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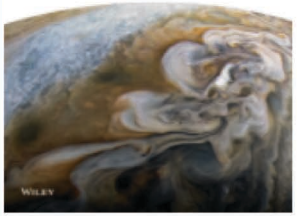

Jupiter's Equatorial Plumes and Hot Spots: Spectral Mapping from Gemini/TEXES and Juno/MWR

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UNIVERSITY OF LEICESTER

arXiv.org > astro-ph > arXiv:2004.00072

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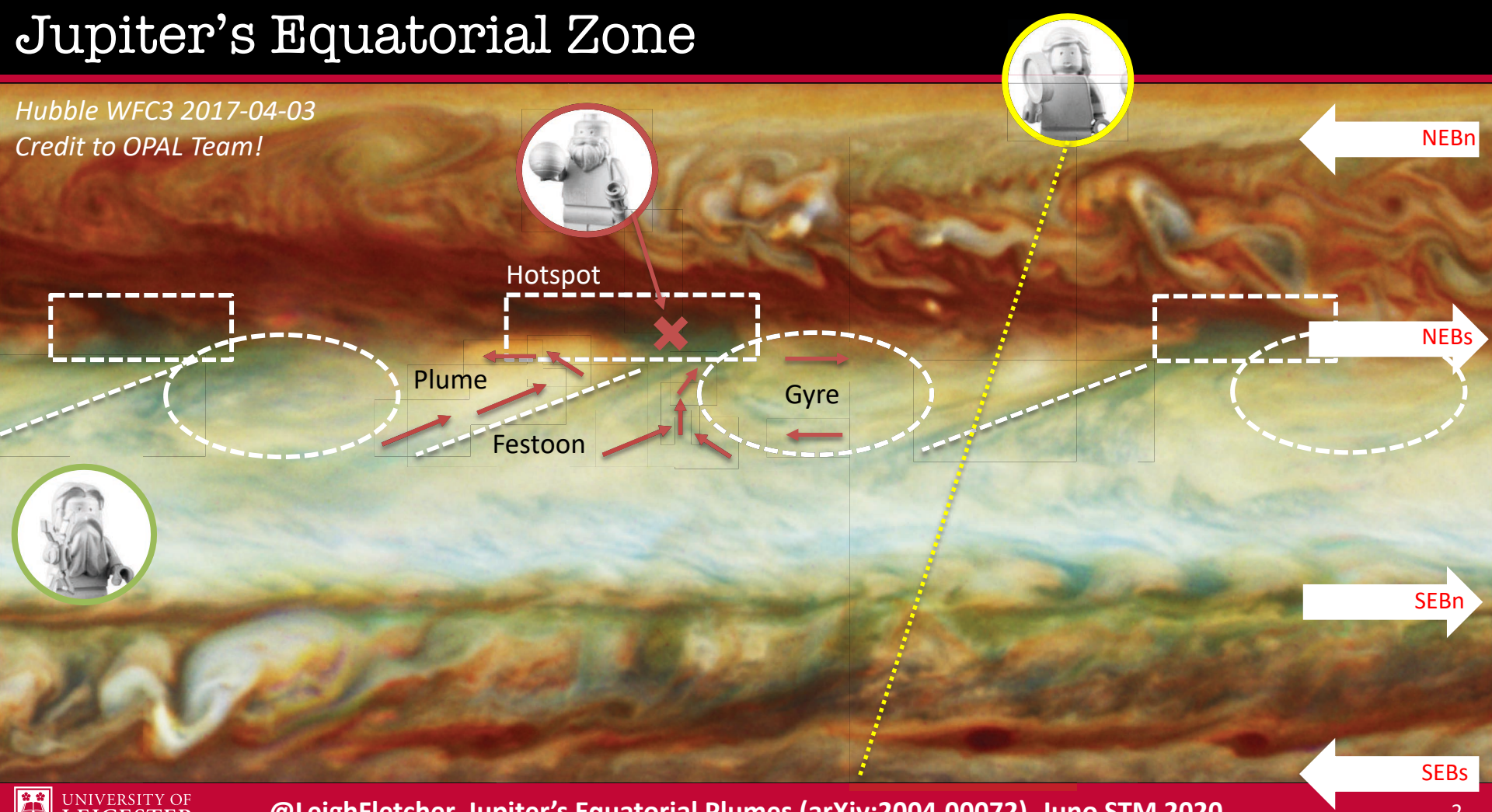
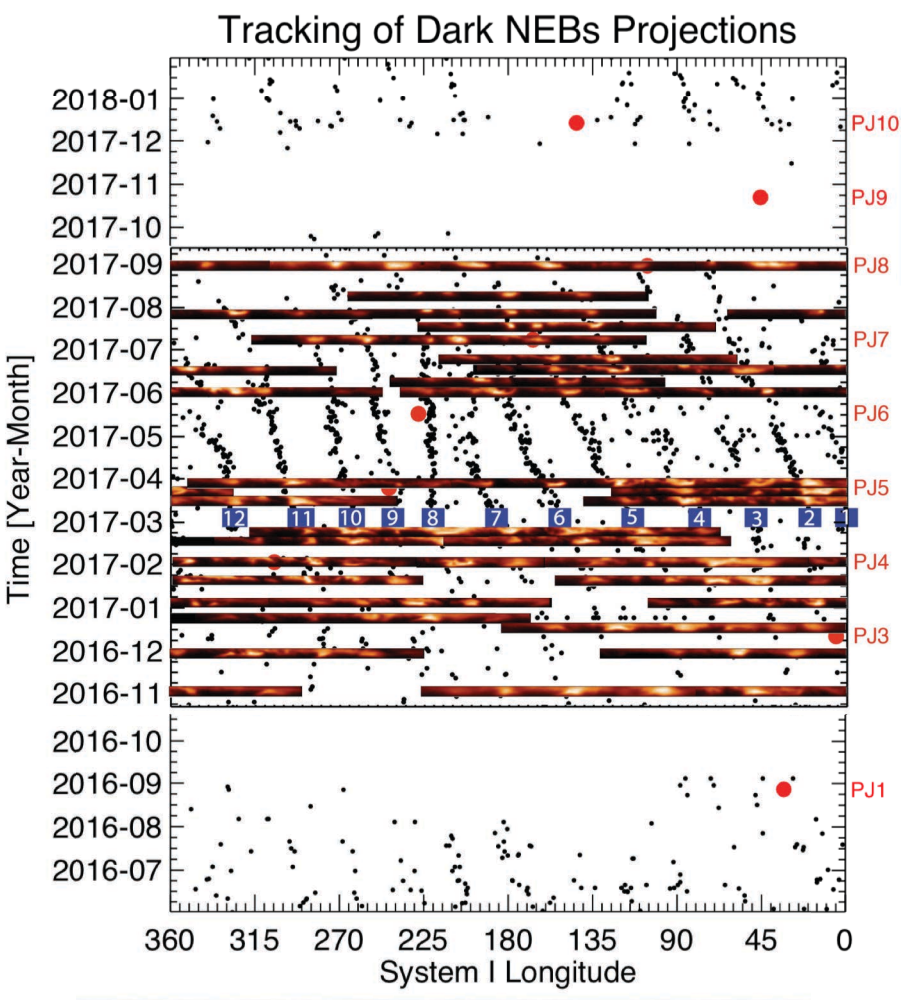
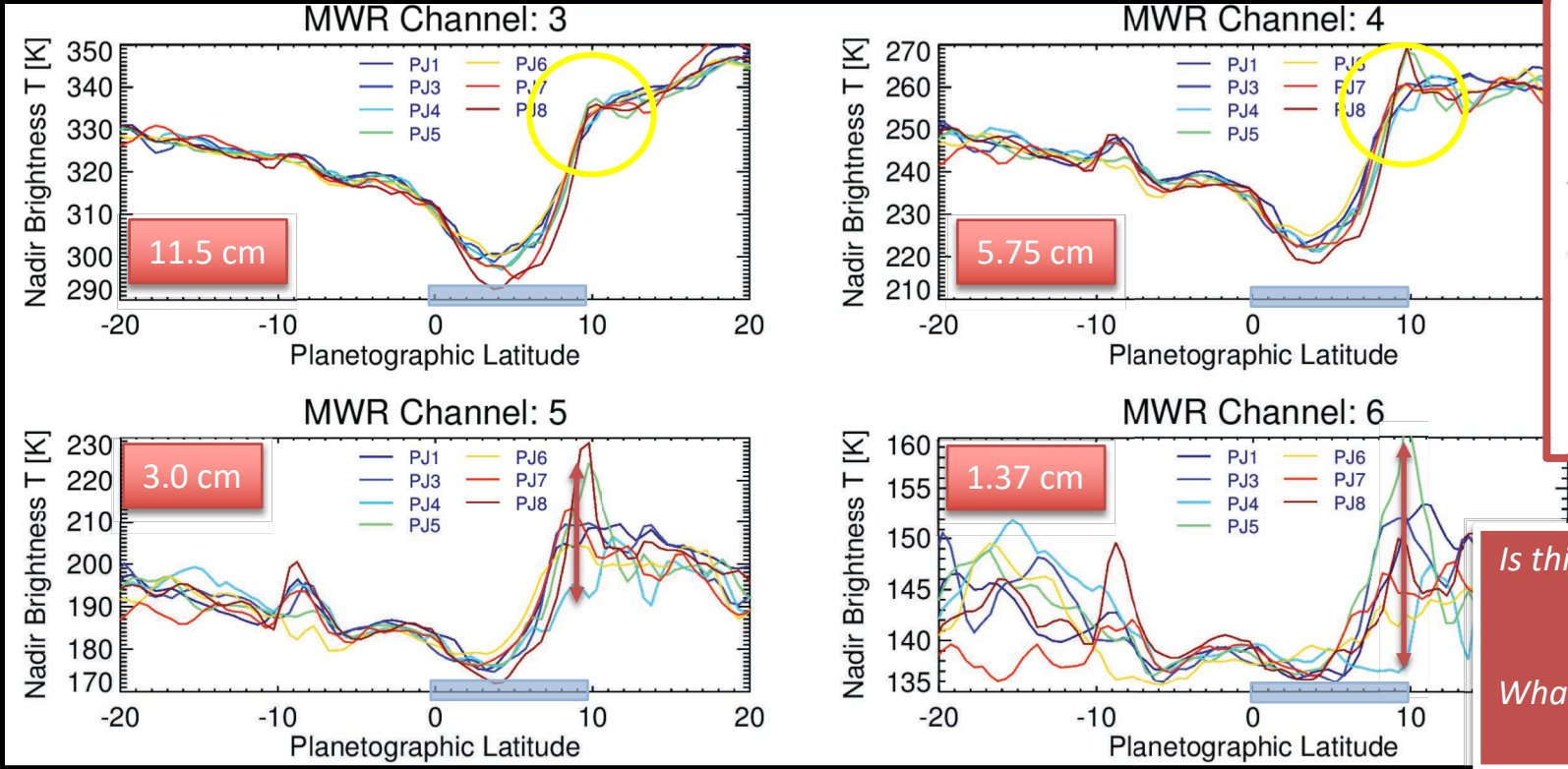


