



International  
Centre for  
Radio  
Astronomy  
Research

# A census of ionospheric activity with MWA EoR

**Christopher Jordan,**  
Cathryn Trott and John Morgan



THE UNIVERSITY OF  
WESTERN AUSTRALIA



International  
Centre for  
Radio  
Astronomy  
Research

# Unexpected, exciting developments in ionospheric imaging

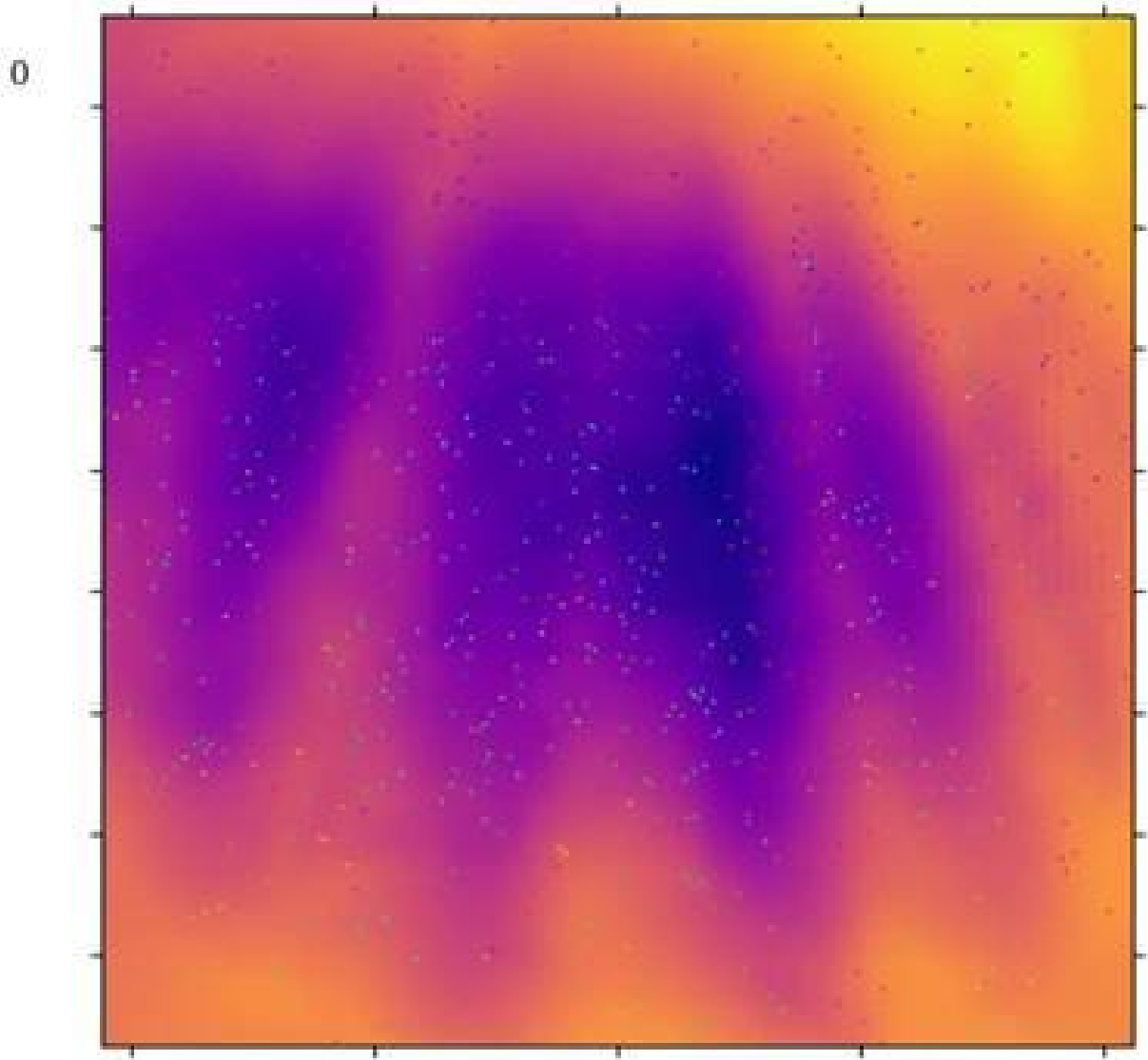
*A census of ionospheric activity with MWA EoR*

**Christopher Jordan,**  
Cathryn Trott and John Morgan



THE UNIVERSITY OF  
WESTERN AUSTRALIA

# Motivation





# Motivation

---

**How does the ionosphere affect us?  
Can we understand and remove its effect?  
Can we predict poor observing conditions?**

