An upper bound of the size of the lunar core inferred from induced dipole observed by LMAG onboard SELENE/KAGUYA

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The existence of magnetic anomalies originated from magnetization of lunar crust has been well recognized. A recent paleomagnetic study by Garrick-Bethell et al. (2009) has shown that long-lived magnetic field must have existed about 4.2 billion years ago and the cause of the magnetization is likely due to the magnetic field generated by the lunar dynamo. However, the size of the lunar core is not well constrained so far; the estimated radius by different disciplines ranges from 170 to 450 km (e.g., Nakamura et al., 1974; Konopliv et al., 1998; Hood et al., 1999; Khan et al., 2004). If an electrically conducting core exists in a very resistive mantle and a magnetic field is applied from outside, the field can penetrate into the mantle but it cannot to the core due to electromagnetic induction in the core. The intensity of the induction signature, induced dipole field, from the core depends on its size, so that we can estimate core radius by measuring the intensity of the induced dipole. We estimated the size of the lunar core by using the magnetic field data obtained by LMAG onboard SELENE/KAGUYA, while the moon is in the Earth's magnetosphere. Pass-stacking of magnetic field components has performed to reduce the effect of short time-scale disturbances. The signature of the core should have 180 degree cycle in latitude or roughly 1 hour period in time. The obtained intensity of the induced dipole having the cycle is less than 1.5 % of the ambient magnetic field at 100 km altitude. This indicates that the upper limit of the radius of electrically conducting lunar core is about 350 km.