Southern Rockies to Northeastern U.S. Winter Storm
December 26 – 29, 2015
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Meteorological Overview:

The precursor of this storm can be identified as a shortwave trough situated just off the Pacific Northwest coast on 24 December, 2015 (Fig. 1). The shortwave tracked steadily southeastward during the next couple of days across the western and southwestern U.S. toward a longwave trough axis oriented along the Rockies (Fig. 3). Farther to the south, a subtropical jet can be seen extending from southwest to northeast across northern Mexico toward Texas. As the shortwave dipped further into the Desert Southwest on 26 December, a cut-off low began to form near the U.S.-Mexican border (Fig. 3b). Much of the heavy snow fell in the southern Rockies prior to and during the intensification of this cut-off low (Fig. 2).

Cold air funneling in from the north behind the low was merging with an influx of warm and moist air from northern Mexico. A polar jet then formed around the eastern flank of the cut-off low (Fig. 4a) in response to the tightening thermal gradient. The ascent associated with the polar jet exit region induced two lines of organized thunderstorms within the cold air mass over the southern Plains. The first line swept eastward across northern Texas in the early morning hours of 27 December before merging with a cold front over eastern Texas during the day (Fig. 5a-c). Convection developed deep into the cold air over western Oklahoma where freezing rain with thunder was reported at some locations (Fig. 5c). Meanwhile, a surface low pressure center formed over southern New Mexico and moved across Texas from 26 to 27 December underneath the left exit region of the subtropical jet (Fig. 4b). Although the central pressure of this low deepened only 4 hPa while moving across Texas, surface analyses indicated that the pressure gradient was tightening around the low as cold and dense arctic air surges in from the north (Fig. 5). In response to the arctic air intrusion, northerly winds steadily strengthened over Oklahoma and the Texas Panhandle where wind gusts of 40 to 50 mph were common. Meanwhile, the second line of thunderstorms associated with the polar jet began to form over western Texas (Fig. 5c-f). This line of storms wrapped tightly around the east flank of the upper-level low and rotated cyclonically across northern Texas throughout the day on 27 December (Fig. 5c-f). Some locations in northern Texas reported snow and thunder, as well as sleet and/or freezing rain with the passage of this second line of storms. In the wake of the intensifying surface cyclone, northerly winds continued to be gusty across western Texas and central Oklahoma into the evening on 27 December as light snow with isolated thunderstorms wrapped around the northwestern quadrant of the upper-level low across Texas Panhandle and into northern Texas.

The surface low pressure system reached a minimum central pressure of about 992 hPa at around 12 UTC on 28 December over western Arkansas as the polar jet and the subtropical jet were consolidating over the central Plains (Fig. 4c, d). Meanwhile, sleet and freezing rain were spreading rapidly northward across the Midwest well in advance of the low pressure center. By the evening hours, the surface low began to occlude and weaken as light to moderate snow was advancing across much of the upper Midwest into the central Great Lakes. As the low center moved into the Great Lakes, the main upper-level dynamics and moisture axis shifted farther to the east into New England where snow, sleet and freezing rain persisted throughout the day on 29 December (Fig. 4e, f). With the upper-level support moving away into the Canadian Maritimes, the storm continued to weaken. The associated wintry precipitation in New England

gradually tapered off during the night on 29 December, bringing this winter weather event to an end.

Impacts:

This late December winter storm brought significant snowfall from the southern Rockies eastward into the southern High Plains. Over two feet of snow fell in the mountainous regions of central New Mexico with the highest total of 41 inches reported at Ski Apache. At the height of the storm, much of the eastern half of New Mexico was under blizzard conditions. Winds gusted to as high as 82 mph at Clovis Municipal Airport late Saturday (Dec. 26) with considerable blowing and drifting of the snow. The entire stretch of Interstate 40 from Albuquerque to Amarillo was shut down for nearly 36 hours. Dozens of motorists were stranded in their vehicles in 6- to 10-foot snow drifts. Department of Public Safety assisted a total of 455 motorists. Emergency response personnel were even stranded trying to reach these motorists. Residents were blockaded in their homes with drifts up to the top of their roofs. Power outages were reported in at least 14,200 residences across eastern New Mexico and at least 30,000 residential disruptions during the storm. Numerous trees and power lines were downed together with several structures due to the weight of heavy snow. Department of Agriculture reported around 12,000 adult milking cows perished in the storm and between 30,000 and 50,000 young livestock died. One person died from exposure in Albuquerque and another while shoveling snow in Roswell.

