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Mapping of Titan surface at high resolution with VIMS/CASSINI hyperspectral images

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The VIMS imaging spectrometer onboard CASSINI provides images of Titan in 352 contiguous spectral channels from 0.3 to 5.1 μm. The infrared domain is particularly useful to image the surface of Titan through the atmosphere, which is completely opaque at visible wavelengths. In this study, the emphasize will be made on the processing strategies for VIMS data in order to improve the surface mapping capabilities, despite the blurring effects of the atmospheric aerosols. Indeed, both spatial and spectral filtering strategies can be applied to the data to help in characterizing Titan surface properties. The spatial dimension provides information about the morphology of surface features, and the spectral information, when combined accurately, allows the mapping of the main compositional heterogeneities. VIMS acquires images of 64x64 pixels using two scanning mirrors. However, it can also operate in single line mode (1x64) using a single scanning mirror, with the second dimension of the image being given by the evolution of the ground track of the satellite ("noodle" mode). This is particularly useful when VIMS is observing within the closest approach period. The first test of this observing strategy was done on 25 October 2006 (T20 flyby). The example of the T20 data, which are so far the best VIMS data in terms of spatial resolution (reaching 500m/pixels at closest approach) will therefore be discussed. Short time exposure are needed to operate fast enough during the closest approach period. We show that the signal quality can be significantly improved in this particular case

by using a series of processing steps such as an optimisation of the dark current removal, a minimum noise fraction analysis, a co-adding of several adjacent spectral channels and the use of band ratios. Infrared images of surface features as small as the dunes can be obtained, which is particularly interesting for the comparison with radar images. Similarly, flow-like features have been mapped, and areas possibly enriched in water ice have been found at the border between bright and dark regions. These processing steps can have implication for the design of the forthcoming flybys both in the nominal and extended mission. The next opportunity for VIMS to observe in this "noodle" mode will be at the end of July 2007 (T34), which will also be presented at the workshop.