Satellite Analysis of the 05-06 June 1998 Severe Weather Event

David S. Wally

National Weather Service Office

Lake Charles, Louisiana*

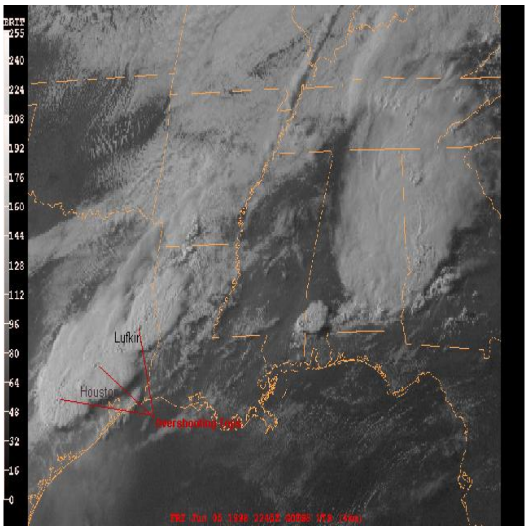

Figure 1. GOES-8 0.65 micron visible

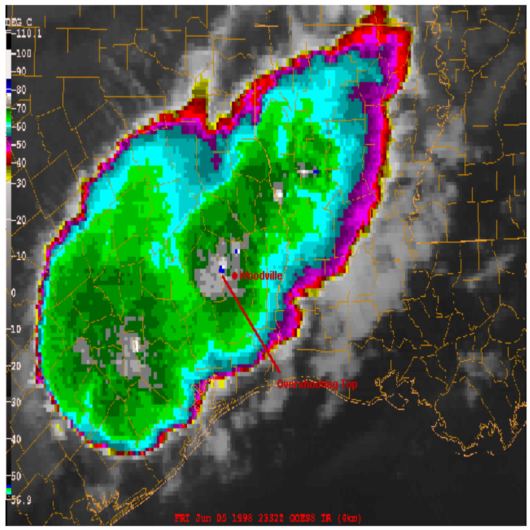

Figure 2. GOES-8 10.7 micron IR

A line of severe thunderstorms developed across Southeast Texas on the afternoon of 05 June 1998. The trigger was an unseasonably strong cold front for late spring that moved quickly eastward and into the Lake Charles County Warning Area (CWA) by early evening.

The GOES-8 visible image (Figure 1) from 22:45 UTC (Coordinated Universal Time) shows this squall line oriented from near Lufkin to southwest of Houston. Notice the overshooting tops throughout the complex; a good indicator that these storms were severe. At the time of this image, these storms were in the County Warning Areas of both the National Weather Service offices in Houston and Shreveport. Local storm reports from these offices indicated severe hail (greater than or equal to 3/4 inch in diameter) and wind damage shortly before and after this image.

The GOES-8 10.7 micron longwave IR image (Figure 2) at 23:32 UTC indicated an overshooting cloud top temperature of -80 degrees Celsius (denoted by the isolated blue pixel) over West-Central Tyler county in Southeast Texas. Using the 00:00 UTC, 06 June 1998 Lake Charles atmospheric sounding, this correlated to a storm top of 65 thousand feet. Twenty one minutes prior to this image at 6:11 p.m. LDT (Local Daylight Time) or 23:11 UTC, the National

Weather Service Office in Lake Charles detected a severe thunderstorm on Doppler Radar and issued a severe thunderstorm warning for Tyler county. A local storm report from the sheriff's office indicated hail 3/4 inch in diameter fell 1 mile Northwest of Woodville in central Tyler county at 6:30 p.m. LDT or 23:30 UTC. The time of this report correlated well with the time of the image.

