Modelling Antarctic sea ice variability using a brittle rheology

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Sea ice plays an important role in determining the exchange of heat, salt, and momentum between the atmospheres and oceans. The Next Generation Sea Ice Model (neXtSIM) is a Lagrangian model aimed to study the behaviour of sea ice in response to various environmental factors. neXtSIM was applied for the Southern Ocean using both a novel brittle rheology (BBM) and a typical Elastic-Viscous-Plastic (EVP) rheology. Both runs well-represented the seasonal cycle of sea ice extent but tended to overestimate it by about 2.5 x 10^6 km^2 (14%) in winter due to a colder ocean forcing. The BBM had larger drift correlation (0.73) in comparison to the EVP run (0.54). This happened because, in the BBM run, sea ice fractures more easily and is more effectively transported by the wind and currents. In contrast, sea ice tends to deform as a viscous fluid in the EVP run. Fractured ice in the BBM run also leads to thicker ice due to increased ridging and ice growth which tends to generate a larger Pan-Antarctic sea ice volume. Preliminary results of a wave-sea-ice coupled model show the penetration of swell hundreds of kilometres into the pack revealing the importance of waves for climate projections.