Oklahoma Event Summary

Oklahoma Ice Storm: December 3, 2002

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As a service to citizens and decision-makers within Oklahoma, the Oklahoma Climatological Survey produces a publication series of Event Summaries. These summaries describe the conditions associated with severe or extreme weather events, impacts of those events, and a comparison to other notable historical occurrences. The summaries are part of the OCS Mission to "conduct and report on studies of climate and weather phenomena of significant socioeconomic importance to the state." Summaries will be produced for any federally declared weather-related disaster in Oklahoma, or for other notable events that may not reach disaster proportions.

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The Ice Storm of December 3, 2002

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On Tuesday, December 3rd, 2002 an ice storm deposited freezing rain across a belt from west-central to northeast Oklahoma. The event was associated with a surface cold front and precipitation-cooled air at the surface. The Oklahoma Mesonet, a statewide network of 115 environmental monitoring stations, observed precipitation accumulations of about 0.75 to 1.75 inches across the ice-impacted area.

While not as severe as two recent major ice storms (in December 2000 and January 2002), the event left millions of dollars in damages, primarily to electric utility infrastructure. The Federal Emergency Management Agency (FEMA) allocated disaster relief funds to "help local governments in 14 counties recover" from the ice storm (Fig. 1).

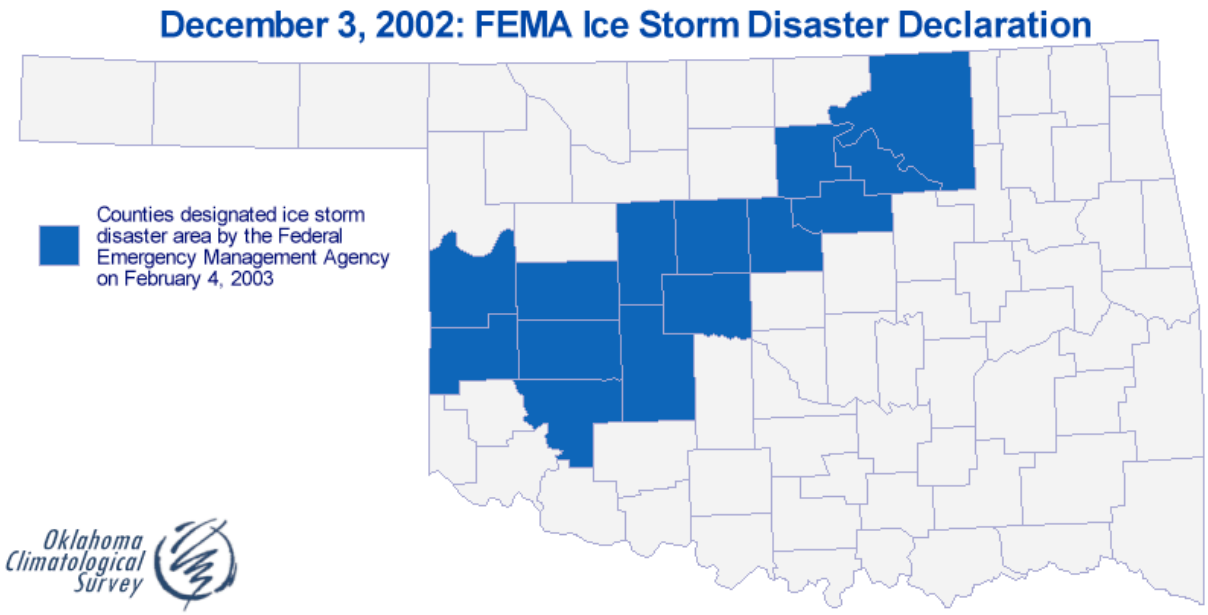

Fig. 1. Counties included in the FEMA Disaster Area 1452, as defined by the Federal Emergency Management Agency.

Evolution of the Event

Freezing rain events occur when liquid precipitation freezes on contact with a sub-freezing surface (trees, power lines, roads, etc.). The icing event of December 3, 2002 occurred north of a cold front that had pushed through Oklahoma and into north Texas on the previous night.

