



Near surface magnetic field mapping over the swirls in the SPA region using Kaguya LMAG data

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Abstract

The EPR (Equivalent Pole Reduction) analysis of Kaguya (SELENE) Lunar magnetometer data (LMAG) over the swirl in the Mare Ingenii and other South Pole Aitken (SPA) region indicates that the strength of horizontal magnetic component (B_h) beautifully coincides with the high albedo part of the swirls. It strongly supports the hypothesis that swirls or high albedo markings (HAM) on the moon are the result of the absence of solar wind due to the shielding effect of the magnetic field.

1. Introduction

The correlation between HAM on the surface of the moon and strong magnetic anomalies has been claimed since the early time of the lunar magnetic field study, *e.g.* [1]. Hood *et al.* [2] mapped the smoothed magnetic field strength over the Reiner Gamma region using Lunar Prospector magnetometer (LP-MAG) data, and suggested that the position of them matches each other well. In this paper, we present the estimated low altitude magnetic field over some of the HAMs from Kaguya-LMAG data using EPR, and show that the B_h matches better to the HAM than the total intensity (B_f).

2. Magnetic field estimates

In order to estimate the magnetic field at low altitude, we developed the EPR method [3]. It is essentially a variant of the equivalent source method but uses magnetic monopoles instead of dipoles. The reason why using monopoles is that juxtaposing dipoles tend to cancel each other so that the significant digits tend to be lost. Using proper stabilization, EPR gave appropriately smooth magnetic field at an altitude of 5km. We can make the map of total intensity, horizontal intensity, each component etc.

The resolution and cleanness of the magnetic anomaly map depends primarily on the altitude of the observation. Kaguya spacecraft flew lower than 10km over the South Pole Aitken basin, where strong magnetic anomalies are observed, in the last month of its mission. It improved the anomaly maps of the area including Abel, Gerasimovich (Crisium Antipode) and Mare Ingenii (Imbrium Antipode) regions.

3. Correlation of B_h to HAM

The lunar magnetic field maps are overlaid on the Clementine albedo maps. We can see correlations between any of the magnetic maps with albedo, but B_h map relate most closely to HAM. In some areas, they astonishingly coincide with each other to the detailed patterns. It is especially true for Mare Ingenii. The B_h high is observed almost all the swirls even the size of less than 10km. This correlation strongly supports the hypothesis that the swirls as well as HAMs are formed by the reduction of solar wind particles, which are trapped or reflected by the magnetic field.

References

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- [3] Toyoshima *et al.*: Equivalent source mapping of the lunar crustal magnetic field using ABIC, *Earth Planets Space*, v.60, pp.365-373, 2008.