Geophysical Research Abstracts
Vol. 14, EGU2012-9141, 2012
EGU General Assembly 2012

On the effect of topography on short-period ambient noise tomography

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Due to the increasing popularity of using empirical Green's functions obtained from ambient seismic noise, more and more regional tomographical studies based on short-periods surface waves are published. Results could potentially be biased in mountainous regions where topography is not small compared to the wavelength and penetration depth of the considered waves. We investigate the effect of topography on the propagation of short-period (3-10 seconds) Rayleigh waves empirically by means of synthetic data using a spectral element code and a 3-D model with real topography. We show that topography along a profile through the studied area can result in an underestimation of phase velocities of up to about 0.7% at the shortest investigated period (3 seconds). Contrary to the expectation that this bias results from the increased surface distance along topography, we find that this error can be estimated by local topographic contrasts in the vicinity of the receiver alone. We discuss and generalize our results by considering topographic profiles through other mountain ranges and find that southern Norway is a good proxy to assess the topography effect. Nevertheless, topographic bias on phase velocity measurements is in general not large enough to produce a significant effect on ambient noise tomographies.