Global warming and glacier/sea ice melting

Science-based analyses of America's key environmental issues

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Claim: *Global warming will melt the world's glaciers and sea ice.*

Most of the "sweeping" claims of polar ice cap melting and sea ice thinning are **derived from model-based extrapolations that are not internally consistent with observed realities**.

The full story must begin with a clear recognition of just how few glacier data exist. Of the 160,000 glaciers presently in existence, only 67,000 (42%) have been inventoried to any degree (Kieffer *et al*., 2000); and there are only a tad over 200 glaciers for which mass balance data exist for but a single year (Braithwaite, R.J. and Zhang, Y. 2000. Relationships between interannual variability of glacier mass balance and climate. *Journal of Glaciology* 45: 456-462). When the length of record increases to five years, this number drops to 115; and if both winter and summer mass balances are required, the number drops to 79. Furthermore, if ten years of record is used as a cutoff, only 42 glaciers qualify. This lack of glacial data, in the words of Braithwaite and Zhang, highlights "one of the most important problems for mass-balance glaciology" and demonstrates the "sad fact that many glacierized regions of the world remain unsampled, or only poorly sampled," suggesting that we **really know very little** about the true state of most of the world's glaciers.

Recognizing the need for "more comprehensive, more homogeneous in detail and quality" glacier data (Kieffer *et al*., 2000, *EOS*, Transactions, American Geophysical Union 81: 265, 270-271), we shift our attention to the few glaciers for which such data exist. During the 15th through 19th centuries, widespread and major glacier advances occurred during a period of colder global temperature known as the Little Ice Age (Broecker, 2001; Grove, 2001). Following the peak of Little Ice Age coldness, it should come as no surprise that many records indicate widespread glacial retreat, as temperatures began to rise in the mid- to late-1800s and many glaciers returned to positions characteristic of pre-Little Ice Age times. What may be surprising, however, is that in many instances **the rate of glacier retreat has not increased** over the past 70 years; and in some cases glacier mass balance has **actually increased**, all during a time when the atmosphere experienced the bulk of the increase in its CO_2 content.

Update:

Mt. Kilimanjaro. 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. According to Pederson et al. 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 et al. report that, "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."

Antarctic sea ice trends. Zwally *et al*. (2002) found that over the 20-year period 1979-1998, they report that the sea ice extent of the entire Southern Ocean increased by 11,181 ± 4,190 square km per year, or by 0.98 ± 0.37 percent per decade, while sea ice area increased by nearly the same amount: 10,860 ± 3,720 square km per year, or by 1.26 ± 0.43 percent per decade. And in contradiction of the climate-alarmist claim that earth's climate should exhibit greater extremes when warming, they observed that the variability of monthly sea ice extent *declined* from 4.0% over the first ten years of the record, to 2.7% over the last ten years (which have supposedly been the warmest of the past millennium.)

Confirming sea ice melting or thinning is inherently a task requiring the resolution in 3 spatial dimensions. The problem is difficult to quantify simply because sea ice can move around from place to place, induced by ocean currents and prevailing surface wind conditions. Also, ice can be thinning in one place and thickening at other locations (Holloway and Sou, 2002).

For example, the April extent of sea ice around the Nordic Sea region is shown from 1864 to 1998 (Vinje, 2001). The record shows that sea ice around this region of the North Atlantic has decreased by 33% over the past 135 years with the most likely explanation as a rebound from the cold period known as the Little Ice Age (ca. 1300-1900). According to Vinje (2001): "Nearly half of this reduction…took place before 1900, that is, before the warming of the Arctic, which took place during

the first three decades of the twentieth century ... The time series indicates that we are in a state of continued recovery from the cooling effects of the Little Ice Age during which a maximum sea-ice expansion was observed around 1800, both in the Iceland Sea ... and in the Barent Sea. [T]he mean annual reduction of the April sea ice extent is decelerating by a factor of 3 between 1880 and 1980." This last observation is **inconsistent** with the expectation of carbon dioxide warming of the global atmosphere and causing more rapid decrease of sea-ice extent, especially in the recent decades when the concentration of carbon dioxide in the air is the highest.

Comment:

In considering the findings of the several research papers described above that apply to the last few decades, if one were to infer anything about the planet in terms of what state-of-the-art climate models predict and what is known about real-world sea ice behavior around Antarctica, one would be tempted to conclude that the globe is currently in a *cooling* mode. Does that mean that the IPCC-endorsed air temperature history of the planet is in error? Or does it mean that the climate models are in error? Or does it mean that both are in error? All three of these important questions need to be pondered before rushing headlong into adopting expensive and economy-wrenching measures to battle what could well turn out to be an imaginary enemy, i.e., CO2-induced global warming. (http://www.co2science.org/scripts/Template/MainPage.jsp?Page=subject/s/summaries/seaiceantarctic)

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