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How variable is the climate impact of tropical explosive volcanic eruptions as seen in ERA40 Re-analysis data?

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Volcanic eruptions of the explosive type are used as an analog for feasibility studies in counteracting global warming, as the sulfate aerosols can efficiently scatter the incoming radiation reducing the global surface temperatures. But, apart from surface cooling, observations have shown significant changes in the winter temperatures in the high latitudes as well as a reduction in stratospheric ozone concentrations after such eruptions. Most importantly, no study exists that focus on the extend to which these impacts could vary. Hence, this study attempts to understand the variability in the global climate impacts of the three major eruptions of the last 50 years. Significant differences are seen in the tropical and high latitude responses though all the three eruptions were tropical eruptions of the explosive type, coincided with El Nino events. Our results show a strong variability in the stratospheric temperature anomalies and this is due to the differences in the QBO phase and amount of ozone depleted. Notable variations are also seen in the high latitude surface temperature response in winter that is understood as a dynamical response associated with the strengthening of the north polar vortex. It is shown that the ẗvolcanic winter patternïs weak following the second winter after Agung and correspondingly the polar vortex was also weak. However, during the first winter Mt. Pinatubo eruption, the surface temperature response was stronger,but the vortex was relatively weak. Similarly differences are also seen in the vertical profiles of zonal mean zonal wind and temperature anomalies.