Severe Weather Outbreak of April 5th, 2011

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INTRODUCTION

In the pre-dawn hours of Tuesday, April 5th, 2011, a line of severe thunderstorms moved rapidly east across southern Alabama, southern Georgia, and northwest Florida. In **W**eather **F**orecast **O**ffice (WFO) Tallahassee's **C**ounty **W**arning **A**rea (CWA), 40 of the 48 counties reported severe weather (i.e. winds of at least 58 MPH or hail diameter at least 1"). This widespread severe weather outbreak came just a week after a major large hail outbreak struck southern Alabama and Georgia.

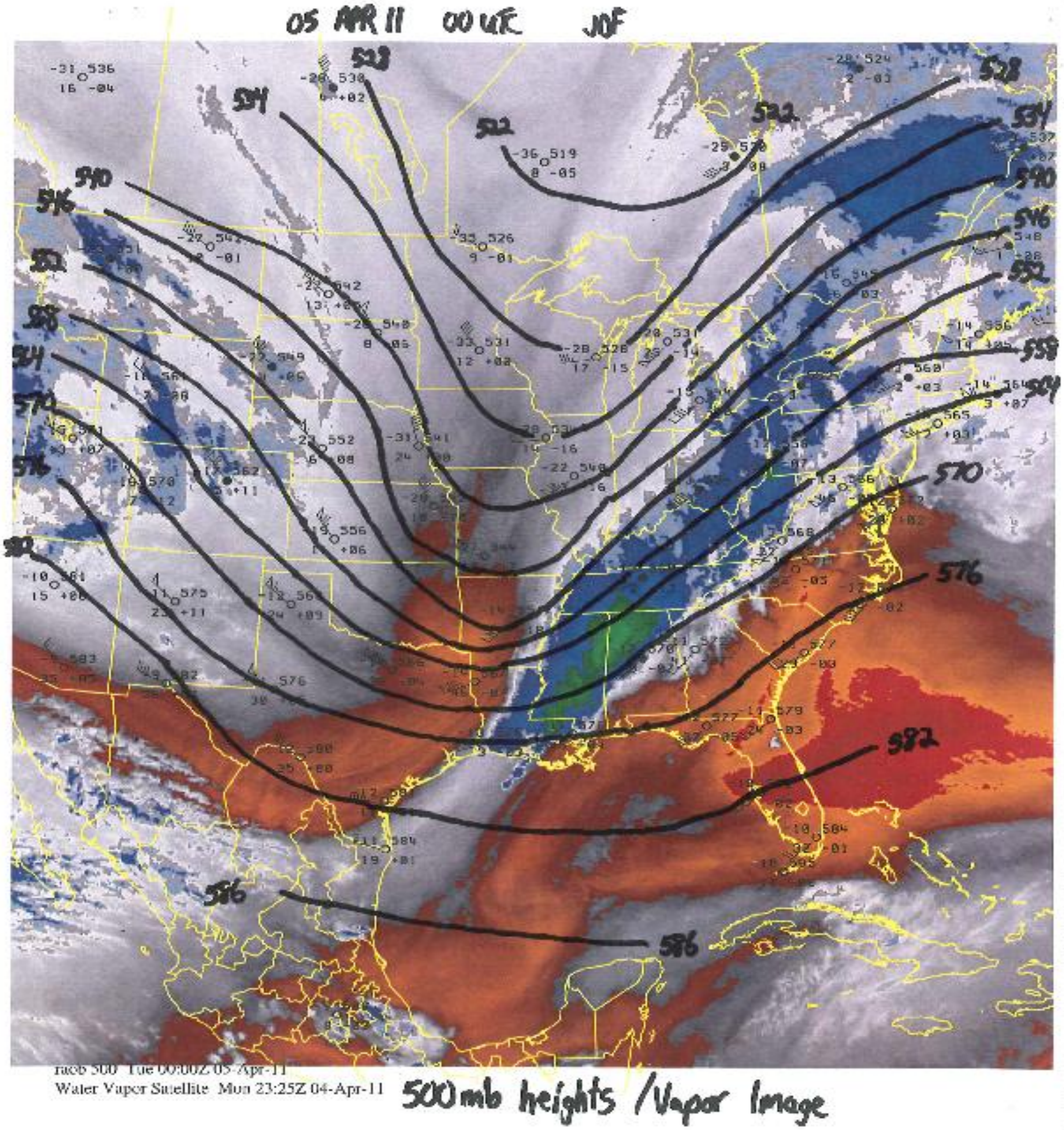
The strongest winds gusts generally ranged from 58 to 75 MPH (based on damage surveys and local wind sensors). The peak measured wind speed was 75 MPH, which occurred at the Perry-Foley Airport at 459 A.M. EDT. Most of the damage came in the form of downed trees and power lines, with numerous reports of road closures, power outages, and building damage caused by fallen trees. One fatality occurred as a tree crashed through a roof. There were also a few injuries.

