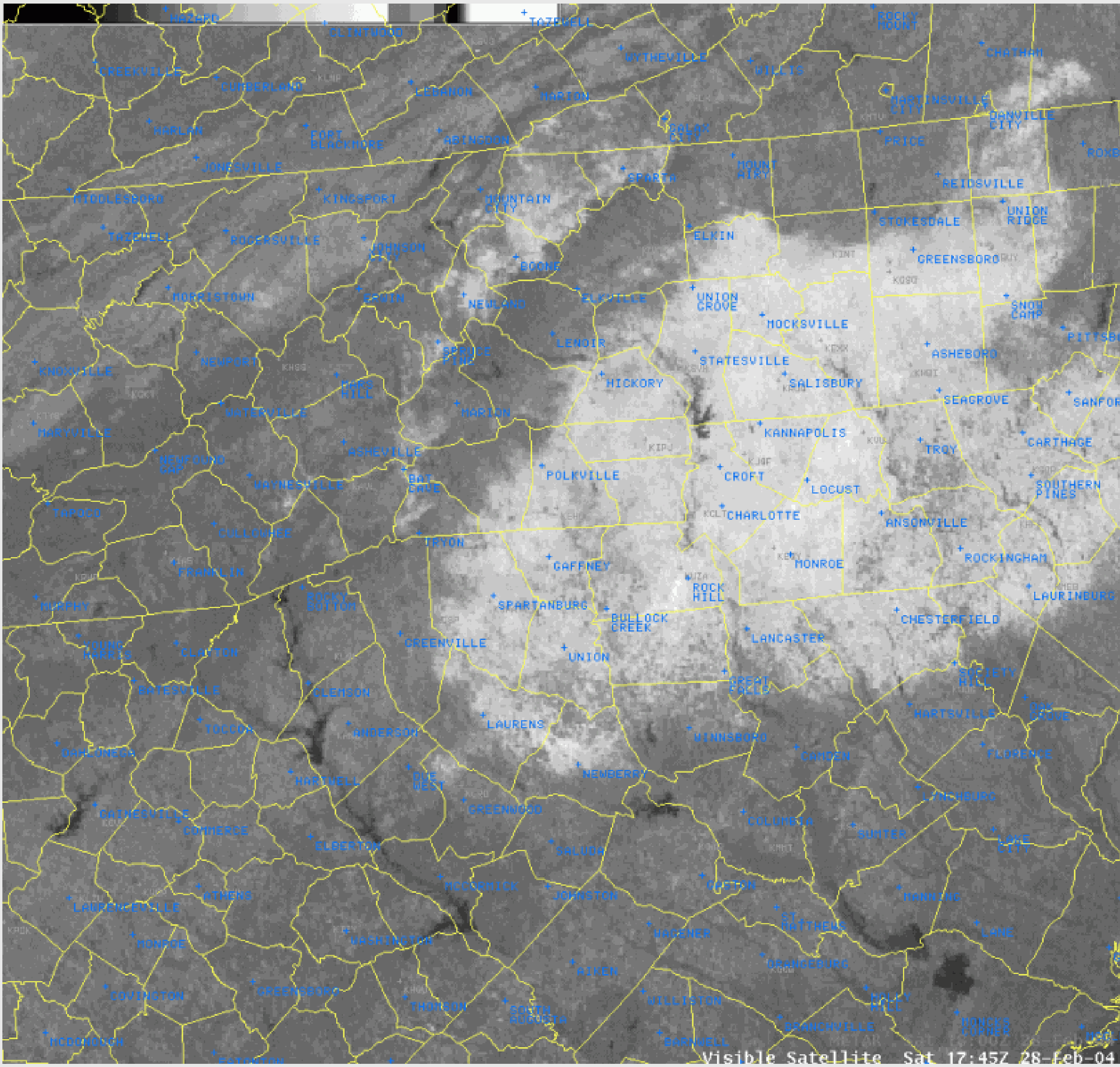
State Climatology Office

Open File Report

Winter Storm of February 25-27, 2004



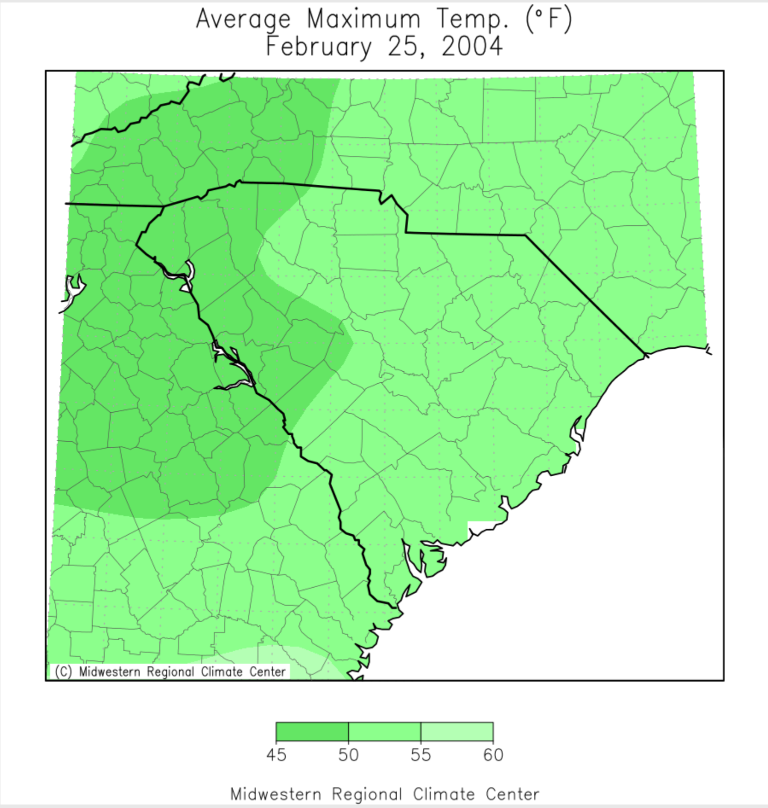
A visible satellite image from 12:45 p.m. EST on February 28, 2004, showing deep the snow cover over the Piedmont, foothills and mountains of South Carolina and North Carolina.

Original author: Jason Caldwell in mid-2004

Updated by Frank Strait on January 12, 2023

Meteorological Synopsis

The winter storm of February 24-26, 2004, was a historic storm for portions of South Carolina, with unofficial snowfall measurements as high as 22 inches in the Rock Hill area. Despite a rapid warmup that occurred in the wake of the storm, effects lasted for a few days.



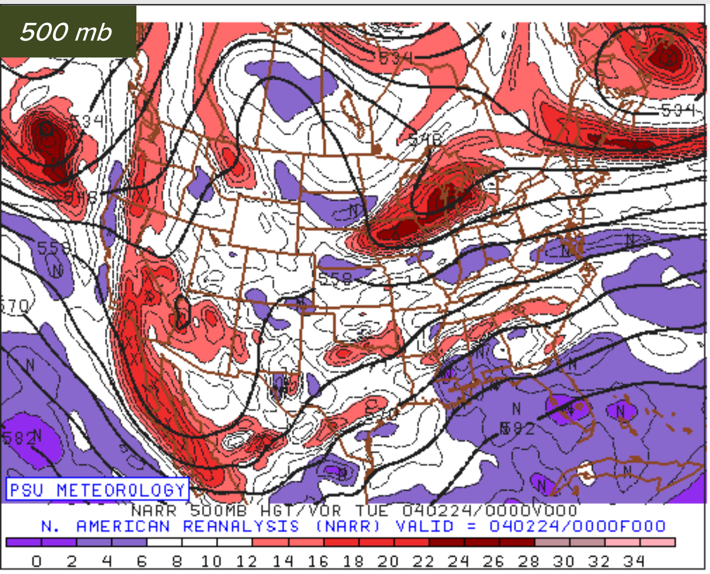
High temperatures in South Carolina on February 25, 2004, were in the upper 40s and lower 50s.

