Atmospheric variability in the ultra-hot Jupiter WASP-121b?

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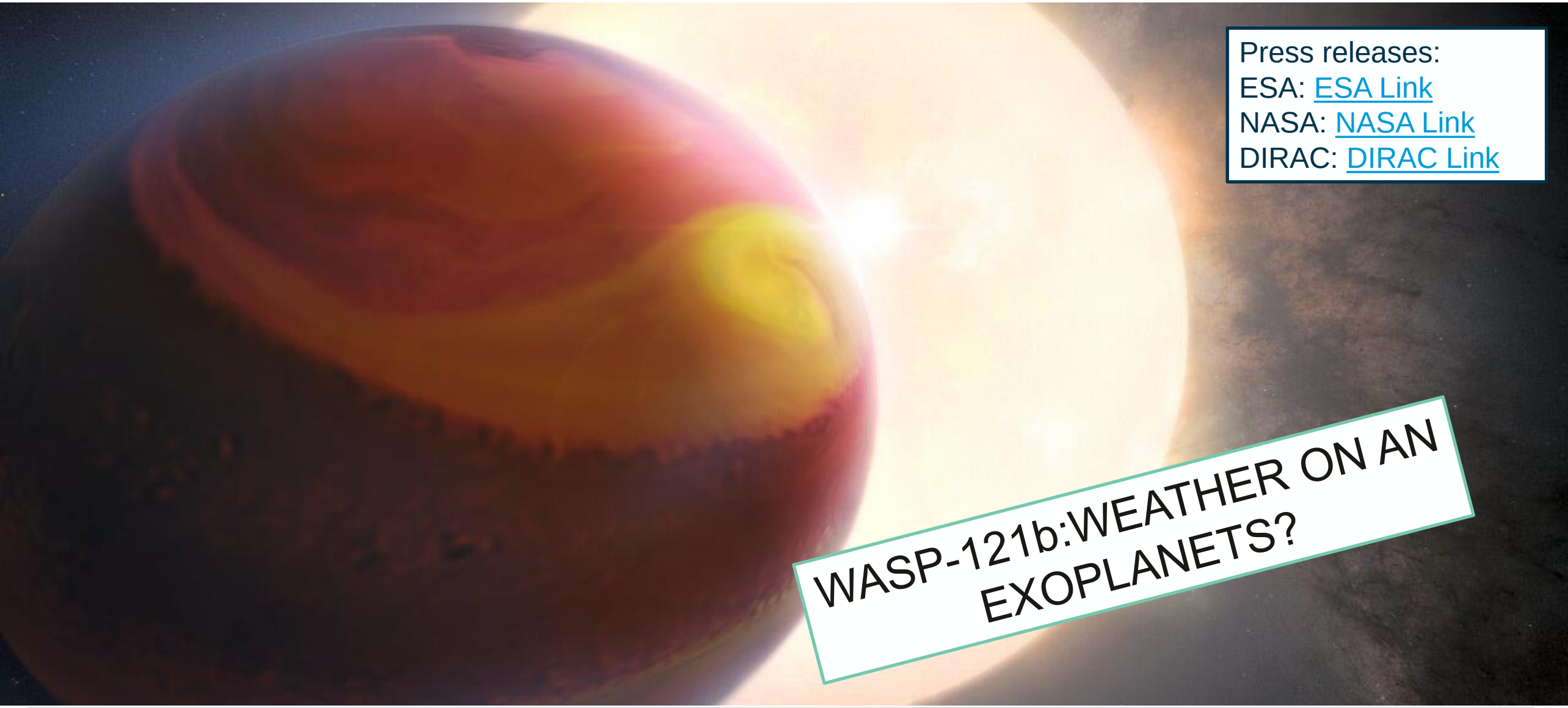
WEATHER ON EXOPLANETS

arXiv:2401.01465 (2024)



WEATHER ON EXOPLANETS

Strategy with current observatories:
- Combine multiple observations to increase SNR.
- Do not repeat high-SNR observations.
→ No data sensitive to weather

WASP-121b with HST:
- Ultra-hot Jupiter: 1.7R_J and T > 2500K.
- 2 phase-curves + 1 transit + 1 eclipse.

