Land Data Operational Product Evaluation (LDOPE) Tools

Version 3.6

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LDOPE Group
NASA GSFC

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Introduction

Tools for assessment of Land data quality are developed and maintained by staff at the Land Data Operational Product Evaluation (LDOPE) facility located at NASA Goddard Space Flight Center. LDOPE was formed prior to launch of MODIS on-board the Terra satellite to support the MODIS Land science team and to provide a coordination mechanism for the LAND quality assessment activities. Over the years LDOPE has transitioned to coordinate the QA of Land products from MODIS on-board the NASA EOS Terra and Aqua, VIIRS on-board JPSS's NPP and J1, and the LTDR data from reprocessing of AVHRR on-board the NOAA series of satellites.

The LDOPE staff continue to develop and maintain a number of dedicated tools for the manipulation and visualization of the MODIS/VIIRS Land products. These tools are being used by the LDOPE staff in assessing the quality of the MODIS/VIIRS product at LDOPE and by the science teams at their science computing facilities. A subset of these tools is also being distributed to the data users by the DAACs.

These tools are being updated by LDOPE for use in assessment of VIIRS algorithms and products generated from processing of the VIIRS data on-board the NPP and J1 missions. In anticipation of the validation activity comparing the VIIRS products to the heritage MODIS products, LDOPE staff upgraded these tools to work transparently with the MODIS and VIIRS data products.

The tools are written in C and can run at command line or called from scripts and other packages. They are invoked using a UNIX-like command and argument syntax. Subset of these tools is integrated to ENVI using the Graphical User Interface (GUI) library developed in ENVI/IDL. The tool command arguments can be specified in any order.

In addressing the introduction of new file format, HDF5/NetCDF4, to the VIIRS land data products (LDPs) and the changes in the metadata of the MODIS LDPs stored in HDF4 file format, LDOPE tools have been enhanced to Version 3.6 (V3.6). The enhanced V3.6 works with the Collection6 MODIS LDPs in HDF4 and the Collection1 VIIRS LDPs in HDF5 or NetCDF4. This V3.6 supports input files in HDF4 or HDF5 but just HDF4 (*not* HDF5) format for the output files. We plan to further enhance these tools by adding the capability to support HDF5 output in the next version release.

The major enhancements for V3.6 are described below:

- Capability to handle the input HDF5 file format. Since NetCDF4 is based on HDF5, V3.6 can handle VIIRS data stored in either HDF5 or NetCDF4.
- Capability to deal with HDFEOS5. For tools involving geolocation or georeference system, V3.6 can deal with either HDFEOS2 (HDF4-based) or HDFEOS5 (HDF5-based). These tools include cp_hdfeos,

cp_proj_param, geolocation, read_proj_param, subset_sds, and sub_set_spatial.

- Capability to deal with metadata differently for HDF4 and HDF5. For HDF4, metadata in XML format belong to file attributes. For HDF5, these XML format data are mostly saved as dataset object, in a same way as physical scientific data sets (SDS) for VIIRS LDPs.
- Update the tools read_l2g and read_l2g_lite to work with Collection6 (C6) version of MODIS L2G and C1 version of the VIIRS L2G products.
- Code change to I/O section of the tools enhancing the efficiency of processes. In this release, this efficiency enhancement has been implemented to 8 tools: comp_sds_stat, copy_sds, cp_hdfeos, read_l2g, read_l2g_lite, reduce_sds, sds2jpg, and unpack_sds_bits. The efficiency enhancement will be expanded to other tools in our next version release.
- Implemented chunked HDF4 internal compression to the output HDF4 file format for 6 tools: copy_sds, mask_sds, read_l2g, read_l2g_lite, reduce_sds and unpack_sds_bits.
- Tools sds2gif and sds2jpg enhanced to handle 3 dimensional SDS in either band-interleaved-by-pixel or band-sequential data storage order.
- Tools support three OS: Linux server, Mac terminal, and Cygwin on Win 7 (details in Appendix A).

These enhancements are transparent to users without any change to the command line format and hence any wrapper or higher level scripts using the earlier version of the tools will not need any change while using the tools from this new version. Users should be cautious that i) for output file formats, V3.6 does NOT support HDF5/NetCDF4 but just HDF4; and ii) for input files in HDF5/NetCDF4 format, SDS name for "-sds=" flag refers to "true" name without the HDF5 group prefix. For example, the true SDS name of NDVI in VIIRS VNP13A1 data product saved in HDF5 file format is "500 m 16 days NDVI" not "/HDFEOS/GRIDS/NPP_Grid_16Day_VI_500m/Data Field/500 m 16 days NDVI". In this case, the HDF5 group prefix refers to "/HDFEOS/GRIDS/NPP_Grid_16Day_VI_500m/Data Field/"

Reference for Acknowledgment

If you wish to acknowledge the use of these tools please reference them as "Software tools provided by the Land Data Operational Product Evaluation (LDOPE) group at GSFC/NASA (Roy et al. 2002)". Roy, D.P., Borak, J.S., Devadiga, S., Wolfe, R.E., Zheng, M., Descloitres, J., 2002, The MODIS Land Product Quality Assessment Approach, *Remote Sensing of Environment*, 83, 62-76.

MODIS/VIIRS LDOPE Tools Capabilities

The following table describes sets of tools included in this delivery. Complete command line syntax for each of the tools will be provided at the time of actual delivery as detailed in the following sections. This document will be updated with each delivery.

Tool Name	Description
bin2dec	Convert a binary string to an equivalent decimal number.
comp_sds_diff_img	Output the difference of the two data sets in the same or two different input hdf files as another data set in an output hdf file
comp_sds_stat	Print summary statistics (mean, standard deviation, minimum, maximum and number of observations) of any SDS, excluding no-data and missing values, of any LAND product.
copy_sds	Apply user specified scale to one or more data set from an input hdf file and copy the scaled dataset to an output hdf file.
cp_hdfeos	Copy HDF EOS metadata from an input HDF file to output hdf file.
cp_proj_param	Copy projection metadata into an HDF file that is defined in the MODIS/VIIRS Land Integerized Sinusoidal projection or Sinusoidal projection. The HDF file may then be reprojected using the reprojection tool. This allows reprojection of MODIS/VIIRS Land L2G/L3/L4 HDF-EOS data product SDS(s) filtered or masked by LDOPE QA tools or other software.
create_mask	Apply relational and boolean operators to one or more SDS in one or more LAND products to create an output 2D HDF SDS that can be read by conventional COTS. For example, create a binary SDS that shows the pixel locations where only good quality, non-cloudy, 16-day vegetation index values with a land cover type = 3 were produced.
create_reg_img	Create a dataset with one or more regions of user specified size and data value in an output HDF file.
dec2bin	Convert a decimal number to a binary and print binary value for the user specified binary positions.
enlarge_sds	The inverse of companion tool *reduce_sds*. Simulate finer resolution data by pixel replication.
geolocation	Compute the latitude and longitude of a MODLAND L2G, 3, 4 pixel coordinate.
geolocation_img	Generate image of geolocation dataset for the user specified resolution and and projection parameter.
jdoy	Print the day of year for the input calendar date.
mask_sds	Mask one of more SDS of a LAND product file and output the SDS values at pixels where the mask criteria are met and output fill values elsewhere.

mosaic_sds	Create a spatial mosaic of SDSs from different L3 LAND products. Specified SDSs are spatially arranged based either on their geolocation or in a user specified manner.
read_12g	The L2G products store one or more L2 observations for each L2G pixel in a series of layers (that reflect the MODIS/VIIRS orbit overpass and swath sensing geometry) in a compressed run length encoded format. This tool reads the L2G format and writes user specified layers to output 2D HDF Science Data Sets (SDSs) that can be read by commercial of the shelf (COTS) software.
read_12g_lite	The L2G-lite format is a L2G format that stores only one observation per orbit. This tool reads the L2G-lite format and writes user specified layers to output 2D HDF Science Data Sets (SDSs) that can be read by commercial of the shelf (COTS) software.
read_meta	Print the ECS core and archive metadata and SDS attributes of any LAND product.
read_pixvals	Read LAND product values at specified pixel locations.
read_proj_param	Read the projection parameter information of a L2G/L3/L4 LAND HDF-EOS product. This information is needed to project non-LAND data into registration with a geolocated MODLAND product.
read_sds_attributes	Print the attributes of one or more SDS of MODIS/VIIRS Land HDF-EOS data products.
reduce_sds	Generate reduced spatial resolution LAND product SDSs by sub-sampling or averaging. Handle the LAND product no-data and missing values. This may be used to reduce data volumes, and to quickly enable analysis of the different MODLAND product spatial resolutions (250m, 500m, 1km), or to enable comparison with other coarser spatial resolution data sets
reduce_sds_rank	Several LAND products (e.g., MCD43 or VNP43) and related MODIS/VIIRS products (e.g., MOD35) contain multidimensional SDSs. This tool converts multidimensional (3D or 4D) SDS to a series of 2D HDF SDSs that can be read by conventional COTS.
rename_sds	Copy user specified dataset from an input HDF file to an output HDF file with a different data set name of user choice.
sds2bin	Convert an SDS of any HDF-EOS file to a flat binary image format.
sds2gif	Convert an SDS of any HDF-EOS file to a gif image.
sds2jpg	Convert three SDS of any HDF-EOS file to a jpg.
sds_hist	Print the histogram of SDS values (frequency and value), excluding no-data and missing values, over a user-requested data range.

sds_math	Perform simple arithmetic on two input data sets from one or more input hdf file and write the result as a data set to an output hdf file.
sds_range	Print the observed range, excluding no-data and missing values, of specified SDSs in any LAND product.
sds_ts_stat	Compute pixel level statistics of one or more datasets from two or more input temporally sequential input hdf files.
sds_values	Print all the unique values found in specified SDSs of any LAND product. This tool is most useful for summarizing the data distribution of SDSs that have few expected values and categorical SDSs (e.g., the LAND snow and fire products).
subset_sds	Create spatial subset SDS(s) from one or more SDS of a MODIS/VIIRS Land HDF-EOS data product.
subset_spatial	Extract spatial subset of one or more data set in an input hdf file and store the subset as a dataset in an output hdf file.
tiltcenter	Compute the centroid of the input tile.
tileid	Compute the LAND L2G, 3, 4 tile id for a given latitude and longitude. This tool identifies the LAND tile that corresponds to a known geographic location.
transpose_sds	Transpose one or more dataset in an HDF file converting the PM satellite acquisition to equivalent AM acquisition.
unpack_sds_bits	The LAND product per-pixel QA information and other information such as the land-sea mask, logical criteria used by the algorithm, and cloud state are stored in an efficient bit encoded manner. This tool decodes requested bit fields and writes them to 2D HDF SDSs that can be read by conventional COTS.

bin2dec

NAME

bin2dec - Convert a singed binary number to decimal

SYNOPSIS

bin2dec [-help]

bin2dec <number>

DESCRIPTION

This routine converts a signed binary number to equivalent decimal. The binary number is considered to be –ve if the most significant bit is a 1.

ARGUMENTS

number	Number in binary

EXAMPLES

bin2dec 010110

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comp_sds_diff_img

NAME

comp_sds_diff_img – Compute the difference between the two input SDS's and store the difference or relative difference in the output hdf file And display percentage(s) of observations within relative difference threshold(s) on screen for the continuous ESDT. Compute the counts of match, false and missed detections between the two input SDSs in the output hdf file and display the numbers and percentages of match, false and missed detections on screen for the discrete ESDT. Compute only the difference between the two input qa SDSs and store the difference in the output hdf file for all ESDTs.

SYNOPSIS

comp_sds_diff_img –help

comp_sds_diff_img –esdt=<ESDT> -sds1=<f1,sds1> -sds2=<f2,sds2>
-sds3=<f3,sds3> [-geo] [-metal] [-qa] [-abs] [-stat=threshold list]

DESCRIPTION

Compute the difference between the two input SSDs and store the difference or relative difference in the output hdf file and display percentage(s) of observations within relative difference threshold(s0 on screen for the continuous ESDT. Only one of the options of –abs and –stat can be chosen for the MOD09. Option of –abs is for the difference and –stat for the relative difference percentage.

Compute the counts of match, false and missed detections between the two input SDSs in the output hdf file and display the numbers and percentages of match, false and missed detections on screen for the discrete ESDTs.

The output SDS content:

For all MOD09 type esdt inputs

sds_val= 2000; one of the input is a fill value

-100 -1000 (percentage relative difference * 10) for no floating data type

-100 -100 (percentage relative difference) for floating data type

For MOD10 esdt type

sds_val= 2000; one of the input is a fill value

%diff or abs diff –For snow range 1-100

for all other classes

0 match

3000 mismatch

For MOF14/MOD14CRS esdt types

sds_val= 2000; one of the input is a fill value

0	match
1	missed fire
2	false fire
5	other difference

For QA sds and CLOUD

Sds_val = 2000; one of the input is a fill value

0	match
5	no match

The fill value attribute is copied from the input. However the output difference SDS may never contain this value. Compute only the difference between the two input qa SDSs and store the difference in the output hdf file for all ESDT. This tool supports 2D/3D SDSs. The tool command arguments can be specified in any order.

ARGUMENTS

-help	Display this help message
-sds1=<f1,sds1>	The first filename and sds name are separated by commas with no space. To process a specific layer of a 3DSDS, specify the element number of the third dimension as a dot extension of the SDS name: sds_name.n (e.g., sur_refl_b02.2=the layer defined by the second element of the 3rd dimension of the 3DSDS sur_refl_b02. The 1st element of the 3rd dimension of the 3D SDS will be used if no element number is specified.
-sds2=<f2,sds2>	The second filename and sdsname are separated by commas with no space. To process a specific layer of a 3D SDS, using the same way as the first SDS.
-sds3=<f3,sds3>	Output filename and sdsname are separated by commas with no space. The dimension of the output SDS is 2D.
-esdt=<ESDT>	ESDT = MOD09|MOD10|MOD14|CLOUD. Use esdt of MOD09 for all continuous products and use other esdts for the discrete produts.
[-geo]	Copy metadata from the first input file to the output file if geolocation SDS is exist in the first input file

[-meta] Copy metadata from the first input file to the output file.

[-qa] Input is a qa SDS and the output is difference of two input qa SDSs with no summary results printed on screen. This option can be used for all ESDTs.

