BIRKELAND CENTRE
FOR SPACE SCIENCE

Hemispheric and seasonal variations in the cold plasma outflow source region: polar cap ionosphere electron density at 350–500 km

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KEY POINTS

- We use ~15 years of Swarm/CHAMP polar cap plasma density N_e, adjusted for altitude and solar activity variations (Appendix A in pre-print, doi:10.1002/essoar.10502854.1)

1. Polar cap N_e is anti-symmetric with respect to IMF *By* in each hemisphere

2. Polar cap N_e decreases with decreasing *Dst* index

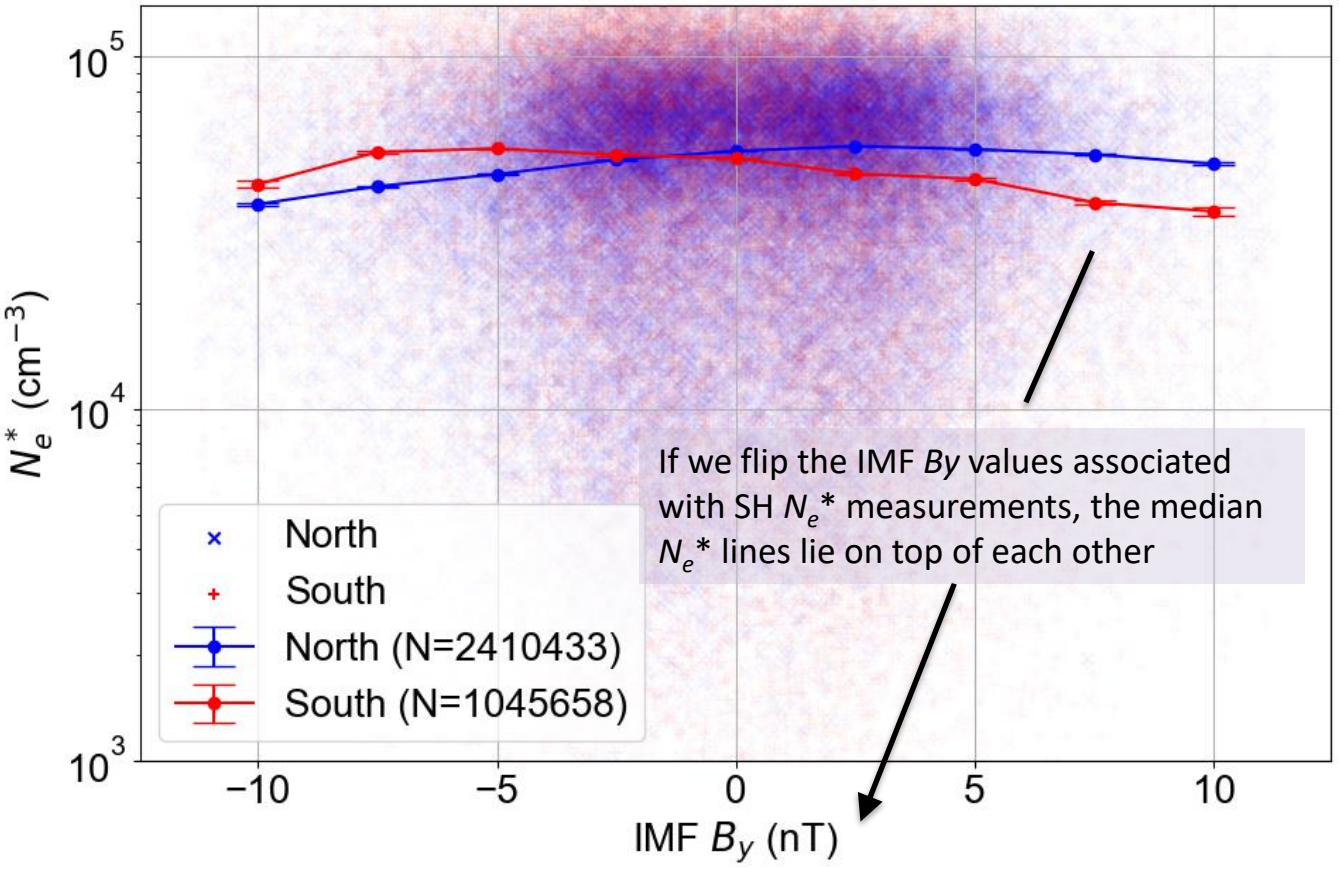
3. Increased solar wind driving «destructively interferes» with overall seasonal polar cap N_e trends at June and December solstices

