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# High-resolution Gravity Field Models of the Moon Using GRAIL mission Data

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The Gravity Recovery and Interior Laboratory (GRAIL) mission was designed to map the structure of the lunar interior from crust to core and to advance the understanding of the Moon's thermal evolution by producing a high-quality, high-resolution map of the gravitational field of the Moon. GRAIL consisted of two spacecraft, with Ka-band tracking between the two satellites as the single science instrument, with the addition of Earth-based tracking using the Deep Space Network. The science mission was divided into two phases: a primary mission from March 1, 2012 to May 29, 2012, and an extended mission from August 30, 2012 to December 14, 2012. The altitude varied from 3 km to 94 km above the lunar surface during both mission phases. Both the primary and the extended mission data have been processed into global models of the lunar gravity field at NASA/GSFC using the GEODYN software up to 1080 x 1080 in spherical harmonics. In addition to the high-resolution global models, local models have also been developed. Due to varying spacecraft altitude and ground track spacing, the actual resolution of the global models varies geographically. Information beyond the current resolution is still present in the data, as indicated by relatively higher fits in the last part of the extended mission, where the satellites achieved their lowest altitude above lunar surface. Local models of the lunar gravitational field at high resolution were thus estimated to accommodate this signal. Here, we present the current status of GRAIL gravity modeling at NASA/GSFC, for both global and local models. We discuss the methods we used for the processing of the GRAIL data, and evaluate these solutions with respect to the derived power spectra, Bouguer anomalies, and fits with independent data (such as from the low-altitude phase of the Lunar Prospector mission). We also evaluate the prospects for extending the resolution of our current models