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First independent lunar gravity field solution in the framework of project GRAZIL

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The twin satellite mission Gravity Recovery and Interior Laboratory (GRAIL) aims to recovering the lunar gravity field by means of intersatellite Ka-band ranging (KBR) observations. In order to exploit the potential of KBR data, absolute position information of the two probes is required. Hitherto, the Graz lunar gravity field models (GrazLGM) relies on the official orbit products provided by NASA. In this contribution, we present for the first time a completely independent Graz lunar gravity field model to spherical harmonic degree and order 420. The reduced dynamic orbits of the two probes are determined using variational equations following a batch least squares differential adjustment process. These orbits are based on S-band radiometric tracking data collected by the Deep Space Network and are used for the independent GRAIL gravity field recovery. To reveal a highly accurate lunar gravity field, an integral equation approach using short orbital arcs is adopted to process the KBR data. A comparison to state-of-the-art lunar gravity models computed at NASA-GSFC, NASA-JPL and AIUB demonstrate the progress of Graz lunar gravity field models derived within the project GRAZIL.