On the morning of December 3rd, the atmospheric sounding at Norman indicated a substantial layer of above-freezing temperatures near the surface (Fig. 2). This layer extended from the surface to about 9,000 ft above ground level. Notably, much of this layer was not saturated, which would allow for evaporative cooling as precipitation fell through the layer. Throughout the early morning, surface temperatures remained in the mid-30s to mid-40s across most of the state. Relative humidities of approximately 70 percent were commonplace at the surface throughout the state.

Shortly before 6:00 am, light rain began in west-central Oklahoma. As the precipitation fell into the unsaturated air, evaporative cooling dropped surface temperatures to near freezing.

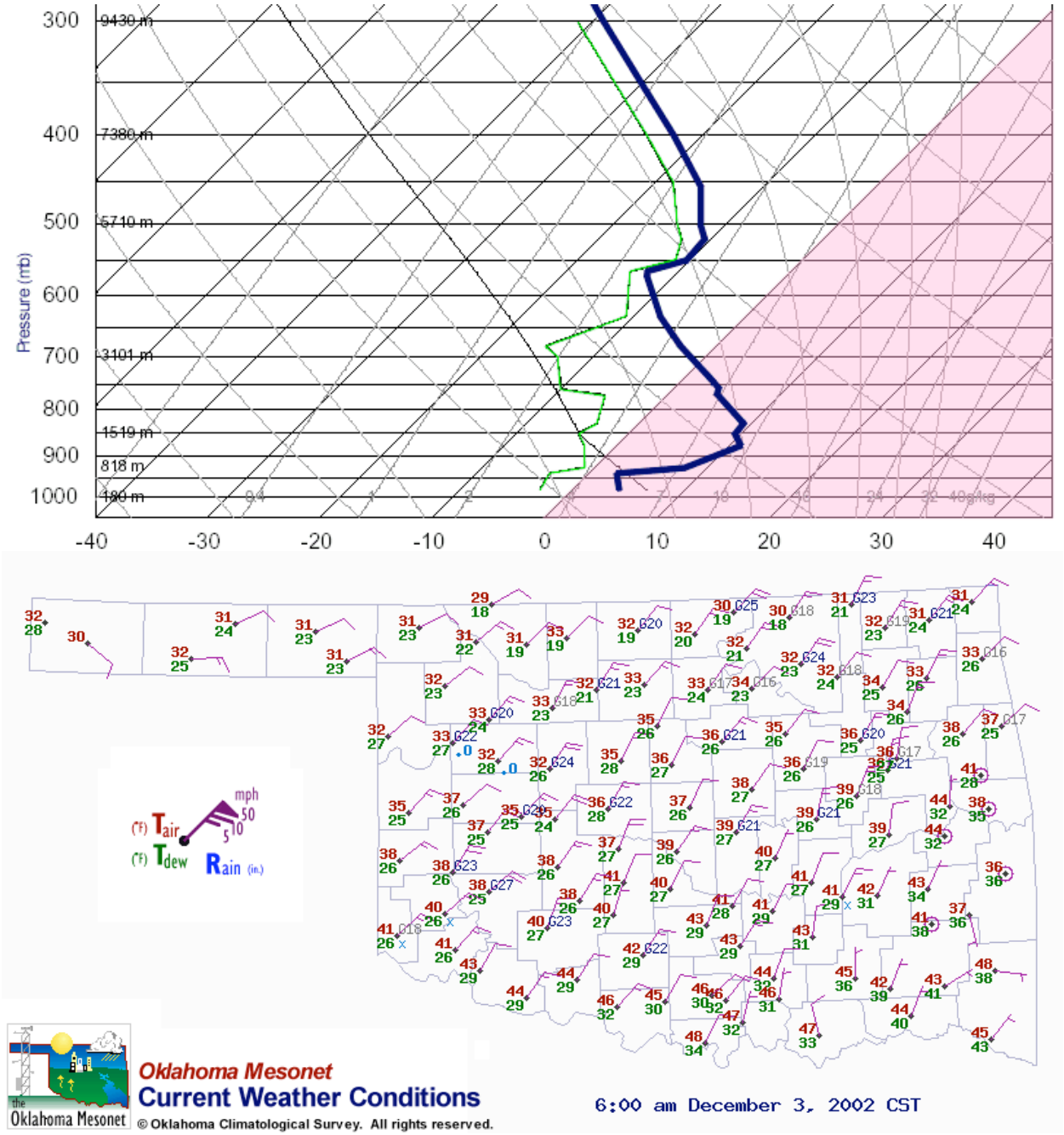

Fig. 2. (top) Vertical profile of atmospheric temperature (thick blue line) and dewpoint temperature (thin green line) above Norman, OK (OUN) at 6:00 am CST December 3, 2002. The pink area represents temperatures greater than freezing. (bottom) Surface conditions as observed by the Oklahoma Mesonet at 6:00 am CST December 3, 2002. Air temperature and dewpoint temperature, in degrees Fahrenheit, are given in red and green. Purple wind barbs indicate speed and direction. Measurable liquid precipitation, if any, is indicated in blue.

During the day, the light rainfall spread to the east. By noon, the effect of evaporative cooling had reduced surface temperatures in much of west-central and central Oklahoma to freezing or below freezing (Fig. 3). Several Mesonet stations indicated freezing rain in a peculiar way: their recorded wind speed slowly decreased to zero as their prop-vanes glazed over with ice. The light rainfall and associated evaporative cooling had spread to much of north-central and northeast Oklahoma, and many Mesonet stations indicated below freezing temperatures and frozen wind monitors by early afternoon.

