Redetermination of the Seimic Source of HFTs using the Lunar Surface Gravimeter Data

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The Apollo Passive Seismic Experiment (PSE) was carried out on Apollo 12, 14, 15 and 16. Network observations of four seismic stations were performed for five years from 1972 to 1977. The PSE was a successful mission that informed us of the lunar crustal thickness and seismic velocity structure of the Moon from direct observations of the lunar interior (e.g. Nakamura, 1983). However, the paucity of seismic stations and the limited number of usable seismic events have been a major problem of lunar seismology. An additional observation point enables us to expand the network and the observable area will expand accordingly. We have been working on the reanalysis of unanalyzed data of the Apollo Lunar Surface Experiments Package observation data from 1976 3/1 to 1977 9/30 and showed that the Lunar Surface Gravimeter on Apollo 17 functioned as a seismograph.

In this study, we redetermined the seismic source of the moonquakes called High Frequency Teleseismic (HFT) with the additional data of the LSG. HFTs are said to be shallow moonquakes with hypocenters from 100km to 300km deep (Nakamura et al., 1974; Nakamura et al., 1979). However, the depth of hypocenters obtained by past studies varies from 0km to 300km (Nakamura et al., 1974; Nakamura et al., 1979; Lognnone et al., 2003) and hence the origin of HFTs is still not clear. By using the expanded network, we may improve the depth resolution of the seismic source and obtain new information on its origin.

There were three HFTs in the data set we used in the analysis and all three were detected by the LSG. For the biggest HFT among the three, we were able to distinguish both the P-wave and S-wave from noise. The new seismic source determined with this additional data implied a shallower seismic source compared to previous studies. Also for other HFTs in the data set, we were able to distinguish the seismic signal from noise and determined its arrival time. We are expecting that all the seismic source of the HFT in the data set can be revised with the LSG data. This revision may provide us with better understanding of HFT.