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Dipole source modeling of the lunar magnetic anomalies using Kaguya LMAG low altitude data

Futoshi Takahashi[1*], Hideo Tsunakawa[1], Hisayoshi Shimizu[2], Hidetoshi Shibuya[3], Masaki Matsushima[1]

[1]Tokyo Institute of Technology, [2]ERI, Univ. of Tokyo, [3]Kumamoto Univ.

One of the objectives of magnetic field observation around the Moon by the Lunar Magnetometer (LMAG) onboard Kaguya is to examine if the Moon once had a global magnetic field of core origin. For this purpose, we have conducted a study of modeling the lunar crustal magnetic field, called the lunar magnetic anomaly, based on a dipole source assumption. Among more than 20 anomalies, we particularly focus on small-scale, isolated anomalies, taking the dipole source assumption into account. Using two independently obtained datasets by LMAG and Lunar Prospector (LP) low altitude observations, it is found that not only the well known, strong magnetic anomalies, Reiner Gamma and Descartes anomalies (>> 10 nT in strength at < 20 km altitude), but also relatively weak anomalies(Abel, Airy, Crisium, Hartwig, Dirichlet Jackson, Mendel, Moscoviense, Rima Sirsalis, and Stofler anomalies) and some currently unnamed anomalies of ¥sim 10 nT at < 20 km altitude can be modeled using single- or multi-dipole source. In most cases, inverting LMAG and LP data separately yields consistent models, which prompts us to invert them simultaneously. Inversion of the combined dataset results in almost the same model with less error. After modeling all the anomalies, which can be represented by dipole source, the obtained magnetization directions would be mapped into distribution of paleo-poles to discuss the ancient lunar dynamo hypothesis.

Keywords: Moon, magnetic anomaly, Kaguya, LMAG, dipole source model