Density and temperature measurements with SPICAM s stellar occulation

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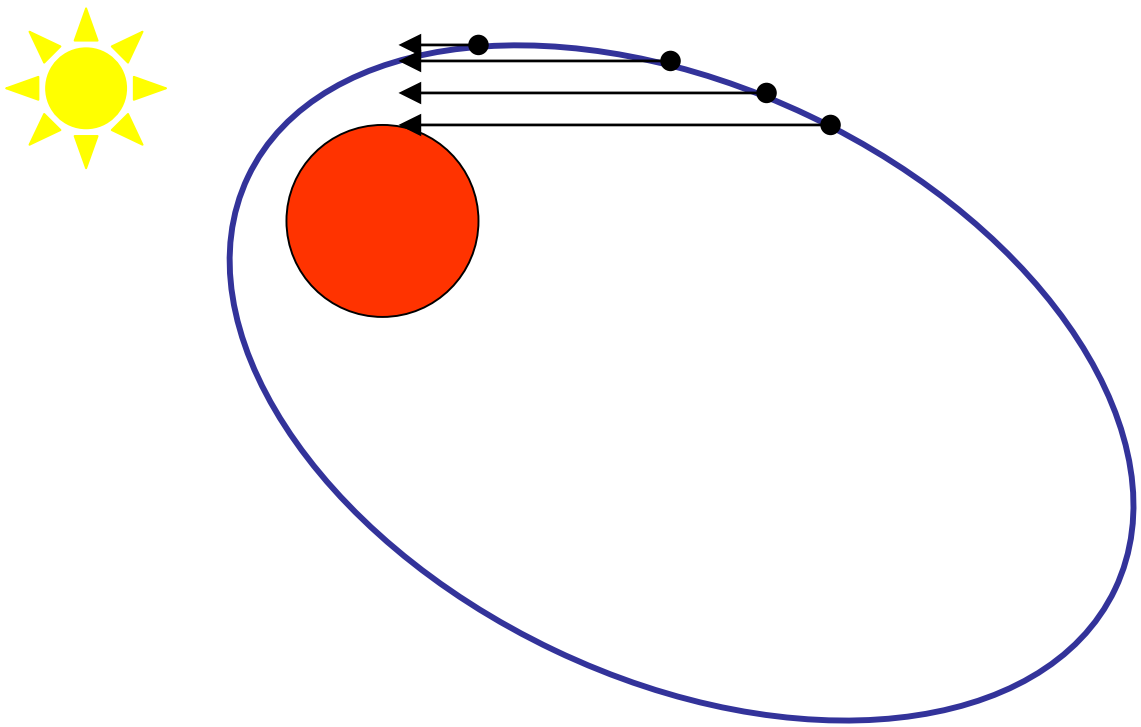
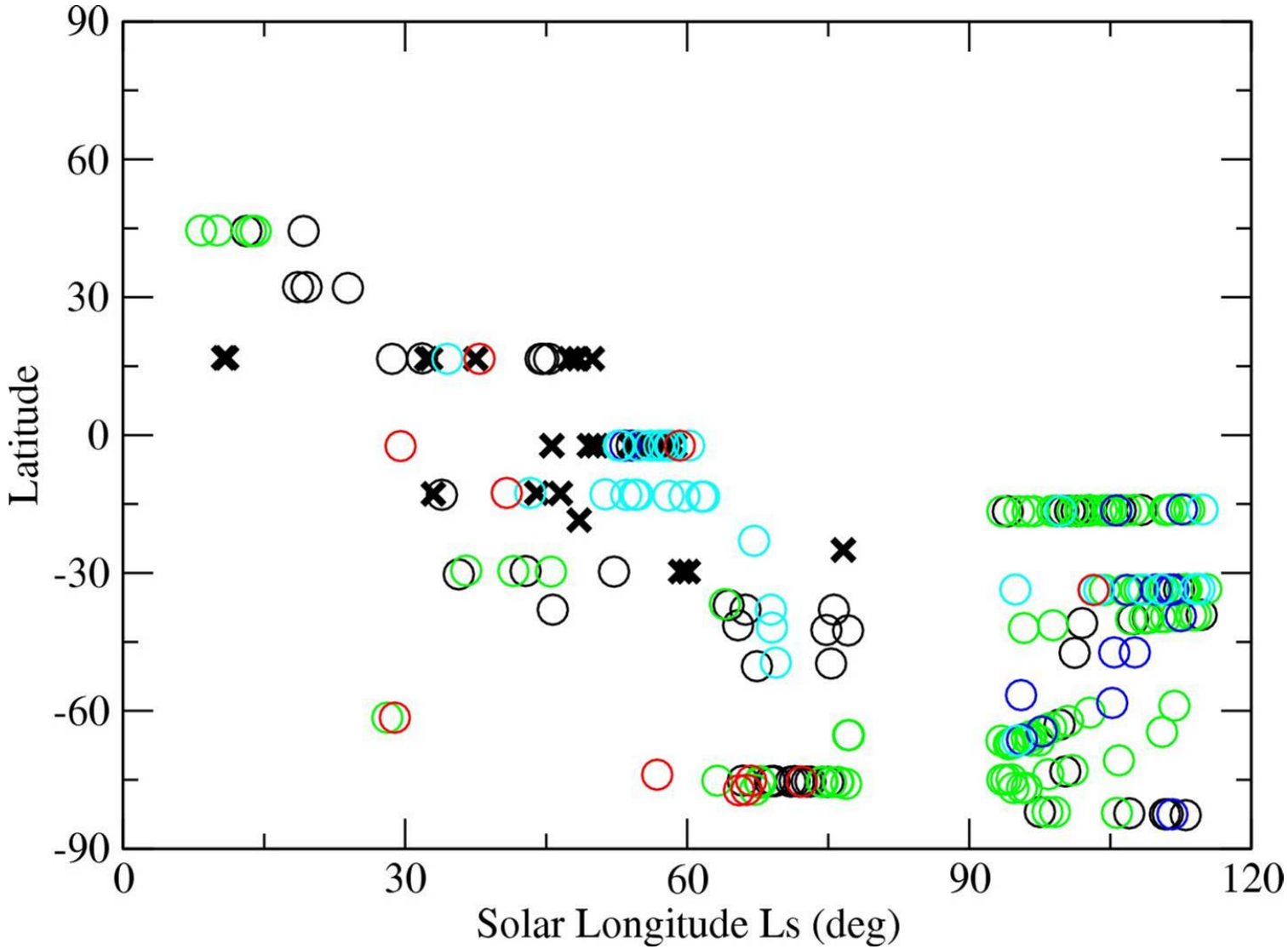
Solar / Stellar occultation



