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Downscaling of sea ice dynamics from mesoscale to local scale

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Sea ice is normally approximated as a continuum in geophysical models where the grid size is much larger than the size of ice floes. In engineering applications the interest is in the local load on ships and fixed structures where the scale is of the order of the floe size or less. Consequently, the relation between stress fields in these scales is non-trivial. The problem is of large practical interest for the development of load forecasting methods for planning and operation in ice-covered seas. Also for basic geophysical research the scaling is an important issue. The length scale of sea dynamics depends on the ice thickness showing up in the stiffness of the ice and expansion of the landfast ice zone. Local consequences of geophysical stress field are formation of sea ice ridges and leads.

In this presentation sea ice dynamics simulations with a numerical model and local force measurements are jointly analysed in the Baltic Sea. The geophysical sea ice stress field is obtained from a well-tested Baltic Sea ice dynamics model, which is a 3-level viscous-plastic model. The influence of a point load is added to the model. This point load arises due to a structure that resists the motions of an individual ice floe. This has consequences to the global behaviour of several ice ice floes in the vicinity of the structure. The reduction of the speed of the floe interacting with the structure is of great interest from the structure point of view. In the present case the model can be calibrated based on routine daily ice chart information. Comparisons are made on case basis and using statistical characteristics of the simulations and force data.