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The East Greenland Coastal Current: Seasonal and Interannual Variability

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The importance of freshwater in the global ocean system has been appreciated for decades, yet gaps in our knowledge of Arctic dynamics and the freshwater budget still exist. One particular feature of importance is the East Greenland Coastal Current (EGCC) which is characterised by a cold, low salinity wedge. This current is a major pathway for freshwater into the North Atlantic Ocean with previous estimates of freshwater transport equivalent to one third of the net Arctic freshwater gain. For some years questions have arisen over (i) the seasonal evolution of the EGCC, (ii) the mechanisms driving the current, and (iii) annual transport values. Using data from moorings deployed on the East Greenland shelf (∼63°N, 0-150 m depth) over 4 years, and the use of high resolution ocean model output (∼5 km) from NEMO, we can address these questions. The mooring data and model output revealed unexpected features of the EGCC. The current is identifiable throughout the year which contrasts previous research that indicated a summer only, buoyancy-driven current. Furthermore, the summer time average velocities are at least half that of the average winter time velocities.

In the spring and summer, ice melt lowers the average salinity profile of the EGCC, though this freshening varies substantially from year to year. For example, between two consecutive years, there was a mean change of 4.5 °C and 1.5 psu in the upper 150 m. Though freshening of the EGCC in the warm seasons creates stronger density gradients, the isopycnals deepen in the winter and shoal in the summer. Preliminary work shows this to be by wind forcing: equatorward winds in the winter force the wedge to the coast, steepening the isopycnals. We are currently calculating the seasonal driving mechanisms to determine when the EGCC is primarily buoyancy-driven or wind-driven. Finally, the strong winter winds increase transport with initial calculations showing the EGCC freshwater transport to average nearly half of the net Arctic freshwater gain (0.09 Sv), supporting previous work on the importance of this freshwater feature.