Implementation of assortment algorithm for excluding noisy data in the lunar web-GIS: GEKKO

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The lunar web-GIS "GEKKO" [Hayashi et al., 2016] is a very convenient system for the users to view the observed spectra on the Moon with the surface images. The main objective of developing the GEKKO is to display the Spectral Profiler (SP) data and visualize the information of the minerals brought out from the data. The SP is a spectrometer, onboard Kaguya which is a Japanese lunar orbiter. The SP observed the visible-near infrared reflected spectra of the lunar surface right under the satellite. We can identify the minerals and constrain the minerals the distribution on the Moon by detecting the absorption bands of the observed spectra. The web-GIS "GEKKO" plots observation footprints of SP on the lunar surface image. When users select any observation point, the GEKKO displays the graph of the SP spectra observed at the spot, the table to show ancillary data, and the high resolution image taken by imager, onboard Kaguya. The users can also download SP data very easily through this GEKKO system too. SP data analysis functions are also implemented in the GEKKO system recently. The analysis system has been installed by Sugimoto et al. [2014] and Iimura et al. [2017]. Sugimoto et al. [2014] developed a framework for real-time analysis of SP and implemented very simple functions of similarity analysis. Iimura et al. [2017] extended the framework of Sugimoto et al. [2014] and implemented practical functions:- principal component analysis (PCA) and clustering analysis. The current GEKKO is useful for viewing and analyzing SP data, however, the system uses and displays all the SP data amounting to about 70 million spectra which include noisy data. The S/N ratios of SP data depend on observation conditions. The noisy data should not be used for the analysis without caution. Especially, in statistical analysis such as PCA using a bunch of data, stacking of noise could affect the results critically and prevent with appropriate evaluation and understandings. Thus, this study tries to evaluate the noise first and develop the algorithm to classify the low-quality SP data. We developed and implemented the new function to discriminate low-quality data in the GEKKO. When users use this function, the data judged as of low-quality are shown by changing the colors of SP footprints where such noisy data are observed. The judgement criteria can be chosen by users flexibly. The users can also tune and adjust the controlling parameters for discriminating noisy data. Thereby, users can check quality of each SP data and select SP data with the higher S/N ratios according to user's objectives or preferences.

Keywords: moon, Kaguya(SELENE), Spectral Profiler, web-GIS, GEKKO, noise evaluation

