Geophysical Research Abstracts, Vol. 9, 03928, 2007
SRef-ID: 1607-7962/gra/EGU2007-A-03928

The response of the northern hemispheric atmosphere to volcanic forcing in an ensemble of 1500 to 2000 AD simulations

D. Hofer, C. C. Raible, T. F. Stocker, M. Renold, S. Kleppek
Climate and Environmental Physics, Physics Institute, University of Bern, Switzerland

Volcanic eruptions are important factors of natural climate variability. Aerosols, that are ejected into the atmosphere by volcanoes, influence the climate for several years. In this work, we revisit the atmospheric response behaviour in earlier studies, using the latest low-resolution version of the NCAR community climate system model (CCSM, version 3). Particularly, the implementation of volcanic forcing in the new version model has been changed from adapting the total solar irradiance to more realistically prescribing volcanic aerosols in the lower stratosphere. The main focus here is set on the effect of volcanic eruptions for teleconnection patterns in the Northern Hemisphere, e.g. the North Atlantic Oscillation (NAO).

The most obvious effect of volcanic eruptions is the lowering of the solar irradiance on the surface. This leads to a statistically significant reduction of the global mean surface air temperature for up to 3 years following a volcanic event. In contrast to the surface, the temperature in the stratosphere, where volcanic aerosols have been spread out, is increased. Apart from the effect on the temperature, a volcanic eruption also affects the large-scale circulation patterns in the atmosphere. For the NAO, simulations and reconstructions exhibit a high positive index in the winter seasons of volcanic activities, with a maximum in the year after the peak volcanic forcing. This behaviour could also be found in our simulations. There are several mechanisms suggested in the literature, e.g., tropical stratosphere warming or changes in transient eddy activity. Two questions will be adressed: (i) which mechanism is responsible in our simulation for the NAO response, and (ii), why is the response larger in the second year after an eruption although the volcanic forcing is nearly vanished.