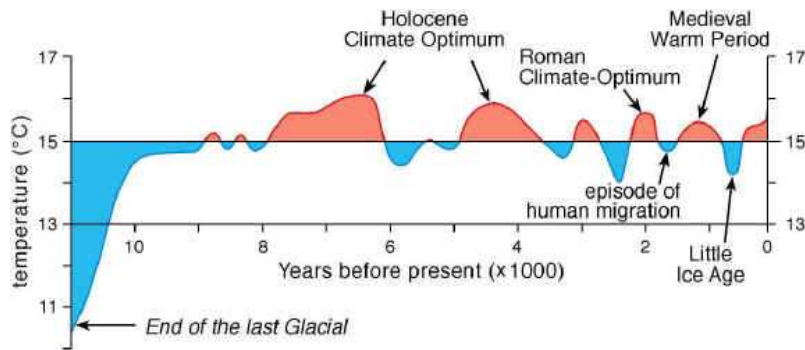


Brief Highlights on Key Climate Science issues

Late 20th Century Surface Temperatures are neither “extreme nor unusual.”



Average near-surface temperatures of the northern hemisphere during the past 11,000 years (after Dansgaard et al., 1969, and Schönwiese, 1995)

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Brief Highlights on Key Climate Science issues

Hockey Stick Temperature Reconstruction

Moberg, A., et al., 2005. Highly variable Northern Hemisphere temperatures reconstructed from low- and high-resolution proxy data. *Nature*, **433**, 613-617.

- Recognizing that different kinds of proxy temperature records may be more appropriately related to climatic variations at different time scales, Moberg applied a statistical technique called 'wavelet analysis' that allows each proxy to explain temperature variations on a timescale that it was most sensitive to. By combining high-resolution with low-resolution proxy information, Moberg produced a 2,000 yr long temperature reconstruction for the Northern Hemisphere. Moberg's reconstruction contains strong Medieval Warm Period and Little Ice Age signals. The natural variation of temperatures in the Moberg reconstruction is two to three times that of the Mann et al. "hockey stick."

Von Storch, H., et al., 2004. Reconstructing past climate from noisy data. *Science*, **306**, 679-682.

- Researcher Hans von Storch and colleagues found that the methodology behind the "hockey stick" 1000-yr temperature reconstruction is insufficient to capture all of the natural variability. In a short "Perspective" in *Science* that evaluates von Storch's article, East Anglia's Timothy Osborn and Keith Briffa comment, "If the true natural variability of Northern Hemispheric temperature is indeed greater than is currently accepted, the extent to which recent warming can be viewed as 'unusual' would need to be reassessed."

Antarctic Ice/Temperatures

Doran, P.T., et al., 2002. Antarctic climate cooling and terrestrial ecosystem response. *Nature*, **415**, 517-520.

- "The average air temperature at the earth's surface has increased by 0.06°C per decade during the 20th century, and by 0.19°C per decade from 1979 to 1998. Climate models generally predict amplified warming in polar regions, as observed in Antarctica's peninsula region over the second half of the 20th century. Although previous reports suggest slight recent continental warming, our spatial analysis of Antarctic meteorological data demonstrates a net cooling on the Antarctic continent between 1966 and 2000, particularly during summer and autumn.... Continental Antarctic cooling, especially the seasonality of cooling, poses challenges to models of climate and ecosystem change."

Parkinson, C.L. 2002. Trends in the length of the southern Ocean sea-ice season, 1979-99. *Annals of Glaciology*, **34**, 435-440.

- While recent studies have shown that on the whole Arctic sea ice has decreased since the late 1970s, satellite records of sea ice around Antarctica reveal an overall increase in the southern hemisphere ice over the same period.

Alaska Climate Change

Hartmann, B., Wendler, G., On the significance of the 1976 Pacific climate shift in the climatology of Alaska. *Journal of Climate*, under review.

