# Space-ground coordinated observations of subauroral ion drifts (SAID)

*Toshi Nishimura[1,2], Bea Gallardo-Lacourt[1], Larry Lyons[1], Eric Donovan[3], Vassilis Angelopoulos[1]

1. University of California, Los Angeles, 2. Boston University, 3. University of Calgary

Duskside plasma convection is often enhanced at narrow latitudes just equatorward of the electron auroral oval (subauroral polarization streams or SAPS). The latitudinal extent of the flows can occasionally become less than a degree with the peak speed exceeding a few km/s. Those are called subauroral ion drifts (SAID), and their formation mechanism and differences from SAPS have been key issues in subauroral magnetosphere-ionosphere coupling.

We aim at understanding occurrence timing and magnetospheric drivers of SAID by using optical imaging, radars, and low-altitude and magnetospheric satellites. Interestingly, although SAID is a subauroral phenomenon where we do not generally expect localized precipitation, all-sky imager data during a subset of SAID events showed a latitudinally narrow (~0.5 deg) auroral arc adjacent to SAID. This unique auroral feature allowed us to optically trace evolution of SAID. We found that SAID was preceded by substorm injections and SAPS, and that subsequent injections without strong proton injection resulted in SAID. This different injection behavior was confirmed by the NOAA and DMSP satellites. DMSP also showed that the bulk of the region-2 field-aligned currents (FACs) are confined to the SAID latitudinal extent. In one of the events, one of the THEMIS satellites crossed the earthward boundary of the electron plasma sheet and detected SAID with much narrower L-shell separation between electron and ion inner boundaries.

These observations indicate that SAID has a similar quasi-steady structure to SAPS both in the ionosphere and magnetosphere except for the latitudinal extent, but the type of particle injection is quite different from SAPS events; namely the injections are dominated by electrons and give much smaller separation with the ion inner boundary.

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