ECMWF - Report on the ERS-2 Scatterometer

Title: MONITORING STATISTICS OF ERS-2 SCATTEROMETER FOR ESA (Project Ref. 11699/95/NL/CN)

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• Date: 2 October 2000

1 - INTRODUCTION

During cycle 56 ERS-2 was stable for most of the period. No data was received at ECMWF 6 UTC 27 August 2000 and 0 UTC 7 September 2000. Lower than usual volumes were received around 0 UTC 8 September 2000 and 0 UTC 9 September 2000. There are no indications of any instrument problems during cycle 56.

The ECMWF data assimilation system was changed during cycle 56. On 12 September 2000 the assimilation system changed from 6 hour 4D-Var to 12 hour 4D-Var. It is not expected to impact the winds over the oceans. The cardio-plots (figs. 2-6) will continue to be processed and presented in 6 hour time resolution. It is expected that fit to first guess will be slightly worse for the 00 UTC and 12 UTC and slightly better for the 06 UTC 18 UTC, because of the 12 hour assimilation cycle. This will show up as more scatter in the standard deviation in figs. 3-6.

2 - ERS-2 STATISTICS FROM 22 AUGUST TO 25 SEPTEMBER 2000

Compared to the results from the previous cycle, the bias level have been reduced slightly for the descending track Fore and Aft beam sigma0 biases over the whole incidence angle range with respect to the ECMWF model first guess winds. For ascending tracks the bias levels are very similar for all three beams

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compared to measurements from the previous monitoring period. All curves still have a fairly flat distribution over the whole incidence angle range.

The distance to the cone history shows the two cycles without data described above. The mean normalised distance to the cone level for all node ranges is similar to the previous report cycle. There is a clear peak visible in the sigma0 distance to the cone measurements for 0 UTC 9 September 2000. This is not due to poor data quality but due to the very low data volume for this cycle. The UWI and 4D-Var processed wind speed and direction monitoring plots also show the peak at 0 UTC 9 September 2000. Except for that there are no problems identifiable in the monitoring plots.

The UWI winds have an average bias of -0.72 m/s, (-1.08 m/s for nodes 1-2 down to -0.53 m/s for nodes 11-19). This is an improvement from the previous report cycle. The standard deviations are slightly higher than the results from the previous cycle: the standard deviation is on the average 1.54 m/s, and similar for all nodes.

The standard deviation for ECMWF (4D-Var) processed data is similar to the results from the last monitoring cycle, the average value is 1.64 m/s. The bias has improved since the results from the cycle 55 report: the average value is now -0.45 m/s. The (scatterometer - model) direction standard deviations were ranging between 30 and 65 degrees for the UWI data (the average value 49.6 degrees) and between 15 and 30 degrees (average value 19.2 degrees) for their 4D-Var counterparts. The direction standard deviations are higher than the numbers in the previous report period. As usual, the directional bias is close to zero for both UWI and 4D-Var products. The scatter plot of model 10 m wind speeds versus UWI wind speeds shows the smaller bias compared to the plot from the previous cycle, as one would expect from the discussion above. The direction scatter plot is in close agreement with the results from the previous cycle. The reduced speed biases could be explained by seasonal variations.

3 - FIGURE CAPTION

Fig. 1:   Ratio of $< \sigma 0**0.625 >$ 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. (fig 1a: as fig1 but proper first guess values used.)

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 proportion of triplets rejected by the ESA flag, the SST or the land/sea mask, i.e. affected by technical problems (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 4D-Var quality control. (fig 3a: as fig3 but proper first guess values used)

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 4D-Var processed data.

Fig. 7:   Two-dimensional histogram of First Guess and UWI wind speeds, for the data kept by the 4D-Var 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.

