

A new global database of volcanic gas emissions

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Volcanic degassing plays a key role in controlling the style, duration and onset of volcanic eruptions. Accurate degassing budgets are crucial for understanding volcanic gas fluxes to the atmosphere and volatile recycling through subduction zones. Volcanic gases influence Earth's climate over various spatial and temporal scales and have notable impacts on human society and terrestrial environments. Precise estimates of global gas fluxes may also inform climate change policy, and counter claims that volcanic emissions exceed anthropogenic output of greenhouse gases.

Degassing is regularly monitored at many volcanoes worldwide, with sophisticated direct sampling and both ground and satellite-based remote sensing techniques. The literature contains a wealth of additional data, arising from campaign measurements of degassing, numerous petrological studies of magmatic volatiles, and various methods targeting proxies for gas fluxes. However, there is currently no existing inventory of volcanic gas emission measurements in an easily accessible form, such as an online relational database.

Inspired by the Deep Carbon Observatory's (DCO) DECADE initiative to estimate global volcanic CO₂ flux, we are building a new database that will incorporate all published degassing and volatile data for Earth's volcanoes. Appropriate metadata is carefully defined, to include detailed information pertaining to the volcano in question (e.g. composition, style of activity, tectonic setting, eruptive history) and also to address data quality issues. Numerous external factors influence the accuracy of gas emission measurements, and some categorisation or quantification of the uncertainty present in each data entry must ideally be included.

The database will be accessed and manipulated through a clear and easily navigable website. Functions allowing rapid visualisation and comparison of datasets from different time periods and regions will enable the database's use as a powerful reference tool, with searchable and downloadable content for more in-depth research. The data will be freely accessible to a wide range of end users, and closely linked to other online resources, including EarthChem and the Smithsonian Global Volcanism Programme. The structure of the GVP eruption and activity archive lends itself readily to the incorporation of emission and volatile data to both specific volcanoes and individual phases of activity; the structure of the EarthChem database is well-suited for compositional data of gas emission samples. Interoperability between the GVP and EarthChem databases will link and integrate activity, emissions, and geological samples and greatly facilitate multi-parameter studies of volcanoes, over selectable spatial and temporal scales. Short exemplar case studies are presented here. A key future objective is full integration of this new database with other existing online resources, such as WOVOdat, Global Volcano Model, GOOGAS, and IRIS.