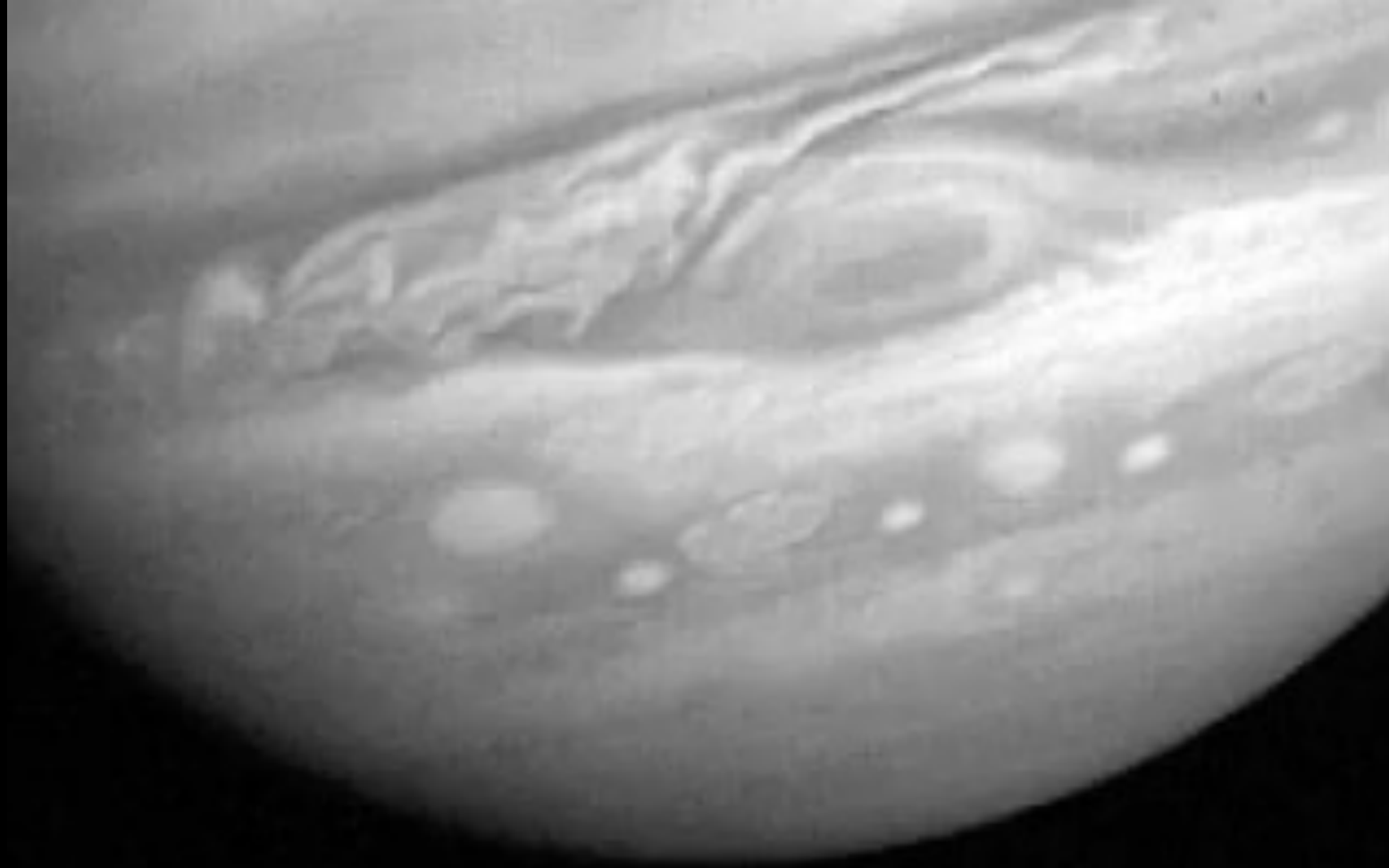


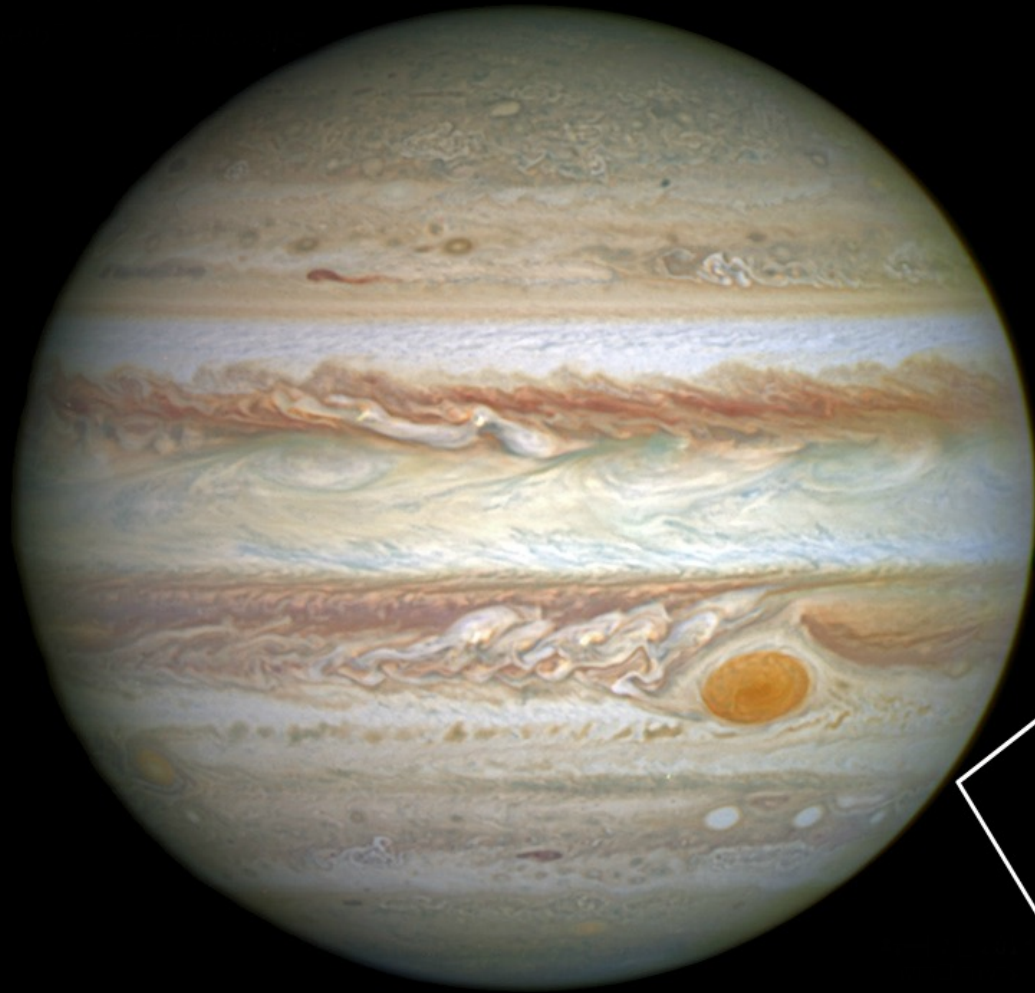
Jupiter's Great Red Spot

Cheng Li, University of Michigan

Image: Gerald Eichstaedt

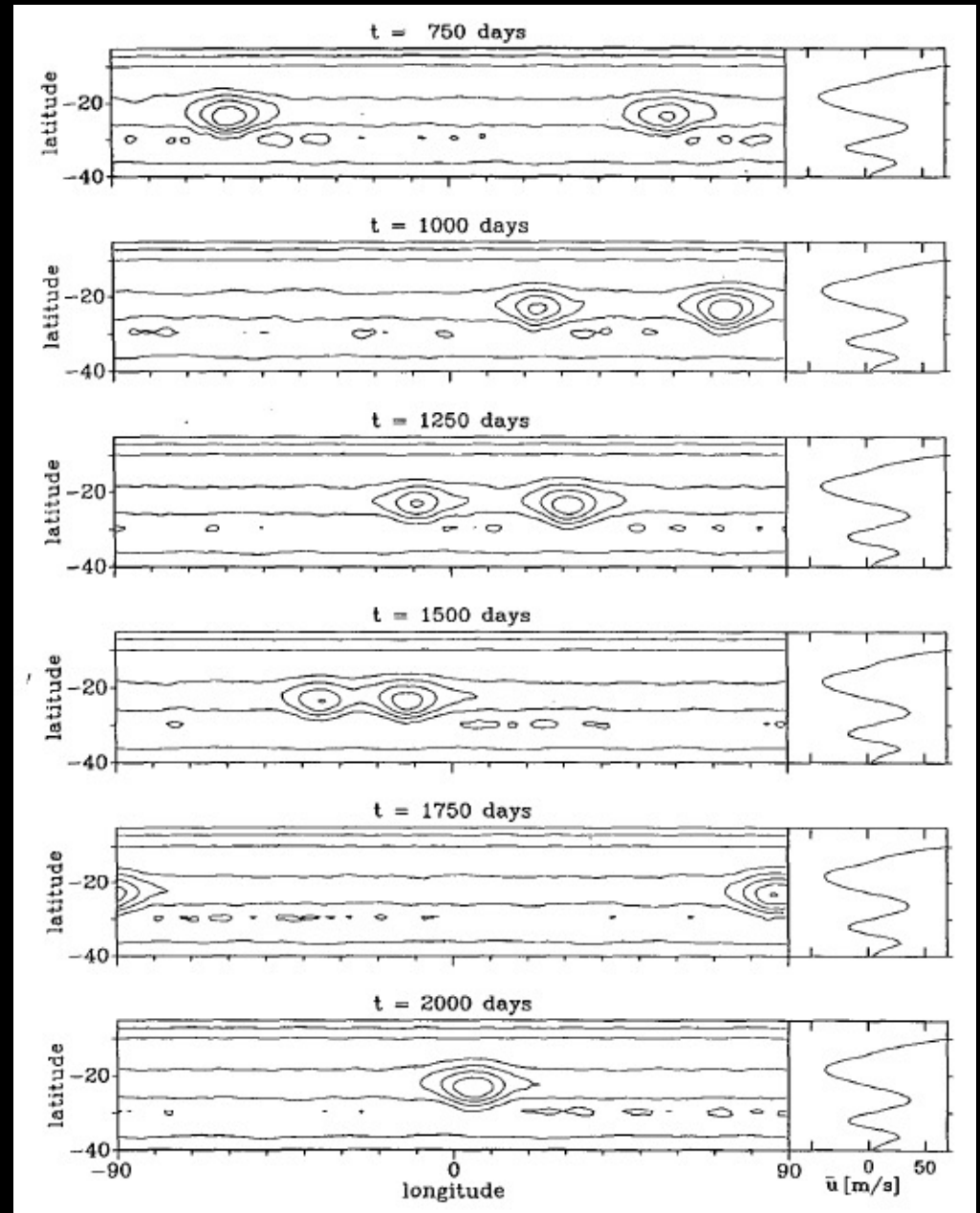
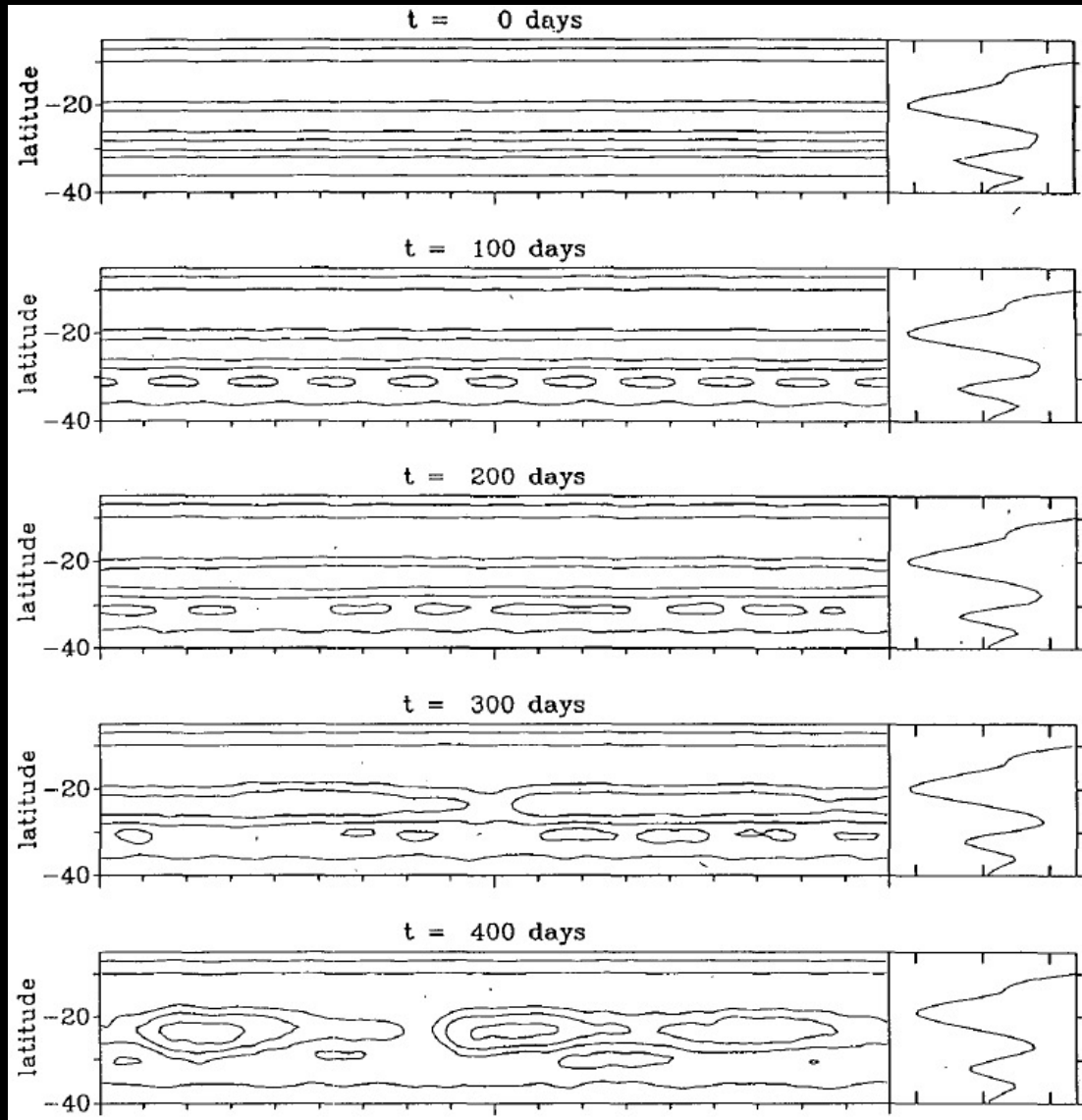


Great Red Spot is dynamic

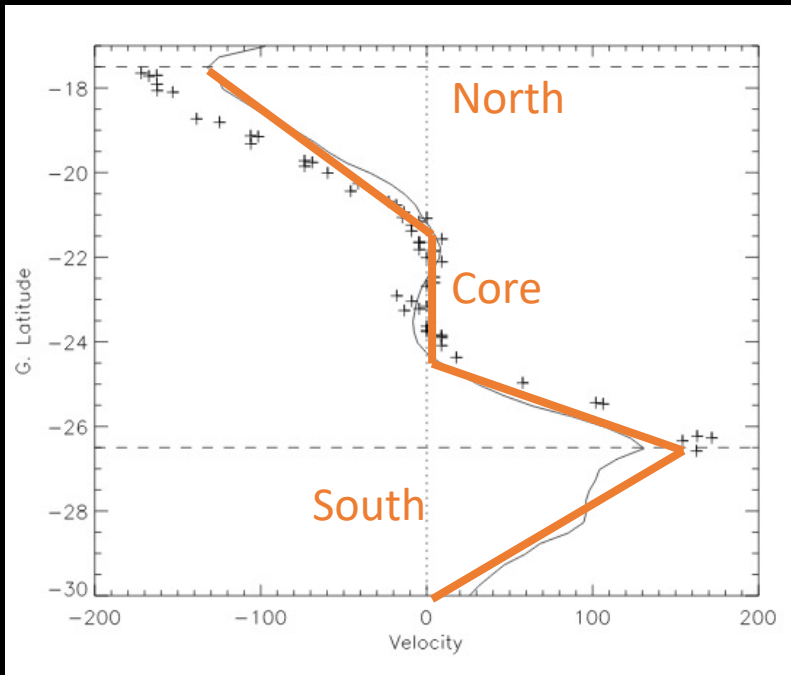
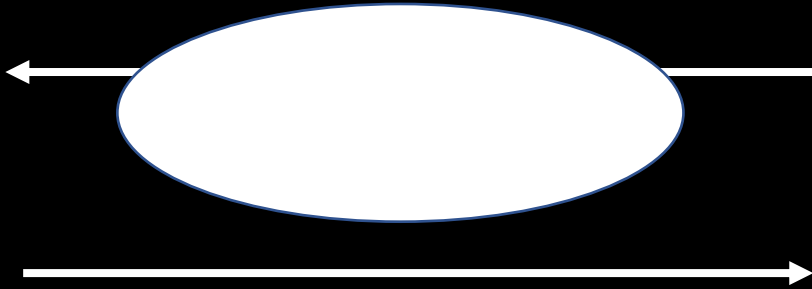


