Scattering Effects of Lunar Surface and Moho Topographies on the Propagation of Deep Moonquakes

*Keisuke Onodera[1,2], Taichi Kawamura[3,4], Yoshiaki Ishihara[2], Takuto Maeda[5], Satoshi Tanaka[2]

1. SOKENDAI (The Graduate University for Advanced Studies), 2. Institute of Space and Astronautical Science/Japan Aerospace Exploration Agency, 3. Institut de Physique du Globe de Paris, 4. National Astronomical Observatory of Japan, 5. Earthquake Research Institute, The University of Tokyo

The internal structure of the Moon is one of the most essential information to understand its origin and evolution. To elucidate the lunar inner structure, seismic observation is one of the most effective ways. In Apollo missions, some seismometers were deployed on the Moon and carried out the observation for about eight years. Since then, the lunar internal structure has been estimated using Apollo seismic data. Although several lunar interior models were proposed so far (e.g. [1][2][3]), each model shows different structure. However, all proposed models can explain the Apollo data. As the uncertainties in arrival time of seismic phases and resulting source locations are quite large, we can obtain several solutions for the inner structure of the Moon.

Low S/N ratio and long coda make it difficult to pick the seismic phases up in lunar seismograms. It is said long coda is caused by intense scattering and low attenuation within the lunar crust. So, understanding the scattering mechanism might improve the determination of the internal structure. Although the source of the lunar coda is not well understood, several ideas are suggested in previous studies (e.g. regolith and mega-regolith layer, local structure, velocity inhomogeneity [4][5]). There are theoretical and experimental studies on the scattering by regolith and mega-regolith [4][5]. However, there are few studies as for the effect of the local structure of the Moon. Recent studies of earthquakes suggested that, besides velocity inhomogeneity, local topographies scatter the seismic wave and develop the long-duration coda [6]. So, in this study, we investigated the scattering effects of the local topographies (surface & Moho) of the Moon on the seismic wave propagation. We assumed 1D velocity model and SELENE moon structure model based on [7] and simulated the propagation of deep moonquakes using OpenSWPC (an Open-source Seismic Wave Propagation Code) [8]. Then, we compared results of both models and evaluated how much surface and Moho topographies scatter the seismic wave.

In the presentation, we will show the results of simulation and discuss the effects of local topographies.

References

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