Characteristics of the Gravity Models Expected for the GRAIL Mission to the Moon

S. W. ASMAR[1], M. T. ZUBER[2], D. E. SMITH[2], A. S. KONOPLIV[1], M. M. WATKINS[1]

[1]*Jet Propulsion Laboratory, California Institute of Technology*
[2]*Massachusetts Institute of Technology*

The lunar Gravity Recovery and Interior Laboratory (GRAIL) mission will utilize a two-spacecraft-formation technique to measure the gravitational field to unprecedented resolution, locally, regionally, and globally. Gravitational fields represent a key tool for probing the interior structure of the planets. The lunar gravity, when combined with topography, lead to geophysical models that address important phenomena such as the structure of the crust and lithosphere, the asymmetric lunar thermal evolution, subsurface structure of impact basins and the origin of mascons, and the temporal evolution of crustal brecciation and magmatism. Long wavelength gravity measurements can also place constraints on the presence of an inner lunar core. The process of measuring dual one-way phase of radio links between the spacecraft, converting that to instantaneous range-rate data, and computing the gravitational field is challenging and requires modeling and simulations of numerous parameters. The required information is grouped in categories such orbital parameters, dynamical errors, kinematic errors, noise characteristics, tracking coverage, and processing techniques. This paper will describe the tools, processes, and results of simulations characterizing the expected gravity data quality of this mission.