

living planet symposium | BONN 23–27 May 2022

TAKING THE PULSE
OF OUR PLANET FROM SPACE



ROLE OF PARTICLE PRECIPITATION IN DIFFERENT ALTITUDES

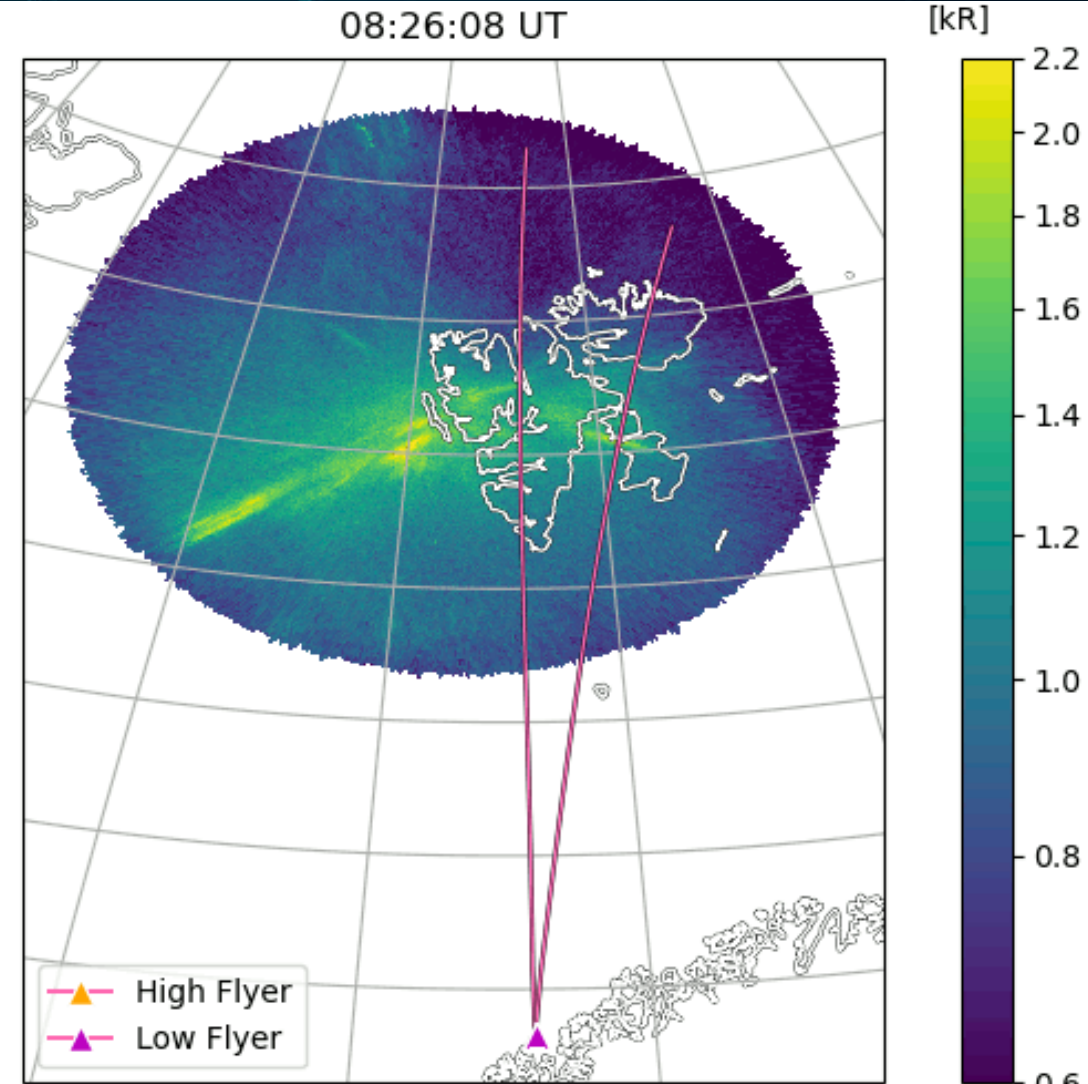
Lisa Buschmann, PhD Candidate, University of Oslo

