

Study of the images of Venus Express/VMC, comparing with the ground infrared observations

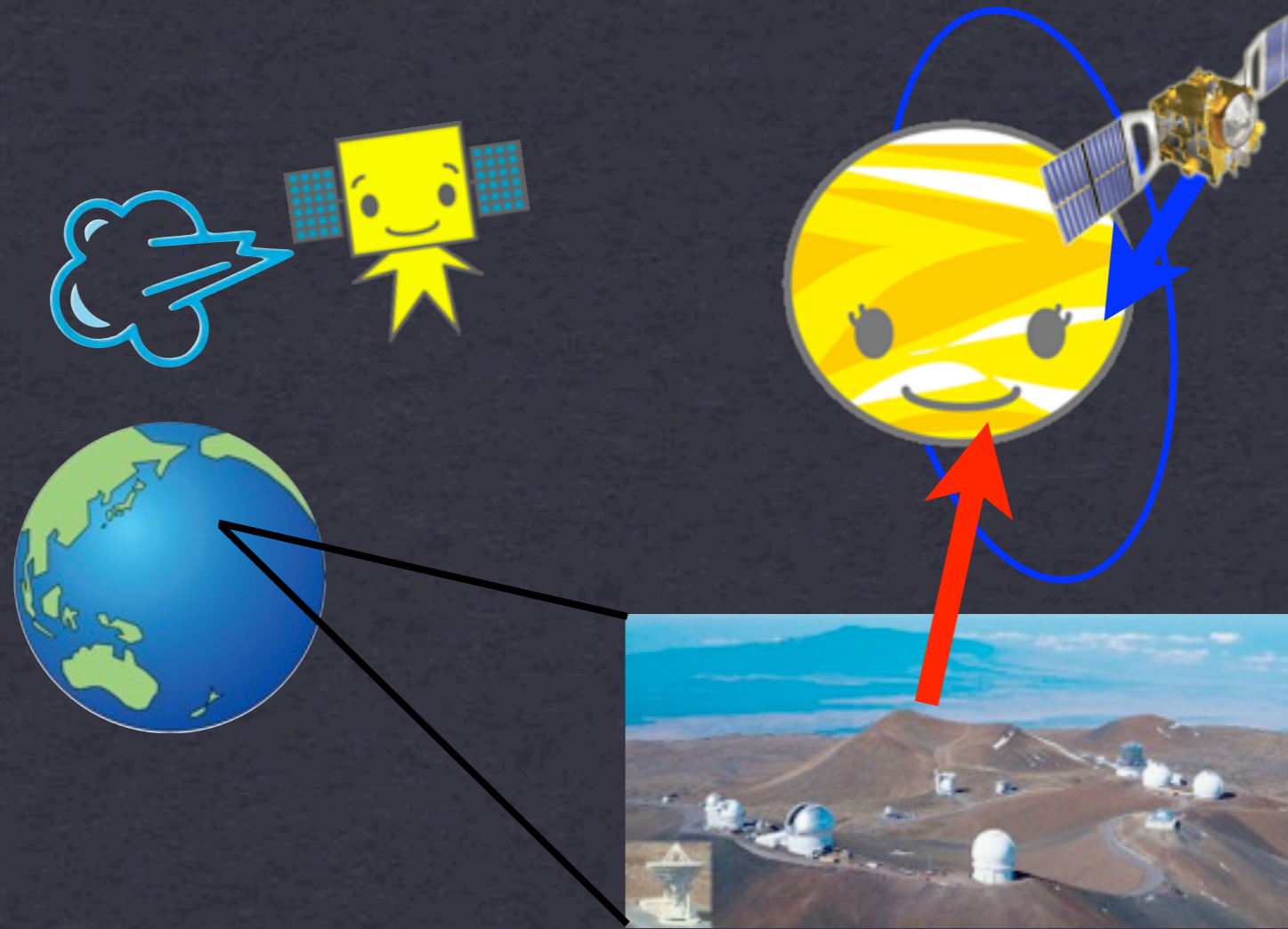
Hosouchi (Univ. of Tokyo) et al.

Abstract

To figure out meteorological phenomenon in the Venus, we are searching wave phenomenon in the Venus. Especially, we want to know vertical changes of waves.

At first, We performed infrared spectroscopic measurements of the Venus' dayside to find out atmospheric wave structures at 60 km in the cloud layer by quantifying CO₂ absorption. The apparent rotation periods of wave-like signature was derived and it may be interpreted as superposition of the mean zonal flow and waves such as the Kelvin and the Rossby.

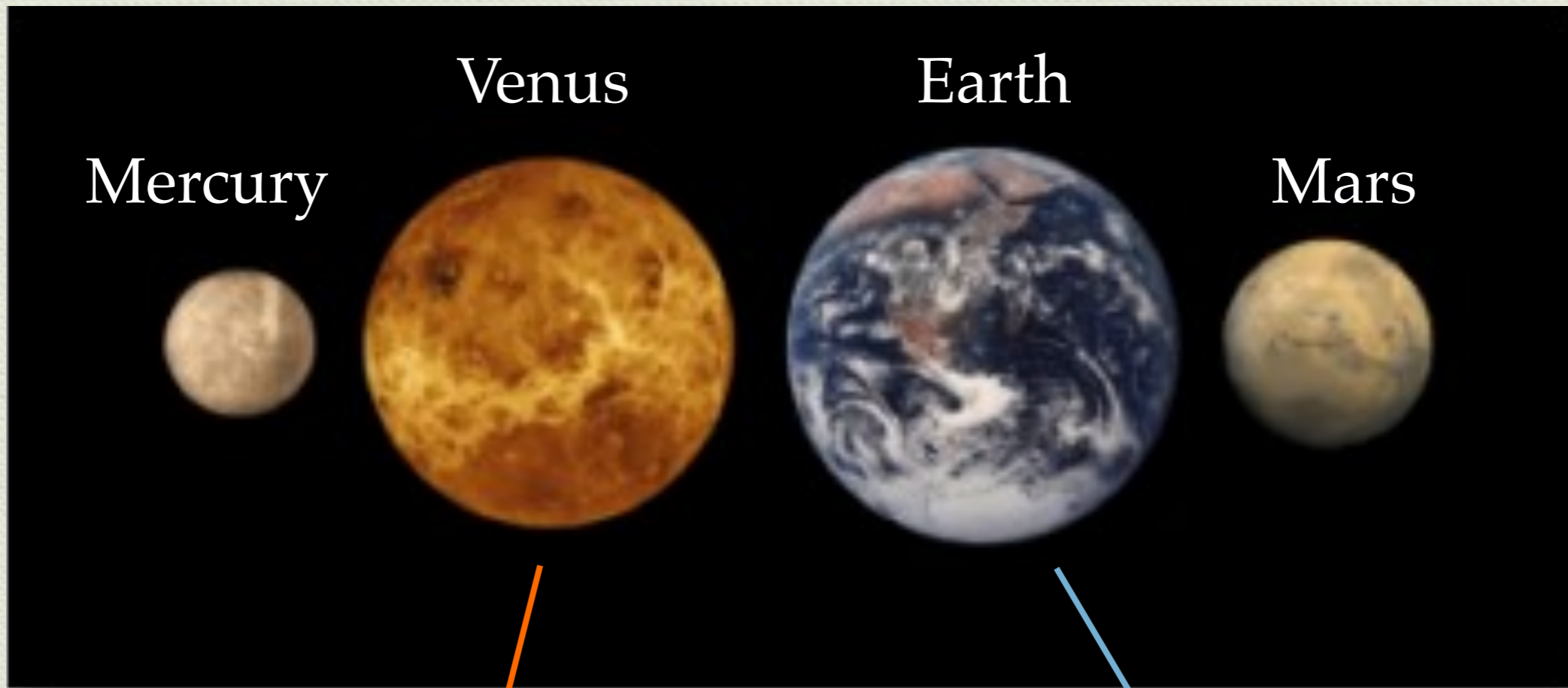
Secondly, we are trying to derive waves with VMC images at the same dates as ground observation. In April 2014, we have the simultaneous observation plan of IRTF and Venus Express.