Great Red Spot is Shrinking

Formation of the GRS

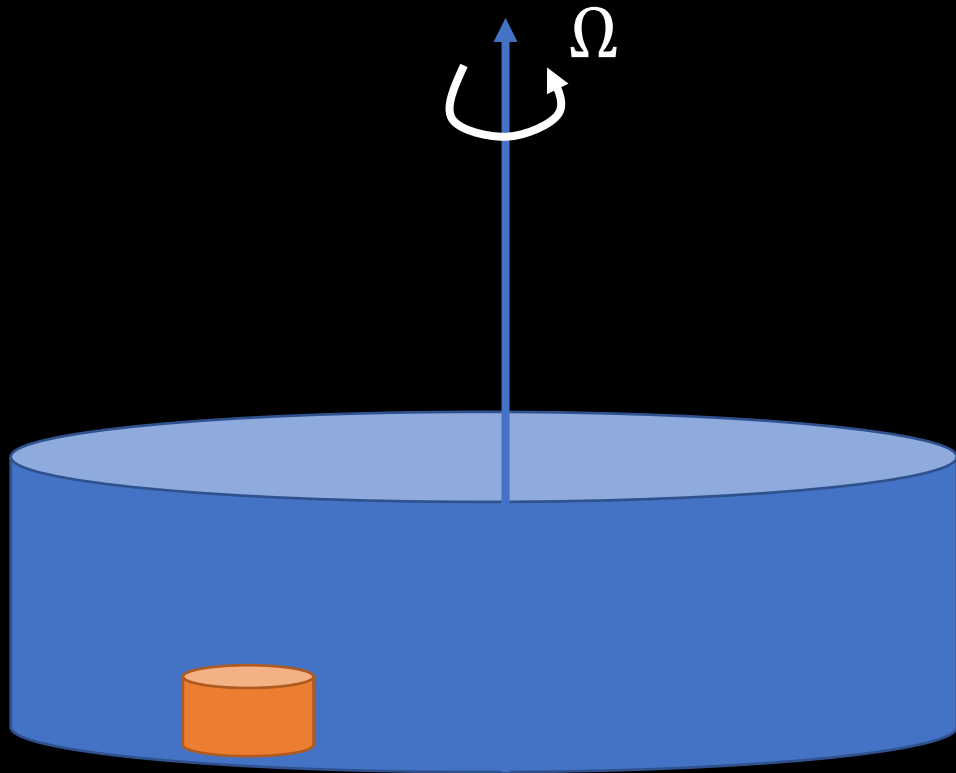


Velocity of GRS



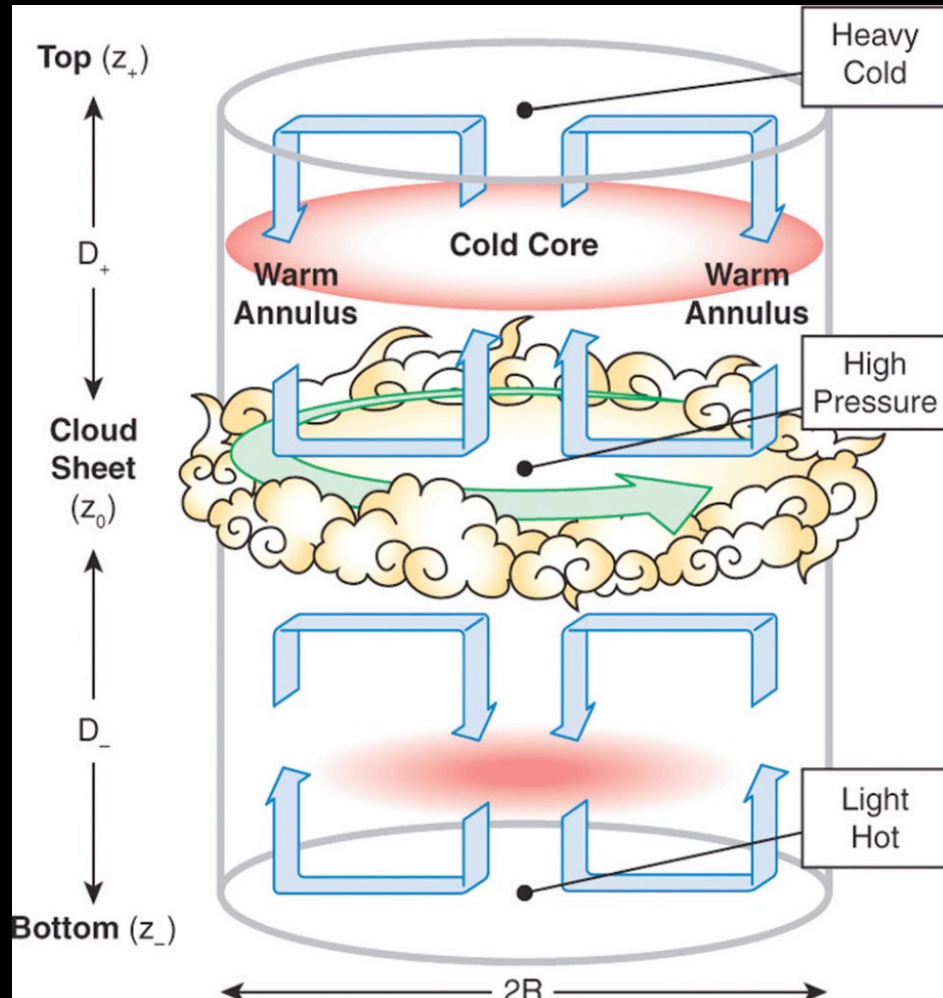
Simon-Miller+2002

Back to the Basics: Taylor-Proudman Theorem (1916)



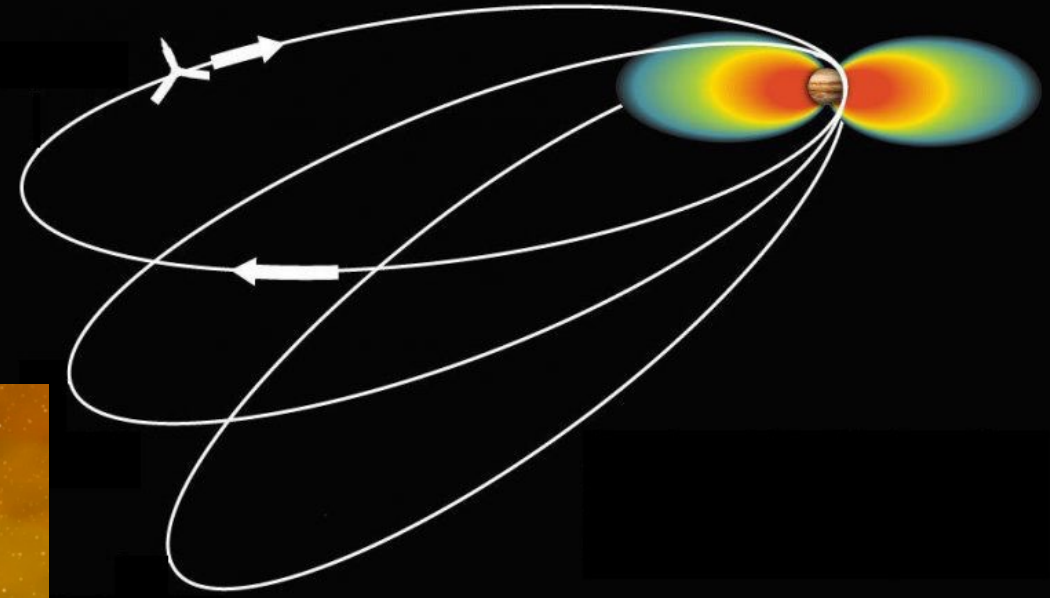
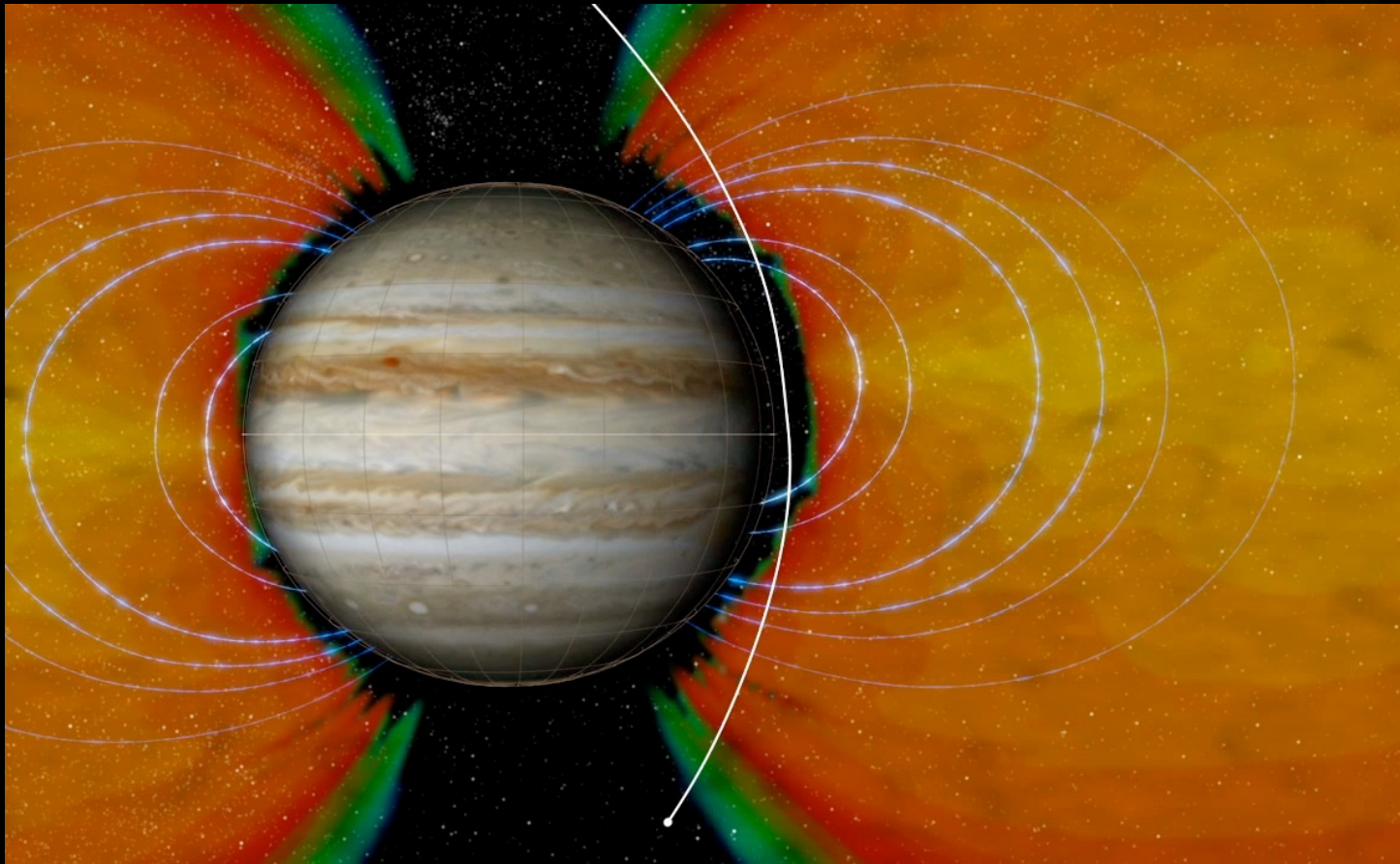
Video footage from UCLA spinlab

Speculative internal structure of GRS

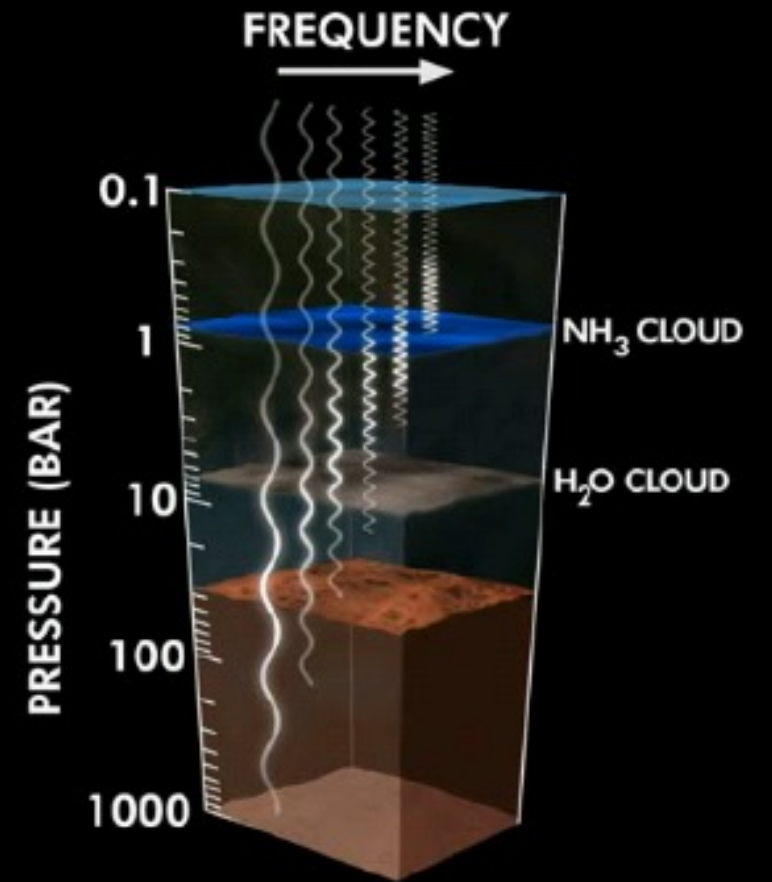
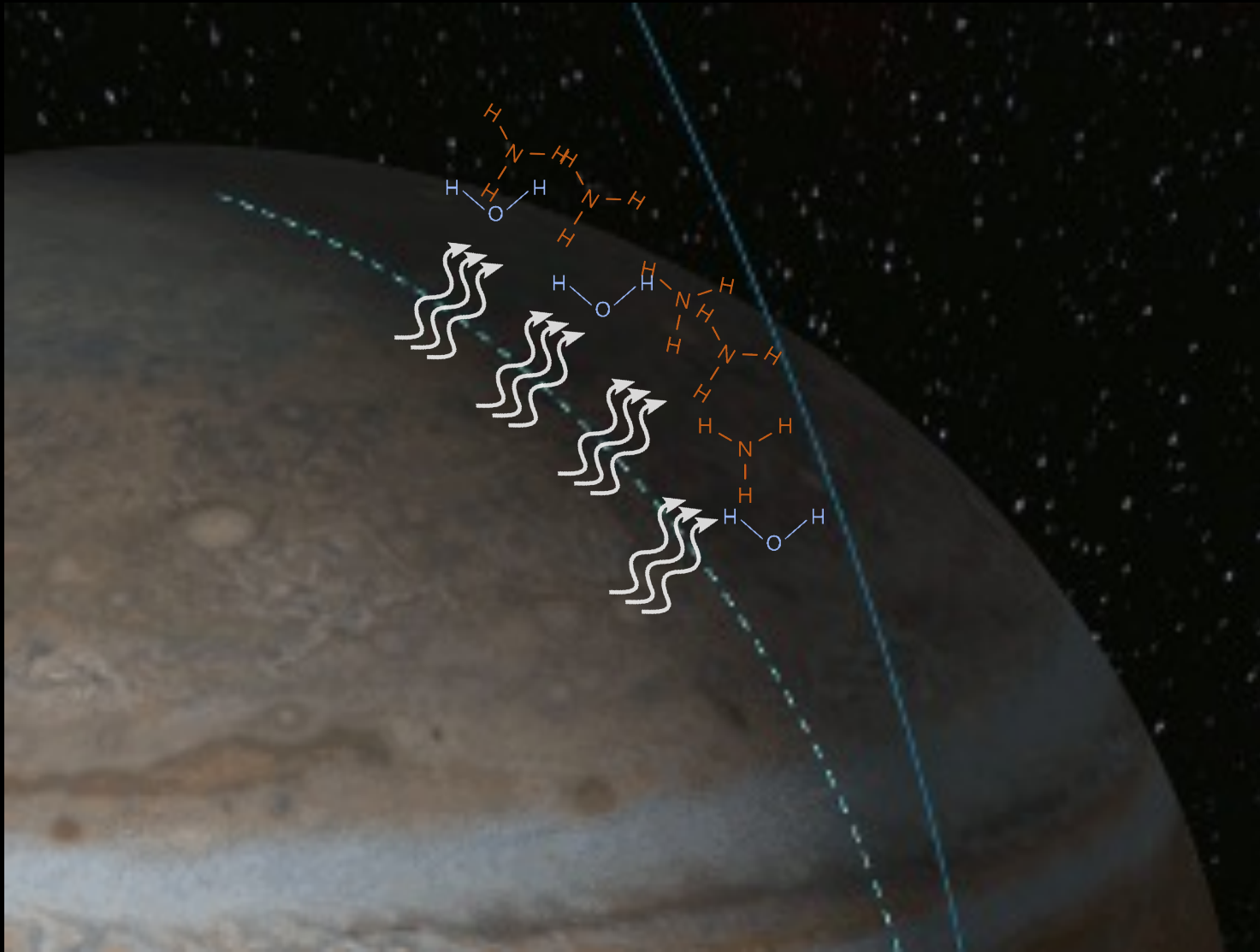


