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Stratospheric ozone levels and their role for the dynamic response to volcanic eruptions

Stefan Muthers (1,2), Julien G. Anet (3), Christoph C. Raible (1,2), Stefan Brönnimann (4,2), Florian Arfeuille (4,2), Tom Peter (3), Eugene Rozanov (3,5), Alexander Shapiro (5), Juerg Beer (6), Friedhelm Steinhilber (6), Yuri Brugnara (4,2), and Werner Schmutz (5)

(1) University of Bern, Physics Institute, Climate and Environmental Physics, Bern, Switzerland (muthers@climate.unibe.ch), (2) Oeschger Centre for Climate Change Research, University of Bern, Bern, Switzerland., (3) Institute for Atmospheric and Climate Science ETH, Zurich, Switzerland, (4) Institute of Geography, University of Bern, Switzerland, (5) Physical-Meteorological Observatory/World Radiation Center, Davos, Switzerland, (6) EAWAG, Surface Waters group, Switzerland

The role of different background ozone climatologies for the dynamic response to tropical volcanic eruptions is analyzed using an ensemble of simulation with the atmospheric-chemistry-ocean model SOCOL/MPIOM.
In this sensitivity study a single tropical eruption of Tambora-size is applied to an ensemble with either pre-industrial ozone concentrations or present day concentrations respectively. The analysis focuses on the characteristic of the Northern Europe winter warming pattern following the eruption, that has been identified after several eruptions in observations and in proxy data.
The sensitivity study reveals a higher probability for a large and significant winter warming pattern with pre-industrial ozone levels, when the dynamic response of the chemistry to the eruption is disabled in the model. The positive temperature anomaly is driven by a positive NAO-like pressure pattern that lead to the advection of warm Atlantic air towards Northern Europe. With present day concentrations winter warmings are also found in some ensemble members, but overall the probability is strongly reduced. It is shown, that with pre-industial day ozone concentrations the coupling between positive anomalies of the polar vortex and the zonal wind in the troposphere is more effective, which could explain the higher likelihood of positive NAO-like pressure patterns and positive temperature anomalies in Northern Europe.