Geophysical Research Abstracts,
Vol. 11, EGU2009-4931, 2009
EGU General Assembly 2009
© Author(s) 2009

The climate impact of a Yellowstone super eruption: An Earth system model approach

C. Timmreck, S. Lorenz, U. Niemeier, and S. V. Group
Max-Planck-Institut für Meteorology, Hamburg, Germany (claudia.timmreck@zmaw.de, +49 40 441173-298)

Very large volcanic eruptions (super eruptions) produce extremely strong radiative forcing, which can affect the Earth system for longer times than the pure residence time of the volcanic aerosol in the atmosphere. In the case of a very large eruption, volcanic sulphate aerosol can persist in the stratosphere for several years up to a decade, scattering incoming radiation back to space and absorbing outgoing longwave radiation. This will lead to large negative temperature anomalies at the surface and significant warming of the aerosol containing layers altering substantial atmospheric and ocean circulation and composition. Simulations of past historic eruptions show that the ocean heat content is reduced after large volcanic eruptions, and that these anomalies can persist for decades. Dominantly cooler surface temperatures, might alter dramatically the terrestrial and marine biosphere, necessarily impact vegetation, especially tropical rain forests, and have at least a transient effect on the carbon and other biogeochemical cycles. Analyzing and understanding the climate effects of a very large volcanic eruption is a quite difficult task due to the various complex interactions between chemical, microphysical, dynamical and biological processes affecting the whole suite of processes (ocean, atmosphere, chemistry, land surface, vegetation, cryosphere, carbon cycle etc.). Hence, the simulation of a volcanic super eruption requires the full complexity of an Earth system model. Here we present simulations of a Northern Hemisphere midlatitude super eruption (Yellowstone) with a fully coupled Earth system model. The volcanic climate impact is investigated by analyzing changes in atmospheric and ocean dynamics, the hydrological and the carbon cycle, marine bioproductivity and terrestrial vegetation.