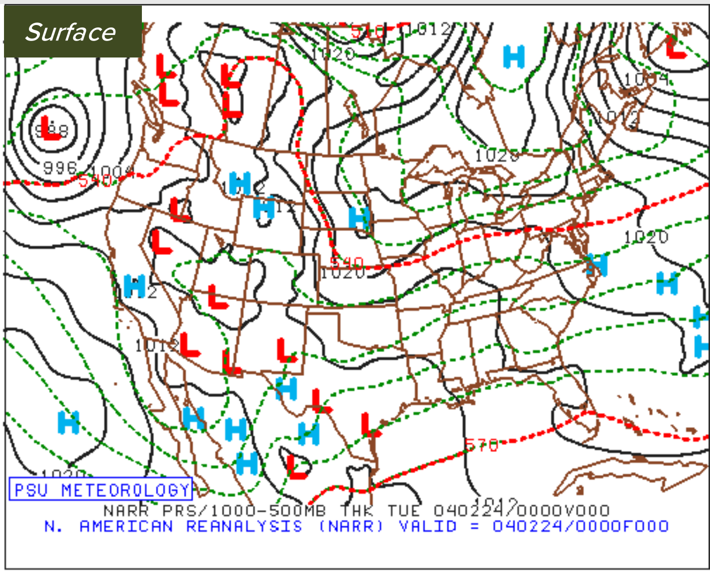
Much of early and mid-February 2004 featured near-average temperatures for late February. A cold front crossed South Carolina during the evening of January 24, bringing fresh arctic air to the state. This front became stationary along the Gulf Coast and Southeast Coast that night. Then a series of low-pressure systems moved along that stationary front from February 25-27, each passing south and east of South Carolina. The most significant of these was associated with a strong shortwave trough at the 500 millibar level, which separated from the main 500 millibar level midlatitude jet over California on February 23, then crossed the southern tier of states through February 27. This shortwave spawned surface low pressure over the north-central Gulf of Mexico during the afternoon of February 25, which tracked to Florida by the morning of February 26.

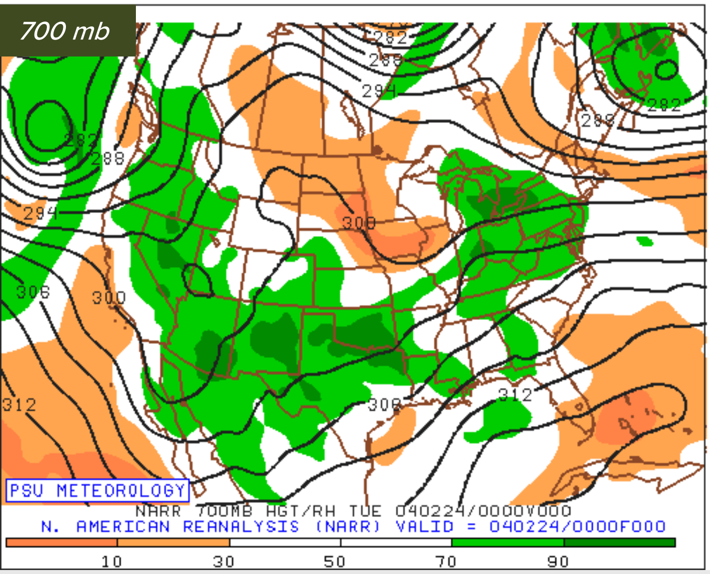
The developing cyclone generated a deep layer of southerly flow from the surface to well over 10,000 feet in the atmosphere, which fed copious amounts of moisture into the storm.

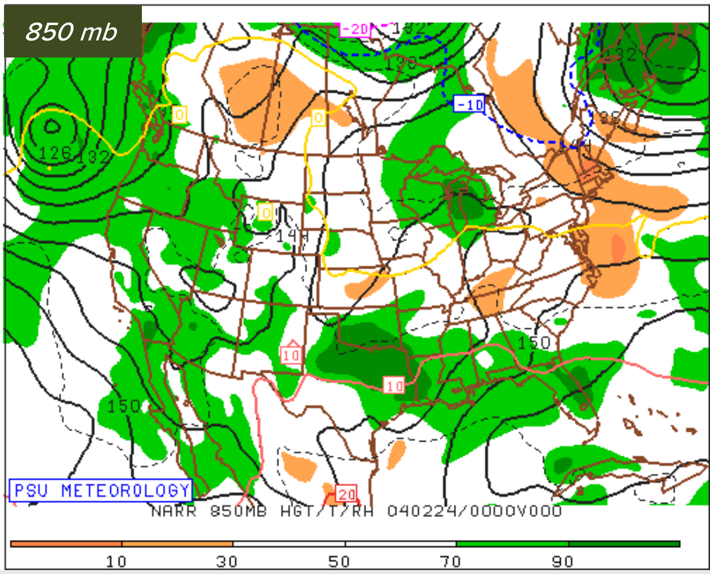
By this time, surface high pressure building southward out of Canada had become anchored over the eastern Great Lakes region, causing cold air damming (CAD) to develop over areas east of the Appalachian mountains. The resulting 'wedge' of cold air became firmly entrenched across South Carolina by the time the approaching storm's moisture moved into the area on February 25.

Meteorological Synopsis







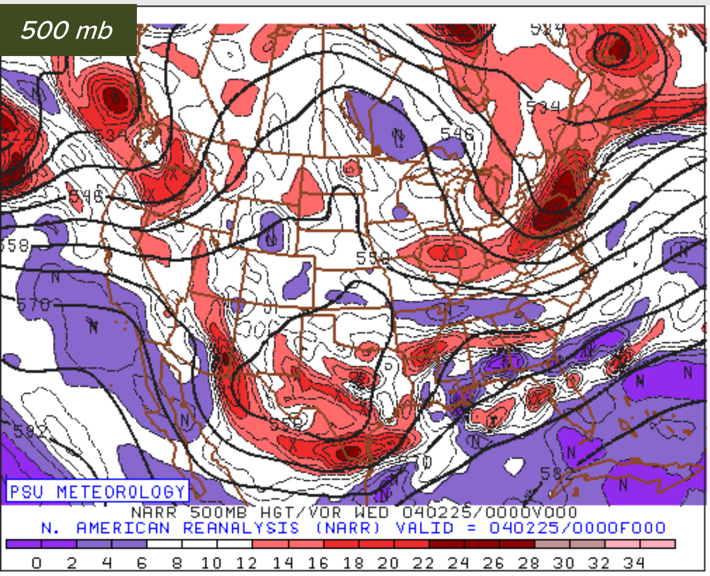


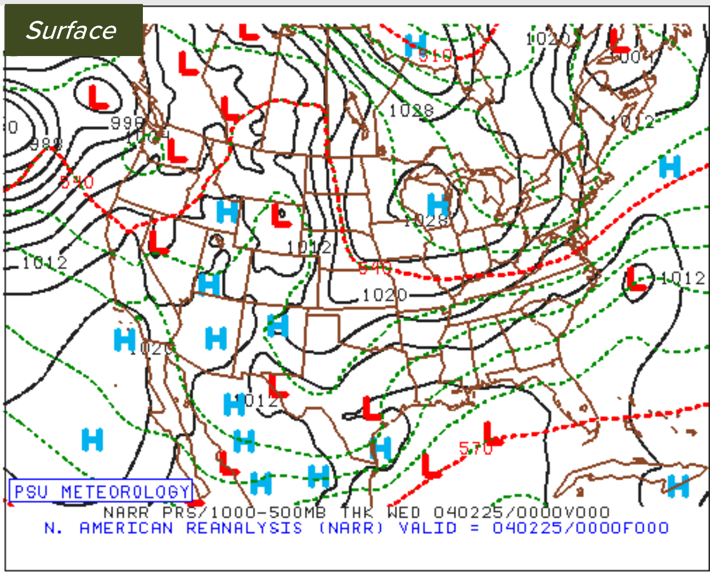
0000 UTC February 24, 2004 (7 p.m. January 23 EST):

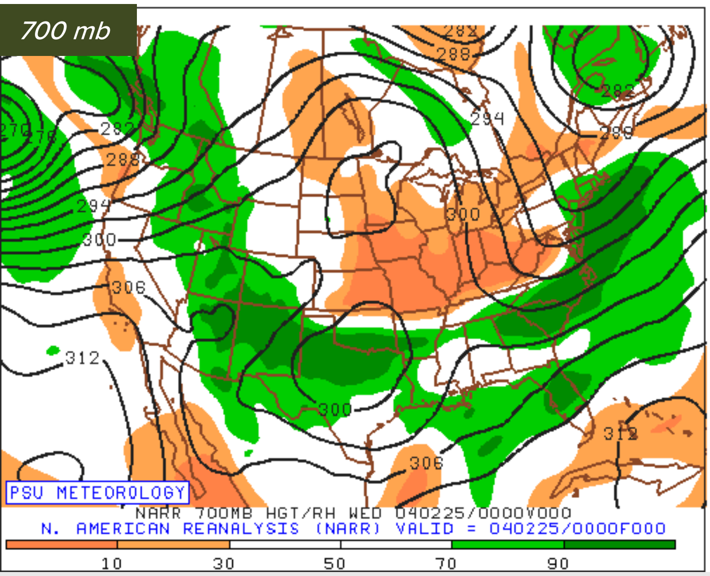
- A 500 millibar level shortwave was crossing the Great Lakes.
- A strong 500 millibar shortwave was over the Southwest and drifting slowly eastward.
- At the surface, a poorly-defined Alberta Clipper storm associated with the Great Lakes shortwave had a weak cold front trailing it into the southern Plains.
- At 700 millibars and 850 millibars, little moisture was involved with the Alberta Clipper system and its trailing front, but moisture was plentiful over the southern tier of states and Mexico.

