Volcanic effects on climate

PCMDI Program for Climate Model Diagnosis and Intercomparison

Objective

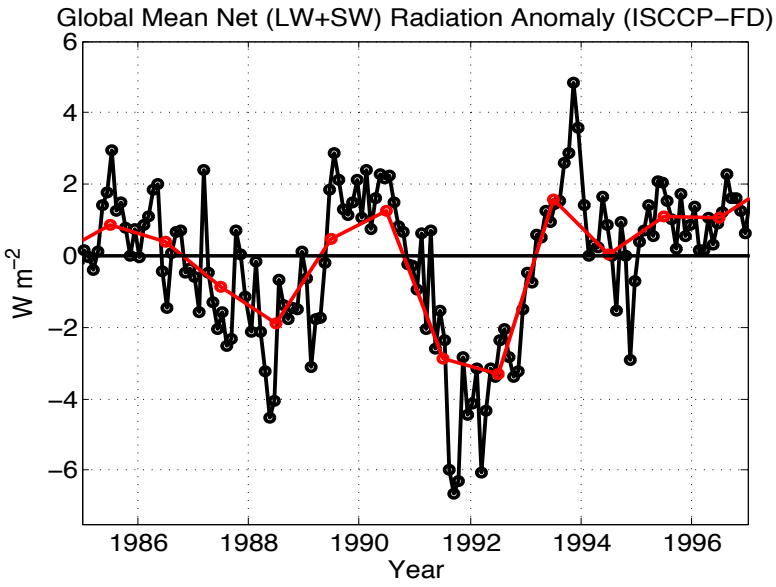
- To understand and interpret results published by Johansson *et al*. in a 2015 paper in *Nature Climate Change*

Research

- To determine why Johansson *et al*. obtained very small estimates of the surface cooling (-0.2°C) and the net radiative forcing (-1W/m^2) caused by the eruption of Pinatubo

Impact

- Johansson *et al.*'s estimate of the radiative forcing from Pinatubo is 2.5 to 5 times smaller than the forcing inferred from direct and indirect observations
- Future Bayesian studies seeking to estimate volcanic cooling signals should incorporate better observational constraints (like ISCCP and CERES measurements of net radiative fluxes)
- Johansson *et al.*'s estimate of volcanically-caused surface temperature changes during the "hiatus" period does not accurately reflect known shortcomings and uncertainties in volcanic forcing



Global-mean net downwelling anomalies from the ISCCP-FD observational data set. Results are monthly means (black) and annual averages (red). The base period used for calculating anomalies is 1983 to 1999. These and other direct observations do not support Johansson *et al.*'s very small (-1W/m^2) posterior best estimate of the net top of atmosphere radiative forcing caused by the June 1991 eruption of Mt. Pinatubo in the Phillipines

Reference: Santer, B.D., S. Solomon, D.A. Ridley, J.C. Fyfe, **F. Beltran**, **C. Bonfils**, **J.F. Painter**, and **M.D. Zelinka**, 2016: Volcanic effects on climate. *Nature Climate Change*, **6**, 3-4.