JUPITER BRIGHTNESS DISTRIBUTION:

an approach to atmospheric turbulence

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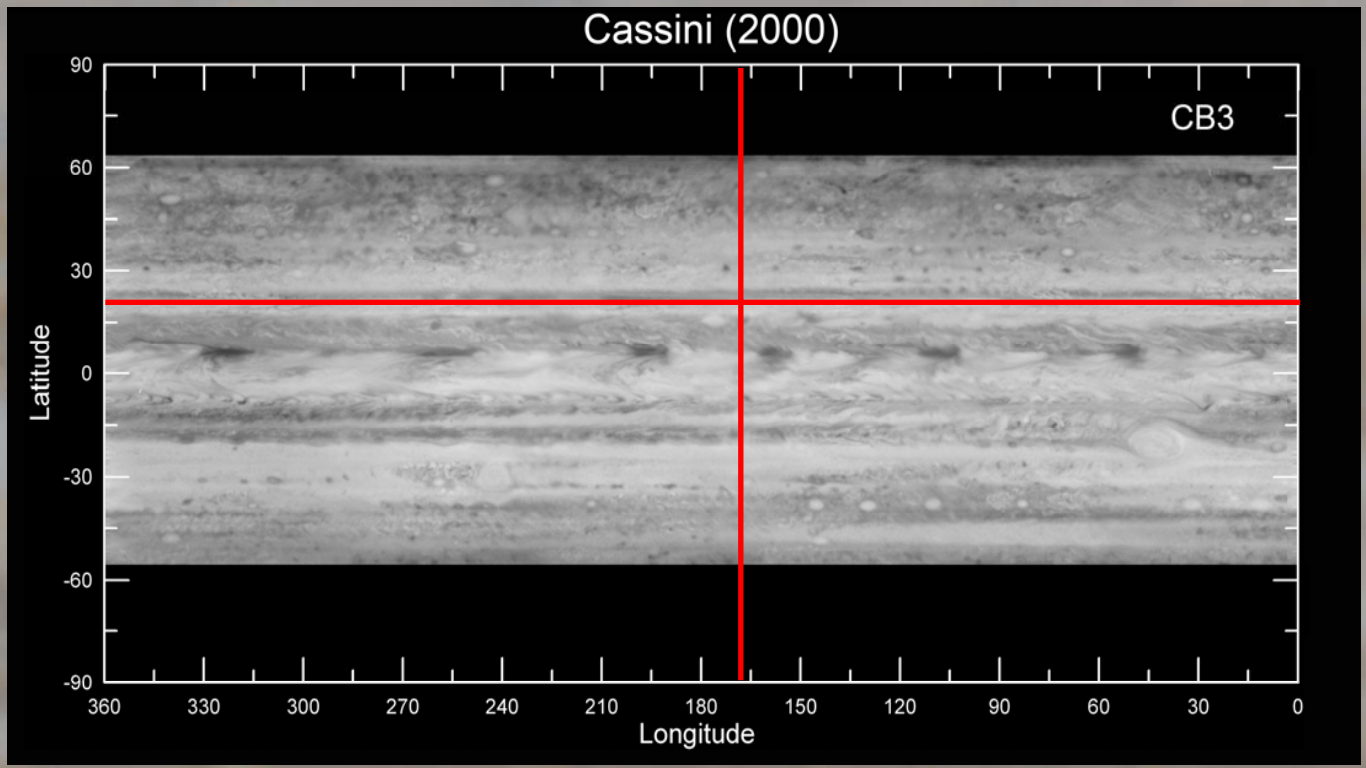
1. Goals

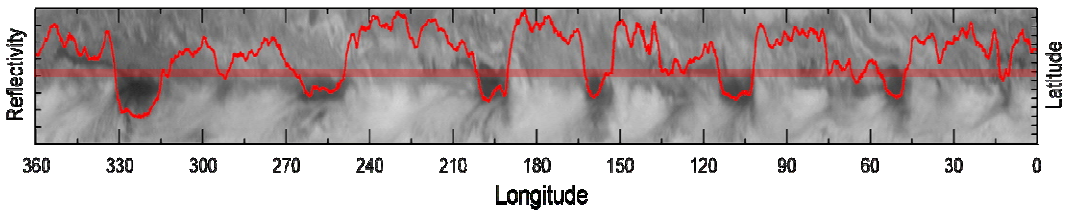
- Study Jupiter's ***brightness distribution.***
- This may be a diagnostic of the ***kinetic energy spectrum****. (Travis, 1978).*
- Composition of ***complete planispheres*** using HST (1995) and Cassini ISS (2000) images.