[-abs] Output difference (-ve to +ve) with no summary results printed on screen. This option is only for MOD09.

[-stat=threshold list] Output the percentage of relative difference and print percentage(s) of observations within relative difference threshold(s) on screen. Thresholds are separated by comma if more than one threshold are used. This option is only for MOD09.

EXAMPLES

```
comp_sds_diff_img -esdt=MOD09 -geo -meta -abs -stat=1
        -sds1=VNP09A1.A2016289.h11v08.001.2017189045223.h5,
              SurfReflect_M1
        -sds2=VNP09A1.A2016297.h11v08.001.2017189113645.h5,
              SurfReflect_M1
        -sds3=VNP09A1.diff.289.297.hdf,SurfReflect_M1

comp_sds_diff_img -esdt=MOD09 -geo -meta -qa
        -sds1="VNP13A2.A2018073.h09v05.001.2018089070229.h5,1 km
        16 days VI Quality"
        -sds2="VNP13A2.A2018017.h09v05.001.2018075160735.h5,1 km
        16 days VI Quality"
        -sds3="MOD13A2.diff.073.017.hdf,1 km 16 days VI Quality"

comp_sds_diff_img -esdt=MOD09 -geo -meta -abs -stat=1
        -sds1=MOD09A1.A2016217.h09v05.006.2016226075317.hdf,
              sur_refl_b02
        -sds2=MOD09A1.A2016209.h09v05.006.2016222123023.hdf,
              sur_refl_b02
        -sds3=MOD09A1.diff.217.209.hdf,sur_refl_b02

comp_sds_diff_img –esdt=MOD10 –meta
        –geo -sds1='MOD10A1. A2003001.h09v05.005.
        2010231100856_base.hdf,Snow_Cover_Daily_Tile'
        -sds2='MOD10A1. A2003001.h09v05.005.
        2010231154155_new.hdf,Snow_Cover_Daily_Tile'
        -sds3='diff.MOD10A1. A2003001.h09v05.005. Hdf,
```

Snow_Cover_Daily_Tile'

comp_sds_diff_img –esdt=CLOUD –meta –geo
-sds1='MOD35_L2.A2003208.2355.005.
2010224033927.hdf,Cloud_Mask_sub'
sds2='MOD35_L2.A2003208.2355.006.
201032609436.hdf.Cloud_Mask_sub'
sds3='MOD35_L2.A2003208.2355.diff.hdf,Cloud_Mask_sub_diff'

comp_sds_diff_img –esdt=MOD14CRS –meta –geo
-sds1='MOD14CRS.A2003001.0815.005.2012294001408.hdf.
CoarseFireCounts'
sds2='MOD14CRS.A2003001.0815.006.2012349130458.hdf,Coars
eFireCounts'
sds3='MOD14CRS.A2003001.0815.diff.hdf,CoarseFireCounts'

comp_sds_diff_img –esdt=MOD09 sds1='MOD13A1.A2003001.
h09v05.005.201023090847_base.hdf,500m 16 days NDVI' -sds2=
'MOD13A1.A2003001.h09v05.0052010231195858_new.hdf,500m
16 cays NDVI' -sds3=data_out/diff.MOD13A1.
A2003001.h09v05.005.hdf,500m_16_days_NDVI_diff –meta –geo
–stat=1

comp_sds_diff_img –esdt=MOD09 -sds1=NPP_SRFLMIP_L2.A20
10251.2220.P1_00753.2011120134238.hdf,M10_SurfRefl -sds2=
NPP_SRFLMIP_L2.A2010251.2225.P1_00753.2011120134238.hdf
,M10_SurfRelf -sds3=data_out/NPP_SRFLMIP_L2.
A2010252.220_2225_diff1.hdf,M10_SurfRefl –meta –geo –stat=1

comp_sds_diff_img –esdt=MOD09
-sds1=NPP_VMAE_L1/2011/348/NPP_VMAE_
L1.A2011348.000.AGG_03000.2011348213939.hdf,
Radiance_Mod_M4 -sds2= /NPP_VMAE_L1/2011/348/
NPP_VMAE_L1.A2011348.000.P103001.2011348185918.hdf,
Radiance_Mod_M4 -sds3=data_out/NPP_VMAE_L1.A20113
48.0000.IDPS_LPEATE_diff.hdf,Radiance_Mos_M4 –meta –geo –
stat=1

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comp_sds_stat

NAME

comp_sds_stat – Copy the hdfeos metadata to the input L3 HDF files.

SYNOPSIS

comp_sds_stat -help

comp_sds_stat -sds=<sds1,sds2. . .> -of=<output_file> f1 [..[f4…]]

DESCRIPTION

Compute pixel level mean of SDS in input HDF files.

ARGUMENTS

-help	Display this help message
-of=filename	Output file
-sds=<SDS list>	List of SDSs to mosaic. The SDS names are separated by commas with no space. By default. all SDSs are processed maintaining the input SDS interleaving.
f1 [..[f4…]]	Input filenames.

EXAMPLES

comp_sds_stat -sds=sur_refl_b01,sur_refl_b04,sur_refl_b03
-of=MOD09A1.mean_2016209_2016217.h09v05.006.hdf
MOD09A1.A2016209.h09v05.006.2016222123023.hdf
MOD09A1.A2016217.h09v05.006.2016226075317.hdf

comp_sds_stat -sds=SurfReflect_M5,SurfReflect_M4,SurfReflect_M3
-of=VNP09A1.mean_2016289_2016297.h11v08.001.hdf
VNP09A1.A2016289.h11v08.001.2017189045223.h5
VNP09A1.A2016297.h11v08.001.2017189113645.h5

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copy_sds

NAME

copy_sds – Copy SDS(s) from input file to an output HDF file
(appends to existing HDF file)

SYNOPSIS

Copy_sds [help]

Copy_sds [-sds=<old name>,<new name>] [-scale=val] [-out_dt=val] -ncp [-meta] -of=<output filename> filename

DESCRIPTION

Copy one or more SDS from an input HDF file to an output HDF file. SDSs are appended to an existing HDF file. User may choose not to copy remaining SDSs else they will be copied.

ARGUMENTS

-help	Display this help message
-sds=<old name,new name>	Input and Output SDS NAMES. To specify additional repeat the option as many times as the number of SDSs to be renamed.
-scale=<val>	Scale the SDS values (2D input)
-of=<filename>	Output filename
-ncp	Do not copy remaining SDS(s)
-meta	Copy all metadata from input to output
-out dt=<val>	User specified out data type (2D input) float32 5 float64 6 int8 20 uint8 21 lint16 22 uint16 23 int 32 24 uint32 25 default output data type is input data type

EXAMPLES

copy_sds VNP09H1.A2016241.h11v08.001.2017180175130.h5
-of=VNP09H1.A2016241.h11v08.001.2017180175130.hdf

copy_sds -sds=”500m 16 days NDVI,500m 16 days NDVI" -ncp -meta
-of=NDVI.hdf
MOD13A1.A2016209.h11v08.006.2016229083040.hdf

copy_sds –sds=sur_refl_b01,sur_refl_Band01
-sds=sur_refl_b022,sur_refl_Band02 –meta –ncp
-of=data_out/copy_sds_NPP_D8SRF1KM_L3D_ncp.hdf
/NPP_ D8SRF1KM_L3D.A2003193.h09v05.P1_00602.2009252
174609.hdf

Copy_sds –sds=”500m 16 days NDVI,hkm 16 days NDVI” –meta –ncp
-of=data_out/copy_sds_MOD13A1_ncp.hdf
MOD13A1.A2007177.h20v07.005.2007200203237.hdf

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cp_hdfeos

NAME

cp_hdfeos – Copy the hdfeos metadata to the input L3 HDF files.

SYNOPSIS

cp_hdfeos –help

cp_hdfeos –of=<output_file> [-ref=<reference L3 file>]
[-tile=<tile_id(s)] filename

DESCRIPTION

Copy the hdfeos structural metadata to the input L3 HDF file.
The information can either be copied from a L3 reference file or by providing the L3 tile id. When tile_id is provided integerized sinusoidal projection parameter for the specified tile is copied from an ancillary table. All the SDS in the input HDF file are written into a new grid named SAMPLE_L3_GRID. If the input file contains many tiles created by mosaicing two or more L3 tiles then multiple tile ids are input.

ARGUMENTS

-help	Display this help message
-of=filename	Output file
-ref=<L3 file/dir>	reference L3_product file (overrides the –tile option)
-tile=<tile id(s)>	L3 tile id(s) Multiple tile ids are separated by comma, (input if the input file is a mosaic of many L3 or L2G tiles.

EXAMPLES

cp_hdfeos -of=VNP09A1.masked_new.hdf
-ref= VNP09A1.A2016289.h11v08.001.2017189045223.h5
VNP09A1.A2016289.h11v08.001.2017189045223.h5

cp_hdfeos -of=Grid.Masked.MOD09A1.A2001145.h20v10.003.
2001214125825.hdf -tile=h20v10 Masked.MOD09A1.
A201145.h20v10.003.2001214125825.hdf

cp_hdfeos -of=Grid.Masked.MOD09A1.A2001145.h20v10.003.
2001214125825.hdf -ref= MOD09A1.A2001145.h20v10.
003.2001214125825.hdf
Masked.MOD09A1.A2001145.h20v10.003.200121425825.hdf

cp_hdfeos -of=Grid.NPP_D16VI1KM_L3D.A2003193.h09v05.P1
00602.2009257123847.hdf –tile=h09v05 NPP D16VI1KM_L3D.
A2003193.h09v05.P1_00602.2009257123847.hdf

cp_hdfeos -of=Grid.NPP_D16VI1KM_L3D.masked.A2003193.h09v05.P1_
00602.2009257123847.hdf -ref=NPP_D16VI1KM_L3D.
A2003193.h09v05.P1_00602.2009257123847.hdf

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Version 3.6 02/12/2020

cp_proj_param

NAME

cp_proj_param – Copy projection meta data into an HDF file

SYNOPSIS

cp_proj_param [-help]

cp_proj_param -of=<output filename> [-ref=<reference>]
[-tile=<tile_id(s)>] [-proj=<projection type>] filename

DESCRIPTION

For certain HDF files, created for example using the LDOPE QA tools or other software, may not contain the HDF-EOS metadata that identify the projection type and the geographic extent of the data. This tool creates an output HDF-EOS file by copying all the SDS(s) from the input HDF file and adding the projection parameters to the output file. The output file may then be reprojected using the MODIS reprojection tool available from LP-DAAC.

This tool is applicable only to geolocated L2G/L3/L4 products or mosaics of these products. There are two ways to use this tool:

1) The projection metadata may be copied from a reference HDF-EOS L2G/L3/L4 product. The reference product should have the same geographical extent as the input HDF file. This method only works for single files (not mosaics).

2) The projection metadata may be copied by specifying the MODLAND product tile id and the projection type. Multiple tile ids may be specified if the input file is a mosaic of two or more files.

The tool command arguments can be specified in any order.

Note: To make this tool function transparently with the MODIS Reprojection Tool the bounding rectangular coordinates are copied to the output file archive metadata without using the SDP toolkit.

ARGUMENTS

-help	Display this help message.
-of=<filename>	Output filename.
-ref=<reference file>	Reference L2G/L3/L4 MODLAND product filename. If this is specified then do not use the -tile and -proj options.
-tile=<tile id(s)>	One or more tile id(s) separated by commas. The

	tile id is of the form hxxvyy where xx and yy are the two digit horizontal and vertical MODLAND product tile numbers.
-proj=<projection type>	One of the following projection types: ISIN (Integerized Sinusoidal) or SIN (Sinusoidal)
filename	Input filename

EXAMPLES

cp_proj_param -of=VNP09A1_SurfReflect_M1_proj.hdf
-ref=VNP09A1.A2016297.h11v08.001.2017189113645.h5
VNP09A1_SurfReflect_M1.hdf

cp_proj_param -of=MOD09GQ_sur_refl_b01_proj.hdf
-ref=MOD09GQ.A2017240.h11v08.006.2017242025318.hdf
MOD09GQ_sur_refl_b01.hdf

AUTHOR

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Documentation: S. Devadiga, X. Zhang, M. Zhao, and B. Pfarr

Version 3.6 02/12/2020

create_mask

NAME

create_mask – Create an SDS that can be used as a mask

SYNOPSIS

create_mask [-help]

create_mask –mask=<mask string> [-on=<output ON value> [-off=<output OFF value>] -of=<filename>

DESCRIPTION

Create a masking SDSusing the user specified masking logic. Output is an HDF file containing the mask SDS. Output SDS pixel values are set to user specified ON value where mask logic is true and is set to OFF value where mask logic is false. Handles 2D/3D/4D input SDS(s) and L2G files. Output is always a 2D SDS.

ARGUMENTS

-help — Display this help message

-mask= string — Define the mask to apply as combination of Individual masks separated by AND or OR. Each individual mask consists of a file, a SDS, A bit descriptor, equality operator (<, >, <=, >=, !=, ==) and a binary bit value string to match: Filename, SDS_name,bits=string. Rather than duplicate the file and SDS names, the * dharacter can be used after initial specification. The bit descriptor is a list of bits or ranges of bits, similar to the Unix filename substitution.

Example: -mask=file1,SDS1,0-2,4==0101,AND,*,SDS2,2,3==10

Warning: Although a bit range in the bit descriptor is specified by the lower bit followed by the higher bit, bit value string are in reverse order, i.e. the lower bit on the right (in the example 0-2,4==0101 is for 4,2,1,0==0101. If the bit descriptor is omitted, then the whole range of bits is assumed, and the value string is parsed as a decimal value. This is a convenient way to refer to a specific value, instead of a list of bits.