- "The regime shift is also examined for its effect on the long-term temperature trends throughout the state. The trends that have shown climatic warming are strongly biased by the sudden shift from the cooler regime to a warmer regime in 1976. When analyzing the total time period from 1951 to 2001, warming is observed, however the 25-year period trend analyses before 1976 (1951-1975) and thereafter (1977-2001) both display cooling. In this paper we emphasize the importance of taking into account the sudden changes that result from abrupt climatic shifts, persistent regimes and the possibility of cyclic oscillations, such as the PDO, in the analysis of long-term climate change in Alaska."

Kaufman, D.S., et al., 2004. Holocene thermal maximum in the western Arctic (0-180°W). *Quaternary Science Reviews*, **23**, 529-560.

- The article notes that Alaska averaged 3°F warmer than present for 2,000 years, from 9,000 to 11,000 years ago. Concurrently, the first civilization radiated forward.

Arctic Climate Change

Polyakov, I., et al., Variability and trends of air temperature and pressure in the Maritime Arctic, 1875-2000, *Journal of Climate*, **16**, 2086-2092, 2003.

- "Arctic atmospheric variability during the industrial era (1875-2000) is assessed using spatially averaged surface air temperature (SAT) and sea level pressure (SLP) records. Air temperature and pressure display strong multi-decadal variability on timescales of 50-80 yr. Associated with this variability, the Arctic SAT record shows two maxima: in the 1930s-40s and in recent decades, with two colder periods in between. In contrast to the global and hemispheric temperature, the maritime Arctic temperature was higher in the late 1930s through the early 1940s than in the 1990s."

Glaciers

The worldwide decline of ice sheets and glaciers appears to be in large part their response to earth's emergence from the last glacial maximum 150 years ago.

Mt. Kilimanjaro

Kaser, G., et al., 2004. Modern glacial retreat on Kilimanjaro as evidence of climate change: observations and facts. *International Journal of Climatology*, **24**, 329-339.

- According to Georg Kaser and four co-authors, "A drastic drop in atmospheric moisture at the end of the 19th century and ensuing drier climatic conditions are likely forcing glacial retreat on Kilimanjaro" not anthropogenic global warming. Kaser's team notes, "In the East African highlands, there is no trend in air temperature records that nearly span the whole 20th century."

Glacier National Park

Pederson, G. T., D. B. Fagre, S. T. Gray, and L. J. Graumlich, 2004: Decadal-scale climate drivers for glacial dynamics in Glacier National Park, Montana, USA. *Geophysical Research Letters*, **31**, L12203, doi:10.1029/2004GL019770.

- The fluctuation of glaciers at Montana's Glacier National Park's is the result of unique interactions between summer drought and winter snow accumulation. During the late 19th century, a shift from cool and rainy conditions toward sustained drought coincides with the onset of glacial retreat from the Little Ice Age's maximum. Extreme drought between 1917 and 1941 coincides with rapid glacial recession in Glacier National Park. Furthermore, as appears to be the case at Mt. Kilimanjaro, Montana's glaciers began to retreat long before the atmospheric concentration of greenhouse gases began to change very much. This research illustrates how natural interactions have resulted in glacial retreat and advance for hundreds of years in the absence of anthropogenic greenhouse gas forcing.

Greenland Ice Sheets

Chylek, P., J.E. Box, and G. Lesins, 2004. Global Warming and the Greenland Ice Sheet. *Climatic Change*, **63**, 201-221

- "Since 1940, the Greenland coastal stations data have undergone predominantly a cooling trend. At the summit of the Greenland ice sheet, the summer average temperature has decreased at the rate of 2.2°C per decade since the beginning of the measurements in 1987. This suggests that the Greenland ice sheet and coastal regions are not following the current global warming trend."

