ECHOES

"I don't know if I can take another flood."

—Debbie Halcomb, Winfield, Illinois, resident, on hoping for a government buyout after this year's severe flooding in the Midwest. After the Great Flood of 1993, thousands of properties were bought out by the government. Residents that qualify can sell their property with 75% of the costs paid by FEMA. FEMA says that the buyouts not only save money but break the cycle of disaster and rebuilding. Buyouts are being considered in Missouri, Iowa, Wisconsin, Indiana, and Illinois. (Source: The Associated Press)

tions. The solar plasma particles arrive later; the first high-energy particles erupt from the sun just minutes behind the radiation but usually take a few hours to half a day or so to arrive at the Earth. These energetic particle events can last for two or three days at elevated levels before receding gradually like flood waters. Gehred noted that space travelers are at great risk during large solar proton events. Spacecraft hardware also sustain damage in proton baths such as this. For example, solar panels lose efficiency and operators generally react by retracting the panels to avoid damage if given enough lead time by the forecast.

Lower energy particle streams (composed of both protons and electrons) may arrive at the Earth about two to four days after a solar flare. These particles cause geomagnetic and ionospheric storms that can last from hours to several days. Typical problems include spacecraft electrical charging, drag on low-orbiting satellites, radar interference, spacetrack errors, and radio wave propagation anomalies. Gehred said that these impacts are most frequently experienced in the nightside sector of the Earth.

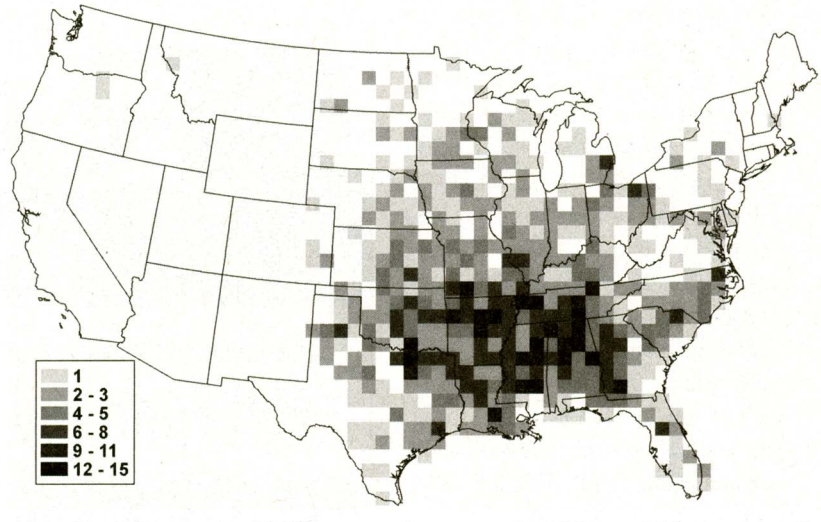
Gehred explained that solar events tend to energize the polar auroral electric fields, often causing the auroral zone to increase southward and trigger the "Northern Lights" and "Southern Lights." One costly impact is when direct current from the auroral electric field is induced into long transformer wires and begins to disrupt the AC-DC power grids. Gehred mentioned that in March of 1989 in Montreal, Canada, transformers actually melted down in a famous solar event. This type of impact can be financially catastrophic if allowed to cascade through electrical transmission equipment.

—Paul A. Gehred
Wright Memorial chapter

PAPERS OF NOTE

Vulnerability Due to Nocturnal Tornadoes

Nocturnal tornado events enhance human vulnerability and reduce the success of mitigation activities for several reasons. First, tornadoes are difficult to visually identify at night by both the public and trained spotters and, even if a warning is provided, the public is less likely to receive that warning at night because of typical sleeping patterns. In addition, the public has a tendency to be in more vulnerable housing and building structures during the night in comparison to safer locations during the day. Furthermore, tornado siren systems are less effective for mitigating nocturnal



Number of nocturnal killer tornado events in 80 km x 80 km grid cells from 1880–2007. Note the highest concentration is in the South, which contains the lower Arkansas, lower and mid-Mississippi, and Tennessee River valleys. This area also has the highest percentage of nocturnal tornadoes when compared to other regions of the United States. (Ashley, Krmenec, and Schwantes)

events when people have a greater tendency to be indoors. Our research emphasizes a potential break in the tornado warning dissemination system utilized currently in the United States.

To investigate the human vulnerability to nocturnal tornadoes, we measured fatality rates caused by tornadoes that occurred between sunset and sunrise from 1880 to 2007. Results showed that the nocturnal tornado death rate over the past century has not shared the same pace of decline as those events transpiring during the daytime. From 1950 to 2005, a mere 27.3% of reported tornadoes were nocturnal, yet 39.3% of tornado fatalities and 42.1% of killer tornado events occurred at night. Quantifying the danger reveals that tornadoes during the overnight period (local midnight to sunrise) are two-and-a-half times as likely to kill as those occurring during the daytime hours.

An analysis of the most recent 30 years of the 128-year period of record indicates that despite the rapid growth in our tornado knowledge and detection technologies, the decreasing annual fatality toll may have bottomed out and is likely increasing. We argue that a core reason why the national tornado fatality toll has not continued to decrease in the past few decades is a result of the vulnerability to these nocturnal events. This vulnerability to nocturnal tornadoes is magnified by other factors such as escalating mobile home stock and an increasing and spreading population.

Spatial analyses reveal that nocturnal tornado vulnerability is not distributed uniformly across the United States. Instead, the South is at much greater risk for nocturnal events, which, when combined with other factors such as high mobile home stock and greater rural population density, enhances vulnerability and leads to the elevated fatality totals found in this region. Conversely, tornadoes in the Midwest and "Tornado Alley" have a greater propensity to occur during the warm season when daylight is at a maximum. These areas tend to have more events occurring during the daytime in comparison to the South, which allows for more successful warning activities used to mitigate events in these regions—as illustrated by fewer fatalities despite higher risk.

Our analysis supplies a single piece to the complex puzzle required to successfully unmask and mitigate human vulnerability to tornadoes. Beyond further inves-

MONSOON CONFUSION

Meteorologists have been at odds for some time over what to call the outbreak of thunderstorms during the summer in the American Southwest. Some of the names used: summer thunderstorm season, Mexican monsoon, Southwest monsoon, and Arizona monsoon. To add to the confusion, the word "monsoon" is derived from the Arabic word "mausim," which means season; to climatological purists "monsoon season" is technically redundant. "The one thing that has been consistent is the lack of uniformity of the monsoon hazards," says Tony Haffer, a meteorologist at the NWS in Phoenix. Weather experts debated initially if the severe rain and damaging winds that strike Arizona and New Mexico each summer constitutes a true monsoon. But in 2004 it was officially declared a monsoon and is now called the North American monsoon. This year, official start and end dates to the season—15 June to 30 September —were established. (Source: LiveScience)