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BIAS: (s0obs**0.625)/(s0fgat**0.625)
ERS-2 obs. from 21/08/2000 21:03 UTC to 25/09/2000 20:42 UTC
DESCENDING TRACKS
2850497 Entries,   42.9 % used (flat wind dir. dist.)
___ Fore _ _Mid ...Aft thin: Error Bar

BIAS: (s0obs**0.625)/(s0fgat**0.625)
ERS-2 obs. from 21/08/2000 21:03 UTC to 25/09/2000 20:42 UTC
ASCENDING TRACKS
2964097 Entries,   48.3 % used (flat wind dir. dist.)
___ Fore _ _Mid ...Aft thin: Error Bar

FIGURE 1

Monitoring of Sigma0 triplets versus CMOD4 for

from 20000822 to 20000925

(solid) mean normalised distance to the cone over 6 h

(dashed) nb of data rejected by ESA flag, SST or land-sea mask / total number

(dotted) total number of data in log. scale (1 for 60000)
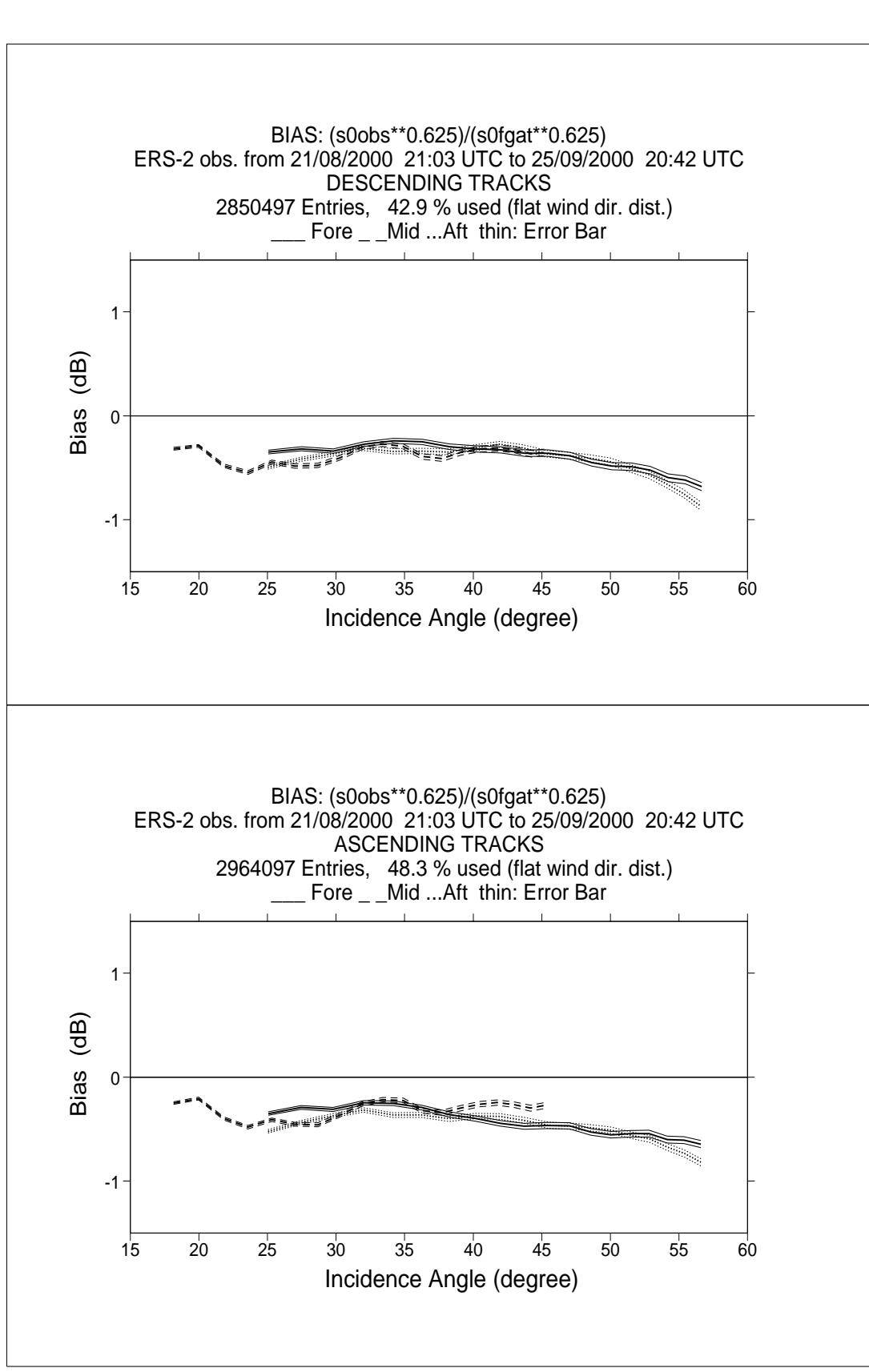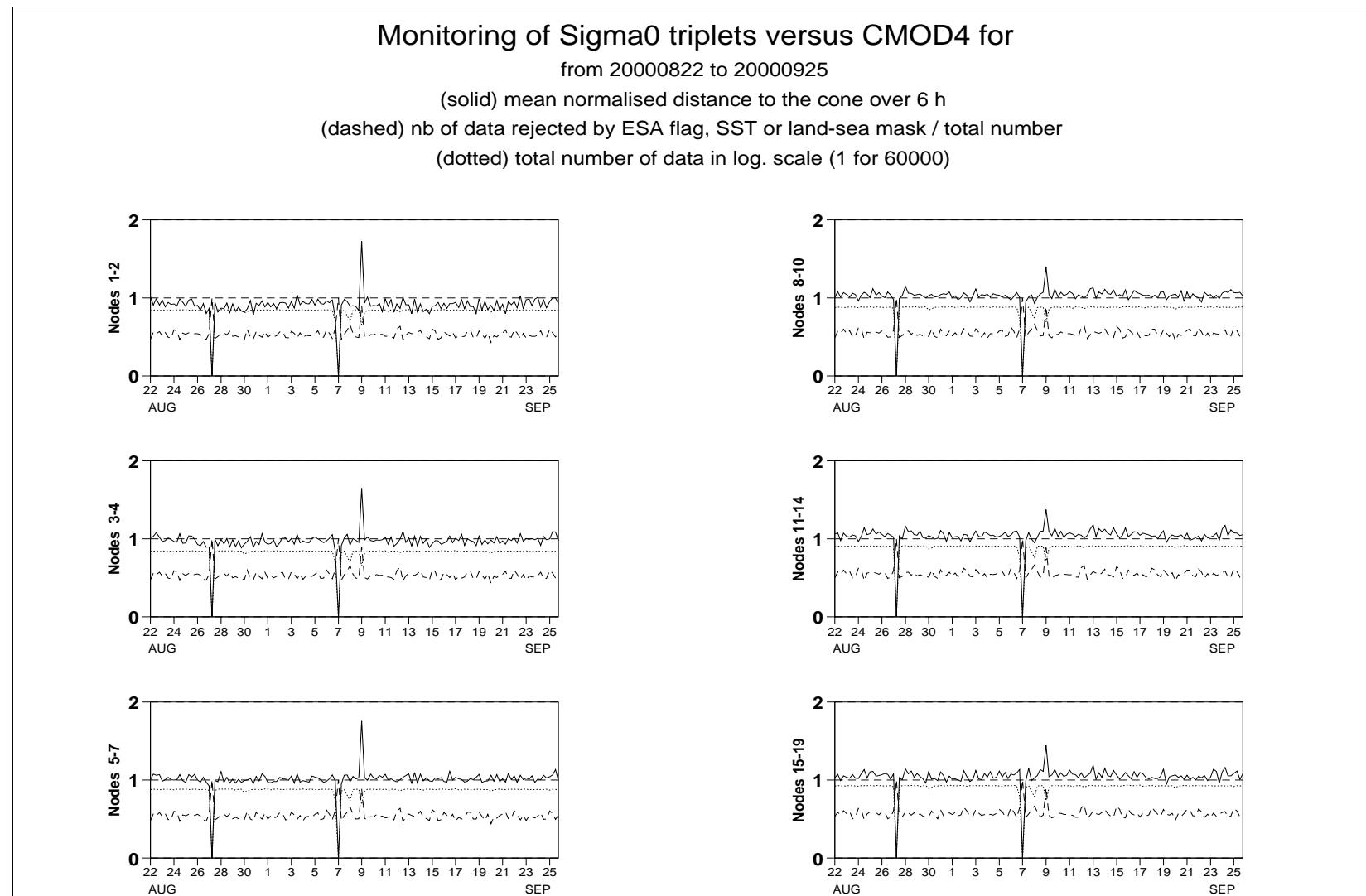
FIGURE 2

