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Interactions between Arctic sea ice drift, concentration and thickness modelled by NEMO-LIM3.6

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Sea ice cover and thickness have substantially decreased in the Arctic Ocean since the beginning of the satellite era. As a result, sea ice strength has been reduced, allowing more deformation and fracturing and leading to increased sea ice drift speed. We use the global ocean-sea ice NEMO-LIM3.6 model as well as satellite and buoy observations over the period from 1979 to 2013 to study the interactions between sea ice drift, concentration and thickness. Overall, the model agrees well with observations in terms of sea ice extent, concentration and thickness. Although the seasonal cycle of sea ice drift is reasonably well reproduced by the model, the modelled values are generally higher and the trend is weaker compared to observations, resulting in lower sea ice export at Fram Strait than observed. NEMO-LIM3.6 is able to capture the relationship between sea ice drift and strength in terms of seasonal cycle, with higher drift for both lower concentration and lower thickness, in agreement with observations. Sensitivity experiments are carried out by varying the initial ice strength and show that higher values of ice strength lead to lower ice thickness. The negative feedback between sea ice strength, heat loss and thickness can explain these results. This study forms part of the EU Horizon 2020 PRIMAVERA project aiming at developing a new generation of advanced and well-evaluated high-resolution global climate models.