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

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1 - INTRODUCTION:

From 12 December onwards 2001 ESRIN has been redistributing ERS-2 scatterometer data to a selected group of users. The quality of this experimental gyroless product was for cycle 70 monitored at ECMWF. The gyroless ERS-2 scatterometer data was not used in the 4D-Var data assimilation system at ECMWF. Therefore, the monitoring tools used when ERS-2 scatterometer data was still assimilated, had to be updated. They were for the first time applied to data for cycle 69. A description may be found in the corresponding monitoring report.

The volume of the retrieved data was constant during the whole period of cycle 70. The quality of the surface winds was found to be lower than for the data received during cycle 69.

On 22 January 2002, a new cycle of the ECMWF assimilation system was introduced. Starting from this date, QuikSCAT scatterometer data is assimilated operationally, using a 50km wind product and the rain quality flag provided by JPL. Aircraft data are less thinned, the redundancy checking of SYNOP/SHIP/DRIBU/ AIREP/TEMP/PILOT data is improved, a scan correction for ATOVS radiance and a new SSMI bias correction were implemented. In addition, a preconditioning of the 4D-Var minimization was introduced, correlation functions were revised, and the observation timeslots were reduced from 1 hour to 30 minutes.

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ERS-2 STATISTICS FROM 25 DECEMBER 2001 TO 28 JANUARY 2002

The sigma0 bias level (compared to simulated sigma0's based on ECMWF model first guess winds) was approximately 0.5 dB more negative for all beams and for both descending and ascending tracks as compared to the corresponding levels during cycle 69. The overall behaviour was unaltered: 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. The bias level of the ascending aft beam is for the whole incidence angle range about 0.5 dB more negative than for the descending aft beam. Finally, the large asymmetry between the for and aft beam for incidence angle larger than 42 degrees, as observed for cycle 69, is still present.

For the higher nodes the distance to the cone history shows many peaks (see Figure 2). For the whole period between 25 December 2001 and 1 January 2002, the distance to the cone is much larger than the normalized values. The fraction of the data rejected by the ESA quality flag or CMOD4 inversion algorithm is for these periods larger than usual. The start and end of this period was marked by short peaks of low quality altimeter wind data on the Southern Hemisphere (not shown), which is usually an indication for enhanced solar activity. For the lower nodes, three peaks (31 December 2001 to 1 January 2002, 18 UTC 10 January 2002, 18 UTC 25 January 2002) were observed. The second of these peaks also corresponds to enhanced solar activity. On average, distances (which are based on the new normalization factors) are larger than one, and increase towards higher nodes.

The UWI winds have an average bias of -1.37 m/s, which was -1.09 m/s for cycle 69. The bias is -1.40 m/s for nodes 1-2 (was -1.20 m/s) and -1.54 m/s for nodes 15-19 (was -1.25 m/s). Biases are smallest for nodes 8-10 (-1.22 m/s, was -0.91 m/s). The standard deviation is on average 1.97 m/s (was 1.86 m/s), and increases from 1.88 m/s (was 1.79 m/s) for nodes 1-2, to 2.04 m/s for nodes 15-19 (was 1.94 m/s). The deterioration in

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performance is largest for the higher nodes. The peaks in the distance to the cone plots correspond to low data quality in the wind speed time series. Especially the enhanced large negative biases (up to -3 m/s) and larger standard deviation (up to 3 m/s) between 28 December 2001 and 1 January 2002, for 18 UTC 10 January 2002 and for 18 UTC 25 January 2002 are clearly visible for all nodes. The deteriorated standard deviation for 12 UTC 21 January 2002 does not show up in the cone-distance time series for the lower nodes. It was also associated with higher solar activity. 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 56.3 degrees, was 53.3) and between 15 and 25 degrees (average value 21.3, unchanged) 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 larger bias (-1.37 m/s) compared to the plot from cycle 69 (-1.09 m/s). Also the standard deviation is larger (1.98 m/s, was 1.88 m/s). If the lower quality periods would not have been included, however, the deterioration of 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 the cycle 60 (bias from 0.0 to 1.0 degrees, and standard deviation from 51 to 55 degrees).

