Effect of reference data on geomagnetic transfer functions

*Shinya Sato[1], Tada-nori Goto[1]

1. Kyoto Univesity, Graduate School of Engineering

It is well-known that inter-station transfer functions (TFs), which are derived generally using two sites (as following Schmucker 1984; Neska 2006), are effected by source field. Also, we sometimes use three sites for deriving TFs in order to reduce the noises mixed in geomagnetic data. These 2 or 3 sites-based TFs have been used for evaluating the spatial characteristics of source field. However, the 3 sites-based TFs (i.e., using site 1, site 2 and reference site) do not always reflect the source field's condition between site 1 and site 2, and can possibly be effected by the source field's characteristics at reference site. Also, the evaluation of source field's condition at time-frequency domain (i.e., at the stage of spectra or spectrograms) will be more accurate. Therefore, for the evaluation we used Multi-Channel Nonnegative Matrix Factorization (MC-NMF, suggested by Sato and Goto 2018), which can extract components included in several geomagnetic spectrograms. Moreover, we derived the condition of geomagnetic events' spatial-characteristics, which triggers the effect of reference data on 3 sites-based TFs. In order to verify that the TFs are effected by the reference site, we derived the temporal changes in 3 sites-based TFs replacing the reference sites. As a result, we founded that the TFs changed not only temporally but dependent on the reference site and the interpretation of source field's spatial characteristics was different dependent on the reference site. For exposing the cause, we evaluated the spatial-characteristics of geomagnetic events using MC-NMF. The evaluated spatial-characteristics of geomagnetic events were corresponding with the condition triggering the effect of reference data on TFs as mentioned above. We succeeded to expose the cause of TFs' variation triggered by reference data evaluating the spatial-characteristics of geomagnetic events at time-frequency domain. Using TFs together with MC-NMF, the interpretation of source-field's spatial characteristics will be with high accuracy.

Keywords: Spatial characteristics of source field, Inter-station Transfer Function, Remote reference