Observations of surface and buried regolith layers by Lunar Radar Sounder (LRS) onboard the Kaguya (SELENE) spacecraft

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Lunar Radar Sounder (LRS) onboard the Kaguya (SELENE) spacecraft successfully obtained 2362-hours worth of radar sounder data and 6523-hours worth of natural plasma wave data in the nominal operation period from October 29, 2007 to September 10, 2008 and 1714-hours worth of natural plasma wave data in the extended operation period until June 10, 2009. Based on the initial analyses of radar sounder data, we have reported that LRS has observed distinct reflection layers with a depth of several hundred meters below the surface of the nearside maria regions, which are probably old regolith layers covered by basalt layers [Ono et al., 2009]. After the initial report, the following studies have been performed based on radar sounder data obtained in wide area of the lunar surface.

Clear subsurface echoes are well found especially in 10% of the western nearside maria such as Mare Humorum, Mare Imbrium, and Oceanus Procellarum. By comparison with surface age determined by crater counting, it is suggested that the thick regolith layers were formed during dormant volcanic period before 3.0 billion years ago [Oshigami et al., 2009]. Based on the difference of altitudes measured by laser altimeter (LALT) and LRS, the thickness of the regolith in four maria regions has been estimated. By comparison with surface age, regolith evolution rate in each mare has been discussed [Kobayashi et al, 2009]. Global mapping of echo power has been obtained based on radar sounder data. It is found that the echo power is mainly correlated with surface roughness and also with FeO abundance in the surface determined by Lunar Prospector (LP) neutron spectrometer [Nakagawa et al., 2009]

Because intense off-nadir echoes superpose on the radargram, it is difficult to analyze radar sounder data obtained in the farside highlands and polar regions. Synthetic aperture radar (SAR) analysis of LRS data and comparison with digital elevation model (DEM) based on LALT and terrain camera (TC) observations will be solutions for those difficulties.

References

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