GALILEO INFRARED OBSERVATIONS OF THE ATMOSPHERE AND SURFACE OF VENUS: THE POTENTIAL FOR VENUS EXPRESS

R. Carlson (1), K. Baines (1), L. Kamp (1)
(1) Jet Propulsion Laboratory, California Institute of Technology
rcarlson@lively.jpl.nasa.gov / Fax: +1 818 393-3218

Near infrared mapping spectrometer (NIMS) measurements obtained during Galileo's brief 1990 flyby show that infrared spectroscopy can be used to study numerous, diverse phenomena and altitude regimes at Venus, ranging in vertical extent from upper atmosphere down to, and including, the surface. To illustrate the great potential of Venus Express we summarize previous NIMS work (Carlson et al., Science 253, 1541, 1991; Special Issue of Planet. Space Sci, 41, No. 7, 1993; Roos-Serote et al, Icarus 114, 300, 1995) and present new analyses of surface and lower atmosphere observations. Venus's upper atmosphere exhibits infrared carbon dioxide and carbon monoxide band emissions formed by resonance scattering of incident solar radiation as well as molecular oxygen band emission of photochemical origin. Thermal emission maps show warm high-altitude polar caps above cooler clouds. Discrete features of unknown cause are evident at mid-latitude cloud top levels. Spectral windows allow infrared sounding of the atmosphere below the clouds and characterization of the lower clouds, which are found to exhibit more spatial structure than higher altitude clouds. Motions of these lower altitude clouds were used to determine Hadley cell velocities while spectroscopic measurements were used to for sounding of carbon monoxide and water in the lower atmosphere below the clouds. Thermal radiation from the surface can be used to generate infrared-derived altimetry and to deduce opacity parameters for high-temperature and high-pressure carbon dioxide.