This is the print version of the Skeptical Science article 'Record snowfall disproves global warming', which can be found at http://sks.to/snowfall.

Does record snowfall disprove global warming?

What The Science Says:
To claim that record snowfall is inconsistent with a warming world betrays a lack of understanding of the link between global warming and extreme precipitation. Warming causes more moisture in the air which leads to more extreme precipitation events. This includes more heavy snowstorms in regions where snowfall conditions are favourable. Far from contradicting global warming, record snowfall is predicted by climate models and consistent with our expectation of more extreme precipitation events.

Climate Myth: Record snowfall disproves global warming
"Global warming continues to cause trouble to this tiny, blue planet: A new record was set Wednesday when Chicago had its ninth consecutive day of measurable snowfall and Flint, Michigan, broke a 95-year-old record early Wednesday morning when the temperature plummeted to a frigid 19 below zero. The previous record? Minus 10, set in 1914. Meanwhile, it will likely to continue to snow in Chicago in the coming days. Global warming sure is... *cold!*" (Michael van der Galien)

The 2009/2010 winter saw a number of dramatic, record breaking snowstorms. Early February saw two "once in a 100 years" snowstorms hit Philadelphia, now being dubbed "Snowmageddon". Does record snowfall prove that global warming isn't happening? What do observations say? 2009 was the second hottest year on record. January 2010 was the hottest January in the UAH satellite record. Satellites data indicates last month was the second hottest February in the satellite record. Observations tell us that rumours of global warming's death have been greatly exaggerated.

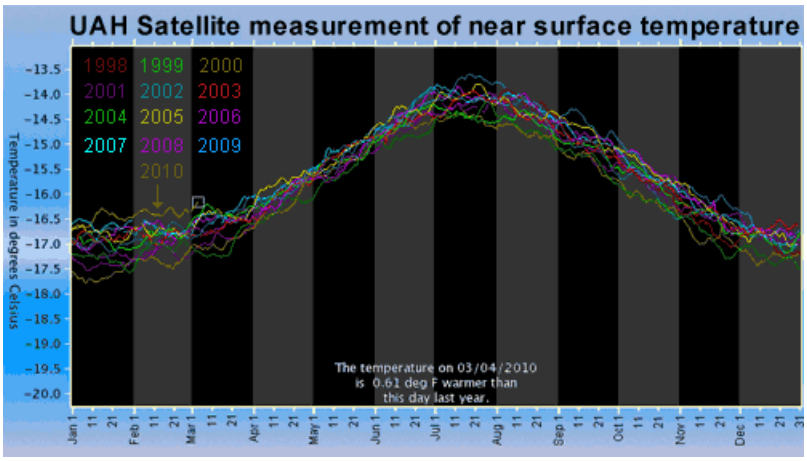

Figure 1: UAH satellite measurement of near surface temperature. January 2010 is the hottest January in the satellite record. February 2010 is the second hottest February in the satellite record. Click on the image for larger version.

If global warming is still happening, why are some areas experiencing record snowfall events? As climate warms, evaporation from the ocean increases. This results in more water vapour in the air. Globally, atmospheric water vapour has increased by about 5% over the 20th century. Most of the increase has occurred since 1970 (IPCC AR4 3.4.2.1). This is confirmed by satellites

that find the total atmospheric moisture content has been increasing since measurements began in 1988 (Santer 2007).

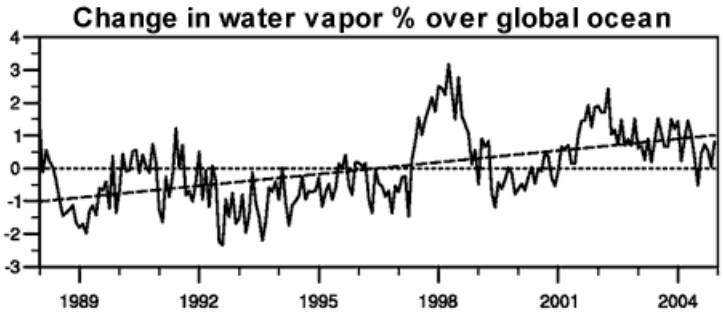

Figure 2: Change in water vapor percentage relative to the 1988 to 2004 period over the global ocean plus linear trend, measured by satellite (IPCC AR4 3.4.2.1).

The extra moisture in the air is expected to produce more precipitation, including more extreme precipitation events. Observations bear this out. A study of precipitation trends over the United States found that heavy precipitation events (over 50mm in a day) have increased 20% over the 20th Century (Groisman 2004). Most of this increase occured after 1970. Various analyses of precipitation over the globe have similarly found a widespread increase in heavy precipitation days since 1950 (Alexander 2006, Groisman 2006).

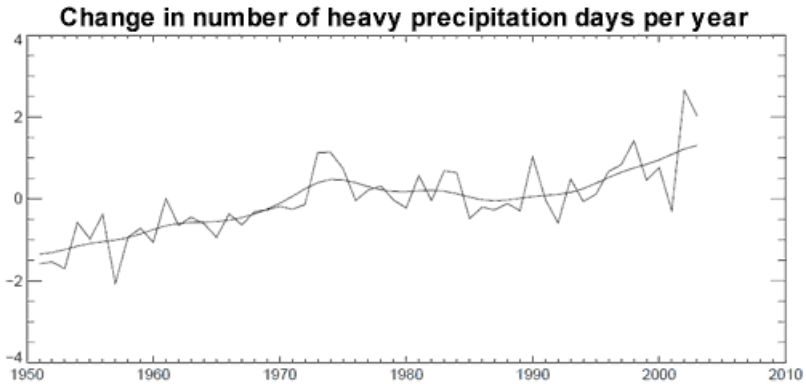

Figure 3: Global number of days per year when precipitation was greater than 10mm per day, expressed as an anomaly from the 1961 tp 1990 reference period (Alexander 2006).

Snowstorms can occur if temperatures are in the range of -10°C to 0°C. Global warming decreases the likeliness of snowstorm conditions in warmer, southern regions. However, in northern, colder regions, temperatures are often too cold for very heavy snow so warming can bring more favourable snowstorm conditions (Kunkel 2008). This is borne out in observations. Over the last century, there has been a downward trend in snowstorms across the lower Midwest, South and West Coast. Conversely, there's been an increase in snowstorms in the upper Midwest East, and Northeast with the overall national trend also upwards (Changnon 2006).

To claim that record snowfall is inconsistent with a warming world betrays a lack of understanding of the link between global warming and extreme precipitation. Global temperatures in the last few months of record snowfall are some of the hottest on record. Warming causes more moisture in the air which leads to more extreme precipitation events. This includes more heavy snowstorms in regions where snowfall conditions are favourable. Far from contradicting global warming, record snowfall is predicted by climate models and consistent with our expectation of more extreme precipitation events.

Intermediate rebuttal written by John Cook

Update July 2015:

Here is a related lecture-video from Denial101x - Making Sense of Climate Science Denial

[*see video at **this link**.*]

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Skeptical Science explains the science of global warming and examines climate misinformation through the lens of peer-reviewed research. The website won the Australian Museum 2011 Eureka Prize for the Advancement of Climate Change Knowledge. Members of the Skeptical Science team have authored peer-reviewed papers, a college textbook on climate change and the book Climate Change Denial: Heads in the Sand. Skeptical Science content has been used in university courses, textbooks, government reports on climate change, television documentaries and numerous books.

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