UNIVERSITAS BERGENSIS
UNIS The University Centre in Svalbard
NTNU Det skapende universitet

1. POLAR CAP N_e VARIATIONS WITH IMF *By*

WHAT THIS FIGURE SHOWS

- Red and blue lines indicate median N_e* in each hemisphere as a function of IMF *By*
- **In Northern Hemisphere:** N_e* tends to increase with increasing IMF *By*
- **In Southern Hemisphere:** N_e* tends to decrease with increasing IMF *By*



Definitions

Polar cap: |MLat| ≥ 80°

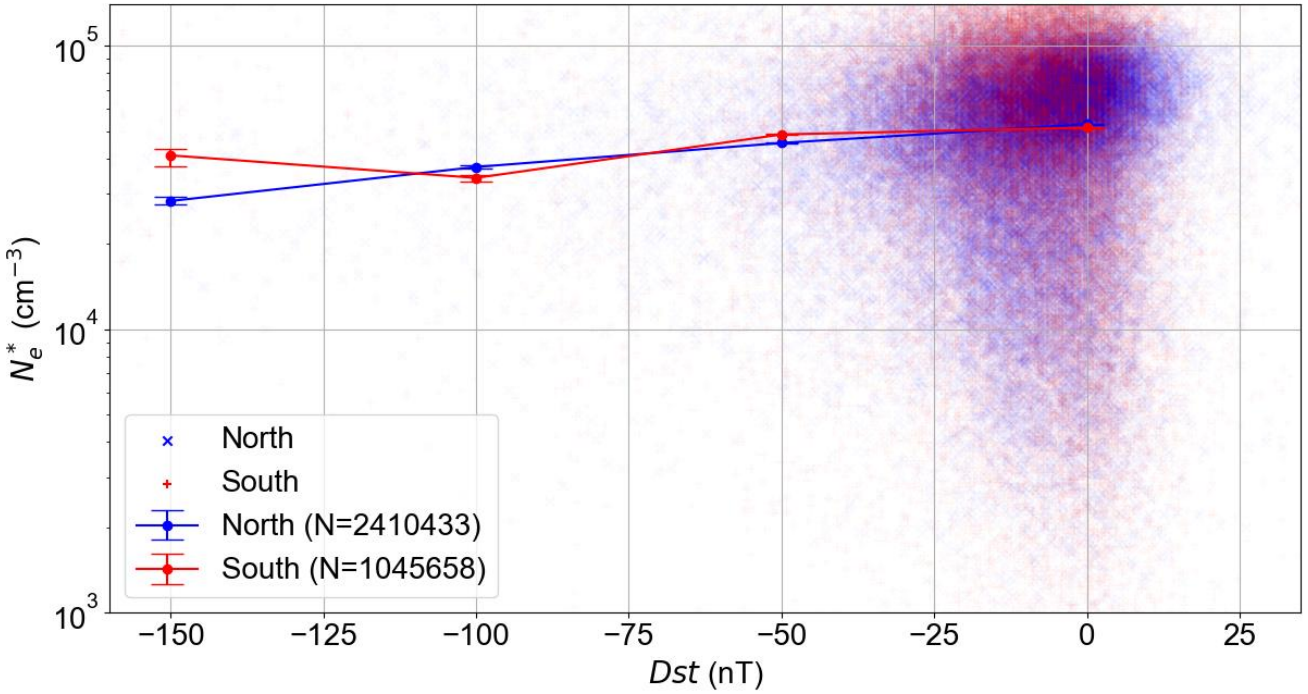
MLat: Magnetic latitude, Apex coordinates

N_e* : Solar activity- and altitude-adjusted polar cap plasma density (see key points)

2. POLAR CAP N_e VARIATIONS WITH *Dst* INDEX

WHAT THIS FIGURE SHOWS

- Red and blue lines indicate median N_e* in each hemisphere as function of *Dst* index
- **In both hemispheres:** N_e* tends to decrease with decreasing *Dst* index
- In other words, **N_e* tends to decrease with increasing geomagnetic activity**
- **→What is the cause of this?**



Definitions
Polar cap: |MLat| ≥ 80°
MLat: Magnetic latitude, Apex coordinates
N_e* : Solar activity- and altitude-adjusted polar cap plasma density (see key points)

