

# **Global Temperature Response to the Major Volcanic Eruptions in Multiple Reanalysis Datasets**

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Global temperature response to the eruptions of Mount Agung in 1963, El Chichón in 1982 and Mount Pinatubo in 1991 is investigated using nine reanalysis datasets (JRA-55, MERRA, ERA-Interim, NCEP-CFSR, JRA-25, ERA-40, NCEP-1, NCEP-2, and 20CR). Multiple linear regression is applied to the zonal and monthly mean time series of temperature for two periods, 1979–2009 (for eight reanalysis datasets) and 1958–2001 (for four reanalysis datasets), by considering explanatory factors of seasonal harmonics, linear trends, Quasi-Biennial Oscillation, solar cycle, and El Niño Southern Oscillation. The residuals are used to define the volcanic signals for the three eruptions separately. In response to the Mount Pinatubo eruption, most reanalysis datasets show strong warming signals (up to 2–3 K for one-year average) in the tropical lower stratosphere and weak cooling signals (down to –1 K) in the subtropical upper troposphere. For the El Chichón eruption, warming signals in the tropical lower stratosphere are somewhat smaller than those for the Mount Pinatubo eruption. The response to the Mount Agung eruption is asymmetric about the equator with strong warming in the Southern Hemisphere midlatitude upper troposphere to lower stratosphere. Comparison of the results from several different reanalysis datasets confirms the atmospheric temperature response to these major eruptions qualitatively, but also shows quantitative differences even among the most recent reanalysis datasets.

**Key words:** volcanic eruptions, temperature, reanalysis, regression