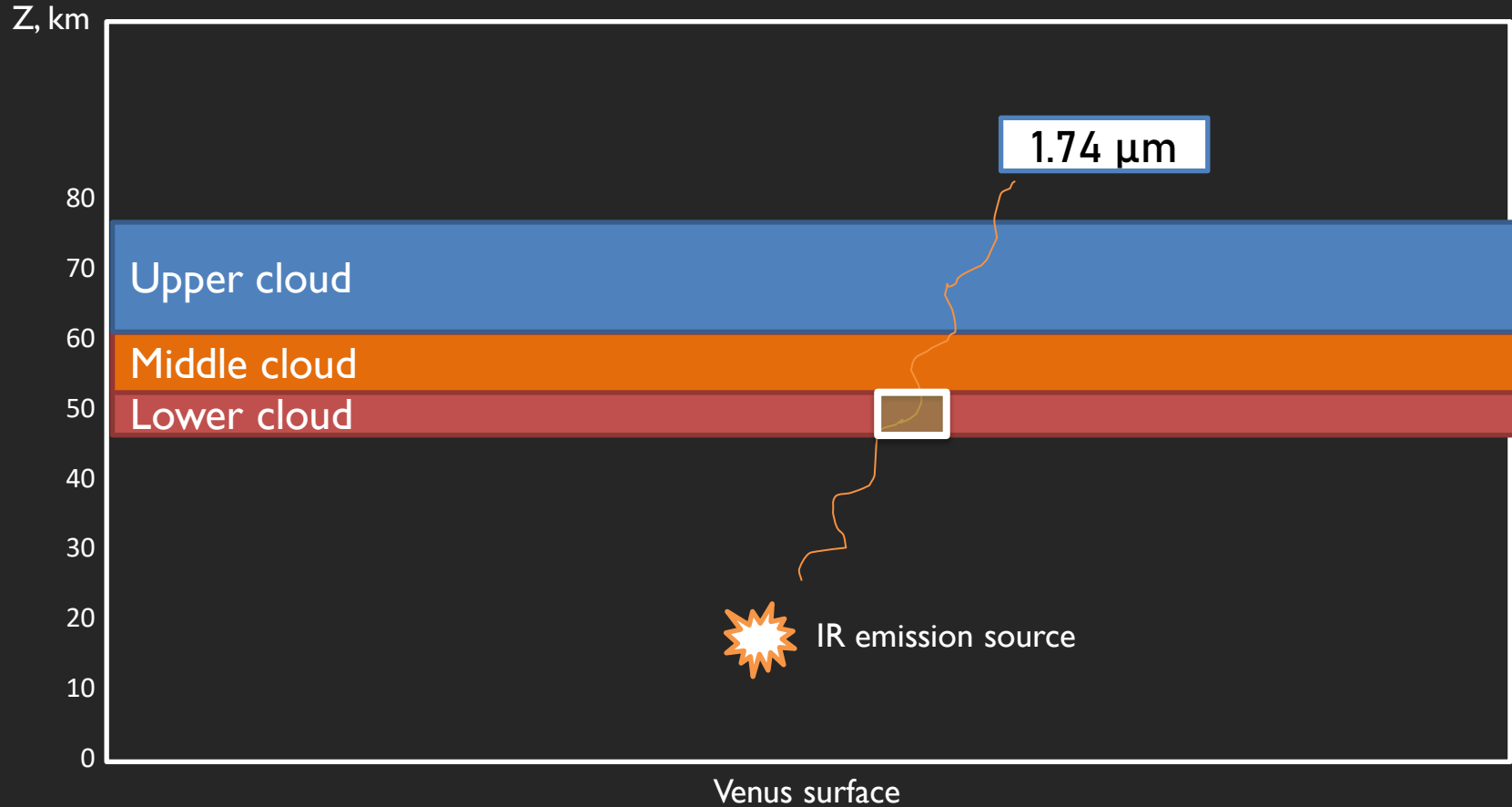


Циркуляция нижнего облачного слоя атмосферы Венеры на ночной стороне по данным прибора IR2 проекта "Akatsuki"

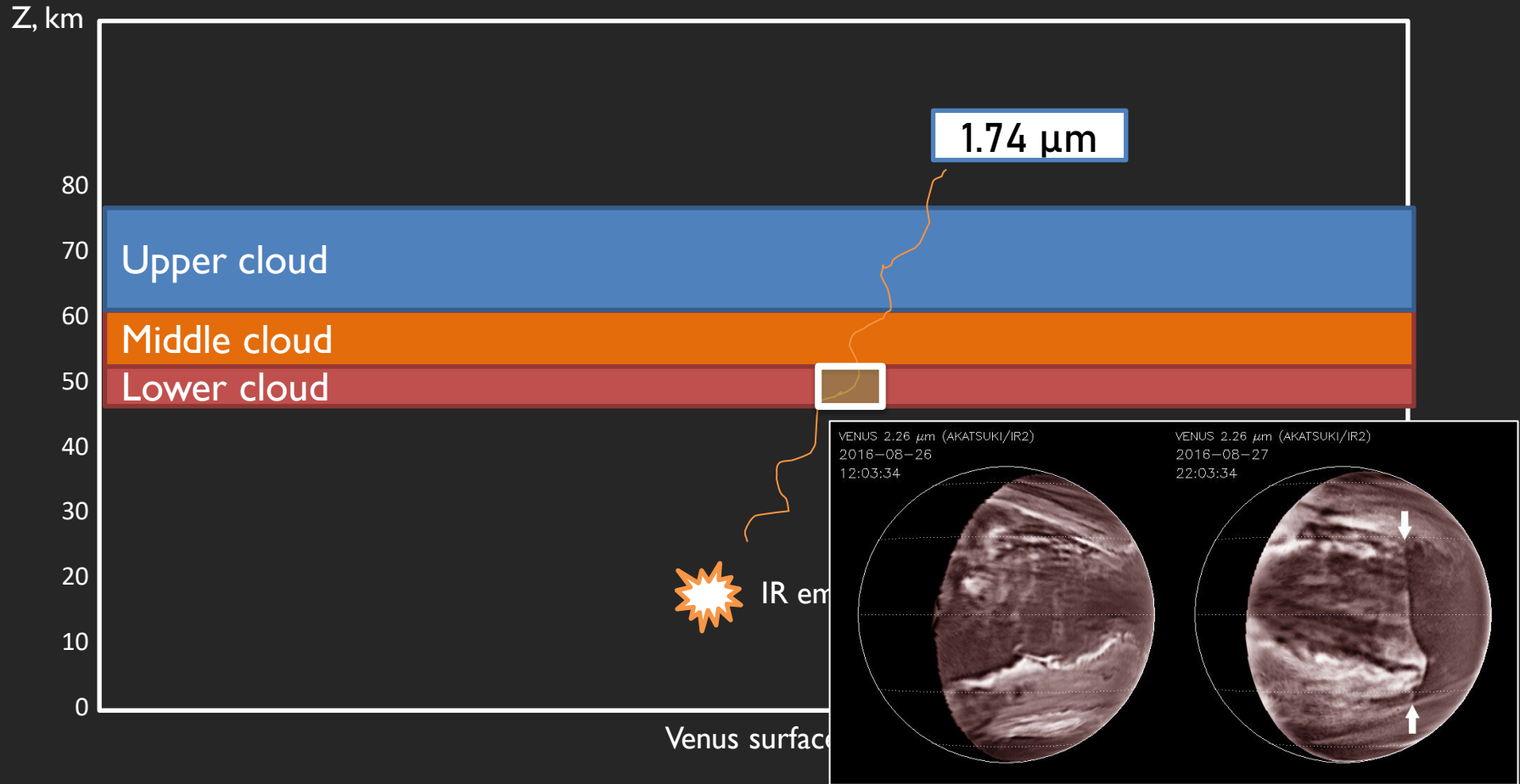
Д. Горинов, Л. Засова, И. Хатунцев, М. Пацаева, А. Тюрин
ИКИ РАН, Москва

