EGU2020-9208
https://doi.org/10.5194/egusphere-egu2020-9208
EGU General Assembly 2020

Changes on Totten glacier dependent on oceanic forcing based on ISMIP6

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Totten glacier is draining 68% of the Aurora basin, East Antarctica, - an equivalent to 3.5m global sea level rise. Further, Totten's thickness and velocity have been fluctuating during the last decades showing periodic speed-ups and thinning.

We investigate the effect of different ocean forcing on Totten glacier using the state-of-the-art ice sheet model BISICLES and based on the high-resolution data sets BedMachine Antarctica and REMA (Morlighem et al., 2019; Howat et al., 2019). Our simulations (2015-2100) are following the ISMIP6 setup and are based on CMIP5 & CMIP6 AOGCM outputs under RCP8.5 and RCP2.6. The contribution to sea level at 2100 varies between plus and minus 6mm. For all scenarios, we see thinning at the sides of Totten glacier in the slower flowing areas, but only climate models with sub-shelf melt rates that are at least 8m/a above the reference melt rates (1995 – 2017) lead to thinning and acceleration across Totten's grounding line. In agreement with ISMIP6 results, non-local quadratic melt rates adjusted to present day conditions at Pine island glacier, West Antarctica, results in the highest sub-shelf melt rates for all AOGCMs (up to 80m/a locally).

The ISMIP6 ocean melt scheme is based on a feedback given the simulated ice draft change: the thermal forcing of the ocean model is taken from the ocean layer closest to the bottom of the ice shelf at the current simulation step. Simulations not including this feedback lead to higher mass loss than the standard ISMIP6 scenario including the feedback.