Early/Fast VLF Events Observed in Florida

Robert C. Moore*
Department of Electrical and Computer Engineering, University of Florida, Gainesville, FL, 32611, http://www.vlf.ece.ufl.edu

The direct coupling of lightning energy to the overlying ionosphere is most prominently evidenced by the fantastic luminous events known as sprites, elves, and other related phenomena. Several of these luminous phenomena have been observed to be correlated in time with the scattering of subionospherically-propagating VLF signals, whose propagation characteristics are sensitive to variations in the electron density and temperature of the *D*-region ionosphere. Lightning-related ionospheric disturbances have been shown to affect wave propagation at frequencies below the very low frequency (VLF, 3-30 kHz) band through to the high frequency (HF, 3-30 MHz) band, at times creating >6 dB perturbations in signal amplitude. Because the luminous phenomena are often closely spaced in time, and due to experimental observations linking different phenomena with the same type of VLF event, there is some controversy regarding which physical mechanism is responsible for the observations of VLF scattering. Additionally, the causative lightning waveform has not yet been fully characterized with high time resolution, primarily due to the difficulty in collecting the vast data sets required to do so. Simple lightning waveform statistics (e.g., peak current) do not appear to be good predictors for the luminous ionospheric events: not every strong, positive polarity cloud-to-ground lightning discharge produces a sprite, for example. The study described herein aims to experimentally determine the phenomenological properties of the causative lightning waveform that successfully produces VLF scattering events.

In this paper, we describe a new effort at the International Center for Lightning Research and Testing (ICLRT) in Camp Blanding, Florida to perform high-resolution, wideband (30 Hz-20 MHz) observations of the lightning waveforms responsible for ionospheric effects, as determined by VLF remote sensing. We describe the event detection methods employed, and we discuss the current status of the experimental preparations.