25.05.2022

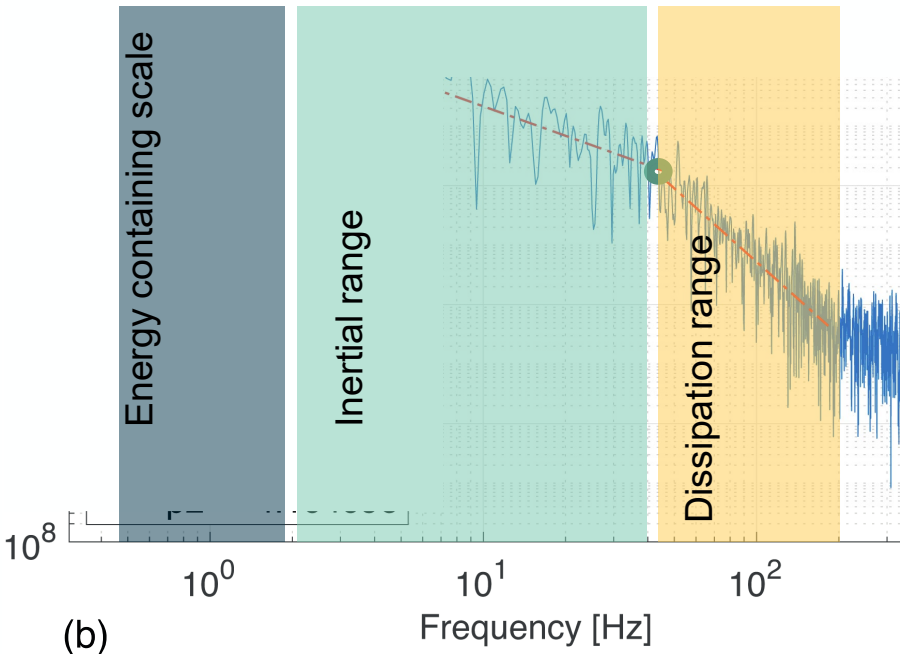
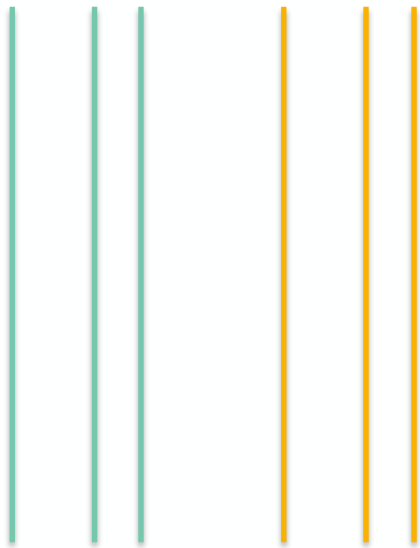
- TRICE-2 Mission
 - Information about the TRICE-2 mission
 - Analysis of the Power Spectra
 - Results TRICE-2 mission
- Swarm Mission
 - Overview about the Swarm Mission
 - Analysis of the Power Spectra
 - Results Swarm mission
- Summary and Outlook

TRICE-2 Mission (GCI Cusp)

- Twin Rocket Experiment that flew on December 08th, 2018 from Andøya (Norway)
- Launched 2 minutes apart into the cusp at 2 different altitudes
- Active green and red aurora
- Multineedle Langmuir Probe (mNLP)
 - Obtains electron density with cadence of 10kHz
 - Very high resolution
 - EEPAA, Electric Field Measurements, Ground Based Measurements

