Ground Rn flux anomaly and crustal activity around Asahi station, Boso Peninsula, Japan

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In recent years, there are many studies reported on electromagnetic phenomena preceding earthquakes such as geomagnetic, ionospheric, and atmospheric anomalous changes. Ionospheric anomalies preceding large earthquakes are most of the promising phenomena. Lithosphere-Atmosphere-Ionosphere Coupling (LAIC) model has been proposed to explain earthquake-related atmospheric and ionospheric phenomena. In this study, to evaluate the possibility of chemical channel of LAIC by observation, we have installed sensors for atmospheric electric field (AEF), atmospheric ion concentration (AIC), atmospheric Rn concentration (ARC), ground Rn concentration (GRC), and weather elements at Asahi station, Boso Peninsula, Japan. Because the atmospheric electricity parameters could be mainly influenced by weather factors, it is necessary to remove these influences as much as possible. In this sense, we apply the MSSA (Multi-channel Singular Spectral Analysis) to remove these influences from the GRC variation and estimate the ground Rn flux (GRF). We investigated the correlations between GRF and crustal activity such as earthquakes and deformation.

For earthquakes within an epicenter distance of 50 km from the station, it is found that the correlation between Rn flux and regional cumulative seismic moment and/or Es index, which indicates the daily local seismic energy received at the station. These earthquakes had the characteristics they occurred directly underneath the station in the boundary of the Pacific Plate and the North American Plate and they are reverse fault type components.

We investigated the relationship between stress change and GRF to consider the model of fluctuation of the GRF. In this study, we calculated the dilatation using the F3 solution published by the Geospatial Information Authority of Japan. As a result, the GRF increased with compression and decreased with expansion. The result suggests that GRF has the sensitivity to stress changes and can be an indicator of large earthquakes that have pre-slip and slow slip events.

Keywords: Lithosphere-Atmosphere-Ionosphere Coupling, atmospheric electric field, atmospheric ion concentration, ground Rn concentration, atmospheric Rn concentration

