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Look-up tables with empirical climatologies for infrasound detection, location, and characterization of long range volcanic eruptions

Energetic volcanic eruptions emit exceptional infrasonic signals (frequency below 20 Hz) to the atmosphere, because eruptions have a punctuated duration and its signals can travel up to thousands of kilometers due to their low frequency nature and atmospheric ducting effects. Because of this, IMS stations can be used to locate and characterize the surface activity of volcanoes. Unfortunately, atmospheric effects (e.g., crosswinds) along the raypaths can change the apparent direction of the incoming signals in the IMS stations, which needs to be addressed in a robust and fast manner to make use of infrasonic data in real time. Empirical climatologies and 3D ray tracing can be used with this purpose to have an a priori value of azimuth deviation to improve the source location (e.g., Matoza et al., 2018). Furthermore, the IMS network can be used to significantly enhance the signal-to-noise ratio (e.g., Matoza et al., 2017). In this work, look-up tables to estimate atmospheric propagation effects have been developed with empirical climatologies. Three test cases of VEI 4 eruptions along the Chile-Argentina Andean Cordillera have been used: Chaitén in 2008, Puyehue-Cordón Caulle in 2011, and Calbuco in 2015. Our results for the source location improvement are showed and analyzed.

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