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Quantifying the impact of submesoscale dynamics on the evolution of Arctic freshwater fronts

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The dramatic decrease in Arctic sea ice has resulted in a corresponding increase in the seasonal freshwater flux due to melt water in the Canada Basin. This source of freshwater can be quite patchy as sea ice breaks aparts and melts, resulting in freshwater fronts that are strained and stirred by the mesoscale eddy field. We would like to understand the relevant processes that determine the evolution of these freshwater fronts and how heat and salt are exchanged between the fresh melt water and the background water masses. In particular we investigate the importance of submesoscale processes for the lateral and vertical exchange of heat and salt, using high resolution observations of a freshwater front in the Arctic to initialise idealised simulations of frontal evolution. We isolate the effect of submesoscale dynamics by comparing high resolution submesoscale-resolving simulations with lower resolution simulations permitting only larger-scale eddies. Comparisons with observed temperature wavenumber spectra will be presented to investigate whether the simulated dynamics are representative of observations. Heat and salt budgets are presented for the simulations and the impact of submesoscale dynamics on the balance between across-front ageostrophic and geostrophic transports will be discussed. We will also discuss the implications of these results on the seasonal redistribution of heat over the upper ocean, specifically do submesoscale dynamics lead to an increase in the vertical transport of heat across the base of the summer mixed layer, therefore increasing the heat content within the winter mixed layer and delaying the formation of sea ice in the fall?