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Topographic shading in Huygens/DISR images of Titan's surface

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During the descent of the Huygens probe in January 2005, its Descent Imager/Spectral Radiometer (DISR) has taken the first close up images of Titan's surface. No *obvious* topographic shading is visible in the images. This was attributed to the fact that the illumination on Titan is very diffuse. However, even a completely isotropic illumination would imply topographic shading. Moreover, although diffuse illumination is dominant in the visible wavelength range on Titan, it is concentrated in a pronounced solar aureole.

The optical properties of the aerosols in Titan's atmosphere have been retrieved from upward and downward looking measurements of DISR visible and infrared spectrometers. Based on these retrievals, we conduct radiative transfer computation to model the atmospheric radiance as seen by the imagers. This modelled radiance is then used to correct the images for the atmospheric contribution. While DISR images of the river bed area originally exhibit a contrast of a few per cent, the corrected contrast of true surface brightness is 10–20 %.

Based on the surface illumination implied by the modelled radiance, we render various digital terrain models to investigate the contribution of topographic shading to the observed contrast. We find that a moderate terrain with slopes of up to 20° yields surface brightness variations which are comparable in magnitude to the observations. We present models for the elevation profile of Titan river beds that can reproduce the observed brightness profiles without assuming local variations in surface albedo, i. e., without any "dark stuff" in the river beds.