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ABSTRACT SUBMISSION FORM

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Title of the Paper **Crossover Analysis of Chang'E-1 Laser Altimeter Data**
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ABSTRACT(more than 300 words) [5]

Altimetric crossovers are the intersection locations of two distinct ground tracks at separate times. Crossover differences (radial distances or heights) reflect the uncertainties in orbit determination (i.e., precision of spacecraft position and orientation) and the precision of laser ranging. Crossover analysis, which aims to adjust the crossover differences and force the planetary radii or height obtained at crossover locations to be consistent, is known as a powerful approach to help improve orbit determination and derive more precise Digital Elevation Model (DEM). As crossover analysis have been mostly used in satellite altimetry for earth observation, especially for sea surface heights applications. So far, no crossover analysis or applications for China's Chang'E-1 laser altimeter (LAM) data has been reported. This paper presents a preliminary result of crossover analysis of Chang'E-1 LAM data of the Moon for global and regional mapping applications.

During the operation of Chang'E-1 from November 28, 2007 to December 4, 2008, the laser altimeter acquired 1,400 orbital profiles with about 912 millions altimetric points. In our experiment, we produced more than 138 millions crossovers with 1,395 ground tracks covering the entire lunar globe after eliminating outliers of orbits and altimetric points. The standard deviation of crossover differences turned out to be 205.7m, showing that the differences are quite large and need to be adjusted.

We have developed a method for least-squares crossover adjustment with a series of basis functions of time (trigonometric functions and polynomials) to minimize the crossover residuals globally. The normal equations are very large but sparse, so they are stored and solved using sparse matrix technique. In a local area (0°N~60°N, 50°W~0°W), the RMS crossovers residuals are reduced from 81.6m to 23.4m (a 71.3% improvement). Accordingly, the quality of DEM generated from the adjusted LAM data is improved. Currently, the result of crossover adjustment of the entire lunar globe is not as satisfactory as the local one. We are making efforts to improve the global adjustment results so that a high precision consistent global DEM can be generated, which can be used as absolute control for lunar mapping with orbital images.