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Modelling of wave propagation along the plate contact of the Hellenic subduction zone

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Measured seismograms of intermediate depth events in the southern Aegean show very different waveforms depending on whether the stations are located in the forearc (Crete, Karpathos, Rhodes), in the volcanic arc (Santorini, Nisyros) or in the backarc (Cyclades). In the fore arc, seismic wavefields typically exhibit high complexity and large amplitudes. The waves propagate along the Hellenic subducted slab and thus experience strong variations of material properties. Martin \& Rietbrock (2006) already showed for the Chile-Peru subduction zone, that these waves can be interpreted as guided waves excited by intermediate depth events located inside a low-velocity layer (LVL) on top of the slab that usually coincides with the subducted oceanic crust. For bended slabs or for slabs with slow velocities in the mantle wedge close to the plate contact a decoupling of guided wave energy from the LVL can happen. Thus, guided waves may be recorded at stations not only close to the waveguide but also in the forearc (Martin et al., 2003; Martin \& Rietbrock, 2006). This effect is also observed for stations on Crete as well as on Karpathos and Rhodes.

We modelled the propagation of seismic waves in such a subduction environment using a 2-D Chebyshev pseudospectral method (Ceranna, 2002). The aim was to investigate the influence of structural properties of the plate contact on the propagation of seismic waves. The 2D-profile we considered runs perpendicular to the strike of the subduction. Besides geometrical effects and the influence of the location of the source, we also focus on how strongly the wavefield is influenced by a deep subduction channel above the subducted slab with velocities and density intermediate between those of the subducted oceanic crust and the overlying Aegean mantle.

If the seismic source is located inside the LVL, dispersive channel waves are generated that propagate along the LVL with high amplitudes compared to body waves. At a bend in the LVL the guided waves are decoupled from the waveguide and radiated into the overlying mantle wedge. Thus, guided waves can be recorded not only at stations close to upper end of the subducted crust but also at stations further north along the forearc.

If a deep subduction channel with intermediate velocities and density is inserted above the LVL a stronger focussing of wave energy radiated into the overlying lithosphere at the slab bend is observed. Thus, records at the forearc exhibit stronger influence from guided waves than records observed close to the upper end of the subducted oceanic crust. If a realistic crustal structure is added at the top of the model, the wavefield is dominated by waves reverberating in the crust. Nevertheless guided waves are still clearly discernible because of their large amplitudes.