Marcus et al., 2013

Juno mission



- ❑ **Spinning spacecraft**
- ❑ **Inside radiation belt**
- ❑ **53-day polar orbit**



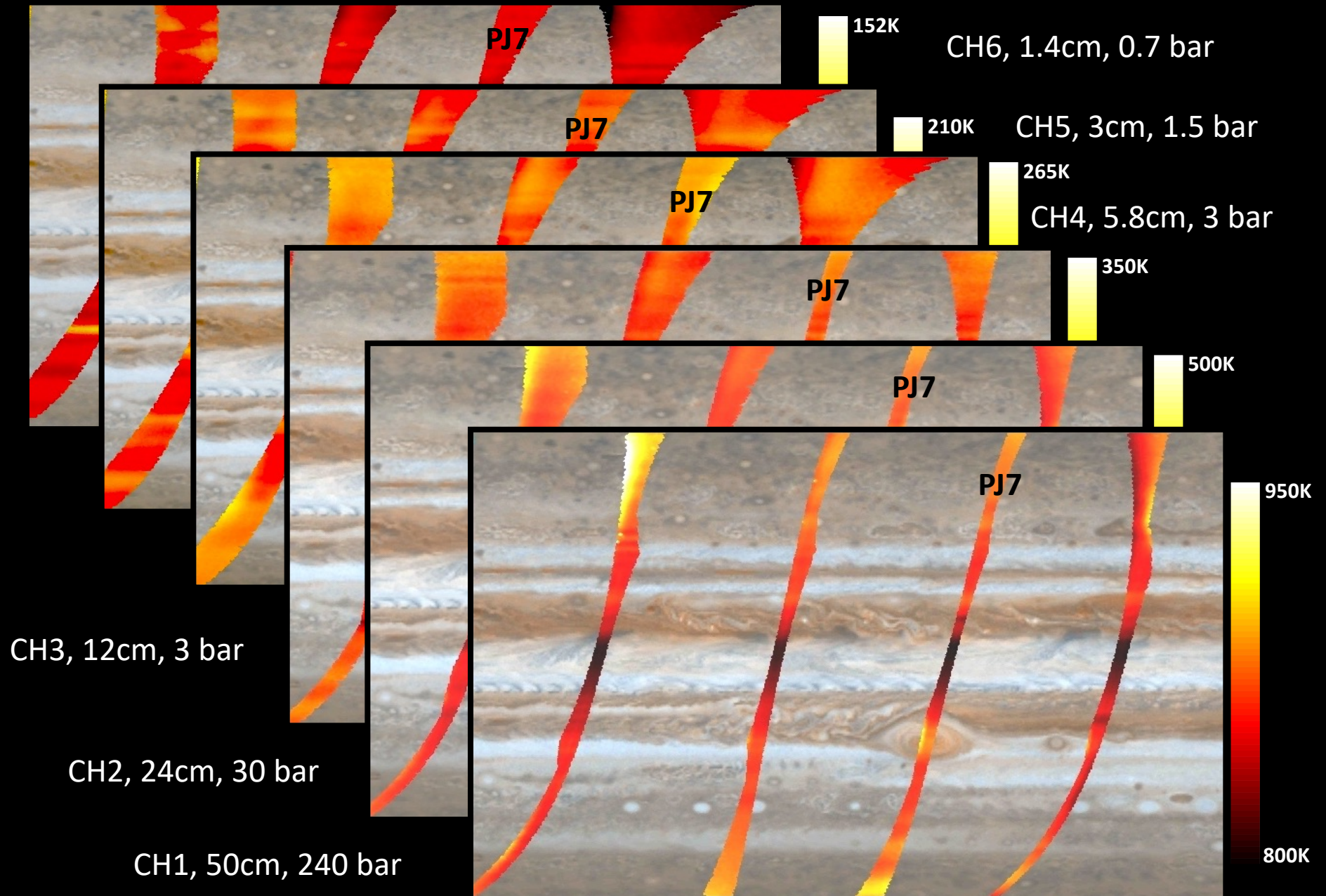
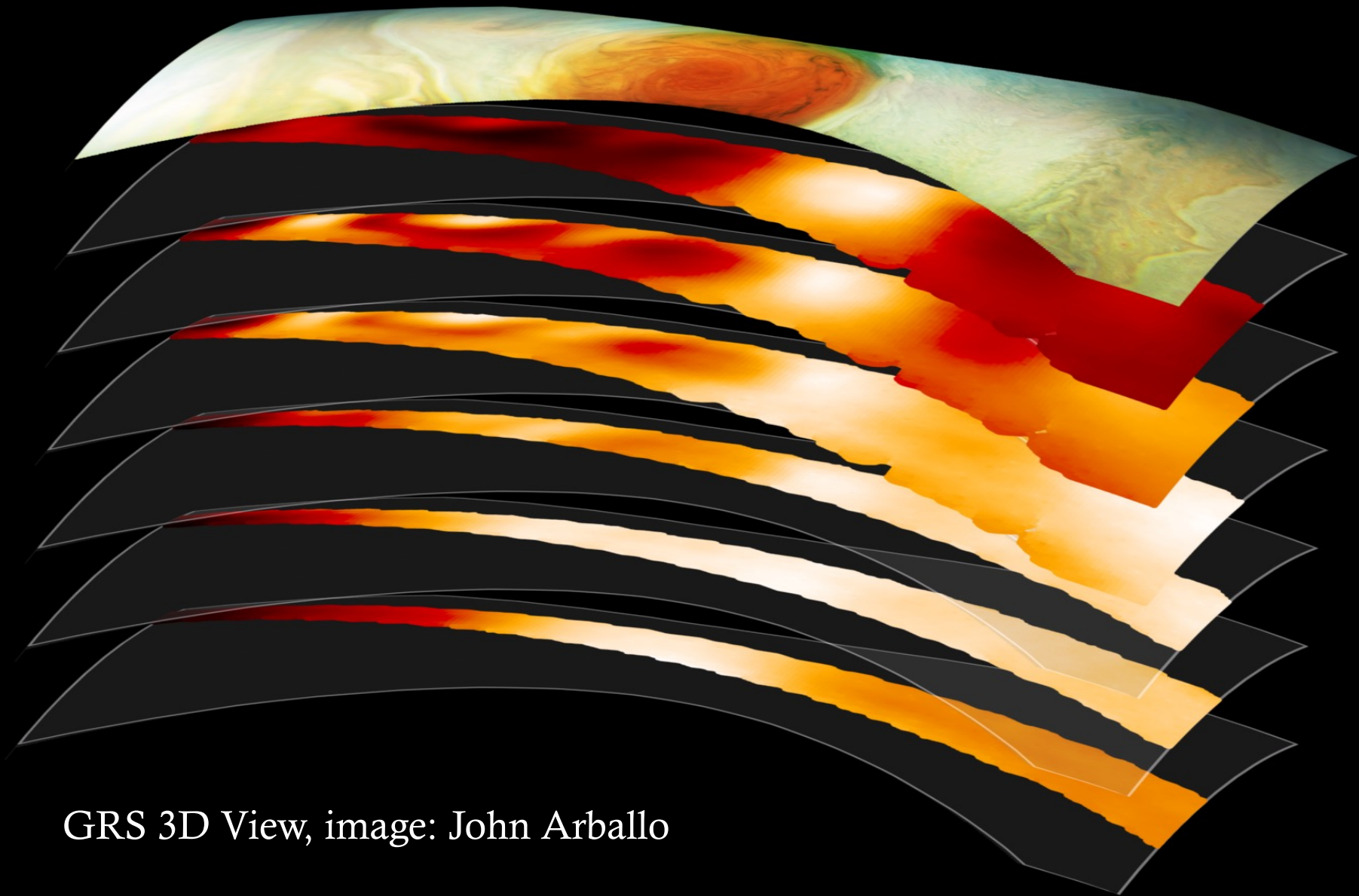
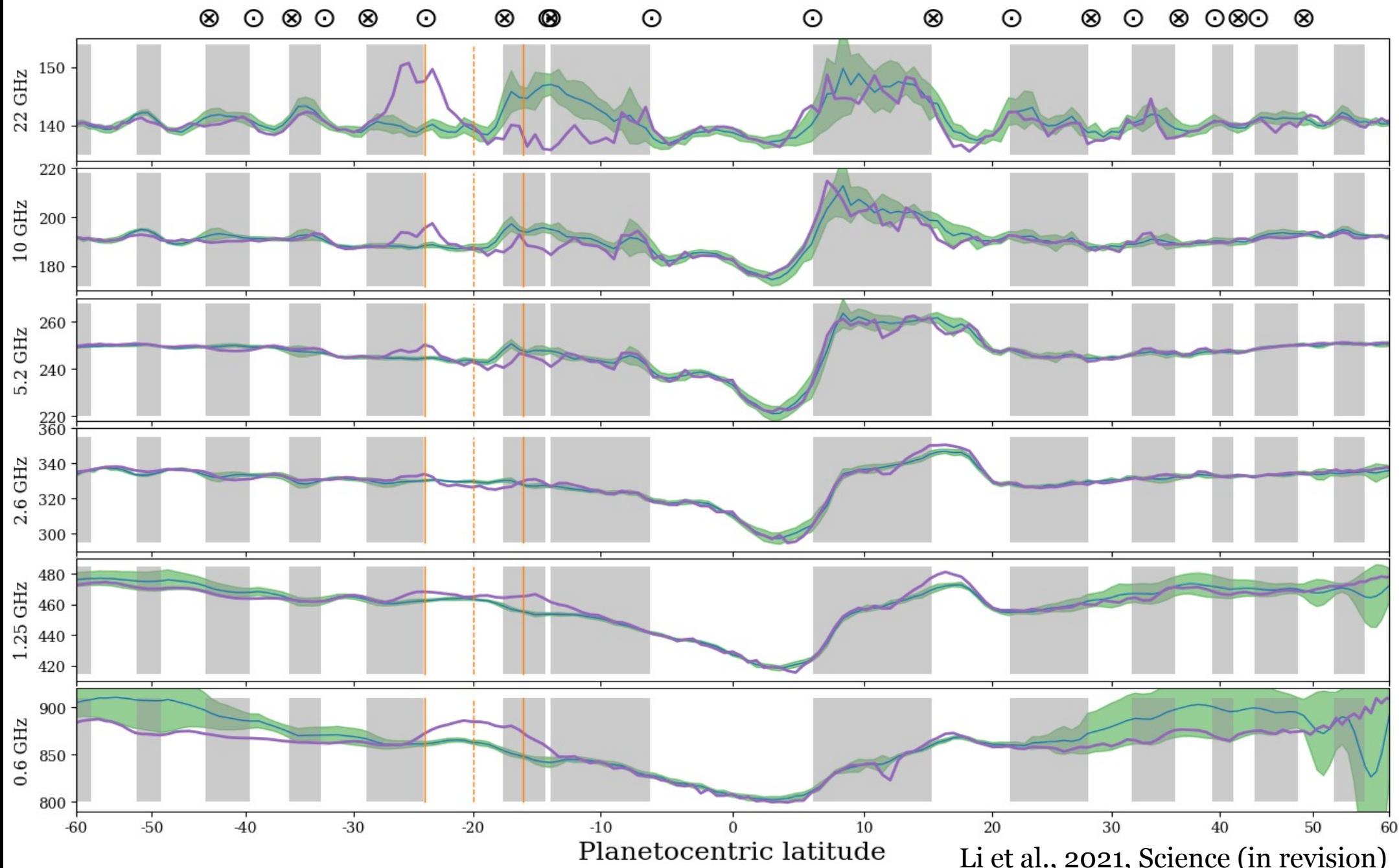


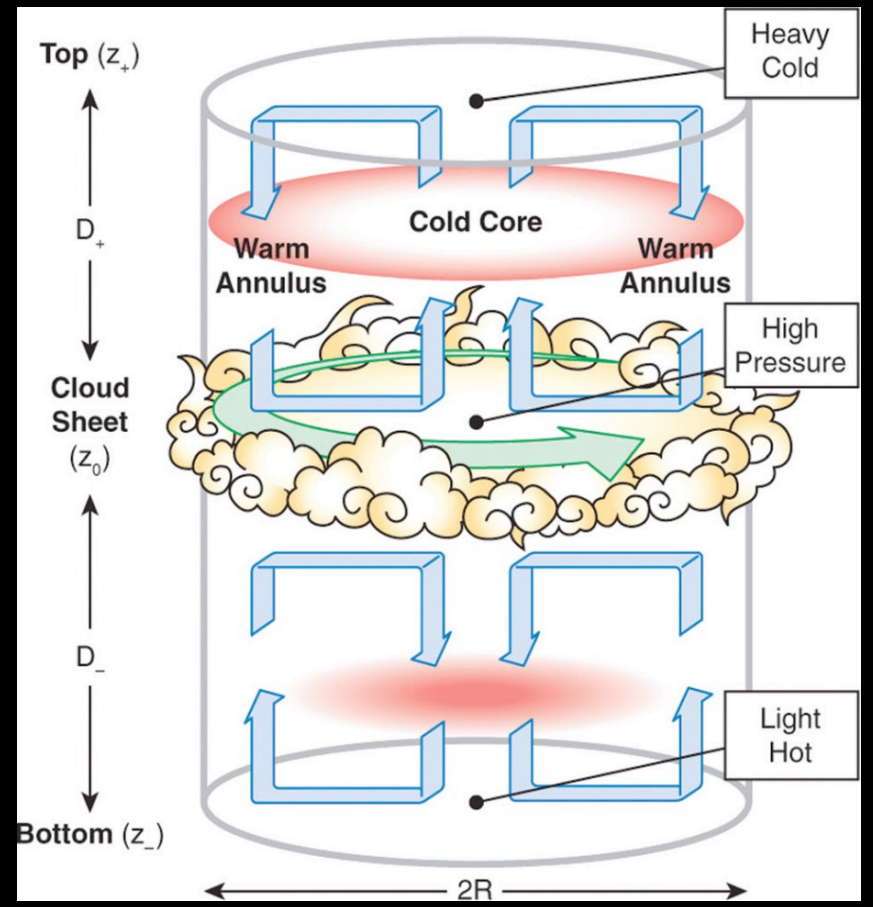
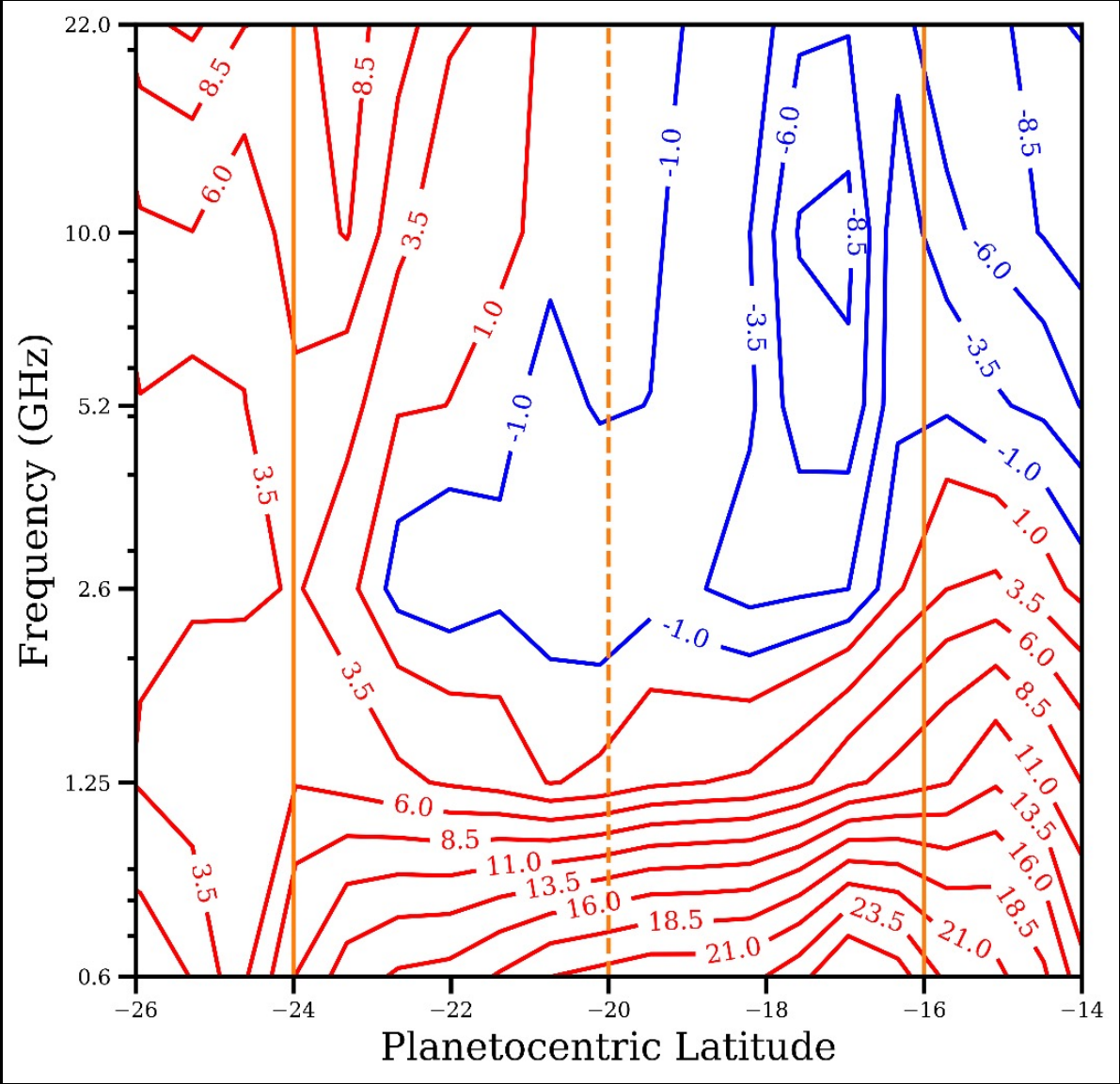
Image: Zhimeng Zhang



