

From Xi'an with Love

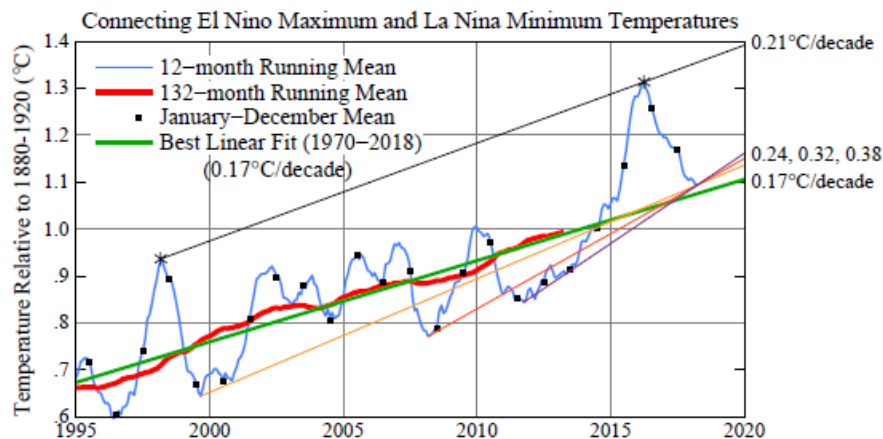
19 October 2018

James Hansen

Stop! No need to read this discussion of global warming acceleration, if you read my 15 October Communication of that title. I edited that Communication for clarity on a flight to China, but thanks in part to a skirmish between Google and China I was unable to get the improved version to Eunbi before she sent out the 15 October version.

You may want to check the figure that I added to the edited version, which is below at the very end of the Communication. Note that the eventual global warming, after fast and slow feedbacks have reached full fruition, is $+3.5^{\circ}\text{C}$ for $\text{CO}_2 = 400$ ppm.

Of course, this relationship can be modified by human-made aerosols, whose cooling effect is not precisely offset by human-made non- CO_2 greenhouse gases. That subject is discussed in my talk at the first joint meeting of the American Geophysical Union and the Chinese Academy of Sciences, which I am attending now. The charts for that talk are largely new, so after annotating them on the return flight to the U.S., I will make them available. I am sure that I will find more e-mails than I can deal with when I return, so if you have an urgent message contact Eunbi at ej2347@columbia.edu.



Global warming acceleration becomes evident by connecting global temperatures at La Nina minima.

Global Warming Acceleration Plus Miscellaneous

Climate models indicate that an El Niño, probably a weak one, will begin this (Northern Hemisphere) winter, and observations show that warming in the tropical Pacific has begun. Current global temperature (12-month running-mean) has thus reached its minimum and will begin to rise during the next few months. The global temperature minima associated with La Ninas are more uniform in depth than El Niño maxima. This provides an excellent opportunity to check whether the global warming rate is accelerating.

Global temperature *appears* to increase almost linearly over the past 50 years (green line above); the 1970-present rate is 0.17°C per decade. Jeremy Grantham [pointed out](#) that the rate of warming inferred by connecting the peak temperatures of the last two El Niño maxima (0.21°C per decade, see figure above) exceeds this longer term rate, and he infers that global warming is accelerating. La Niña minima probably provide a better estimate, and they provide a more recent rate. As the figure shows, the most recent two La Ninas imply a warming rate of 0.38°C per decade, at least double the longer term rate! Acceleration is predicted by climate models for continued high fossil fuel emissions as a result of amplifying climate feedbacks and is a cause for concern. We expect global temperature to rise in the next few months and confirm that the global warming rate has accelerated.

I am leaving today for Xi'an, China to attend the joint American Geophysical Union/Chinese Academy of Sciences conference on atmospheric aerosols and upon return I want to focus on preparations for the trial of the Trump Administration in the lawsuit brought by Our Children's Trust. So I summarize here a few items that Eunbi has put or will put on Facebook:

(1) In Bemidji, Minnesota last week I was not able to testify on behalf of the "raging grannies" who turned off a tar sands oil pipeline, because the judge threw out the case after a jury was selected. Frankly, I believe that the prosecution intentionally presented a weak case, expecting it to be thrown out. They didn't want the publicity that would have been associated with jailing these determined ladies, who were just barely strong enough to turn off the pipeline. You can see a photo of these two heroines on my Facebook.