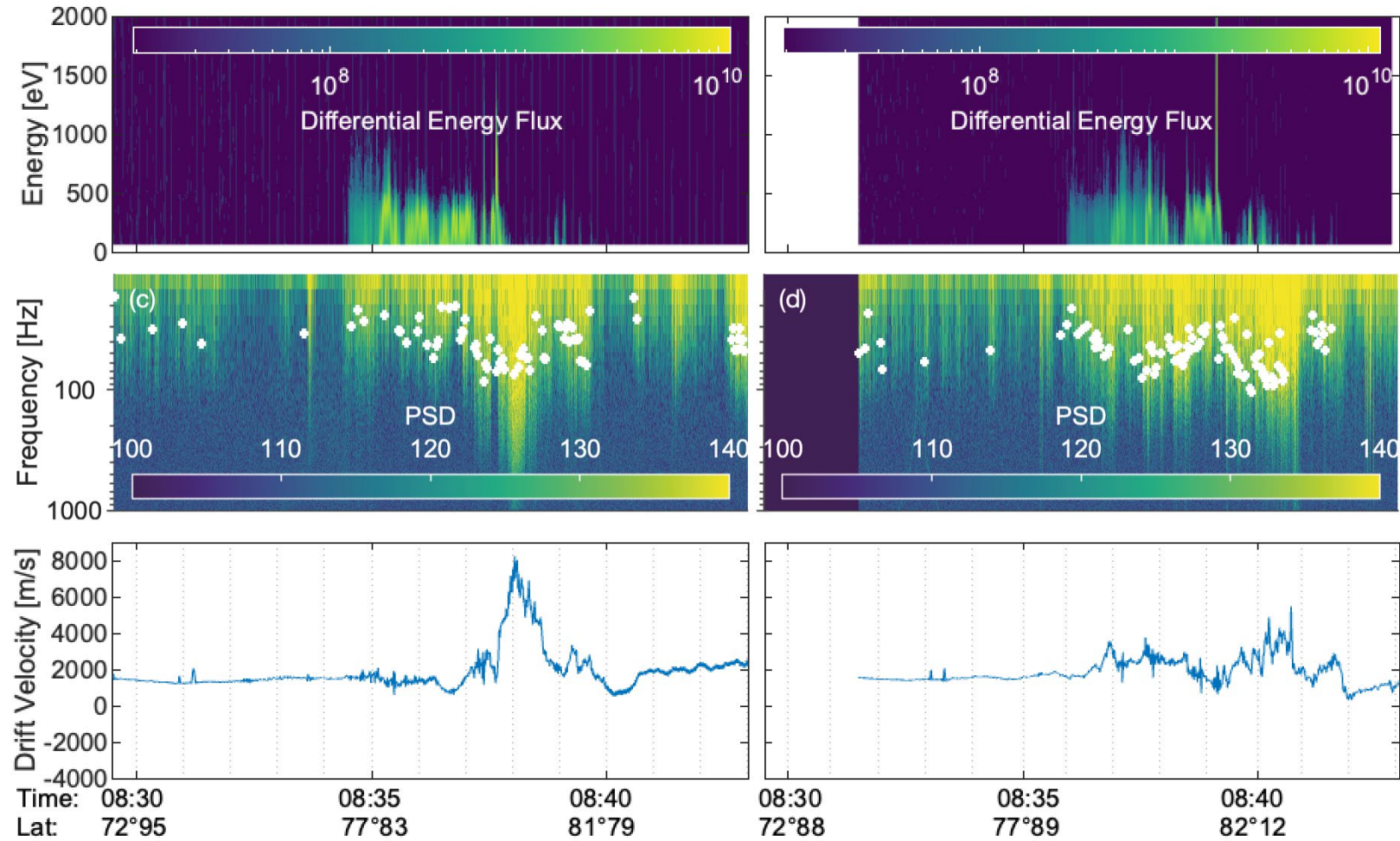


Power Spectra Analysis



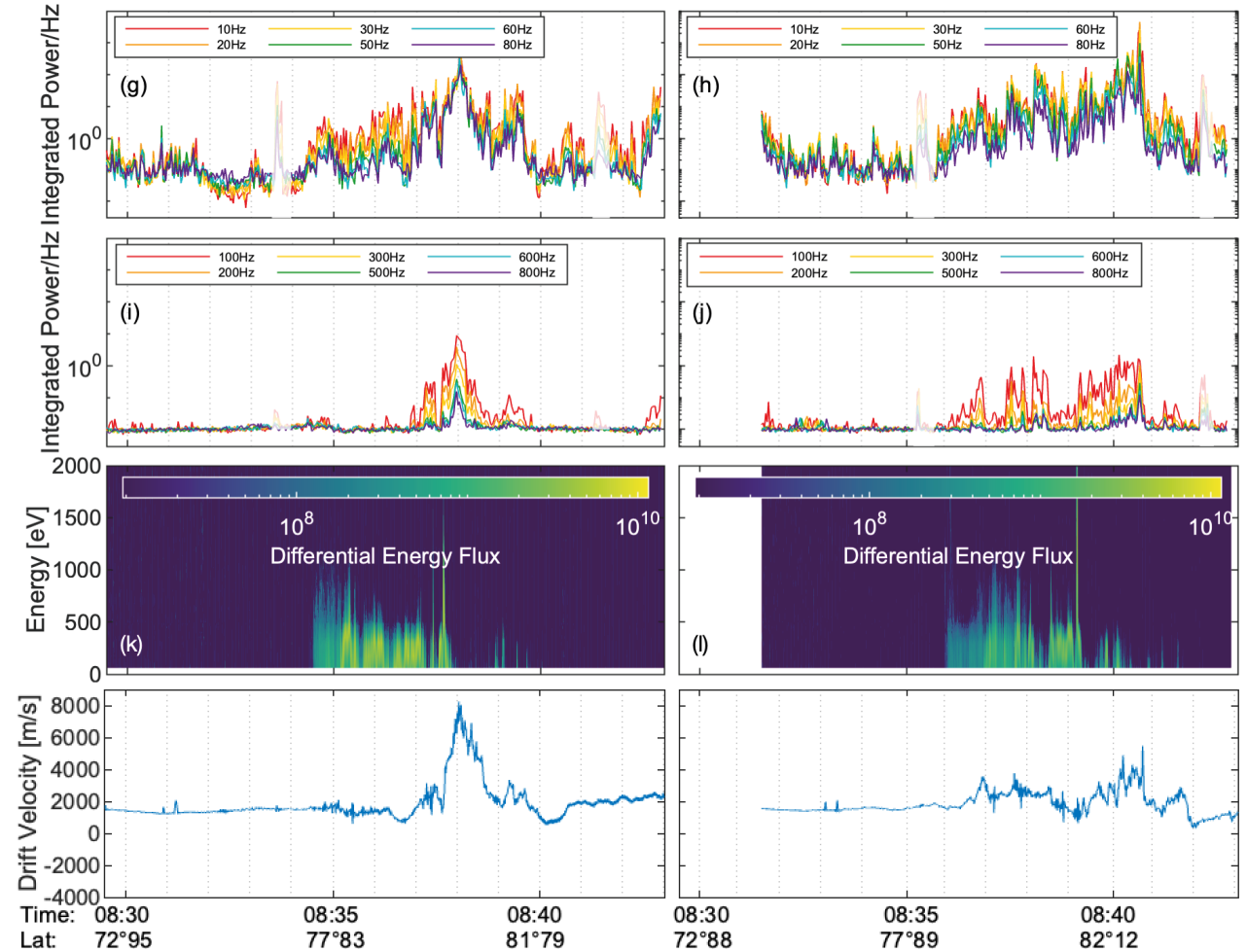
Results Rocket Data

- Begin of precipitation coincides with begin of double slopes
- The overall course of the spectral break frequency follows the absolute drift velocity
 - Doppler Shift?
- Low frequencies elevated throughout the whole flight
- High frequencies only elevated through certain times
 - Integrated power peaks seem to fall into precipitation gaps
 - High Flyer: All frequencies elevated
 - Low Flyer: 1-200Hz more elevated than the rest



Precipitation Data courtesy of the University of Iowa
Electric Field Data courtesy of the University of California, Berkeley

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Precipitation Data courtesy of the University of Iowa
