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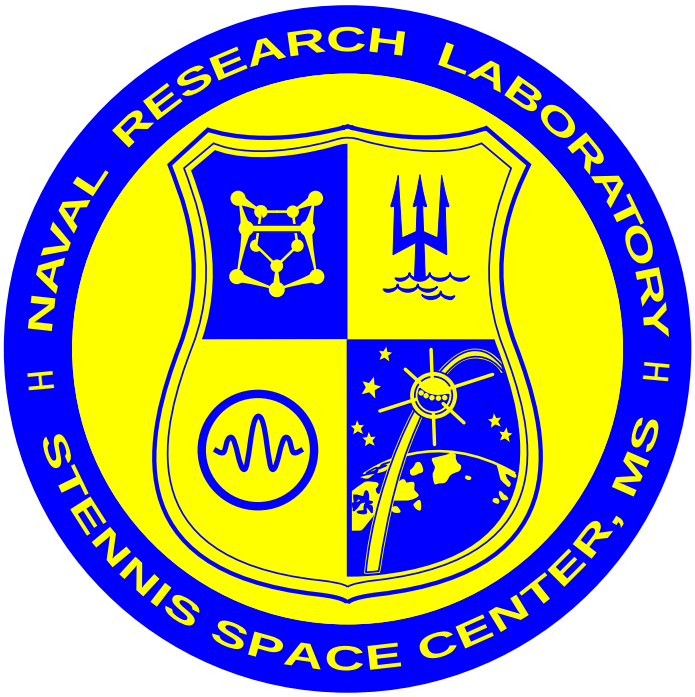
APS Data Product User's Guide
File Specification Version 2.5



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6 September 2004

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ABSTRACT

The Regional Data Products produced by the Navy's Automated Processing System (APS) contains atmospherically corrected geophysical products in a standard map projection for a specific region of interest derived from one of several different satellites (SeaWiFS, MODIS, AVHRR, or MOS). This User's Guide will describe version 2.5 of the APS file format, introduced with APS version 2.6.

1. Level−3 Regional Data Products

1.1. Introduction

A Level−3 Regional Data Product file contains atmospherically corrected geophysical products in a standard map projection for a specific region of interest derived from one of several different satellites (SeaWiFS, AVHRR, MOS, ..). A Level−3 Regional Data Product is stored using the Heiarchical Data Format (HDF) developed by the National Center for Supercomputer Applications (NCSA) at U. of Illinois Urbana-Champaign (version 4.1r4).

1.2. Naming Convention

The form of a Level−3 Regional Data Product file name is `XXyyyydddhhmmss`.L3_H`YYY_RRR`, where `XX` is `S` for SeaWiFS, `M` for MOS, `ND` for AVHRR NOAA-12, `NJ` for AVHRR NOAA-14, `NK` for AVHRR NOAA-15, `NL` for AVHRR NOAA-16, `NM` for AVHRR NOAA-17, `MODAM` for MODIS on Terra (EOS-AM) (daytime passes), `MODPM` for MODIS on Aqua (EOS-PM) (daytime passes), `MODAMN` for MODIS on Terra (EOS-AM) (nightime passes), `MODPMN` for MODIS on Aqua (EOS-PM) (nightime passes), and `yyyydddhhmmss` is the concatenated digits for the UTC year, day of year, hours, minutes and seconds of the first scan line processed to form the Level−3 file. `YYY` is the HRPT station code and `RRR` is a user-defined code to represent the region. Examples of Level−3 Regional Data Product file names are: `S2001219180008.L3_HNAV_GOM` and `NJ2001026211209.L3_HNAV_NYB`.

1.3. Global Attributes

The global attributes are associated with all products in the HDF file. These attributes contain such information as the creation of the file, the sensor platform for which the data was derived, and geographical coverage. The attributes are divided into several groups and are discussed below.

1.3.1. HDF File Meta Data

The following global attributes contain information about the product and file.

`char file`
: The file name of the product (without path)

`char fileClassification`
: Set to "UNCLASSIFIED".

`char fileStatus`
One of ‘‘EXPERIMENTAL’’ or ‘‘OPERATIONAL’’

`char fileTitle`
The title of file. Set to ‘‘NRL Level-3 Data’’

`char fileVersion`
The version number of the file specification as described in this manual. Currently set to ‘‘2.5’’

1.3.2. HDF File Creation Meta Data

The following global attributes are defined when the file is initially created. Additional data sets may be added to the file without affecting these attributes. These attributes contain information about the software and platform which created the file and the date when the file was created.

`char createAgency`
This string contains the agency which created the file.

`char createSoftware`
This string contains the version of the software which created the file.

`char createPlatform`
This string contains which platform the file was created on.

`char createTime`
This string contains the date and time when the file was created.

1.3.3. Sensor Meta Data

These attributes are used to describe the specific sensor from which the Level−3 Regional Data Product was derived. The APS software can handle several data streams including AVHRR, SeaWiFS and MOS.

`char sensor`
String containing the name of the sensor. Valid options include: ‘‘AVHRR’’ ‘‘SeaWiFS’’ ‘‘MOS’’

`char sensorAgency`
Agency/Owner of Sensor.

`char sensorType`
Type of sensor: ‘‘scanner’’, ‘‘pushbroom‘‘, ‘‘whiskbroom’’, ‘‘photographic’’, ‘‘altimeter’’, ‘‘radar’’

`char sensorSpectrum`
Description of spectrum, ‘‘visible’’ ‘‘near-IR’’ ‘‘thermal’’ ‘‘microwave’’

`int sensorNumberOfBands`
Number of Bands.

`char sensorBandUnits`
Units of wavelengths in `sensorBands`, like ‘‘nm’’

`double sensorBands`
Center wavelengths.

`double sensorBandWidths`
Nominal width of bands.

`char sensorNominalAltitudeInKM`
Nominal Altitude of sensor.

`char sensorScanWidthInKM`
Distance on earth of Field of View in kilometers.

`char sensorResolutionInKM`
Distance on earth of a single pixel in kilometers.

`char sensorPlatform`
Platform carrying sensor, like ‘‘Orbview-2’’

`char sensorPlatformType`
Type of platform: ‘‘Polar-Orbiting Satellite’’, ‘‘Geostationary Satellite’’, ‘‘Aircraft’’

1.3.4. Processing Meta Data

The processing meta data includes a description of the inputs used to create this Level−3 Regional Data Product file. Not all attributes given here will be present in a given file − several are sensor specific.

The `prodList` attribute is a list of the geophysical products stored in the file. It excludes the standard data sets like `CP_Pixels`, etc.

`char inputLevel1AFile`
Name of the input Level-1 file.

`char inputMET1`
Name of 1st MET data file used. SeaWiFS/MOS/MODIS specific.

`char inputMET2`
Name of 2nd MET data file used. SeaWiFS/MOS/MODIS specific.

`char inputMET3`
Name of 3rd MET data file used. SeaWiFS/MOS/MODIS specific.

`char inputOZONE1`
Name of 1st OZONE data file used. SeaWiFS/MOS/MODIS specific.

`char inputOZONE2`
Name of 2nd OZONE data file used. SeaWiFS/MOS/MODIS specific.

`char inputOZONE3`
Name of 3rd OZONE data file used. SeaWiFS/MOS/MODIS specific.

`int inputCalibrationFile`
Name of the calibration file used. SeaWiFS/MOS specific.

`int inputParameters`
A string indicating the options used during the processing of the file.

`int inputMasksInt`
The mask defined as an integer.

`char inputMasks`
A comma seperated list of flags that were used as masks during processing.

`char prodList`
A comma seperated list of products stored in this file.

`char processedVersion`
This global attribute indicates the algorithm state of the product. This is to distinguish the differences in the software which may have enchancments and/or bug fixes that do not have any bearing on the data product algorithms.

1.3.5. Time Meta Data

This information provides information about the starting and ending time of the data used to create this product. This information is relative to the input product file.

`char timeStart`
UTC start time as an ASCII string.

`int timeStartYear`
UTC year of data start.

`int timeStartDay`
UTC day−of−year of data start.

`int timeStartTime`
UTC milliseconds−of−day of data start.

`char timeEnd`
UTC end time as an ASCII string.

`int timeEndYear`
UTC year of data end.

`int timeEndDay`
UTC day−of−year of data end.

`int timeEndTime`
UTC milliseconds−of−day of data end.

`char timeDayNight`
Flag indicating if data collected during day or night. May be one of ‘‘Day’’, ‘‘Night’’, ‘‘Day/Night’’.

1.3.6. Location Meta Data

This meta data contains information about the geographical coverage of the input data file and the resulting regional geographical coverage.

Because the Level−3 Regional Data Product files are mapped images, the following information provides the navigation information of the projection used. The projection system used by APS v2.8 is based on the NASA PC-SeaPAK projection system which uses two tie-points and the USGS projection software to perform the navigation.

`char navType`
Navigation type of data. Always set to ‘‘mapped’’.

`char mapProjectionSystem`
Map projection system used. Always set to ‘‘NRL(USGS)’’.

`char mapProjection`
Name of the SDS included in the file that contains the map projection parameter values.

`double mappedUpperLeft[2]`
Latitude and longitude of upper left (1,1) point of each product.

`double mappedUpperRight[2]`
Latitude and longitude of upper right (1,n)point of each product.

`double mappedLowerLeft[2]`
Latitude and longitude of lower left (m,1) point of each product.

`double mappedLowerRight[2]`
Latitude and longitude of lower right (m,n) point of each product.

These attributes contain information about the geographical coverage of the *input* data. This data is still in sensor view.

`double localeUpperLeft[2]`
latitude and longitude of upper left (1,1) point of original input data.

`double localeUpperRight[2]`
latitude and longitude of upper right (1,n)point of original input data.

`double localeLowerLeft[2]`
latitude and longitude of lower left (m,1) point of original input data.

`double localeLowerRight[2]`
latitude and longitude of lower right (m,n) point of original input data.

`double localeNWCorner[2]`
latitude and longitude of NorthWestern point of original input data.

`double localeNECorner[2]`
latitude and longitude of NorthEastern point of original input data.

`double localeSECorner[2]`
latitude and longitude of SouthEastern point of original input data.

`double localeSWCorner[2]`
latitude and longitude of SouthWestern point of original input data.

