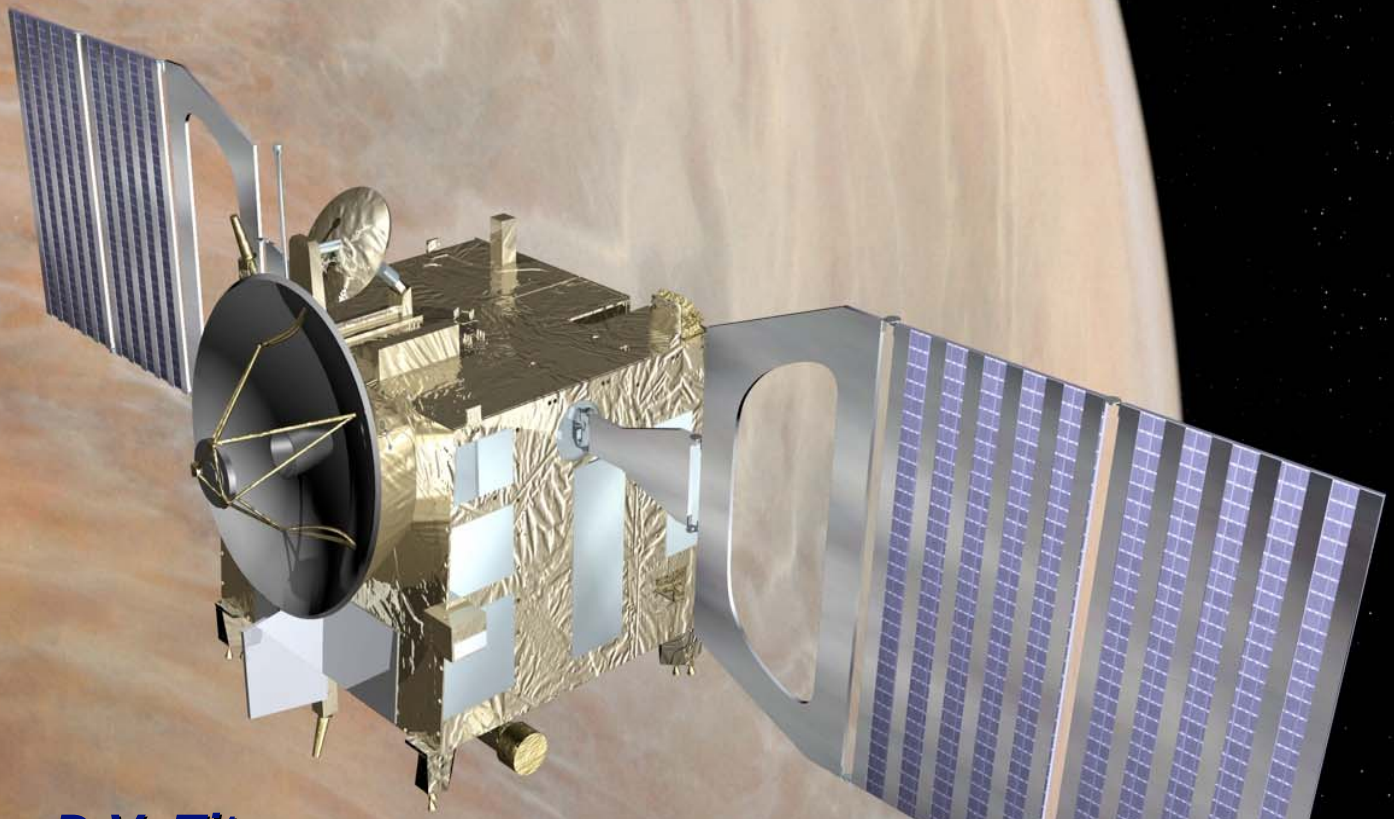
Scientific highlights of the Venus Express mission



