SCIPP RESEARCH BRIEF:
AN ASSESSMENT OF THE EXTREMES AND IMPACTS OF THE FEBRUARY 2021 SOUTH-CENTRAL U.S. ARCTIC OUTBREAK, AND HOW CLIMATE SERVICES CAN HELP

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PROBLEM:

In early 2021, the South Central United States faced a period of extreme cold and two major winter storms, later being dubbed the Valentine's Week Winter Outbreak. **What were the causes of this event, later to be dubbed the Valentine's Week Winter Outbreak, and what were its impacts on affected communities?**

OUTCOMES:

- 5923 daily, 577 monthly, and 141 all time temperature records were set during the event.
- Precipitation related watches, warnings, and advisories most frequent in western Texas and from eastern Kentucky to western Tennessee into Mississippi.
- Cold related watches, warnings and advisories most frequent along Gulf Coast.
- Total snowfall accumulation for February 10th-19th mostly stayed between 5-25 cm, but some areas saw snowfall maximums greater than 25 cm.
- Duration of freezing precipitation was above average, but not record breaking and greater than 90% of observations were less than 2.5 mm/h.

EFFECTS:

The meteorological extremes that occurred did have precedent in the historical record, but the lack of preparedness for a storm of this scale was visible in the associated impacts. Failure to integrate climate services into planning left communities at risk for disaster. During event, nearly 5 million electric customers in Texas, Louisiana, and Oklahoma were without power, with 4.5 million outages in Texas alone. Texas also suffered most of the casualties, with the Texas Department of State Health Services reporting 246 storm-related deaths. However, this report's accuracy is questioned and a study using excess death numbers from the Center for Disease Control estimates the Texas death toll to be closer to 700 (with an uncertainty range of 426-798). Water pressure loss from burst pipes and water main breaks caused boil water notices and advisories, some remaining in effect for over a month. Overall, hazard mitigation efforts should be implemented based on advances in climatological data and climate services should be employed into state and local planning to prevent a similar disaster in the future.

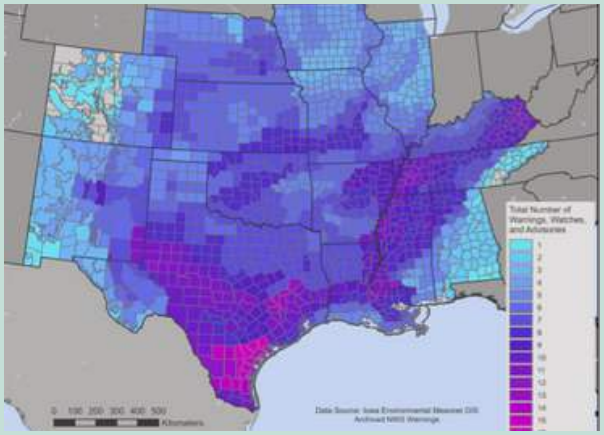

Fig. 7. Total number of winter weather related warnings, watches, or advisories from 00 UTC 10 February to 23:59 UTC 19 February including blizzard, freeze, freezing fog, hard freeze, ice storm, wind chill, winter storm, and winter weather (Bolinger et al., 2022).

SERIES OF EVENTS:

Sudden stratospheric warming in the Arctic

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Negative anomalies in Arctic Oscillation

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Stratospheric polar vortex deteriorated and reversed

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Polar jet stream dislodges and displaced equatorward

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Stratospheric vortex stretched south

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Cold polar air and surface high-pressure system strengthened over Canada

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Initial cold front brought polar air into Unites States

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The Valentine's Week Winter Outbreak bringing extreme temperatures along with Winter Storms Uri and Viola to the South-Central US

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GLOSSARY

Sudden stratospheric warming: Warming of upper stratosphere in Northern Hemisphere in response to disruption of normal circulation by planetary waves.
Arctic Oscillation: The Arctic Oscillation is a pattern in which atmospheric pressure at polar and middle latitudes fluctuates between negative and positive phases.
Stratospheric Polar Vortex: Strong, thermally driven wind system in the Northern Hemisphere's stratosphere during the winter. Disruption impacts polar jet stream.
Polar Jet Stream: Flow of winds in troposphere that separates polar air from the warmer mid-latitude air. A stronger jet stream better contains the cold air.
**All definitions from publication or National Weather Service Glossary*

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