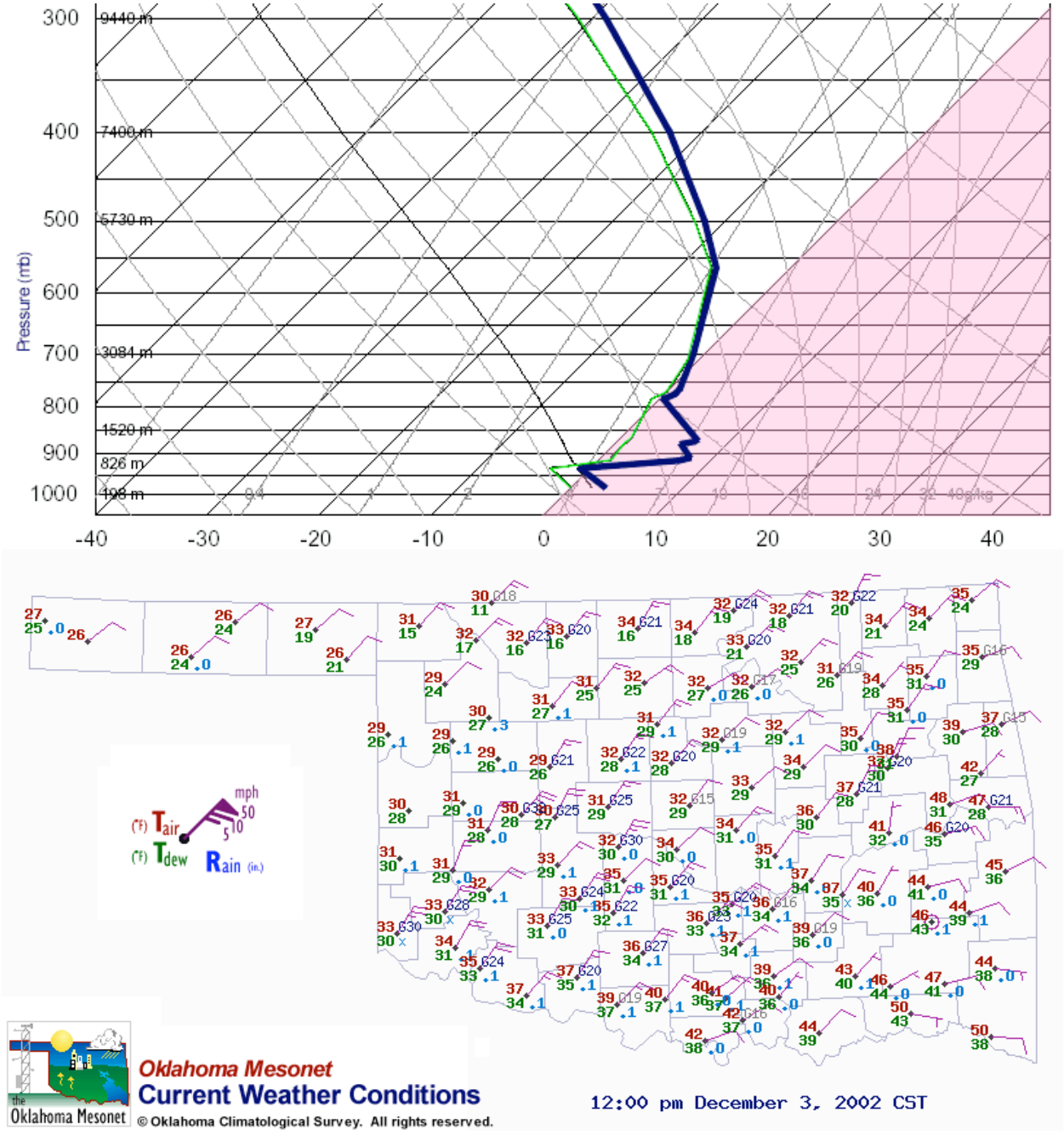

Fig. 3. As in Figure 2, but for 12:00 noon CST December 3, 2002. Missing wind barbs indicate stations whose wind monitors have iced over.

Rainfall rates increased during the afternoon, especially in central and eastern Oklahoma. By sunset, 40 of the Mesonet's 115 stations indicated ice-glazed instrumentation. The stations were oriented in a swath approximately 70 miles wide from roughly Cheyenne to Vinita (Fig. 4). Oklahoma Mesonet gauges are not heated, and do not observe frozen precipitation. Therefore, while several rain gauges in the swath indicated a half-inch or so of precipitation, the bulk of the frozen precipitation had not yet been recorded, and would not be recorded until melting several days later.

