OMI Level 3 OMUVBd README File

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OMUVBd High Level Overview:

This is the main program for the OMI (Ozone Monitoring Instrument) OMUVBd Product Generation Executive (PGE). The OMUVBd PGE creates the OMUVBd data product, which is the primary Level 3 (L3) surface UV irradiance and erythemal dose product of the OMI Science Team.

The OMUVBd PGE creates a (Total Ozone Mapping Spectrometer) TOMS-like daily L3 gridded data product file from (as many as) three consecutive OMUVBG daily Level 2G (L2G) gridded data product files, where each OMUVBG file contains 24 consecutive UTC hours of OMUVBG orbital Level 2 (L2) swath data subsetted onto a 0.25-degree by 0.25-degree grid in longitude and latitude.

A TOMS L3 day is defined as the ensemble of all L2 ground pixels with pixel centers that have the same local calendar date on the ground. There are two reasons behind such a definition. First, a TOMS L3 day provides complete coverage of Earth, since every point on Earth (outside of polar night) experiences daylight on each calendar date (in comparison, 24 consecutive UTC hours of OMI observations do not completely cover Earth). Second, the TOMS L3 day puts the discontinuity (i.e., where the L2 observations within a given day differ by almost 24 hours) at +/-180 degrees longitude, and, thus, the discontinuity can be placed undistractingly along the extreme left and right edges of several commonly used map projections.

The calendar date of the TOMS L3 day is the calendar date at Greenwich midway through the TOMS L3 day, and is specified via the L3 day of year parameter in the PCF (Process Control File) of the OMUVBd PGE. Note that some of the L2 observations at the beginning of a TOMS L3 day will correspond to the previous calendar date at Greenwich, and some of the L2 observations at the end of a TOMS L3 day will correspond to the next calendar date at Greenwich. Consequently, data from three consecutive OMI L2G files are required to fully populate the L3 grid at all longitudes for any given TOMS L3 day.

Adopted OMUVBd Grid:

The adopted L3 grid is a 1.0-degree by 1.0-degree grid in longitude and latitude. The dimensions of the grid are 360 by 180. The center of the first grid cell is located at longitude -179.5 and latitude -89.5. The center of the final grid cell is located at longitude 179.5 and latitude 89.5. The center of the grid itself is located at longitude 0.0 and latitude 0.0, and corresponds to the corners of four grid cells.

The grid and data format of the OMUVBd product files are consistent with NASA document number NASA/TM-2000-209896 entitled "Total Ozone Mapping Spectrometer (TOMS) Level-3 Data Products User's Guide" by R. McPeters, P.K. Bhartia, A. Krueger, J. Herman, C. Wellemeyer, C. Seftor, W. Byerly and E.A. Celarier.

OMUVBd Gridding Algorithm:

The values in the OMUVBd data product file for each L3 grid cell are weighted averages of the OMI L2 observations that 1) survive several exclusion criteria, and 2) overlap spatially with the L3 grid cell. The weights are based upon the fractional area of overlap of each L2 observation with the L3 grid cell.

The overlap between an L2 observation and an L3 grid cell is determined in a manner consistent with the document entitled "Total Ozone Mapping Spectrometer (TOMS) Level-3 Data Products User's Guide" mentioned above.

The L2 observation exclusion criteria are summarized here in sequence.

Let l3_tnoon be the time at noon UTC for the TOMS L3 day, and let l2g_time be the L2 observation time.

A1) As a rough first cut, L2 observations made outside of the 48-hour time interval centered at l3_tnoon are excluded. Thus, L2 observations with

l2g_time < l3_tnoon - (24 hours - 15 minutes)

or

l2g_time >= l3_tnoon + (24 hours - 15 minutes)

are excluded.

At any given moment, all points on Earth between the longitude of midnight and the dateline that are on the same side of the dateline have the same calendar date. The calendar dates on opposite sides of the dateline differ by one day, except at the instant when the longitude of midnight and the dateline coincide, in which case the date is the same everywhere on Earth.

Let l2_lom be the longitude of midnight at l2g_time, and let l2g_lon be the longitude at the center of the L2 observation. The dateline is assumed to lie strictly at a longitude of +/-180 degrees for the sake of simplicity, which ignores the zigs and zags of the actual dateline.

