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Recent Enhancements of the Volcanic Information System (VIS): An Infrasound-Based Long-Range Volcanic Eruption Notification System

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Volcanic explosive eruptions produce large amounts of low-frequency (<20 Hz) acoustic waves, called infrasound. Notably, infrasound waves experience minimal attenuation in the atmosphere and can propagate over hundreds to thousands of kilometers, being a valuable resource for remote monitoring of volcanic hazards. This is a core reason why the Comprehensive Nuclear-Test-Ban Treaty Organization (CTBTO) has been tasked with installing and operating the International Monitoring System (IMS) infrasound network, with 53 (of 60 planned) infrasound stations continuously recording to detect any nuclear explosion on Earth.

A software prototype for long-range volcanic eruption notification called VIS (Volcanic Information System) was developed within the Atmospheric dynamics Research InfraStructure in Europe (ARISE) project (FP7, H2020), in collaboration with the Toulouse Volcanic Ash Advisory Centre (VAAC). The VIS main goal is to detect volcanic eruptions at regional to global distances (15-250 km; >250 km) with sustained ash-columns and provide early warnings to mitigate the risk that eruptions pose to civil aviation. Additionally, it can reconstruct the chronology of eruptions, and provide volcanic source constraints (acoustic intensity, gas flow, etc.). The system is designed to integrate the IMS and national infrasound stations to gather all available infrasound detections in the area of interest. The detections rely on the Progressive Multi-Channel Correlation (PMCC) method, which separates coherent infrasound waves (detections) from noise. The VIS is based on the Infrasound Parameter (IP) criterion to establish when an eruption is in course, accounting for atmospheric propagation effects, detection persistency, and amplitude. An operational VIS demonstrator will be deployed on servers of the Observatoire de Physique du Globe de Clermont-Ferrand (OPGC, CNRS-INSU and University Clermont Auvergne) to monitor Mt. Etna and Stromboli in real-time using data from the Amiata infrasound array (AMT) operated by the University of

Florence. The data products of the VIS demonstrator will be available through an application programming interface (API) hosted at OPGC, where also an archived catalogue of European volcano eruptions and the real-time data products for AMT will be hosted.

As part of the European Geo-INQUIRE project (HORIZON-INFRA-2021-SERV-01), the VIS will be integrated into the Thematic Core Service Volcano Observation (TCS-VO) of the European Plate Observing System (EPOS). Future developments will include integration into web services such as the HOTVOLC web-GIS interface (OPGC, CNRS-INSU) or the EPOS Data Portal.