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Constraining the parameters of the EAP sea ice rheology from satellite observations and discrete element model

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The elastic-plastic anisotropic (EAP) sea ice rheology explicitly accounts for the observed sub-continuum anisotropy of the sea ice cover and has been implemented as an option into the latest version of the Los Alamos sea ice model CICE. The EAP model is starting to be used in several modeling centres and is the default rheology choice in CPOM.

The EAP rheology contains one new prognostic variable, the local structure tensor, which quantifies the degree of anisotropy of the sea ice, and two parameters that set the time scale of the evolution of this tensor. Observations from high-resolution satellite SAR imagery and discrete element modelling show how cracks can form, propagate, and heal to form an emergent anisotropic or isotropic sea ice state.

In this work we analyse satellite imagery using an anisotropy metric (a tensorial Minkowski functional) to measure quantitatively the degree of anisotropy and alignment of the sea ice at different scales. We apply the methodology to the GlobICE Envisat satellite deformation product (www.globice.info) and to discrete element simulations. This analysis helps us to study anisotropy evolution and further constrain uncertainty in EAP model parameters.