 Electric Field Data courtesy of the University of California, Berkeley

Conclusion (TRICE-2)

- Spectral breaks and integrated power from PSD rather follow the electric field than the particle precipitation
- However
 - Enhancements of the density and integrated power seem to fall into gaps of the precipitation
 - Double slopes start with the onset of precipitation
- Precipitation may trigger irregularities but the overall course seems to rather follow the electric field

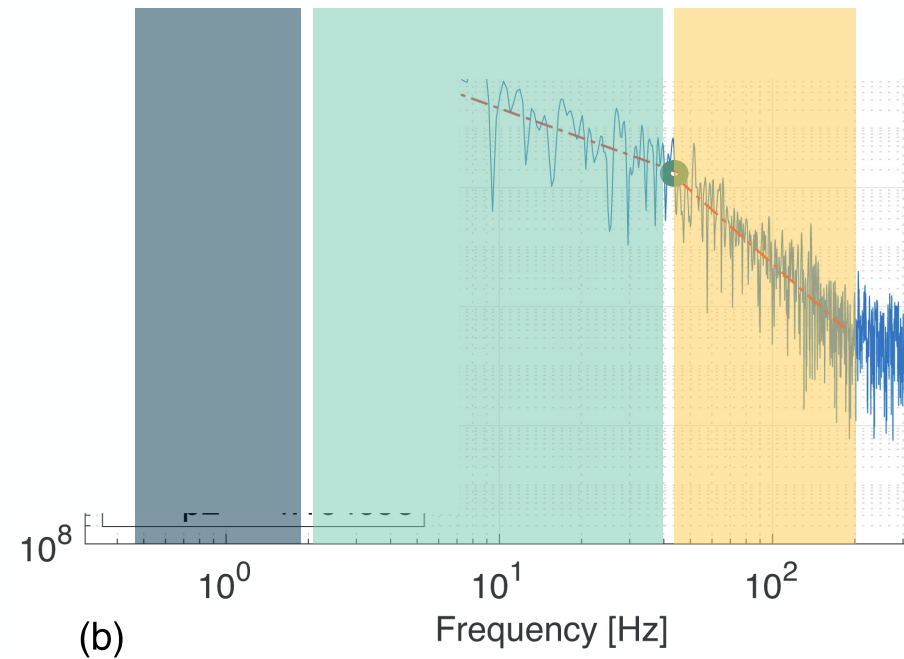
- More than 2 years of Swarm A data
 - October 2014 – December 2015
 - January 2021 – December 2021
- 16 Hz Faceplate Electron Density Data
 - Power Spectra for 1 Minute intervals
 - FAC as a measure of particle precipitation, ROD, ROT and 50Hz magnetic field data



