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Stability of current Antarctica grounding lines

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Global warming has a huge impact on the different climatic components. In Antarctica, small changes on the ice-sheet or the ocean may drive the continent to some large instabilities. At a certain threshold, a tipping point might be crossed and the ice-sheet might retreat faster and irreversibly. The TiPACCs (Tipping Points in Antarctic Climate Components) project aims to a better understanding of the tipping points of Antarctica, both in the ocean and in the glaciers. 3 different ice-flow models (Elmer/Ice, PISM, and Ua) are used in the project. This study is focusing on the Elmer/Ice model to determine and characterize tipping points for its grounding lines. In this presentation, the most famous instability of Antarctica, the Marine Ice-Sheet Instability (MISI), will be investigated. The goal is to define the stability regime of the current Antarctic ice-sheet. For this purpose, multiple initial states have been created. The Elmer/Ice model uses the inverse method as it has been done in InitMIP-Antarctica (Seroussi et al. 2019) to define initial states. A common initial state for the three TiPACCs models has been defined by the use of common datasets and parameters. The melt at the base of the ice-shelf is defined by the PICO parametrization (Reese, 2016) which permits to define the melting per basins with a box model. Then, perturbations of basalt melt are be applied by modifying the ocean far-field temperature and salinity. The stability of the current grounding line is evaluated by calculating the grounding line migration for the different ice-shelf. The experiments are driven by a small but numerically significant perturbation to observe a retreat of the grounding line. If the grounding line is moving backward when removing the perturbation, then we can conclude that it is stable. Otherwise, if the grounding line is continuing its retreat then it is unstable.