Paper Method:

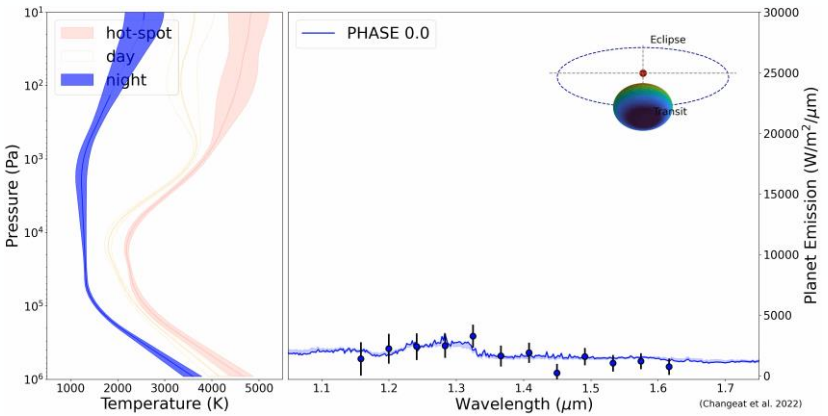
1) Data reduction
→ Obtain consistent set of each observation.

2) 1.5D retrieval on combined observations
→ Method from Changeat+ 2021.
→ Global properties.

3) Individual 1.5D & 1D retrievals:
→ Re-inject priors from global retrieval
→ Show the variability!

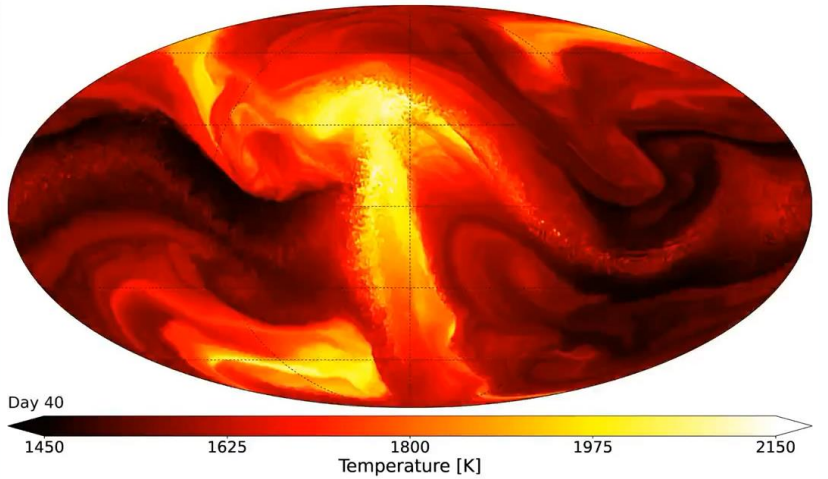
4) 3D modeling:
→ Use constraints from observations GCM
→ Post process to produce observables

