



## Central Coast Climate Science Education

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Misperception 5: “40 Years Ago All Climate Scientists Predicted an Ice Age”

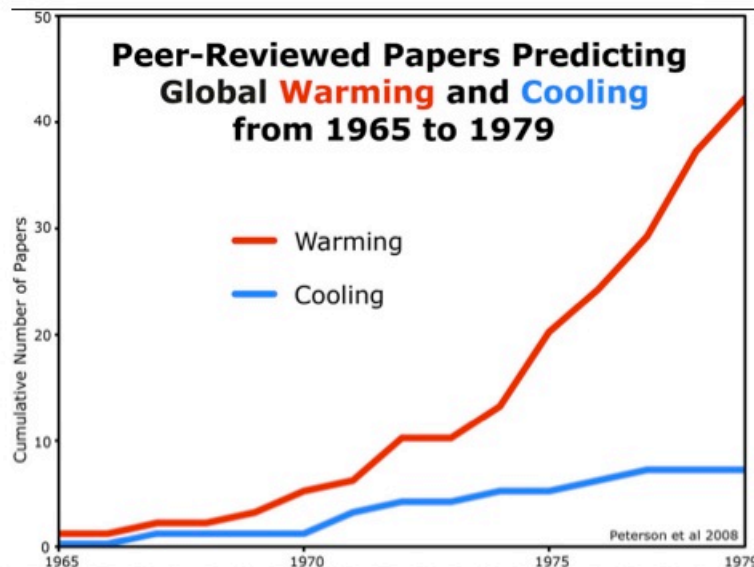
### Response:

One of the most frequent misconceptions I encounter when discussing climate change goes something like this: “Just 40 years ago ‘all you guys’ were telling us we were headed for another ice age and now you’re telling us we’re all gonna burn up. You were wrong then, so why should we believe you now?”

It is true that there were a few climate scientists who were considering this possibility but it was hardly “all you guys”. In fact, most of the publicity about this was generated by not-exactly-professional-scientific magazines such as this cover of Time magazine in 1977, following an earlier story in Newsweek in April 1975.

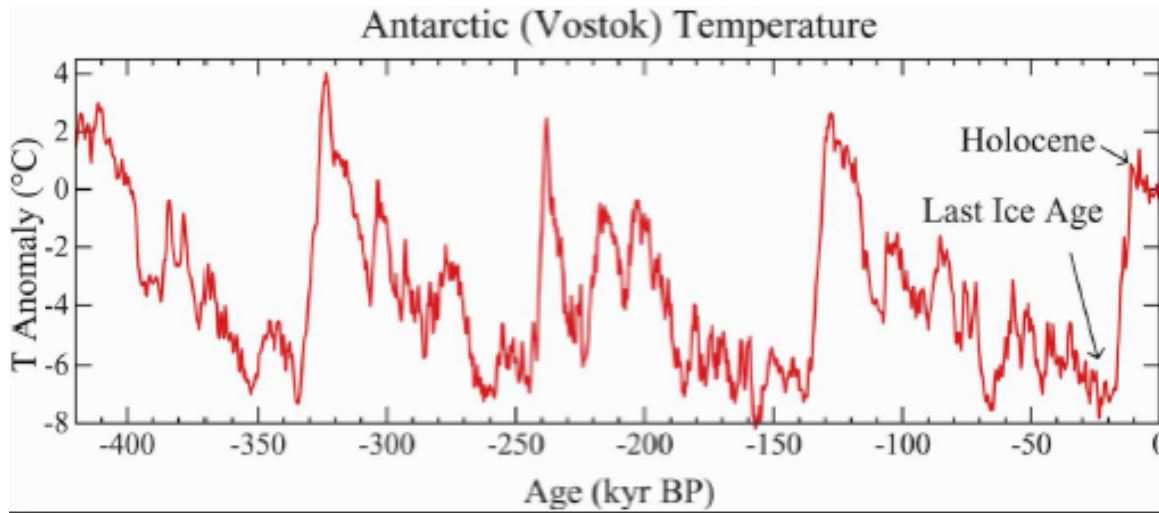


Actually, a survey of the professional climate science literature over this period, from 1965 through 1979, showed a much larger fraction of actual climate scientists predicting a warming world rather than a cooling one:

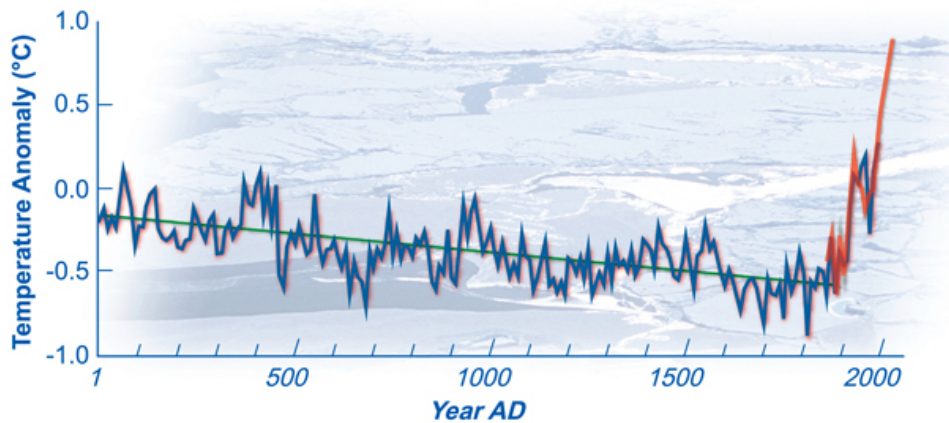


Nevertheless, it is true that a few highly qualified climate scientists were considering the possibility of a cooling world and it is worth considering the reasons for this.

First, if one looks at the history of the Earth’s climate over the past million years, there have been episodes of cold periods with large ice sheets covering much of North America and other portions of the northern hemisphere—these are the “ice ages”. Roughly every 100,000 years these glacial periods have been interrupted by the warmer but much shorter “interglacial” periods when the ice sheets retreated. In fact, for the past 10,000 years or so—comprising almost the entire history of the development of human civilization--we have been in a very stable interglacial period already lasting at least as long as the previous interglacial periods. Here is the temperature record going back about 425,000 years based on analysis of ice cores drilled into the Antarctic ice sheet. The air bubbles trapped in the ice carry with them a record of the temperature when the snow was deposited that became part of the ice sheet.



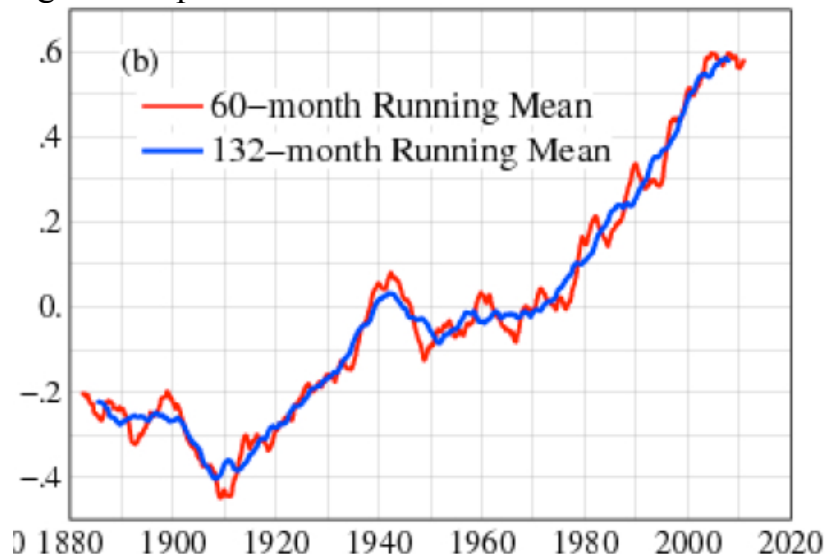
The “beginning of the end” of the last (most recent) ice age occurred about 20,000 years ago. (With so much water frozen into huge ice sheets, sea level was very much lower than it is today, enabling the migration of humans across the (dry) Bering Strait into North America). The end of this last ice age marked the beginning of the “Holocene” with some cooling then commencing anew, and it is easy to see why another ice age might have been anticipated. These very slow semi-cyclic swings in climate over the last million years or so are understood to be driven by subtle changes in the Earth’s orbit. In fact, these changes were beginning to cause cooling, especially in the far north, until, as the next image shows, this was suddenly reversed by human-induced warming.



