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Recent seismicity in central Italy as observed by the Gran Sasso Underground Seismic Array

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Since early May, 2002, the underground Physics Laboratories of Gran Sasso, (central Apennines, Italy) are equipped with a small-aperture seismic array. This array is located in the seismically active region of Central Apennines, near some active faults, 1400 m below the Earth surface, in the central part of an underground tunnel 10.5 km long. In its latest configuration, the array depicts 20 three-components short-period seismometers deployed over an area of 400 x 600 m^2 with average sensor spacing of 90 m. We first performed a detailed analysis of the background noise properties by calculating spectrograms over a 20-day-long time window (feb. 15 to mar. 6, 2005). Then, we studied the spatial correlation of background noise as a function of frequency over daily and nightly time windows. We used the results from spectral and correlation analysis to select the frequency band for multichannel analyses. We developed an automatic signal detection procedure based on the thresholding of the power of the slowness spectra evaluated using the MUSIC algorithm. Application of this procedure to the continous recordings collected during the year 2005 allowed for discriminating about 500 events occurred at epicentral distances ranging up to 200 km and magnitudes between 1 and 4.

Most of these earthquakes ($\sim$270) have magnitudes between 1.5 and 2 and epicentral distances less than 50 km. About 10% of them were not included in the INGV bulletin, thus indicating that UNDERSEIS also provides a significant improvement on the completeness of the catalogue. After the first, rough evaluation of the propagation parameters derived from the automatic procedure, refined multichannel analyses are conducted over the transverse components, thus allowing for robust and precise estimates about the Direction-of-Arrival of plane waves crossing the array. Measurements of propagation azimuth and S-P delay times are then used to obtain reliable epicentral

locations. The discrepancies among our locations and those from the INGV's National Seismic Network rarely exceed 10 km over the whole range of epicentral distances, thus confirming the resolving capabilities of our instrument toward real-time detection and analysis of small- to moderate-size seismicity.