

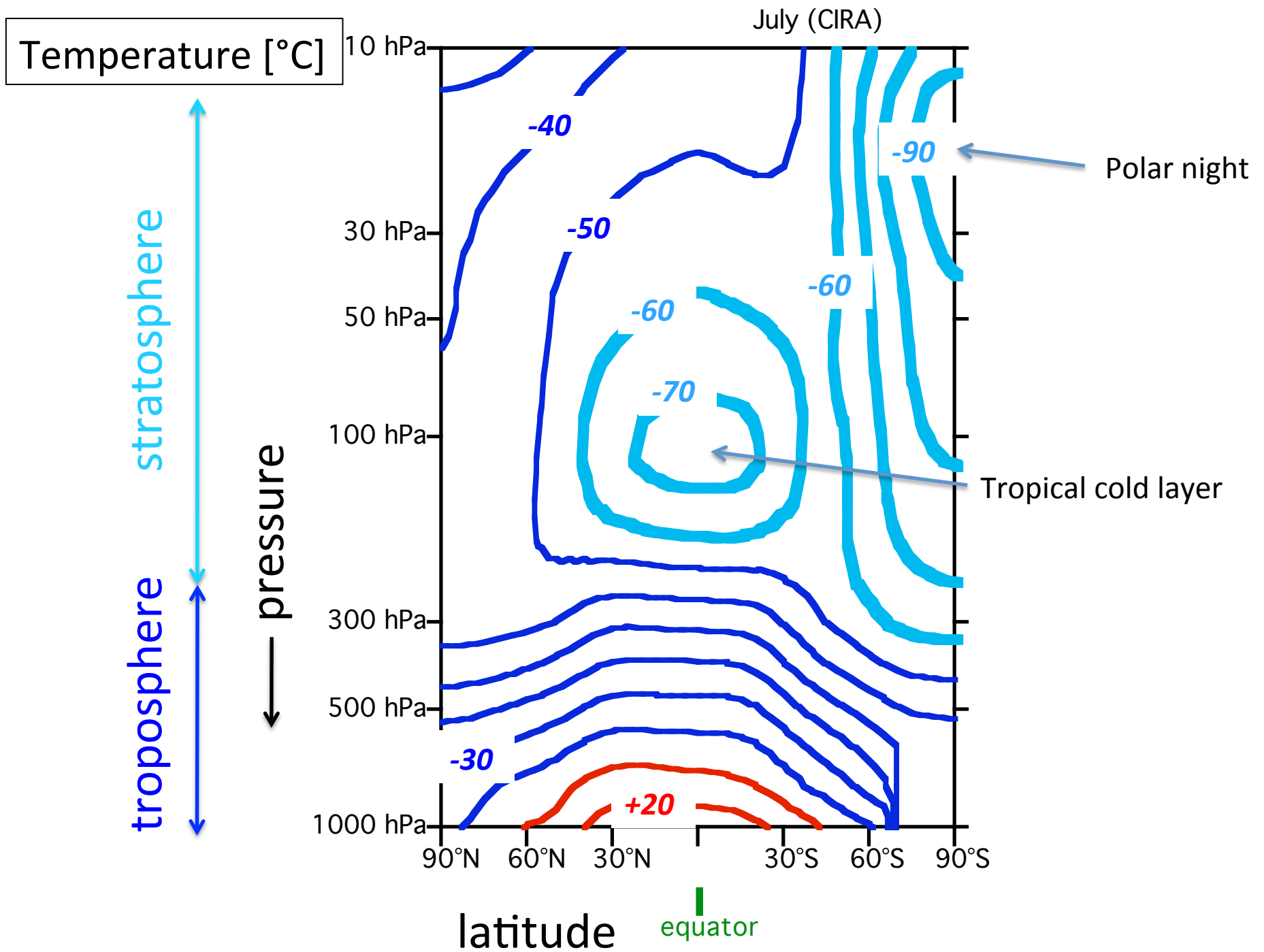
Some Aspects of the General Circulation of the Atmosphere

