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Color variation on Mercury's surface: results from Messenger data in support to BepiColombo

Francesca Zambon (1), Cristian Carli (1), Fabrizio Capaccioni (1), Valentina Galluzzi (1), Matteo Massironi (2), Pasquale Palumbo (1,3), and Gabriele Cremonese (4)

(1) INAF - IAPS, Roma, Italy (francesca.zambon@iaps.inaf.it), (2) Dipartimento di Geoscienze, Padova University, Padova, Italy, (3) DiST Parthenope University, Napoli, Italy, (4) INAF – Osservatorio Astronomico di Padova

Due to its proximity to the Sun and its hard thermal and radiative environment, for decades Mercury has been one of the least explored planets in the solar system. After the Mariner 10, which carried out only few flybys of the planet, about 37 years passed before the NASA MESSENGER mission entered in orbit around Mercury in March 2011. During four years of operating life, MESSENGER allowed for mapping the entire surface of Mercury at different spatial scales, revealing aspects hitherto hidden, but arising new questions. In this regard, the future BepiColombo mission, whose launch is scheduled in autumn 2018, will answer questions still unsolved. The availability of the data acquired by MESSENGER may therefore be considered an opportunity for the planning and the selection of scientific targets for BepiColombo, and in particular for SIMBIO-SYS (Spectrometer and Imagers for MPO BepiColombo-Integrated Observatory SYStem), the integrated system containing the HRIC (high-resolution imager) and STC (stereo imaging system) cameras and the visible-near-infrared imaging spectrometer (VIHI), dedicated to the study of Mercury's surface.
This work focuses on the results obtained from the color data analysis of MDIS-WAC camera (Mercury Dual Imaging System - Wide Angle Camera) onboard MESSENGER mission, in support of the SIMBIO-SYS instrument. Here, we concentrated on two regions in the northern hemisphere of Mercury: Victoria (21 ° N-66 ° N, 0 ° -90 ° W) and Hokusai (21 ° N-66 ° N, 270 ° -360 ° W) quadrangles. A large amount of data of these areas are available, both in terms of coverage and spatial resolution (up to $\sim$ 200 m/pixel); furthermore, they are characterized by several geological features of interest, such as smooth plains, pyroclastic deposits, crater rays and hollows. From the analysis of selected spectral parameters, like spectral slopes, and using appropriate methods of analysis, i.e. RGB combinations, principal components and classification algorithms, a clear color variation has been observed, likely linked to a compositional variability and/or a different terrain maturity. The aim of this work, however, is not only to show compositional differences between the various features, but also within the same typology of features at different spatial scales. At the same time, comparing the WAC color maps and the geological maps, derived by the MDIS basemaps publicly available, we can verify possible correlations between geological and compositional units. This work, beyond defining the spectral characteristics of large regions and specific features at the local scale, can be of support for SIMBIO-SYS in the identification of appropriate targets of interest.