SPIDER multi-point measurements to investigate the multi-scale structure of an auroral electrojet.

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The SPIDER sounding rocket released ten Free Flying Units (FFUs) in the ionospheric E region (100 to 120 km) during its February 2016 flight. Each FFUs was equiped of four spherical electric field probes (high impedance probes close to the floating potential) deployed on 2-meter long wire booms, and four spherical Langmuir probes mounted on 1-meter long wire boom. These instuments were designed to measure the plasma properties and electric field vector in the auroral electrojet. At these ionospheric altitudes, the electric field is expected to induce a relative drift motion between the electrons and ions, thus exciting electrostatic waves in a process refered as Farley-Buneman instability. By providing multi-point measurements via its ten FFUs, the SPIDER experiment aimed at characterizing such non-linear coupling between the waves on various spatial scales.

Although only six FFUs were successfully recovered after landing, the recording data presents interesting results. Plasma properties (electron density and temperature) were sucessfully retrieved for two FFUs (short-circuits due to wobble motion corrupted the data for the other FFUs). Local distubances in the plasma were observed simulatenously between the two FFUs along their respective trajectory, revealing the 3D structure of the aurora. Similarly, the electric field (i.e. projection on the FFU plane) was successfully retrieved in the Earth coordinate system for four FFUs. Although the direction of electric field vector shows some spread along the FFUs trajectories, correlation on the electric field direction was observed between all four FFUs.

This presentation will discuss the spatial and temporal evolution of the plasma properties and electric field along the FFUs trajectories in the context of ground based optical and radar measurements, demonstrating the capability of multi-point *in-situ* measurements for auroral studies.