HIGH FREQUENCY MEASUREMENTS OF PARALLEL ELECTRIC FIELDS AND WAVES IN THE IONOSPHERE OVER AN ACTIVE THUNDERSTORM

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Sounding rockets launched by the Cornell group demonstrated the existence of transient (1 ms) electric fields associated with lightning strikes at high altitudes above active thunderstorms. These electric fields had a component parallel to the Earth's magnetic field, and were unipolar and large in amplitude. They were thought to be strong enough to energize electrons and generate strong turbulence as the beams thermalized. The parallel electric fields were observed on multiple flights, but high time resolution measurements were not made within 100 km horizontal distance of lightning strokes, where the electric fields are largest. In 2000 the "Lightning Bolt" sounding rocket (NASA 27.143) was launched directly over an active thunderstorm to an apogee near 300 km. The sounding rocket was equipped with sensitive electric and magnetic field instruments as well as a photometer and electrostatic analyser for measuring accelerated electrons. The electric and magnetic fields were sampled at 10 million samples per second, letting us resolve the structure of the parallel electric field pulse up to and beyond the plasma frequency. In addition, many lightning strokes within 100 km horizontal distance of the rocket were observed.

We will present results from the Lightning Bolt mission, concentrating on the parallel electric field pulses that arrive before the whistler wave modes. We observe pulses with peak electric fields of a few mV/m lasting for a substantial fraction of a millisecond. Superimposed on this is a high-frequency signature, comparable in amplitude to the pulse itself. Parallel fields of both polarities were observed, and there was a strong decrease in parallel field strength both with increasing altitude and increasing horizontal distance from the lightning stroke. In addition, there is suggestive evidence of a reversal of the parallel electric field polarity with increasing altitude. These are the first direct observations of this structure in the parallel electric field, within 100 km horizontal distance of the lightning stroke. We will present evidence for the method of generation of these parallel fields, including evidence for the probable wave mode, and will discuss their probable effect on ionospheric electrons.

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2. H - Waves in Plasma

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4. I - Invited Paper, Program chair: Steve Cummer

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