CGMS-XXVII
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USA WP-24 (1)

DERIVATION OF WINDS USING SHORTER SCAN INTERVALS (PART 1)

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Visible, IR and Water Vapor Winds (Velden, UW-CIMSS)

Winds were derived over the central United States from the GOES -10 full resolution water vapor, infrared window, and visible images from April 8, 1998 near 2300 UTC using the CIMSS automated procedures. Our evaluation was aimed at examining the effect of more frequent imaging made possible during the GOES-10 science test (nearly continuous 5 minute scans). Three images were used in the wind derivations. For our evaluations, the image spacing was varied at 5, 10, 15, and 30 minute intervals, with the shorter intervals nested inside the longer loops for the best time matching. Based on vector field quantity, quality (coherence), and comparison with radiosonde observations, results indicate that the optimal time intervals between images for visible channel low-level winds, infrared channel cloud motion winds, and water vapor channel moisture drift winds in clear skies are 5 min, 10 min and 30 min, respectively. Operational and experimental processing currently uses 30 min sampling for all bands.

Table 5. Number of wind vectors (raw and edited) at various time intervals derived from ten GOES-10 visible, IR and WV images around 2300 UTC, 8 April 1998. **Table 5** shows the vector quantities (raw and after objective editing) derived using the different imaging frequency intervals. There is a remarkable increase in the number of vectors in the VIS and IR channels (by

		Number of Winds	
Band	Interval	RAW	EDIT
VIS	30 minutes	1451	1109
	15 minutes	1674	1333
	10 minutes	2261	1907
	5 minutes	2819	2555
IR	30 minutes	1063	787
	15 minutes	1568	1196
	10 minutes	1807	1351
	5 minutes	1850	1399
WV	30 minutes	1324	807
	15 minutes	1473	851
	10 minutes	1506	867
	5 minutes	1521	838

a factor of 2) when more frequent imagery is used. The percentage of vectors objectively edited is also dramatically reduced, which indicates that the increased quantities are coherent. Little impact is seen with the WV channel. Wind vectors plots for the visible **(Figure 33)**, IR **(Figure 34)**, and water vapor **(Figure 35)** spectral frequencies show the difference between image spacing intervals. Note the increased coherent coverage in the VIS and IR.

