Geophysical Research Abstracts
Vol. 13, EGU2011-10320, 2011
EGU General Assembly 2011

Nonlinear atmospheric circulation responses to tropical volcanic eruptions: implications for ice core-derived volcanic forcing reconstructions

Matthew Toohey (1), Ulrike Niemeier (2), Claudia Timmreck (2), and Kirstin Krüger (1)
(1) IFM-GEOMAR, Kiel, Germany, (2) MPI, Hamburg, Germany

Reconstructions of past volcanic forcing of climate are usually based upon sulfate levels in ice cores, and are produced by assuming that ice core sulfate deposition scales linearly with global (or at least hemispheric) aerosol loading. Using simulations with the MAECHAM5-HAM general circulation model including detailed aerosol microphysics, we examine the relationship between volcanic aerosol loading and the deposition of sulfate to the polar ice sheets for major tropical eruptions, and how this relationship changes depending on the season, latitude and magnitude of eruption. We show that heating of volcanic aerosols through absorption of infrared radiation leads to atmospheric circulation changes, affecting the global transport of aerosols. Our results indicate that for large volcanic eruptions, such anomalous atmospheric circulation patterns can lead to strong nonlinearity in the aerosol loading to ice sheet deposition relationship. We explore the mechanisms leading to such nonlinearity, and discuss implications for the reconstruction of aerosol optical depth from ice cores, used in the model simulation of past climate.