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Precise orbit determination of the Lunar Reconnaissance Orbiter and first gravity field results

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The Lunar Reconnaissance Orbiter (LRO) was launched in 2009 and is expected to orbit the Moon until the end of 2014. Among other instruments, LRO has a highly precise altimeter on board demanding an orbit accuracy of one meter in the radial component. Precise orbit determination (POD) is achieved with radiometric observations (Doppler range rates, ranges) on the one hand, and optical laser ranges on the other hand. LRO is the first satellite at a distance of approximately 360 000 to 400 000 km from the Earth that is routinely tracked with optical laser ranges. This measurement type was introduced to achieve orbits of higher precision than it would be possible with radiometric observations only. In this contribution we investigate the strength of each measurement type (radiometric range rates, radiometric ranges, optical laser ranges) based on single-technique orbit estimation. In a next step all measurement types are combined in a joined analysis. In addition to POD results, preliminary gravity field coefficients are presented being a subsequent product of the orbit determination process. POD and gravity field estimation was accomplished with the NASA/GSFC software packages GEODYN and SOLVE.