1.4. Data Sets

There are a *variable* number of datasets in an APS Level−3 Regional Data Product file. However, several data sets are standard. These data sets are meta data sets containing information related to the actual geophysical data products. The first group of data sets listed below provide geographical coverage and data quality information. The last group of data sets are the actual geophysical products and vary in number.

1.4.1. Location Data Sets

The following data sets provide for a grid of control points that relate the image locations (pixel,line) with a geographical location (lat,lon). The grid is a 2-D regular ‘‘square’’ grid with each latitude and longitude positioned at the given pixel and line locations. These are single dimensional arrays indicating the pixel and line locations for each grid point. Though every Level−3 Regional Data Product file is map projected, this control points array is provided to give the user an alternative method of georeferencing each pixel in the data products.

`double CP_Pixels[m]`
Control point pixel locations. For example, ‘‘1, 21, 41, ..., 1021’’.

`double CP_Lines[n]`
Control point line locations. For example, ‘‘1, 2, 3, ..., 600’’.

`double CP_Latitudes[m][n]`
Latitudes in decimal degrees, positive North. For example,
‘‘31.0, 30.0, ... 25.0’’.

`double CP_Longitudes[m][n]`
Longitudes in decimal degrees, positive East. For example,
‘‘-90.0, -90.5, ... -80.0’’.

The file attribute `mapProjection` if present will contain the name of the SDS containing the map projection coordinate system information. This SDS consists of an array of 29 double values.

Field	Name	Description
1		Always set to 1, will be incremented if table changes
2	`sys`	USGS GCTP projection code
3	`zone`	Zone of projection
4	`datum`	USGS GCTP spheroid code
5-19	`param`	USGS GCTP projection parameters (15)
20	`ousize[0]`	width of map projected image
21	`ousize[1]`	height of map projected image
22	`pt1_ll[0]`	longitude of 1st tie point
23	`pt1_ll[1]`	latitude of 1st tie point
24	`pt1_ij[0]`	image sample (column) of 1st tie point
25	`pt1_ij[1]`	image line (row) of 1st tie point
26	`pt2_ll[0]`	longitude of 2nd tie point
27	`pt2_ll[1]`	latitude of 2nd tie point
28	`delta`	distance (in pixels) horizontally (+value)/ vertically (-value) between 1st and 2nd tie point
29	`aspect`	aspect ratio

The following code shows how the APS projection system computes the slope and intercepts that convert the image coordinates (x,y) to map coordinates (i,j) in meters. These can then be used to convert meters into geographic coordinates (lon,lat) using the USGS GCTP package. Please see the *APS User's Guide* for an in-depth description of the map projection system used by APS.

```
/*
```

```
 *  convert point 1 and 2 from geographical
 *  coordinates to map projection distances (x,y)
 */

    gctp(  pt1_ll, &insys, &inzone, inparam, &inunit, &indatum,
           &ipr, NULL, &jpr, NULL,          /* no reporting */
           pt1_xy, &ousys, &ouzone, ouparam, &ouunit, &oudatum,
           NULL, NULL, &error );        /* no State Plane files */
    if ( error != 0 )
        return NULL;

    gctp(  pt2_ll, &insys, &inzone, inparam, &inunit, &indatum,
           &ipr, NULL, &jpr, NULL,          /* no reporting */
           pt2_xy, &ousys, &ouzone, ouparam, &ouunit, &oudatum,
           NULL, NULL, &error );        /* no State Plane files */
    if ( error != 0 )
        return NULL;

/*
 *  Now, convert from map distances to image coordinates
 *  using delta and aspect.  This portion determines the
 *  resolution of the output image and determines the
 *  conversion from (x,y) to (i,j) coordinates
 */

    dltx = pt2_xy[0] - pt1_xy[0];
    dlty = pt2_xy[1] - pt1_xy[1];
    if ( dltx == 0.0 ) {
        error = APS_PROJ_NO_X_DELTA;
        return NULL;
    }
    if ( dlty == 0.0 ) {
        error = APS_PROJ_NO_Y_DELTA;
        return NULL;
    }
    if ( delta > 0 ) {
        dltpix = delta;
        dltlin = delta * (dlty/dltx) * aspect;
    } else {
        dltpix = -delta * (dltx/dlty) / aspect;
        dltlin = -delta;
    }
    /* origin top,left */
    pix2  = pt1_ij[0] + copysign( dltpix, dltx );
    lin2  = pt1_ij[1] + copysign( dltlin, dlty );

    opslp  =  dltx / ( pix2 - pt1_ij[0] );
    olslp  = -dlty / ( lin2 - pt1_ij[1] );
    opint  = pt1_xy[0] - pt1_ij[0]*opslp;
    olint  = pt1_xy[1] - pt1_ij[1]*olslp;
```

Now to convert a geographic coordinate (lon,lat) to an image coordinate (x,y) call the GCTP routine and then apply the slope and intercept found above.

```
in[0] = lon;
in[1] = lat;

gctp( in, &insys, &inzone, inparam, &inunit, &indatum,
      &ipr, NULL, &jpr, NULL,       /* no reporting */
      ou, &wmap->sys, &wmap->zone, wmap->param, &ouunit, &wmap->datum,
      NULL, NULL, &error );     /* no State Plane files */

if ( error != 0 )
    return APS_ERROR;

*x = (ou[0] - opint) / opslp;  /* meters to image column */
*y = (ou[1] - olint) / olslp;  /* meters to image row */
```

1.4.2. Data-Quality Data Sets

The data quality data sets provide information about the data quality of each pixel in the geophysical product data sets.

`uint32 l2_flags[m][n]`
Level-2 processing flags.

The l2_flags contain 32 bits. Each bit represents a condition or state for the pixel in question. Each bit and their associated keywords are shown in the following table.

1	ATMFAIL	Atmospheric correction algorithm failure
2	LAND	Land pixel
3	BADANC	Missing ancillary data
4	HIGLINT	Sun glint
5	HILT	Total radiance greater than the knee value
6	HISATZEN	Large sensor zenith angle
7	COASTZ	Shallow water
8	NEGLW	Negative Water-Leaving Radiance
9	STRAYLIGHT	Stray Light
10	CLDICE	Cloud or ice
11	COCCOLITH	Coccolithophores
12	TURBIDW	Case 2 waters
13	HISOLZEN	Large solar zenith angle
14	HITAU	High aerosol concentration
15	LOWLW	Low water-leaving radiance at band 5
16	CHLFAIL	Chlorophyll algorithm failure
17	NAVWARN	Questionable navigation
18	ABSAER	Absorbing aerosol
19	TRICHO	Tricodesmium
20	MAXAERITER	NIR algorithm exceeded maximum iteration
21	MODGLINT	Moderate Sun glint
22	CHLWARN	Chlorophylla < 0.01 or > 64
23	ATMWARN	Epsilon out of range
24	DARKPIXEL	Dark pixel
25-31	SPARE	Spare bits.
32	OCEAN	Ocean pixel

`uint16 flags_carder[m][n]`
Carder semi-analytical algorithm processing flags.

1.4.3. General DataSets

The remaining datasets in the Level−3 Regional Data Product data file are general in nature and may or may not exist in the given dataset. A description of each product follows. All products below that exist in the Level−3 Regional Data Product file are listed in the global attribute `prodList`.

1.4.3.1. General DataSet Attributes

Each time a data set is created, information about the time, software, and platform is stored in these attributes.

`char createSoftware`
: This string contains the version of the software which created the product.

`char createTime`
: This string contains the date and time when the product was created.

`char createPlatform`
: This string contains a triple describing the cpu-machine-os which created the scientific data set.

To describe the product, several attributes are attached to the data set. These include a long descriptive name, the units and valid range of the data.

The long descriptive name is an ASCII string. In some cases, the algorithm used is also provided in the name. Examples are ‘‘Remote Sensing Reflectance at 443 nm’’ and ‘‘Chlorophyll Concentration, OC4 Algorithm’’.

The units are stored in an ASCII string. Examples of unit strings are ‘‘mg mˆ-3’’ and ‘‘mW cmˆ-2 umˆ-1 srˆ-1’’.

The valid range attribute provides a suggested range of valid data. This attribute can be used to filter out values that are outside the given range, for example, for compositing several scenes together. In general, values outside this range are considered suspect.

Additionally, the value used to represent invalid values is also defined. An invalid value represents locations where a value can not be computed. For example, when trying to compute a chlorophyll-a value in which the remote sensing reflectance at 443 nm is negative. Or, when a particular pixel is over land and the land is being mask out (the normal procedure).

`char productName`
: This is a description of the product.

`char productAlgorithm`
: This is a notation about the algorithm, usually a paper reference.

`char productUnits`
: This is a description of the units of the product.

`char productStatus`
: This new SDS attribute will give an indication of the status of the product. The valid values are ‘‘alpha’’ ‘‘beta’’ ‘‘provisional’’ or ‘‘validated’’

Alpha Products	Alpha Product are not validated at all. They are implementation of algorithms to begin testing. Product is not appropriate for scientific publication
Beta Products	Beta Products are minimally validated, early release products that enable users to gain familiarity with data formats and parameters. Product is probably not appropriate as the basis for quantitative scientific publications.

Provisional Products	Provisional Products are partially validated and improvements are continuing. Provisional products are viewed as early science validated products and useful for exploratory and process scientific studies. Quality may not be optimal since validation and quality assurance are ongoing. Users are expected to review products quality summaries before publication of results
Validated Products	Validated Products have well defined uncertainties. These are high quality products suitable for longer term or systematic scientific studies and publication. There may be later improved versions. Users are expected to review products quality summaries before publication of results.

`double validRange[2]`
This is a suggested range of valid data. *APS v2.3*: previously named `productValidRanges[2]`.

`double invalid`
This is the geophysical value which will represent invalid data for the given product. (OPTIONAL)

In general, most of the archival products are stored as signed 16-bit integers. In all cases for products produced by APS to date, the scaling is linear. Note, that not all products are stored as integers; some are stored as floating point values. The products listed below that indicate floating point representation are generally not archival products. In the cases of floating point products, these attributes are not available.

If the product is stored as integers, then it will also have the next two attributes, which are the slope and intercept for converting the integers into floating points. The integer value should be read from the SDS and multiplied by the slope and then have the intercept added.

`char productScaling`
The type of scaling of the product. Currently, always "Linear".

`double scalingSlope`
The slope for product scaling.

`double scalingIntercept`
The intercept for product scaling.

