A ROCKET-BASED STUDY OF AURORAL ELECTRODYNAMICS WITHIN THE CURRENT CLOSURE IONOSPHERE

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ABSTRACT: The Auroral Current and Electrodynamics Structure (ACES) mission consisted of two sounding rockets launched nearly simultaneously from Poker Flat Research Range, AK on January 29, 2009 into a dynamic multiple-arc aurora. The ACES rocket mission, in conjunction with the PFISR Radar, was designed to observe the three-dimensional current system of a stable auroral arc system. ACES utilized two well instrumented payloads flown along very similar magnetic field footprints, at various altitudes with small temporal separation between both payloads. ACES High, the higher altitude payload (apogee 360 km), took in-situ measurements of the plasma parameters above the current closure region to provide the input signature into the lower ionosphere. ACES Low, the low-altitude payload (apogee 130 km), took similar observations within the current closure region, where cross-field currents can flow. We present results comparing observations of the electric fields, magnetic fields, electron flux, and the electron temperature at similar magnetic footpoints between both payloads. We further present data from all-sky imagers and PFISR detailing the evolution of the auroral event as the payloads traversed regions connected by similar magnetic footpoints. Current measurements derived from the magnetometers on both payloads are further compared. We examine data from both PFISR and observations on the high-altitude payload which we interpreted as a signature of electron acceleration by means of Alfvén waves. We further examine all measurements to understand ionospheric conductivity and how energy is being deposited into the ionosphere through Joule heating. Data from ACES is compared against models of Joule heating to make inferences regarding the effect of collisions at various altitudes.