Even though lesser amounts of snow fell farther to the south and east over the southern High Plains, numerous new snowfall records were established. Roswell, New Mexico, set a record one-day snowfall of 12.4 inches on Sunday December 27, with a storm total of 15.6 inches. In Texas, El Paso International Airport picked up 8.1 inches of snow, exceeding that city's average annual snowfall of 5.5 inches. Lubbock had its snowiest December day on record, picking up 11 inches of snow on December 27. Parts of the Midland metropolitan area picked up 7 inches of snow. The storm also delivered up to an inch of freezing rain in Oklahoma, Kansas, Illinois, and Wisconsin, with significant amount of sleet in parts of Oklahoma, Missouri, Iowa, Illinois, Indiana, and Michigan. Trees and power lines were downed at many locations. The highest sleet amount was an impressive 4.8 inches reported in Springville, Iowa.

The storm then headed northeastward and brought additional snowfall across the upper Midwest, the Great Lakes, and northern New England. Some of the highest totals include 14.6 inches in New London, Wisconsin, 12.5 inches in Mapleton, Minnesota, 11.5 inches in Monona, Iowa, and 11.0 inches in Rogers City, Michigan. New England generally received less than 10 inches of snow during the weakening phase of the storm. The highest reported totals were around a foot near Garland and Stetson in central Maine.