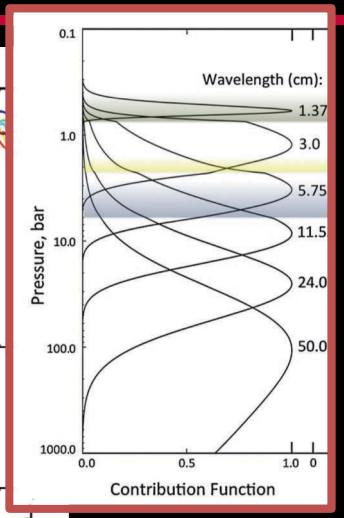
Tracking Hotspots & Gyres

- NEBs features move ~113.9 m/s (10,000 km/day).
- Longitude “System I” used for features ±7° of equator.
- WinJupos (jupos.org) used to trace hotspot locations, but not precise enough.
- 5-μm brightness confirmed by Orton et al. SpeX programme.



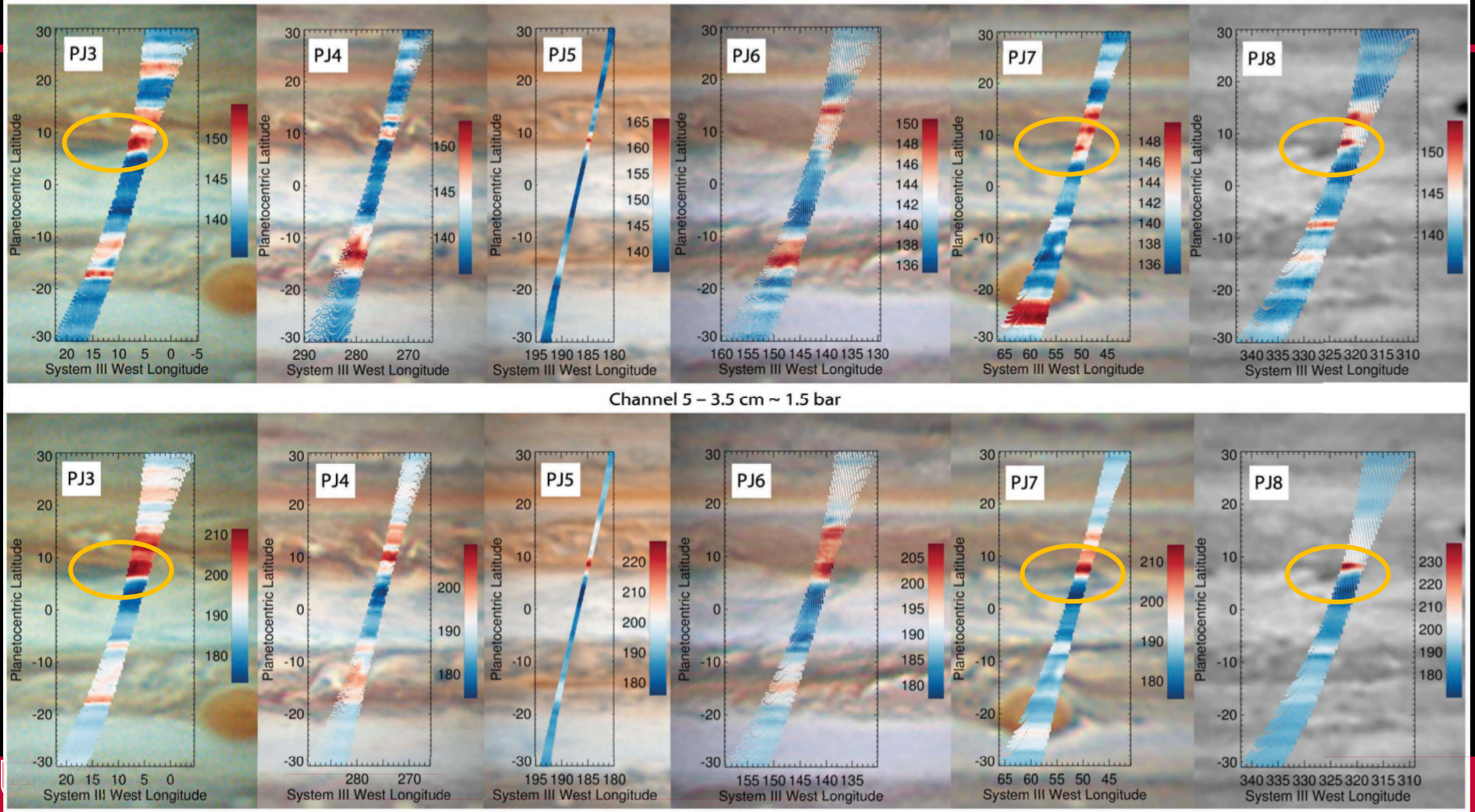
Significant Variability Observed by Juno/MWR



