EGU23-1678, updated on 23 Mar 2023
https://doi.org/10.5194/egusphere-egu23-1678
EGU General Assembly 2023
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A synthetic ambient-noise data set fortime-lapsed monitoring

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Synthetic simulation of seismic wave propagation is a fundamental way to evaluate the accuracy and performance of signal processing methods developed for application to real seismic datasets. Various research papers have introduced state-of-the-art synthetic active and passive seismic datasets to implement this critical step. However, a versatile seismic data set for ambient noise is still missing in the literature. In this study, we conducted synthetic simulations by leveraging the noise simulation modules of SPECFEM3D Cartesian open-source codes. The simulation is carried out for the geometries of station pairs of the YB Cavola Broadband Dense Array temporary network installed in 2004 through the village of Cavola, northern Apennine, Italy. This is a dense array (8m separation one way and
10m the other way) installed on an active landslide through the village of Cavola, northern Apennines, Italy. By considering a fixed crustal velocity model reported for this region, a noise correlation seismogram is computed for each station pair by implementing three processing steps: 1) simulation for generating wavefields, 2) simulation for ensemble forward wavefields, and 3) simulation for ensemble adjoint wavefields and sensitivity kernels. The generated cross-correlation seismograms are post-processed, detrended, and decimated by a factor of 2 to obtain a dataset with a sampling rate of 0.01sec. Then the traces are rotated to the transverse-radial-vertical coordinate system making 3-component data for each station pair. To make the simulation more realistic, the data is contaminated by Gaussian noise (bandpass-filtered in the range of [0.02, 100] Hz) to give a Signal to Noise Ratio (SNR) of 10. The generated dataset provides one epoch of a synthetic time-lapsed ambient noise dataset as a reference for evaluating time-lapsed processing algorithms. This research contributes to the ALLAB project.

The authors would like to thank the support of the Instituto de Telecomunicaçõe. This work is funded by FCT/MCTES through national funds.