



Reconstruction of the Greenland ice sheet surface mass balance over 1900-2015 with the help of the regional climate MARv3.6 model

Xavier Fettweis (1), Cécile Agosta (1), and Hubert Gallée (2)

(1) University of Liège, Laboratory of Climatology, Department de Geography, Liège, Belgium (xavier.fettweis@ulg.ac.be),

(2) Laboratoire de Glaciologie et Géophysique de l'Environnement, CNRS, Grenoble, France

With the aim of studying the recent Greenland ice sheet (GrIS) Surface Mass Balance (SMB) decrease with respect to the last century, we have forced the regional climate MAR model (version 3.6) with the ERA-Interim (1979-2015), ERA-40 (1958-2001), NCEP1 (1948-2015), NCEP2 (1979-2015), JRA-55 (1958-2015), 20CRv2(c) (1880-2012) and ERA-20C (1900-2010) reanalysis. While all of these forcing products are reanalyses, MAR simulates differences in SMB over the common period. A temperature correction of $+1^{\circ}\text{C}$ (resp. -1°C) had notably to be applied to the MAR boundary conditions given that ERA-20C (resp. 20CRv2) is $\sim 1^{\circ}$ colder (resp. warmer) over Greenland than ERA-Interim data over 1980-2010. Comparisons with PROMICE daily temperature measurements valid these corrections.

In most of regions, the SMB discrepancies between the different simulations are not significant except in the South-East where the maximum of precipitation occurs and where SMB measurements are missing. This suggests that uncertainties in the current SMB reconstruction remain and that observations are still needed. Comparisons with SMB measurements from the PROMICE data set, ice cores and satellite derived melt extent allows to select the best reanalysis forced data set.

All of these simulations show that i) the period 1961-1990 usually chosen as reference for SMB and ice dynamics (stable ice sheet) over GrIS is a period when the SMB was abnormally high in respect to the last 120 years; ii) SMB has been significantly decreasing after this reference period due to increasing melt. Both ERA-20C and 20CRv2 forced simulations suggest a precipitation increase since the beginning of the last century and the ERA-20C forced simulation only suggests that SMB during the 1920-1930 warm period over Greenland was comparable with the SMB of the 2000's.

Finally, the sensitivity of switching on the erosion of the snow by the wind in MARv3.6 over GrIS will be discussed.