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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: 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

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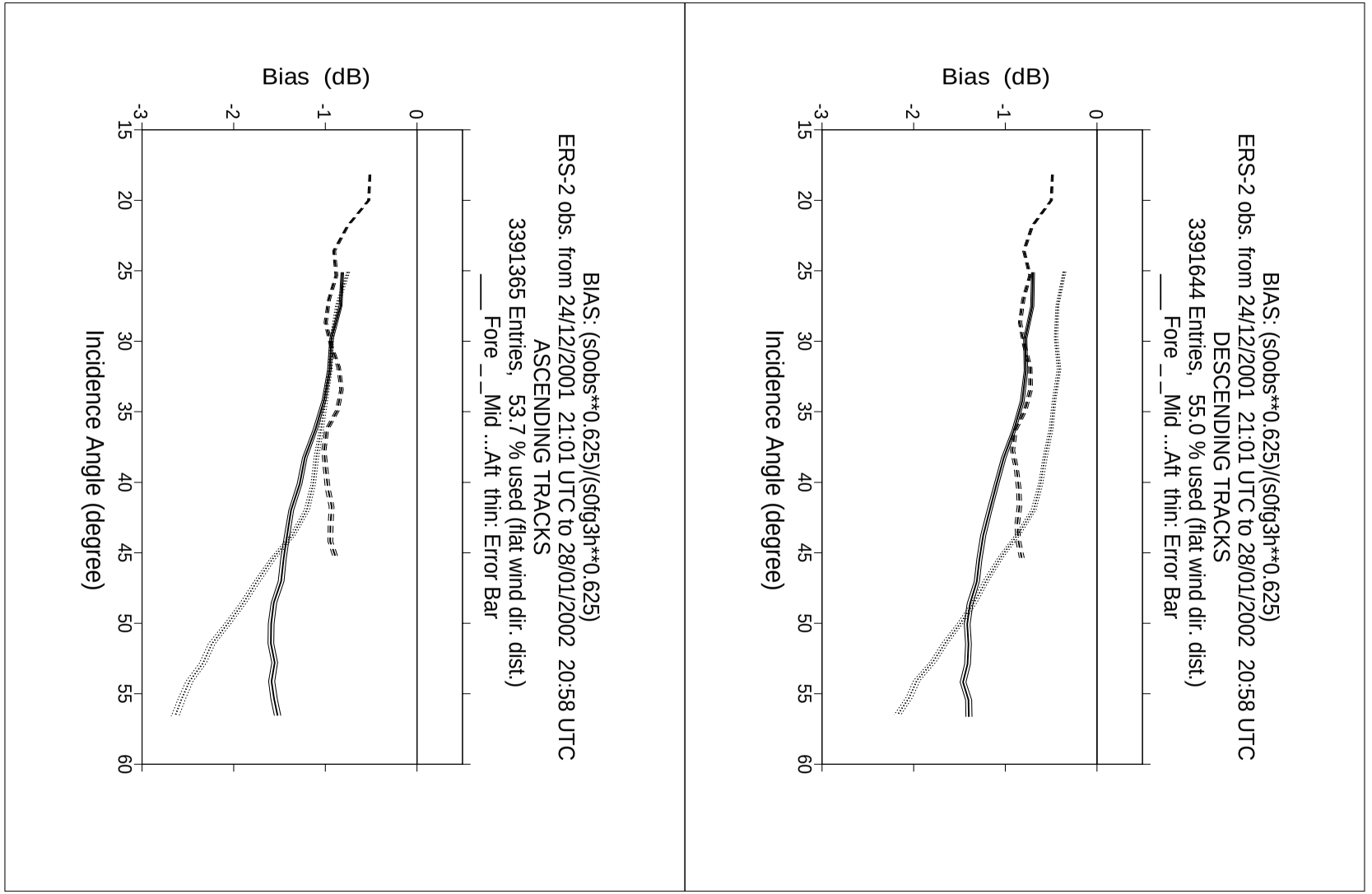