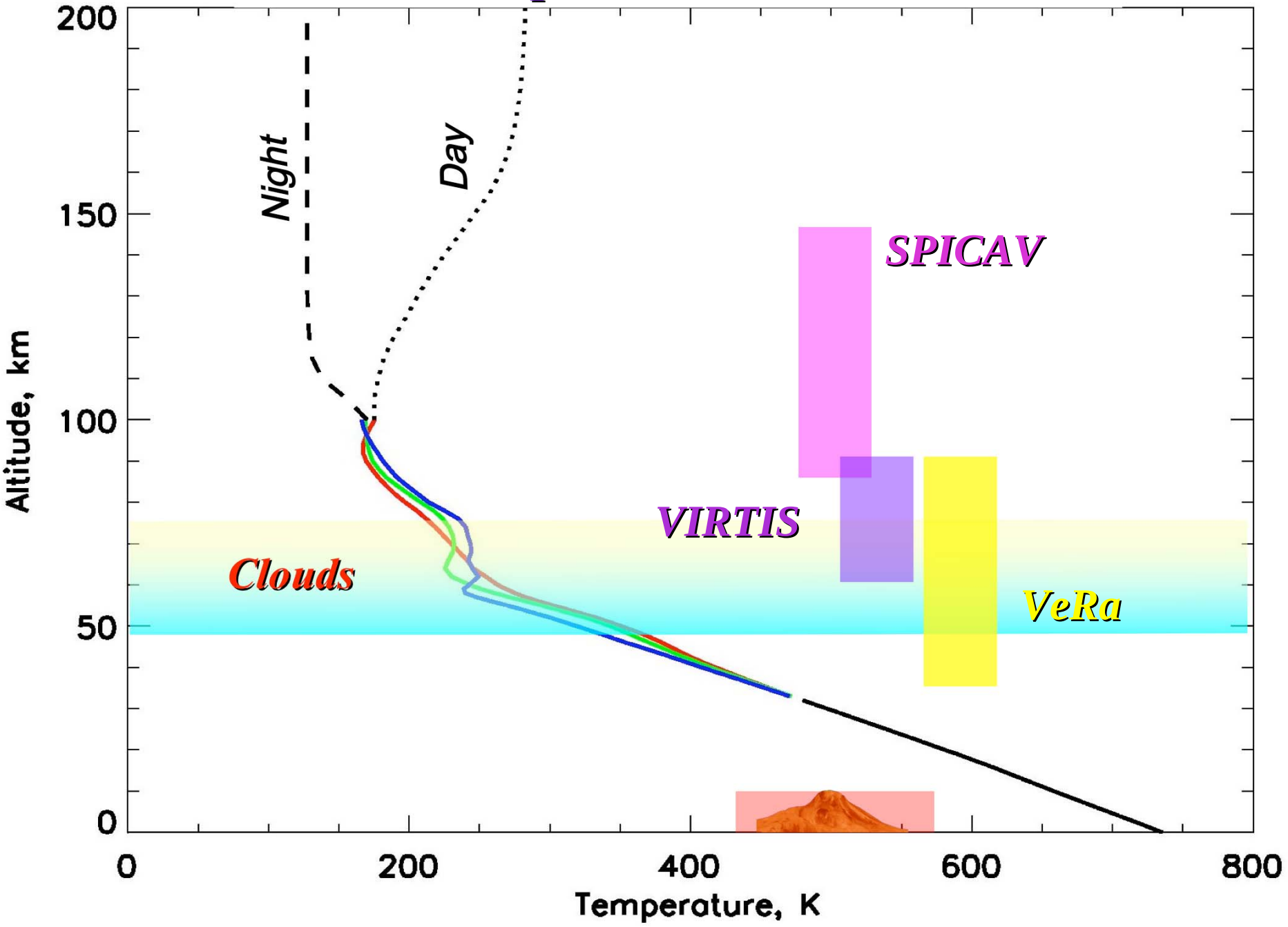
D.V. Titov

Max Planck Institute for Solar System Research

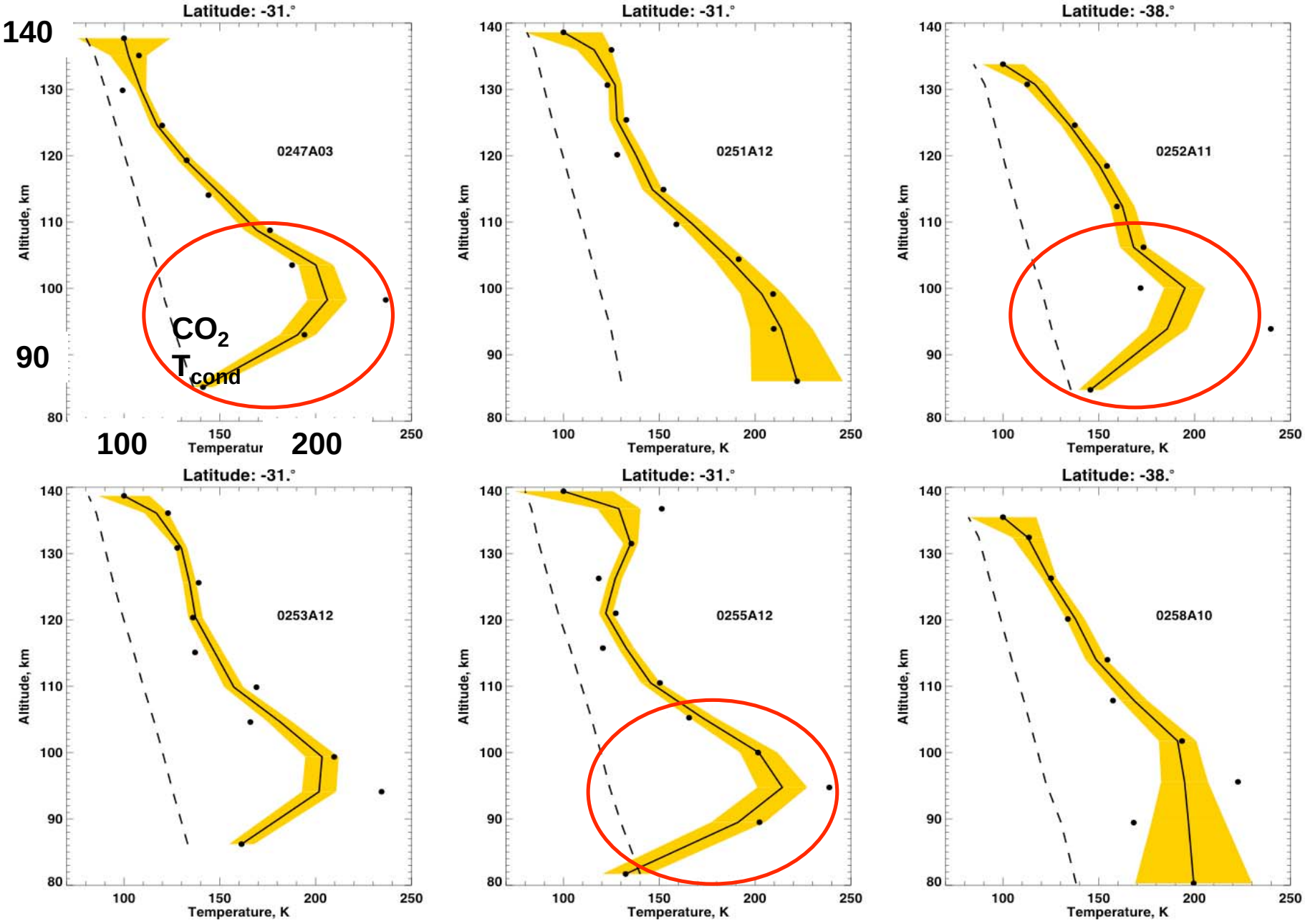
Katlenburg-Lindau, Germany

Structure of the Atmosphere

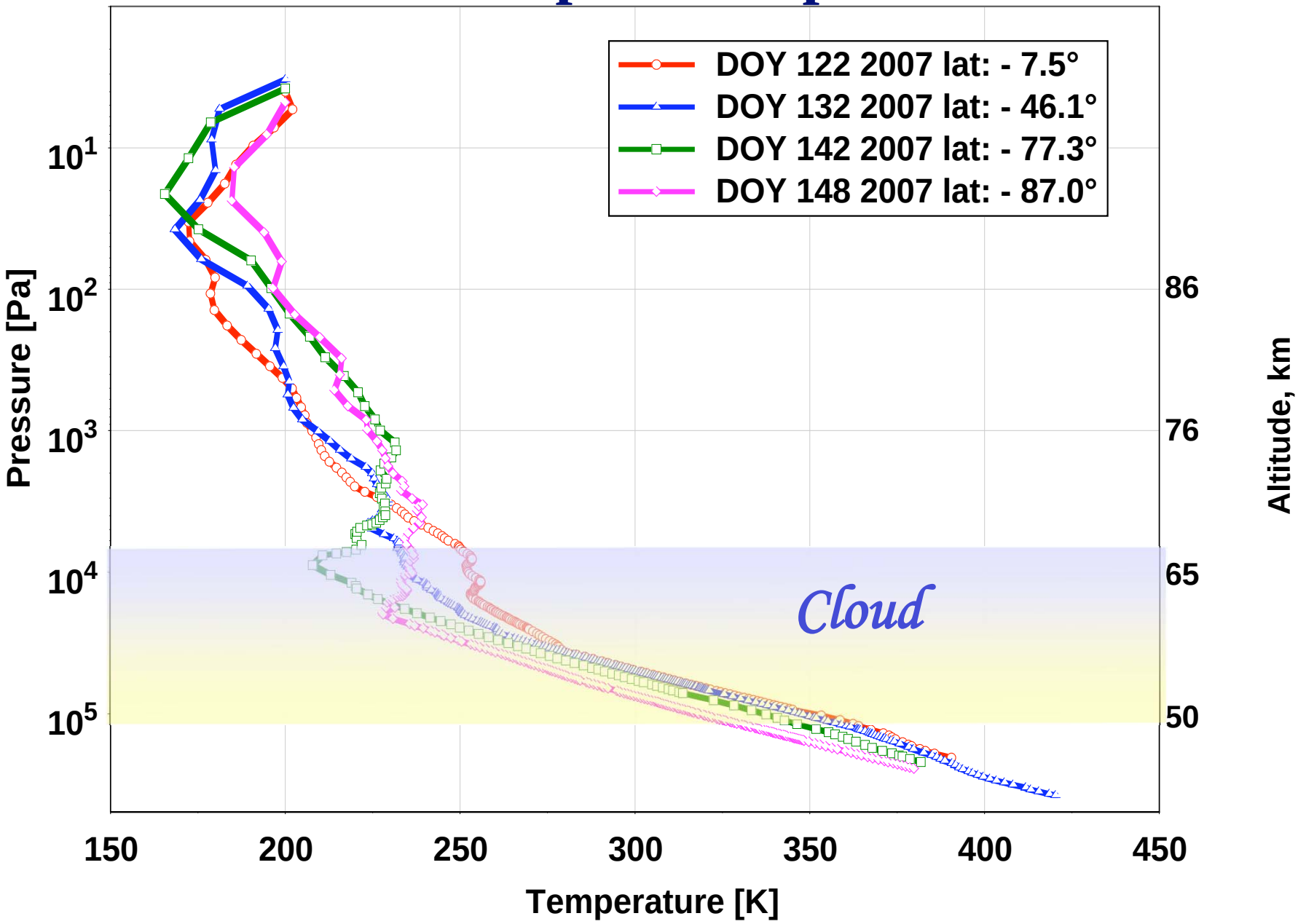
Temperature structure



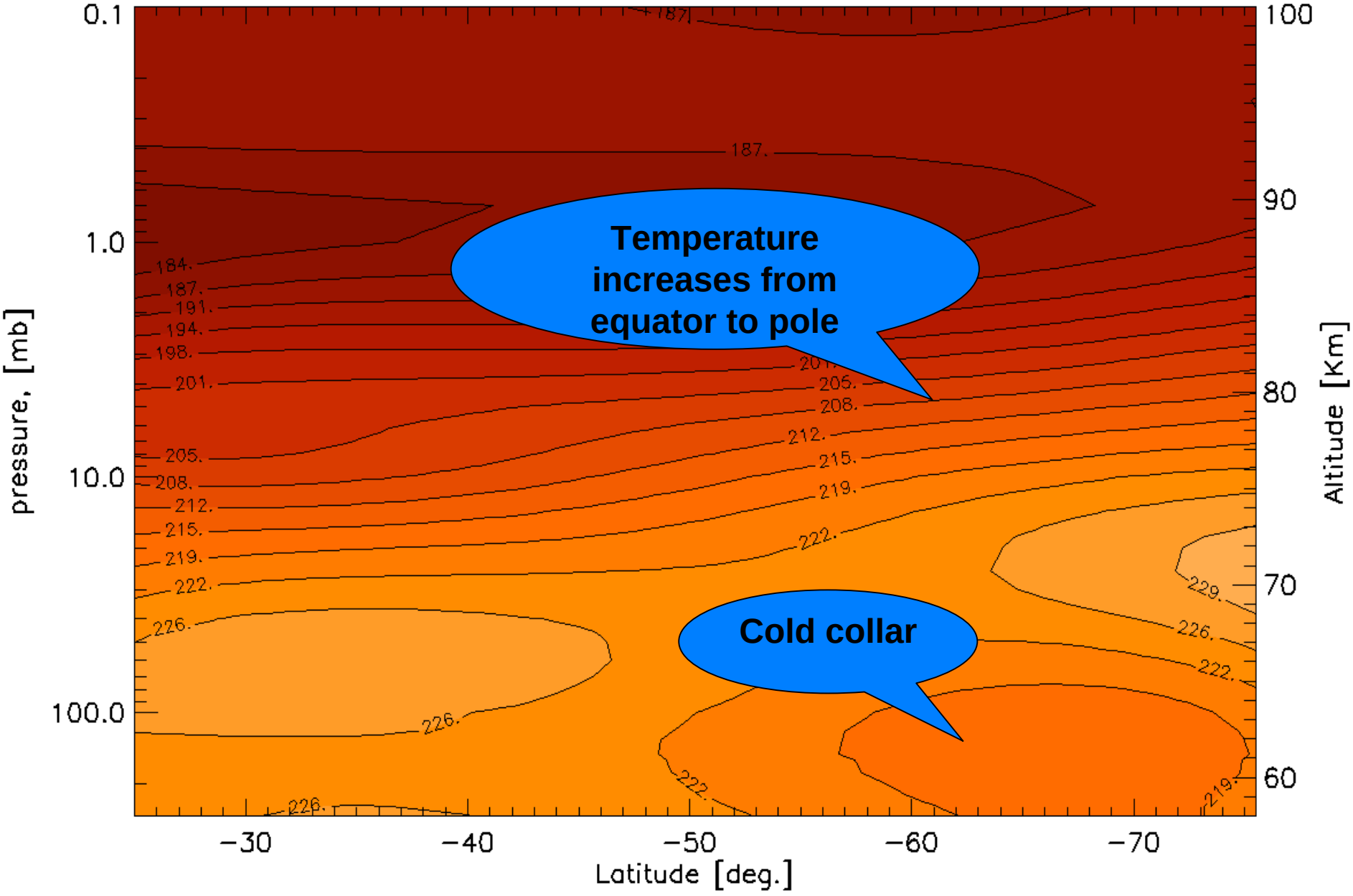
SPICAV UV temperature sounding in stellar occultation



