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EMERGENCE OF DIRECT P-PHASE FROM SEISMIC AMBIENT NOISE IN DEHDASHT AREA

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The theoretical studies have revealed that cross correlation of seismic ambient noises can estimate the Green's functions between a pair of stations (e.g. Snieder, 2004; Wapenaar, 2004). This idea encourages the researchers to do study using seismic ambient noise to determine the velocity structure.

Several studies extracted the surface waves from seismic ambient noise and presented the corresponding surface wave tomography (e.g. Sabra et al., 2005; Bensen et al., 2007). In contrast, extraction of the body waves from the seismic ambient noise is still a critical issue, because the amplitude of the surface waves is dominant compared to the amplitude of body waves. However, some studies can retrieve the direct P wave (e.g. Roux, et al., 2005; Nakata et al., 2015, 2016) and reflected P wave (e.g. Draganov et al., 2009) from seismic ambient noises in local scale.

In this study, we attempt to extract the direct P wave from seismic ambient noise data. We use the continues recorded ambient noises by an array network, including 120 broadband 3-component stations spaced about 2 km, installed in Dehdasht area, Iran. The data is recorded with a sample rate of 250 sps, however, it is decimated to 25 sps.

To retrieve the P wave, we firstly separate the records to windows of 10 minutes (with no overlap) and calculate the Green's function for all pair of stations via cross coherence formula of Nakata et al. (2015) for vertical (Z), radial (R) and transverse (T) components. Secondly, we linearly stack the corresponding cross coherency of the windows. To better extraction of the P wave, the suggested algorithm of Takagi et al. (2014) is used. This method requires full correlation tensor and is based on the polarization of the recorded noises, implying that the summation of ZR and RZ correlations eliminate the Rayleigh wave and retain the P wave. The complete expected phases from different types of correlations are listed in Table 1 (Takagi et al., 2014).

Table 1. The theoretical relationship between types of phases that can be extracted from different forms of correlations (Takagi et al., 2014).

Correlation vs phase	P	S_V	S_H	Rayleigh	Love
ZZ	✓	✓	×	✓	×
(ZR+RZ)/2	✓	✓	×	×	×
(ZR-RZ)/2	×	✓	×	✓	×
TT	×	×	✓	×	✓

(✓: Extractable, ×: Not existed)

Finally, for better illustration of the retrieved phases, results are bin-stacked with bin space of 250 m. The ZZ and summation of ZR and RZ are shown in Figure 1. In this figure, the amplitude of traces is normalized in order to eliminate the impact of geometrical spreading and also for better illustration of the retrieved phases. In addition, the frequencywavenumber (F-K) analysis of the ZZ and ZR+RZ are provided as well (Figure 2). Investigation of F-K results and Figure 1 show that a clear P wave can be retrieved in the velocity of around 5 km/s.

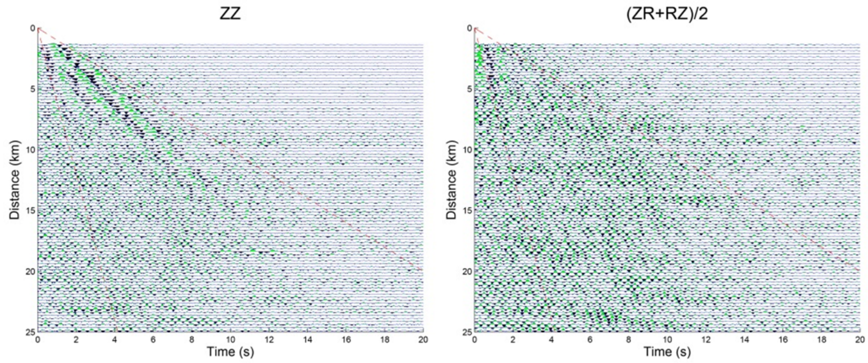

Figure 1. The ZZ (left) and summation of ZR and RZ (right) that bin-stacked for 4 days of all virtual sources-all virtual stations. The dashed red lines correspond to velocity of 1 and 6 km/s.

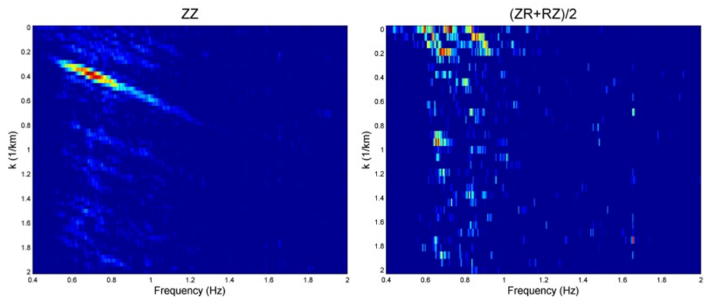

Figure 2. Frequency-wave number (F-K) analyses for ZZ and (ZR+RZ)/2.

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