To provide for making quick-look browse images, suggestions about the scaling and data ranges for making images of the product data are stored in the following two attributes. The APS program imgBrowse will use these attributes as default scaling and data ranges for automatic creation of quick-look browse images.

For some products, like diffuse attenuation, it is generally accepted that a logarithmic scaling for images brings out the best detail. Therefore, for this product a logarithmic function will be used. Other products like sea surface temperature are generally best displayed using linear scaling.

The display range of the data may or may not be the same as the `validRange` attribute above since in some cases (e.g. rrs_412), the data has been known to fall outside a geophysical valid range, but we wish to display the un-physical data since some physical oceanographical structure or feature may still be present in the data.

`int16 browseFunc`
This is a suggested function to apply to convert the data in the SDS into an image. A value of 1 indicates linear scaling; a value of 2 indicates log10 scaling.

`int16 browseRanges[2]`
This is a suggested display range when converting the data in the SDS into an image. This may or may not be the same as `validRange` because in some cases (e.g. rrs_412), the data has been known to fall outside the range, but we wish to display the invalid data. This attribute is used by the APS program imgBrowse when creating quick-look browse images of different products.

1.4.3.2. General Data Sets

The following data sets may or may not exist in a Level−3 Regional Data Product depending upon the user's selections.

In the definitions that follow, the values m and n represent the number of samples and lines in the image, respectively. The terms XXX or YYY should be replaced by the desired wavelength. For SeaWiFS, XXX may be 412, 443, 490, 510, 555, or 670; and YYY may be 412, 443, 490, 510, 555, 670, 765, 865. For MOS, XXX may be 408, 443, 485, 520, 570, or 685; and YYY may be 408, 443, 485, 520, 570, 685, 750, 870. For MODIS, XXX may be 412, 443, 488, 531, 551, or 667; and YYY may be 412, 443, 488, 531, 551, 667, 678, 750, 865.

1.4.3.2.1. SeaWiFS/MOS Data Sets

The following data sets may be generated by SeaWiFS or MOS data.

SeaWiFS/MOS Data Products				
Name	Units	Slope	Int	Description
Lt_YYY	mW cm^-2 um^-1 sr^-1	*	*	Calibrated TOA radiance at YYY nm
TLg_YYY	mW cm^-2 um^-1 sr^-1	*	*	TOA glint radiance at YYY nm
Lr_YYY	mW cm^-2 um^-1 sr^-1	*	*	Rayleigh radiance at YYY nm
La_YYY	mW cm^-2 um^-1 sr^-1	*	*	Aerosol radiance at YYY nm
tLf_YYY	mW cm^-2 um^-1 sr^-1	*	*	White-cap radiance at TOA at YYY nm
Lw_YYY	mW cm^-2 um^-1 sr^-1	0.001,0.0001	0.0	Water-leaving radiance at YYY nm
nLw_YYY	mW cm^-2 um^-1 sr^-1	0.001,0.0001	0.0	Normalized water-leaving radiance at YYY nm
rhos_YYY	dimensionless	0.0001	0.0	Surface reflectance at YYY nm
taua_YYY	dimensionless	0.0001	0.0	Aerosol optical thickness at YYY nm
angstrom_YYY	mW cm^-2 um^-1 sr^-1	0.0002	0.0	Angstrom coefficient, YYY to ZZZ nm, where ZZZ is 865 for SeaWiFS and 870 for MOS.
Es_YYY	mW cm^-2 um^-1 sr^-1	*	*	Solar Irradiance at surface at YYY nm
foq_YYY	dimensionless	*	*	f/Q correction at nadir at YYY nm
t_sol_YYY	dimensionless	*	*	Rayleigh-Aerosol diffuse transmittance, Sun to surface, at YYY nm
t_sen_YYY	dimensionless	*	*	Rayleigh-Aerosol diffuse transmittance, surface to sensor, at YYY nm
t_oz_sol_YYY	dimensionless	*	*	Ozone transmittance, Sun to surface, at YYY nm
t_oz_sen_YYY	dimensionless	*	*	Ozone transmittance, surface to sensor, at YYY nm
t_o2_YYY	dimensionless	*	*	Total oxygen transmittance, surface to sensor, at YYY nm
latitudes	degree	*	*	Latitude of each pixel in decimal degrees, postive North.
longitudes	degree	*	*	Longitudes of each pixel in decimal degrees, postive East.
solz	degree	1.0/360.0	90.0	Solar zenith angles.
sola	degree	1.0/90.0	0.0	Solar azimuth angles.
satz	degree	1.0/360.0	90.0	Satellite zenith angles.
sata	degree	1.0/90.0	0.0	Satelite azimuth angles.
cloud_albedo	dimensionless	0.01	0.0	Cloud albedo used for thresholding
ozone	cm	*	*	Ozone concentration
pressure	millibars	*	*	Pressure.
windspeed	m s^-1	*	*	Wind speed at 10 meters.
zwind	m s^-1	*	*	Zonal wind speed at 10 meters.
mwind	m s^-1	*	*	Meridional wind speed at 10 meters.
windangle	degrees	*	*	Wind direction at 10 meters.

SeaWiFS/MOS Data Products				
Name	Units	Slope	Int	Description
humidity	%	*	*	Relative humidity
water_vapor	g cmˆ-2	*	*	Water vapor
glint_coef	dimensionless	*	*	Cox-Munk normalized glint radiance
rrs_YYY	srˆ-1	0.000002	0.05	Remote sensing reflectance at YYY nm
epsilon	dimensionless	0.01	0.0	Epsilon of aerosol correction at 765 and 865 nm
chl_nn	mg mˆ-3	0.001	32.0	Chlorophyll a concentration using neural net pigment algorithm (Frouin)
chl_ndpi	mg mˆ-3	0.001	32.0	Chlorophyll a concentration using normalized difference pigment index
pig_oc2	mg mˆ-3	0.001	32.0	Pigment concentration, derived from OC2 algorithm
pig_oc4	mg mˆ-3	0.001	32.0	Pigment concentration, derived from OC4 algorithm
pig_nn	mg mˆ-3	0.001	32.0	Pigment concentration using neural net pigment algorithm (Frouin)
pig_ndpi	mg mˆ-3	0.001	32.0	Pigment concentration using normalized difference pigment index
par	mW cmˆ-2 umˆ-1	0.002	65.5	Photosynthetically Available Radiation, R. Frouin
chl_oc2v2	mg mˆ-3	0.001	32.0	Chlorophyll a concentration using OC2v2 algorithm.
chl_oc4v4	mg mˆ-3	0.001	32.0	Chlorophyll a concentration using OC4v4 algorithm.
chl_stumpf	mg mˆ-3	0.001	32.0	Chlorophyll a concentration using Stumpf's algorithm.
chl_carder	mg mˆ-3	0.001	32.0	Chlorophyll a concentration using Carder's semi-analytical algorithm.
K_490	mˆ-1	0.0002	0.0	Diffuse attenuation at 490 nm using Mueller's algorithm.
K_532	mˆ-1	0.0002	0.0	Diffuse attenuation at 532 nm using Mueller's algorithm with Austin/Petzold spectral K algorithm.
a_XXX_arnone	mˆ-1	0.0001	2.5	Total absorption using Arnone's algorithm.
bb_XXX_arnone	mˆ-1	0.000005	0.16	Backscattering using Arnone's algorithm.
b_XXX_arnone	mˆ-1	0.0005	2.5	Total scatttering using Arnone's algorithm.
c_XXX_arnone	mˆ-1	0.0005	16.0	Beam attenuation using Arnone's algorithm.
a_XXX_carder	mˆ-1	0.0001	2.5	Total absorption using Carder's algorithm.
adg_XXX_carder	mˆ-1	0.0001	2.5	CDROM/detritis absorption using Carder's algorithm.
aph_XXX_carder	mˆ-1	0.0001	2.5	Phytoplankton absorption using Carder's algorithm.
bb_XXX_carder	mˆ-1	0.000006	0.16	Backscattering using Carder's algorithm.

SeaWiFS/MOS Data Products				
Name	Units	Slope	Int	Description
b_XXX_carder	mˆ-1	0.0005	16.0	Total scatttering using Carder's algorithm.
c_XXX_carder	mˆ-1	0.0005	16.0	Beam attenuation using Carder's algorithm.
ndvi	dimensionless	0.0001	0.0	Normalized Difference Vegetation Index
evi	dimensionless	0.0001	0.0	Enhanced Vegetation Index
smoke	dimensionless	0.0001	0.0	Smoke index
visibility	m	0.01	0.0	Horizontal diver visibility @555nm, McBride algorithm
aerindex	dimensionless	*	*	Aerosol index
aer_model_min	dimensionless	*	*	Lower bounding aerosol model index
aer_model_max	dimensionless	*	*	Upper bounding aerosol model index
aer_model_ratio	dimensionless	*	*	Aerosol model interpolation ratio
aer_num_iter	dimensionless	*	*	Number of aerosol iterations
depth	dimensionless	*	*	Water depth index
N_small_particles	dimensionless	*	*	Number of small particles using Haltrin algorithm
N_large_particles	dimensionless	*	*	Number of large particles using Haltrin algorithm
N_particles	dimensionless	*	*	Number of particles using Haltrin algorithm
true_color	dimensionless	*	*	True color image

1.4.3.2.2. AVHRR Data Sets

The following data sets may be generated by AVHRR data.

AVHRR Data Products				
Name	Units	Slope	Int	Description
albedo_ch1	%	0.002	0.0	Percent albedo of AVHRR channel 1.
albedo_ch2	%	0.002	0.0	Percent albedo of AVHRR channel 2.
btemp_ch3	Kelvin	0.005	200.0	Brightness temperatures of AVHRR channel 3.
btemp_ch4	Kelvin	0.005	200.0	Brightness temperatures of AVHRR channel 4.
btemp_ch5	Kelvin	0.005	200.0	Brightness temperatures of AVHRR channel 5.
sst	Celsius	0.001	20.0	Sea surface temperature
c_660	mˆ-1	0.005	0.0	Beam attenuation at 660 nm.
K_PAR	mˆ-1	0.01	0.05	Diffuse attenuation coefficient (K) for photosynthetically active radiation (PAR)
suspend	mˆ-1	1.0	0.0	Suspended solids.

1.4.3.2.3. MODIS Data Sets

The following data sets may be generated by MODIS data.