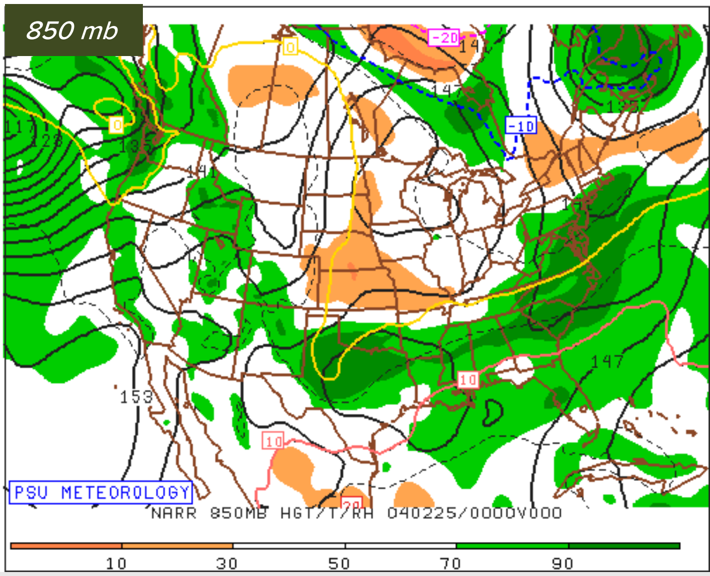
Imagery from the [Penn State University eWall website]

Meteorological Synopsis







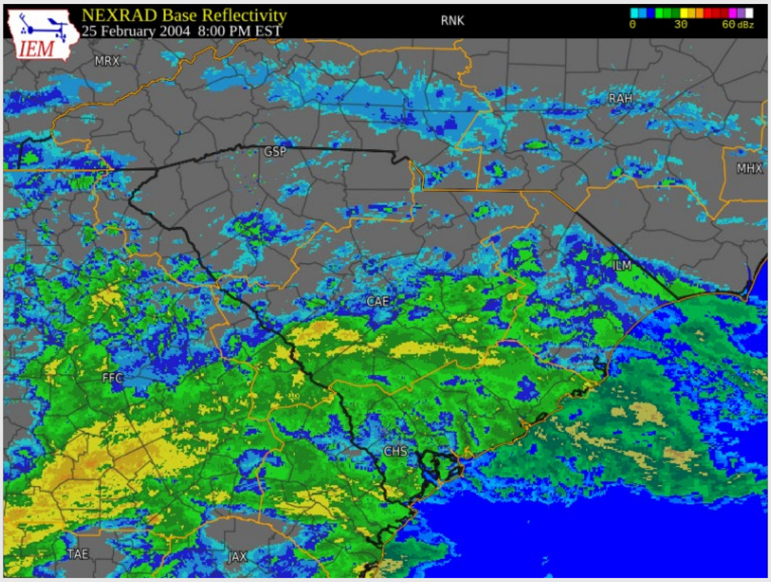


0000 UTC February 25, 2004 (7 p.m. January 24 EST):

- The 500 millibar level shortwave previously over the Great Lakes had moved to New England.
- The 500 millibar shortwave from the Southwest had moved to Texas and northeastern Mexico.
- At the surface, a cold front stretched from low pressure off the East Coast across South Carolina to South Texas.
- Moisture was becoming plentiful at 700 millibars and 850 millibars along the front and around the shortwave over Texas and Mexico.

Imagery from the [Penn State University eWall website]

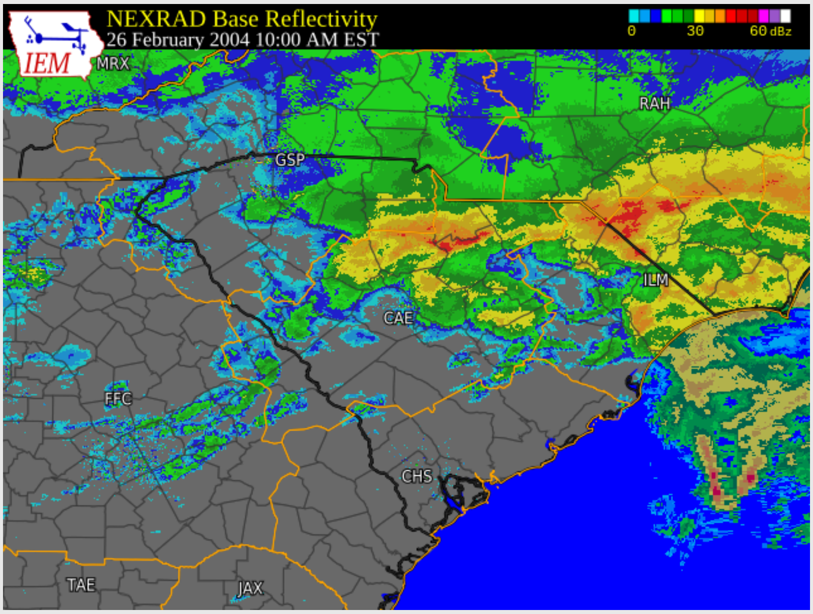
Meteorological Synopsis



Weather radar from 8:00 p.m. EST on February 25, 2004, shows precipitation covering most of South Carolina.

Precipitation spread into South Carolina on February 25 from the southwest; it fell in the form of rain over the Lowcountry and a mix of rain and sleet over areas along Interstate 20. However, temperatures were in the high 30s and 40s, which was too warm for accumulations to occur in these areas. However, dewpoint temperatures were in the teens and 20s, so cooling by evaporation resulted in falling temperatures once precipitation started.

The rain and sleet became more widespread through the early morning of January 26. By 3 a.m., temperatures fell to near freezing. Snow began to fall across the Upstate, while rain mixed with or turned to sleet in the northern Midlands.



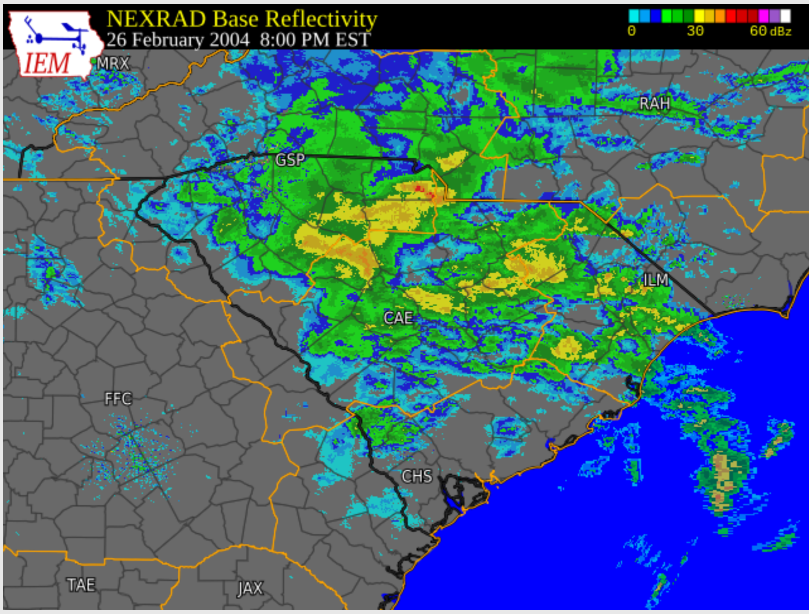
Weather radar from 10:00 a.m. EST on February 26, 2004, shows areas of heavy precipitation over the northern part of South Carolina.

By mid-morning on January 26, heavy snow was falling across Spartanburg, Greenville, Union, Cherokee, Laurens, Chester, York, and Lancaster Counties. Farther south and east, mixed snow and sleet over Newberry, Fairfield, and Chesterfield also became more intense.

The most intense precipitation occurred as a deformation area moved over the state that evening with strongly diffluent flow aloft and unusually steep lapse rates in the middle levels of the atmosphere.