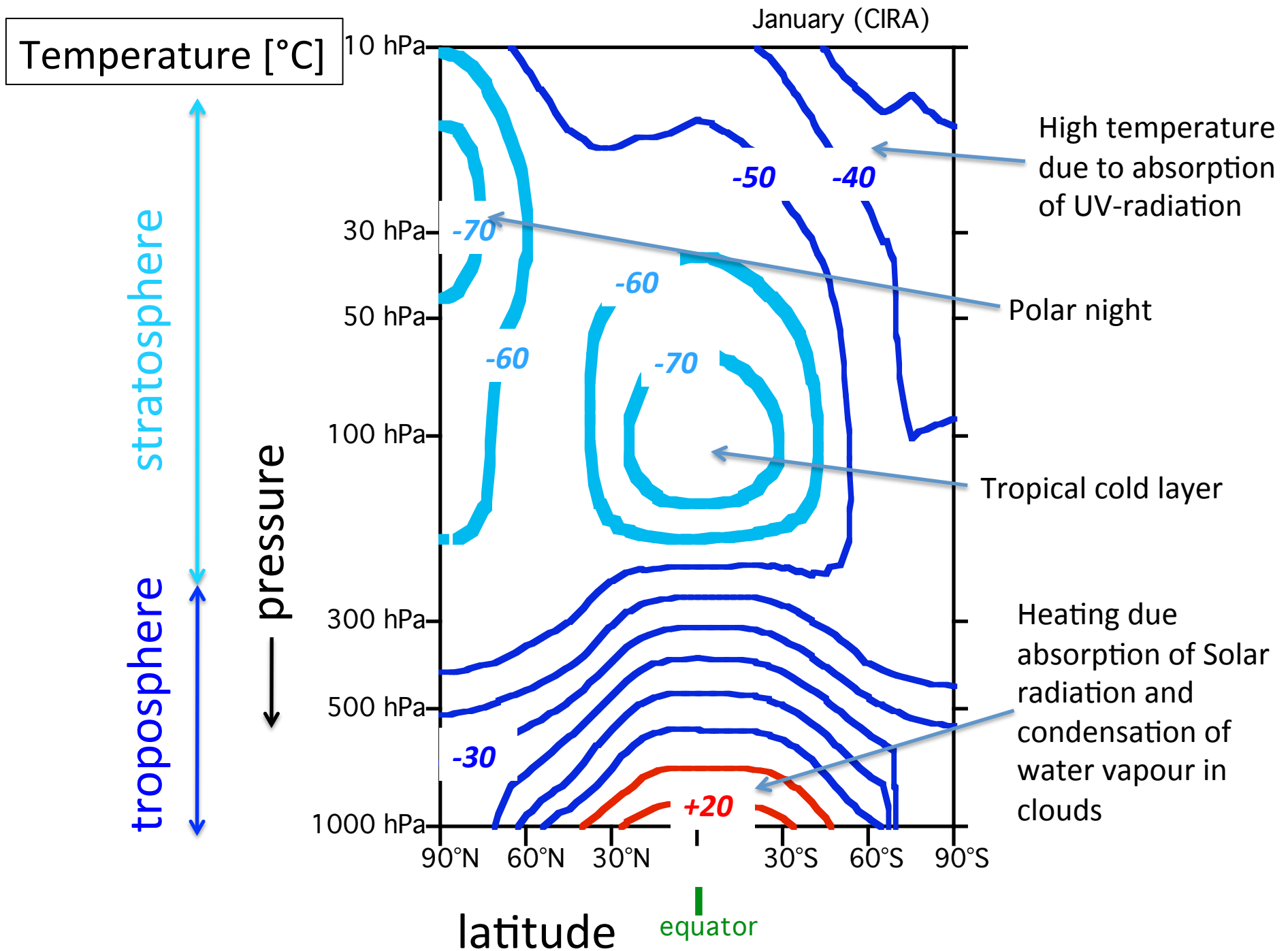
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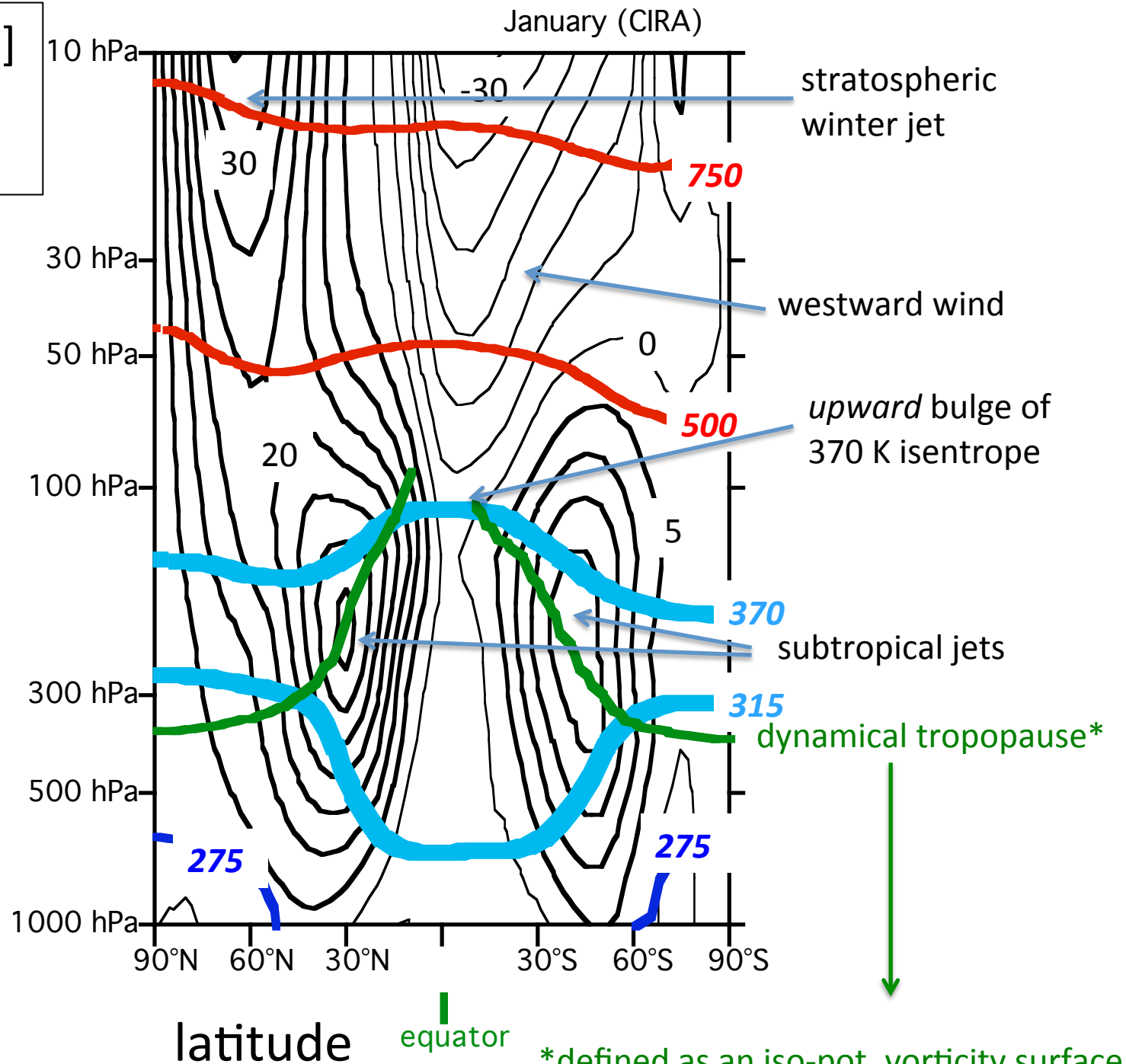