VeRa Temperature profiles

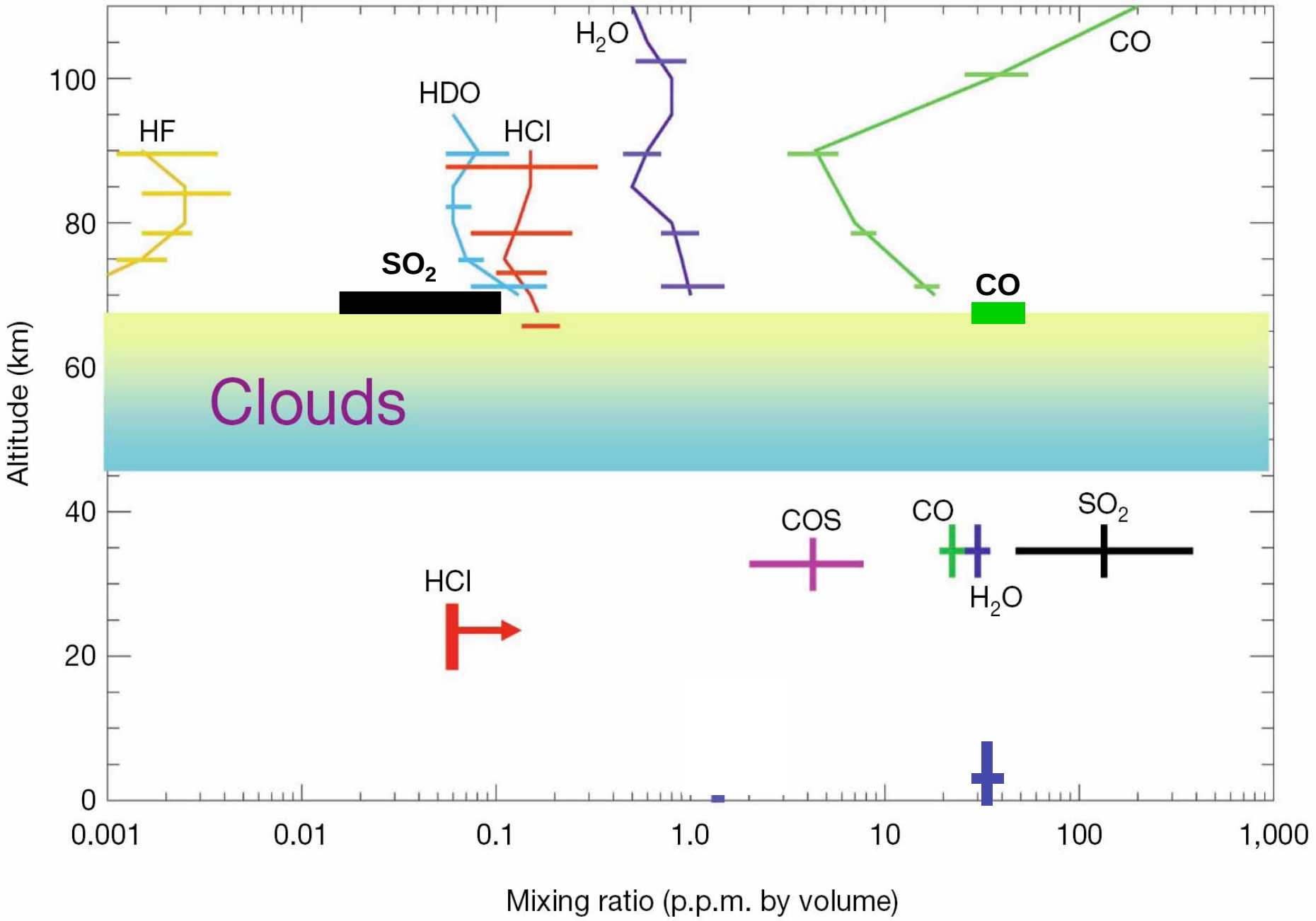


VIRTIS temperature field

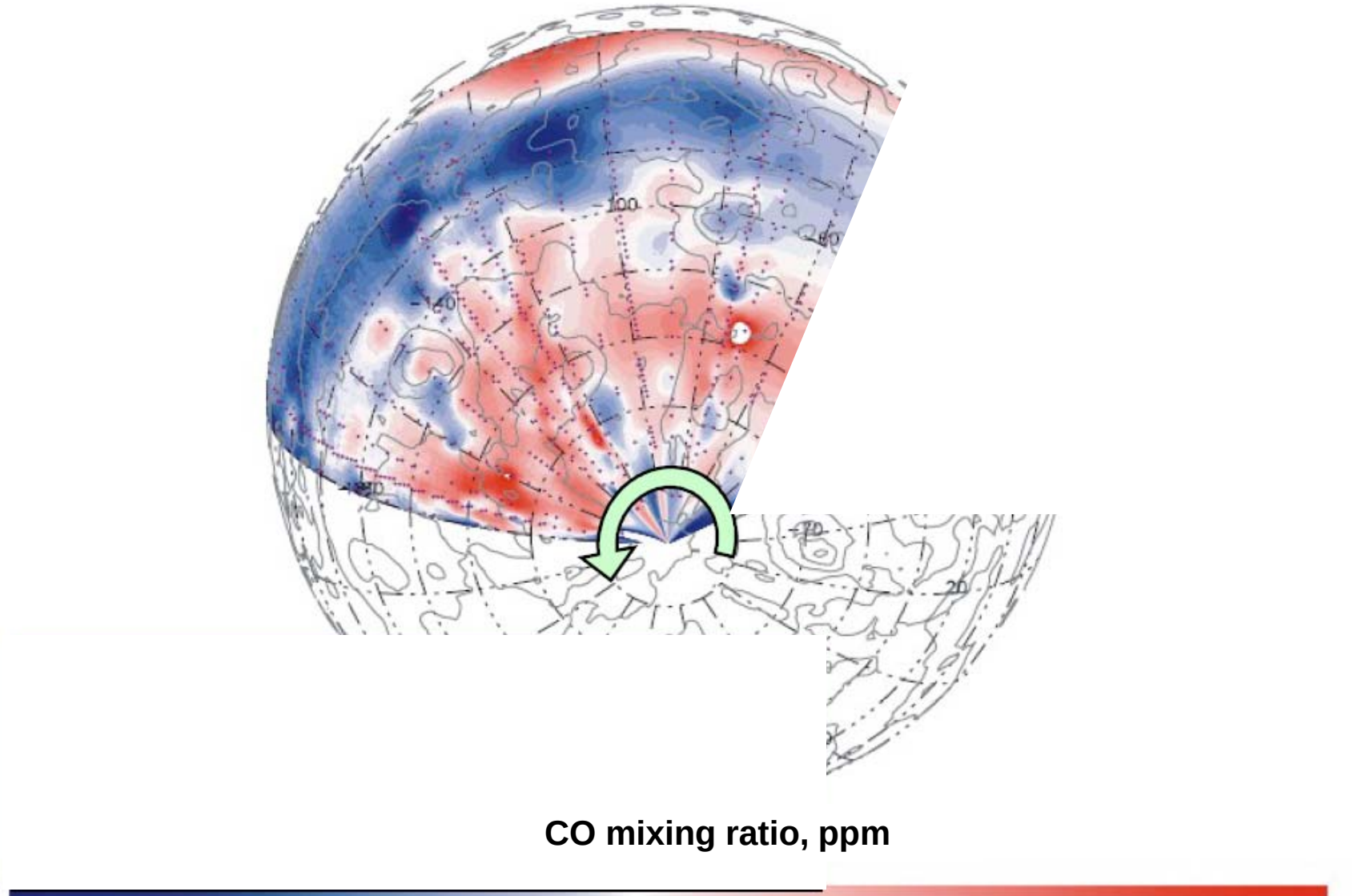


Atmospheric composition

Summary of composition results

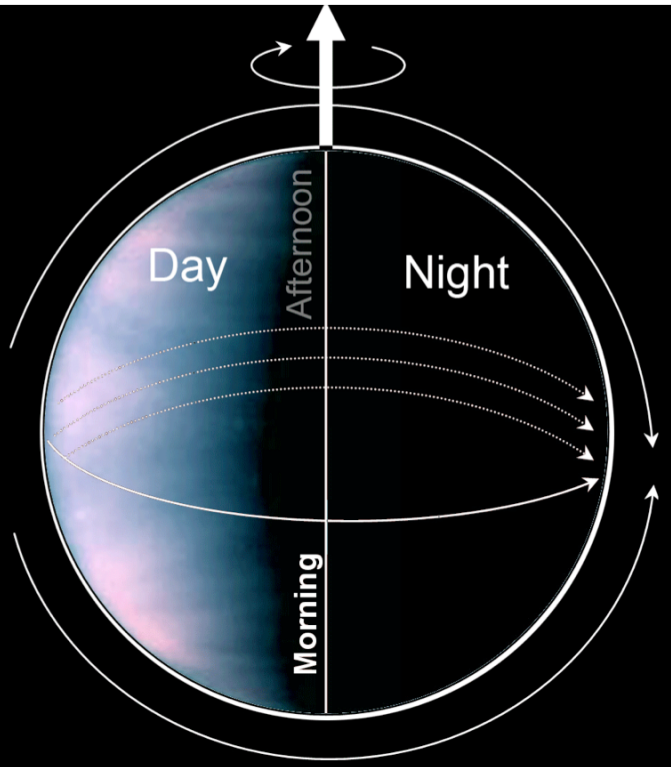


Meridional transport of CO by Hadley cell



Non-LTE emissions

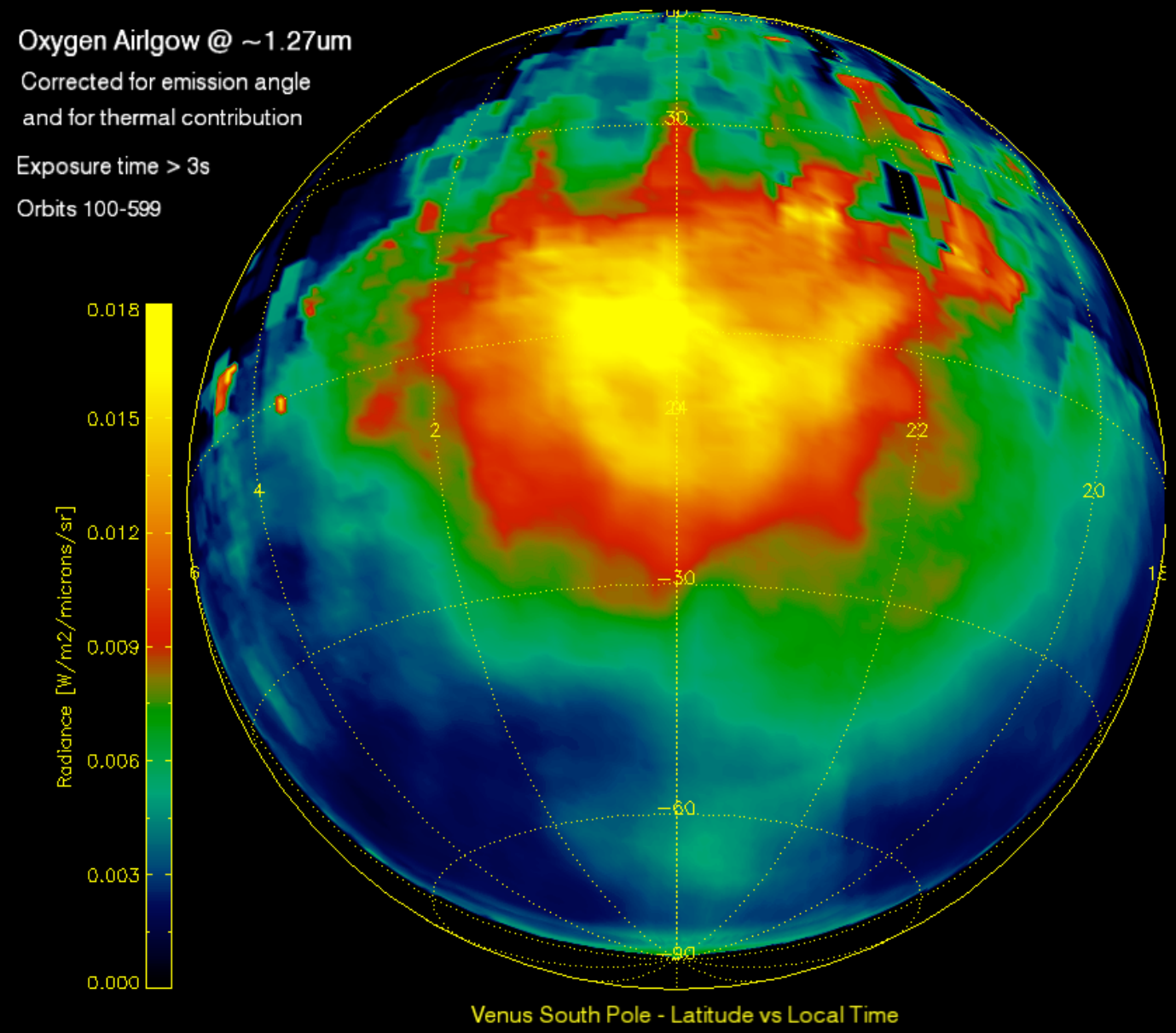
Origin of airglow on Venus



Recombination	**$O + N \rightarrow NO^*$**
3-body recombination	**$O + N + CO_2 \rightarrow NO + CO_2$**
Emission	**$NO^* \rightarrow NO + h\nu$**
Loss	**$N + NO \rightarrow N_2 + O$**

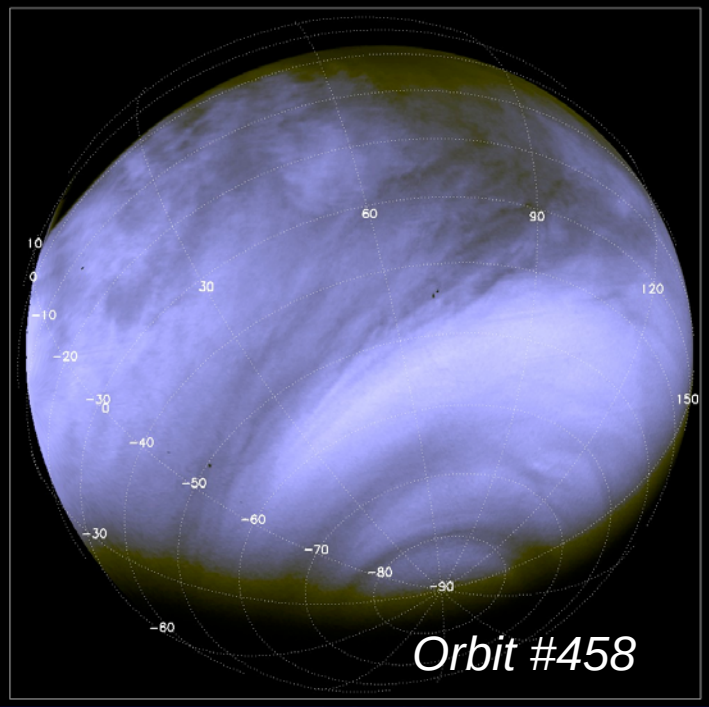
Recombination	**$O + O + CO_2 \rightarrow O_2^* + CO_2 + 5.17\ eV$**
De-excitation	**$O_2^* \rightarrow O_2 + h\nu$**
Quenching	**$O_2^* + M \rightarrow O_2 + M$**

