Influence of volcanic SO_2 emissions on the climate and ozone layer evolution during early 21st century.

Timofei Sukhodolov[1], Aryeh Feinberg[2], Beiping Luo[2], Thomas Peter[2], Andrea Stenke[2], and Eugene Rozanov[1,2]

[1] *Physikalisch-Meteorologisches Observatorium Davos and World Radiation Center, Davos, Switzerland.*
[2] *Institute for Atmospheric and Climate Science, ETH Zurich, Zurich, Switzerland.*

Volcanic activity is one of the major natural climate forcings. Influence of the powerful volcanic eruptions on climate was recognized long ago. Overall, this effect consists of: an increase in aerosol loading in the stratosphere followed by planetary albedo enhancement; cooling of the surface; warming in the tropical lower stratosphere followed by warming of the northern landmasses during several post-volcanic winters; and a decrease of precipitation intensity over the tropics. All this causes many further feedbacks including also an alteration of the stratospheric chemistry. Beginning of the 21st century wasn't marked by very powerful eruptions with volcanic explosivity index of more than 4. However, recently it was suggested that more numerous small volcanic eruptions can also significantly influence stratospheric aerosol loading and hence climate. There is an increasing trend in the observed explosive volcanic SO_2 emissions over this period, as well as an increasing trend in the stratospheric aerosol optical depth.

In this study, we aim to clarify the contribution of the volcanic activity to the observed stratospheric aerosol layer changes and its influence on climate and atmospheric chemistry. To do so we intend to use a new coupled atmosphere-ocean-aerosol-chemistry-climate model (AOACCM) SOCOLv4 driven by the SO_2 emissions from degassing and explosive volcanoes retrieved from the multi-satellite observations. Interactive treatment of the ocean, atmospheric dynamics, atmospheric chemistry and sulfate aerosol microphysics allows taking into account all main feedbacks between these components of the Earth system.

Key words: Stratosphere, Sulfate aerosols, Ozone, Climate modeling, Volcanic eruptions.