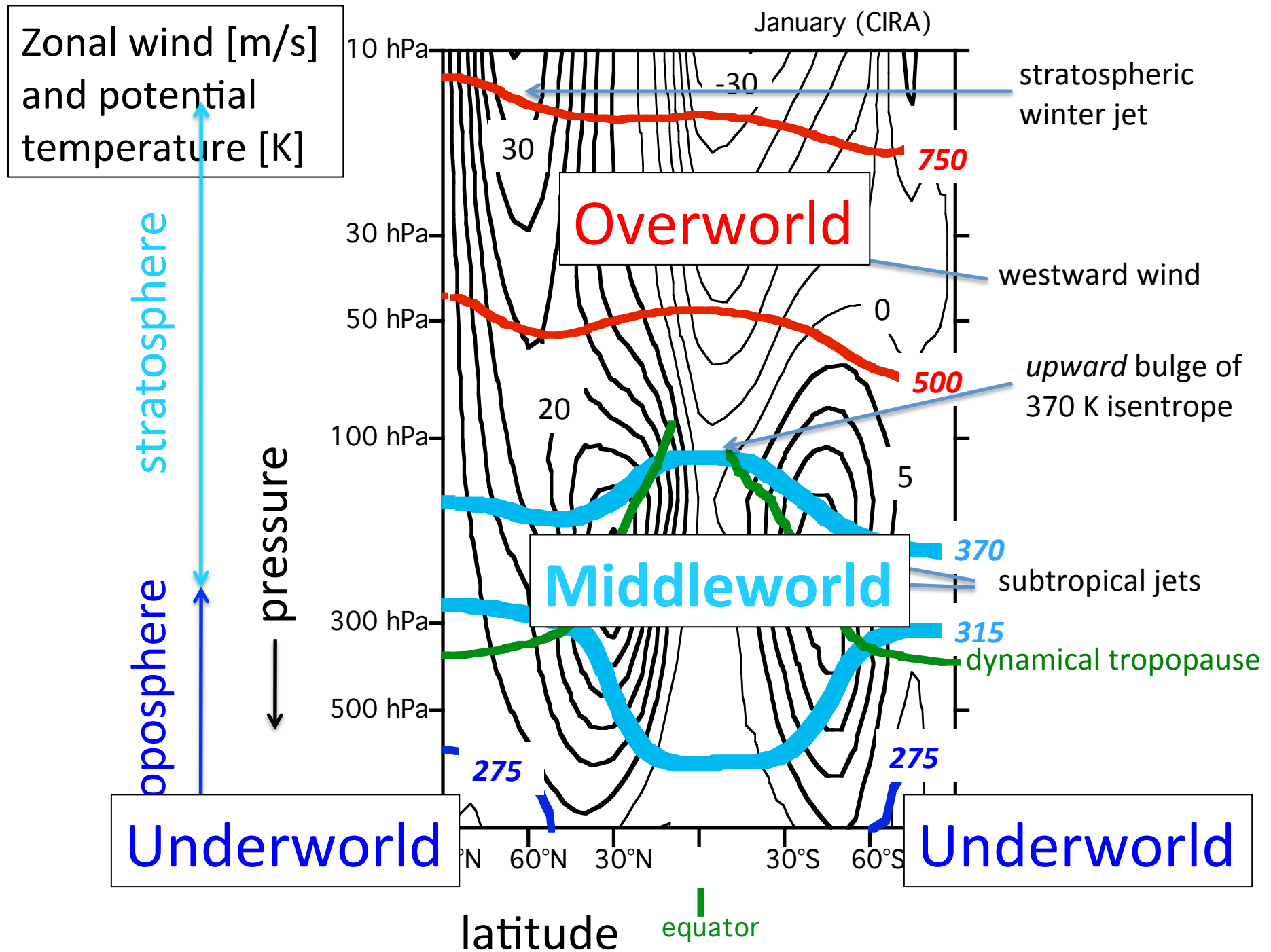
Zonal wind [m/s]
and potential
temperature [K]