Example: -mask=file,SDS,==200

In case of 3D and 4D input SDS user must specify the layer numbers in the 3rd and 4th dimension by entering the layer numbers as dot extension in the SDS name within the –mask option

Example: -mas=file,SDS.n1.m2,0-2==011,
AND,file.SDS.n1,0-1==11
In case of L2G specify the observation number as dot extension in the SDS name (without the _1 or _c) in the –mask option.
Example –mask=file,QC_500m.2,10-13=1100
-on=<ON value>
Output SDS value where mask is true (default 255)

-off=<OFF value> Output SDS value where mask is false (default 0)

-of=filename Output filename

EXAMPLES

```
create_mask -mask="VNP09A1.A2016289.h11v08.001.2017189045223.h5,
            SurfReflect_State,0-5==001000,AND,*,*,6-9>=0001,AND,*,*,6-
            9<=0010,AND,*,*,13==0"
            -of=VNP09A1.good_state.hdf

create_mask -mask="MOD09A1.A2017129.h11v03.006.2017138034901.hdf,
            sur_refl_state_500m,2==0,AND,*,*,3-5==001,AND,*,*,6-
            10>=00001,AND,*,*,6-10<=00010,AND,*,*,15==0"
            -of=MOD09A1.good_state.hdf

create_mask -mask=MOD35_L2.A2000366.2355.005.200826322
            1257.hdf,Cloud_Mask.1,6.7==11,OR,*,*,1-2==00”
            -of=data_out/mod35_land_cld.hdf

create_mask -mask=”MOD09A1.A2000305.h20v10.005.20082
            10094208.hdf,sur_refl_state_500m,3-5==001,AND,*,*,01==00”
            -of=MOD09A1_land_clr.hdf
```

AUTHOR

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Documentation: S. Devadiga, X. Zhang, M. Zhao, and B. Pfarr

Version 3.6 02/12/2020

create_reg_img

NAME

create_reg_img –Create HDF image with blocks of gray values.

SYNOPSIS

create_reg_img [-help]

create_reg_img [-sds=<sds_namd>] [-sz=<row,col>] –of=<output filename> -reg=r_min,r_max.c_min,c_max,val [-dt=<data type>] [-fill=<fill value>]

DESCRIPTION

Create an image containing many regions of user specified size and gray values. User can specify up to a maximum of 255 regions bounded by minimum and maximum row column numbers.

ARGUMENTS

-help Display this help message

-sds=<SDS name> Image size in number of rows and columns. (default: 1200, 1200)

-of=<filename. Output filename

-reg=<region size and val>
Regions with bounding box and gray values.
Example: -reg=100,149,100,149,25
The option can be repeated for as many times as required to specify multiple regions within the same SDS. Regions can be entered in a file and the filename can be input as argument value. Each region is entered in a separate line in the same format as above. (e.g. a line in the file: 100,149,100,149,25).

-dt=<data type> Data type (CHAR8|UCHAR8|INT8|Uint8| INT16|UINT16|INT32|UINT32) (default: UINT8)

-fill=<fill value> SDS fill value (default:255)

EXAMPLES

create_reg_img -sds=location_test -sz=2400,2400 -of=reg_img1.hdf
-reg=0,20,0,20,25 -reg=22,42,22,42,35

```
create_reg_img -sds=location_test -sz=2400,2400 -of=reg_img2.hdf
        -reg=img_reg.txt
```

AUTHOR

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Version 3.6 02/12/2020

dec2bin

NAME

dec2bin – Convert a signed decimal number to binary string

SYNOPSIS

dec2bin [-help]

dec2bin <number> [-bn=<bit number|bit number range>]

DESCRIPTION

This routine converts a signed decimal number to equivalent binary. Output is in 32 bit binary form. Optional bit number argument can be used to print only the required bit or range of bits.

ARGUMENTS

-help	Display this help message
-bn=<bit number>	Zero-based bit number or bit number range.
number	Number in decimal

EXAMPLES

dec2bin 10> data_out/dec2bin.txt

dec2bin 101 –bn=0-7

dec2bin 101 –bn=5

AUTHOR

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Documentation: S. Devadiga, X. Zhang, M. Zhao, and B. Pfarr

Version 3.6 02/12/2020

enlarge_sds

NAME

enlarge_sds – Enlarge the spatial dimensions of one or more SDS from a MODIS/VIIRS Land HDF-EOS data product by pixel replication.

SYNOPSIS

enlarge_sds -help [filename]

enlarge_sds -of=<output filename> -sf=<scale factor>
[-sds=<SDSname1>[<,SDSname2>...]] [-meta] -fill_value=<fillVal> filename

DESCRIPTION

Each pixel value at (i, j) in the input SDS is duplicated from (sf*i, sf*j) to (sf*i + sf - 1, sf*j + sf - 1) pixels in the output SDS. The enlargement scale factor (sf) must be a non-zero positive integer. The output is an HDF-EOS file. One or more SDSs may be enlarged.

This tool can be used to create fine resolution data set from a coarse resolution data set, e.g., a 500m resolution data set can be created from an input 1km resolution data set using a scale factor of 2. The output dataset will have blocky structure due to pixel replication.

This tool is complemented by the tool *reduce_sds*.

This tool supports 2D/3D/4D SDS(s).

The tool command arguments can be specified in any order.

ARGUMENTS

-help	Display this help message.If the input filename is specified with this option, then the names of all the SDSs in the file are displayed.
-of=<filename>	Output filename.
-sf=<factor>	Scale factor (a non-zero positive integer).
-sds=<SDS list>	List of SDS to enlarge. SDS names are separated by commas with no space. By default all SDSs are processed maintaining the input SDS interleaving. To process a specific layer of a 3D SDS specify the element number of the third dimension as a dot extension of the SDS name: sds_name.n (e.g., sur_refl_b02.1 = the layer defined by the 1st element of the 3rd dimension of the 3D SDS sur_refl_b02).

To process a specific layer of a 4D SDS, specify the higher dimension element number(s) as a dot extension of the SDS name: sds_name.n.m (e.g., Surface_Refl.1.2 = the layer defined by the 1st element of the 3rd dimension and the 2nd element of the 4th dimension of the 4D SDS Surface_Refl).

Note that wildcards and ranges of element values may be specified as sds_name.* and as sds_name.n1-n2.m respectively.

-meta Copy metadata from input to output file.

-fill_value=fillVal User inputs fill value

filename Input filename.

EXAMPLES

enlarge_sds -help MYD021KM.A2002189.0350.003.2002191000652.hdf

enlarge_sds -sds=SurfReflect_M1 -sf=2 -meta -of=SurfReflect_M1.hdf
VNP09A1.A2016289.h11v08.001.2017189045223.h5

enlarge_sds -sds=M02 -sf=2 -meta -of=VJ102MOD_M02.hdf
VJ102MOD.A2017359.2236.001.2017360055003.nc

enlarge_sds -sf=4 -sds="Cloud_Mask.*,Quality_Assurance" –
of=myd35_x4.hdf -meta
MYD35_L2.A2002189.2040.003.2002191125354.hdf

enlarge_sds -sf=4 -of=refsb_1kmto250m.hdf -sds="EV_1KM_RefSB.4-6"
MYD021KM.A2002189.0350.003.2002191000652.hdf

enlarge_sds -sds="500m Surface Reflectance Band 1" -sf=2 –
of=enlarge2_MOD09.A2010015.0015.005.2010020231418.hdf -
fill_value=-28672 -meta
/MOD09.A2010015.0015.005.2010020231418.hdf

enlarge_sds -sds="sur_refl_b01" -sf=2 -of=enlarge2_NPPD8SRF1KM_
L3D.A2003193. h17v07.hdf -fill_value=-5 -meta NPP
_D8SRF1KM_L3D.A2003193.h17v07.P100602.
2009252202610.hdf

enlarge_sds -sf=2.0000000 -of=DIMxP.MOD14A1.A2010001.

h10v04.005.2010010211836.hdf -sds="FireMask.1-3,QA.1-3,MaxFRP.1-3,sample.1-3" MOD14A1.A2010001.h10v04.005.2010010211836.hdf

enlarge_sds -sds="BRDF_Albedo_Parameters.*.2" -sf=2 –meta -of=brdf_x2.hdf MYD43B1.A2002177.h11v11.003.2002210233848.hdf

{Note: This example enlarges selected layers of a 4D SDS. All the layers defined by all the elements of the 3rd dimension and the 2nd element of the 4th dimension of the SDS BRDF_Albedo_parameters are enlarged using a scale factor of 2. The metadata is copied from the input file to the output file. }

AUTHOR

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Version 3.6 02/12/2020

geolocation

NAME

geolocation - Compute the geolocation of a pixel in a L3/L4 Land HDF-EOS product.

SYNOPSIS

geolocation –help

geolocation –proj=<SIN|ISIN> -xy=<column,row> [-res=qkm|hkm|1km] {-hv=<horizontal,vertical>} [filename|local granule id]

DESCRIPTION

Compute the geolocation of a pixel in L3 MODIS/VIIRS Land product file. Pixel location is specified as row column number at a specified resolution and the tile id is ether explicity input or is implied by the local granule id of the L2G/L3/L4 MODIS/VIIRS Land product file.

ARGUMENTS

-help	Display this help message
-res=qkm|hkm|1km	Reference resolution (default = 1km)
-xy=<column,row>	Row and column location of pixel. (valid: 0-1199 for 1km; 0-2399 for hkm and 0-4799 for qkm)
-hv=<horizontal,vertical>	Horizontal and vertical tile number. Valids for horizontal: 0-35, vertical: 0=17
Filename	MODIS/VIIRS Land product filename/local granule id of a L2G|L3|L4 product.

EXAMPLES

geolocation –xy=750,500 –hv=12,4 –proj=SIN

geolocation -proj=SIN -xy=205,1452 -res=hkm -hv=11,9

geolocation –xy=750,500
MOD09GHK.A1997223.h17v03.001.199915204552.hdf

AUTHOR

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Version 3.6 02/12/2020

geolocation_img

NAME

geolocation_img - Compute the geolocation image for a Land tile

SYNOPSIS

geolocation_image - help

geolocation_image [-res=qkm|hkm|1km] –hv=<horizontal, vertical> [-if=<filename>] –of=<filename>

DESCRIPTION

Compute the geolocation image for a MODIS/VIIRS tile at specified resolution.

ARGUMENTS

-help	Display this help message
-res=qkm|hkm|1km	Reference resolution (default = 1km
-hv=<horizontal,vertical>	Horizontal and vertical tile number Valids for horizontal: 0-35, vertical: 0-17
-if=<filename>	File containing lat/long limit for projection. If not input the points outside of projection will not be identified. The file sn_bound_10deg.txt is provided with this source code.
-of=<filename>	Output filename

EXAMPLES

geolocation_image -res=1km -hv=11,9 -of=h11v09_geolocation.hdf

geolocation_image –hv=12,04 –proj=SIN –of=latlon1km.hdf

geolocation_image –hv=12,04 –res=hkm –proj=SIN –of=latlon500m.hdf

geolocation_image –hv=24,02 –res=qkm –if=sn_bound_10deg.txt –of=latlon500m.hdf

AUTHOR

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Documentation: S. Devadiga, X. Zhang, M. Zhao, and B. Pfarr

Version 3.6 02/12/2020

jdoy

NAME

jdoy – Convert Julian day to day of month and vice versa

SYNOPSIS

jody [-help]

jdoy [yyyy-mm-dd] [yyy-jjj]

DESCRIPTION

Convert the input date in Julian day number to date in month day and year format. If the date input is in month day and year format then the routine will return the date in Julian day number.

ARGUMENTS

-help	Display this help message
yyyy-mm-dd	Input date in day of month format '-' can be omitted or replaced by a space.
yyyy-jjj	Input date in Julian day number '-' can be omitted or replaced by a space. Year can be omitted for the current year.

EXAMPLES

jdoy 2018-4-12

jdoy 2018102

AUTHOR

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Version 3.6 02/12/2020

mask_sds

NAME

mask_sds – Mask one of more integer SDS of a MODLAND product file and output the SDS values at pixels where the mask criteria are met and output fill values elsewhere. The mask criteria are specified using relational and logical operators applied to the SDS of the same or different L2/L3/L4 MODLAND HDF-EOS products.

SYNOPSIS

mask_sds -help

mask_sds -mask=mask1[,AND|OR,mask2...] -sds=SDS_name [-of=output_file] [-meta] -fill_value=<fillVal> filename

DESCRIPTION

Produces data of pixels from the specified SDS that verify a given mask. The mask is a combination of individual masks combined with the logical AND or OR operator. Each individual mask is based on a separate SDS from same or separate files. The mask is activated according to a list of bits and associated bit values of each individual SDS (or the SDS value itself). The SDS used to compose the mask can belong to any file, including the input file itself.

The values of pixels satisfying the mask are output into an ASCII file and(or) stored as SDS in a user specified output HDF file. When more than one input SDS is masked multiple SDS output are created and(or) values of output pixels from different SDS are listed in different columns of the same ASCII file. The tool handles user specified layers of 3D and 4D in the mask and also in the input HDF file to be masked. Effective mask is always a 2D SDS. SDS to be masked can be 2D/3D/4D. The same 2D mask is used to mask all user specified layers in 3D and 4D.

To specify a L2G SDS enter the layer number as dot extension in the SDS name. However do not use the _1 or _c as given in the HDF file. They stand for first layer and additional layers in compact form. In MOD09GQK SDS sur_refl_b03_1 and sur_refl_b03_c contain 1st layer and additional layers in compact form. To specify observation layer number 4 of sds sur_refl_b03 file, in the command enter -sds=file,sur_refl_b03.4

ARGUMENTS

-help Display this help message

-mask=string Define the mask to apply as combination of individual masks

separated by AND or OR. Each individual mask consists of a file, a SDS, a bit descriptor, and a binary bit value string to match: filename,SDS_name,bits<operator>string. Valid operators are >, <, <=, >=, ==, !=. Rather than duplicate the file and SDS names, the * character can be used after initial specification. The bit descriptor is a list of bits or ranges of bits, similar to the Unix filename substitution. Ex: -mask=file1,SDS1,0-2,4==0101,AND,*,SDS2,2,3==10 Warning: Although a bit range in the bit descriptor is specified by the lower bit followed by the higher bit, the bit value string are in reverse order, i.e. the lower bit onthe right (in the example 0-2,4=0101 is for 4,2,1,0=0101). If the bit descriptor is omitted, then the whole range of bits is assumed, and the value string is parsed as a decimal value. This is a convenient way to refer to a specific value, instead of a list of bits.

Ex: -mask=file,SDS,>=200

If SDS is a 3D or 4D specify the dimension value as dotextension in the sds name:

Ex: -mask=file,SDS.n1,0-2==001,AND,file,SDS.n2.m2,0-1==01

If SDS is a L2G in compact form specify the observation layer number as dot extension in the sds name:

Ex: -mask=file,SDS.n1,0-2==001,AND,file,SDS.n2.m2,0-1==01

-sds=SDS_name SDS to mask.
If SDS is a 3D or 4D specify the dimension value as dot extension in the sds name. If SDS is L2G in compact form specify the observation layer number as dot extension in the name.

