R006-44
Zoom meeting B ：11/4 AM1 (9:00-10:30)
10:00〜10:15

Signal and Noise Separation From Satellite Magnetic Field Data Through Independent Component Analysis

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We propose an application of the independent component analysis (ICA) to separate satellite-induced time-varying stray fields from magnetic field data obtained using onboard multiple magnetometers. The ICA is a method for estimating source signals at multiple sites so that the estimated source signals can become statistically independent of each other. Since stray field variations are statistically independent of external natural field variations, the ICA method is expected to separate the natural variations from stray fields. Thus, we applied the ICA to magnetic field data from the first Quasi- Zenith Satellite, which has two triaxial fluxgate magnetometers, without using an extendable boom. First, we removed the long-period trend from the original data to create detrended data. Then, we applied the FastICA algorithm to the detrended data and obtained six independent components (ICs). The stray fields were successfully separated into three ICs (noise ICs), and the natural signals were represented by the other three ICs (signal ICs). Finally, we restored the observed signals from the signal ICs, and confirmed that the natural phenomena variations were not altered by the processing step. We also proposed a selection method of the noise ICs using the C coefficient, which is the coefficient of the variance of the mixing vectors. There was a large difference in C between the ICs whose C coefficients are the largest third and fourth ones. Overall, these results demonstrate the possibility that the ICA method can support for boom-less magnetic observations in future satellite missions. The result has been published in Imajo et al. [2021, JGR] (doi:10.1029/2020JA028790).