



Chatham Star-Tribune

## Twittering

16 December 2020

James Hansen

**Sorry that I don't twitter yet, but I need to finish the book I'm writing before our wedding anniversary at the end of January, or Anniek may kick me out into the Covid world – but there were questions that I should answer regarding climate restoration in response to my last post (on global warming acceleration and aerosols).**

**I looked for instructions on twittering, but it seems that I asked the [wrong bird](#).**

*Dermot O'Logical @o\_logical: James, serious question. Is restoration of the climate even feasible at this stage? I accept some mitigation may be possible and anything is better than nothing.*

Don't be pessimistic. The delayed response of the climate system – which got us into trouble – also helps us; it gives us time to change the forcing before most consequences are locked in.

Global sea level is only up about 20 cm (8 inches) so far and species extinctions due to climate change are still small compared to what is possible. Those are the big irreversible things. To save our shorelines we need to reverse tracks and get back to at least mid-20<sup>th</sup> century climate, which will cause regional climates to be closer to what they were then.

*The Blob warned us @systemrename: 2019-2020, an acceleration or a detonation?*

It's an acceleration, but that's enough to be a big problem – we need to be slow the freight train, stop it, and put it in reverse – it's hard to get the world to understand that.

*Oliver Morton @Eaterofsun: Fascinating post, Jim. Does it lead you to reconsider the arguments in Crutzen 2006? [Albedo Enhancement by Stratospheric Sulfur Injections: A Contribution to Resolve a Policy Dilemma?]*

Hmm, somehow you must have missed my presentation at the Chinese Academy of Sciences – American Geophysical Union first joint meeting in Xian, China in October 2018. My

PowerPoint charts, including a discussion of each one, are available on my web site in [my communication of 24 October 2018](#). Access to a [PDF](#) of the presentation is also available. I show results of climate simulations with four different distributions of the stratospheric aerosols.

The remarkable thing about the results is that they all give maximum internal ocean cooling at depth along the Antarctic coast, right where we want it to slow the melt of the ice shelves. It's the mirror image of what we are getting now with global warming and freshwater injection from ice shelves into the upper layers of the Southern Ocean. The biggest cooling occurs if the aerosols are placed over just the Southern Ocean and Antarctica, where people do not live. It would be possible to do that, because of the way the stratospheric circulation works.

However, I'm not recommending this. I have a different suggestion, which minimizes geoengineering, which I will discuss in *Sophie's Planet*.

Craig Rye et al. published a [paper](#)<sup>1</sup> this year that confirms the principal conclusion in our paper [Ice Melt, Sea Level Rise and Superstorms](#)<sup>2</sup>: freshwater injection from Antarctica is already cooling the surface of the Southern Ocean and slowing the SMOC (Southern Meridional Overturning Circulation). This tends to close off the escape valve for deep ocean heat, which is the reason that the Southern Ocean has been warming at depth along the Antarctic coast and accelerating ice shelf melt. This is not a smooth change – the ocean dynamics around Antarctica is affected by ENSO (El Niño Southern Oscillation). Probably as a consequence of the 2016 Super El Niño, there was a burp of deep ocean heat loss, i.e., reversion to a stronger SMOC with a reduction of Southern Hemisphere sea ice. The sea ice has now recovered, however, and there is essentially no long-term trend of Antarctic sea ice cover. If global warming continues, freshwater injection will grow, warming at depth in the Antarctic coastal region will grow, and ice shelf melt will accelerate. We need to avoid that.

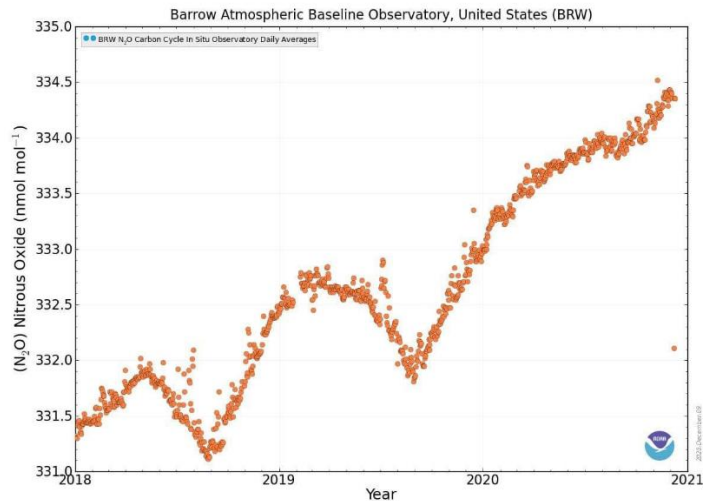
*UteratiOvaria @UteratiOvaria: Can you predict when global food shortages will be extreme?*

If we follow a sensible approach to climate change, which means putting a gradually rising price on fossil fuel emissions and strengthening international cooperation, it is possible for global economic well-being to resume its long-term growth. As the fraction of people in poverty declines – and with all the other potential advances that we know are possible, e.g., equal rights for women – there is the prospect that population will stabilize and perhaps decline, in which case it should not be difficult to avoid global famine.

The pessimist may argue that the recent global trend toward political extremisms makes the required cooperation and progress implausible. I give my opinions on how we may overcome the political problems in the final chapter of *Sophie's Planet* – but I'm a physicist, not a politician or sociologist. I'm going to stay out of this discussion until I finish my book.

From Facebook

*Kent James Deal: This graph has been on my mind recently, would love to know what could be affecting N2O readings in Alaska like this.*



I presume that the temporary declines are related to stratospheric-tropospheric exchange of air. The N<sub>2</sub>O chemical sink is in the stratosphere, so N<sub>2</sub>O amounts decline there – but you need to ask some who knows about stratospheric chemistry and dynamics.

You can sign up for our monthly global temperature updates [here](#).

You can sign up for my other Communications [here](#).

<sup>1</sup> Rye, C.D., J. Marshall, M. Kelley, G. Russell, L.S. Nazarenko, Y. Kostov, G.A. Schmidt and J. Hansen, 2020: [Antarctic Glacial Melt as a Driver of Recent Southern Ocean Climate Trends](#), *Geophysical Research Letters* **47**, 11, doi:10.1029/2019GL086892, 2020.

<sup>2</sup> Hansen, J., M. Sato, P. Hearty, R. Ruedy, M. Kelley, V. Masson-Delmotte, G. Russell, G. Tselioudis, J. Cao, E. Rignot, I. Velicogna, B. Tormey, B. Donovan, E. Kandiano, K. von Schuckmann, P. Kharecha, A.N. Legrande, M. Bauer, and K.-W. Lo: [Ice melt, sea level rise and superstorms:/ evidence from paleoclimate data, climate modeling, and modern observations that 2 C global warming could be dangerous](#) *Atmos. Chem. Phys.*, **16**, 3761-3812, 2016.