Oxygen dayglow on Venus: consequences of the upper limit from the VIRTIS-Venus Express observations

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Oxygen dayglow in the Venus' atmosphere was detected only once about 30 years ago (Connes, et al., 1979). The emission at 1.27μm was investigated from ground, using a high resolution spectrometer, reporting a mean value of 1.5 MR (1R = 10^6 photon cm^{-2} sec^{-1} $(4\pi ster)^{-1}$) for the (0,0) O_2 dayglow intensity, as observed in Nadir geometry. Such value is very comparable to the retrieved nightglow intensity of 1.2 MR, coming from the same observations campaign.
Subsequent observations failed in detecting oxygen dayglow emissions. The European mission to Venus Venus Express, is currently observing the planet since April 2006. It offers the opportunity to better investigate the day side of Venus with VIRTIS, the Visible and Infrared Thermal Imaging spectrometer on board the spacecraft, covering in particular the infrared spectral range from 1 to 5 μm with a spectral sampling of 10 nm.
Data acquired in limb mode and selected in the altitude range 90-150 km were analyzed in order to detect the dayglow emission. The O_2 emission on the day side of Venus does not seem to be present on the large available dataset. The research allowed then to set an upper limit for the O_2 dayglow emission, equal to 1MR, as observed in limb view. This would imply a detection limit equal to 20 kR as observed in Nadir mode view, quite low with respect to the previous ground based detections.
The reason of this so large discrepancy is not clear. It would imply that either dayglow emission occurs at an altitude much different from that one explored in orbit, or its intensity, whether the emission is coming from the same region of altitude, is much lower than the value reported in the former observation from ground, which perhaps could be investigated in its variability. New observations both from ground and from space are then needed in order to solve this puzzle.
In this paper we discuss the method used for the upper limit investigation and the consequences of this large discrepancy that needs still to be resolved.