3. POLAR CAP N_e VARIATIONS WITH SOLAR WIND DRIVING

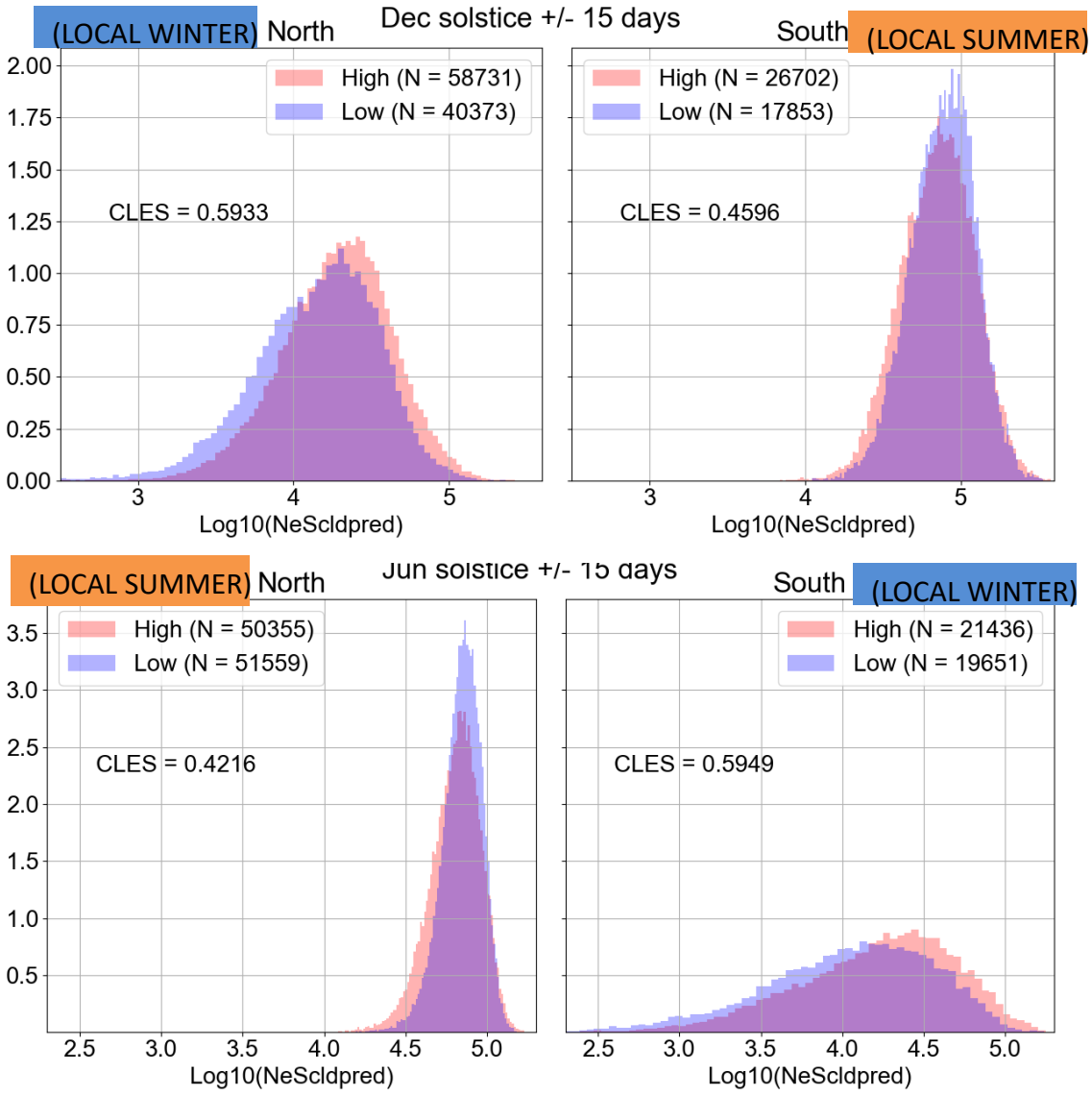
WHAT THESE HISTOGRAMS SHOW

- NH statistics in LH column, SH in RH column
- Stats around Dec solstice are in top row
- Stats around Jun solstice are in bottom row
- *x* axis shows $\log_{10}$ Ne*

- **During LOCAL WINTER:**
  N_e* distribution shifted to overall **HIGHER** values for "High" solar wind driving relative to distribution under "Low" solar wind driving

- **During LOCAL SUMMER:**
  N_e* distribution shifted to overall **LOWER** values for "High" solar wind driving relative to "Low" solar wind driving

- **QUESTION: Why is high solar wind driving associated with a shift to lower densities during local summer, and a shift to higher densities during local winter?**



Definitions

High: $d\Phi/dt > 4421(km/s)^{4/3}(nT)^{2/3}$

Low : $d\Phi/dt < 4421(km/s)^{4/3}(nT)^{2/3}$

CLES: «Common language effect size» statistic