MRD 195 Density Model for Internal Structure

Data Product Overview
The "density model for internal structure" data product models the internal mass distribution of the asteroid represented as an internal density distribution.

Overview
This data product is used for sample site selection (safety) science value, and long-term science.

This data product is, by definition, not unique and thus there may be more than one model for the internal density distribution of the body, and potentially more than one set of descriptive products for this. These models will, fundamentally, consist of data tables providing the location and geometry of each constant density element within the asteroid.

It should be noted that the reason there may be several equivalent models of the internal density distribution is because we can't directly measure the density distribution on OSIRIS-REx. The technique used to create this data product (algorithm outlined here) estimates possible internal density distributions that create the observed gravity field. However, as mentioned above, this process is not unique so that multiple internal density distribution models can reproduce the same observed gravity field. All possible candidates will be produced.

Inputs:

Asteroid Shape Model [Shape model (MRD-123)]

Mass Model [Asteroid Mass Model (MRD-133)]

Gravity Field

Spin State [Pole location (MRD-127), wobble (MRD-128) and rotation period (MRD-129)]

This product is derived purely from other data products, and as such doesn't directly use any observations. It can be produced during all phases of the DRM whenever updates to the input data are received.

Time to produce varies from hours to days, depending on the specific algorithm used. See the Algorithm Description for Asteroid Density.

Data Product Structure and Organization
This data product is delivered as an ASCII file. There will be multiple files, depending on what algorithms are chosen and used.

Data Format Descriptions
The header information will detail which input products were used to generate this data product.

The data format is described in the RSWG SIS.

Data Product Generation

Algorithms for this approach are still being developed, although some already exist in the literature. Two relevant approaches are described in:

D.J. Scheeres, B. Khushalani and R.A. Werner. 2000. “Estimating Asteroid Density Distributions from Shape and Gravity Information,” Planetary and Space Science 48: 965–971.

Y. Takahashi and D.J. Scheeres. “Small Body Surface Gravity Field Estimation from Orbit Determination,” invited paper presented at the 34th Annual AAS GN&C Conference, Breckenridge, Colorado, February 2011. Paper AAS-11-053.

Further approaches are being developed under OSIRIS-REx support to the RS team.

The inputs to this algorithm are listed above.

Multiple versions of the product will be generated as more/new inputs become available, and as time passes. At any given time, however, there will be one official version of the data product for each model chosen. The cadence will vary as it depends on when new data appears, and how long it takes to process said data.

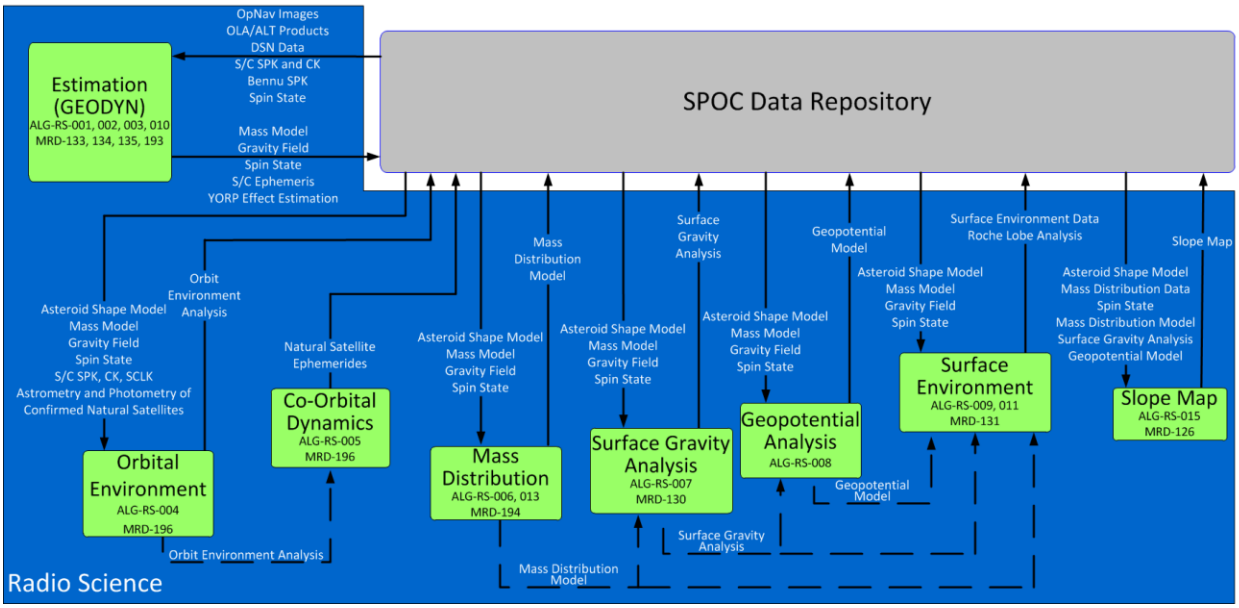
The algorithm which produces this data product is discussed here.

Data Product Validation

Verification will be ascertained by comparison with legacy computations and analyses, with known models and analytically derived results.

Data Flow

In the current RSWG data flow diagram, shown below, the generation of this data product can be found in the fifth box from the right.



Data flow for this data product is simple: inputs come from the SPOC (or directly from other RSWG algorithms), go through our algorithm, and the data product is produced.

The file size for this product can be fairly large, but depends on the specific algorithm chosen.

Standards used to generate data product
Each specific algorithm makes different assumptions about constant density regions and distributions. These assumptions will be clearly listed in the header.

Data is stored as ASCII.