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'Understanding volcanoes and society: the key for risk mitigation'



Volcanic air pollution during a flood basalt eruption: from vent to exposed communities

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Flood basalt eruptions (fissure eruptions producing over 1 km³ of lava) are considered one of the most dangerous eruption types in Iceland because of severe environmental and air pollution, both in Iceland and further afield. However, our ability to forecast and mitigate the pollution caused by flood basalt eruptions is limited by a lack of understanding of the plume dynamics, conversion rates of SO₂ to aerosol, and atmospheric residence times of the plume components.

The Icelandic Holuhraun eruption 2014-2015 presented the first opportunity in the modern age to study the environmental impact of a flood basalt. The eruption produced 11 Mt of SO₂ over six months and caused air pollution events in Iceland and Europe.

We sampled the plume both at the eruption site and in downwind populated areas to determine the chemical composition of the plume, the size of the aerosol, and the changes which occur as the plume ages, with a special focus on species posing health hazards (SO₂, PM₁₀ and PM_{2.5}, heavy metals).

The volcanic plume was dominated by PM_{2.5} with exposure guidelines for airborne pollutants frequently exceeded in an area up to 20km from the eruption site. Populated area located ~100 km downwind also experienced frequent high-pollution episodes, both from a 'young' plume (rich in SO₂ gas) carried straight from the eruption site, and an 'old' plume (poor in SO₂ and rich in PM_{2.5} sulphate), which is believed to have been several days old when it reappeared in the populated area. Work is currently ongoing to compare the direct observations of the old plume with dispersion models. The appearance of the old plume in populated areas may have implications for air pollution forecasts in future eruptions, as public air pollution alerts during Holuhraun were issued based only on presence of a young plume.