High resolution imaging and relocation of Lebanon's Seismicity

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Geophysical studies intend to image the subsurface structures. An earthquake recording provides information about the source, the path through the Earth, and the structure beneath the receiver. In this project, Lebanon's existing seismological database will be used to produce high-resolution images of the subsurface structure and accurately localize the seismic activity in this region. To achieve these objectives the receiver functions method (RF) and the probabilistic localization of earthquakes will be employed. Ultimately, an investigation will be conducted to assess the effect of Lebanon's seismic activity on the structural damage of Beirut buildings.

RF is a powerful technique for imaging the discontinuities in the crust and the upper mantle, by analyzing the earth's structure response beneath the seismic station, to incident teleseismic waves.

When a seismic wave strikes an interface between two elastic media of different propagation velocities, a P to S converted wave will be generated. The RF technique aims to isolate these converted waves at discontinuities in the earth's crust or upper mantle. The RF method consists of three main steps. First, rotation of the three orthogonal components of the seismogram (typically oriented North-South, East-West, and vertically) by an angle equal to the backazimuth of the incident ray, in order to transform them into radial, transverse, and vertical components. Actually, the incidence angle of P waves at the surface is not completely vertical, so the ZRT system can be rotated in the direction of the incoming P-wave (L) and its perpendicular (Q) in the radial-vertical plane. Second, application of a bandpass filter to improve the signal-to-noise ratio. Finally, to obtain the RF, it is necessary to perform a deconvolution. In this first part of my PhD, I compared different techniques of deconvolution.

The radial RF calculated for BHL station (Fig.1a) in Lebanon exhibits a consistent positive amplitude at t ≈ 4.5s, implying an increase in velocity with depth. This feature corresponds to the P to S converted phase at the Moho discontinuity. The presence of energy on the transverse component for BHL station (Fig.1b), and the flipping from negative to positive polarity of the P-wave energy

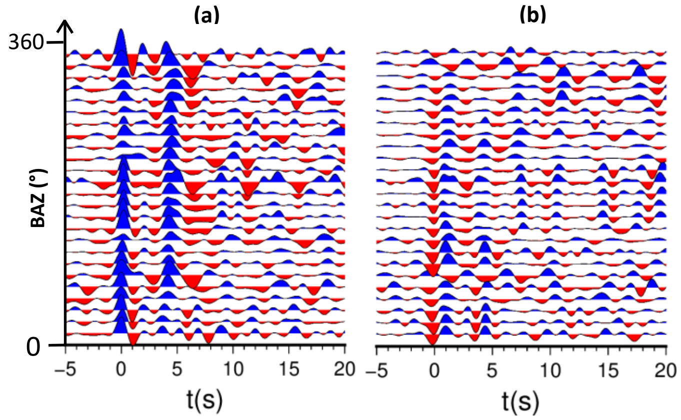

Figure 1: (a) Radial RF (b) Transverse RF for BHL station

at t=0s for certain back azimuths, are indications of a dipping Moho. The value of the dip angle will be characterized in a future step.

I will also apply the *H-k* stacking technique (Zhu and Kanamori 2000) to constrain the thickness and Vp/Vs ratio of the crust. I will compare the result of this common approach to a grid search aiming to minimize observed and analytical P to S arrival times. This approach will also provide the associated uncertainties.

Bibliographic references

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