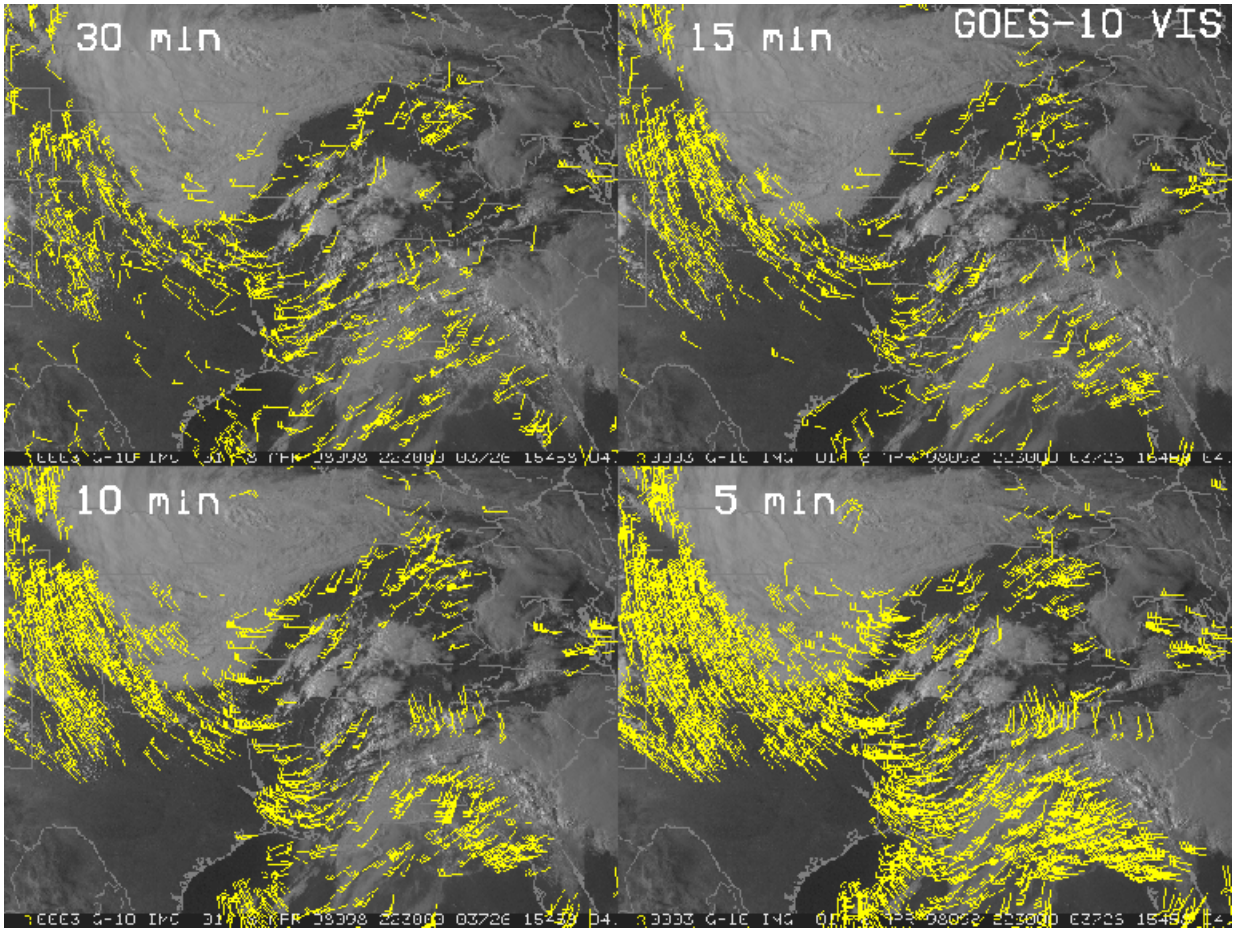

Figure 33. GOES-10 visible wind vectors derived at 30-minute (top left), 15-minute (top right), 10- minute (lower left) and 5-minute (lower right) intervals on 8 April 1998.

