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Influence of aerosol heating on the stratospheric transport of the Mt. Pinatubo eruption

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On June 15th, 1991 the eruption of Mt. Pinatubo (15.1°N, 120.3°E) in the Philippines injected about 20 Tg of sulfur dioxide in the stratosphere, which was transformed into sulfuric acid aerosol. The large perturbation of the background aerosol caused an increase in temperature in the lower stratosphere of 2-3 K. Even though stratospheric winds climatologically tend to hinder the air mixing between the two hemispheres, observations have shown that a large part of the SO2 emitted by Mt. Pinatubo have been transported from the Northern to the Southern Hemisphere.

We simulate the eruption of Mt. Pinatubo with the Goddard Earth Observing System (GEOS) version 5 global climate model, coupled to the aerosol module GOCART and the stratospheric chemistry module StratChem, to investigate the influence of the eruption of Mt. Pinatubo on the stratospheric transport pattern. We perform two ensembles of simulations: the first ensemble consists of runs without coupling between aerosol and radiation. In these simulations the plume of aerosols is treated as a passive tracer and the atmosphere is unperturbed. In the second ensemble of simulations aerosols and radiation are coupled.

We show that the set of runs with interactive aerosol produces a larger cross-equatorial transport of the Pinatubo cloud. In our simulations the local heating perturbation caused by the sudden injection of volcanic aerosol changes the pattern of the stratospheric winds causing more intrusion of air from the Northern into the Southern Hemisphere. Furthermore, we perform simulations changing the injection height of the cloud, and study the transport of the plume resulting from the different scenarios. Comparisons of model results with SAGE II and AVHRR satellite observations will be shown.