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Ganymede from 2D to 3D: A multidisciplinary approach in preparation for JUICE. Preliminary results.

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The research project: "*Ganymede from 2D to 3D: A multidisciplinary approach in preparation for JUICE*", was selected in 2019 in the framework of an "INAF Mainstream" call. This work aims to show the potential of a multidisciplinary data analysis approach in anticipation of the JUICE mission.

We focus on three instruments carried onboard the ESA JUICE mission, where Italy's National Institute for Astrophysics (INAF) is involved: the optical camera (JANUS), sensitive to the 0.4-1.0 μm spectral region [1], the VIS-NIR imaging spectrometer (MAJIS), operating in the overall 0.5-5.54 μm spectral domain [2], and the radar sounder (RIME), operating at 9 MHz (33.3 m) [3]. This project is important to prepare combined analysis techniques and models that could be applied to a larger number of regions of interest that will be observed by JUICE in the 2030s, when data of the icy Galilean moons will be finally acquired. Here we show regions of interest on Ganymede that are most promising for a multi-sensor data analysis, first of all by combining optical images acquired by the Galileo/SSI framing camera and by the Galileo/NIMS imaging spectrometer with good spatial resolution. Unfortunately, topographic information is currently not available for most of the Ganymede's surface. However, we built a synthetic topographic dataset for the Nippur Sulcus region based on the existing high-resolution optical images, which could be representative of topographic models that will be obtained in the future by means of JUICE data. We process such a synthetic topographic dataset with a self-similar clustering method [e.g., 4] able to model how the fractures are distributed not only on the surface, but also inside the icy crust.

In the near future, this synthetic topographic dataset will also be used to apply a code able to simulate radar echoes coming from the radio waves investigation of Ganymede's subsurface, which was successfully tested on Mars by means of the MARSIS radar data [5].

Among other things, the study of specific regions of interest on Ganymede is key to drive the planning and prioritization of the observations to be carried out by multiple JUICE instruments, especially during the dedicated Ganymede orbit phase, which will be the final and salient phase of the entire mission.

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