

FDTD STUDIES OF THE DIURNAL AND SEASONAL VARIATIONS IN SCHUMANN RESONANCE PARAMETERS

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Observations of Schumann resonances (SR) in the Earth-ionosphere cavity [Schumann, Z. Naturforsch., 7a, 149, 1952] represent a powerful tool for variety of remote sensing applications [e.g., Williams, Science, 256, 1184, 1992; Cummer, IEEE Trans. Antennas Propagat., 48, 1420, 2000; Roldugin et al., JGR, 109, A01216, 2004], which in recent years included studies of thunderstorm related transient luminous events in the middle atmosphere and related lightning discharges [e.g., Sato and Fukunishi, GRL, 30, 1859, 2003; Su et al., Nature, 423, 974, 2003]. The observed SR parameters are strongly related to the distributions of the conductivity and global lightning activity in the Earth-ionosphere cavity. In the realistic cavity, the conductivity distribution is not laterally uniform, but varies with the local time and seasons. Additionally, the lightning activity in the three main areas (Africa, South-East Asia, and South America) exhibits strong diurnal and seasonal variation patterns. The resultant diurnal and seasonal variability of the SR parameters has been well documented in the existing literature [e.g., Sentman and Fraser, JGR, 96, 15973, 1991; Satori, JATP, 58, 1483, 1996; Price and Melnikov, JASTP, 66, 1179, 2004]. In this talk we report results from a 3D FDTD model of the Earth-ionosphere cavity with realistic conductivity profile and realistic distribution of lightning sources, which is designed to account for the observed diurnal and seasonal variations of the SR parameters. The employed model was first introduced in [Yang and Pasko, EOS Trans. AGU, 84, Fall Meet. Suppl., AE42A-0796, 2003] and has recently been extensively validated [e.g., Yang and Pasko, EOS Trans. AGU, 85, Fall Meet. Suppl., 2004] by comparisons of eigenfrequency and quality factor solutions derived from the model with a set of classical results available in the literature for the laterally uniform spherically symmetric Earth-ionosphere cavity [Sentman, JATP, 45, 55, 1983; JATP, 52, 35, 1990; JGR, 101, 9479, 1996; Greifinger and Greifinger, Radio Sci., 13, 831, 1978; Mushtak and Williams, JASTP, 64, 1989, 2002] and with the recent observations of SR during solar proton events and X-ray bursts [Roldugin et al., JGR, 106, 18555, 2001; JGR, 108, 1103, 2003; 2004]. Specifically in this talk, we will report comparisons of the FDTD model results with the diurnal and seasonal variability of SR parameters reported recently by Price and Melnikov [JASTP, 66, 1179, 2004]. We will also discuss variability of SR power at different locations on the Earth surface as a function of the local and universal time and provide comparisons with related experimental measurements by Sentman and Fraser [JGR, 96, 15973, 1991].

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2. H - Waves in Plasma

3. (a) G/H Lightning and Sprites

4. C - Contributed Paper

5. No special instructions