Study of the images of Venus Express/VMC, comparing with the ground infrared observations

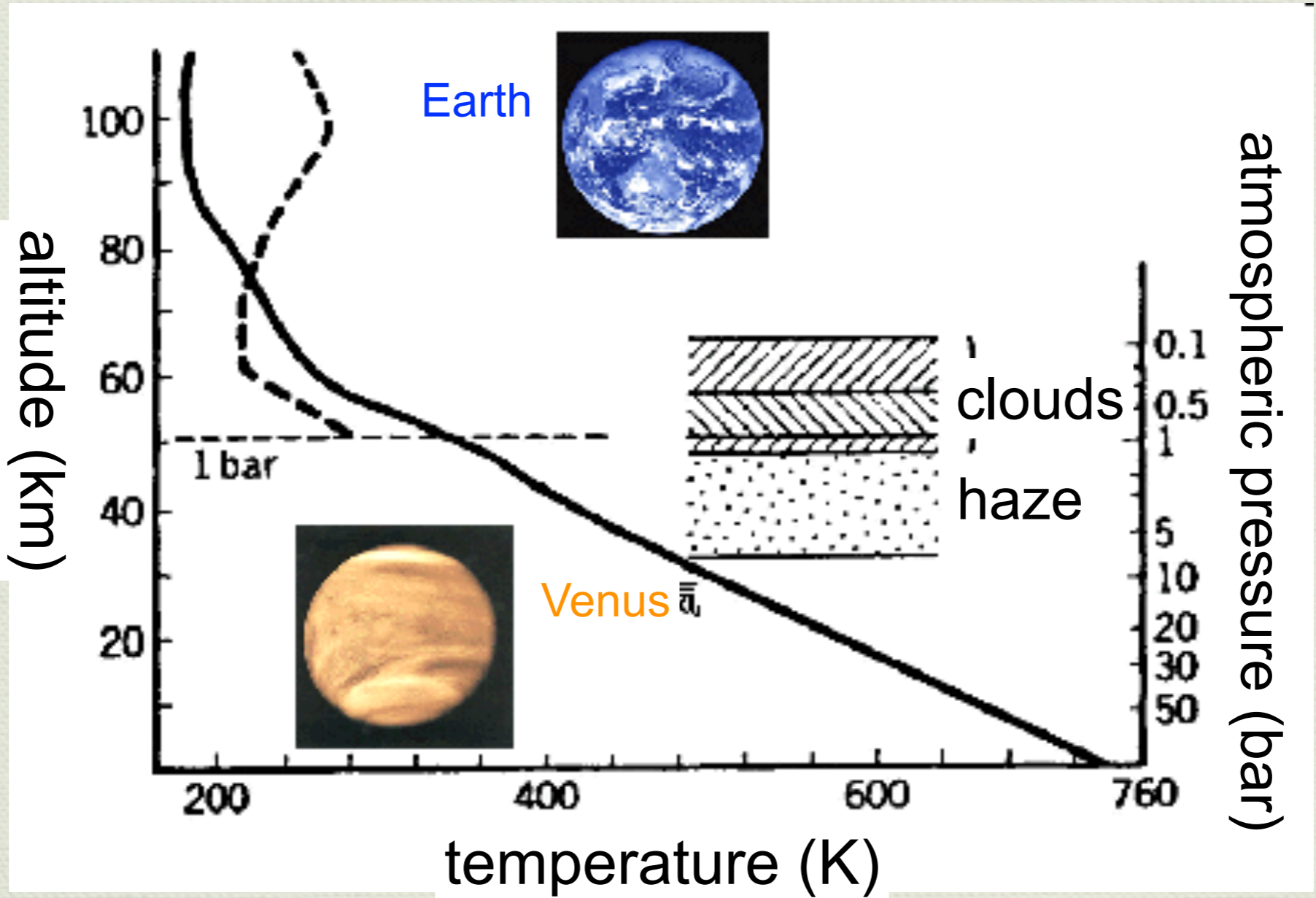
細内 麻悠^[1]; 神山 徹^[2]; 岩上 直幹^[1]; 大月 祥子^[3]; 高木 征弘^[4]

[1] 東大・理・地惑; [2] 産総研; [3] 専修大; [4] 京産大・理

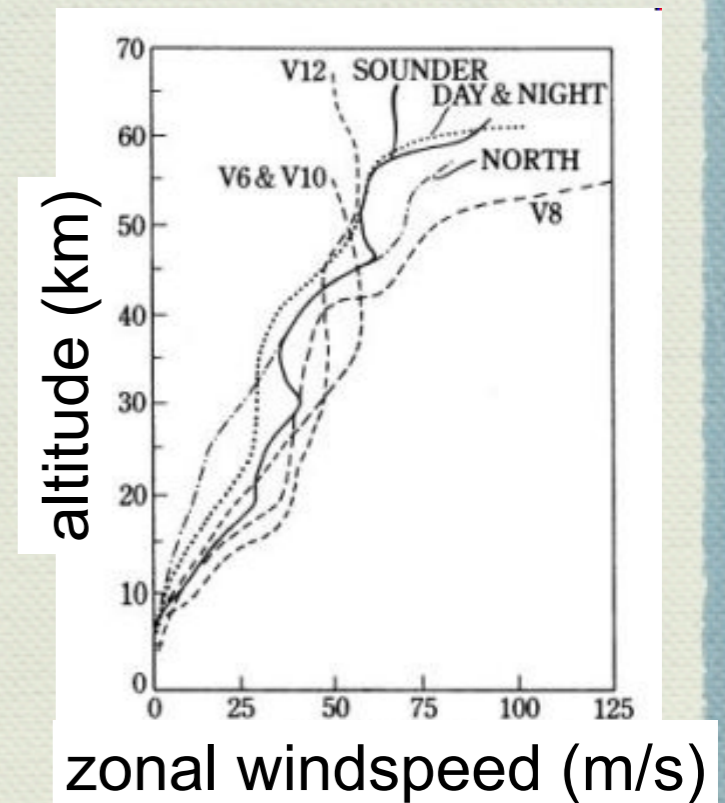
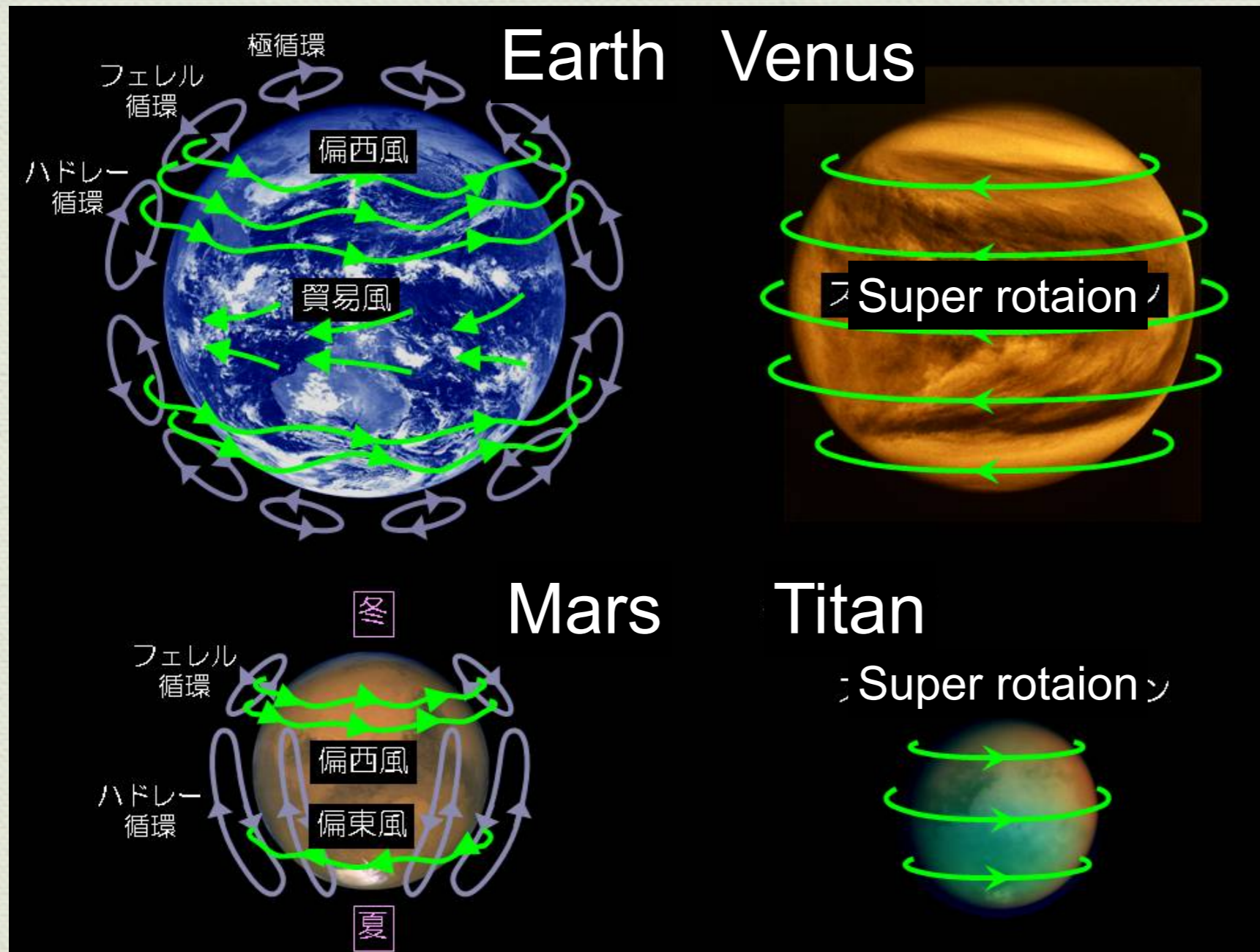


Equatorial radius 6052(km)
Density 5.24(g/cm³)

Equatorial radius 6378(km)
Density 5.52(g/cm³)