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Monitoring of UWI winds versus First Guess for

from 20000822 to 20000925

(solid) wind speed bias UWI - First Guess over 6h (m/s)

(dashed) wind speed standard deviation UWI - First Guess over 6h (m/s)
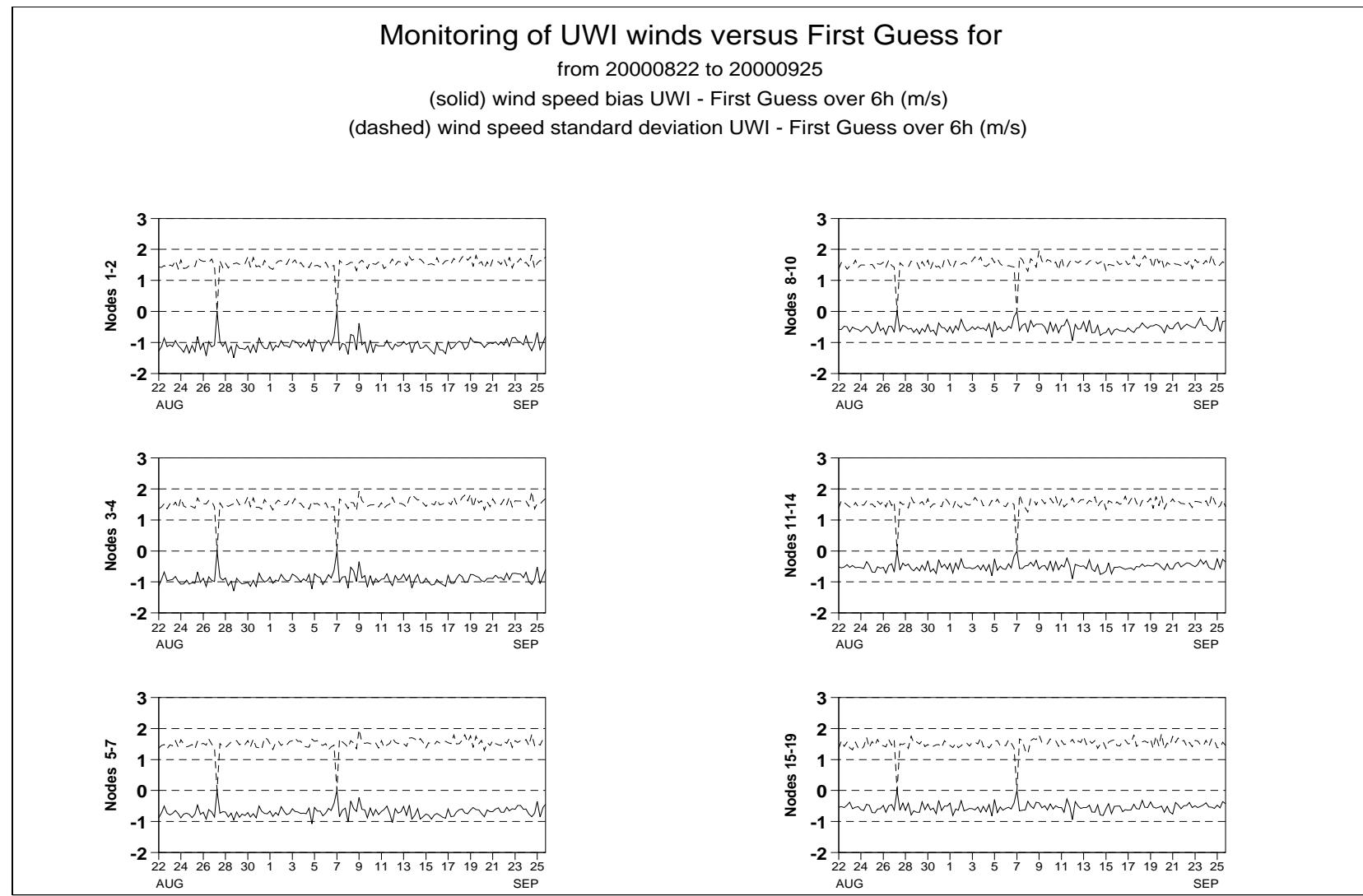
FIGURE 3