stratosphere

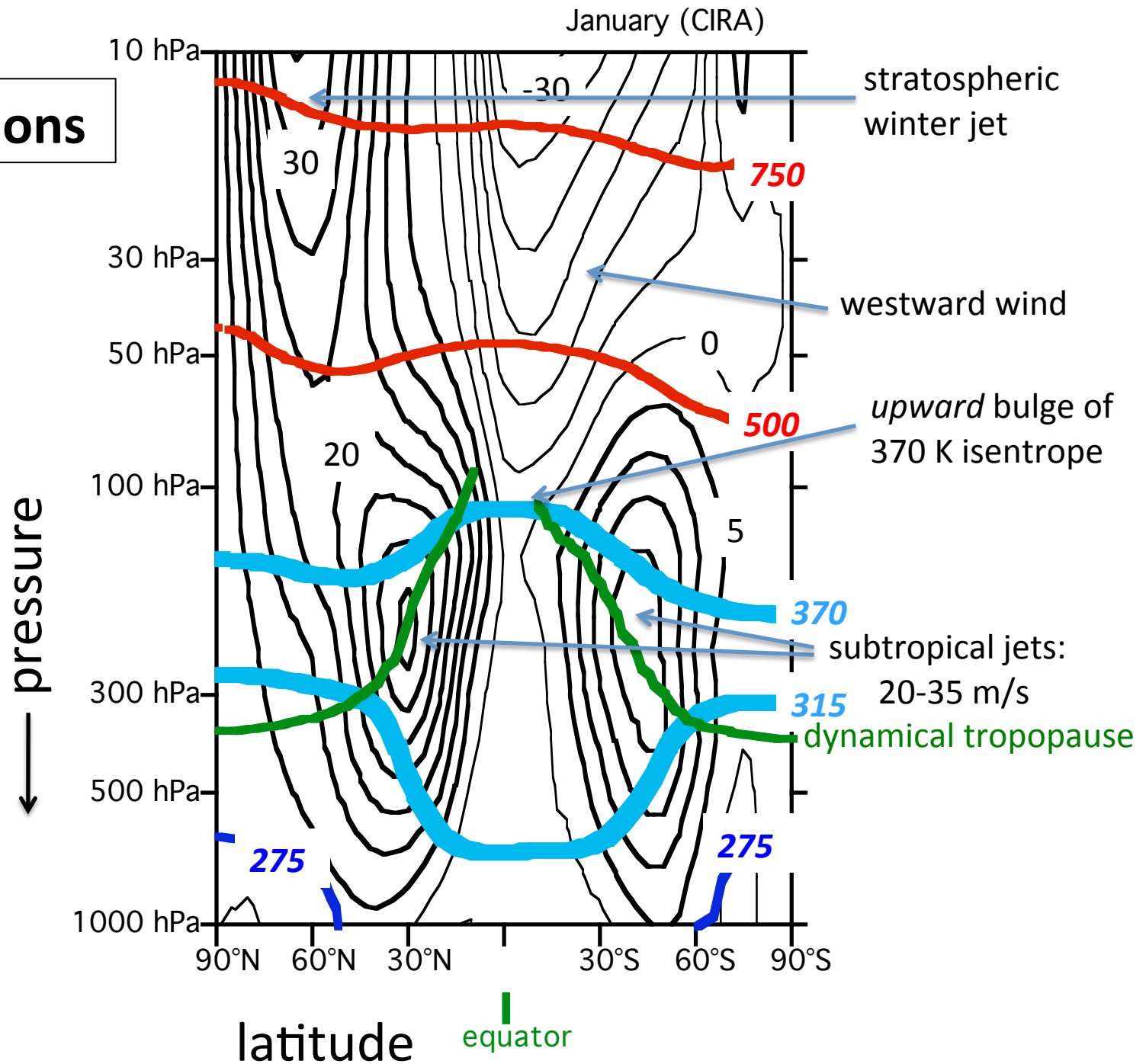
troposphere

pressure
↓

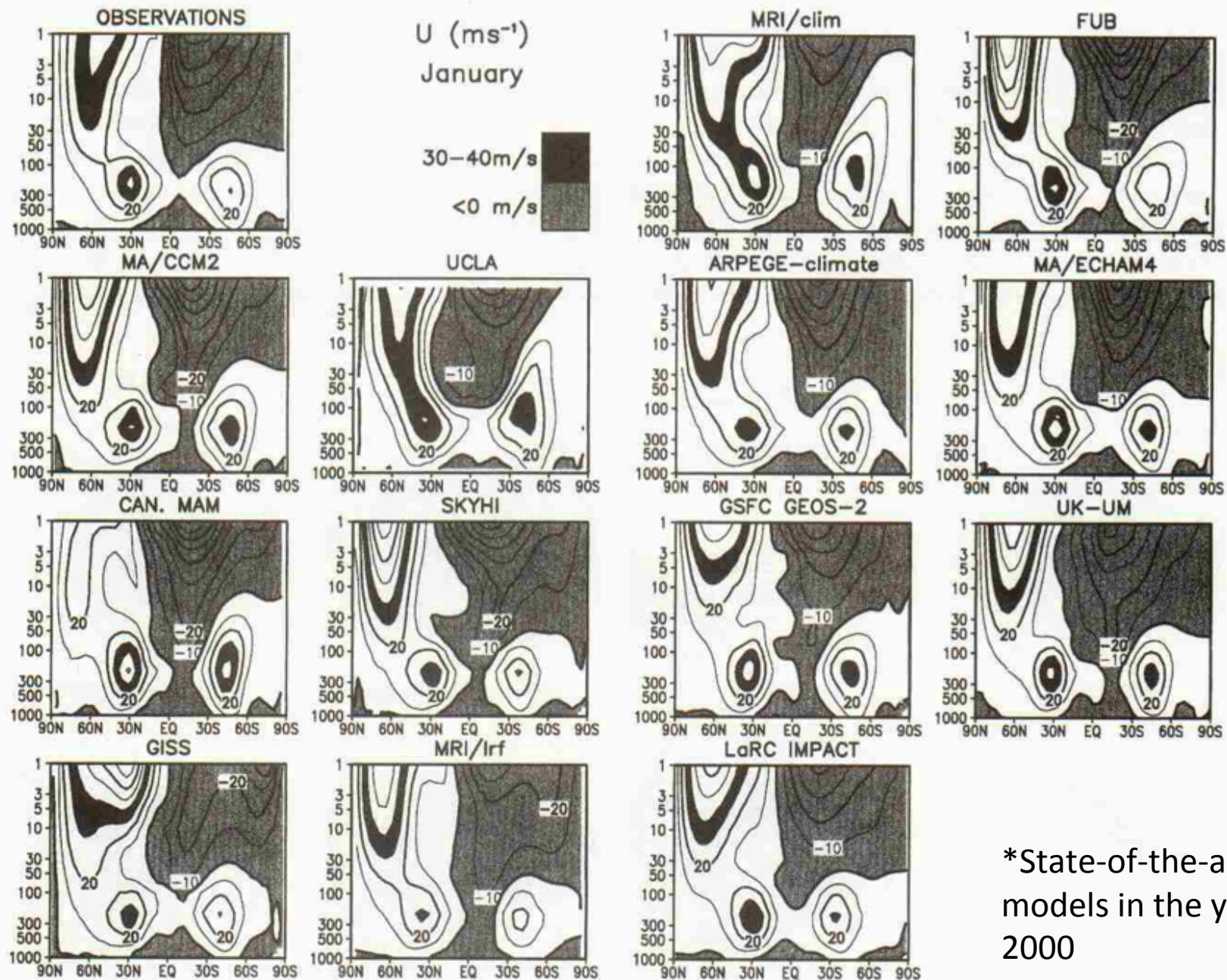




Observations



Climate Model* Simulations



*State-of-the-art
models in the year
2000

Do we understand these model outcomes?

**2D (lat, height) model based on hydrostatic
“primitive” equations**

Model takes following processes into account :