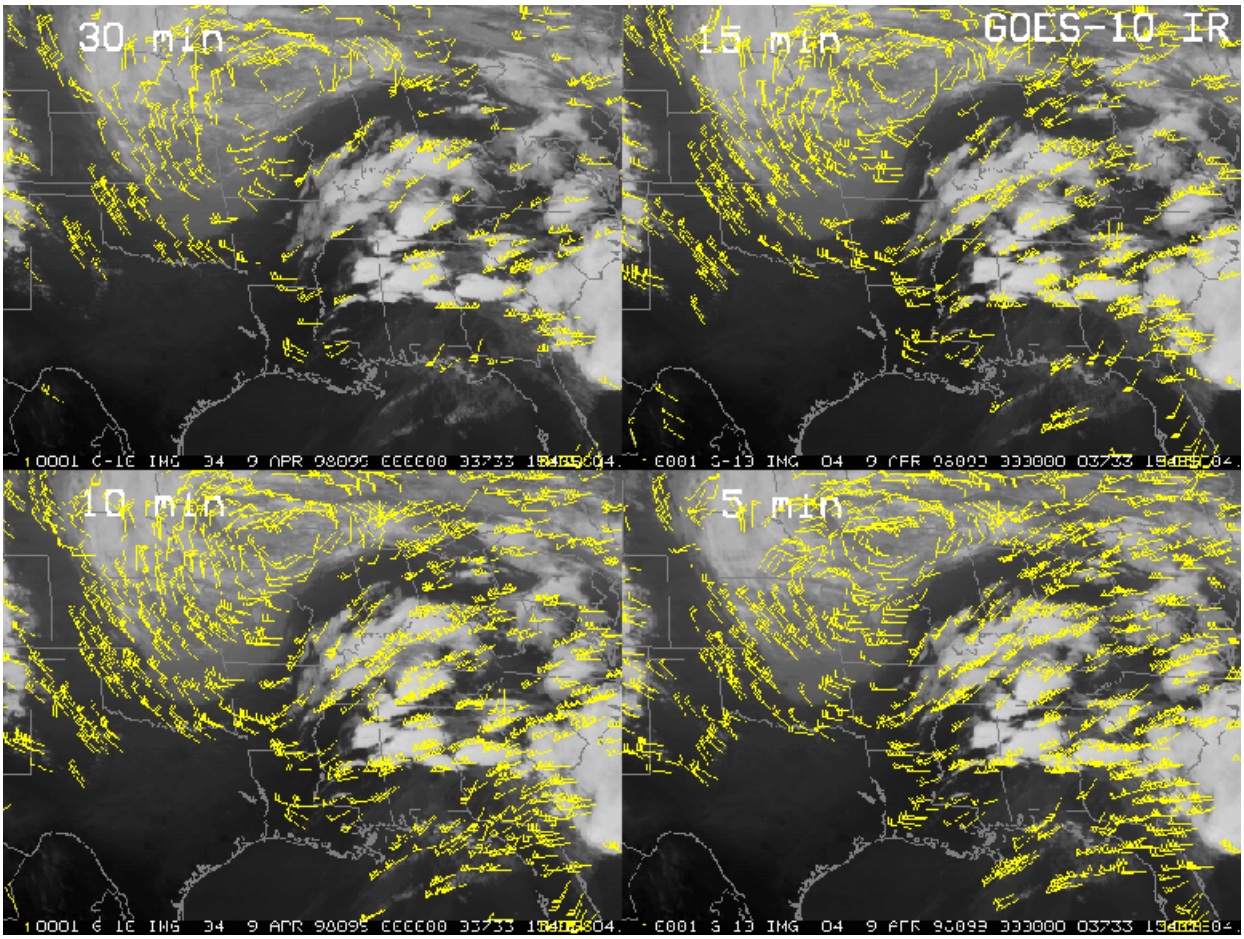

Figure 34. Same as Figure 33, except for GOES-10 IR wind vectors.

Statistical analyses of visible **(Table 6)**, IR **(Table 7)**, and water vapor **(Table 8)** data sets (after objective editing) versus rawinsonde verification show that the optimal image processing intervals (wind set RMS and BIAS compared to co-located background guess) are 5 min for VIS, 10 min for IR, and 30 min for WV. The high-cloud WV vectors **(Figure 35)** may benefit from

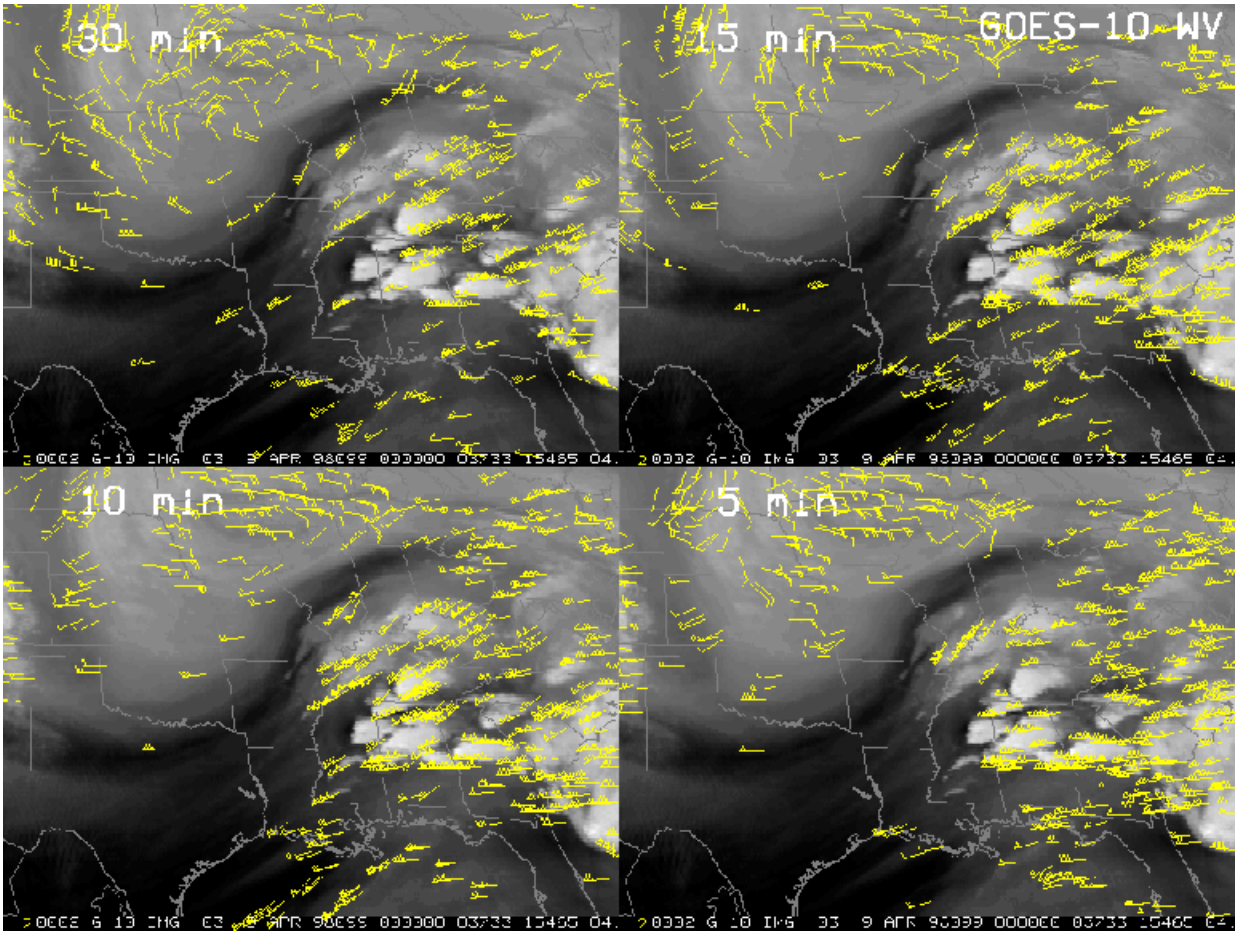

Figure 35. Same as Figure 33, except for GOES-10 Water Vapor wind vectors.