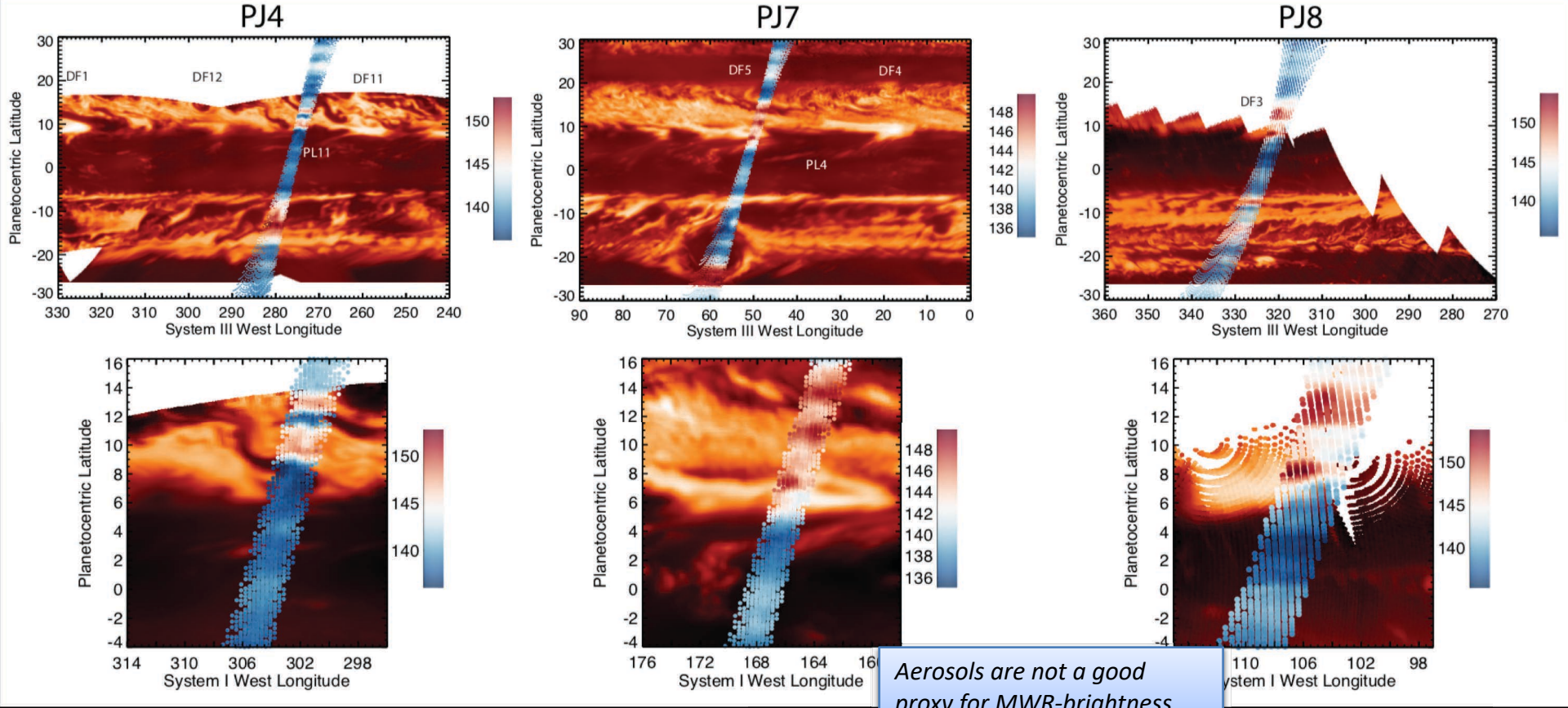


Is this variability due to ammonia? Temperature? What are we looking at here?

- Nadir brightness temperatures along PJ passes – variability im Ch4-6 (p<5-8 bar).


Channel 6 – 1.37 cm ~ 0.7 bar
PJ3
PJ4
PJ5
PJ6
PJ7
PJ8
Planetocentric Latitude
System III West Longitude
Channel 5 – 3.5 cm ~ 1.5 bar
PJ3
PJ4
PJ5
PJ6
PJ7
PJ8
Planetocentric Latitude
System III West Longitude