1 2D adiabatic dynamics

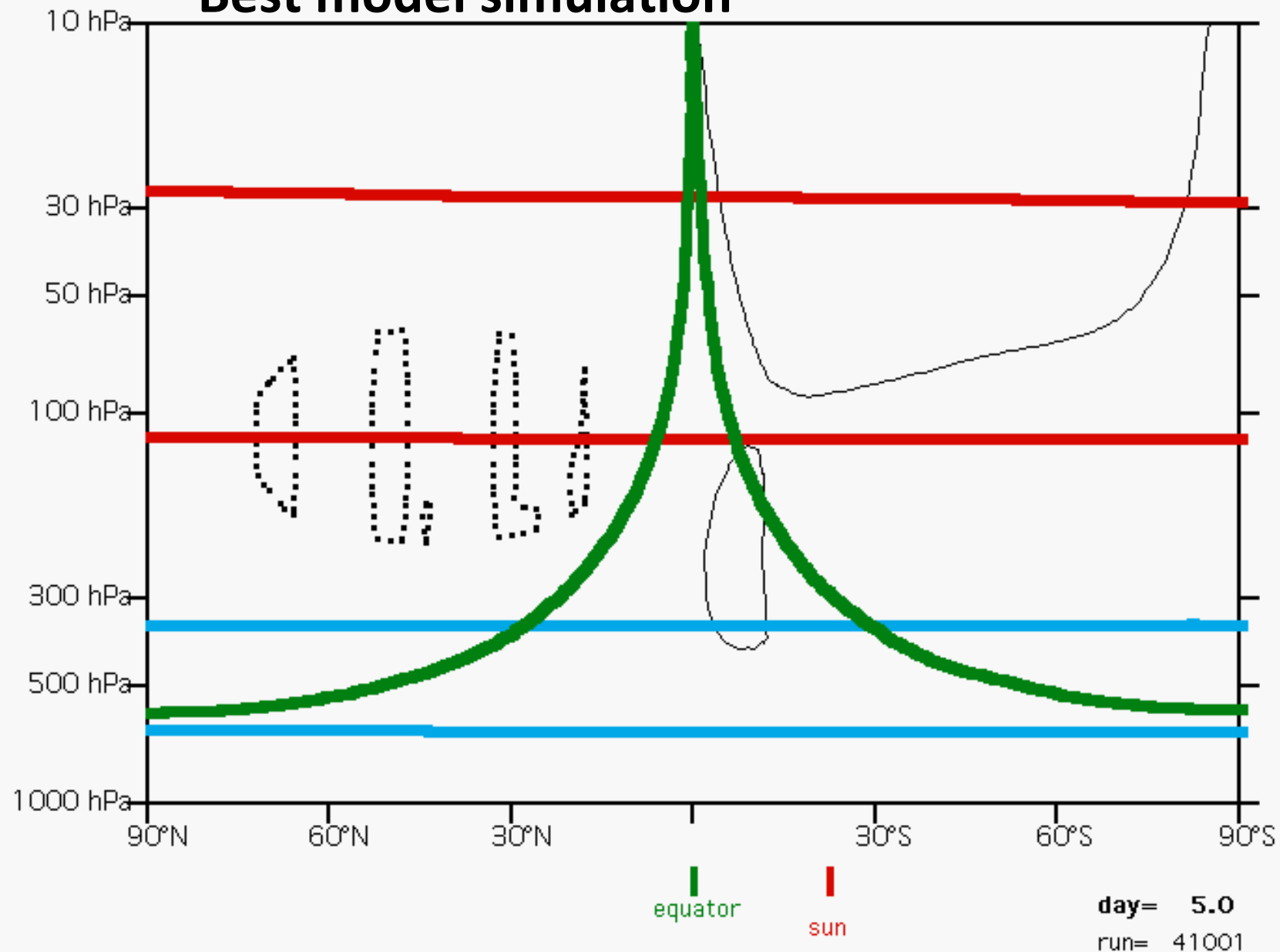
2 Radiation

3 Dry convective adjustment

4 Water cycle

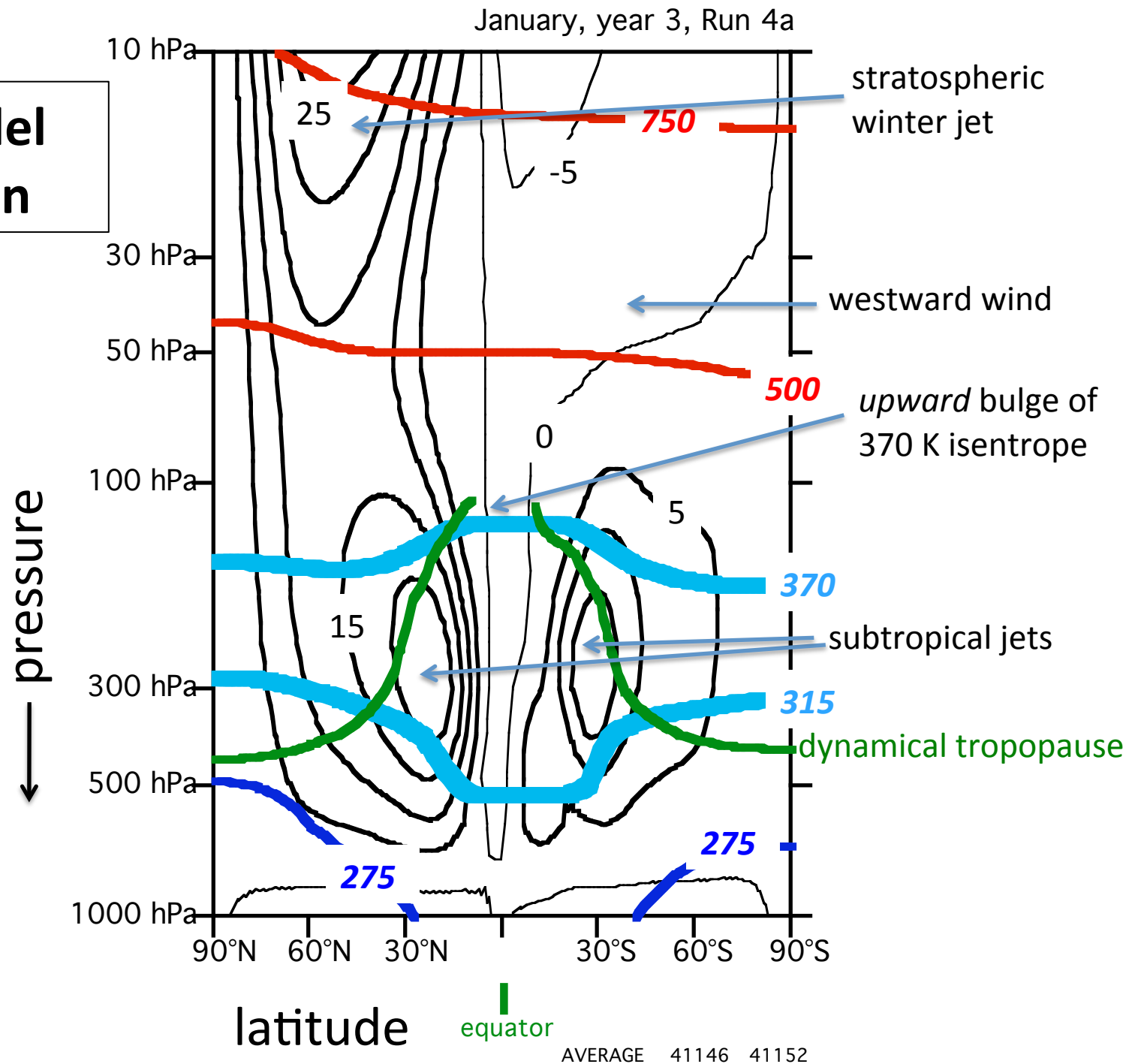
5 “Wave drag”