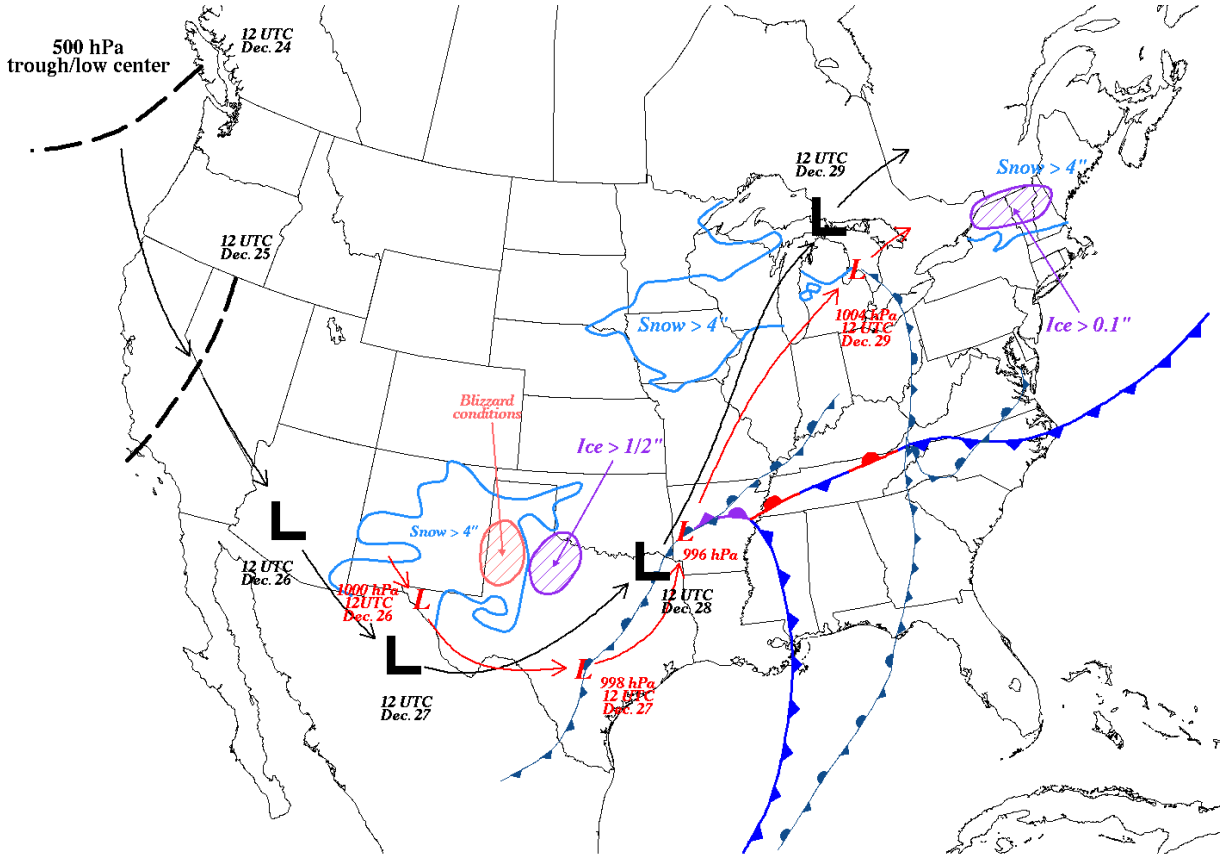

Figure 1. A summary diagram of the event showing the track of the 500 hPa and surface low centers, the 12 UTC surface frontal positions on Dec. 27, 28, and 29, and the approximate areas of snow greater than 4 and 12 inches.

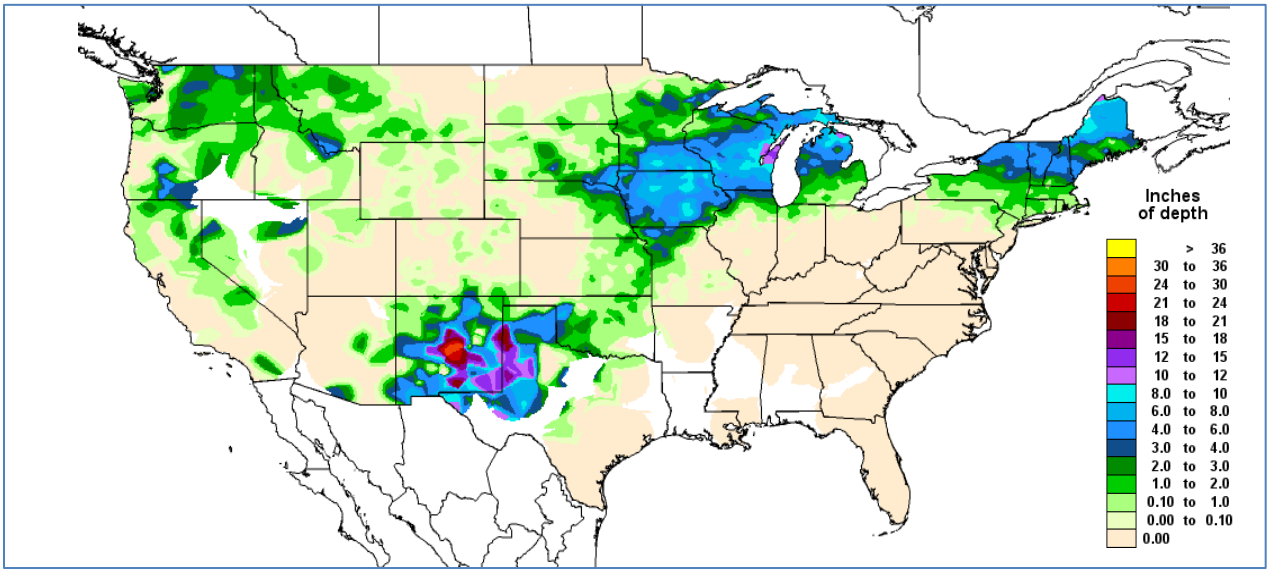

Figure 2. A map of total observed snowfall amounts for the 72 hours ending at 12 UTC December 29, 2015.