A2) L2 observations with local calendar dates on the ground that correspond to the day before the TOMS L3 day are excluded. This has been implemented as L2 observations with

l2g_time < l3_tnoon - 15 minutes

and

-180 degrees <= l2g_lon < l2_lom

are excluded.

A3) L2 observations with local calendar dates on the ground that correspond to the day after the TOMS L3 day are excluded. This has been implemented as L2 observations with

l2g_time >= l3_tnoon + 15 minutes

and

l2_lom <= l2g_lon < 180 degrees

are excluded.

Let bit5 be bit 5 (the 6th bit) of the "ground pixel quality flag" of the L2 observation. This is the solar eclipse possibility flag.

A4) L2 observations with the solar eclipse possibility flag set are excluded. Thus, L2 observations with

bit5 /= 0

are excluded.

A5) L2 observations with the Fatal input data flag set are excluded. Thus, L2 observations with

bit0 /= 0

are excluded.

A6) L2 observations with the Missing data flag set are excluded. Thus, L2 observations with

bit15 /= 0

are excluded.

A7) L2 observations with XTrackQualityFlag set are excluded. Thus, L2 observations with

l2g_xtqf > 0

are excluded.

Let first4bitsA be bits 0 through 3 (the first four bits) of the "quality flag" of the L2 observation, which has the following values:

0 - good sample

1 - glint contamination (corrected)
2 - sza > 84 (degree)
3 - 360 residual > threshold
4 - residual at unused ozone wavelength > 4 sigma
5 - SOI > 4 sigma (SO2 present)
6 - non-convergence
7 - abs(residual) > 16.0 (fatal)
Add 8 for descending data.

A8) L2 observations gathered on the ascending part of the orbit that are not either a "good sample" or "glint contamination corrected" are excluded, as are all observations gathered on the descending part of the orbit.
Thus, L2 observations with both

first4bitsA /= 0

and

first4bitsA /= 1

are excluded.

A9) L2 observations with a path index greater than or equal to 7.0 are excluded.
Thus L2 observations with

path_index >= 7.0

are excluded.

A10) L2 observations with erythemal dose rate outside L2 valid range are excluded.
Thus L2 observations with

l2g_edr < 0.0

or

l2g_edr > 500.0

are excluded.

OMUVBd Subroutines Called:

OMUVBd_ReadPCF - Reads OMUVBd PCF.
OMUVBd_EndInFailure - Ends OMUVBd execution in failure.

OMUVBd_OpenL2GFile - Opens L2G file and attaches to grid in file.
OMUVBd_ReadL2GECSMeta - Reads ECS Metadata from L2G file.`
OMUVBd_ConvertECT - Converts eq. cross. data to solar and TAI93 times.
OMUVBd_ReadL2GFileMeta - Reads file-level Metadata from L2G file.
OMUVBd_ReadL2GGridMeta - Reads grid-level Metadata from L2G file.
OMUVBd_CheckL2GInputs - Checks if L2G files correspond to consecutive days.
OMUVBd_ReadL2GFieldInfo - Reads names of grid fields from L2G file.

OMUVBd_ReadL2GFieldMeta - Reads grid-field Metadata from L2G file.
OMUVBd_ReadL2GGridFields - Reads fields from grid in L2G file.
OMUVBd_MidnightLong - Calculates long. of midnight for L2 cand. scene.
OMUVBd_CloseL2GFile - Detaches from grid in L2G file and closes file.

OMUVBd_WriteL3FilesASCII - Writes out ASCII TOMS-like L3 files.
OMUVBd_WriteL3FieldMeta.f90 - Writes grid-field Metadata to L3 file
OMUVBd_WriteL3FileMeta.f90 - Writes file-level Metadata to L3 file
OMUVBd_WriteL3GridMeta.f90 - Writes grid-level Metadata to L3 file
OMUVBd_WriteL3GridFields.f90 - Writes fields to grid in L3 file
OMUVBd_OpenL3File.f90 - Opens L3 file
OMUVBd_CloseL3File.f90 - Closes L3 file

External Function Called:
OMI_SMF_setmsg - OMI messaging function.

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