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Improved High Resolution Controlled Enceladus Atlas derived from Cassini-ISS Images

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1. Introduction

The Cassini Imaging Science Subsystem (ISS) acquired 684 high-resolution images (< 1 km/pixel) of Enceladus during its tour through the Saturnian system since 2004. We have combined these images with lower-resolution Cassini images to produce a new high-resolution global controlled mosaic of this moonf Enceladus. This global mosaic is the baseline for the high-resolution Enceladus atlas that consists of 15 tiles mapped at a scale of 1:500,000. The nomenclature used in this atlas was proposed by the Cassini imaging team and was approved by the International Astronomical Union (IAU). The whole atlas is available to the public through the Imaging Team's website [http://ciclops.org/maps].

2. Data Processing

The image data processing chain consists of the same steps as described in [1]: radiometric calibration, geometric correction, map projection, and mosaicking.
Spacecraft position and camera pointing data are available in the form of SPICE kernels [(http://naif.jpl.nasa.gov]. While the orbit information is sufficiently accurate to be used directly for mapping purposes, the pointing information must be corrected by photogrammetric bundle adjustment. Here, a 3-D control net was set up to correct errors in the nominal camera pointing data. The network consists of about 36,000 image coordinates collected in 209 NAC images. The image coordinates, the resulting ground points (3D points), and the camera pointing angles were treated as unknowns and the spacecraft orbit was fixed during adjustment. In result we obtained improved camera pointing angles and about 7,000 adjusted ground points with average 1σ errors of ~20 m, ~20 m, ~40 m for the x, y, z coordinates, respectively. Unfortunately, the ground points are not equally distributed over Enceladus' surface due to missing stereo data in the Northern part of Enceladus. The coordinate system adopted by the Cassini mission for satellite mapping is the IAU "planetographic" system, consisting of planetographic latitude and positive West longitude. The surface position of the prime meridian as defined by the IAU cartography working group [2] is coincident withdefined by the small crater Salih. New values for the rotational parameter W_0 which defines the location of the prime meridian at Jan 1, 2000 were calculated based on the high-resolution mosaics to be consistent with this definition [3] and approved by the IAU [2].

3. Enceladus map tiles

The Enceladus atlas was produced in a scale of 1: 500,000 and consists of 15 tiles that conform to the quadrangle scheme proposed by Greeley and Batson [4]. The Cassini

imaging team proposed 62 names for geological features, in addition to the 22 features already named by the Voyager team that are used in the maps. By international agreement, the features must be named after people or locations in the medieval Middle Eastern literary epic “The Thousand Nights and a Night”. Quadrangle 06 in Mercator projection is shown in Figure 1 as an example.

Reference

[1] Roatsch, T. et al.., 2006, Mapping of the icy Saturnian satellites: First results from Cassini-ISS, Planetary Space Sciences 54, 1137 – 1145.

[2] Archinal, B. et al., 2011, Report of the IAU Working Group on Cartographic Coordinates and Rotational Elements: 2009, Celest. Mech. Dyn. Astr. 109, 101–135

[3] Roatsch, Th., Jaumann, R., Stephan, K., Thomas, P.C., 2009b, Chartographic Mapping of the Icy Satellites Using ISS and VIMS Data, in Saturn from Cassini-Huygens, edited by Dougherty, M.K., Esposito, L.W., Krimigis, S.M., 763-782, Springer, NY

[4] Greeley, R. and Batson, G., 1990, Planetary Mapping, Cambridge University Press.

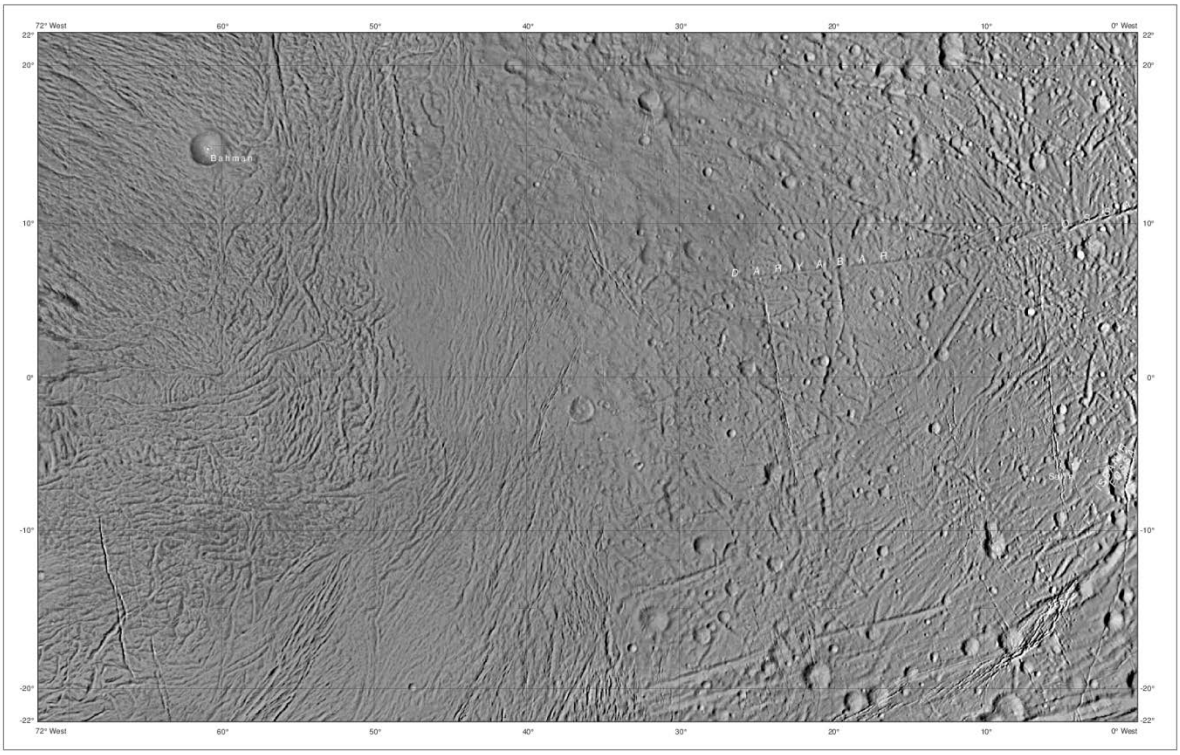

Figure 1: Quandrangle 06 of the Enceladus atlas