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Stress and deformation characteristics of sea ice in a high resolution numerical sea ice model.

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The drift and deformation of sea ice floating on the polar oceans is due to the applied wind and ocean currents. The deformations of sea ice over ocean basin length scales have observable patterns; cracks and leads in satellite images and within the velocity fields generated from floe tracking. In a climate sea ice model the deformation of sea ice over ocean basin length scales is modelled using a rheology that represents the relationship between stresses and deformation within the sea ice cover. Here we investigate the link between observable deformation characteristics and the underlying internal sea ice stresses and force balance using the Los Alamos numerical sea ice climate model.

In order to mimic laboratory experiments on the deformation of small cubes of sea ice we have developed an idealised square domain that tests the model response at spatial resolutions of up to 500m. We use the Elastic Anisotropic Plastic and Elastic Viscous Plastic rheologies, comparing their stability over varying resolutions and time scales. Sea ice within the domain is forced by idealised winds in order to compare the confinement of wind stresses and internal sea ice stresses. We document the characteristic deformation patterns of convergent, divergent and rotating stress states.