GRS 3D View, image: John Arballo

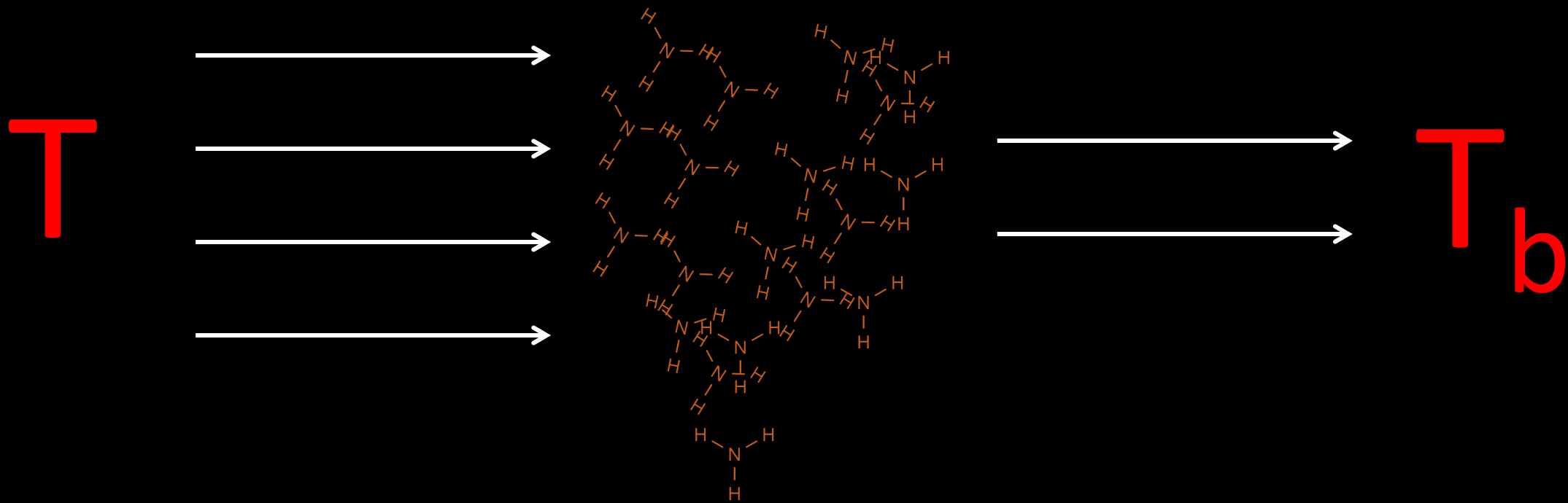


MWR GRS anomaly (observed)

