ENVIRONMENTAL AND ENERGY STUDY INSTITUTE
122 C STREET, N.W., SUITE 630 ■ WASHINGTON, D.C., 20001 ■ 202-628-1400 ■ www.eesi.org

CAROL WERNER
EXECUTIVE DIRECTOR

The Earth's Climate, 2005

Released: July 26, 2006

Contact:
Fredric Beck (202) 662-1892, fbeck@eesi.org

The most advanced models of the Earth's climate predict gradual warming of the average surface temperature due to the release of carbon dioxide (CO_2) from the burning of fossil fuels. With a good historical temperature record, this warming should be observable by climate monitoring stations. What have scientists observed about the Earth's climate to date?

On January 13, 2006, the National Oceanic and Atmospheric Administration (NOAA) National Climatic Data Center (NCDC), the world's largest active archive of weather data, released their Climate of 2005 report. The report contains a number of sobering observations about the Earth's climate: average surface temperature continues to warm; polar ice is melting rapidly; hurricane activity is at a record high; and in the United States, low Northwest snowpack contributed to a period of drought in the region.

The NOAA Climate of 2005 report is the highly reputed, carefully analyzed product of climate data from around the world, containing the most up-to-date information from the field of climate monitoring. This fact sheet summarizes some highlights from the report, including climate anomalies in the United States.

According to NOAA, 2005 had…

- **Warmest average global temperature on record**
- **Lowest Northern Hemisphere sea ice extent on record**
- **Highest number of named storms and hurricanes in Atlantic on record**
- **Northwest U.S. snowpack less than 50% of normal**

In addition,

- **Global temperature has risen 0.6°C (1.1°F) since 1900**
- **The rate of increase has tripled over the past 30 years**

EARTH CONTINUES TO WARM: 2005 IS HOTTEST YEAR ON RECORD

The most direct evidence of global warming is the instrumental temperature record. This record is derived from a widespread global network of weather stations and is reliable as far back as the late 1800s. However, natural 'archives' of temperature can reveal information about climate trends over much longer periods – archives such as tree rings and layers of ice can extend the climate record back over 600,000 years, giving a longer perspective on recent warming. As Figure 1 (following page) shows, temperatures have increased rapidly over the past three decades. Increasing average surface temperature can change weather patterns, leading to drought in some areas and flooding in others. Higher temperatures melt polar ice caps and expand ocean water, raising sea levels and threatening low-lying or coastal communities. Higher temperatures may also result in less accumulated snowpack in parts of the western United States, where the spring melting of that snow serves as a major freshwater supply for much of the West. Scientists are studying potential connections between warmer sea surface temperatures and stronger hurricanes.

Definition: El Niño
A natural phenomenon in which a disruption in the tropical Pacific changes weather conditions around the globe, generally resulting in warmer than average temperatures.
Source: http://www.pmel.noaa.gov/tao/elnino/el-nino-story.html

The NOAA Climate of 2005 report says:

- Global surface temperatures have increased 0.6°C (1.1°F) over the past century (see Figure 1 below).
- Rate of temperature increase has tripled over the past 30 years: from 0.6°C/century over the past century as a whole, to 1.8°C/century during the past three decades.
- 2005 was the warmest year on record by 0.03°C, just surpassing 1998, which was an El Niño year (see Definition previous page). 2005 had no El Niño event and still reached record high temperatures, though due to realistic error estimates in the global temperature estimate, 1998 and 2005 are statistically indistinguishable from each other, meaning either one could be the warmest on record.
- Temperatures were highest above normal in the Northern Hemisphere high latitudes: over much of Russia, Scandinavia, Canada and Alaska, temperatures were 3-5°C (5.4-9.0°F) above the 1961-1990 average.

SEA ICE EXTENT AT RECORD LOW IN 2005

Decreasing sea ice coverage of the Arctic Ocean is another indicator of global warming. Sea ice provides the habitat for many Arctic species, such as polar bears, as well as being an integral part of the livelihood of Arctic peoples. Beyond the impact on Arctic peoples and ecology, melting sea ice affects global climate by increasing the rate of warming due to the lower reflectivity of water than ice to the sun's energy. The darker Arctic Ocean absorbs more solar energy during the long daytime hours in the Arctic summer and becomes part of a positive feedback loop causing more sea ice to melt and more warming to occur.