Best model simulation



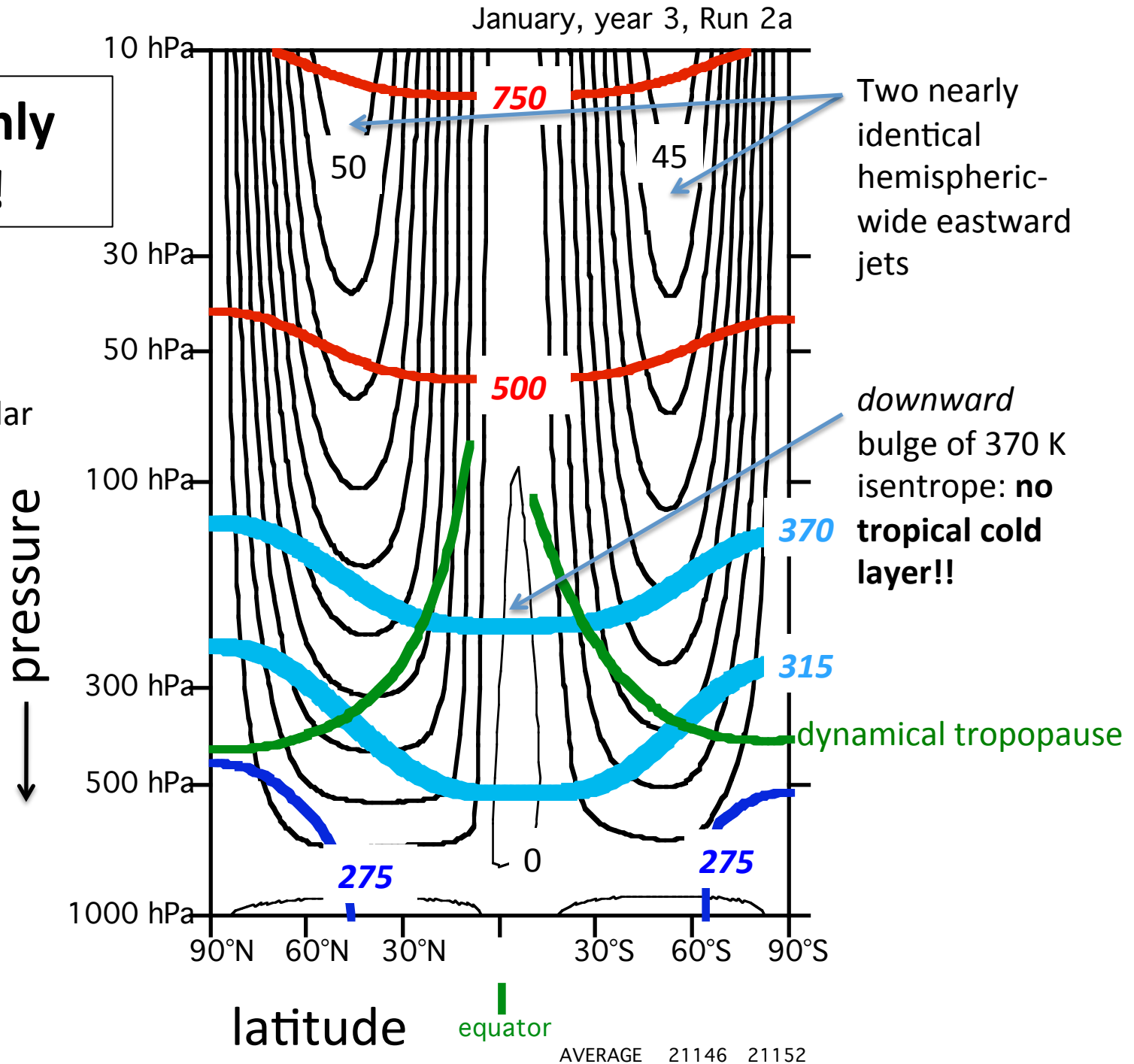
Green: tropopause (± 2 PVU); dotted: wave drag ($-0.000025 \text{ m s}^{-2}$)
 Black: isotachs (thick: >0 ; thin: <0 ; interval: 5 m/s)
 Blue(Underworld), cyan(Middleworld), red(Overworld) isentropes (275,315,370,500,750 K)