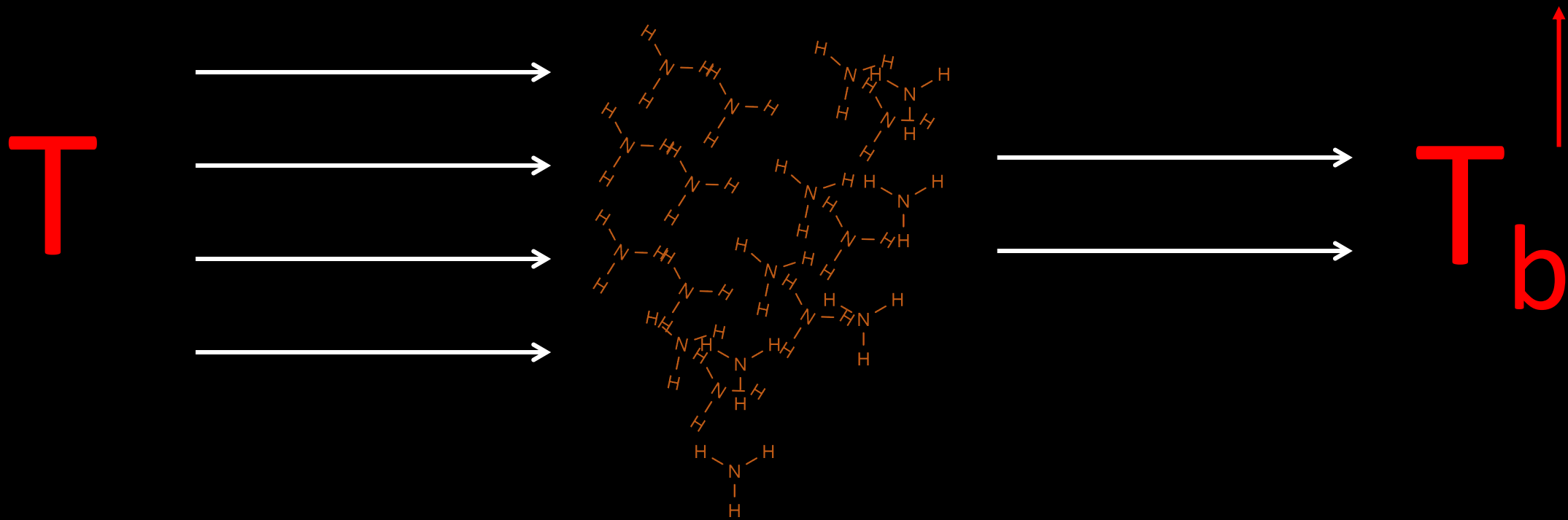


Marcus et al., 2013

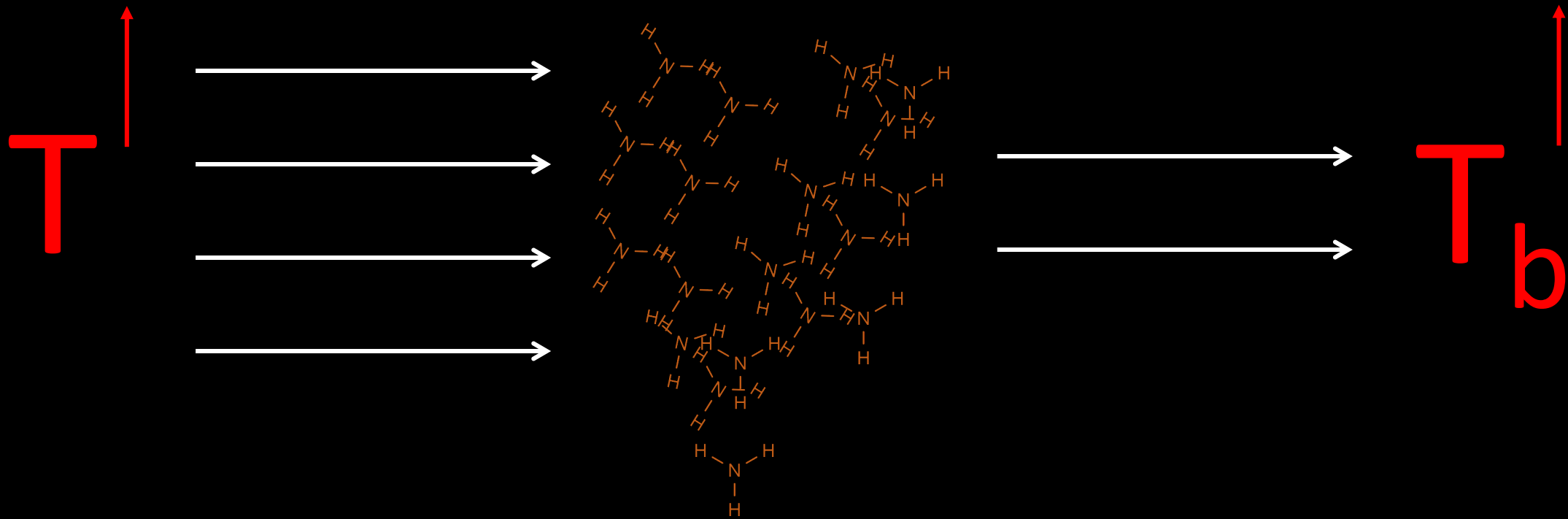
Radiative Transfer 101



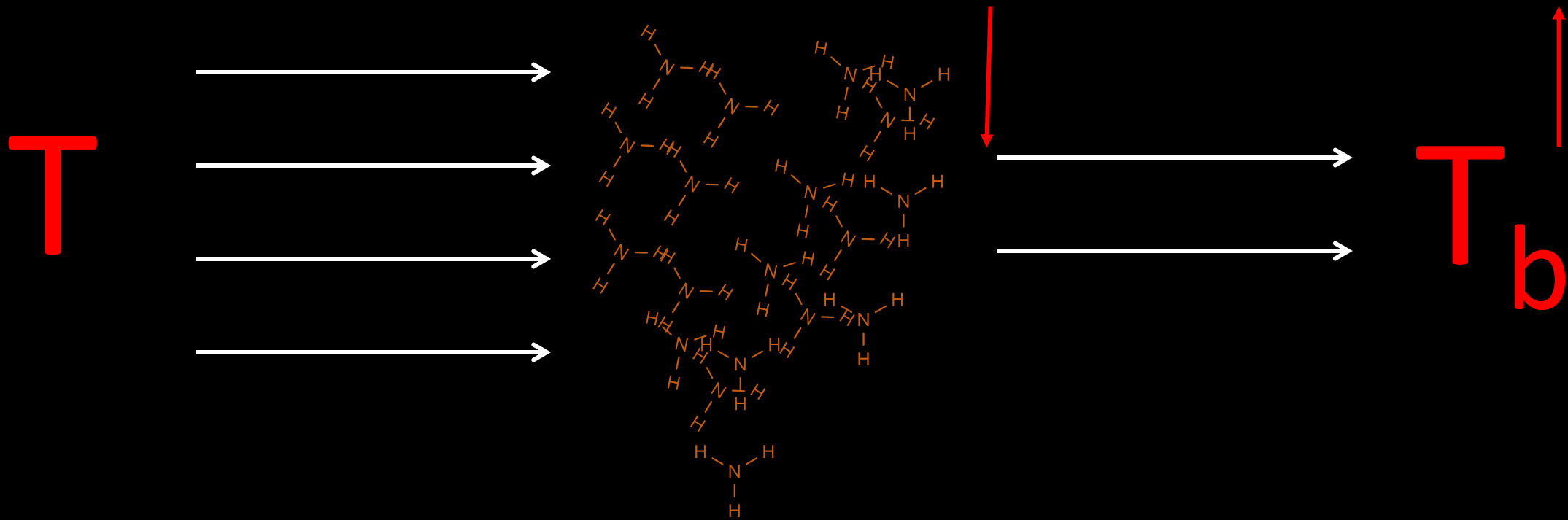
Radiative Transfer 101



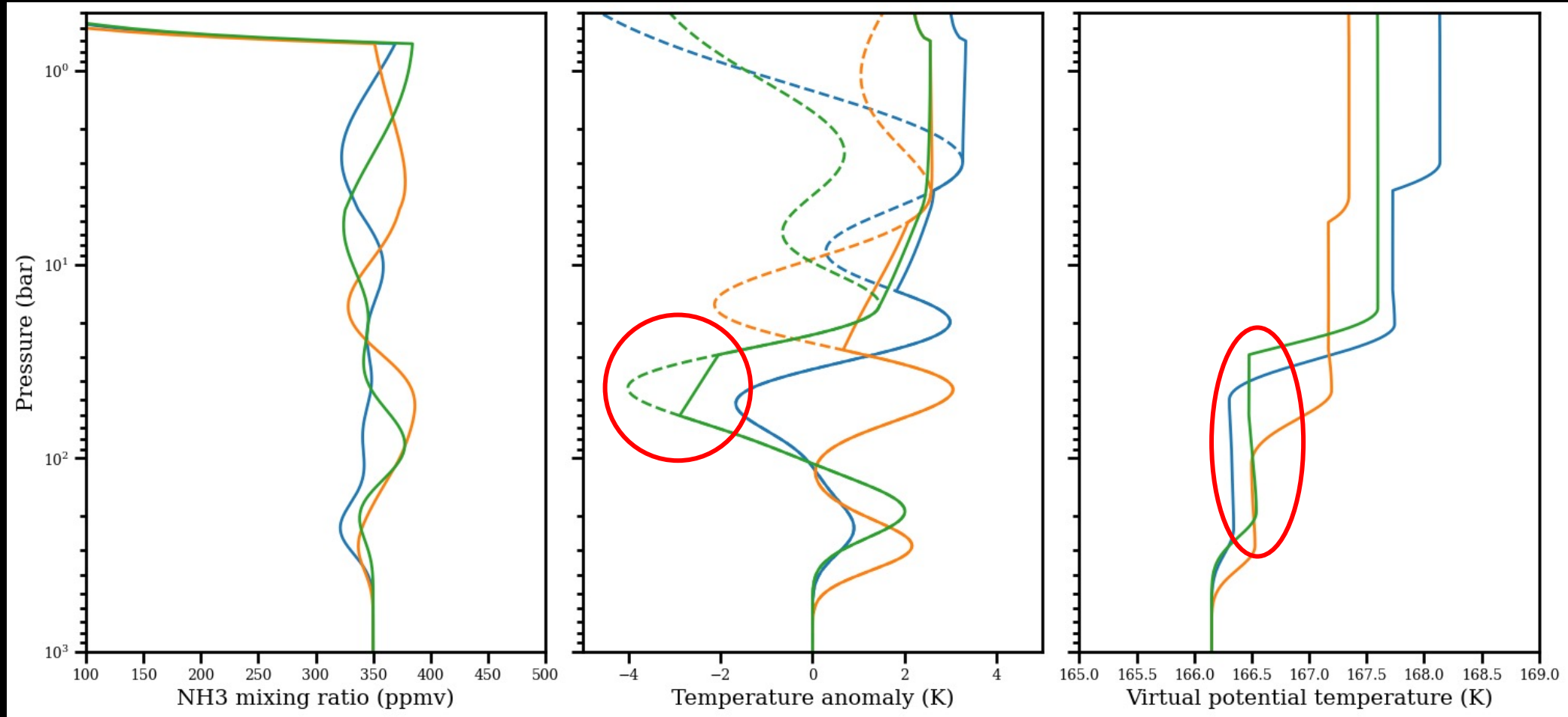
Radiative Transfer 101



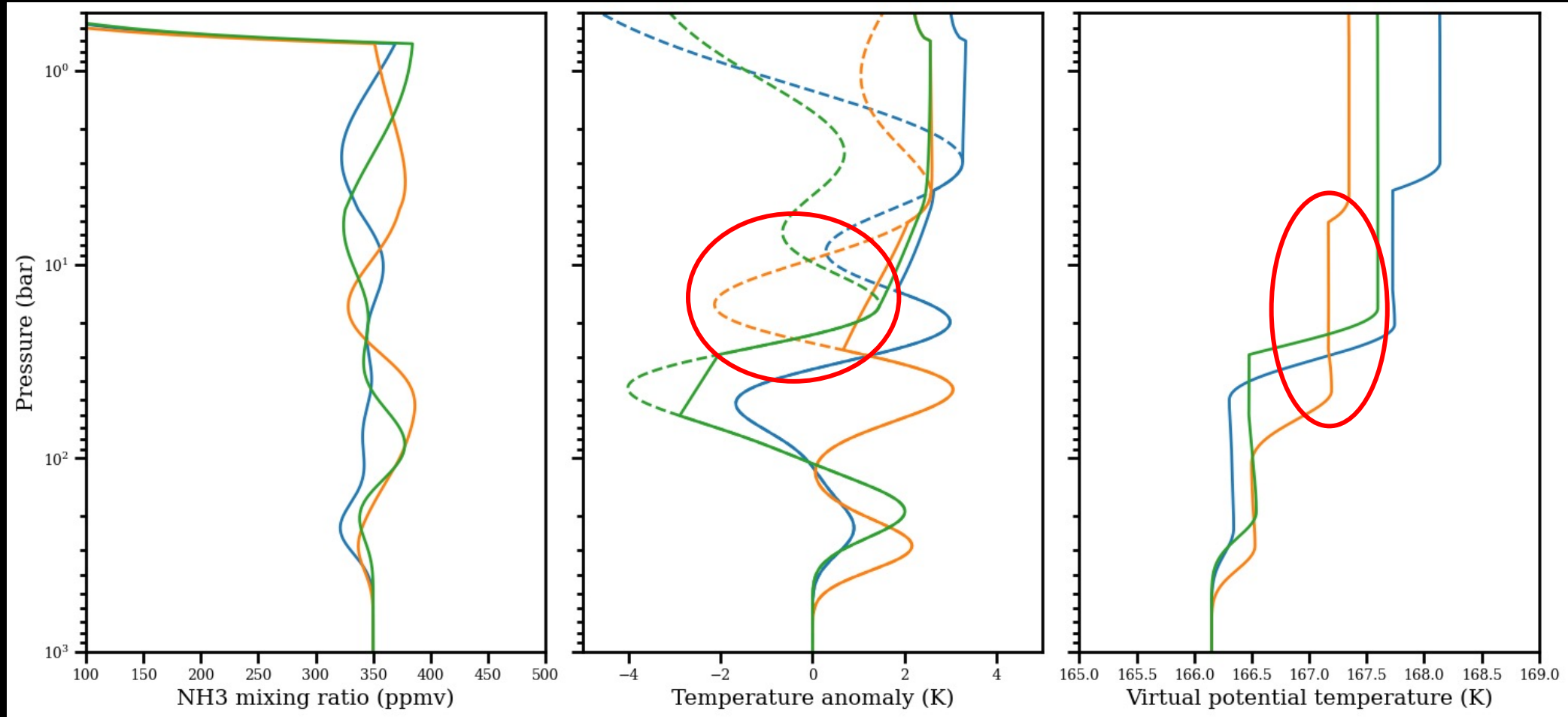
Radiative Transfer 101



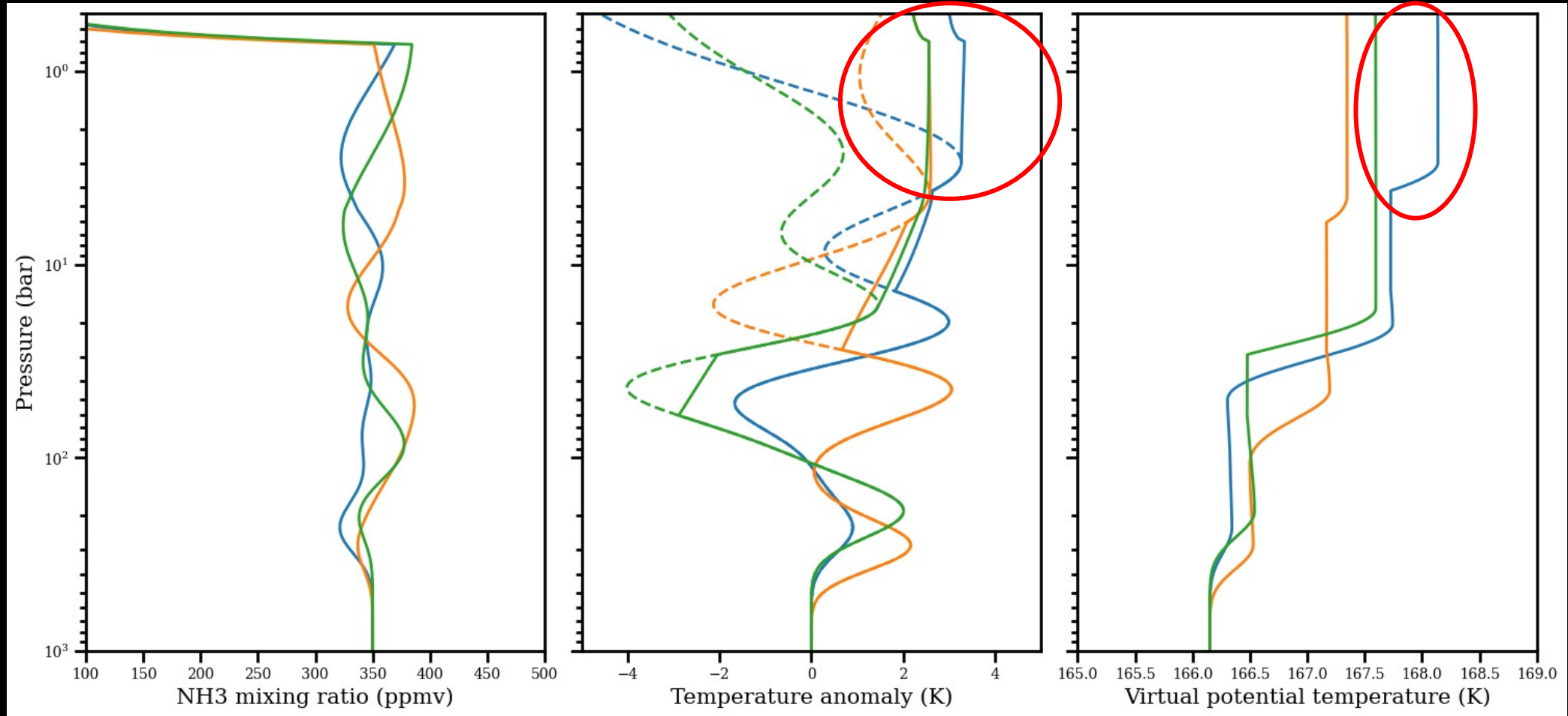
MCMC inversion using Rectified Gaussian Process



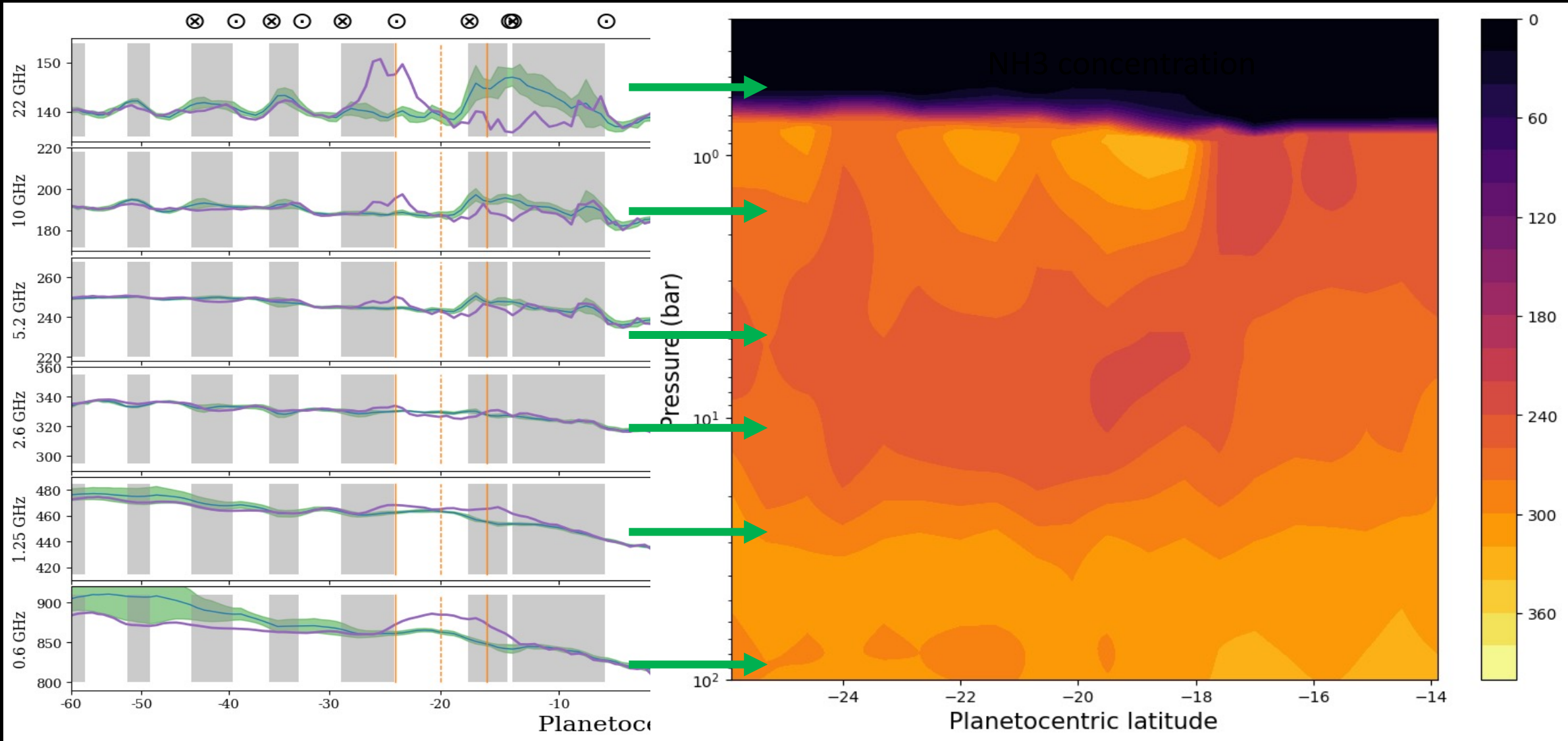
MCMC inversion using Rectified Gaussian Process

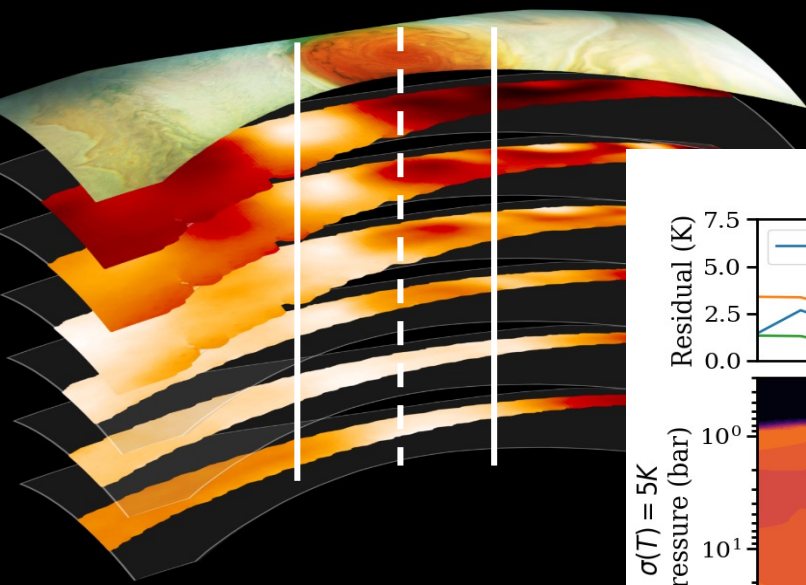


MCMC inversion using Rectified Gaussian Process



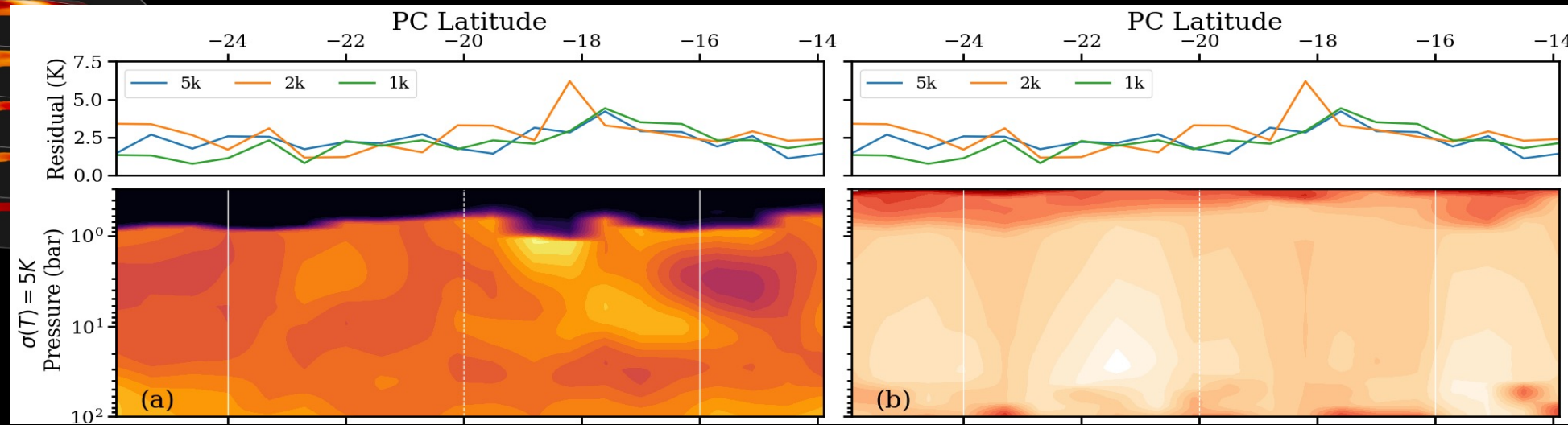
Background ammonia concentration (PJ1 ~ PJ9 / PJ8)