5) Comparison with observations:
→ Compare amplitude / period of variability

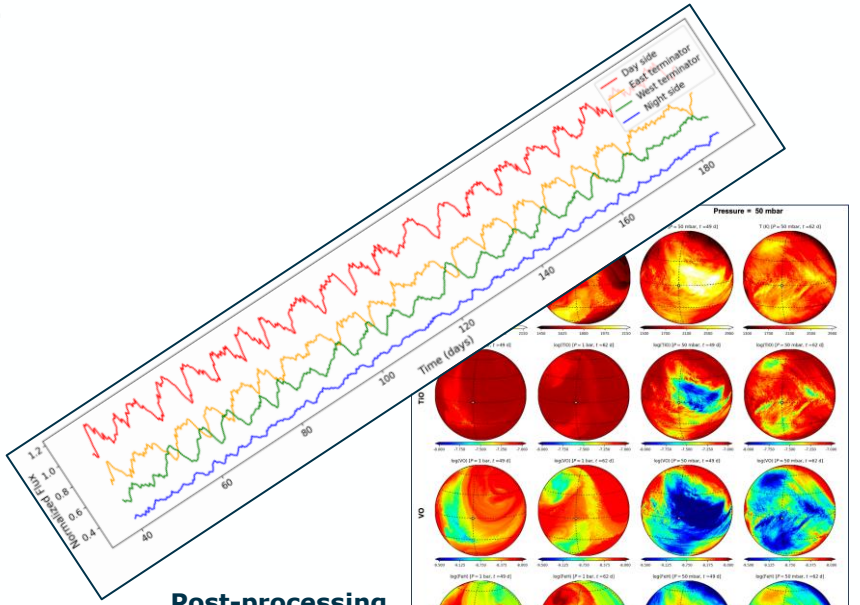


Data reduction and global retrievals

THEORY EXPLORATION



3D Modeling



Post-processing

WEATHER ON EXOPLANETS

OBSERVATIONS

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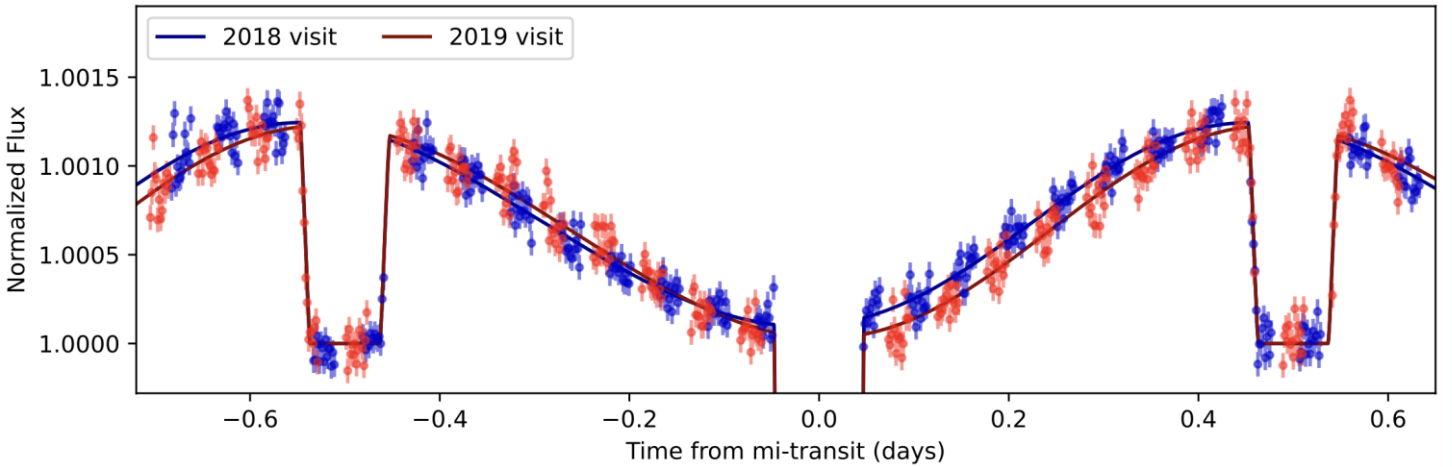
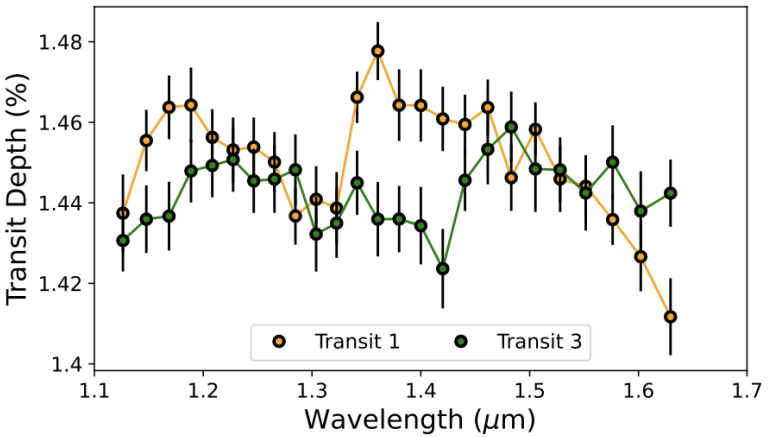
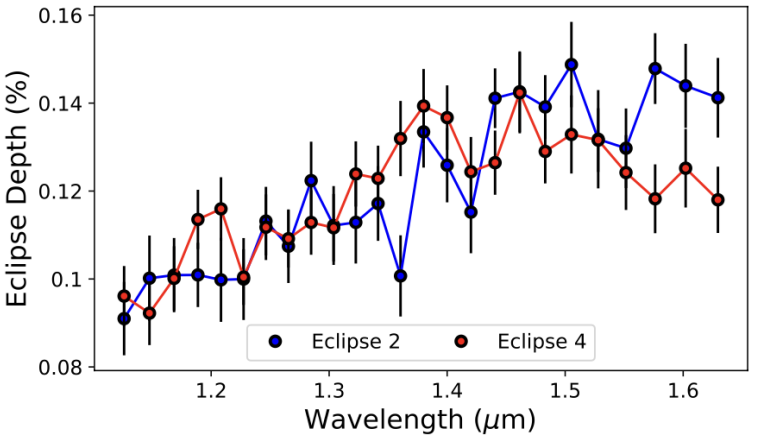
Phase-curve variability: hot-spot offset changes