O_2 airglow at 1.27 µm

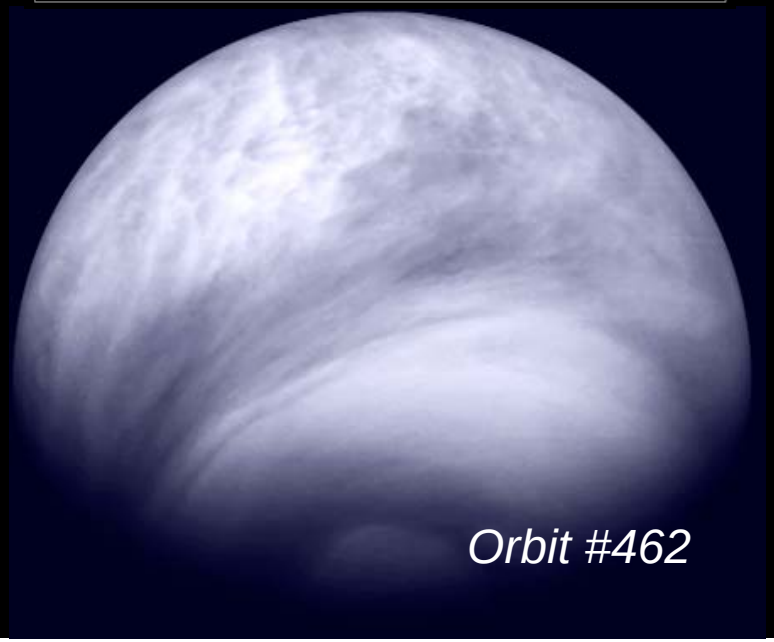


Clouds and hazes

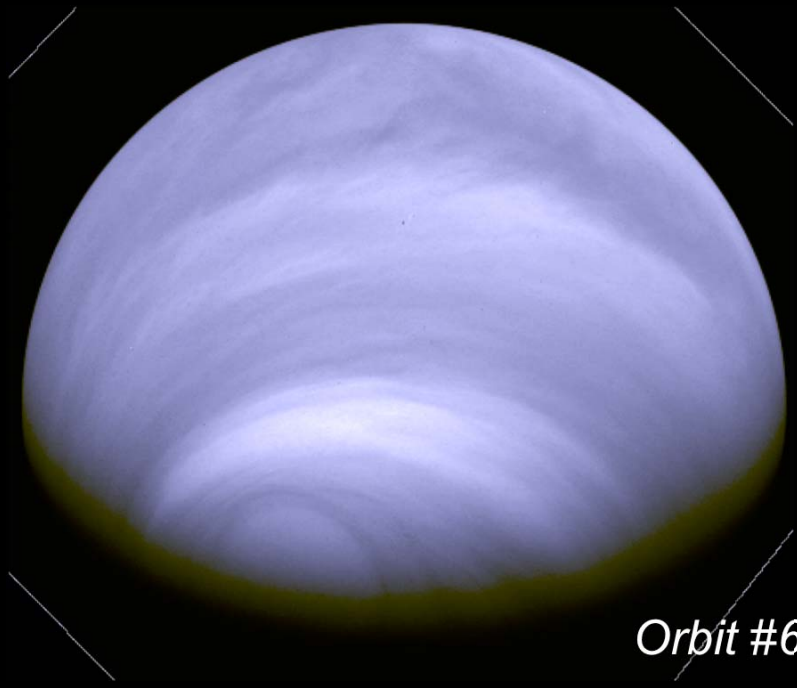
Cloud morphology: Global UV view



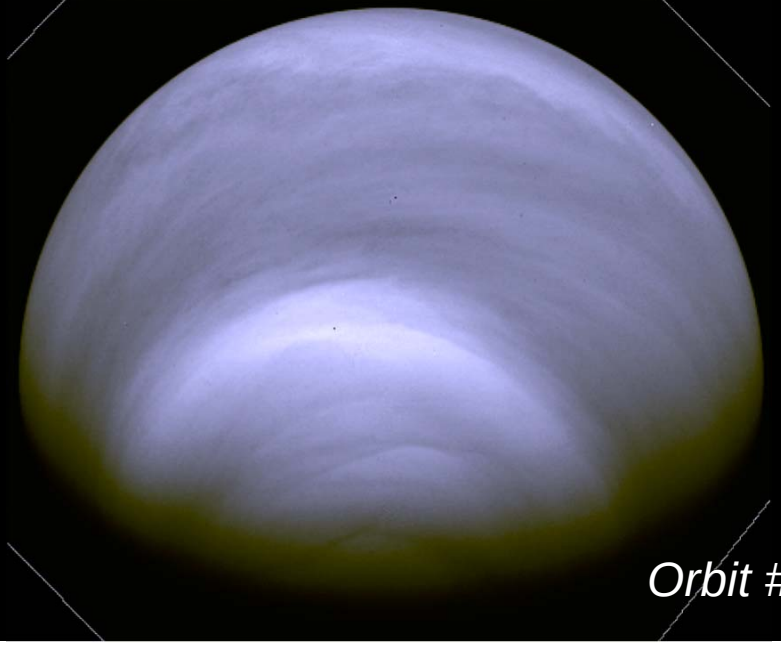
Orbit #458



Orbit #462

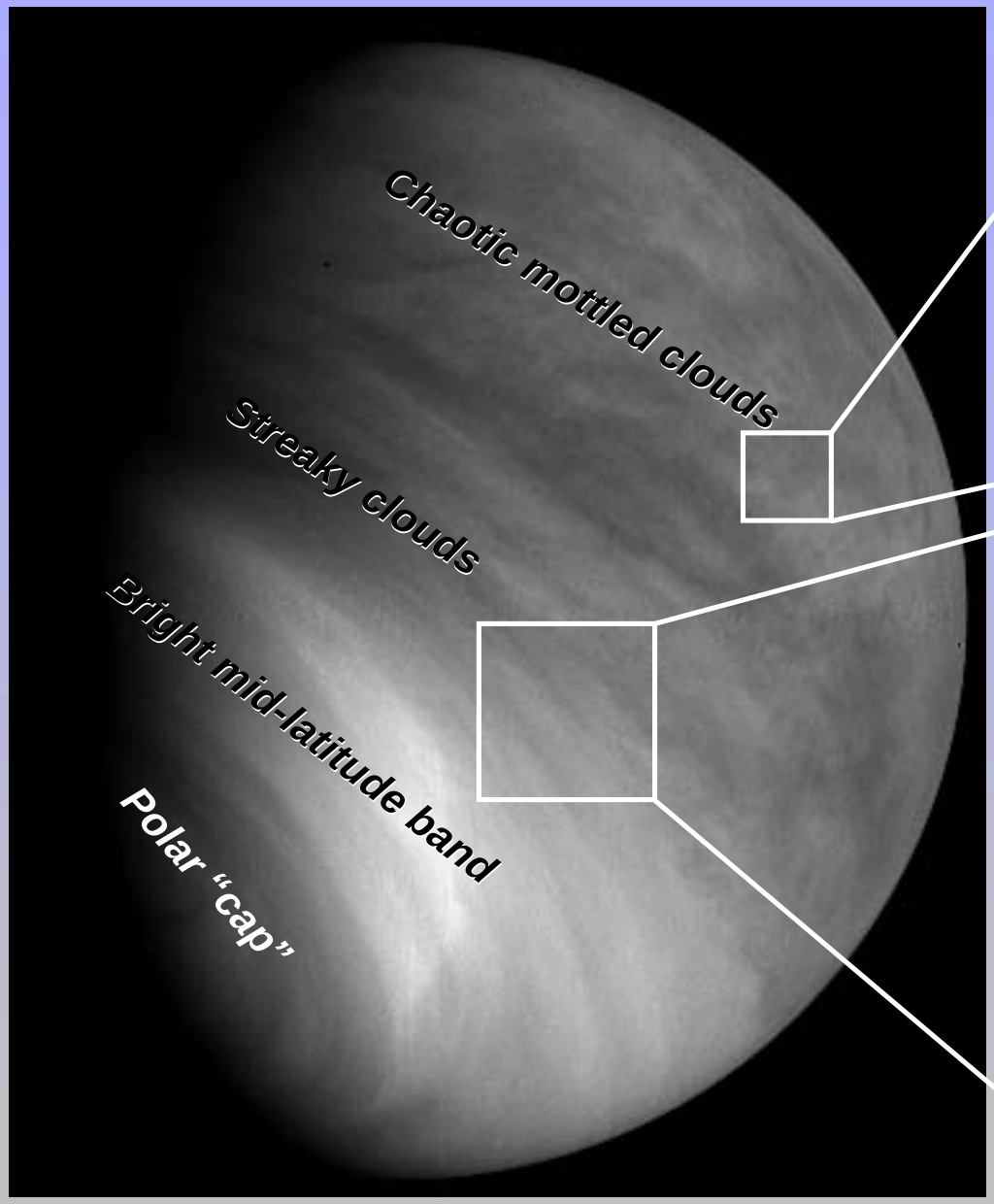


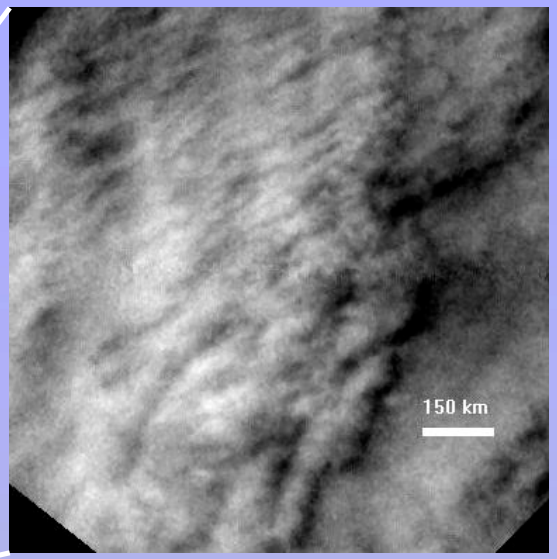
Orbit #673

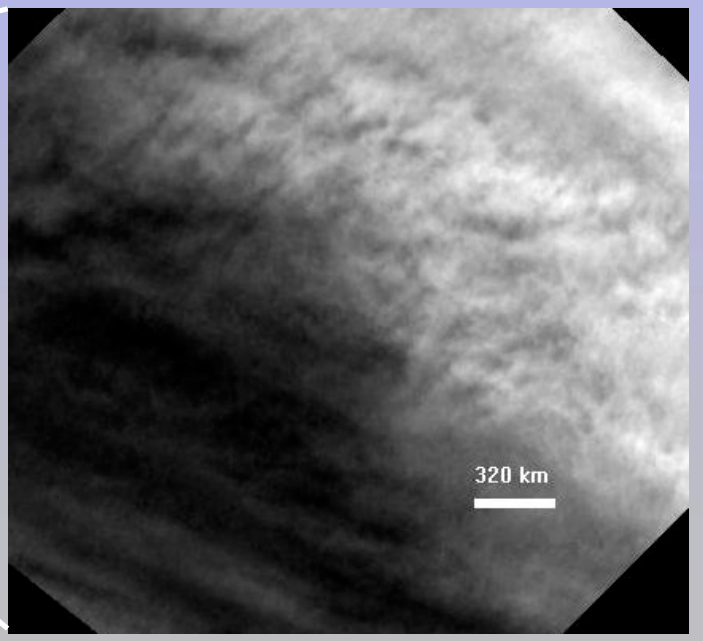


Orbit #679

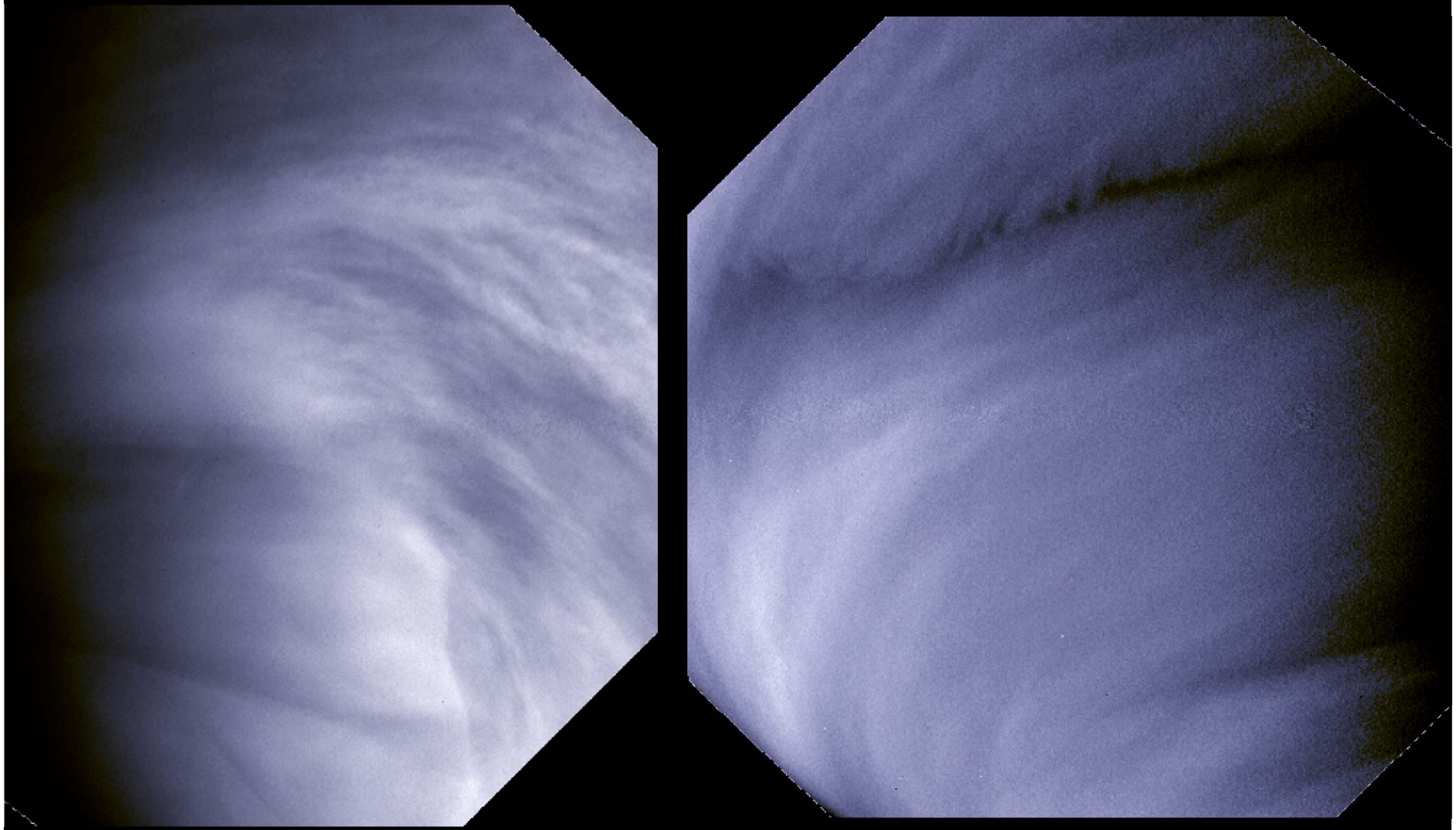
Cloud morphology







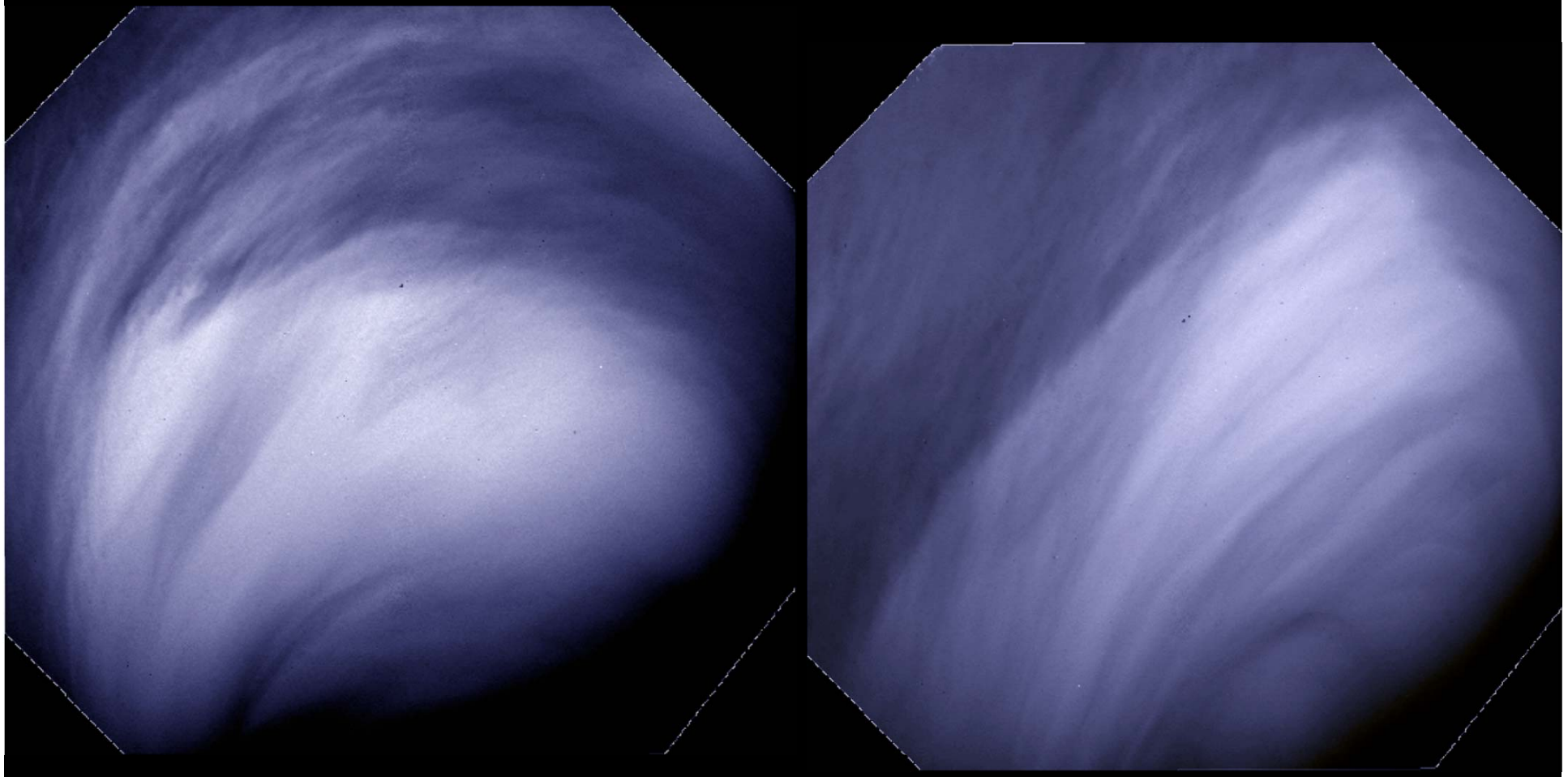
Transition region



Orbit #829