Surface Temperature Records

Increasingly, observational evidence indicates local and regional processes such as changes in land use, urban heat island effects, and localized surface warming in industrialized regions are important factors in recent changes in global temperature. As alternative and contributing influences emerge, greenhouse gas increases from fossil fuel combustion play a diminished role compared to that previously assigned to

them in reports such as those of the Intergovernmental Panel for Climate Change (IPCC, 2001).

de Laat, A. T. J., and A. N. Maurellis, 2004. Industrial CO₂ emissions as a proxy for anthropogenic influence on lower tropospheric temperature trends. *Geophysical Research Letters*, **31**, L05204, doi:10.1029/2003GL019024.

- Dutch researchers, Jos de Laat and Ahilleas Maurellis of the Earth Oriented Science Division at the National Institute for Space Research in the Netherlands, report that local surface changes caused by industrialization account for a significant portion of global temperature increases in recent decades. Similarly, as the degree of industrialization increases, so does the temperature trend. This is true both at the surface and in the balance of the lower atmosphere (troposphere).

Kalnay, E., and M. Cai, 2003. Impact of urbanization and land use change on climate. *Nature*, **423**, 528–531.

- Eugenia Kalnay and Ming Cai are University of Maryland researchers and have determined that the effect of urbanization and land-use changes on U.S. average temperatures is at least twice as great as has been previously estimated. Their finding eventually will have a profound impact on the climate change debate because it provides further proof that the influence of carbon dioxide increases on surface temperatures is much less than assumed by the UN's Intergovernmental Panel on Climate Change (IPCC).

McKittrick, R., and P.J. Michaels, 2004. A test of corrections for extraneous signals in gridded surface temperature data. *Climate Research*, **26**, 159-173.

- McKittrick and Michaels found the net effects of non-climatic signals in the data led the Intergovernmental Panel on Climate Change to overstate the overall average of warming rates in its surface data. The amount of warming that results from those signals varies between 26 percent to more than 90 percent of the observed warming. McKittrick and Michaels provide further evidence that such contamination has not been removed and that it adds up to a net warming bias at the globally-averaged level. Consequently IPCC surface temperature data should not be interpreted as measuring only climate. Instead IPCC temperature data also reflects a complex blend of local economic and social factors.

Minnis, P., J. K. Ayers, R. Palikonda, and D. Phan, 2004: Contrails, Cirrus Trends, and Climate. *Journal of Climate*, **17**, 1671–1685.

- Minnis et al. calculate the net temperature change associated with an increase in aircraft contrails over the United States amounts to a warming of 0.2° to 0.3°C per decade. Based on comparisons with observed trends in surface and atmospheric temperatures over the United States, the researchers find that increases in cirrus coverage related to air traffic could account for nearly all of the surface and tropospheric warming observed in and over the U.S. during the last twenty-five years. Such findings provide further evidence that the observed warming of recent

decades is not solely the product of increased anthropogenic emissions of greenhouse gases.

Atmospheric Temperature Trends

Christy, J. R., and W. B. Norris, 2004: What may we conclude about global tropospheric temperature trends?, *Geophysical Research Letters*, **31**, L06211, doi:10.1029/2003GL019361.

- John Christy and William Norris selected high-quality weather balloon observations (from records kept at the U. S. National Climatic Data Center) from locations around the world between January 1979 through July 2001 and compared them with their satellite data. They find very close correspondence between the UAH satellite record and the independent weather balloon record. In fact, the differences between the records are statistically indistinguishable. The evidence presented by the UAH researchers seems as conclusive as any that exists. It demonstrates that the most accurate MSU record is that with the least amount of warming during the past 25 years and the one that differs most from predictions generated by climate models, when independent weather balloon temperature data serves as referee.

Future Temperature Trends

Hansen J.E., and M. Sato, 2001. Trends of measured climate forcing agents. *Proceedings of the National Academy of Sciences*, **98**, 14,778–14,783.

- James Hansen, with co-author Makiko Sato, examined actual observations of global temperature change and changes in greenhouse gas emissions during the past several decades. After doing so, they conclude that “a byproduct of the above analysis is the conclusion that future global warming can be predicted much more accurately than is generally realized...Given these constraints on climate forcing trends, we predict additional warming in the next 50 years of $3/4^{\circ}\text{C} \pm 1/4^{\circ}\text{C}$, a warming rate of $0.15 \pm 0.05^{\circ}\text{C}$ per decade.”