Atmospheric circulations in planets

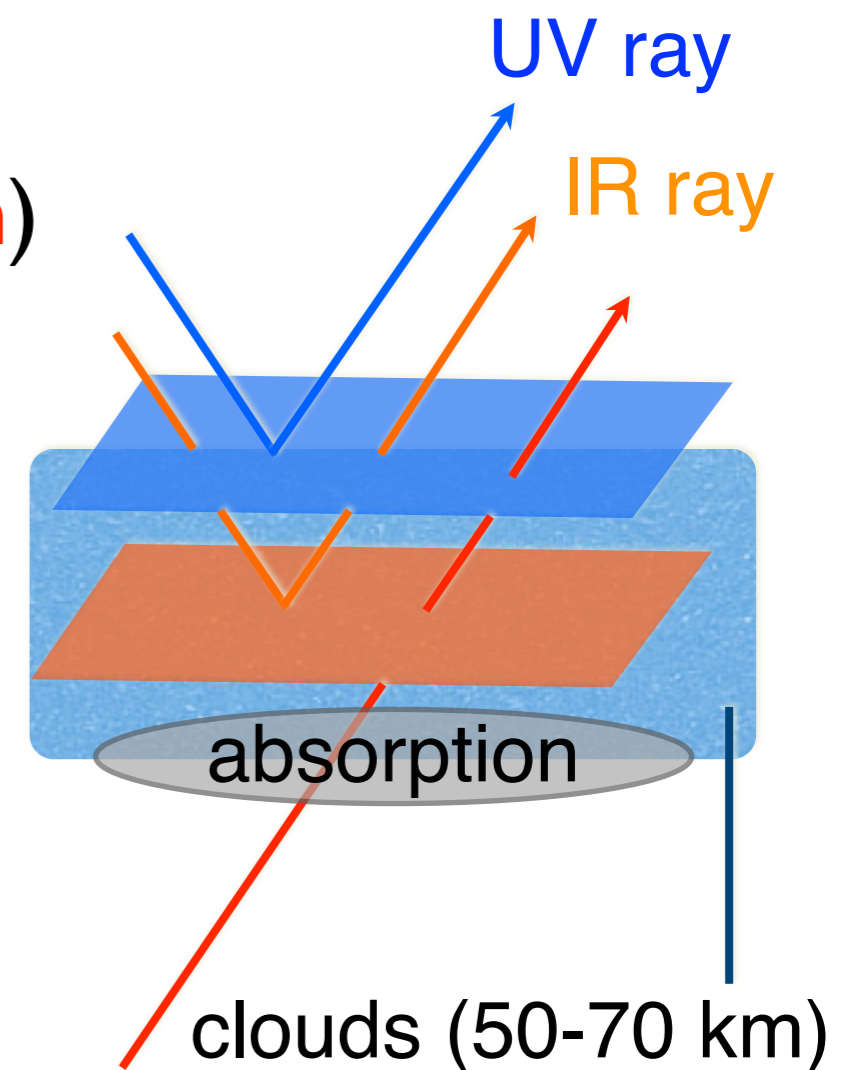


Windspeed
 in the Venus
 [Schubert, 1983]

- ✱ We will figure out meteorological phenomenon in the Venus (they are different from those in the earth. Ex:super rotation).
- ✱ To do this, we are searching wave phenomenon. Especially, **we want to know vertical changes of waves.**

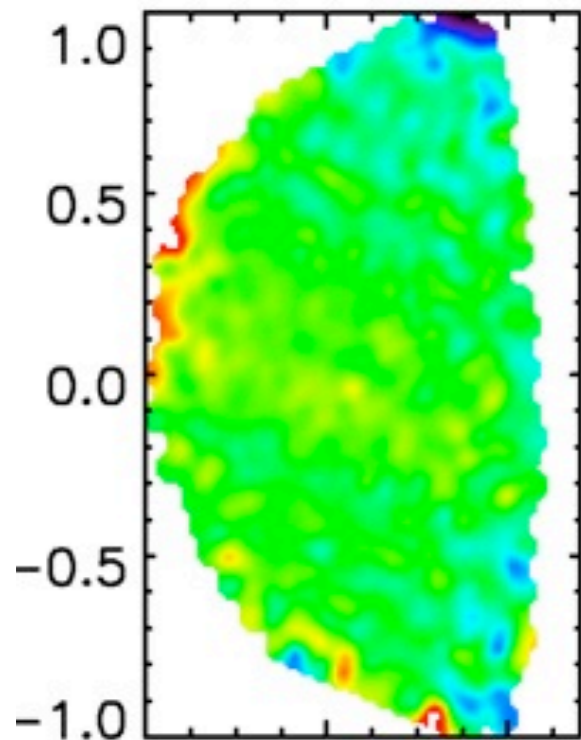
Observation of Venus

- Different altitudes by different wavelengths
 - **UV ray**, reflected at the clouds top (**70 km**)
 - **Thermal emission (IR)**, from the lower atmosphere absorbed at the lower clouds (**50 km**)
 - **CO₂ absorption (58-64 km)**
IR ray reflected after penetrating more into the clouds than UV
... not studied in the past
- We will be able to study 3-D wave phenomena



Variation of cloud altitudes

Nov. 10

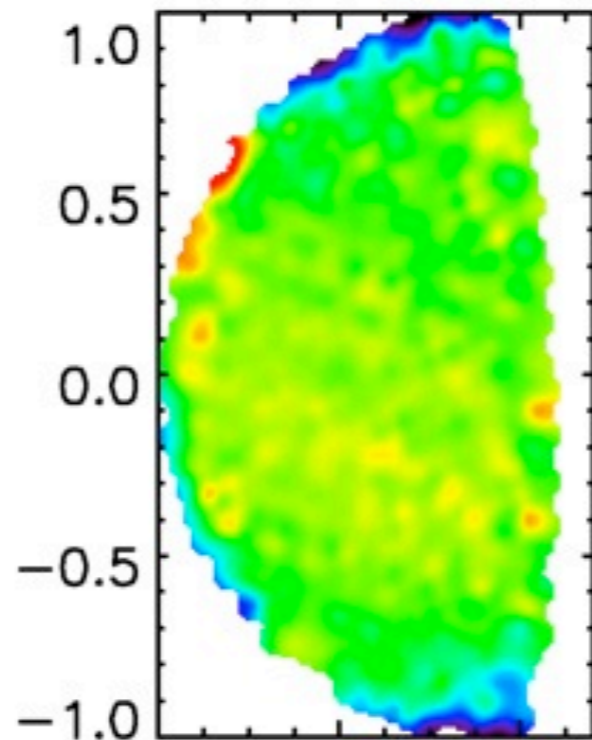


-1.0 -0.5 0.0



-4 8 [km]

Nov. 11

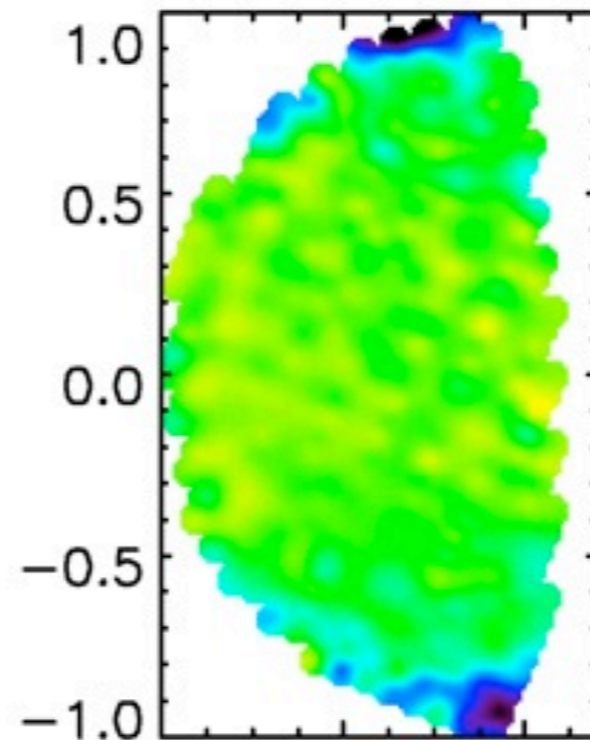


-1.0 -0.5 0.0



-4 8 [km]

Nov. 12

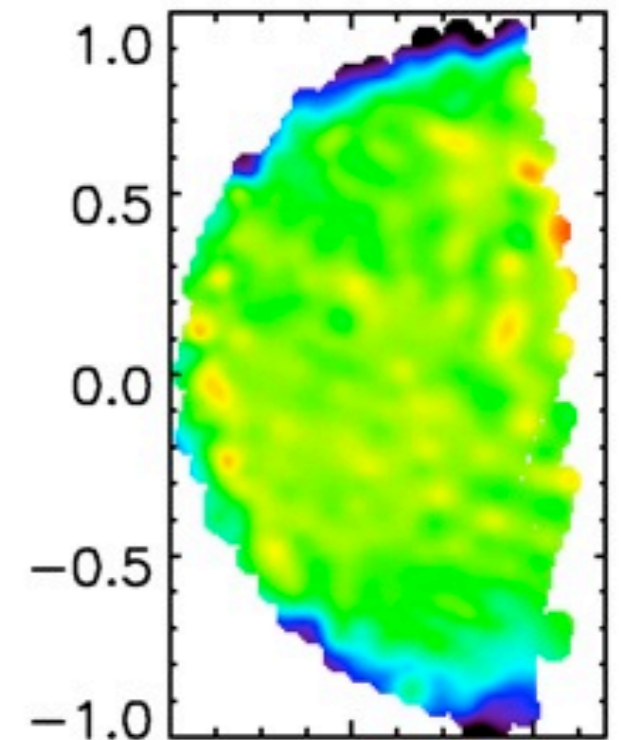


-1.0 -0.5 0.0



-4 8 [km]