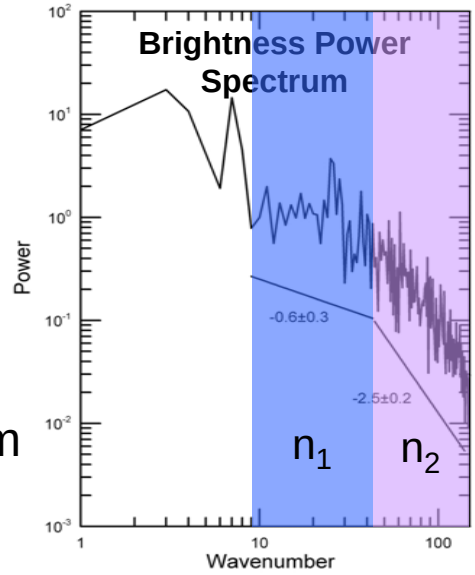
- ***Analyze*** albedo scans:
  - *Zonally*
  - *Meridionally*
- ***Power spectra's decay***.
- Discussion in terms of ***turbulence*** theories.

2. Technique

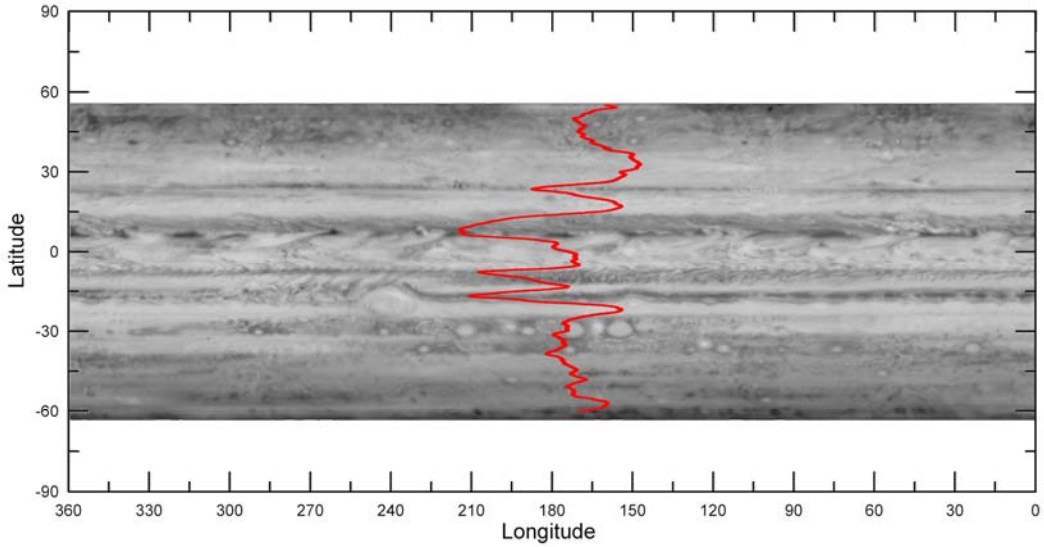
Zonal