14 ноября 2022

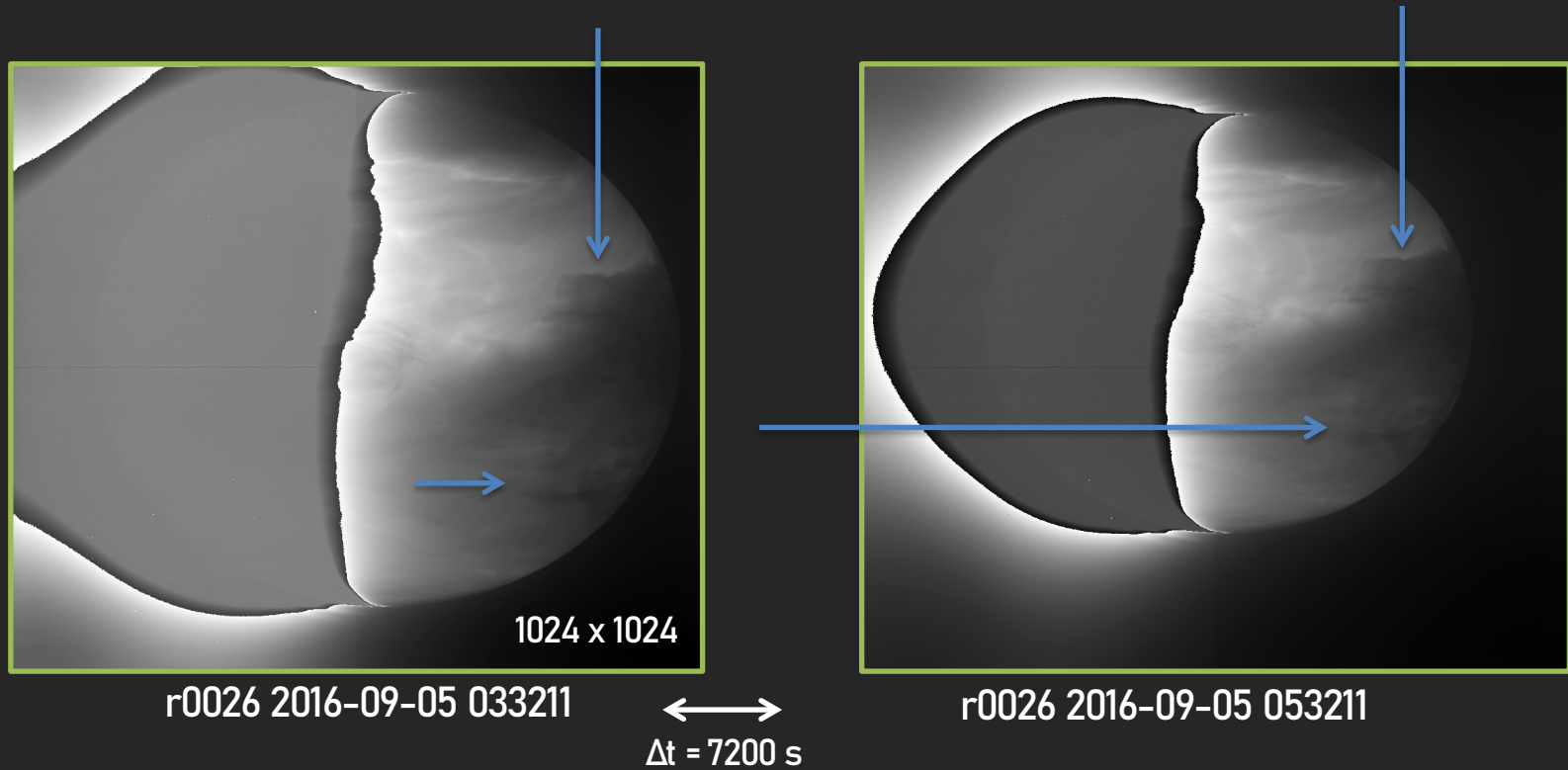
Emission observed in 1.74 μm on Venus nightside



Emission observed in 1.74 μm on Venus nightside



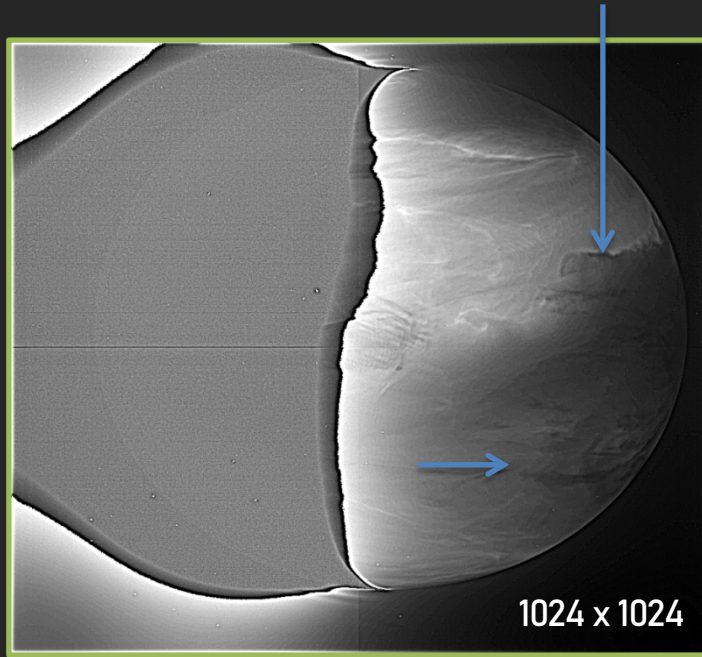
Measuring horizontal wind velocities by tracking cloud features



$$u = \frac{(\lambda_2 - \lambda_1)(R + h) \cos(\varphi_1)}{\Delta t}$$

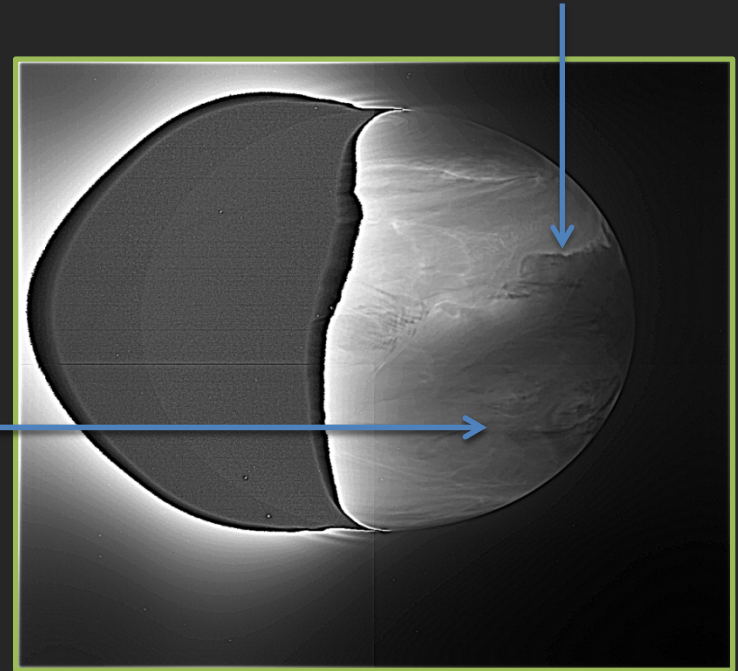
$$v = \frac{(\varphi_2 - \varphi_1)(R + h)}{\Delta t}$$

