

Climate/Chemistry Effects of the Pinatubo Volcanic Eruption Simulated by the University of Illinois at Urbana-Champaign Stratosphere/Troposphere GCM With Interactive Photochemistry

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The influence of the sulfate aerosol formed following the massive Pinatubo volcanic eruption in June 1991 on the chemical composition, temperature and dynamics of the atmosphere has been investigated with the University of Illinois at Urbana-Champaign stratosphere/troposphere GCM with interactive photochemistry. Ensembles of 5 runs have been performed for the unperturbed (Control) and perturbed (Experiment) conditions. The simulated repartitioning within the chlorine and nitrogen groups, as well as the ozone changes, are in reasonable quantitative agreement with observations and theoretical expectations. The simulated changes in ozone mixing ratio are found to be statistically significant only in the middle and upper tropical stratosphere. The simulated total ozone loss reached 15% over the northern middle and high latitudes in winter and early spring; however, most of the simulated changes are not statistically significant. The magnitude of the simulated total ozone depletion is generally less than that observed, but some members of the experiment ensemble are in better agreement with the observed ozone anomalies. The model simulates a pronounced stratospheric warming in the tropics, which exceeds the warming derived from observations

by 1-2 K. The model matches well the intensification of the polar-night jet in December 1991; the statistically significant cooling of the lower polar stratosphere and warming of the surface air in boreal winter over the U.S., northern Europe and Russia; as well as the cooling over Greenland, Alaska and Central Asia.