Re-investigation of the Farside Deep Moonquake with the Lunar Surface Gravimeter

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The internal structure of the Moon is essential information that infers the origin and evolution of the Moon. Many attempts have been made for its estimation and seismic analysis using the data from the Apollo Passive Seismic Experiment (PSE) is one of the most successful methods carried out. We have been focusing on the possibility of applying the Lunar Surface Gravities (LSG) data of Apollo 17 to seismological investigation. Through analyses of intensive lunar seismic events called High Frequency Teleseismic events we showed that with appropriate data processing, the data can be used in seismic analyses. In this study we focused on farside deep moonquakes which play important role in estimating the deep inner structure of the Moon.

Deep moonquakes are known to occur periodically at particular source regions and farside deep moonquakes are those with their source regions at the lunar farside. Generally, the farther the source regions and the seismic station becomes, the deeper into the Moon the seismic signal propagates. Thus, the signals of farside deep moonquakes may provide us with new information of the deep inner structure of the Moon. In Nakamura (2005), 8 farside deep moonquakes and 28 candidates of farside deep moonquakes were reported. Among these, 28 candidates did not provide enough arrival times to determine their sources. Also within the 8 determined sources, some of the locations have large uncertainties as large as 2000 km. This can result in 90 degrees of uncertainties in the distance to the seismic stations. In turn, it can vary the deepest region to be probed by the seismic ray from 1080 km to 1360 km in depth. These regions are those that could not be probes sufficiently with precious studies. For more detailed analyses of these regions, we need to refine the locations of these farside deep moonquakes. In this study we carried out source determination for these events and try to improve there location with additional data of the LSG. Especially for the 28 candidates, their source region is still undetermined and we may be able to determine its source with additional data of the LSG.

First, we examined whether the LSG was detecting signals from farside deep moonquakes and its candidates. The data we are using in the analyses covers observation from March 1, 1976 to September 30, 1977. During that period, 90 events from farside deep moonquakes and its candidates were reported and we have examined 75 of them, so far. Among the 75 events we identified 22 events from 11 source regions. As the first attempt, we carried out the source determination of a typical farside deep moonquake, A33. Our result supported the previous estimation and the A33 deep moonquake was confirmed to be on the lunar farside. We now working on other source regions and searching for more farside deep moonquakes.