Available occultations : 238 usable observations

Disttibution in latitude and season



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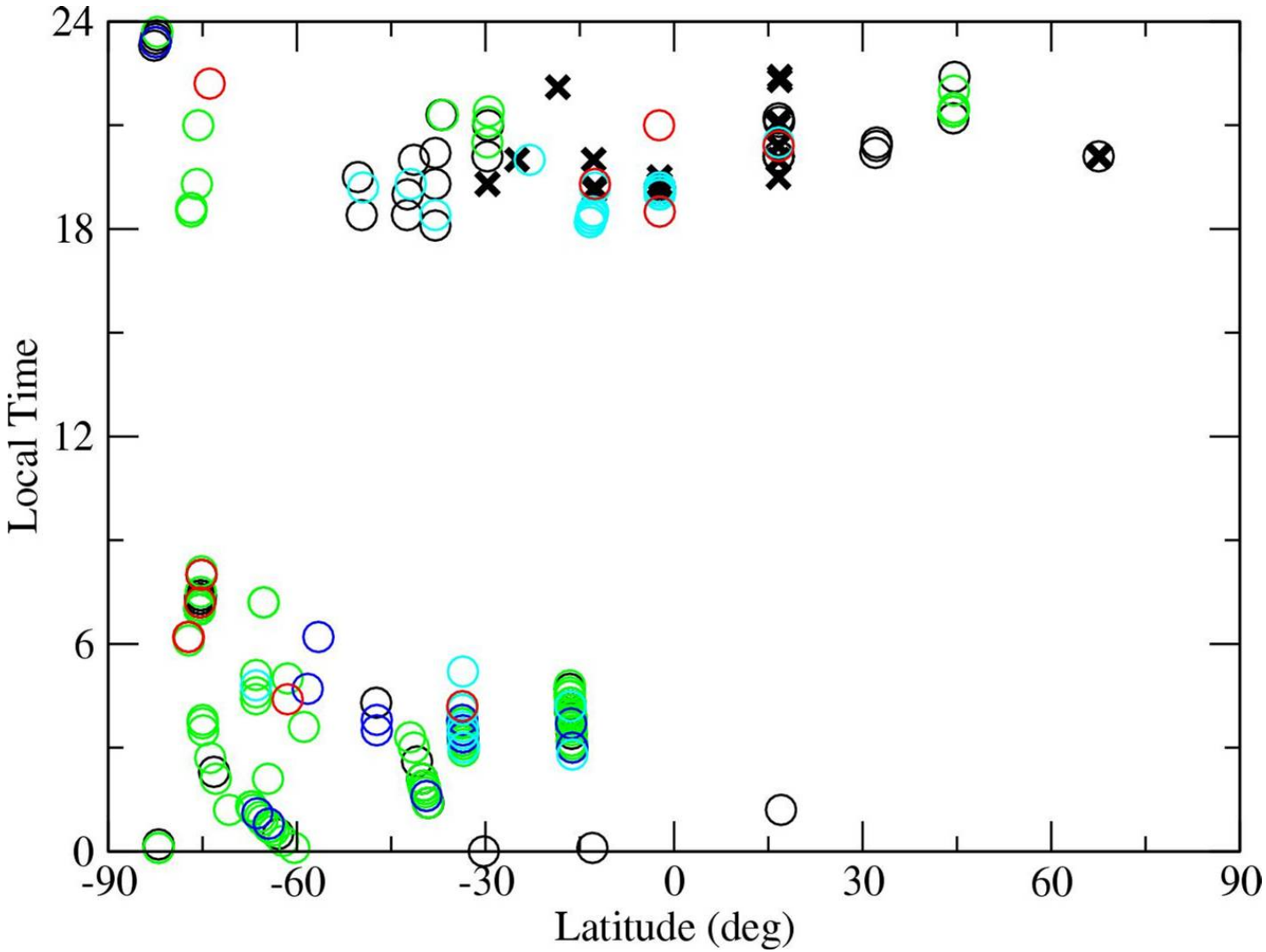
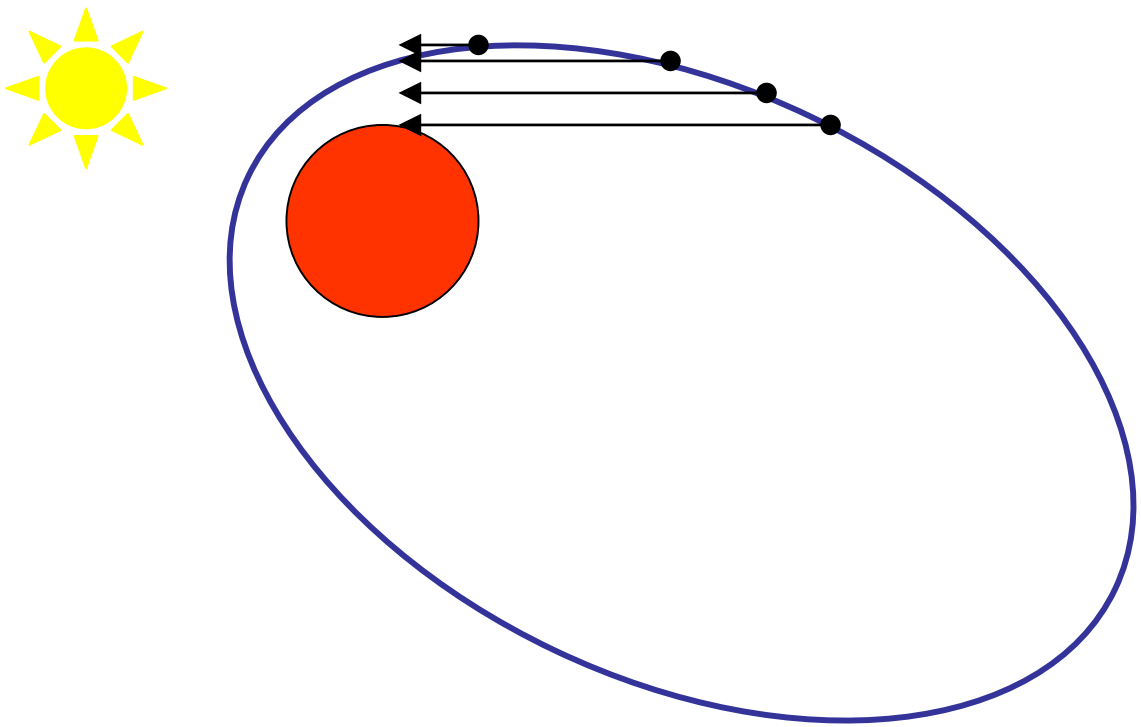
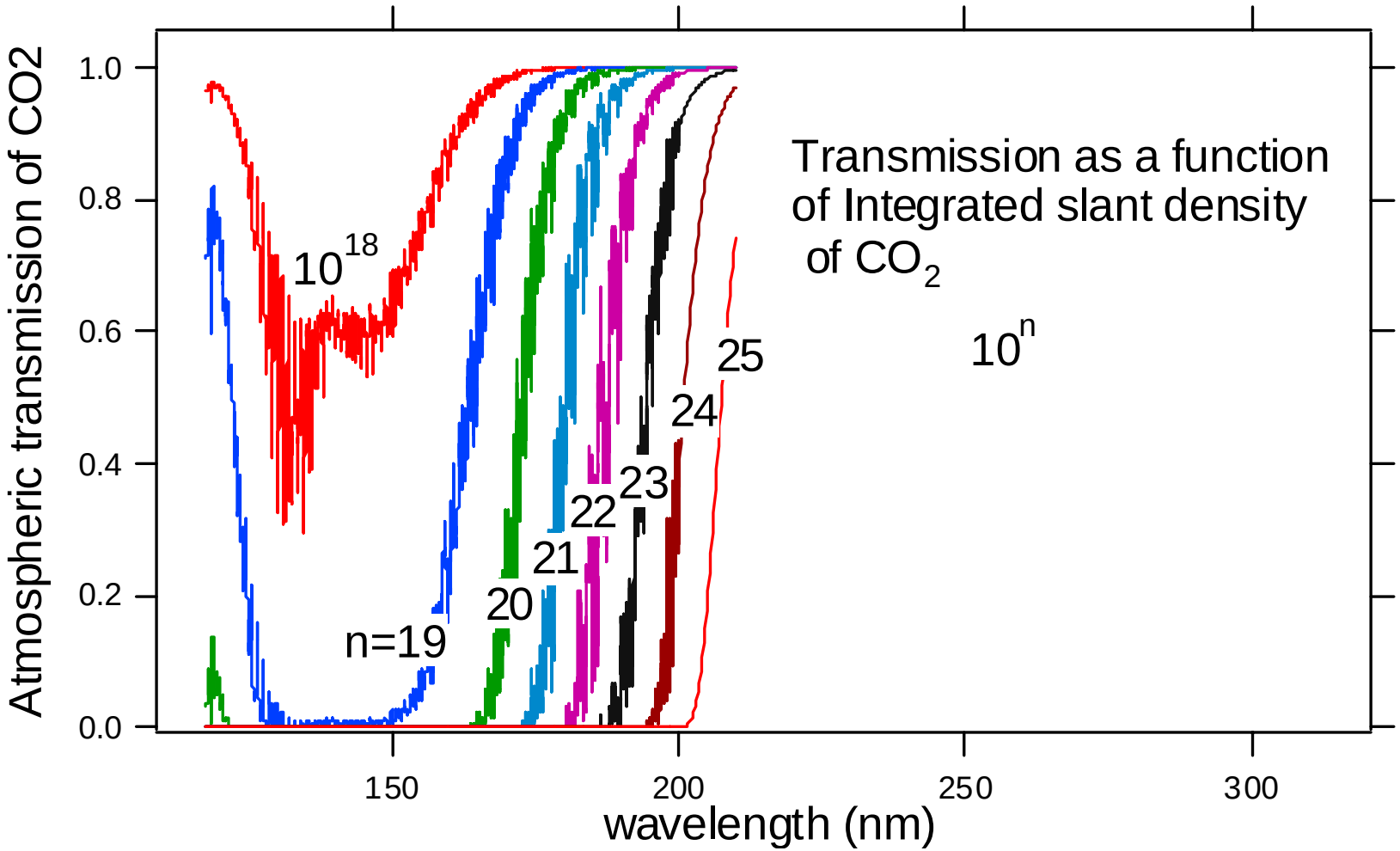
Distribution in Local time and Latitude



