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# Response of the Indian Ocean Dipole to tropical volcanic eruptions

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Large tropical explosive volcanic eruptions, such as Pinatubo in June 1991, emit stratospheric aerosols that backscatter shortwave radiation and cool earth's surface. The impacts of explosive volcanism on the highly-populated, climate-sensitive Indian Ocean region, in particular on its dominant climate mode, the Indian Ocean Dipole (IOD), however remain unclear. Here, we show that volcanism significantly forces a negative IOD-like oceanic response, using the CMIP database and dedicated experiments with a climate model forced by a Pinatubo-like eruption. In the first boreal fall after the eruption, such eruptions induce a spatially-variable cooling of the Indian Ocean. The cooling is stronger in the Northwest than in the Southeast Indian Ocean because of climatologically clearer skies. The resulting zonal SST gradient favors equatorial westerlies, which drive a typical negative IOD-like subsurface response (anomalously shallow/deep thermocline in the west/east with a consistent impact on primary production in CMIP5 models). The possible mechanisms of such response, and of its possible amplification through IOD positive coupled feedbacks, are quantified through a hierarchy of atmosphere and ocean numerical experiments. Improving current models (and their volcanic observations/assimilation systems), that agree qualitatively but not quantitatively on this volcanically-induced oceanic negative IOD, should lead to precious added skill for climate/ocean seasonal forecasting.