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Scaling properties of Arctic sea ice deformation in high-resolution viscous-plastic sea ice models and satellite observations

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Sea ice models with the traditional viscous-plastic (VP) rheology and very high grid resolution can resolve leads and deformation rates that are localised along Linear Kinematic Features (LKF). In a 1-km pan-Arctic sea ice-ocean simulation, the small scale sea-ice deformations in the Central Arctic are evaluated with a scaling analysis in relation to satellite observations of the Envisat Geophysical Processor System (EGPS). A new coupled scaling analysis for data on Eulerian grids determines the spatial and the temporal scaling as well as the coupling between temporal and spatial scales. The spatial scaling of the modelled sea ice deformation implies multi-fractality. The spatial scaling is also coupled to temporal scales and varies realistically by region and season. The agreement of the spatial scaling and its coupling to temporal scales with satellite observations and models with the modern elasto-brittle rheology challenges previous results with VP models at coarse resolution where no such scaling was found. The temporal scaling analysis, however, shows that the VP model does not fully resolve the intermittency of sea ice deformation that is observed in satellite data.