Measuring horizontal wind velocities by tracking cloud features



r0026 2016-09-05 033211

↔
 $\Delta t = 7200 \text{ s}$



r0026 2016-09-05 053211

$$u = \frac{(\lambda_2 - \lambda_1)(R + h) \cos(\varphi_1)}{\Delta t}$$

$$v = \frac{(\varphi_2 - \varphi_1)(R + h)}{\Delta t}$$

Algorithm from [Khatuntsev et al., 2013]

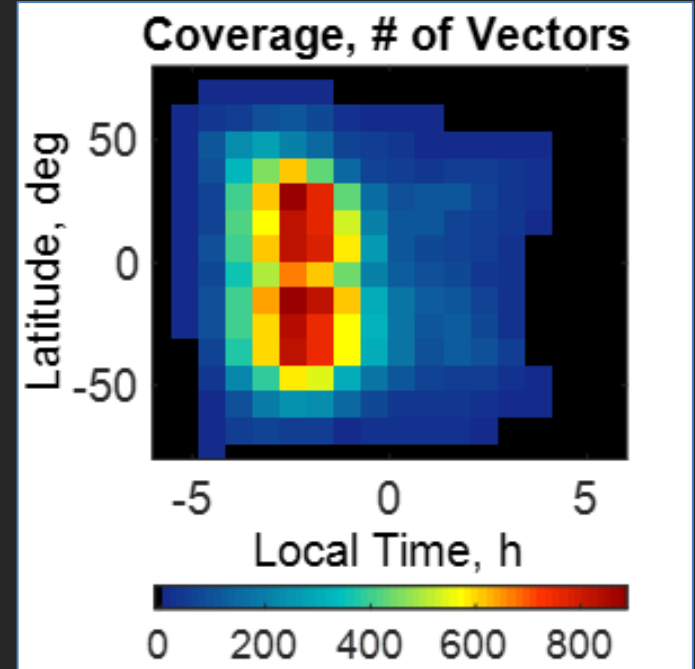
IR2 wind tracking data in 1.74 μm

	Begin / End	Orbit range	Orbits	Vectors
automated	2016-03-25 / 2016-10-27	0011 - 0030	14	35525
manual	Where automated method was not available			6086

The wind tracking procedure resulted in 41,611 retrieved horizontal wind velocity vectors.

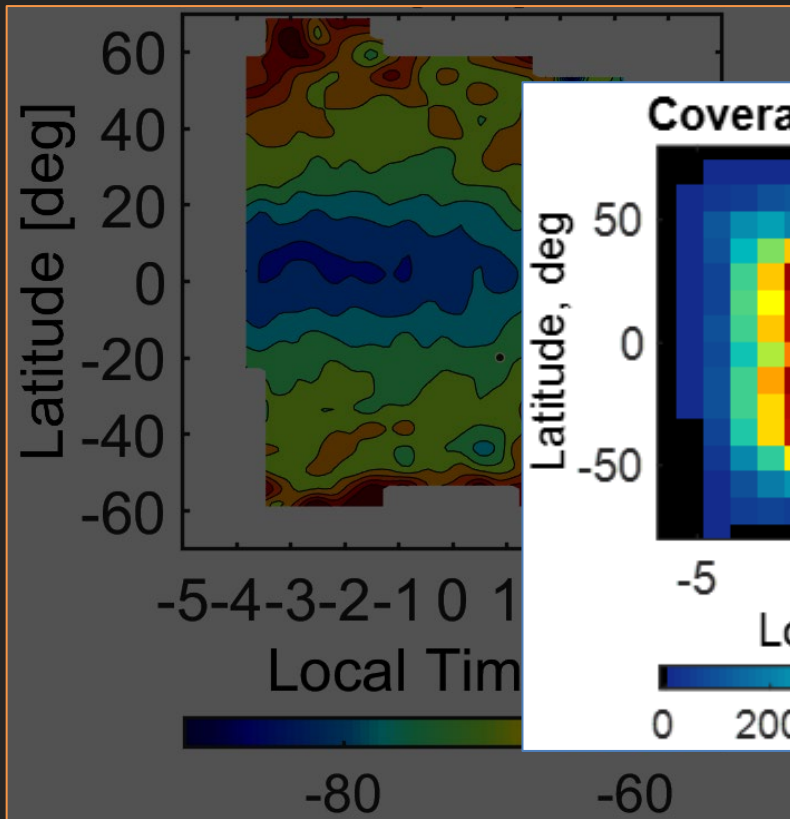
An automated algorithm [Patsaeva et al.] was used to process the data.

The algorithm was verified by manual wind tracking method.

