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# Arctic sea ice thermostatic control of global temperature

John Nissen
Cloudworld Ltd (jn@cloudworld.co.uk)

We show how the Arctic sea ice has been part of a thermostatic control mechanism, limiting temperature to a fixed ceiling during the interglacial periods between Ice Ages. But now the mechanism appears to be broken, with severe consequences unless appropriate action is taken.

The proposed mechanism involves the amplification of temperature changes, both positive and negative, in the surface waters of the AMOC (Atlantic Meridional Overturning Circulation) as they flow into the Arctic Ocean. We postulate that the Arctic climate system is loosely coupled to the rest of the climate system partly through this flow. Temperature changes are amplified by the albedo effect, as ice gives way to water which absorbs more insolation or the converse.

However, in the past, temperature amplification in the positive sense has been limited by a delayed negative feedback. This aspect of the thermostatic control mechanism is the rapid discharge of meltwater and ice into the North Atlantic, serving to nudge the eastbound AMOC current in a slightly more southerly direction towards Spain, thereby cooling the water entering the Arctic Ocean. This cooling is then amplified by the reformation of sea ice.

We show how this mechanism has been effectively broken by a huge anthropogenic pulse of CO2 into the atmosphere. We show that, instead of limiting the current global warming, the Arctic sea ice is now serving to further amplify that warming. In the absence of effective negative forcing, either natural or contrived, this could lead the planet to a new super-hot state. We will discuss various feedbacks in the Arctic system, including the mechanical feedback whereby strong winds can break up the sea ice and discharge it into warmer water where it melts.

Whereas some researchers treat the Arctic sea ice retreat as an episodic event, lasting perhaps 10-20 years, we will argue that there is no obvious immediate limiting mechanism on local and global warming, once the sea ice is gone. On the contrary, the demise of sea ice would inevitably lead to accelerated local warming, massive methane release and Greenland ice sheet instability. Therefore appropriate geoengineering action must be taken to halt the retreat of the Arctic sea ice. Fortunately there appear to be two albedo engineering techniques that might do this effectively – one using stratospheric aerosols and the other using marine cloud brightening.