FIGURE 2

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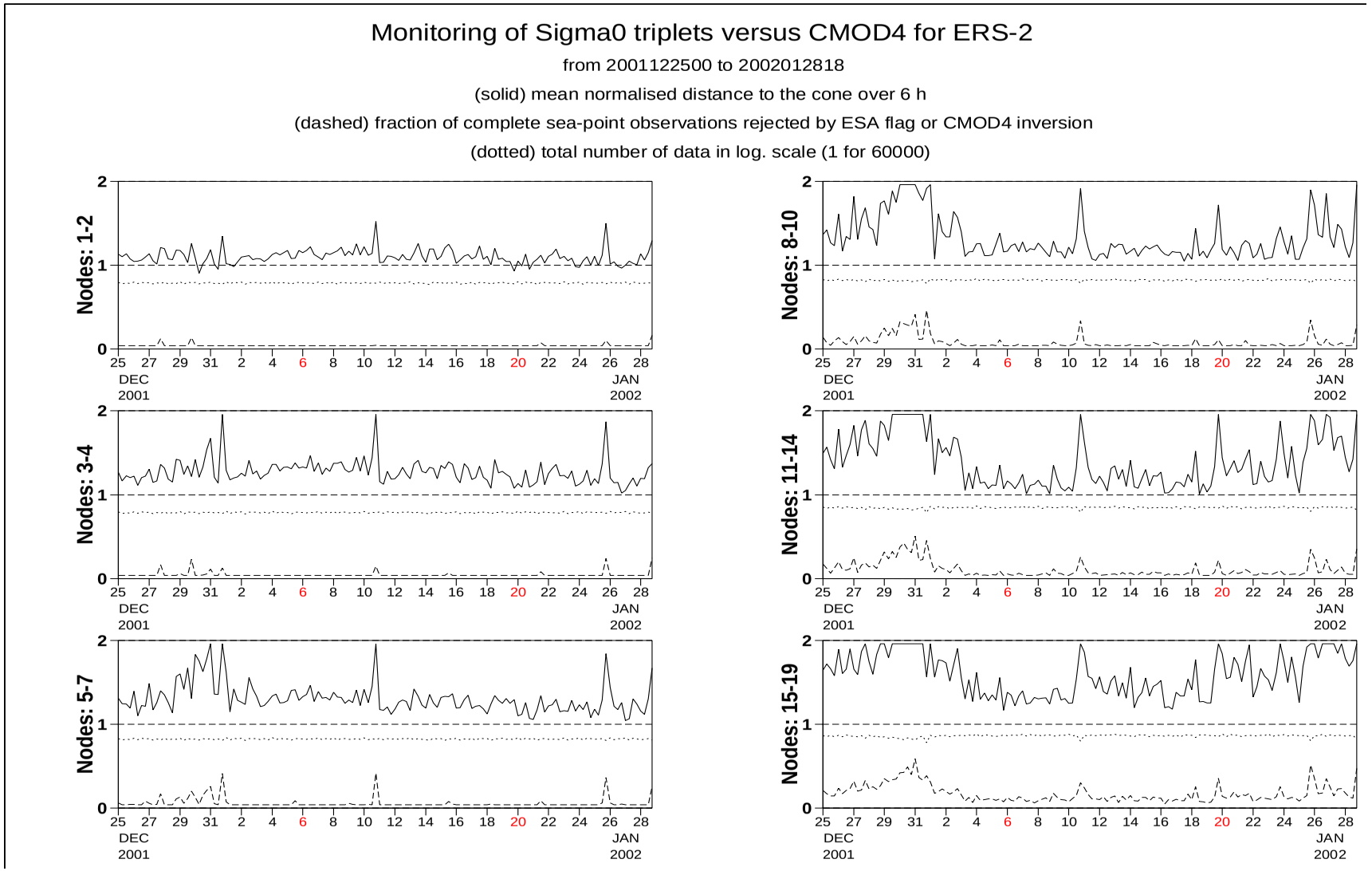