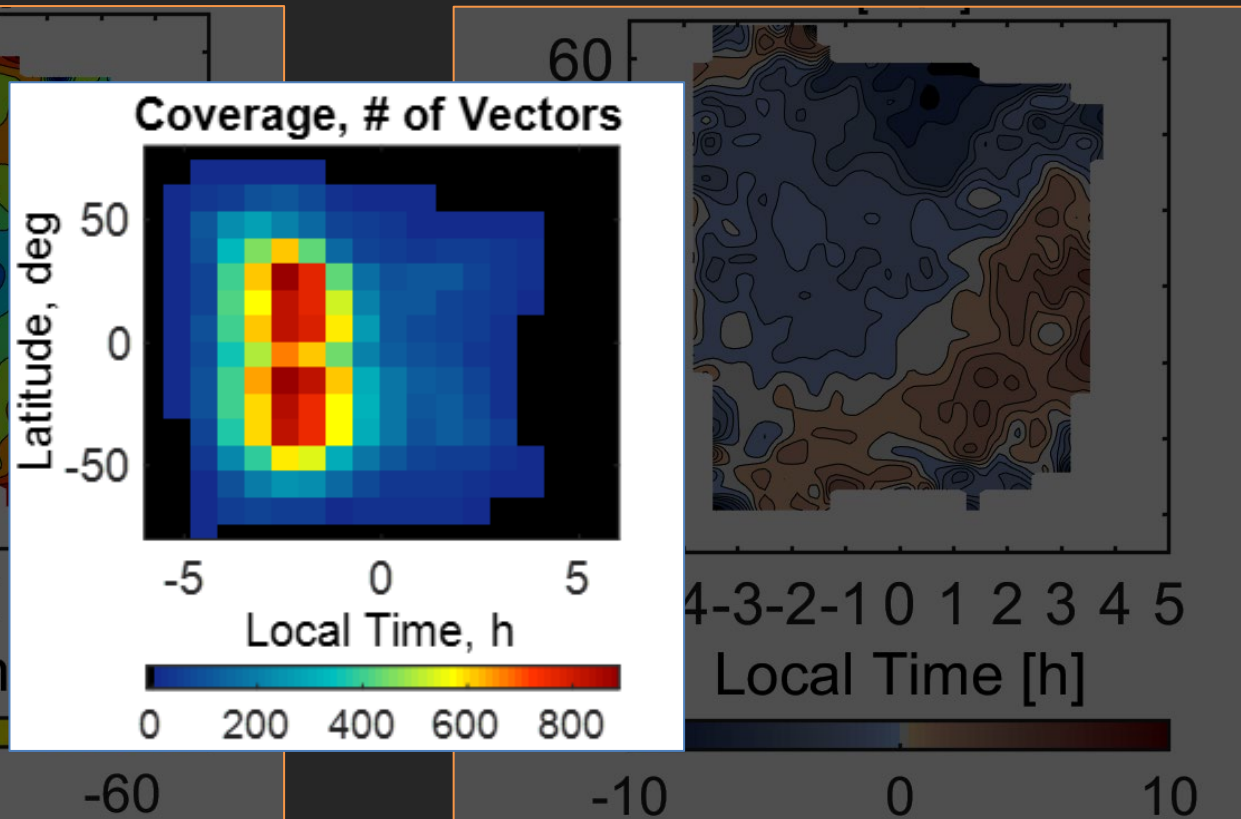


Mean horizontal velocities from IR2

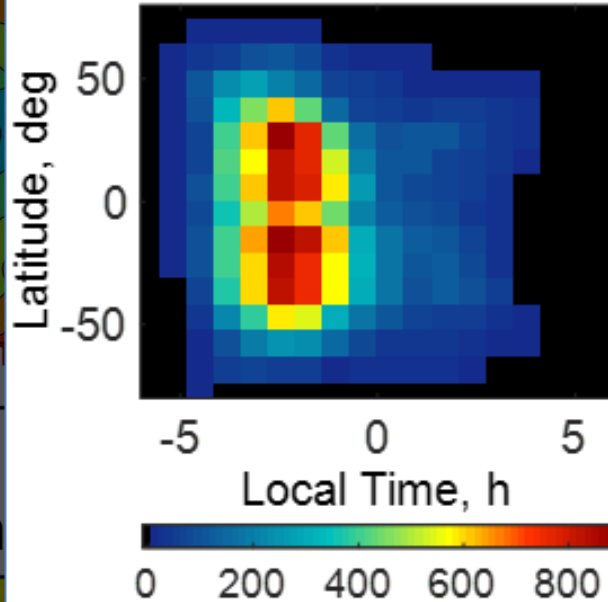
Zonal (u):



Meridional (v):



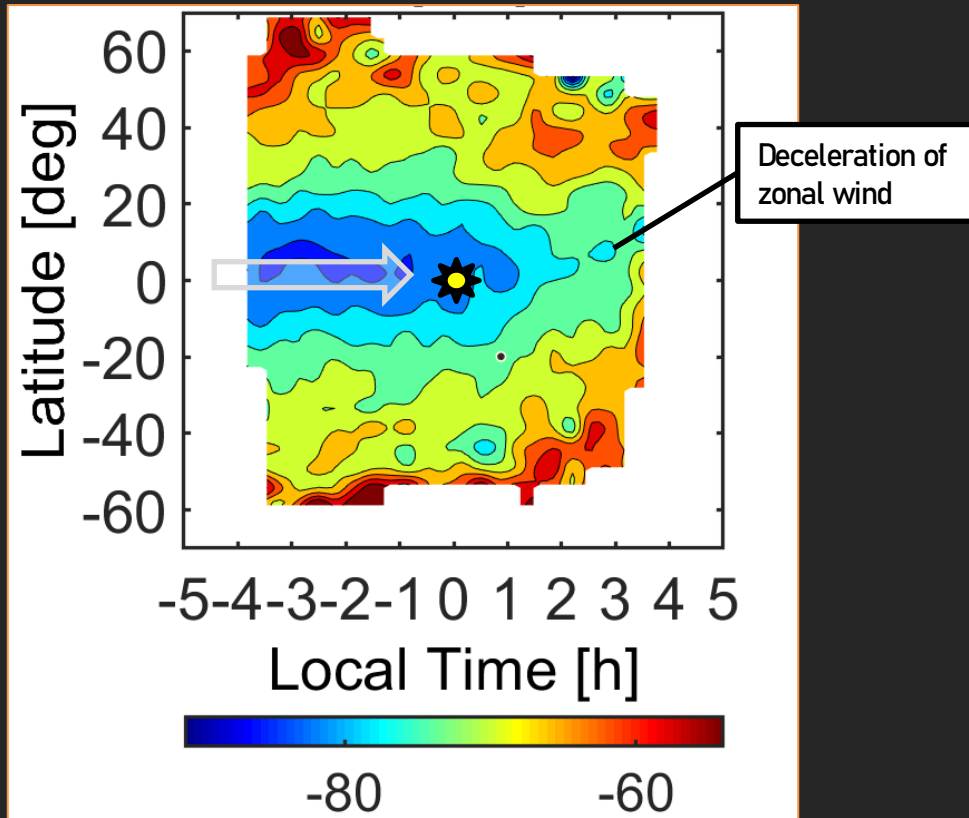
Coverage, # of Vectors



Mean horizontal velocities from IR2

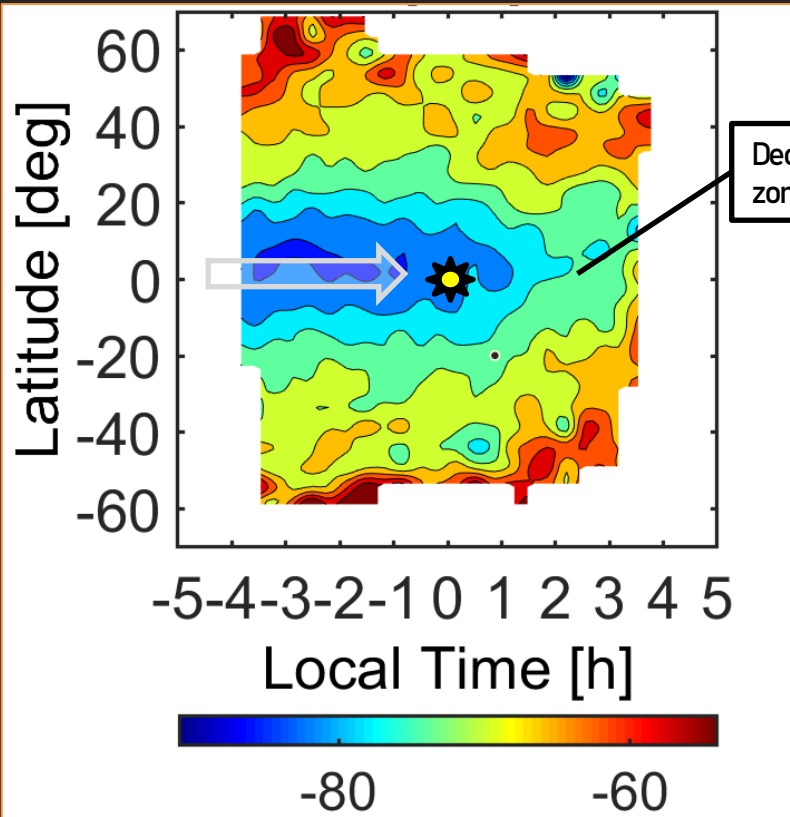
Zonal (u):

Meridional (v):