# MWA → ionospheric imager

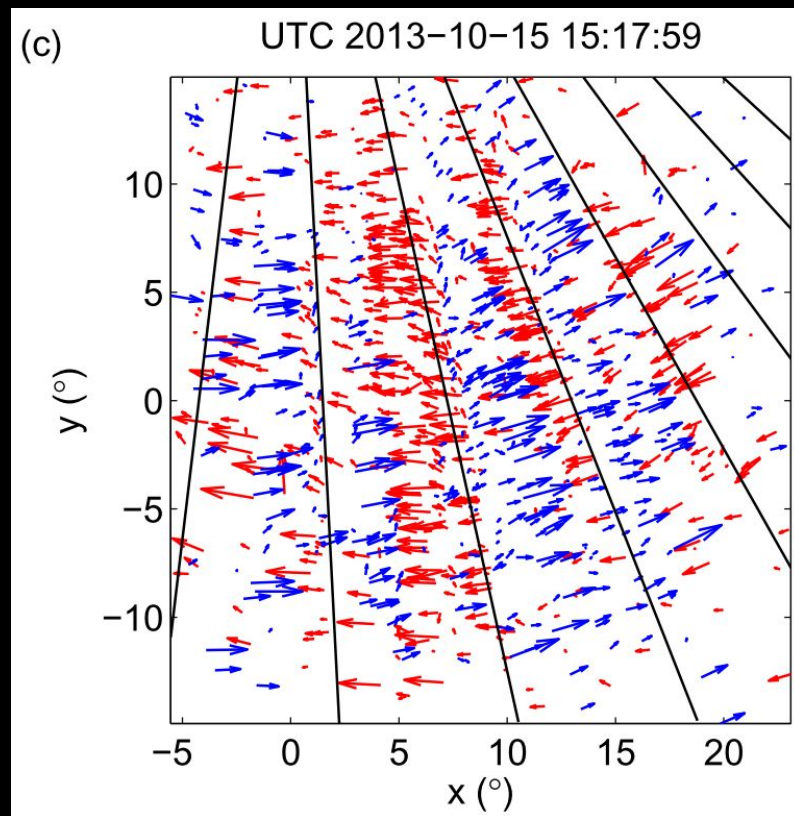
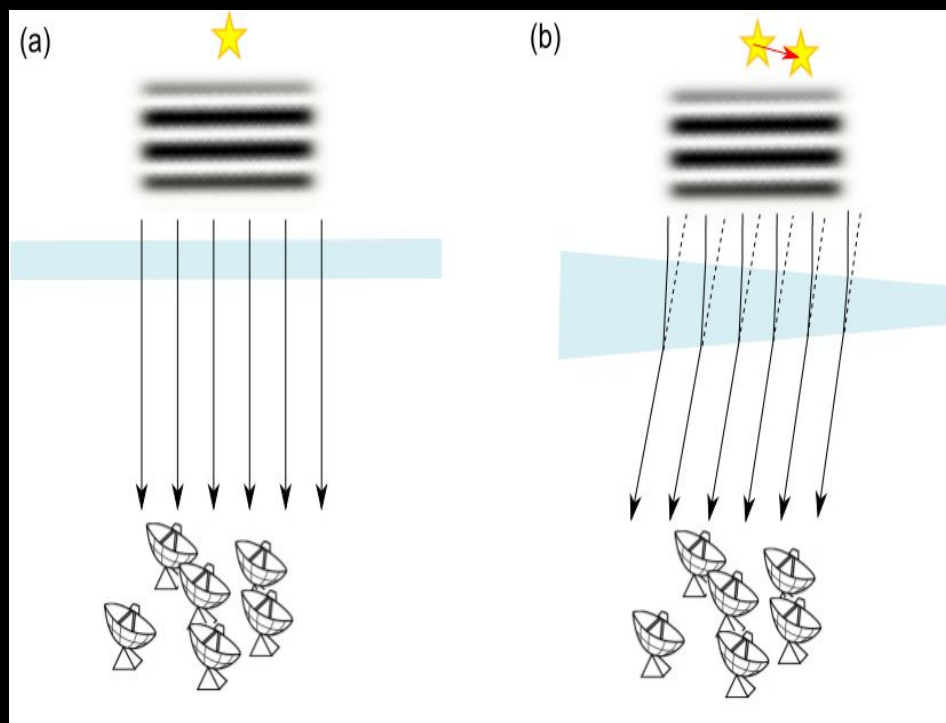
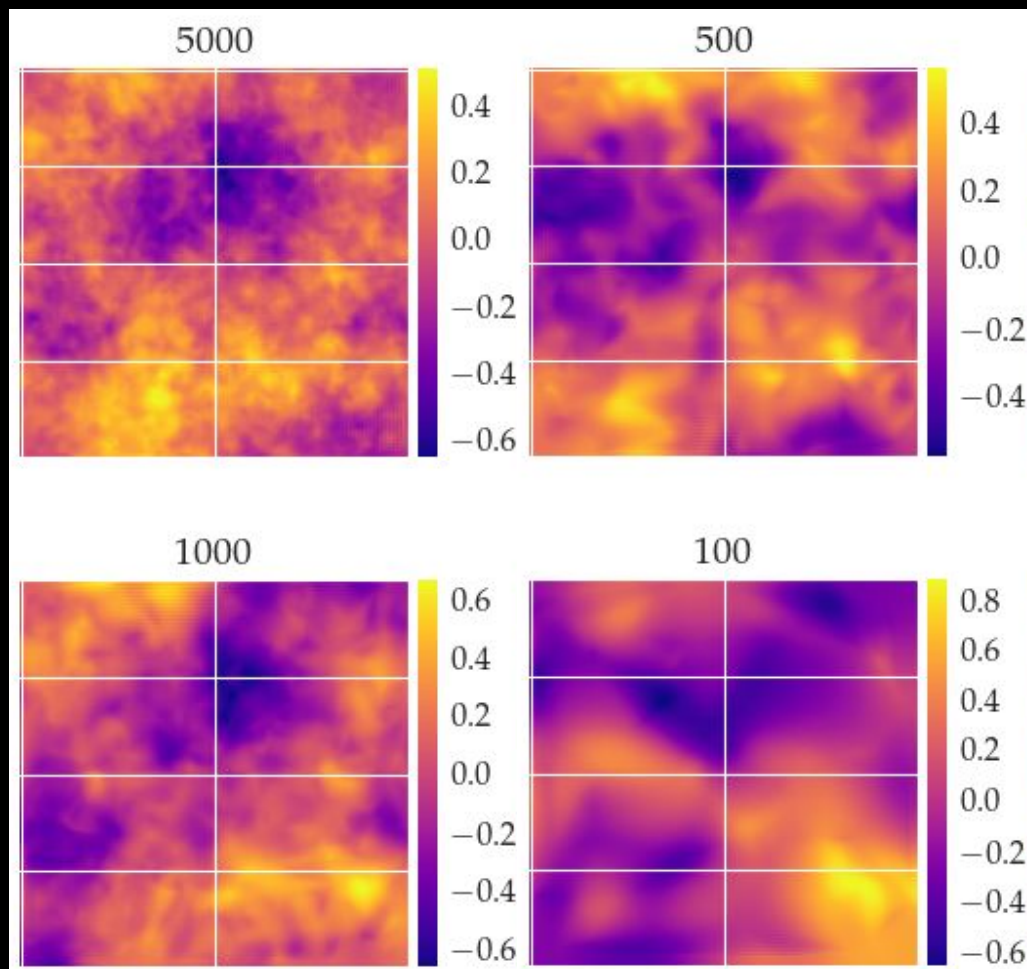
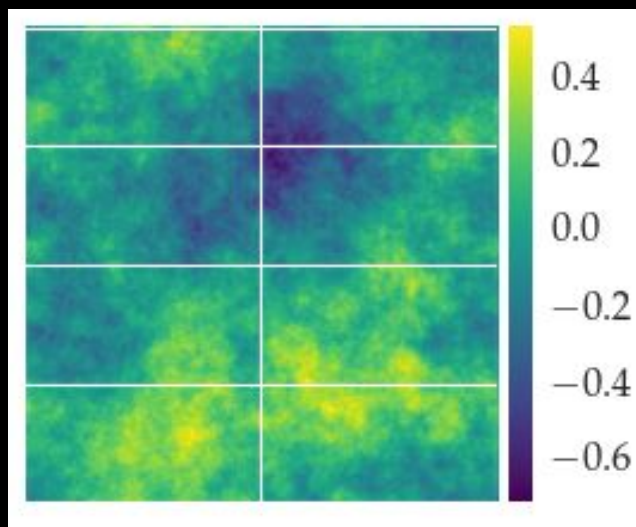


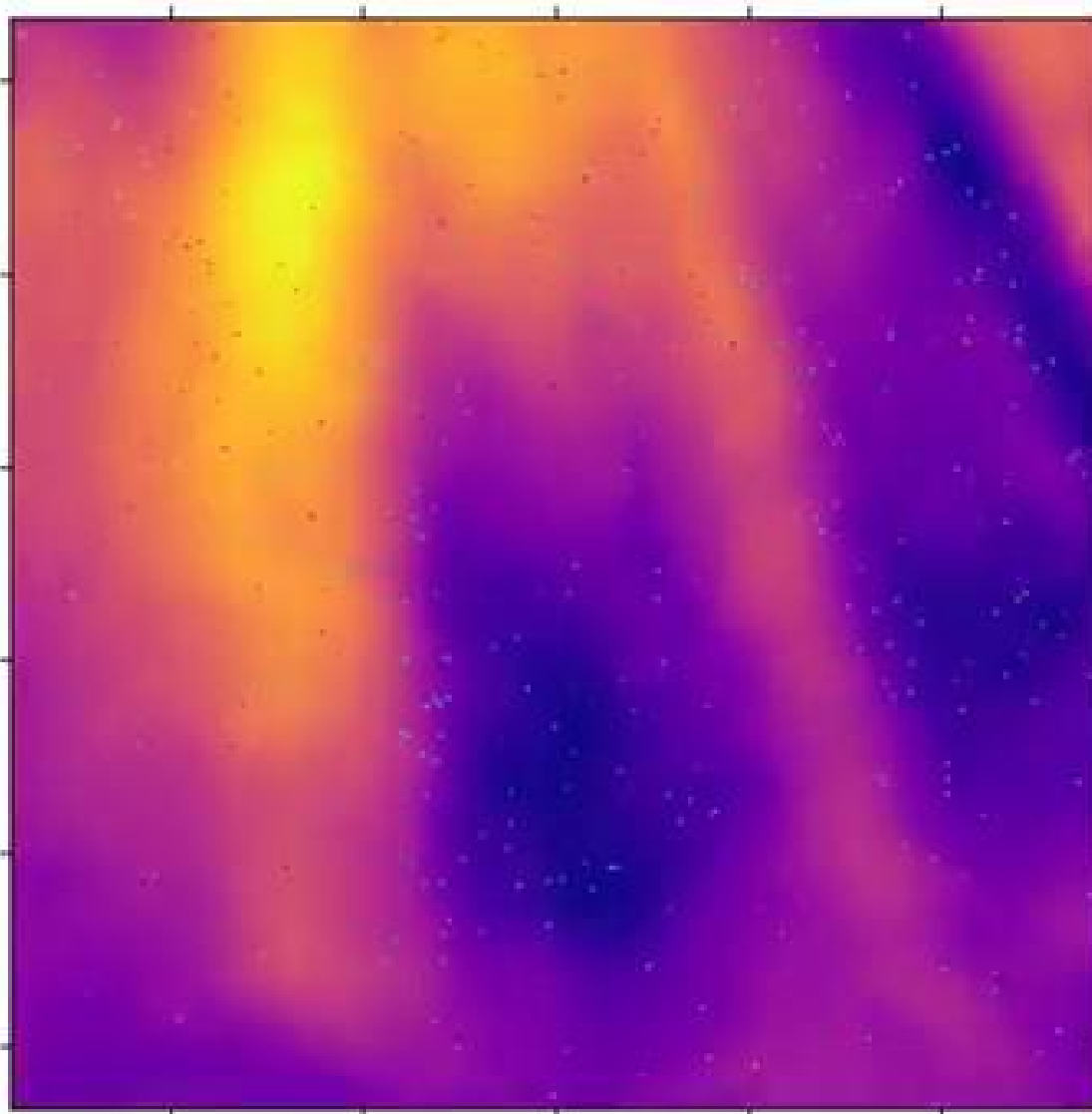
Figure credit (x2): Loi+ 2015

“The Harker–O’Leary method”  
(Harker M., O’Leary P., 2015)



