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Impact of Volcanic Eruptions on Rainfall in Hong Kong: Relevance to Water Resource Management

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Abstract:

Past volcanic eruptions in the Indo-Pacific region and elsewhere are not only found to lower Hong Kong's temperature but also lead to extremely dry and wet years. In the present study, three examples of volcanic eruptions have been examined. They are the 1963 Agung eruption in Indonesia, the 1982 El Chichón eruption in Mexico and the 1991 Pinatubo eruption in the Philippines. Table 1 shows the latitude, first eruption date, volume of materials erupted and annual precipitation at the Hong Kong Station of the Hong Kong Observatory during the three eruptions. The low rainfall in 1963 (the driest year since record began in 1884) and 1991 (the 10th driest year since record began in 1884) may be accounted for by the Agung eruption and the Pinatubo eruption respectively. In both cases, the rising thermal plumes of the eruption cause the surrounding cooler air to be drawn in. Because of the coastal location of Hong Kong at the margin of the largest continental mass in the world, the change from the normal wind directions to predominantly offshore wind would be conducive to drought. In contrast, the 1982 El Chichón eruption is a trans-Pacific Ocean event. Satellite tracking of the volcanic dust cloud spreading across the Pacific Ocean reached the South China Sea by ~16th April, 1982 (Rampino and Self, 1984). From 22nd April to 31st May, 1982, the total rainfall recorded at the Hong Kong Station was 1041.2 mm with the rainfall in May ranking the fourth highest on record. This is attributed to the volcanic cloud providing condensation nucleus to cause abnormally heavy rainfall for this period and the remainder of the year making 1982 the second wettest year since record began in 1884. There is therefore an important role for volcanic eruptions to influence Hong Kong's rainfall variability. This is seen to be relevant to water resource management not only to Hong Kong but also to the adjacent coastal and inland regions of China.

Table 1 Latitude, first eruption date, volume of materials erupted and annual precipitation at the Hong Kong Station during the 1963 Agung, 1982 El Chichón and 1991 Pinatubo eruptions.

Volcano	Latitude	First eruption date	Volume of materials erupted	Precipitation (mm)	Comment
Agung, Indonesia	8^{o}S	February 18, 1963	~ 1 km^3 (Rampino and Self, 1982)	901.1	Driest year
El Chichón, Mexico	17^{o}N	March 28., 1982	~ 0.6 km^3 (Rampino and Self, 1984)	3247.5	2nd wettest year
Pinatubo, Philippines	15^{o}N	June 15, 1991	~ 5 km^3 (Self et al., 1999)	1639.1	10th driest year

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