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True propagation paths of surface waves from regional and teleseismic earthquakes across AlpArray Austria

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We utilize array beamforming techniques to investigate deterministic surface waves from regional and teleseismic earthquakes. Because the signal is well recognized and the fundamental mode for both Love and Rayleigh waves is separated before the beamforming, instead of searching for energy of all possible signals, we identify the frequency dependence of surface wave phase velocity and the true backazimuths of propagation. Using the dense AlpArray seismic broadband network distributed in the greater Alpine region across Europe with interstation distances around 40 km, we consider each station as a centre of an array of neighboring 5 to 6 stations. This allows us to calculate the local phase velocity dispersion curves for individual regions with diameter of approximately 80 – 100 km. By the beamforming, phase velocities are corrected for the true propagation backazimuth, which is slightly frequency dependent for each event. We invert the dispersion curves for S and P wave velocity distribution with depth. Measuring the phase velocity from different events distributed around the world, azimuthal dependence of the phase velocity is estimated and thus anisotropy constrained for particular depths. Beamforming of the signals in the time window sliding along the coda after the fundamental mode allows us to detect deterministic late surface-wave signals coming from certain directions dissimilar from the direct fundamental mode backazimuths for some of the events – these can be considered as surface wave reflections from lateral heterogeneities and vertical boundaries.