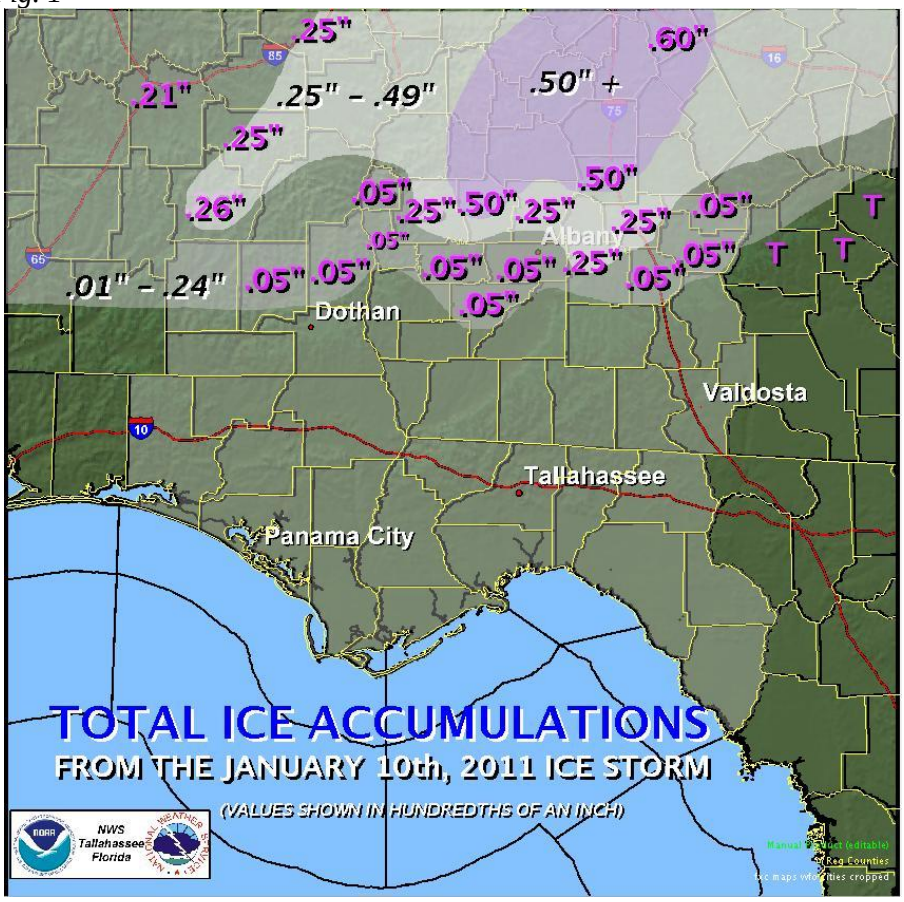
THE GULF COAST ICE STORM OF JANUARY 2011

Introduction

On the Monday morning of January 10, 2011, freezing rain fell across portions of Georgia and Alabama. Most of the precipitation in the southern portions of these states was rather light and brief with amounts ranging from a trace to a quarter of an inch; but a few areas had half an inch of total ice accumulation (Fig. 1 below).

