Geophysical Research Abstracts
Vol. 14, EGU2012-10800, 2012
EGU General Assembly 2012

The Influence of Volcanic and Solar forcings on the Freshwater Budget of the Arctic Ocean

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In recent decades the quantity and spatial extent of measurements for the atmospheric, terrestrial and oceanic sources and sinks, that comprise the freshwater budget of the Arctic Ocean has increased. This has been driven by a need to understand the variability of the freshwater budget, as a response to anthropogenically induced climate change, and the effects upon climate. However, the natural variability of the system due to specific forcings over a number of temporal scales, is yet to be clearly defined. This is due to several factors. A lack of a reliable freshwater proxy, coupled with a truncated instrumental record, make it difficult to elicit meaningful trends from the data that is currently available. In addition, modelling studies have not taken up the opportunity to evaluate the historical freshwater budget, instead focusing all their efforts in ascertaining the future response of the system. Therefore, when it comes to understanding the role individual forcings, such as volcanic and solar, have upon the natural variability of the freshwater budget, a noticeable void is evident. In order to understand the natural variations over the recent past one has to first consider the effects that natural forcings have upon the system, both independently and simultaneously. Therefore, in this study we seek to understand the effects solar and volcanic forcings have upon the freshwater budget of the Arctic, and by association, the climate.

Here we present results of a series of transient simulations spanning the last 2000 years, performed with the earth model of intermediate complexity, LOVECLIM (Goosse *et al*., 2010). These series of simulations use a combination of orbital parameters, greenhouse gas concentrations, total solar irradiance and volcanic forcings. By comparing the simulation with only long-term forcings (orbital and greenhouse gas), to experiments in which the impacts of short-term forcings (solar and volcanic) are added incrementally to the effect of these long-term forcings, we are able to assess to what extent solar and volcanic forcings influence the variability of the Arctic freshwater budget. Time-series analysis will be applied to the output of the different experiments to evaluate the changes in the different frequency domains.

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