Hansen, J.E., March 2004. Defusing the global warming time bomb. *Scientific American* (extended version), 70-77, www.sciam.com/ontheweb.

- Hansen writes that the climate change scenarios put forth in the Intergovernmental Panel on Climate Change’s (IPCC) 2001 Third Assessment Report “may be unduly pessimistic” and that the IPCC extreme scenarios are “implausible” and that “emphasis on extreme scenarios may have been appropriate at one time, when the public and decision-makers were relatively unaware of the global warming issue.... Now, however, the need is for demonstrably objective climate forcing scenarios consistent with what is realistic.”

Hurricanes

Landsea, C. 2005. Open letter announcing his withdrawal from the IPCC process due to the growing politicalization of the IPCC process.

Christopher Landsea, a leading expert in the field has withdrawn from participation in the IPCC 4th *Assessment Report* (due out in late 2007), citing concerns the process has become too politicized and "motivated by pre-conceived agendas." Author of over 40 refereed scientific publications on the subject, and contributing editor in the last two IPCC Assessments, Landsea stated: "It is beyond me why my colleagues would utilize the media to push an unsupported agenda that recent hurricane activity has been due to global warming...making pronouncements far outside the current scientific understandings that...will harm the credibility of climate change science and...diminish our role in public policy."

- "The evidence is quite strong and supported by the most recent credible studies that any impact in the future from global warming upon hurricanes will likely be quite small."

U.S. Flood Damage

Downton, W.M., Miller, J.Z.B., Pielke Jr., R.A., 2005. Reanalysis of U.S. National Weather Service Flood Loss Database. *Natural Hazards Review*, **6**, 13-22.

- The research team led by Mary Downton analyzed historic flood damage in the United States and adjusted it for changing demographic patterns. When flood damage is standardized in terms of total damage per unit wealth it shows a slight (statistically insignificant) downward trend. This means that floods have had a lessening (or neutral) impact on our personal wealth over the course of the past 65 years or so.

Heat Wave Deaths

Davis, R.E., Knappenberger, P.C., Novicoff, W.M., and P.J. Michaels, 2003. Decadal Changes in Summer Mortality in U.S. Cities, *International Journal of Biometeorology*, **47**, 166-175.

- The authors analyzed heat-related deaths across the major cities in the United States and found that despite evidence of increasing heat and humidity, adaptations (such as increased access to air-conditioning, improved medical care, and better community awareness programs) have significantly reduced death rates. "This result has profound implications on the accuracy of projections of future increases in heat-related mortality generated from global warming scenarios," Davis and his coauthors conclude. "Until more accurate weather-mortality models are developed, it is necessary to adjust these mortality projections downward in light of the observed decline in the sensitivity of the mortality of the U.S. population to high apparent temperatures." (This work was awarded "Paper of the Year 2004" for climate science by the Association of American Geographers.)

Malaria

Reiter, P., et al., 2004. Global warming and malaria: A call for accuracy. *The Lancet*, **4**, 323-324.

- The authors caution that the link between global warming and malaria spread is not nearly as straightforward as many would have you believe, citing numerous examples. They concluded “We understand public anxiety about climate change, but are concerned that many of these much publicized predictions are ill informed and misleading. We urge those involved to pay closer attention to the complexities of this challenging subject.”

Effectiveness of the Kyoto Protocol

Wigley, T.M.L., 1998, The Kyoto Protocol: CO₂, CH₄ and climate implications. *Geophysical Research Letters*, **25**, 2285–2288.

- Wigley analyzed the effect that a complete and strict adherence to the emissions reductions called for under the Kyoto Protocol would have on the future rate of global temperature rise and found that it would only prevent 0.07°C of warming in the next 50 years (0.15°C in the next 100 years)—an amount that is virtually undetectable and physically meaningless.