Geophysical Research Abstracts
Vol. 21, EGU2019-15059-1, 2019
EGU General Assembly 2019

Precipitation Ansatz dependent Future Sea Level Contribution from Antarctica under CMIP5 Forcing

Christian Rodehacke (1,2), Madlene Pfeiffer (1), Tido Semmler (1), Thomas Kleiner (1), and Gurses Gurses (1)

(1) Alfred-Wegener-Institut für Polar- und Meeresforschung, Climate Sciences/Paleoclimate Dynamics, Bremerhaven, Germany (christian.rodehacke@awi.de), (2) Danish Meteorological Institute, Copenhagen Ø, DK-2100, Denmark,

To assess the impact of various future climate scenarios (RCP2.6, RCP4.5, RCP8.5) on the Antarctic Ice Sheet and its contribution to the global sea level, we exploit a large ensemble of ice sheet simulations with the Parallel Ice Sheet Model (PISM). It covers the period from 1850 to 5000 to determine short-term and long-term implications of different future climate paths. To sample the uncertainty range, we use the full spatially and temporally evolving atmospheric and oceanic output of nine CMIP5 models, two initial ice sheet states, and different ways in applying the climate forcing.

The following challenges are detected: First, the oceanic and atmospheric conditions of global climate models are too warm for preindustrial and present-day climates, thus we use anomaly forcing. Second, the way the precipitation is implemented determines the sea level projection strongly. This uncertainty limits conclusions of how global climate warming impact Antarctica's contribution to the global sea level. In the study, we analyzed two ways to provide precipitation anomaly fields on top of the reference distribution. The reference distribution resembles the currently observed state and comes from the regional atmosphere model RACMO that includes a dedicated description of snow processes. We apply a precipitation anomaly derived from the precipitation excess relative to preindustrial distribution both coming from the CMIP5 data set. In additional simulations the precipitation anomaly is derived from temperature anomaly distributions via scaling using 5% precipitation increase per degree warming deduced from ice cores. Both ice loss terms by either ice discharge or basal melting of ice shelves increase since 1850 and the implemented precipitation methods does not impact these losses. However, the simulations driven by the temperature scaling method are subject to a sea level rise, while the sea level lowers for ensemble members driven by the standard method.