# TEC reconstruction

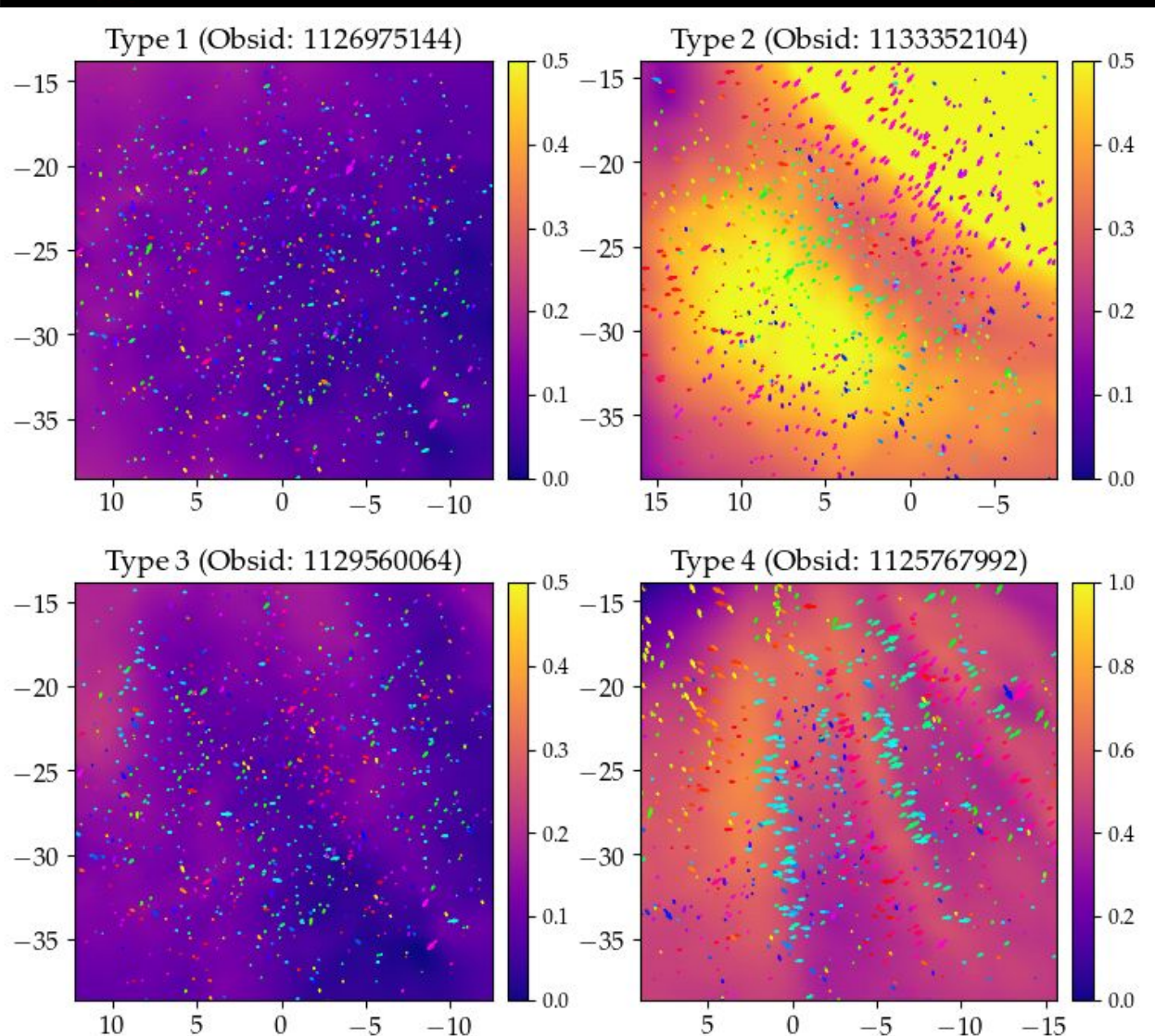
256



# “Characterisation of the ionosphere above the Murchison Radio Observatory using the Murchison Widefield Array”

- 927 two minute observations in 2015
- Analyses demonstrating our ability to determine ionospheric activity
  