FIGURE 3

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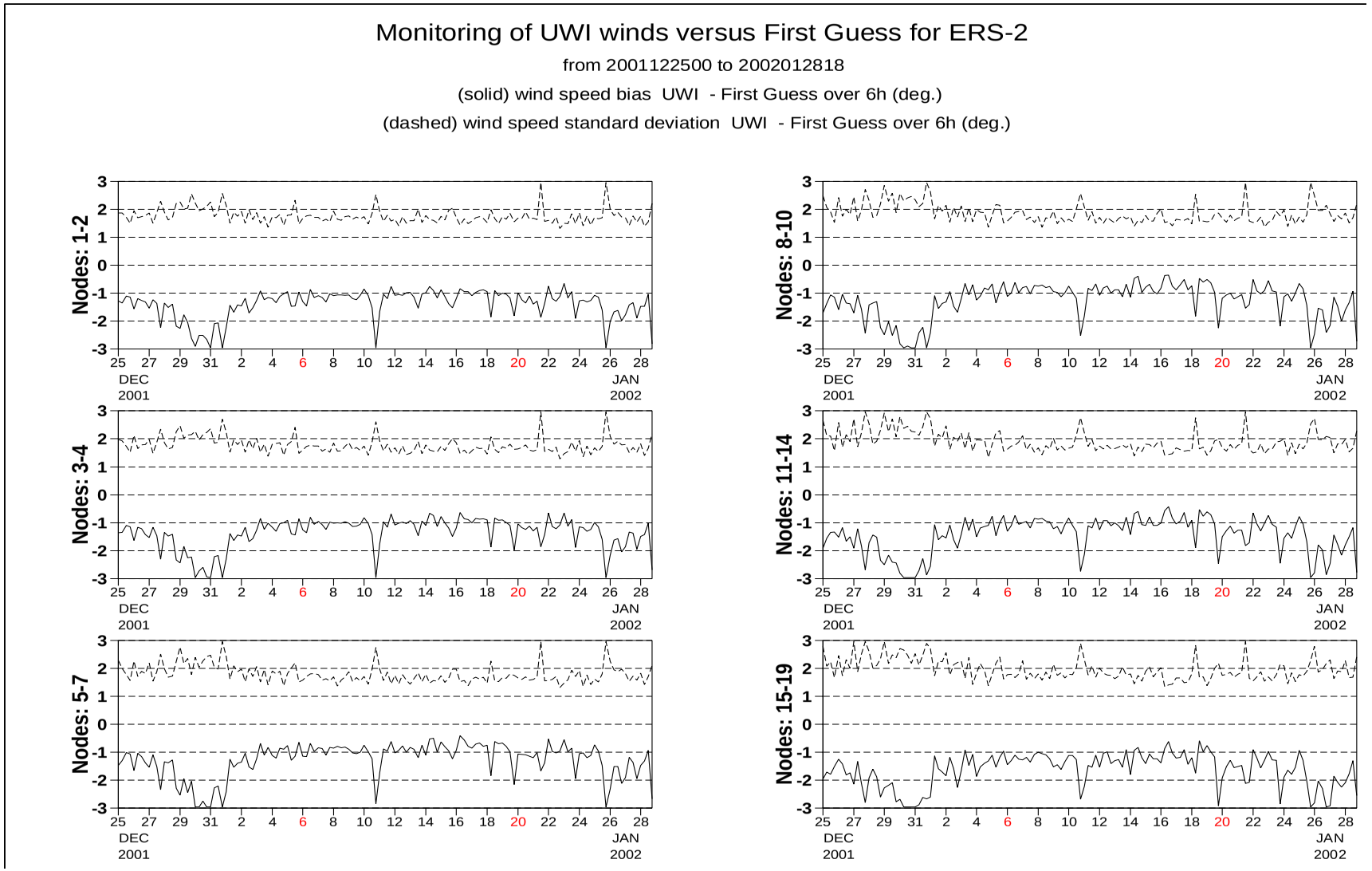