Fig. 1

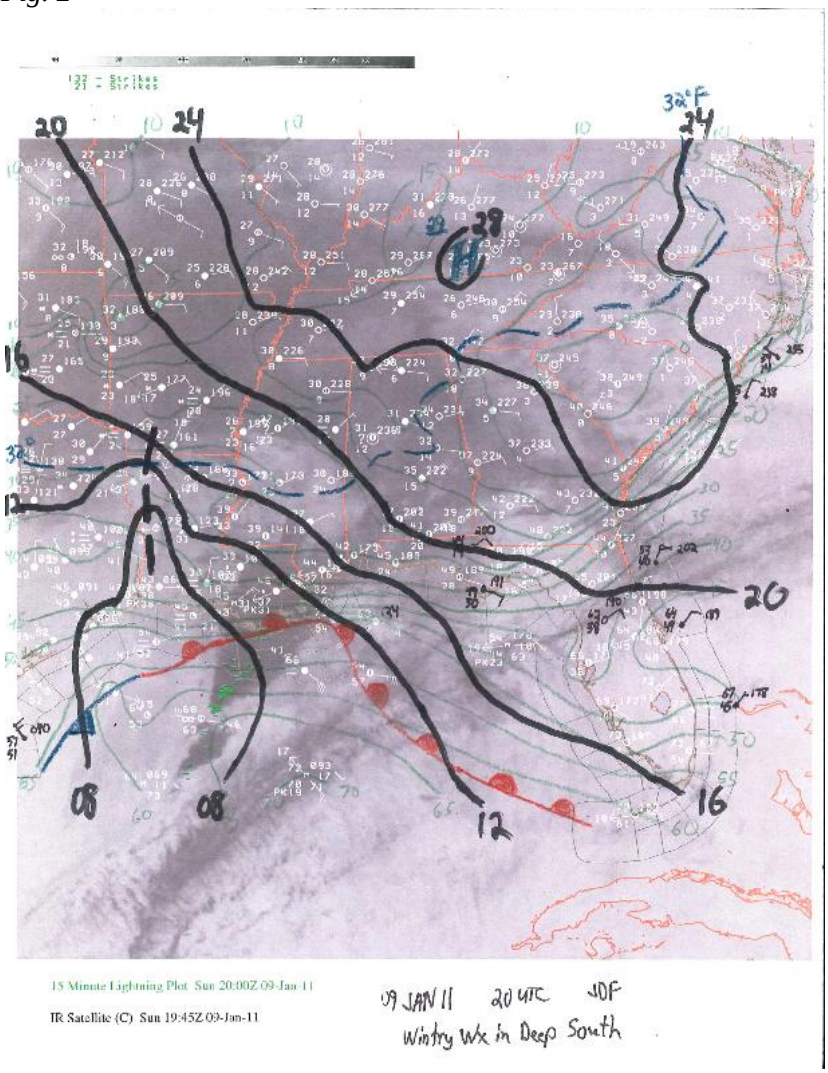


In central Georgia, the main impacts from the ice storm were hazardous road conditions and power outages. In southeast Alabama, where there was less ice, the impact was limited to slippery roads. Weather conditions were marginal for freezing rain this far south, and it was only cold enough for a few hours around daybreak for ice accumulation to take place. Accumulations of more than an inch would have caused more serious problems like widespread power outages and prolonged road closures.

Overview of Synoptic Weather Pattern

The afternoon before the ice storm, a low pressure system was beginning to form off the Texas coast. This occurred as a strong upper level trough (approaching from northern Mexico) interacted with a stationary front over the Gulf of Mexico. Over the southeast U.S. there was a cold, dry airmass associated with an area of high pressure at the surface. Compared to some of the other cold spells this winter, this airmass was not exceptionally cold; but it was very dry. Dewpoint temperatures (one of the ways used to measure the moisture content in the air) were in the single digits to lower teens across much of Georgia and Alabama. This dry air would play a role in helping to cool the surface enough for freezing rain the next morning.

