



Do tropical volcanic eruptions influence the Southern Annular Mode?

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Large tropical volcanic eruptions have been observed to have a significant influence on the large-scale circulation patterns of the Northern Hemisphere, through mechanisms related to the radiative effects of the sulfate aerosols resulting from the volcanic injection of SO₂ into the stratosphere. While no such volcanically induced anomalies in Southern Hemisphere circulation have yet been observed, we find that general circulation model simulations of eruptions with SO₂ injections larger than that of the 1991 Mt. Pinatubo eruption do result in significant circulation changes in the SH, specifically an enhanced positive phase of the southern annular mode (SAM). We explore the mechanisms for such a SAM response, as well as the corresponding changes in SH temperature, sea ice and precipitation. We also explore how the anomalously strong zonal winds characteristic of the positive SAM regime affect the rate of sulfate deposition to the Antarctic ice-sheet, and related implications for ice-core based reconstructions of past volcanic activity. This study has relevance for better understanding SAM forcing mechanisms, interpreting observed SAM time series, and predicting future SAM changes after major volcanic eruptions.