The NOAA Climate of 2005 report says:

- Northern Hemisphere sea ice extent was lowest on record in September 2005 (see Figure 2, following page).
- 2005 was the fourth consecutive year with ice extent below the long-term mean.
- Increasing surface temperatures have contributed to progressively more summer melt and less ice growth in the fall and winter.
- Four consecutive extreme minimum sea ice extent years and observed thinning of the ice pack suggest that the sea ice system is experiencing changes not due to natural variability.

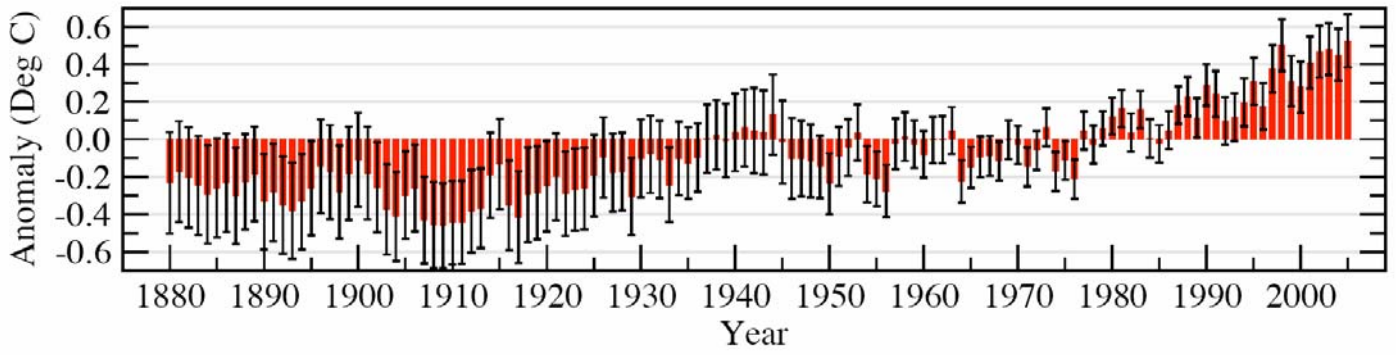

Figure 1. Global mean surface temperature has increased over the past 125 years, from 1880-2005. The temperature is shown in terms of the °C difference (anomaly) from the 1961–1990 average, because this eliminates problems in comparing datasets from different regions of the globe. Error bars shown are two standard deviations, and decrease in recent years due to improved accuracy of temperature measurements. Faster warming is apparent since about 1980. Some spikes in the trend, for example the high temperature in 1998, are due to El Niño years.

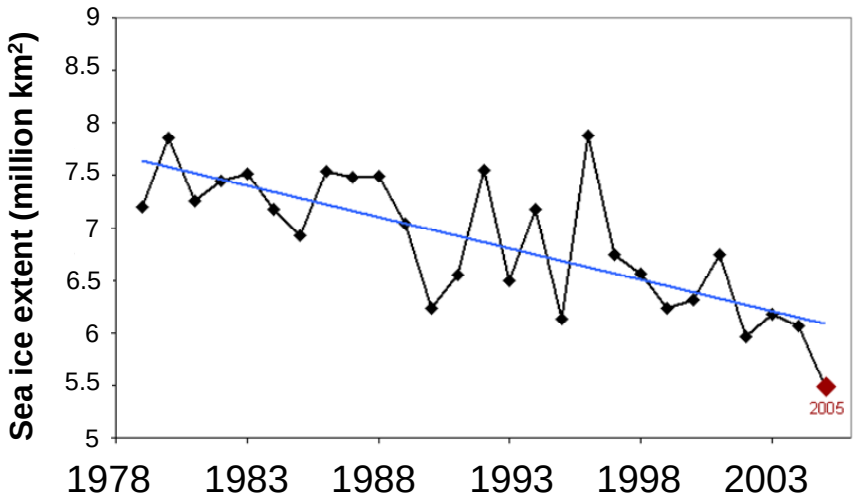

Figure 2. While Northern hemisphere sea ice extent varies year-to-year, measurements show a steady decrease over the past three decades. The average eight percent per decade decrease is shown as a straight line. 2005 had the lowest sea ice extent on record, since satellite record keeping began in 1978.