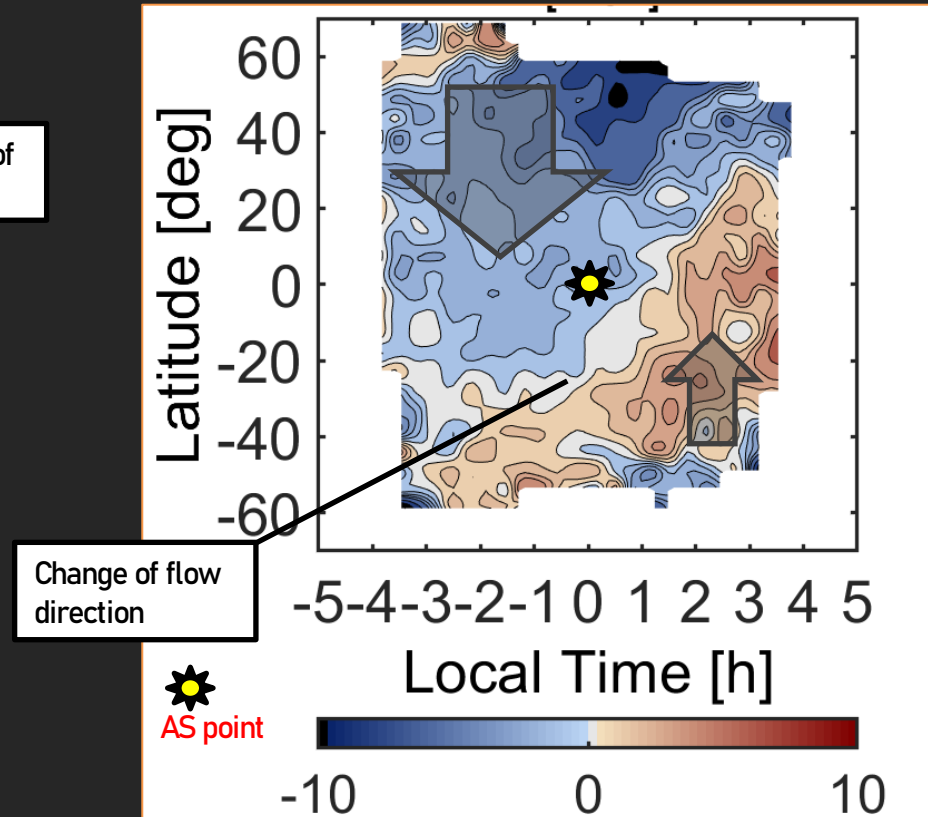


Mean horizontal velocities from IR2

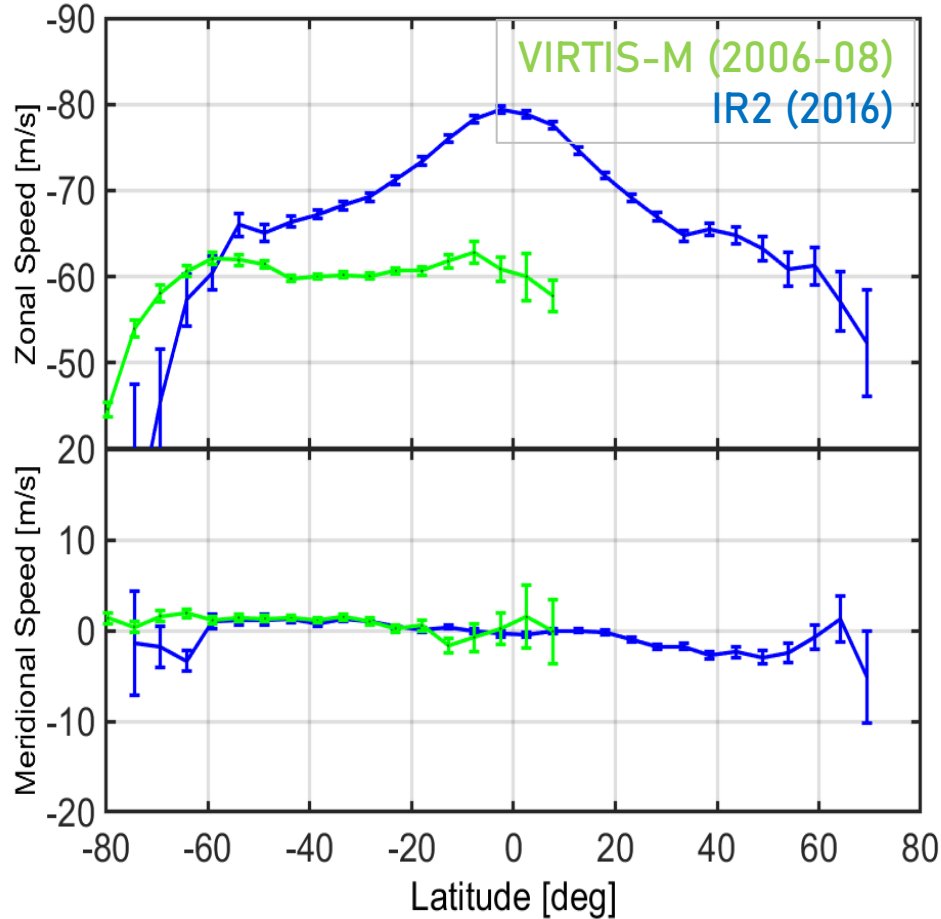
Zonal (u):



Meridional (v):