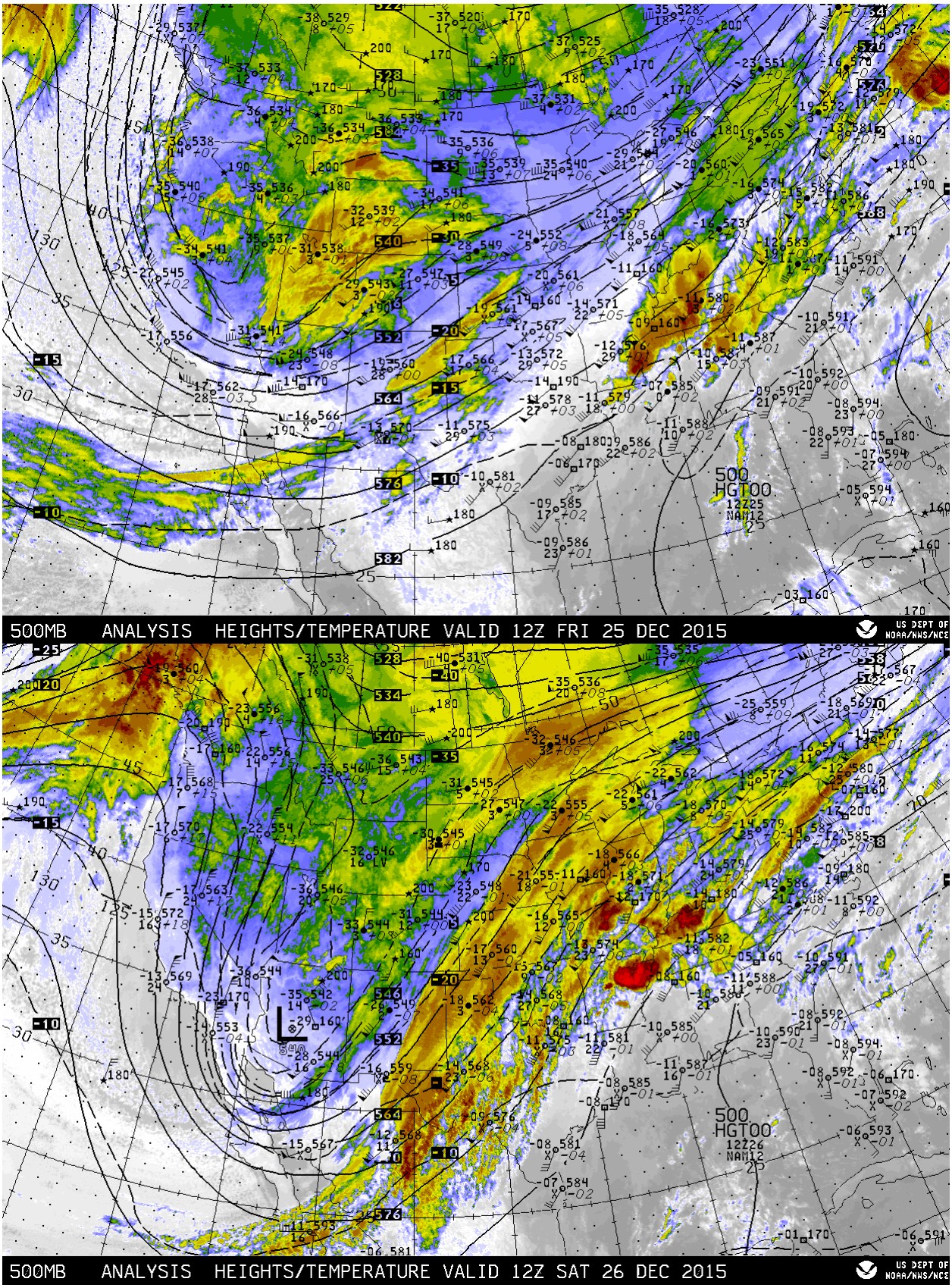

Figure 3. 500hPa analyses overlaid on GOES-East/West infrared composites at 12 UTC on (a) 25 Dec., and (b) 26 Dec., 2015.