RECORD HIGH HURRICANE ACTIVITY IN 2005

With warming of the Earth's atmosphere and oceans, higher sea surface temperatures could lead to more intense, longer duration tropical storms and hurricanes. With high population density in coastal areas, a continued trend of increasing storm intensity could be very costly.

The NOAA Climate of 2005 report says:

- Of the record high 27 named storms in the Atlantic basin, a record-breaking 14 were hurricanes, including seven major hurricanes. For comparison, the 1944-1996 average annual hurricane activity includes about 10 named storms, of which six are hurricanes, including two to three major hurricanes (see Figure 3 below).
- Hurricane Katrina (see Figure 4, following page) caused more than 1300 deaths and will likely cost more than $100 billion—by far the highest cost of any hurricane in history.

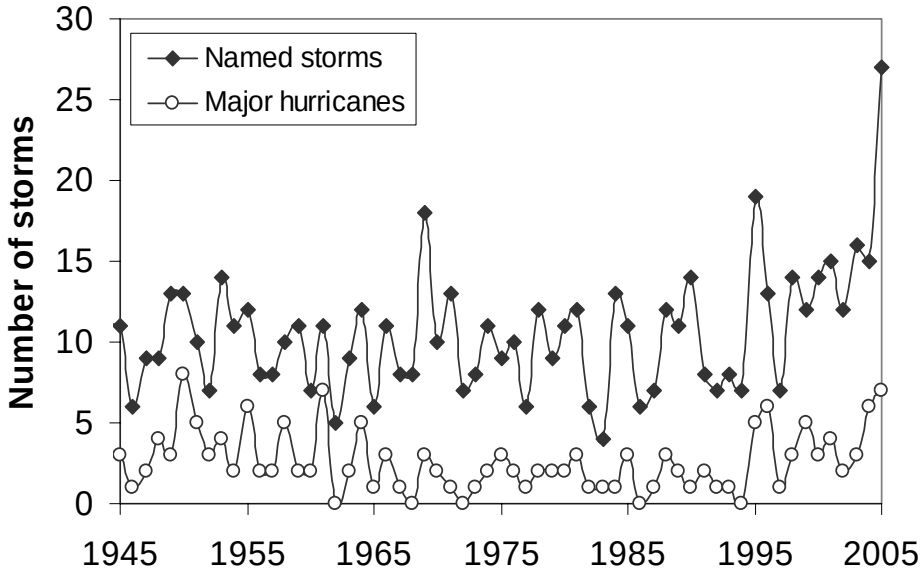

Figure 3. The number of both named storms and major hurricanes peaked in 2005, with major Hurricanes Dennis, Katrina, Rita, and Wilma contributing a total of over $124 billion in losses, according to insurance industry estimates.

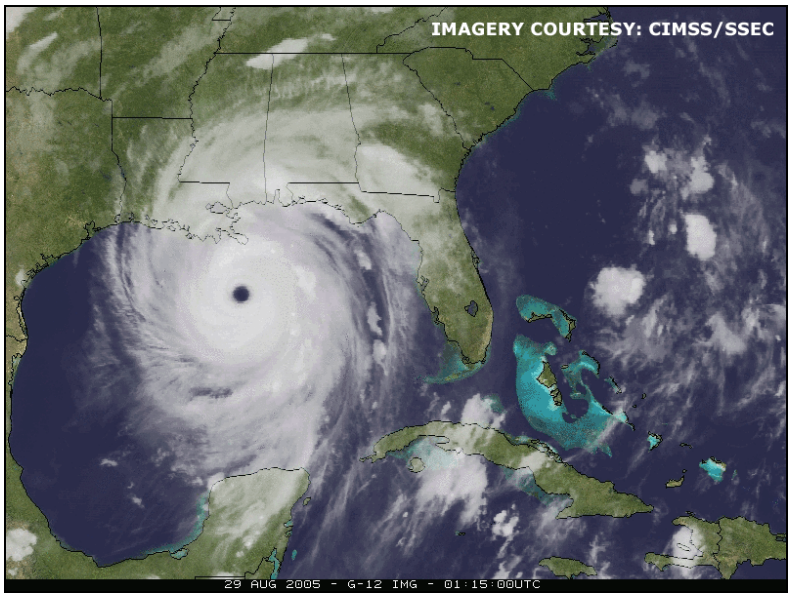

Figure 4. Satellite image of Hurricane Katrina on August 29, 2005. Making landfall in Louisiana and Mississippi at category 3 strength after having been a category 5 hurricane at one point, Katrina alone caused over $100 billion in damages.

