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Emission of gas and atmospheric dispersion of SO_2 during the December 2013 eruption at San Miguel volcano (El Salvador)

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San Miguel volcano, also known as Chaparrastique, is a basaltic volcano along the Central American Volcanic Arc (CAVA). Volcanism is induced by the convergence of the Cocos Plate underneath the Caribbean Plate, along a 1200-km arc, extending from Guatemala to Costa Rica and parallel to the Central American Trench. The volcano is located in the eastern part of El Salvador, in proximity to the large communities of San Miguel, San Rafael Oriente, and San Jorge. Approximately 70,000 residents, mostly farmers, live around the crater and the city of San Miguel, the second largest city of El Salvador, ten km from the summit, has a population of ∼180,000 inhabitants. The Pan-American and Coastal highways cross the north and south flanks of the volcano.San Miguel volcano has produced modest eruptions, with at least 28 VEI 1-2 events between 1699 and 1967 (datafrom Smithsonian Institution http://www.volcano.si.edu/volcano.cfm?vn=343100). It is characterized by visible milddegassing from a summit vent and fumarole field, and by intermittent lava flows and Strombolian activity. Since the last vigorous fire fountaining of 1976, San Miguel has only experienced small steam explosions and gas emissions, minor ash fall and rock avalanches. On 29 December 2013 the volcano erupted producing an eruption that has been classified as VEI 2. While eruptions tend to be low-VEI, the presence of major routes and the dense population in the surrounding of the volcano increases the risk that weak explosions with gas and/or ash emission may pose. In this study, we present the first inventory of SO_2, CO_2, HCl, and HF emission rates on San Miguel volcano, and an analysis of the hazard from volcanogenic SO_2 discharged before, during, and after the December 2013 eruption. SO_2 was chosen as it is amongst the most critical volcanogenic pollutants, which may cause acute and chronicle disease to humans. Data were gathered by the geochemical monitoring network managed by the Ministerio de Medio Ambiente y Recursos Naturales (MARN) of El Salvador and by a network of geophysical and geochemical stations established on the volcano by the Italian Istituto Nazionale di Geofisica e Vulcanologia (INGV), immediately after the December 2013 eruption, on the request of MARN. During the eruption, SO_2 emissions increased from a background level of ∼330 t d-1 to 2200 t d-1, dropping after the eruption to an average level of 680 t d-1. Wind measurements and SO_2 fluxes during the pre-, syn- and post-eruptive stages were used to model SO_2 dispersion around the volcano. Air SO_2 concentration exceeds the dangerous threshold of 5 ppm in the crater region, and in some middle sectors of the highly visited volcanic cone.