Nov. 13

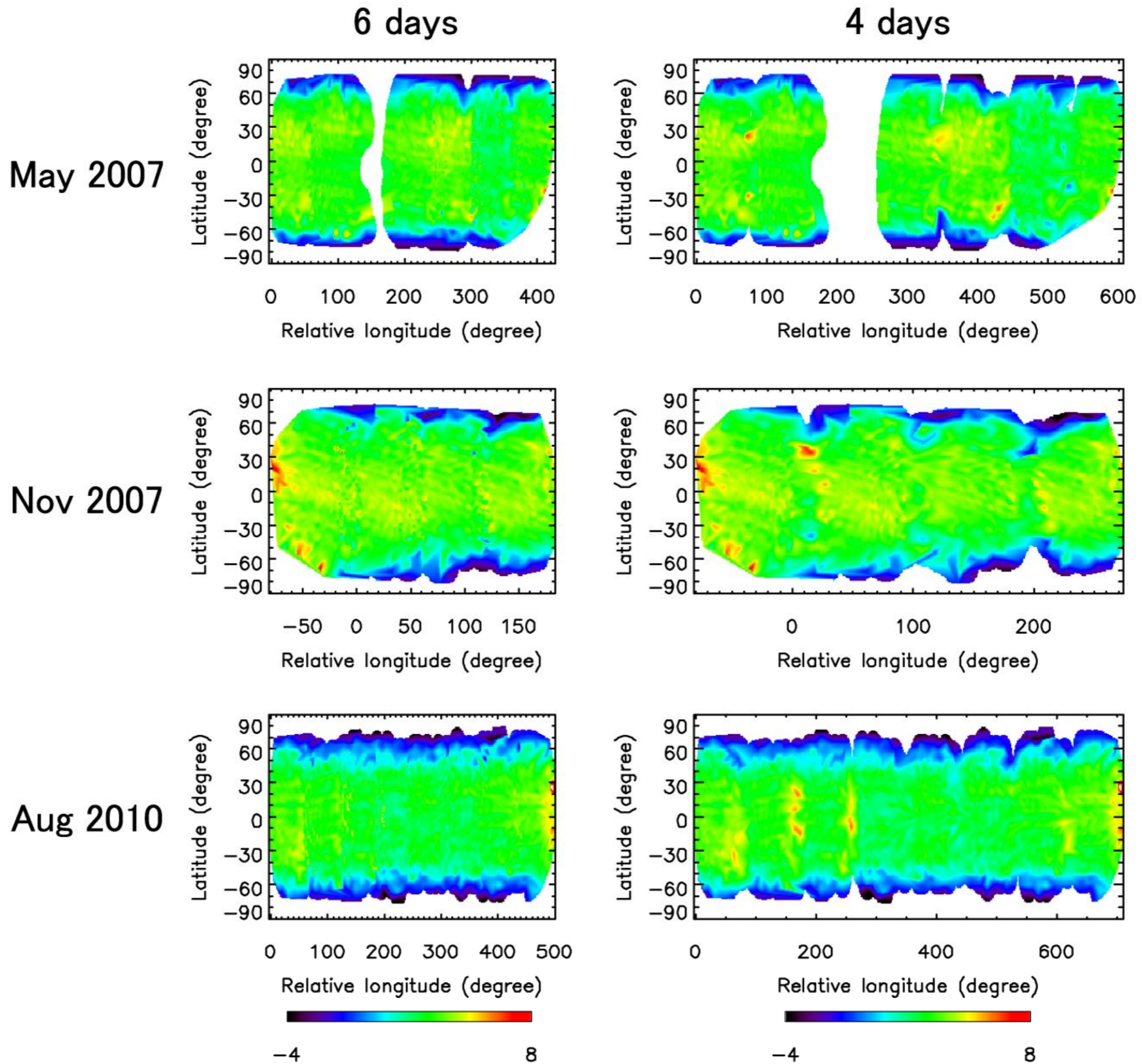


-1.0 -0.5 0.0



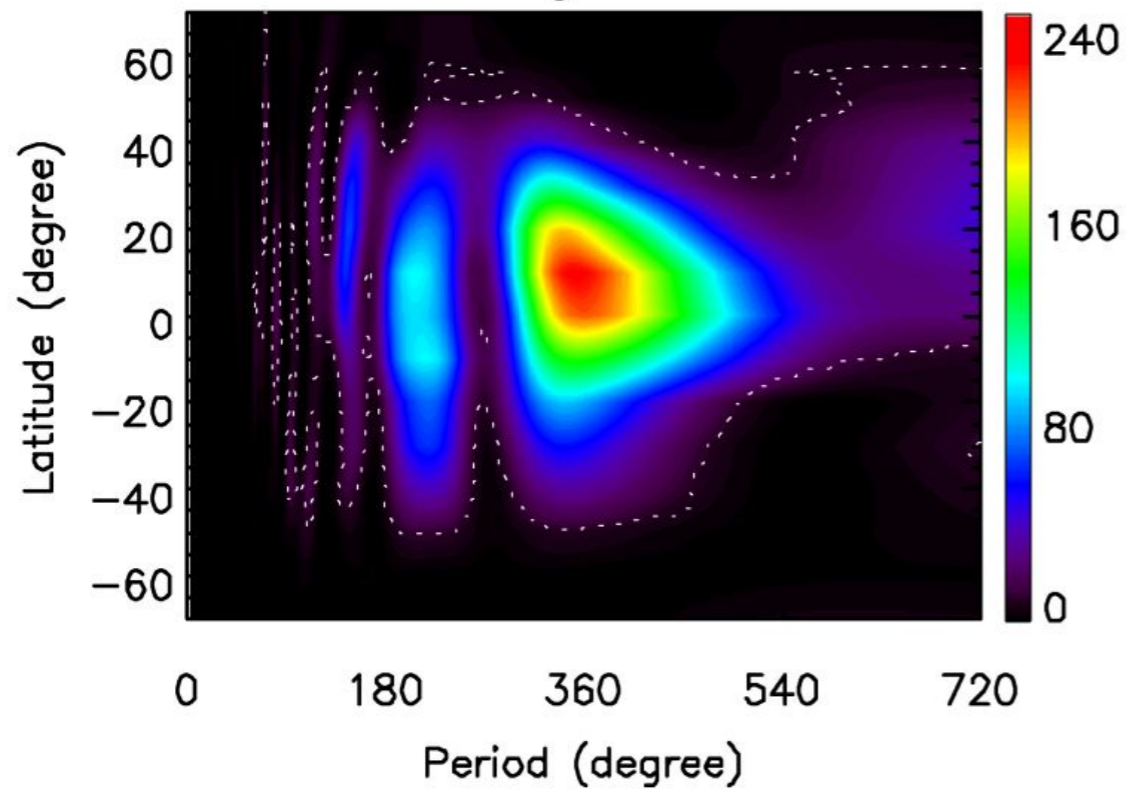
-4 8 [km]

