

## **Cascading Hazards: Can Excessive Precipitation Trigger Volcanic Eruptions?**

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Asia and Oceania encompass many of the most volcanically active regions of our planet, frequently responsible for catastrophic loss of life and livelihood. Moreover, these many of these areas are periodically subject to extreme weather events due their tropical monsoon climate. Torrential rainfall, flash flooding and lightning strikes are well-known and immediate hazards related to the onset of the rainy season. However, the potential influence of extreme rainfall on the likelihood or magnitude of regional volcanic activity is a poorly-understood phenomenon.

We present a systematic analysis of correlations between the historic eruption catalogue and precipitation. We observe that a significant proportion of the historical eruptions of Gunung Merapi (Indonesia) coincide with the rainy season of Central Java (October to March). In the absence of any external trigger, we would expect eruptive events to be more-or-less uniformly distributed over time: an eruption in June would be equally as probable as an eruption in January, for example. Instead, however, an anomalously high number of eruptions are observed between August and January, and far fewer than average between February and July (notably, no eruption of any magnitude has been recorded in June). In terms of explosivity, it can be observed that of all recorded VEI 3+ events ( $n = 11$ ), none fall within the period May - July. Between 80 and 90% of historical eruptions occur during the rainy season. Not all volcanoes have exhibited sufficient eruptive activity to result in statistically significant datasets. Nevertheless, when volcanic activity is collated regionally, similar trends emerge. In the Banda Sea, five volcanoes have had observed historical eruptions (Serua, Teon, Banda Api, Nila, and Wurlawi).

Compiling these data, we observe that eruptions in Indonesia are generally less prevalent between July and October. These results indicate that certain volcanic systems may exhibit a strong correlation between precipitation and eruptive events, constituting a significant cascading hazard.