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"SEVERE WINTER WEATHER"

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Mr. Chairman and Members of the Committee, I am Dr. Louis W. Uccellini, Director of the National Centers for Environmental Prediction, in the National Weather Service (NWS), at the National Oceanic and Atmospheric Administration (NOAA), in the Department of Commerce. Thank you for inviting me here today to discuss the role of the National Weather Service in forecasting and warning for winter storms.

A major winter storm can last for several days and be accompanied by freezing rain (ice) or sleet, heavy snowfall, and high winds that combine with cold temperatures to produce dangerous wind chills. The severity of a winter storm can range from a storm that produces snow or freezing rain over a few hours to blizzard conditions lasting several days. Extreme cold, accumulating or blowing snow, strong winds, and coastal flooding can cause long-term hazardous conditions. Winter storms can threaten lives, disrupt transportation systems and have a significant impact the national economy. A single winter storm can cause major damage and billions of dollars in economic losses.

The impacts of heavy snow and high winds in the Northeast United States have been documented by the earliest settlers dating to the 17th century. Legendary events, such as the "great snow" of 1717, the Washington-Jefferson Snowstorm of 1772, the blizzards of 1888 and 1899, the 1922 Knickerbocker storm, and the great New England snowstorm of 1978 are recalled for generations by those who lived through these events or learned about them through local lore. Just last month an East Coast storm impacting regions from Alabama through Maine set an all time snowfall record in New York City. Over time, we may see this February storm included in this list of major U.S. winter storms.

Winter storms also pose enormous challenges to the meteorological research and operational communities who have attempted to understand and predict them, often with mixed results.

Heavy snow causes concerns larger in scope than mere discomfort and inconvenience of shoveling the driveway or walks. The impact to the airline and shipping industries can be devastating. The Nation's complex infrastructure of highways, city streets, and local roads present a challenge to the Department of Transportation, state agencies, and municipal governments, when hazardous winter weather conditions threaten our ability to maintain safe transit conditions for the public and the flow of commerce. Most people are unaware of the significant efforts, in terms of both planning and expense, by local and state agencies to remove snow and ice from our roadways.

While severe winter weather can be debilitating and pose a serious threat to safety anywhere in our Nation, winter storms can have a particularly devastating impact to the economy in heavily populated and highly industrialized areas. The Northeast region from Virginia to Maine is such an area, and includes the densely populated metropolitan centers of Washington, Baltimore, Philadelphia, New York, and Boston. This region is home to nearly 50 million people. In the Northeast, heavy snowfall associated with intense coastal storms, often called nor'easters, may strand millions of people at home, at work or in transit; severely disrupt human services and commerce; and endanger the lives of those who venture outdoors. Snowstorms have their greatest impact on transportation, being especially disruptive to automotive travel, trucking, and aviation.

The aviation industry can be significantly affected by snowstorms causing widespread delays, airport closings and occasionally contributing to serious airline accidents. For example, the snowstorm of 7-8 January 1996 crippled air transportation on the East Coast (New York, Washington, Boston, Philadelphia), causing an estimated $50-$100 million in losses to the airlines industry. During the 12 February 2006 snowstorm, airlines cancelled 2500 flights in the New York City area alone.

East Coast snowstorms can also have a long-term impact on the Nation's economy. Examples include the snowstorms of March 1993 and January 1996, which caused economic losses in the billions of dollars. In both of these instances, state and local resources were unable to keep pace with the enormous expenses incurred during each storm, and the President responded with numerous disaster declarations, allowing federal funds to be used in disaster relief. The Department of Commerce measured a downturn in the economy following the March 1993 Super Storm. Studies based on economic indicators that are heavily weighted by employment statistics have also suggested that a major snowstorm in heavily populated areas, such as the Northeast, significantly influences the regional and the national economies, since a major storm temporarily puts millions of people out of work. Retail sales and housing activity are affected by heavy snows and severe cold. Reports have suggested that the Nation's economic strength was significantly weakened following the major snowstorms in February 1978, March 1992, and January and February 1994. During the harsh winter of 1977-78, the economy slowed from a 9% growth rate at the beginning of the winter season to only 1% during the winter itself. Once severe weather conditions eased, the economy rebounded significantly.

