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Multiscale and multiangle analysis of receiver functions: application to the slab of the Hellenic subduction zone

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A major issue at subduction zones is the shape and the nature of the slab and its dehydration. Because the oceanic crust at its top represents a low velocity zone between the arc mantle and the slab mantle, it can be a characteristic marker in receiver functions (RF) studies. Indeed the negative and positive pulses corresponding to the P to S conversions at the top and at the base of the oceanic crust are now clearly observed on RF processed from seismograms recently recorded in Greece (NOA network and EU Thales was right project).

We show from these data that waveforms and amplitudes of converted waves at the top of the slab depend on the signal frequency. In order to study this, synthetic RF are computed for several periods of signal and models of the top of the slab in order to be compared to observations. This permits a better interpretation of data and gives an opportunity to constrain the thickness and the nature of heterogeneity by analysing different parts of the spectrum. This original multiscale analysis for P to S conversion in transmission is applied in the case of the Hellenic subduction zone, where it leads us to propose models for the top of the slab different from a simple oceanic crust.

For dipping interfaces like the slab, arrival times, polarities and amplitudes of converted waves are also dependent on azimuth and incidence of incoming waves under the receiver as shown by computed synthetic RF. Therefore we can use earthquakes from different backazimuths and distances to constrain the geometry of the slab. This multiangle approach leads us to propose a depth, a dip direction and a dip value for

the slab of the Hellenic subduction zone, different from some previous studies.