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Microwave data and a regional climate model for studying the Greenland ice sheet surface mass balance over 1979-2009

Xavier Fettweis (1) and Marco Tedesco (2)

(1) University of Liège, Laboratory of Climatology, Department de Geography, Liège, Belgium (xavier.fettweis@ulg.ac.be, +32 (0)4 3665722), (2) City College of New York, City University of New York, New York, NY, 10031, USA.

Results (melt extent and winter accumulation) from an atmosphere-snow coupled regional climate model are compared with microwave brightness temperatures-derived estimates to study the surface mass balance (SMB) changes over the Greenland ice sheet (GrIS) since 1979. Two simple algorithms are selected to retrieve the melt extent from the brightness temperatures. The first one is sensible to the production of surface meltwater as suggests the regional model and the second one is rather sensible to the presence of liquid water content into the snowpack. Both algorithms compare very well with model outputs and they are unanimous to show a significant increase of the surface melt over 1979-2009. We found also a good correlation between the March-April mean brightness temperatures and the simulated winter snow accumulation although no significant changes are found in both simulated and microwave-derived snow accumulation. The interannual variability of the brightness temperature-derived SMB components compare very well with the model results. This suggests that the variability of the model is reliable and that the model can be used to detect SMB changes over longer periods where no satellite data is available. Finally, both model and satellite agree to confirm the acceleration of the GrIS surface melting since 30 years.