



Long-term investigation of dynamics in the Venusian upper atmosphere

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Abstract

The planet Venus is one of the terrestrial planets. Even there are a lot of differences between Earth and Venus commonalities make it possible to adopt models from Earth and describe the Venusian atmosphere. To understand the global processes and proof and advance such models it is important to have measurements of crucial physical parameters. One key parameter is wind. Therefore ground-based investigations of wind velocities in the upper atmosphere have been accomplished in the past and efforts are still ongoing. [1, 2, 3, 4, 5]

Data with high spectral resolution from infrared heterodyne spectroscopy was taken in January and February 1990 and August and September 1991 with the instrument IRHS, operated by NASA Goddard Space Flight Center (GSFC) at the IRTF telescope in Hawaii. Non-LTE emission lines of Carbon dioxide at 967.71 cm^{-1} were used to determine wind velocities from Doppler shifts. These lines occur in the illuminated part of the atmosphere at an altitude of about 110km. The technique provides high spatial resolution and several positions on the planet were observed. The instrument IRHS uses lamb-dip stabilisation to gain an extraordinary high spectral stability of about 0.1 MHz. Due to this accuracy the wind velocities of the non-LTE features are extremely definite (up to 1m/s).

By comparing results to models and recent campaigns it is possible to confirm or impair our understanding of the processes in the atmosphere and take into account the long-term processes.

References

- [1] R.T. Clancy, B.J. Sandor and G.H. Moriarty-Schieven: Venus upper atmospheric CO, temperature, and winds across the afternoon/evening terminator from June 2007 JMCT sub-millimeter line observations. Planetary and Space Science, 56:1344-1354, August 2008
- [2] J.J. Goldstein, M.J. Mumma, T. Kostiuik, D.Deming, F. Espenak and D. Zipoy: Absolute wind velocities in the lower thermosphere of Venus using infrared heterodyne spectroscopy. Icarus, 94:45-63, November 1991.
- [3] E. Lellouch, J.J. Goldstein, J. Rosenqvist, S.W. Bougher and G. Paubert: Global circulation, thermal structure, and carbon monoxide distribution in Venus mesosphere in 1991. Icarus, 110: 315-339, August 1994.
- [4] M. Rengel, P. Hartogh and C. Jarchow: Mesospheric vertical thermal structure and winds on Venus from HHSMT CO spectral-line observations. Planetary and Space Science, 56:1368-1384, August 2008
- [5] M. Sornig, T. Livengood, G. Sonnabend, P. Kroetz, D. Stupar, T. Kostiuik, R. Schieder: Venus upper atmosphere winds from ground-based heterodyne spectroscopy of CO₂ at $10\mu\text{m}$ wavelength, Planetary and Space Science 56:1399-1406, 2008.