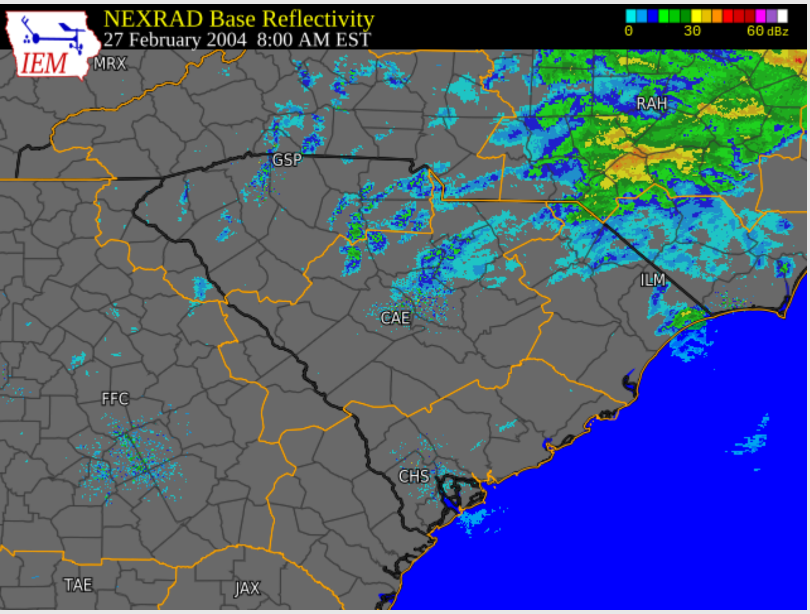
Meteorological Synopsis

During this time, intense snowfall and gusty winds occurred over York County and the vicinity. Snow fell at one to three inches per hour, and Rock Hill-York County Airport reported wind gusts up to 28 mph. These near-blizzard conditions made travel extremely hazardous through the evening of February 26. Also, the National Weather Service received reports of thunder and lightning from the area.



Weather radar from 8:00 p.m. EST on February 26, 2004, showing intense precipitation occurring in a band across York, Chester, Lancaster, Saluda, Newberry, Fairfield and Laurens Counties.

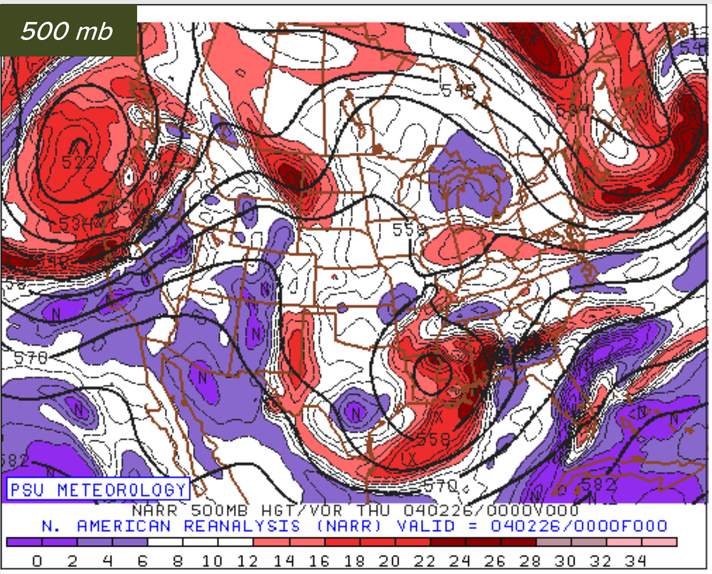
More of the Midlands and northern Pee Dee regions saw precipitation turn to snow, sleet, and freezing rain through the night, causing an expanding area of hazardous travel. Less intense snowfall kept roads slippery across the Upstate.

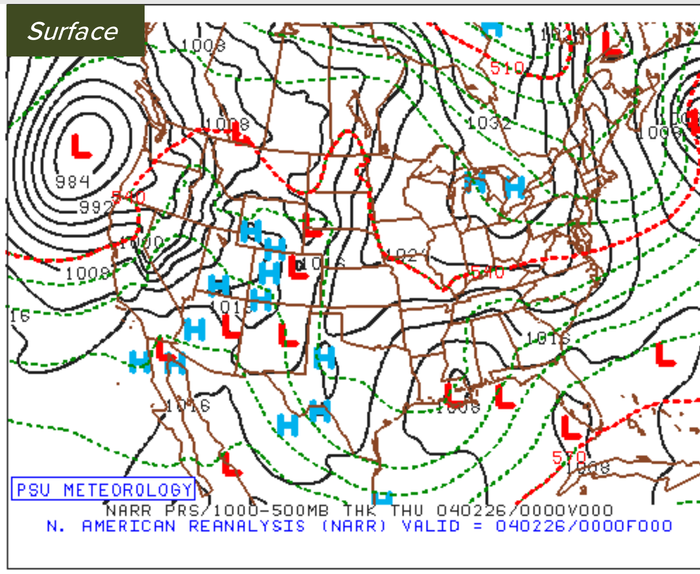


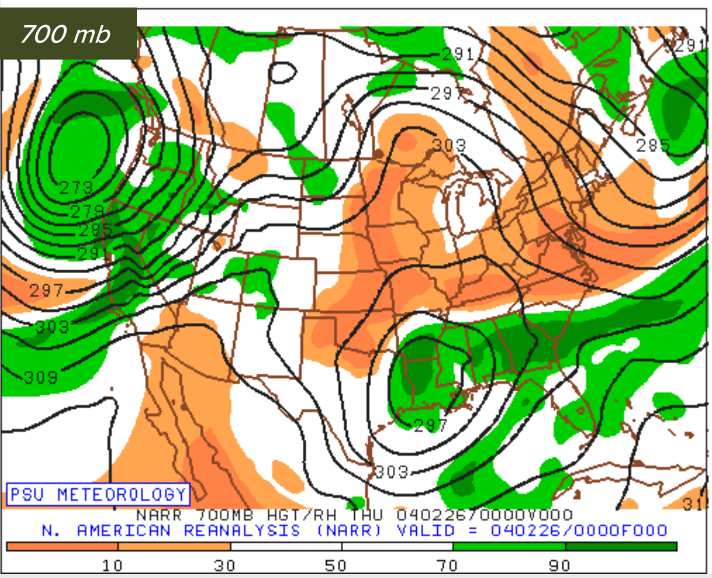
Weather radar from 8:00 a.m. EST on February 27, 2004, showing light precipitation lingering over South Carolina, mostly across the northern half of the state.

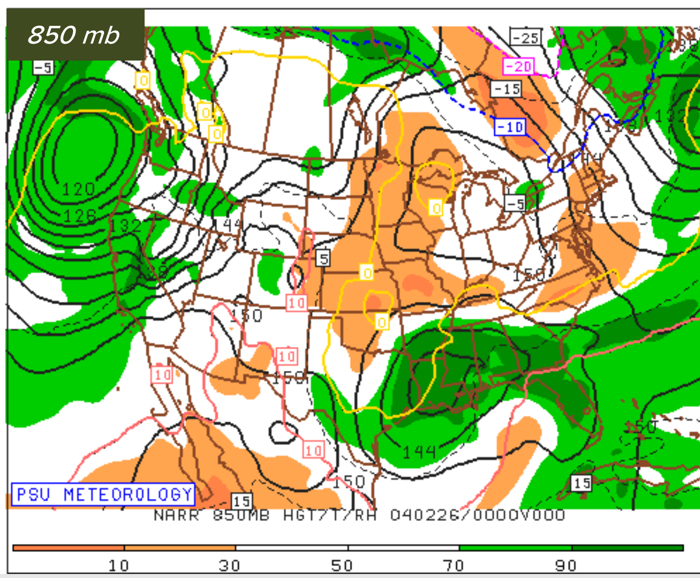
Precipitation rates lessened during the early morning of January 27 as the upper shortwave axis shifted east over the coastal waters and the surface low pressure moved away over the Atlantic Ocean. However, another shortwave feature at 500 millibars arrived from the northwest later in the morning of January 27. The result was additional light precipitation over much of South Carolina through this day. However, temperatures near the surface and aloft warmed, leading to this falling as mixed rain and snow, so little additional accumulation occurred during this time.