- MNRAS, accepted July 2017

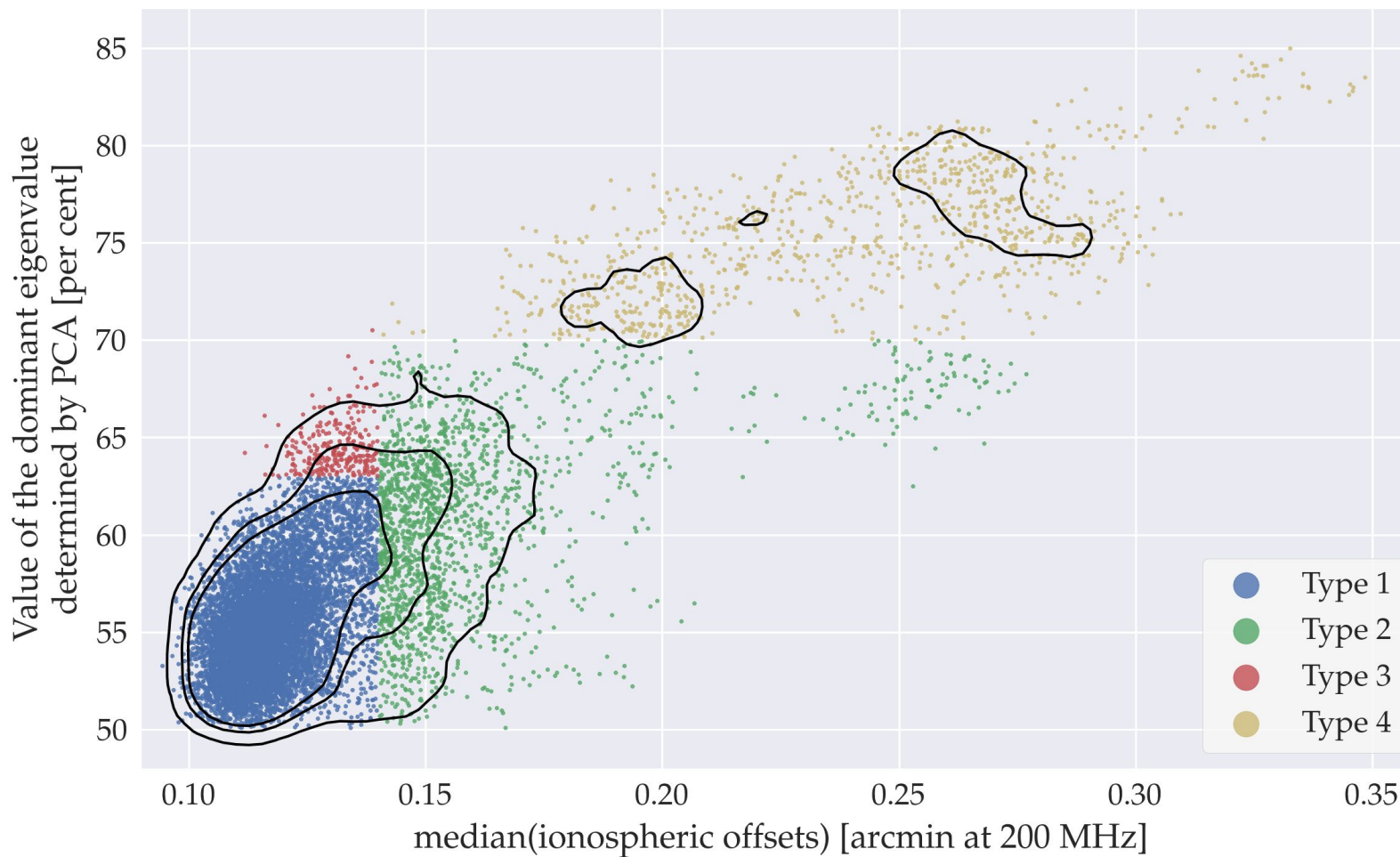




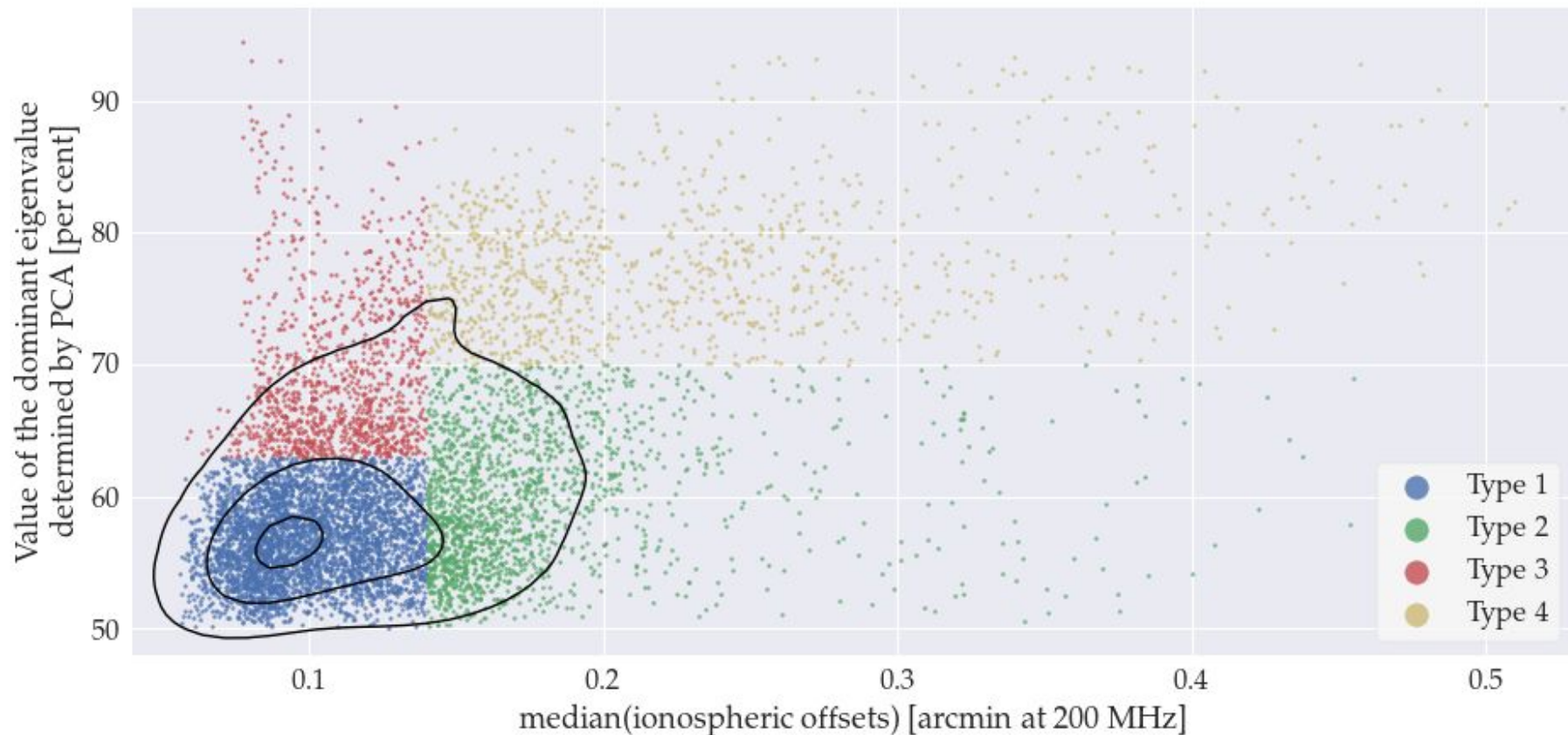
Four “types” identified:

- “quiet”
- “large scale”
- “anisotropic”
- “stormy”