MODIS Data Products				
Name	Units	Slope	Int	Description
albedo	dimensionless	0.01	0.0	Cloud albedo used for thresholding
rrs_YYY	srˆ-1	0.000002	0.05	Remote sensing reflectance at YYY nm
chl_oc2v2	mg mˆ-3	0.001	32.0	Chlorophyll a concentration using OC2v2 algorithm.
chl_oc3m	mg mˆ-3	0.001	32.0	Chlorophyll a concentration using OC3M algorithm.
chl_modis	mg mˆ-3	0.001	32.0	Chlorophyll a concentration using Clarks's algorithm.
chl_carder	mg mˆ-3	0.001	32.0	Chlorophyll a concentration using Carder's semi-analytical algorithm.
K_490	mˆ-1	0.0002	0.0	Diffuse attenuation at 490 nm using Mueller's algorithm.
K_532	mˆ-1	0.0002	0.0	Diffuse attenuation at 532 nm using Mueller's algorithm with Austin/Petzold spectral K algorithm.
a_XXX_arnone	mˆ-1	0.0001	2.5	Total absorption using Arnone's algorithm.
bb_XXX_arnone	mˆ-1	0.000005	0.16	Backscattering using Arnone's algorithm.
b_XXX_arnone	mˆ-1	0.0005	2.5	Total scatttering using Arnone's algorithm.
c_XXX_arnone	mˆ-1	0.0005	16.0	Beam attenuation using Arnone's algorithm.
a_XXX_carder	mˆ-1	0.0001	2.5	Total absorption using Carder's algorithm.
adg_XXX_carder	mˆ-1	0.0001	2.5	CDROM/detritis absorption using Carder's algorithm.
aph_XXX_carder	mˆ-1	0.0001	2.5	Phytoplankton absorption using Carder's algorithm.
bb_XXX_carder	mˆ-1	0.000006	0.16	Backscattering using Carder's algorithm.
b_XXX_carder	mˆ-1	0.0005	16.0	Total scatttering using Carder's algorithm.
c_XXX_carder	mˆ-1	0.0005	16.0	Beam attenuation using Carder's algorithm.
aph_415_hoge	mˆ-1	0.0005	16.0	Phytoplakton Absorption at 415nm, Hoge Algorithm
adg_415_hoge	mˆ-1	0.0005	16.0	CDOM Absorption at 415nm, Hoge Algorithm
bb_415_hoge	mˆ-1	0.0005	16.0	Total Constituent Backscatter at 415nm, Hoge Algorithm
peb_555_hoge	mˆ-1	0.0001	0.0	PEB Absorption at 555nm, Hoge Algorithm
pub_490_hoge	mˆ-1	0.0001	0.0	PUB Absorption at 490nm, Hoge Algorithm
ipar_carder	Ein mˆ-2 sˆ-1	0.0001	0.0	Integrated Total Sub-surface Irradiance, Carder (Case 2) Algorithm
arp_carder	Ein mˆ-2 sˆ-1	0.0001	0.0	Integrated Total Photons Absorbed by Phytoplankton, Carder Algorithm

2. Level-4 Regional Data Products

2.1. Introduction

A Level–4 Regional Data Product file contains atmospherically corrected geophysical products in a standard map projection for a specific region of interest derived from one of several different satellites (SeaWiFS, AVHRR, MOS, ...). A Level–4 Regional Data Product is stored using the Heiarchical Data Format (HDF) developed by the National Center for Supercomputer Applications (NCSA) at U. of Illinois Urbana-Champaign (version 4.1r4).

2.2. Naming Convention

The form of a Level–4 Regional Data Product file name will depend upon the composite type. But will generally follow the nomenclature: `XXyyyydddyyyyddd.L4_YYY_RRR`, where `XX` is `S` for SeaWiFS, `M` for MOS, `ND` for AVHRR NOAA-12, `NJ` for AVHRR NOAA-14, `NK` for NOAA-15, `NL` for NOAA-16, `MODAM` for MODIS on Terra (EOS-AM), `MODPM` for MODIS on Aqua (EOS-PM), and `yyyydddyyyy-ddd` is the concatenated digits for the UTC start year, start day of year, end year, and end day of year of all file which form the composite. For daily composites, the end year and end day of year will be removed.

`YYY` is the composite type code. It will be `DAY` for a daily composite, `8D` for an 8-day composite (weekly), `MO` for a monthly composite, and `YR` for a yearly composite, or `LP` for a latest pixel composite. `RRR` is a user-defined code to represent the region. Examples of Level–4 Regional Data Product file names are: `MODAM2001274.L4_DAY_GOM`, `NJ20021212002151.L4_MO_MSB`, and `S2002154.L4_DAY_GOM`.

2.3. Global Attributes

The global attributes are associated with all products in the HDF file. These attributes contain such information as the creation of the file, the sensor platform for which the data was derived, and geographical coverage. The attributes are divided into several groups and are discussed below.

2.3.1. HDF File Meta Data

The following global attributes contain information about the product and file.

`char file`
: The file name of the product (without path)

`char fileClassification`
: Set to ‘‘UNCLASSIFIED’’.

`char fileStatus`
: One of ‘‘EXPERIMENTAL’’ or ‘‘OPERATIONAL’’

`char fileTitle`
: Set to ‘‘NRL Level-4 Data’’

`char fileVersion`
: Set to ‘‘2.5’’

`char compType`
: Set to ‘‘Daily Composite’’, ‘‘Weekly Composite’’, ‘‘Monthly Composite’’, ‘‘Yearly Composite’’, ‘‘Latest Pixel Composite’’

2.3.2. HDF File Creation Meta Data

The following global attributes are defined when the file is initially created. Additional data sets may be added to the file without affecting these attributes. These attributes contain information about the software and platform which created the file and the date when the file was created.

`char createAgency`
: This string contains the agency which created the file.

`char createSoftware`
This string contains the version of the software which created the file.

`char createPlatform`
This string contains which platform the file was created on.

`char createTime`
This string contains the date and time when the file was created.

2.3.3. Sensor Meta Data

These attributes are used to describe the specific sensor from which the Level–4 Regional Data Product was derived. The APS software can handle several data streams including AVHRR, SeaWiFS and MOS.

`char sensor`
String containing the name of the sensor. Valid options are: "AVHRR" "SeaWiFS" "MOS"

`char sensorAgency`
Agency/Owner of Sensor.

`char sensorType`
Type of sensor: "scanner", "pushbroom", "whiskbroom", "photographic", "altimeter", "radar"

`char sensorSpectrum`
Description of spectrum, "visible" "near-IR" "thermal" "microwave"

`int sensorNumberOfBands`
Number of Bands.

`char sensorBandUnits`
Units of wavelengths in `sensorBands`, like "nm"

`double sensorBands`
Center wavelengths.

`double sensorBandWidths`
Nominal width of bands.

`char sensorNominalAltitudeInKM`
Nominal Altitude of sensor.

`char sensorScanWidthInKM`
Distance on earth of Field of View in kilometers.

`char sensorResolutionInKM`
Distance on earth of a single pixel in kilometers.

`char sensorPlatform`
Platform carrying sensor, like "Orbview-2"

`char sensorPlatformType`
Type of platform: "Polar-Orbiting Satellite", "Geostationary Satellite", "Aircraft"

2.3.4. Processing Meta Data

The processing meta data includes a description of the inputs used to create this Level–4 Regional Data Product file.

The `prodList` attribute is a list of the geophysical products stored in the file. It excludes the standard data sets like `CP_Pixels`, etc.

`char inputFiles`
A comma seperated list of input file.

`int inputParameters`
A string indicating the options used during the processing of the file.

`int inputMasksInt`
The mask defined as an integer.

`char inputMasks`
A comma seperated list of flags that were used as masks during processing.

`char prodList`
A comma seperated list of products stored in this file.

2.3.5. Time Meta Data

This information provides information about the starting and ending time of the data used to create this product. This information is relative to the input product file.

`char timeStart`
UTC start time as an ASCII string

`int timeStartYear`
UTC year of data start.

`int timeStartDay`
UTC day−of−year of data start.

`int timeStartTime`
UTC milliseconds−of−day of data start.

`char timeEnd`
UTC end time as an ASCII string

`int timeEndYear`
UTC year of data end.

`int timeEndDay`
UTC day−of−year of data end.

`int timeEndTime`
UTC milliseconds−of−day of data end.

`char timeDayNight`
Flag indicating if data collected during day or night. May be one of ‘‘Day’’, ‘‘Night’’, ‘‘Day/Night’’.

2.3.6. Location Meta Data

This meta data contains information about the geographical coverage of the input data file and the resulting regional geographical coverage.

Because the Level−4 Regional Data Product files are mapped images, the following information provides the navigation information of the projection used. The projection system used by APS v2.8 is based on the NASA PC-SeaPAK projection system which uses two tie-points and the USGS projection software to perform the navigation.

`char navType`
Navigation type of data. Always set to ‘‘mapped’’.

`char mapProjectionSystem`
Map projection system used. Always set to ‘‘NRL(USGS)’’.

`char mapProjection`
Name of the SDS included in the file that contains the map projection parameter values.

`double mappedUpperLeft[2]`
Latitude and longitude of upper left (1,1) point of each product

`double mappedUpperRight[2]`
Latitude and longitude of upper right (1,n)point of each product

`double mappedLowerLeft[2]`
Latitude and longitude of lower left (m,1) point of each product

`double mappedLowerRight[2]`
Latitude and longitude of lower right (m,n) point of each product

2.4. Data Sets

There are a *variable* number of datasets in an APS Level–4 Regional Data Product file. However, several data sets are standard. These data sets are meta data sets containing information related to the actual geophysical data products. The first group of data sets listed below provide geographical coverage and data quality information. The last group of data sets are the actual geophysical products and vary in number.

2.4.1. Location Data Sets

The following data sets provide for a grid of control points that relate the image locations (pixel,line) with a geographical location (lat,lon). The grid is a 2-D regular ‘‘square’’ grid with each latitude and longitude positioned at the given pixel and line locations. There are single dimensional arrays indicating the pixel and line locations for each grid point. Though every Level–4 Regional Data Product file is map projected, this control points array is provided to give the user an alternative method of georeferencing each pixel in the data products.

`double CP_Pixels[m]`
: Control point pixel locations. For example, ‘‘1, 21, 41, ..., 1021’’.

