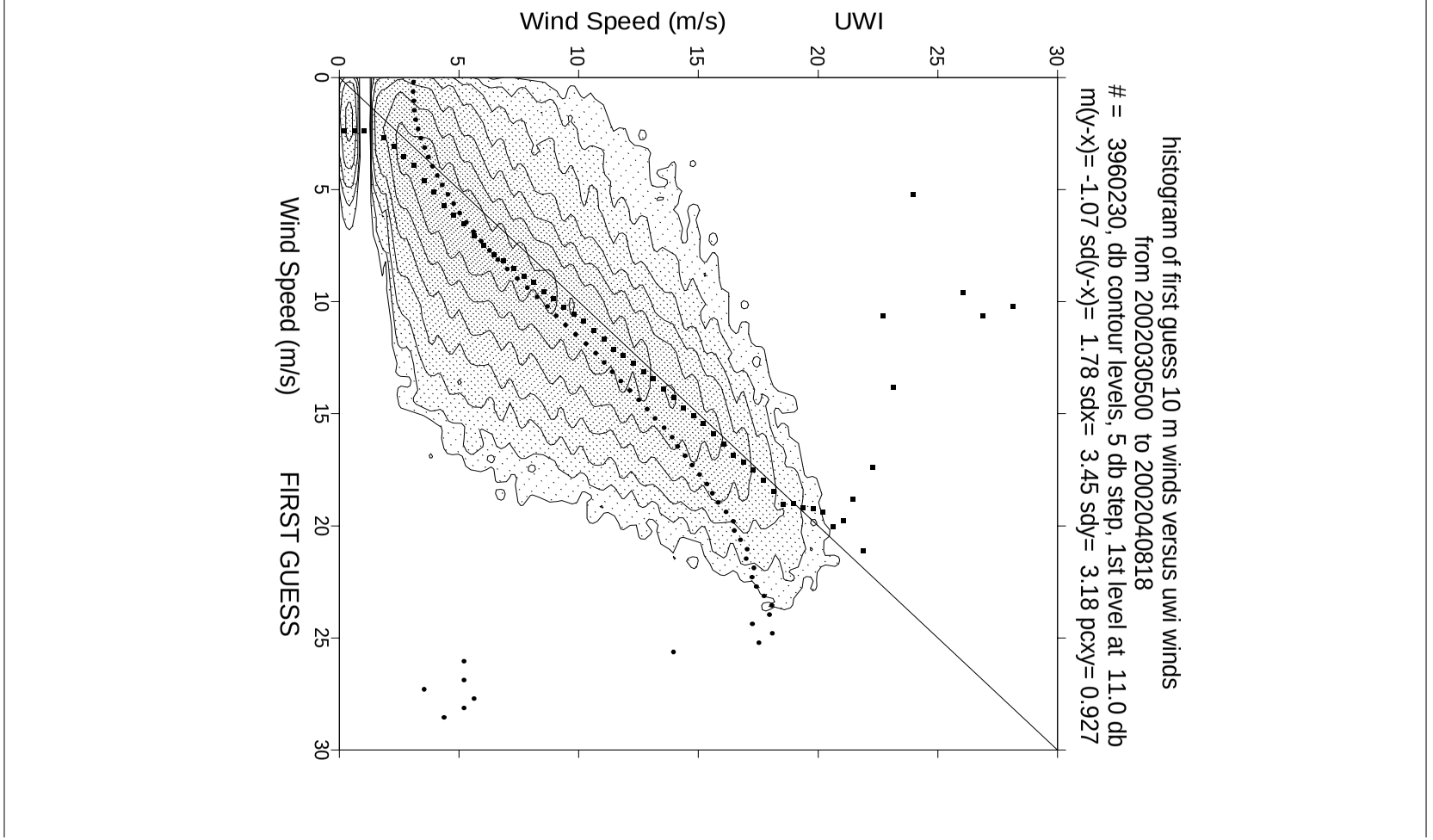

FIGURE 7

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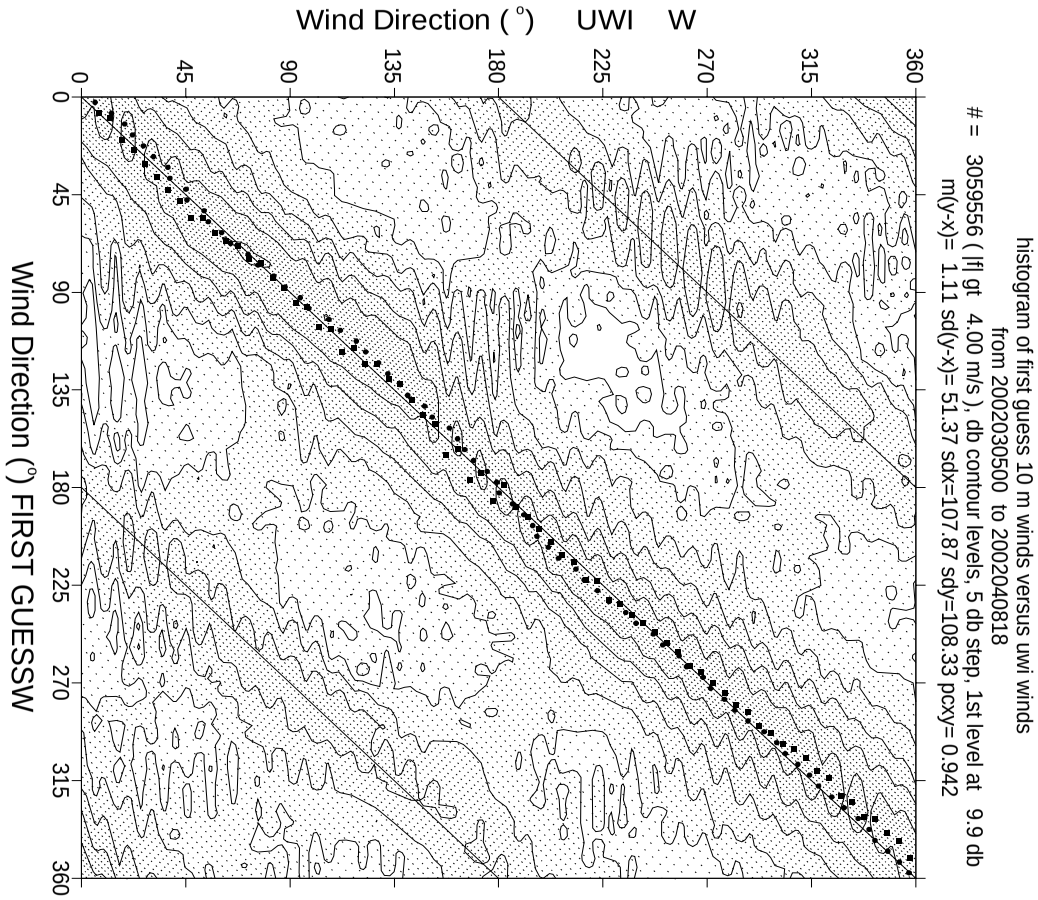

