P224-P004 **Room: Poster Session Hall** **Time: May 20**

Equivalent source mapping of lunar magnetic field using ABIC

Masahiro Toyoshima[1]; Hidetoshi Shibuya[2]

[1] Earth Sci, Kumamoto Univ; [2] Dep't Earth Sci., Kumamoto Univ.

Equivalent source mapping of lunar magnetic field using ABIC

Masahiro Toyoshima and Hidetoshi Shibuya
Graduate School of Science and Technology, Kumamoto University

SELENE spacecraft will measure the magnetic field by LMAG magnetometer, going around the moon, primarily, at altitudes of about 100 km. For the preparation of the data processing, we report an objective scheme for restoring the spatial distribution of the lunar crustal magnetic field from the orbital measurement data.

In this study, the magnetic field is restored by solving a linear inverse-problem determining the sources distributed on the lunar surface to satisfy the observational data, which is known as the equivalent source method. Our scheme improves the method in three features.

The first feature is that the source calculation is performed simultaneously with detrending. The observational data is a sum of time varying interplanetary field and lunar crustal field. In general, the former is removed by subtracting the trend of each orbital data segment. The trend is calculated by least squares fitting of a quadratic polynomial. However, the calculated trend includes the crustal field itself, and the reduction tends to go over-detrending. In this study, coefficients of the polynomial and equivalent sources are determined simultaneously, adding the detrending equations to the equivalent source equations matrix. The trend and crustal field can be distinguished using the observation in different altitudes, since a series of sources producing a polynomial trend in an altitude does not make a field described by another polynomial in a different altitude.

The second is that magnetic charges (magnetic monopoles) are used as the equivalent sources. The source can be any shape, because the magnetic field is divergent free potential field above the surface. Although dipoles are generally used as the sources in equivalent source method, we use magnetic monopoles for the simpler shape of magnetic field and the ease of calculation.

The third is that the charges are set on a very fine grid which means a great number of charges to avoid the influence of the grid phase to the results. Their intervals are short enough to avoid the irregularity in the magnetic field. As the total number of charges exceeds the number of observation points, we introduce a damping constraint that the juxtaposed charges are not much different. The strength of damping is represented by a hyper parameter. The optimum value of the hyper parameter can be determined objectively by minimizing Akaike's Bayesian Information Criterion (ABIC).

For test the scheme, we apply to the Lunar Prospector (LP) magnetometer data, and provide magnetic field map in the region centered at Reiner Gamma anomaly which is known as the strongest anomaly group on the moon. This region is the most intensively studied and has been mapped by previous studies. Hood et al.(2001) provided anomaly map by a two-dimensional averaging and Kurata et al.(2005) restored the magnetic field by a nonlinear inverse-problem.

This study improves the restoration of 3-d magnetic field distribution. Because of the linearlity, we do not have to shepherd the calculation, and thus can process a lot of data being provided by SELENE. We will show the magnetic field maps at three different altitudes (10 km, 20 km, and 30 km). Comparing to the previous studies, our maps reproduce observation more accurately.