The contribution of volcanic gas and particle fluxes to the troposphere

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Volcanoes release considerable fluxes of gases and particles to the atmosphere, both during eruptions and during long-term non-eruptive degassing. While the volcanic fluxes of many species are very poorly known (often only to 1 or 2 orders of magnitude), the volcanic contribution to the tropospheric burden of certain gases (including SO_2, HCl, HF, BrO); volatile trace metals (including Cd, Hg, Zn) and aerosol (including sulphate) is certainly significant.

In terms of sulphur dioxide, most of the long-term time-averaged volcanic emission is from non-erupting volcanoes (6-9 Tg/yr), or during relatively minor eruptions (6-8 Tg/yr), rather than from large explosive eruptions (1-2 Tg/yr). Emissions from 'passively degassing' volcanoes are significant since they are mostly to the free troposphere (due to the vent elevation, or the plume rise height) where species lifetimes are extended, and the impact of volcanic sources is enhanced.

Volcanic emissions are not limited to species released directly from magma, but also include those produced by chemical reaction in the extreme environments associated with the volcano. Newly discovered volcano-related gases include NO_x and HNO_3, which form by thermal decomposition of atmospheric nitrogen at the magma-air interface, and halocarbons produced by reactions between volcanic fluids and surrounding materials.