Geophysical Research Abstracts, Vol. 8, 09499, 2006
SRef-ID: 1607-7962/gra/EGU06-A-09499

Atmospheric volcanic loading derived from bipolar ice cores

A. Robock, C. Gao, L. Oman, and G. Stenchikov

Department of Environmental Sciences, Rutgers University, New Brunswick, New Jersey, USA (robock@envsci.rutgers.edu / Phone: +1-732-932-9478)

Ice cores in Antarctica and Greenland record the sulfate signatures of major volcanic eruptions. Using these records to derive the atmospheric volcanic loading, which is needed to calculate the radiative forcing of the aerosol clouds and the effects of volcanic eruptions on climate, requires addressing a number of important issues. These include the spatial variability of sulfate deposition on ice sheets because of different wet deposition rates, stochastic variations of atmospheric circulation in the stratosphere and over the ice sheets, variable partitioning of tropical volcanic injections between the hemispheres, and uncertainties in the transport mechanisms from the stratosphere to the ice. By using the most comprehensive set of ice core measurements of volcanic deposition so far, 24 from the Greenland and 19 from the Antarctica, climate model simulations with the NASA GISS ModelE general circulation model of volcanic deposition following the 1783 Laki, 1912 Katmai, and 1991 Pinatubo eruptions, and a reexamination of the deposition of radioactivity from nuclear bomb tests in the atmosphere, we quantify each of these issues. We then present factors that need to be multiplied by the ice core deposition to reconstruct the initial atmospheric loading from eruptions, with an error estimate based on the uncertainties in each issue. Based on the relative wet and dry deposition for individual cores, we show how small numbers of cores can be used to reproduce the volcanic loading.