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Ellipticity of Rayleigh waves from polarization analysis of seismic noise

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We develop a new method for measuring ellipticity of Rayleigh waves from ambient noise records by degree-of-polarization (DOP) analysis. The new method, named DOP-E, shows a good capability to retrieve accurate ellipticity curves separated from incoherent noise. In order to validate the method we perform a synthetic test simulating noise in a 1D earth model. We also perform measurements on real data from Antarctica and Northern Italy. Observed curves show a good fit with measurements from earthquake records and with theoretical ellipticity curves. The inversion of real data measurements for Vs structure shows a good agreement with previous models. In particular the shear-wave structure beneath Concordia station in Antarctica shows no evidence of a significant layer of liquid water at the base of the ice. The new method can be used to measure ellipticity at high frequency and therefore it will allow the imaging of near-surface structure and possibly of temporal changes in subsurface properties. It promises to be useful to study near-surface processes in a wide range of geological settings such as volcanoes, fault zones and glaciers.