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# Impact of Different Atmospheric Forcings on Surface Mass Balance Estimates In Greenland

The Greenland Ice sheet (GIS) is the second largest ice sheet on Earth and thus stores a large amount of Earths freshwater. Because of climate change and the Arctic amplification, GIS is experiencing changes and increased melt rates. The total mass budget determines the amount of sea level rise caused by input from freshwater from the GIS.

Surface mass balance (SMB) plus the dynamic mass losses from calving and submarine melt constitutes the total mass budget. The SMB is the balance between accumulation and precipitation. Having accurate estimates of SMB is vital for estimates of future sea level rise and eventual changes in the thermohaline circulation.

This study aims to investigate the impact of different atmospheric forcing on SMB estimates on the GIS. For this, three different models, one regional climate model, HIRHAM5, and two numerical weather prediction (NWP) models, HIRLAM7 and HARMONIE-AROME cy 40h1.1 are used. These models are chosen since the Danish Meteorological Institute currently or previously used these models as forcing to a SMB model. The NWP models are used for daily updates on the Polar Portal website, where estimates are compared to a climatological background where HIRHAM is used as forcing. HIRLAM was previously replaced by HARMONIE-AROME. It has never before been investigated whether estimates from these models are comparable or not. HARMONIE has not been extensively evaluated over GIS before.

In this study, the models HIRHAM and HIRLAM were found to be comparable, even though spatial differences were present. A high temporal correlation was found between the two models for SMB and its components. Also HIRHAM and HARMONIE were found to be comparable for the investigated time period. HARMONIE was found to represent incoming longwave and shortwave radiation well, compared to observational data. Precipitation was found to be better represented at some sites compared to others, but further investigation or improved observational datasets would be needed.

Keywords: Physical Geography and Ecosystem analysis, Surface Mass Balance, Greenland, Climate Models, Numerical Weather Prediction Models, Surface Energy Balance, Arctic, Climate Change

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