Geophysical Research Abstracts
Vol. 18, EGU2016-12810, 2016
EGU General Assembly 2016

Green Mountains and White Plains: the effect of Northern Hemisphere ice sheets on the global energy budget

William Roberts and Paul Valdes
University of Bristol, Bristol, United Kingdom (william.roberts@bristol.ac.uk)

There are two physical features of a large ice sheet that can fundamentally change the global climate: the topography and albedo. Using a series of climate model experiments we shall show how the climate responds to these features, acting alone and in concert. We shall focus on the global energy budget.

We shall use as a tool the HadCM3 climate model. We shall examine three suites of experiments in which we impose the albedo, topography or both of the Laurentide Ice Sheet. In each suite we vary the size of the ice sheet in order that we may examine how the climate's response varies with ice sheet size. Understanding the effect of ice sheets at a size below their maximum is important because, during any glacial period the ice sheets exist at these lesser extents for the majority of the time.

We shall show that the albedo of the ice sheet causes a reduction in the incoming shortwave radiation over the ice sheet and that this is balanced by a compensating incoming energy flux into the Southern Hemisphere. The topography of the ice sheet causes an increase in the incoming shortwave radiation over the ice sheet that is balanced by an outgoing energy flux to the south of the ice sheet, with little change in the Southern Hemisphere. The topography and albedo of the ice sheet cause an increase in the outgoing shortwave radiation over the icesheet that is balanced by incoming fluxes to the south of the ice sheet and in the Southern Hemisphere.

The magnitude of the cross equatorial atmospheric heat flux shall be related to the position of the ITCZ. We shall show there is a close correlation between the position of the ITCZ and the cross equatorial heat flux, if there is no change in the ice sheet. Changing the ice sheet topography causes this relationship to breakdown.