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The Cryosphere Discussions

Interactive comment on "North Atlantic warming and declining volume of arctic sea ice" *by* V. A. Alexeev et al.

Anonymous Referee #1

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Title: North Atlantic warming and declining volume of arctic sea ice Authors: V. A. Alexeev, V. V. Ivanov, R. Kwok, and L. H. Smedsrud

Summary: In this paper, the authors document an anomaly in sea-ice thickness along the continental shelf between Svalbard and Franz Joseph Land. They argue that this ice thickness anomaly is due to ocean heat fluxes between warm Atlantic waters and sea ice – causing basal melt. The authors also eliminated the possibility (after investigation) that anomalous sea ice drift, snow accumulation and downwelling longwave radiation could be responsible for the observed ice thickness anomaly. Major Points: 1- The ice thickness anomaly in the paper is described as a local minima, yet ICESat does not give data to the south of the region of interest. [I am assuming that the discontinuity in the ICESat data south of the continental shelf means that there is no data from

ICESat there]. So we cannot tell if there exists a local minima in the sea ice thickness - with thicker ice north and south of this elongated feature – or if it is the natural transition between central pack ice and the ice edge to its south. The author should provide a figure of the ICESat data for the entire Arctic to convince the reader that the elongated features following the continental shelf between Svalbard and Franz Joseph Land is indeed a unique feature that is not present anywhere else. Why is ICESat capable of giving ice thickness estimates so close to the ice edge around Svalbard and cant give an ice thickness estimate in the Barents Sea south of the region of interest? 2- Error estimate: In the text it is said: "Uncertainty of ICESat products at 25 km length scale is 0.5m based on assessment with submarines and upward looking sonars. Averaging over the larger area reduces the uncertainty in the overall noise; therefore, we argue that the uncertainty is significantly smaller than the observed anomalies". How large of an area was the ICESat data averaged over? This averaging reduces the error by how many centimeters? Given that this is the basis of the whole article, a more elaborate error discussion is in order. 3- The authors give an estimate of the ocean heat flux from the NOREsm global climate model (50 km resolution). Does the NOREsm simulate a cold halocline layer in the Arctic as observed? How do we know that the simulated increase ocean heat flux along the continental shelf between Svalbard and Franz Joseph Land is not the results of an absence of the CHL in the model as opposed to something akin to the observations? 4- The anomaly in the downwelling longwave radiation has the same shape as the ice thickness anomaly (over the region where both NCEP and ICESat data exist) contrary to what is said in the text. In the paper, the authors assume that the ice thickness anomaly follows the continental shelf and does not exist to the south over shallower depth but there is no ICESat data in this region to assess whether this is true of not.

Technical Points: Page 5, line 24: There is a missing "period" after"2007". Page 7, line 2: "should therefore BE particularly useful. Page 7, line 18: "to be 10-2W/m2" – what does that mean? 10-2=8? Between 10 and 2? This needs to be clarified. Page 8, line 15: "..lasted for a day or three.." Which one is it? One, two or three days? I am

guessing it must be stated in the paper by McPhee. Fig 3: The sea ice thickness from IceSat is discontinuous south of the region of interest in the Barents Sea – with colors shifting from blue to white along a very definite line. I am assuming that ICESat does not give an ice thickness estimate in this region of the Barents Sea. This needs to be stated. Fig 4: NorESM ice thickness is 4m everywhere in the central Arctic. This is very different from observations. Is it the colorbar that is poorly chosen? The sea ice edge simulated by the model should be superimposed on the ice thickness field. The colorbar should be changed. All we can see clearly in this figure is ice of 4 m and 0 m thickness.

Interactive comment on The Cryosphere Discuss., 7, 245, 2013.