Geophysical Research Abstracts,
Vol. 11, EGU2009-12016, 2009
EGU General Assembly 2009

Modelling of melt ponds on a sea ice floe

F Scott (1) and D Feltham (1,2)

(1) Centre for Polar Observation and Modelling, University College London, London, United Kingdom , (2) British Antarctic Survey, Cambridge, United Kingdom (dlf@cpom.ucl.ac.uk)

During winter the ocean surface at the poles freezes over to form sea ice. Sea ice floats on the ocean surface and has a matrix structure caused by the rejection of salts during freezing. In the summer sea ice melts at its surface creating melt ponds.

An accurate estimate of the fraction of the upper sea-ice surface covered in melt ponds during the summer melt season is essential for a realistic estimate of the albedo for global climate models. We present a sea ice model that simulates the two-dimensional (areal) evolution of melt ponds on an Arctic sea-ice surface. Water transport across and through the sea-ice surface is described by the major hydraulic processes believed to be present. Thermodynamic processes are modelled using heat flux equations. Lateral and vertical melt water transport is described by Darcy's Law.

The model simulates a section of a sea ice floe where edge effects such as the presence of leads are neglected. The model consists of a grid of cells, each of which can be in one of four possible configurations: snow covered ice; bare ice; melt pond covered ice or open water. A cluster of adjacent cells containing melt water may be considered to have formed a melt pond.

The model is initialised with ice topographies that represent either first-year or multi-year sea ice, these are reconstructed from ice thickness data using standard statistical methods; in this way characteristic examples of both first-year ice and multi-year ice can be constructed. The roughness of the ice and snow surfaces were altered and the sensitivity of the model to the initial data was tested.

First-year ice and multi-year ice simulations agreed with observed differences in individual pond size and depth. Sensitivity studies showed that pond fraction is most sensitive to mean initial snow depth in first-year ice simulations and reduction of ice permeability all cases.