



KAGUYA(SELENE) Laser altimeter : one year in orbit

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The Laser ALTimeter(LALT) aboard Japanese lunar explorer KAGUYA(SELENE) is a ranging instrument which measures the distance between the satellite and the lunar surface with accuracy of 1 m by detecting the timing delay of the reflected laser light. The aim of the LALT is to obtain the lunar global topographic data including polar regions for the study of the origin and the evolution of the Moon.

The normal operation of the LALT began on 30th, December 2007 after two months' commissioning phase. Before the end of the normal operation phase in October 2008, the LALT measured more than 10 million range data. As KAGUYA is in a polar orbit, the first global and precise topographic map was obtained. Measurement has been done with repetition rate of 1 Hz except the period of unloading of the momentum wheels. Due to the decrease of the laser power, however, the measurement has been done intermittently after the middle of April 2008.

Based on the topographic data by the LALT, we derived the following parameters for the lunar global figures: 1) mean/polar/equatorial radii 1737.15 / 1735.66 / 1738.64 km, 2) the center of mass - center of figure offset (-1.772, -0.731, 0.239) km in the Mean Earth coordinate system, or 1.93 km in total. The highest point is located in the south rim of the Dirichlet-Jackson basin (-158.64 E, 5.44 N 10.75 km) and the lowest point is in the small crater in the Antoniadi crater (-172.58E, 70.43 S, -9.06 km). The altitude is expressed as the hight from the reference sphere of 1737.4 km.

Data at high latitude regions above 75 degrees were obtained for the first time. Based on the elevation model above 85 degrees, we calculated the solar illumination condition around the polar regions for 2000 days, showing that the most sun lit rate is 89 % and 86 % of the lunar year for the north and south regions respectively and that there are no eternal peak of light regions on the Moon. The area of the permanent shadow regions are 1236 and 4466 km² for north and south respectively, and are comparable to the previous estimation when areas above 87.5 degrees are compared (2) . These information will be useful for the landing experiments on the Moon and possibly for the human activity on the Moon in the near future.

references:

1. H. Araki et al., submitted to Science.
2. H. Noda et al., GRL, 35, L24203, 2008.