

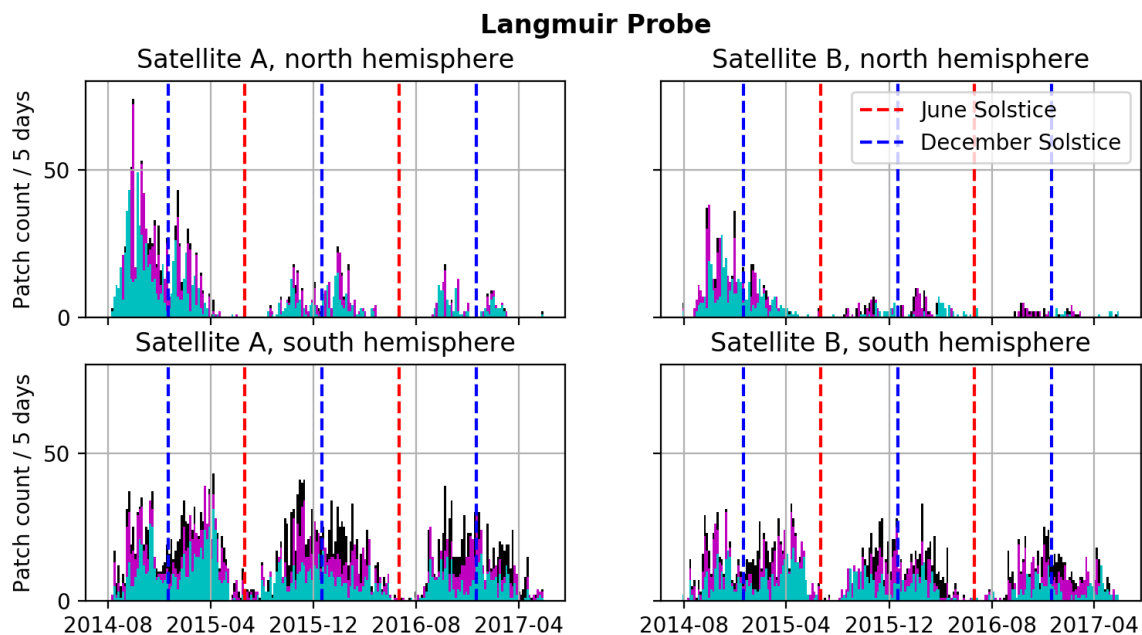
# Ionospheric Polar Cap Patches Observed in Antarctic Summer using Swarm

Alex T. Chartier<sup>1</sup>, Cathryn N. Mitchell<sup>2</sup>, Ethan S. Miller<sup>1</sup>

<sup>1</sup> Johns Hopkins Applied Physics Laboratory, Laurel MD 20723

<sup>2</sup> University of Bath, Claverton, Bath, BA2 7AY

Dense, fast-moving regions of ionization called patches are known to occur in the high-latitude F-region ionosphere. Patches are widely believed to be caused by convection of dense, sunlit plasma into a dark and therefore low-density polar cap. Therefore patches are not expected to be found in summer. Counter to previous reports, a long-term analysis of Swarm ionospheric measurements shows that patches typically occur in the same calendar months across both hemispheres, with very few around June in either hemisphere. This finding is surprising because it means there are many patches in southern hemisphere summer, and very few in southern hemisphere winter. Therefore current patch formation theories are incomplete and the physical cause of this annual variability remains unknown.



**Figure 1:** Patch detections between August 2014 and June 2017 using Swarm A and B Langmuir probe data. This algorithm (D3) uses a new absolute test related to 81-day averaged  $F_{10.7}$  values to determine the presence of patches. Black indicates patches above  $55^\circ$  MLAT, magenta above  $70^\circ$  MLAT and cyan above  $78^\circ$  MLAT