Quantitative comparison of lunar crustal magnetic field observed by Kaguya and Lunar Prospector missions

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The magnetometer on board Kaguya (Kaguya-LMAG) has been almost continuously observing the magnetic field at about 100km altitude since October 29, 2007. The observations are beautiful because of the very low solar activity, and the crustal field is well recognized at 100km altitude from the record in the lunar wake and the tail-lobe environments.

As the lunar crustal magnetic field does not vary, those results are comparable with the Lunar Prospector magnetometer (LP-MAG). Such a comparison has been made between Apollo sub-satellite data and LP-MAG, but only qualitative similarity has been discussed, since the altitude effect to the intensity and shape of the magnetic field was not quantitatively evaluated.

We have developed a method to recover the 3-d magnetic field from satellite field observations (EPR method which stands for Equivalent Pole Reduction; Toyoshima et al., 2008). Applying EPR to the LP-MAG data, we presented, at JpGU 2008 meeting, the global magnetic anomaly map. As the EPR reduce the field observation to the magnetic monopole distribution, the magnetic field at the Kaguya track is also calculated, so that the quantitative comparison between the observations of the two missions becomes possible.

The comparison in several strong magnetic anomaly regions, Abel, Descartes, Reiner Gamma, Rima Sirsalis, Crisium Antipode, Orientale Antipode and South Pole-Aitken regions, shows the EPR field and observation agree very well. In some passes, the discrepancy is less than 0.1nT though out the 20^o span in latitude. This agreement indicates that the calibrations of both Kaguya and LP are very precisely consistent, and the EPR works very well to restore the magnetic field in three dimensions. It is also found in most of the areas that the radial component is more consistent than the other components. It would be due to the moon surface current generated by the varying interplanetary field.

They are also compared at noisy area in EPR global field map. The northern equatorial area in the far side is one of those regions. As the anomaly itself is small in this region, the Kaguya observation also marginal to detect the crustal anomaly, but some passes indicate similar wobbles in shape and amplitude. Those results indicate that the quantitative comparison is very important to certify weaker magnetic anomalies.