`double CP_Lines[n]`
: Control point line locations. For example, ‘‘1, 2, 3, ..., 600’’.

`double CP_Latitudes[m][n]`
: Latitudes in decimal degrees, positive North. For example, "31.0, 30.0, ... 25.0’’.

`double CP_Longitudes[m][n]`
: Longitudes in decimal degrees, positive East. For example, "-90.0, -90.5, ... -80.0’’.

2.4.2. General DataSets

The remaining datasets in the Level–4 Regional Data Product data file are general in nature and may or may not exist in the given dataset. All products listed in the tables above under ‘‘General DataSets’’ may also be composited. The difference here is that they are averages of all input data.

Additionally, other data sets which describe the minimum, maximum, standard deviation, and number of pixels may also be present. These datasets use the same name as those described in above, except that an ‘‘`_min`’’, ‘‘`_max`’’,‘‘`_stddev`’’, and ‘‘`_num`’’ are appended to each product name. For example, the file may contain the data set `sst_max`, which is the maximum composite of the `sst` product.

3. Examples

The following text shows some example files using the **hdf** (1) program of APS. This programs output is similar to the CDL of netCDF.

3.1. SeaWiFS Example

This is an example of a SeaWiFS Level-3 Regional Data Product.

```
File: S2002152183606.L3_HNAV_MSB

File Attributes: (59)

createTime = "Sat Jun  1 14:33:20 2002"
createAgency = "Naval Research Laboratory, Stennis Space Center"
createSoftware = "APS v2.6"
createUser = "aps"
createPlatform = "i686-pc-linux-gnu"
file = "S2002152183606.L3_HNAV_MSB"
fileTitle = "NRL Level-3 Data"
fileVersion = "2.5"
fileClassification = "UNCLASSIFIED"
```

```
fileStatus = "Operational"
processedVersion = "2.6"
sensor = "SeaWiFS"
sensorAgency = "Orbital Sciences"
sensorType = "scanner"
sensorSpectrum = "Visible"
sensorNumberOfBands = 8
sensorBandUnits = "nano meters"
sensorBands = [412,443,490,510,555,670,765,865]
sensorBandWidths = [20,20,20,20,20,20,40,40]
sensorNominalAltitudeInKM = 705
sensorScanWidthInKM = 2801
sensorResolutionInKM = 1
sensorPlatform = "OrbView-2"
sensorPlatformType = "Polar-orbiting Satellite"
inputLevel1AFile = "S2002152183606.L1A_HNAV"
inputMET1 = "/home/aps/aps_v2.6/data/CLIMATOLOGY.MET"
inputMET2 = ""
inputMET3 = ""
inputOZONE1 = "/home/aps/aps_v2.6/data/CLIMATOLOGY.OZONE"
inputOZONE2 = ""
inputOZONE3 = ""
inputCalibrationFile = "/home/aps/aps_v2.6/data/seawifs/cal/SEAWIFS_SENSOR_CAL.TBL"
inputParameters = "IFILE = S2002152183606.L1A_HNAV|OFILE1 = S2002152183606.L
2_HNAV_MSB|L2PROD1 = rrs_412 rrs_443 rrs_490 rrs_510 rrs_555 rrs_670 K_532 c
hl_oc4 chl_stumpf chl_carder a_412_arnone a_443_arnone a_490_arnone a_510_ar
none a_555_arnone a_670_arnone a_412_carder a_443_carder a_490_carder a_510_
carder a_555_carder a_670_carder aph_443_carder adg_412_carder aph_443_stump
f adg_412_stumpf bb_555_arnone bb_555_carder c_670_carder cloud_albedo l2_fl
ags true_color|CALFILE = /home/aps/aps_v2.6/data/seawifs/cal/SEAWIFS_SENSO
R_CAL.TBL|RFLAG = ORIGINAL|OFMT =     3|SPIXL =   900|EPIXL =  1221|DPIXL =
    1|SLINE =  1281|ELINE =  1601|DLINE =     1|CTL_PT_INCR =    20|DEF_L2PR
OD_FILE = /home/aps/aps_v2.6/data/seawifs/seawifs_def_l2prod.dat|PROC_OCEA
N =   1|PROC_LAND =   1|AER_OPT = -113|AER_ITER_MIN =   1|AER_ITER_MAX =  10
|FOQ_OPT =   0|VCAL_OPT =   1|SL_PIXL =  -1|SL_FRAC =   0.2500|GLINT_OPT =
 1|OUTBAND_OPT =   2|OXABAND_OPT =   1|FILTER_OPT =   0|FILTER_FILE = /peopl
e/aps/aps_v2.6/data/seawifs/seawifs_filter.dat|MET1 = /home/aps/aps_v2.6/d
ata/CLIMATOLOGY.MET|MET2 = |MET3 = |OZONE1 = /home/aps/aps_v2.6/data/CLIMA
TOLOGY.OZONE|OZONE2 = |OZONE3 = |LAND = /home/aps/aps_v2.6/data/landmask.d
at|WATER = /home/aps/aps_v2.6/data/watermask.dat|ELEV = /home/aps/aps_v2
 .4/data/common/DEM.90N.90S.180W.180W.43200x21600.16bit|GAIN =   1.0179,   0.
9974,   0.9623,   0.9771,   0.9775,   0.9530,   0.9440,   1.0000|TAU_A =   -
1.000|ALBEDO =    1.500|ABSAER =    0.500|GLINT_THRESH =    0.005|SUNZEN =
 75.000|SATZEN =   56.000|MASKLAND =  1|MASKBATH =  0|MASKCLOUD =  1|MASKGLI
NT =  1|MASKSUNZEN =  0|MASKSATZEN =  0|MASKHILT =  0|MASKSTLIGHT =  0|CARDE
R_OPT =   0|CARDER_VERSION =   5|CARDER_ITER = 0|CARDER_GAIN =   1.0000,   1
 .0000,   1.0000,   1.0000,   1.0000,   1.0000|
"
inputMasks = "ATMFAIL,LAND,CLDICE,HIGLINT"
inputMasksInt = 523
prodList = "rrs_412,rrs_443,rrs_490,rrs_510,rrs_555,rrs_670,K_532,chl_oc4,ch
l_stumpf,chl_carder,a_412_arnone,a_443_arnone,a_490_arnone,a_510_arnone,a_55
5_arnone,a_670_arnone,a_412_carder,a_443_carder,a_490_carder,a_510_carder,a_
555_carder,a_670_carder,aph_443_carder,adg_412_carder,aph_443_stumpf,adg_412
```

```
_stumpf,bb_555_arnone,bb_555_carder,c_670_carder,cloud_albedo,true_color"
timeStart = "Sat Jun  1 18:40:13 2002"
timeStartYear = 2002
timeStartDay = 152
timeStartTime = 67213250
timeDayNight = "Day"
timeEnd = "Sat Jun  1 18:42:39 2002"
timeEndYear = 2002
timeEndDay = 152
timeEndTime = 67359416
localeUpperLeft = [37.0751,-88.322]
localeUpperRight = [35.2334,-78.6121]
localeLowerLeft = [28.3918,-91.1214]
localeLowerRight = [26.9324,-82.1592]
localeNWCorner = [37.0751,-91.1214]
localeNECorner = [37.0751,-78.6121]
localeSECorner = [26.9324,-78.6121]
localeSWCorner = [26.9324,-91.1214]
navType = "mapped"
mapProjectionSystem = "NRL(USGS)"
mapProjection = "MissBight"
mapUpperLeft = [31.0086,-90.51]
mapUpperRight = [31.0086,-84.5]
mapLowerLeft = [28.3854,-90.51]
mapLowerRight = [28.3854,-84.5]

Data Sets: (37)

int16   rrs_412 [300,600]
    createTime = "Sat Jun  1 14:33:20 2002"
    createSoftware = "APS v2.6"
    createUser = "aps"
    createPlatform = "i686-pc-linux-gnu"
    productName = "Remote Sensing Reflectance at 412 nm"
    productUnits = "dimensionless"
    productScaling = "Linear"
    scalingSlope = 2E-06
    scalingIntercept = 0.05
    validRange = [2E-06,0.04]
    browseRanges = [-0.015,0.015]
    browseColorTable = 4
    browseFunc = 0

int16   rrs_443 [300,600]
    createTime = "Sat Jun  1 14:33:20 2002"
    createSoftware = "APS v2.6"
    createUser = "aps"
    createPlatform = "i686-pc-linux-gnu"
    productName = "Remote Sensing Reflectance at 443 nm"
    productUnits = "dimensionless"
    productScaling = "Linear"
    scalingSlope = 2E-06
    scalingIntercept = 0.05
    validRange = [2E-06,0.04]
```

```
    browseRanges = [-0.015,0.015]
    browseColorTable = 4
    browseFunc = 0

int16   rrs_490 [300,600]
    createTime = "Sat Jun  1 14:33:20 2002"
    createSoftware = "APS v2.6"
    createUser = "aps"
    createPlatform = "i686-pc-linux-gnu"
    productName = "Remote Sensing Reflectance at 490 nm"
    productUnits = "dimensionless"
    productScaling = "Linear"
    scalingSlope = 2E-06
    scalingIntercept = 0.05
    validRange = [2E-06,0.04]
    browseRanges = [-0.015,0.015]
    browseColorTable = 4
    browseFunc = 0

int16   rrs_510 [300,600]
    createTime = "Sat Jun  1 14:33:20 2002"
    createSoftware = "APS v2.6"
    createUser = "aps"
    createPlatform = "i686-pc-linux-gnu"
    productName = "Remote Sensing Reflectance at 510 nm"
    productUnits = "dimensionless"
    productScaling = "Linear"
