



An assessment of volcanic unrest in the 21st century

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Volcanic unrest is the deviation from the background or baseline behaviour of a volcano towards a level of activity, which is cause for concern in the short term because it might be a prelude to an eruption. When volcanic unrest is preceded by lengthy periods of quiescence it is particularly difficult to foresee how a volcano might behave. One of the most important problems is forecasting whether the unrest will culminate in an eruption or not. The objective of this study is to evaluate reported global unrest at volcanoes with documented unrest between 2000-2011 to test for correlations between unrest parameters in a view to help better assess future unrest episodes. This investigation draws largely from information presented by the Global Volcanism Program. Timelines for different volcanoes were created to demonstrate how unrest develops over time and to highlight the reactivation period prior to an eruption. Through combination of time series and statistical analyses we find that of every three volcanoes with reported unrest, two culminated in an eruption; this ratio varies when considering different volcano types. No correlation was found between length of repose and unrest duration. Ground deformation and seismic activity, as well as other signals, are generally reported on various scales prior to an eruption; but their presence alone is not indicative of whether unrest will culminate in an eruption. We find that the reactivation process is mostly dependent on the local tectonic setting, magma composition and volcano type. Our analysis enables us to characterise volcanic unrest as reactivation, prolonged, pulsatory and irregular. To improve this evaluation, to overcome statistical biases and to improve our understanding of the cause of unrest a better knowledge of the magmatic and eruptive history of restless volcanoes is required as well as a better knowledge of the local tectonics.