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Volcanic Ash Monitoring From Satellite Measurements And Coupled Methods : An Overview

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Satellite techniques have now been used for about three decades to detect, track and quantify volcanic ash emission in the atmosphere. Thermal Infrared (8-14µm) sensors are particularly appropriate for day/night characterization of very fine ash (< 10 µm) commonly transported thousands of kilometres away, over timescales typically spanning hours to days. Although challenging, the real-time assessment of ash cloud concentration and altitude remains critical for early warnings and risk mitigation. In this aim, geostationary satellites (e.g., Meteosat) capable of providing up to 1 image every five minutes are very good candidates. They also permit the monitoring of fast evolving processes such as aggregation, dispersion and sedimentation of ash hence allowing a better understanding of ash cloud dynamics in the atmosphere. However, numerous important parameters such as the source mass eruption rate, atmospheric dispersion forecast and total grain size distribution in ground deposits cannot be retrieved easily using satellite measurements solely. Therefore, when available, the combination of additional data and methods will be very helpful. We emphasize in particular the coupling with (i) source modelling from either empirical or theoretical approaches allowing a better assessment of the mass eruption rate, (ii) volcanic ash transport and dispersion modelling from meteorological models (e.g., NAME, MOCAGE) to improve ash concentration forecast and (iii) ash transport and deposition modelling using FALL3D model, for instance, to better constrain the eruption source parameters such as the total grain size distribution which lead to the ash sedimentation rates. Finally, we present the new open access Web-GIS tool of the HOTVOLC system, dedicated to the real-time monitoring of both active lava, ash and SO2 emissions, that could be further used during a volcanic crisis and serve as a starting point for multiple data integration.