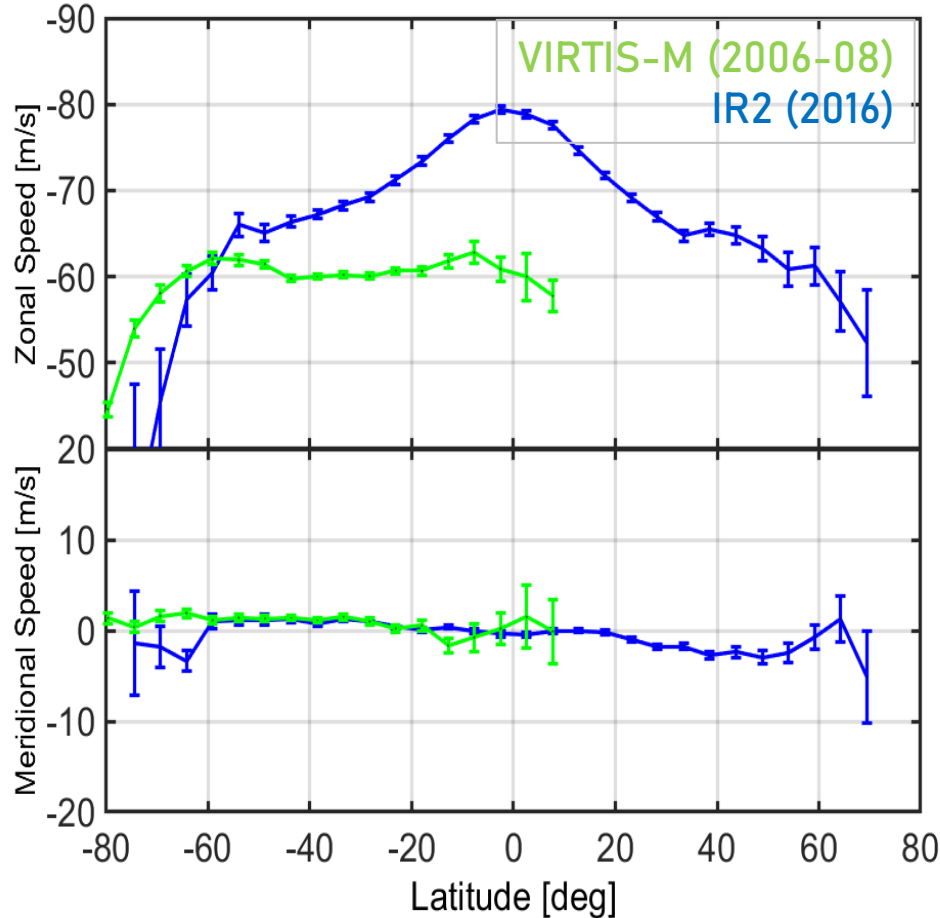
Latitudinal wind profiles



Zonal speed

Meridional speed

Latitudinal wind profiles



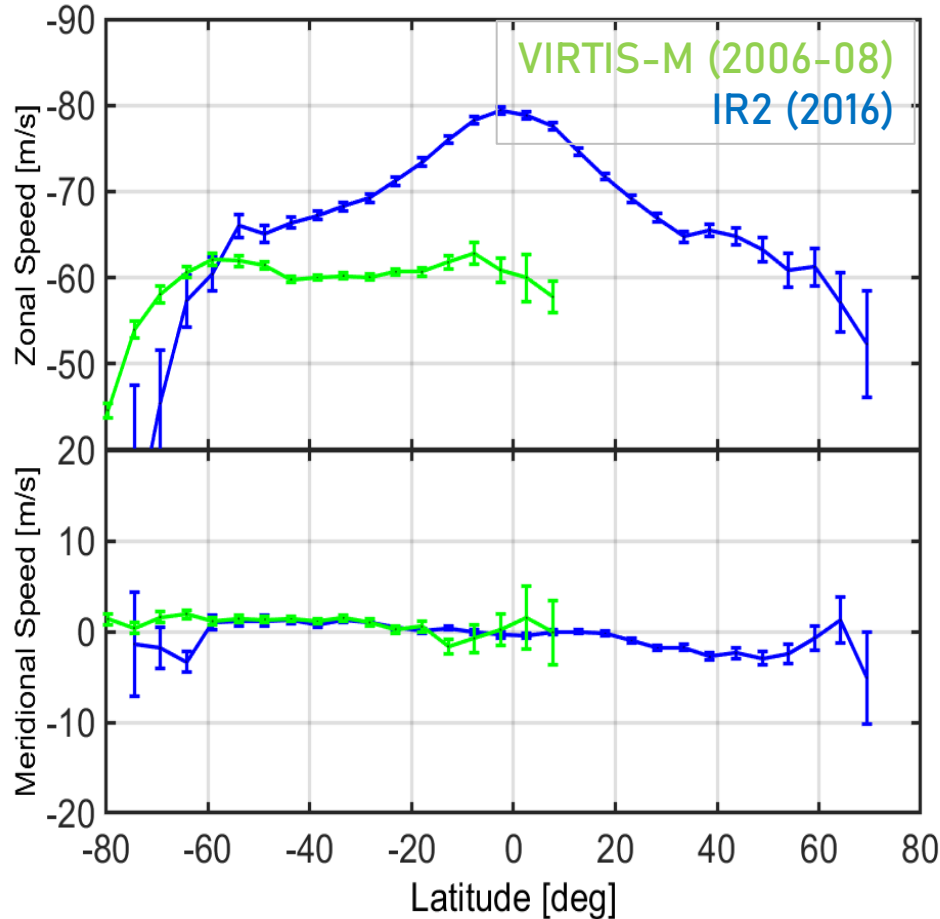
Zonal speed

Significant difference in u values and overall profile shape, can be caused by:

- 1) change in circulation
- 2) sensing different layers due to optical properties

Meridional speed

Latitudinal wind profiles

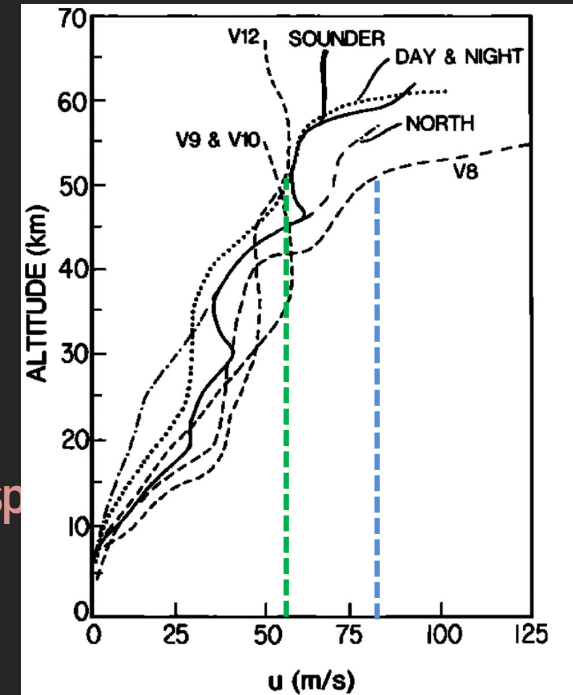


Zonal speed

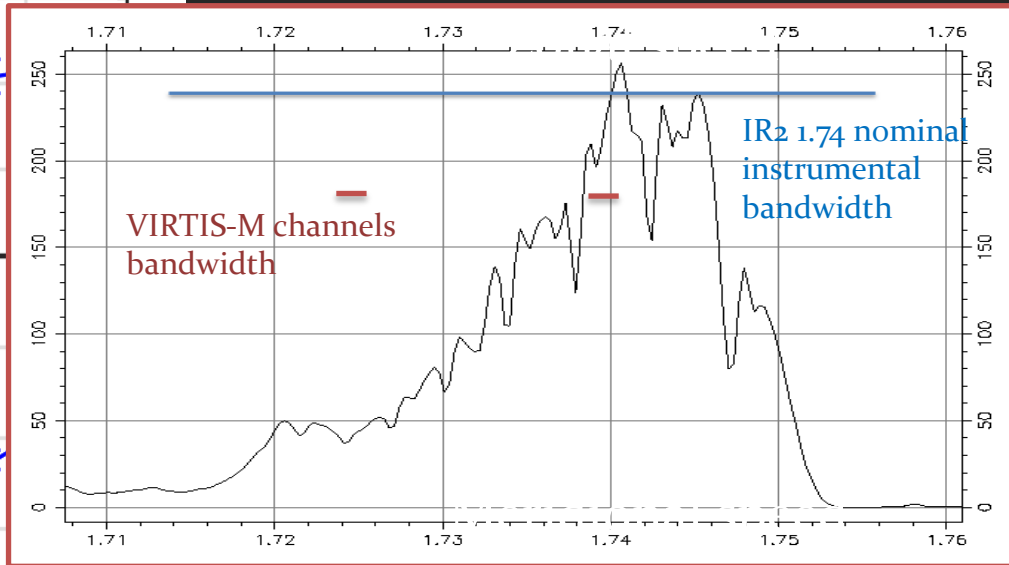
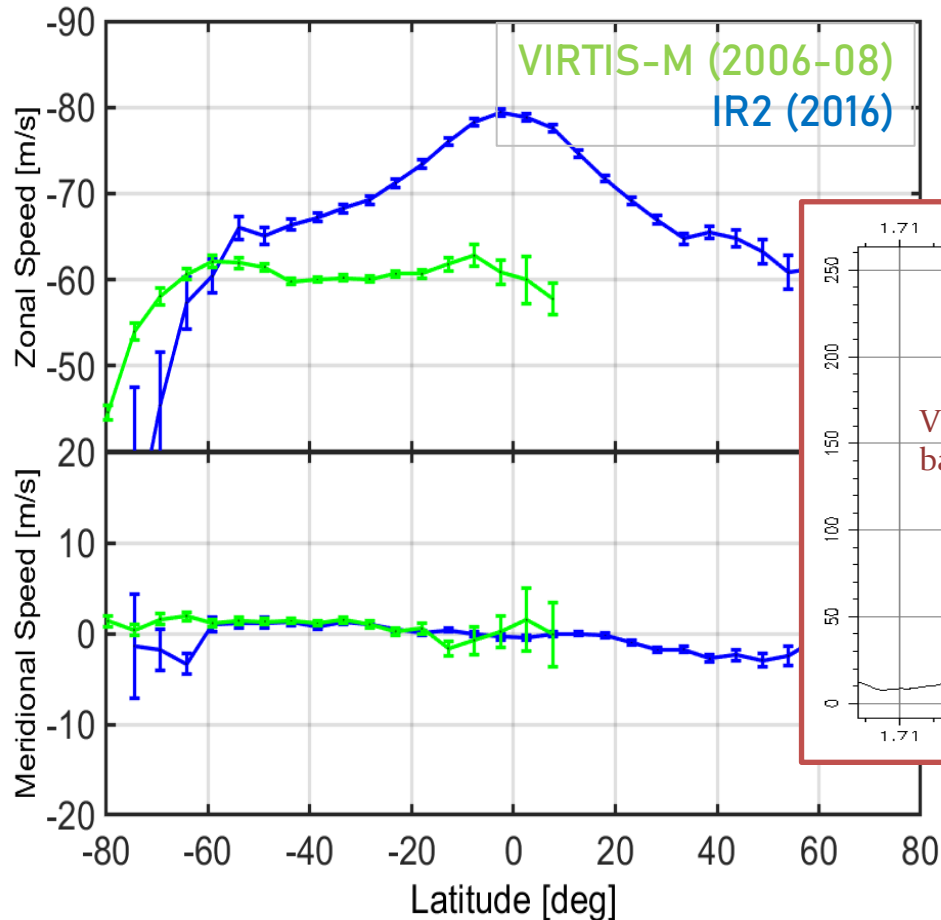
Significant difference in u values and overall profile shape, can be caused by:

