OMMYDAGEO README

1. Overview

OMMYDAGEO is a merged A-Train product designed for users of the Level II MODIS and OMI aerosol data. This product co-locates pixel geo-locations from the Moderate Resolution Imaging Spectroradiometer (MODIS) on Aqua at 3 and 10 km resolutions onto the orbital track of the Ozone Mapping Instrument (OMI), which flies on board the Aura satellite. Aura and Aqua are sun synchronous, earth observing satellites in the NASA A-Train. A schematic of the A-Train is shown in Fig. 1. This constellation of polar orbiting satellites collects near simultaneous measurements of atmospheric parameters along the same orbital track.

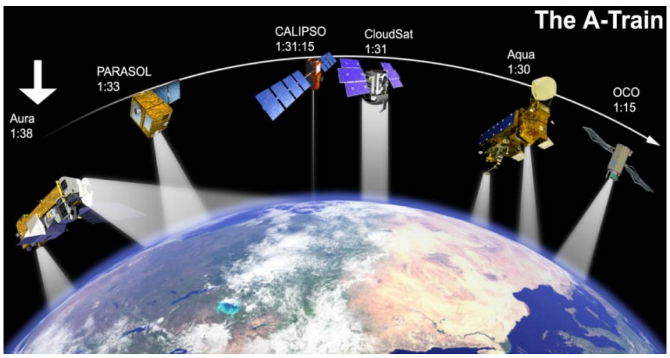

FIG. 1 The NASA A-Train

The co-location of measurements from two different orbiting satellites represents a time-consuming step of spatio-temporally matching pixel locations from data sets (SDS) collected from two different satellites. This product allows users to more readily design studies for directly comparing aerosol measurements from MODIS and OMI.

2. Co-location algorithm

The co-location algorithm applies a crossing number methodology to determine whether or not a given MODIS pixel center falls inside of the geometrical boundaries defined by the OMI pixel. This methodology requires that the boundaries of the pixel be known but can in general be applied to any N-sided polygon.

The boundaries of the OMI pixel are defined by the corner points provided by the OMI pixel corner product (OMPIXCOR). OMPIXCOR provides corner latitude and longitude coordinates corresponding to two flavors: 1) non-overlapping (i.e., tiled) – boundaries separating adjacent pixels do not overlap and 2) overlapping – includes 75% of the energy in the along-track field of view. This product assumes that the pixels overlap and uses the corner coordinates corresponding to 2). OMPIXCOR also provides the four corner points for the three different fields of view (FOV): UV1, UV2 and VIS. The VIS window is used for this application.

The line-crossing algorithm assumes that the OMI FoV corners are connected by straight lines, not geodesics (i.e., lines drawn on a curved surface). These lines form a pseudo-rectangle when projected onto the Earth's surface. The OMI pixel corners also determine a sample space around the OMI pixel. The sample space, as shown in FIG. 2, is defined along constant latitudinal and longitudinal boundaries by the minimum and maximum corner latitude and longitude values. The sample space effectively limits the testing of MODIS pixels to a small subset of points within the MODIS granule.

The line crossing method selects a test point that is defined just outside of the sample space. A test ray is then defined by the line connecting the center of each MODIS pixel to the test point, see Fig. 2. The line crossing test decides whether the points are inside the pixel boundaries by counting the number line crossings that occur between the test ray and the boundaries of the OMI pixel. If the number is odd then the MODIS pixel is co-located with OMI, and if the number is even number pixel is excluded from the statistics.

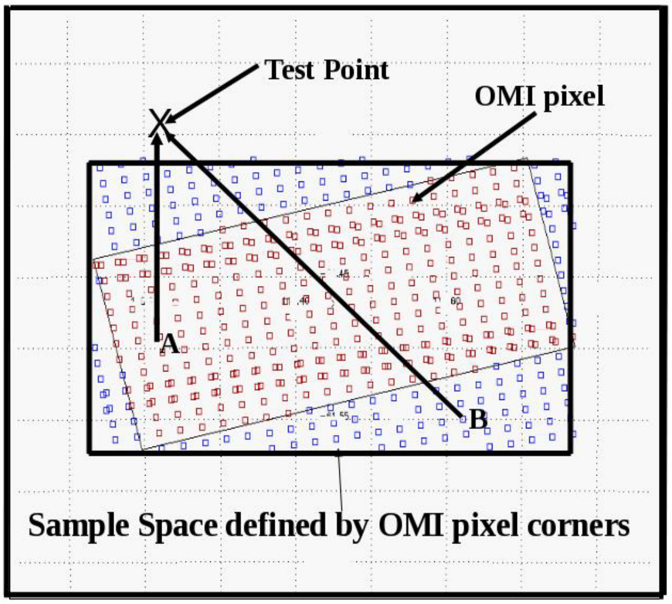

Fig. 2 - *Illustration of the sample space generated from the OMI pixel corner product. The sample space is defined by the minimum and maximum values of the pixel corner geolocations. The OMI pixel is embedded in this space. All of the MODIS pixels existing in this space are tested to see if they fall within the boundaries of the OMI pixel. Pixels outline in red were found inside, whereas those in blue were determined to be outside.*

3. Product Details

In OMMYDGEO, the OMI orbit is portioned into as 5-minute data chunks along the ascending portion of the OMI orbit corresponding to the MODIS granules. The HDF file is subdivided into three swaths corresponding to MODIS3km fields, MODIS10km fields and OMI fields (FoVArea, latitude, longitude and time). The data fields in each MODIS swath provide users with the OMI row index, OMI scan index and the distance between the MODIS and OMI pixel centers (in kilometers) for every MODIS pixel. With this information, users can easily match MODIS coordinates to a point inside the OMI pixel. A 3km cloud fraction estimated using a 500 m cloud mask is also provided.

