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Behaviour of volcanogenic S-bearing compounds (H_2S and SO_2) in air at Vulcano Island (Aeolian Archipelago, southern Italy)

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The main sources of SO_2 and H_2S in air consist of both natural fluid emissions related to active/quiescent volcanoes and hydrothermal systems, and anthropogenic activities (e.g. gas and oil refineries, steel industries, urban traffic). These gas compounds have a strong impact on air quality, since they are strong toxic and climate forcing agents. Notwithstanding, the behaviour of these S-compounds in air once they are released from the contaminant source(s) is poorly known, due to the scarce available data from thermodynamics and direct measurements. Hydrogen sulfide is considered to be relatively reactive in the atmosphere, being easily oxidized to SO_2 by photochemical reactions, even though the efficiency of the H_2S to SO_2 conversion is significantly lowered under dark, dry and relatively cold conditions, leading to a residence time of H_2S in air up to 42 days in winter.
In this work, H_2S and SO_2 measurements in air carried out at the Levante beach (Vulcano Island, Aeolian Archipelago), where a number of hydrothermal fluid discharges consisting of fumaroles and submarine emissions occur, are presented and discussed. These volcanic fluids, characterized by an H_2S-rich chemical composition, are released in a close proximity to the touristic village of Vulcano Porto. The measurements were carried out using a Thermo Scientific™ Model 450i Analyzer coupled with a Davis® Vantage Vue weather station (air humidity and temperature, wind direction and speed) in 34 fixed spots and along 8 pathways, selected according to: (i) distance from the contaminant source, (ii) wind direction and (iii) accessibility by car (where the instrument was installed). The main aim was to provide empirical insights on the behavior of these air pollutants in relation to the physical and chemical processes controlling their spatial distribution. The measured data were elaborated using a statistical approach to construct spatial distribution maps and conceptual models able to forecast the dispersion of the S-compounds at different environmental conditions to define the potential hazard to human health.