Molecular Ion Up-flows and Hot Oxygen Atoms in Magnetosphere-Ionosphere-Thermosphere Coupling

*Andrew W Yau¹, Victoria Foss¹, Bernard D. Shizgal²

1. University of Calgary, 2. University of British Columbia

The CASSIOPE Enhanced Polar Outflow Probe (e-POP) has been in operation since its launch into a polar orbit in September 2013. In the present study, we use the high-resolution in-situ data from e-POP to investigate a specific magnetosphere-ionosphere-thermosphere (MIC) coupling process: the acceleration and up-flows of molecular ions in the auroral ionosphere and the subsequent production of hot neutral oxygen atoms. Specifically, we present observations of enhanced molecular NO⁺ and possibly O₂⁺ ion densities in the F-region and topside ionosphere (up to ~1000 km altitude), and density and temperature estimates of the hot oxygen atoms resulting from the dissociative recombination of the observed ions: we obtain these estimates by solving the Boltzmann equation for the collisional relaxation between the non-thermal nascent and ambient oxygen atoms, and compare them with previous observations and theoretical model predictions.

Keywords: magnetosphere, ionosphere, thermosphere, molecular ions, oxygen