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IPLOR performance in detecting infrasound from volcanic eruptions

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Plostina infrasound array (IPLOR) is located in the central part of Romania, in Vrancea region, its current configuration consisting of 6 elements equipped with Chaparral Physics sensors deployed over a 2.5 km aperture. The array detectability observed after processing of more than 6 years of data has shown that IPLOR is more effective in measuring mainly infrasound signals produced by natural and anthropogenic impulsive sources. This can be explained by the sensors' characteristics (frequency response, dynamic range) and the large aperture of array.

Among the types of events observed with IPLOR, an emphasis can be given to the Mt. Etna volcanic eruptions as one of the powerful infrasound source recorded by the array. Located at about 1320 km distance from volcano, the array has proved efficient in observing both large and small eruptions. In case of the most large eruptive episodes occurred lately (April and October 2013, December 2015), long duration infrasonic signals were detected, the initial impulsive signature of the volcanic explosion being followed by a long train of irregular waves with smaller amplitudes and higher frequency, extended over periods ranging from 6 hours to more than three days (in December 2015).

For the purpose of assessing the IPLOR performance in detecting Etna eruptions, the signal interactive analysis was performed using WinPMCC, CEA/DASE version of PMCC software. The infrasound detections obtained were plotted in function of back-azimuth, velocity and frequency, showing that the detectability is dependent both on the diurnal variations of the noise around the array (during the night the human activity diminishes) and on the seasonally dependent stratospheric winds (westward propagation during summer and eastward propagation during winter). In case of the Etna eruptive episodes detected by IPLOR, the back azimuth observed is in good agreement with the expected value (230^o), i.e. an average value of 232 ± 2^o could be resolved. The average apparent sound speed was estimated to be 335 ± 5 m/s. The frequency content of 0.4 to 3.5 Hz was observed in the volcanic infrasound detected with IPLOR.

The detected signals can be very useful for the calibration of IPLOR station performance, as long as the Etna source location is known and the infrasound waves generated by eruptions are propagating more than one thousand kilometers.