Developing the Lunar Moho Depth / Crustal Thickness Model from Selenodetic Data of SELENE (Kaguya)

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The SELENE (Kaguya) mission has successfully completed its nominal mission phase at the end of October 2008. Three selenodetic missions (RSAT/VRAD/LALT) of SELENE (Kaguya) provide excellent data for both gravity and topography than any previous missions. These data sets enable us to developing a new lunar crustal thickness model. Our model is the first model based on globally accurate gravity and topography data.

One year of Kaguya tracking data (Main/Rstar/Vstar) has been combined with historical data (e.g., Lunar Prospector) to create a lunar gravitational potential model expressed by spherical harmonics of degree and order 100, named SGM100g (Selene Gravity Model). This model dramatically improved the far-side gravity anomaly.

We have developed two spherical harmonic models of topography using the LALT topographic data as of 27 October 2008. One is spherical harmonics model of degree and order 359, named STM359_grid-03 (Selene Topography Model). Another is spherical harmonics model of degree and order 1439, named STM1439_grid-03.

We are now developing a new lunar Moho model based on newest gravity and topography models (SGM100g and STM359_grid-03). We assumed that the lunar gravitational perturbations are due to surface topography, surface basalt flows and Moho (crust / mantle interface) relief, however, in this time, we neglect the effect of surface basalt flows. The current model that will be considered is one with a uniform density crust with compensation occurring at the lunar Moho. In this model, we have used crustal density rho_c = 2800 kg/m^3 and mantle density rho_m = 3350 kg/m^3. The first step of the analysis is to compute the complete Bouguer correction that is due to the surface relief. We use gravity and topography spherical harmonics up to 60 degree and minimum amplitude type downward continuation filter that is constrained to be 0.5 at degree 45. This is mainly due to the limitation of far-side accuracy of gravity model.

Shallowest lunar Moho interface or thinnest crust region is located at Moscoviense basin. Moho depth of that region is about -5 km from 1737.4 km radius sphere from center of mass (crustal thickness is about 1.5 km). Deepest lunar Moho interface or thickest crust region is located at rim of Dirichlet-Jackson Basin. Moho depth at that region is about -95 km from 1737.4 km radius sphere from center of mass (crustal thickness is about 105 km).

In the next step, we will include effect of surface basalt flows and mare fill. In that phase, collaboration with LRS and LISM/TC is very important to realistic estimation of mare basalt thickness.