Singular Spectral Analysis of ULF electromagnetic Data

Katsumi Hattori[1]; daishi kaida[2]

[1] Chiba University; [2] Earth Science Sci,Chiba Univ

http://www-es.s.chiba-u.ac.jp/geoph/ulf/

ULF electromagnetic data (frequency range 0.001 ˜1 Hz) are consider a superposition of signals of different origins. The first one is originated from the external source field associated with the solar-terrestrial interactions such as the geomagnetic pulsations or geomagnetic storms, and their induced field, which appear in the global (hundreds of km) scale. The second one is the regional (a few tens of km) signals such as artificial noises associated with the leakage current from DC-driven trains, and signals propagating under the ground, which are considered earthquake-related signals and to be detected. The third one is local signal associated with motion of magnetized objects such as cars. In order to detect the weak earthquake-related signals, the effective signal discrimination will be required. In this paper, the singular spectrum analysis (SSA) has been adopted to develop the signal discrimination method for removing the intense noises. We perform SSA to the site data and the adequate reference data and the both data are decomposed to a lot of principal components. The correlation among the principal components is investigated. When we remove the high correlated principal components from the original time series, the common variation have disappeared.

The major findings are summarized as follows. (1) SSA has a capability to remove the intense noises. (2) For the reduction of magnetic pulsations, it is essential to use the reference data without artificial noises. For reducing the DC-driven train noises from geopotential diffeence data, the substation data are one of good references.