Meteorological Synopsis







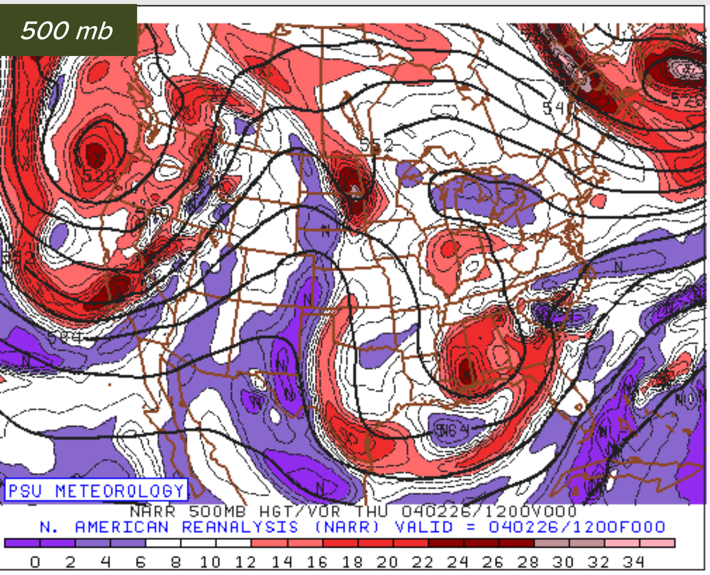


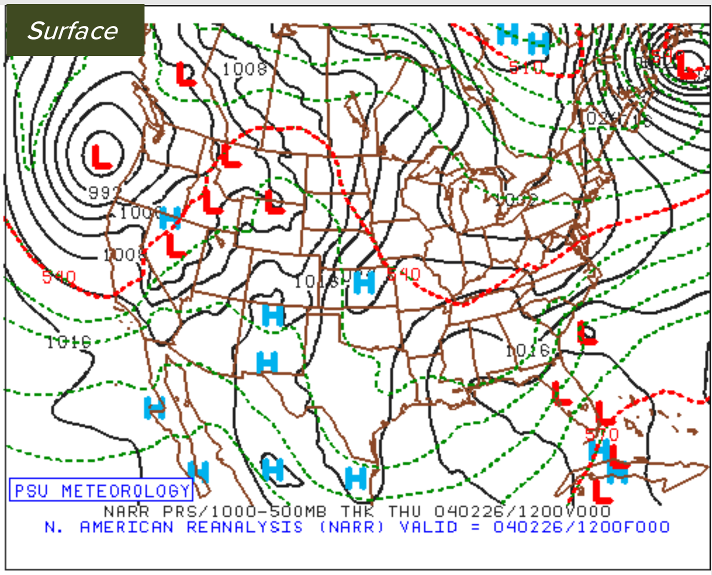
0000 UTC February 26, 2004 (7 p.m. February 25 EST):

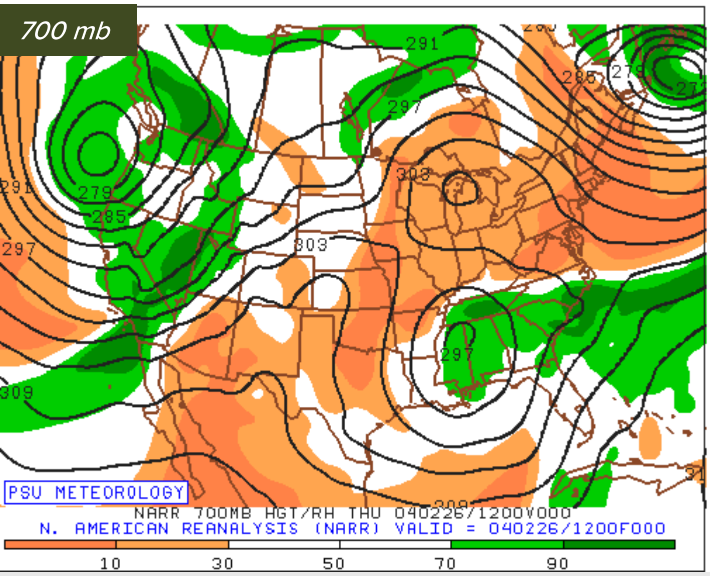
- The shortwave at 500 millibars had moved from Texas to the lower Mississippi Valley.
- Surface low pressure had formed near New Orleans.
- Moisture at 700 millibars and 850 millibars was gathering around the developing storm center and was aligned along a warm front extending eastward from the storm.

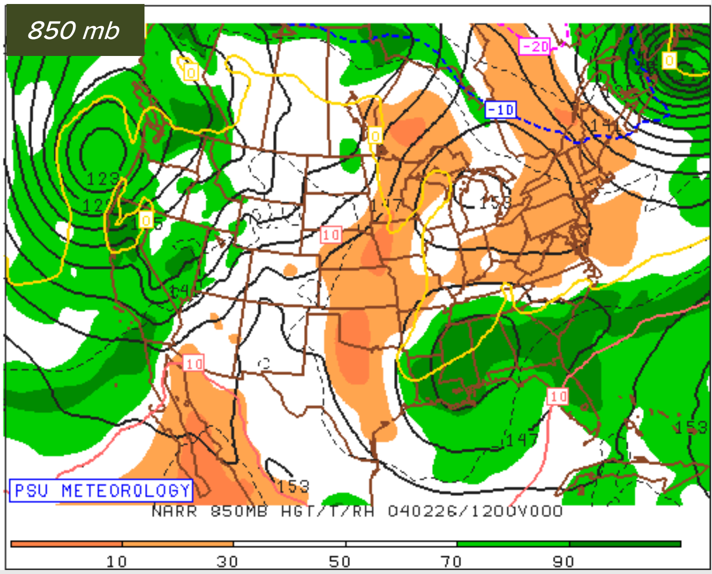
NARR imagery from the [Penn State University eWall website]

Meteorological Synopsis







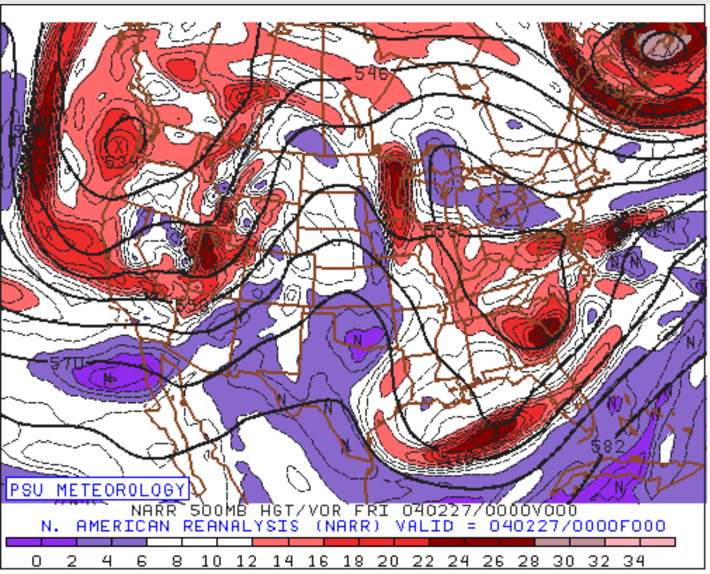


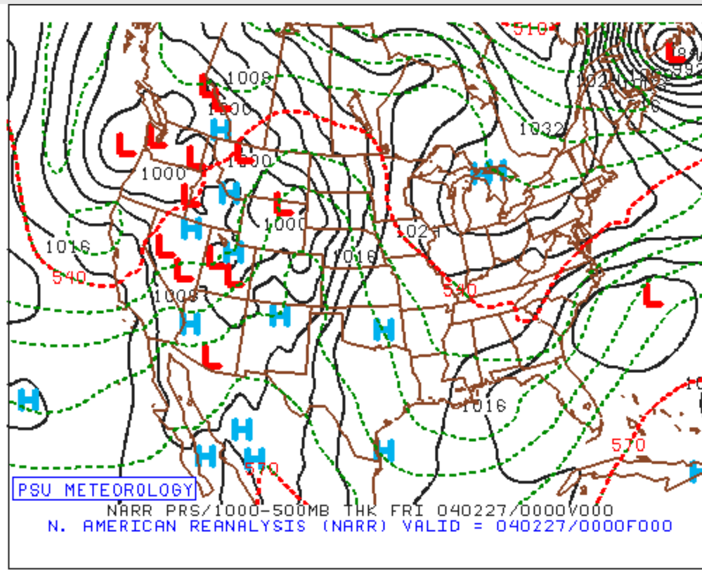
1200 UTC February 26, 2004 (7 a.m. February 26 EST):

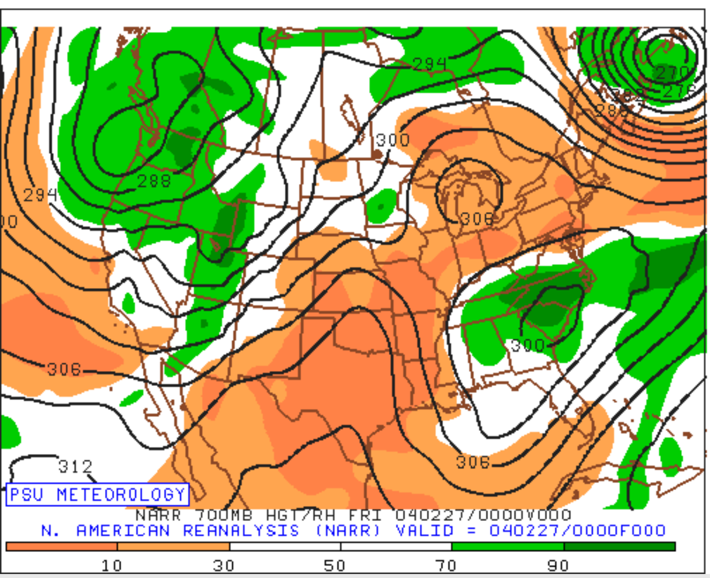
- The 500 millibar shortwave had moved to Alabama and Mississippi.
- Surface low pressure was over peninsular Florida. Cold air damming was evident in the surface isobar pattern over the Carolinas.
- Moisture at 700 and 850 millibars was spreading northward into South Carolina.

