CGMS-XXVII USAWP-22
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Agenda Item: II/3 and III/2

1998/99 REPORT ON NOAA/NESDIS GOES SOUNDINGS AND WINDS

An summary procedures and last year results for generating GOES soundings and winds; research areas are also indicated.

1998/99 Report on NOAA/NESDIS GOES Soundings and Winds

I. Introduction

The NESDIS operational GOES-8/10 soundings and winds production has continued to evolve. Soundings are being produced every hour at 50 km resolution in clear skies; three layers of moisture definition are being used operationally by the regional forecast models (Menzel et al., 1998). Winds are being produced every three hours from IR window water vapor, and visible (when available) images with high spatial density in the past year; the quality of the wind product is being reported monthly in accordance with CGMS reporting procedures (Schmetz et al., 1999). Improvements in both product areas are planned.

II. NESDIS Operational Winds and Research Areas

The NESDIS operational winds inferred from infrared window (IR) and water vapor (WV) images continue to perform well. The quality of the wind product is being tracked according to CGMS guidelines. Figure 1 presents the summary from the last twelve months.

The wind statistics have been affected by a couple of changes in the processing over the past 6 months. A speed bias correction was applied incorrectly of 8.5%; before November 98 it was applied to IR winds with speeds less than 10 m/s and pressures greater than 300 Mb (resulting in a positive bias in the RAOB comparison statistics for the low level winds). After November 98 a programming mistake turned off the bias correction for all IR winds (all levels, all speeds) reducing the wind speeds/bias for the IR winds. As of April 99, an 8.5% bias correction is correctly applied to (a) all cloud drift winds with speeds greater than or equal to 10 m/s and pressures less than or equal to 300mb and (b) cloud (not clear air) WV winds with speeds greater than or equal to 10 m/s and pressures less than or equal to 300mb.

The major operational changes in the past year include production of motion vectors from sequences of visible images from the imager as well as mid-tropospheric water vapor channels from the sounder. All operational winds are distributed in the new BUFR format as of March 99.

Research areas include further exploration of winds from five minute interval images (as reported last year), incorporation of the EUMETSAT quality indicator (QI) with the NESDIS quality flag (RFF), and examination of nighttime 3.9 micron winds. Some real time five minute wind data sets have been produced to examine mesoscale atmospheric motions. A comparison of the EUMETSAT and NESDIS wind quality indicators was performed; the former accepts more good vectors with high speed and acceleration while the latter relies less on “buddy checking” and hence accepts more single good vectors (Holmlund, 1998). A combination of the two quality indication systems has been tested and is in the process of being implemented. The 3.9 micron band is more sensitive to lower-tropospheric radiation than the 10.7 micron counterpart. Initial results show a marked increase in vector coverage at night over low-level cloudy regions and show promise in helping to fill in data void regions (see example in Figure 2).

III. NESDIS Operational Soundings and Research Areas

The GOES-8/10 sounders continue to produce operational soundings every hour over North America and nearby oceans. Atmospheric temperature and moisture profiles are generated using a simultaneous physical retrieval algorithm. During the past year GOES-10 moisture retrievals were added to GOES-8 moisture retrievals in the operational Eta model, the cloud mask was improved to help distinguish clear sky snow situations, and sounder derived product images are becoming more useful to the weather service forecasters.

A comparison of layer means of moisture between GOES-10, the current NCEP forecast first guess (from the Eta model), and radiosonde determinations is found in Table 1. The total column water vapor RMS difference with respect to radiosondes for this twelve month period in 1998-99 has been reduced from 2.9

mm for the forecast first guess to 2.5 mm for the GOES retrievals, roughly an improvement of 15%. It is found that GOES improves the layer mean values by 0.1 to 0.3 mm in each layer.

Table 1. Comparison of moisture (mm) and atmospheric stability (deg C) retrievals April 1998 to March 1999 of the Eta model first guess and the GOES-10 retrievals with respect to radiosonde determinations. Collocation is within 0.25 degrees. Bias and root mean square (RMS) scatter about bias are indicated. Sample size is 1290. Sigma levels are pressure divided by surface pressure.