Winter storms in the Central states can be equally devastating to the local economy and threaten life and safety. Heavy snow, strong winds and cold temperatures have shut down our interstate highway system, at times stranding hundreds of travelers and having a detrimental impact on our trucking industry.

Winter storms along the West Coast provide a mixed blessing. While snow, ice and subfreezing temperatures are not as common in the major West Coast cities as in East or Central U.S. cities, impacts from winter storms can be just as devastating as in the East. Strong storms bring very heavy rains to coastal areas causing major flooding, flash floods, and mud, or debris, slides. Pacific Northwest storms which undergo "explosive cyclogenesis," or very rapid intensification, can strike quickly bringing hurricane-force winds into the region. These storms frequently knock down power lines causing widespread power outages. The NWS works closely with our partners in the U.S. Geological Survey (USGS) and will issue a debris slide warning for vulnerable areas at the request of the USGS, when conditions warrant.

While the impact from winter storms can be devastating, these storms also provide the lifeline for residents in the West. They bring heavy snow to the mountains to form the winter "snowpack," which provides essential springtime and summer water as the snow melts in the mountains and feeds into the streams and rivers, providing water to farmers and the public. When too few winter storms occur in the West, the region can be faced with severe water resource challenges, particularly in the dry summer months.

Some of the harshest winter weather conditions imaginable effect Alaska, including heavy snow, biting winds, and extreme cold. Eastern Pacific Ocean waters south of Alaska experience some of the most ferocious winter storms. Strong winds, waves of thirty feet or more, and subfreezing temperatures, combine to make this region very dangerous to shipping and fishing industries. Waves from intense storms crossing the Bering Sea produce coastal flooding and can drive large chunks of sea ice inland, destroying buildings near the shore. Blizzards occur across Alaska's Arctic coast, some causing extreme wind chill temperatures reaching as low as -90°F. Extreme cold and ice fog may last a week at a time. Heavy snow can impact the interior part of the state and is common along the southern coast. Improved forecasts will have a large impact across Alaska, given the state's reliance on aviation for transportation, and on the marine fishing and shipping industries.

During winter El Niño episodes, a strong jet stream and storm track generally persists across the southern part of the United States, and milder-than-average conditions producing fewer storms prevail across the northern part of the country. In contrast, El Niño conditions result in exceptionally stormy winters and increased precipitation across California and the southern United States. La Niña episodes generally produce the opposite pattern – bringing colder and stormier-than-average conditions across the North, and warmer and less stormy conditions across the South. Also during La Niña, there is generally considerable month-to-month variation in temperature, rainfall and storminess. We are currently experiencing weak La Niña conditions across the country.

The science of winter storm prediction has improved steadily over the past decades. Our 72-hour forecasts are as accurate today as our 36-hour forecasts were 20 years ago. Tremendous advances have been made in the prediction and subsequent warnings of heavy snow events. In the 1970's we could provide less than 12 hours advanced notice for snow fall amounts greater than 4 inches. Today, we are predicting heavy snow events 3-5 days in advance and are differentiating between 4-, 8-, 12-inch snow fall amounts out to 3 days in advance. The average lead time for winter storms has been increasing and in FY 2005 the lead time was 17 hours, surpassing the Government Performance and Results Act (GPRA) goal of 15 hours. This improvement is due in large part to continual improvements in our ability to observe and describe the current state of the atmosphere and to model the future state of the atmosphere.

Specifically, this forecast improvement is due to (1) increases in the number of observations available, particularly satellite information and increases in surface observations; (2) improvements in depicting and understanding the state of the atmosphere through NOAA aircraft reconnaissance flights, which increase the number of observations over an area of the globe where additional information is needed to improve the accuracy of the numerical model's prediction of winter storms; (3) more sophisticated model data assimilation systems that are run on some of the most powerful high-performance computing systems in the world; and (4) improved global atmospheric modeling.