Despite the widespread damage, the NWS was unable to find any evidence of tornadoes. This event should serve as a reminder that severe straight-line winds from thunderstorms can sometimes have more of an impact than tornadoes. Even though tornadoes usually have stronger winds, their small size tends to limit their effects to areas the size of neighborhoods. A squall line (like the one that came through the area on April 5) can affect a much larger area than even multiple tornadoes, and should be treated with great caution.

ANALYSIS

The large scale weather pattern for this event was similar to past widespread damaging wind events in this region (November 1995, February 2000, and March 2007). At the 500 MB level there was a deep long wave trough propagating eastward over the Southeast U.S., and a powerful 100 knot jet maximum pivoting around the base of this trough (Fig. 1) approximately 6 hours before the squall line reached southeast Alabama and the Florida Panhandle. The depth of this trough and its corresponding high wind speeds are comparable to some of the vigorous troughs that affect the Gulf Coast region in the winter time. However, these systems rarely produce widespread wind damage like this system did.

Fig.1. Subjective analysis of 500 MB heights overlaid on a GOES Water Vapor Image from April 4, 2011 at 8 PM EDT.



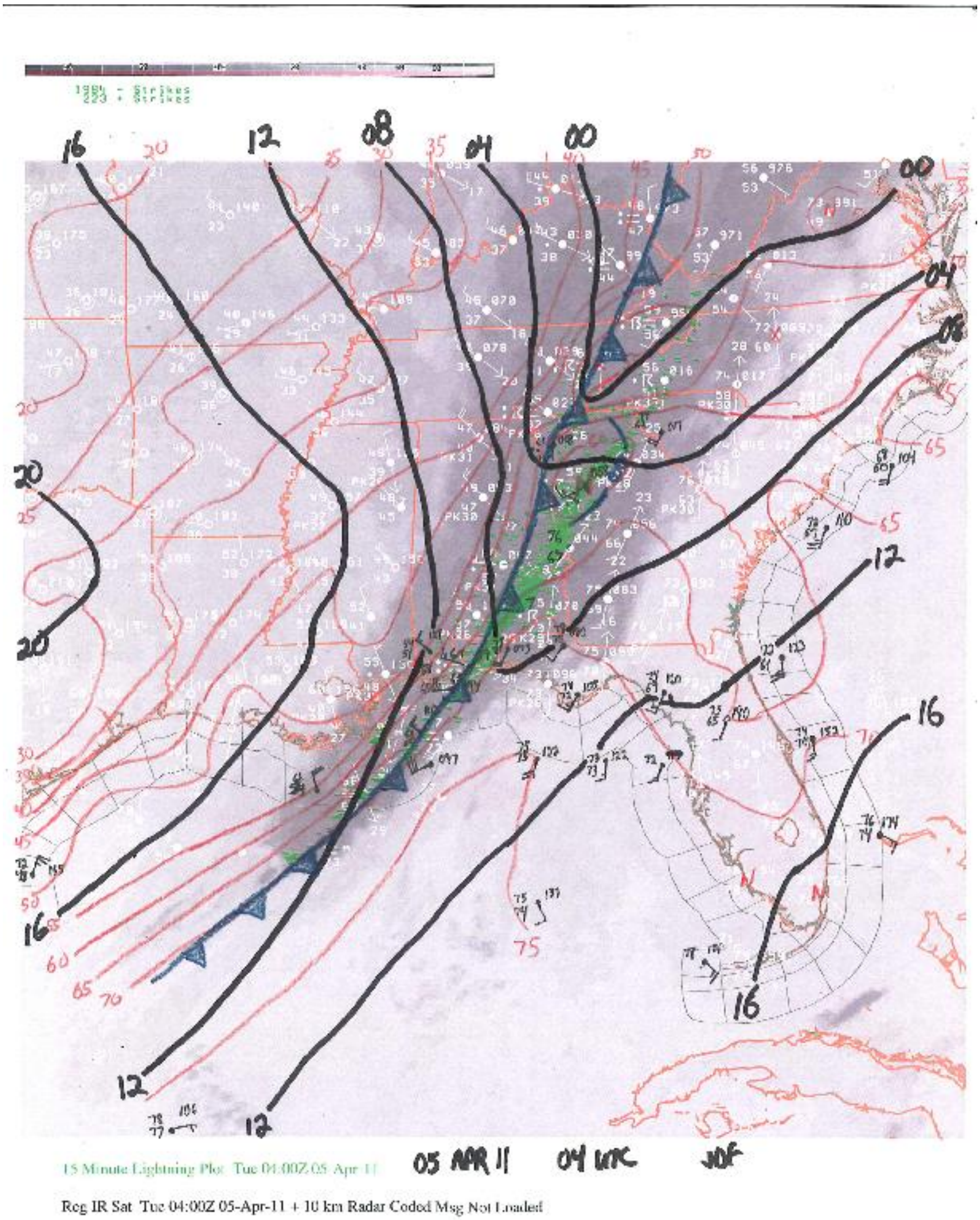


Fig. 2. Subjective surface analysis of Mean Sea Level Pressure (black), dewpoint (red), CG lightning (green), station plots (black/white), overlaid on GOES IR satellite image from April 4, 2011, at 11 PM EDT.

Fig. 2 shows the strong cold front as it's approaching WFO Tallahassee's CWA from the northwest. The close spacing of dewpoint lines is indicative of the stark contrast between the cold, dry airmass behind the front and the warm, moist airmass ahead of it. Leading up to this event, there were several hours of strong southerly winds transporting warm, moist air from the Gulf of Mexico inland ahead of the approaching cold front. The combination of this warm, moist air at the surface and cooler, drier air aloft provided potential energy (called **C**onvective **A**vailable **P**otential **E**nergy, or CAPE for short) for thunderstorms. High values of CAPE indicate a potential for strong thunderstorm updrafts, which is a necessary ingredient for severe storms. Often, when strong cold fronts like this move through the Gulf Coast region during the winter, this potential energy is lacking because of the prevalence of cooler waters in the Gulf of Mexico and the relatively cool, dry air from the continent. Because this particular system occurred so late in the season, the Gulf of Mexico was much warmer and there was a lack of a cold, dry airmass in place ahead of the cold front. Thus this system had much more potential energy to work with.

