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Monsoon collapse following tropical super-volcanic eruptions

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This study considers whether tropical super-volcanic eruptions based on scalings of the 1991 Pinatubo eruption can lead to collapse of the South Asian monsoon in integrations of the coupled GCM HadCM3. Empirical time-latitude functions for stratospheric aerosol optical depth that closely match observations following the Pinatubo eruption are scaled between one and 100 times that of Pinatubo in a series of 30-year integrations, to determine at what stage monsoon collapse occurs. In the summer following a 15xPinatubo eruption, the South Asian monsoon begins to collapse, the south-westerly flow deflecting from the Indian peninsula towards the equator. At 100xPinatubo, the monsoon flow resembles that normally found during winter. Comparison with a 1050-year control integration of the model reveals precipitation anomalies over South Asia to be well below those occurring due to natural variability. We also discuss the recovery time for the monsoon following eruption and the likelihood of such an event.