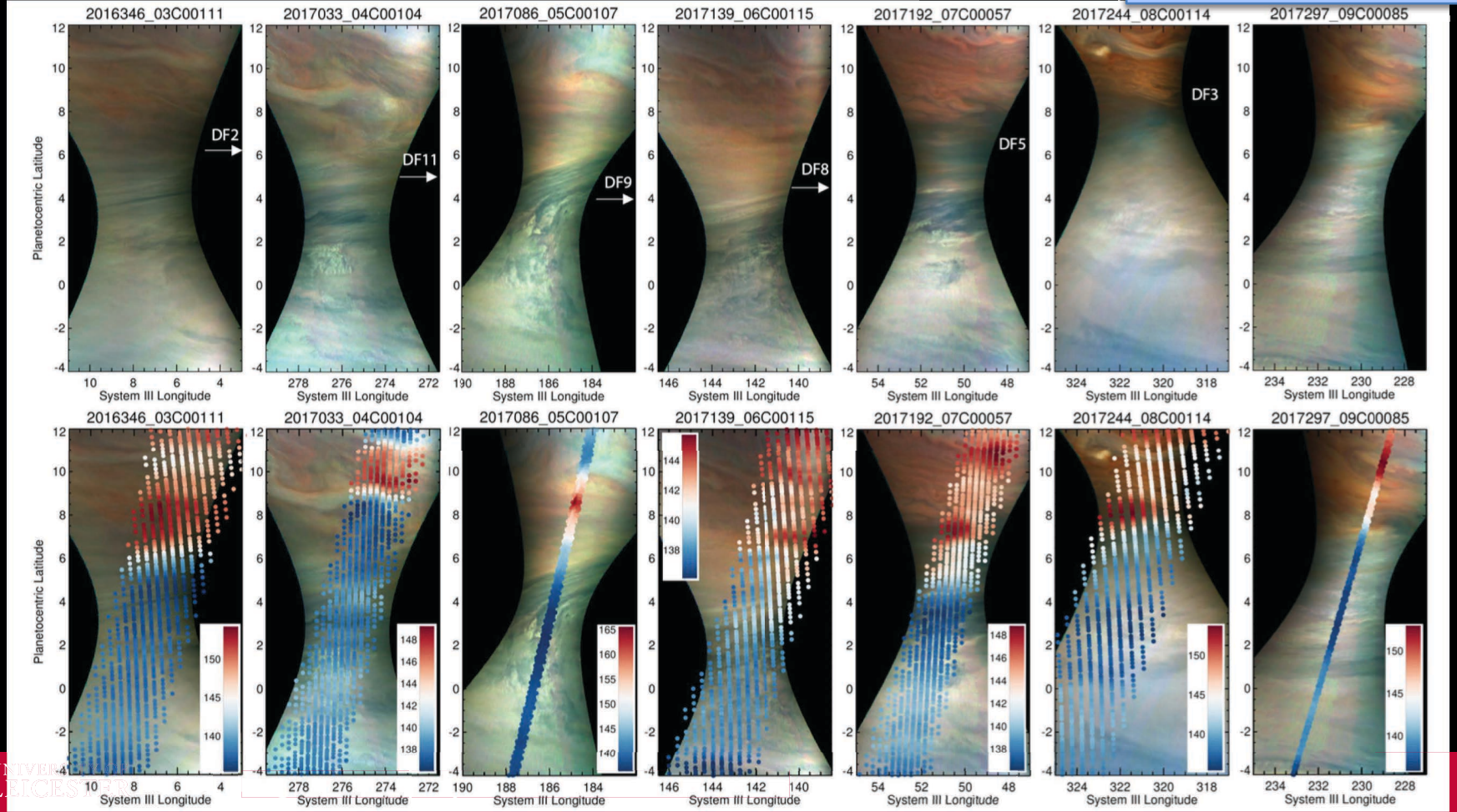
Cross-Comparison with JIRAM



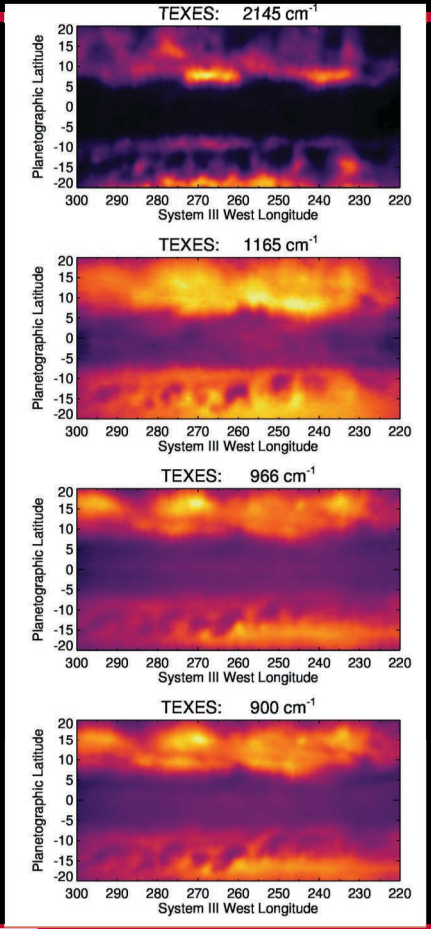
Aerosols are not a good proxy for MWR-brightness.

