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An implementation of a visualization system for large scale moonquake data considering waveform similarity

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Large-scale seismic data were obtained from seismometers located on the Moon by the NASA Apollo missions from 1969 to 1977. According to previous analysis of the lunar seismic data (e.g., Lammlein, 1977), we found that deep moonquakes occur periodically from identical sources at a depth of about 700 to 1200km. The deep moonquakes occurred from identical sources have high similarities among each waveform (e.g., Nakamura, 2003). This similarity is important to classify the sources and investigate the generation mechanism of moonquakes. From the reason, classification of moonquakes has been processed, and much of lunar seismic data observed by long-period seismometers are labeled in term of type of moonquakes and location of sources (Nakamura et al., 2008).

However, classification of enormous moonquake data is usually difficult even if we use the computers, because we don't have any true references and the lunar seismic data are contaminated by large noises. We may not necessarily obtain useful results using classical cross-correlation method to all lunar seismic data.

We, therefore, develop the web system for visualizing moonquakes considering waveform similarity to progress study of moonquake classification. Our system maps moonquakes data to two dimensional output space using Self-Organizing Map (SOM). We use Hadoop in the back-end system to apply visualization methods to enormous moonquakes data. We will be able to indicate the results of classification in terms of various physical conditions, because SOM can automatically classify the waveforms based on our designed characteristics. Through development of this Web interface system, it will be expected that many researchers can utilize our indicated results and moonquake data to their analysis. In this presentation, we will show results of the classification of moonquakes by the SOM and current situation of our development.

Keywords: Moonquake, Visualization, Self-Organizing Map, Hadoop