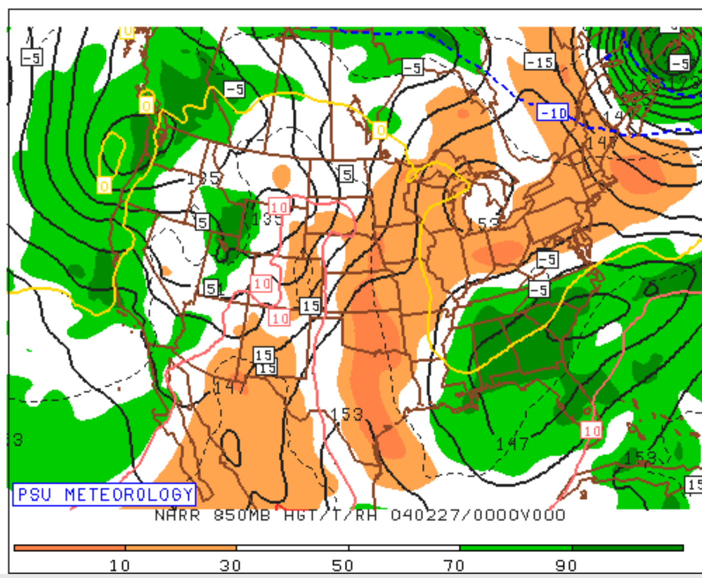
NARR imagery from the [Penn State University eWall website]

Meteorological Synopsis







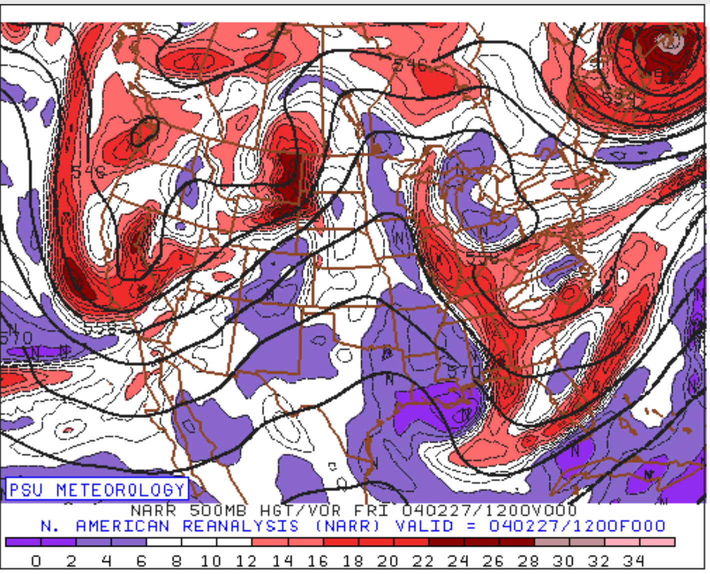


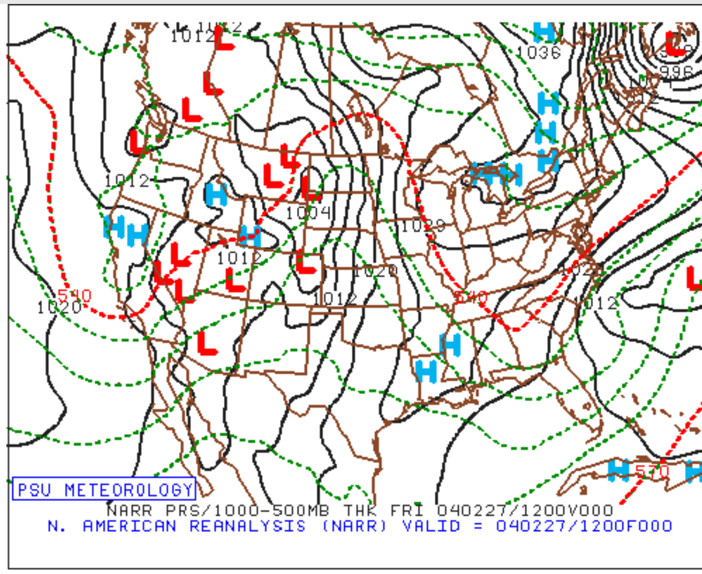
0000 UTC February 27, 2004 (7 p.m. February 26 EST):

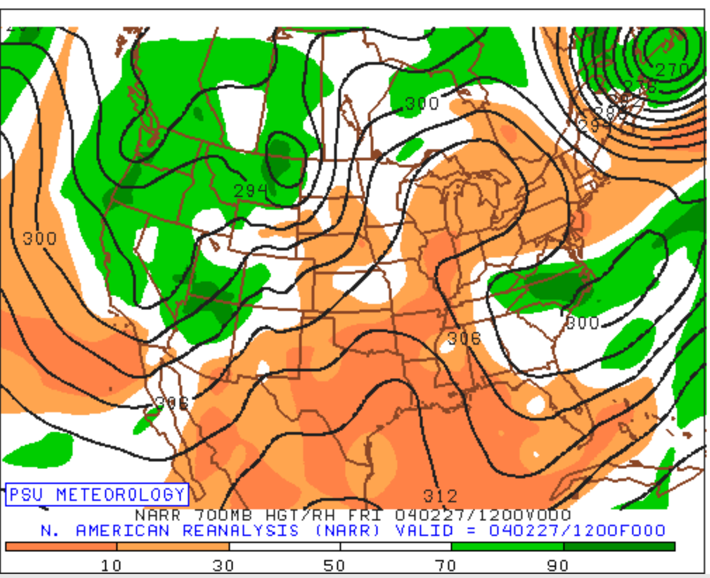
- The 500 millibar shortwave feature was over South Carolina and had taken on a negative tilt.
- Surface low pressure was strengthening near the East Coast.
- At 700 millibars and 850 millibars, moisture was plentiful; around this time, the Upstate was hammered with heavy snow.

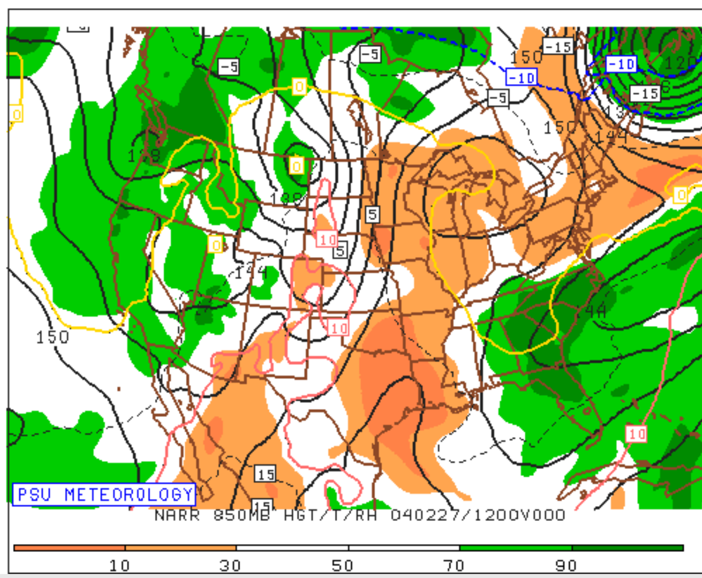
NARR imagery from the [Penn State University eWall website]

