Japan Geoscience Union Meeting 2010
(May 23-28 2010 at Makuhari, Chiba, Japan)

PPS003-20 Room: 201A Time: May 24 14:45-14:57

Lunar Vis/NIR photometric correction for SELENE (Kaguya) Spectral Profiler

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The SELENE (Kaguya) Spectral Profiler (SP) acquired lunar visible to NIR spectral data at a spatial resolution of ~500 m [1]. Photometric correction by an adequate phase curve is crucial for detailed analysis of the spectra. Many researchers (e.g., [2-7]) have investigated photometric correction of lunar data, but extensive study of wave-length coverage, geology dependence, and applicability for high-latitude regions, namely, observation at large inci-dence and phase angles, is still important. Here we report refined results of the phase curves derived from SP data.
Ideally, multiple observations in various geometry conditions are necessary to simultaneously decide all photometric parameters in a detailed model such as the Hapke model [9]. However, it is difficult to observe the entire lunar surface at various geometric conditions. Thus, an alternative empirical function is required. In this study, we followed the model of McEwen et al. [2, 3], which was proposed for Clementine photometric correction.
We used nearly 7000 orbits of SP data. The raw DN was converted to the radiance factor (RADF) by the procedures prepared for public release of SP data. Since the radiometric calibration for longer wavelengths exceeding 1.6 um remains incomplete, we use only the data at wavelengths shorter than 1645nm.
To derive phase curve from the observation, we needed a dataset that consist of relatively uniform albedo. To collect such data, we made a reference map by the SP 753nm band. Yokota et al. [6] demonstrated that the 750nm band phase curve of [3] can properly correct both highland and mare data at phase angle=20 to 40 deg. We applied this phase curve to the SP 753nm band data in this phase angle range and made a reflectance map from the average in 1x1 degree resolution tiles. Based on this map, we devide the target lunar surface into three albedo groups (Low, Medium, and High).
The observed phase curve plots for the three groups were successfully derived from the SP data. Since the assessment of the coherent backscatter opposition effect is a difficult topic (e.g. [10, 1 1]), the data at small phase angle (<5 deg.) were excluded from the fitting. At large phase angle (> ~80), the observed data rapidly decreases with phase angle. Thus, the data at phase angle >75 deg. were also excluded from the fitting. Interestingly, no wavelength dependency was found for this trend. This trend is probably caused by the macroscopic roughness. We prepared the extra 3-order polynomial to treat this geometry range.
References: [1] Matsunaga T. et al. (2008) GRL, 35, L23201. [2] McEwen A. S. (1996) LPS XXVII, Abstract p841. [3] McEwen A. S. et al. (1998) LPS XXIX, Abstract #1466. [4] Hillier J. K. et al. (1999) Icarus, 141, 205-225. [5] Kreslavsky M. A. et al. (2000) JGR., 105 E8, 20,281-20,29 5. [6] Yokota Y. et al. (2003) LPS XXXIV, Abstract #1885. [7] Buratti et al. (2008) LPS XXXIX, Abstract #1471. [8] Yokota Y. et al. (2009) LPS XL, Abstract #2525. [9] Hapke, B. (1993), Theory of Reflectance and Emittance Spectroscopy, Cambridge Univ. Press, New York. [10] Helfenstein et al. (1997), Icarus, 128, 2-14. [11] Shkratov et al. (1999), Icarus, 141, 132-155.

Keywords: Kaguya, Photometry, moon, calibration, reflectance, spectra