Unsupervised Classification of MESSENGER MASC Data

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The MESSENGER spacecraft flew by Mercury as part of its journey to Mercury orbit insertion. The Mercury At-mospheric and Surface Composition Spectrometer (MASCS) observed Mercury during the first two flybys, includ-ing high-spatial-and spectral-resolution visible to near-infrared (IR) spectra of the Mercury surface. The Visible and InfraRed Spectrograph (VIRS) component of MASCS consists of two linear photodiode arrays covering a spectral range 320-1450 nm. We applied classification method to MASCS data in order to extract information on the mineralogy of Mercury. The classification of the Messenger data will permit to obtain maps of Mercury surface, giving us indication of the different mineralogy and maturity present on the Hermean surface.

The data were pre-processed applying photometric correction and the VIS and NIR data were collected in a single spectrum. The data set show very similar featureless spectra. The main differences are in the reflectance levels and in the spectral slopes. To emphasize the spectral differences we have normalized the spectra to an average reflectance spectrum for each flyby. This allows to point out variation of different regions with respect to the aver-age spectral behaviour. Two different approaches have been used to analyze MASCS data of the two Messenger flybys: ISODATA unsupervised classification and a classification based on three different spectral slopes (in the wavelengths' ranges 0.3-0.55, 0.55-0.8 and 0.95-1.49 μm).

The identified classes shows differences linked with slopes and reflectance's level: the proposed methods allows to correlate the most important classes with different morphological features on Mercury's surface which differ for weathering, maturity and composition. Our analysis is done in order to test and verify these classification methods that shall be necessary to analyze similar data harvested by SIMBIO-SYS/VIHI (Visible and Infrared Hyper-spectral Imager) aboard the future ESA's BepiColombo mission to Mercury.