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Ground-based measurements of the Holuhraun eruption cloud

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The 2014-2015 Bárðarbunga fissure eruption at Holuhraun was distinguished by high emission of gases and very low emission of tephra. Three scanning DOAS streamed data in near real-time. A filtered subset of the scanning DOAS data least affected by within-plume scattering provides the majority of the SO2 emission rates. These measurements are augmented by car-mounted traverses along the ring road and along the lava field. The entire eruption released ~12 Mt SO2. ~1% of the SO2 emitted by the eruption is calculated to have outgassed from cooling lava, with detectable emissions continuing for at least four months after the end of the eruption. The ratios of other gases concentrations to SO2 were measured using FTIR and MultiGAS. FTIR measurements (using the main vent as the IR source) indicate a significantly drier plume than MultiGAS measurements (made on the edge of the lava field when the plume was grounded) suggesting the addition of meteoric water within the more aged plume. HCl/SO2 and HF/SO2 ratios show a halogen-poor eruption cloud. Plume heights were measured using: visual observations from field, airborne, webcam and NICAIR2 infrared images, triangulation of two scanning DOAS, and by consistency of measured and modeled wind directions. Plume height was distinctly higher at the start of the eruption, varied between 1-3 km above ground level in the following months, and was greatly influenced by meteorological conditions. There is great variance in measurements with the same technique on the same day, and between different techniques. The plume height and emission rate measurements were critical for initializing gas dispersal simulations for hazard forecasting for vulnerable downwind communities. The eruption was extremely tephra-poor. A down-wind OPC was unable to distinguish between PM from the eruption and PM from other sources. Two weather radars detected reflectivity indicative of tephra on very few days.