BELOW AVERAGE NORTHWESTERN U.S. SNOWPACK ACCUMULATION CAUSED SPRING DROUGHT IN 2005

Snowpack in the northwestern United States provides water supply for much of the area's residents, farmers, fish, and wildlife. A more southerly storm track shifted precipitation to the Southwest during the 2004/2005 winter, leading to flooding and damage to the Southwest and much below average rain and snow for the Northwest causing an early spring drought in the region.

The NOAA Climate of 2005 report says:

- Accumulated snowpack was much *above* average for the Southwest and much *below* average for the Northwest U.S. in the 2004/2005 winter.
- Northwest U.S. snowpack measured less than 50 percent of normal by the end of winter. Because this region relies on melting snow to replenish reservoirs, drought conditions developed in early spring. Figures 5a and 5b illustrate the effects of drought on crops and ecosystems.
- Snowpack in Washington and Oregon was less than one quarter of the average spring amount.

Figure 5a. A California Lake affected by drought in 1991.

Photo courtesy United States Department of Agriculture

Figure 5b. Corn crops damaged under drought stress.

Photo courtesy of University of California Riverside

SIGNIFICANT U.S. CLIMATE ANOMALIES IN 2005

An overview of US climate anomalies and events in 2005 is shown in Figure 6 below. The July heat wave in parts of the West continued a trend of warmer-than-average summers in the West, while wet weather and increased snowpack in the Southwest revived the region from the Southwestern drought during the previous several years. Wildfires burned a record high area in 2005, including a large area of Alaska, following the record area burned in that state in 2004. Rain and flooding in the Northeast resulted in the wettest October on record for nine states, following rain and flooding from Georgia to New York in September 2004. The 2005 hurricane season was very costly along the Gulf Coast, with total damages over $124 billion breaking the previous record of $42 billion in damages in 2004.

SUMMARY

The Earth's climate in 2005 continued a warming trend, consistent with the warming expected to result from human induced emissions of greenhouse gases. These greenhouse gas emissions increased over the past thirty years, a trend which is reflected by the acceleration of warming over the past three decades. Decreased sea ice extent, spring snow cover, and Northwest U.S. snowpack characterized 2005, also in keeping with recent trends, threatening freshwater supply for the Northwestern U.S., as well as all human, animal, and plant life dependent on the Arctic ice for survival. In addition, 2005 saw record-setting Atlantic hurricane activity, resulting in the costliest hurricane season on record, surpassing 2004's record high costs by more than a factor of two.

