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Ambient noise Scholte-wave tomography of the Hawaiian magmatic plume

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Results of 3D tomographic reconstruction of the Hawaiian magmatic plume are presented. The experimental data obtained in 2005-2007 by an ocean bottom network of broadband seismic stations in the framework of the PLUME experiment on Hawaiian Islands are considered for the reconstruction. In contrast to the studies based on the earthquake tomography, the ambient noise surface-waves tomography approach is used. The reconstruction procedure includes three following stages: 1) Determination of surface waves travel times between all pairs of receivers by analyzing the cross-correlation function of ambient noise, recorded during one year; 2) Reconstruction of the velocity structure in the horizontal planes for individual frequencies (corresponding to various depths) based on the regularized linear inverse problem solution with iteration procedures; 3) Inversion of the dispersion curves obtained for each node of the horizontal grid into a vertical layered medium and combination of the reconstruction results to the final 3D-model.

The possibility of using ambient seismic noise, formed at the ocean floor by surface waves of Scholte type, to study the structure of the solid medium by the passive methods is demonstrated. It has been shown that it is possible to significantly reduce the necessary time of data acquisition during field experiments in comparison with studies based on the earthquake tomography. The novel approach to find the solution of the inverse problem is regarded which incorporates the iteration procedure to improve the reconstruction results and imposes additional smoothness conditions on the reconstructed functions both in the vertical and horizontal planes. Comparative analysis of results with respect to previous studies demonstrates robustness of the proposed approach.

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