Orbit #754

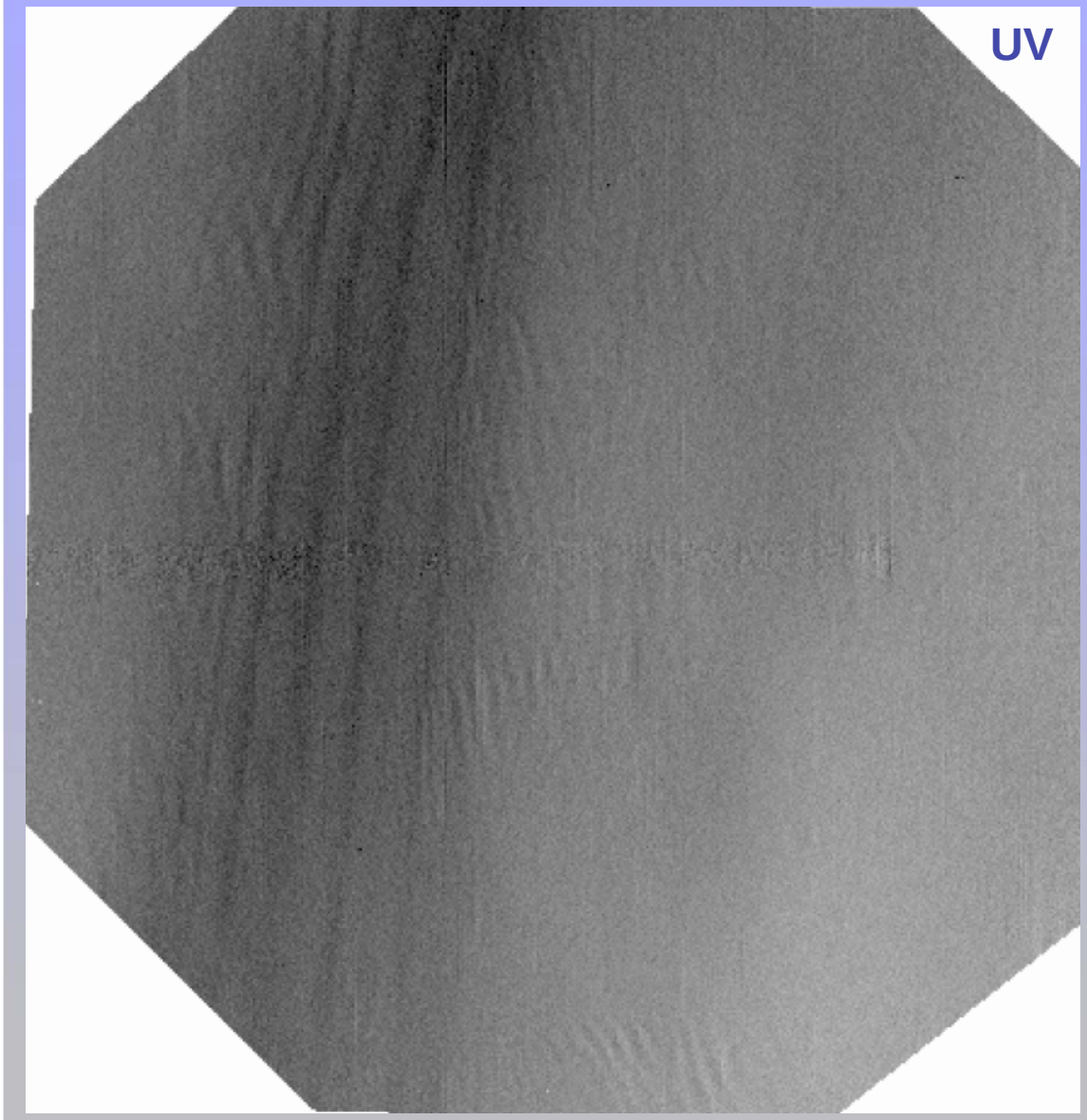
Polar “cap” and transition region

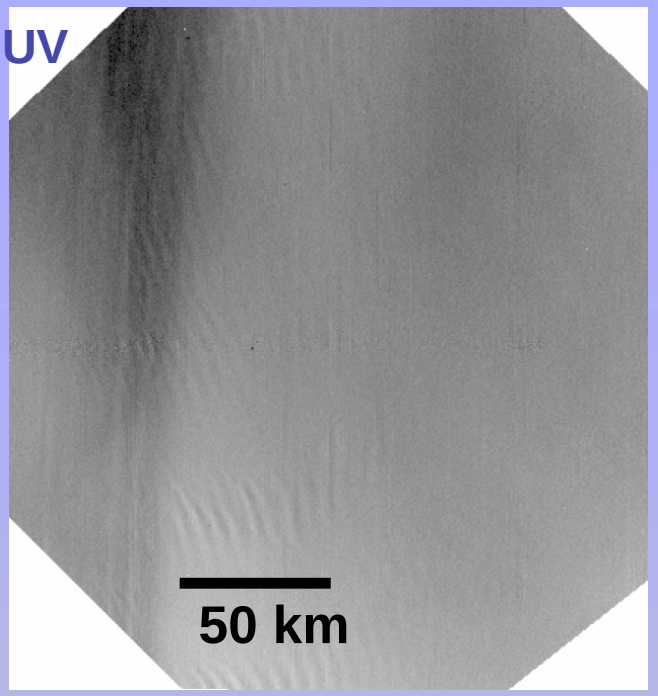


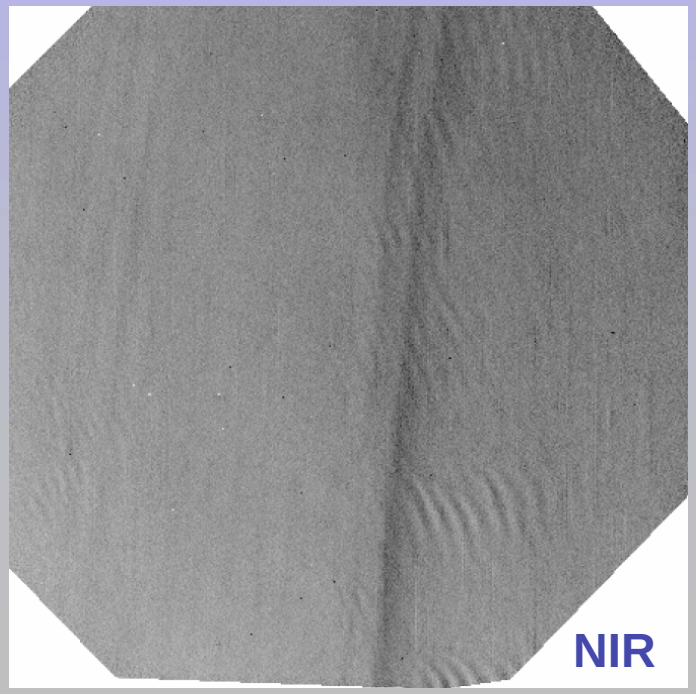
Orbit #809

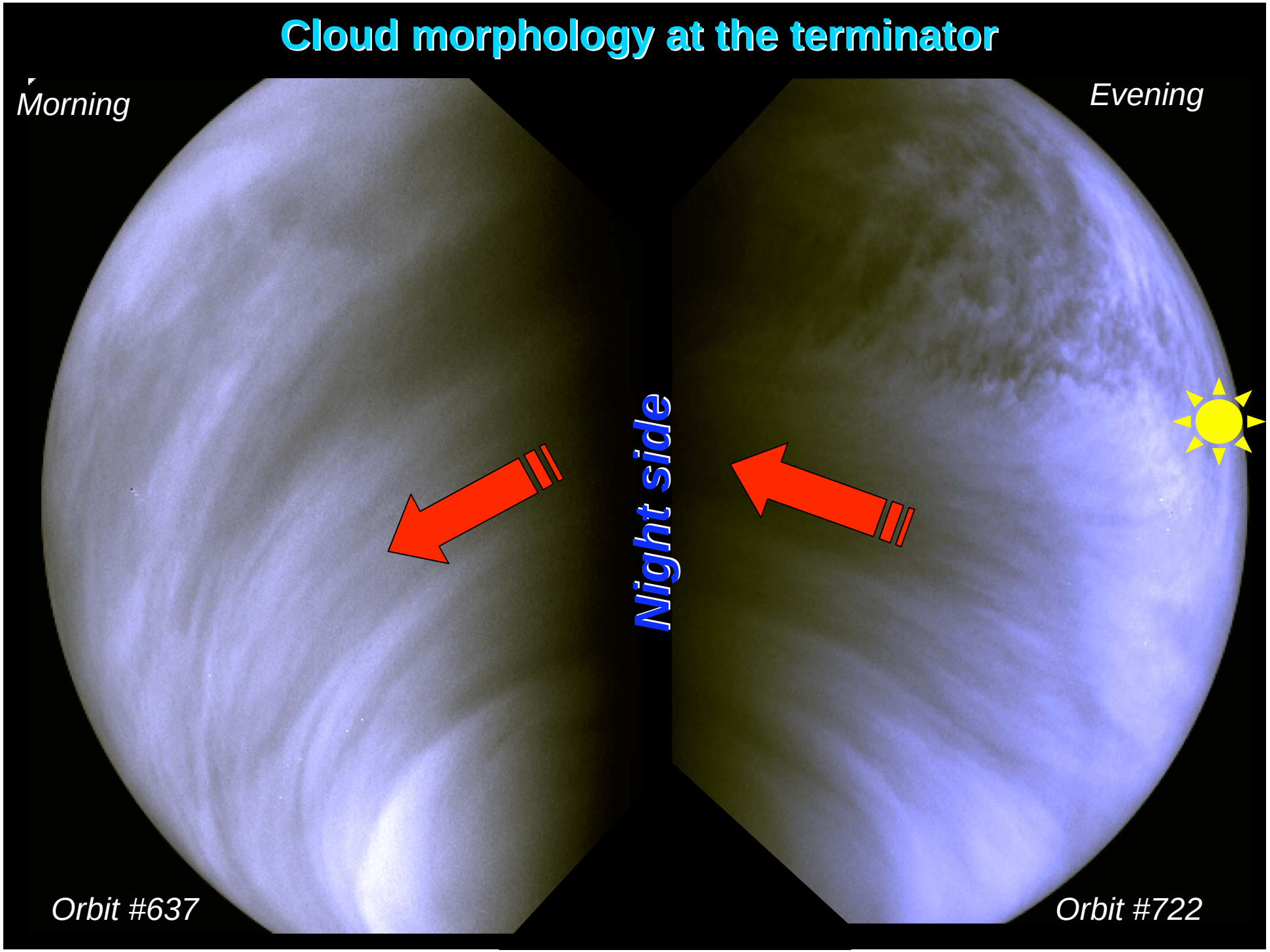
Orbit #812

Waves in polar region (65-70 N)

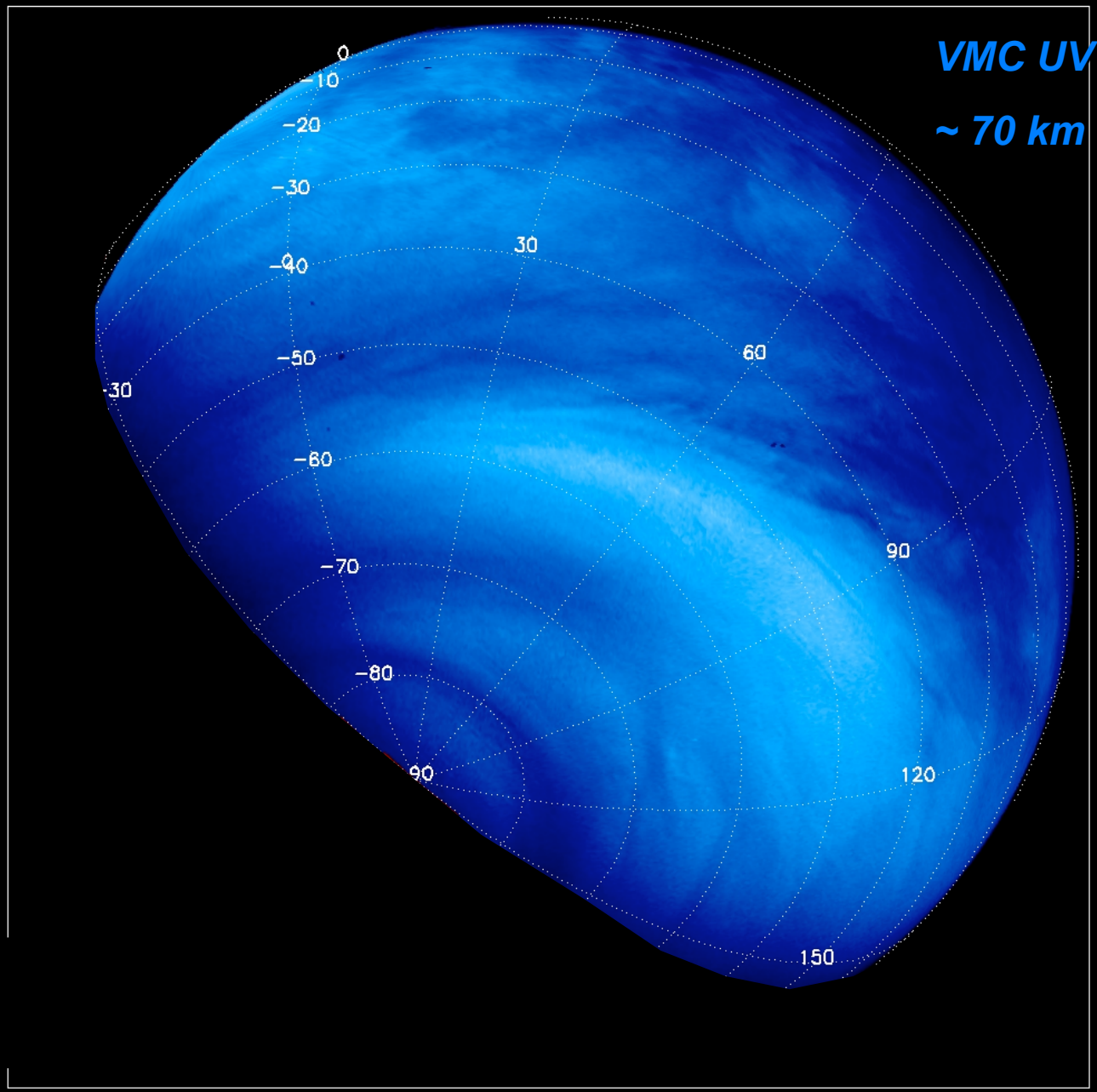







Cloud morphology at the terminator
Morning
Evening
Night side
Orbit #637
Orbit #722

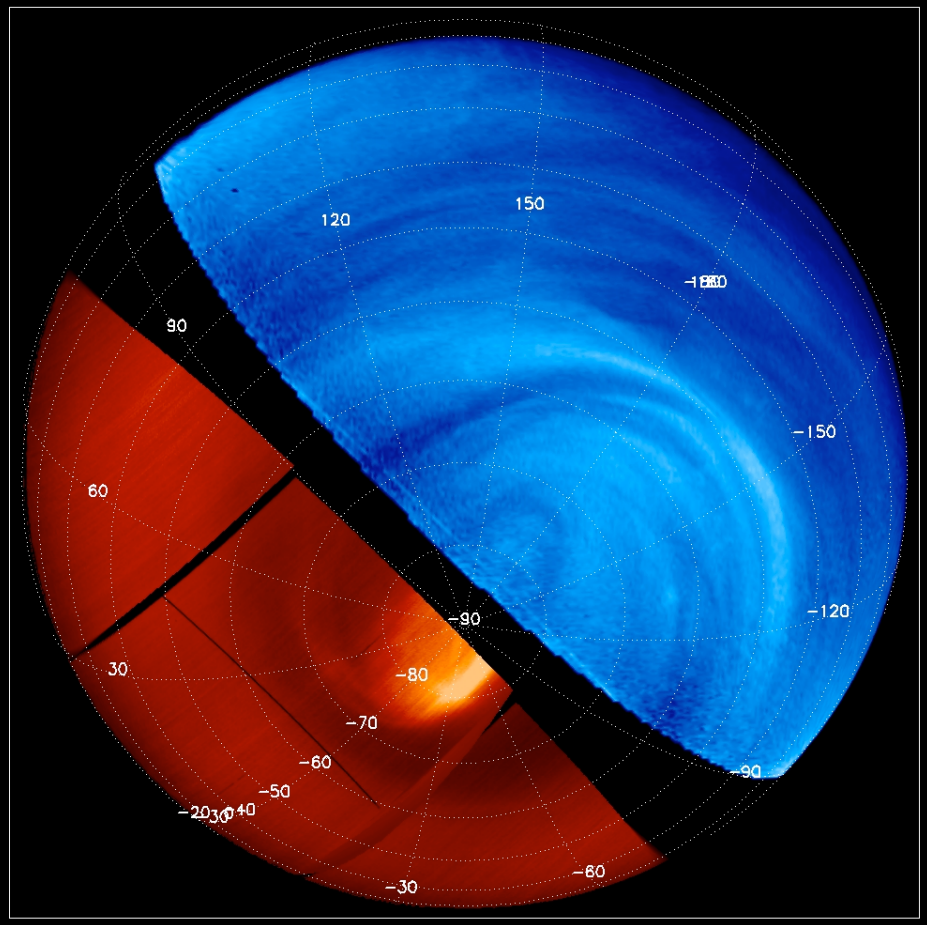
Global cloud morphology

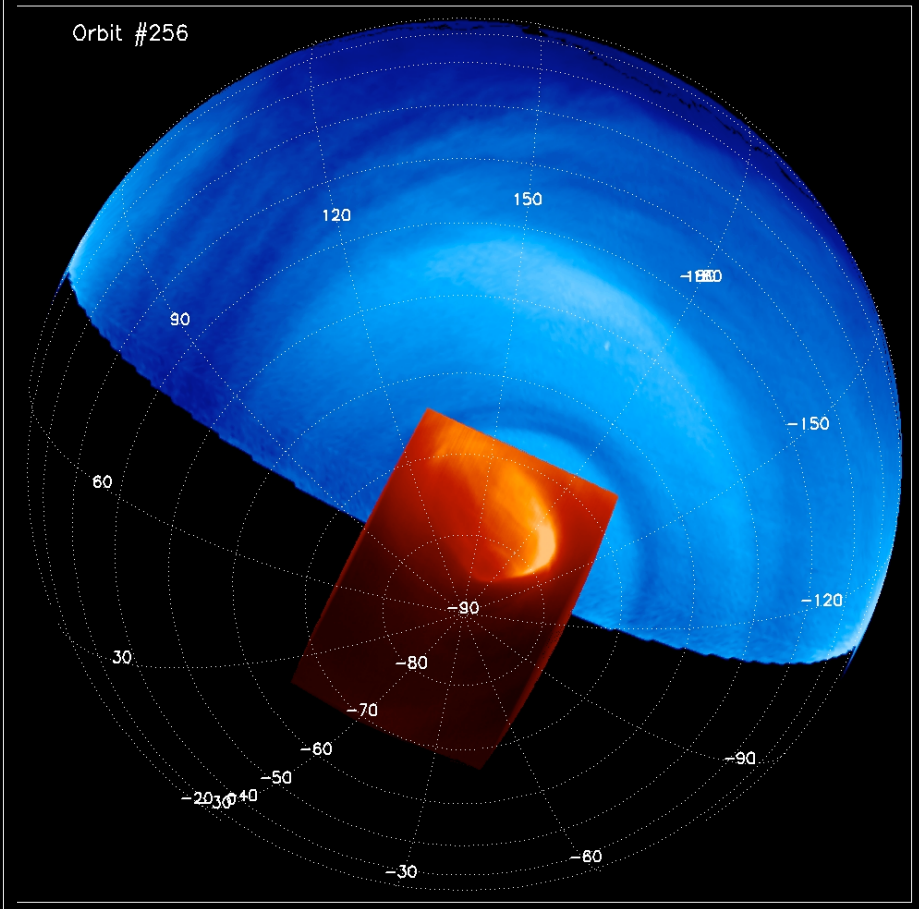


VMC UV (0.365 μm)