Power Spectra Analysis

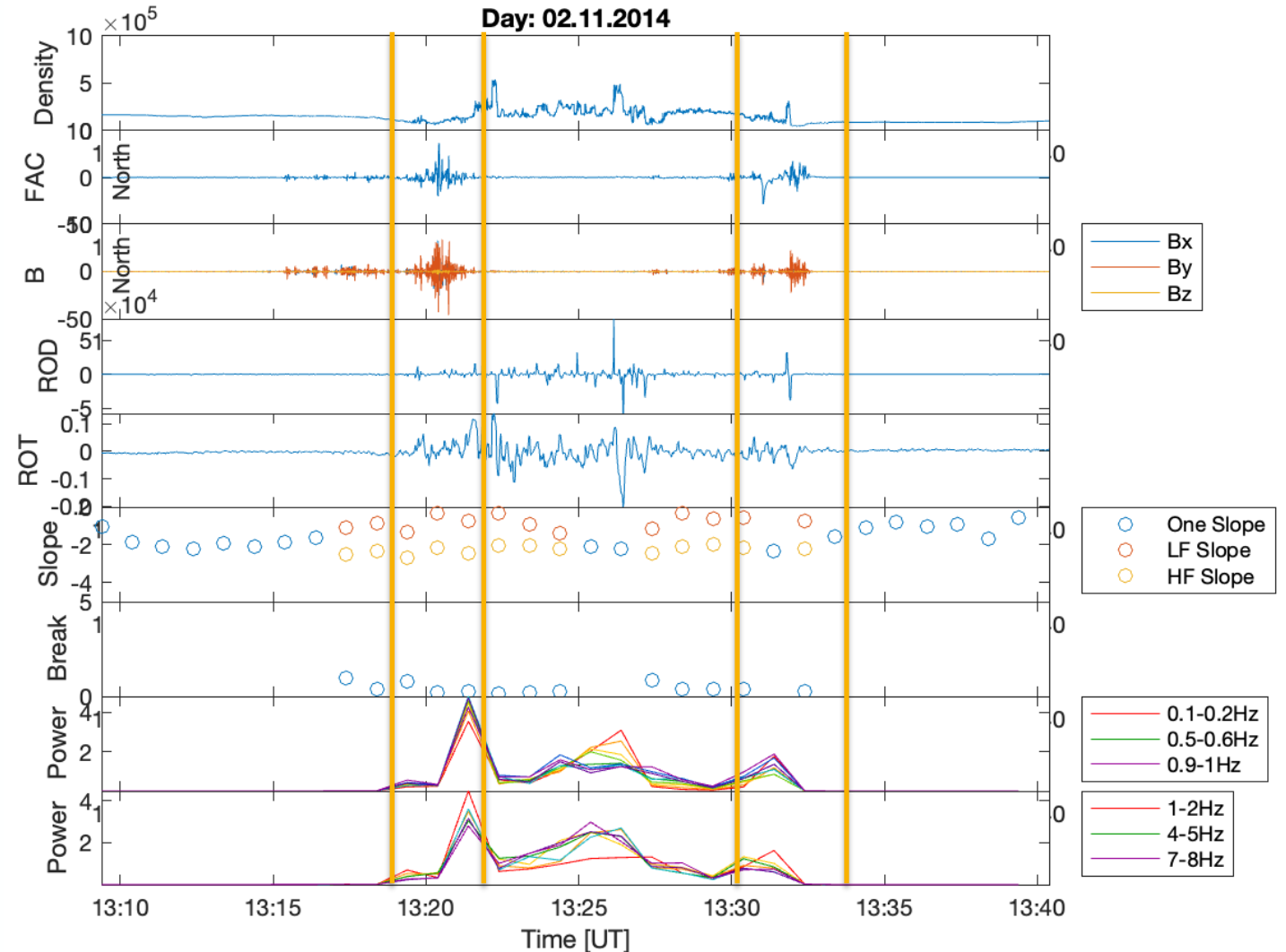
Trice-2 Data: 10kHz
Trice-2 av. Velocity ~ 2.5km/s
Scales: Down to meters

