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SNES - Seismic Network Evaluation through Simulation: an application to the Italian RSNC-INGV

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In this work we present a new method to evaluate the location performance of a seismic network through earthquakes simulation (SNES - Seismic Networks Evaluation through Simulation).
To be applied, the SNES method require: P and S velocity models, seismic attenuation law, seismic stations positions and their experimental noise spectra and, finally, an empirical law that link the variance of the residual times of a station to the hypocenter position.
This method allow to map the confidence interval estimates of the hypocentral parameters as function of magnitude, focus depth and confidence level.
The simulation was carried out assuming that the epicentres of synthetic earthquakes are located in the knots of a square grid which was covering the investigated area. For each synthetic earthquake, the seismic spectrum was calculated in every station to determine the local Signal to Noise Ratio (SNR): the set of active stations in the location procedure and the relative azimuthal gap was determined by a threshold value of this parameter. Finally, the covariance matrix of synthetic data and the partial derivatives of the model were determined and used to estimate the covariance matrix of the hypocentral parameters.
This method was applied to the Italian RSNC-INGV to evaluate its location performance, with a 95% confidence level. This simulation was carried out for small magnitude earthquakes (1.5<ML<3, H=10km), both using only P arrival times and P and S arrival times.
This simulation allowed to highlight some zones of the Italian peninsula and its surrounding seas that need an improvement of the seismic network. We show how the Ocean Bottom Seismometers can play an important role in this network improvement.