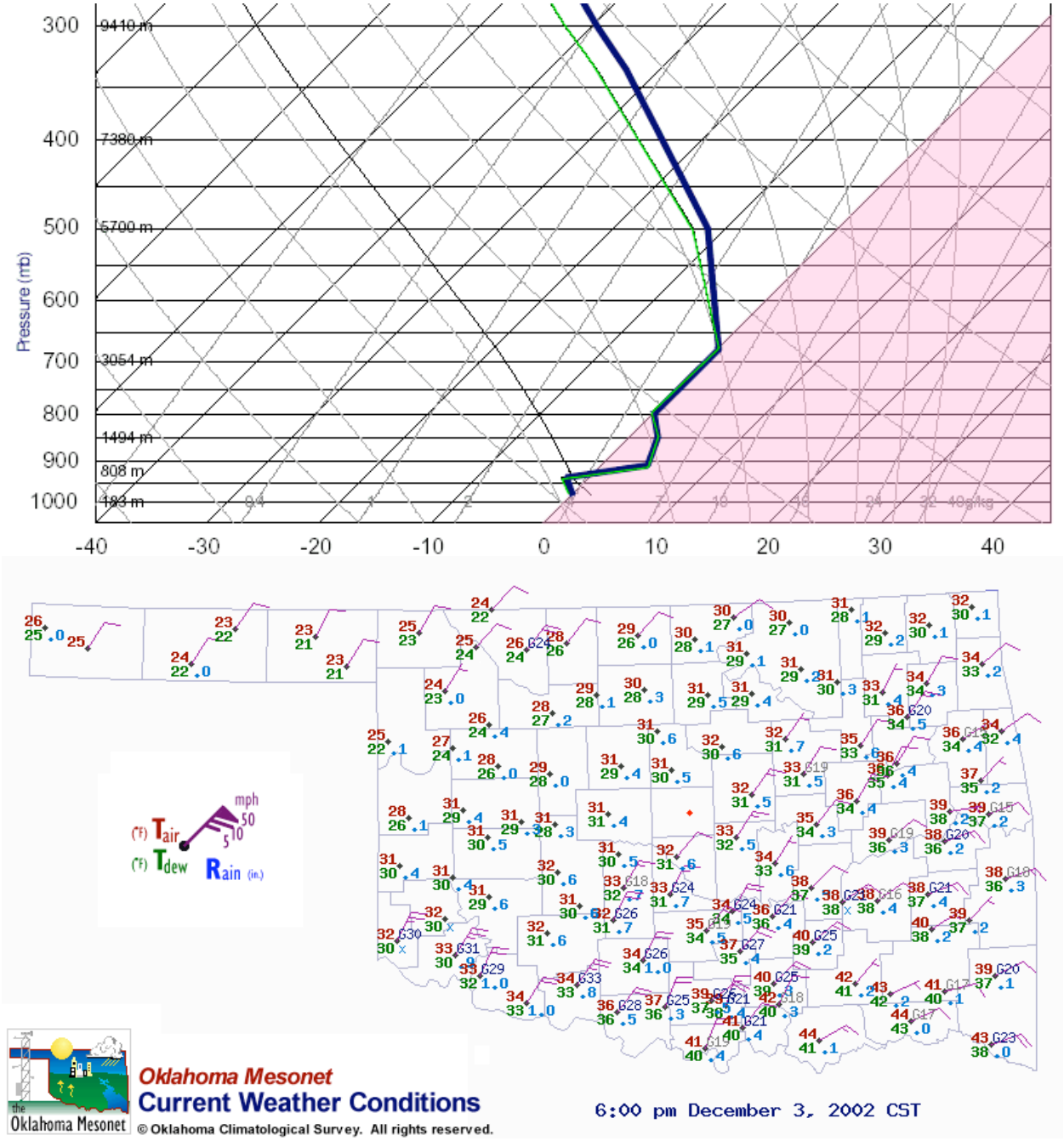

Fig. 4. As in Figure 1, but for 6:00 pm CST December 3, 2002. Missing wind barbs indicate stations whose wind monitors have iced over.

The area of significant icing, based on Mesonet data and reports, is shown as Figure 5. Areas north of the icing region generally received 2-6 inches of snow, with some areas reporting more than eight inches. Moderate to heavy rainfall occurred to the south.

