

The search for active volcanism on Venus with Venus Express/VIRTIS data

C.C.C. Tsang (1), F.W. Taylor (1), P.G.J. Irwin (1), G. Piccioni (3), P. Drossart (4), A. Adriani (5), F. Angrilli (10), G. Arnold (12), K. H. Baines (7), G. Bellucci (5), J. Benkhoff (12), B. Bezard (4), J. P. Bibring (6), A. Blanco (8), M.I. Blecka (9), R. Carlson (7), A. Coradini (5), A. Di Lellis (3), T. Encrenaz (4), S. Erard (6), S. Fonti (8), V. Formisano (5), T. Fouchet (4), R. Garcia (10), R. Haus (12), J. Helbert (12), N.I. Ignatiev (11), Y. Langevin (6), S. Lebonnois (13), M.A. Lopez Valverde (14), D. Luz (2), L. Marinangeli (2), V. Orofino (8), A.V. Rodin (11), M.C. Roos-Serote (15), B. Saggin (16), A. Sanchez-Lavega (17), D.M. Stam (18), D. Titov (19), G. Visconti (20), M. Zambelli (3)

(1) Atmospheric Oceanic and Planetary Physics, Department of Physics, University of Oxford, United Kingdom, (2) IRSPS, Italy, (3) INAF-IASF, Italy, (4) LESIA, France, (5) CNR-IFSI, Italy, (6) Institut d'Astrophysique Spatiale, France, (7) Jet Propulsion Laboratory, USA, (8) Università degli Studi di Lecce, Italy, (9) Space Research Centre of Polish Academy of Science, Poland, (10) IPG, France, (11) Space Research Institute of Russian Academy of Sciences (IKI), Russia, (12) Institute of Planetary Research, DLR, GERMANY, (13) Laboratoire de Meteorologie Dynamique Jussieu, France, (14) Instituto de Astrofísica de Andalucía (CSIC), Spain (15) Observatorio Astronomico de Lisboa Centro de Astronomia e Astrofísica da Universidade de Lisboa, Portugal, (16) Politecnico di Milano, Italy, (17) Dpto. Física Aplicada I Escuela Superior de Ingenieros Universidad del País, Spain (18) Astronomical Institute "Anton Pannekoek" University of Amsterdam, The Netherlands, (19) Max-Planck-Institute for Solar System Research, Germany, (20) Department of Physics University of L'Aquila, Italy

The composition of the lower atmosphere of Venus is of primary importance in understanding the past, and indeed current, evolution of climatology on this most enigmatic of planets. In discovering the near infrared windows, centered at 2.3, 1.7 and 1.18 microns, Allen and Crawford [1] in 1983 paved the way for the lower 40km of the atmosphere to be probed remotely from space. This has led Venus Express to carry imaging spectrometers, such as VIRTIS, to make full use of this phenomenon. Some fundamental questions concerning the exact makeup of the atmosphere will be answered by analyzing VIRTIS data.

Data collected from past observations indicate the possibility of current volcanic activity on the surface of Venus. The monitoring of SO₂ at the cloud tops indicate a steady drop in concentration, suggesting a possible source of SO₂ is due to volcanism [2], whilst deep atmospheric values below the clouds suggest a uniform mixing ratio [3]. The analysis VIRTIS data at 2.48 micron window will no doubt shed light on this matter.

Analysis of the micro-window complex at 1.18 microns shows that we can image the surface of the planet in the infrared, whilst negating most of the effects of the atmosphere [4]. We can monitor the surface brightness temperatures to look for hot spots indicative of volcanic plumes, another key goal of Venus Express and VIRTIS.

We have developed a radiative transfer model to analyse Venus Express/VIRTIS data in the near infrared windows. The retrieval model uses the correlated-k distribution method, which incorporates the use of a matrix operator model for multiple scattering. We present initial work on the retrieved trace gas mixing ratios in the lower atmosphere, as well as infrared surface maps, with the view of searching for signs of volcanic activity on Venus.

References

- [1] Allen, D.A., Crawford, J.W., 1984, Cloud structure on the dark side of Venus. *Nature* 307, 222-224
- [2] Esposito, L. 1984, Sulphur Dioxide: Episodic Injection shows evidence for active Venus volcanism. *Science* 223, 1072-1074
- [3] Bezdard, B., de Bergh, C., Fegley, B., Maillard, J., Crisp, D., Owen, T., Pollack, J., Grinspoon, D., 1993, The abundance of sulphur dioxide below the cloud of Venus. *Geophysical Research Letters* 19(2), 151-154
- [4] Hashimoto, G., Imamura, T., 2001, Elucidating the rate of volcanism on Venus: Detection of lava eruptions using near-infrared observations. *Icarus* 154, 239-243