    scalingSlope = 2E-06
    scalingIntercept = 0.05
    validRange = [2E-06,0.04]
    browseRanges = [-0.015,0.015]
    browseColorTable = 4
    browseFunc = 0

int16   rrs_555 [300,600]
    createTime = "Sat Jun  1 14:33:20 2002"
    createSoftware = "APS v2.6"
    createUser = "aps"
    createPlatform = "i686-pc-linux-gnu"
    productName = "Remote Sensing Reflectance at 555 nm"
    productUnits = "dimensionless"
    productScaling = "Linear"
    scalingSlope = 2E-06
    scalingIntercept = 0.05
    validRange = [2E-06,0.04]
    browseRanges = [-0.015,0.015]
    browseColorTable = 4
    browseFunc = 0

int16   rrs_670 [300,600]
    createTime = "Sat Jun  1 14:33:20 2002"
    createSoftware = "APS v2.6"
    createUser = "aps"
    createPlatform = "i686-pc-linux-gnu"
```

```
    productName = "Remote Sensing Reflectance at 670 nm"
    productUnits = "dimensionless"
    productScaling = "Linear"
    scalingSlope = 2E-06
    scalingIntercept = 0.05
    validRange = [2E-06,0.04]
    browseRanges = [-0.015,0.015]
    browseColorTable = 4
    browseFunc = 0

int16   K_532 [300,600]
    createTime = "Sat Jun  1 14:33:20 2002"
    createSoftware = "APS v2.6"
    createUser = "aps"
    createPlatform = "i686-pc-linux-gnu"
    productName = "Diffuse attenuation coefficient at 532 nm"
    productUnits = "m^-1"
    productScaling = "Linear"
    scalingSlope = 0.0002
    scalingIntercept = 0
    validRange = [0.01,5]
    browseRanges = [0.02,2]
    browseColorTable = 0
    browseFunc = 2

int16   chl_oc4 [300,600]
    createTime = "Sat Jun  1 14:33:20 2002"
    createSoftware = "APS v2.6"
    createUser = "aps"
    createPlatform = "i686-pc-linux-gnu"
    productName = "Chlorophyll Concentration, OC4 Algorithm"
    productUnits = "mg m^-3"
    productScaling = "Linear"
    scalingSlope = 0.001
    scalingIntercept = 32
    validRange = [0.01,64]
    browseRanges = [0.01,45]
    browseColorTable = 0
    browseFunc = 2

int16   chl_stumpf [300,600]
    createTime = "Sat Jun  1 14:33:20 2002"
    createSoftware = "APS v2.6"
    createUser = "aps"
    createPlatform = "i686-pc-linux-gnu"
    productName = "Chlorophyll Concentration, Stumpf Algorithm"
    productUnits = "mg m^-3"
    productScaling = "Linear"
    scalingSlope = 0.001
    scalingIntercept = 32
    validRange = [0.01,64]
    browseRanges = [0.01,15]
    browseColorTable = 0
    browseFunc = 2
```

```
int16   chl_carder [300,600]
    createTime = "Sat Jun  1 14:33:20 2002"
    createSoftware = "APS v2.6"
    createUser = "aps"
    createPlatform = "i686-pc-linux-gnu"
    productName = "Chlorophyll Concentration, Carder Algorithm"
    productUnits = "mg m^-3"
    productScaling = "Linear"
    scalingSlope = 0.001
    scalingIntercept = 32
    validRange = [0.01,64]
    browseRanges = [0.01,45]
    browseColorTable = 0
    browseFunc = 2

int16   a_412_arnone [300,600]
    createTime = "Sat Jun  1 14:33:20 2002"
    createSoftware = "APS v2.6"
    createUser = "aps"
    createPlatform = "i686-pc-linux-gnu"
    productName = "Total Absorption at 412 nm (Arnone)"
    productUnits = "m^-1"
    productScaling = "Linear"
    scalingSlope = 1E-04
    scalingIntercept = 2.5
    validRange = [0.0001,5]
    browseRanges = [0.005,1.5]
    browseColorTable = 0
    browseFunc = 2

int16   a_443_arnone [300,600]
    createTime = "Sat Jun  1 14:33:20 2002"
    createSoftware = "APS v2.6"
    createUser = "aps"
    createPlatform = "i686-pc-linux-gnu"
    productName = "Total Absorption at 443 nm (Arnone)"
    productUnits = "m^-1"
    productScaling = "Linear"
    scalingSlope = 1E-04
    scalingIntercept = 2.5
    validRange = [0.0001,5]
    browseRanges = [0.005,1.5]
    browseColorTable = 0
    browseFunc = 2

int16   a_490_arnone [300,600]
    createTime = "Sat Jun  1 14:33:20 2002"
    createSoftware = "APS v2.6"
    createUser = "aps"
    createPlatform = "i686-pc-linux-gnu"
    productName = "Total Absorption at 490 nm (Arnone)"
    productUnits = "m^-1"
    productScaling = "Linear"
    scalingSlope = 1E-04
```

```
    scalingIntercept = 2.5
    validRange = [0.0001,5]
    browseRanges = [0.005,1.5]
    browseColorTable = 0
    browseFunc = 2

int16   a_510_arnone [300,600]
    createTime = "Sat Jun  1 14:33:20 2002"
    createSoftware = "APS v2.6"
    createUser = "aps"
    createPlatform = "i686-pc-linux-gnu"
    productName = "Total Absorption at 510 nm (Arnone)"
    productUnits = "m^-1"
    productScaling = "Linear"
    scalingSlope = 1E-04
    scalingIntercept = 2.5
    validRange = [0.0001,5]
    browseRanges = [0.005,1.5]
    browseColorTable = 0
    browseFunc = 2

int16   a_555_arnone [300,600]
    createTime = "Sat Jun  1 14:33:20 2002"
    createSoftware = "APS v2.6"
    createUser = "aps"
    createPlatform = "i686-pc-linux-gnu"
    productName = "Total Absorption at 555 nm (Arnone)"
    productUnits = "m^-1"
    productScaling = "Linear"
    scalingSlope = 1E-04
    scalingIntercept = 2.5
    validRange = [0.0001,5]
    browseRanges = [0.005,1.5]
    browseColorTable = 0
    browseFunc = 2

int16   a_670_arnone [300,600]
    createTime = "Sat Jun  1 14:33:20 2002"
    createSoftware = "APS v2.6"
    createUser = "aps"
    createPlatform = "i686-pc-linux-gnu"
    productName = "Total Absorption at 670 nm (Arnone)"
    productUnits = "m^-1"
    productScaling = "Linear"
    scalingSlope = 1E-04
    scalingIntercept = 2.5
    validRange = [0.0001,5]
    browseRanges = [0.4,0.9]
    browseColorTable = 0
    browseFunc = 1

int16   a_412_carder [300,600]
    createTime = "Sat Jun  1 14:33:20 2002"
    createSoftware = "APS v2.6"
```

```
    createUser = "aps"
    createPlatform = "i686-pc-linux-gnu"
    productName = "Total Absorption at 412 nm (Carder)"
    productUnits = "m^-1"
    productScaling = "Linear"
    scalingSlope = 1E-04
    scalingIntercept = 2.5
    validRange = [0.0001,5]
    browseRanges = [0.005,1.5]
    browseColorTable = 0
    browseFunc = 2

int16   a_443_carder [300,600]
    createTime = "Sat Jun  1 14:33:20 2002"
    createSoftware = "APS v2.6"
    createUser = "aps"
    createPlatform = "i686-pc-linux-gnu"
    productName = "Total Absorption at 443 nm (Carder)"
    productUnits = "m^-1"
    productScaling = "Linear"
    scalingSlope = 1E-04
    scalingIntercept = 2.5
    validRange = [0.0001,5]
    browseRanges = [0.005,1.5]
    browseColorTable = 0
    browseFunc = 2

int16   a_490_carder [300,600]
    createTime = "Sat Jun  1 14:33:20 2002"
    createSoftware = "APS v2.6"
    createUser = "aps"
    createPlatform = "i686-pc-linux-gnu"
    productName = "Total Absorption at 490 nm (Carder)"
    productUnits = "m^-1"
    productScaling = "Linear"
    scalingSlope = 1E-04
    scalingIntercept = 2.5
    validRange = [0.0001,5]
    browseRanges = [0.005,1.5]
    browseColorTable = 0
    browseFunc = 2

int16   a_510_carder [300,600]
    createTime = "Sat Jun  1 14:33:20 2002"
    createSoftware = "APS v2.6"
    createUser = "aps"
    createPlatform = "i686-pc-linux-gnu"
    productName = "Total Absorption at 510 nm (Carder)"
    productUnits = "m^-1"
    productScaling = "Linear"
