Geophysical Research Abstracts
Vol. 21, EGU2019-3911, 2019
EGU General Assembly 2019

Clarifying the relative role of forcing uncertainties and initial-condition unknowns in spreading the climate response to volcanic eruptions

Davide Zanchettin (1), Claudia Timmreck (2), Matthew Toohey (3), Johann H. Jungclaus (2), Matthias Bittner (2), Stephan J. Lorenz (2), and Angelo Rubino (1)

(1) University Ca' Foscari of Venice, Dept. of Environmental Sc., Informatics and Statistics, Mestre, Italy (davide.zanchettin@unive.it), (2) Max Planck Institute for Meteorology, Bundesstr. 53 D-20146 Hamburg, Germany, (3) GEOMAR Helmholtz Centre for Ocean Research Kiel, Düsternbrooker Weg 20, 24105 Kiel, Germany

Radiative forcing from volcanic aerosol impacts surface temperatures. The background climate state is known to also affect the response. A key question thus concerns whether constraining forcing estimates is more important than constraining initial conditions for accurate simulation and attribution of post-eruption climate anomalies. In this contribution, we investigate whether different realistic volcanic forcing magnitudes for the 1815 Tambora eruption yield distinguishable ensemble surface temperature responses. We perform a cluster analysis on a super-ensemble of climate simulations with the Max Planck Institute Earth System Model including three 30-member ensembles. The ensembles use the same set of initial conditions but different volcanic forcings based on current uncertainty estimates and generated with the Easy Volcanic Aerosol module. We will show results that clarify how forcing uncertainties can overwhelm initial-condition spread in boreal summer due to strong direct radiative impact while the effect of initial conditions predominate in winter, when dynamics contribute to large ensemble spread. We will also discuss how current uncertainties affecting reconstruction-simulation comparisons prevent conclusions about magnitude of the Tambora eruption and its relation to the "year without summer" of 1816.