John R. Weirich
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Assessment of Dione

This document contains products used to assess the quality of the Dione global DTM in this bundle. Dione has an imaging campaign that approaches ideal at many locations near the equator, but would be classified as sufficient at the poles. See Weirich et al. (2022) for definitions of a sufficient and ideal image set. Details of the assessment data found in document/productdescription.pdf should be read before proceeding. Taken as a whole, the assessment data indicates the uncertainties given in the product description are good. Furthermore, the imaging campaign for Dione indicates that higher resolution regional models can be generated in many locations. Most of these locations already have maplets with a higher resolution than the global DTM, and for about a third of the global the imagery supports generating even higher resolution maplets than those already present. Note that the assessment products should be used as a guide to understand the quality of the DTM.

The accuracy of topography generated by SPC has been well-tested, but the relative albedo has not. If the quality of the albedo data is in doubt, a comparison with spacecraft images would be required before considering it as valid. When there is a limited imaging campaign such as Dione's, there will be aliasing of topography into the albedo channel. Additionally, unmasked shadows can contribute to the darkening of the albedo. This darkening can be expressed as directional asymmetry in craters, especially near the poles. Where there is significant aliasing there is error in both the albedo and topography. The albedo artifacts, and thus the topography, could be improved with additional viewing geometries, but this data is not available.

Below are figures of the assessment data, along with a short exposition on the quality of each. Figures of radius and albedo are included. All figures shown here are available in the bundle as digital files that can be used for quantitative purposes. For assessment figures, the grayscale progression has been adjusted so brighter regions always represent better quality data.

Figures of the assessment data with more detailed explanation are below.