Global map of cloud height distribution

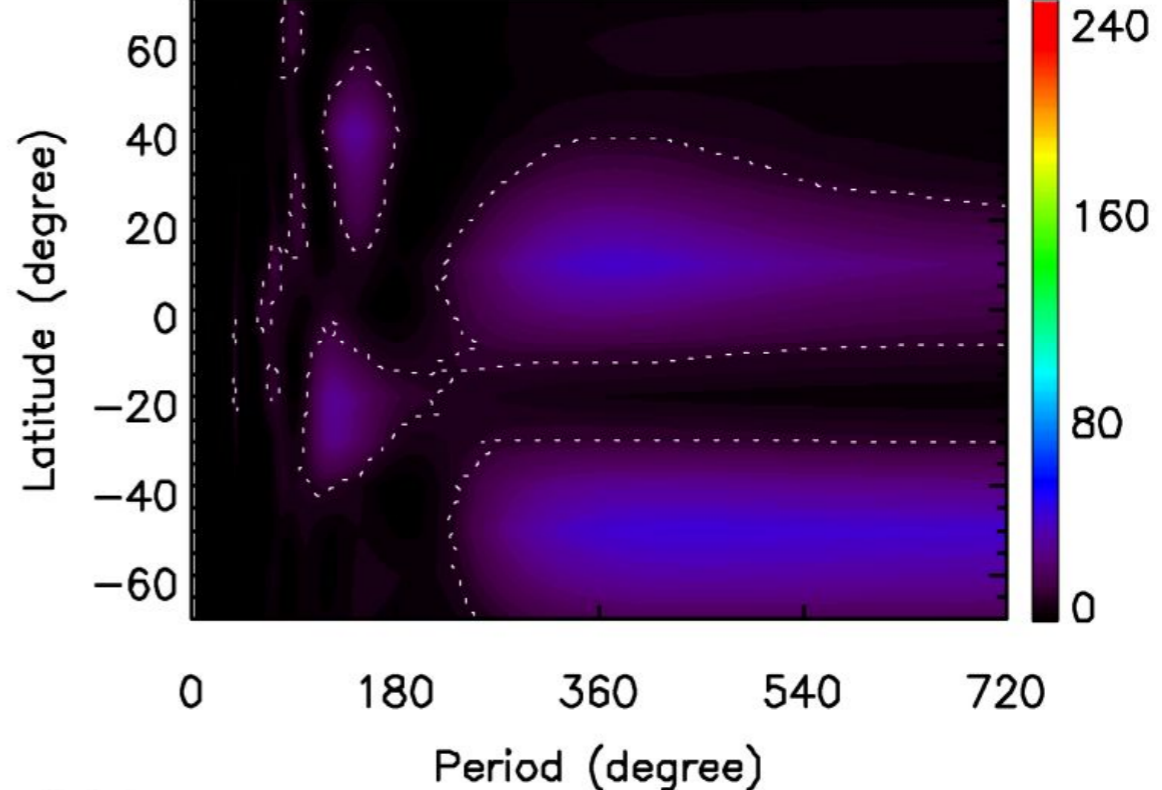


distribution of wave predominant

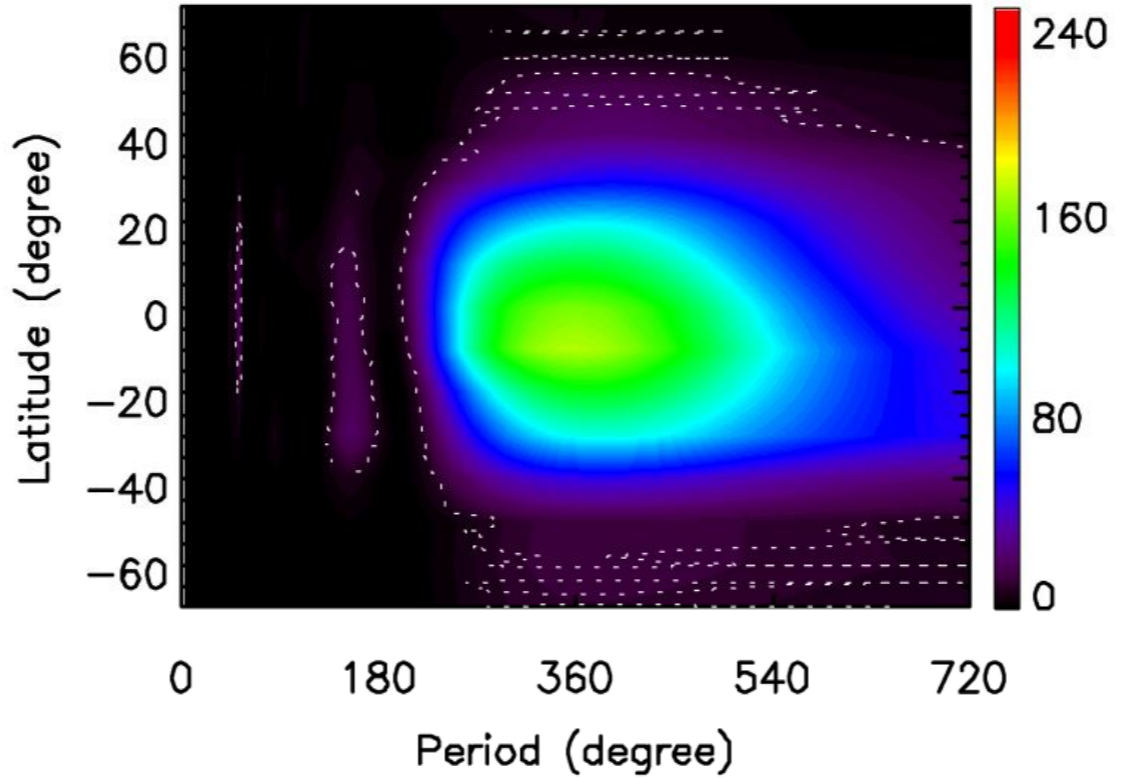
May 2007



Nov 2007



Aug 2010

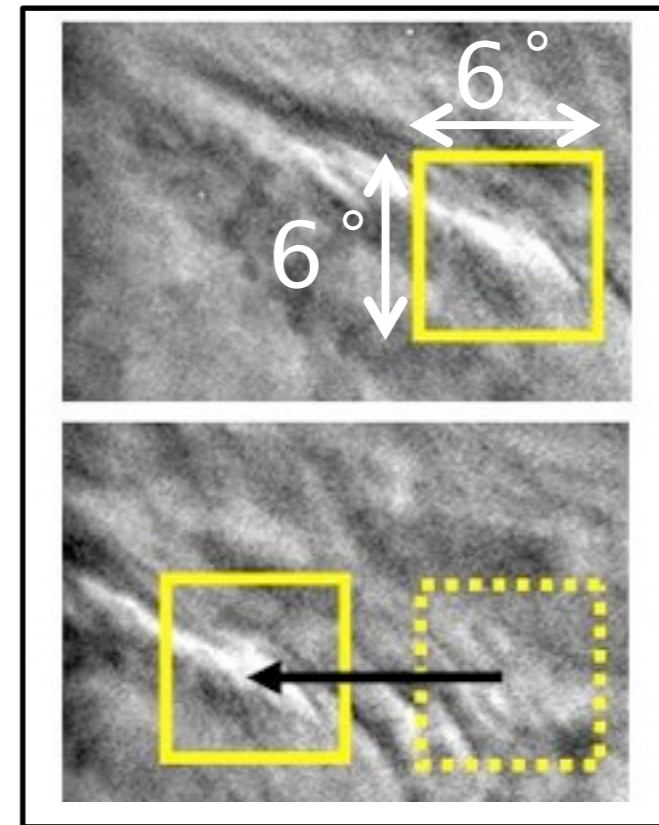
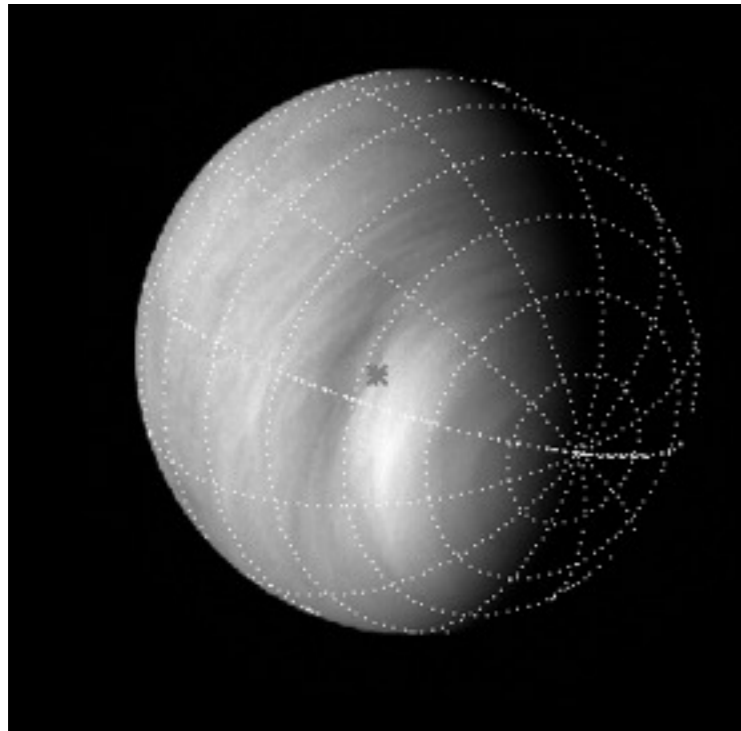