Cross-Comparison with JunoCam

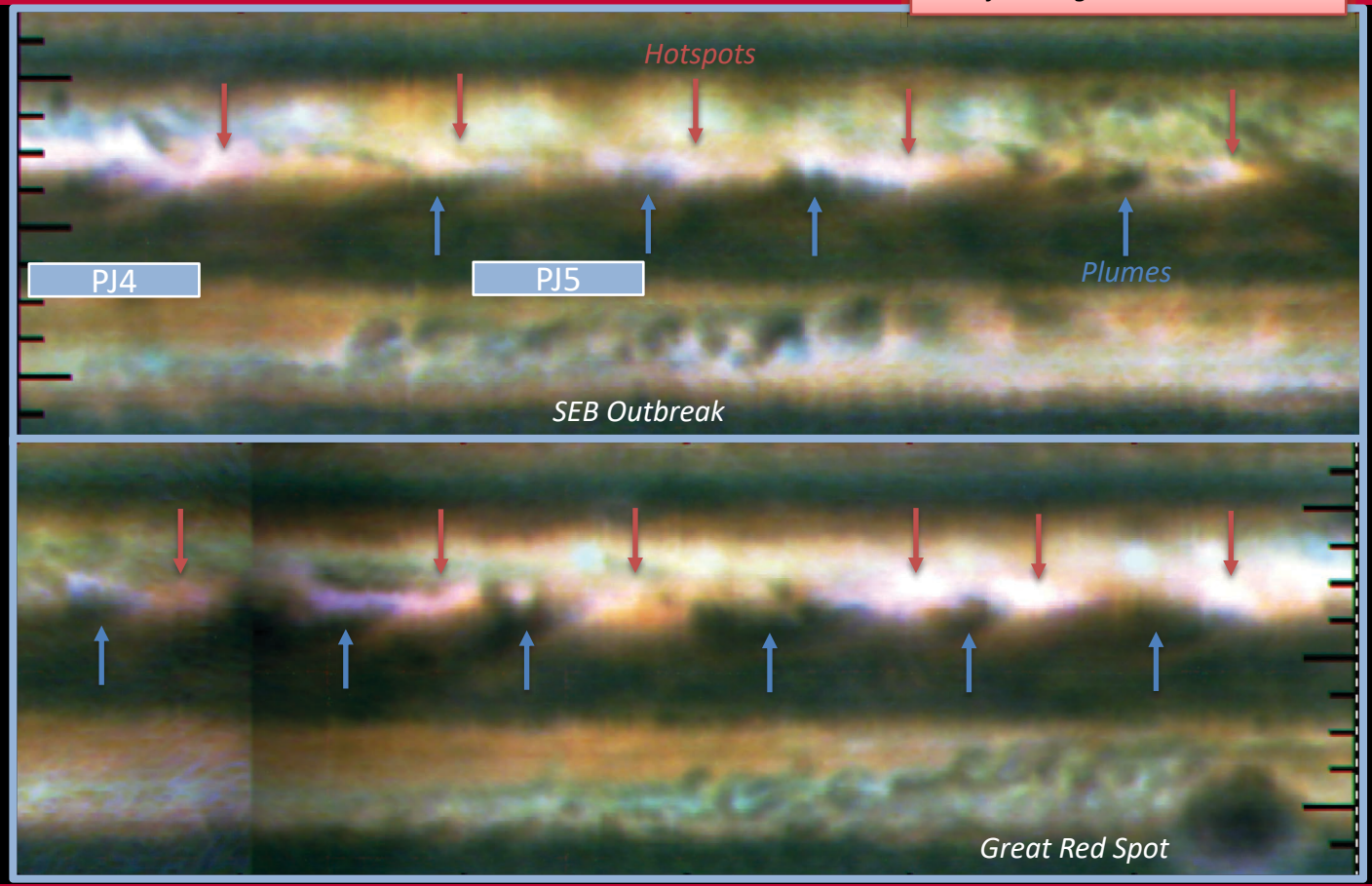
Aerosols are not a good proxy for MWR-brightness.