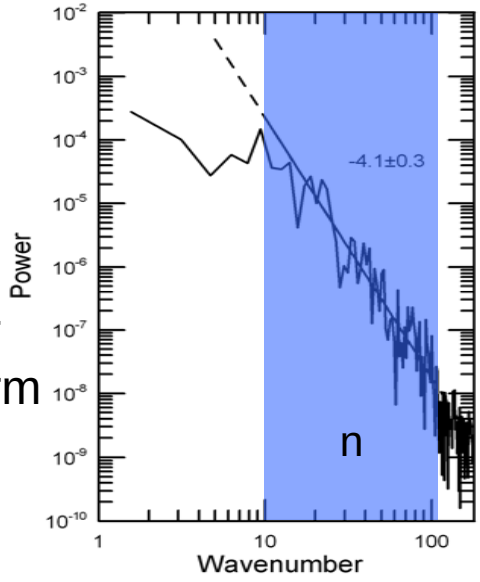
Fast Fourier Transform



Meridional



Fast Fourier Transform

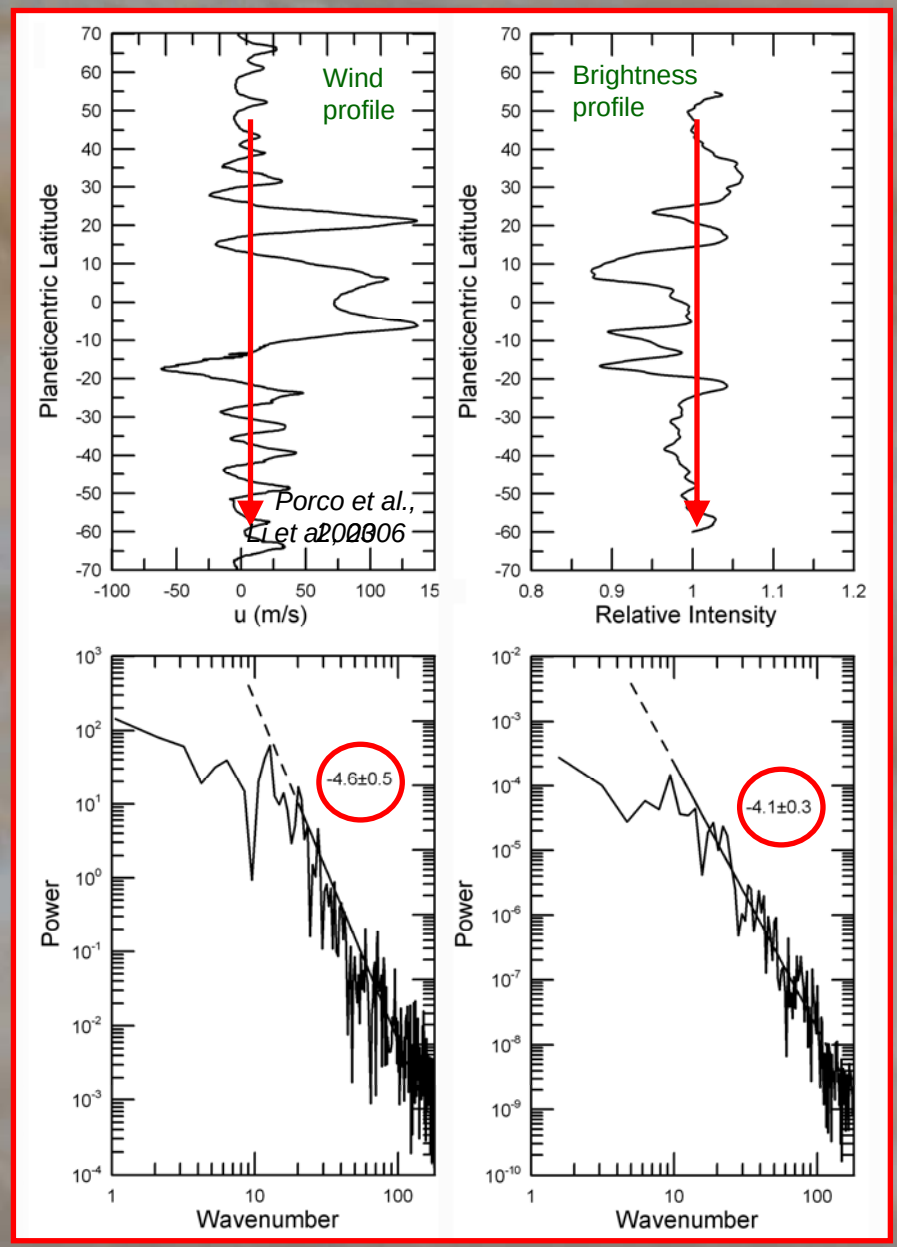


3. Meridional Power Spectra

Averaged meridional ***brightness*** and ***wind*** profiles' power spectrum analysis :

Near Infrared:

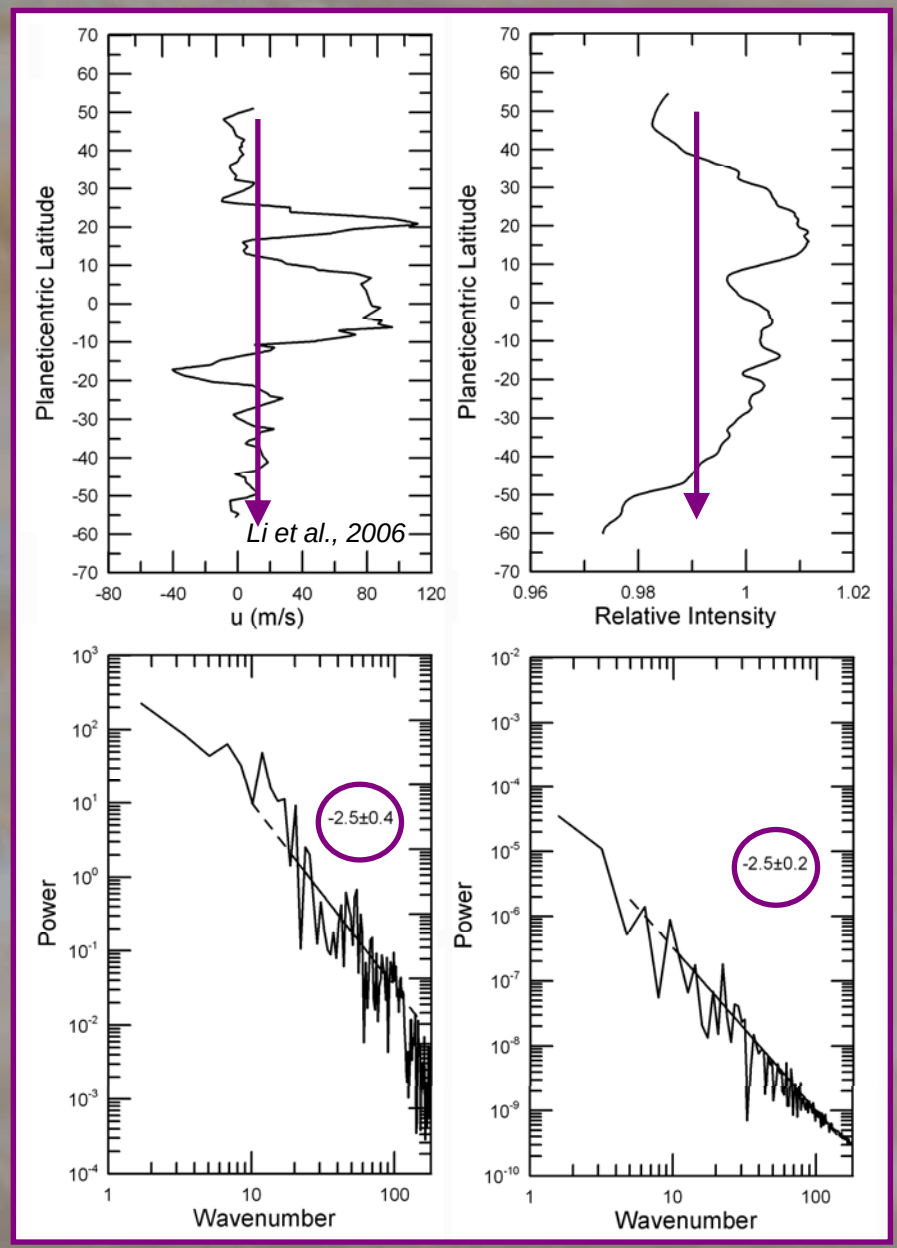
Galperin et al., 2001
Physics of Fluids



3. Meridional Power Spectra

Averaged meridional ***brightness*** and ***wind*** profiles' power spectrum analysis :

Ultraviolet:

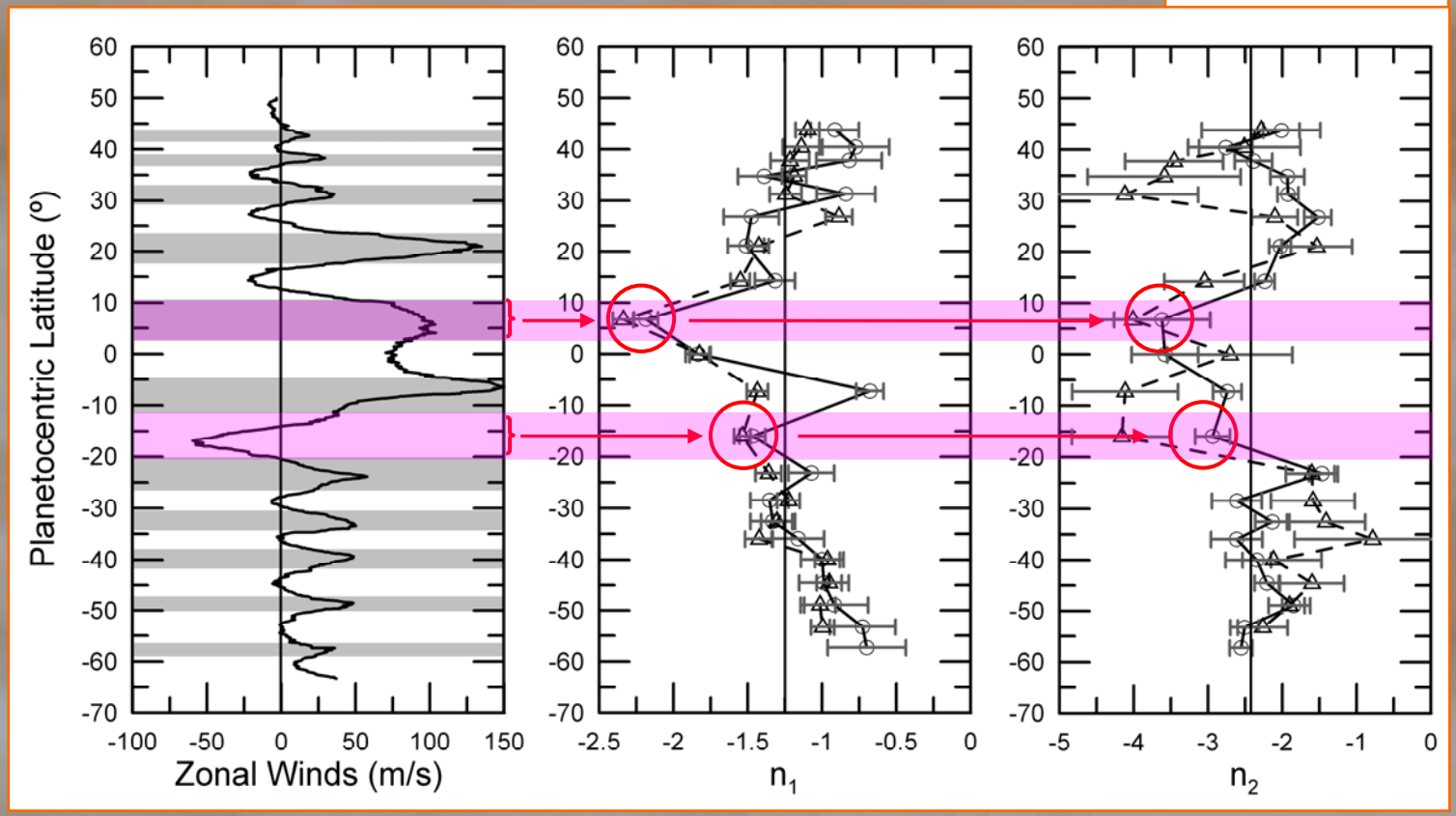


4. Zonal Power Spectra

We assume three integration criteria depending on:

- Wind direction
- Vorticity
- Brightness

Near Infrared



Eastward jets: $\langle n_1 \rangle = -1.1 \pm 0.4$ and $\langle n_2 \rangle = -2.3 \pm 0.6$

