[EJ] Evening Poster | S (Solid Earth Sciences) | S-SS Seismology

## [S-SS10]Seismic wave propagation: Theory and Application

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Thu. May 24, 2018 5:15 PM - 6:30 PM Poster Hall (International Exhibition Hall7, Makuhari Messe)

Seismic wave propagation provides rich information of earth's heterogeneities and the excitation sources. In order to extract the information, integrated studies are needed among mathematical/numerical studies based on the wave theory, miniature physical experiments using rock specimens, and practical data analyses.
Furthermore, it is greatly beneficial to conduct comparative studies of various kinds of waves, such as elastic, acoustic, traveling ionospheric disturbances, and oceanic waves. This session widely invites presentations about the theories and applications related to seismic and other geophysical waves.

# [SSS10-P15]Radiation structure of hypocenter vibration and azimuth characteristics of the main vibration

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Keywords:Hypocenter vibration, Radiation pattern, Singular value decomposition method

We analyze radiation pattern to the azimuth of hypocenter vibration by three different methods and show that they all have unique patterns. The methods are: 1) Head pressure pattern, 2) Spectrum peak frequency pattern, and 3) Primary frequency pattern. The pressure of the head of P waves received at observation stations are obtained, and they are expressed in the azimuth from a hypocenter. Since this method uses the head part of the seismic wave obtained at observation stations, it is easily affected by the propagation environment from a hypocenter to an observation station and the observation station environment. In order to solve we obtain the wave that replaced an observed wave to a seismic source position using a time reversal method, that is, the hypocenter vibration itself. Frequency spectrum are obtained by Fourier transformation of the obtained hypocenter vibration. The frequency at which the spectral amplitude is maximized is called a spectral peak frequency, and its azimuth pattern are obtained. The above two methods represent only the characteristic part of seismic waves call the head part of a seismic wave and the peak frequency. Therefore, as a factor reflecting the whole of seismic wave, the main vibration component of a seismic wave obtained. That is, a trajectory matrix is created from a time series of seismic wave. Applying a singular value decomposition method to the trajectory matrix, seismic waves are separated into constitute components. The lowest frequency component among the obtained vibration components is used as the main component. Then, the azimuth distribution of the main component is determined. As a result, it became clear that specific frequency was rediated to a specific azimuth. The radiation patterns obtained by the above three methods all matched in shape. Therefore, these radiation patterns represent one of the inherent characteristics of the hypocenter vibration.
As an example, we deal with M5.4 earthquake that occurred in Eastern Yamanashi on January 28, 2012. The radiation pattern of the spectrum peak frequency of the earthquake is shown in figure below. As can be seen from the figure, the change to the azimuth is steep in the eastern part, but the change in the western part is gentle. It clearly differentiated into two shapes. In order to investigate this cause, we introduce the concept of "pushing wave" and "drawing wave" used in beachball. The seismic waves are separated with the phase at the head of the seismic wave being "positive or

negative". As a result, the azimuth in which the phase is positive is concentrated in the western part of the figure and the negative azimuth in the phase is located in the eastern part of the figure. Therefore, the shock wave with the sharp azimuth change is radiated in the azimuth range corresponding to "pushing wave". On the other hand, a sustained wave with slow azimuth variation is radiated in the azimuth range corresponding to the "pulling wave ". This range coincides with the range where the main component of 3) above is emitted.