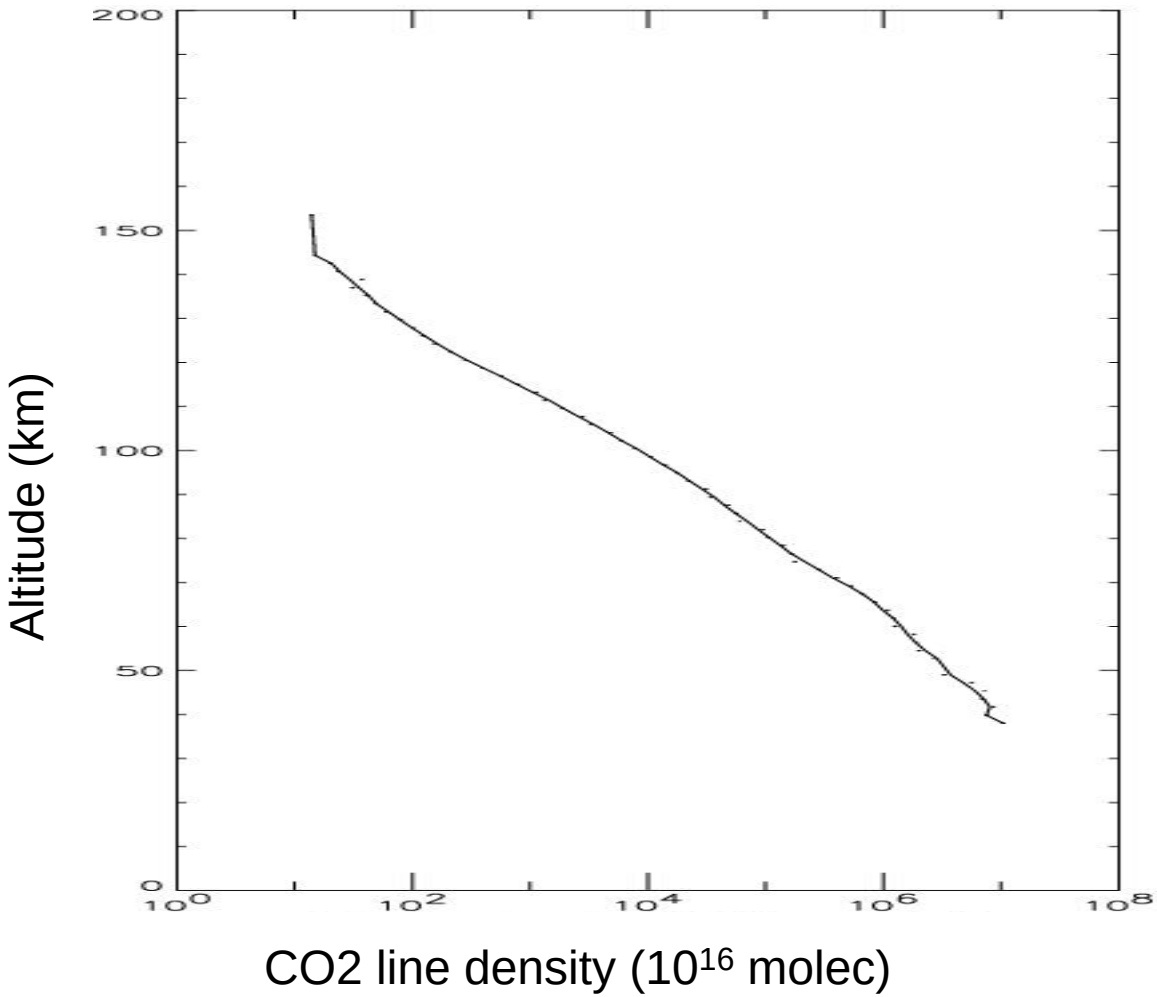
Solar / Stellar occultation



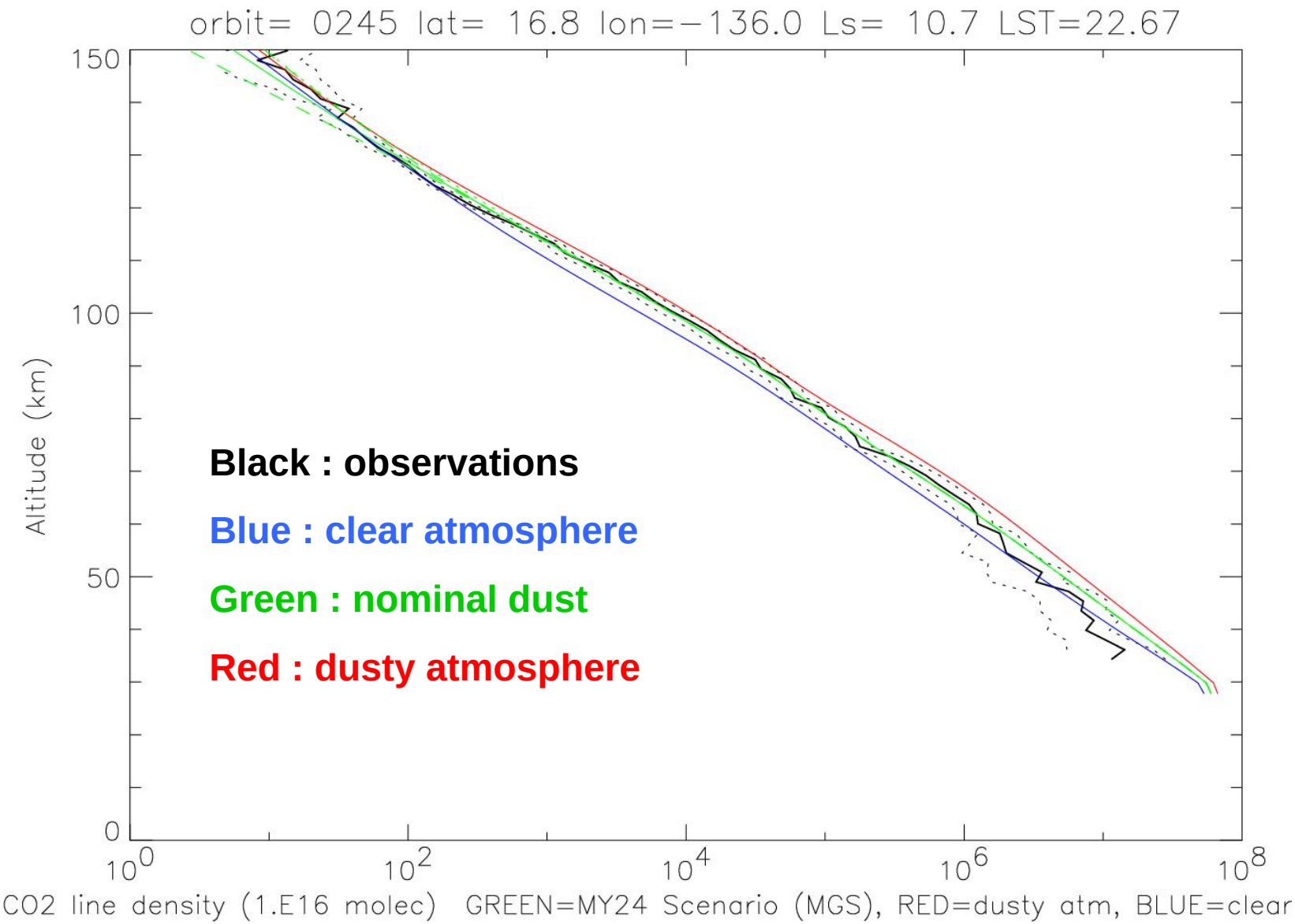
Model Transmission as a function of wavelength of CO2 (integrated slant density in molecules per cm2)