Warning: All input SDS must be of same resolution.

-of=filename Output file

-log=filename ASCII logfile that lists all the pixels matching the specified mask. Values from each SDS are stored in different columns within the same file.

-meta Copy metadata from input file to output

-fill_value=fillVal User inputs fill value

EXAMPLES

mask_sds -sds=SurfReflect_M5,SurfReflect_M4,SurfReflect_M3
-mask="VNP09A1.A2016297.h11v08.001.2017189113645.h5,
SurfReflect_M5,<=10000,AND,*,SurfReflect_QC,0-
1==00,AND,*,*,30==1,AND,*,SurfReflect_State,0-
5==001000,AND,*,*,6-9>=0001,AND,*,*,6-9<=0010,AND,*,*,13==0"
-of=VNP09A1.masked.hdf
VNP09A1.A2016297.h11v08.001.2017189113645.h5

mask_sds -sds=sur_refl_b01,sur_refl_b04,sur_refl_b03
-mask="MOD09A1.A2017129.h11v03.006.2017138034901.hdf,
sur_refl_b01,<=10000,AND,*,sur_refl_qc_500m,2-
5==0000,AND,*,*,14-17==0000,AND,*,*,10-
13==0000,AND,*,*,30==1,AND,*,sur_refl_state_500m,2==0,AND,*,
,3-5==001,AND,,*,6-10>=00001,AND,*,*,6-
10<=00010,AND,*,*,15==0" -of=MOD09A1.masked.hdf
MOD09A1.A2017129.h11v03.006.2017138034901.hdf

mask_sds -sds=sur_refl_b01.1 -mask="MOD09GHK.A2010001.h20v11.
005.2010007014814.hdf,QC_500m.1,0-1==10"
-of=MOD09GHK_obs1_mask.hdf MOD09GHK.A2010001.h20v11.
005.2010007014814.hdf

mask_sds -sds=sur_refl_b01.1 -mask="MOD09GA.A2012248.h09v05.
005.2012250180722.hdf,QC_500m.1,0-1==10"of=MOD09GA_
obs1. mask.hdf MOD09GA. A2012248.h09v05.
005.2012250180722.hdf

mask_sds -sds=sur_refl_b01.1 -mask="MOD09GA.A2012248.
h09v05.005.2012250180722.hdf,sur_refl_b01.1,>1000" -
of=data_out/MOD09GA_obs1.mask1.hdf
MOD09GA.A2012248.h09v05.005.2012250180722.hdf

AUTHOR

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Documentation: S. Devadiga, X. Zhang, M. Zhao, and B. Pfarr

Version 3.6 02/12/2020

mosaic_sds

NAME

mosaic_sds - prepare a mosaic of SDSs from L3/L4 MODIS/VIIRS Land HDF-EOS data products.

SYNOPSIS

mosaic_sds -help [filename]

mosaic_sds -of=<output filename> [-sds=<SDSname1>[<,SDSname2>...]]
[-fill=<fill value>][-gr=<nh,nv>] [-gr=<hb, vb>]
f1 [-row=<min,range>] [-col=<min,range>] f2 [-row=<min,range>]
[-col=<min,range>]
f3 [..[f4…]]

DESCRIPTION

Create a spatial mosaic from different L3/L4 MODIS/VIIRS Land HDF-EOS data products. Specified SDSs are spatially arranged based either on their geolocation (defined by their tile id) or in a user specified manner. The horizontal and vertical tile numbers are identified from the filename or from the VERTICALTILENUMBER and HORIZONTALTILENUMBER metadata. Any missing tiles (i.e. gaps in the output mosaic) are replaced with a user specified fill value. Multiple SDSs are written to the mosaic if two or more SDSs are listed in the input argument If the tile id is not recognized in one or more of the input files, then the tiles may be mosaiced with a user specified number of output horizontal and vertical tiles using the–gr option. If the tile id is not recognized and the –gr option is not used, then the tiles are mosaiced in an optimal “least-space” row column order. In either case the first file in the filenames list is placed in the north-west corner and the last file in the south-east corner.
This tool supports 2D/3D/4D SDSs.
The tool command arguments can be specified in any order.

ARGUMENTS

-help [filename]	Display this help message. If the input filename is specified with this option, then the names of all the SDS in the file are displayed.
-of=<filename>	Output filename.
-sds=<SDS list>	List of SDSs to mosaic. The SDS names are separated by commas with no space. By default. all SDSs are processed maintaining the input SDS interleaving. To process a specific layer of a 3D SDS, specify the element number of the third dimension as a dot extension of the SDS name: sds_name.n (e.g.,

sur_refl_b02.1 = the layer defined by the 1st element of the 3rd dimension of the 3D SDS sur_refl_b02).

To process a specific layer of a 4D SDS, specify the higher dimension element number(s) as a dot extension of the SDS name: sds_name.n.m (e.g., Surface_Refl.1.2 = the layer defined by the 1st element of the 3rd dimension and the 2nd element of the 4th dimension of the 4D SDS Surface_Refl).

Note that wildcards and ranges of element values may be specified as sds_name.* and as sds_name.n1-n2.m respectively.

-row=<min,max> Range of SDS rows to be included in the mosaic. (default: all rows). Input for each file separately following the input filename.

-col=<min,max> Range of SDS columns to be included in the mosaic. (default: all columns). Input for each file separately following the input filename.

-fill=<fill value> Output fill value for missing “gap” tiles. The fill value must be within the valid range of the input SDS data type, e.g., if the input SDS is of type INT8 then valid range for the fill value is {–128 :127}. If no fill value is specified a fill value equal to the input SDS fill value is used.

-gr=<nh,nv > Number of horizontal and vertical tiles in the output mosaic where each tile is occupied by one of the input tile. If –gr option is not specified and tile ids are not recognized, then the tiles are arranged in a “least-space” manner.

f1 f2 f3 Input filenames (followed by –row and –col options if subset is required.

EXAMPLES

```
mosaic_sds -of=mosaic_VNP13A2.hdf
                -sds="1 km 16 days NDVI,1 km 16 days EVI"
                VNP13A2.A2018073.h08v04.001.2018089073438.h5
                VNP13A2.A2018073.h08v05.001.2018089070837.h5
                VNP13A2.A2018073.h09v05.001.2018089070229.h5

mosaic_sds -of=mosaic_MOD13A2.hdf
                -sds="1 km 16 days NDVI,1 km 16 days EVI"
```

MOD13A2.A2017193.h08v04.006.2017209232631.hdf
MOD13A2.A2017193.h08v05.006.2017209233459.hdf
MOD13A2.A2017193.h09v05.006.2017209233239.hdf

mosaic_sds -sds=sur_refl_b01,sur_refl_b02
-of= tst12_mosaic_MOD09A1.A2001201.h20-21.v05-06.hdf
MOD09A1.A2001201.h20v05.003.2002281080105.hdf
-row=1500,2399 -col=1000,2399
MOD09A1.A2001201.h20v06.003.2002281080112.hdf
-row=0,1200 -col=1000,2399
MOD09A1.A2001201.h21v05.003.2002281080255.hdf
-row=1500,2399 -col=0,1200
MOD09A1.A2001201.h21v06.003.2002281080110.hdf
-row=0,1200 -col=0,1200

mosaic_sds -sds=fire_mask_1 -row=0,599 -col =0,599
-of=fire_mask_mosaic.hdf
MYD14GD.A2002186.*.hdf

mosaic_sds -sds=EV_Band26 -fill=-100 -gr=3,3
-of =myd021km_mosaic.hdf
MYD021KM.A2002189.07*.hdf

mosaic_sds –sds ="BRDF_Albedo_Parameters.1.2"
-of=brdf_mosaic.hdf
MYD43B1.A2002177.h*.hdf

AUTHOR

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Documentation: S. Devadiga, X. Zhang, M. Zhao, and B. Pfarr

Version 3.6 02/12/2020

read_l2g

NAME

read_l2g - Read specified layers or granules from a MODIS/VIIRS Land L2G HDF-EOS data product and write out to 2D SDSs.

SYNOPSIS

read_l2g –help [filename]

read_l2g -of=<output filename> -layer[=layer1[,layer2...]] glist[=orbit,gran1[,gran2...]] -gpidx[=index1[,index2...]] –gid=[granule1[,granule2..]] [-meta][-sds=<SDSname1>[<,SDSname2>...]] [-ptr=<pointer file>] filename

DESCRIPTION

The different MODIS/VIIRS Land L2G HDF data products store one or more L2 observations for each L2G pixel in a series of layers (that reflect the MODIS/VIIRS orbit overpass and swath sensing geometry) in a compressed run length encoded format. This tool extracts SDSs from a Land L2G file, selecting observations according to the layer number, granule number, granule pointer index, or granule id and writes them to an output HDF-EOS file as separate 2D SDSs.

The output file SDS names reflect the input SDS name and the layer number, granule number, granule pointer index, or granule id. For example:

sur_refl_b01_layer2 (layer 2 of input SDS ‘sur_refl_b01’),

fire_mask_gran166_orb8318 (granule 166 from orbit 8318 of input SDS ‘fire_mask’),

SolarZenith_gpnt2 (granule with granule pointer index 2 of input SDS ‘SolarZenith’),

Snow_Cover_ A2001192.1340 (granule with granule id A2001192.1340 of input SDS ‘Snow_Cover’).

Note that the associated L2G pointer file for MODIS/VIIRS must be defined in the argument list if observations are selected by granule number, granule pointer index or granule id. But L2G pointer file for NPP is not defined in the argument list in this case and it will be defined automatically in code

This tool supports L2G only.

The tool command arguments can be specified in any order.

ARGUMENTS

-help [filename]	Display this help message. If the input filename is specified with this option, then the valid values for options –layer, -glist, -gpidx, -gid, -ptr, and –sds are displayed.
-of=<filename>	Output filename.
-layer=layer1[,layer2...]	Select by layer number (1-based). If this option is specified without any value, then all layers are output.
-glist=orbit,gran1[,gran2...]	Select by granule number using orbit and granule number as the unique granule identification. To select granules from an orbit enter the orbit number followed by the granule numbers. Repeat the option to select granules from additional orbits. If this option is specified without any value, then all granules are output.
-gpidx=index1[,index2...]	Select by granule pointer index (0 based). If this option is specified without any value, then all granules are output.
-gid=granule1[,granule2...]	Select by granule ID (e.g., Ayyyyddd.hhmm). If this option is specified without any value, then all granules are output.
-sds=<SDS list>	List of SDS to read. SDS names are separated by commas with no space. By default all SDS in the file are read. SDS names are input without the _1 and _c extensions used to indicate the first layer and the compact layer SDS, e.g., although the MOD09GHK files contain SDS sur_refl_b01_1 and sur_refl_b01_c, the SDS name should be specified as sur_refl_b01.
-ptr=pointer filename	Pointer filename. Required if reading an SDS by the identity of the L2 granule, using -glist, –gpidx or –gid option.
-meta	Copy metadata from input file to output file.
filename	Input filename.

EXAMPLES

read_l2g -help MOD09GHK.A2018005.h12v02.006.2018009190349.hdf

read_l2g -help VNP09G1KI.A2018005.h12v02.001.2018008142514.hdf

read_l2g -gid -sds=SurfReflect_M1 -of=test_G1KI_gid.hdf
VNP09G1KI.A2018005.h12v02.001.2018008142514.hdf

read_l2g -glist -sds=SurfReflect_M1 -of=test_G1KI_glist.hdf
VNP09G1KI.A2018005.h12v02.001.2018008142514.hdf

read_l2g -layer=1-2 -sds=Snow_Cover –of=myd10l2g_layers1_2.hdf
MYD10L2G.A2002177.h09v05.003.2002180140700.hdf

{Note: This example extracts the first and second layers of SDS Snow_Cover from the input MYD10L2G file.}

read_l2g –sds=fire_mask -glist=13928,230,231 –
of=fire_mask_orbit13928.hdf -meta
-ptr=MODPT1KD.A2002212.h09v05.003.2002218193538.hdf
MOD14GD.A2002212.h09v05.003.2002218194510.hdf

{Note: This example extracts granules 230 and 231 of orbit 13928 of SDS fire_mask from the input MOD14GD file. Two SDSs are written to the output file. The associated MODPT1KD.2002212.h09v05.003.2002218193538.hdf pointer file has to be specified. The metadata is copied from the input file to the output file.}

read_l2g -sds=sur_refl_b01,sur_refl_b03,sur_refl_b04 -layer=1-3
-glist=8319,186 -of=mod09gst_grans8319_layers1_3.hdf
–ptr=MODPTHKM.A2001192.h12v09.003.2001309125954.hdf
MOD09GHK.A2001192.h12v09.003.2001309142732.hdf

{Note: This example extracts granule number 186 of orbit 8319 and layers 1 to 3 of the SDSs sur_refl_b01, sur_refl_b03, sur_refl_b04 from the input MOD09GHK file. Twelve SDSs are written to the output file. The associated pointer file MODPTHKM.A2001192.h12v09.003.2001309125954.hdf has to be specified.}

read_l2g –sds=SolarZenith,SolarAzimuth,SensorZenith,SensorAzimuth
-gpidx=0-1 -of=modmggad_granid0_1.hdf
-ptr=MODPT1KD.A2002212.h09v05.003.2002218193538.hdf
MODMGGAD.A2002212.h09v05.003.2002218193604.hdf

{Note: This example extracts the first two granules (defined in the associated MODPT1KD file with granule pointer index 0 to 1) from the input MODMGGAD file of SDSs SolarZenith, SolarAzimuth, SensorZenith and SensorAzimuth. Eight SDSs are written to the output file. The associated pointer file MODPT1KD.2002212.h09v05.003.2002218193538.hdf has to be specified.}

read_l2g –sds=state_1km -gid=A2002212.1900,A2002212.1905 –meta -of=mod09gst.gran_a2002212.003.hdf –ptr=MODPT1KD.A2002212.h09v05.003.2002218193538.hdf MOD09GST.A2002212.h09v05.003.2002218193744.hdf

