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Sea ice strength in SI3

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The NEMO sea ice model, SI3, includes the simple formulation of Hibler (1979; H79) to parameterise the compressive strength of sea ice. This assumes that thick and compact sea ice has more strength than thin and low concentration sea ice. However, the H79 strength scheme does not consider physical assumptions around energy conservation. The strength scheme of Rothrock (1975; R75) is based on the amount of potential energy gained and frictional energy dissipated during ridging, and has been introduced to SI3. Additionally, the option for a negative exponential redistribution of ridged ice among thickness categories, to better approximate observations and improve stability compared to the existing uniform redistribution when using R75, has been included. The R75 strength formulation is stable and works well in SI3 at version 4.2 with an EVP rheology, under a Met Office forced NEMO/SI3 model configuration. Sea ice strength is generally reduced for the R75 scheme compared to H79. The most notable effect on the model output is a greater number of, and sharper, features in the resulting modelled ice field when using the R75 scheme compared to the H79 scheme, which are particularly apparent in the ice thickness field. An increase in the model effective resolution is therefore demonstrated.