

IMPACT OF CLOUDINESS ON THE DEGENERACY OF EXOPLANETARY SPECTRA

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SCIENTIFIC QUESTION

Can different cloud distributions on the terminator produce measurable and statistically significant ingress-egress differences?

NASA PLANETARY SPECTRUM GENERATOR MODEL

WASP-17b | spectrum range 0.8 – 2.2 μm
R = 300

CONTROLLED EXPERIMENT

1. Only one parameter varied at the time;
2. Other variable parameters in future works.

Param	0.0	0.1	0.2	...	0.9	1.0
Cloud fraction	0.5 / 0.5	0.55 / 0.45	0.6 / 0.4	...	0.95 / 0.05	1.0 / 0.0
Abun.	0.08 / 0.08	0.172 / 0.072	0.264 / 0.064	...	0.908 / 0.008	1.000 / 0.000

Table 1 – Ingress/Egress parameter grid with each one done separately while other fixed on default values

INGRESS MID-TRANSIT EGRESS

☉ → ☉ → ☉ →
☉ → ☉ → ☉ →
Cloudy terminator Central passing Cloudy terminator

Clouds are mostly on one side of the terminator

$\alpha = 0.0, 0.1, \dots, 0.9, 1.0$

Asymmetry levels

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MAIN RESULTS - HOW THE ASYMMETRY CHANGES PHASE DIFFERENCES

Pairs of graphs with wavelength on x-axis, one with Transit depth spectra on y-axis, other with relative differences



Figure 1 – Null case scenario, symmetrical case test with asymmetry parameter taking its minimal value of 0.0



Figure 2 - Halfway though case scenario, with asymmetry parameter being 0,5



Figure 3 - Extreme case scenario, with asymmetry parameter taking its maximum value of 1.0

FINAL DETECTABILITY MAP

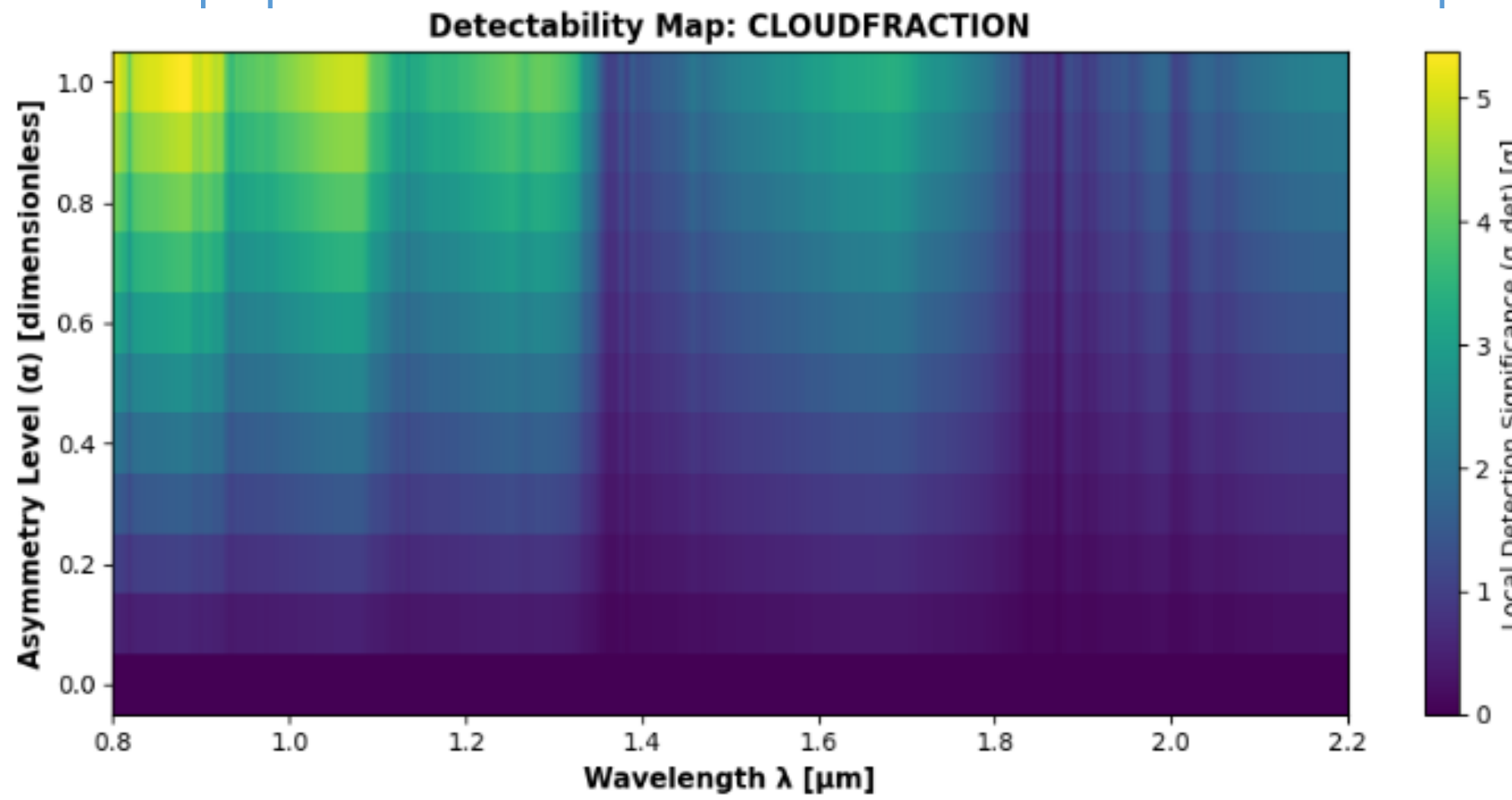


Figure 4 – Local detection significance heatmap in dependency of wavelength (x-axis) and Asymmetry level (y-axis)

TAKE HOME MESSAGE

1. Phase-dependent differences increase with cloud asymmetry;

2. Sensitivity varies with wavelength;

3. Detectability depends on observational noise.

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