

## **Sulfur dioxide emissions from effusive volcanic eruptions**

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Recent effusive eruptions of Nyiragongo (DR Congo) and Etna (Sicily) have highlighted the threat to society from such events which, although less acute than the threat from large explosive eruptions, can still be locally severe. Effusive eruptions of basaltic lava also release large amounts of sulfur dioxide (SO<sub>2</sub>) into the atmosphere, as documented by the Total Ozone Mapping Spectrometer (TOMS) instruments since their first launch in 1978. The 23-year TOMS volcanic emissions database contains significant contributions from effusive eruptions of Nyamuragira (DR Congo), the Galapagos Islands (Sierra Negra, Cerro Azul, Fernandina, Marchena & Wolf) and Icelandic volcanoes (Krafla, Hekla). Although much of this SO<sub>2</sub> does not reach the stratosphere, it can cause considerable local environmental stress, and models indicate that SO<sub>2</sub> from effusive eruptions can reach the stratosphere under certain conditions. Although less than 20% of the volcanoes with TOMS-detected eruptions since 1978 are of the effusive type, they are responsible for around 30% of detected eruptions and around 35% of the total number of days (666) of volcanic cloud observations to date, reflecting the relatively long duration of these eruptions. The years since the launch of Earth Probe TOMS in 1996 have seen a dearth of major explosive activity, with the short-term volcanogenic SO<sub>2</sub> flux over the last 5-6 years dominated by emissions from Nyamuragira. Continuous emission and coincident removal of SO<sub>2</sub> during effusive events makes estimation of total SO<sub>2</sub> production problematic using daily polar-orbiting satellite 'snapshots'. However, satellite data such as TOMS provide the only information on these important SO<sub>2</sub> emissions, for comparison with other data such as lava effusion rates and lava flow volume. They also allow modeling of the potential SO<sub>2</sub> output and atmospheric impact of future, larger effusive eruptions.