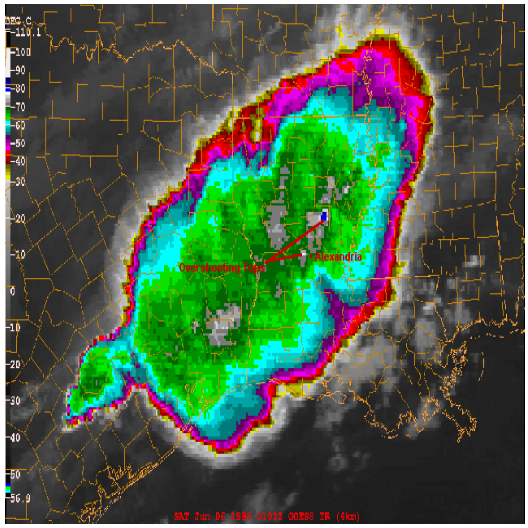

Figure 3. GOES-8 10.7 micron IR

Later that evening, the GOES-8 10.7 micron longwave IR (Figure 3) at 01:02 UTC indicated another overshooting top over North-Central Rapides parish. The cloud top temperature was also near -80 degrees Celsius. Thirty three minutes prior to this image at 7:29 p.m. LDT or 00:29 UTC, the National Weather Service Office in Lake Charles detected another severe storm on Doppler Radar and issued a severe thunderstorm warning for Rapides parish. The following were storm reports received from the parish 911 emergency center leading up to the time of this image:

1. 7:32 p.m. LDT or 00:32 UTC - wind damage with a roof blown off in the Boyce Cotile area (15 miles northwest of Alexandria).
2. 7:45 p.m. LDT or 00:45 UTC - wind damage with a roof blown off in Alexandria.
3. 7:47 p.m. LDT or 00:47 UTC - wind damage with a roof blow off in Pineville (5 miles north of Alexandria).

In addition, numerous newspaper articles with unconfirmed times indicated widespread damage across Rapides parish. The hardest hit area was the Gardner community, including the Kincaid Lake and Cotile areas. Kincaid Lake Recreation Area closed for the summer with an estimated $250,000 in damage. The storm knocked power out to 10,000 residents with numerous trees toppled on power lines and roadways.

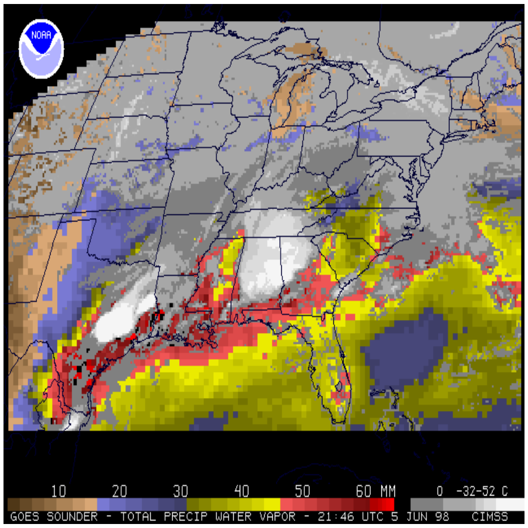

Figure 4. GOES-8 sounder Total Precipitable Water

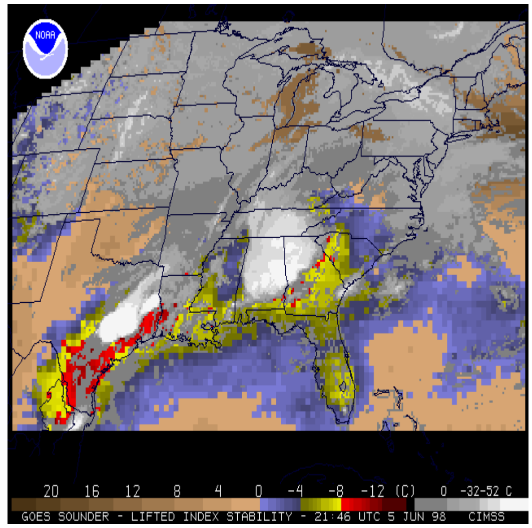

Figure 5. GOES-8 sounder Lifted Index

The GOES-8 sounder derived Lifted Index (LI) and Total Precipitable Water (TPW) products are shown in Figures 4 and 5. These products indicated that the atmosphere over East Texas and Louisiana was very unstable and ripe for thunderstorm development. LI values were around -8 to -12 degrees Celsius with TPW values between 50 and 55 millimeters (correlates to 2 inches). The strong cold front that collided with this moist and unstable air mass provided the lift needed to initiate a multicell convective system which went on to produce large hail and damaging winds.

