



The formation of the Panama Isthmus during the Pliocene in a fully coupled GCM - implications for northern hemisphere cooling.

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It is thought that the final closure of the Panama seaway, and formation of the Panama Isthmus, occurred during the Pliocene, approximately 3.0-4.0 MyrBP. It has been suggested that this had a number of effects on the earth-system, including the intensification of the North Atlantic MOC, leading to elevated Atlantic SSTs at high latitudes, and an associated intensification of the hydrological cycle. It has been further suggested that this increased supply of moisture at high latitudes led to the growth and establishment of the Greenland ice-sheet, ultimately leading to the onset of the glacial-interglacial cycles of the Quaternary.

In this paper we first present results from a pair of GCM simulations of the Pliocene, with and without the Panama Isthmus. We use the fully coupled dynamic atmosphere-ocean model, HadCM3. The Pliocene boundary conditions, including orography and icesheet extent, are from the PRISM project. We then present results from the GLIMMER icesheet model, which we force using the GCM-predicted climatologies.

The GCM results show the expected post-closure warming of the North Atlantic, in addition to a warming in the Greenland Sea and an associated cooling in the Barents Sea. The temperature over Greenland also increases post-closure, as does the precipitation, in particular in the East.

Putting the GCM results into the icesheet model indicates an increase in the size of the equilibrium Greenland icesheet after the formation of the Panama Isthmus, supporting the hypothesis that this event was very significant in determining the subsequent evolution of the Earth-System.