Intermodel diversity in the impact of tropical volcanic eruptions on ENSO

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Temporary negative radiative forcing caused by sudden super volcanic eruptions (SVEs) in the tropics reduces global surface temperatures and then weakens atmospheric and ocean circulations that can significantly affect interannual-to-interdecadal climate variations. Studies on the relationship between the El Nino-Southern Oscillation (ENSO) and SVEs had been discussed within limited data. However, the last 1000-years SST data reconstructed from the composited proxy suggested significant increase in the probability of the occurrence of El Niño one-year after the SVEs. Our SVE-forced experiment by using an air-sea coupled model (Ohba et al. 2013) also showed that El Niño is also tends to be excited in after the mature of SVEs as similar to findings from reconstructed SST. It is shown that the SVE-forcings can cause westerly wind anomalies in the western Pacific (i.e., weakened Walker circulation), and then El Niño can be excited one year after the SVEs. Similar results and mechanisms have been demonstrated from validation experiments on the other following studies. It is considered that the development of such westerly wind anomalies can be related to the decrease in precipitation on the Indian Ocean to the marine continent due to the SVE cooling that result in the basin-scale east-west gradient of surface temperature. In this study, we evaluate the effect of SVE-induced radiative forcing on ENSO in models using the results of the latest coupled model intercomparison data (CMIP5 and CMIP6) and verifiy the intermodel diversity of the SVE response among the models.

Keywords: ENSO, Volcanic eruption, CMIP6, Climate model

