P036-024 Room: C401 Time: May 28 11:09-11:21

Crustal Structure of Lunar from Topography and Gravity

Hajime Hikida[1], Hitoshi Mizutani[1]

[1] ISAS

The mean density and moment of inertia are two major geophysical constraints when modeling the internal structure of a planet. Since the crustal structure of a planet occupies a significant fraction of the total moment of inertia, an accurate estimate of the crustal structure is important to infer the internal structure of a planet. In this study we construct a lunar crustal thickness model, assuming that the Bouguer gravity is solely due to the variation in the relief of a subsurface interface with a density jump. Although crustal models are previously assumed to be a constant crustal density (e.g. Neumann et al., 1996; Wieczorek and Phillips, 1998), the infrared and visible spectra over the lunar surfaces (e.g. Pieters, 1993) clearly show that crustal materials are laterally heterogeneous. Lawrence et al. (2001) presented the quantitative estimates of global iron abundances from the Lunar Prospector Neutron Spectrometer and the Gamma-ray Spectrometer data. In this study we converted their global iron map into the global crustal density map by utilizing the linear relation between the iron abundances and normative densities of various Apollo samples (Papike, 1998). We also assume that the crustal density is constant with depth, although it may change with depth.

We consider the effect of basalt flows filled in basins which cause the so called mascons. First, we estimate the initially excavated depth of each basin by using the power low relation between the rim-to-floor depth of a fresh lunar crater and its rim-to-rim diameter (Pike, 1974; Williams and Zuber, 1998). Second, we include the effect of the viscous relaxation of topographic relief for a basin and the effect of the isostatic compensation of a lunar mantle on the basis of the idea that most impact basins are formed in a hot thermal state of the early lunar history. Finally, the mare thickness is derived from the difference between the degraded basin depth and observed depth to the mare surface.

The thickness of a crust is previously constrained by the depths of the crust-mantle seismic discontinuities observed beneath the Apollo 12 and 14 sites (Toksöz et al., 1974). Recently Khan et al. (2000) suggest the thinner crust by the re-analysis of the Apollo seismic data. We compare the effects of these constraints on our crustal model.