After several days, the ice that had frozen in the Mesonet's rain gauges melted, allowing an estimate, in sub-county detail, of the amount of freezing precipitation. Amounts ranged from about three-quarters of an inch to nearly two inches within the area of significant icing (Fig. 6).

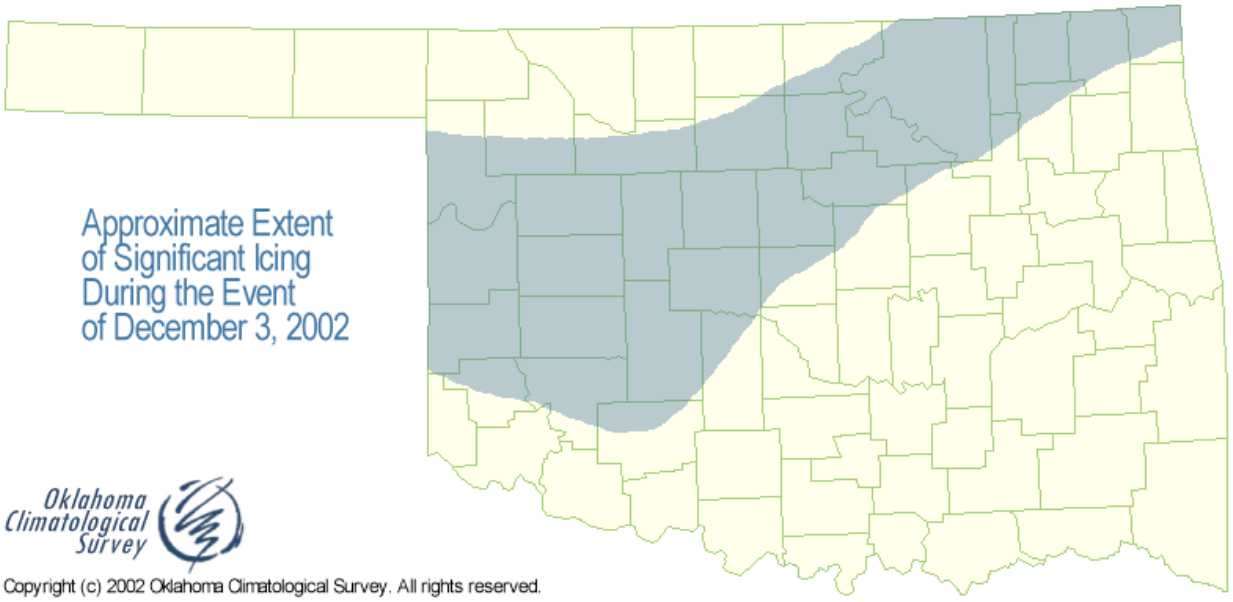

Fig. 5. Approximate extent of significant icing during the event of December 3, 2002, based on reports and evidence from frozen Oklahoma Mesonet wind sensors.