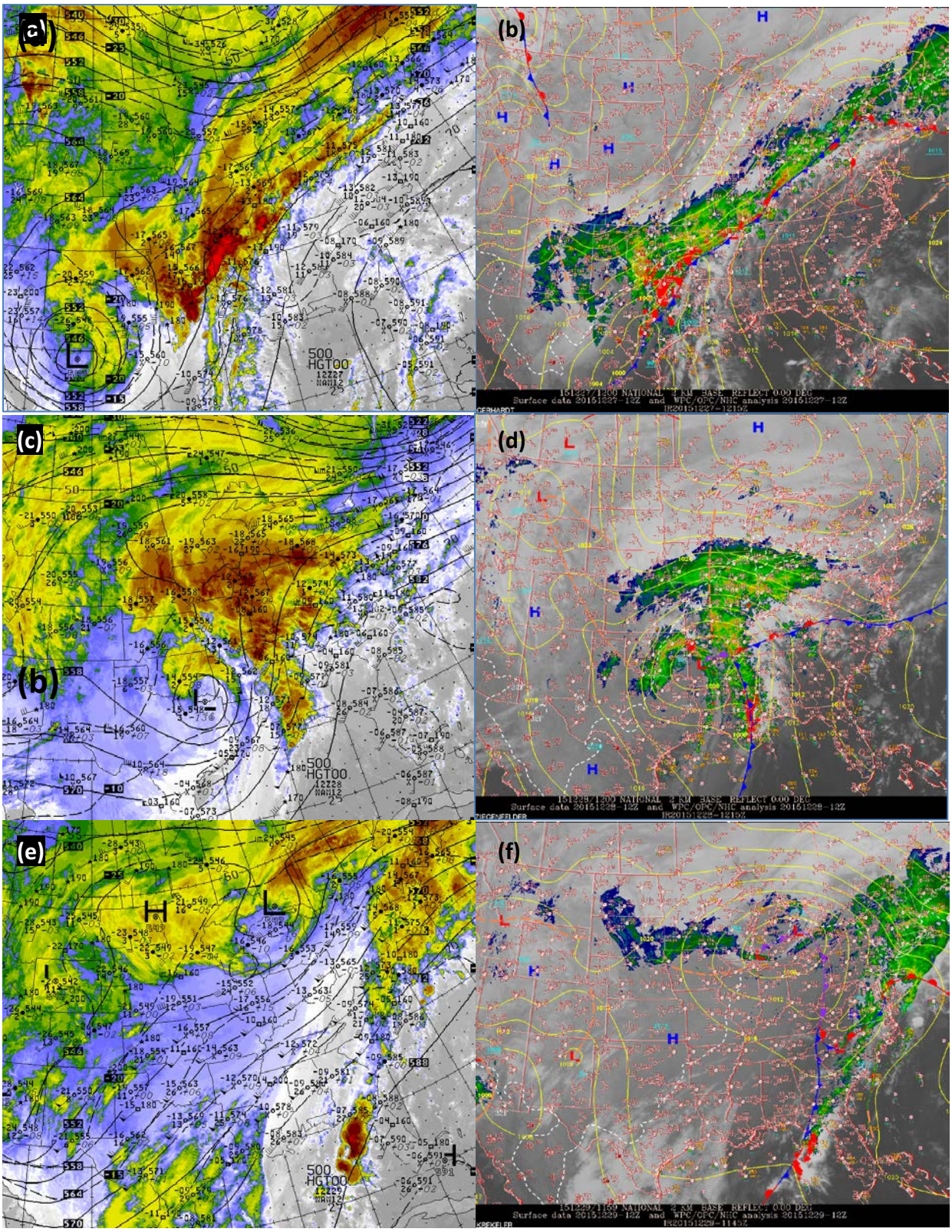

Figure 4. 500hPa analyses overlaid on GOES-East/West infrared image composites (left column) and WPC surface analyses overlaid on GOES-East infrared and radar composites (right column) (a, b) 12 UTC December 27; (c, d) 12 UTC December 28; and (e, f) 12 UTC December 29, 2015. Lightning locations are indicated in red crosses. The 0°C surface isotherms (white dashed lines) are also plotted.

