Daily and seasonal variations of Schumann Resonance

Akihiro Ikeda[1]; Teiji Uozumi[2]; Akimasa Yoshikawa[3]; Akiko Fujimoto[4]; Shuji Abe[5]
[1] KNCT; [2] ICSWSE, Kyushu Univ.; [3] ICSWSE/Kyushu Univ.; [4] Kyutech; [5] ICSWSE, Kyushu Univ.

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 frequency appears in ground magnetic field variation. Thus, the SR reflects both global lightning activity and ionospheric conditions and varies considerably with location.

We aim to construct an empirical model of the SR parameters as a function of local time and day of year. The model can be a base line of SR variations and will help us to find the new aspect of SR during solar flare and solar proton events (SPEs). In this study, we focused on the daily and seasonal variation of the SR parameters as the first step to constructing the empirical model.

The ground magnetic field variation in the extremely low frequency (ELF) range has been measured by an induction magnetometer at Kuju, Japan (KUJ, M.Lat. = 23.4 degree, M. Lon. = 201.0 degree) since 2003. The observation is a part of activities by International Center for Space Weather Science and Education Kyushu University.

The first mode of the Schumann resonance (SR1) around 8 Hz can be seen at KUJ. The power of SR1 in H (horizontal northward component) and D (horizontal eastward component) become maximum in June and July. It is reasonable to predict that the influence of the lightning activity becomes intense in summer at KUJ. Also the power of SR1 in H shows daily variations with maximum peaks around 15 UT throughout the entire period. In the case of D, the SR1 shows its maximum peak around 8 UT. The three major regions of thunderstorm activity (tropical Asia, Afria and America) affect amplitude of SR. The maximum peak times of SR1 in H and D are coincident with the enhancement of thunderstorm activity in Africa and Asia, respectively. This can be explained by the geographical location.