Environmental pressure from the 2014-15 eruption of the Bardarbunga volcano, Iceland

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The effusive six months long 2014–2015 Bardarbunga eruption (31 August-27 February) released 11.8 Mt of SO_2 gas to the atmosphere, 5.6 Mt of CO_2, about 0.1 Mt of HCl and some HF [1]. The SO_2 gas flux was more than the anthropogenic flux from Europe in 2011 and similar to the annual average SO_2 gas emission from all the Earth's volcanoes. The ground level concentration of SO_2 exceeded the 350 μg m^{-3} hourly average health limit over much of Iceland for days to weeks. Anomalously high SO_2 concentrations were also measured at several locations in Europe in September 2014 when magma effusion rates were highest. The lowest pH of fresh snowmelt at the eruption site was 3.3, and 3.2 in precipitation 105 km SE from the source. Elevated dissolved SO_4, Cl, F, and metal concentrations were measured in snow and precipitation. Continuous monitoring of average daily dissolved constituents with osmotic samplers and discharge of a direct runoff river 100 km east of the eruption site for March to July 2015, covering the early and late snowmelt within the catchment, shows that the median riverine H^+ concentration were 61% higher in the 2015 than the years before the eruption, dissolved median Cl 65% higher, and the median 2015 SO_4 concentration was 34% higher than the control year's concentrations. These observations suggest that; 1) the dry westerly-wind transporting the volcanic plume over the catchment, 2) the relatively high wind speed and 3) limited light in the winter time at the high latitude, all resulted in minor SO_2 oxidation. In general at high latitude, during winter there is perhaps greater environmental and human health risk from SO_2 gas than from SO_4 aerosol particles due to reduced conversion efficiency, whereas in summer the aerosol particle effects may dominate [1].

[1] Gislason et al. (2015), *Geochemical Perspective Letters* 1, 84-93.