{Note: This example extracts granules with granule id A2002212.1900 and A2002212.1905 of SDS state_1km from the input MOD09GST file. Two SDSs are written to the output file. The pointer file MODPT1KD.2002212.h09v05.003.2002218193538.hdf associated with MOD09GST.A2002212.h09v05.003.2002218193744.hdf has to be specified. The metadata is copied from the input file to the output file.}

read_l2g -layer=0-5 -sds=SurfReflect_Mod_b01 -of=l2g_npp_layers.hdf NPP_DSRF1KD_L2GD.A2003170.h09v05.C1_00602.2009254171332.hdf

{Note: This example extracts the first to fifth layers of SDS SurfReflect_Mod_b01 from the input NPP_DSRF1KD_L2GD file.}

read_l2g -gpidx -sds=SurfReflect_Mod_b01 -of=l2g_NPP_DSRF1KD_L2GD_gpidx.hdf NPP_DSRF1KD_L2GD.A2003170.h09v05.C1_00602.2009254171332.hdf

{Note: This example extracts the all granules (defined in the associated NPP_DPT1KD_L2GD file with all valid granule pointer index) from the input NPP_DSRF1KD_L2GD file of SurfReflect_Mod_b01. Three SDSs are written to the output file. The pointer file is NPP_DPT1KDl_L2GD.A2003170.h09v05.C1_00602.2009254170102.hdf}

read_l2g -gid=A2012366.1925,A2012366.1930 -sds=SurfReflect_Mod_b02 -of=l2g_NPP_DSRF1KD_L2GD_gid.hdf

NPP_DSRF1KD_L2GD.A2012366.h09v05.C1_03001.2013005080512.hdf

{Note: This example extracts granules with granule id A2012366.1925 and A2012366.1930 of SDS SurfReflect_Mod_b02 from the input NPP_DSRF1KD_L2GD file. Two SDSs are written to the output file. The pointer NPP_DPT1KD_L2GD.A2012366.h09v05.C1_03001.2013005074358.hdf file is automatically extracted from the input file of NPP_DSRF1KD_L2GD.A2012366.h09v05.C1_03001.2013005080512.hdf

The metadata is copied from the input file to the output file.}

read_l2g -glist -sds=SurfReflect_Mod_b02 -of=l2g_NPP_DSRF1KD_L2GD_glist_all.hdf NPP_DSRF1KD_L2GD.A2012366.h09v05.C1_03001.2013005080512.hdf

{Note: This example extracts all granule number of the SDSs SurfReflect_Mod_b02 from the input NPP_DSRF1KD_L2GD file. Four SDSs are written to the output file. The associated pointer file NPP_DPT1KD_L2GD.A2012366.h09v05.C1_03001.2013005074358.hdf . is automatically extracted from the input file.}

AUTHOR

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Version 3.6 02/12/2020

read_12g_lite

NAME

read_12g_lite – Read data from L2G files in the L2G_lite format.

SYNOPSIS

read_12g_lite -help [filename]

read_12g_lite -layer=n1[,n2…] -of=output_file [-meta] [-sds=SDSname1 [,SDSname2…]] filename

DESCRIPTION

Extracts a subset of parameters (full format or compact format) from a L2G file in lite format, selecting pixels according to the layer number. The output is an HDF file where all the selected items are stored as separate SDS.

ARGUMENTS

-help [filename]	Display this help message. If the input filename is specified with this option, then the spatial resolution for the SDS, SDS names, and the derived maximum number of layers are displayed.
-layer=n1[,n2]	Select by layer number (1-based). If no layer number is specified, all available layers will be extracted.
-sds=<SDSlist>	List of SDS to read (separated by commas) Use sds_name without the layer number e.g. use SDS name as sur_refl_b01 to retrieve any layer of SDS sur_refl_b01
-of=filename	Output file
-meta	Copy metadata from input file to output

EXAMPLES

read_l2g_lite –help VNP09GA.A2017240.h09v05.001.2017241195209.h5

read_l2g_lite -layer -meta -sds=SurfReflect_M1,SurfReflect_I1
-of=VNP09GA.A2017240.h09v05_layers.hdf
VNP09GA.A2017240.h09v05.001.2017241195209.h5

read_l2g_lite -layer -meta -sds=sur_refl_b01,QC_250m
-of=MOD09GQ.A2017240.h09v05_layers.hdf
MOD09GQ.A2017240.h11v08.006.2017242025318.hdf

read_l2g_lite –layer=1-2 –sds=SurfReflect_Mod_
bo2,Land_Quality_Flags_b01 -of=NPP_DSRFLD-
L2GD_12g_lite_layer1_2.hdf –meta
NPP_DSRFLD_L2GD.A2012225.h20v11.C1_01164.20130801444
0.hdf
read_l2g_lite –layer=1,2 –sds=sur_refl-b03,state_1km,SensorZenith
-of=MOD09GA_12g-lite-layers1-2.hdf –meta
MOD09GA.A2012248.h20v11.005.2012250180349.hdf

read_l2g_lite –layer=2 –sds=SurfReflect_MOD_b02
-of=data-out/NPP_DSRFLD_L2GD_12g-lite-layer2.hdf –meta
NPP_DSRFLD_L2GD.A2012225.h20v11.C1_01164.20130801044
40.hdf

AUTHOR

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Version 3.6 02/12/2020

read_meta

NAME

read_meta - Read metadata from any MODIS/VIIRS Land HDF-EOS data product.

SYNOPSIS

read_meta –help

read_meta [-core|arch|struct|qa] [-meta=<metadata1>[<,metadata2>...]] [-case] filename(s)

DESCRIPTION

Read a set of specified metadata from MODIS/VIIRS Land HDF-EOS file(s) and write the output to stdout. If no options are specified, all metadata are read. Option -case allows the metadata names to be specified case insensitive.

The tool command arguments can be specified in any order.

ARGUMENTS

-help	Display this help message.
-core	Print core metadata.
-arch	Print archive metadata.
-struct	Print struct metadata.
-qa	Print only QA metadata.
-meta=<metadata list>	Print the specified metadata. This option is ignored if one of the options above is used. Metadata names are separated by commas with no space.
-case	Make specified metadata name(s) case insensitive. This option can be used only with the -meta option.
filename(s)	One or more input files separated by space. Files are processed in the order they are listed in the command line.

{Note: For NPP, no options of core, arch and qa. User can chose meta option. if no options are supplied, process all metadata but not StructMetadata.
Note: For -struct option, the tool just simply dump its content and -meta deson't work for -struct option.}

EXAMPLES

read_meta -meta VNP09GA.A2017240.h09v05.001.2017241195209.h5

read_meta -struct VNP09GA.A2017240.h09v05.001.2017241195209.h5

read_meta -core MOD13A1.A2016209.h11v08.006.2016229083040.hdf

read_meta -meta=AUTOMATICQUALITYFLAG MOD09GHK.*.hdf

read_meta MYD021KM.A2002189.0350.003.2002191000652.hdf

read_meta -arch MOD021KM.A2002189.0350.003.2002191000652.hdf

read_meta -core MYD09GHK.A2002177.h09v05.003.2002180140102.hdf

read_meta -qa MYDPTHKM.A2002177.h09v05.003.2002180134421.hdf

read_meta -meta=EQUATORCROSSINGDATE –case
MYD09GHK.A2002177.h09v05.003.2002180140102.hdf

read_meta -meta= DAYNIGHTFLAG, GRINGPOINTLONGITUDE,
GRINGPOINTLATITUDE MYD03.A2002*.hdf

read_meta -
meta=DAYNIGHTFLAG,AUTOMATICQUALITYFLAG,PARAMETE
RNAME MOD13C1.A2012113.005.2012130093534.hdf

read_meta -meta=StructMetadata.0
NPP_D16BRDF4_L3D.A2003193.h09v05.P1_00602.20092571259
40.hdf

read_meta
NPP_D17BRDFIP_L3.A2012222.h09v05.P1_01110.2012305165838.hdf

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Version 3.6 02/12/2020

read_pixvals

NAME

read_pixvals – Read MODLAND product values at specified pixel locations

SYNOPSIS

read_pixvals [-help] [filename]

read_pixvals -xy=col[.cs[.cs]],row[.rs[.rs]]|<coordinates filename> [-res=qkm|hkm|1km] filename(s)

DESCRIPTION

Read the pixel values at specified locations in one or more input MODLAND product files and output to stdout. The pixel values for each SDS in each file are output as separate lines.

If more than one input MODLAND product file is specified then they must be all L2 products *or* all L2G/L3/L4 MODLAND products.

The MODLAND files may contain SDSs with different spatial dimensions corresponding to the 250m, 500m and 1km MODLAND pixel resolutions. In this case, the –res option is used to specify which of the 1km, 500m or 250m pixel resolutions is referenced. If -res is not specified then the –xy location is assumed to reference the coarsest spatial resolution of the different SDSs.

Sub pixel locations may be output by specifying a sub pixel offset (0 or 1 in the x and/or y axes). If not specified a 0 pixel offset is assumed. See examples below.

This tool supports 2D/3D/4D and L2G and L2g_lite compact and full format SDSs. Pixel values for each layer of the 3D/4D and L2G SDSs are output.

ARGUMENTS

-help [filename]	Display this help message. If the input filename is specified with this option, then the names of all the SDSs in the file are displayed.
-res=qkm|hkm|1km	Reference SDS resolution (qkm=250m, hkm=500m, 1km=1000m) of the pixel location specified in the –xy argument. If unspecified the coarsest resolution of all the SDSs in the input file list is used.

-xy=col[.cs[.cs]],row[.rs[.rs]]|<coordinates filename>

Column and row pixel locations (0-based) or name of an ASCII coordinates file containing the column and row pixel locations. Multiple locations may be specified by repeating the –xy option or by specifying the x and y coordinates on different lines in the ASCII coordinates file.

Sub pixel offsets for higher spatial resolution SDS may be specified as col.cs row.rs. The offsets refer to the top left corner pixel. For example:

-res=hkm -xy=100.0, 200.0
(read values at pixel 100,200 from the 500m SDS, and at pixel 200,400 from the 250m SDS)

-res=hkm -xy=100.1, 200.1
(read values at pixel 100,200 from the 500m SDS, and at pixel 201,401 from the 250m SDS)

-res=1km -xy=100.0.1,200.0.1
(read values at pixel 100,200 from the 1km SDS, at pixel 200,400 from the 500m SDS, and at pixel 401,801 from the 250m SDS)

filename(s) One or more input files separated by space.

EXAMPLES

read_pixvals -xy=840,360 -res=1km
VNP13A2.A2018073.h08v05.001.2018089070837.h5

read_pixvals -xy=840,360 -res=1km
MOD13A2.A2017193.h08v04.006.2017209232631.hdf

read_pixvals -xy=1000,200 –xy=0,0
MOD09A1.A2003057.h29v11.004.2003069051044.hdf

read_pixvals -xy=10,10 -res=1km
MOD09GHK.A2002225.h19v09.003.2002227235523.hdf
MOD09GQK.A2002225.h19v09.003.2002227235424.hdf

read_pixvals -xy=840,360 -res=1km
MOD09GA.A2012248.h20v11.005.2012250180349.hdf

read_pixvals -xy=840,360 -res=qkm
MOD09GQ.A2010013.h35v10.005.2010015104431.hdf

read_pixvals -xy=840,360 -res=1km
MODAGAGG.A2008058.h09v05.005.2008061075754.hdf

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Version 3.6 02/12/2020

read_proj_param

NAME

read_proj_param - Read the projection parameter information of a L2G/L3/L4 MODLAND HDF-EOS product.

SYNOPSIS

read_proj_param [-help]

read_proj_param filename

DESCRIPTION

Read the projection parameter information stored in the metadata of a L2G/L3/L4 MODLAND HDF-EOS product (i.e., one that is geolocated) and output to stdout. This information is needed to project non-MODLAND data into registration with a geolocated MODLAND product.

An example of the output is:

Tile ID: h07v10
UpperLeftPointMtrs: (-2383921.627500, -476784.325500)
LowerRightMtrs: (-1430352.976500, -1430352.976500)
Projection Code: (11, GCTP_LAMAZ)
Projection parameters: (6371228.000000, 0.000000, 0.000000, 0.000000, 0.000000, 90000000.000000, 0.000000, 0.000000, 0.000000, 0.000000, 0.000000, 0.000000, 0.000000)

The tile id is of the form hxxvyy, where xx and yy are the two digit horizontal and vertical land product tile numbers.

The UpperLeftPointMtrs and LowerRightMtrs values are the coordinates of the top left and bottom right pixel centers.

The Projection Code and Projection parameter values are defined by the General Cartographic Transformation Package (GCTP). For further GCTP information please see the MODIS Reprojection Tool documentation or http://mapping.usgs.gov/www/html/cartsoft.html.

ARGUMENTS

-help	Display this help message
filename	Input filename

EXAMPLES

read_proj_param VNP21A2.A2017193.h11v08.001.2018044141221.h5

read_proj_param MOD09Q1.A2001193.h09v05.004.2002200065231.hdf

read_proj_param MYD43B4.A2003081.h26v06.003.2003103182903.hdf >
parameters.txt

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Version 3.6 02/12/2020

read_sds_attributes

NAME

read_sds_attributes - read attributes of one or more SDS of a MODIS Land HDF-EOS data product.

SYNOPSIS

read_sds_attributes -h [filename]
read_sds_attributes -help [filename]
read_sds_attributes [-sds=<SDS_name1>[,<SDS_name>. .]] filename

DESCRIPTION

Read attributes of one or more SDSs of an input MODIS Land HDF-EOS data product and output the result to stdout. The SDS attributes include: fill values, units, scaling and offset values, SDS long name, etc.

ARGUMENTS

-help Display this help message, If the input filename is specified with this option, then the names of all the SDSs in the file are displayed.
-sds=<SDS_list> List of SDS to process. SDS names are separated by commas with no space. By default attributes for all SDSs in the input file are output.
filename Input filename.

EXAMPLE

read_sds_attributes -h
VNP02DNB.A2019200.0606.001.2019200125817.nc

read_sds_attributes -help
VNP13A2.A2018073.h09v05.001.2018089070229.h5

read_sds_attributes -sds="1 km 16 days EVI,1 km 16 days VI Quality"
VNP13A2.A2018073.h09v05.001.2018089070229.h5

read_sds_attributes VNP13A2.A2018073.h09v05.001.2018089070229.h5

read_sds_attributes -sds="1 km 16 days NDVI,1 km 16 days VI Quality"
MOD13A2.A2017193.h08v04.006.2017209232631.hdf

read_sds_attributes MOD13A2.A2017193.h08v04.006.2017209232631.hdf

AUTHOR

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Version 3.6 02/12/2020

reduce_sds

NAME

reduce_sds - Reduce the spatial dimensions of one or more SDSs of a Land HDF-EOS data product.

