# Analysis of radiation transport effects on passive remote sensing of $SO_2$ from the Bárðarbunga fissure eruption at Holuhraun, Iceland

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Measurements of the emission rate of magmatic volatiles provide important information about the geochemical and geophysical state of erupting volcanoes. Sulfur dioxide ($SO_2$), a reliable indicator of the presence and rise of magma at shallow levels, is commonly measured using remote sensing techniques from ground or space. This is usually achieved through the use of optical techniques that measure the absorption of diffuse solar radiation in ultraviolet bands. A recognized source of uncertainty in these types of measurements is radiative transfer, because scattering in hazy atmospheres and the volcanic plume itself can produce a variety of optical paths, and not a single path through the column, which is the key assumption of operational data retrieval schemes.

The eruption of the Bárðarbunga fissure in Holuhraun, central Iceland, in 2014-2015 provided a dramatic example of this situation. The eruption was responsible for the emission to the atmosphere of at least 9.6 Mt of $SO_2$, quantified through the use of several techniques, in particular differential optical absorption spectroscopy (DOAS). The exceptionally large amount of gas, relatively low levels of natural ultraviolet radiation at high latitudes, and the common occurrence of haze, dust, and clouds posed a challenge to the analysis of remote sensing data. Using a new method for the analysis of radiative transfer effects, we present a new assessment of the emissions from this eruption, which remains the largest source of $SO_2$ from volcanoes in the last decade.

## References

Pfeffer, M.A., Bergsson, B., Barsotti, S., Stefánsdóttir, G., Galle, B., Arellano, S., Conde, V., Donovan, A., Ilyinskaya, E., Burton, M., et al., 2018: Ground-Based Measurements of the 2014–2015 Holuhraun Volcanic Cloud (Iceland). Geosciences 8(1):29. https://doi.org/10.3390/geosciences8010029