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8. Seismic and Remote Sensing Based Preliminary Results in the ET Region (Belgium)

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The variations in ambient noise levels, subsurface elastic properties and surface deformation can affect the performance of Einstein Telescope (ET) in various ways. Therefore, the present study aims at providing an overview of integrated geophysical and remote sensing approaches in the Belgian side of prospective ET installation region, an advanced and super sensitive Gravitational-wave observatory. The study includes: i) assessing levels of ambient noise from the continuous data recorded at the borders and to quantify local seismicity, ii) seismic temporary arrays and HV measurements to retrieve the subsurface elastic properties and iii) remote sensing to detect the ground surface displacements and environmental changes (in perspectives).
Our continuous seismic data acquisition campaigns started in February 2020 to the present. Seven broadband velocimeters CMG-6TDs were installed in private properties (cellars) along the BE-NL-DE borders. Similar sensors were used for the temporary survey including passive seismic data at arrays of variable apertures and single station HV measurements. The remote sensing analyses consist in processing Sentinel-1 images with Synthetic Aperture Radar Interferometry (InSAR) techniques validated by corner reflectors and GNSS measurements. A Drone will also enable the creation of surface models of target areas along fault lines. The InSAR processing will include the use of the geohazard platform and multi-temporal small baselines (MSBAS) time series algorithms.
The preprocessing of continuous data, includes removing instrumental response, demeaning, detrending and saving data in miniSEED files as per SEED standards. We calculated the displacement RMS amplitude at different frequency ranges (0.10-1.00, 1.00-20.00, 0.01-100.00) compared them with the people's mobility using change-point analysis (PCA) which found well correlated. Additionally, the time-lapse HVSR curves were also calculated at the semi-permanent array to see the possible changes in frequency and amplitude of the peak as a function of different socio-climatological factors. From the array measurements, 1D shear wave velocity profiles were retrieved at different sites from the inversion of surface wave dispersion properties. This study, on completion will help in better understanding of the sources of noise, subsurface elastic structures and ground surface displacements in the prospective site for installation of ET.

Keywords: Corner reflectors; ground surface displacements; HV; RMS amplitude; shear wave velocity

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