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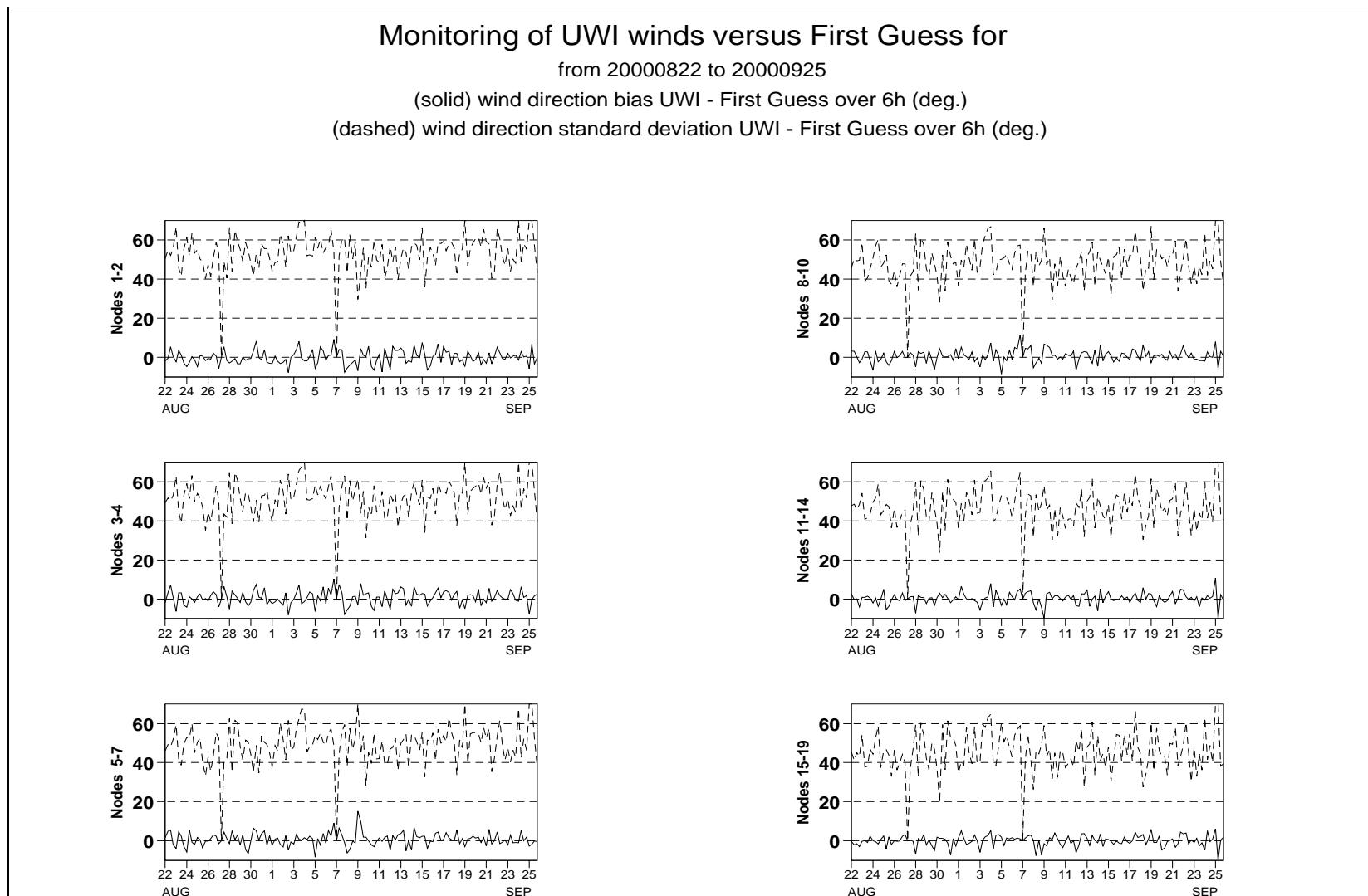
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Monitoring of UWI winds versus First Guess for
from 20000822 to 20000925
(solid) wind direction bias UWI - First Guess over 6h (deg.)
(dashed) wind direction standard deviation UWI - First Guess over 6h (deg.)

FIGURE 4

Monitoring of 4D-Var processed winds versus First Guess for

from 20000822 to 20000925

(solid) wind speed bias 4D-Var - First Guess over 6h (m/s)

