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EFFECT OF VOLCANIC AEROSOLS ON THE POLAR STRATOSPHERIC TEMPERATURE (ABSTRACT)

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Using a fixed dynamical heating model, the effect of volcanic aerosols on the polar stratosphere is investigated, focused on the comparison between northern and southern hemispheres. The model resolution is, in the vertical, about 3 km (23 layers) from 1000 to 0.05 hPa, and 5° in latitude. The radiative calculation is made with a four-stream approximation for both the solar and infrared regions. NMC monthly mean temperature for 12 years (1979–1990) is used for the tropospheric temperature below 300 hPa and for the calculation of dynamical heating. Aerosol properties are taken principally from the LOWTRAN codes. Time integration starts on June 15.

Ash-type aerosol shows much larger absorption in the solar region than emission and absorption in the infrared region, resulting in warming of the stratosphere in summer. Sulfate aerosol, on the other hand, does not absorb but reflects solar radiation, so that cooling and heating in the infrared region plays a dominant role in the entire region. In the southern hemisphere warming occurs in winter and cooling in summer, in sharp contrast with cooling in the whole year in the northern hemisphere. This prominent interhemispheric difference comes from that the southern winter is much colder, about 20 K in mid-winter, than the northern winter. Whether sulfate aerosols induce warming or cooling strongly depends on the local atmospheric (temperature) condition.

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