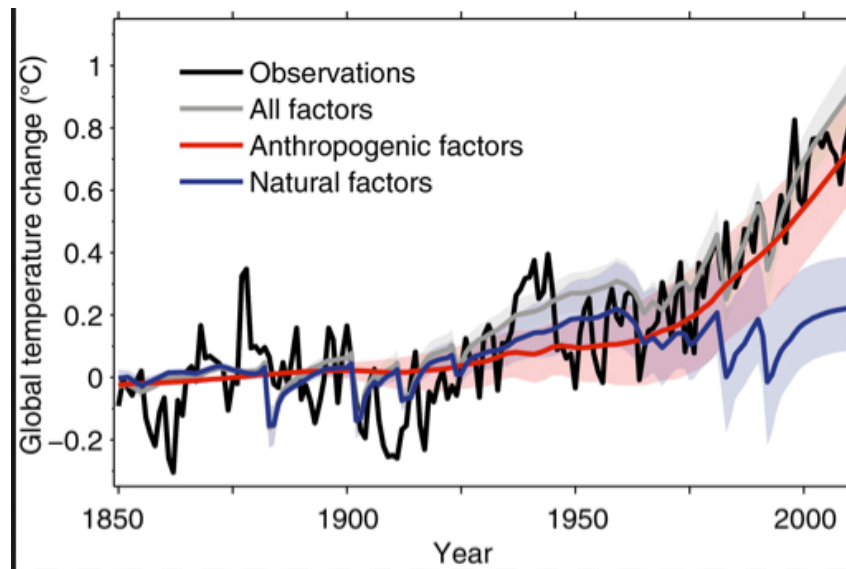
The plot above shows temperature reconstructions north of latitude 60N (blue) with the thermometer-based record in red. This plot is based upon the publication by Kaufman et al in the September 4<sup>th</sup> 2009 issue of SCIENCE magazine.

On a much shorter timescale, around the 1960's to 1970s, there was reason to believe that one of the human influences on the climate might exert a cooling effect comparable to, or even exceeding, the warming induced by emission of greenhouse gases. One of the reasons for this is reflected in some observations quoted in the original Newsweek article of April 28, 1975: “...a study released by...two NOAA scientists notes that the amount of sunshine reaching the ground in the continental U.S. diminished by 1.3 percent between 1964 and 1972”. This was almost certainly not due to decreased brightness of the sun itself, but instead due to dirty air blocking sunlight. The rapid growth of the post-WWII economy both in the U.S. and in the industrialized world produced, as a result of coal powered plants for example, large amounts of small particles that, like large volcanic eruptions, block sunlight and have a cooling effect. The first Clean Air act had only recently been passed and had just begun to have an impact in the U.S. while in many parts of the rest of the world the air was getting even hazier.

This “particle cooling” offset, or even more than offset, the warming from carbon dioxide and led to a period of nearly 30 years from about 1940 to 1970 when the global temperature was flat or slightly cooling as shown in the following NASA plot:



Now, with the advent of enormously powerful computers that can simulate the Earth's climate, along with what we know about the greenhouse gas concentration history, the sun's past brightness and the dimming of sunlight from the dirty air, it is possible to try to reproduce what was expected during this period (as well as before and after.) The computer simulations do a fairly decent job of reproducing the temperature history given the imprecision with which this past history is known and the uncertainties in the climate models.



The light gray curve (“All factors”) is a little hard to see but it is the best estimate taking account of all influences on climate change, both natural and human caused, of how the global temperature should have behaved and it does a fair job of reproducing the actual observations (black curve). It is noteworthy that if only natural factors are taken into account in the simulations (blue curve) and without including the human-caused factors (red curve) it is simply impossible to come close to reproducing the observed rapid rise in temperature beginning a little after 1970.

This brings us to the final point. While it is true that the basic physics involved in the greenhouse gas effect and the role that carbon dioxide might play in changing the Earth’s climate have been known for a century or more, detailed understanding of the Earth’s climate system was still in its infancy in 1975. In fact, in the same Newsweek article mentioned above, you will also find the following being quoted from a National Academy of Sciences report that had recently been released: *“Our knowledge of the mechanism of climatic change is at least as fragmentary as our data...Not only are the basic scientific questions largely unanswered but in many cases we do not yet know enough to pose the key questions.”*

Those not involved in the physical and biological sciences may not appreciate the almost unbelievably explosive growth in these sciences that has taken place over the 40 years since that report was issued. Climate science is no exception to this. The development of huge lightning-fast computers noted above is one factor but another major factor is the space age. At about the time of the Newsweek article, weather satellites were just coming into their own and satellites devoted specifically to understanding long-term climate effects were yet to come. Today there are currently 16 NASA climate satellites orbiting the Earth, joined by others, especially from

the European Space Agency (See [http://climate.nasa.gov/nasa\\_role](http://climate.nasa.gov/nasa_role) for a bigger image and NASA's role in studying the Earth's climate).



Other sophisticated measurements are being carried out that could not have even been contemplated in 1975. For example there are now thousands of robotic probes (“Argo” floats: see [http://www.argo.ucsd.edu/How\\_Argo\\_floats.html](http://www.argo.ucsd.edu/How_Argo_floats.html)) deployed over the world's oceans which descend to great depths measuring temperature, salinity and other ocean properties, then periodically rising to the surface to report the data to satellites.

It is literally not the same world today as it was in 1975 as far as our climate is concerned. Neither is it the same world today as it was in 1975 as far as our understanding of how and why our climate is changing.