CO2 line density

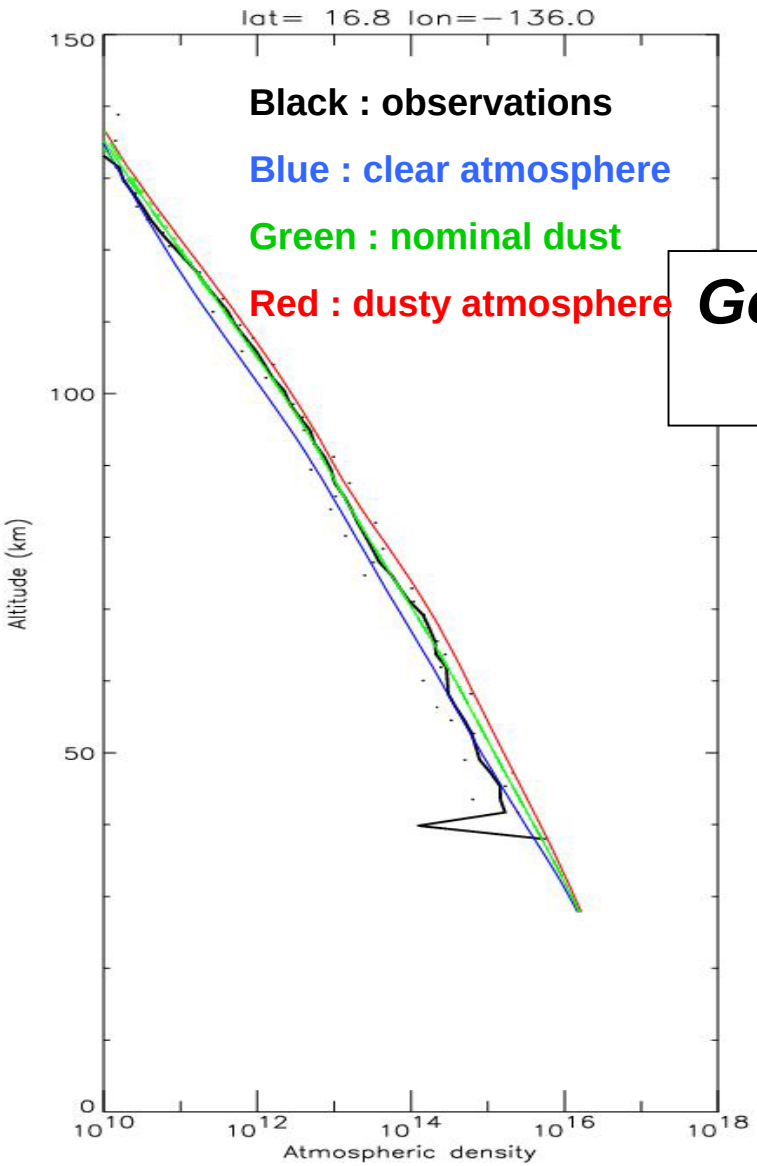


In some cases : very good match with model prediction

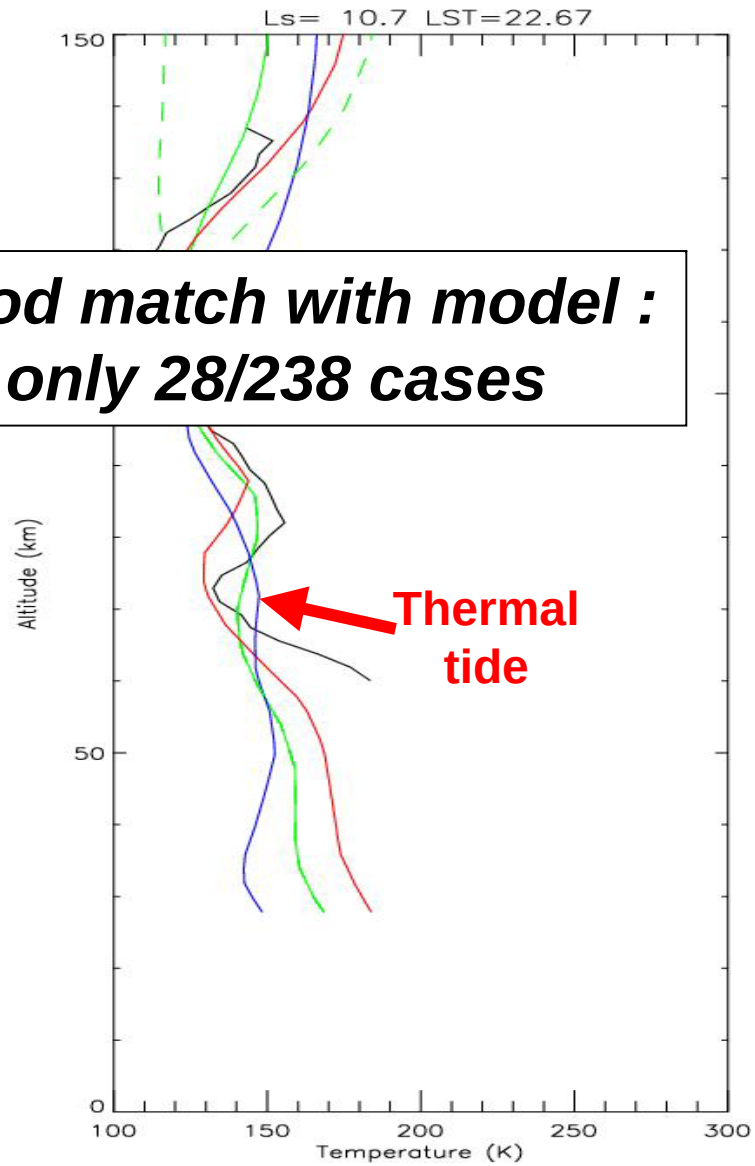


