High-Resolution, Low-Frequency Electric field measurements on an Auroral Sounding Rocket Experiment

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The NASA SIERRA rocket mission was a multiple-payload experiment which flew into a 100 nT auroral substorm at altitudes up to 735 km over the Poker Flat Research Range in Alaska on January 14, 2002. The SIERRA experiment was composed of electric field instruments, magnetometers, and particle detectors. Here we examine the high resolution and high sensitivity electric field results from the three payloads. The particle instrumentation indicates an equatorward region of inverted-V electron precipitation followed by a poleward region of mostly field-aligned suprathermal electron bursts. In the inverted-V region, the electric field varies inversely with the intensity of the electron precipitation, and the index of refraction implies a static FAC closing in the ionosphere. In the poleward precipitation region, the electric field is much larger, with values exceeding 100 mV/m and periods of 0.5-5 s and indices of refraction indicative of Alfvén wave activity. We examine the coherency and phase of the fields to determine if the waves should be reflected. We compare the wave Poynting flux with dispersed electron signatures, and our reflection expectations, and we use the multiple payload observations to estimate perpendicular scale-sizes.