# Ionospheric types

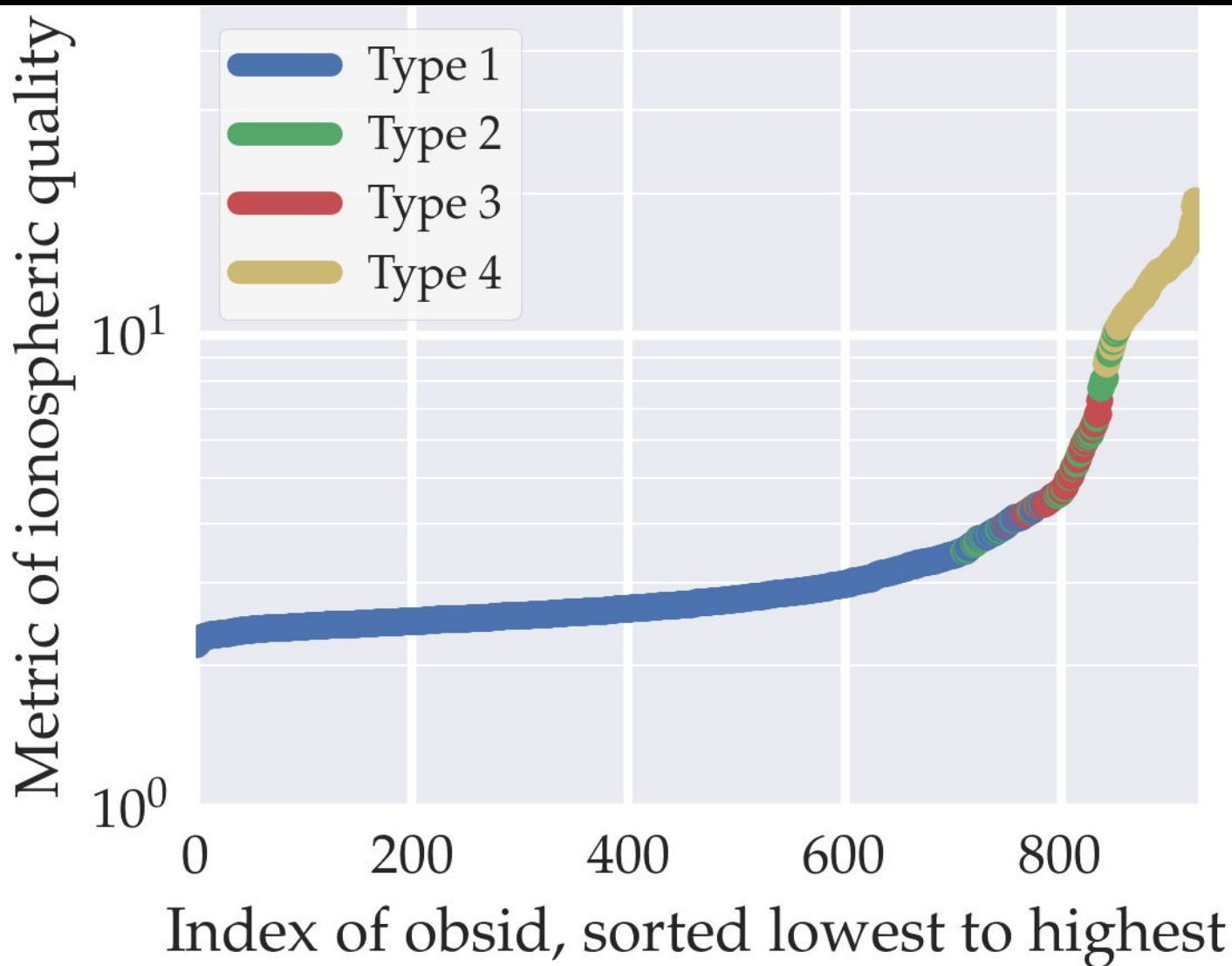


**Types 1-4: 74%, 15%, 2.3%, 8.4%**



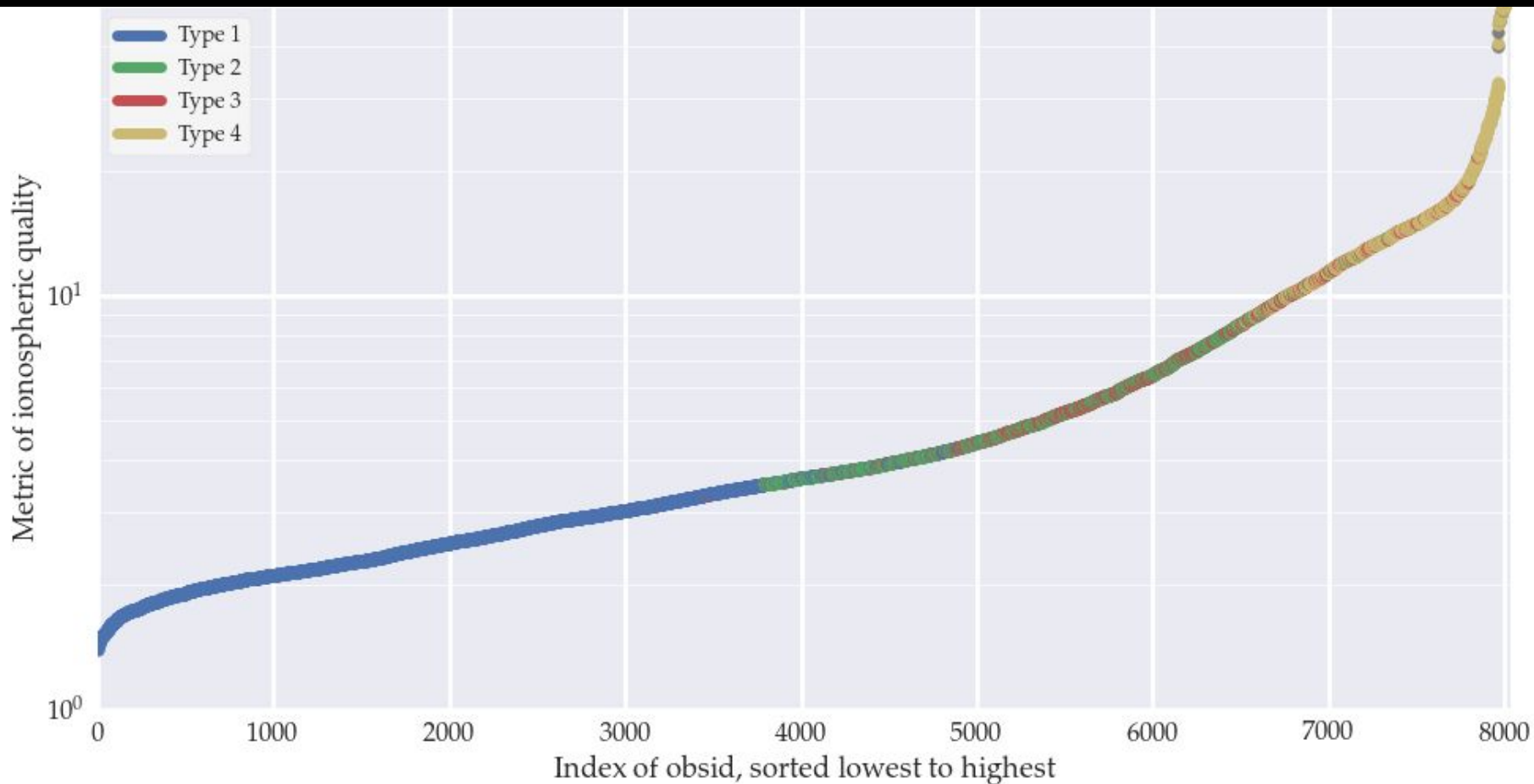
**Types 1–4: 50%, 23%, 14%, 13%**

# Ionospheric types



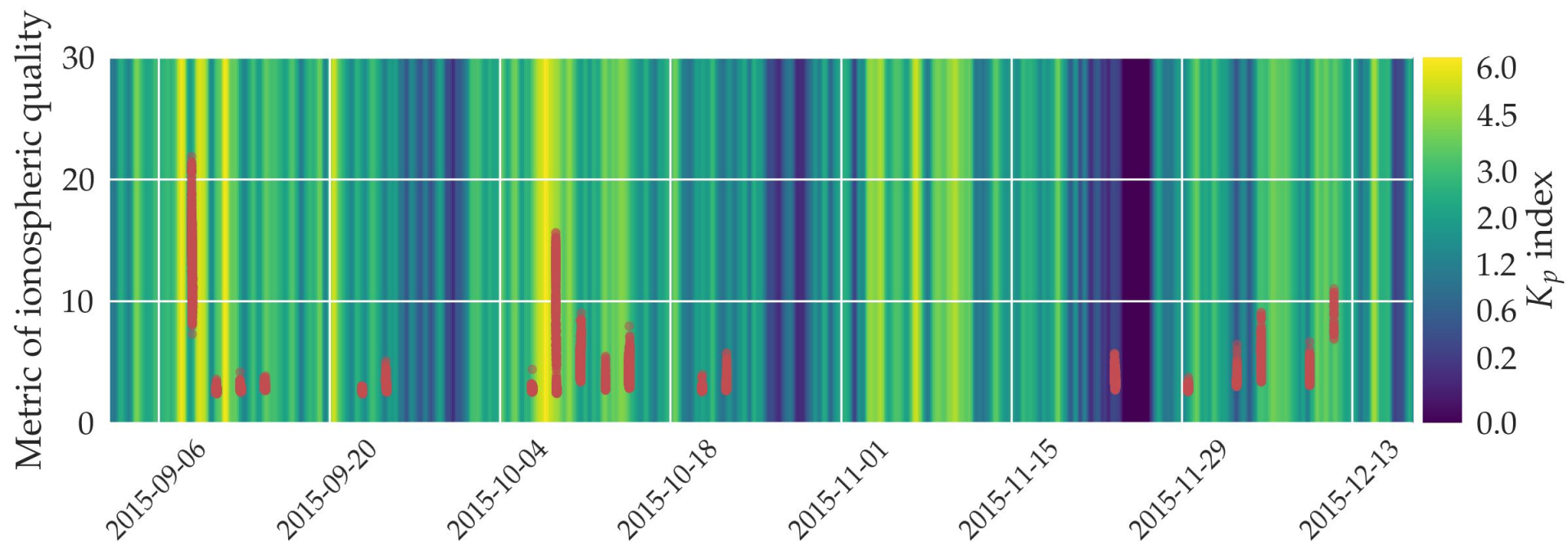


