Integration of Chang'E-1 Imagery and Laser Altimeter Data for Precision Lunar Topographic Mapping

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Lunar orbital imagery and laser altimeter data are two major data sources for lunar topographic modeling. Most of the previous work has processed imagery and laser altimeter data separately. Usually though there are inconsistencies between the topographic models derived from them. This talk presents an endeavor to integrate the Chang'E-1 imagery and laser altimeter data for consistent and precision lunar topographic modeling. A combined adjustment model for the Chang'E-1 imagery and laser altimeter data is developed, in which the participants are the laser altimeter points, image exterior orientation (EO) parameters, and tie points collected from the stereo images. A weighting scheme is designed for the participants in the adjustment and a local surface constraint is imposed to improve the adjustment performance. The output of the combined adjustment is the refined image EO parameters and laser ground points. Experimental results using the Chang'E-1 data in the Apollo 15 and 16 landing site areas show that the proposed combined adjustment approach can reduce the mis-registrations between the imagery and the laser altimeter data by maximum 1- 18 pixels in image space. The Japanese SELENE laser altimeter data at the Apollo 15 and 16 landing site areas are employed for comparison analysis. Small shifts between the SELENE and Chang'E-1 laser altimeter data were found. The topography derived from Chang'E-1 data after the combined adjustment shows a relatively consistent trend with the topography determined by the SELENE laser altimeter data.