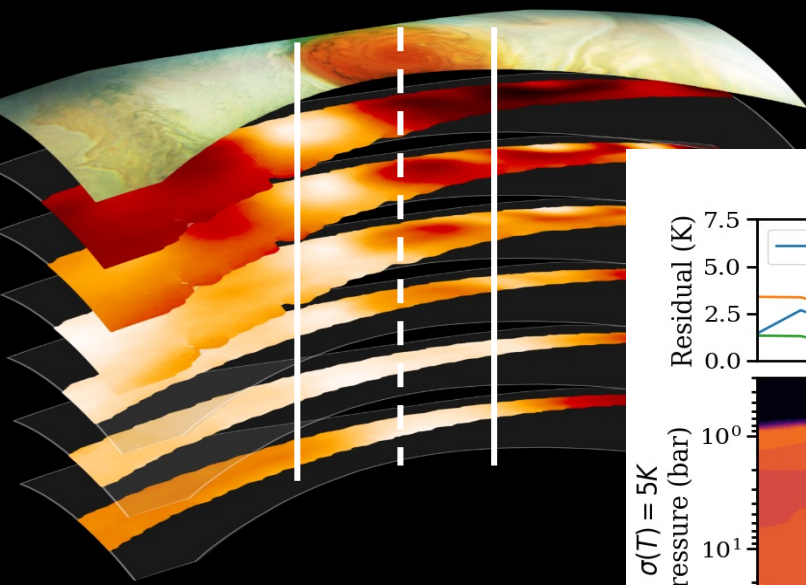




$$L = 40 \text{ km}$$

$$\sigma(T) = 5K$$

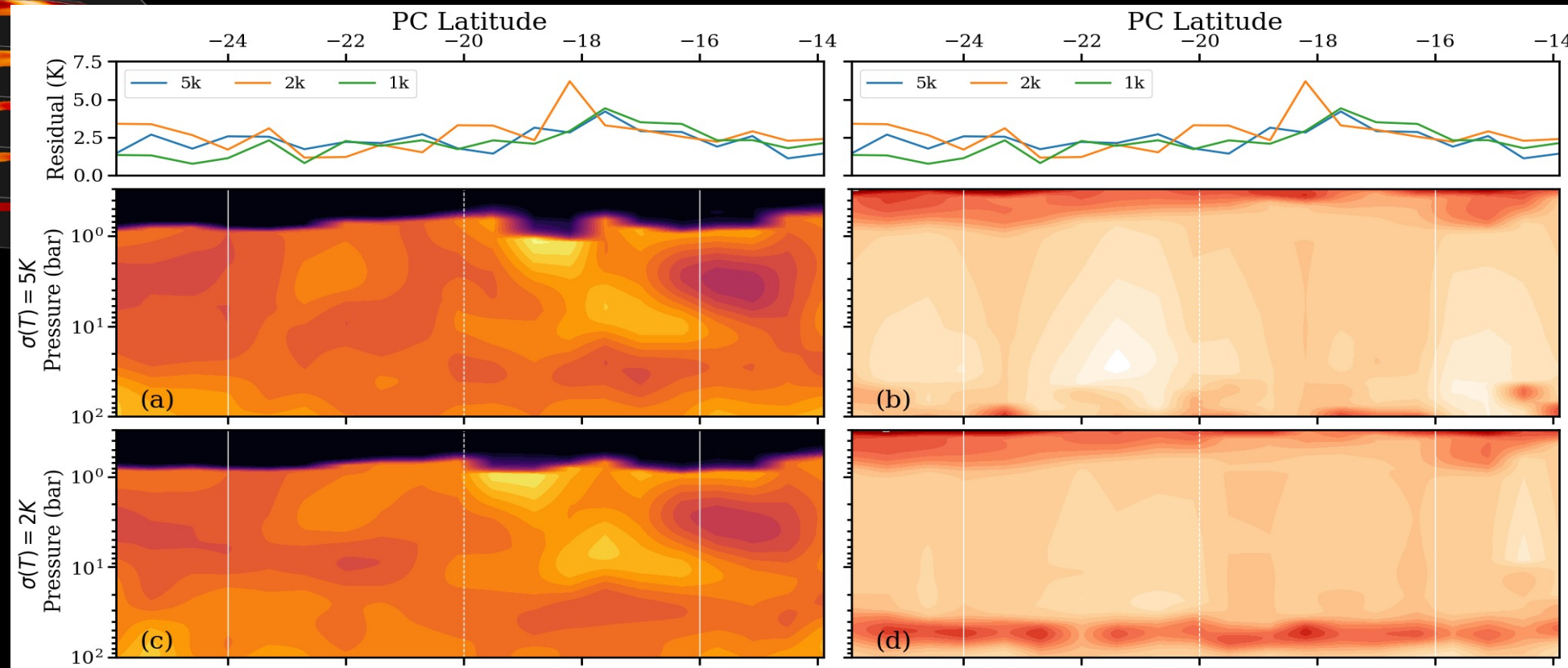


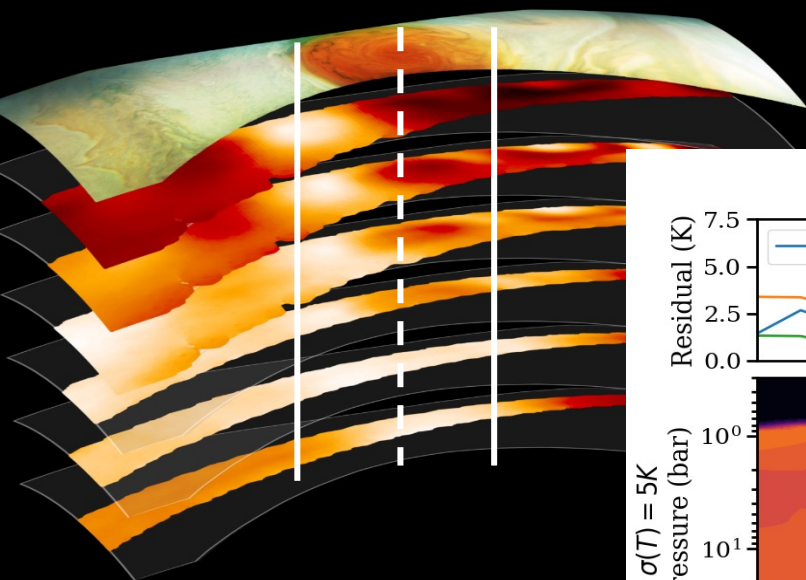


$$L = 40 \text{ km}$$

$$\sigma(T) = 5K$$

$$\sigma(T) = 2K$$



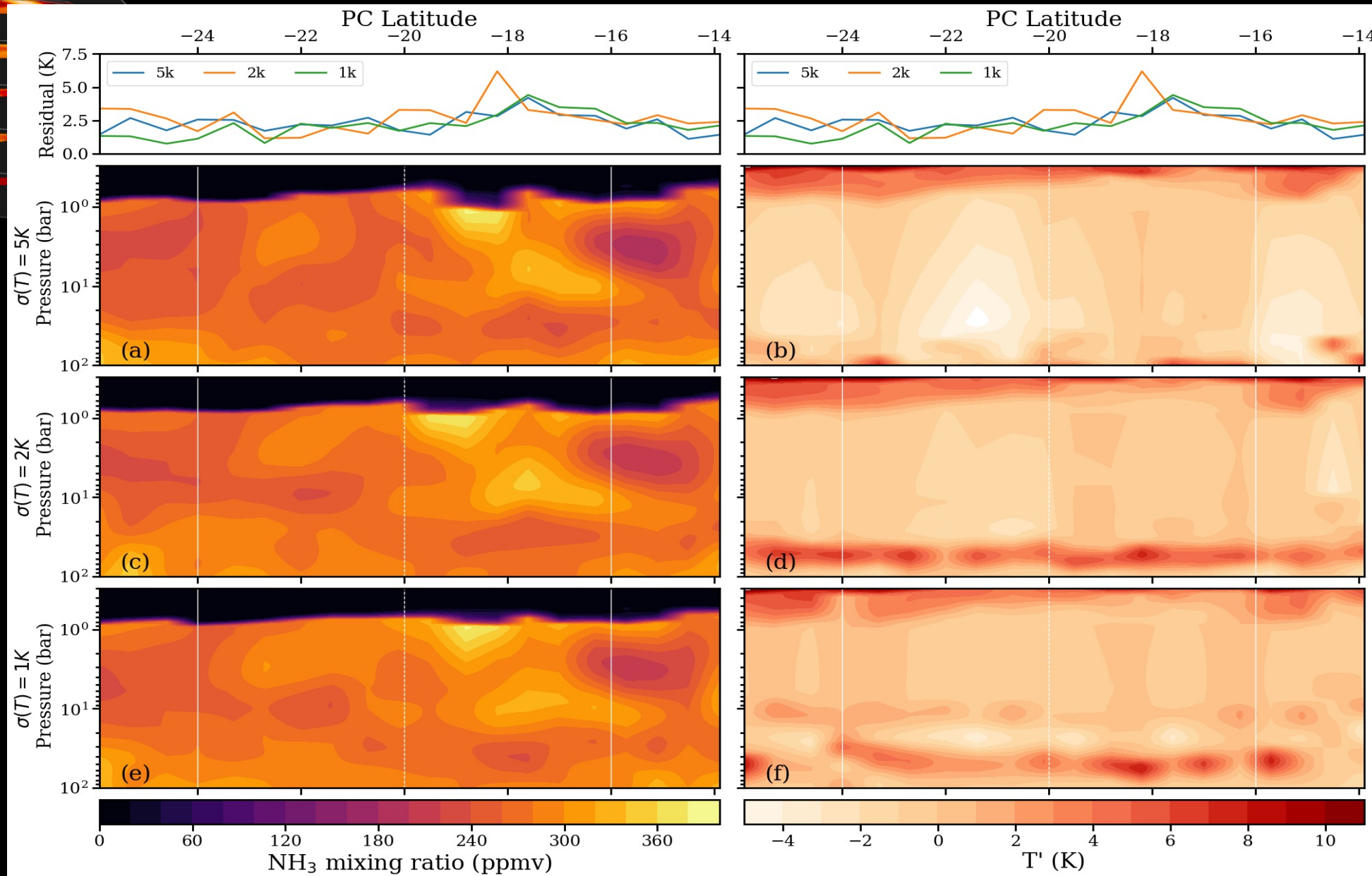


$L = 40 \text{ km}$

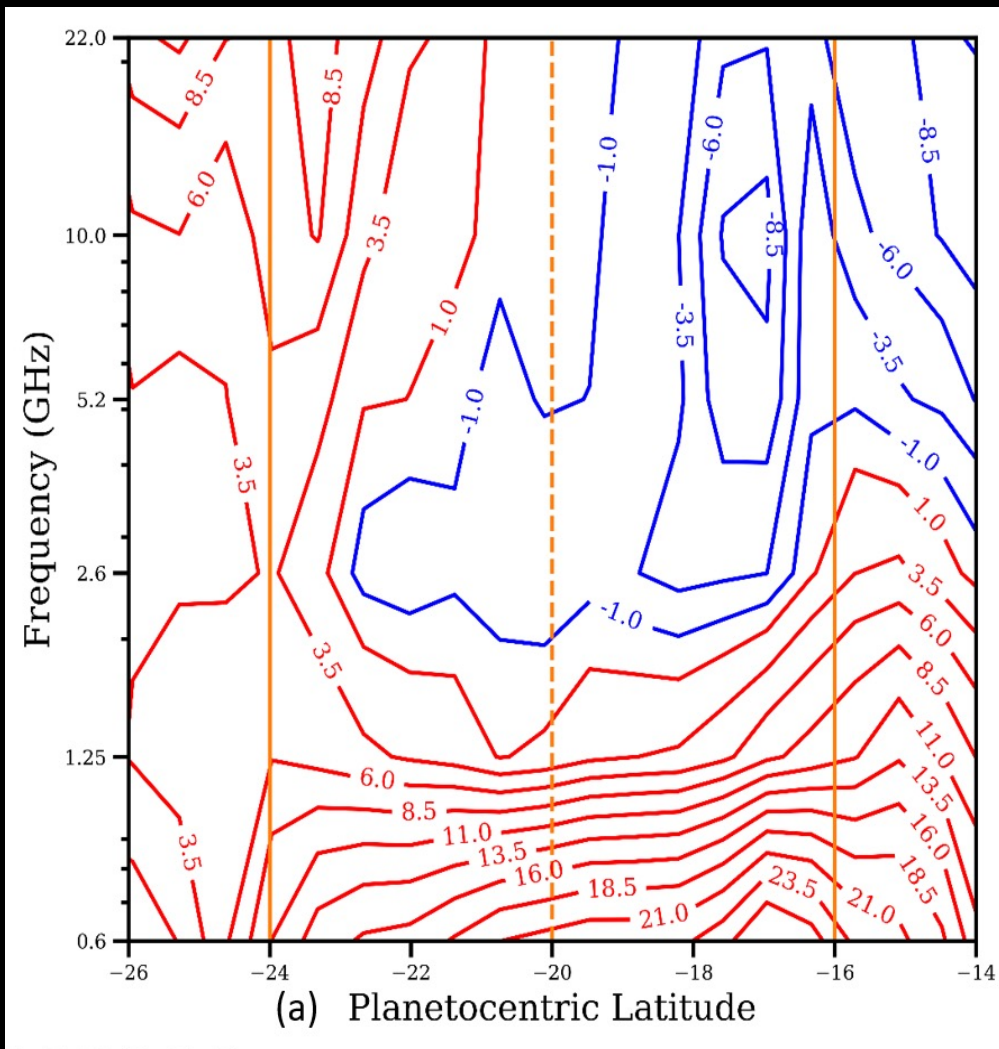
$\sigma(T) = 5K$

