How results from the regional model MAR can be used to force ice sheet models at higher resolutions over the Greenland ice sheet ?

Xavier Fettweis

University of Liège, Laboratory of Climatology, Department de Geography, Liège, Belgium (xavier.fettweis@ulg.ac.be, +32 (0)4 3665722)

With the aim of coupling the regional climate model MAR running at a resolution of 25 km with ice sheet models running at higher resolutions (5-10km) over the Greenland ice sheet (GrIS), the new version of MAR uses a fractional (0-100%) ice sheet mask. Over tundra surrounding the GrIS, the ice covered area is at least 0.01 % and MAR computes the surface mass balance (SMB) for both sub-pixels (i.e. covered by tundra and ice). This is particularly useful afterwards to extrapolate the MAR based SMB at higher resolutions using an interpolation based on SMB gradients vs surface height. Indeed, previously developed SMB "intelligent" interpolations allow to reconstruct with success the SMB at higher resolutions in the interior of the ice sheet. However, they fail along the ice sheet margin where the spatial variability is the highest and where the SMB exponentially decreases with altitude.

We present here a comparison over the 2000's between MAR 25 km SMB results interpolated at 12.5 km with SMB results computed natively at 12.5 km by MAR, both simulation being forced by ERA-INTERIM. By using the SMB components simulated over the tundra areas, we improve a lot the comparison along the ice sheet margin. This suggests that the MAR 25 km future projections can be reliably used to force ice sheet models at higher resolutions using different ice sheet masks than MAR.