Our improved ability to predict major snow events with increased confidence allows our diverse user community to make decisions prior to major snow events concerning public safety, transportation and commerce. For example, before the recent 12 February 2006 winter storm along the Northeast corridor, state and local communities up and down the coast had:

- Road crews positioned and schedules prepared to apply chemicals,
- Retail outlets had snow removal and heavy clothing made available with advertising of "Blizzard Blowouts" days before this major snow event,
- Remarkable recovery due to planning ahead.

Medium range and short range forecasts were accurate and provided the state and local governments with the information they needed to take action to mitigate the impact of this snowstorm. The public and private industry also had advance lead time to take necessary actions to prepare for this record-breaking winter storm.

Using the new Northeast Snowfall Impact Scale (NESIS), the 12 February 2006, storm was preliminarily classified as a "Major," or a Category 3 storm. NESIS uses five categories (Notable, Significant, Major, Crippling, or Extreme) to communicate the severity of a storm based on snowfall amount and the population of the affected areas. NESIS will permit meteorologists to quickly communicate a snowstorm's potential impact and compare it with a past storm.

While NOAA's storm prediction capabilities have improved over time, we continue to work to improve our forecasts. For the 12 February 2006 storm, we predicted a major snowstorm, but we did not predict the snowfall amounts would be as heavy as they were. In New York City, we predicted a blizzard well in advance, with snowfall amounts more than a foot in places, but we did not forecast the storm would dump 26.9 inches of snow in Central Park. We updated our forecasts based on the latest radar data and small scale reports we had, but we need to be able to predict these smaller scale situations within the overall larger storm.

One of the biggest challenges in winter storm prediction is determining what type of precipitation will fall (rain, snow, sleet or freezing rain), how long it will last, and how much will fall. Meeting this challenge depends on our ability to accurately measure the current state of the atmosphere from the global scale to the local scale, to integrate this information into our forecast systems, and to predict the future state of the atmosphere. Specifically, understanding and depicting moisture throughout the atmosphere is a key area targeted for improvement as we strive to advance our models and predictions of the future state of the atmosphere.

Another challenge we face is how to better communicate the uncertainty of our predictions. We asked the National Research Council to conduct a study to recommend how we might improve the methods we use to communicate forecast uncertainty and suggest ways to improve our products toward that end. We expect the report to be complete later this spring or early summer.

NOAA produces a suite of winter weather products to assist state and local governments, private industry, and the media in communicating the effects and impacts of developing and ongoing weather systems to the general public and to help determine appropriate preparations in advance of a winter storm event. Winter Storm Outlooks are given when forecasters believe winter storm conditions are possible, and are usually issued 3 to 5 days in advance of a winter storm. Winter Storm Watches are issued 12 to 48 hours before the beginning of a Winter Storm and alert the public to the possibility of a heavy snow, heavy freezing rain, or heavy sleet. Winter Storm Warnings are issued when hazardous winter weather is imminent and are now being issued with lead times greater than 12 hours before the winter weather is expected to begin.

NOAA's data and information are critical to ensure government officials, the public and private industry are informed of impending winter storms.   NOAA provides essential observations, including radar data, surface observations, sea surface temperatures, and satellite images, as well as computer model simulations of the atmosphere that are used by the entire weather community. NOAA's data and information, including forecasts and warnings, are disseminated through the vast NWS dissemination network including NOAA Weather Radio All Hazards, Emergency Managers Weather Information Network, NOAA Weather Wire Service, the Emergency Alert System where applicable, and the Internet. Most of the public receives the weather information through the media. We work in close partnership with the media to ensure dangerous and potentially life threatening weather situations, such as winter storms, are communicated to the public.

The private meteorological community also plays a critical role to ensure the public, and industry, are informed.

Research into winter storms by universities, the private sector, and the Federal Government has provided us insight to understand the inner workings of these weather situations, but we can do more. As we increase our understanding of these storms, and increase observations of the environment with increasing detail, our storm predictions become more accurate – defining when and where the storm will hit. People now expect more from the National Weather Service, and believe we should get it right every time. At NOAA we will continue our efforts to improve winter storm forecasting, and all other weather predictions, to meet this high expectation.

That concludes my statement, Mr. Chairman. Thank you for the opportunity to provide information on NOAA's winter storm forecasting capabilities. I am happy to respond to any questions the Committee may have.