Geophysical Research Abstracts,
Vol. 11, EGU2009-3112, 2009
EGU General Assembly 2009

Could vegetation feedbacks determine whether the Greenland ice sheet regrows after deglaciation?

E.J. Stone, D.J. Lunt, and P.J. Valdes

BRIDGE, University of Bristol, School of Geographical Sciences, Bristol, United Kingdom (emma.j.stone@bristol.ac.uk)

The importance of vegetation feedbacks for the process of ice sheet regrowth have largely been neglected from previous studies (e.g. Lunt *et al.* 2004; Toniazzo *et al.*, 2004) but could be potentially important in realistically modelling the past and future evolution of the Greenland ice sheet. This work focuses on modelling the regrowth of the Greenland ice sheet if it completely melted and CO_2concentrations returned to pre-industrial levels (280ppm).

We have used the fully coupled atmosphere-ocean model, HadCM3, to assess the response of the climate when the Greenland ice sheet is replaced with a number of fixed vegetation types. An ensemble of 100 year simulations have been performed with the Greenland ice sheet replaced with bare soil and five plant functional types (PFT): broadleaf and needleleaf trees, c3 and c4 grasses and shrubs. Sensitivity studies with respect to the surface roughness length and change in orographic height have also been carried out. The summer temperature change relative to an ice sheet being present, ranges from 1˚C for bare soil to almost 16˚C for needleleaf trees. Furthermore, snow cover diagnostics indicate almost snow free summers for all fixed vegetation with only significant coverage occurring in high altitude eastern regions for bare soil.

HadCM3 also includes a coupled vegetation model, TRIFFID. We present results where dynamic vegetation is turned on for the initial conditions of bare soil and needleleaf coverage. Simulations were run as extensions from the fixed vegetation experiments until the vegetation was found to be in equilibrium.

Finally, in addition to using the snow diagnostic to predict regrowth we present results where the ice sheet model, GLIMMER, is forced offline using climate input from the ensemble of vegetation experiments. Initial results indicate that there is a threshold over which ice regrowth can occur between bare soil and the PFT fixed vegetation experiments. This work highlights that in order to model reglaciation it is necessary to take vegetation feedbacks into account.