CROSS-INSTRUMENT COMPARISON OF MERTIS AND MASCS OBSERVATIONS OVER TOLSTOJ BASIN FROM BEPICOLOMBO'S 5TH MERCURY FLYBY. M. D'Amore[1], A. Maturilli[1], A. Van den Neucker[1], O. Barraud[1], D. L. Domingue[2], N. Izenberg[3], Giacomini, L.[4], S. Adeli[1], H. Hiesinger[5]. [1]Institute for Planetary Research, DLR, Rutherfordstrasse 2, 12489 Berlin, Germany (mario.damore@dlr.de), [2]Planetary Science Institute, 1700 East Fort Lowell, Suite 106 Tucson, AZ, USA, [3]Johns Hopkins University Applied Physics Laboratory 11100 Johns Hopkins Road, Laurel, Maryland, USA, [4]IAPS - INAF Istituto di Astrofisica e Planetologia Spaziali. Via del Fosso del Cavaliere 100, 00133, Roma, [5]Institut für Planetologie (IfP), Universität Münster, Wilhelm-KlemmStr. 10, 48149 Münster, Germany.

Introduction: The MErcury Radiometer and Thermal Infrared Spectrometer (MERTIS) on board BepiColombo acquired the first Mercury surface measurements on December 1, 2024, during the 5th Mercury swing-by (MSB#5)[1]. The instrument's TIS channel successfully observed the planet in the 7-14 μm spectral range at a spatial resolution of ~28 km/pixel. The data offers an unprecedented opportunity to cross-validate findings with the Mercury Atmospheric and Surface Composition Spectrometer (MASCS) VIRS channel from NASA's MESSENGER mission, which operated in the visible to near-infrared range (300-1450 nm). This study focuses on the Tolstoj Basin and its surrounding Goya Formation, leveraging laboratory spectral data to connect the two instruments. This work can lead to a boost in both instrument's scientific results, thanks to their complementary nature.

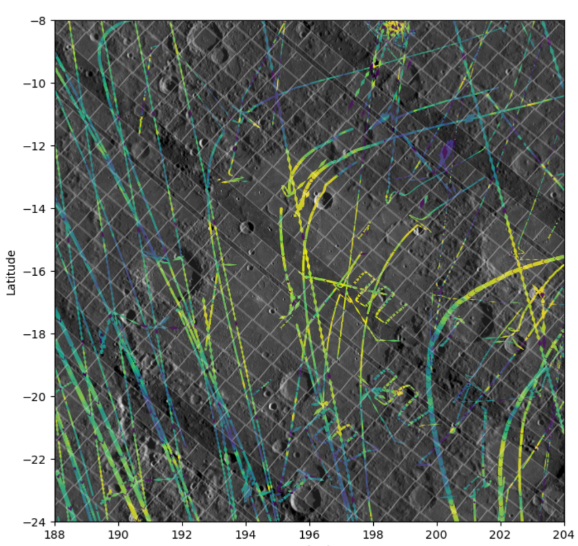

Fig.1*: Pixel stripes from MERTIS/TIS (gray square) and MASCS/VIRS (colored diamonds) over Tolstoj basin. Black bar on the bottom is ~50km. TIS measurement frequency is 100ms, 1 of each 130 observations was filtered to visualize them. VIRS FOV color are proportional to reflectance at 750nm, dark:low/light:high.*

Methodology: This study focuses on comparing and cross-validating data from the MERTIS/TIS on ESA's BepiColombo mission and the MASCS/VIRS instrument on NASA's MESSENGER. Tolstoj Basin and its ejecta blanket (i.e. Goya Formation) were chosen as the target regions due to their contrasting geological features: the bright interior plains of the basin and the low-reflectance material (LRM) of the surrounding ejecta [2,3]. These regions also include several MASCS/VIRS normal operations and targeted observations, offering a wide range of observation geometries for robust comparison. Following the flyby, the DLR team received, calibrated, and geometrically registered the MERTIS data. To align these with MASCS/VIRS observations, the datasets are being spatially clustered using the public DLR database available via the Europlanet/VESPA [4] interface. A novel geometry calculation method was developed for MASCS/VIRS data [5], enabling computation of local observation times. This is crucial for assessing Mercury's surface conditions and ensuring accurate comparison with the MERTIS data. Both datasets are converted to emissivity to isolate surface properties. Laboratory spectra of Mercury-analog materials will be selected to match the spectral characteristics observed by both instruments [6]. This includes comparing emissivity from MERTIS/TIS with reflectance from MASCS/VIRS, under the assumption that reflectance can be approximately converted to emissivity (i.e., Kirchhoff law). While this assumption is valid in laboratory settings where total emitted and reflected radiation is integrated, it does not fully hold in remote sensing settings. To address this, we will compare observations taken under varying local times and geometries to assess potential deviations and validate the results.

Conclusions: This study leverages data from MERTIS on ESA's BepiColombo and MASCS/VIRS on NASA's MESSENGER to cross-validate observations of Mercury's surface. By focusing on the Tolstoj Basin and the surrounding Goya Formation, we explore regions with contrasting surface properties—bright interior plains and LRM. Planned outputs include an evaluation of the spectral compatibility between MERTIS emissivity and MASCS/VIRS reflectance, supported by laboratory spectral data of Mercury-analog materials [6, 7]. The work will also address the validity of converting reflectance to emissivity in remote sensing scenarios, which is crucial for integrating data from instruments operating in different spectral ranges. Emissivity measurements directly probe surface thermal properties, while reflectance provides information on composition and texture. Bridging these two data types allows for a more comprehensive understanding of Mercury's surface characteristics. This is particularly important when combining datasets like MERTIS and MASCS, as it enables a unified analysis of surface materials despite differences in observational methods. These efforts aim to demonstrate the complementary nature of the MERTIS and MASCS observations and provide a foundation for future multi-instrument studies of Mercury's surface composition and properties and can increase both instrument's scientific results.

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