

Air temperatures of Venus Mesosphere as observed by the VIRTIS-H instrument on board of Venus Express

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Abstract

VIRTIS-H is the high spectral resolution unit of the Visual and Infrared Thermal Imaging Spectrometer (VIRTIS), a payload component of the Venus Express spacecraft. Its coverage of the $4.3 \mu\text{m}$ carbon dioxide band enables – in night time conditions – an effective monitoring of air temperatures in the indicative pressure range between 100 and 1 millibar. Operative mode of the instrument allows coverage of the northern hemisphere, completing the monitoring performed by VIRTIS-M at the southern latitudes. Several latitudinal-altitude cross sections at different local times are presented, demonstrating the effective symmetry of temperature fields between the two hemispheres.

1. Introduction

The high opacity of CO_2 in its $4.3 \mu\text{m}$ band ensures that an effective opacity well above one is achieved in a number of VIRTIS-H spectral sampling channels for altitude levels above the main cloud deck. Since the total radiation field in these channels is dominated – in nighttime condition – by air thermal emission, observed radiances can be exploited to retrieve, by numerical inversion, the air temperature profile in the atmosphere [1,2].

2. Dataset

Among the interesting characteristic of VIRTIS-H dataset we shall note its extensive coverage of equatorial and northern latitudes (Fig. 1). This experimental set nicely complements the southern latitudes mapping performed by the sister instrument

VIRTIS-M [2]. Data at these latitudes consist mostly of swaths of spectra acquired during nadir observations while the satellite is moving along its quasi-polar orbit. From each swaths we can therefore reconstruct a latitude-altitude air temperature cross section at almost fixed local time.

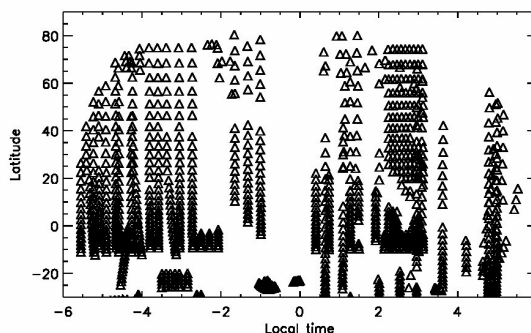


Figure 1: Coverage of VIRTIS-H retrievals at the current date.

3. Results

Temperature cross sections produced so far (fig. 2-3) qualitatively matches the trends detected by VIRTIS-M around the south pole. Namely, we can observe an almost monotonous increase of temperatures toward the pole for latitudes north of 40N and pressures below 50 millibars, as well as some initial evidence of the northern cold collar. Preliminary inspection of local time trends also confirm the VIRTIS-M findings, with a the collar colder in the morning quadrant and higher atmosphere (few millibars) around 40N colder in the evening quadrant.

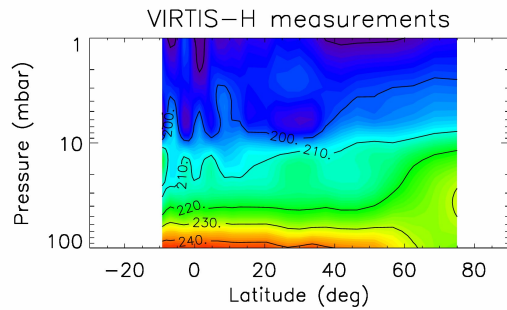


Figure 2: Thermal fields derived from VIRTIS-H cube 0090_03. Local time is about 20.

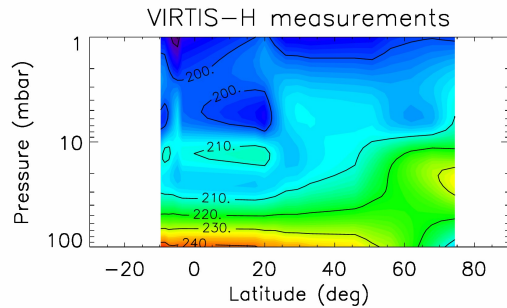


Figure 3: Thermal fields derived from VIRTIS-H cube 0154_03. Local time is about 3.1

Acknowledgements

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References

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