

EGU2020-7179

<https://doi.org/10.5194/egusphere-egu2020-7179>

EGU General Assembly 2020

© Author(s) 2020. This work is distributed under the Creative Commons Attribution 4.0 License.



Reconciling phase velocities from ambient noise and earthquake-generated surface waves by accounting for arrival-angle effects

Giovanni Diaferia¹, Fabrizio Magrini¹, Lapo Boschi^{2,3,4}, and Fabio Cammarano¹

¹Dipartimento di Scienze, University of Roma TRE, Rome, Italy

²Dipartimento di Geoscienze, Università degli Studi di Padova, Italy

³Sorbonne Université, CNRS, INSU, Institut des Sciences de la Terre de Paris, IStEP UMR 7193, F-75005 Paris, France

⁴Istituto Nazionale di Geofisica e Vulcanologia, Sezione di Bologna, Bologna, Italy

The shear-wave velocities structure at depth can be unraveled from ambient noise (AN) as well as from earthquake-generated (EQ) surface waves. While the first approach mostly provides information at crustal scale, earthquake-based surface waves sense deeper structures due to their lower frequency content. However, for periods between 20 and 40 s, where the two methods often overlap, a number of studies have shown that phase velocities from EQ surface waves are systematically higher (~1%) than those retrieved from AN. The reason for such systematic bias is still debated; finite-frequency effects, overtone contamination, and off-path propagation of surface waves due to structural inhomogeneities have all been invoked as possible explanations of the discrepancy in question.

We explore the validity of the latter hypothesis, by correcting Rayleigh-wave phase velocities for the effect of off-path arrivals at two stations. The deviation from the theoretical path is estimated by evaluating the resemblance of the vertical with the $\pi/2$ -shifted radial component of the recorded seismograms. We developed a two-station algorithm implementing such a correction and tested it on a dataset of seismograms collected from more than 350 stations recording 443 earthquake events from 2005 to 2019. We demonstrate that by compensating for the arrival-angle effects, the discrepancy between the two methods is significantly reduced. This result suggests that the off-path propagation between epicenters and receivers due to lateral inhomogeneity in the Earth's structure explains most of the discrepancy between AN and EQ phase velocities previously reported in the literature. Such improvement in determining Rayleigh phase velocities will lead to more reliable seismic tomographies and enhanced interpretations of seismic anomalies in terms of thermo-chemical characteristics.