The empirical mode analysis of the decadal variations in the geomagnetic Gauss coefficients

*Ryosuke Nakashima[1], Shigeo Yoshida[2]

1.Department of Earth and Planetary Sciences, Graduate School of Science, Kyushu University,
2.Department of Earth and Planetary Sciences, Faculty of Science, Kyushu University

Decadal geomagnetic field oscillations are often considered to be caused by waves in the Earth's outer core. The waves often used in interpreting decadal variations are torsional oscillations and axisymmetric Magnetic-Archimedes-Coriolis (MAC) waves (Braginsky 1993; Buffett, 2014). Both waves are characterized by axisymmetric flows, but decadal variations can, in principle, be explained in terms of non-axisymmetric waves. In order to extract such non-axisymmetric wave components from the Gauss coefficients, we first apply the empirical mode analysis to extract decadal components, and then subtract variations caused by axisymmetric flows.
We use the time series of the last 150 years of the Gauss coefficients with degrees up to 4, from 1865 to 2014. We combine the data from gufm1 model (Jackson, 2000), IGRF-12 and CHAOS-5 model (Finlay, 2015), and apply the empirical mode decomposition (EMD) (Huang et al., 1998) to time series of the Gauss coefficients.
The decomposition shows that the equatorial antisymmetric components of Gauss coefficients have periods of 40 and 80 years. The g-h plots of these components show linearly polarized oscillations, which indicate either forced oscillations, or advection by oscillating flows.
Next we subtract the components which can be caused by advection by axisymmetric flows. The results will be shown at the conference.

Keywords: geomagnetic decadal variations, Gauss coefficients, outer core, torsional oscillations, empirical mode decomposition