Meteorological Synopsis







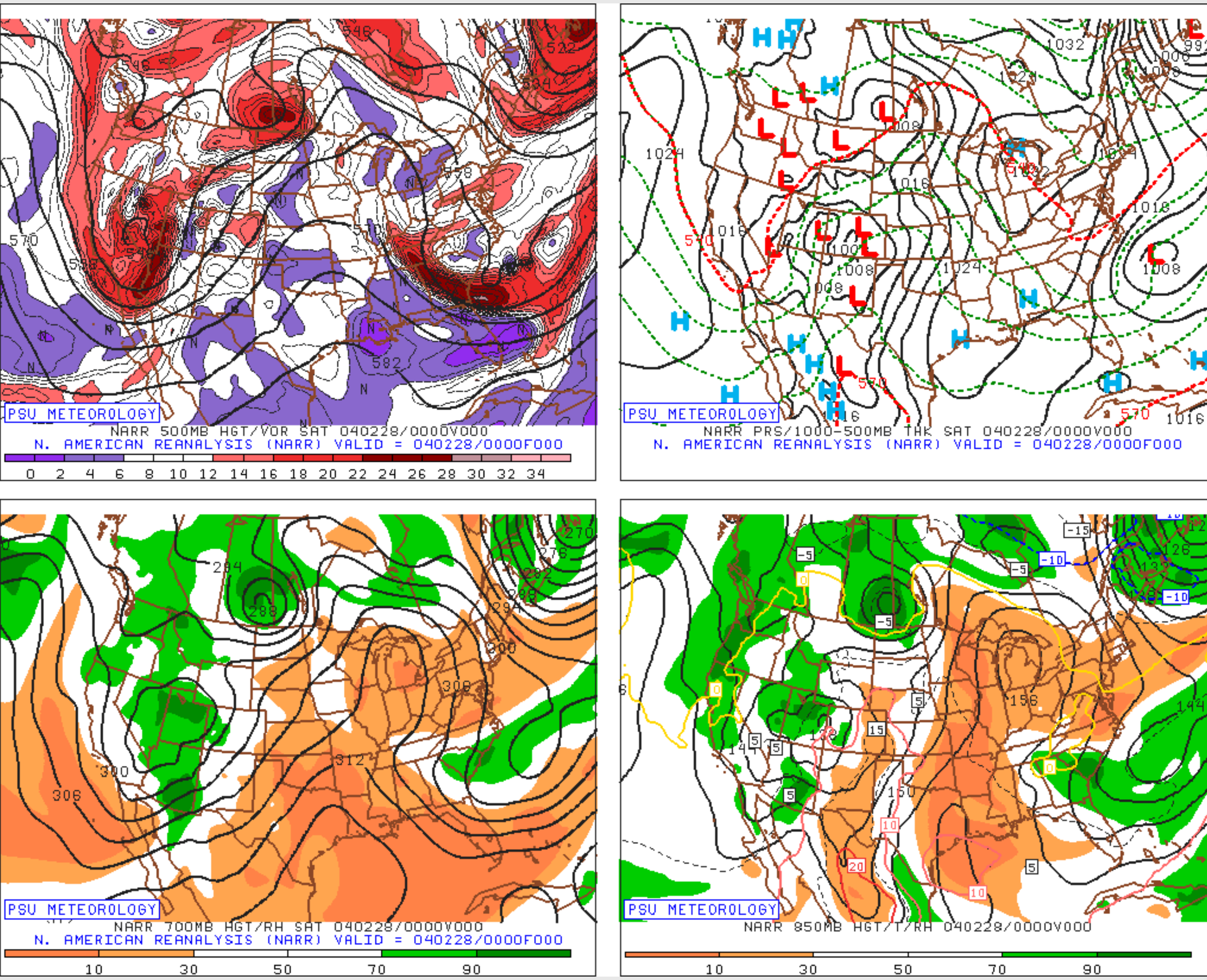


1200 UTC February 27, 2004 (7 a.m. February 27 EST):

- At 500 millibars, the shortwave which caused intense snowfall departed to the east. However, a new shortwave at this level approached from the northwest to bring additional light precipitation.
- At the surface, low pressure over the Atlantic was moving away to the east.
- At 700 millibars, drier air had moved over South Carolina.
- At 850 millibars, considerable moisture was still present.

NARR imagery from the [Penn State University eWall website]

Meteorological Synopsis



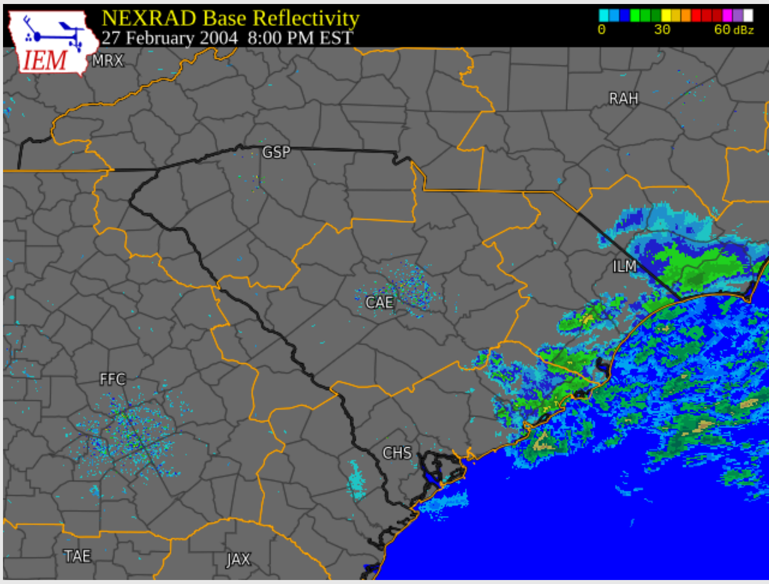
0000 UTC February 28, 2004 (7 p.m. February 27 EST):

- The last trailing shortwave at 500 millibars was over South Carolina and moving away to the east.
- A second surface low had formed east of South Carolina but was moving away to the east.
- Lingering moisture at 700 millibars and 850 millibars brought more light precipitation to the state, mostly a mixture of drizzle and light snow.

NARR imagery from the Penn State University eWall website

Meteorological Synopsis

Precipitation ended from west to east during the afternoon and evening of February 27. Temperatures remained at or just above freezing during this time. However, temperatures would fall far below freezing over much of the state that night. Lows were in the teens where the heaviest snow occurred in York, Chester, and Cherokee Counties. This caused slush and meltwater to freeze, keeping roads treacherous over much of the state on February 28. Subfreezing temperatures that night led to refreezing of slush and meltwater, causing slippery travel again for the areas which saw heavy snowfall on February 29. On February 29 and March 1, temperatures fell to or below freezing each night, resulting in icy patches on roads to start the following mornings due to refreezing.

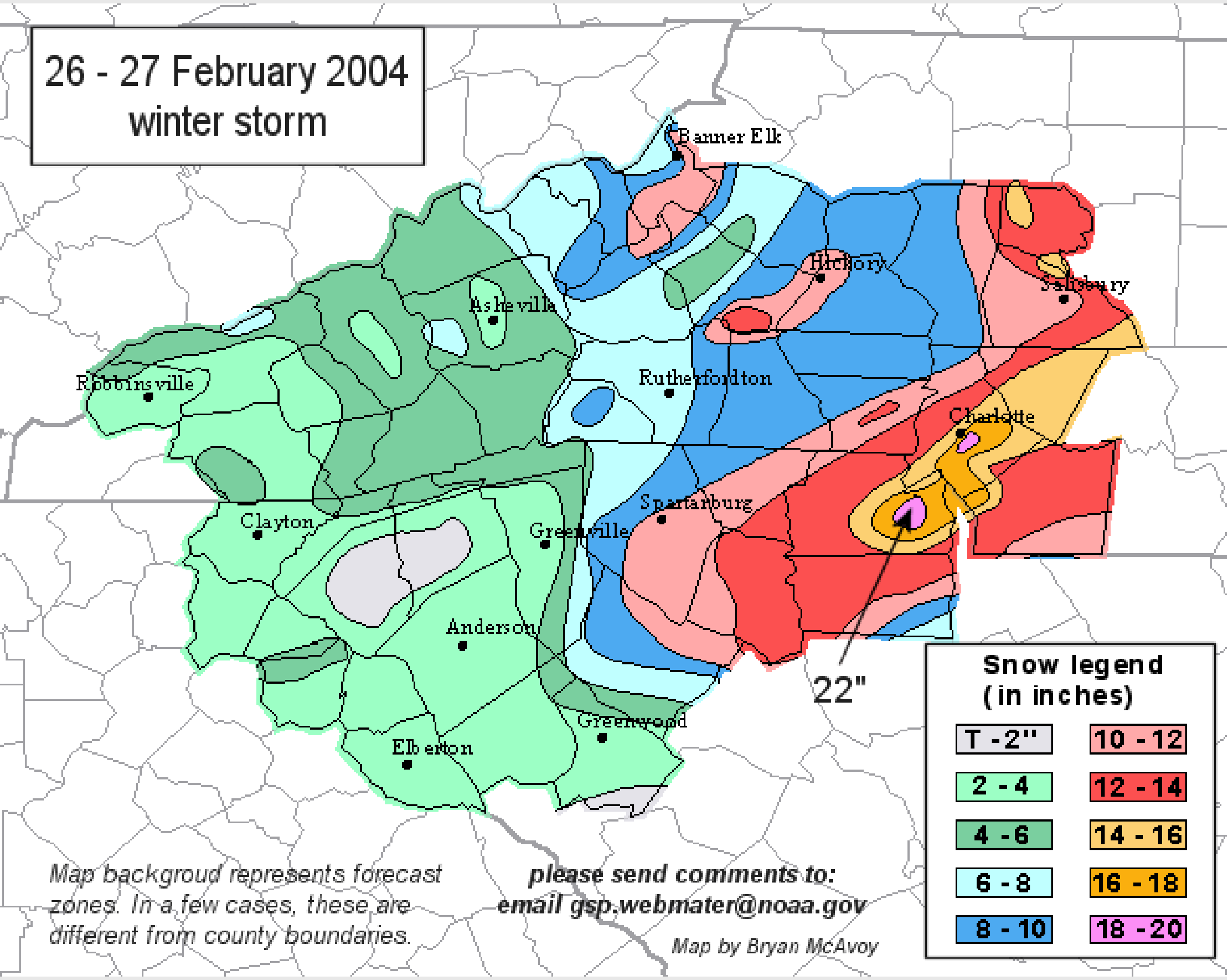


Weather radar from 8:00 a.m. EST on February 27, 2004, showing light precipitation still lingering over a part of the Coastal Plain.

