

Reflectance Properties of Titan's Surface as determined by DISR

S.E. Schröder (1), S. Douté (2), H.U. Keller (1), M.G. Tomasko (3), DISR team

(1) Max-Planck-Institut für Sonnensystemforschung, Katlenburg-Lindau, Germany, (2) Laboratoire de Planétologie Grenoble, Grenoble, France, (3) Lunar and Planetary Laboratory, Tucson AZ, USA (schroder@mps.mpg.de)

Retrieving the properties of Titan's surface is of paramount importance to understanding this mysterious world. The Descent Imager / Spectral Radiometer (DISR) aboard Huygens amassed a wealth of data during its descent through Titan's atmosphere in January last year. More specifically, the Downward Looking Visual and Infrared Spectrometers (DLVS/DLIS) viewed the surface with increasing clarity as the probe approached landing. The analysis of the DLIS data is hampered by the fact that, due to the probe not knowing where it was pointing, for most of the descent the DLIS summed spectra acquired at different azimuth angles on board. However, during two special observing cycles called spectrophotometric maps (4 and 18 km altitude) the DLIS recorded single, unsummed spectra in rapid succession for the duration of about one probe rotation. In addition, single spectra were recorded in the last stage of the descent (below 3 km altitude). These measurements were recorded at a unique azimuth angle, which allows us to calculate the phase angle with which we correlate the observed intensity. Because the atmosphere strongly absorbs at certain wavelengths due to haze and methane, we must take care to disentangle atmospheric from surface contributions. The DLIS spectra reveal that in near-infrared methane windows atmospheric absorption appears to be negligible below 4 km, which allows for the determination of the surface bi-directional reflectance distribution function (BRDF). The retrieved BRDF shows a relative increase of intensity at lower phase angles that is approximately constant with wavelength. Such a constant relative rise can be modeled assuming a certain degree of surface roughness (i.e. shadow hiding), with no intrinsic or coherent backscattering by the surface particles necessary. Spectra acquired by the DLVS show that in the visible wavelength range the atmosphere contributes to the observed intensity all the way to the surface. By comparing how intensity varies with phase angle at different altitudes we can estimate the degree of backscattering by the atmosphere, enabling us to compare the reflectance properties of different types of terrain.