Fig. 2

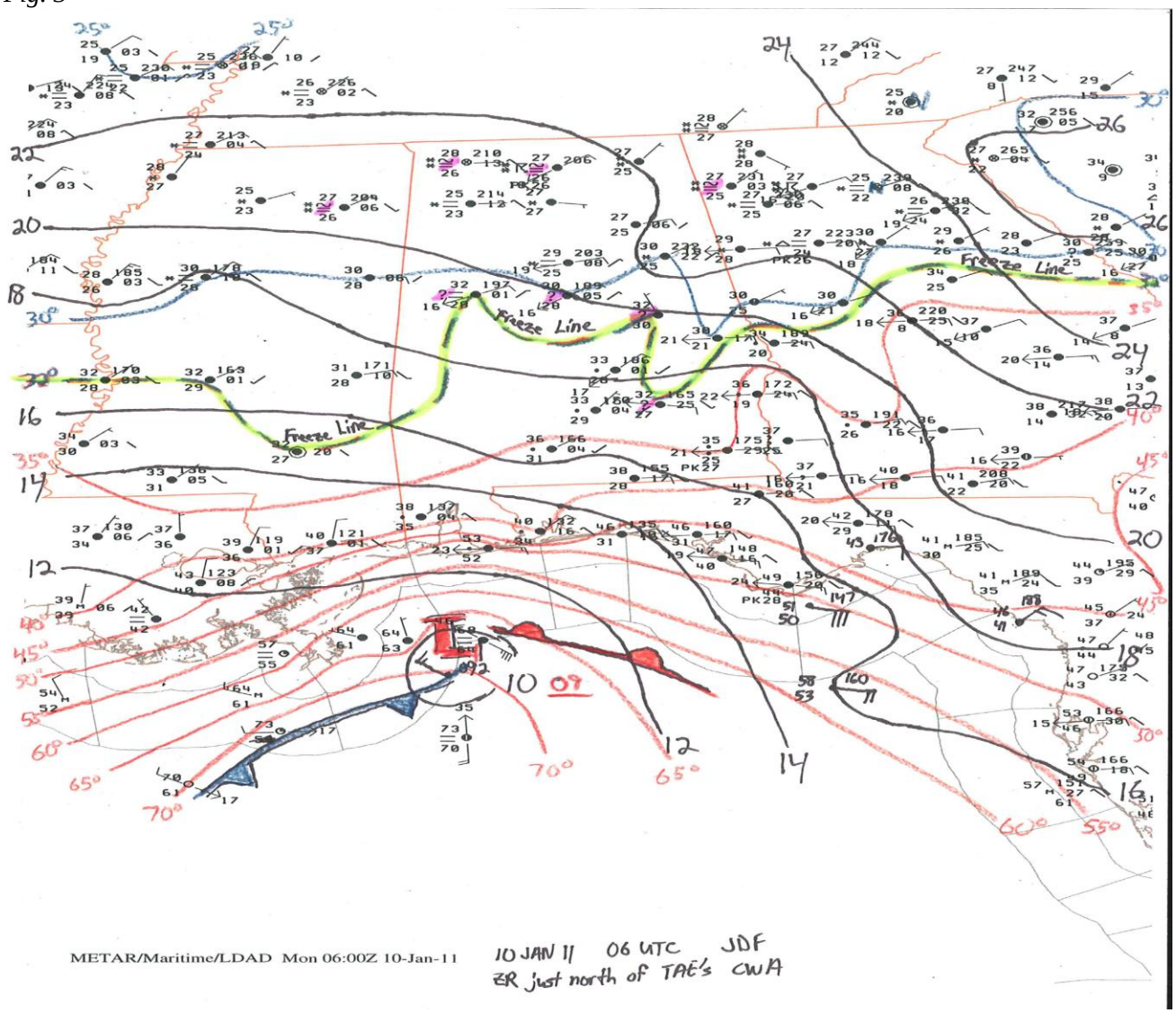


Surface analysis from Sunday afternoon (the day before the ice storm), showing dewpoint (green lines), Mean Sea Level Pressure (solid black lines), lightning strikes (green dashes), surface station plots (white & black text), freezing line (blue dashed line), and cloud cover (dark gray shading).

As the low pressure system developed and began moving quickly eastward Sunday afternoon and evening, light precipitation overspread much of the Gulf Coast states. Most of the precipitation evaporated in the very dry air beneath the clouds, but some of it occasionally reached the surface. Despite relatively warm temperatures (in the mid to upper 40s), sporadic reports of ice pellets were received from residents in the Florida Panhandle, South Alabama, and South Georgia. The warm ground temperatures and light precipitation rates prevented any accumulation.

Late Sunday night and early Monday morning, the approaching Gulf low peaked in intensity near the Louisiana coast (with gale force winds reported at several oil platforms and buoys). Although the region from North Florida northward remained in the cool air north of the frontal system, conditions were quite different about 4 thousand feet above the surface. A conveyor belt of strong southerly winds was transporting warm, moist air from the Gulf of Mexico northward and over the shallow, cold airmass beneath. This not only aided in cloud and precipitation formation, but also warmed the clouds enough to prevent any ice from forming. Measurements taken from Monday morning rawinsondes showed temperatures in the mid 40s (F) at 4 thousand feet. (Rawinsondes are small, battery-powered instrument packages lifted through the atmosphere by weather balloons. Along with position data tracked by GPS, the instruments send back valuable temperature, moisture, and pressure data. This data is plotted and analyzed by meteorologists, and is also entered into various weather computer models for forecasting). Through the early morning hours on Monday, the precipitation fell as cold rain in South Georgia and South Alabama. However, the freezing line was just north of this region, and several observing stations in central Alabama and central Georgia reported freezing rain.