Venus Express / VMC

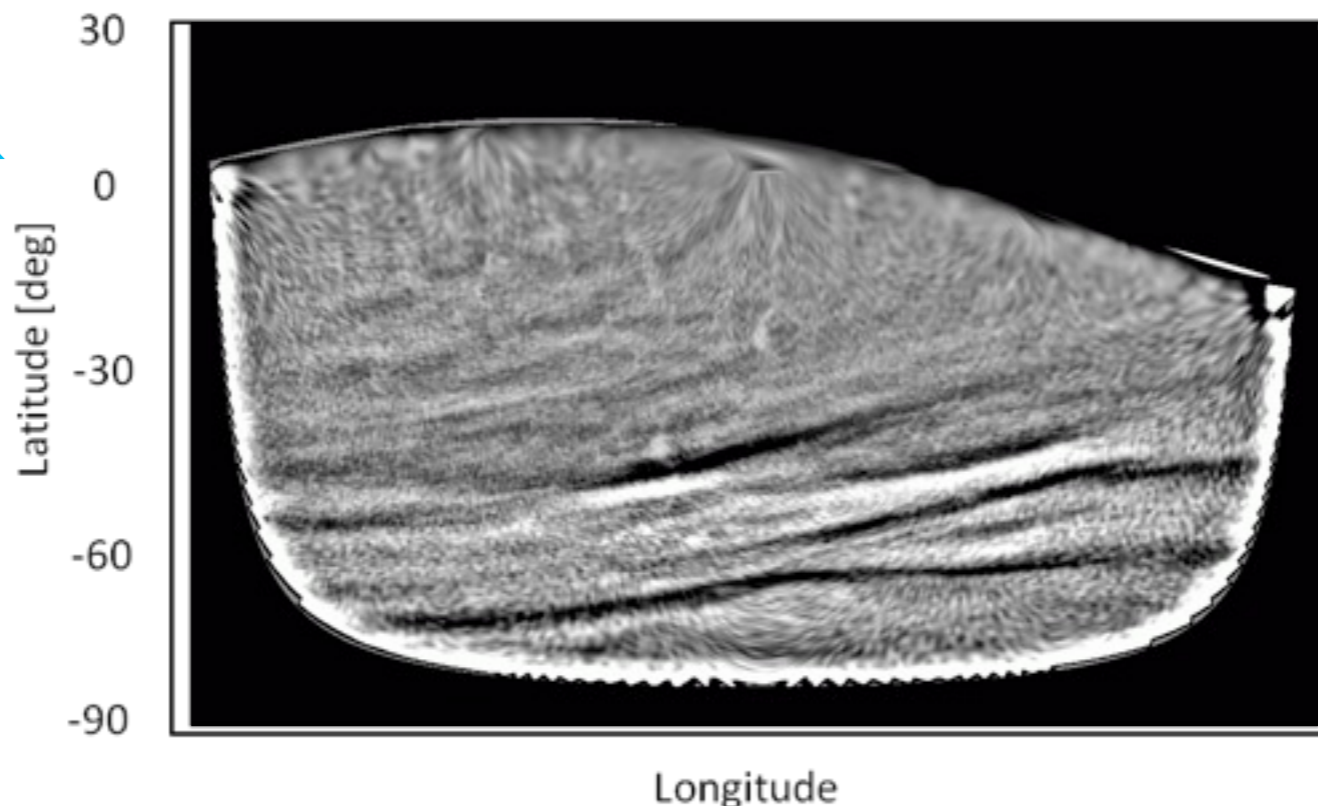
- * ESA's Venus express is exploring the secrets of the Venus atmosphere.
- * LAUNCH : 2005/11/9 03:33(UT)
- * **VMC...VEx's camera,**
which has 4 filters (**UV : 365nm**, Vis : 513nm,
Near-IR1 : 965nm, Near-IR2 : 1010nm)

Cloud tracking method (often used to derive the wind speed)

