



## Nighttime D-region electron density measurements from VLF Higher Harmonic tweeks at low latitude Station, Varanasi, India

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The very low frequency (VLF) energy radiated by the return strokes of lightning discharges propagates in the Earth-ionosphere waveguide to large distances by the process of multiple internal reflections. These signals recorded in the conjugate region are known as sferics. The lower frequency ends of the sferics at times show cumulative dispersion and are generally termed as tweeks [1-2].

We present here analysis of tweeks with higher harmonics recorded at our low-latitude station Varanasi (geographic lat.  $25^{\circ} 20'$  N and long.  $83^{\circ}$  E), during the year 2015. The analysis of recorded tweeks during one month each from summer (August), winter (December), and equinox (March) seasons are presented. Higher harmonic tweeks up to 12 harmonics in numbers observed for the first time at our low latitude station Varanasi and the analysis shows that these higher harmonic tweeks are usually not associated with whistlers and occur when the ionization in the lower ionosphere would not increase with height. These dispersive atmospheric (tweeks) have been used to estimate the nighttime D region electron density at the ionospheric reflection height under the local nighttime propagation [3].

The summer season shows the maximum number of occurrence of tweeks as compared to that during equinox and winter seasons. We further observed that tweek (ionospheric) reflection height in the pre-midnight (18:00-00:00 LT) in winter is less as compared to that during equinox and summer. Annual (seasonal average) variation of the mean ionospheric reflection height shows a gradual increase in the reflection height.

### References:

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