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# Global noise reduction of ULF geomagnetic data using singular spectral analysis and principal component analysis of the reduced data for the 2000 Izu Islands Earthquake swarm in Japan

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ULF geomagnetic data (frequency range 0.001 $\sim$ 1 Hz) are consider a superposition of signals of different origins. The most intense 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 the most intense signals of external geomagnetic variations. In this paper, the principle of SSA will be given at first and simulation has been performed to evaluate the signal discrimination using SSA using remote reference data. Then, the principal component analysis (PCA) has been applied to the noise-reduced data observed in the seismically active period (the 2000 Izu islands earthquake swarm in Japan).