INTEGRATION OF MULTI-INSTRUMENTAL DATA SETS OF KAGUYA, LISM AND LALT.

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Introduction: Integration science based on KAGUYA and other missions requires spatial registration of different types of data sets. For example, two types of topographic data sets; Digital Terrain Model (DTM) in 10m/pixel based on stereoscopic images of Terrain Camera (TC) in the Lunar Imager/Spectrometer (LISM) and lunar surface profiles in 1km interval derived from Laser Altimeter (LALT). The former is areal data and the latter is linear one. Combining both data at certain areas provides detailed views of morphology for geological interpretations. Another two types of spectral data sets are also remarked; multiband color images and spectral profiles derived from and Spectral Profiler (SP) and Multiband Imager (MI) in LISM. This also shows the same relationship, the former is areal data and the latter is linear one. Here we report current status on our project to develop the procedures.

Integration of Spectroscopic Data: SP is a line profiler to observe the nadir points of the spacecraft. At the Level 2C (L2C) of the ground data processing, locations of the SP footprints are identified on a correspondence image, which is a TC or MI image obtained simultaneously with the SP data by a radiance-based matching process. The correspondence image and the result of the matching process are attached to the SP L2C data. It is difficult to make mutual adjustment of the SP footprint location by referring the correspondence images because appearance of the images highly depend on the solar illumination conditions. We adopted DTM as a general reference of all SP data. A simulated image is generated from the DTM for each correspondence image at the same illumination condition of the correspondence image. Comparing the simulated image and the real image, the location of the SP footprints relative to the DTM can be obtained indirectly but precisely. We've developed a rendering software to generate simulated images from DTM and navigation data of the spacecraft. An example of the simulated image is shown in Fig. 1.

Integration of Topographic Data: DTM derived from TC covers wide areas of the lunar surface, while LALT directly measures topographic profiles along the sub-spacecraft lines. Locations of LALT footprints on a DTM can be searched by a altitude-based matching process. First, the LALT footprints are plotted on a map-projected DTM by referring the geographic coordinates attached to the LALT data. Then the best location of the LALT footprints is searched based on the cross correlation function between the LALT altitude profile and the DTM profile extracted from the DTM along the plotted LALT footprints (See Fig. 2).

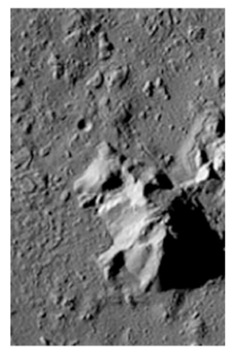

Fig. 1. Simulated image depicted the central peak of Tycho crater.

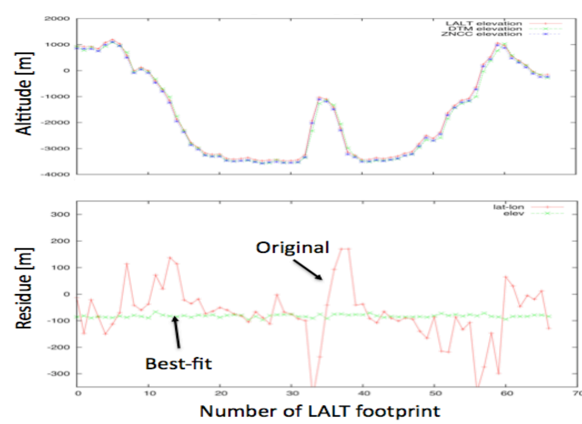

Fig. 2. Altitude profiles of LALT and TC DTM (both the original LALT footprint location and the best-fit location; upper panel) and residual of them (lower panel).