Bipolar climate change: 
Earth’s ice sheets in a warming world

During recent decades, Earth’s Polar Regions have been warming at a fast rate. In response, the Greenland and Antarctic ice sheets have changed rapidly. In Greenland, summer surface melt has increased significantly, which enhanced meltwater runoff into the ocean. In West Antarctica, ice shelves have thinned and partially disintegrated, leading to glacier speed up, whereas East Antarctica received more snowfall in response to higher temperatures. These ice sheet-variant responses to climate warming call for a better process understanding using climate models. In this talk I present the use of a high-resolution regional climate model with sophisticated snow and firn treatment (RACMO2) to simulate ice sheet surface climate processes, such as drifting snow, surface melt, and precipitation. RACMO2 is extensively evaluated by novel in-situ and remote sensing observations. In such a model, however, feedbacks from the ice sheet to the atmosphere, ocean and sea ice are not considered - for which we need a coupled climate model framework. Ongoing work involves the use the Community Earth System Model (CESM). I show initial results to improve CESM snow and atmospheric processes, with the overall aim to study ice sheet climate variability and change in a global context, and to reduce uncertainties in the ice sheet contribution to past, present and future sea level rise.