Title: Using discontinuous Galerkin method for modeling ice-sheet / ocean interactions in Greenland fjords

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Abstract:
Ice-sheet/ocean interaction in narrow fjords around Greenland is one of the key outstanding challenges in climate modeling. The runoff from Greenland's ice-sheet is a significant factor in the regional ocean dynamics and global sea-level rise, yet present-day climate models are not able to resolve fine-scale processes in the fjords. This is due to orders of magnitude difference of spatial scales between the open ocean (~1000km) and fjord (<1km) as well as complicated bathymetry and coastline.

I will be presenting the progress of the NUMO project (Non-hydrostatic Unified Model of the Ocean). The goal of NUMO is to develop a non-hydrostatic ocean model with an unstructured grid and local non-conforming mesh refinement, able to resolve fine scale ice-sheet / ocean interactions, the 3-dimensional circulation within Greenland fjords and exchanges with the ocean outside. As a proof-of-concept, we focus on Sermilik Fjord and its interaction with Helheim glacier and the sub-polar North Atlantic Ocean. An unstructured mesh is used to realistically represent the geometry of the fjord, while in the areas of particular importance (i.e. glacier front) the resolution is increased by non-conforming mesh refinement. NUMO models the ocean using the incompressible Navier-Stokes equation discretized with unified continuous/discontinuous Galerkin method. The long-term goal is to simulate all Greenland's fjords and adjacent coastal ocean and couple this simulation to regional or global Earth System Models.