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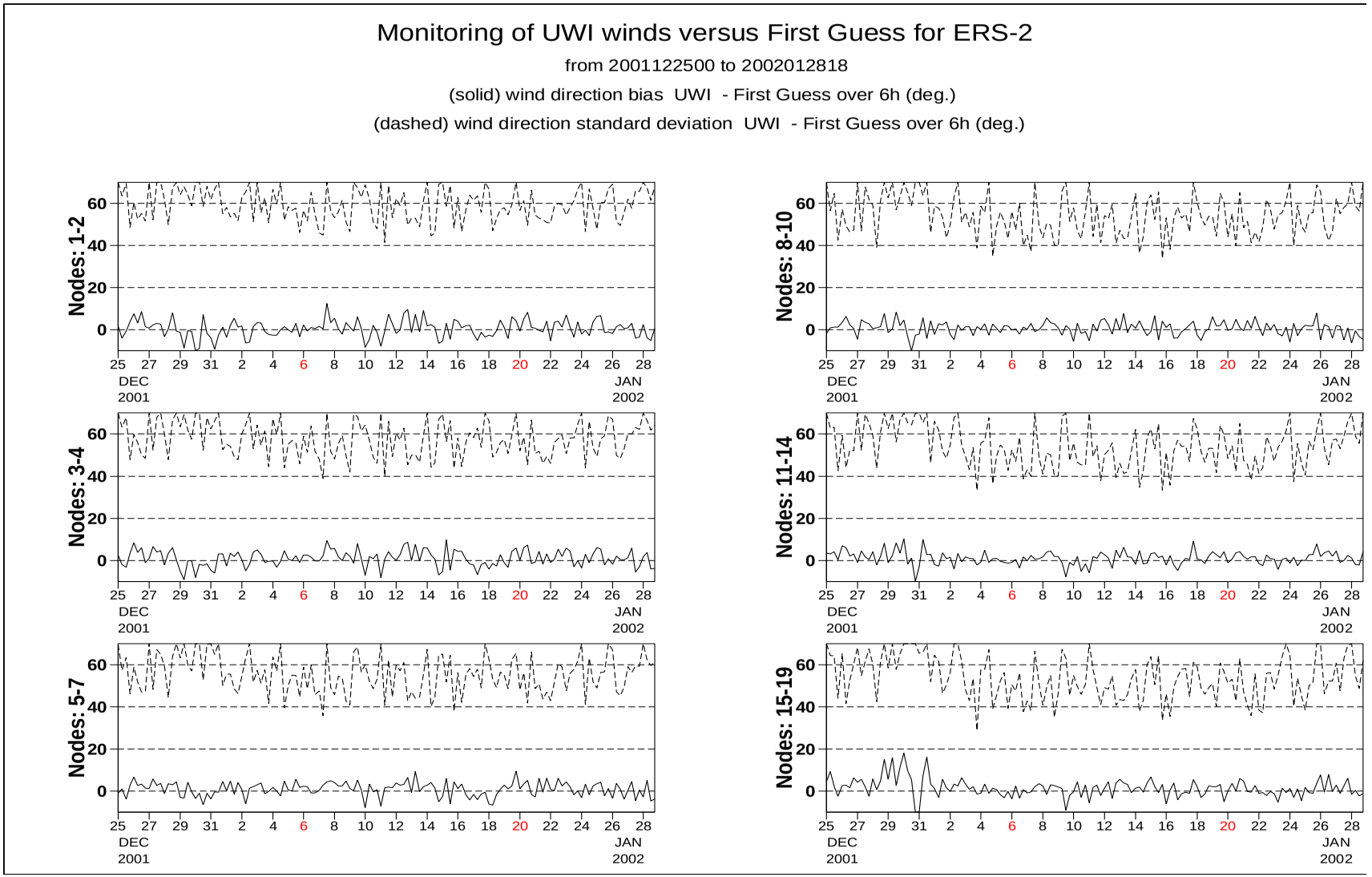

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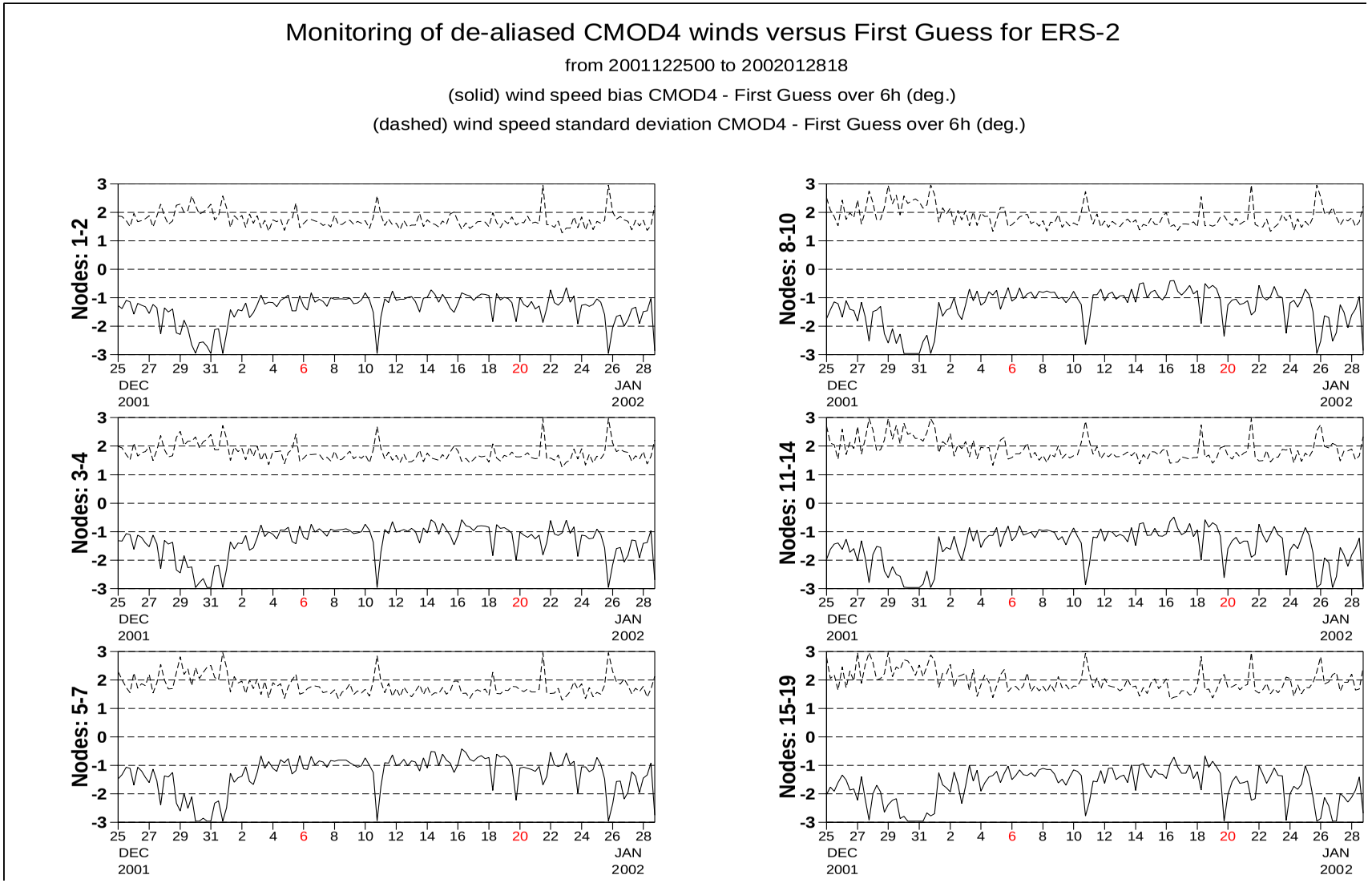