Swarm Faceplate Data: 16Hz
Swarm av velocity: ~ 8km/s
Scales: ~ 500-1000m



Swarm Preliminary Results

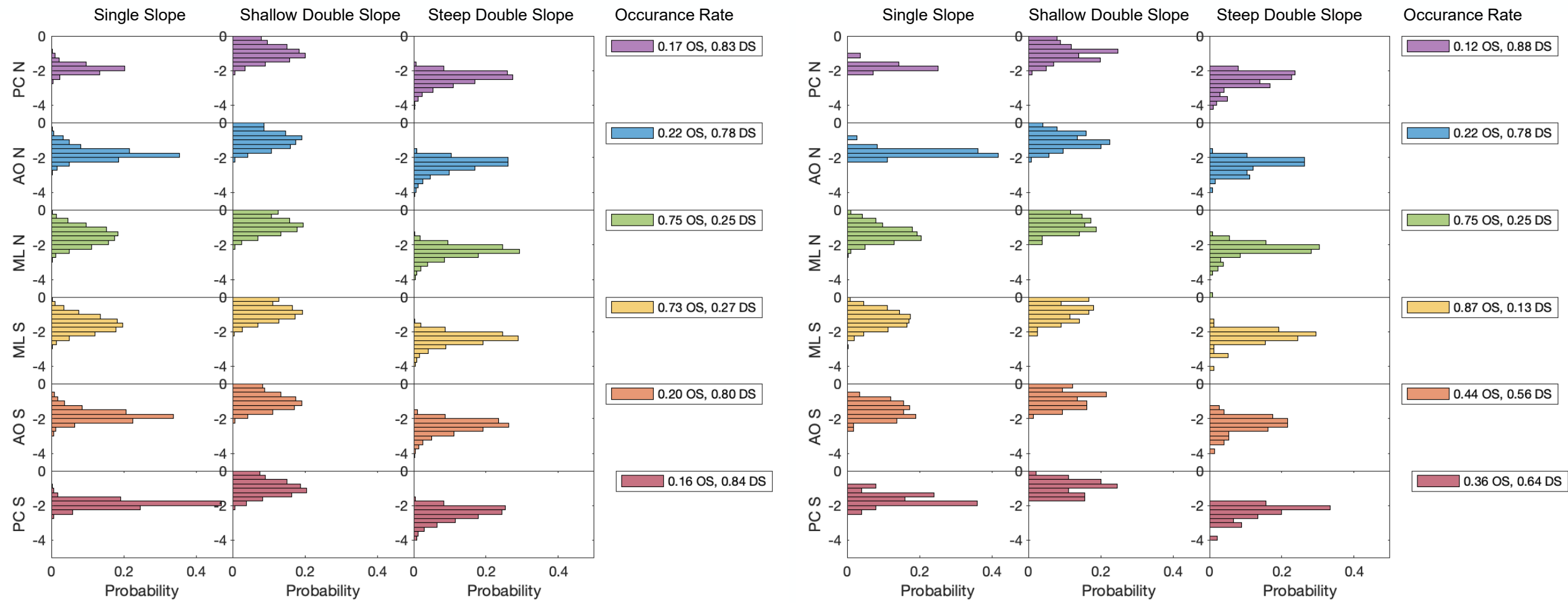
- Divide into 3 sections
 - Mid Latitudes (ML)
 - Auroral Oval (AO)
 - Polar Cap (PC)
 - Distinction between northern (N) and southern (S) hemisphere
 - No further distinction between day and night side
- Higher integrated power within AO and PC
 - Higher integrated power in 2014/2015 compared to 2021
- Higher occurrence rates of double slopes within AO and PC



Swarm Preliminary Results



Occurance of Single (OS) or Double Slopes (DS) in 2014/2015 and 2021



Conclusion and Outlook (Swarm)

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 - Double slopes start with the onset of precipitation
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- Increase in integrated power and occurrence of double slopes within Auroral Oval and Polar Cap
 - Higher integrated power in PSD in 2014/2015 than 2021
- Asymmetry in occurrence of double/single slopes around solar minimum

- Take 50Hz magnetic field data into account for more in depth analysis of the FAC
- Widen data range from 2 years to the range 2014-2022

Thank you!