



Volcanic eruptions since 1883 and East Asian monsoon variability

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The injection of tephra, aerosols and water vapour into the stratosphere during volcanic eruptions is a possible cause of monsoon variability because of the reduction in solar heating. In the present study, 13 volcanic eruptions with Volcanic Explosivity Index of 5 and above from 1883 to the present are investigated for their influence on temperature and precipitation variability in the East Asian Monsoon region of southern China based on the instrumental record of the Hong Kong Station. The main conclusions drawn are:

(1) Volcanic eruptions within the tropics reduce solar heating more than those from higher latitudes. The highest successive number of years with lower annual mean temperatures than the eruption year was found for Krakatau in 1883, followed by Santa Maria in 1902, El Chichón in 1982 and Pinatubo in 1991.

(2) In 9 of the 13 volcanic eruptions, abnormally dry years have been found. These include the driest year on record in 1963, the eight driest in 1933, the ninth driest in 1912, the tenth driest in 1991, the eleventh driest in 1956, the seventeenth driest in 1980 and the nineteenth driest in 1886. This is explained by a shift in surface wind circulation in southern China to predominantly offshore.

(3) An exceptionally wet year (monsoon strengthening) was found in 1982 when El Chichón erupted. This is the second wettest year on record explained by the spread of the eruption cloud across the Pacific Ocean

In addition to the reduction in solar heating other climatic effects of volcanic eruptions include:

(1) The interference of the 'normal' atmospheric circulation by the eruption clouds.

(2) The interaction between the atmospheric circulation and oceanic circulation.

(3) The provision of condensation nuclei by tephra and aerosols.

(4) The transfer of water vapour from the troposphere into the stratosphere.

(5) The increase in frequency of drought years associated with salinization and crop failure.

(6) Acid rain.