SYNOPSIS

reduce_sds -help [filename]

reduce_sds -of=<output_filename> -rf=<reduction factor> -sub|avg|cnt|cl
[-sds=<SDSname1>[<,SDSname2>...]] [-fill_value=<fill value>]
[-bit=[<bit range>]<opr><value>[,[<bit range>]<opr><value>]…]
[-min] [-max] [-std] [-num] [-meta] [-float] filename

DESCRIPTION

The spatial dimensions of input SDS(s) may be reduced using one of four different methods. The reduction factor (rf) must be a non-zero positive integer. The output SDS x dimension will be ((x div rf) + (x mod rf)) and similarly the y dimension will be ((y div rf) + (y mod rf)). If the input SDS list contains SDSs with different spatial dimensions the reduction factor will be applied to the SDS with the smallest spatial dimension and the other SDS(s) will be reduced to have the same output dimension.

All SDS fill values are ignored.

This tool may be used to reduce data volumes, and to enable analysis of the different MODLAND product spatial resolutions (250m, 500m, 1km), or to enable quick comparison with other coarser spatial resolution data sets.

This tool compliments the tool *enlarge_sds*.

This tool supports 2D/3D/4D SDS(s).

The tool command arguments can be specified in any order.

ARGUMENTS

-help [filename]	Display this help message. If the input filename is specified with this option, then the names of all the SDSs in the file are displayed.
-of=<filename>	Output filename
-rf=<reduction factor>	Reduction factor (a non-zero positive integer)
-sub	Reduce by sub-sampling. Pixel value at (i, j) in the output SDS is copied from the pixel at (rf*i + rf/2, rf*j + rf/2) in the input SDS.

-avg	Reduce by averaging. Pixel value at (i, j) in the output SDS is the average of pixel values in a sub window defined from (rf*i, rf*j) to (rf*i + rf - 1, rf*j + rf -1) in the input SDS. Optional minimum, maximum, standard deviation, and number of averaged pixels may be output as separate SDS.
-cnt	Reduce by pixel counting. Pixel value at (i, j) in the output SDS is the number of pixels in a sub window defined from (rf*i, rf*j) to (rf*i + rf –1, rf*j + rf -1) in the input SDS with bit value equal to the user specified value. Relational operators may be used. The output SDS value is in the range {0 : rf x rf}.
-cl	Reduce by majority class value. Pixel value at (i, j) in the output SDS is set to the majority value of the pixels in a sub window defined from (rf*i, rf*j) to (rf*i + rf –1, rf*j + rf -1). This option is best used for data with a small number of nominal pixel values.
-sds=<SDS list>	List of SDSs to reduce. SDS names are separated by commas with no space. By default all SDSs are processed maintaining the input SDS interleaving. To process a specific layer of a 3D SDS specify the element number of the third dimension as a dot extension of the SDS name: sds_name.n (e.g., sur_refl_b02.1 = the layer defined by the 1st element of the 3rd dimension of the 3D SDS sur_refl_b02). To process a specific layer of a 4D SDS, specify the higher dimension element number(s) as a dot extension of the SDS name: sds_name.n.m (e.g., Surface_Refl.1.2 = the layer defined by the 1st element of the 3rd dimension and the 2nd element of the 4th dimension of the 4D SDS Surface_Refl).

Note that wildcards and ranges of element values may be specified as sds_name.* and as sds_name.n1-n2.m respectively.

-bit=[<bit range>]<operator>< value>,[<bit range>]<operator><value>, . . .
This option is applicable only with the –cnt option. The SDS bit range and corresponding value are specified in decimal separated by a relational operator. If the bit range is not specified the tool considers all the bits in the SDS. Multiple range, operator and value combinations separated by commas will result in separate output SDS for each of such combination. Valid relational operators are: ==, <, >, <=, >=, !=

-std — Compute the standard deviation in each sub window (for -avg option only).

-min — Compute the minimum value in each sub window (for -avg option only).

-max — Compute the maximum value in each sub window (for -avg option only).

-num — Compute the number of averaged pixels in each sub window (for -avg option only).

-meta — Copy metadata from input file to output file.

-float — Output average value SDS in float data type, default is the input data type (for -avg option only).

-fill_value — Specify the fill value in case of no fill value of attribute or the fill value of attribute is different than the fill value in data set.

filename — Input filename.

EXAMPLES

```
reduce_sds -avg -meta -sds=SurfReflect_I2 -rf=5
        -of=reduce_new.hdf .
        VNP09H1.A2016241.h11v08.001.2017180175130.h5

reduce_sds -avg -sds=SurfReflect_I2 -rf=5
```

-of=reduce_new1.hdf
VNP09H1.A2016241.h11v08.001.2017180175130.hdf

reduce_sds -sds=Fpar_1km -sub -rf=10 -of=sub_fpar.hdf
MOD15A1.A2001193.h09v05.004.2002198025239.hdf

{Note: This example reduces the spatial dimensions of SDS Fpar_1km by 10 using the sub-sampling method. The output file will have spatial dimensions approximately 10 times smaller.}

reduce_sds -sds=Lai_1km -avg -min -max -std -num -rf=10 -of=avg_lai.hdf
MOD15A1.A2001193.h09v05.004.2002198025239.hdf

reduce_sds -sds=Cloud_Mask -sub -rf=5 -of=cloud_sub.hdf
MYD35_L2.A2002189.2040.003.2002191125354.hdf

reduce_sds -sds=Cloud_Mask.1-2 -avg -rf=5 -of=cloud_avg.hdf
MYD35_L2.A2002189.2040.003.2002191125354.hdf

reduce_sds -cnt -bit='0-3>=7' -sds='fire mask' -rf=5 -of=fire_mask_crs.hdf
VNP14IMG.A2020030.1112.001.2020030190902.nc -meta

reduce_sds -cnt -bit="0-3<=2,0-3==3,0-3==4,0-3==5,0-3==6,0-3==7" -
meta -sds="most confident detected fire" -rf=5 -of=fire_class.hdf
MOD14A1.A2002185.h30v11.003.2002204204451.hdf

reduce_sds –rf=2 -cl –of=land_cover_class.hdf
MOD12Q1.A2000289.h01v11.003.2002171021653.hdf

reduce_sds -sds="sur_refl_b01" -sub -rf=5 -
of=red5_sur_refl_b01_NPP_D8SRF1KM_L3D.hdf
NPP_D8SRF1KM_L3D.A2003193.h17v07.P1_00602.20092522026
10.hdf -fill_value="-5"

reduce_sds -sds="CMG 0.05 Deg 16 days NDVI" -sub -rf=10 -
of=red10_MOD13C1.A2012113.005.2012130093534.hdf
MOD13C1.A2012113.005.2012130093534.hdf

AUTHOR

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Documentation: S. Devadiga, X. Zhang, M. Zhao, and B. Pfarr

Version 3.6 02/12/2020

reduce_sds_rank

NAME

reduce_sds_rank – Convert one or more 3D/4D SDS from a MODIS/VIIRS Land HDF-EOS data product to many 2D SDSs.

SYNOPSIS

reduce_sds_rank -help [filename]

reduce_sd_rank -of=<output filename> -fill_value=<fillVal>
{[-sds=<SDSname> [-dim=<dimstr> [-dim=<dimstr>. .]]]} [-all]
[-meta] filename

DESCRIPTION

Several MODIS/VIIRS Land HDF-EOS data products (e.g., MOD43, MYD43, VNP43) and related MODIS/VIIRS products (e.g., MOD35) contain multidimensional SDSs. This tool converts one or more multidimensional (3D or 4D) SDSs to a series of 2D HDF SDSs. Specific SDS layers may be selected using the –sds and –dim options for each input 3D or 4D SDS.

The output file SDS names reflect the input SDS name, the dimension name and the dimension element numbers. For example:

BRDF_Albedo_Parameters.Num_Land_Bands_Plus3_3.Num_Parameters_1 (parameter 1 for land band 3 of SDS BRDF_Albedo_Parameters in MOD43B1. Note that BRDF_Albedo_Parameters is the input SDS name, Num_Land_Bands_Plus3 and Num_Parameters are the 3rd and the 4th dimension names)

Surface_Refl.Num_Obs_Max_1.Num_Land_Bands_2 (1st observation of land band 2 of SDS Surface_Refl in MODAGAGG. Note that Surface_Refl is the input SDS name, Num_Obs_Max and Num_Land_Bands are the 3rd and the 4th dimension names)

Angles.Num_Obs_Max_2.Num_Angles_3 (2nd observation of the 3rd angle component of SDS Angles in MODAGAGG. Note that Angles is the input SDS name, Num_Obs_Max and Num_Angles are the 3rd and the 4th dimension names)

This tool supports 3D and 4D SDS(s).

The tool command arguments can be specified in any order.

ARGUMENTS

-help [filename] Display this help message. If the input filename is provided with this option, then the names of all the SDS in the file with the SDS dimension name and size are displayed.

-of=<filename> Output filename.

-sds=<SDS name> Name of SDS to convert. By default all 3D/4D SDS in the input file are converted to 2D SDSs.

-dim=<dimension name, dimension element number(s)>
Name of the 3rd or higher SDS dimension and the dimension element number(s) (1-based). The dimension element numbers can be separated by comma or by '-'. The –dim option must be repeated for each of the defined SDS dimension names, e.g., -dim=Band_id,1-7 –dim=obs_id,0,1.

This option should follow the –sds option for each input SDS. By default, the tool reduces all of the 3rd and 4th dimensions of a specified SDS.

-all Create an additional output SDS containing all the 2D SDSs mosaiced in a single SDS in row-column order.

-meta Copy metadata from input file to output file.

-fill_value=fillVal User inputed fill value

filename Input filename.

EXAMPLES

reduce_sds_rank -sds=BRDF_Albedo_Parameters_M1
-of=VNP43M1_ BRDF_Albedo_Parameters_M1.hdf
VNP43M1.A2016195.h09v05.001.2017223180734.h5

reduce_sds_rank -sds=BRDF_Albedo_Parameters
-dim=Num_Land_Bands_Plus3,1-7
-dim=Num_Parameters,1-3 -of=brdf_albedo_2dsds.hdf
MYD43B1.A2002177.h11v11.003.2002210233848.hdf

{Note: This example extracts twenty-one 2D SDSs from the 4D SDS BRDF_Albedo_Parameters stored in the input MYD43B1file. In this

example, the values of the BRDF_Albedo_Parameters 1, 2 and 3 are written as separate 2D SDSs for each of the first 7 land bands. }

reduce_sds_rank -sds=Angles -dim=Num_Obs_Max,1-4 -
dim=Num_Angles,1-4 -all-of=agg_angles.hdf
MODAGAGG.A2002017.h20v11.004.2002203181248.hdf

{Note: This example extracts sixteen 2D SDSs from the 4D SDS Angles stored in the input MODAGAGG file. In this example, the values of the four angles (View Zenith, Solar Zenith, Solar Azimuth, View Azimuth) are written as separate 2D SDSs for each of the four observations). An additional output SDS containing all the 2D SDSs in a single SDS in row-column order is also output. }

reduce_sds_rank –sds=Surface_Refl –dim=Num_Obs_Max,1,2
–dim=Num_Land_Bands,1-7 –sds=Band_QC –
dim=Num_Obs_Max,1,4
-dim=Num_Band_QC,1-7 -of=agg_angles_bandqc.hdf
MODAGAGG.A2002017.h20v11.004.2002203181248.hdf

reduce_sds_rank -sds=FireMask -dim="Number of Days:NPP_Grid_Daily
Fire" -of=reduce_NPP_DAF1KM_L3D_rank.hdf NPP
DAF1KM_L3D.A2003193. h30v11.P1_00602.2009252194057.hdf

{Note: This example extracts eight 2D SDSs from the 3D SDS FireMask stored in the input NPP_DAF1KM_L3D.hdf file. The values of FireMask 1-8 are written as seperate 2D SDSs for each of the eight days.}

reduce_sds_rank -sds="BRDF Coeff_M02" -dim="numBRDF_
Coefficients:VIIRS_GriddedIP_17Day_BRDF,1-3" -
dim="maxVegLayers:VIIRS_GriddedIP_17Day_
BRDF,1-3" -of=reduce NPP D17BRDFIP_L3.hdf NPP_
D17BRDFIP_L3.A2012222. h09v05.P1_01110.2012305165838.hdf

{Note: This example extracts sixteen 2D SDSs from the 4D SDS BRDF Coeff_M02 stored in the input NPP_D17BRDFIP_L3 file. In this example, the values of the three maxVegLayers are written as separate 2D SDSs for each of the three numBRDF_Coefficients). An additional output SDS containing all the 2D SDSs in a single SDS in row-column order is also output. }

AUTHOR

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rename_sds

NAME

rename_sds – Rename SDS(s) in an HDF files (creates new HDF file)

SYNOPSIS

Rename_sds [-help]

Rename_sds [-sds=<old name>,<new name>] –ncp [-meta] –of=<output filename> filename

DESCRIPTION

Rename one or more SDS in an HDF files. A new HDF file with user specified SDS(s) is created. SDSs not renamed by the user are copied to the output file with the original SDS names. User may choose not to copy remaining SDSs.

ARGUMENTS

-help Display this help message

-sds=<old name,new name>
Input and Output SDS names. To specify additional repeat the option as many times as the number of SDSs to be renamed.