The organization of the scientific data sets for each swaths are shown in FIG. 3. The OMI orbit is portioned into 5-minute data chunks along the ascending portion of the OMI orbit corresponding to the MODIS granules. The data is co-located on the MODIS granule to ensure one-to-one correspondence between the MODIS and OMI pixels and for computational efficiency. OMMYDCLD provides a direct intermediary link between MODIS and OMI pixels, preserving all of the coordinate information between the two satellites.

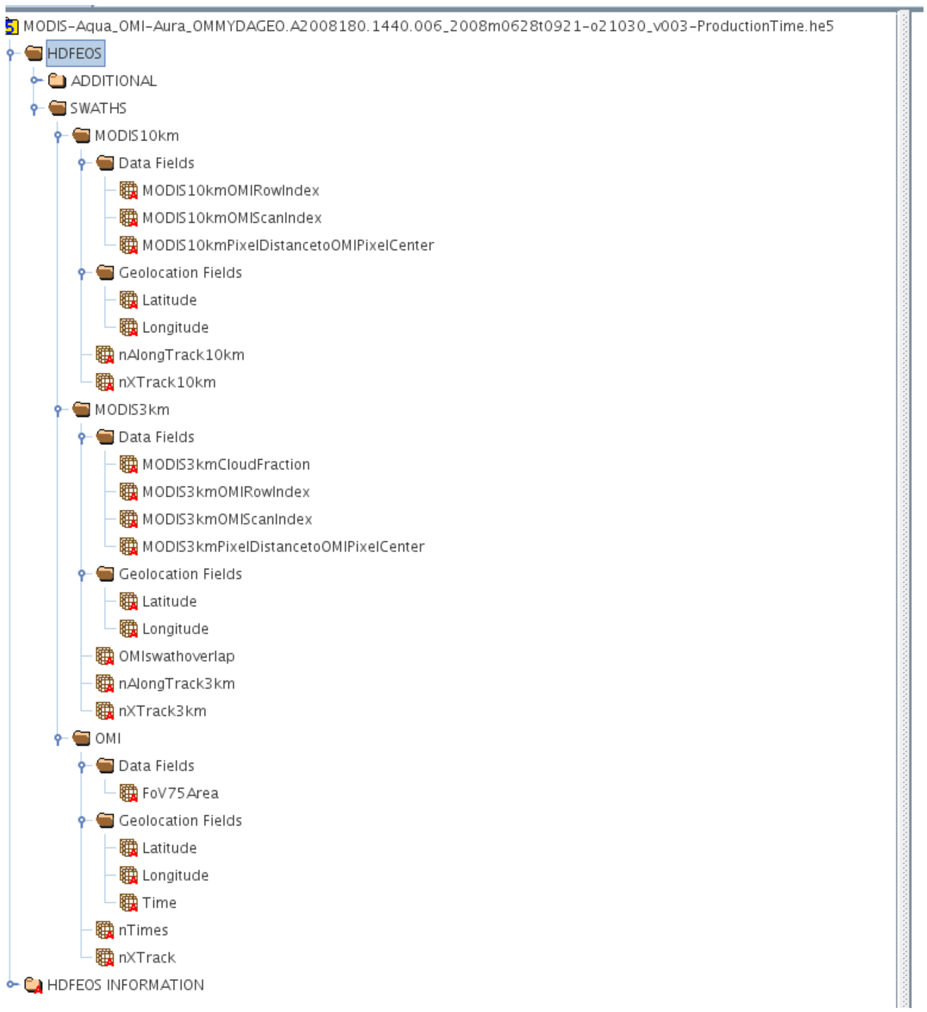

FIG. 3 Organizational structure of OMMYDAGEO

4. References:

Shimrat, M., *Algorithm 112, Position of Point Relative to Polygon*, CACM, p. 434, August 1962.

Badouel, Didier, *An Efficient Ray-Polygon Intersection, Graphics Gems* (Andrew S. Glassner, ed.), Academic Press, pp. 390-393, 1990.

Kuruso, Thomas, *OMPIXCOR README FILE*, Dec. 6, 2010: https://disc.gsfc.nasa.gov/uui/datasets/OMPIXCOR_V003/summary?keywords=Aura#documentation

Ozone Monitoring Instrument Team, Ozone Monitoring Instrument (OMI) Data User's Guide, Jan. 5, 2012: disc.sci.gsfc.nasa.gov/Aura/additional/documentation/README.OMI_DUG.pdf