- 1) change in circulation
- 2) sensing different layers due to optical properties

Meridional speed



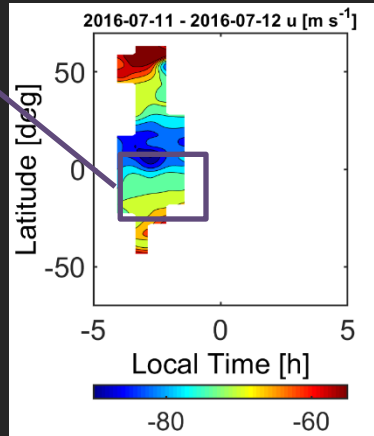
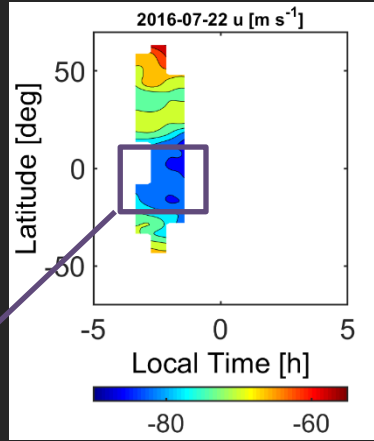
Latitudinal wind profiles



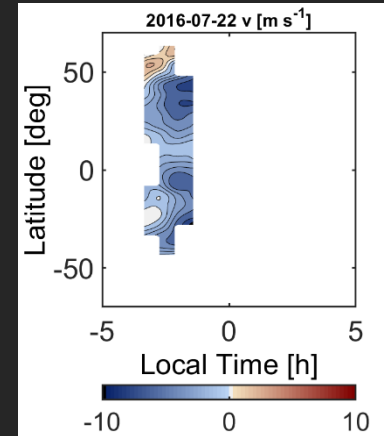
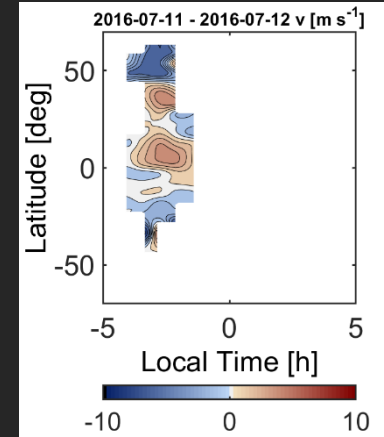
Orbit-to-orbit variations

The atmospheric circulation in the lower cloud level shows short-term variability

In 10-11 days the maximum of zonal speed (blue contours) moves northward

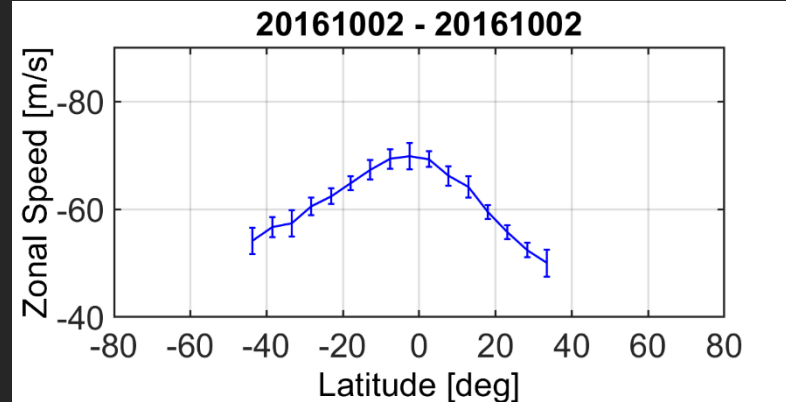


In the same time interval, meridional speed shows even more change, as the meridional flow changes from mostly northward to southward

