R010-22
Zoom meeting C ：11/4 PM1 （13:45-15:30）
15:00-15:15

Statistical analysis of short-wave fadeout for extreme event estimation

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Solar flares trigger an increase in plasma density in the ionosphere including the D-region and cause the absorption of radio waves, especially in high-frequency (HF) ranges, called short wave fadeout (SWF) or Dellinger phenomena. In order to evaluate SWF duration and absorption statistically, we analyze long-term ionosonde data observed by the National Institute of Information and Communications Technology (NICT). The minimum reflection frequency, fmin, is used to detect SWFs from 15-min-resolution ionosonde observations at Kokubunji, in Tokyo, from 1981 to 2016. Since fmin varies with local time (LT) and season, we refer to dfmin, which is defined as fmin subtracted by its 27-day running median at the same LT. We found that the occurrence of SWFs detected by three criteria, (i) dfmin >=2.5 MHz, (ii) dfmin >=3.5 MHz, and (iii) blackout, during daytime associated with any flare(s) greater than the C-class is maximized at local noon and decreases with increasing the solar zenith angle. We confirm that the dfmin and duration of SWFs increase with the solar flare class. We estimate the absorption intensity from observations, which is comparable to an empirical relationship obtained from sudden cosmic noise absorption. A generalized empirical relationship for absorption from long-distance circuits shows quantitatively different dependences on solar flare flux, solar zenith angle, and frequency caused by different signal passes compared with that obtained from cosmic noise absorption. From our analysis and the empirical relationships, we estimate the duration of extreme events with occurrence probabilities of once per 10, 100, and 1000 years, to be 1.8?3.6, 4.0?6.8, and 7.4?11.9 h, respectively. The longest duration of SWFs of about 12 h is comparable to the solar flare duration derived from an empirical relationship between the solar flare duration and the solar active area for the largest solar active region observed so far.
In this presentation, we will also discuss relationship between the signal absorption and plasma density profiles derived from numerical simulations using GAIA (Ground-to-topside model of Atmosphere and Ionosphere for Aeronomy).