Observations of Mesoscale and Microscale Space Weather Processes on the Canadian CASSIOPE Enhanced Polar Outflow Probe (e-POP)

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CASSIOPE is a Canadian small satellite scheduled for launch in late 2007 into a polar orbit (300 $\times$ 1500 km, 80° inclination). The scientific objective of its Enhanced Polar Outflow Probe (e-POP) payload is to make observations of mesoscale and microscale space weather processes in the topside polar ionosphere at the highest-possible resolution, specifically to study the microscale characteristics of plasma outflow and related plasma processes, the occurrence morphology of neutral escape, and the effects of auroral currents on plasma outflow and those of plasma microstructures on radio propagation. The e-POP payload will carry a suite of 8 scientific instruments, including imaging plasma and neutral particle sensors, magnetometers, dual-frequency GPS receivers, CCD cameras, a radio wave receiver and a beacon transmitter. It will utilize the large (terabyte) data storage and downlink capacity (up to 350 megabits/s and 15 gigabytes per day) onboard to support the planned high-resolution observations. The imaging plasma sensors will measure particle distributions and the magnetometers will measure field-aligned currents on the time scale of 10 ms and spatial scale of $\sim$100 m. The CCD cameras will perform auroral imaging on the time scale of 100 ms. The GPS and radio-wave receivers will perform near real-time imaging studies of the ionosphere in conjunction with ground-based radars, and the beacon transmitter in conjunction with ground receiving stations. In this paper, we discuss planned investigations of plasma outflow, wave propagation, and related space weather processes using these observations.