$\sigma(T) = 2K$

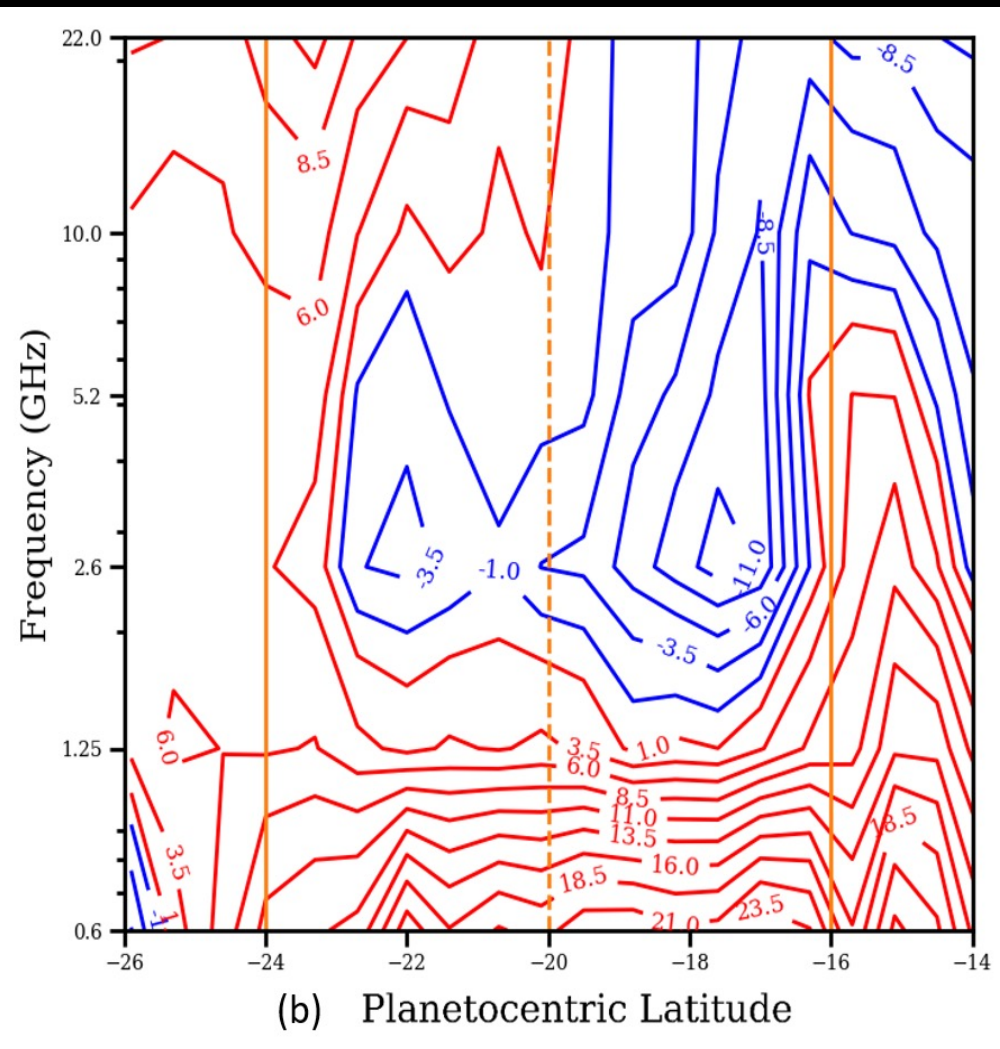
$\sigma(T) = 1K$



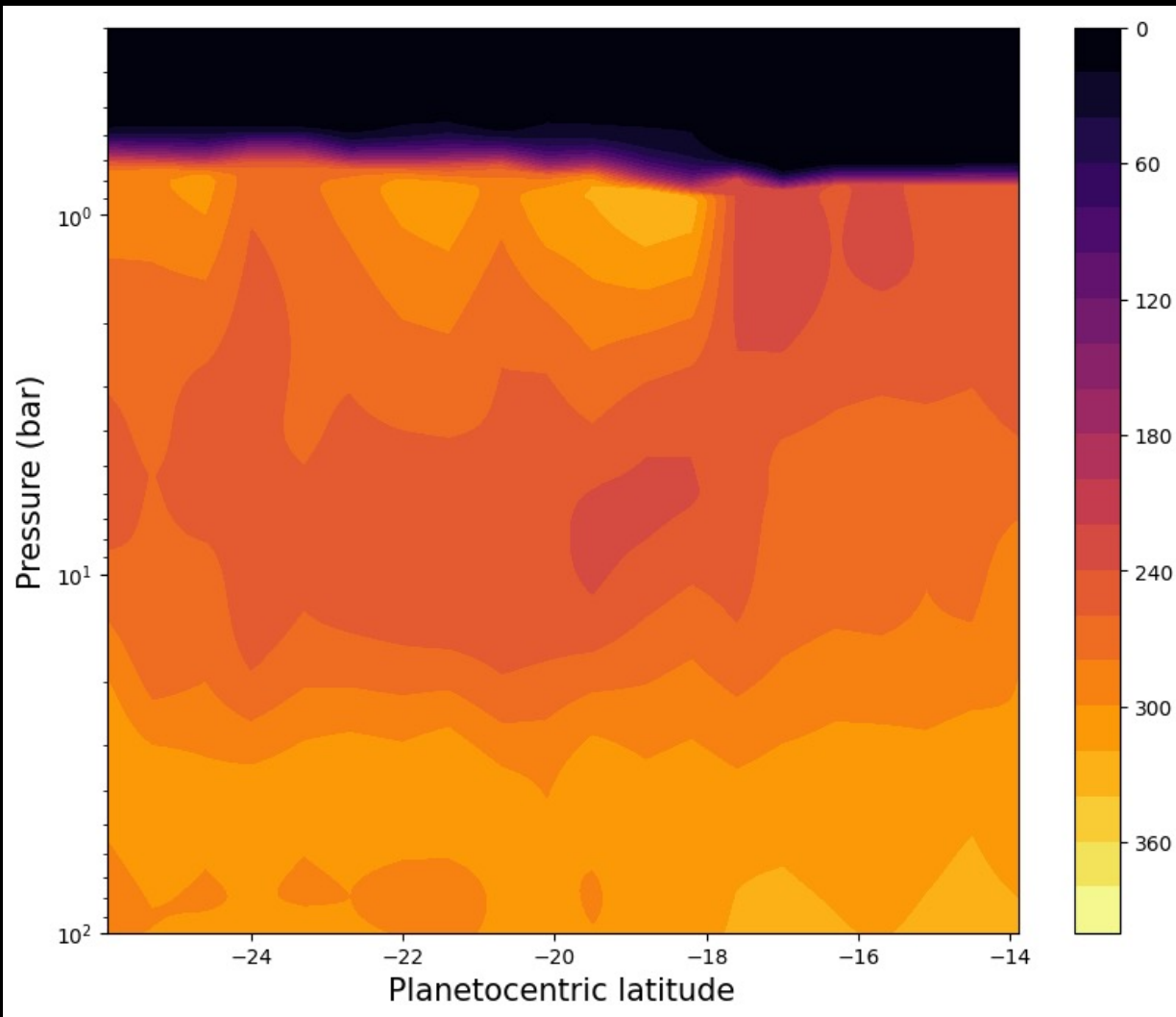
Observation



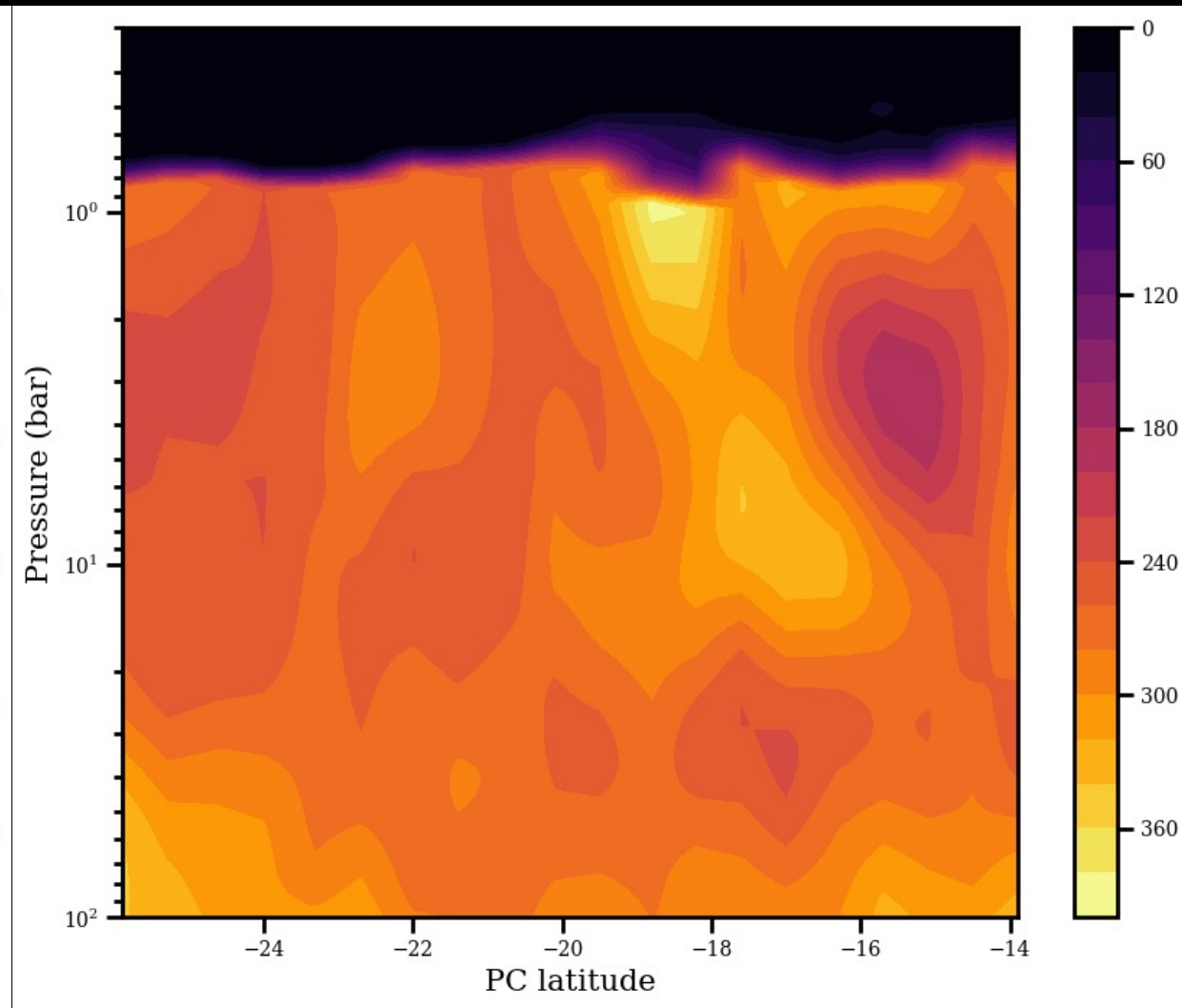
Model



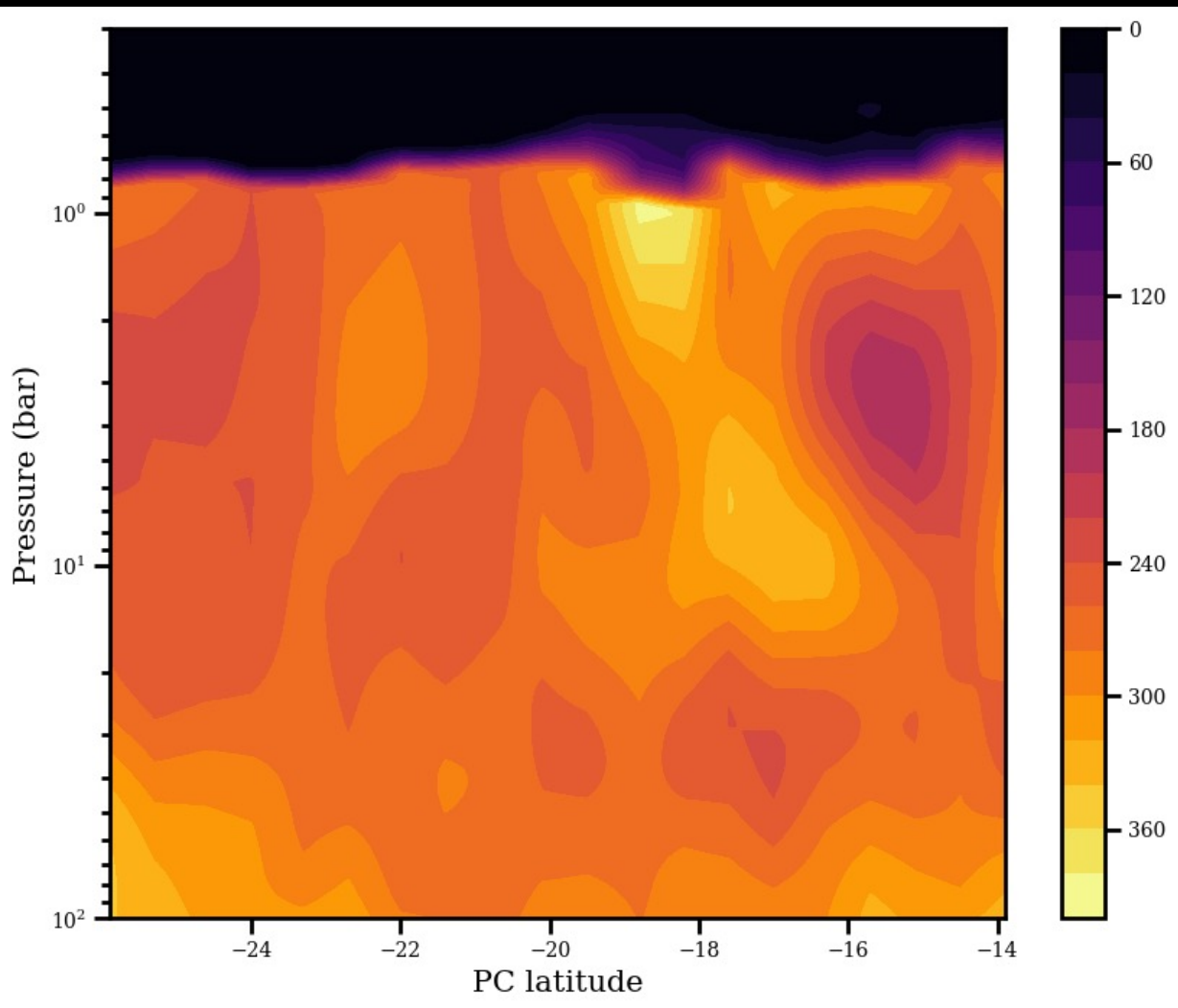
Background NH3



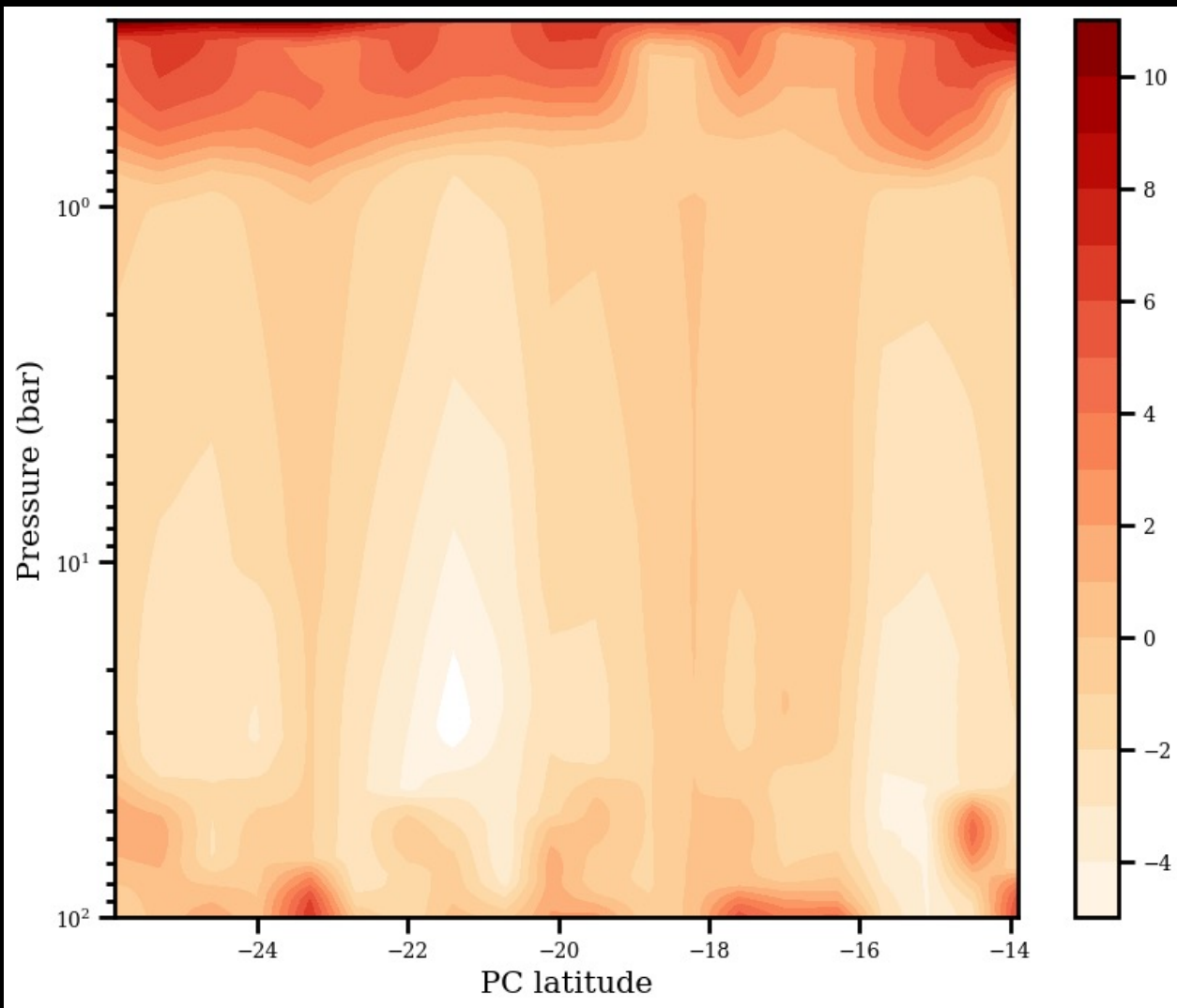
GRS NH3



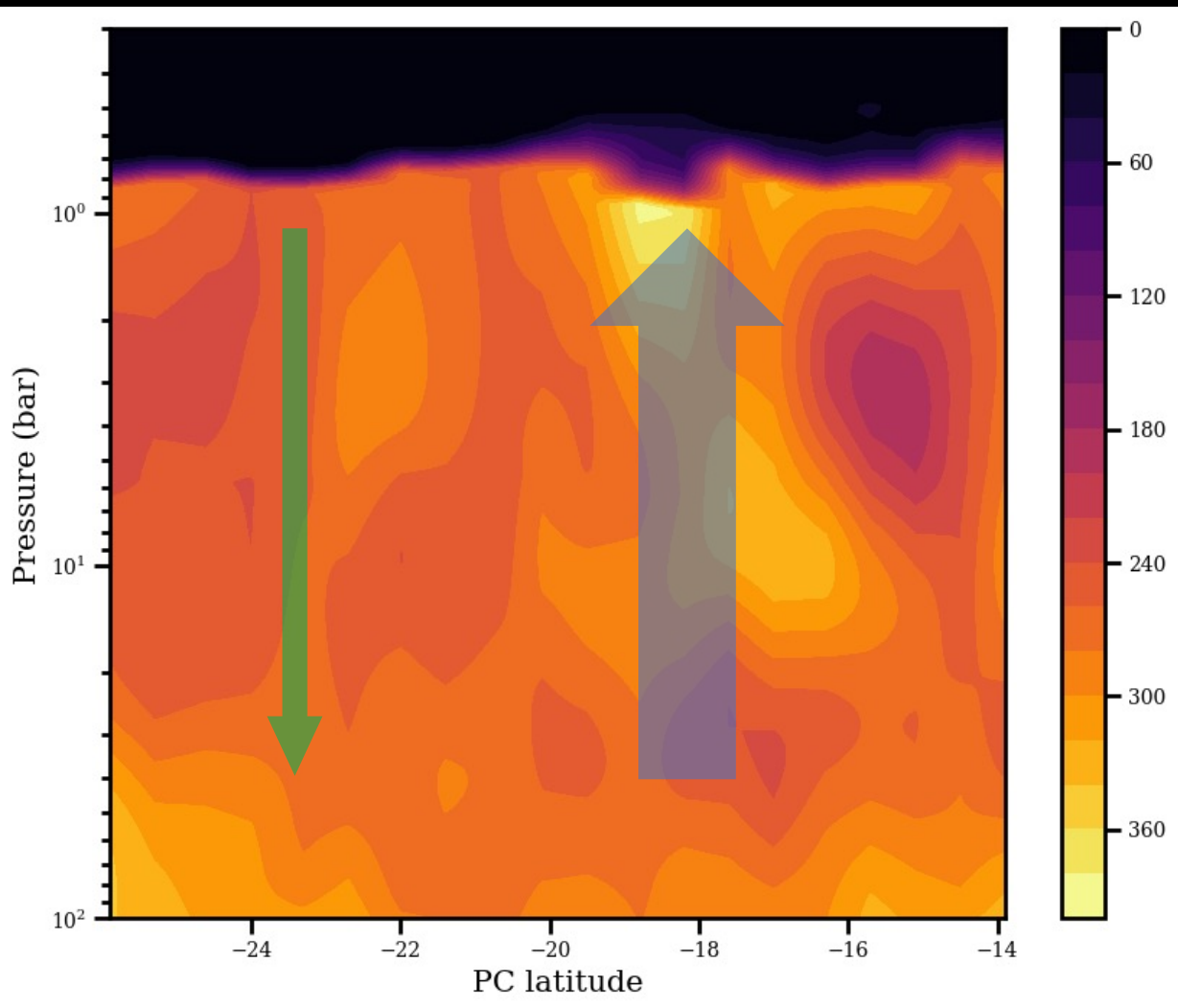
GRS ammonia mixing ratio (ppmv)



