MRD 183a- Dust Cover Index

Data Product Overview

The dust cover index (DCI) is a measure of the spatial distribution of surfaces on Bennu having a thermal infrared spectral signature indicative of the presence of fine particulates (less than ~65 µm). Global and site-specific maps of this value are derived from binned and averaged values of the dust cover index, which is calculated from OTES emissivity spectra (the average emissivity over a specific spectral range, default 1400 - 1350 cm^-1, approximately 5 OTES channels). The heritage for the dust cover index is a product first published by *Ruff and Christensen* [2002].

Overview

OTES spectra from Detailed Survey and Reconnaissance phase observations will be processed to calculate the strength of a spectral parameter indicative of the dominance of fine particulates in the upper few 10s - 100s of microns of the surface of Bennu. These data will be mapped at TBD resolution and projection to produce dust cover index maps, which will be an input to the global and site-specific Sampleability maps. Producing the spot products will require that OTES emissivity data are available (along with reconstructed geometry) and have been processed to calculate the DCI and standard deviation for each spot. At present, we expect that getting to that stage may take up to four days, including validation. Map-making requires the selection of data (i.e., a database query), binning, plotting, and validation. A conservative estimate would add up to two full days for making maps once processed OTES data are available (for a total of approximately six days).

Data Product Structure and Organization

Dust cover index values (and the associated standard deviation) are stored as described below and in the SAWG SIS (for PDS products).

Data Format Descriptions

DCI values will be archived in the PDS in HDF format according to the algorithm description page and SAWG SIS. The DCI values and standard deviations returned to the SPOC database will be in the format below and the version of the DCI software used will accompany the spectra. The spacecraft clock time (sclk) will be used to associate the DCI values with the predecessor data (e.g., emissivity, calibrated radiance) and other ancillary information in the database (e.g., geometry).

Data Product Generation

Processing of OTES emissivity spectra will produce spot values for DCI along with the standard deviation. Davinci is the software package/programming language in which the DCI algorithm has been written. This software will be installed on the SPOC system for use on relevant spectral data processing. At present, the default processing values for the DCI will be: starting wavenumber = 1350; ending wavenumber = 1400. (Users wishing to test the effects of non-default values will have access to the DCI algorithm via the Davinci data processing software and will be free to generate their own DCI product for personal use.)

Required inputs for calculating spot values are:

- OTES spot emissivity data
  - Two-dimensional floating-point array
- Starting wavenumber range for calculation (algorithm default = 1350)
- Ending wavenumber range for calculation (algorithm default = 1400)

The format of the final map products produced using these spot values is described in a separate "map Data Product Description", currently in progress (March 2016).

Co-I Hamilton has been assigned to this product.

Data Product Validation

Data processing at each step is rapid (<1 sec/spectrum), but validation for science requires human examination; e.g., to verify that there is no evidence of anomalous values in the data (e.g.,unrealistic values >1.0). The validation step (at a high level) can be done at a rate of a few seconds/spectrum.

Data Flow

OTES spot emissivity spectra will be retrieved from the SPOC and run through the DCI algorithm to produce the spot DCI and standard deviation values.

Observation Requirements

DCI values will be generated for OTES spectral data having target temperatures greater than a TBD value acquired in the Detailed Survey and Reconnaissance phases. For the DCI data to meet the expected areal coverage and spatial resolution requirements, the spacecraft must be within the stated delivery uncertainty of the range, latitude, and longitude. The TBD temperature value will be determined from the observed data quality at Bennu, but will coincide with all or a

subset of the "dayside" data. (Temperature dictates SNR, and point-to-point noise in excess of the observed range of emissivity values will produce useless index values.)