

Remote Sensing of the Night-time Lower Ionosphere from Lightning Generated Sferics Recorded in the South Pacific Region

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The lightning generated Extremely Low Frequency (ELF) and Very Low Frequency (VLF) radio signals (tweeks) recorded using the lightning detection system under *World Wide Lightning Location (WWLL) Network* at Suva (18.2° S, 178.3° E), Fiji, a low latitude ground wave station in the South Pacific region, are used to determine the lower ionospheric electron content and its variation during night-time. Due to its least relative inaccessibility, the lower ionosphere, consisting of D-region, is among the least studied regions of the Earth's atmosphere. The lightning generated sferics which are short pulses, typically of 1-10 ms with significant spectral contents over the ELF/VLF can be used in the study of the lower ionosphere. A total of 400 tweeks recorded in the time period of 1800-0600 hrs FST during 2003- 2004 have been analysed. Matlab codes are used to analyse the data files recorded using lightning software and each of data file is of 11 MB with one minute duration. The value of ionospheric reflecting height (h) calculated using waveguide mode theory of electromagnetic wave propagation in the spherical cell Earth-ionosphere waveguide having perfectly conducting boundaries is found to vary from 80-95 km in the night-time. To estimate the electron density at the ionospheric reflection heights i.e. lower ionosphere, we perform a qualitative analysis based on the propagation theory of radio waves in an infinite, collisionless, anisotropic ionospheric plasma (Shvets and Hayakawa, *J. Atmos. Sol.-Terr. Phys.*, 60, 461, 1998). The electron density (n) at the ionospheric reflecting heights is found to vary from 25-110 cm⁻³ in the altitude range of about 4 km over 88 km which agrees quite well with experimental data. This corresponds to a scale height of 1.3 km in terms of usually used exponential electron density profile. The value of reference height (z) and sharpness factor (β) estimated from variation in electron density over the reflection heights have been used to generate electron density profiles of night-time *D*-region of the ionosphere.