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Effects of the atmospheric structure and topography on infrasound propagation around Sakurajima

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In volcano-acoustics is commonly believed that infrasound is less modified during propagation than seismic waves, because the atmosphere is more uniform than the ground. Recently, advanced observations and numerical studies have revealed that effects of the atmospheric structures and of the topography are more significant than it was thought. The topographic effect is significant in near-source (less than 10 km) infrasonic observation while the atmospheric structure has a strong effect at the regional scale (>100-1000 kilometers).
We use a dataset of infrasound generated by Vulcanian activity at Sakurajima and recorded by a dense network of well-calibrated infrasound sensors.
We show how the amplitude ratio of individual stations, located at a distance of <60 km from the crater, with the reference station at $\sim$3 km from Sakurajima show remarkable differences between the summer and the winter season. Amplitude ratio can vary 2 times at the same distance but different azimuth due to topography and/or 5 times at the same station within one day by atmospheric changes.
Besides, taking in account the atmospheric structure measured twice a day the amplitude variation increases with increasing of wind speed at high altitude (6-12 km). The wave propagation is numerically investigated by a 2.5D finite difference (FDTD) method. Numerical results indicate that topography and atmospheric variations are the main factors affecting the acoustic wave propagation. Our work provide evidence that a detailed knowledge of the topography and of the meteorological conditions are needed for accurate analysis of the acoustic source, which have a strong impact on the use of infrasound to monitor volcanoes at a medium-range scale (ARISE FP7 project).