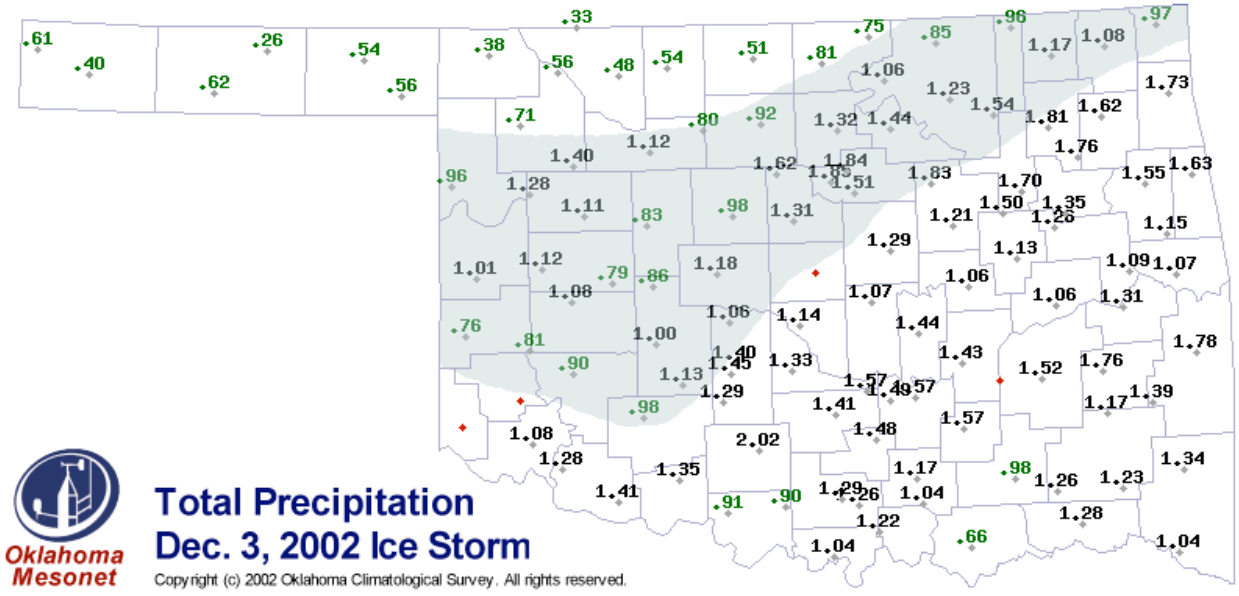

Fig. 6. Storm-total precipitation, as observed by the Oklahoma Mesonet, for the event of December 3, 2002. The approximate extent of significant icing is reproduced as the shaded area.

Impacts

Travel

Because ground temperatures remained in the 40s across the ice-impacted area, roadways remained relatively ice-free, except for untreated bridges and overpasses. Several traffic accidents with injuries were attributed to the inclement weather or subsequent re-freezing of melted precipitation, but no deaths were reported.

Electrical Service Interruption

The main impact of the ice storm of December 3, 2002 was damage to electrical distribution systems. For the electric utility industry, an ice storm strikes in two waves: first from the initial ice accumulation and wind stress; then later from stresses caused by the rapid recoil of power lines when accumulated ice melts and falls.

Because much of the area impacted by the storm is rural, the primary victims of the storms were owner-members of rural electric cooperatives (RECs). About 30,000 REC customers were without power for some time during the storm. According to the Oklahoma Association of Electric Cooperatives, REC losses were about $4.5 million. Eight of the state's 32 generation or distribution coops were impacted significantly by the event.