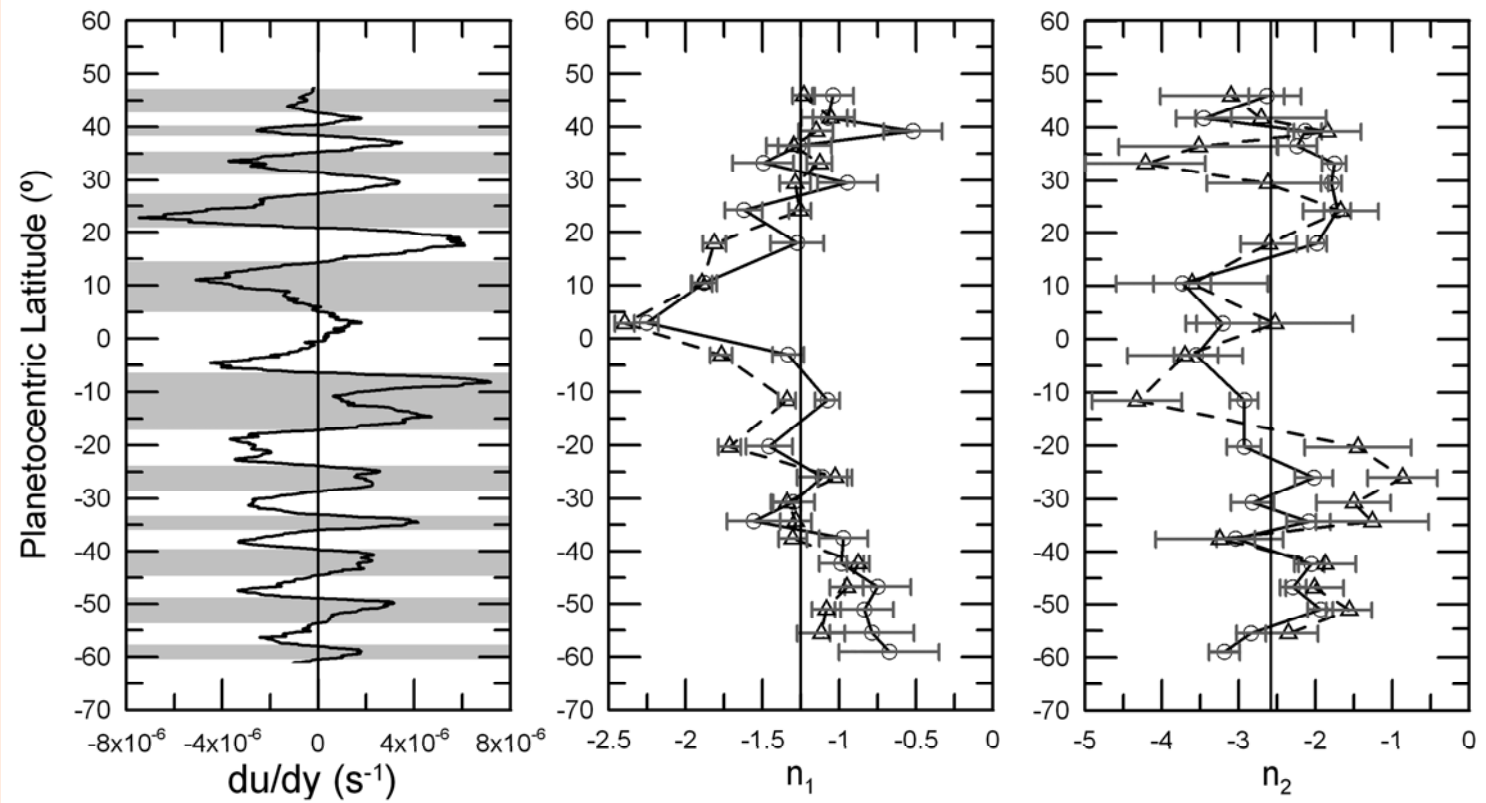
Westward jets: $\langle n_1 \rangle = -1.2 \pm 0.3$ and $\langle n_2 \rangle = -2.5 \pm 0.6$

4. Zonal Power Spectra

We assume three integration criteria depending on:

- Wind direction
- Vorticity
- Brightness

Near Infrared



Anticyclonic regions (white): $\langle n_1 \rangle = -1.2 \pm 0.4$ and $\langle n_2 \rangle = -2.7 \pm 0.7$

