SPACE WEATHER IN THE SATURN SYSTEM. F. SCIPIONI[1], P. Schenk[1], and F. Tosi[2], [1]Lunar and Planetary Institute, 3600 Bay Area Boulevard, 77058 Houston, TX – Scipioni@lpi.usra.edu; [2]IAPS/INAF, Via del fosso del cavaliere 100, 00133 Rome, Italy.

Introduction: Water ice is the most abundant component of Saturn's mid-sized moons. However, these moons show an albedo asymmetry – their leading sides are bright while their trailing side exhibits dark terrains. Such differences arise from two surface alteration processes.

The first is due to bombardment of charged particles from the interplanetary medium and driven by Saturn's magnetosphere (e.g. [1]). These particles fracture the surface, forming sub-micron ice particles, and get contaminants implanted in the upper ice layer (e.g. [2]). The second process results from the impact of E-ring particles on the satellites' leading side. The E-ring is composed primarily of pure water ice grains, which originate from Enceladus' southern polar plumes. Tethys, Dione, and Rhea orbit outside the E-ring, while Mimas orbits inside. E-ring ice particles are continuously refreshing the leading hemisphere surfaces of Tethys, Dione, and Rhea, thereby making them bright (e.g. [3] [4] [5] [6] [7] [8]).

Data analysis: Space weather effect translates in a variation of the main water ice absorption bands on the surface of Saturn' satellites. In general, absorption bands will be shallower if the water ice's abundance is reduced, or the ice grains are smaller, or if the ice layer is covered or mixed by some contaminants.

We present here the analysis of data retuned by the Visual and Infrared Mapping Spectrometer (VIMS) onboard the Cassini mission. We focuse on the infrared portion of the spectrum, between 0.8 and 5.1 µm. In this spectral range the main water ice absorption bands are located, at 1.04, 1.25, 1.52, and 2.02 µm.

To understand the degree of surface alteration in the Saturn' system, we will map the variation of the water ice absorption bands at 1.25 and 2.02 µm for five Saturn' satellites, Mimas, Enceladus, Tethys, Dione, and Rhea. In Figure 1 we show the variation of the band at 2.02 µm for Enceladus.

For Dione and Rhea, we will also show the results published by [7] and [8] respectively, about the identification of homogeneous terrain units on their surface. The different terrain types had been identified by applying a classification technique to the spectra of the two satellites. The differences in composition between terrains are all due to the space weather mechanisms acting on the surface of Dione (Figure 2, TOP) and Rhea (Figure 2, BOTTOM).

Results: The variation of the depth of the water ice absorption bands across the surface reflects the different space weather mechanisms acting on them. Terrains where E-ring's ice particles deposit have in general deeper water ice absorption bands, meaning that this mechanisms refreshes that portion of surface. On the other hand, terrains subject just to bombardment of charged particles and micrometeorite gardening have shallower absorption bands. This can be due to and increase in contaminats abundance, and/or to a finer grain size.

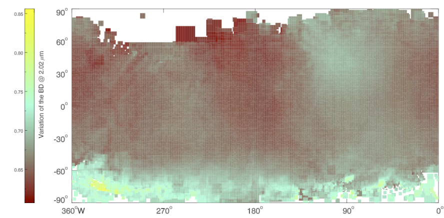

Figure 1: Variation of the 2.02 µm water ice absorption band across Enceladus' surface

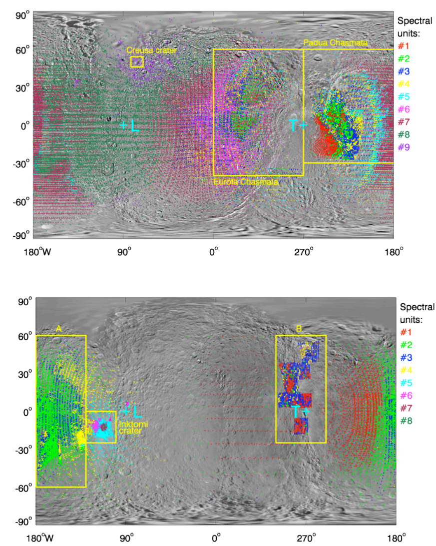

Figure 2: Homogeneous terrain units identified on Dione' (TOP) and Rhea' (BOTTOM) surface by applying the Spectral Angle Mapper classification technique to their VIMS spectra

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