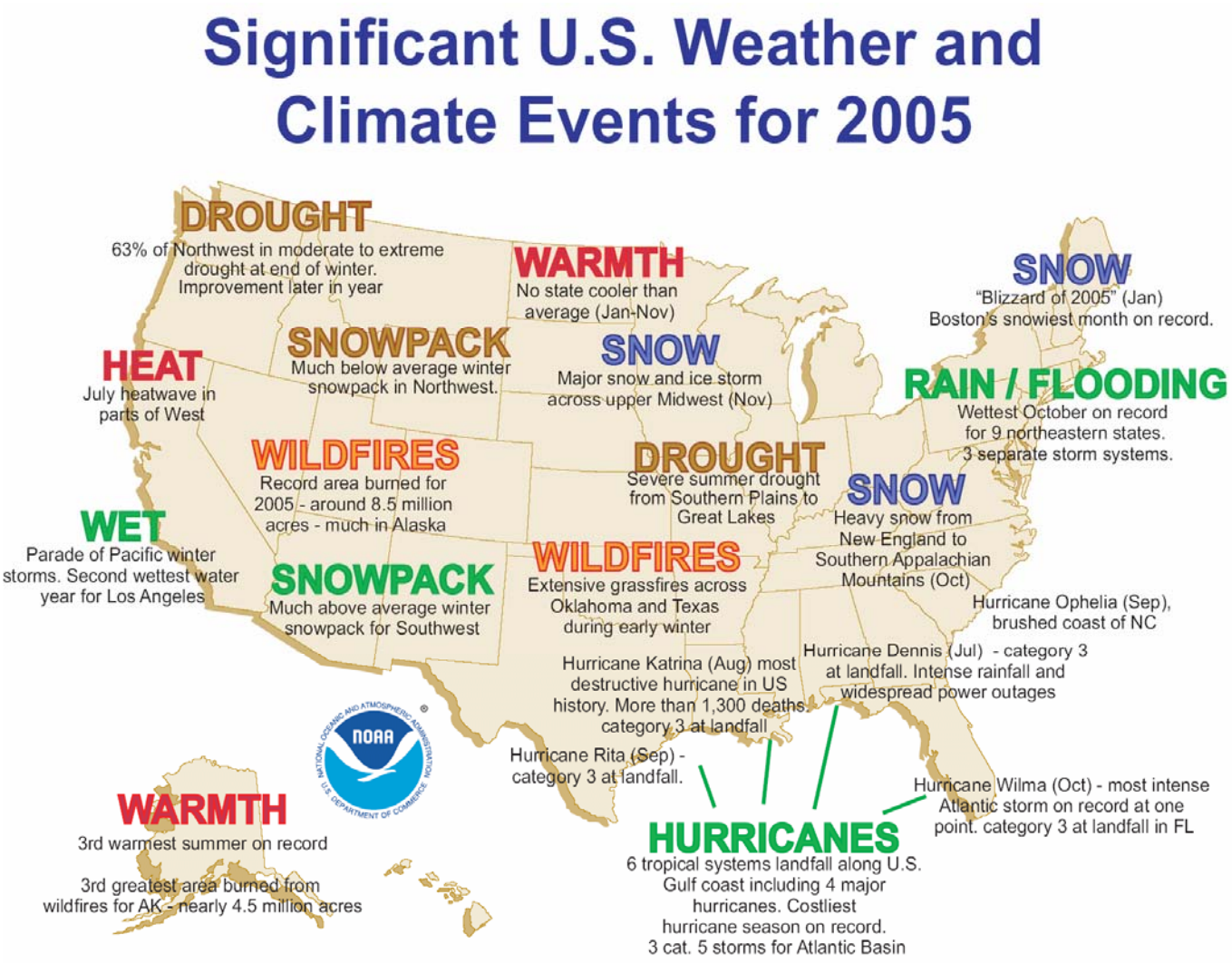

Figure 6. Significant US climate anomalies and events in 2005 range from heat, drought, and wildfires to flooding, heavy snow, and severe hurricanes.

REFERENCES: NOAA CLIMATE OF 2005 REPORT

Full Report	http://www.ncdc.noaa.gov/oa/climate/research/2005/ann/ann05.html
Temperature Trends	http://www.ncdc.noaa.gov/oa/climate/research/anomalies/anomalies.html
Sea Ice Extent	http://nsidc.org/news/press/20050928_trendscontinue.html
Hurricane Activity	http://www.ncdc.noaa.gov/oa/climate/research/2005/hurricanes05.html
Snow and Ice Melt	http://www.ncdc.noaa.gov/oa/climate/research/2005/snow0405.html
Significant Events	http://www.ncdc.noaa.gov/oa/climate/research/2005/ann/events.html

ADDITIONAL RESOURCES

NOAA National Climatic Data Center (NCDC) Climate indicator measurement techniques; annual and monthly data and graphics; trend analysis; news	http://www.ncdc.noaa.gov/
NASA Goddard Institute for Space Studies (GISS) Monthly analysis of global surface temperatures	http://data.giss.nasa.gov/gistemp/
The Arctic Climate Impact Assessment (ACIA) Discussion of impacts of a warming arctic on vegetation, animal and indigenous human populations, infrastructure, marine transport, and access to resources	http://amap.no/acia/
EESI: Congressional Briefing Summary — "What Does Climate Change Mean for the Arctic?" March 15, 2005	http://www.eesi.org/publications/publications.htm

---

Writer: Juliane L. Fry, Ph.D., Climate Fellow

Editor: Fredric A. Beck, Senior Policy Associate

Special thanks to Catherine Norman, Ph.D. and Adam Brundage for their contributions to this report, and to NOAA Research Climatologist Anne Waple for her review comments.

The Environmental and Energy Study Institute is a non-profit organization established in 1984 by a bipartisan, bicameral group of members of Congress to provide timely information on energy and environmental policy issues to policymakers and stakeholders and develop innovative policy solutions that set us on a cleaner, more secure and sustainable energy path.