    scalingSlope = 1E-04
    scalingIntercept = 2.5
    validRange = [0.0001,5]
    browseRanges = [0.005,1.5]
```

```
    browseColorTable = 0
    browseFunc = 2

int16   a_555_carder [300,600]
    createTime = "Sat Jun  1 14:33:20 2002"
    createSoftware = "APS v2.6"
    createUser = "aps"
    createPlatform = "i686-pc-linux-gnu"
    productName = "Total Absorption at 555 nm (Carder)"
    productUnits = "m^-1"
    productScaling = "Linear"
    scalingSlope = 1E-04
    scalingIntercept = 2.5
    validRange = [0.0001,5]
    browseRanges = [0.005,1.5]
    browseColorTable = 0
    browseFunc = 2

int16   a_670_carder [300,600]
    createTime = "Sat Jun  1 14:33:20 2002"
    createSoftware = "APS v2.6"
    createUser = "aps"
    createPlatform = "i686-pc-linux-gnu"
    productName = "Total Absorption at 670 nm (Carder)"
    productUnits = "m^-1"
    productScaling = "Linear"
    scalingSlope = 1E-04
    scalingIntercept = 2.5
    validRange = [0.0001,5]
    browseRanges = [0.4,0.9]
    browseColorTable = 0
    browseFunc = 1

int16   aph_443_carder [300,600]
    createTime = "Sat Jun  1 14:33:20 2002"
    createSoftware = "APS v2.6"
    createUser = "aps"
    createPlatform = "i686-pc-linux-gnu"
    productName = "Phytoplankton Absorption at 443 nm (Carder)"
    productUnits = "m^-1"
    productScaling = "Linear"
    scalingSlope = 1E-04
    scalingIntercept = 2.5
    validRange = [0.0001,5]
    browseRanges = [0.0005,1]
    browseColorTable = 0
    browseFunc = 2
int16   adg_412_carder [300,600]
    createTime = "Sat Jun  1 14:33:20 2002"
    createSoftware = "APS v2.6"
    createUser = "aps"
    createPlatform = "i686-pc-linux-gnu"
    productName = "DOM and Detritus Absorption at 412 nm (Carder)"
    productUnits = "m^-1"
```

```
    productScaling = "Linear"
    scalingSlope = 1E-04
    scalingIntercept = 2.5
    validRange = [0.0001,5]
    browseRanges = [0.01,1]
    browseColorTable = 0
    browseFunc = 2

int16   aph_443_stumpf [300,600]
    createTime = "Sat Jun  1 14:33:20 2002"
    createSoftware = "APS v2.6"
    createUser = "aps"
    createPlatform = "i686-pc-linux-gnu"
    productName = "Phytoplankton Absorption at 443nm, Stumpf Algorithm"
    productUnits = "m^-1"
    productScaling = "Linear"
    scalingSlope = 0.001
    scalingIntercept = 2.5
    validRange = [0,2]
    browseRanges = [0.0005,1]
    browseColorTable = 0
    browseFunc = 2

int16   adg_412_stumpf [300,600]
    createTime = "Sat Jun  1 14:33:20 2002"
    createSoftware = "APS v2.6"
    createUser = "aps"
    createPlatform = "i686-pc-linux-gnu"
    productName = "DOM and detritus Absorption at 412 nm, Stumpf Algorithm"
    productUnits = "m^-1"
    productScaling = "Linear"
    scalingSlope = 1E-04
    scalingIntercept = 2.5
    validRange = [0,10]
    browseRanges = [0.01,1]
    browseColorTable = 0
    browseFunc = 2

int16   bb_555_arnone [300,600]
    createTime = "Sat Jun  1 14:33:20 2002"
    createSoftware = "APS v2.6"
    createUser = "aps"
    createPlatform = "i686-pc-linux-gnu"
    productName = "Backscattering at 555 nm (Arnone)"
    productUnits = "m^-1"
    productScaling = "Linear"
    scalingSlope = 5E-06
    scalingIntercept = 0.16
    validRange = [5E-06,1]
    browseRanges = [0.0005,0.5]
    browseColorTable = 0
    browseFunc = 2

int16   bb_555_carder [300,600]
```

```
    createTime = "Sat Jun  1 14:33:20 2002"
    createSoftware = "APS v2.6"
    createUser = "aps"
    createPlatform = "i686-pc-linux-gnu"
    productName = "Backscattering at 555 nm (Carder)"
    productUnits = "m^-1"
    productScaling = "Linear"
    scalingSlope = 5E-06
    scalingIntercept = 0.16
    validRange = [5E-06,1]
    validRange = [5E-06,1]
    browseRanges = [0.0005,0.5]
    browseColorTable = 0
    browseFunc = 2

int16   c_670_carder [300,600]
    createTime = "Sat Jun  1 14:33:20 2002"
    createSoftware = "APS v2.6"
    createUser = "aps"
    createPlatform = "i686-pc-linux-gnu"
    productName = "Beam Attenuation at 670 nm (Carder)"
    productUnits = "m^-1"
    productScaling = "Linear"
    scalingSlope = 0.0005
    scalingIntercept = 16
    validRange = [0.0005,10]
    browseRanges = [0.05,5]
    browseColorTable = 0
    browseFunc = 1

int16   cloud_albedo [300,600]
    createTime = "Sat Jun  1 14:33:20 2002"
    createSoftware = "APS v2.6"
    createUser = "aps"
    createPlatform = "i686-pc-linux-gnu"
    productName = "Cloud albedo used for thresholding"
    productUnits = "dimensionless"
    productScaling = "Linear"
    scalingSlope = 0.01
    scalingIntercept = 0
    browseColorTable = 0
    browseFunc = 0

int32   l2_flags [300,600]
    createTime = "Sat Jun  1 14:33:20 2002"
    createSoftware = "APS v2.6"
    createUser = "aps"
    createPlatform = "i686-pc-linux-gnu"
    productName = "Level-2 Processing Flags"
    productUnits = "dimensionless"
    browseColorTable = 0
    browseFunc = 0
    f01_name = "ATMFAIL"
    f02_name = "LAND"
```

```
    f03_name = "BADANC"
    f04_name = "HIGLINT"
    f05_name = "HILT"
    f06_name = "HISATZEN"
    f07_name = "COASTZ"
    f08_name = "NEGLW"
    f09_name = "STRAYLIGHT"
    f10_name = "CLDICE"
    f11_name = "COCCOLITH"
    f12_name = "TURBIDW"
    f13_name = "HISOLZEN"
    f14_name = "HITAU"
    f15_name = "LOWLW"
    f16_name = "CHLFAIL"
    f17_name = "NAVWARN"
    f18_name = "ABSAER"
    f19_name = "TRICHO"
    f20_name = "MAXAERITER"
    f21_name = "MODGLINT"
    f22_name = "CHLWARN"
    f23_name = "ATMWARN"
    f24_name = "DARKPIXEL"
    f25_name = "SPARE"
    f26_name = "SPARE"
    f27_name = "SPARE"
    f28_name = "SPARE"
    f29_name = "SPARE"
    f30_name = "SPARE"

uint8   true_color [300,600,3]
    createTime = "Sat Jun  1 14:33:20 2002"
    createSoftware = "APS v2.6"
    createUser = "aps"
    createPlatform = "i686-pc-linux-gnu"
    productName = "True Color Image"
    productUnits = "dimensionless"
    productScaling = "Linear"
    scalingSlope = 1
    scalingIntercept = 0
    browseColorTable = 0
    browseFunc = 0

float64 MissBight [29]
    createTime = "Sat Jun  1 14:35:44 2002"
    createUser = "aps"
    createPlatform = "i686-pc-linux-gnu"
    productName = "Map Projection Parameters"

float64 CP_Pixels [31]
    createTime = "Sat Jun  1 14:35:44 2002"
    createUser = "aps"
    createPlatform = "i686-pc-linux-gnu"
    productName = "Sample Locations"
    productUnits = "pixels"
```

```
float64 CP_Lines [16]
    createTime = "Sat Jun  1 14:35:44 2002"
    createUser = "aps"
    createPlatform = "i686-pc-linux-gnu"
    productName = "Line Locations"
    productUnits = "pixels"

float64 CP_Longitudes [16,31]
    createTime = "Sat Jun  1 14:35:44 2002"
    createUser = "aps"
    createPlatform = "i686-pc-linux-gnu"
    productName = "Longitudes"
    productUnits = "decimal degrees"
    validRange = [-180,180]
    dataRange = [-90.5,-84.5]

float64 CP_Latitudes [16,31]
    createTime = "Sat Jun  1 14:35:44 2002"
    createUser = "aps"
    createPlatform = "i686-pc-linux-gnu"
    productName = "Latitudes"
    productUnits = "decimal degrees"
    validRange = [-90,90]
    dataRange = [28.3854,31]
```