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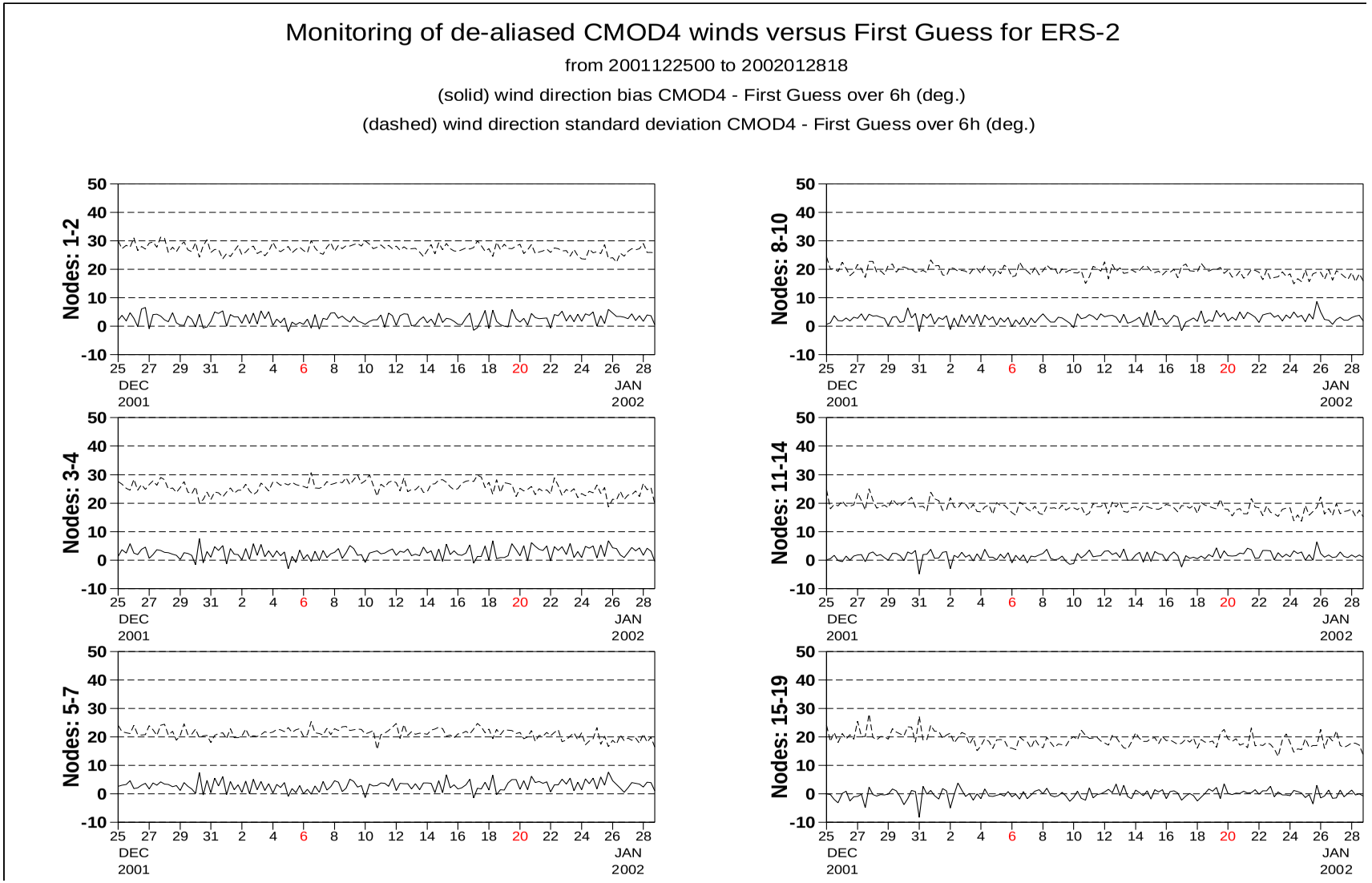