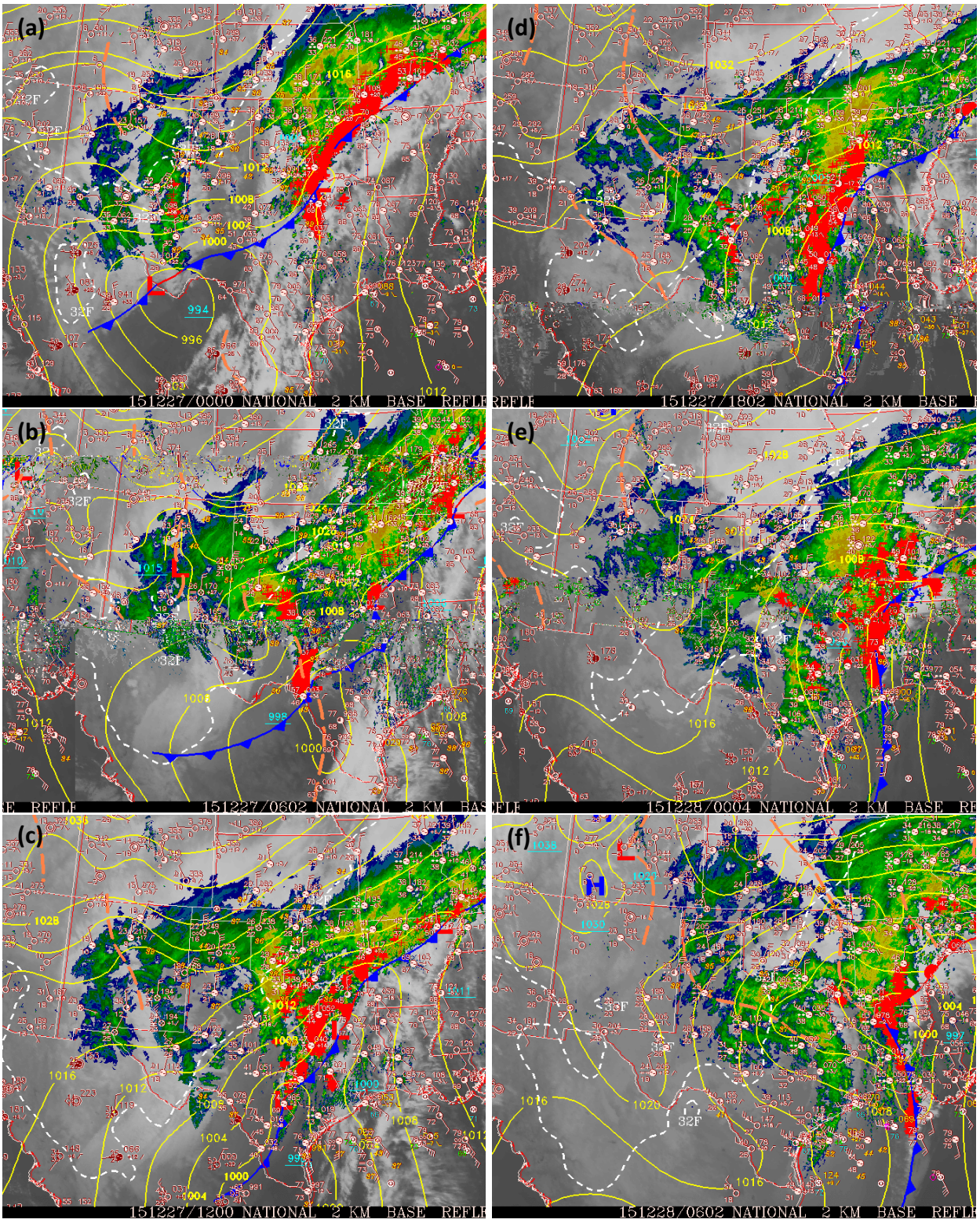

Figure 5. WPC surface analyses overlaid on GOES-East infrared images and radar composites at (a) 00, (b) 06, (c) 12, (d) 18 UTC 27 December, (e) 00, and (f) 06 UTC 28 December, 2015. Lightning locations are indicated with red crosses. The 0°C surface isotherms (white dashed lines) are also plotted.