The Cryosphere Discuss., 6, C2386–C2388, 2012
www.the-cryosphere-discuss.net/6/C2386/2012/


The Cryosphere Discussions

# *Interactive comment on* "Mechanisms causing reduced Arctic sea ice loss in a coupled climate model" *by* A. E. West et al.

**Anonymous Referee #2**

Received and published: 10 December 2012

Review of West, Keen and Hewitt " Mechanisms causing reduced Arctic sea ice loss in a coupled climate model".

Whilst the Arctic observations has shown accelerated ice loss this summer, I still feel there is relevance to this study where the details of the Arctic ice budget and mechanisms in a climate model where the Arctic ice loss decreases on multi-decadal is worth publishing and I recommend it for publication with minor clarifications and additional figures listed below. Page 2655 line 14. The reference to the Wang and Overland (2009) paper. I looked back at this paper, whilst only one of the ensemble members used in this study was included there, I could not see the temporary halt in September ice reduction in their graph. Can you clarify?

I also looked at the more recent Wang and Overland 2012 based on CMIP5 models



where the HADGEM2-CC and HADGEM2-ES, which use a similar physical model to HADGEM-1 used in this study where included and they also did not show any halts in September ice loss. Looking at the limited data published on other CMIP5 models, there are however decadal signals in some of the other models included in the Wang and Overland paper where ice almost disappears and recovers, and also decadal signal in the Massonnet al paper In 2012 paper in 'Cryosphere discussions'. So the decadal processes from the ocean heat transport to the Arctic outlined in this paper could be relevant to those models. I suspect however in the real world in future decades as the warming trend accelerates (rather than the 90s than the authors talk about in the discussion) that the flushing of multiyear ice from the Arctic will only have multi-annual rather than decadal effects on slowing the ice covers rate of retreat.

One issue to comment is that the phenomena you describe shows up in all ensemble members across 2 ensembles (ALL and ANT), which slightly surprised but probably is linked to the ice loss halt is controlled by the wider context of the variability in the northward ocean heat flux, the variability in the overturing and the ice export form the Arctic. It might be more useful to include the actual time series you used for Figure 3 so that the reader can match the variability with the time of the ice variability. The section on bottom of page 2665 top of 2666 on MOC links to the temperature would benefit from having this time series to cross reference. Line 23 page 2659. Suggest you re-word the time mean control the same as you used in the figure caption, it is what I thought you meant, before I saw the figure caption but it was a bit ambiguous.

As an aside did you look at the decadal variability in the control, whilst there may not be as much a trigger from increased northward heat transport as in the historical-recent period, did any of the other mechanisms seen in this study show up, for example the impact of the flushing of the ice from the Arctic basin. In line 11 page 2660 and line3 page 2261 you talk about sharp drop and sharp decrease. As these are both negative and your sign convention is positive northwards I would rephrase them as change in outflow of the ice transport it reads more logically. I found line 21 page 2661 confusing,

though I think it is right to clarify suggest you say 'ALL IHT drop occurs a decade earlier than that seen in the ALL IHU', It was confusing as it could have been talking about the decadal difference between ALL and ANT. Page 2663 24-29, and Page 2667, 9-11 you refer to episodes of heat convergence in the WA region, as this is a key argument it would be good to illustrate it with a figure for one of the cases, I recognise it is not in all ensemble members. Fig 6 caption you define WA Western Arctic in Figure 4 not section 4. A couple of omissions in the study, you probably have not included an age tracer so cannot distinguish if the ice is multi-year or new ice, but the observations suggest tracking this would be useful in future simulations. Also you make no reference to the effect of the freshening of the Arctic Ocean/ Greenland Sea system from the ice melt which could also contribute to a reduction in ice-ocean flux and reduce ice melt though I would expect that to occur more on an annual than decadal time scale.

---

Interactive comment on The Cryosphere Discuss., 6, 2653, 2012.