	Eta Guess			Retrieval	
	Bias	RMS		Bias	RMS
Total Water Vapor	-0.4	2.9		-0.5	2.5
WV1 (Surface to .9 sigma)-0.9	1.2		-0.9	1.1	
WV2 (0.9 to 0.7 sigma)	0.2	1.5		0.3	1.4
WV3 (0.7 to 0.3 sigma)	0.3	1.2		0.2	0.9

Hourly moisture information regarding three layers as well as the total column are being assimilated in the Eta model for the regional forecasts. They were found to improve the equitable threat scores of the 24 hour forecast of precipitation over the United States by about 2 % in a parallel test from October 1998 through July 1999. Work continues to improve the impact of these data.

Soundings and Derived Product Images (DPI) continue to be made available to NWS Forecast Offices in real time, assisting them with their short term forecast responsibilities. Forecasters have found that the sounder profiles and DPIs are making significant positive impact to their forecasts of location and timing of severe weather (such as thunderstorms) activity. Figure 3 shows a recent example of the lifted index DPI delineating very unstable air over Salt Lake City, Utah six hours before a tornado visited.

During the spring of 1999, an improvement to the cloud detection subroutine was tested. Several shortwave channel checks are incorporated to distinguish snow from cloud. The algorithm is based on the decreasing reflectivity of the shortwave channels with increasing wavelength. The positive results suggest operational implementation in the coming year.

Real-time examples of both retrieved moisture and stability information as well as cloud top pressures can be seen on the CIMSS web page at http://cimss.ssec.wisc.edu. Another site with real-time GOES sounder products supported by the NOAA/NESDIS Forecast Products Development Team is http://orbit-net.nesdis.noaa.gov/goes/.

IV. References

Holmlund, P. K, 1998: The utilization of statistical properties of satellite-derived atmospheric motion vectors to derive quality indicators. Weather and Forecasting, **13**, 1093-1104.

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Menzel, W. P., F. C. Holt, T. J. Schmit, R. M. Aune, A. J. Schreiner, G. S. Wade, G. P. Ellrod, and D. G. Gray, 1998: Application of the GOES-8/9 soundings to weather forecasting and nowcasting. Bull. Amer. Meteor. Soc., **79**, 2059-2077.

Schmetz, J., D. Hinsman, and W. P. Menzel, 1999: Summary of the Fourth International Winds Workshop. Bull. Amer. Meteor. Soc., **80**, 893-899.