(dashed) wind speed standard deviation 4D-Var - First Guess over 6h (m/s)
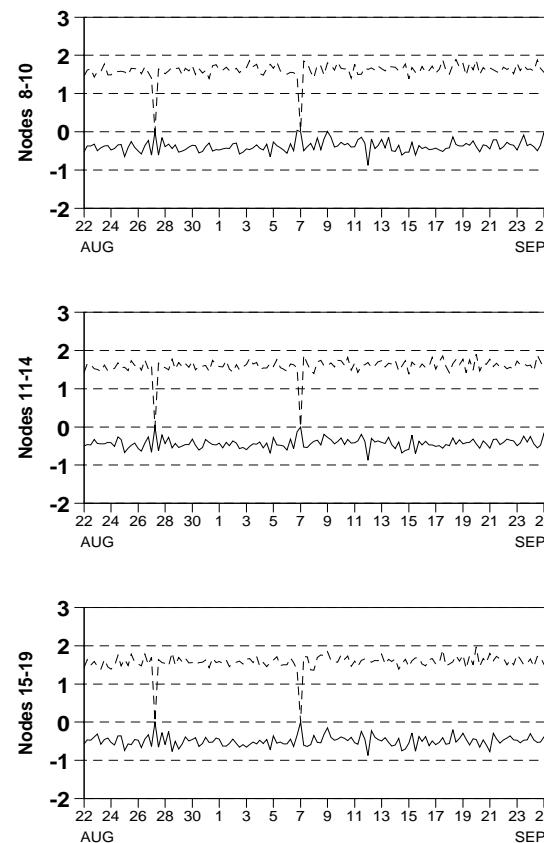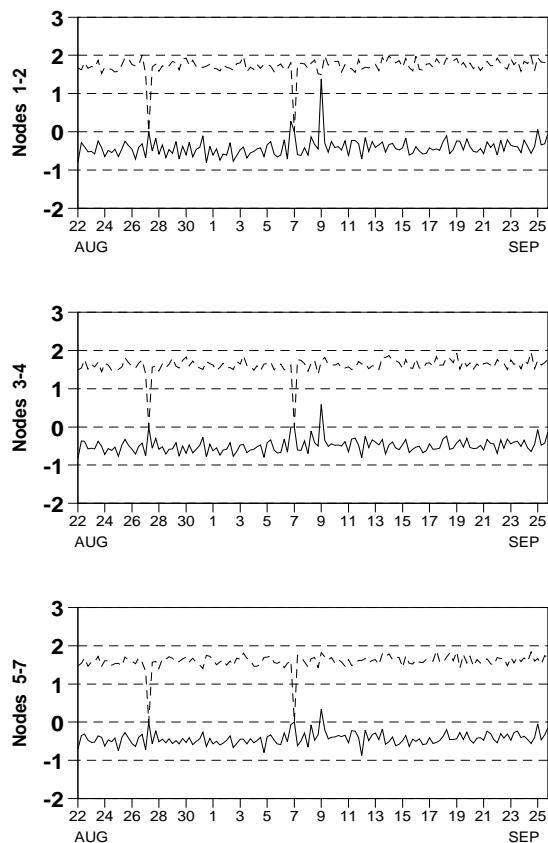
FIGURE 5

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Monitoring of 4D-Var processed winds versus First Guess for
from 20000822 to 20000925
(solid) wind direction bias 4D-Var - First Guess over 6h (deg.)
(dashed) wind direction standard deviation 4D-Var - First Guess over 6h (deg.)
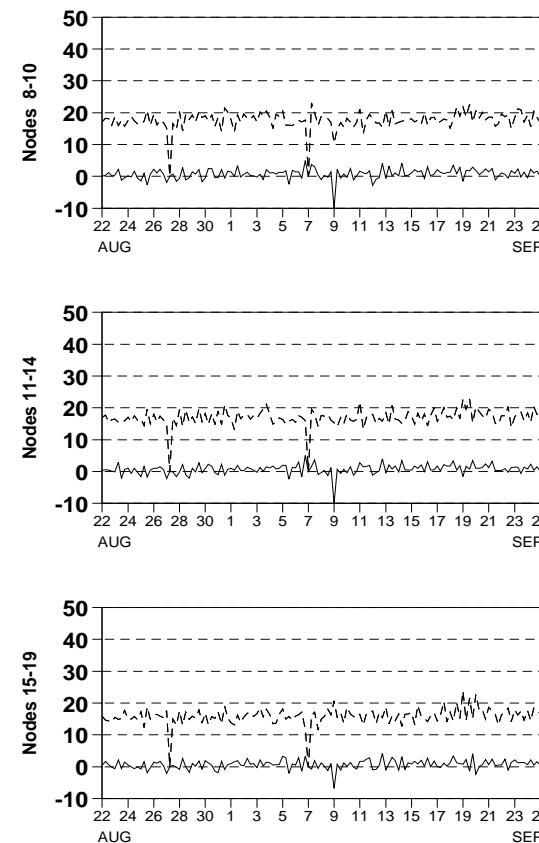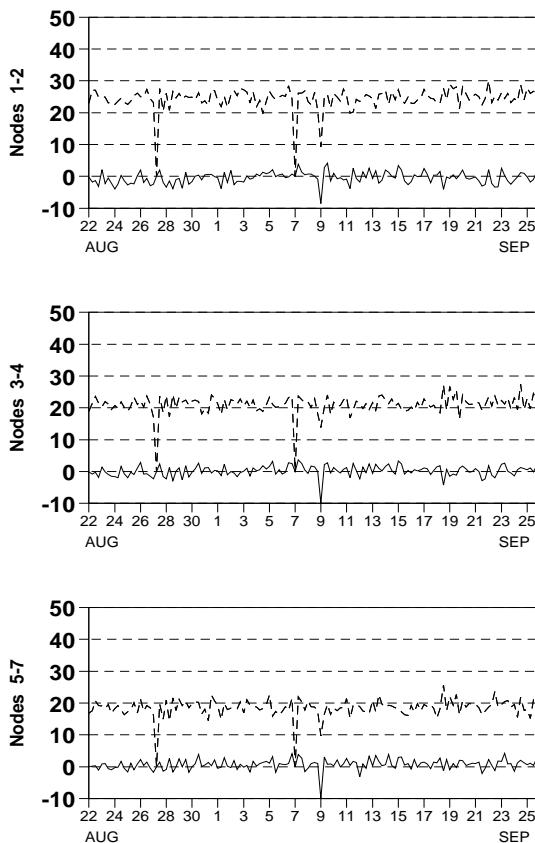

