

Overview of radio tracking data and its application of ChangE missions

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Since ChangE-1 was launched at 2007, there have been a series of successful ChangE missions. ChangE-1 was Chinese first lunar exploration mission, and aimed for mapping of global topography and material distribution; ChangE-2 was launched at Oct 2010, the main achievements of this mission were a high-resolution lunar global image with 7 meter/pixel; and first close-distance investigation of asteroid 4179 Toutatis; ChangE-3 was launched at Dec 2013, and implemented first Chinese lunar landing mission, and studied successfully of the subsurface geological structure of Mare Imbrium. Currently there is a lunar satellite ChangE-5T1 is still orbiting the Moon, it is a remaining orbiter of ChangE-5 experiment, which successfully tested the technology of reentry and return. During all the missions, the radio tracking data play an important role in orbit navigation and related scientific achievement. In this report, we re-process all the ChangE radio tracking data by our independent developed software LUGREAS. In the process we use updated models, especially for the gravity field model. We assess the ChangE-1 orbit accuracy with image data, and try to solve Toutatis mass with ChangE-2 flyby data. For the ChangE-3 data we re-assess the lander position; For the ChangE-5T1 we solve a gravity field model considering its free flying without limited orbital maneuver and its inclination with 48° , which is different from polar orbits which were applied in lunar gravity field model generation.

Keywords: ChangE missions, Precise orbit determination, Lander positioning, Toutatis