The implications of selected processing methods on satellite altimetry derived sea ice thickness state and trends in the seasonal ice zone

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The ice cover of the Arctic Ocean is increasingly becoming dominated by seasonal sea ice. It is important to focus on the processing of altimetry ice thickness data in thinner seasonal ice regions to understand seasonal sea ice behaviour better. This study focusses on Baffin Bay as a region of interest to study seasonal ice behaviour.

We aim to reconcile the spring sea ice thickness derived from multiple satellite altimetry sensors and sea ice charts in Baffin Bay and produce a robust long-term record (2003-2020) for analysing trends in sea ice thickness. We investigate the impact of choosing different snow depth products (the Warren climatology, a passive microwave snow depth product and modelled snow depth from reanalysis data) and snow redistribution methods (a sigmoidal function and an empirical piecewise function) to retrieve sea ice thickness from satellite altimetry sea ice freeboard data.

The choice of snow depth product and redistribution method results in an uncertainty envelope around the March mean sea ice thickness in Baffin Bay of 10%. Moreover, the sea ice thickness trend ranges from -15 cm/dec to 20 cm/dec depending on the applied snow depth product and redistribution method. Previous studies have shown a possible long-term asymmetrical trend in sea ice thinning in Baffin Bay. The present study shows that whether a significant long-term asymmetrical trend was found depends on the choice of snow depth product and redistribution method. The satellite altimetry sea ice thickness results with different snow depth products and snow redistribution methods show that different processing techniques can lead to different results and can influence conclusions on total and spatial sea ice thickness trends. Further processing work on the historic radar altimetry record is needed to create reliable sea ice thickness products in the marginal ice zone.