FIGURE 6

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HISTOGRAM OF FIRST GUESS 10 m WINDS VERSUS UWI WINDS
from 20000822 to 20000925
= 6002823, dB contour levels, 5 dB step, 1st level at 12.8 dB
M(y-x)= -0.67 SD(y-x)= 1.58 SDx= 3.46 SDy= 3.33 PCxy= 0.945

FIGURE 7

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HISTOGRAM OF FIRST GUESS 10 m WINDS VERSUS UWI WINDS
from 20000822 to 20000925
= 4685799 (|f| gt 4.00 m/s), dB contour levels, 5 dB step, 1st level at 11.7 dB
M(y-x)= 0.48 SD(y-x)= 47.35 SDx= 98.34 SDy=100.04 PCxy= 0.941
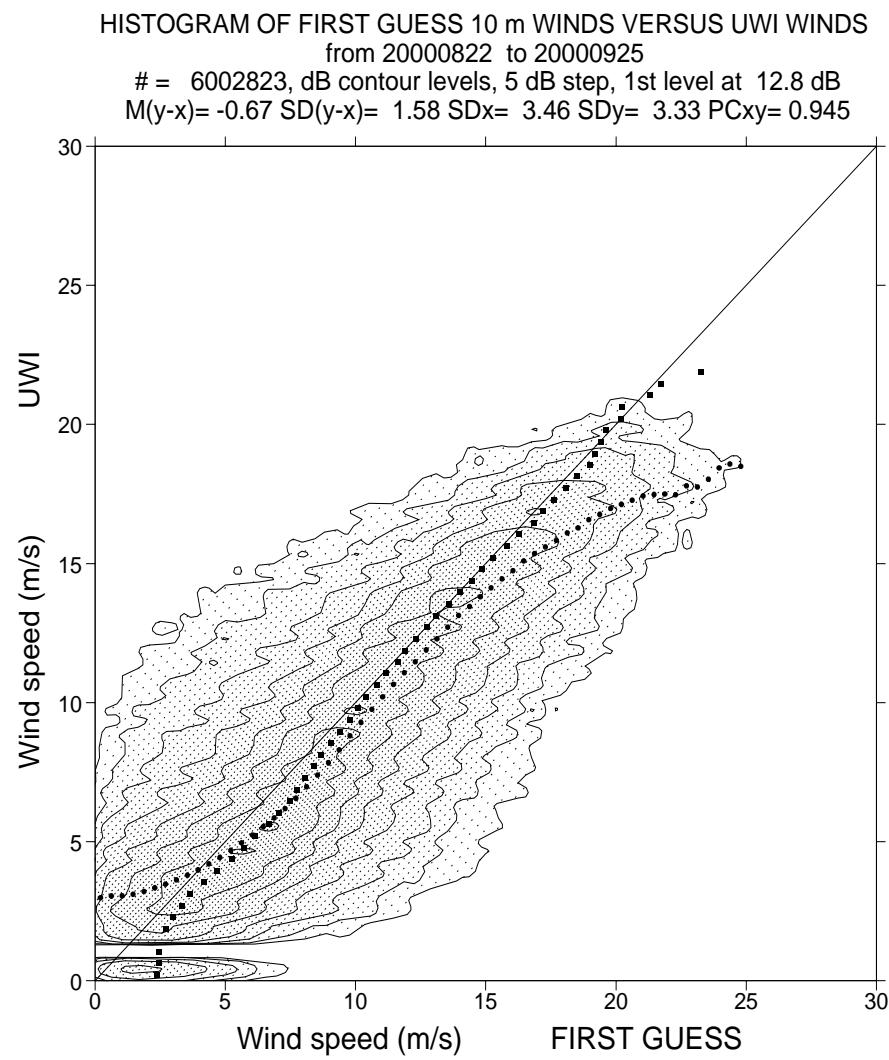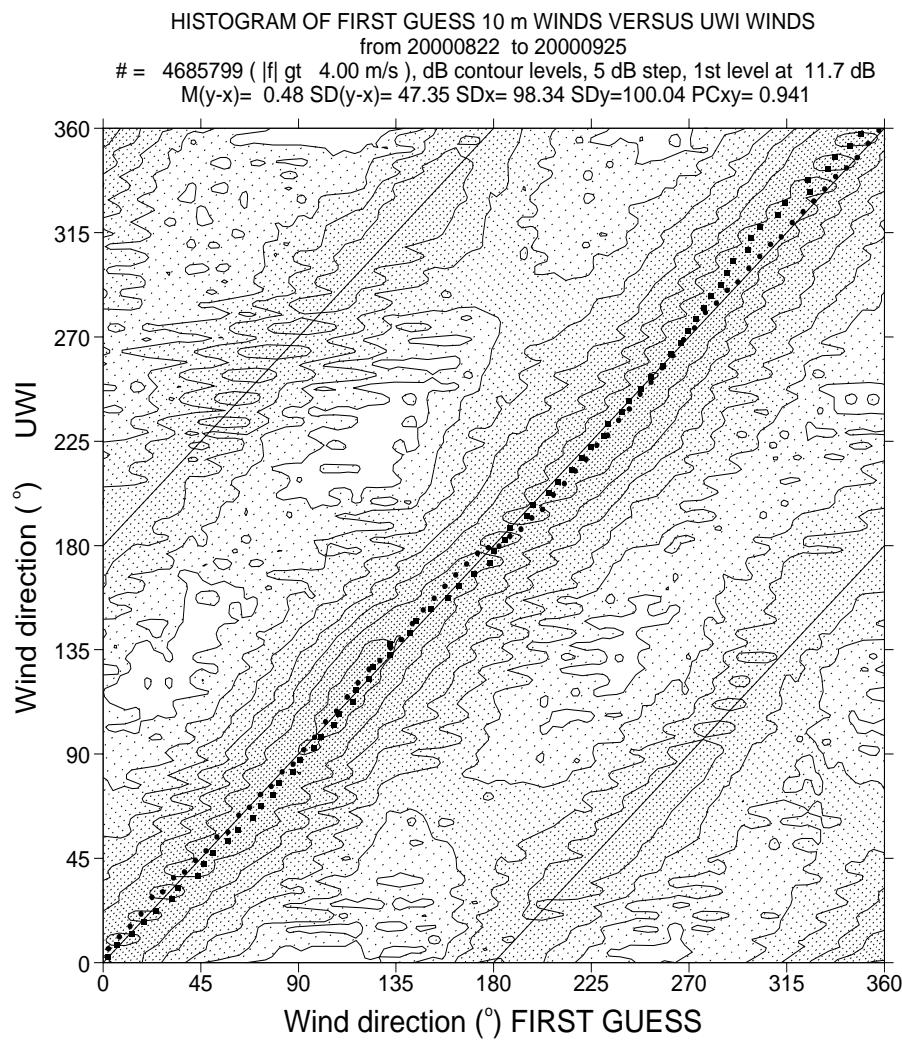
FIGURE 8

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