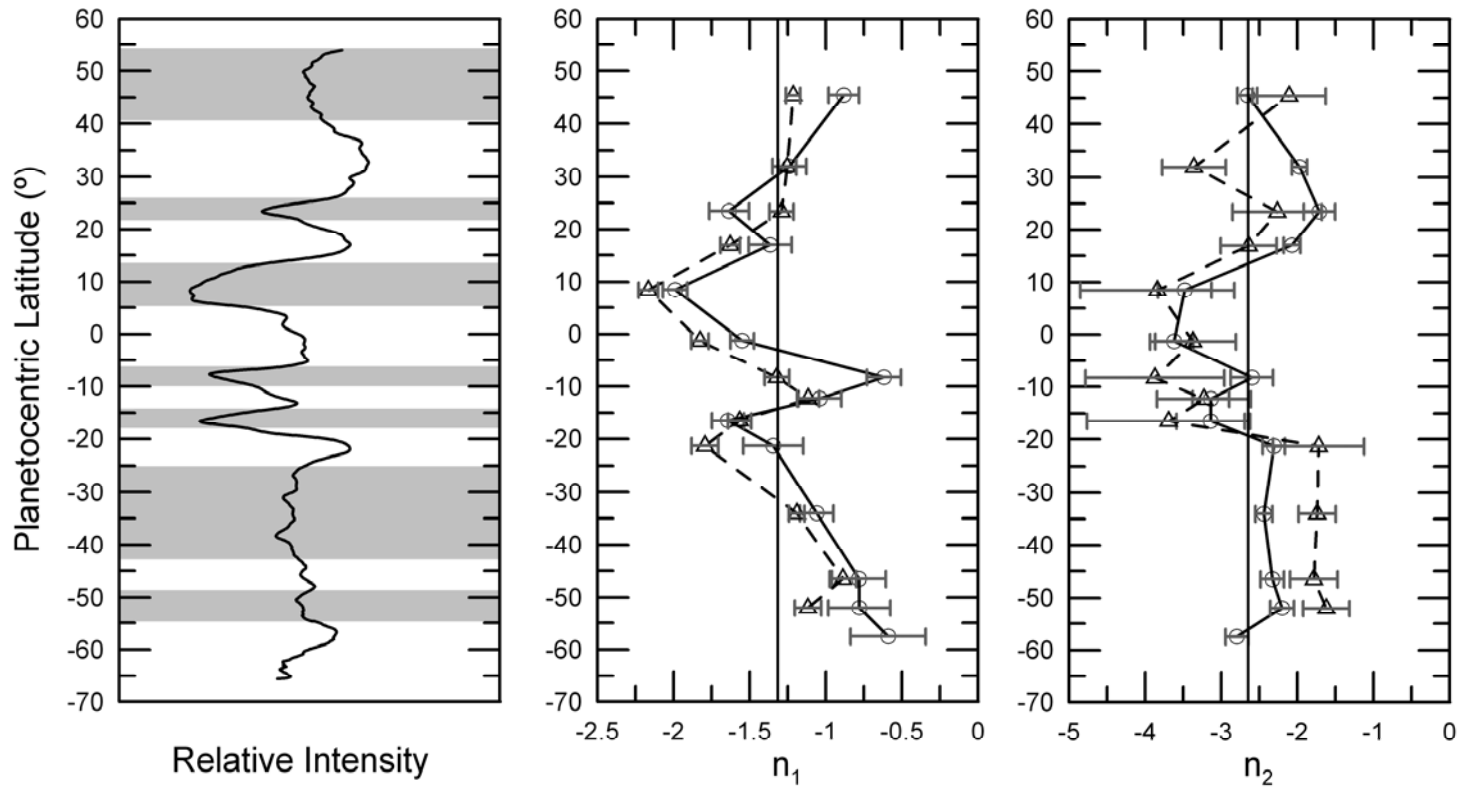
Cyclonic regions (grey): $\langle n_1 \rangle = -1.2 \pm 0.4$ and $\langle n_2 \rangle = -2.4 \pm 0.6$

4. Zonal Power Spectra

We assume three integration criteria depending on:

- Wind direction
- Vorticity
- Brightness

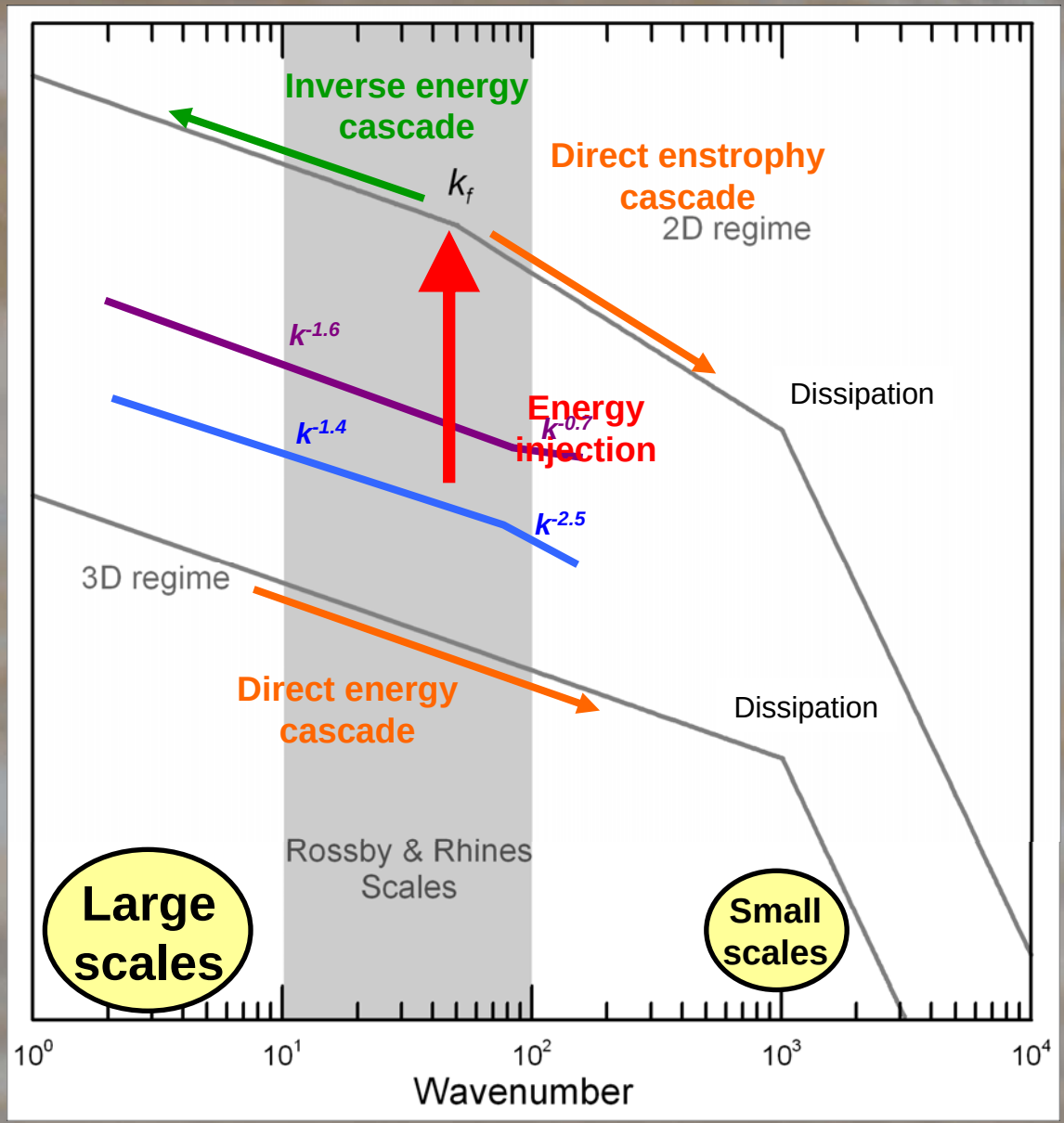
Near Infrared



Belts: $\langle n_1 \rangle = -1.2 \pm 0.5$ and $\langle n_2 \rangle = -2.6 \pm 0.6$

Zones: $\langle n_1 \rangle = -1.1 \pm 0.3$ and $\langle n_2 \rangle = -2.6 \pm 0.6$

5. Classical turbulence theories



- *Theory* predicts:
  - ***3D***: One slope. (-5/3 ~ -1.7)
  - ***2D***: Two slopes. (-5/3, -3)
- Our zonal *results*:
  - Ultraviolet.
  - Near infrared and blue.

6. Conclusions

Meridionally:

- Spectral analysis is ***in good agreement*** with recent theoretical and experimental results.
- Ultraviolet results differ from those in the blue and infrared, possibly due to a ***different dynamics*** at higher atmospheric levels.

Zonally:

- Spectral slopes are not correlated with ***wind direction***, ***shear*** or ***albedo***, although they are ***latitude dependant***.
- These results resemble the ***2D kinetic energy spectrum.***

Future Work: Application of 2D FFT in specific zones of the atmosphere for brightness and kinetic energy.