How resolving are teleseismic forward and backscattered P to S converted waves?

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The Receiver Function (RF) technique, that aims to isolate P to S teleseismic converted waves, is largely used to image seismic discontinuities at depth. In particular, in subduction zones, the subducting crust has often be identified on RF as a Low Velocity Layer (LVL) embedded between the mantle of the overriding plate and the mantle of the subducting lithosphere. In several subduction zones, a high Vp/Vs ratio inside this LVL has been estimated from the arrival times of the primary and backscattered P to S converted waves at the top and at the base of the LVL. However seismograms are filtered to enhance the signal over noise ratio and this processing step can dramatically reduce the resolution of the converted waves. In order to check if the signal periods associated to common filters could lead to an overestimation of the Vp/Vs ratio, a wavelet response in conversion for primary and backscattered converted waves is developed for a LVL typical of an oceanic crust. This multiscale analysis allows to illustrate that the LVL characteristics can be misinterpreted for the common frequency range due to interferences between the converted waves at the top and at the base of the LVL. For a dominant period of about 3s, the Vp/Vs of a typical oceanic crust can be largely overestimated (about Vp/Vs=2.8 instead of Vp/Vs=1.8) and its thickness underestimated (about 5 km instead of 7 km). The characteristics of a typical oceanic crust can be reliably retrieved only in the non interaction domain that corresponds to a constant spacing between the converted waves at the top and at the base of the LVL. This non-interaction domain corresponds to dominant signal period smaller than 1 s for the primary converted waves and 3 s for the backscattered. As the Vp/Vs is generally estimated based on the interpretation of both primary and backscattered waves, the period of 1 s is required for a reliable interpretation. The multiscale approach is applied to a real data example of teleseismic events recorded at a 3-component seismometer in order to reliably constrain the Vp/Vs ratio and the thickness of the oceanic crust at the top of the Hellenic subduction.