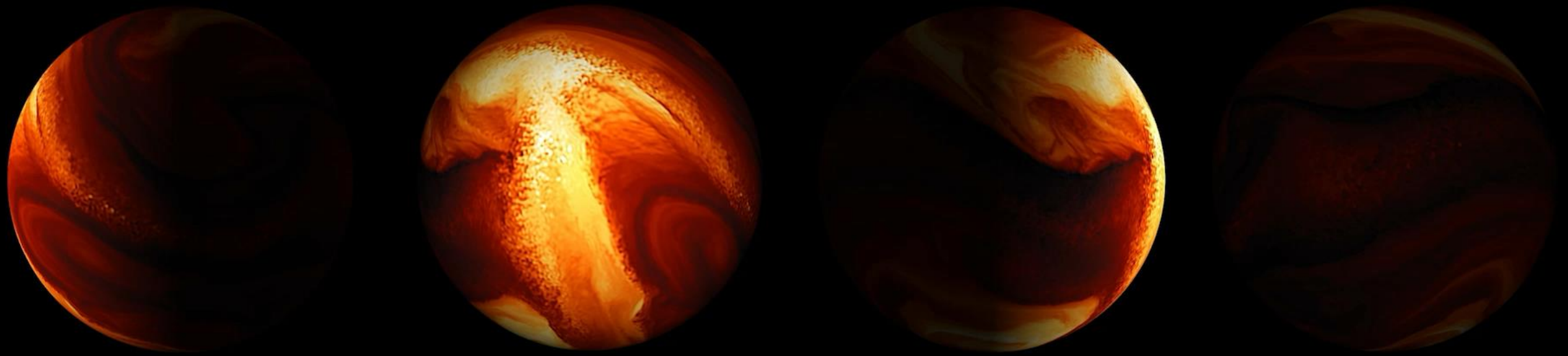


Transit variability: clouds?



Eclipse variability: T-p structure changes

Temperature forecast for exoplanet Tylos (WASP-121b)



Sunrise
Phase: 25%

Noon
Phase: 50%

Sunset
Phase: 75%

Midnight
Phase: 100%

Day 0.00

1450K 1800K 2150K