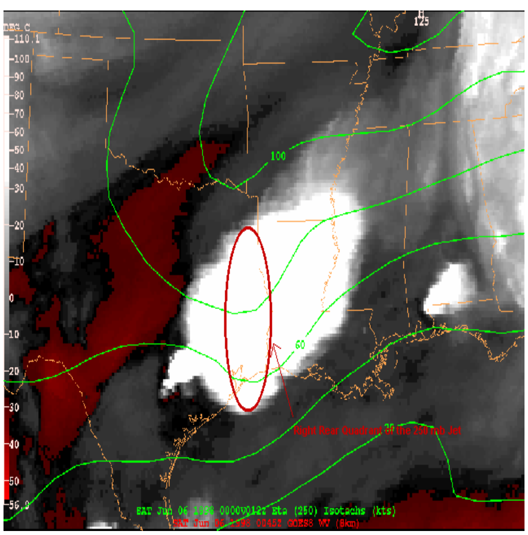

Figure 6. 250 mb ETA model isotachs superimposed on GOES-8 6.7 micron water vapor

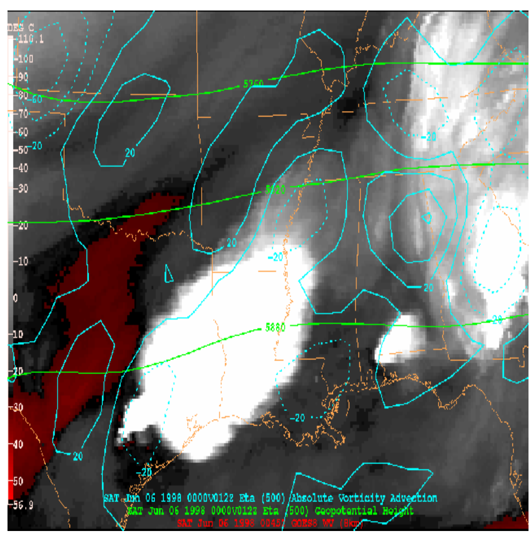

Figure 7. 500 mb heights and absolute vorticity advection superimposed on GOES-8 6.7 micron water vapor

In addition to the low-level instability, favorable upper-level dynamics contributed to these thunderstorms reaching severe levels and for sustaining the complex for several hours. The ETA model 12-hour forecast, valid at 00:00 UTC, 500 mb absolute vorticity advection and 250 mb winds in isotachs superimposed on the GOES-8 6.7 micron water vapor imagery (Figures 6 and 7) indicated that there was moderate upper level dynamics. Notice the darkening on the water vapor imagery from Central Texas into Southeast Oklahoma. This was a good indicator of the presence of an upper level jet and its subsidence region of the left rear quadrant. The ETA model indicated the forecast area was under the favorable right rear quadrant of the 250 mb jet maximum. Notice in Figure 6 how the right rear quadrant coincides with the thunderstorm cloud tops; indicating this is a region of upward vertical motion. In addition, positive vorticity advection at 500 mb (Figure 7) indicated the presence of mid level lift. The water vapor imagery helped to validate the accuracy of the ETA model, which in this situation was very good.

Conclusion: Through satellite analysis of this event, one could see a correlation between the overshooting tops and severe thunderstorms. While real-time satellite imagery is not yet available to the operational meteorologist, satellite analysis is crucial in assessing the pre-storm environment, validating the accuracy of the forecast models, and monitoring trends in upstream thunderstorm activity. **Satellite imagery is best used when integrated into the forecast and warning processes**.

A special thanks to the Cooperative Institute for Meteorological Satellite Studies (CIMSS) at the University of Wisconsin for providing GOES-8 Sounder Derived products.

Address any questions or comments to David Wally *

*** Author's Current Affiliation:** NWS's National Centers for Environmental Prediction - Hydrometeorological Prediction Center, Camp Springs MD