Much of the damage required replacement or repair of distribution lines and crossarms, rather than poles. Because precipitation totals were generally modest and winds were moderate, pole losses were small (RECs lost about 150 poles compared to over 40,000 in the January 2002 storm). Larger transmission lines suffered only minor damage.

Other power suppliers were impacted also. At the storm's peak, about 25,000 Oklahoma Gas & Electric (OG&E) customers lost power. Most of the offline OG&E customers were in suburban Oklahoma City. A total of about 4,500 AEP Public Service of Oklahoma customers were knocked offline, primarily in municipalities in west-central Oklahoma.

The utilities were able to restore power quickly. Surface roads remained adequately navigable, allowing ready access to downed lines, and allowing support crews from other areas to arrive on short notice. Because pole losses were small, work progressed relatively quickly. Most affected customers were without power for a few hours or less. Some REC customers in remote locations were offline for a few days.

Tree Damage

The footprint of the December 3, 2002 storm was very similar to that of a much more severe storm in January 2002. Because most of the trees in the area had only begun to recover from the January storm, noticeable tree damage from the December storm was light to moderate. Significant tree damage occurred on the southern edge of the ice storm's path, some of which was spared during the January 2002 event.

Historical Perspective

Recent Episodes

The ice storm of December 2002 was the third, and least severe, of three major icing events to occur in Oklahoma within a 24-month period.

In December 2000, a major event struck much of the southeastern two-thirds of Oklahoma. Ice accumulations exceeding three inches (and in some places, five inches) brought severe consequences to the southeastern half of Oklahoma and catastrophic damage to much of southwestern and central Arkansas. An estimated 170,000 homes and businesses in Oklahoma were without power, some for several weeks. Sub-freezing ground temperatures fostered freezing on roads and highways, leading to many auto accidents early in the storm's visit. The storm and its aftermath claimed 26 lives in the state and caused over $200 million in damages. Electric utilities and forestry were especially hard hit. In all, 67 of Oklahoma's 77 counties were declared disaster areas.

January 2002 brought heavy icing to much of west-central to northeast Oklahoma, in a damage swath roughly similar to that of the December 2002 event. However, accumulations exceeded three inches in several locations in north-central and northeast Oklahoma. Damages totaled $100 million within the state. 255,000 electric customers were left without power, 39,000 of those for more than a week. Some customers were left without power for more than five weeks. The Oklahoma Association of Electric Cooperatives lost an estimated 40,000 poles to the event, a testament to locally heavy icing and high winds. Ground temperatures in the mid-40s prevented significant icing on roadways, and auto traffic was relatively unhampered, except for icing of bridges and overpasses.

Other Notable Events

In December 1987, a large snow and ice storm caused more than $10 million in damages across the northwestern two-thirds of the state. About 114,00 customers were left without power and tree damage was severe. All flights to and from Will Rogers World Airport in Oklahoma City were cancelled, and several large broadcast antennas collapsed.

An ice storm that struck eastern Oklahoma in December 1937, damaged trees, shrubs, and electric, telephone and telegraph wires. Damages exceeded $250,000, equivalent to about $3.1 million today.

For More Information

Web sites, current as of February 2003, are subject to change.

The **Oklahoma Climatological Survey** (OCS) operates and archives data from the Oklahoma Mesonet, which allows detailed weather information from 115+ stations across the state. For more information about the weather event of December 3, 2002, or for related data, contact OCS at: 100 East Boyd, Suite 1210, Norman, OK 73019-1012, or via the world wide web at http://www.ocs.ou.edu/.

The **National Climatic Data Center** (NCDC) publishes *Storm Data and Unusual Weather Phenomena*. Final summaries of qualifying events are usually available after 6-8 months. OCS maintains an archive of the publication, or one can contact NCDC at 151 Patton Avenue, Asheville, NC 28801-5001, or via the world wide web at: http://www.ncdc.noaa.gov/.

The **Federal Emergency Management Agency** (FEMA) evaluates the need for federal relief due to certain weather-related and other disasters. The December 3, 2002 ice storm event is addressed as FEMA Disaster Number 1452. FEMA can be contacted at 500 C Street, Washington, DC 20472 or via the world wide web at http://www.fema.gov/.