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Pine Island Glacier – basal properties and sliding laws

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The dynamics of the Antarctic Ice Sheet can be well seen and studied on the behavior of Pine Island Glacier. Despite the long time believe in a slow response of the ice sheet to changing atmospheric and oceanic forcing, Pine Island has shown acceleration, thinning and a significant grounding line retreat in the past decades. These ongoing processes are coinciding with a concentrated mass loss in the area around Pine Island Glacier, the Amundsen Sea Embayment. The area is of additional interest due to its retrograde bed slope below the glacier. The postulated instability of the setting turns the glacier into an even more suitable object for modeling studies.

Plenty of working groups have conducted modeling studies of Pine Island Glacier with varying model complexity and diverse focuses. We want to add to this by conducting model experiments with a diagnostic 3D full-stokes model of Pine Island Glacier. The model is thermo-mechanically coupled and implemented with the commercial finite-element package COMSOL Multiphysics©. We use remotely sensed surface velocity data to validate our results.

The focus of our work lies on the basal properties below the glacier and the connection to sliding behavior. We believe that this is a crucial part, as different basal conditions might cause different responses to ongoing changes in the area. Recent studies presented evidence for the existence of a water saturated sediment basin below the main trunk of the glacier. We conduct a variety a numerical experiments with which we test different approaches of combining information about the basal properties with sliding laws.