Best model simulation

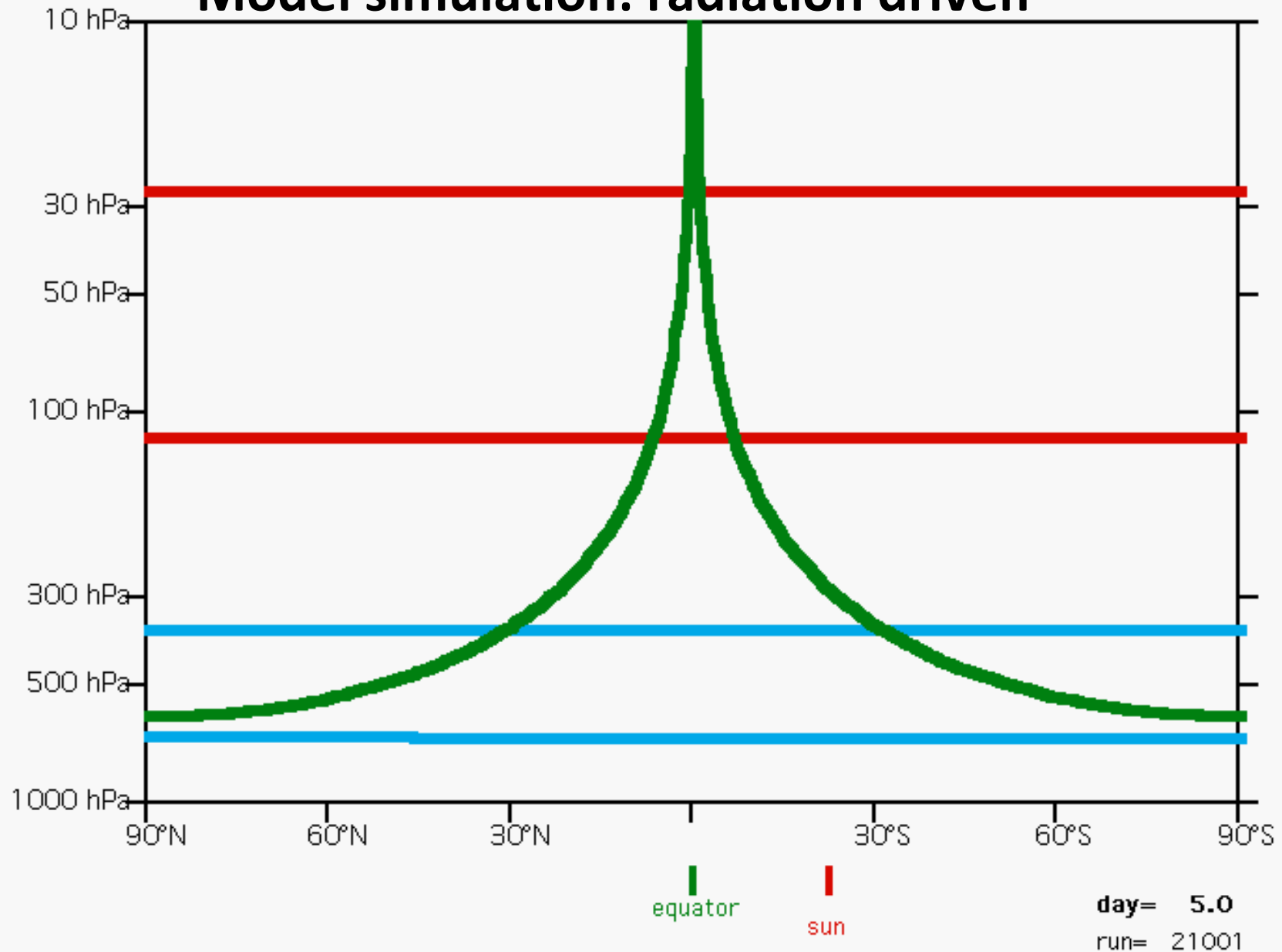


Model: only radiation!

1. No water cycle
2. No wave drag
3. Atmosphere transparent to Solar radiation



Model simulation: radiation driven



Green: tropopause (± 2 PVU); dotted: wave drag ($-0.000025 \text{ m s}^{-2}$)

Black: isotachs (thick: >0 ; thin: <0 ; interval: 5 m/s)

Blue(Underworld), cyan(Middleworld), red(Overworld) isentropes (275,315,370,500,750 K)

Conclusion:

Water cycle and wave drag are needed to produce the important features of the general circulation:

- 1) Subtropical jet
- 2) Cold tropical layer
- 3) Stratospheric seasonal wind reversal
- 4) Enhanced meridional slope tropopause

Reference:

“Do we Understand Model Outcomes?” <http://news.imau.nl/?p=2118>

This lecture:

<http://www.staff.science.uu.nl/~delde102/USPC.htm>

Model:

<http://www.staff.science.uu.nl/~delde102/GeneralCirculation.htm>