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Volcanic activity before and after large tectonic earthquakes: Observations and statistical significance

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The study of volcanic triggering and coupling to the tectonic surroundings has received special attention in recent years, using both direct field observations and historical descriptions of eruptions and earthquake activity. Repeated reports of volcano-earthquake interactions in, e.g., Europe and Japan, may imply that clustered occurrence is important in some regions. However, the regions likely to suffer clustered eruption-earthquake activity have not been systematically identified, and the processes responsible for the observed interaction are debated.
We first review previous works about the correlation of volcanic eruptions and earthquakes, and describe selected local clustered events. Following an overview of previous statistical studies, we further elaborate the databases of correlated eruptions and earthquakes from a global perspective. Since we can confirm a relationship between volcanic eruptions and earthquakes on the global scale, we then perform a statistical study on the regional level, showing that time and distance between events follow a linear relationship. In the time before an earthquake, a period of volcanic silence often occurs, whereas in the time after, an increase in volcanic activity is evident. Our statistical tests imply that certain regions are especially predisposed to concurrent eruption-earthquake pairs, e.g., Japan, whereas such pairing is statistically less significant in other regions, such as Europe. Based on this study, we argue that individual and selected observations may bias the perceptible weight of coupling. Volcanoes located in the predisposed regions (e.g., Japan, Indonesia, Melanesia), however, indeed often have unexpectedly changed in association with either an imminent or a past earthquake.