Geophysical Research Abstracts
Vol. 15, EGU2013-389, 2013
EGU General Assembly 2013

High-resolution modelling of the Antarctic surface mass balance, application for the 20th, 21st and 22nd centuries

Cécile Agosta (1,2), Vincent Favier (1), Gerhard Krinner (1), Hubert Gallée (1), and Christophe Genthon (1)

(1) UJF–Grenoble 1/CNRS, Laboratoire de Glaciologie et Géophysique de l'Environnement (LGGE) UMR 5183, Grenoble, F-38041, France, (2) Département de Géographie, Université de Liège, Liège, Belgium

Although areas below 2000 m above sea level (a.s.l.) cover 40% of the Antarctic grounded ice-sheet, they represent about 75% of the surface mass balance (SMB) of the continent. Because the topography is complex in many of these regions, SMB modelling is highly dependent on resolution, and studying the impact of Antarctica on the future rise in sea level requires high resolution physical approaches. We have developed a new, low time consuming, physical downscaling model for high-resolution (15 km) long-term SMB projections. Here, we present results of our SMHiL (surface mass balance high-resolution downscaling) model, which was forced with the LMDZ4 atmospheric general circulation model to assess SMB variation in the 21st and the 22nd centuries under two different scenarios.

The higher resolution of SMHiL reproduces the geographical patterns of SMB better and induces a significantly higher averaged SMB over the grounded ice-sheet for the end of the 20th century. Our comparison of more than 2700 quality-controlled field data showed that LMDZ4 and SMHiL fit the observed values equally well. Nevertheless, field data below 2000 m a.s.l. are too scarce to settle SMHiL efficiency. Measuring the SMB in these undocumented areas is a future scientific priority. Our results suggest that running LMDZ4 at a finer resolution may give a future increase in SMB in Antarctica between 15% to 30% higher than its standard resolution. Future changes in the Antarctic SMB at low elevations will result from the conflict between higher snow accumulation and runoff. For this reason, developing a downscaling model was crucial to represent processes in sufficient detail and correctly model the SMB in coastal areas.