# Ionospheric types

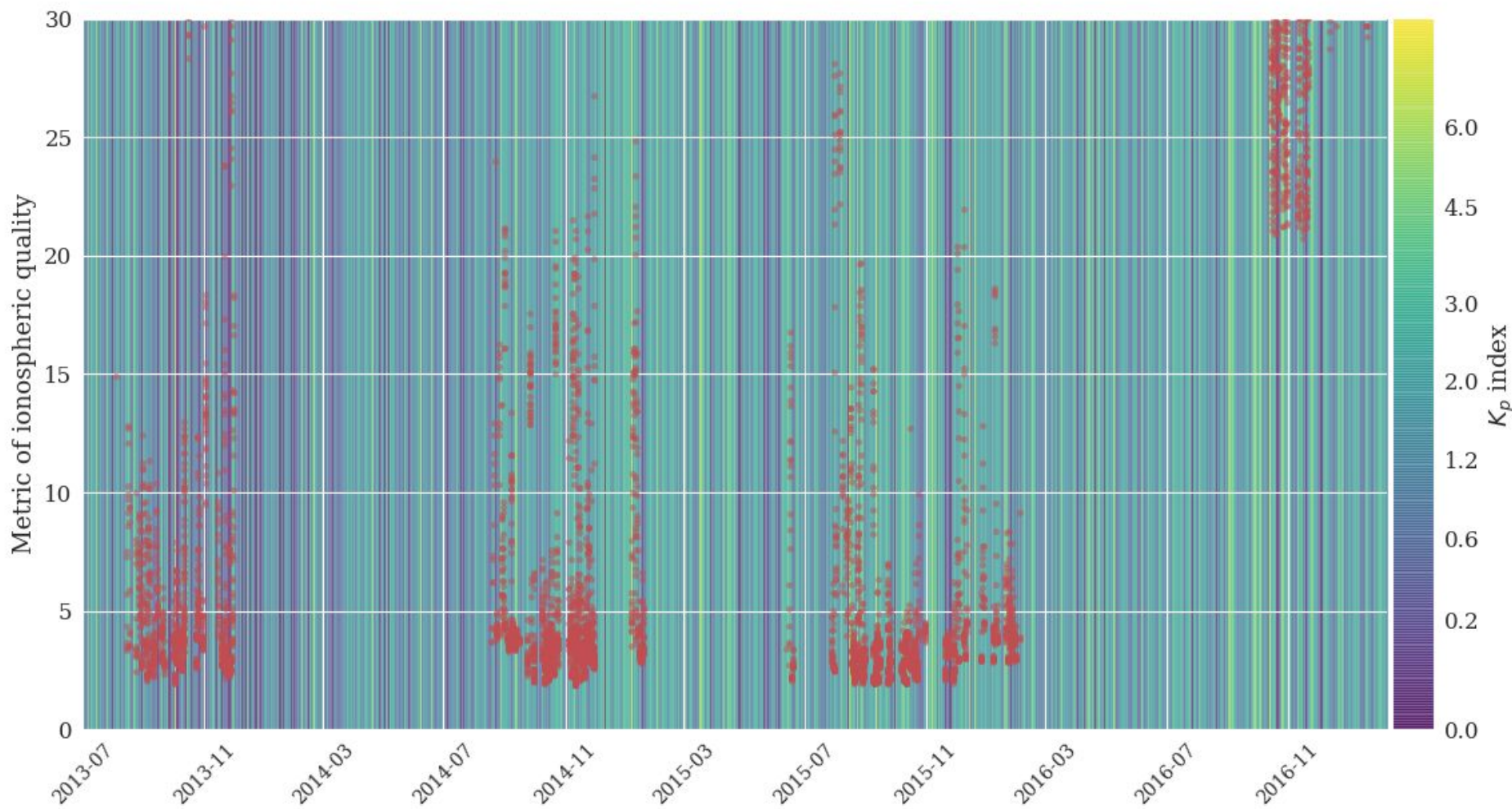




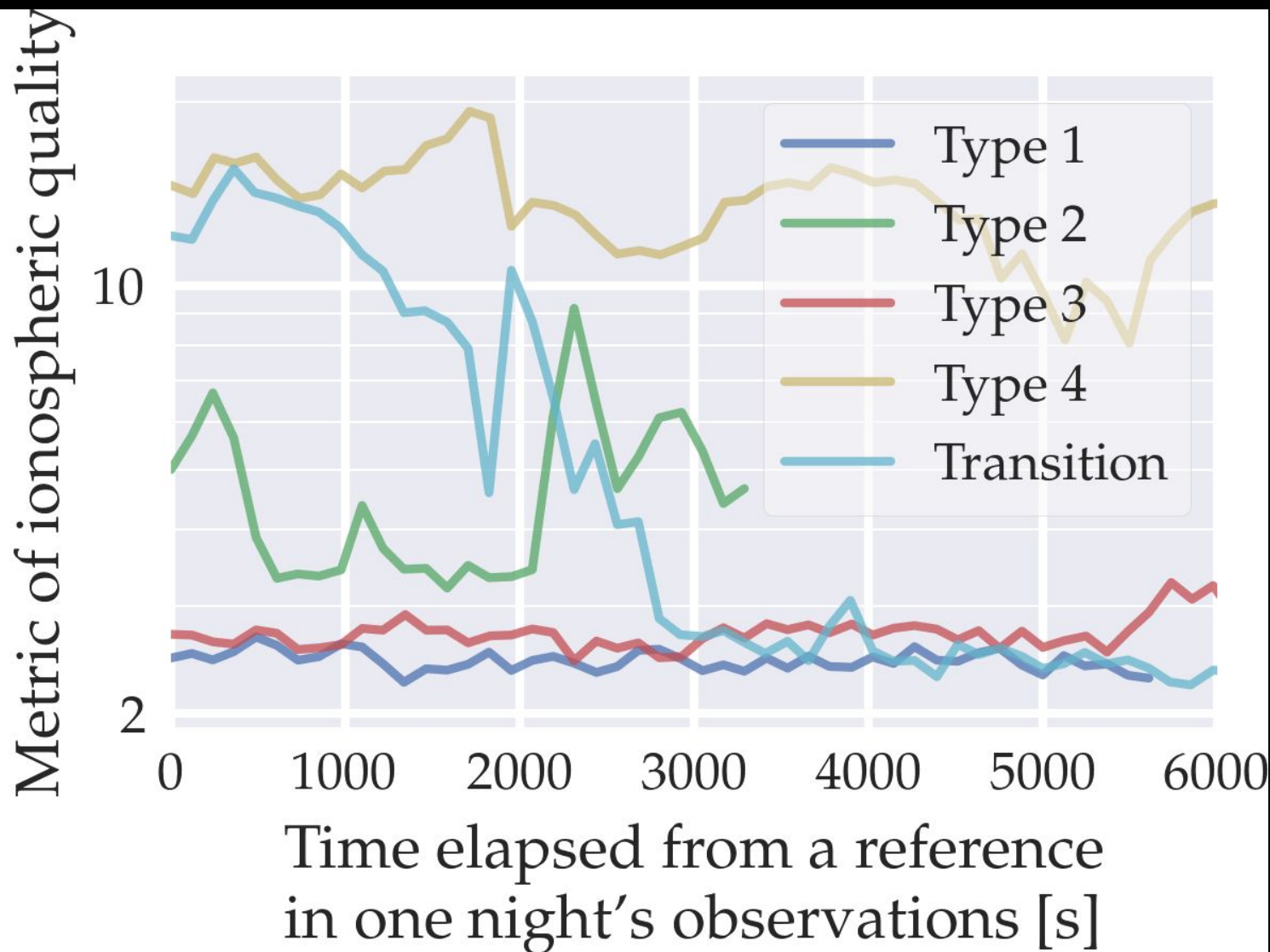
# Comparison with Kp indices



# Comparison with Kp indices



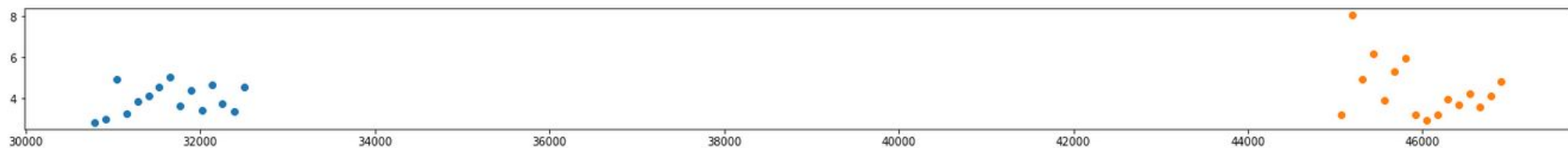
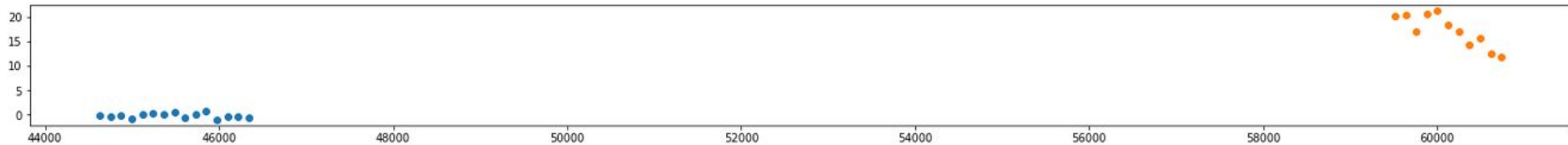