Inversion of line density

Density

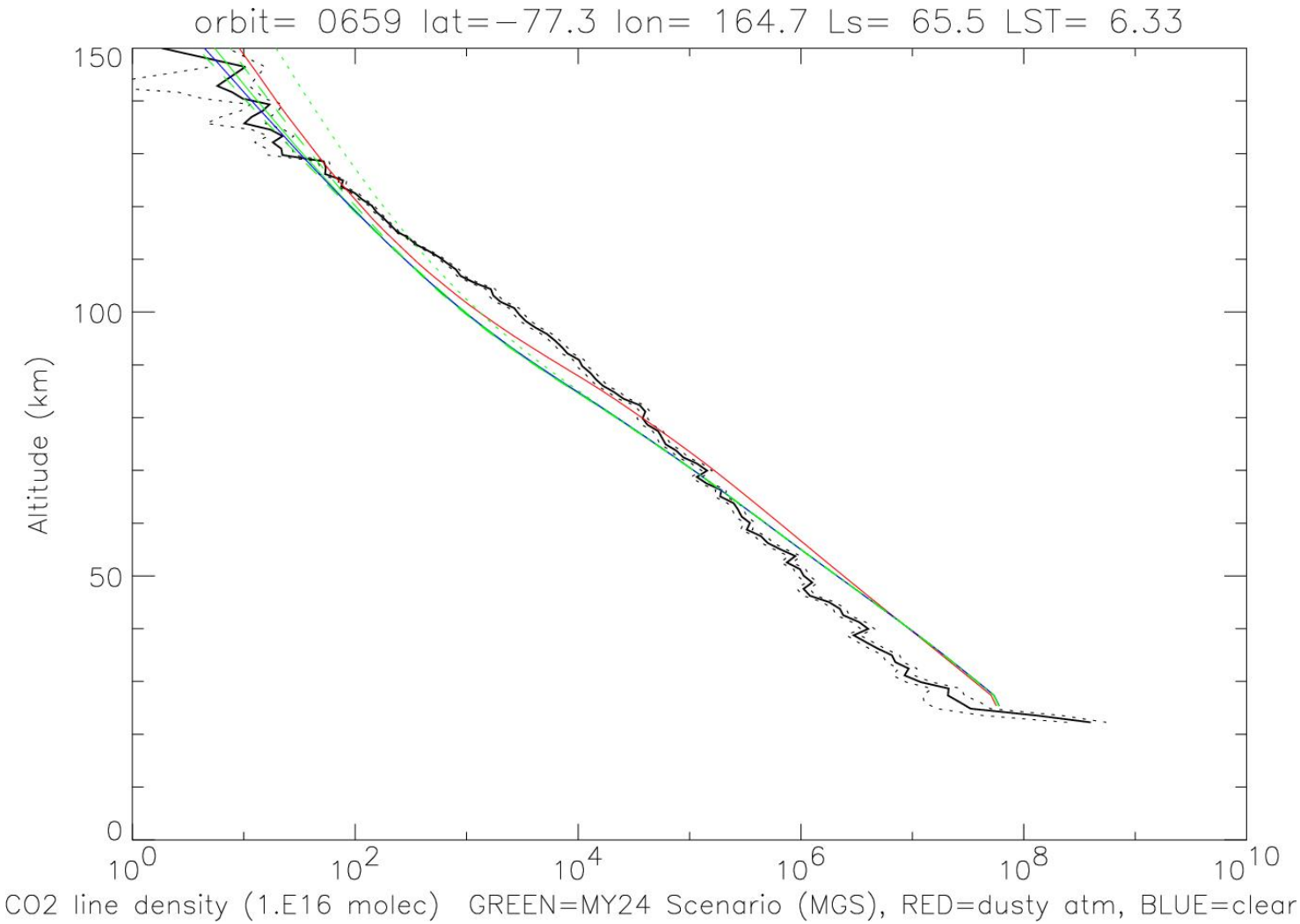


Temperature



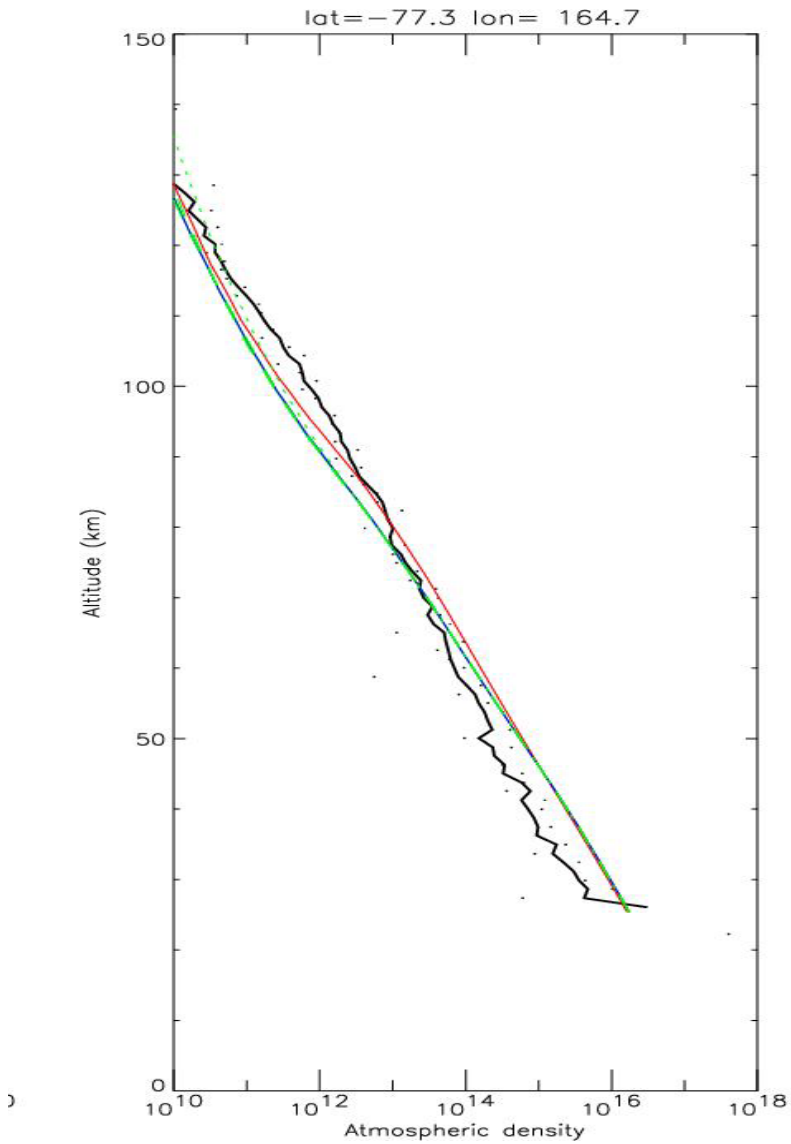
Good match with model : only 28/238 cases