Venus Express/VMC



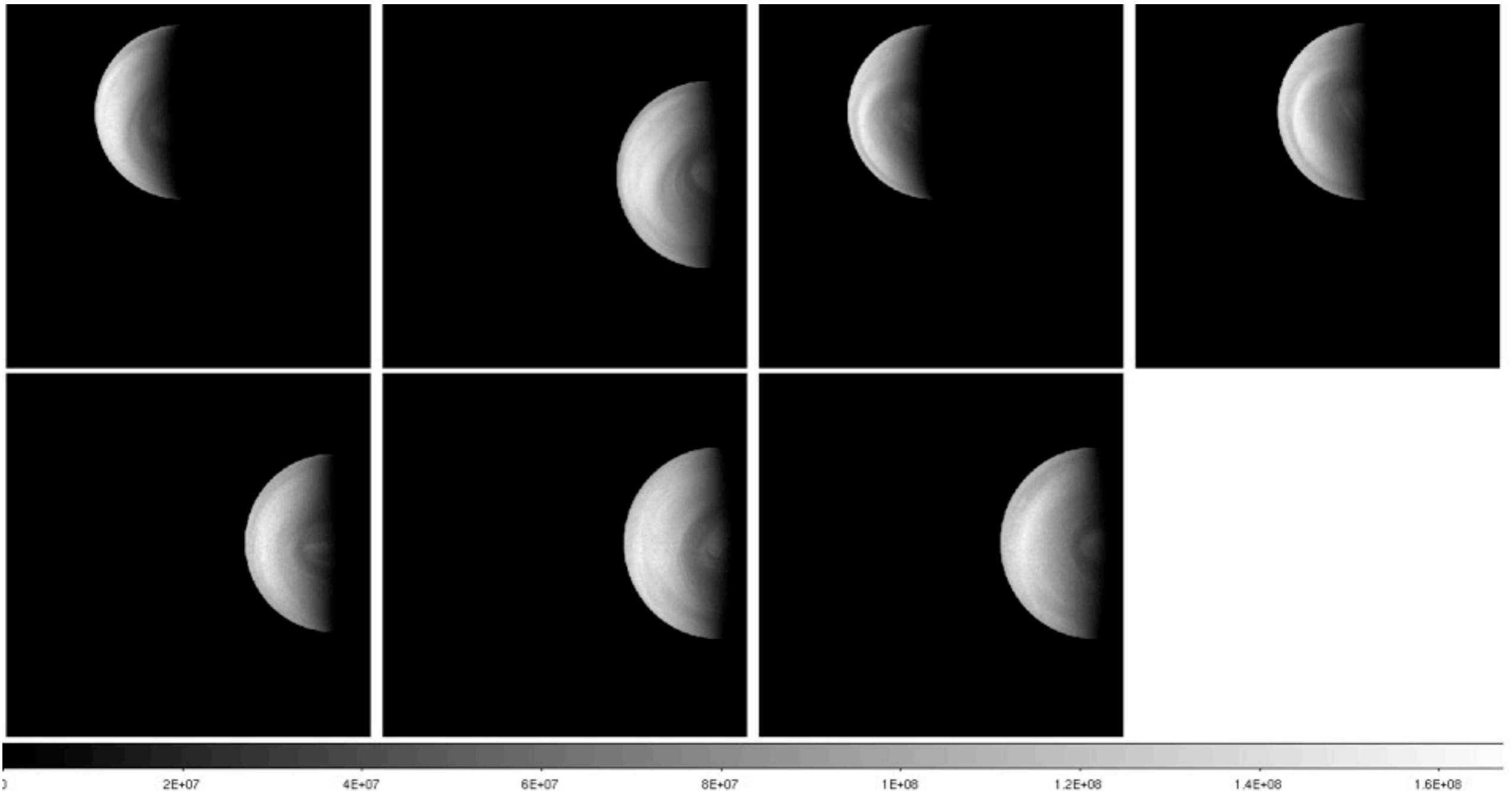
ΔT

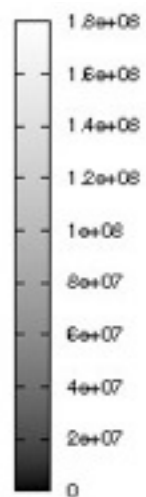
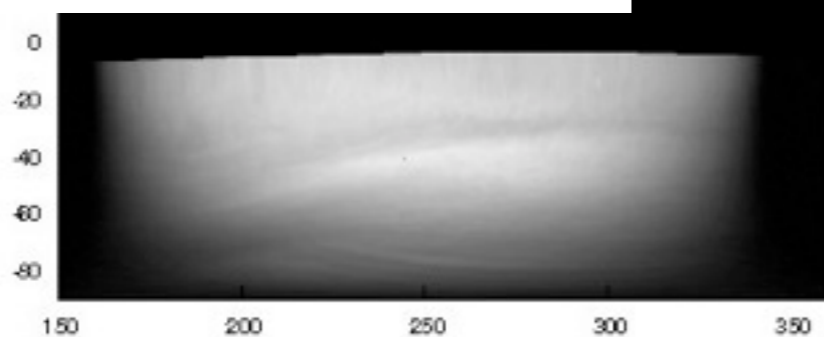
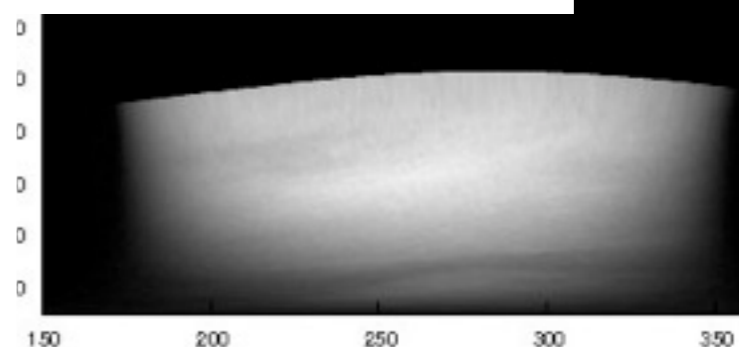
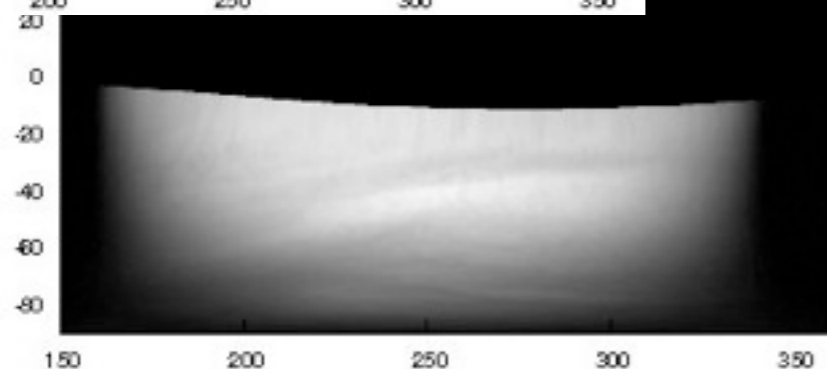
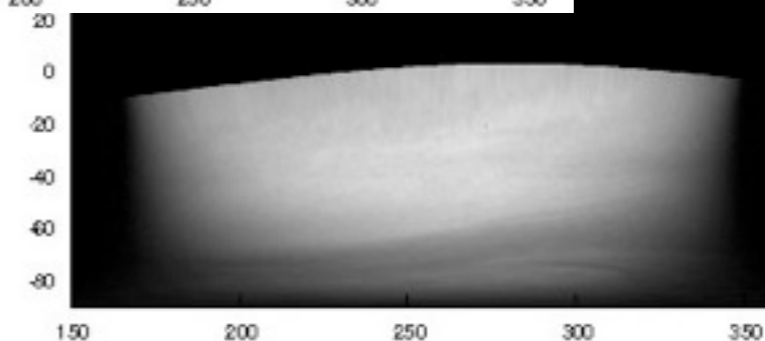
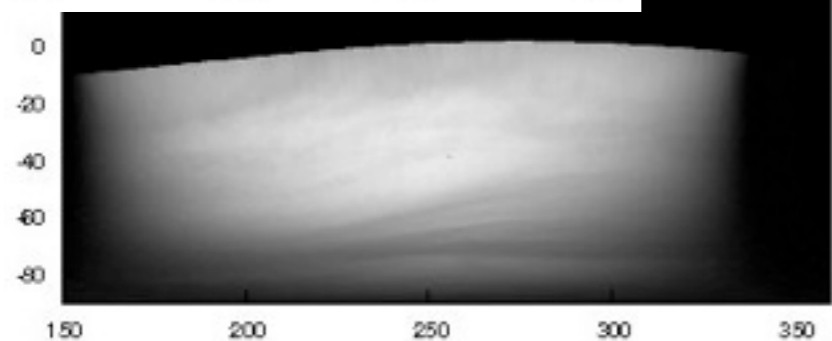
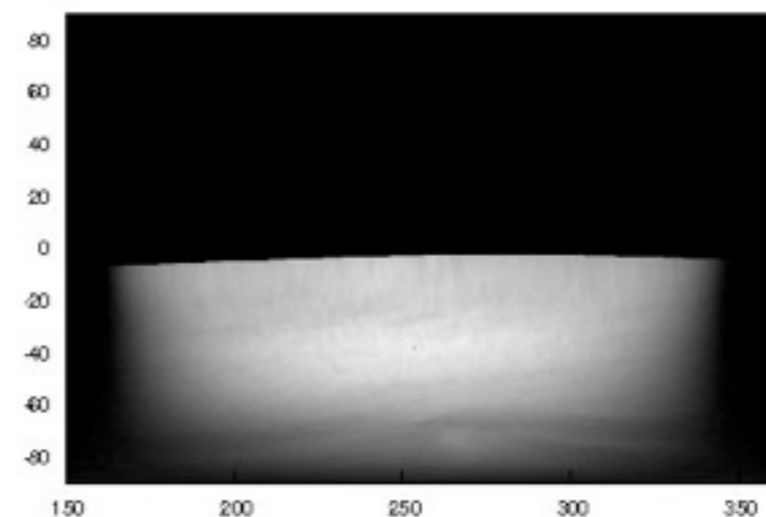
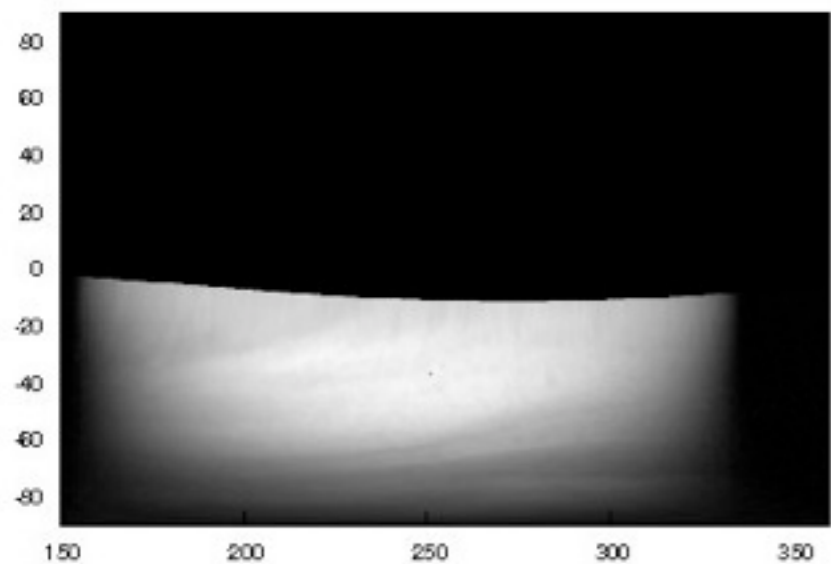


Figures from
Dr.Kouyama's study

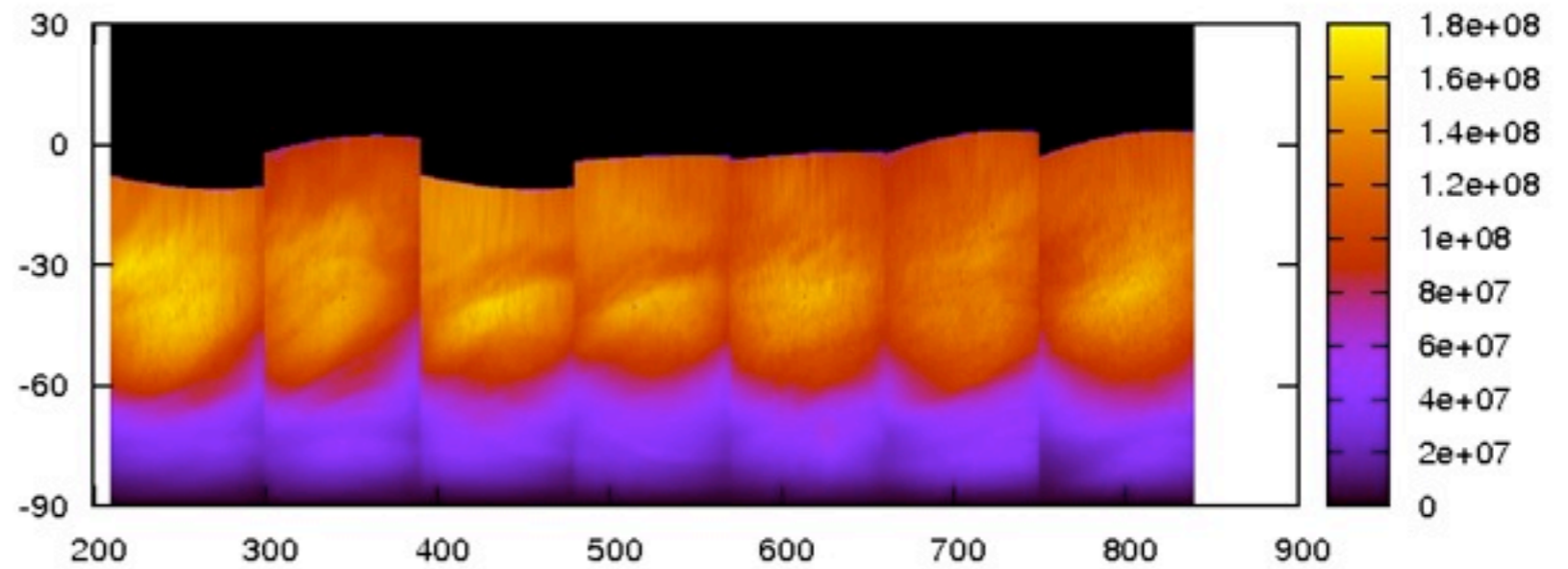
VMC UV images in Aug. 2010

(3rd-9th; the same dates as ground observation)