3.2. MODIS Example

This is an example of a monthly MODIS Level-4 Regional Data Product.

```
File Attributes: (40)

createTime = "Fri Jun  7 13:53:27 2002"
createAgency = "Naval Research Laboratory, Stennis Space Center"
createSoftware = "APS v2.5"
createUser = "apsdev"
createPlatform = "i686-pc-linux-gnu"
file = "MODAM20012442001273.L4_MO_GOM"
fileTitle = "NRL Level-4 Data"
fileVersion = "2.6"
fileClassification = "UNCLASSIFIED"
fileStatus = "Experimental"
sensor = "MODIS"
sensorAgency = "NASA"
sensorType = "whiskbroom"
sensorSpectrum = "Thermal"
sensorNumberOfBands = 5
sensorResolutionInKM = 1
sensorPlatform = "TERRA-AM"
sensorPlatformType = "Polar-orbiting Satellite"
navType = "mapped"
mapProjectionSystem = "NRL(USGS)"
mapProjection = "GulfOfMexico"
mapUpperLeft = [31.0064,-98.0074]
mapUpperRight = [31.0064,-80.0074]
```

```
mapLowerLeft = [18.811,-98.0074]
mapLowerRight = [18.811,-80.0074]
inputParameters = "-vcL -H chl_oc3m,K_532,sst -f 1,0,0 -T 2 -o MODAM20012442001273.L
inputMasks = ""
inputMasksInt = 0
timeStart = "Sat Sep  1 04:15:00 2001"
timeStartYear = 2001
timeStartDay = 244
timeStartTime = 15300000
timeDayNight = "Day/Night"
timeEnd = "Sun Sep 30 17:39:59 2001"
timeEndYear = 2001
timeEndDay = 273
timeEndTime = 63599000
prodList = "chl_oc3m,chl_oc3m_cnt,K_532,K_532_cnt,sst,sst_cnt"
Composition Type = "Monthly Composite"
inputFiles = "MODAM2001244041500.L3_HNAV_GOM,MODAM2001244042000.L3_HNAV_GOM,
MODAM2001244162500.L3_HNAV_GOM,MODAM2001244180000.L3_HNAV_GOM,MODAM200124418
0500.L3_HNAV_GOM,MODAM2001245032000.L3_HNAV_GOM,MODAM2001245032500.L3_HNAV_G
OM,MODAM2001245050000.L3_HNAV_GOM,MODAM2001245153000.L3_HNAV_GOM,MODAM200124
5170500.L3_HNAV_GOM,MODAM2001245171000.L3_HNAV_GOM,MODAM2001246040000.L3_HNA
V_GOM,MODAM2001246040500.L3_HNAV_GOM,MODAM2001246161000.L3_HNAV_GOM,MODAM200
1246161500.L3_HNAV_GOM,MODAM2001246175000.L3_HNAV_GOM,MODAM2001247030500.L3_
HNAV_GOM,MODAM2001247031000.L3_HNAV_GOM,MODAM2001247044500.L3_HNAV_GOM,MODAM
2001247045000.L3_HNAV_GOM,MODAM2001247165500.L3_HNAV_GOM,MODAM2001248035000.
L3_HNAV_GOM,MODAM2001248035500.L3_HNAV_GOM,MODAM2001248053000.L3_HNAV_GOM,MO
DAM2001248160000.L3_HNAV_GOM,MODAM2001248173500.L3_HNAV_GOM,MODAM20012481740
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,MODAM2001249043500.L3_HNAV_GOM,MODAM2001249164000.L3_HNAV_GOM,MODAM20012491
64500.L3_HNAV_GOM,MODAM2001250034000.L3_HNAV_GOM,MODAM2001250051500.L3_HNAV_
GOM,MODAM2001250052000.L3_HNAV_GOM,MODAM2001250154500.L3_HNAV_GOM,MODAM20012
50155000.L3_HNAV_GOM,MODAM2001250172500.L3_HNAV_GOM,MODAM2001250173000.L3_HN
AV_GOM,MODAM2001251024500.L3_HNAV_GOM,MODAM2001251042000.L3_HNAV_GOM,MODAM20
01251042500.L3_HNAV_GOM,MODAM2001251163000.L3_HNAV_GOM,MODAM2001251180500.L3
_HNAV_GOM,MODAM2001251181000.L3_HNAV_GOM,MODAM2001252032500.L3_HNAV_GOM,MODA
M2001252033000.L3_HNAV_GOM,MODAM2001252050500.L3_HNAV_GOM,MODAM2001252153500
 .L3_HNAV_GOM,MODAM2001252171000.L3_HNAV_GOM,MODAM2001252171500.L3_HNAV_GOM,M
ODAM2001253041000.L3_HNAV_GOM,MODAM2001253161500.L3_HNAV_GOM,MODAM2001253162
000.L3_HNAV_GOM,MODAM2001253175500.L3_HNAV_GOM,MODAM2001253180000.L3_HNAV_GO
M,MODAM2001254031500.L3_HNAV_GOM,MODAM2001254045000.L3_HNAV_GOM,MODAM2001254
045500.L3_HNAV_GOM,MODAM2001254152000.L3_HNAV_GOM,MODAM2001254152500.L3_HNAV
_GOM,MODAM2001254170000.L3_HNAV_GOM,MODAM2001254170500.L3_HNAV_GOM,MODAM2001
255035500.L3_HNAV_GOM,MODAM2001255040000.L3_HNAV_GOM,MODAM2001255053500.L3_H
NAV_GOM,MODAM2001255160500.L3_HNAV_GOM,MODAM2001255174000.L3_HNAV_GOM,MODAM2
001255174500.L3_HNAV_GOM,MODAM2001256030000.L3_HNAV_GOM,MODAM2001256030500.L
3_HNAV_GOM,MODAM2001256044000.L3_HNAV_GOM,MODAM2001256044500.L3_HNAV_GOM,MOD
AM2001256164500.L3_HNAV_GOM,MODAM2001256165000.L3_HNAV_GOM,MODAM200125703450
0.L3_HNAV_GOM,MODAM2001257052000.L3_HNAV_GOM,MODAM2001257052500.L3_HNAV_GOM,
MODAM2001257155000.L3_HNAV_GOM,MODAM2001257155500.L3_HNAV_GOM,MODAM200125717
3000.L3_HNAV_GOM,MODAM2001257173500.L3_HNAV_GOM,MODAM2001258025000.L3_HNAV_G
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8163500.L3_HNAV_GOM,MODAM2001258164000.L3_HNAV_GOM,MODAM2001258181500.L3_HNA
V_GOM,MODAM2001259033000.L3_HNAV_GOM,MODAM2001259033500.L3_HNAV_GOM,MODAM200
1259051000.L3_HNAV_GOM,MODAM2001259051500.L3_HNAV_GOM,MODAM2001259154000.L3_
```

```
HNAV_GOM,MODAM2001259154500.L3_HNAV_GOM,MODAM2001259171500.L3_HNAV_GOM,MODAM
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,MODAM2001261050000.L3_HNAV_GOM,MODAM2001261152500.L3_HDAM2001263031000.L3_H
NAV_GOM,MODAM2001263044500.L3_HNAV_GOM,MODAM2001263045000.L3_HNAV_GOM,MODAM2
001263165000.L3_HNAV_GOM,MODAM2001263165500.L3_HNAV_GOM,MODAM2001264035000.L
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MODAM2001265030000.L3_HNAV_GOM,MODAM2001265043000.L3_HNAV_GOM,MODAM200126504
3500.L3_HNAV_GOM,MODAM2001265164000.L3_HNAV_GOM,MODAM2001265164500.L3_HNAV_G
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6051500.L3_HNAV_GOM,MODAM2001266052000.L3_HNAV_GOM,MODAM2001266154500.L3_HNA
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DAM2001268171000.L3_HNAV_GOM,MODAM2001268171500.L3_HNAV_GOM,MODAM20012690410
00.L3_HNAV_GOM,MODAM2001269161500.L3_HNAV_GOM,MODAM2001269162000.L3_HNAV_GOM
,MODAM2001269175500.L3_HNAV_GOM,MODAM2001269180000.L3_HNAV_GOM,MODAM20012700
31500.L3_HNAV_GOM,MODAM2001270045000.L3_HNAV_GOM,MODAM2001270045500.L3_HNAV_
GOM,MODAM2001270152000.L3_HNAV_GOM,MODAM2001270152500.L3_HNAV_GOM,MODAM20012
70170000.L3_HNAV_GOM,MODAM2001271035500.L3_HNAV_GOM,MODAM2001271040000.L3_HN
AV_GOM,MODAM2001271053500.L3_HNAV_GOM,MODAM2001271160500.L3_HNAV_GOM,MODAM20
01271174000.L3_HNAV_GOM,MODAM2001271174500.L3_HNAV_GOM,MODAM2001272030000.L3
_HNAV_GOM,MODAM2001272030500.L3_HNAV_GOM,MODAM2001272044000.L3_HNAV_GOM,MODA
M2001272164500.L3_HNAV_GOM,MODAM2001272165000.L3_HNAV_GOM,MODAM2001273034500
 .L3_HNAV_GOM,MODAM2001273052000.L3_HNAV_GOM,MODAM2001273052500.L3_HNAV_GOM,M
ODAM2001273155000.L3_HNAV_GOM,MODAM2001273155500.L3_HNAV_GOM,MODAM2001273173
000.L3_HNAV_GOM,MODAM2001273173500.L3_HNAV_GOM"

Data Sets: (7)

float64 GulfOfMexico [29]
    createTime = "Tue Jun  4 08:58:47 2002"
    createSoftware = "imgReformat"
    createUser = "apsdev"
    createPlatform = "i686-pc-linux-gnu"
    productName = "Map Projection Parameters"

int16   chl_oc3m [1810,2430]
    createTime = "Fri Jun  7 13:53:27 2002"
    createSoftware = "imgMean"
    createUser = "apsdev"
    createPlatform = "i686-pc-linux-gnu"
    productScaling = "Linear"
    scalingSlope = 0.01
    scalingIntercept = 32
    productName = "Chlorophyll-a Concentration, OC3m Algorithm"
    productAlgorithm = "OC3m Algorithm (2000)"
    productUnits = "mg m^-3"
```

```
    productStatus = "mg m^-3"
    validRange = [0.01,64]
    productDataRanges = [0.01,55.4577]
    productActualRanges = [0,345.201]
    browseRanges = [0.01,45]
    browseColorTable = 0
    browseFunc = 2

uint16  chl_oc3m_cnt [1810,2430]
    createTime = "Fri Jun  7 13:53:27 2002"
    createUser = "apsdev"
    createPlatform = "i686-pc-linux-gnu"

int16   K_532 [1810,2430]
    createTime = "Fri Jun  7 13:53:27 2002"
    createSoftware = "imgMean"
    createUser = "apsdev"
    createPlatform = "i686-pc-linux-gnu"
    productScaling = "Linear"
    scalingSlope = 0.001
    scalingIntercept = 3
    productName = "Diffuse Attenuation at 532 nm (488/551)"
    productAlgorithm = "SeaWiFS K490 (2000) + Austin/Petzold (1984)"
    productUnits = "meters^-1"
    productStatus = "meters^-1"
    validRange = [0.01,6.4]
    productDataRanges = [0.0492047,6.35099]
    productActualRanges = [0,184431]
    browseRanges = [0.01,2]
    browseColorTable = 0
    browseFunc = 2

uint16  K_532_cnt [1810,2430]
    createTime = "Fri Jun  7 13:53:27 2002"
    createSoftware = "imgMean"
    createUser = "apsdev"
    createPlatform = "i686-pc-linux-gnu"
    productScaling = "Linear"
    scalingSlope = 0.01
    scalingIntercept = 32
    productName = "Chlorophyll-a Concentration, OC3m Algorithm"
    productAlgorithm = "OC3m Algorithm (2000)"
    productUnits = "mg m^-3"
    productStatus = "mg m^-3"
    validRange = [0.01,64]
    productDataRanges = [0.01,55.4577]
    productActualRanges = [0,345.201]
    browseRanges = [0.01,45]
    browseColorTable = 0
    browseFunc = 2

uint16  chl_oc3m_cnt [1810,2430]
    createTime = "Fri Jun  7 13:53:27 2002"
    createUser = "apsdev"
```

```
    createPlatform = "i686-pc-linux-gnu"

int16   K_532 [1810,2430]
    createTime = "Fri Jun  7 13:53:27 2002"
    createSoftware = "imgMean"
    createUser = "apsdev"
    createPlatform = "i686-pc-linux-gnu"
    productScaling = "Linear"
    scalingSlope = 0.001
    scalingIntercept = 3
    productName = "Diffuse Attenuation at 532 nm (488/551)"
    productAlgorithm = "SeaWiFS K490 (2000) + Austin/Petzold (1984)"
    productUnits = "meters^-1"
    productStatus = "meters^-1"
    validRange = [0.01,6.4]
    productDataRanges = [0.0492047,6.35099]
    productActualRanges = [0,184431]
    browseRanges = [0.01,2]
    browseColorTable = 0
    browseFunc = 2

uint16  K_532_cnt [1810,2430]
    createTime = "Fri Jun  7 13:53:27 2002"
    createUser = "apsdev"
    createPlatform = "i686-pc-linux-gnu"

int16   sst [1810,2430]
    createTime = "Fri Jun  7 13:53:27 2002"
    createSoftware = "imgMean"
    createUser = "apsdev"
    createPlatform = "i686-pc-linux-gnu"
    productScaling = "Linear"
    scalingSlope = 0.01
    scalingIntercept = 0
    productName = "Sea Surface Temperature"
    productAlgorithm = "modsst 1.124 2002/03/25 (U. Miami)"
    productUnits = "deg C"
    productStatus = "deg C"
    validRange = [0,40]
    productDataRanges = [2.38047E-05,39.5584]
    productActualRanges = [-89.3757,43.3022]
    browseRanges = [0,35]
    browseColorTable = 0
    browseFunc = 0

uint16  sst_cnt [1810,2430]
    createTime = "Fri Jun  7 13:53:27 2002"
    createUser = "apsdev"
    createPlatform = "i686-pc-linux-gnu"
```