A few cases :warmer, denser high atmosphere

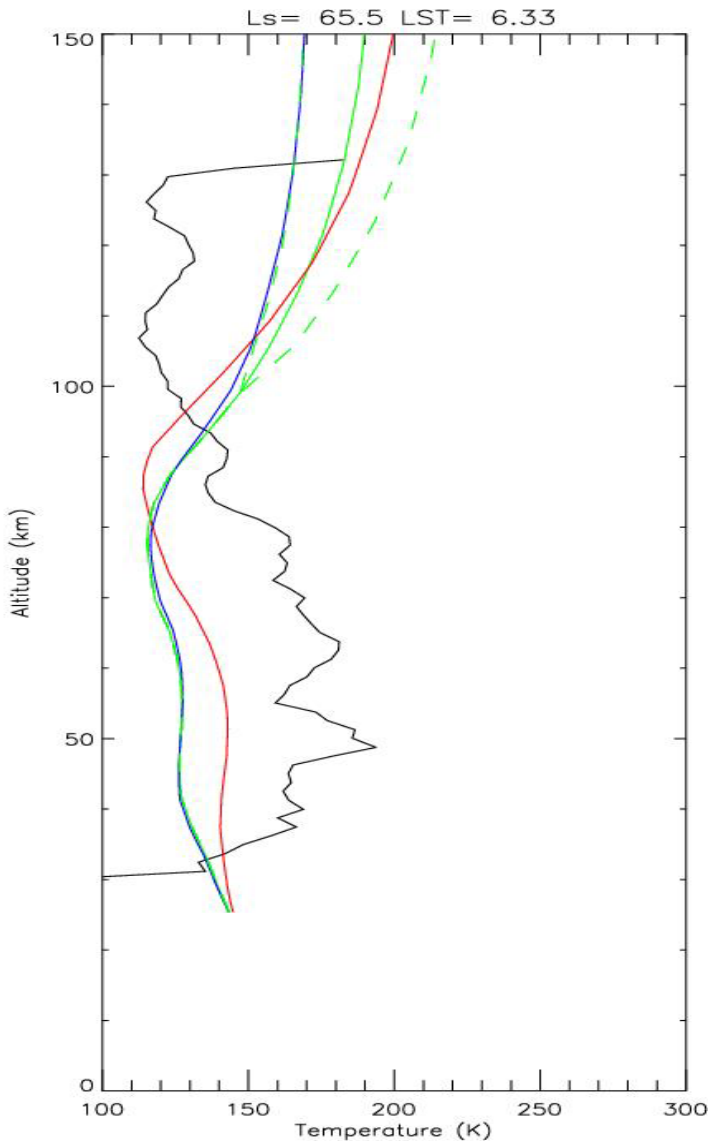


A few cases :warmer, denser atmosphere

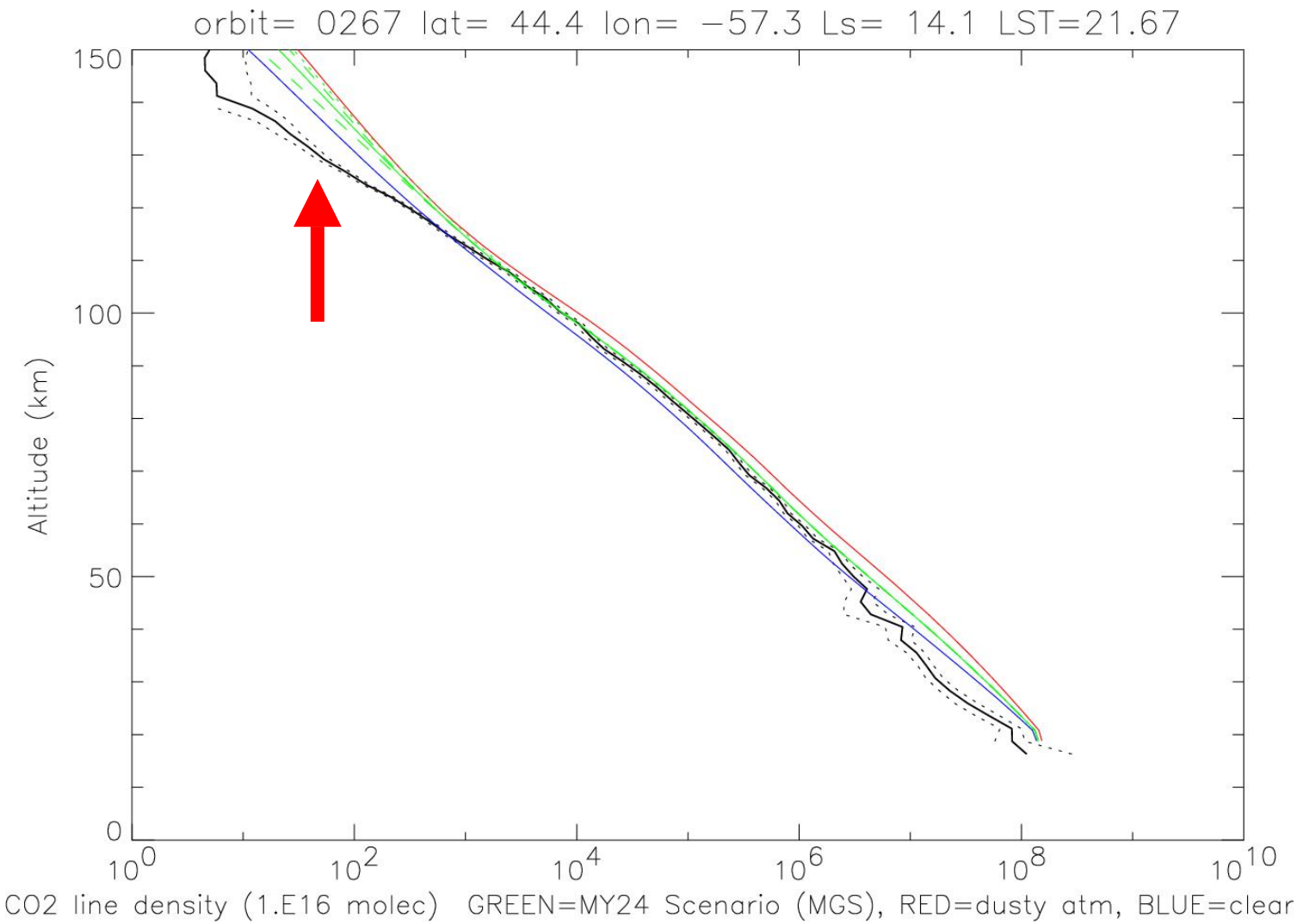
Density



Temperature



Most cases : low density / cold atmosphere above



