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Enhancing routine seismicity monitoring by using a small aperture seismic array, preliminary results from the Pylos array (Western Peloponnese, Greece)

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In the frame of the RADONS project of the National Observatory of Athens (NOA), a small aperture seismic array has been deployed aiming to assist a multi-parameter earthquake forecasting lab in the south-western Peloponnese. The study area was the broader region of the very seismically active western segment of the Hellenic Subduction Zone. It is worth noting that in the study area, hypocentral solutions routinely provided by NOA, especially those offshore, are poor because of the low station density and poor event detectability capabilities, low azimuthal coverage (<180°), and a velocity structure hardly resembled by a simple 1D velocity model. For the first time will be presented the results from the experimental stage of the Pylos array (April-October 2016), consisting of 5 seismic stations, deployed to test its benefits in terms of seismicity monitoring capabilities and the suitability of the site before the final 9 stations design. The 5 stations array, was deployed within the Kynigos solar farm close to Pylos (western Peloponnese), had an aperture of about 750 m and consisted of 4 stations (Trimble REF TEK 130S-01 broadband seismometers) disposed in half-circle around a central station (Guralp CMG-40T intermediate period seismometer). The average inter-station distance was about 360 m. Earthquakes recorded at the seismic array were manually detected and picked. Only earthquakes which had clear P and S onsets at the central station of the array and at least at an additional station of the Hellenic Unified Seismic Network (HUSN), and that showed clear backazimuth and slowness for the first arrival were located. F-k analysis and beamforming were performed to calculate P and S backazimuth and slowness values. Earthquake locations were obtained by using HYPOSAT, an algorithm which allows to use array parameters (backazimuth and slowness) in combination with P and S phase onsets at additional stations. A new 1D velocity model, obtained by combining results from previous active and passive seismic studies was built and used for earthquake locations. The use of the seismic array allowed to lower the offshore magnitude of completeness from Ml values of about 2.3 (in the case of routine locations) to Ml values of about 1.5. Only the 30% of the events located by using the seismic array were also present in the revisited NOA catalogue. Moreover it helped to better constrain the hypocentral solutions of the offshore seismicity included in the revisited NOA catalogue. Clusters of earthquakes and seismogenic structures (e.g., interplate seismogenic zone) otherwise not visible with the routine locations were detected. The first months of data have provided promising results clearly showing the benefit derived by the use of a seismic array in the monitoring of local seismicity especially in the outer part of the Hellenic Sedimentary Arc.
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