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Numerical modeling on landfast ice in Arctic region

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Sea ice is regarded as a significant indicator of climate change in the Arctic Ocean. Landfastice is sea ice that is immobile or almost immobile in coastal regions, decreasing the transfer of heat, moisture, and momentum. As an extension of the land for travel and hunting, landfast ice also influences the construction of ice roads and arctic shipping routes in the summertime. Despite the important role of landfast ice in the climate system, the formation and maintenance of landfast ice are not well simulated by current sea ice models. Lemieux (2015) came up with the grounding scheme, by adding a basal stress term according to the water depth, improving landfast ice representation in shallow regions while underestimating in deep regions especially in the Kara Sea. The two different resolution model configurations with the MIT General Circulation Model (MITgcm) sea ice package is compared in landfast ice simulation in the arctic region. Preliminary results show that a higher resolution model better represents landfast ice in deep regions. The proper illustration of coastlines, which serve as pinning points for sea ice arches, in the high-resolution model can improve the representation of landfast ice. We also apply a new parameterization lateral drag term, a function with sea ice thickness, drift velocity, and coastline intricacy, in the model to better simulate landfast ice. The results suggest a combination of lateral drag and basal stress terms successfully simulates fast ice in most regions