Fig. 3

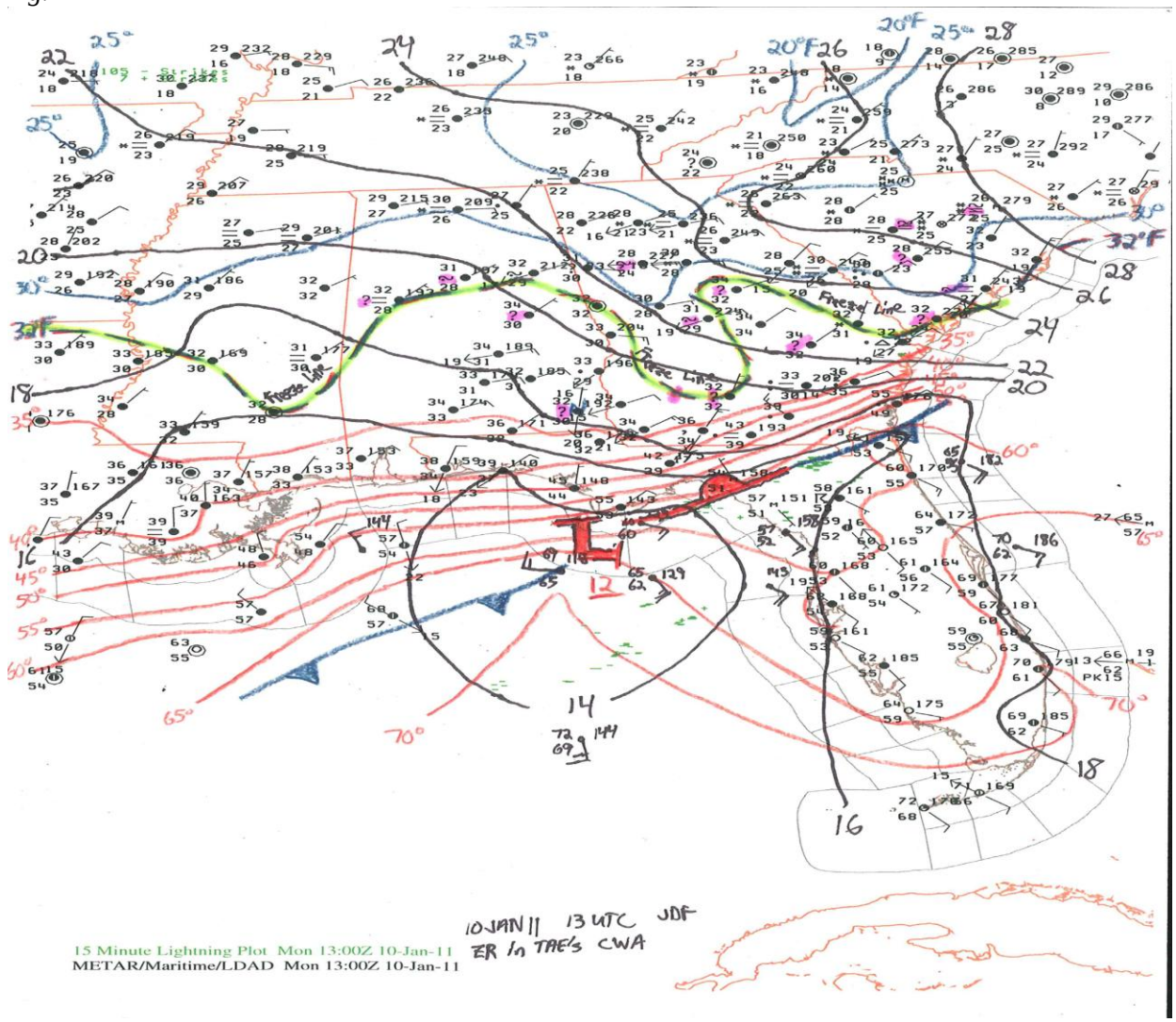


Surface analysis from late Sunday night, showing temperature (solid red lines), Mean Sea Level Pressure (solid black lines), freezing rain reports (pink highlights), freezing line (dashed/yellow highlighted line), and surface station plots (black).

By daybreak Monday, the Gulf low (now in a weakening phase) was near Apalachicola, Florida. After periods of light rain throughout the night, the surface finally reached the freezing point in portions of South Georgia and South Alabama for a few hours. Normally, thick cloud cover prevents the surface from cooling much at night, as clouds give off infrared radiation that offsets the normal cooling process. In this case, however,

the rain was falling through a layer of very dry air (at least initially) near the surface. When water changes phase from liquid to gas as it falls through the dry air, the surrounding air is cooled as energy is taken away from it. If this process occurs over a long enough period of time for a substantial amount of precipitation, the layer of air affected by the evaporation can be cooled by several degrees. (Think about getting out of a swimming pool on a warm, dry, day; or how skin cools when rubbing alcohol evaporates from it). The large scale evaporation that occurred Sunday night and early Monday morning eventually helped temperatures to cool to freezing at the surface. At this point, when the rain drops reached the surface, they began to freeze on impact. By mid to late morning the surface warmed just enough to melt the ice.

Fig. 4



Surface analysis from Monday morning, showing temperature (solid red lines), Mean Sea Level Pressure (solid black lines), lightning strikes (green dashes), freezing rain reports (pink highlights), freezing line (dashed/yellow highlighted line), and surface station plots (black).There are a few freezing rain reports with temperatures just above freezing, but that could be because the ground temperature was freezing while the thermometer reading at 2 meters (which is where the official air temperature is taken) was slightly warmer.