MELTING GLACIERS

Ice sheets

Greenland Ice Sheet

During the 1977-1998 warm period, the Greenland ice sheet experienced some melting and the news media has recently featured many stories that melting of the ice sheet is occurring at an unprecedented, extreme rate that threatens to raise sea level rapidly. However, past climatic records show that Greenland is following a normal pattern of warming and cooling. Melting of Greenland ice has waxed and waned repeatedly in the past, following both global temperatures and the warming/cooling patterns in the oceans. Until the 1977 “Great Pacific Climate Shift” that initiated global warming from 1977 to 1998, Greenland had been cooling for the previous three decades (1945 to 1977) (Fig. 6) and the ice sheet was growing. From 1915 to 1945, Greenland warmed faster than from 1977 to 1998 and was actually warmer in the 1930’s than at present (Fig. 6), so the 1977–1998 warming is not at all unusual, much less ‘extreme.’ Since the climate turned cool in 1999, we are unlikely to reach the warming levels of the 1930s.

Reconstruction the surface temperature history of the Greenland Ice Sheet over the past 50,000 years from ice cores show that late Pleistocene temperatures were 23 ± 2 °C colder than at present (Dahl-Jensen et al., 1998). Temperatures during the Holocene, 4,000 to 7,000 years ago rose to a maximum of 2.5°C warmer than at present and the Medieval Warm Period was 1°C warmer than present. In the 20th century, temperatures reached a maximum in the 1930s.

Temperature records over the past century in southern and central Greenland show that maximum temperatures in coastal Greenland occurred between 1930 and 1940, and current coastal temperatures are about 1°C below their 1940 values (Chylek et al., 2004). Between 1920 and 1930, the average annual temperature rose between 2 and 4°C and by as much as 6°C in the winter in less than ten years at five coastal locations. Since no significant increase in CO2 occurred during that time, the warming cannot have been caused by CO2.

Chylek et al. (2006) found that "two periods of intense warming (1995-2005 and 1920-1930) are clearly visible in the Godthab Nuuk and Ammassalik temperature records," but "the average rate of warming was considerably higher within the 1920-1930 decade than within the 1995-2005 decade." The 1920–1930 warming rate was 50% greater than the 1995-2005 decade.

Figure 6. Temperature changes in Greenland over the past century (Chylek et al., 2004, 2006). (Graphs modified from World Climate Report, 2004; based on data from Jones et al., 1986)

Antarctic ice sheet

Ocean water around the west Antarctic Peninsula that warmed during the 1977-1998 warm cycle has caused some breaking off of shelf ice, but the volume is insignificant and is not unusual during a warm cycle. The main Antarctic ice sheet (eastern Antarctica) is not shrinking. Fifty year records at the South Pole and at the Vostock station on the central ice sheet show no significant temperature change (Fig. 7). In fact, some historic human–built structures have been buried by thickening ice.
Arctic and Antarctic sea ice

Is polar sea ice disappearing? Assertions that Arctic sea ice is vanishing at an accelerating rate and that the Arctic Ocean will soon be ice free appear almost daily in the news media. Breaking off of large pieces of shelf ice in Antarctica is cited as showing accelerating warming in Antarctica. But what does the data show? According to data from the University of Illinois, Antarctic sea ice area has increased recently and the anomaly has reached one million km$^2$, an area equal to Texas and California (or 250 Rhode Islands). The net global sea ice anomaly is also positive, an increase of 850,000 km$^2$ and arctic ice is at the highest level since 2002.

Figure 8A shows the increase of arctic sea ice since 2004 and Figure 8B shows the cooling arctic temperature since 2005. The alleged ‘accelerating decline’ of sea ice isn’t happening. It underwent normal melting during the 1977-1998 warm cycle, aided in large part by warm ocean water entering the Arctic through Bering Strait as a result of the 1977-1998 PDO warm cycle, but it is now increasing again during the present cool cycle.

Breaking up of the Wilkins shelf ice received much attention in the news media, with allegations that normal iceberg spalling was in fact proof of accelerating warming of Antarctica. Breaking up of ice shelves is a local event that has been repeated many times over the past 15 years and before and does not amount to even a blip on the Southern Hemisphere ice extent.

The 2009 extent of Antarctic shelf ice compared to the 1979–2000 median extent (Fig. 9A) shows several areas of enhanced ice coverage and a few areas of decreased coverage, but overall, the Antarctic shelf ice has increased (Fig. 9B).
Alpine glaciers

Because their ice volume is not large and they are close to equilibrium with local climate, alpine glaciers record climatic changes by retreating during warm periods and advancing during cool periods. The news media has made much of the glacier recession resulting from the 1977 to 1998 warm period as proof of warming allegedly caused by rising atmospheric CO$_2$, but ignore the glacial advances that occurred during the 1945 to 1977 cool period when CO$_2$ rose dramatically. During the past century, alpine glaciers expanded during the 1880 to ~1915 cool period, retreated during the ~1915 to ~1945 warm period, expanded again during the ~1945 to 1977 cool period, and finally retreated again during the 1977 to 1998 warm period. Thus, three of the four most recent glacial oscillations occurred before significant rise of CO$_2$ (or advanced during rising CO$_2$) and cannot have been caused by changes in CO$_2$.

Alpine glaciers advanced far downvalley during the Little Ice Age (~1300 to late 1800s) and have generally retreated upvalley during the following warming from the cooler climates of the Little Ice Age. Thus, they are well upvalley from their Little Ice Age maximums, even during the later cool periods.

**Figure 9A.** A extent of Antarctic shelf ice in 2009 compared to the median extent from 1979 to 2000. **B.** Graph of expanding Antarctic sea ice from 1979 to 2009.