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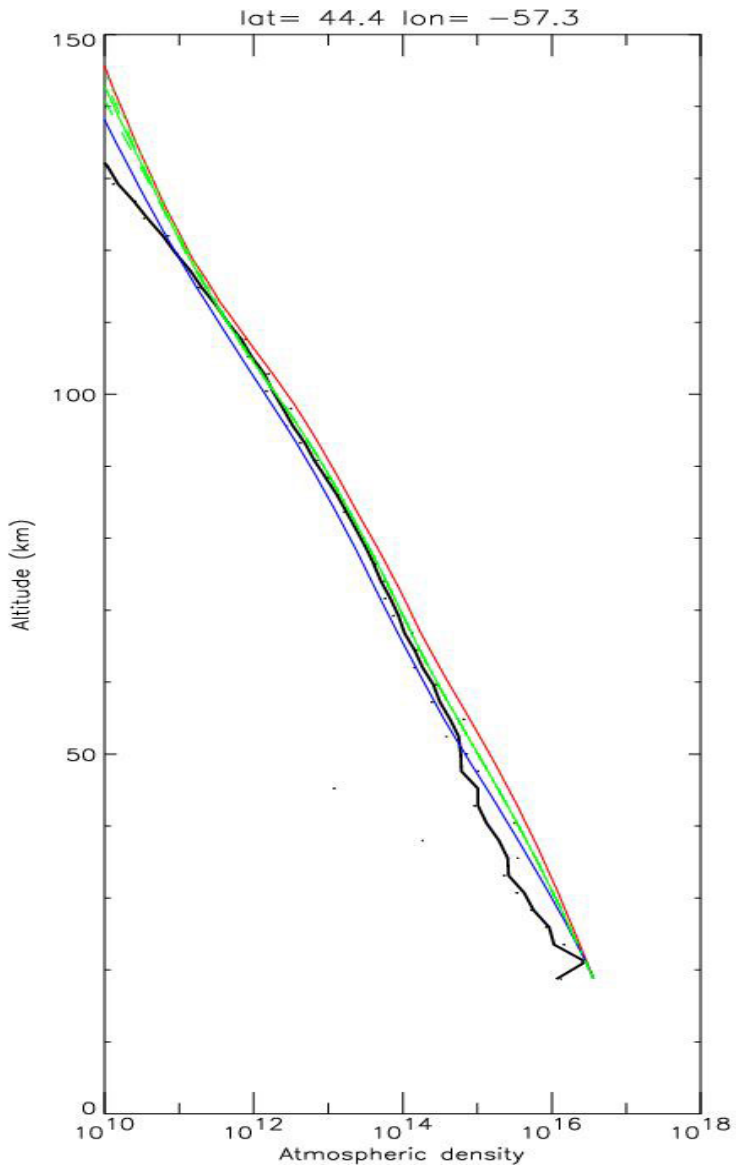
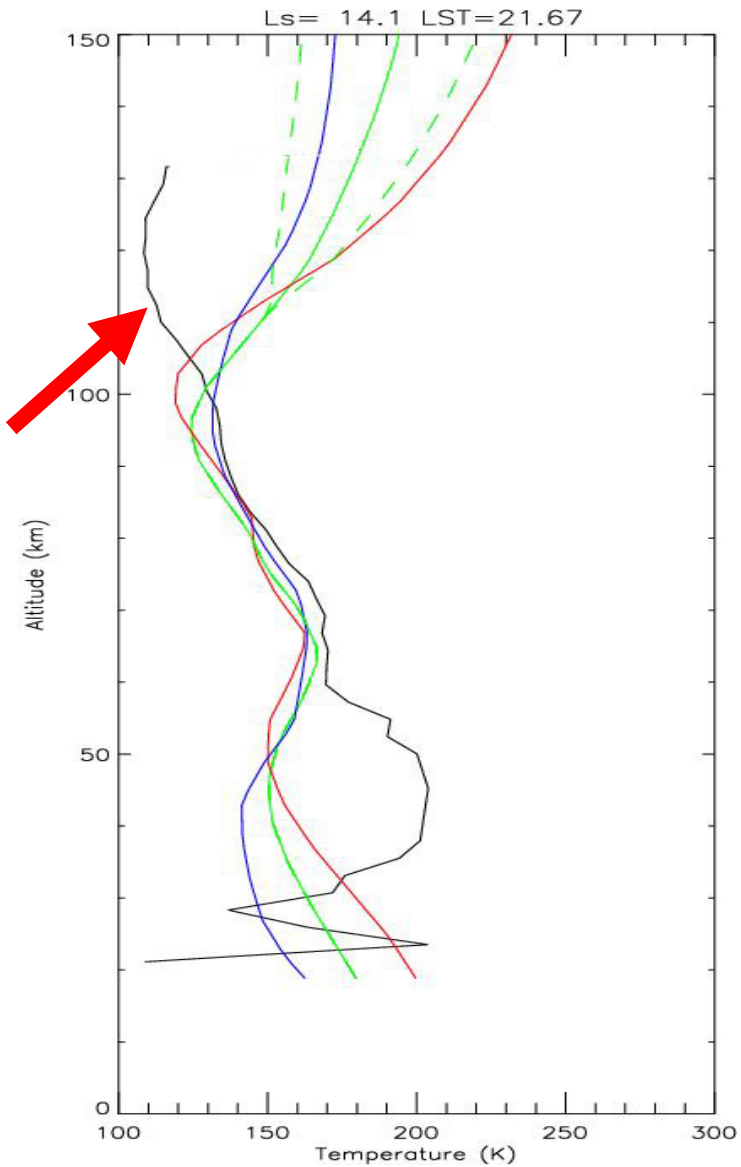
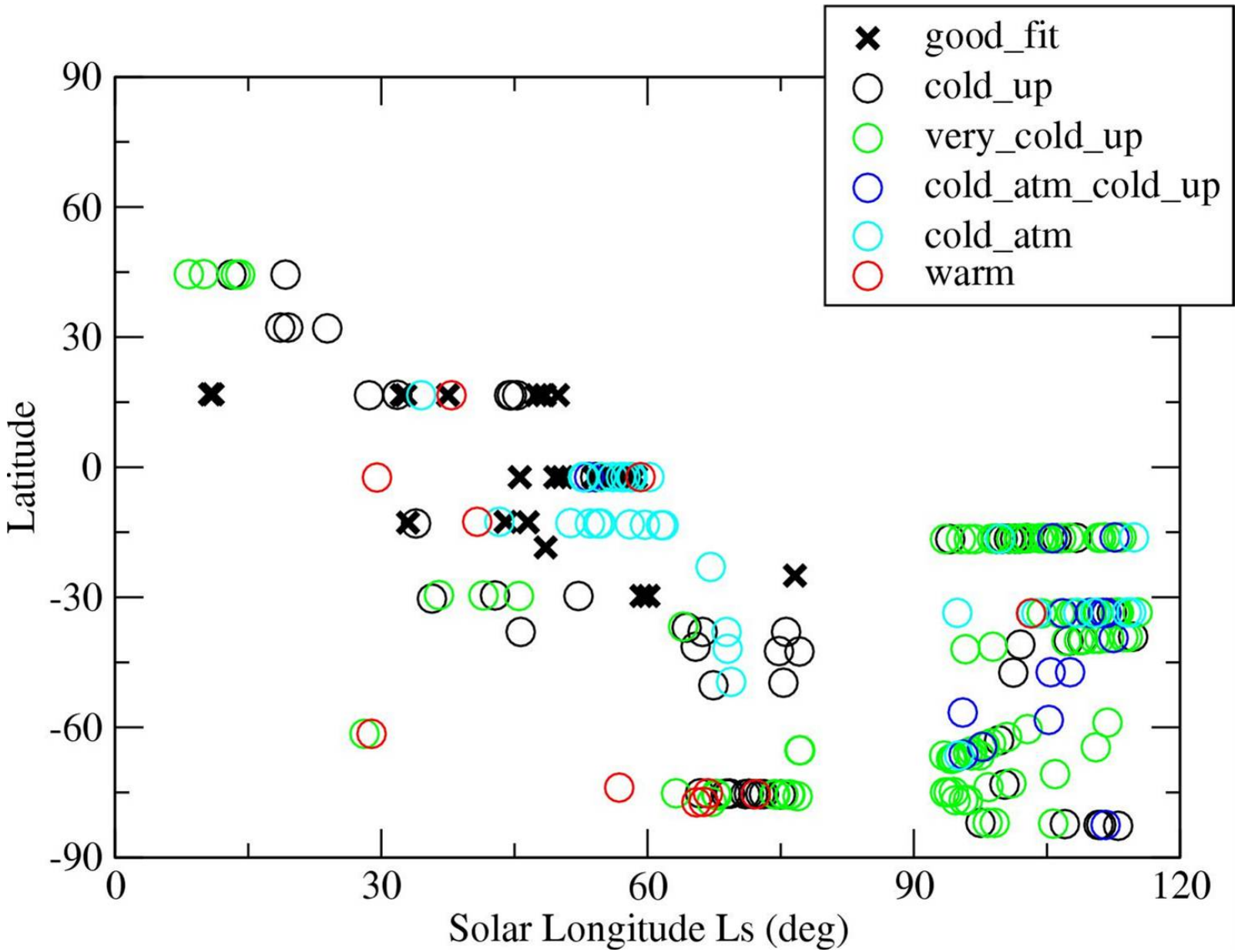
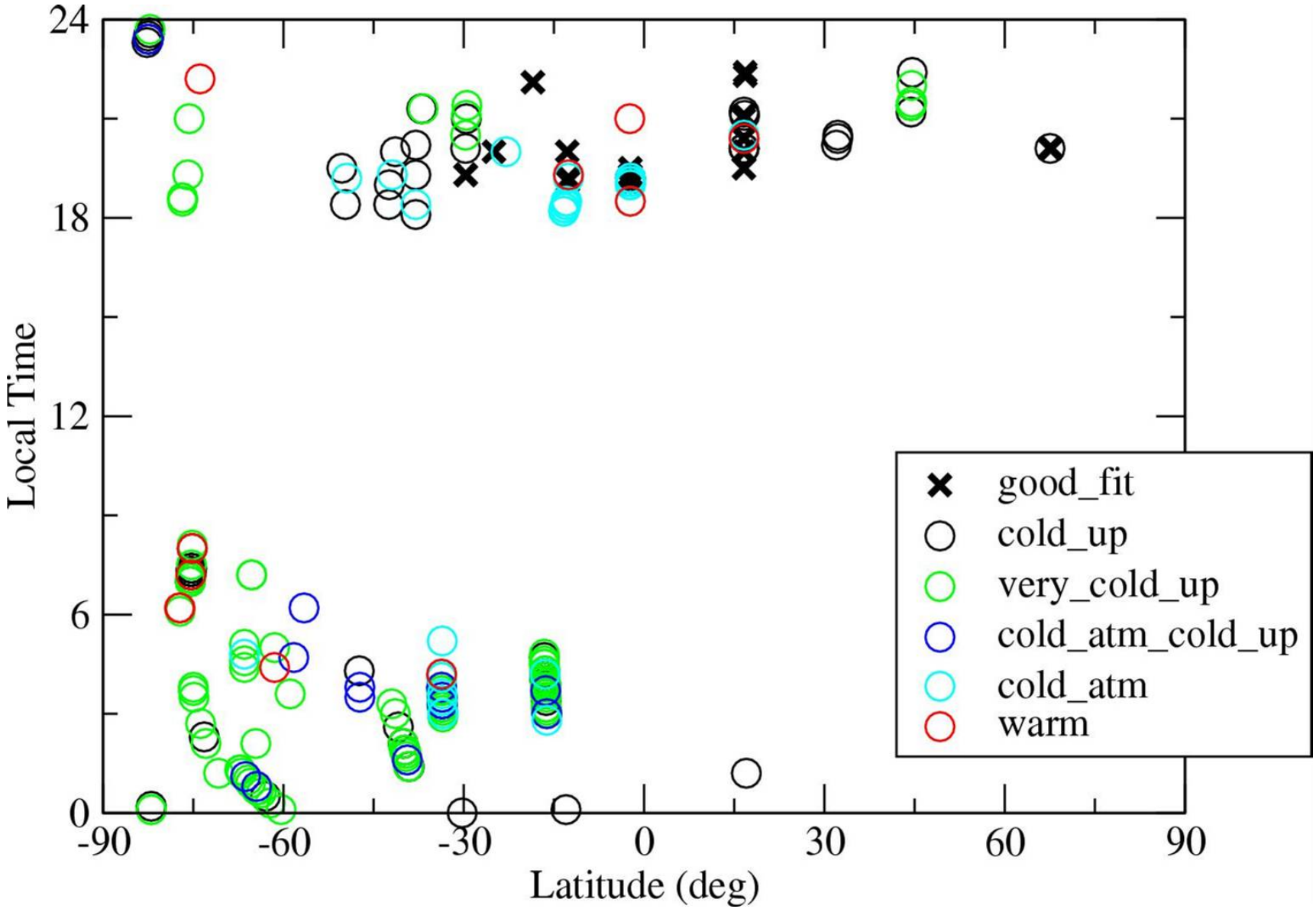