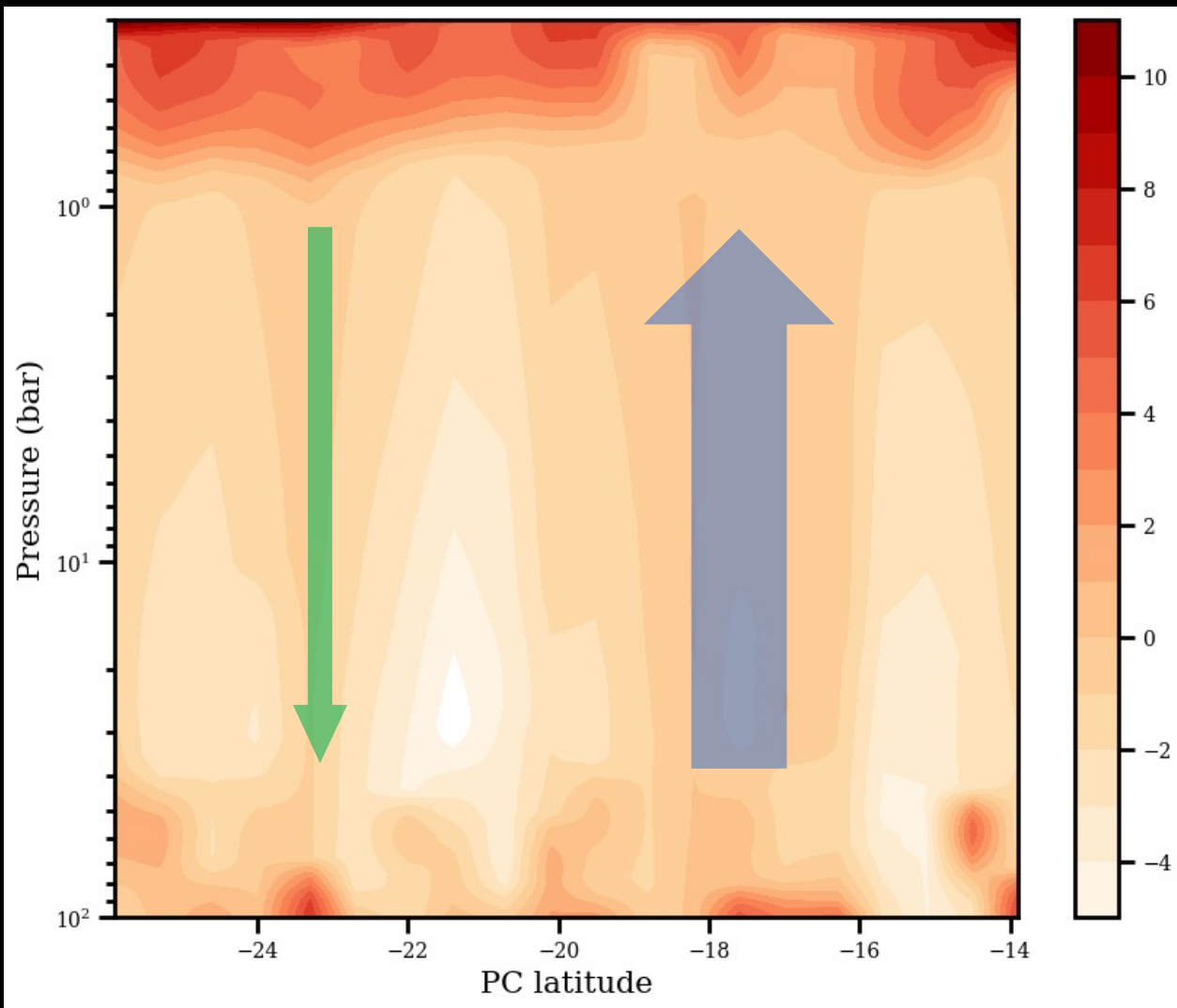
GRS temperature anomaly (K)

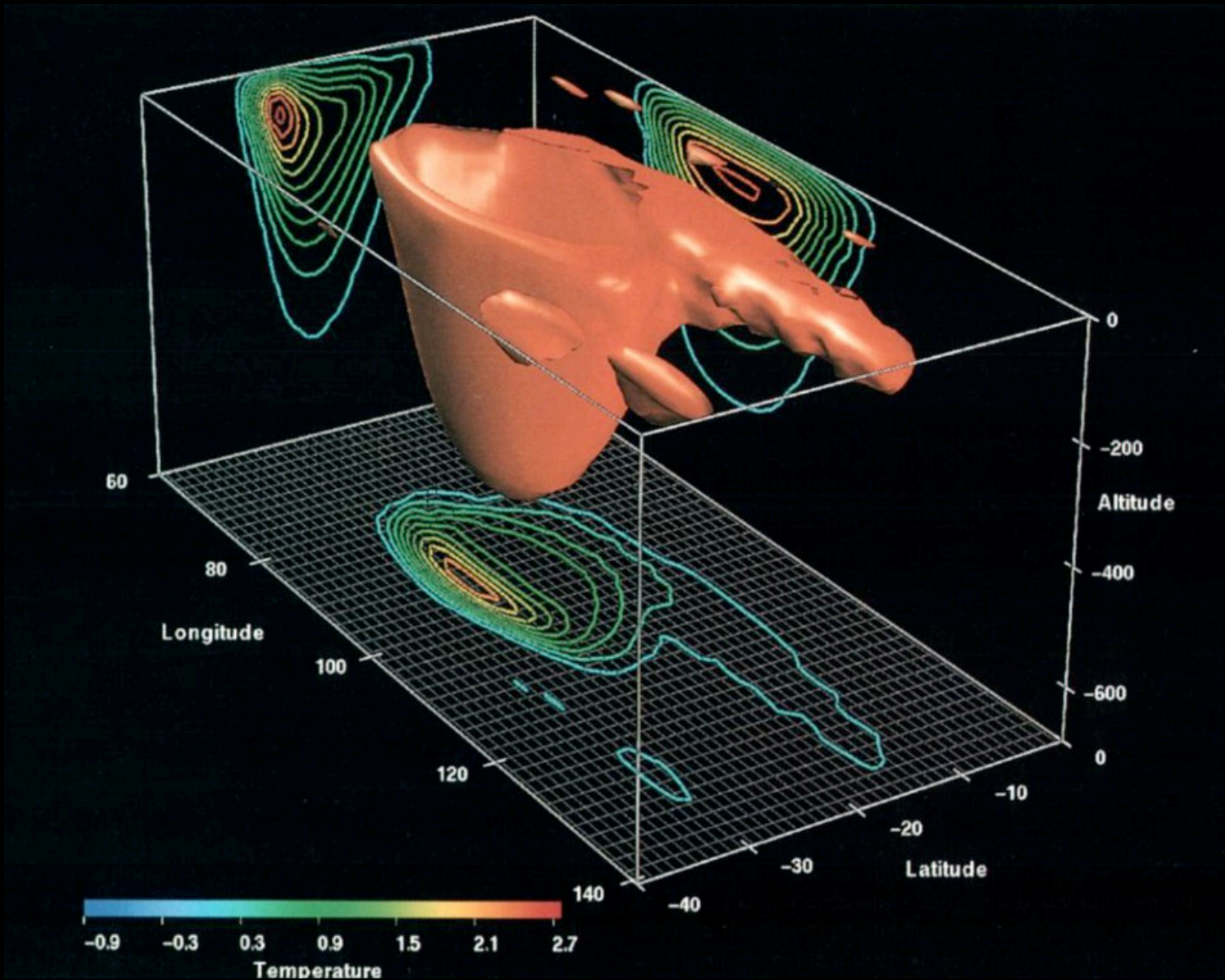


GRS ammonia mixing ratio (ppmv)



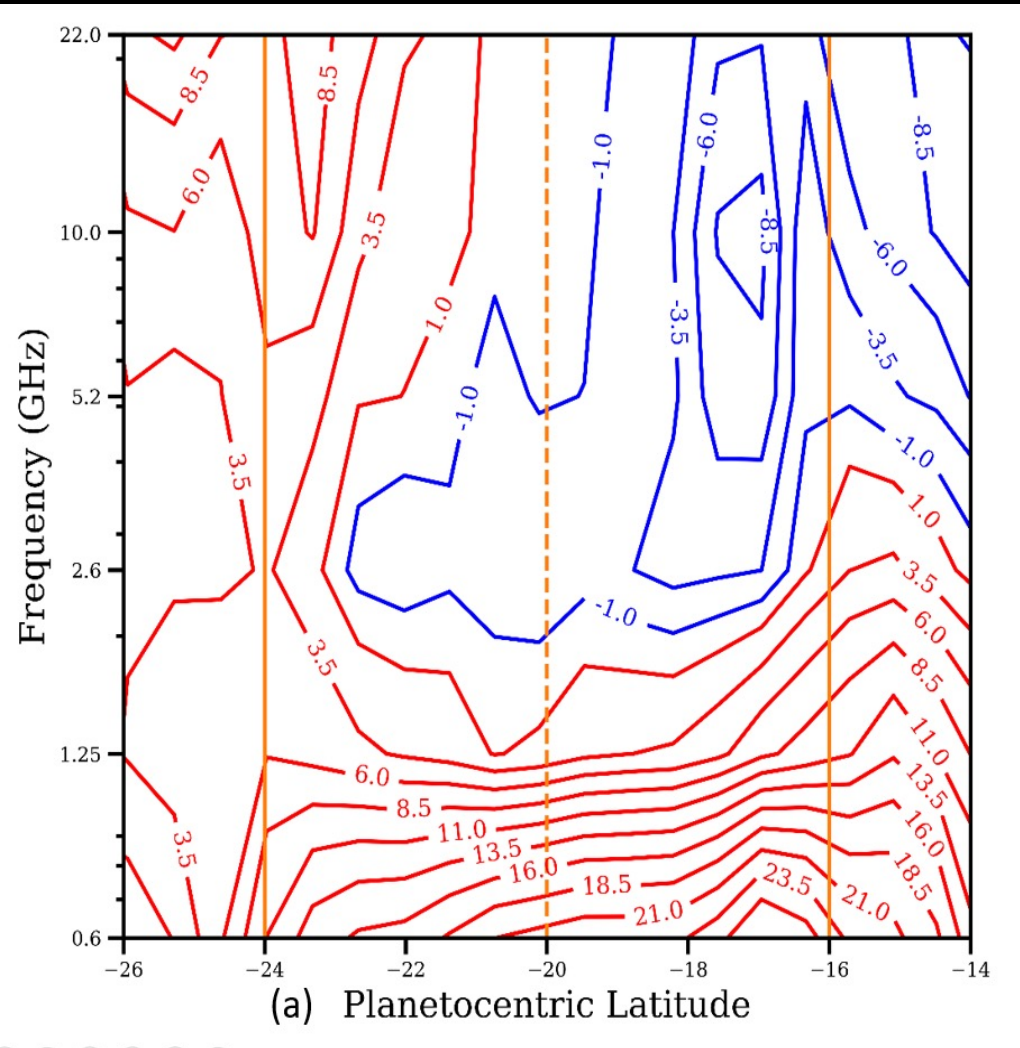
GRS temperature anomaly (K)





Williams 1997

Take home messages



Planetary Atmosphere

Observation

Inference

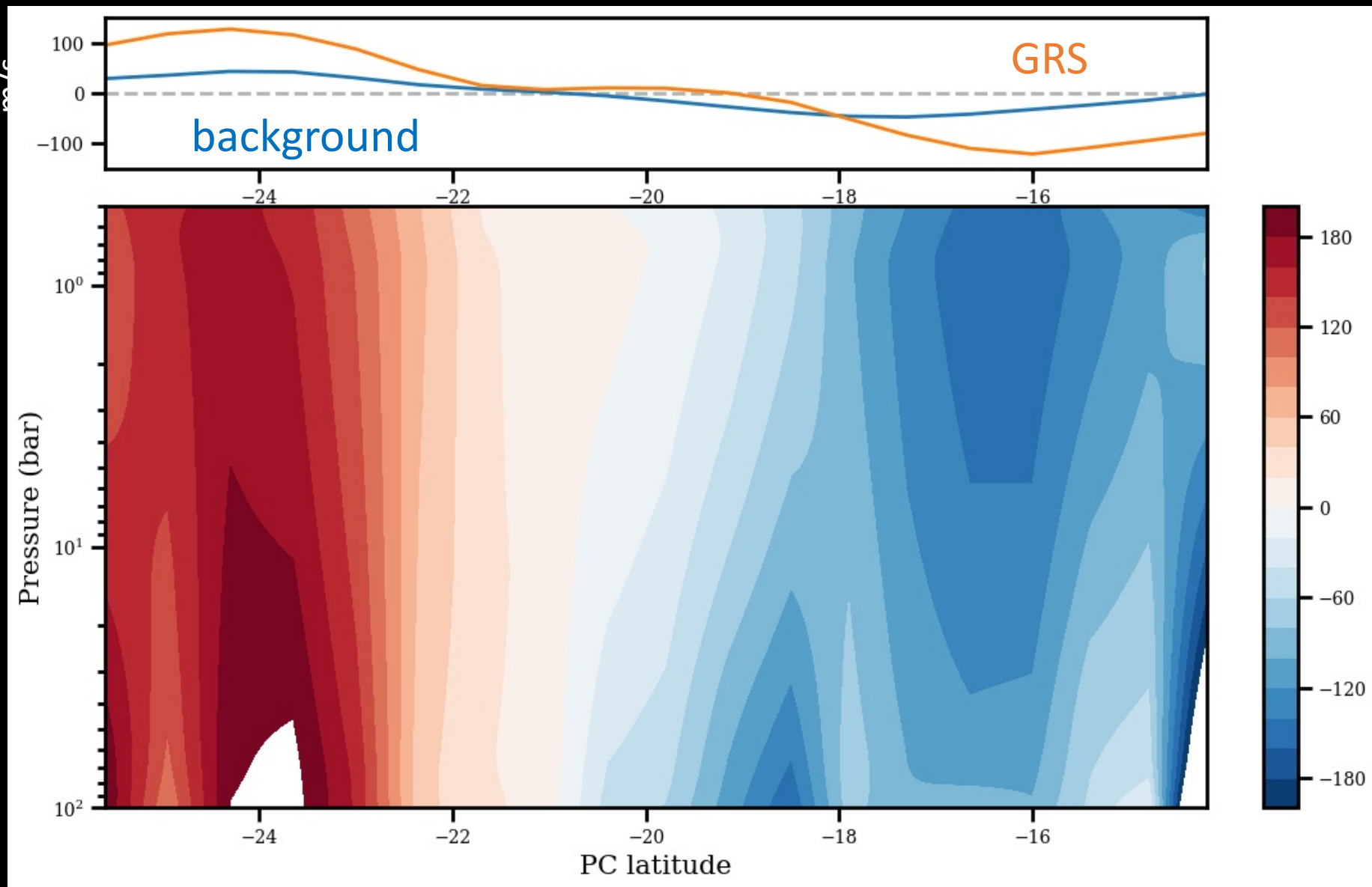
Modeling

Backup

Take home messages

- Overall depletion of ammonia at the body of the GRS
- Enriched ammonia at the northern part of the GRS
- Depth > 100 bars
- Broad upwelling in the north, narrow downwelling in the south periphery

Thermal wind relation



Thermal wind relation