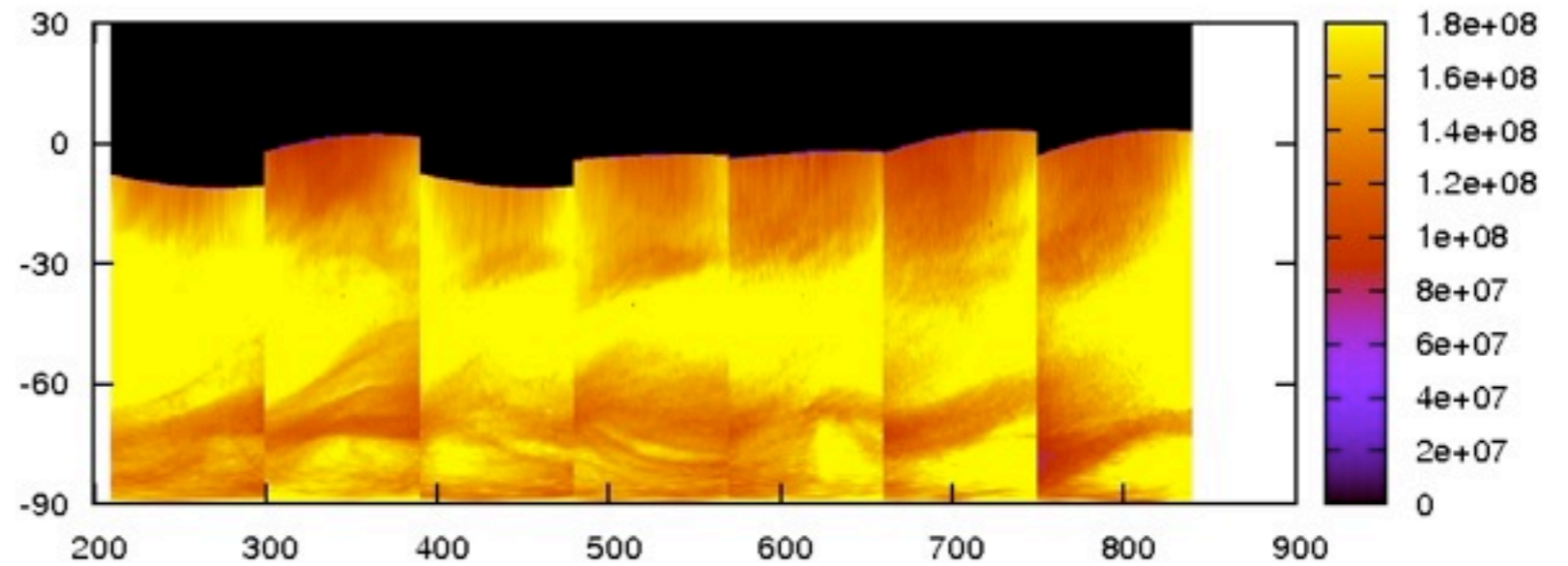




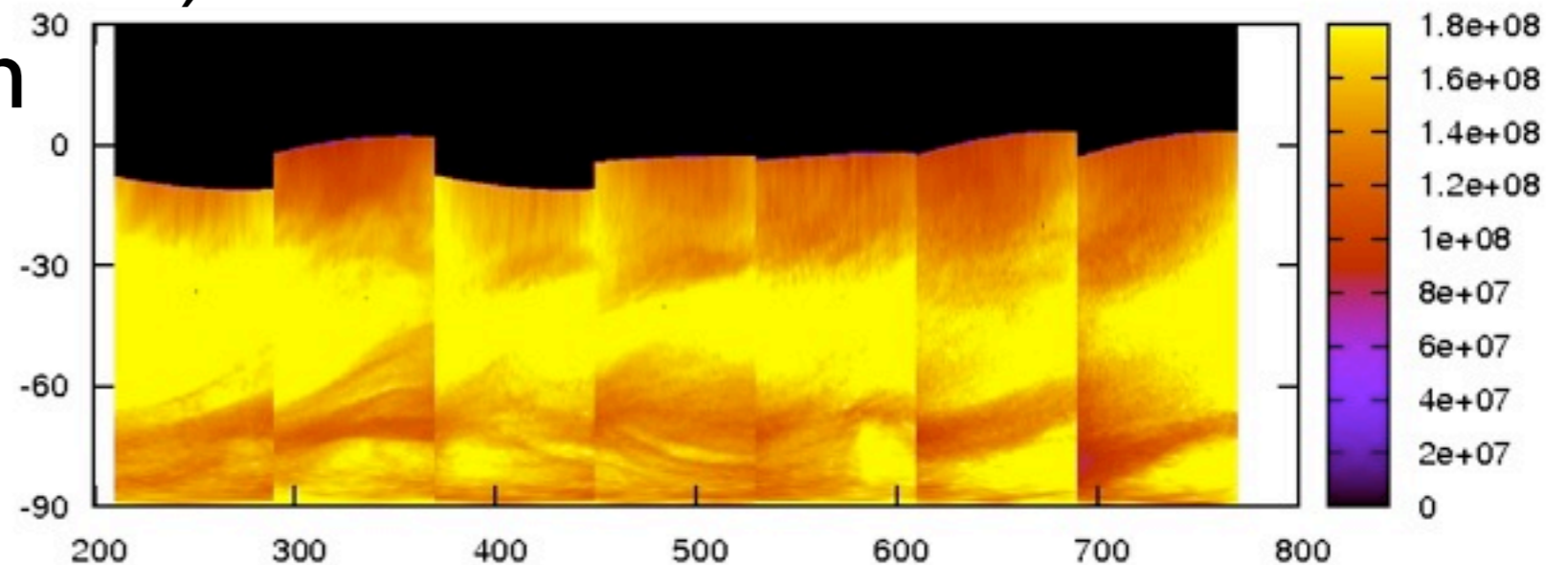
90°/day
(4-day rotation)



With Lambertian
reflectance



80°/day(4.5-day rotation)
with Lambertian
reflectance



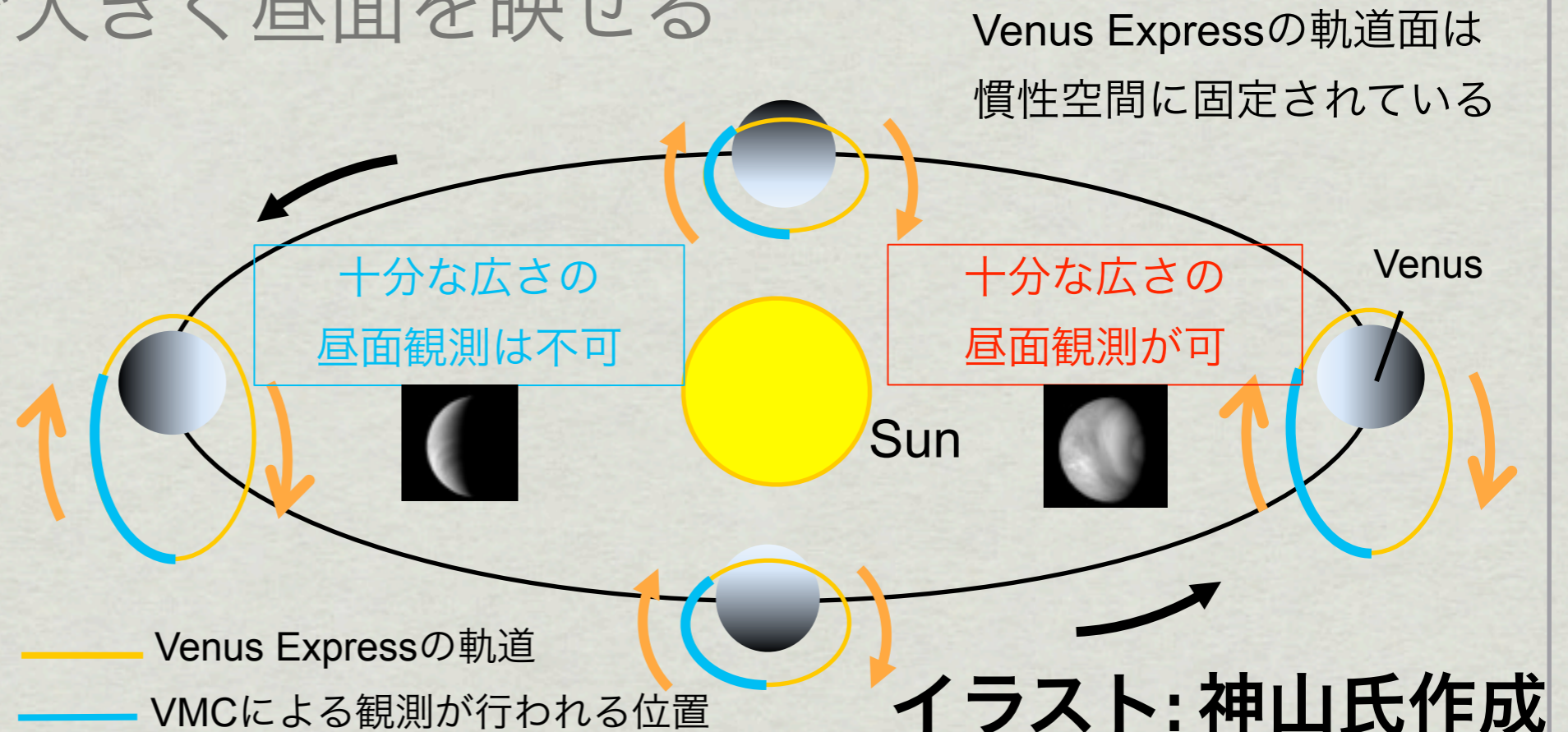
Summary (VMC images)

- **We made global maps with VMC images**
- **Thinking about how to correct the brightness...**

This time we use the Lambertian reflectance, and try to use the empirical equation in Belton et al. (1991)

おまけ 次回の観測予定 (2014年5月中旬)

- ＊ 地上・衛星同時観測の好機
- ＊ VMCが観測を行う際の衛星直下ローカルタイムが10時ごろで大きく昼面を映せる



FY	4月	5	6	7	8	9	10	11	12	1	2	3
平成26年	地 →											
	← VEX →							← VEX →				
平成27年	← 地 →						← 地 →					
			← VEX →								← VEX →	
									あかつき			
平成28年									← 地 →			
	VEX →						← VEX →					
						あかつき						

表: 神山氏作成