Dione

Spacecraft Imaging Campaign

BEST IMAGE RESOLUTION
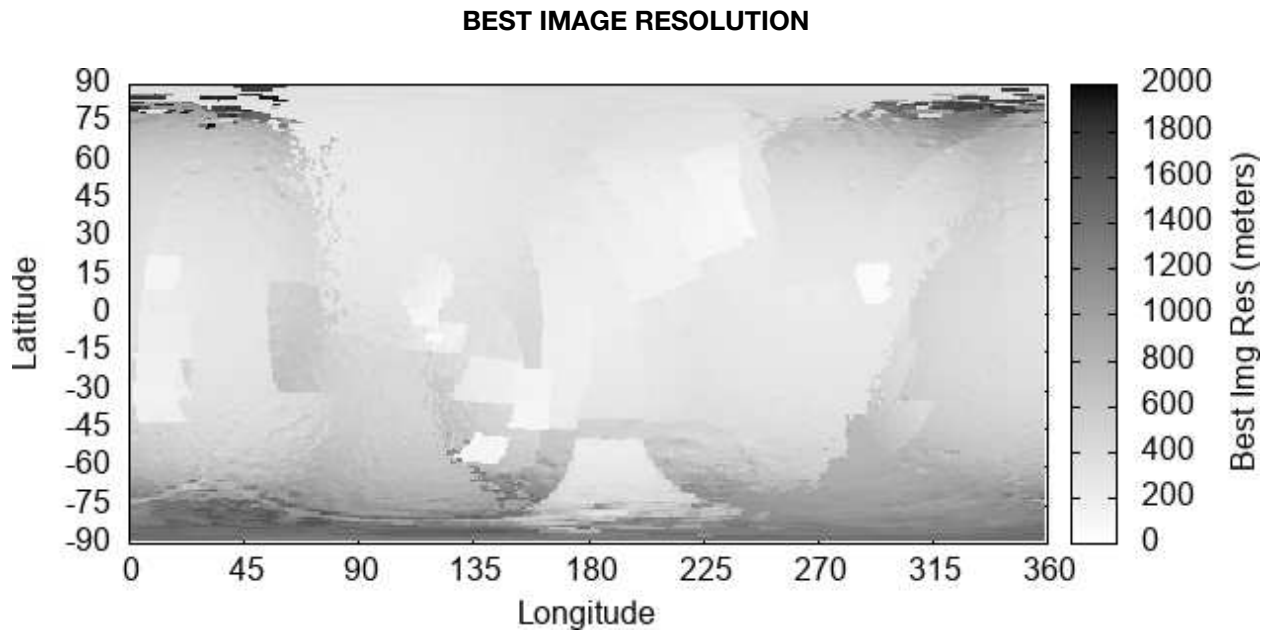
This figure presents the same information as dione_bestimg_c.cub. The worst image resolution is ~1990 m/px and occurs near -75° latitude and 35° east longitude. The best image resolution is ~40 m/px and occurs near -10° latitude and 120° east longitude. Nearly all of Dione (~99%) has been imaged at ~1580 m/px or better matching the GSD of the Q=512 global DTM. ~1500 m/px is the brightness at -80° latitude 45° east longitude, anything darker has images with a worse resolution than the Q=512 model. In these darker areas the Q=512 model has an effective resolution equivalent to the best image resolution, not that of the GSD of the model. Hence the topography data of the Q=512 model is oversampled in the dark areas. The Q=128 model, with a GSD of 6.3 km, has a best image resolution better than the model GSD everywhere, so it does not oversample the topography data anywhere.
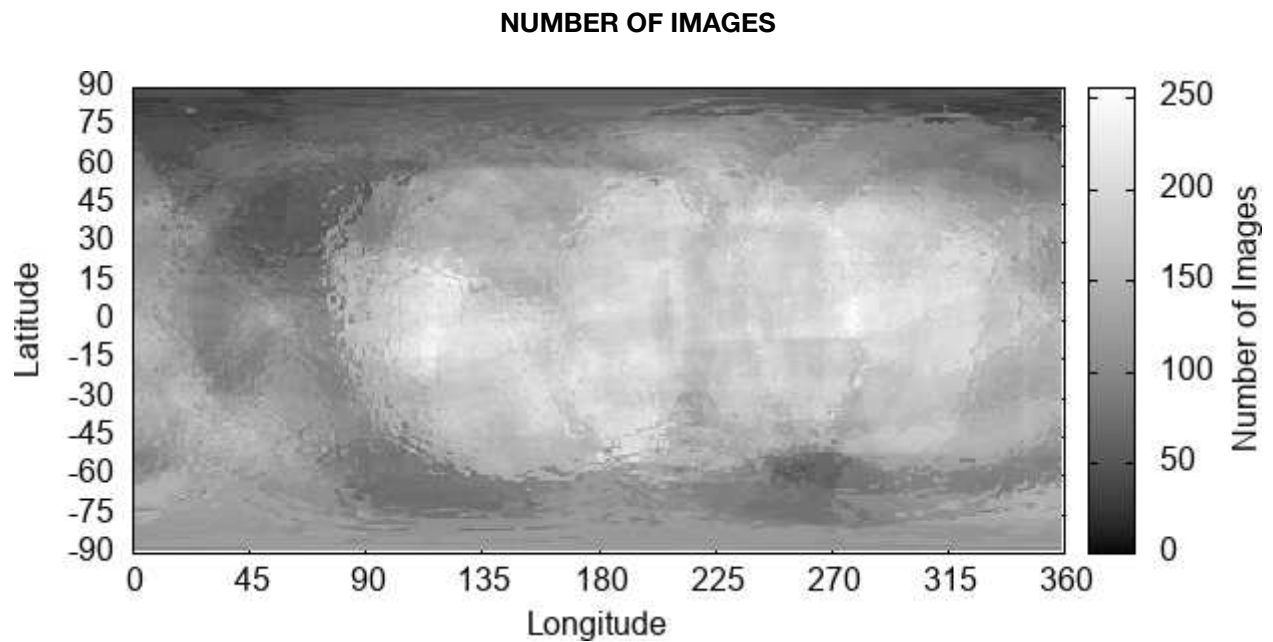
NUMBER OF IMAGES

This figure presents the same information as dione_numimg_c.cub. Number of images is everywhere greater than 28, and usually (i.e. ~98% of the surface) greater than 40. The number of images give confidence to the estimated radius uncertainties. Note that this data product only counts images that are better than 3300 m/px, and reports pixels with more than 255 images as 255 (i.e. off scale).

