Simulations of the evolution of the Greenland ice sheet under Paris Agreement warming scenarios

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At the 2015 United Nations Climate Change Conference (COP21), it was negotiated to limit global warming to well below 2.0°C and, if possible, to 1.5°C above pre-industrial levels ("Paris Agreement"). The Intergovernmental Panel on Climate Change (IPCC) will provide a special report on the impacts of a 1.5°C warming ("SR1.5"). A major consequence of global warming is sea level rise, for which increased mass loss of the Greenland and Antarctic ice sheets is a significant contribution. Here, we focus on the Greenland ice sheet, and use two different ice sheet models, namely SICOPOLIS and ISSM, to simulate the response of the ice sheet to several future climate scenarios. In order to do so, an initial condition for the present-day ice sheet is required, which will be produced as the result of a paleoclimatic spin-up as described by Goelzer et al. (2017). The five future climate scenarios to be considered are a constant-climate control run, 1.5°C warming with or without interim overshooting, and 2°C warming with or without interim overshooting. These scenarios were produced by several general circulation models (GCMs) within the Inter-Sectoral Impact Model Intercomparison Project (ISIMIP2b; Frieler et al., 2016) and, together with a post-processing by the Surface Energy and Mass balance model of Intermediate Complexity (SEMIC; Krapp et al., 2017), will be defined as space- and time-dependent anomalies of the surface temperature and surface mass balance over the Greenland ice sheet. Using these anomalies as forcings, we will investigate the change of ice thickness, extent, discharge and mass balance of the ice sheet with SICOPOLIS and ISSM for all scenarios until the year 2300. In addition to the results themselves, using the two models allows assessing uncertainties that arise from different model physics and numerical techniques.

References

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