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Ambient Noise Tomography across the Oman Ophiolite

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The Oman ophiolite is one of the best preserved and studied ophiolites, where oceanic lithosphere was obducted on top of a continent. It covers an area of about 700 x 140 km with a thickness of up to 12 km. In this work, we use ambient noise surface wave tomography to image the 3D geometry of the ophiolite which is almost entirely unknown. This will lead to a better understanding about the origin of the Oman ophiolite, the obduction process which occurred around 94-97 million years ago, and the internal properties of the Oman ophiolite itself. Therefore, we operated a network of 40 temporary, complemented by 18 permanent seismic stations for passive seismic registration from October 2013 to February 2016. The analysis of ambient seismic noise allows us to calculate the Green's function for vertical, radial and transverse components by cross correlating the data of two different stations. This has been done for every possible combination of stations (#2100). Afterwards we estimate phase velocities for Rayleigh- and Love waves by taking the observed phases from our Green's functions and fitting them to a Bessel function which depends on frequency and phase velocity. With this approach we can calculate phase velocities out of our ambient noise cross correlations in a period range of 2 to 40 s. Automation of the measurement also allows for determination of multiple dispersion curves per path, for example by separately measuring causal and acausal components of the Green's function, or by stacking of differently calculated cross-correlation functions (e.g. daily, hourly and monthly, annual stacks). This yields additional constraints on uncertainties of the final dispersion curves. Our phase velocity maps show distinct discrepancies at different periods due to the existence of the ophiolite. The region across the Al-Hajar Mountains, which consist mostly of obducted oceanic lithosphere and metamorphic autochtonous continental sediments show higher phase velocities at lowest periods than further south where young, mostly unconsolidated sediments prevail at shallow depths. At longer periods we can observe an increase in velocity in the eastern part of Oman. This might be explained by a shallower Moho in this area. inversion of local dispersion curves is then performed using a novel implementation of a particle-swarm optimization approach and will be discussed for selected points in our study region.