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The effect of more realistic forcings and boundary conditions on the geometry and volume of the Greenland ice sheet compared with EISMINT-3

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Ice thickness and bedrock topography are essential boundary conditions for the numerical modelling of the evolution of the Greenland ice sheet. The datasets currently in use by the majority of Greenland ice sheet modelling studies are over a decade old and based on data collected from the 1970s (Letreguilly *et al.*, 1991). An up-to-date and more accurate dataset of ice thickness in conjunction with a Digital Elevation Model of the Greenland bedrock topography has subsequently been produced (Bamber *et al.*, 2001). Significant differences have been found between these two sets of data which have considerable impacts on the ice sheet dynamics of numerical models and therefore the resultant ice sheet geometry and volume.

In addition to these boundary conditions, ice sheet models are sensitive to the temperature and precipitation used to force the surface mass balance model. We compare results using the forcings applied in the EISMINT-3 exercise with more realistic, present-day temperatures derived from the AVHRR APP-x satellite dataset and ERA-40 precipitation.

The GLIMMER ice sheet model was run offline using both sets of boundary conditions and forcings until equilibrium was reached. When only the bedrock topography and ice sheet thickness are varied the new dataset (Bamber *et al.*, 2001) results in an increase in ice sheet volume of 13% compared with the older (Letreguilly *et al.*, 1991) dataset. Furthermore, when the temperature forcing is varied the recent temperature dataset gives an ice volume 6.5% larger than the dataset used in EISMINT-3. This work highlights the need to assess carefully future and past Greenland ice sheet modelling results in terms of the forcings and boundary conditions applied as well as tuning of the model in terms of lapse rate corrections and Positive Degree Day factors.