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Propagation of heat anomalies toward the Arctic in the Nordic Seas studied using satellite altimetry

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The Nordic Seas connect the North Atlantic Ocean and the Arctic Ocean; warm and salty Atlantic water flows northward in an eastern boundary current system that constitutes the main oceanic heat transport to the Arctic. As such, the currents play an important role for the Arctic climate and effect e.g. the sea ice distribution in both the Arctic Ocean and in the Barents Sea.
Heat anomalies have been found to slowly migrate counter-clockwise around the Arctic Mediterranean at speeds remarkably slower than the mean advective speed. Here we use satellite altimetric sea surface height during the 22 year period 1993-2014 to investigate propagation of heat anomalies in the Nordic Seas. A lead-lag correlation analysis along the eastern boundary current reveals an elevated correlation pattern that corresponds to a slow propagation speed of about 2.5 cm/s. This is comparable to previous estimates of propagation speeds in the Nordic Seas, which suggests that the altimetric data captures a migrating low-frequency steric signal. These previous studies have been based on hydrographic or sea surface temperature data; the higher resolution in time and space of the satellite data gives an advantage in a lead-lag analysis and our study shows that it can be used to identify low frequency heat anomalies propagating toward the Arctic.
An interesting unsolved question is why the propagation of heat anomalies is slower than the mean current speed. A simplistic conceptual model, in which a thin high-speed current core interacts with an adjacent larger, relatively low-speed, pool of Atlantic water, is presented as a possible mechanism for the delayed transit time. Interestingly, this mechanism acts as a low pass filter, preventing high frequency temperature variations of the Atlantic water inflow to the Nordic Seas to penetrate into the Arctic Ocean.