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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Ice melt, sea level rise and superstorms: evidence from paleoclimate data, climate modeling, and modern observations that 2 °C global warming is highly dangerous" *by* J. Hansen et al.

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Title: Our awesome responsibility

Jason Box has made a major contribution to the argument that the Arctic, as a key component of the Earth System, is already passed a tipping point.

Far from rapid sea level rise being an extreme view on the tail end of a probability

distribution, as we would all wish to believe (see for example the Short Comment C6867 submitted by Jason Williams on September 15), there is strong evidence for other non-linearities and exponential trends, indicating that rapid change in the Arctic is underway and accelerating. This acceleration is not captured in any of models conventionally used in making projections through this century, e.g. by IPCC, and therefore invalidates scenarios on which much public policy is based.

Climate scientists have an awesome responsibility to tell the truth about what is happening to the Earth System and its Arctic component. We cannot gamble with the huge risk of the sea ice disappearing in summer, sea level rising many metres per century, climate changing abruptly and methane emissions reaching the gigaton/year level. Yet a huge gamble is being taken by those climate scientists who advise government and industry and who claim that it is safe to let the sea ice go, for the Arctic to continue warming, and for the methane emissions to escalate.

These scientists are currently telling government and industry that the only thing that really matters is to reduce carbon emissions. They are saying that the disappearance of the sea ice is a marvellous opportunity for a bonanza, with untold wealth from exploitation of resources and the sea routes which are opened up. Even President Obama is buying into this, and he must be one of the best advised US presidents we have ever had.

These scientists are gambling the future of the human race on their models being correct, when they forecast that the sea ice will last for decades, that the Arctic will warm only twice as fast as global warming, that the Greenland Ice Sheet mass loss cannot rise exponentially, that climate change has little to do with the Arctic and that the methane escalation has peaked.

These scientists frequently argue that these disasters cannot happen because there is no mechanism. But these mechanisms do exist.

1. There is a mechanism for exponential decline in sea ice through albedo positive

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feedback. There is a vicious cycle of Arctic warming and snow and sea ice retreat. As the sea ice retreats further, more open water is exposed which absorbs insolation; this heat accumulates in saline water below the surface, leading to a trend of further retreat of sea ice in subsequent years. Similarly on land, as snow retreats more heat is absorbed in a positive feedback loop.

2. Because of this vicious cycle, the Arctic will warm even faster, relative to global warming, until the sea ice has gone for much of the summer (and likewise for snow) when it will be warming at several degrees C per decade, ten to twenty times faster than expected global warming.

3. Jason Box has shown how the GIS mass loss can rise and is rising exponentially. The Eemian shows us how, following rapid warming there was 6-9 metres of sea level rise above the present sea level before something caused a cooling with the onset of the glaciation which marked the end of the Eemian. There is no reason why the rate of sea level rise should not reach levels observed in the great meltwater pulses of the past, averaging half a metre per decade.

4. Jennifer Francis has shown how recent climate change has been driven by rapid Arctic warming as the sea ice retreats. Much of the extreme weather observed in the past two decades can be attributed to changes in jet stream behaviour as the temperature gradient between tropics and Arctic has reduced. Abrupt climate change is coming from rapid Arctic warming rather than the much slower global warming.

5. Shakhova has shown how the methane from ESAS can continue escalating, possibly to the gigaton/year level. The source is not methane hydrate as has been modelled in an attempt to prove that such an outburst was impossible.

Thus there are mechanisms in place. And the processes are underway with exponential trends observable over the past two decades. This can no longer be denied by climate science advisers.

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And now they can no longer deny that these dreadful things can happen because they have never happened before, because now we have the Eemian as a dreadful precedent for what could happen to us over the next few decades. The situation in the Eemian immediately prior to a sea level rise of 6-9 metres seems to have been extraordinarily similar to our current situation as regards global temperature and sea level.

Climate scientists must now accept that there is a huge risk of major disasters consequent on sea ice decline, unless emergency action is taken to halt and then reverse this decline. And the sooner this intervention can start, the more likely it is to succeed. Government and industry should be advised accordingly.

From now on, effort needs to be focussed on finding solutions and implementing them, rather than gambling on the hope that these huge Arctic problems don't exist.

Interactive comment on Atmos. Chem. Phys. Discuss., 15, 20059, 2015.