Geophysical Research Abstracts
Vol. 20, EGU2018-4547, 2018
EGU General Assembly 2018

Global and seasonal climate changes after a hypothetical Agung eruption in 2017

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The likelihood of a large volcanic eruption in the future represents the largest uncertainty concerning the evolution of the climate system on the time scale of a few years. It is still uncertain how predictable the response of the climate system to volcanic eruptions is and how strongly a volcanic perturbation could affect global and regional climate on seasonal-to-decadal time scales. These questions became recently very prominent in the context of decadal climate prediction, as in the 2nd half of 2017 the likelihood of a large volcanic eruption was very high. Increased seismic activity was observed from Mt. Agung (Bali, Indonesia), which started on August 10th, 2017 and continued with variable intensity until the end of the year. The Mt. Agung volcano last erupted in 1963 with a VEI 5 eruption and an estimated SO_2 emission of 6.5 Tg. It was one of the largest eruptions of the 20th century with an estimated global cooling of 0.1 °C to 0.4 °C in the aftermath of the eruption. The recent increased activity of Mt. Agung raised the likelihood of another climatic relevant eruption. To investigate its possible climate impact we have performed decadal climate forecasts with the MiKlip decadal prediction system for an artificial Agung-like eruption starting in October 2017. In a first step we have simulated the evolution of the volcanic aerosol and the related radiative forcing with the global aerosol model ECHAM5-HAM with high vertical resolution (L90) and internally generated QBO. The SO_2 emission profile has been adapted from the 1963 eruption. In a second step, the calculated optical parameters are used as monthly mean forcing in the decadal prediction system. Here, we investigate the response of different climate variables, e.g. near-surface air temperature, precipitation and sea ice on global and regional scale. We also discuss strategies how to be prepared for the next climate relevant volcanic eruption.