-of=<filename> Output filename

-ncp Do not copy remaining SDS(s)

-meta Copy all metadata from input to output

EXAMPLES

rename_sds -sds=BRDF_Albedo_Parameters_M1,P_M1 -ncp –meta
-of=P_M1.hdf
VNP43M1.A2016195.h09v05.001.2017223180734.h5

rename_sds -sds=BRDF_Albedo_Parameters_Band1,P_B1 -ncp -meta
-of=P_B1.hdf
MCD43A1.A2016195.h09v05.006.2016222161001.hdf

rename_sds –sds=sur_refl_b01.sur_refl_Band01 –sds=sur_
refl_bo2.sur_refl_Band02 –meta -of=rename_NPP_
D8SRF1KM_L3D.hdf NPP_D8SRF1KM_L3D.A2003193.h09v05.
P1_00602.2009252174609.hdf

rename_sds –sds=”500m 16 days NDVI,hkm 16days NDVI” –ncp –meta

-of=rename_MOD13A1_ncp.hdfMOD13A1.A2007177.
h20v07.005.2007200203237.hdf

rename_sds –sds=”500m 16 days NDVI,hkm 16 days NDVD” –meta
-of=rename_MOD13A1.hdf MOD13A1.A2007177.h20v07.
005.2007200203237.hdf

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Version 3.6 02/12/2020

sds2bin

NAME

sds2bin –Convert an SDS of a MODIS/VIIRS Land HDF-EOS data product
to binary format.

SYNOPSIS

sds2bin –help [filename]

sds2bin -of=<filename> -sds=<SDSname> filename

DESCRIPTION

Convert a user specified SDS from a MODIS/VIIRS Land HDF file to an output binary format file.

The tool supports 2D/3D/4D SDSs.

The tool command arguments can be specified in any order.

ARGUMENTS

-help	Display this help message.
[filename]	If the input filename is specified with this option, then the names of all the SDS in the file are displayed.
-of=<filename>	Output filename
-sds=<SDS name>	SDS to be converted To process a specific layer of a 3DSDS, specify the element number of the third eimension as a dot extension of the SDS name:sds_name.n (e.g., sur_refl_b02.1 = the layer defined by the 1st element of the 3rd dimension of the 3D SDS sur_refl_b02. To process a specific layer of a 4D SDS, specify the higher dimension element number(s) as a dot extension of the SDS name: sds_name,n.m (e.g., Surface_Refl.1.2 = the layer defined by the 1st element of the 3rd dimension and the 2nd element of the 4th dimension of the 4D SDS Surface_Refl).

Note that wildcards and ranges of element values may be specified as sds_name.* and as sds_name,n1-n2,m respectively.

Filename Input filename.

EXAMPLES

sds2bin -sds=SurfReflect_M1 -of=SurfReflect_M1.int16
VNP09A1.A2016289.h11v08.001.2017189045223.h5

sds2bin –sds=sur_refl-b01 -of=sur_refl_b01.img
MOD09A1.A2001145.h20v10.003.2001214125825.hdf

sds2bin -sds=EV_1KM-Emissive -of=ev_1km-emissive.img
MMYD021KM.A2002189.2040.003.2002191123800.hdf

sds2bin –sds="BRDF_Albedo_Parameters.1.2" -of=brdf_albedo.img
MYD43B1.A2002177.h11v11.003.2002210233848.hdf

{Note: This example converts the layer defined by the 1st element of the 3rd dimension and the 2nd element of the 4th dimension of the SDS BRDF_Albedo_parameters to the binary format file brdf_albedo.img. The output is a 2D binary image}

sds2bin –sds="BRDF_Albedo_Parameters.1-7.1" –of=brdf_albedo.img
MYD43B1.A2002177.h11v11.003.202210233848.hdf

{Note: This examples converts the 7 layers defined by the 1st seven elements of the 3rd dimension and the 1st element of the 4th dimension of the SDS BRDF_Albedo_parameters to the binary format file brdf_albedo.img. The 7 layers are output as a single 3D binary image where the number of elements in the 3rd dimension is 7}.

sds2bin –sds=sur_refl_b01-of=NPP_D8SRF1KM_L3D.
A2003193.h09v05.P1_00602.2009252174609.img NPP_
D8SRF1KM_L3D.A2003193.h09v05.P1_00602.2009252174609.hdf

AUTHOR

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sds2gif

NAME

sds2gif – Convert a SDS in an HDF file to GIF

SYNOPSIS

sds2gif –help

sds2gif –sds=SDSname [-clr=<color talbe>] –of=<out filename> [-scale[=min[,max]]] [-res=<value list] filename | sds2gif

DESCRIPTION

Convert user specified SDS in an HDF file to GIF. If color output is required input color table, else output will be grayscale.
Data will be scaled if it is no in the range 0 to 255. To force scaling anyway enter –scale option and provide optional range of input to be scaled. When range is specified all values less than min is set to min all values greater than maxis set to max. Color table can also contain a set of ranges of input values and associated color mapping (5 columns). In this case scale option is invalid or ignored. First two columns are considered as input range value.

ARGUMENTS

-help	Display this help message
-sds=<SDS name>	SDS to be converted to GIF, Only 2D SDS is allowed.
-of=<filename>	Output filename
-clr=<filename>	Input optional color talbe filename
-scale[=min[,max]]	Scale input. Minimum and maximum value are optional. This option is ignored if color table set of range values???????
-res=<value list>	List of SDS values (separated by comma) not to be scaled

EXAMPLES

sds2gif -of=SurfReflect_M5.gif -sds=SurfReflect_M5
VNP09A1.A2016297.h11v08.001.2017189113645.h5

sds2gif -of=BRDF_Albedo_Parameters_Band1.1.gif
-sds=BRDF_Albedo_Parameters_Band1.1
MCD43A1.A2016195.h09v05.006.2016222161001.hdf

{Note: This example use the first layer of the 3D SDS BRDF_Albedo_Parameters_Band1in MCD43A1 to plot the data image in gif and output the image as BRDF_Albedo_Parameters_Band1.1.gif }

sds2gif –sds=PsnNet_5km -clr=colorlut.MOD17A2.psn.txt
-of=MOD17A2HGFC.PsnNet_500m.A2003193.h09v05.gif
MOD17A2HGFC.A2003193.h09v05.006.2019232103711.hdf

sds2gif –sds=ET_500m -clr=colorlut.MOD16A2-ET_V6.0.txt
-of=MOD16A2GFC.ET_500m.A2003193.h09v05.gif
MOD16A2GFC.A2003193.h09v05.006.2019175152754.hdf

sds2gif –sds=sur_refl_bo1 –scale=-100,1600
-of=NPP_D8AF1KM_L3D.A2003.P1_00602.2009252174609.gif
NPP_ D8AF1KM_L3D.A2003.P1_00602.2009252174609.hdf

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Version 3.6 02/12/2020

sds2jpg

NAME

sds2jpg – Convert SDS(s) of an HDF file to a JPEG

SYNOPSIS

sds2jpg - help

sds2jpg -of=<filename> [-qa=<quality>] –R=<sds_id>[,<range_string>] -G=<sds_id>[,<range_string>] –B=<sds_id>[,<range_string>] [-log] [-off] [-esdt=<ESDTname>] –gray=<sds_id>[,<range_string>] [-bg= r,g,b] [-SZ=<sds_indes>] filename

DESCRIPTION

Convert the input SDS(s) of an HDF file into a JPEG. User can either specify three SDSs for color or single SDS for grayscale output. This tool is designed to use predetermined colors for a set of fill values used by the projection tool e.g. grid lines, maps etc. To turn off this use the option –off Projection specific fill values are assumed to be present in all the three input bands to use the predetermined colors. The input SDS are scaled using the SDS specified in the –SZ option when specified.

ARGUMENTS

-help	Display this help message
-of=filename	Output filename
-qa=quality	Output JPEG quality (scale of 0 – 100, default 75)
-sf=smoothing factor	Output JPEG smoothing factor (scale of 0 – 100, default 0)
-R=sds_id[,range_string]	SDS index (1-based) or name, and SDS value range for RED band. Range of SDS values to be stretched can be specified by providing min and max of SDS values for linear stretching or by specifying series of SDS values and output values for piecewise linear stretching of input SDS . Format for range string: Xmin,Xmax X0,DNO,X1,DN1,X2,DN2…

	Examples: -R=sur_refl_b03,0,1500 -R=sur_refl_b03,0,0,1000,125,2000, 200,3000,255 (default for range_string is valid_range of sds.) (single value entry is considered max, and min set to 0.)
-G=sds_id[,range_string]	The input SDS can be 2D or a 2D layer of a 3D SDS. The 2D layer number is input dot extension in the SDS name e.g. –R=surf_refl_bo1.1 or –R=1.1 sds _index and layer numbers are 1-based number. SDS index (1-based) or name, and SDS value range for GREEN band. (default for range_string is valid_range of sds.) (single value entry is considered max, and min set to 0.)
-B=sds_id[,range-string]	SDS index (1-based or name, and SDS value range for BLUE band (default for range_string is valid_range of sds.) (single value entry is considered max, and min Set to 0.)
-gray=sds_id[,range_string]	SDS index (1-based) or name, and SDS value range for gray output (default for range_string is valid_range of sds.) (single value entry is considered max, and min set to 0.)
-bg=r,g,b	RGB color code for SDS background color inside the domain. Default is (35, 35, 115)
-SZ=sds_index	SDS index of SDS Solar Zenith angle for Scaling input SDS.
-off	Turn off predetermined projection specific colors.
-log	Use log scaling for all the input bands. Ignore value input to range_string in the option -R, -G, and –B
-esdt	ESDT of the product only for

MODL1B, MODL2, NPPL1B, NPPL2

EXAMPLES

sds2jpg -log -of=VNP09A1.A2016297.h11v08.jpg
-R=SurfReflect_M5,0,15000
-G=SurfReflect_M4,0,15000
-B=SurfReflect_M3,0,15000
VNP09A1.A2016297.h11v08.001.2017189113645.h5

sds2jpg -of=VNP43M1.A2016195.h09v05.jpg
-R=BRDF_Albedo_Parameters_M1.1,0,250
-G=BRDF_Albedo_Parameters_M1.2,0,250
-B=BRDF_Albedo_Parameters_M1.3,0,250
VNP43M1.A2016195.h09v05.001.2017223180734.h5

{Note: This example uses the three data layers from a 3D SDS "BRDF_Albedo_Parameters_M1" in VNP43M1 as RGB to plot the JPEG image VNP43M1.A2016195.h09v05.jpg }

sds2jpg –qa=75 –R=1,0,01500,70,6000,255 –G=2,0,0,4500,70,
18000,255 –B=3,0,0,4500,70,18000,255 – log -of =HAM.
A2010328.MOD02.005.jpg HAM.A2010328.MOD02.005.hdf

sds2jpg –R=sur_refl_bo1 –G=sur_refl-b02 –B=sur_refl_bo1 –qa=75
-of=NPP_D8SRF1KM_L3D.A2003193.h09v05.P1_00602.2009252
17609.jpg NPP_D8SRF1KM_L3D.A2003193.h09v05.
P1_00602.200925217469.hdf

sds2jpg –R=I1_SurfRefl_1 –G=12_SurfRefl_1 –B=13_SurfRefl_1 –qa=75
-of=NPP_DSRFHKD_L2GD.A2003193.h20v11.C1_00602.2009252
170437.jpg NPP_DSRFHKD_L2GD.A2003193.
h20v11.C1_00602.2009252170437.hdf

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Version 3.6 02/12/2020

sds_hist

NAME

sds_hist – Compute histogram of SDS values.

SYNOPSIS

sds_hist [-help]

sds_hist [-sds=<sds_name>] [-layer] [-range=<min,mas>] filename

DESCRIPTION

Compute histogram of data values in an SDS. Tool accepts 2D/3D/4D SDS. In case of 3D and 4D SDS user can request the detail for every SDS layer/slice. Output is directed to stdout. Output contains SDS name with dimension size and fill value followed by list of SDS values. In case of 3D and 4D SDSs fill value and list of SDS values are listed for each layer. SDS layers are identified by the dimension index of that layer.

ARGUMENTS

sds=<sds_name>	SDS names separated by comma. (default: all SDS)
-layer	Compute histogram for every layer separately
-range=<min,max>	Histogram range (minimum and maximum values). Default is set to valid range o the SDS. Fill value is counted separately. If valid range attribute is not available the range of the SDS data type is used as the limit. The range value for various data type is shown below: INT8: (-128, 127) UINT8: (0, 255) INT16: (-32768, 32767) UINT16: (0, 65535) INT32: (-2147483648, 2147483647) UINT32:(0, 4294967295) FLOAT32: UNDEFINED For float data type the histogram is computed after converting the float values to their closest integer .
filename	One or more input filenames

EXAMPLES

sds_hist -layer -sds=BRDF_Albedo_Parameters_M1 -range=0,10000

VNP43M1.A2016195.h09v05.001.2017223180734.h5

sds_hist -sds=sur_refl_b01
MOD09A1.A2016217.h09v05.006.2016226075317.hdf

sds_hist –sds=SurfRefl_Obs_1.1 –range=0,1000 NPP_DSRFIP_
L3.A2003193.h19v10.P1_00602.2009257194820.hdf

sds_hist –layer –sds=FireMask –range=0,11
NPP_DAF1KM_L3D.A2003193.h30v11.P1_00602.
2009252194057.hdf

sds_hist –sds=sur_refl_b01 –range=0,1000 MOD09A1.
A2000305.h20v10.005.2008210094208.hdf

AUTHOR

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Documentation: S. Devadiga, X. Zhang, M. Zhao, and B. Pfarr

Version 3.6 02/12/2020

sds_math

NAME

sds_math – Perform simple arithmetic on two input SDS.

SYNOPSIS

sds_math -help

sds_math -math=SDSname,f1,<op>,SDSname,f2,dt,f_nop1,f_nop2,f_nop3,f_ovf -of=<filename>

DESCRIPTION

Perform simple arithmetic on two input SDS of same or different resolution. If the two input SDSs are of different resolution then resolution of one SDS must be an integral multiple of the other and the output difference SDS will be of higher of the two input resolutions. Output is an HDF file containing one or more SDS of pixelwise arithmetic result. The –math option may be repeated to perform other arithmetic operations.

Tool supports 2D/3D/4D SDS in band sequential or bit sequential interleaved format. If no layers are specified all layers are processed and the original rank of the SDS is retained. To specify particular layer in 3D or 4D SDS include the layer number as dot extension in the input SDS name.