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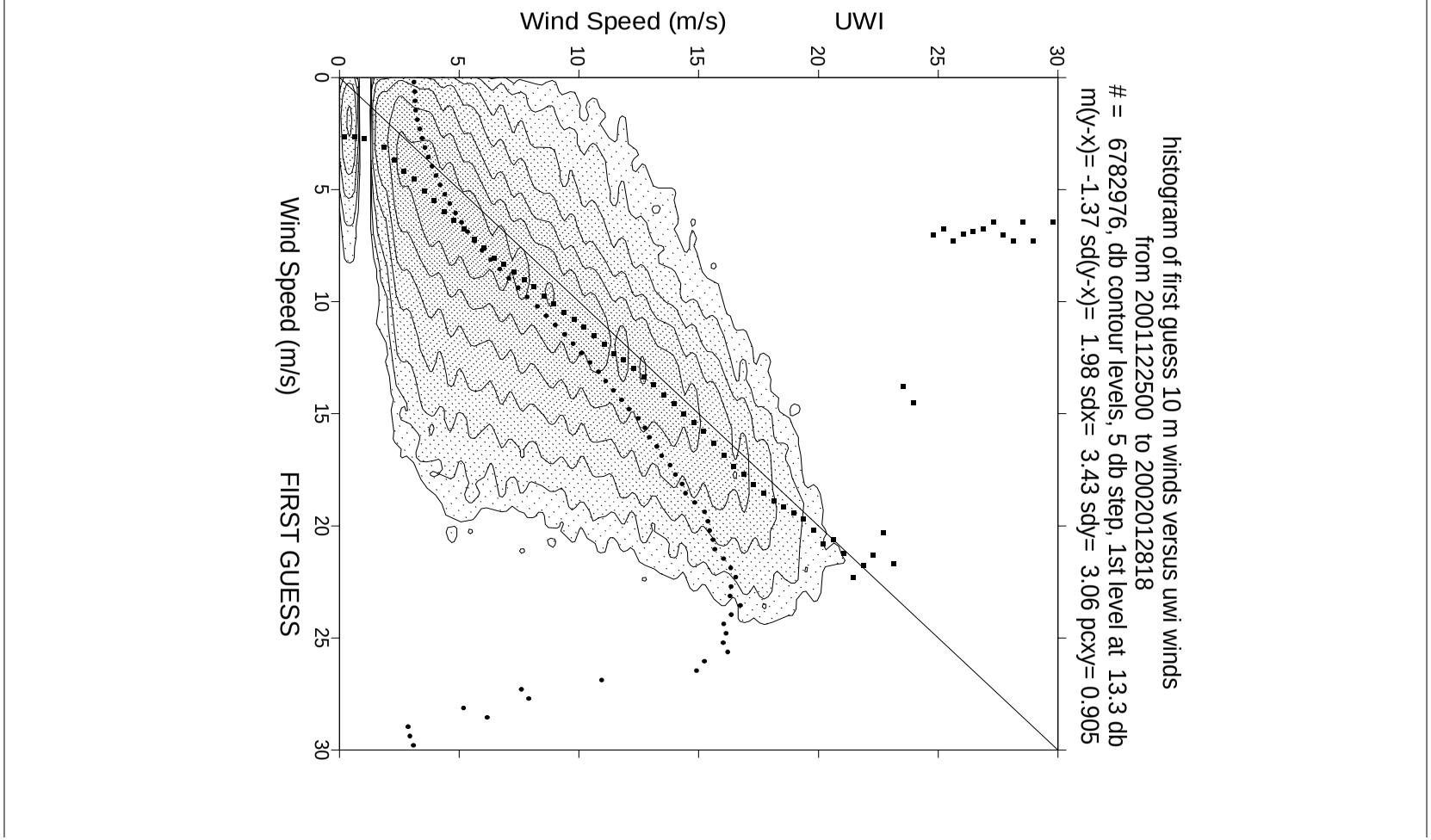