Gemini/TEXES – March 12th-14th 2017

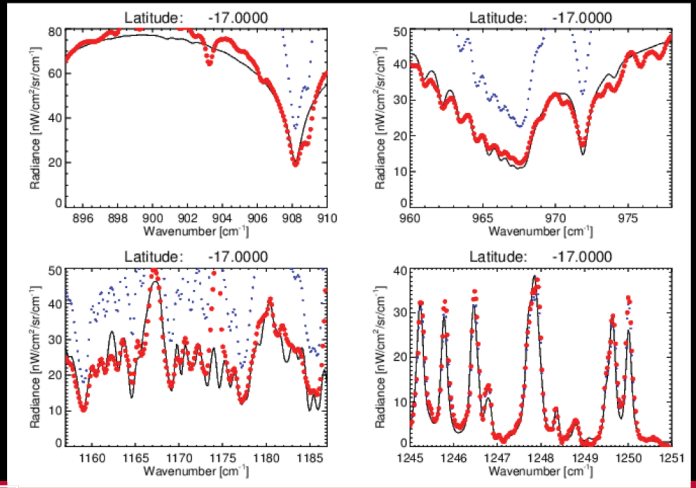


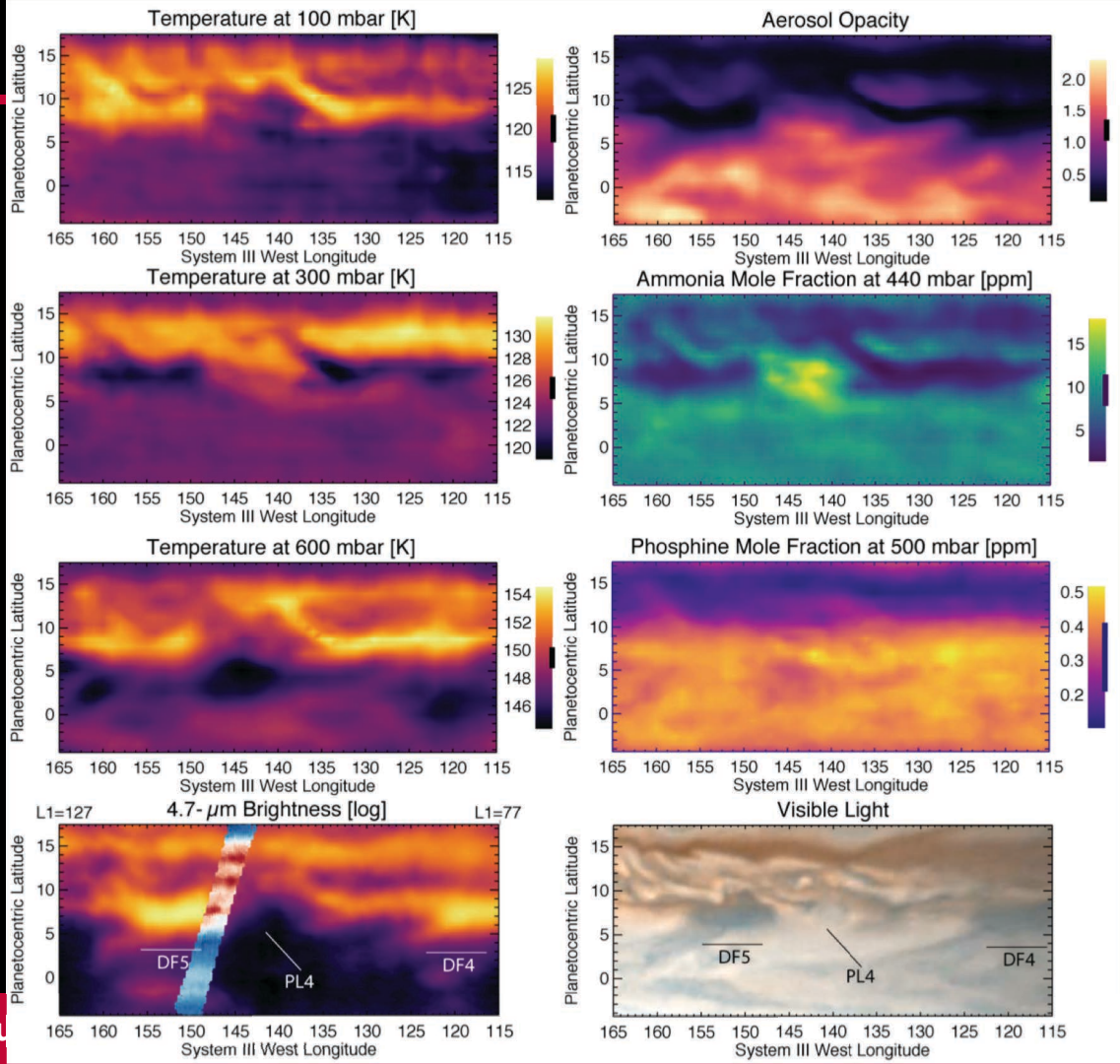
RGB from regions near 1165 cm^{-1}.



TEXES Inversions

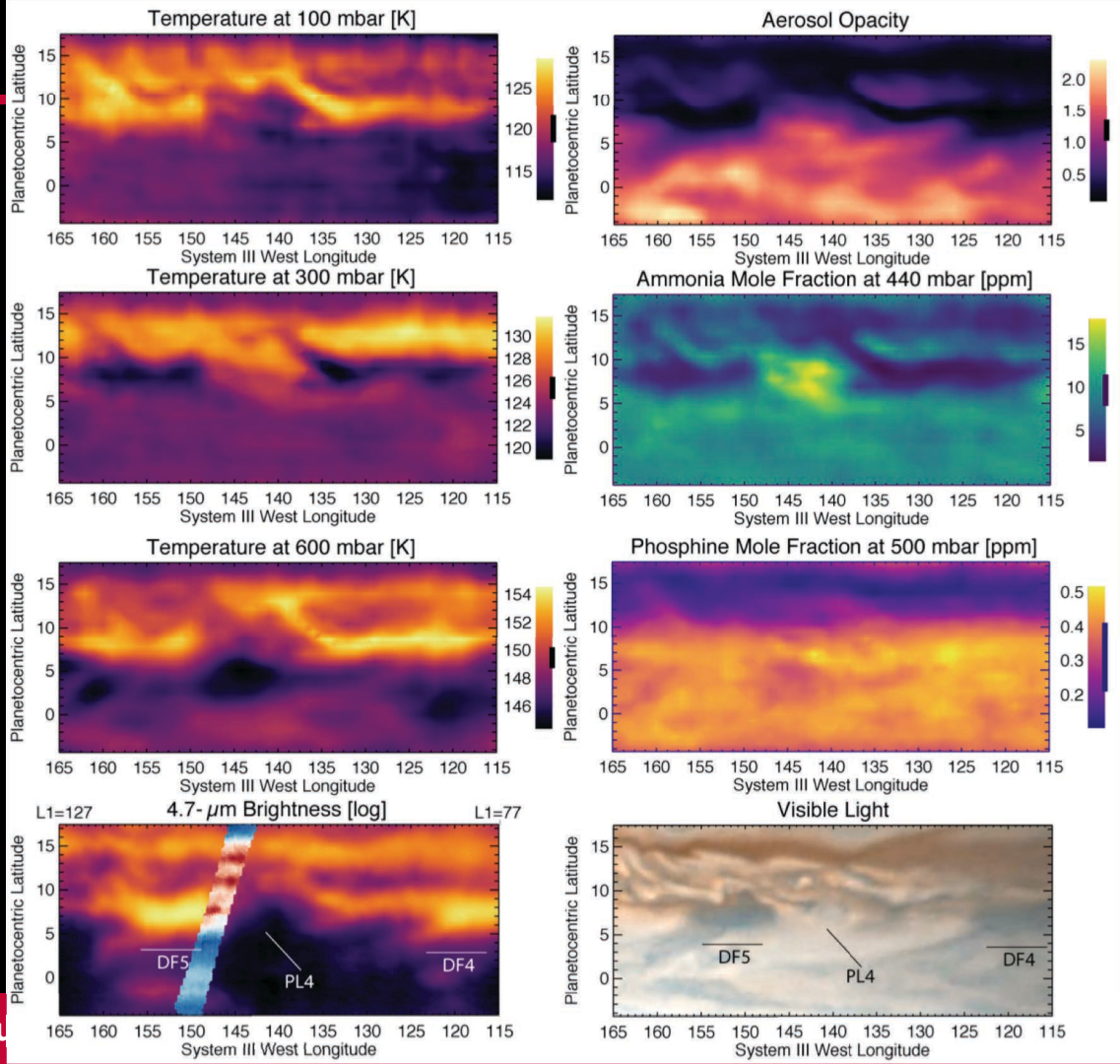
- Spectral mapping 7-20 μm from TEXES
  - NEMESIS retrieval: temperature (1-10 and 80-700 mbar), gases (NH_3, PH_3, C_2H_2, C_2H_6), ~600-mbar aerosols (arXiv:1606.05498)
- Seven groups covers whole 25N-25S region, all longitudes.
- All examples in arXiv:2004.00072



