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How does the impact of tropical volcanic eruptions depend on eruption season?

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Major volcanic eruptions in the tropics have particularly strong climate impacts, since the circulation pattern of the stratosphere, or Brewer-Dobson circulation, leads to long lifetimes and near-global coverage for aerosols introduced into the tropical stratosphere. The Brewer-Dobson circulation is strongly hemispherically and seasonally dependent, with poleward meridional transport and mixing occurring most strongly in the winter hemisphere. Using simulations with the MAECHAM5-HAM general circulation model including detailed aerosol microphysics, and the MPI Earth System Model, we examine how the transport of volcanic aerosols, and the resulting climate impact of major tropical eruptions depends on the season of eruption. A number of paleo-eruptions in the Central American Volcanic Arc (CAVA) are simulated, with different SO2 emission strengths estimated from field measurements. We examine how the magnitude and season of eruption affect the hemispheric asymmetry of both stratospheric aerosol optical depth (AOD) and sulphur deposition over the poles. Large hemispheric asymmetries in stratospheric aerosol distribution may affect how the global mean temperature is perturbed by a given volcanic eruption. This work could be useful in better interpreting volcanic signals in paleo-ice core data and improving the accuracy of estimated AOD data sets used in the model simulation of past climate.