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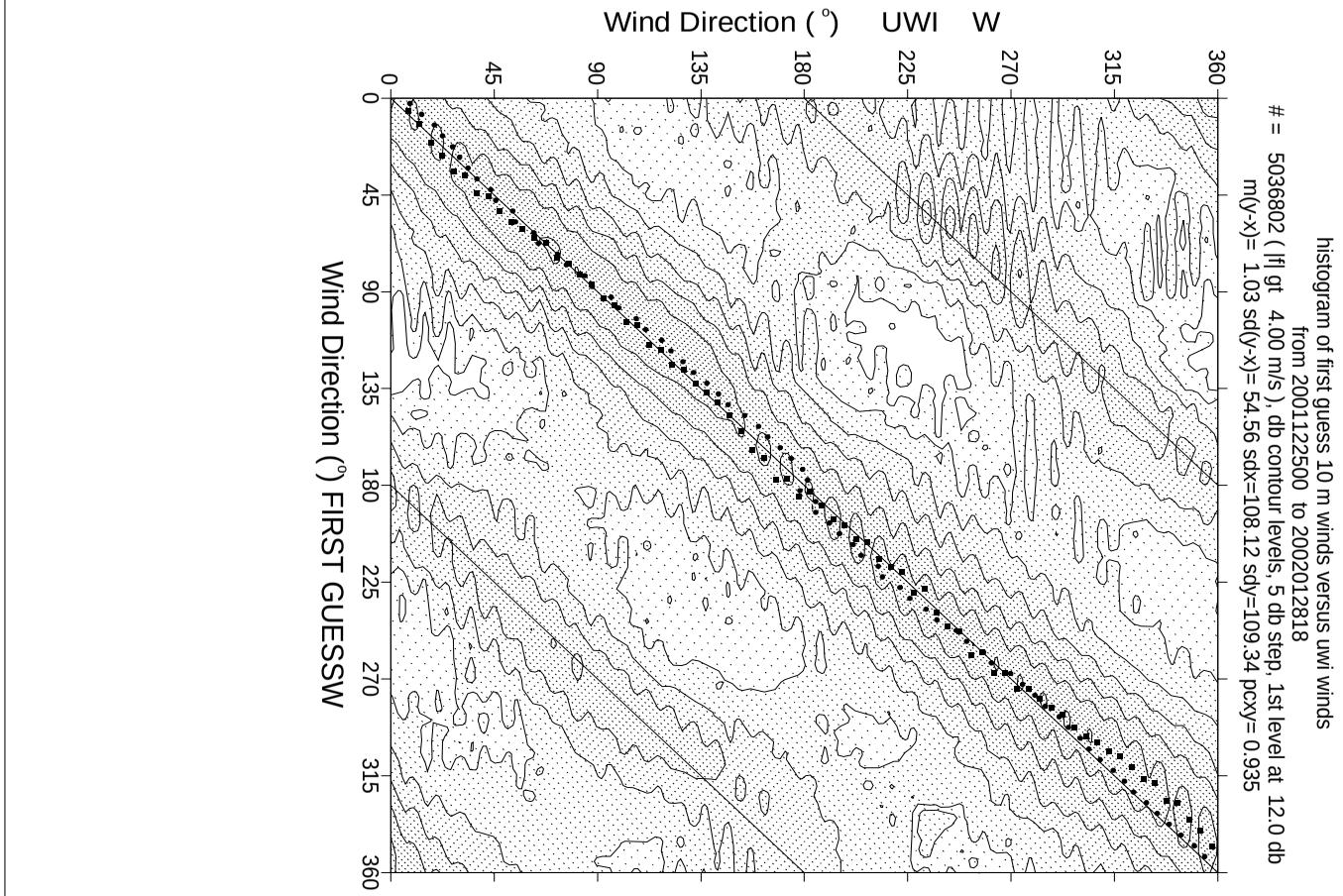

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