

Global Warming Debate Upside-Down: Antarctic Update

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No presentation of global warming is complete without a visual of some gigantic block of ice moving away from Antarctica – throw in a few penguins looking at the disappearing ice and ... it works every time. But is it all true? Is Antarctica warming and melting away? If you consult the latest report of the United Nations' Intergovernmental Panel on Climate Change (IPCC), you would find statements on the subject in the summary including "Antarctic sea ice extent continues to show inter-annual variability and localized changes but no statistically significant average trends, consistent with the lack of warming reflected in atmospheric temperatures averaged across the region" and "Current global model studies project that the Antarctic ice sheet will remain too cold for widespread surface melting and is expected to gain in mass due to increased snowfall." Amazing – one would never suspect such conclusions given a cover story in *National Geographic* titled "THE BIG THAW."

Two more articles have appeared on this subject and both, in some ways, reinforce the conclusions of the IPCC. The first is published in *Geophysical Research Letters* and is by a pair of scientists from the University of Washington. Johanson and Fu collected radiosonde (balloon-based) temperature records from Antarctica, but they note that many of the records are incomplete or totally missing for long periods of time. They collected computer-generated "re-analysis" records, but they note the many shortcomings of using the model-based data as opposed to actual measurements. Finally, they collected satellite-based microwave sounding unit (MSU) records and made the case that the satellite records would be the most appropriate for determining trends over the past few decades. In the end, the different records all told the same story – and the results will not please the global warming supporters.

When comparing the radiosonde records from nine stations to the satellite-based data, the pair of scientists reports that "The seasonal and spatial patterns of warming and cooling are independent of dataset. Both radiosonde and MSU trends indicate that at these stations the summers and autumns are largely cooling while the winters and springs are warming. In both datasets, the troposphere cooling from December to May partly cancels the warming from June through November such that the annual mean trend is small."

Figure 1 shows the lower-atmospheric (tropospheric) temperature trends of interest to us along with temperature trends in the stratosphere (a layer 4 to 10 miles above the surface). What stands out most is the overall cooling during Antarctica's summer (DJF) and autumn (MAM). Some warming appears in Antarctica's winter and spring, but those seasons are bitterly cold with temperatures far below freezing and when small amounts of warming would have no impact on glacial or sea ice. The icepack of Antarctica doesn't start melting if the winter temperature increases from -50°F to -48°F! The summer is the critical season for melting ice, and the Johanson and Fu study clearly shows widespread summertime cooling in Antarctica from 1979 to 2005.

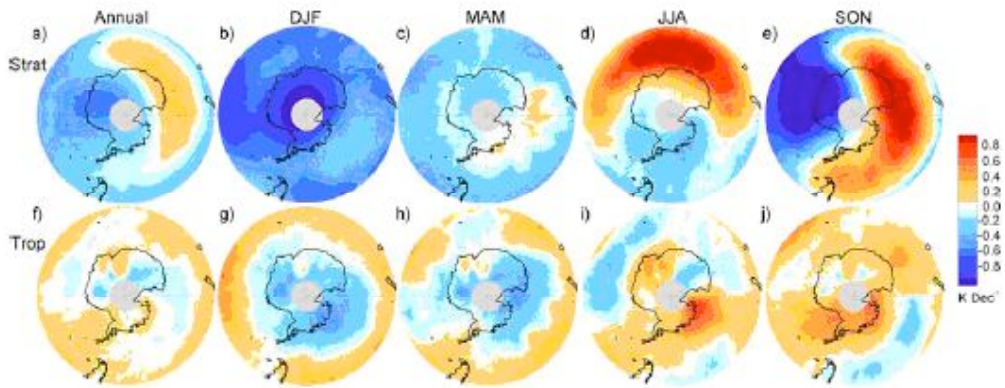
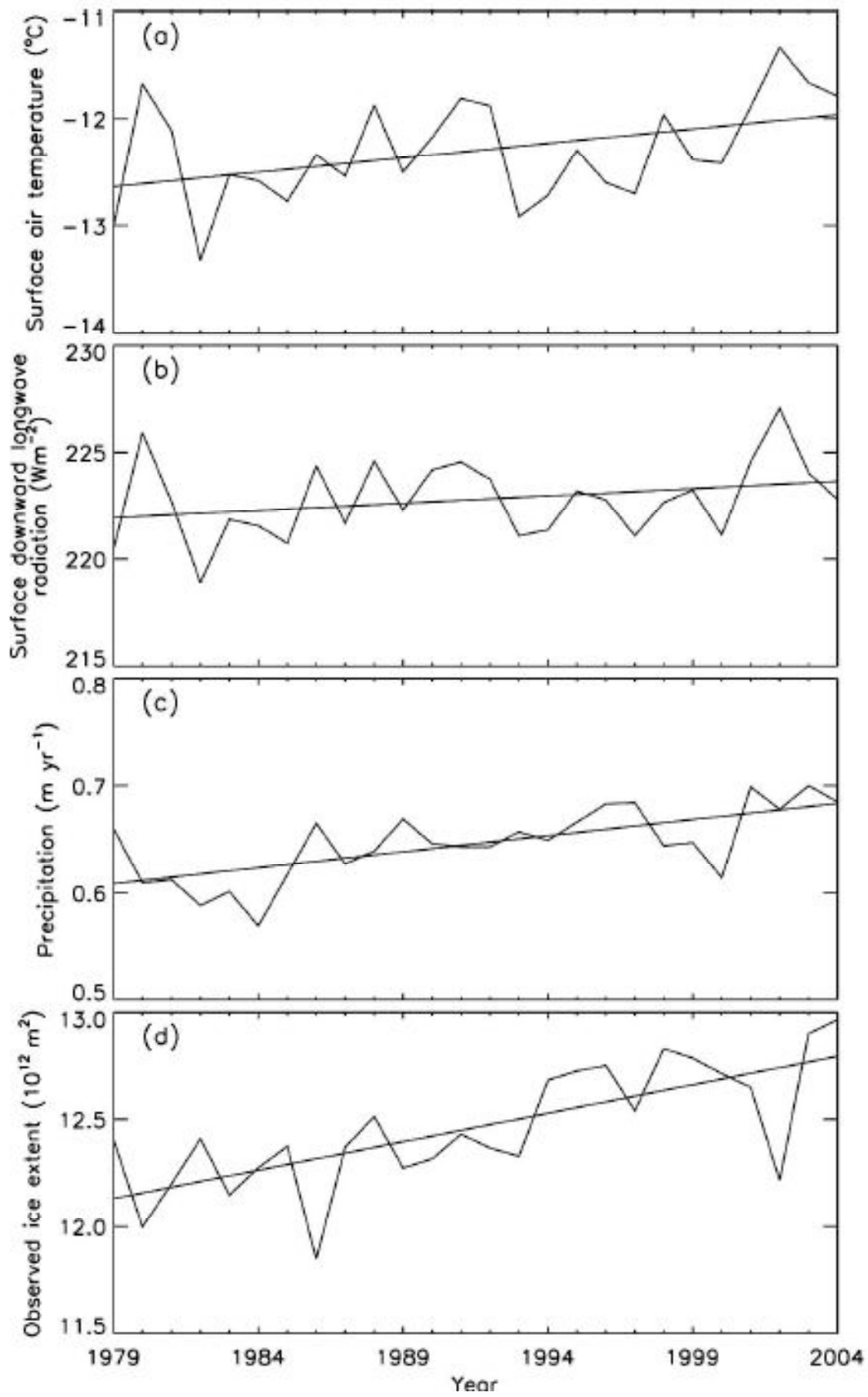