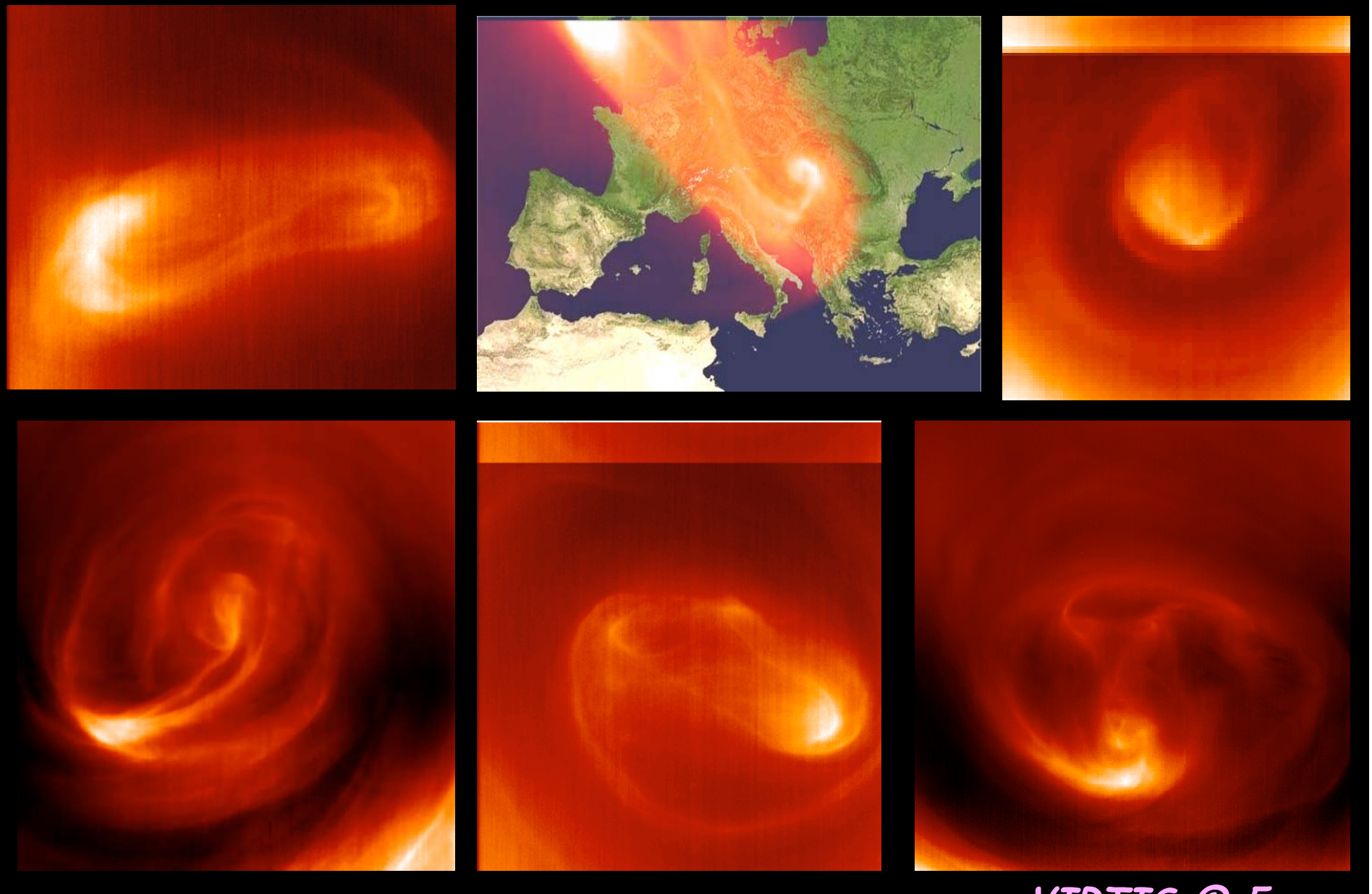
~ 70 km

Relation between polar UV and thermal-IR features





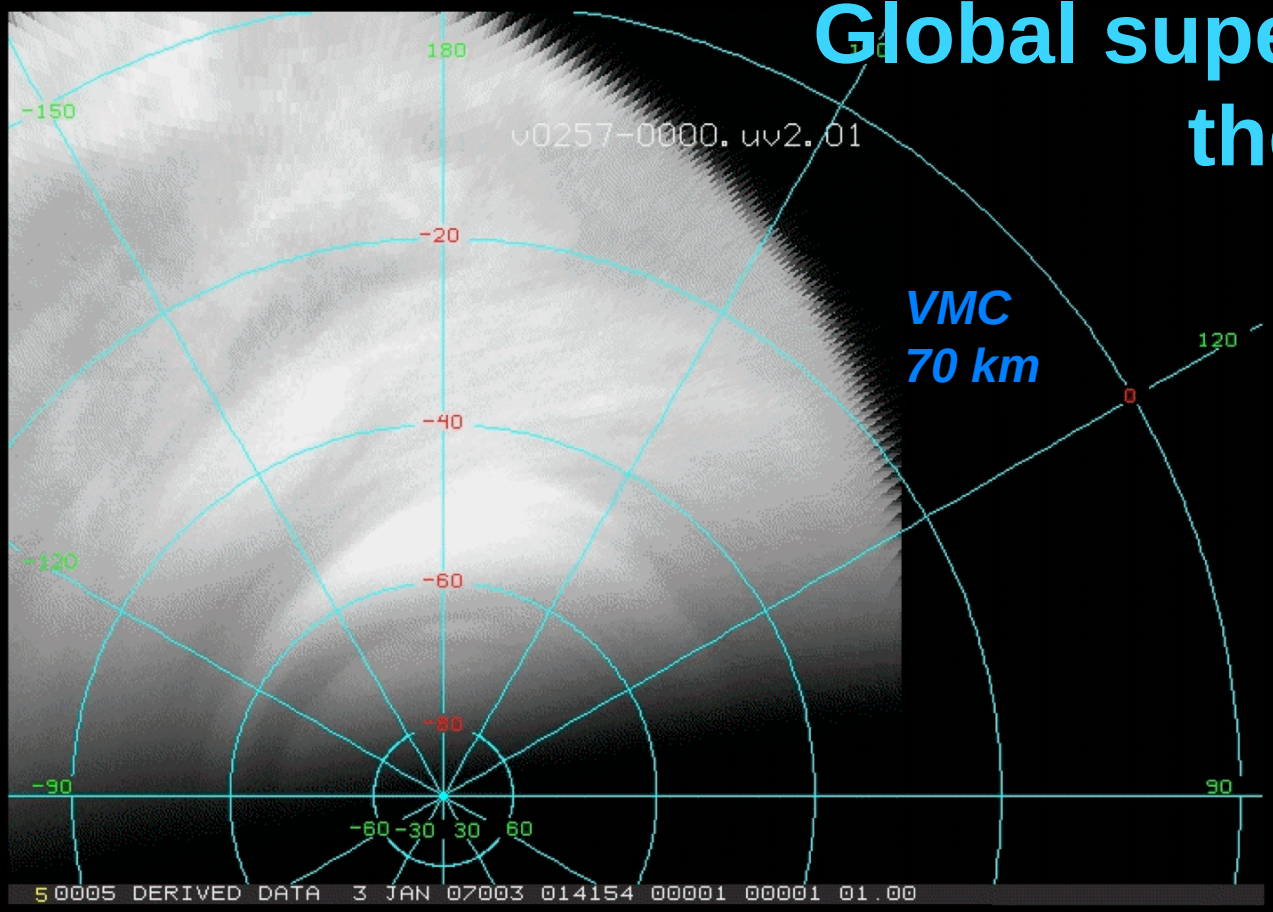
Eye of the polar vortex



VIRTIS @ 5 μm

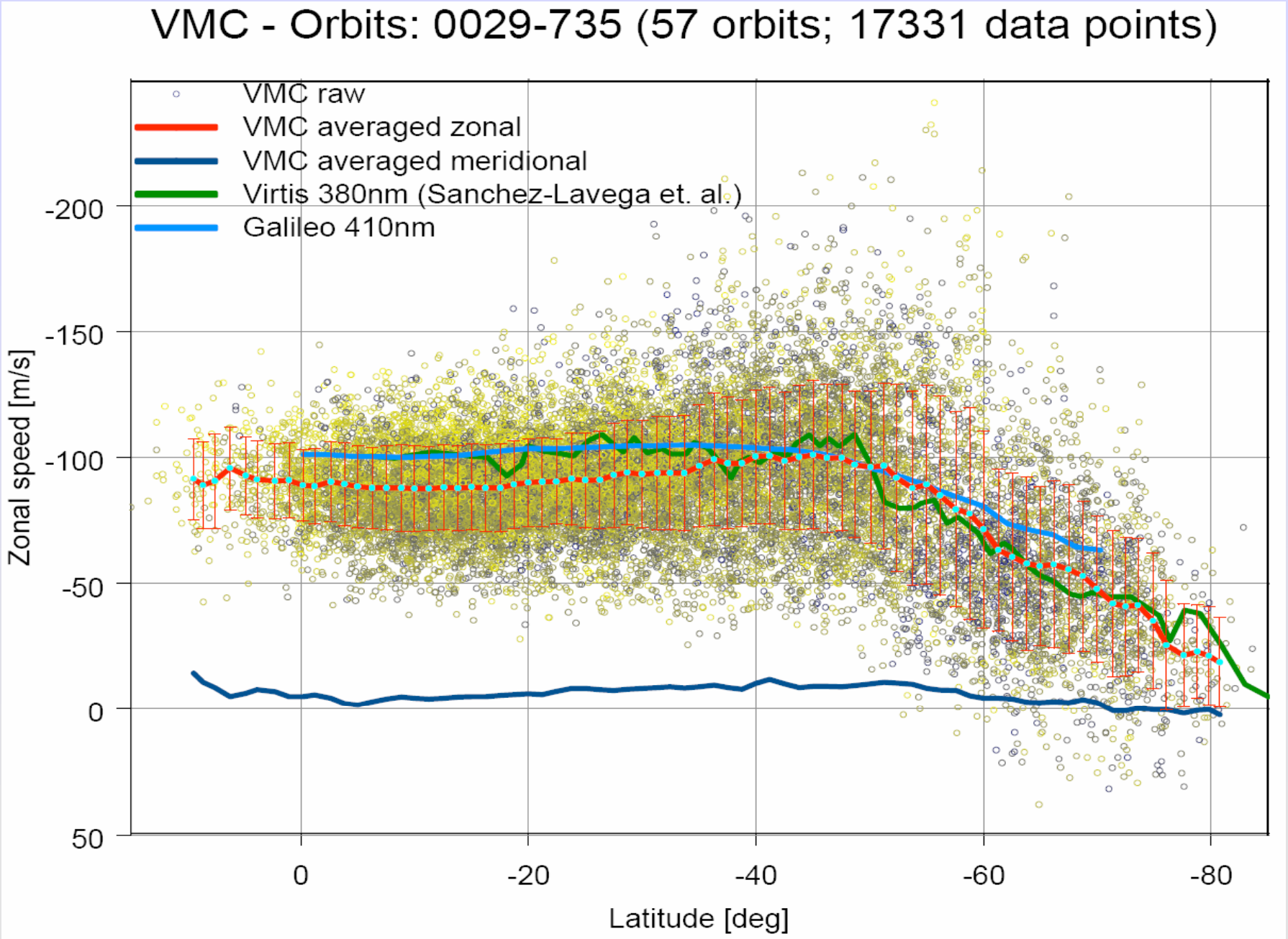
Atmospheric dynamics

Global super-rotation at the cloud level

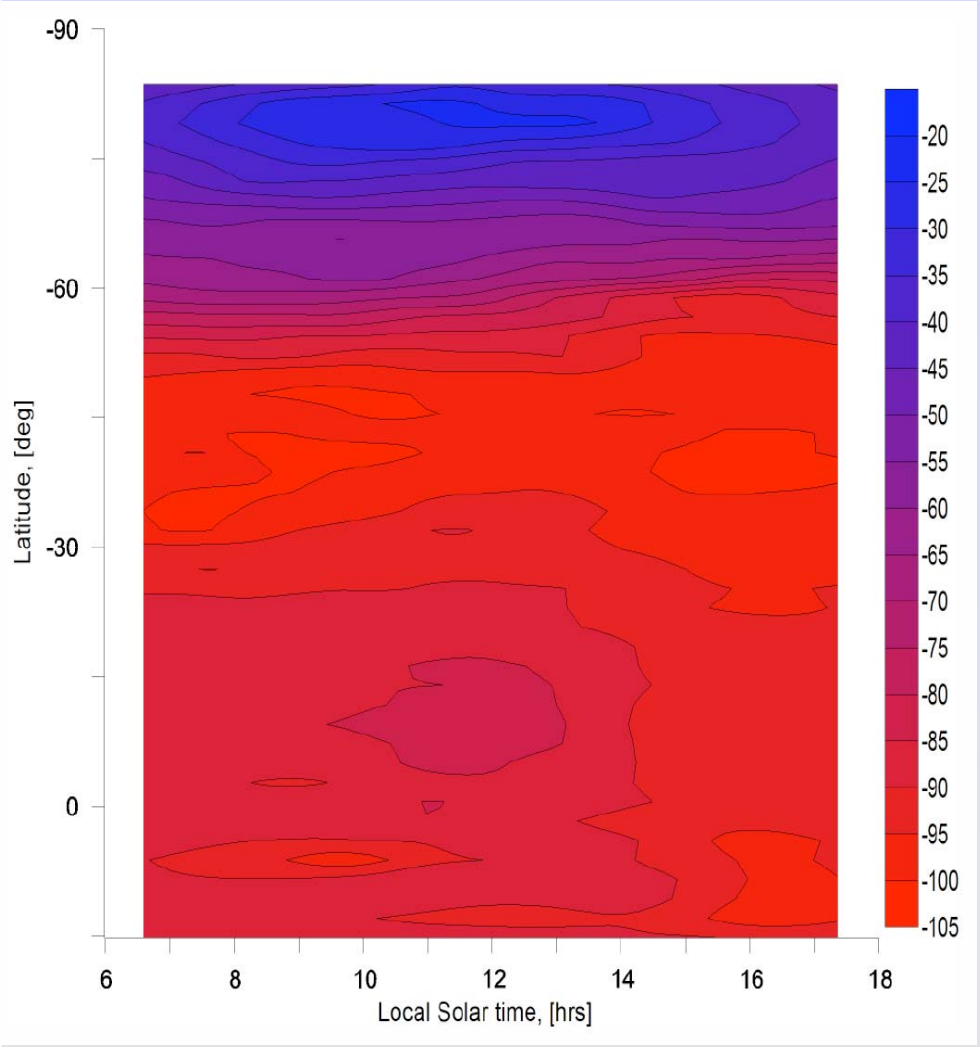


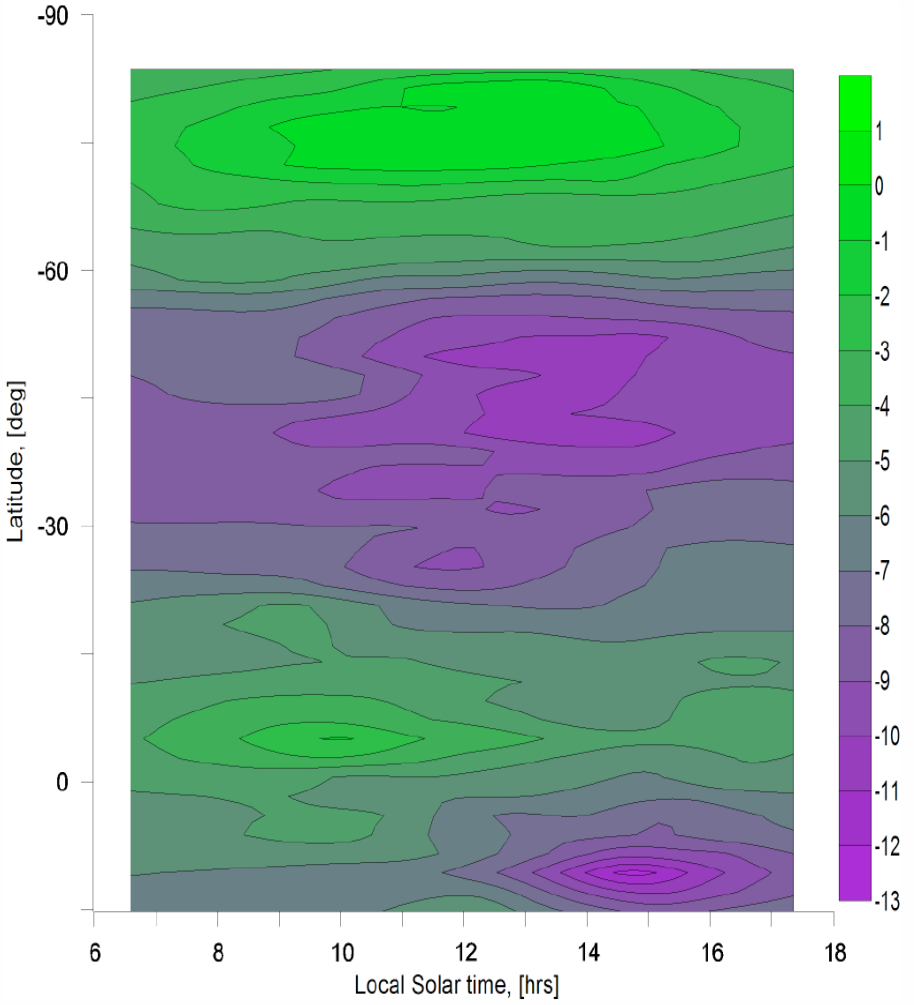
VMC
70 km

Winds from cloud features tracking

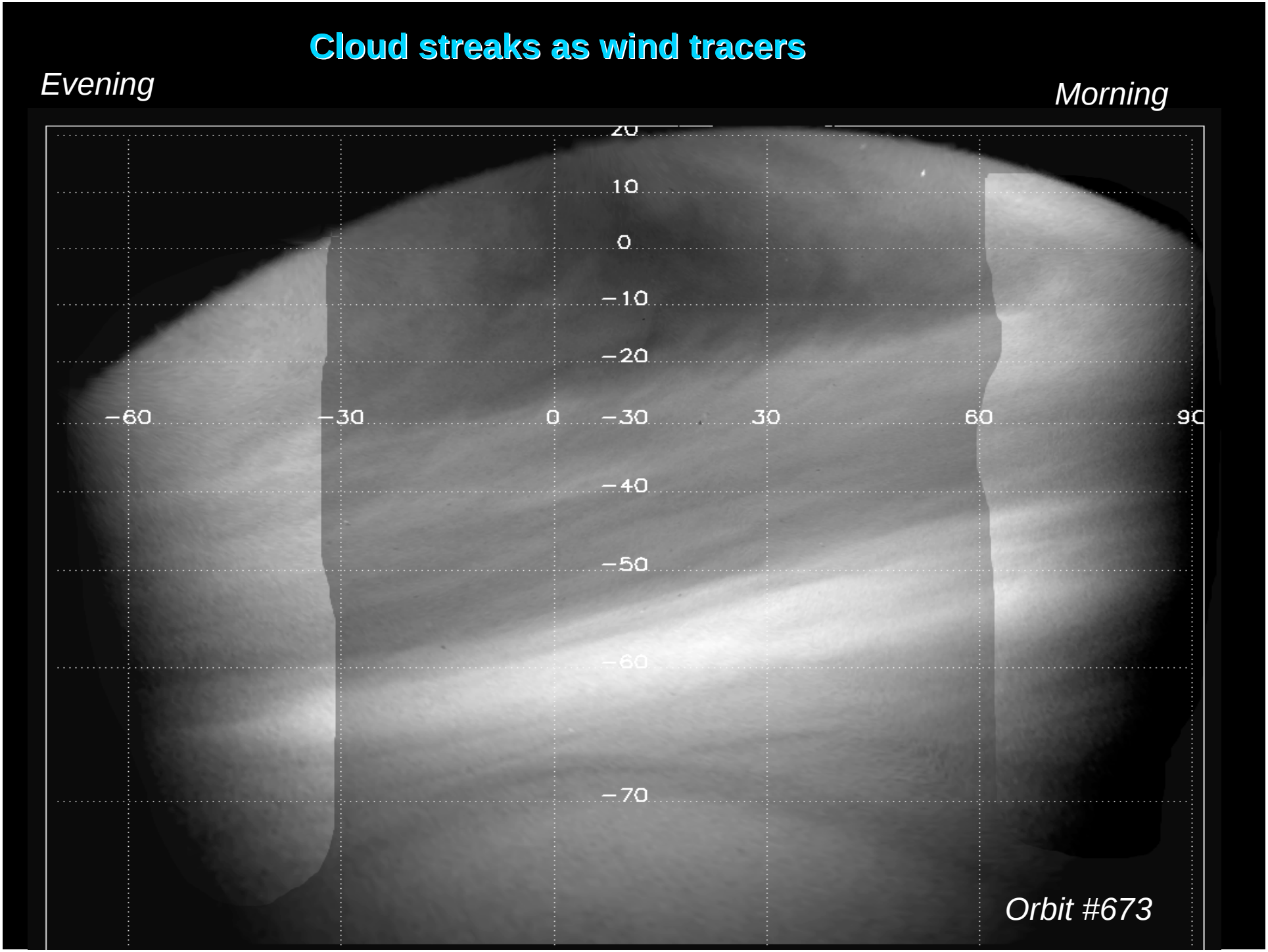


Mean wind fields





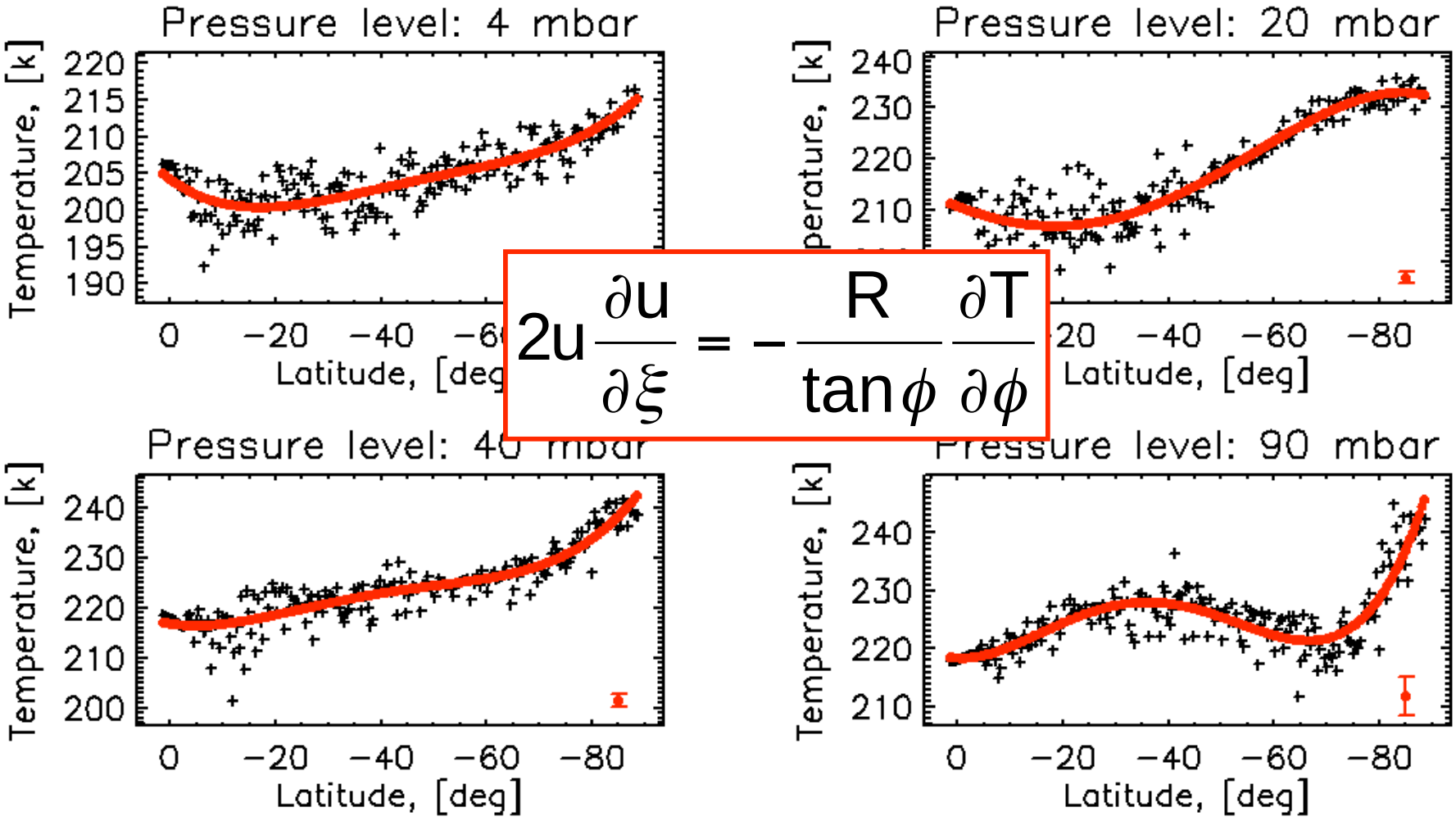
