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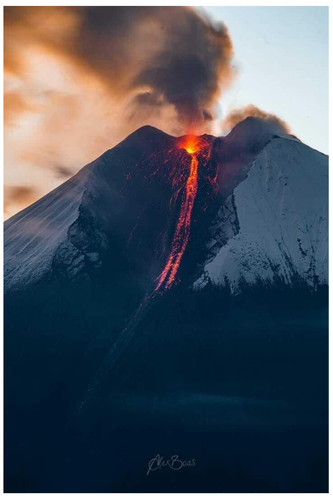
LONG-RANGE TRANSPORT AND MICROSCOPY ANALYSIS OF SANGAY VOLCANIC ASHES IN ECUADOR

PROBLEM



Volcanic eruptions are short to long-lasting events that are a source of ash particles and aerosols, which are released into the atmosphere over time. A significant portion of expelled volcanic ash can be carried by winds hundreds of kilometers away. Under proper meteorological conditions, energetic volcanic eruptions may even traverse the world. More recently, the Sangay, which is an active volcano located in the southwest part of Ecuador, has been a topic of attention due to its dynamic activity with a combination of more energetic eruptions with an adequate meteorological conditions caused Guayaquil to be coated by a fine layer of volcanic ash of approximately 1 mm thick among all the events.

MAIN GOAL

This study aims to conduct a spatiotemporal analysis of the long-range transportation of volcanic ashes that originates from the eruption of the Sangay volcano and reached Guayaquil during the months of June 2020; September 2020; and April 2021.

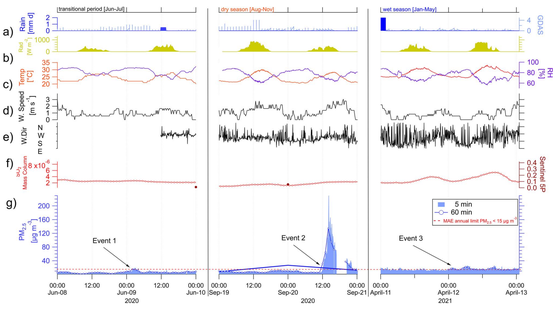
METHODOLOGY

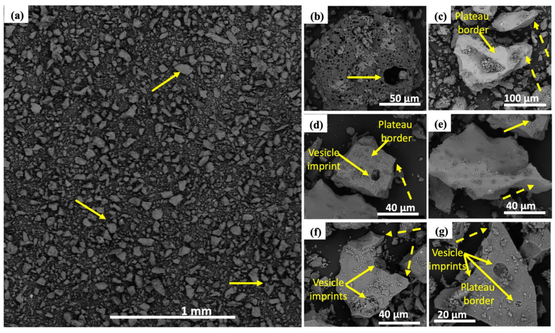
The ***measurement of PM2.5*** suspended particles in the air during volcanic eruptions of the Sangay was carried out by using an air quality monitoring capability of measuring PM2.5 in conjunction with the meteorological Weather Station WS-2000 from Ambient Weather.

The ***time series of the meteorological*** data corresponds to the period from March 2020 to April 2021, when the eruption occurred.

The ***samples of the volcanic ash*** were collected during the different volcanic eruption events (Event 1: June 9, 2020; Event 2: September 20, 2020; Event 3: April 12, 2021). The samples were collected during the morning after each eruption between 08:00 and 08:30 am. To prevent contamination or remobilization of the ashes, masks and gloves were used and samples were handpicked and saved into sample bags.

Scanning electron microscopy (SEM) was applied to obtain insights into the structure, composition, and morphological characteristics of the ash samples collected. Precautions were taken during the sampling and storage of the ash to prevent moisture absorption as fresh volcanic ash can be hygroscopic



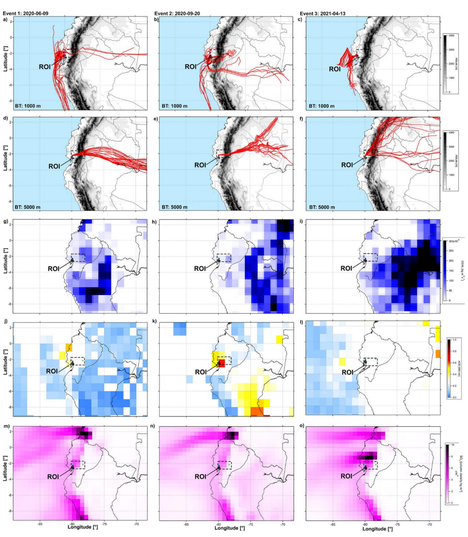


RESULTS

Climatic conditions seemed to be a direct driver of the long-range transport occurring in the three volcanic eruptive events.

Evaluating the individual backward trajectories shows Fig. 3a–d and Fig. 3b–e that during Event 1 and Event 2, there is an influx of air masses from the north and east, such occurrences are not present during Event 3 for 1000 or 5000 m asl (Fig. 3c–f). At 1000 m asl, there is a similar trend between the transitional and the dry seasons in contrast with the wet season (Fig. 3a–c). At 5000 m asl, the east trend path is present during all three events, along with some broader trends towards the northeast during the wet season (Fig. 3d–f and Fig. S1).

This seasonality effect, from the transitional period towards the dry season with the strong presence of winds, may explain the transport of volcanic plumes that occurred during volcanic Events 1 and 2. In parallel, the precipitation rate is almost absent during the transitional (Fig. 3g) and dry seasons (Fig. 3h), but it is stronger during the wet season (Fig. 3i).



CONCLUSIONS

The present study emphasizes the importance of continuous PM2.5 ground measurements in Guayaquil. The adequate use of meteorological, PM2.5, and satellite data helped to monitor aerosols concentrations to quantify the impact of Sangay volcanic plumes on the air quality in the city of Guayaquil and to visualize the dispersion of the volcanic aerosols.

The results of this study provide a analysis of volcanic product and events that provides sensitive information during long-range transport dispersion as in the case of the Sangay volcano.

ACKNOWLEDGEMENTS

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