the more frequent imagery (as in the IR); however, the clear sky WV tracers are best depicted in the 30 min intervals currently employed.

	GOES-10 VIS	
	SAT	GUESS
30 minutes		
BIAS	-1.09	-2.11
RMS	5.69	4.74
Sample	167	
15 minutes		
BIAS	-1.54	-2.25
RMS	4.55	4.68
Sample	199	
10 minutes		
BIAS	-1.19	-2.13
RMS	4.73	4.86
Sample	298	
5 minutes		
BIAS	-1.16	-2.08
RMS	5.11	5.32
Sample	429	

Table 6. Statistical analysis of GOES-10 visible winds and first guess winds, verified with radiosonde wind data.

	GOES-10 IR	
	SAT	GUESS
30 minutes		
BIAS	-0.81	-0.89
RMS	6.38	5.98
Sample	144	
15 minutes		
BIAS	-0.97	-1.37
RMS	6.76	6.05
Sample	251	
10 minutes		
BIAS	-0.55	-0.97
RMS	7.11	6.61
Sample	290	
5 minutes		
BIAS	-1.74	-1.27
RMS	8.01	7.21
Sample	396	

Table 7. Statistical analysis of GOES-10 IR winds and first guess winds, verified with radiosonde wind data.

Synoptic analysis of the wind fields over the Alabama region shows a much improved depiction of the upper-level jet streak and divergence in the optimized (10-min loop) IR winds. The short-wave circulation to the northwest of the severe weather outbreak is best described by the clear-sky WV winds at 30 min intervals. Finally, the 5-min loop VIS winds clearly show a strong low-level inflow into the developing cells which was not depicted well at the 30 min image frequency.

Band		GOES-8	GOES-10
IR	BIAS	-2.44	-0.37
	RMS	8.61	7.68
	Sample	43	66
WV	BIAS	-0.97	-3.92
	RMS	8.61	10.46
	Sample	78	61

Table 9. Statistical comparison of GOES-10 IR and WV winds versus GOES-8 (visible winds not available) around 2300 UTC on 8 April 1998.

	GOES-10 WV	
	SAT	GUESS
30 minutes		
BIAS	-2.71	-1.89
RMS	8.22	6.81
Sample	129	
15 minutes		
BIAS	-3.68	-1.24
RMS	10.31	7.82
Sample	144	
10 minutes		
BIAS	-3.39	-0.64
RMS	9.22	7.51
Sample	149	
5 minutes		
BIAS	-4.31	-0.04
RMS	10.82	8.81
Sample	168	

Table 8. Statistical analysis of GOES-10 WV winds and first guess winds, verified with radiosonde wind data.

A statistical comparison (vs. radiosonde) of GOES-8/10 **(Table 9)** and GOES-9/10 **(Table 10)** wind sets (all using a 30 min image interval) was performed over the same respective domains (no GOES-8 VIS winds were available for comparison). The processing algorithm and methodology were identical. It is demonstrated in this case that the GOES-10 winds are comparable to those from GOES-8/9.

Table 10. Statistical comparison of GOES-10 IR and WV winds versus GOES-9 around 2300 UTC on 8 April 1998.

Band		GOES-9	GOES-10
VIS	BIAS	-1.01	-0.89
	RMS	4.03	4.31
	Sample	31	110
IR	BIAS	2.15	-1.67
	RMS	6.04	4.71
	Sample	39	76
WV	BIAS	-2.71	-1.82
	RMS	7.46	5.34
	Sample	111	69

This initial case study demonstrates the ability to extract wind information from GOES-10 and demonstrates the potential value of rapid scan imagery for the derivation of winds from geostationary satellites, particularly for meso scale applications. A more comprehensive study is underway which will compare the imaging frequencies (as done above) over the entire 4 week test period. This should provide a more firm statistical base for the evaluation. In addition, winds from the GOES-10 sounder WV bands (10 and 11) will be assessed in a similar manner using 15 vs. 30 vs. 60 (now used) min image frequency.