Anonymous Referee #1
We thank the reviewer for the constructive and useful comments. Below are our answers.

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?"

We do not retrieve ice thickness in the Barents Sea because the larger uncertainty in the snow depth in the region and hence large uncertainty in the retrieved snow thickness. Also, there is no large-scale climatology of snow depth in that region for comparisons.
We added a plot showing movement of ice for each year (back trajectories) that is showing that for all years except for 2004 ice originates from areas with thicker ice.

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."

Based on number of points (N, number of measurements from satellite) used for creating the gridded sea ice data and 0.5m for an error at a single point we estimate our overall error by dividing by the square root of N. Our estimates show that for the region of interest the satellite made at least 20 measurements in each box 5 by 2.5 degrees (longitude by latitude) in each mission. This number is significantly larger for the whole domain (15E-90E and 80N-85N). We changed the wording to 'somewhat smaller' rather than 'significantly smaller'.

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?"

A cold halocline has protected the arctic sea ice from the heat of the Atlantic

Water for much of the observational record, and in many regions. Cold halocline forms in the region east of St.Anna Trough. In the region nortgh-east of Svalbard CTD sections (Figure 1) clearly show the warm Atlantic water layer directly underneath the sea ice. The cold halocline is thus not present in this region, and the important question is if the NorESM correctly simulates vertical thermohaline structure in the AW inflow area? More of the new NorESM simulations have now been analyzed, and the Atlantic inflow and the cold halocline seems reasonably well reproduced, although the Atlantic layer is overall slightly too deep and broadly distributed with the Arctic Basins. This is a work in progress for other projects and evaluation of the CMIP5 models in the Arctic Ocean is beyond the scope of this paper. In the region north of Svalbard though, the Atlantic Water is found directly under the ice, quite close to the situation in the observations between 2004 and 2008. The NorESM simulations therefore illustrate nicely the situation typical of recent years in this region, and this is why they were included in the first place.

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."

We find it hard to see how the anomaly in the downwelling longwave radiation looks the same as sea ice anomaly, especially in 2008. The minimum in sea ice thickness is reached right along the zero line of the downwelling radiation anomaly.

Technical Points:
Page 5, line 24: There is a missing "period" after"2007".
Done
Page 7, line 2: "should therefore BE particularly useful.
Done.
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.
Changed to 10-20 W/m2
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.
It is either one, or three days bursts. There are several peaks with varying duration on the graph of vertical heat flux (MacPhee et al, 2003, Fig. 6-f).

"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."
See our comment to Major question #1

"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."

The NorESM thickness is clearly not a perfect match towards the observations, but for large areas of the Arctic Ocean 4 m is a reasonable horizontal average value as the figures below from Haas et al (2010) shows. We have now chosen a different colorbar that shows more of the gradient. Note that both the gradient in thickness across the Fram Strait and north of Svalbard in the NorESM field is quite similar to the observations of Haas et al (2010).

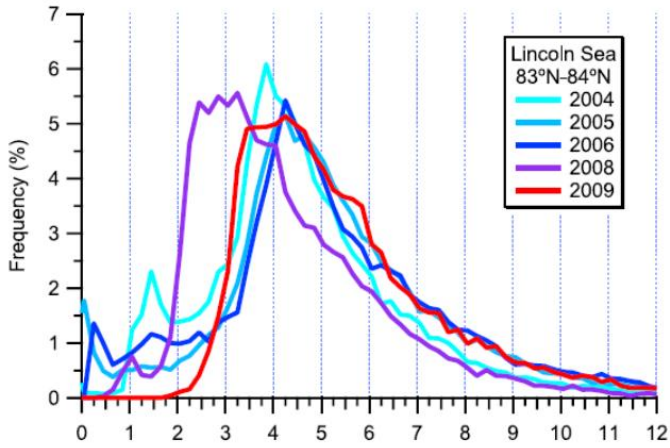

Figure 3b) from Haas et al 2010. Lincoln Sea is section 4 in the plot below, and the Ice Thickness Distribution above shows that a 4 m mean value is reasonable for this area in the 2000's.

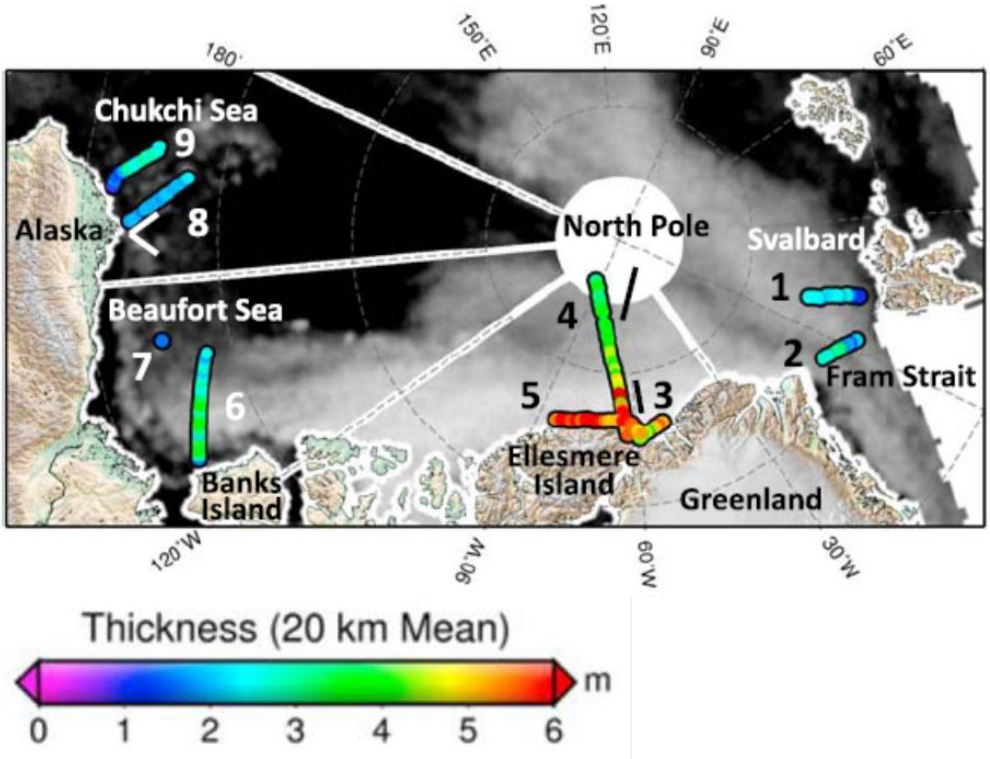

Figure 1 in Haas et al 2010. Copyright AGU.