Another important ingredient in this event was the very strong wind field associated with the large trough. These winds not only helped to force the air upward (which is necessary for the initial development of storms), but they also helped organize the storms into a narrow band ahead of the cold front. Thunderstorms that form in weak wind fields (like those that develop during the summer along the Gulf Coast) tend to develop and dissipate within an hour or so as their updrafts (rising moist air that allows storms to grow or sustain) get destroyed by their own downdrafts (sinking air currents caused by falling precipitation). Storms that develop within strong wind fields tend to be more organized, and can sustain themselves for several hours. Depending on the orientation of the wind field, storms in a strong wind environment can become organized into a narrow band of strong to severe thunderstorms, often oriented parallel to the cold front.

The squall line that moved through this region maintained itself the entire way, and produced numerous damaging wind gusts (and occasional large hail). In most cases, the wind gusts were marginally severe (near 60 mph), which is just strong enough to knock down trees and power lines, and damage small structures. However, there were some wind gusts near (or at) hurricane force. Squall lines can produce tornadoes, though most tend to be weaker and short-lived compared to their isolated supercell counterparts. In this case, however, there was no evidence of tornadoes as all the debris patterns fell roughly along the same direction, which is indicative of straight line wind gusts.

CONCLUSION

The squall line that moved quickly through WFO Tallahassee's CWA early in the morning of April 5th caused widespread severe weather, mainly in the form of wind gusts of 58 MPH or higher. Most of the damage was downed trees and power lines, but there were reports of isolated structural damage as well, including one fatality. The event occurred shortly after this region's unofficial severe weather season, which usually runs from November through mid March. This weather system had the energy of a strong winter system, but (because of the relatively late date) was able to utilize much more potential energy (in the form of warm, moist air at the surface) than would otherwise be available in the winter. On the large scale, the squall line had a favorable environment with strong vertical wind shear, ample moisture, high values of CAPE, and a focus for sustained upward motion (the strong cold front behind the squall line). Since other squall lines occasionally encounter similarly favorable large scale conditions, there may have been other factors that allowed for such a widespread event. Further research is needed to determine what these factors were.