Trends in the characteristic of the observations – model disagreement

- Good fit : 12%
- Cold upper atmosphere : 25 %
- Very cold upper atmosphere : 38%
- Cold upper atm. + cold lower atm 6%
- Cold lower atm. : 14 %
- Warm atmosphere : 5%

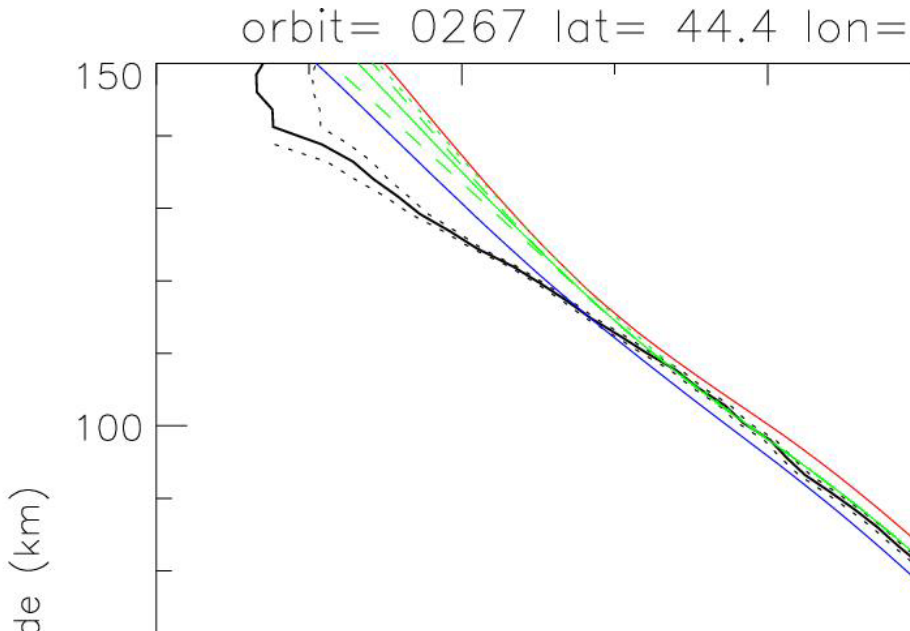

good_fit
cold_up
very_cold_up
cold_atm_cold_up
cold_atm
warm
90
60
30
0
-30
-60
-90
Latitude
0
30
60
90
120
Solar Longitude Ls (deg)


24
18
12
6
0
Local Time
-90
-60
-30
0
30
60
90
Latitude (deg)
good_fit
cold_up
very_cold_up
cold_atm_cold_up
cold_atm
warm

Why low density / cold temperature ?

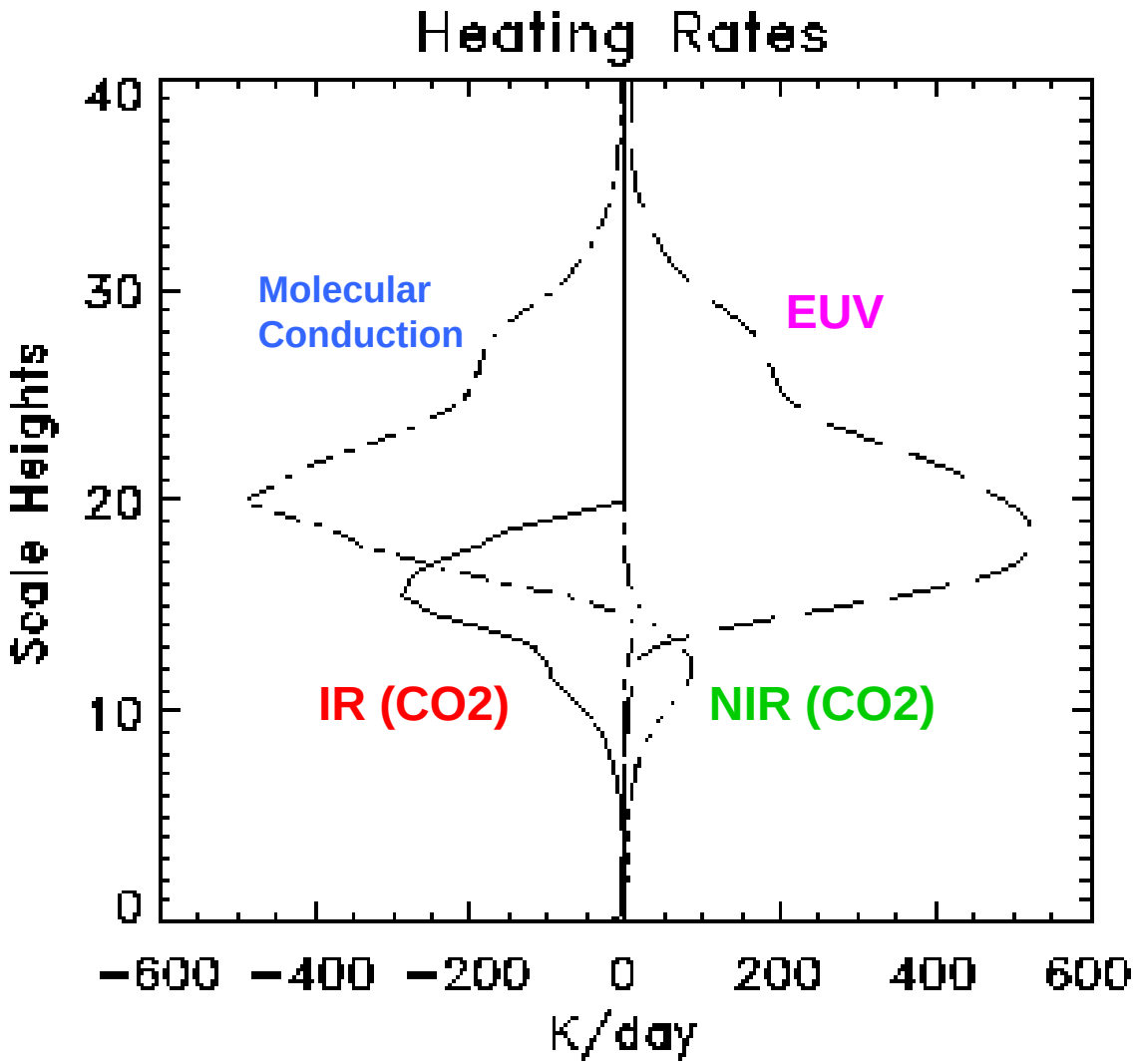
- Problem with data…
- Strong decrease of CO2 mixing ratio above the homopause ? Unlikely
- Actual low temperature ?

⇨ Energy balance



Why so cold ?

Energy balance of the upper atmosphere



Conclusions

- Hundreds of good quality profile of the Mars atmosphere. Work in progress:
  - CO2 cross sectiion poorly known at low temperature
  - Inversion must be improved
- If one believe the observations : upper atmosphere (> 100 km) much less dense or colder than expected.