Figure 1. Satellite-based microwave sounding unit (a–e) stratospheric and (f–j) tropospheric temperature trends for 1979–2005 (from Johanson and Fu, 2007).

Given the observed cooling in summer, we might expect a thickening of the ice, not an overall melting. Well, in a recent article in the *Journal of Climate*, we see why the debate regarding climate change is alive and well. Another scientist at the University of Washington investigated trends in sea ice extent in Antarctica, and quite possibly to the surprise of Johanson and Fu, Zhang begins the article stating “Significant climate changes observed in the Antarctic include the increase in surface air temperature (SAT). SAT over the Antarctic as a whole has increased by 0.5°C in the last 50 yr, which appears to be part of a global SAT warming trend in recent years.” Further, we learn that “Except for some areas of the Atlantic and Indian sectors where SAT has decreased, a significant increase in SAT has occurred in most of the Southern Ocean according to the reanalysis data. Since 1979 the increase in SAT is 0.027°C yr⁻¹ over the ice-covered areas of the Southern Ocean. In conjunction with an increase in SAT is an increase in the NCEP–NCAR reanalysis surface downward longwave radiation (SDLR) and precipitation.” According to the data analyzed by Zhang, Antarctica has warmed, precipitation has increased, and the downward longwave (infrared) energy has increased ... go figure (well, at least have a look at the figure below).



Annual mean (a) surface air temperature, (b) surface downward longwave radiation, (c) precipitation averaged over the ice-covered areas of the Southern Ocean, and (d) annual mean satellite-observed ice extent. Straight lines are trend lines (from Zhang, 2007).

Anyway, Zhang notes that "Contrary to this warming trend, satellite passive microwave images display a significant increase in Antarctic sea ice concentration and extent since 1979 when quality space-based observations are available." Zhang then creates a complex numerical model of the situation and to make a long story short, the warming of the ocean surface around Antarctica changes (a) the salinity of the water near the surface, (b) the vertical temperature gradients of the local ocean, and (c) the overturning of the water. Less water comes to the surface, the potential heat energy of that water is lost to the surface, and the sea ice expands. The extra precipitation helps the sea ice as well.

Are you confused? These two recent articles illustrate the complexity of climate change – simple questions like "Is Antarctica warming or cooling" can be answered different ways depending on data sets used, time periods involved, and who does the analyses. Nonetheless, we learn that contrary to popular presentations on the subject, there is no evidence that Antarctica is melting away.

THE BIG THAW better cool it for a while!

References

Johanson, C. M., and Q. Fu (2007), Antarctic atmospheric temperature trend patterns from satellite observations, *Geophysical Research Letters*, 34, L12703, doi:10.1029/2006GL029108.

Zhang, J. (2007) Increasing Antarctic sea ice under warming atmospheric and oceanic conditions, *Journal of Climate*, 20, 2515-2529.