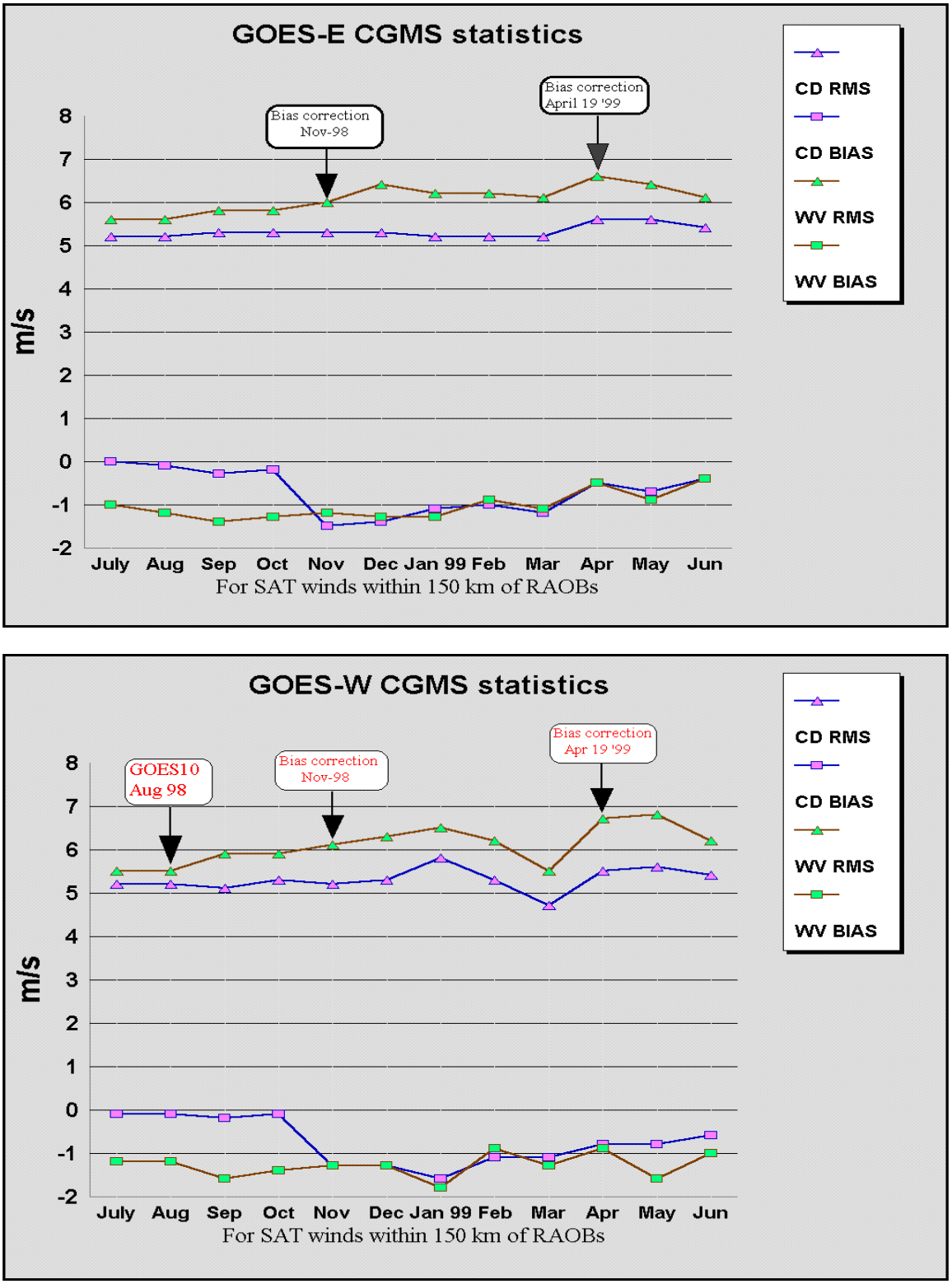

Fig. 1. CGMS statistics (bias and root mean square) for GOES-8/10 cloud drift (CD) and water vapor motion (WV) winds for July 1998 through June 1999.