Snowfall Reports from February 24-28, 2004

Station	Snowfall	Station	Snowfall
Winthrop University	17.3	Laurens	4.6
McColl 3 NNW	15.0	Chappells 2 NNW	4.0
Catawba	14.1	Anderson	4.0
Santuck	12.2	Greenville	3.5
Chesterfield 3 E	10.0	Hunts Bridge	3.0
Greenville-Spartanburg Int'l Airport	8.3	West Pelzer	3.0
Ninety-Nine Islands	8.0	Sandy Springs 2 NE	2.5
Gaston Shoals	8.0	Greenwood	1.5
Union 8 S	7.5	Clemson University	1.5
Gaffney 6 E	7.0	Little Mountain	1.3
Caesars Head	5.0	Walhalla	1.0

Meteorological Synopsis



A snow accumulation map created by the Greenville-Spartanburg National Weather Service Office, covering their only their county warning area. The map was drawn from a plot of all the snowfall reports from this storm, from official cooperative observers and other sources. The highest official snowfall reported was 17.3 inches at Winthrop University, but there were numerous reliable reports from sources such as law enforcement of 18-22 inches in eastern York County. The 22-inch reports are only a couple of inches below the state's record 24-hour snowfall of 24 inches, recorded in Rimini on February 10-11, 1973.

A quick return to above-normal temperatures during early March led to rapid melting of lingering snow cover, and, even in York County, the snow had all melted by March 3. Then, on March 4, both Winthrop University and Rock Hill – York County Airport recorded a high temperature of 80°F.

Effects on South Carolina

The storm was well-forecast, giving South Carolina's decision-makers days of lead time to prepare for the storm. While the historic nature of the storm was not foreseen until it was underway, the potential for a major winter storm with wide-ranging impacts over parts of South Carolina was noted in forecast discussions from the National Weather Service as early as February 20.

The event broke a few snowfall records. Rock Hill's official storm total of 17.3 inches (at Winthrop University) was the highest on record for this location and this record still stands as of September 2022. The storm topped other memorable storms in Rock Hill, including the winter storm of January 7, 1988, when 12 inches fell, and February 16, 1902, when 14 inches fell. The 17.3-inch measurement ranks sixth all-time in South Carolina's single-storm snowfall (for events up to three days long), behind snowfall at several locations from the February 9-11, 1973, snowstorm and a three-day snowstorm of 28.9 inches at Caesars Head in mid-February 1969. The reports in the Rock Hill area of 22 inches are unofficial; they would rank in a tie for second on this all-time list if they were verifiable.

The Department of Public Safety reported over 1,400 traffic incidents and four traffic fatalities due to the storm in South Carolina.

The storm caused minor damage, including the collapse of several small aluminum buildings at Rock Hill – York County Airport due to the weight of snowfall on their roofs.

This winter storm resulted in only sporadic power outages in areas affected by the storm, despite the heavy snowfall. At least 1,500 customers in York County were without power for a time during the storm, but no other power outage reports were found.

For additional information:

National Weather Service products issued during the storm and observations from civilian and military airports during the storm can be found at the Iowa State University's Iowa Environmental Mesonet website. Radar imagery from the storm is also available from this website.

South Carolina Winter Weather Database: Winter Storm of January 24-26, 2004. (2021, November 1). The South Carolina Winter Weather Database. *https://scdnr.maps.arcgis.com/apps/opsdashboard/index.html#/617c9914b64f4ef1937e39f2c1c52a40?p1=156&event=156*

Collins, J., Associated Press (2004, February 28). Rock Hill buried under 18 inches of snow. *Herald-Journal (Spartanburg, SC)*, p. A1. Available from NewsBank: America's News – Historical and Current: https://infoweb-newsbank-com.scsl2.idm.oclc.org/apps/news/document-view?p=AMNEWS&docref=news/10429A0B71EAD8AA. (S. C. State Library card required for access, free to all South Carolinians)

(2004, February 28). Heavy Snow Buried Parts of S. C. The State, p. A1, A7. Available from NewsBank: America's News – Historical and Current: https://infoweb-newsbank-com.scsl2.idm.oclc.org/apps/news/document-view?p=AMNEWS&docref=image/v2%3A11210D30DA68B248%40EANX-NB-1657B6C958ABC122%402453064-1657B4E4E297A84B%406. (S. C. State Library card required for access, free to all South Carolinians)

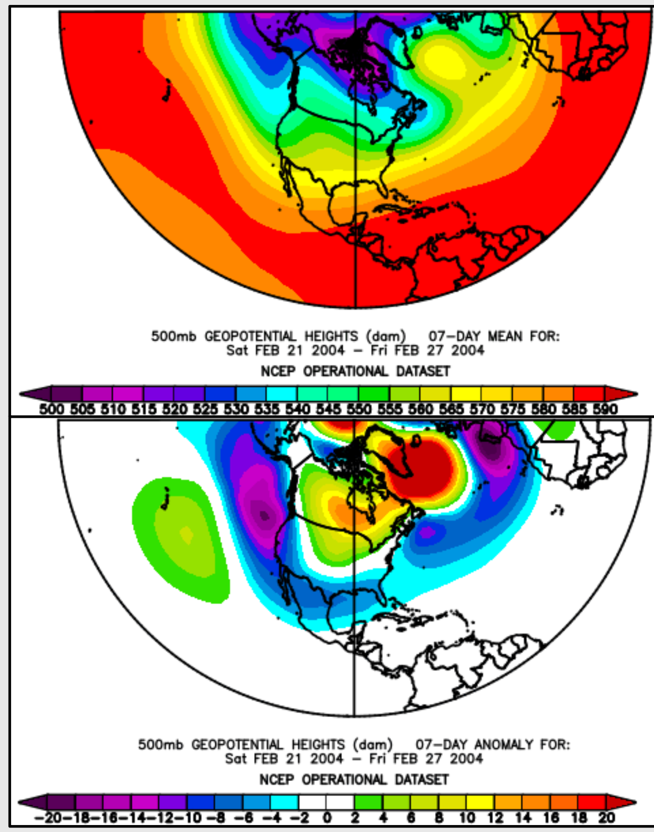
Appendix: Teleconnection States

The Northern Hemisphere's weather pattern and major teleconnection indices were favorable, though not ideal, at the time for a winter storm to occur in South Carolina.

The Arctic Oscillation (AO) was strongly negative at the time, favoring frequent invasions of arctic air into the Northern Hemisphere mid-latitudes. Also, the North Atlantic Oscillation (NAO) was strongly negative at the time, which often causes cold and stormy weather over the eastern part of North America during winter. The Pacific-North American Pattern (PNA) was also in its positive phase, favorable because this results in an upper trough over the southeastern states and an upper ridge over the western states.

The East Pacific Oscillation (EPO) was in an unfavorable positive phase at the time. The West Pacific Oscillation (WPO) was also positive, not favorable for winter weather in South Carolina. A positive EPO results in a trough over Alaska, while the positive phase of the WPO brings an upper-level trough to far eastern Russia and the Aleutian Islands. Both conditions make it less likely for arctic air to travel into eastern North America because they cause the upper-level flow to pass over the northern Pacific Ocean. Their negative phase would force the jet stream closer to the North Pole, which tends to steer arctic air into North America.

500-millibar mean heights (top) and mean height anomaly (bottom) for February 21-27, 2004.



- Positive height anomalies near the North Pole indicate a negative AO.
- Low heights and negative anomalies over and near the Gulf of Alaska indicate a positive EPO and positive WPO.
- An upper ridge over the western United States and positive anomalies over western Canada indicate a positive PNA.
- An upper ridge near Greenland and positive height anomalies in that area, along with negative anomalies directly south, indicate a negative NAO.

At the time, the Madden-Julian Oscillation (MJO) was not active and had no affect on the likelihood of a winter storm in South Carolina.