Water vapour in and below the clouds on Venus

C.C.C. Tsang[1], C.F. Wilson[2], J.K. Barstow[2], B. Bezard[3], K. McGouldrick[4], J. Bailey[5], P.G.J. Irwin[2], F.W. Taylor[2], G. Piccioni[6], P. Drossart[3]

[1] Southwest Research Institute, Department of Space Studies, 1050 Walnut St., Suite 300, Boulder, 80302, Colorado, USA
[2] University of Oxford, Atmospheric, Oceanic and Planetary Physics, Department of Physics, Parks Road, Oxford, Oxon, OX1 3PU, U.K.
[3] LESIA, Observatoire de Paris, 5 place Jules Janssen, 92195 Meudon, France
[4] Department of Space Sciences, Denver Museum of Nature & Science, Denver, Colorado, USA
[5] School of Physics, University of New South Wales, NSW 2052, Australia
[6] INAF-IASF, Via del Fosso del Cavaliere, 100 00133 Rome, Italy

One of the striking similarities of the Venus atmosphere with Earth's is the basic meteorological cycle of the clouds. Despite unique differences in composition, height and vertical extent of the Venus clouds, much of the fundamental principles that govern cloud formation, chemistry and convection still dominate, forming the global cloud structure we see today. With the arrival of Venus Express and four years of regular observations of the clouds, we are gaining a fascinating insight into their complex properties and structure.

Here, we present a comprehensive study, both modelling and observational, of nightside 2.3 μm thermal emission spectra from the Visible and Infrared Thermal Imaging Spectrometer (VIRTIS). We have retrieved abundances of tropospheric water vapour (H_2O) and carbonyl sulphide (OCS) in the 30 - 45 km height level. The results suggest either complex dynamical/chemical links between the sub-cloud H_2O and the overlaying cloud layers, or spatially varying concentrations of H_2SO_4/H_2O within the clouds themselves. Both interpretations have important implications for our understanding of the Venus atmosphere.