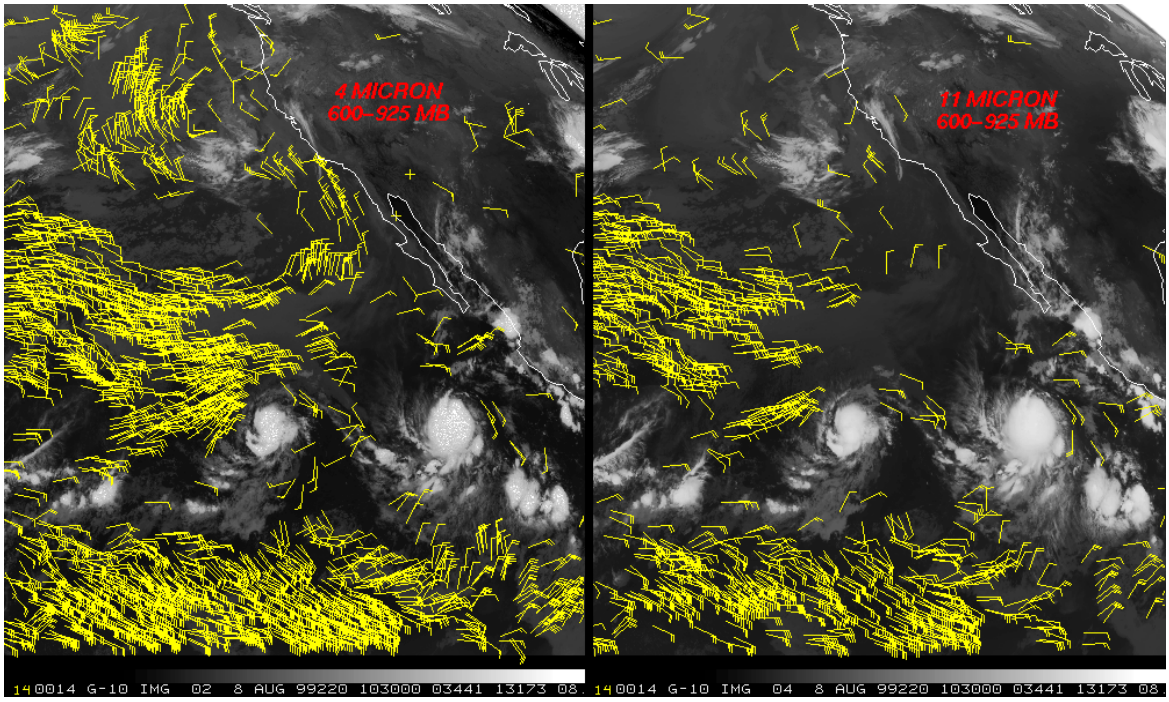

Fig.2. Comparison of winds produced by tracking features in half hourly 4 micron (left panel) versus 11 micron (right panel) images.

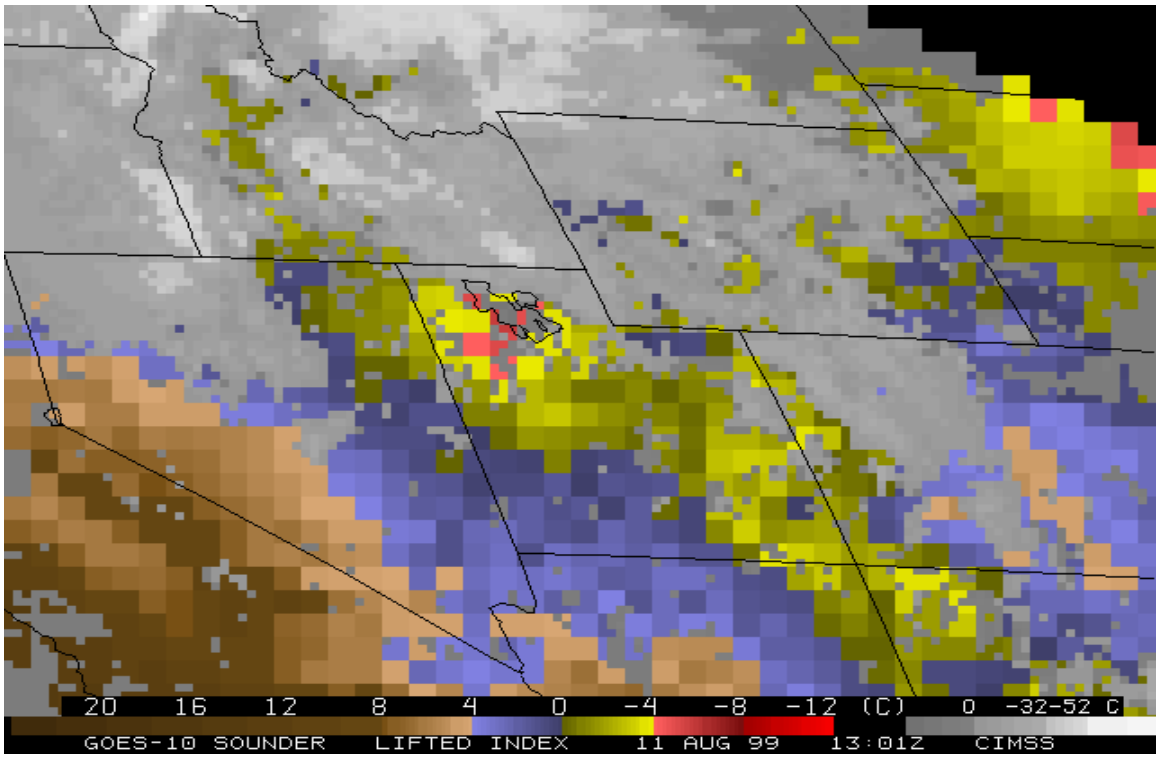

Fig.3. GOES-10 Sounder lifted index for 13 UTC on 11 August 1999. A tornado went through Salt Lake City at 19 UTC.