Surface wave imaging of the Juan de Fuca plate and Cascadia subduction zone
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The Juan de Fuca plate, which over the past 4 years has been the location of the onshore-offshore Cascadia Initiative array, presents a prime location to image the evolution of mantle structure of an entire plate from the Juan de Fuca ridge through the Cascadia subduction zone. The Cascadia subduction zone is capable of up to a M9 megathrust earthquake; seismic imaging provides a major constraint on the structure and hydration state of the plate. Here we use phase and amplitude measurements of Rayleigh waves from 84 earthquakes recorded over the first three years of the deployment to image the structure of the Juan de Fuca plate. Phase velocity maps (shown below) are dominated by the transition from high-velocity oceanic to low-velocity continental lithosphere, particularly at shorter periods, across the deformation front. We also observe evidence of the fast subducting slab, and the slow volcanic arc and ridge. This is despite the different noise characteristics of the onshore sites and the ocean bottom seismometers (OBS). Among the OBS sites there are additional differences between those deployed in deep water on the plate and those in shallow water on the continental shelf. Noise properties of sites vary significantly across the array and, in some cases, compliance and tilt corrections significantly improve data quality.