



Iceland infrasound network performance and optimization for real-time monitoring

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The efficiency of the infrasound network in Iceland is analysed in terms of providing input to an Early Warning System for volcanic eruptions. We evaluate possible improvements of the actual geometry of the infrasound network with respect to the 33 active volcanoes that we want to monitor. The distance between the infrasound arrays and the volcanoes spans from a minimum of 19 km up to > 200 km.

Efficiency of the network is time dependent because of the seasonal variation of the atmosphere affecting infrasound propagation and the consequent position of the shadow zones. In order to provide a robust and reliable early warning it is important to be able to detect direct waves, that are less affected by seasonal and atmospheric variability than the stratospheric and thermospheric arrivals, and are in addition transmitted faster. Therefore, for monitoring purposes it is convenient to locate infrasound arrays close enough to the volcanoes to be able to rely on acoustic direct arrivals only. From FDTD modeling of the sound propagation in Iceland, considering a standard atmospheric profile, it is evident that direct waves arrive at a maximum distance of 80 km, while stratospheric arrivals occur after 190 km. Shadow zone is confined between 80 and 190 km from the volcano.

The additional requirement for a robust early warning is that a minimum of 2 arrays are detecting the same acoustic signal associated to the eruptive onset. Such constraints are expected to be full-filled with the current geometry of the infrasound network, for nine active volcanoes. We calculate that early warnings for the above volcanoes could be provided within a maximum of 5 minutes from event occurrence.

We propose improvements of the network by implementing a new array in central Iceland and show that network efficiency can be improved significantly, as the number of active volcanoes that will be monitored by 2 arrays within 80 km distance, increases by a factor of two.