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Mimas: Preliminary Evidence For Amorphous Water Ice From VIMS (*Invited*)

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We have conducted a statistical clustering analysis (1,2) on a mosaic of VIMS data cubes obtained on February 13, 2010, for Saturn's satellite Mimas. Seven VIMS cubes were geometrically projected and re-sampled to a common spatial resolution. The clustering technique consists of a partitioning algorithm coupled to a criterion that prevents sub-optimal solutions and tests for the influence of random noise in the measurements. The clustering technique is agnostic about the meaning of the clusters, and scientific interpretation requires their a posteriori evaluation. The preliminary results yielded five clusters, demonstrating that spectral variability across Mimas' surface is statistically significant. The ratios of the means calculated for each of the clusters show structure within the 1.6-µm water ice band, as well as the shape and the central wavelength of the strong ice band at 2 µm, that map spatially in patterns apparently related to the topography of Mimas, in particular certain regions in and around Herschel crater. The mean spectra of the five clusters, show similarities (band shape and central wavelength) with lab spectra of amorphous and crystalline H2O ice (3) that are suggestive of the presence of an amorphous (or "disordered") ice component in certain regions of Mimas, notably on the central peak of Herschel, on the crater floor, and in faults surrounding the crater. Mimas is too warm to sustain H2O ice in a possibly original amorphous form for the great age of the surface, and its appearance may represent a mixture of both ice phases, or perhaps a layer of disordered ice on a base of crystalline ice. Another possible occurrence of non-crystalline ice appears southwest of Herschel, close to the south pole.
(1) Marzo, G. A. et al. J. Geophys. Res. 111, E03002, 2006.
(2) Marzo, G. A. et al. J. Geophys. Res. 113, E12009, 2008.
(3) Mastrapa, R. M., et al. Astrophys. J. 701, 1347-1356, 2009.

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