Geophysical Research Abstracts
Vol. 21, EGU2019-**PREVIEW**, 2019
EGU General Assembly 2019

Passive seismic investigations of sedimentary infill validated by borehole data and active seismics

Irene Bianchi (1), Nicola Piana Agostinetti (2), Kurt Decker (2), and Nicola Levi (2)

(1) Department of Meteorology and Geophysics, University of Vienna, Vienna, Austria (irene.bianchi@univie.ac.at), (2) Department of Geodynamics and Sedimentology, University of Vienna, Vienna, Austria

A detailed knowledge of the velocity of seismic S- waves of the rocks filling densely populated sedimentary basins is a fundamental information on which regional seismic hazard studies should be based. Here we develop, test and verify a new methodology based on passive seismic measurements for providing un-biased estimates of seismic S-waves velocity (Vs) within shallow sedimentary layers (<1-2 km) that fill regional-scale basins.

Teleseismic Receiver Functions (RFs) are a proxy for the Vs distribution beneath a single seismic station. High-frequency (up to 8Hz) RFs contain a full-spectrum of information about the shallowest layers of the Earth's crust, in terms of both their S-wave velocity and thickness. However, RFs computed for seismic stations located across sedimentary basin show peculiar features, like, e.g., a very-low amplitude direct P-wave peak followed by pronounced multiples. Such features, which are diagnostic of very-low S-wave velocity at near-surface depths, prevent the correct interpretation of RF data if standard tools are applied.

To solve for the Vs distribution in the shallow sedimentary layers, we invert RF data adopting a modification of a standard trans-dimensional Markov chain Monte Carlo algorithm (trans-D McMC). The standard trans-D McMC allows for varying both elastic properties, depth-distribution and number of layers of a 1D model, which are considered as unknown and are defined by the data themselves. We mixed a Metropolis sampler and a Gibbs sampler for obtaining un-biased sampling of the properties in the shallowest layer. In fact, we combine the advantages of the Metropolis sampler in creating and deleting interfaces (trans-D behavior), and the advantages of the Gibbs sampler given by the possibility of comparing a number of candidate models at each iteration (no acceptance/rejection step needed). The combination of the two samplers gives an unbiased convergence to the posterior of the low S-wave velocity distribution in the shallow sedimentary layers.

Teleseismic records collected by 3- component seismic stations of permanent and temporary networks, deployed on different sedimentary basins, are gathered for creating real-cases of RF data-sets. Comparing the outcomes of the inversion with previous knowledge of the structure and velocity of the basins, geology and active seismic studies, validates the success of the technique for increasing the number and quality of inferences on the Vs within sedimentary basins and for improving the 3D reconstructions of such basins.