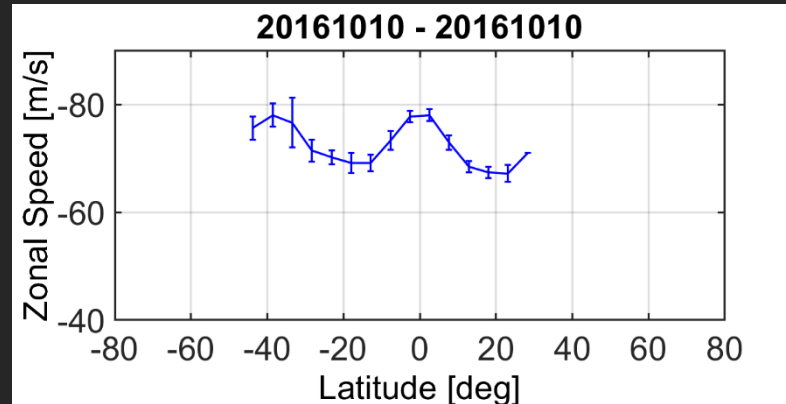


Orbit-to-orbit variations

Another example of short-term variability

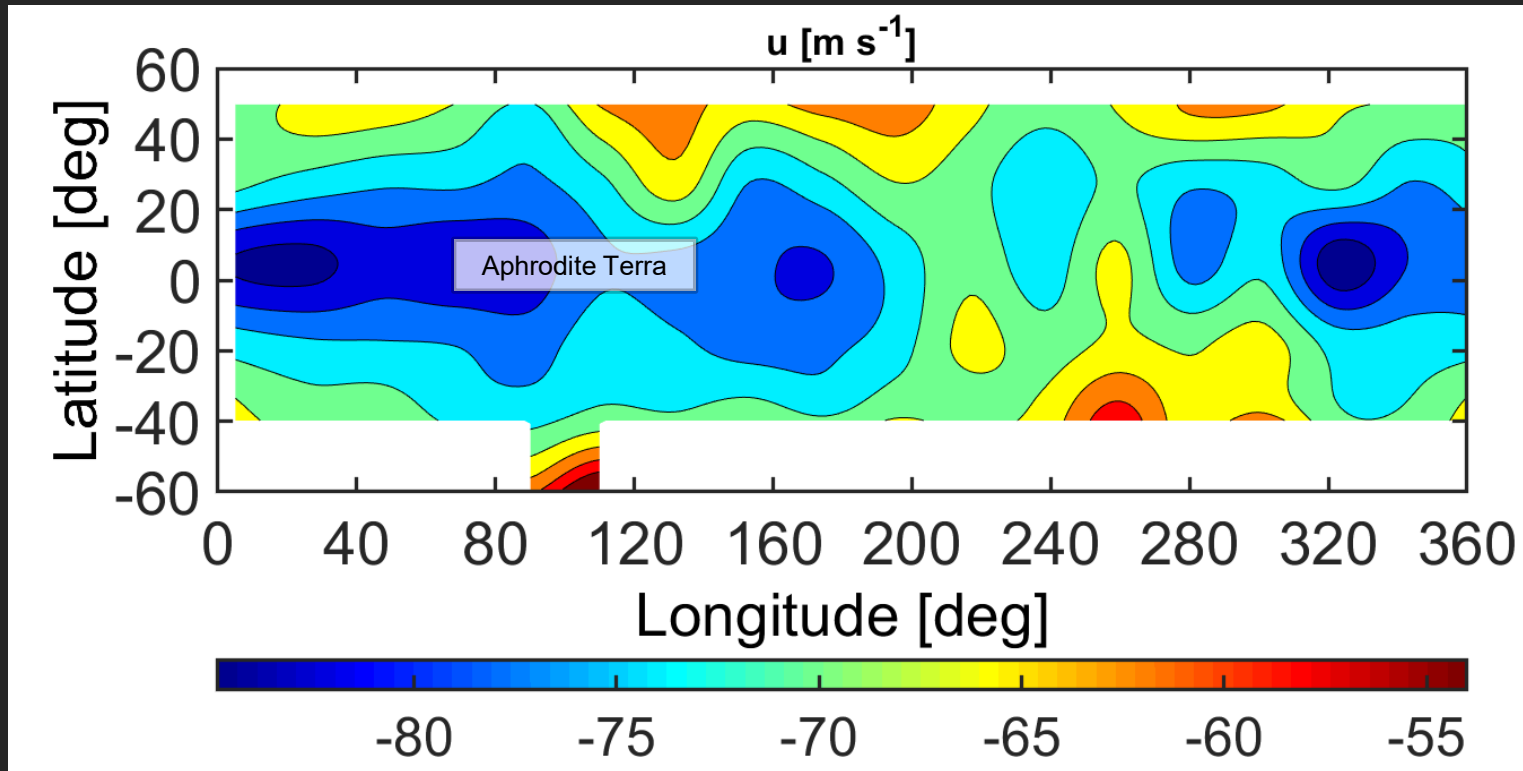


zonal speed profiles separated by 8 days show a change in values (acceleration) and latitude dependence



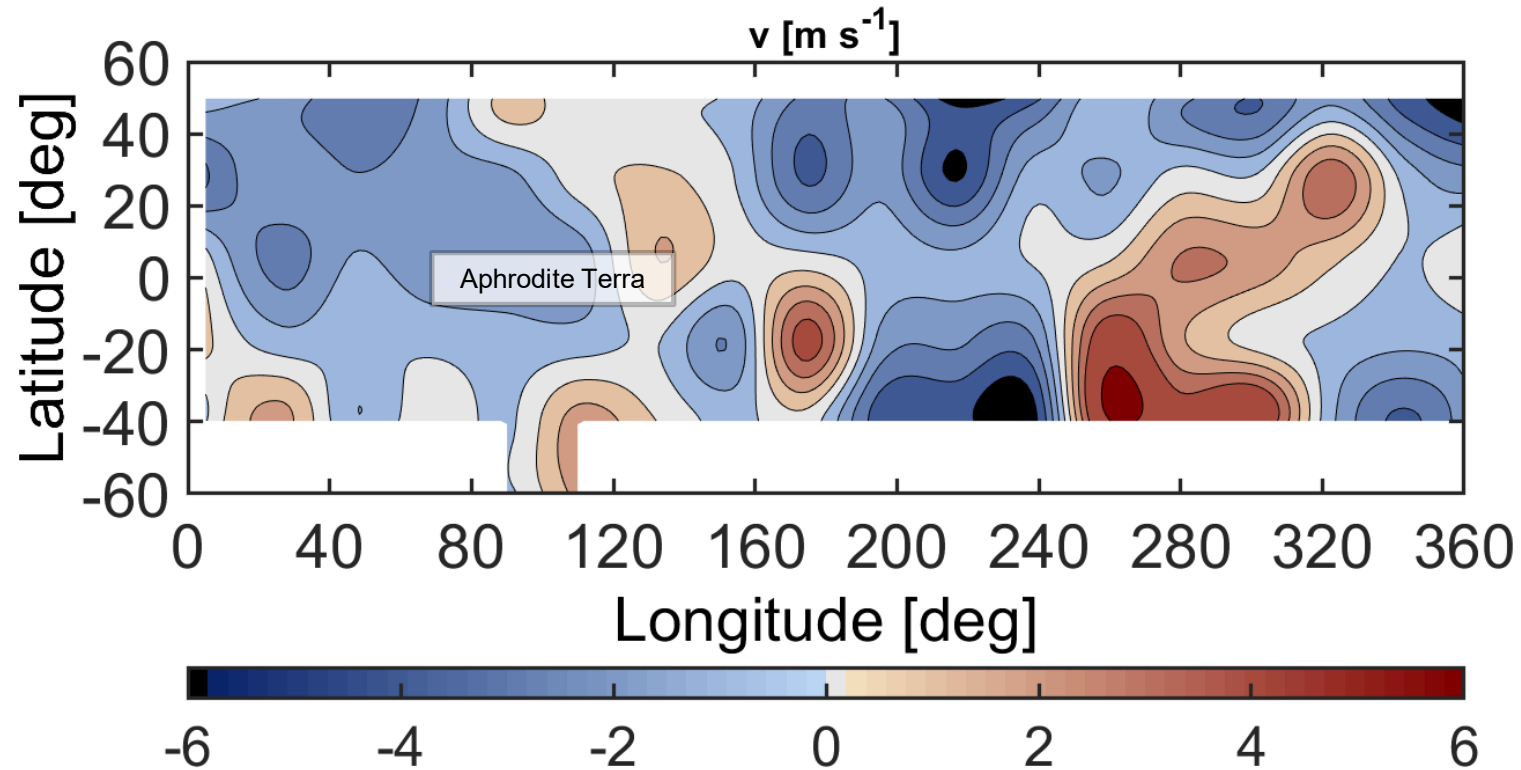
Longitude variations

Zonal speed



Longitude variations

Meridional speed



Заключение

- Проанализировано полное количество изображений, полученных камерой IR2 за всё время её функционирования. Получена база данных векторов скорости ветра в нижнем облачном слое на ночной стороне Венеры;
- Сравнение результатов IR2 и VIRTIS/Venus Express показывает **существенную разницу в поведении зональной компоненты скорости** – в данных IR2 она выше на 18 м/с на экваторе; форма профилей также принципиально отличается; предложены несколько объяснений;
- Обнаружены **существенные долготные вариации**, которые, однако, могут быть отнесены не к влиянию поверхности, а к солнечносвязанным или короткопериодическим вариациям

Спасибо за внимание!