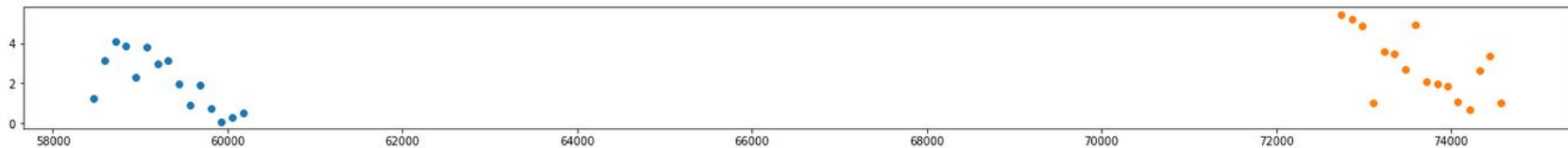
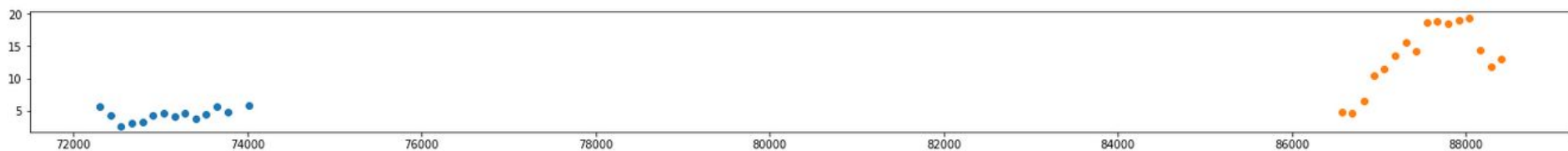
# Variability





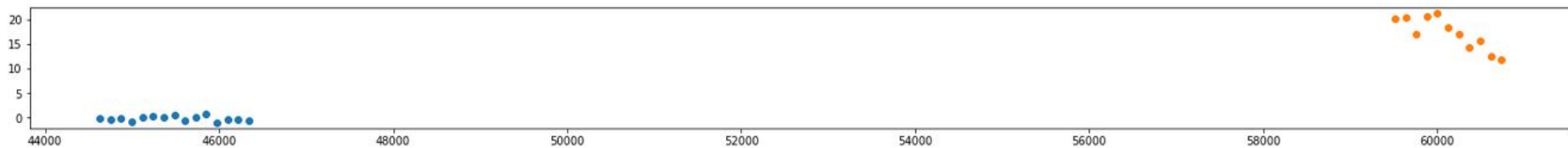
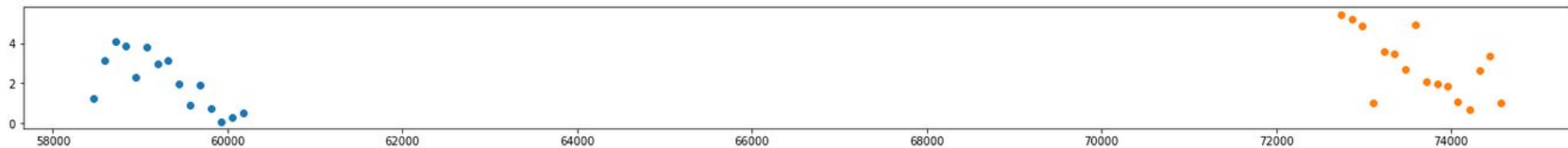
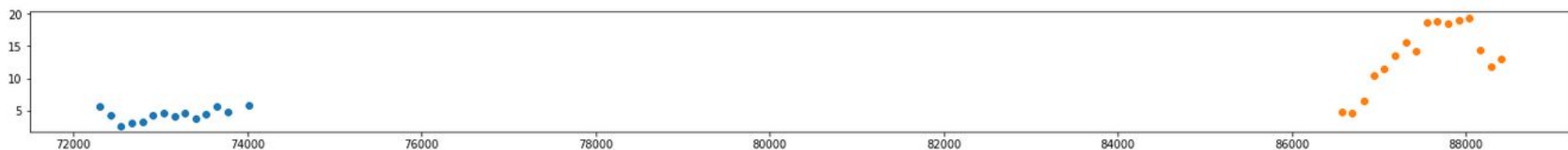


