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Seismic ambient noise modeling for Lausitz ET candidate site

Understanding the ambient seismic noise field and its attenuation with depth is an important consideration for the decision to build the Einstein Telescope at a proposed site. Here, we perform 2D and 3D ambient noise simulations for the Lausitz region by solving the seismic wave equation using Spectral Element Method (SEM), a high-fidelity numerical technique capable of handling complex geometries and subsurface heterogeneities. Initial simulations incorporate realistic topography, a two-layer velocity model with strong velocity contrast using velocity information from an active seismic campaign, and by randomly distributed seismic sources mimicking the observed background noise field. We assess their individual and combined influence on the simulated ambient seismic noise fields. Firstly, we use 2.5Hz Ricker wavelets to investigate scattering effects caused by topography on observations at surface or buried. While topography induces slight scattering, the presence of a low-velocity surface layer leads to significant differences in amplitude and waveform shape between surface and subsurface recordings. To further explore the ambient noise field, we calculate a Green's function library using approximate broadband sources and convolve them with different noise sources based on randomly perturbed phase shift. This modular approach enables flexible testing of source configurations and frequency content in a computationally efficient strategy. Preliminary results highlight the importance of both recording depth and noise source distribution in shaping the ambient noise field. These insights are directly applicable to optimizing station deployment and understanding wave propagation in loose sedimentary structures. Future work will extend this framework to a more realistic reflector interface from borehole mapping and seismic reflection studies, realistic source distributions based on local noise sources (e.g. towns, streets, etc.) and detailed comparisons with observed data (at the surface and depth).

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