(2) In an interview for [an article in the Guardian](#) I decried the decision in the UK to "ape" Trump (the reporter's choice of words) and develop fracking for gas. The UK just discovered a huge gas deposit offshore. What sense does it make for them to develop fracking, with its greater carbon footprint via leaked methane and its local pollution, when they have more than enough conventional gas to pass the dangerous level?

(3) Pierre Friedlingstein points out that the linear scale used for CO₂ in Charts 30 and 31 of my Taiwan talk is misleading when compared with the temperature scale in the same figures. He is right that we should use a log scale for CO₂ for comparison of CO₂ with temperature change, especially if we using the graph to estimate the expected eventual warming for the present large CO₂ amount. As is well known, partial saturation of CO₂ absorption bands requires the CO₂ amount to double for each successive increase of 4 W/m² of climate forcing, and expected global warming increases approximately linearly with the climate forcing.

Here's the bottom line. Remarkable fit of CO₂ and temperature for the past 800,000 years (Charts 30 and 31) is maintained with CO₂ plotted on a logarithmic scale. CO₂ is a tight control knob for global temperature. However, the eventual global warming expected for a given increase of CO₂ above the preindustrial level is reduced. Chart 31 shows, for example, that if CO₂ is held at 400 ppm the eventual global temperature is expected to be about +3.5°C relative to pre-industrial temperature, including the effects of fast and slow feedbacks (see new Chart 31 below). Charts 30 and 31 have been replaced in my [Taiwan Charts](#) (under Fig. 28). Of course the correct relation has been used in all of our climate simulations – this was only a plotting error made in these two charts.

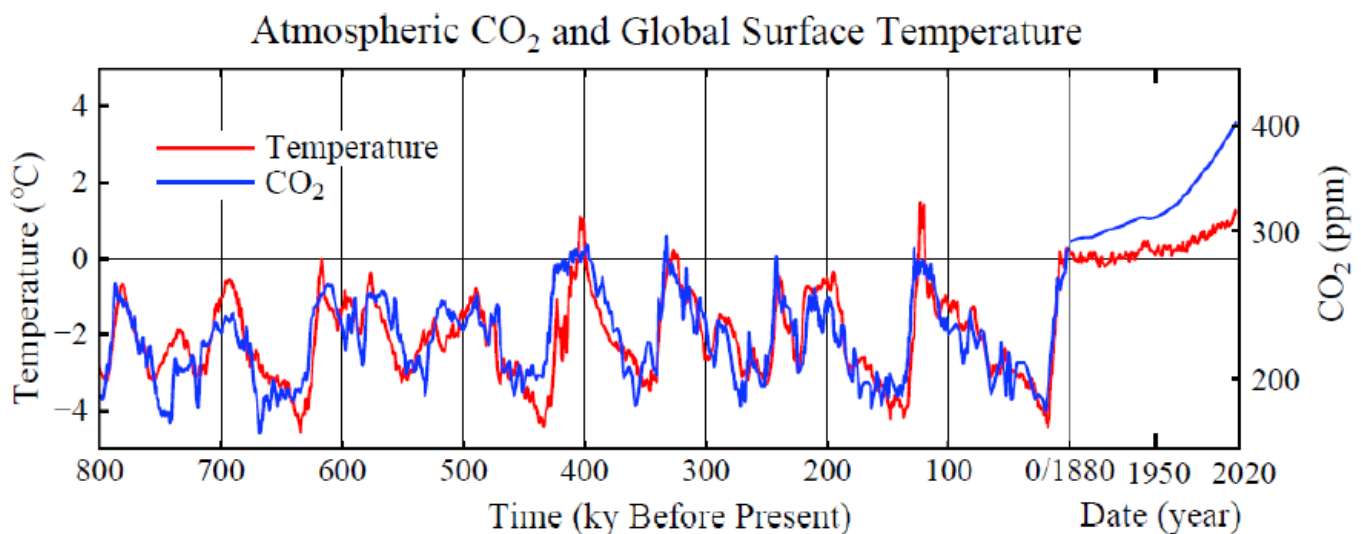


Chart 32 with logarithmic CO₂ scale.