Global DTM Assessment

BEST MAPLET RESOLUTION
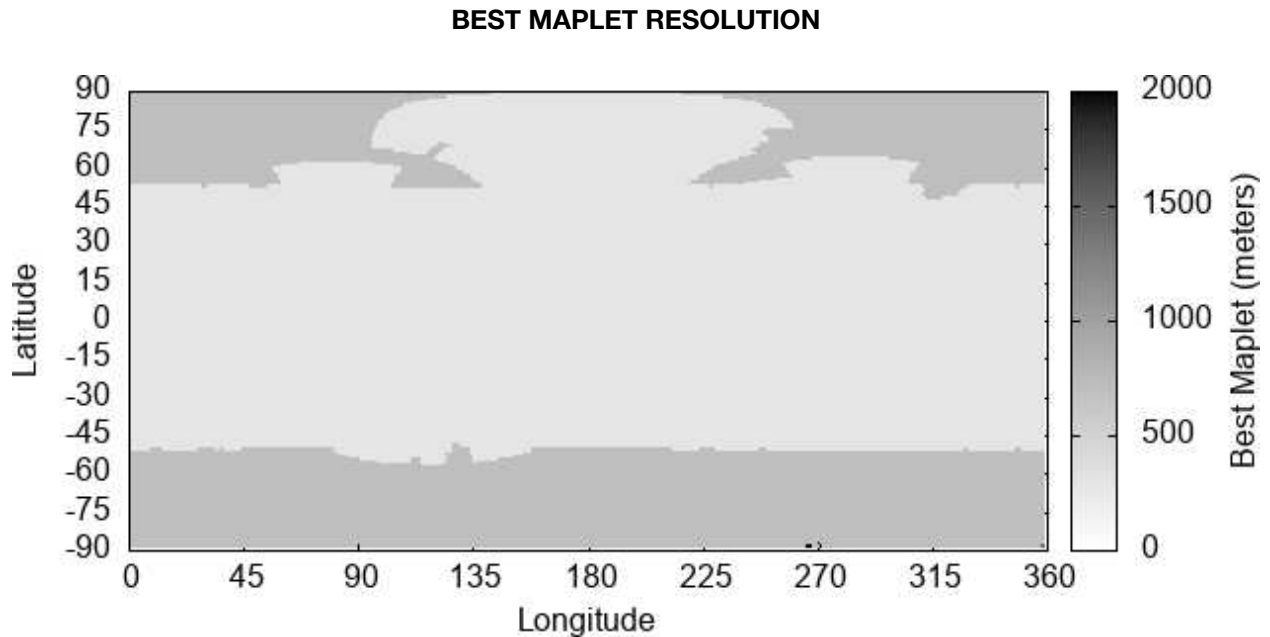

This figure presents the data in dione_bestmap_c.cub. Dione is covered by maplets with a GSD of 300 m along equatorial, mid-latitude regions, and a portion near the north pole, and 700 m over the whole globe. The graphic above has black pixels at the poles which indicate a higher (i.e. worse) GSD, though this is only a sampling gap. The best maplet resolution is everywhere more than ~2 times better than the Q=512 global model, indicating that the maplet resolution is not the limiting factor for uncertainty.

SIGMAS
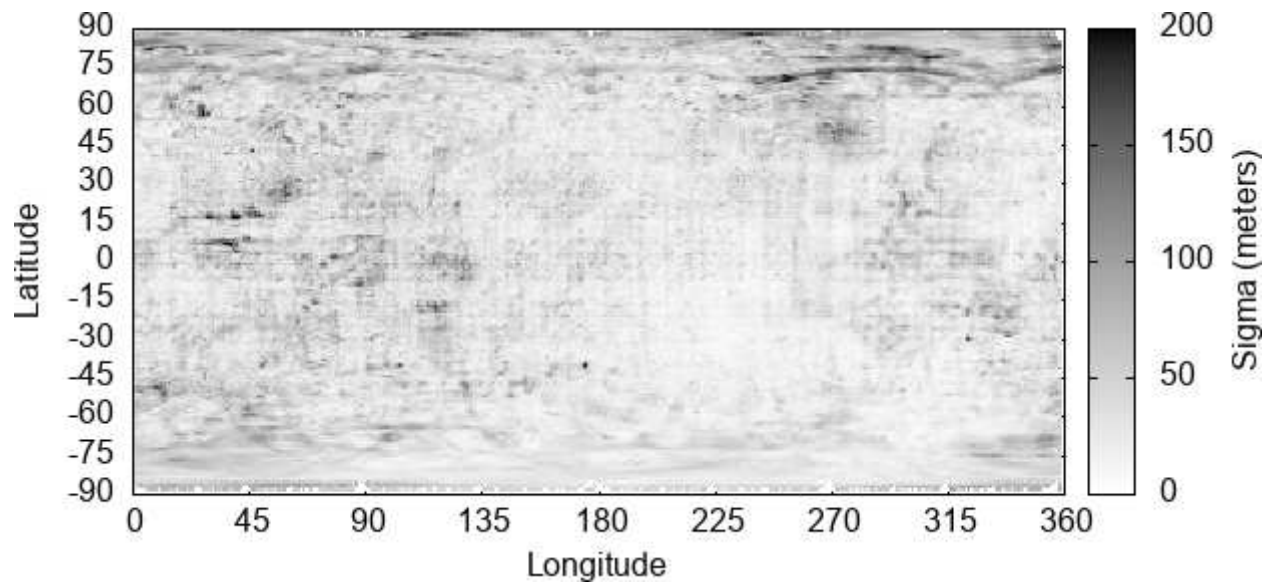
This figure presents the data in dione_sigmas_c.cub. The worst sigma is ~258 m (note the color bar stops at 200 m), which is significantly less than the GSD of the Q=512 model, and the vast majority (~99%) of the model has a sigma better than 158 m, which is one-tenth the GSD of the Q=512 model. These values indicate the maplets agree to a high confidence level. **Sigmas everywhere are good for the global model, hence the reasons for higher sigmas in various regions are outside the scope of this project.** Data gaps at the poles of this graph are due to the projection as there is complete coverage of the body.