Cloud streaks as wind tracers



Temperature at isobaric levels

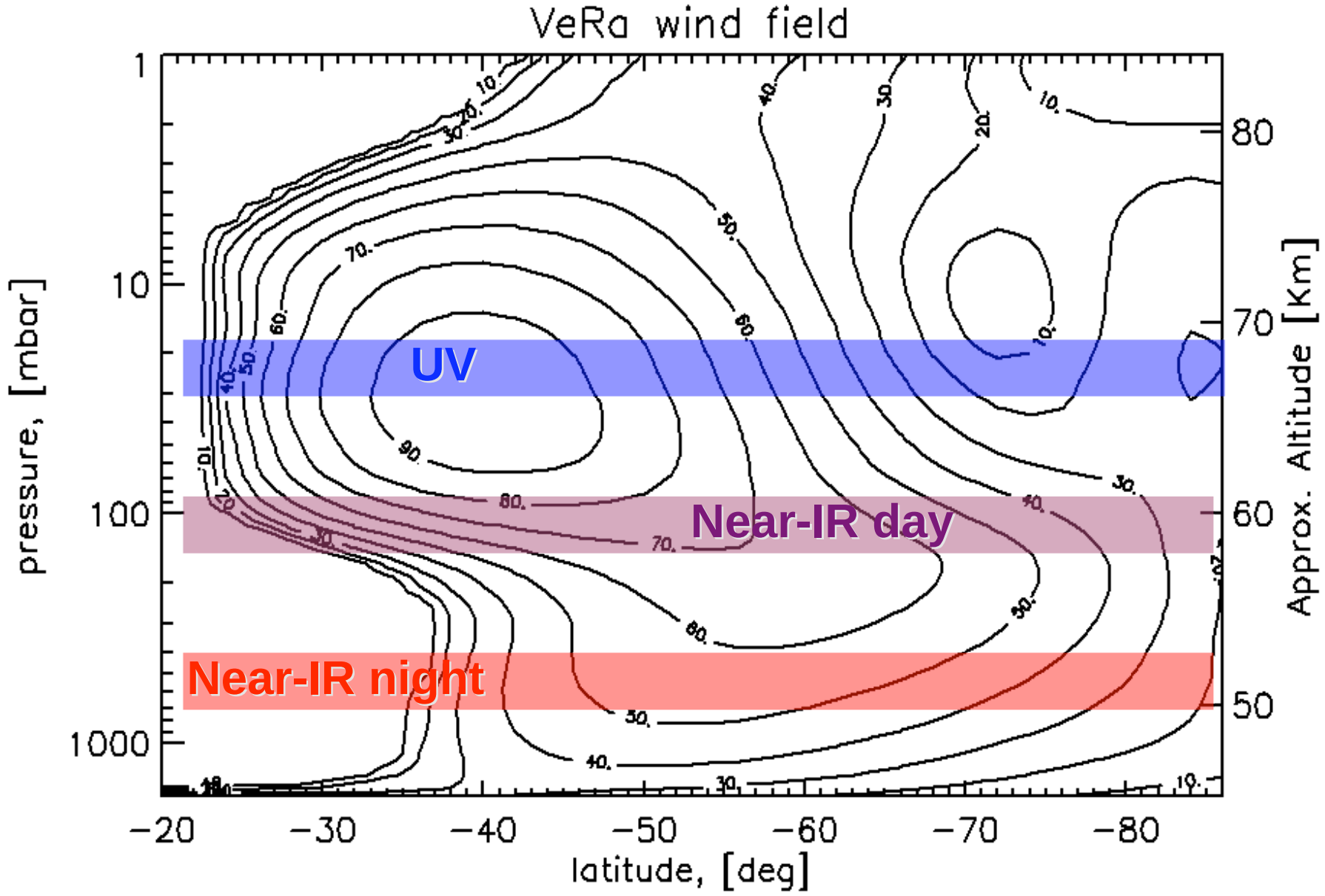
VIRTIS Data points

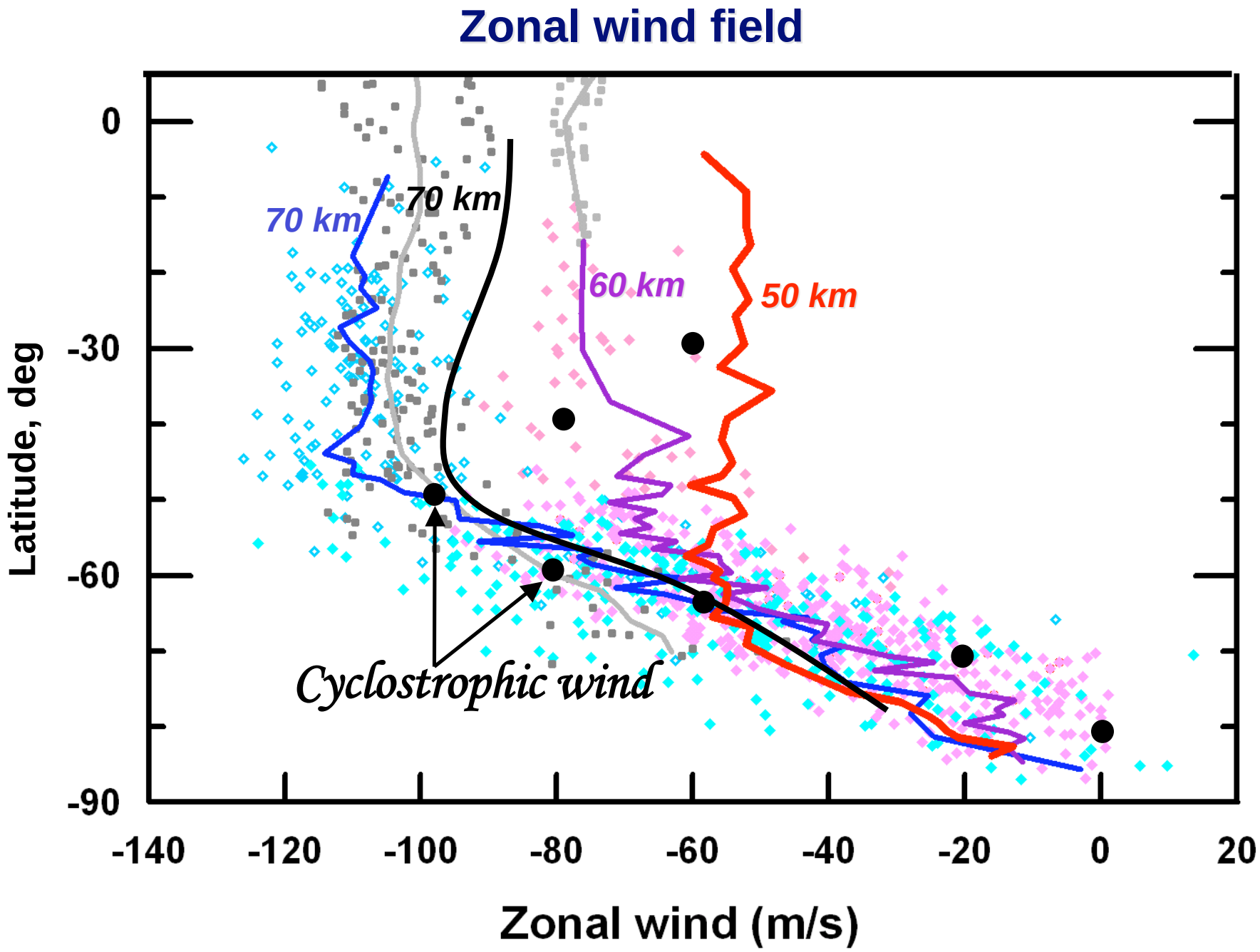
Chebyshev polynomials



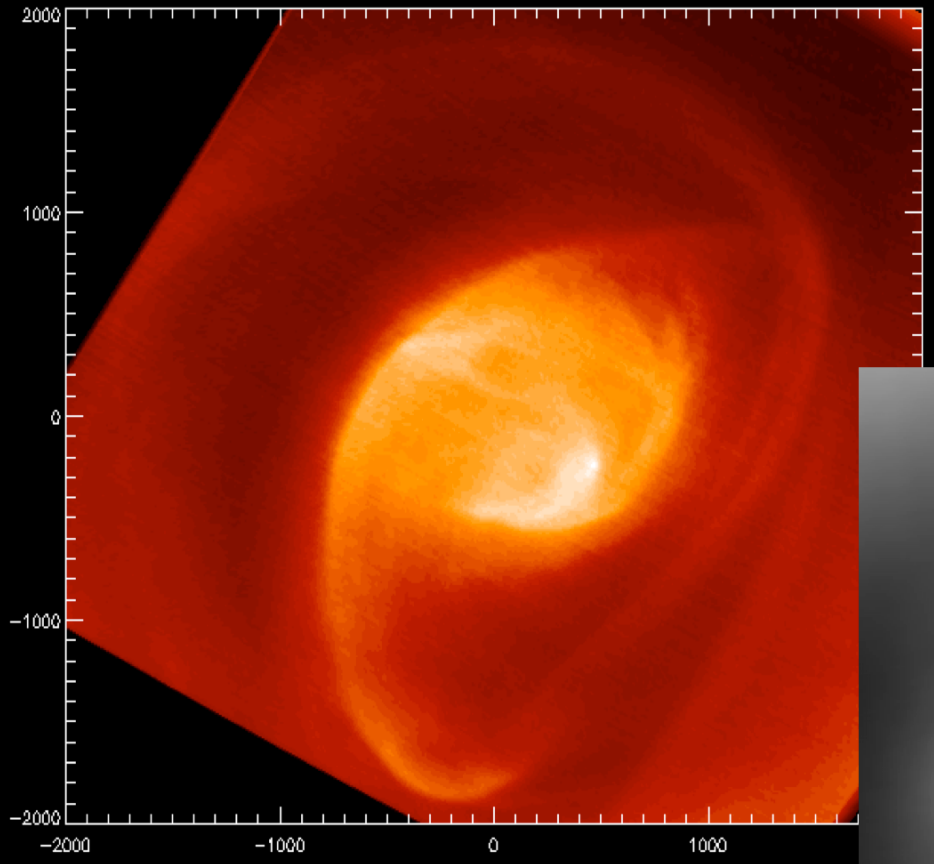
$$2u\frac{\partial u}{\partial \xi} = -\frac{R}{\tan\phi}\frac{\partial T}{\partial \phi}$$

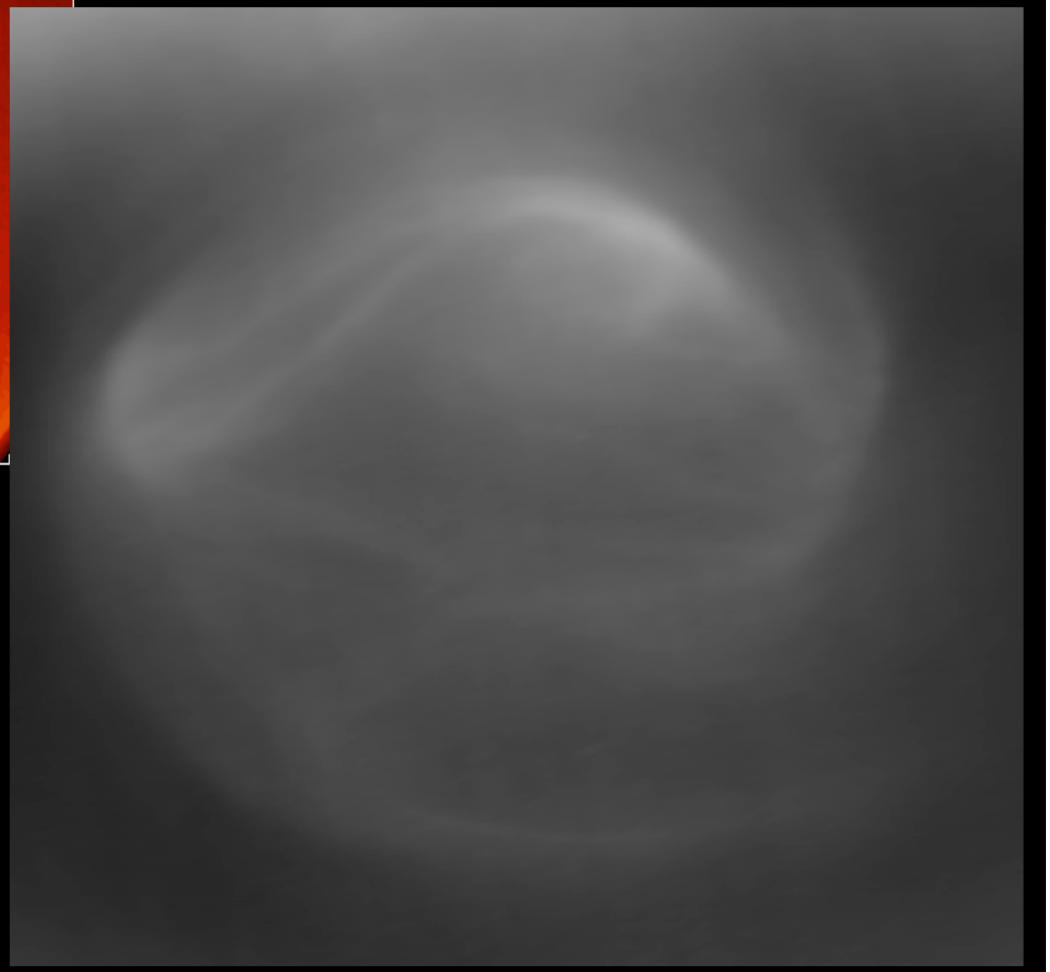
Cyclostrophic wind vs observations




Zonal wind field
0
-30
-60
-90
Latitude, deg
-140
-120
-100
-80
-60
-40
-20
0
20
Zonal wind (m/s)
70 km
70 km
60 km
50 km
Cyclostrophic wind