# Looking for variability...

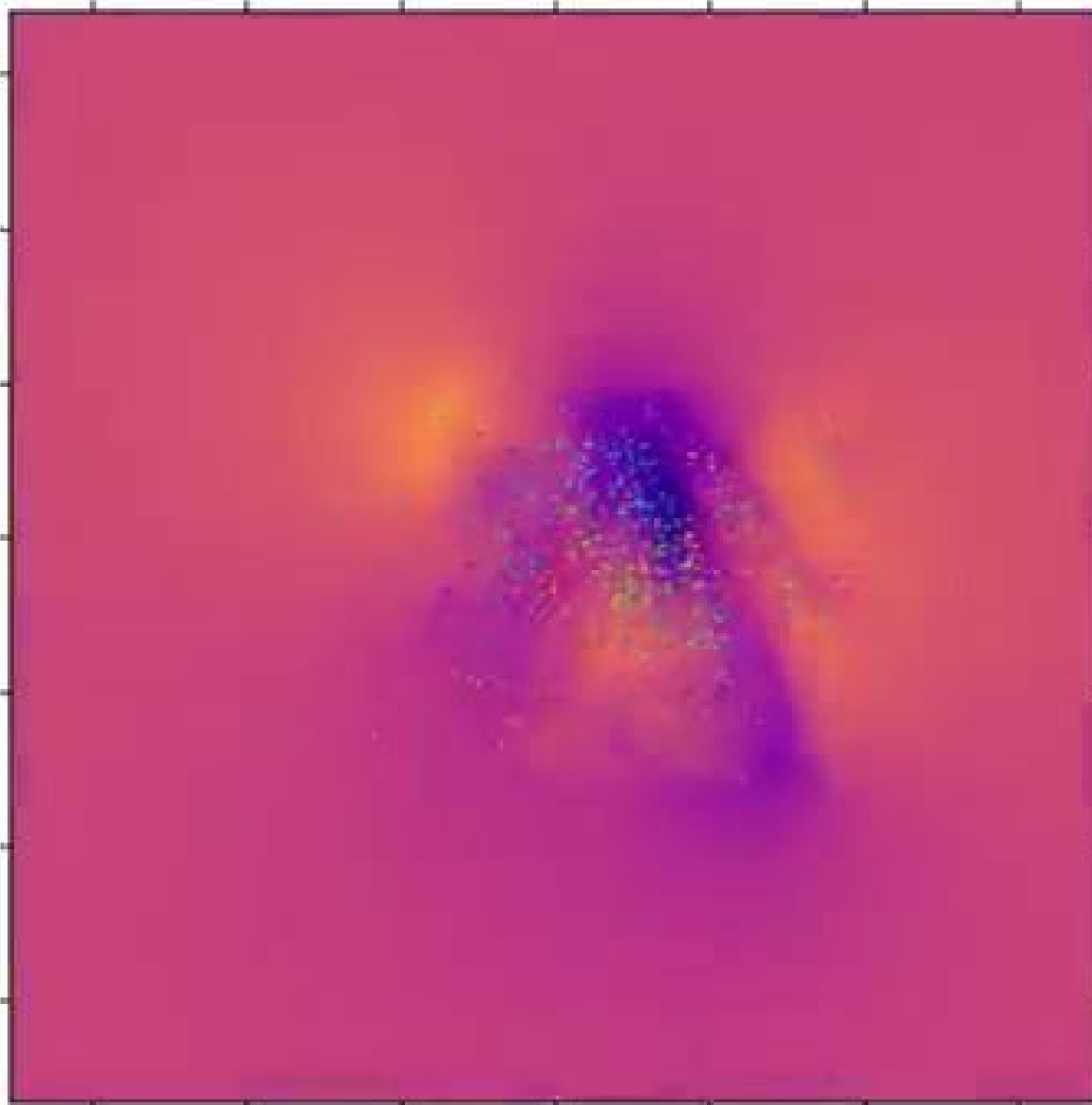




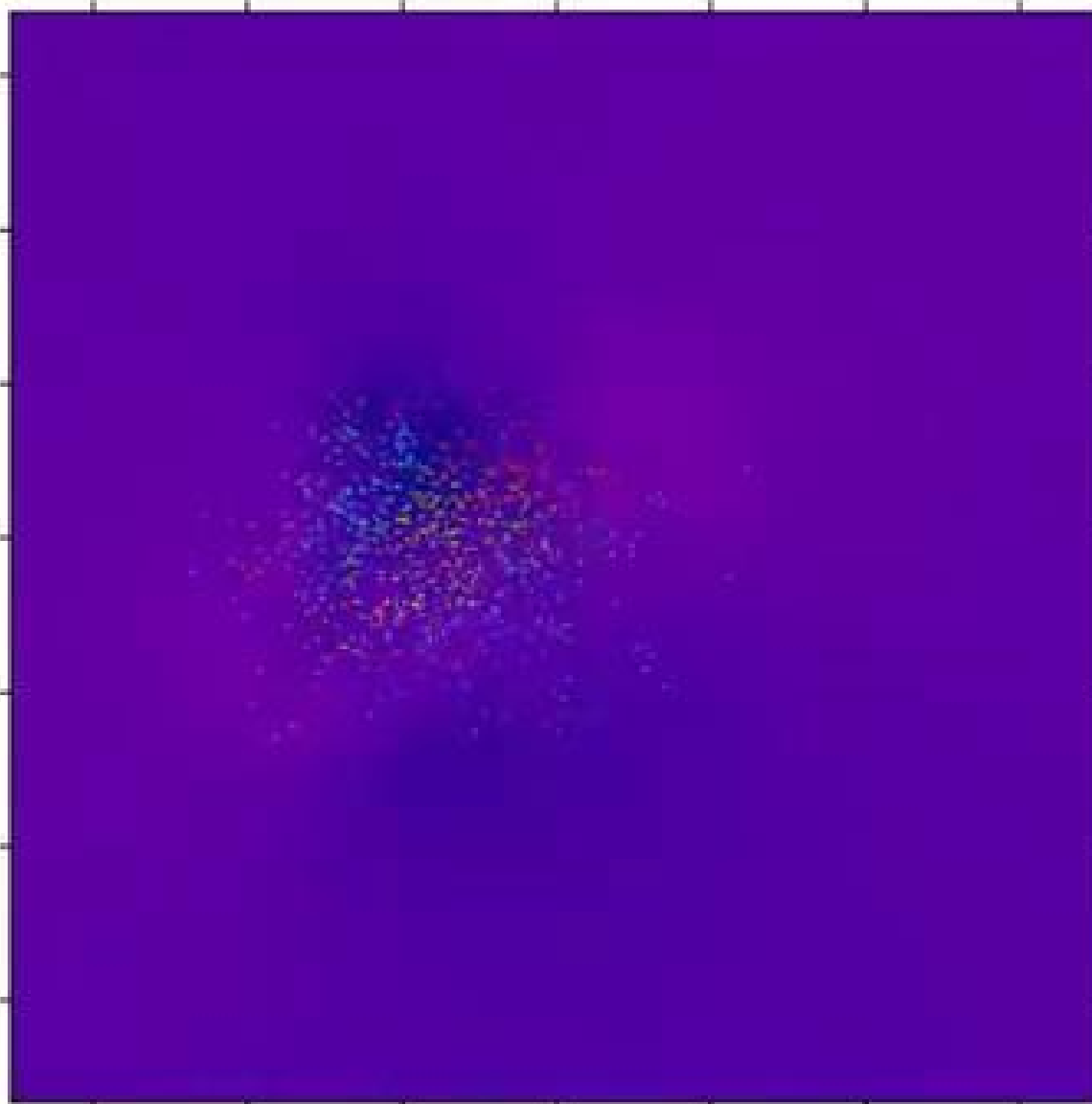
# Looking for variability...



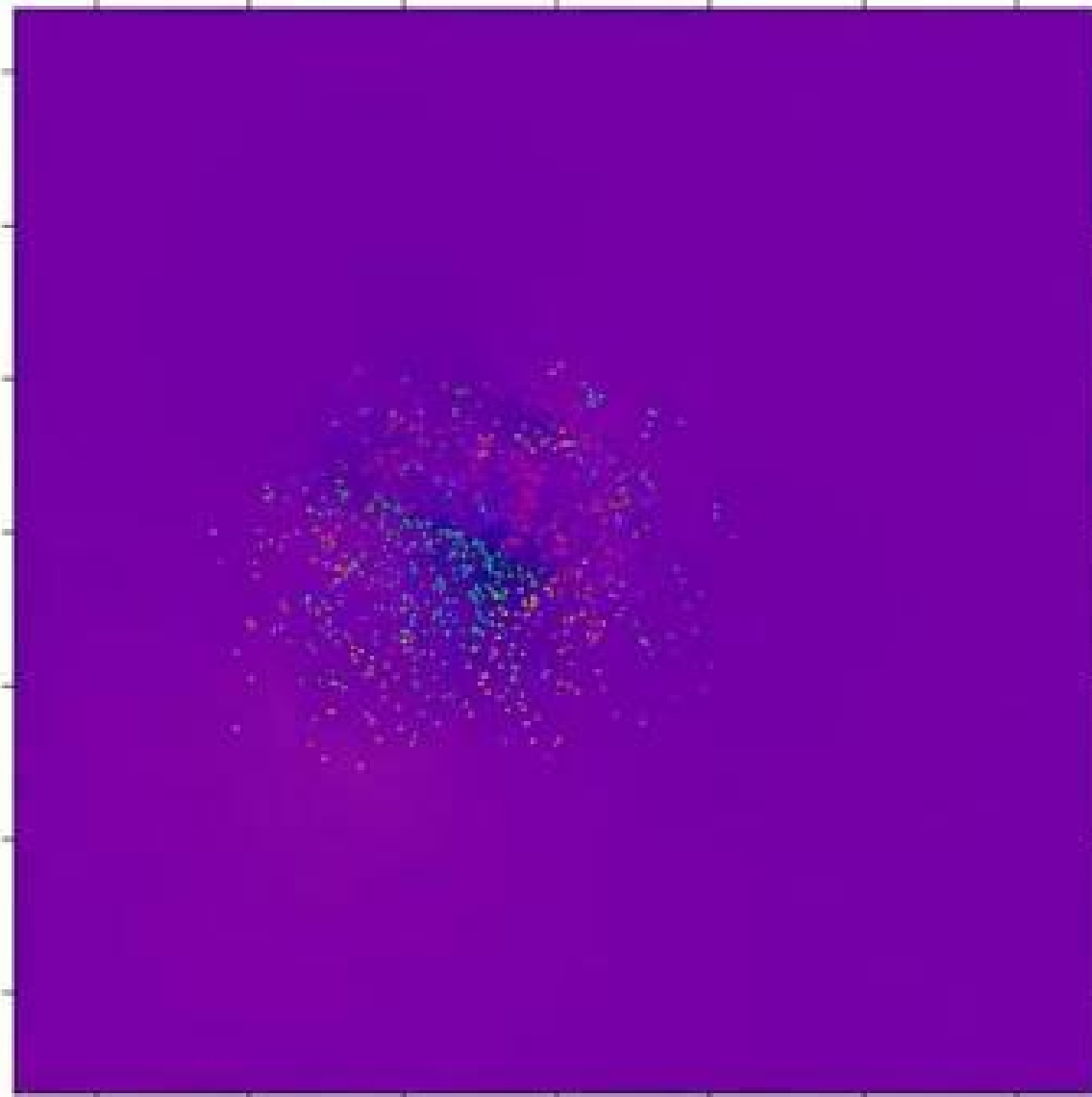
22856



3816



1920



- The ionosphere is a complicated beast
- On the horizon:
  - A census of ionospheric activity
  - How the ionosphere affects an EoR PS
  - Unusual ionospheric effects

Thanks for your attention!

