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Shallow Structure of Taiwan using Ambient Noise Tomography with Empirical Topography Correction

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One unique advantage of noise cross-correlation technique is that it provides robust short period surface waves which are very sensitive to the shallow crust and are usually inaccessible from seismic records of nature earthquakes. We apply this technique to three component continuous data recorded at 80 short period stations in Taiwan and derive the empirical Green's functions (EGF) of both Love and Rayleigh waves. We implement a de-noise technique, a time-frequency stacking algorithm based on discrete orthonormal S transform, to improve the data quality of the noise-derived EGFs. The effective energy of the EGFs distributes within a narrow period range from about 2 to 6 seconds. To get around the serious cycle-skipping ambiguity at shorter periods, we propose a "progressing measuring approach" for the phase velocity measurement. Prior the construction of 2D phase velocity maps and 3D shallow structure of curst, we investigate how the measured phase velocities are influenced by the topography, which is a non-negligible factor for short period surface waves particular in Taiwan where high mountain ranges run thought most parts of the island. This is done by comparing the synthetics computed by the spectra element method in 3D models with and without topography. After the empirical corrections for topography, we derive the 2D phase velocity maps for both Rayleigh and Love waves using a wavelet-based multi-scale inversion technique. Finally, the 3D VP and VS model is assembled by inverting the best-fitting 1D models using the dispersion information at each pixel. We discuss the effects of topography on the surface waves and present the resulting 3D VP and VS models.