Dance of the Vortex eye





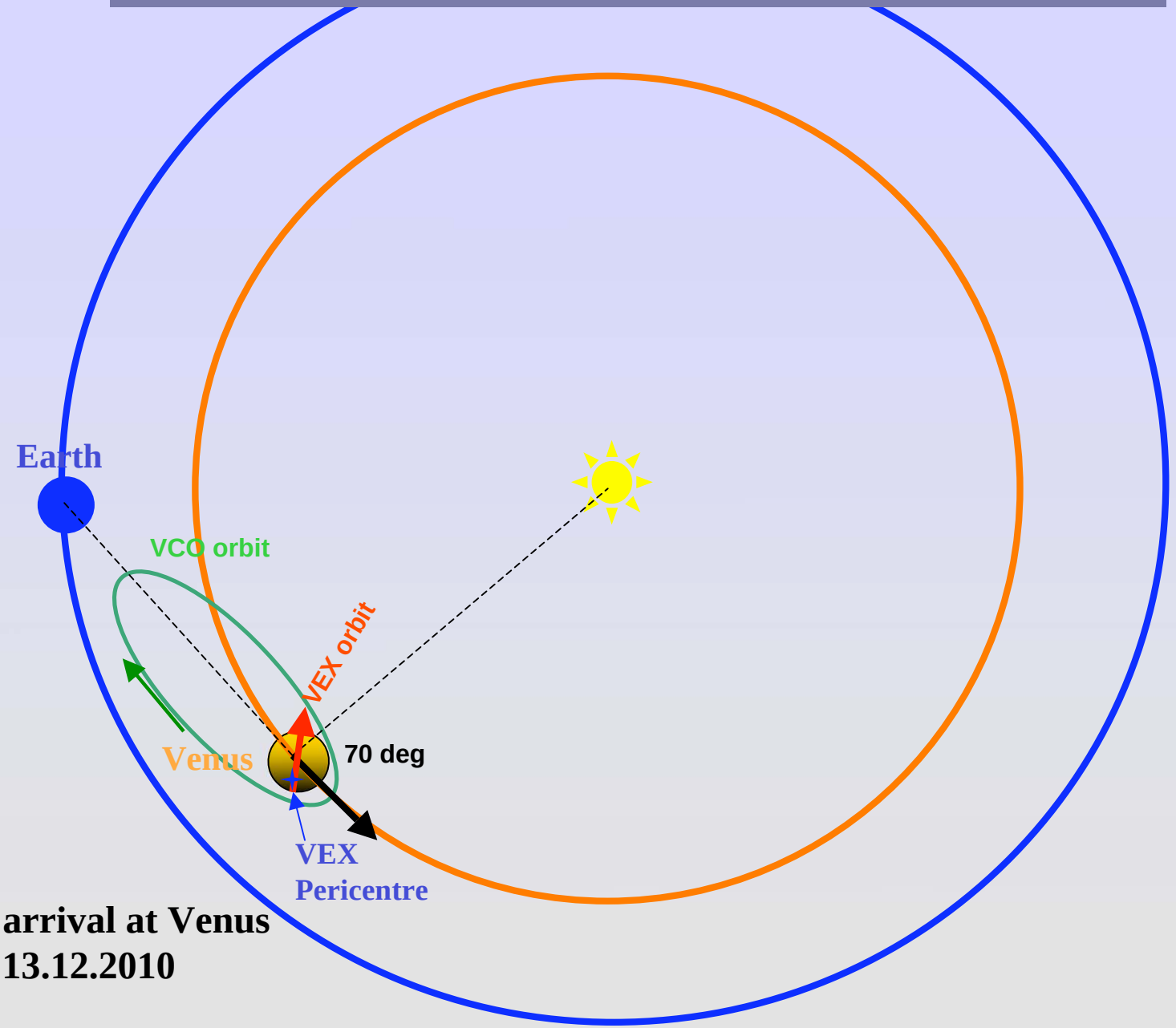
Publication harvest

- Special issue of ESA-SP (~15 papers, 2007)
- Special section of Planetary & Space Science

(35 papers, 2007)

- Special issue of PSS Letters (~15 papers, 2007)
- Special section of Nature (9 papers, 2007)
- Special section of PSS on ground-based observations
- Several papers in Icarus, GRL, A&A
- Special section of Journal Geophysical Research (~50 papers, 2008)

Joint VEX &VCO observations at Venus



VCO arrival at Venus
13.12.2010