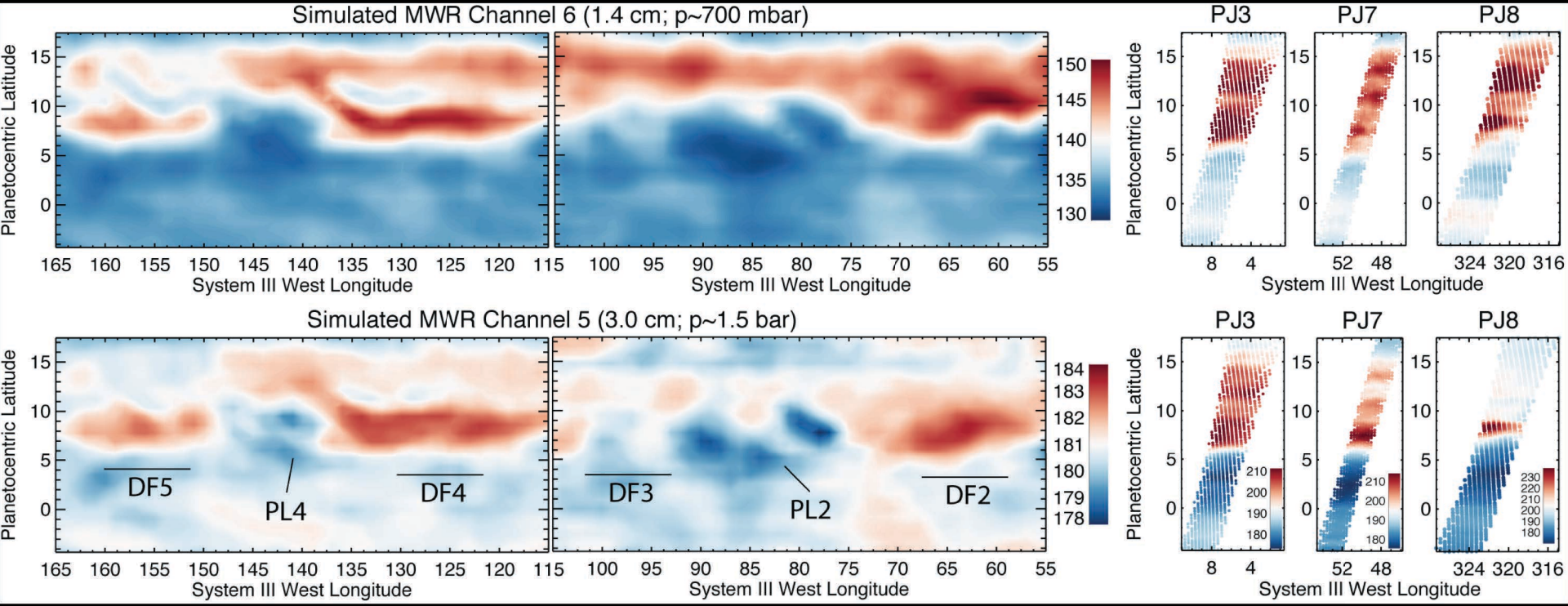


Conclusions

- **No two hotspots are equal**
  - NH_3 depletion and T(p) often indistinguishable from rest of NEB at 200-800 mbar.
  - Aerosol opacity is primary distinguishing variable and not a good proxy for NH_3/T.
    - *Don't expect MWR to look like JIRAM/JunoCam*
  - No PH_3 variation - shallow?
  - T/NH_3 varies *within a hotspot.*
- **Plumes are cold, cloudy, NH_3-rich:**
  - Conditions vary from plume to plume
  - Sign of plume "freshness"?
- **MWR passed 3 hotspots in 2017 (one centre, two edges)**
  - Similar TB to NEB in Ch6.
  - Indistinguishable from NEB in Ch3.
  - Hotspots/plumes shallow (p<8-10 bar)
- **Relevant to MWR – both NH3 and T are varying at p<800 mbar (Ch6)**



Use TEXES to Simulate MWR



- TEXES-MWR consistent for Ch6, not for Ch5 (there's more NH_3 depletion or warmer T below level of TEXES sensitivity)

Next Steps

- **Hotspot 2017 study complete, but needs extending 2018-20.**
  - Additional TEXES coverage of GRS and mid-SEB outbreak (2017).
- **Joint MWR-thermal inversion:**
  - JAMRT Installation (done)
  - NH_3/H_2O opacities from Steffes et al. -> NEMESIS (underway)
  - Cross-comparison of lapse rate calculations (to do)
  - Forward model intercomparison (to do)
  - Joint MWR-thermal inversion for consistent NH3/T (goal)
- **Proposed joint MWR and JWST/MIRI (5-11 µm) study in ~2022.**