Global DTM Values
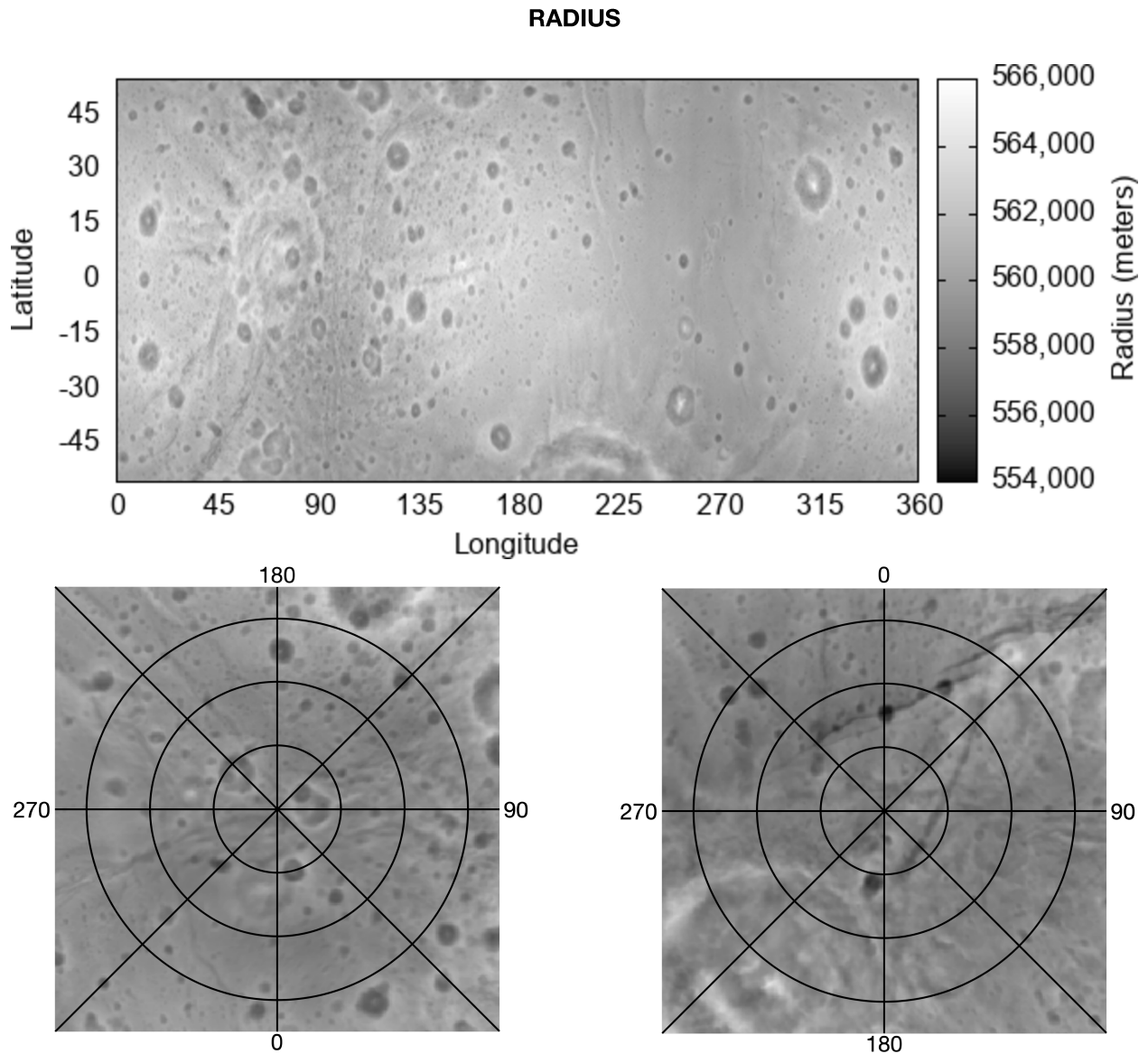
RADIUS

Top: This panel presents the data in dione_eqradius_c.cub, dione_eqradius_g.tif.
Bottom: The left panel presents the data in dione_npradius_c.cub and dione_npradius_g.tif, while the right panel presents the data in dione_spradius_c.cub, and dione_spradius_g.tif. Circles indicate 80, 70, and 60 degrees latitude. The brightness scale is similar to the top panel.

