



WOVOdat: A Worldwide Volcano Unrest Database

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The advances in volcano monitoring allow to continuously collect large amounts of multi-parameter datasets that need to be managed, archived, and analysed. Therefore, an efficient and robust data management system is crucial for better hazard mitigation and crisis response. WOVODat (Newhall et al., 2017; wovodat.org) is a growing global database on volcanic unrest aimed to capture the changes in geochemical, geophysical, and geodetic signals that occur before, during and after an eruption. It is an international effort of the WOVO (World Organization of Volcano Observatories) communities and is complementary to other volcano-related databases like the Global Volcanism Program and the Global Volcano Model. Since 2009, the Earth Observatory of Singapore has taken the lead on hosting and developing it. WOVODat is intended to provide reference data useful for volcanic crises, for comparative studies, and for basic research on pre-eruption processes. Through WOVODat, users will be able to search analogous historical unrest that can be compared to ongoing unrest, to find the range and estimate probabilities of possible outcomes allowing for improving eruption forecasts. WOVODat stores multi-parametric instrumental and observational data during unrest. Some compilations exist of individual types of monitoring data, e.g., seismic, or deformation, or gas, but only in WOVODat they are brought together from around the world and made easily accessible on common timescales, in side-by-side comparisons. Data homogeneity and consistency is important for comparative studies between different unrest episodes, therefore data have been archived following a common standard formats and complemented with its metadata to capture data quality and accuracy. The database has a structure and format (WOVODat documentation (wovodat.org/doc/index.php) that has now been adopted by several institutions in Japan, the Philippines, and Indonesia. The volcano table is the center of the data structure from which all other data can be linked. Monitoring data are generally linked from the instrument/station where the data were collected, to the network of stations, and to the volcano. The MySQL hierarchical database allowing connection between each data entity e.g. seismicity and deformation time series from different station can be interconnected with eruption phases and alert levels. Main data contributors for WOVODat are volcano observatories, but we also explore data from open catalogs and references (legacy data), as well as liaise with ongoing research projects related to volcano unrest. We have now incorporated about 47% of worldwide unrest data in WOVODat, covering 135 volcanoes with more than 921 unrest episodes. To improve and promote the use of WOVODat, we are creating a robust online-interface that allows exploring and effectively use the database. Main tools in WOVODat currently include spatio-temporal interactive visualization, data search and data download, and analytics tools for advanced analyses. The web analytics tools employ various statistical and machine learning algorithms. The tools allow users to perform analysis of various types of data, both temporal and spatial. The main objective is to find unrest indicators and identify precursory pattern to improve eruption forecasts.

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