FIGURE 8

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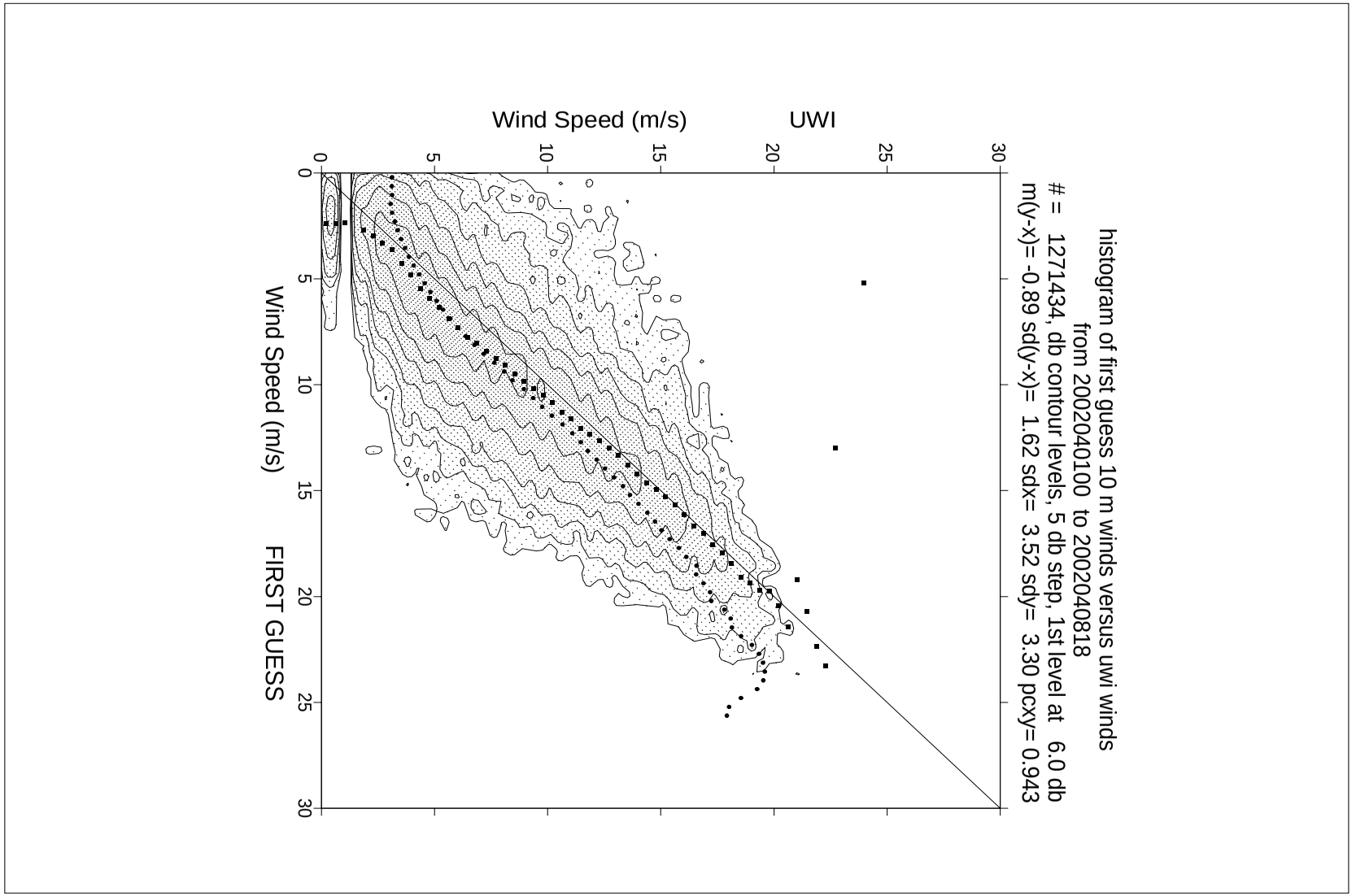

FIGURE 9

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