Dependence of Schumann resonance parameters on solar activity

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The Schumann resonance (SR) is the global resonance of electromagnetic waves generated by global lightning activity. The resonance is formed by the Earth-ionosphere cavity and the specific resonance frequencies, which are about 8, 14, 21, and 26 Hz, appears in ground magnetic field variation. The diurnal variations of SR parameters reflect the properties of both global lightning activity and the state of the Earth-ionosphere cavity.

Recently the SR is further expected as an indicator of earth's climate. In order to use the SR parameters for studying such earth's climate, we need a better understanding of the long-term variations of the SR in terms of correlation between solar activities. In this study, we examined the fundamental mode of SR at Kuju, Japan (KUJ, M.Lat. = 23.4 degree, M. Lon. = 201.0 degree) by comparing solar activities.

The ground magnetic field variation in the extremely low frequency (ELF) range has been measured by an induction magnetometer at KUJ since 2003. The observation is a part of activities by International Center for Space Weather Science and Education Kyushu University. The components of ground magnetic field used in this study are horizontal northward component (H) and horizontal eastward component (D). To compare the magnetic field data with solar activity, we also used daily F10.7 and daily EUV flux data in 0.1-50 nm wavelength bands. The EUV data is obtained by the Solar EUV Monitor (SEM) aboard the Solar Heliosphere Observatory (SOHO) satellite at the L1 point.

The fundamental mode of the SR frequency follows solar activity (i.e., F10.7 and EUV flux). The SR frequency tends to increase with increasing solar activity. Such tendency is especially prominent in the H component. Also the correlation coefficient between the SR frequency in the H component and EUV flux is high (C.C. = 0.71). We conclude that the SR frequency depends on the density in the ionospheric D region which varies with solar activity.