RELATIVE ALBEDO
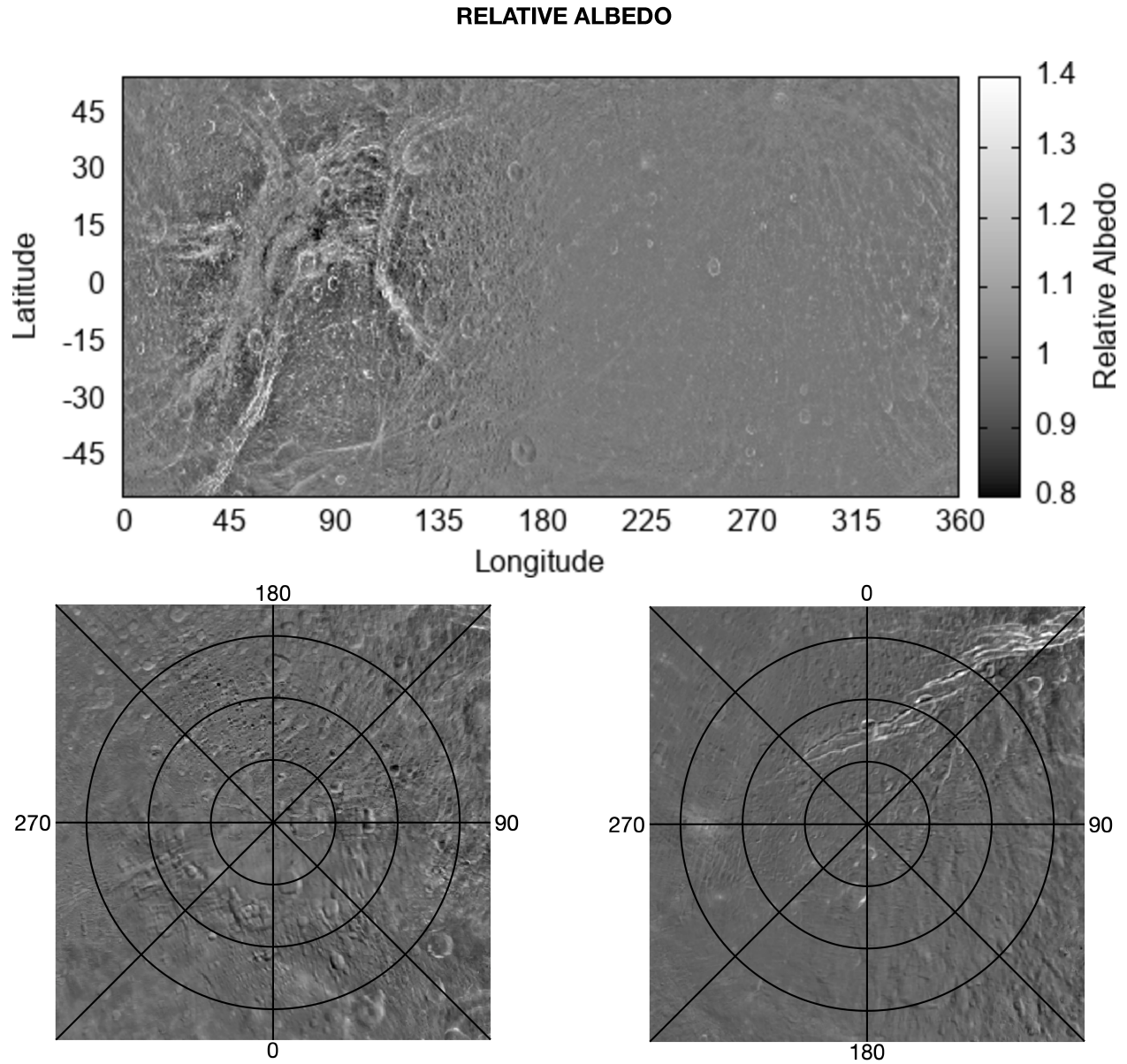
Top: This panels presents the data in dione_eqalbedo_c.cub and dione_eqalbedo_g.tif.

Bottom: The left panel presents the data in dione_npalbedo_c.cub and dione_npalbedo_g.tif, while the right panel presents the data in dione_spalbedo_c.cub, and dione_spalbedo_g.tif. Circles indicate 80, 70, and 60 degrees latitude. The brightness scale is similar to the top panel.

Due to the limited imaging campaign there may be aliasing of topography into the albedo channel.