ARGUMENTS

-help Print this help message

-math=SDSname,f1,<op>,SDSname,f2,dt,f_nop1,f_nop2,f_nop3,f_ovf
Arithmatic expression containing SDS name. filename, an operator (+,-,*,/), output data type and fill values for output data type are INT8,UINT8,INT16, UINT16, INT32, UINT32, FLOAT32. f_nop1,f_nop2 and f_nop3 are no operation fill values in the two input SDS and the output SDS. The arithmetic operation is not performed if SDS values in the input SDS1 is f_nop1 or SDS2 is f_nop2. The output fill value in such case is f_nop3, f_ovf is the fill value in the output SDS if the arithmetic operation results in overflow. The overflow fill is not implemented for float data type. If SDS is a 3D or 4D specify the dimension value as dot extension in the sds name,e.g. -math=SDS.n1,file,+,SDS.n1,m1,file

Default values are:

dt=data type of SDS1
f_nop1,f_nop2 = corresponding input SDS fill values,
f_nop3 = fill value of SDS1
f_ovf = f_nop3

For one or more parameters to take default values use * as value.

-of=<filename> Output filename

EXAMPLES

sds_math -math="SurfReflect_M2,
VNP09A1.A2016297.h11v08.001.2017189113645.h5,-,SurfReflect_M1,
VNP09A1.A2016289.h11v08.001.2017189045223.h5,FLOAT32,*,*,*,*"
-of=VNP09A1.h09v05.b03.297_289.hdf

sds_math -math=LST_Day_lkm,MOD11A1.A2003193.h20v11,005.
200733520335203321.hdf,-, LST_Day_1km,MOD11A1.
A2003193.h20v11.005.2007335203321.hdf,INT16,0,0,1,2
-of=sds_math_diff_MOD11A1.hdf

sds_math–math="500m 16 days NDVI,NPP_D16VI1KM_
L3D.A2003193.h09v05.P1_00602.2009257123847.hdf,-,
1km 16 days NDVI,
NPP_D16VI1KM_L3D.A2013049.ho9v05.C1_03001.2013065172014.hdf,
INT16,-3000,-3000,-3000,-3000"
-of =sds_math_diff_NPP_D16VI1KM_L3D.VI.hdf

AUTHOR

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Version 3.6 02/12/2020

sds_range

NAME

sds_range –Print the observed range of an SDS in an HDF file

SYNOPSIS

sds_range [-help]

sds_range [-sds=<sds_name>] [-layer] [-scale] filename

DESCRIPTION

Read the SDS and print the minimum and maximum value in the SDS that is not a fill value and also print the fill value. Tool accepts 2D/3D/4D SDS. In case of 3D and 4D SDS user can request the detail for every SDS layer/slice.

Output is directed to stdout and contains following information:
SDS name, Layerid, Minimum, Maximum,fill value and out of range indicator.
Layer id is provided only for 3D and 4D SDS upon request by the user. If an SDS contains only fill value then minimum and maximum field will contain a string of *. SDS attributes scale_factor and add_offset are printed when –scale option is used.

ARGUMENTS

-help	Display this help message
-sds=<sds_name>	SDS name
-layer	Report details for every layer
-scale	Scale the range values
filename	One or more input filenames

EXAMPLES

sds_range -sds=SurfReflect_M1
VNP09A1.A2016289.h11v08.001.2017189045223.h5

sds_range -sds=SurfReflect_State
VNP09A1.A2016289.h11v08.001.2017189045223.h5

sds_range –sds=”CMG 0.05 Deg 16 days EVI” –scale –layer
MOD13C1.A2012113.005.2012120093532.hdf

sds_range –sds=”BRDF Coeff_Mo1” –scale –layer
NPP_D17BRDFIP_L3.A2012222.h09v05.
P1_01110.2012305165838.hdf

sds_range –sds=”Nadir_Reflectance_Band1” –scale –layer
NPP_D16BRDF4_L3D.A2003193.h09v05.
P1_0062.2009257125940.hdf

sds-range –sds=”TOA_NDVI” –scale –layer
NPP_VRVI_L2.A2012157.2025.
AGG_03000.2012158124407.hdf

sds-range –sds=”Radiance_Mod_M1” –scale
NPP_VMAR-L1.
A2003193.11930.P1_00602.2009237223832.hdf

AUTHOR

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Documentation: S. Devadiga, X. Zhang, M. Zhao, and B. Pfarr

Version 3.6 02/12/2020

sds_ts_stat

NAME

sds_ts_stat – Compute pixelwise statistics of SDS in set of tiles.

SYNOPSIS

sds_ts_stat -help

sds_ts_stat -sds=<sds_name,sds_min,sds_max,f_nop_in,f_nop_out,dt> -of=<filename> -param=avg,std,min,max,npix,sum f1 f2 f3.. fn

DESCRIPTION

Compute statistics of sds values at each pixel for a set of input tiles. User can specify range of the sds values to be considered for computing statistics and a fill value to be excluded from consideration. Multiple SDSs are specified by repeating the option. Output is an HDF file containing one or more statistics parameter SDS. Statistics parameter include mean, standard deviation, minimum, maximum, number of pixels and sum of sds values at each pixel for each input SDS. By default all parameters are output. An input file is ignored if the user specified SDS is missing in the file.

ARGUMENTS

-help Print this help message

-sds=SDSname,sds_min,sds_max,f_nop_in,f_nop_out,dt

Input sds name, minimum and maximum of sds values to be considered for statistics, no operation fill value in input SDS and no operation fill value in output SDS and output data type. Output data type of SDS number of pixels is always INT16. Each of the parameters except the SDS name can be replace by * to assign respective default values. Default values are:

sds_minm,sds_max; sds attribute valid range.
f_nop_in: sds attribute fill value
f_nop_out: f_nop_in
dt: input sds data type
values for data type: INT8, UINT8, INT16, UINT16, INT32, UINT32, FLOAT32

-param=avg,std,min,max,npix,sum

Output statistics parameter. One or more parameter is specified in random order. Default: all parameters are computed.

-of=<filename> Output filename

EXAMPLES

sds_ts_stat -sds=SurfReflect_M5,0,10000,-28672,-28672,INT16
-param=avg,std,min,max,npix,sum -of=VNP09A1_ts_stat.hdf
VNP09A1.A2016289.h11v08.001.2017189045223.h5
VNP09A1.A2016297.h11v08.001.2017189113645.h5

sds_ts_stat –sds="SurfaceReflectance_MO1,*,*,*,*,*"
-param=avg,std.min,max,npix,sum -of=NPP_DSRFIP_L3.
sds_ts_stat.hdf NPP_DSRFIP_L3.A20130*h09v05*.hdf

sds_ts_stat –sds="sur_refl_b01,*,*,*,*,*" -param=ave,std,min,max,npix,
sum -of=MOD09A1.sds_ts-stat.hdf MOD09A1.*.hdf

sds_ts_stat –sds="Radiance_Mod_M1,*,*,*,*,*" -param=avg,std,min,
mas,npix,sum -of=NPP_VMAE_L1.sds_ts_stat.hdf
NPP_VMAE_L1.A2003193.P1.00602.2009237223832.hdf
NPP_VMAE_L1.A2003193.P1.00602.2009237224000.hdf

AUTHOR

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Version 3.6 02/12/2020

sds_values

NAME

sds_values – Print the list of different values present in one or more SDS of an HDF file and optionally produce the ENVI compatible density slice color table.

SYNOPSIS

sds values [-help]

sds values [-sds=<sds_name>] [-layer] [-clr=<nc,f1,f2>] filename

DESCRIPTION

Read the SDS and print all different values present in one or more SDS of an HDF file. Tool accepts 2D/3D/4D SDS. In case of 3D and 4D SDS user can request the detail for every SDS layer/slice. Output is directed to stdout. Output contains SDS name with dimension size and fill value followed by list of SDS values. In case of 3D and 4D SDSs fill value and list of SDS values are listed for each layer. SDS layers are identified by the dimension index of that layer.

An ENVI compatible density slice color table can be produced. Requested number of colors at equal intervals are selected from the input color table covering the full range of sds values. Output color table is written to ASCII file. If the number of distinct sds values are less than or equal to specified number of output colors distinct colors are assigned to distinct SDS values, otherwise the SDS value range is divided into number of colors and colors are assigned to range of SDS values.

ARGUMENTS

-help	Display this help message
-sds=<sds_name>	SDS name
-layer	Report details for every layer
-cir=<nc.f1,f2>	Number of output colors, input file f1 containing full range color table, and output file f2 for ENVI compatible density slice color table.
filename	One or more input filenames

EXAMPLES

sds_values -sds=SurfReflect_I2

VNP09H1.A2016241.h11v08.001.2017180175130.h5

sds_values –sds="500m Reflectance Band Quality"
MOD09.A2010015.0015.005.2010020231218.hdf

sds_values -sds="LandSurfTemp_QCFlags_0,
LandSurfTemp_QCFlags_1, LandSurfTemp_WCFlags_2"
NPP_VLST_L2.A2003193.000.P1_00502.2009252143904.hdf

Note:
This tool is mainly for use when an SDS contains few number of different values such as QA SDS. The tool limits the maximum number of output values to 16000. The tool takes enormously long time to complete the run on regular Science Data that contains wide range of values.

AUTHOR

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Version 3.6 02/12/2020

subset_sds

NAME

subset_sds - Create spatial subset SDSs of one or more SDS of a MODIS Land HDF-EOS data product.

SYNOPSIS

subset_sds -help [filename]

subset_sds -of=<output filename> -row=<start,end> -col=<start,end> [-sds=<SDS_name1>[,<SDS_name2>,. .]] filename

DESCRIPTION

Create spatial subset SDS(s) of one or more SDS of an input MODIS Land HDF-EOS data product. The spatial subset is specified by the pixel row-column range in the input product.

This tool supports 2D/3D/4D SDS(s).

The tool command arguments can be specified in any order.

ARGUMENTS

-help	Display this help message, If the input filename is specified with this option, then the names of all the SDS in the file are displayed.
-sds=<SDS_list>	List of SDS to subset. SDS names are separated by commas with no space. By default all SDSs are subsetted maintaining the input SDS interleaving. To process a specific layer of a 3D SDS specify the element number of the third dimension as a dot extension of the SDS name: sds_name.n (e.g., sur_refl_b02.1 = the layer defined by the 1st element of the 3rd dimension of the 3D SDS sur_refl_b02). To process a specific layer of a 4D SDS, specify the higher dimension element number(s) as a dot extension of the SDS name: sds_name.n.m (e.g., Surface_Refl.1.2 = the layer defined by the 1st element of the 3rd dimension and the 2nd element of the 4th dimension of the 4D SDS Surface_Refl). Note that wildcards and ranges of element values may be specified as sds_name.* and as sds_name.n1-n2.m respectively.
-row=<start,end>	Subset row range (start and end are inclusive)
-col=<start,end>	Subset column range (start and end are inclusive)
-of=<out filename>	Output filename

filename Input filename

EXAMPLES

```
subset_sds -meta -sds=SurfReflect_M5,SurfReflect_M4,SurfReflect_M3
        -row=300,900 -col=300,900 -gname=VNP_Grid_1km_L3_2d
        -of=VNP09A1.subset.hdf
        VNP09A1.A2016289.h11v08.001.2017189045223.h5

subset_sds -sds="most confident detected fire" -row=0,10
        -col=1130,1140
        MYD14A1.A2003281.h09v05.003.2003296025915.hdf
        -of=Subset_MYD14A1.A2003281.h09v05.003.2003296025915.hdf

subset_sds -sds=Surface_Refl -row=10,100 -col=100,200
        -of=Subset_MODAGAGG.A2003077.h19v07.004.
                2003079210733.hdf
        MODAGAGG.A2003077.h19v07.004.2003079210733.hdf

subset_sds -sds=EV_Band26 -row=300,400 -col=1000,1100
        -of=Subset_MOD021KM.A2004007.0155.004.2004007095233.hdf
        MOD021KM.A2004007.0155.004.2004007095233.hdf
```

AUTHOR

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Version 3.6 02/12/2020

subset_spatial

NAME

subset_spatial – Create spatial subset SDSs of one or more SDS from an MODIS/VIIRS Land HDF-EOS data product.

SYNOPSIS

subset_spatial -help

subset_spatial –sds=<sds_names> -row=<st,end> -col=<st,end> -gname of=<output file> <file> -meta

DESCRIPTION

Create spatial subset SDS(s) of one or more SDS from an input MODIS/VIIRS LAND HDF-EOS data product. Spatial subset is specified by the row-column range of the data in input product.

This tool support 2D/3D/4D SDS(s)

The tool command arguments can be specified in any order.

ARGUMENTS

-help	Display this help message.
-sds=<sds names>	SDS names in the input files separated by Comma
-gname	Get grid name from input file and create grid EOS For output
-row=<st,end>	Subset row range (st and end are inclusive)
-col=<st,end>	Subset column range (st and end are inclusive)
-of=<out filename>	Output filename
-meta	Copy meta data for <input file> to <output file>

EXAMPLES

subset_spatial -sds=SurfReflect_M5,SurfReflect_M4,SurfReflect_M3
-row=300,900 -col=300,900 -gname -meta
-of=VNP09A1.subset_spatial_1.hdf
VNP09A1.A2016289.h11v08.001.2017189045223.h5

subset_spatial –col=0,400 –row=0,400 –meta –gname

-of=subset.Mod14A.hdf
MOD14A1.A2000305.ho9v05.005.2008210044044.hdf

subset_spatial –col=0,400 –row=0,400 –meta –gname –of=subset.
MCD43A1.A2009257.h09v05.005.2009276202524.hdf
MCD43A1.A2009257.ho9v05.005.2009276202524.hdf

subset-spatial –sds="CMG 0.05deg 16 days NDVI,CMG 0.05deg 16 days EVI,CMG 0.05deg 16 dyas NDVI Quality,CMG 0.05deg 16 days EVI Quality" –row=1880,2145 –col=2316,2676
-of=test_out_MOD13C1.hdf
MOD13C1.A2005193.004.2005223014529.hdf

Subset_spatial –col=0,400 –row=0,400 –meta –gname -of=subset.
NPP_D8AF1KM_L3D.hdf
NPP_D8AF1KM_L3D.A2003209.h09v05.P1_00602.200925313280
9.hdf

AUTHOR

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Version 3.6 02/12/2020

tilecenter

NAME

tilecenter – Compute the centroid of the input tile

SYNOPSIS

tilecenter [-help]

tilecenter [tileid] [h.v]

DESCRIPTION

This routine computes the longitude and latitude of the centroid of an input tile. Tile is specified by either the tileid or the vertical and horizontal tile number.

ARGUMENTS

-help	display this help message
tileid	8 digit tileid
h,v	horizontal and vertical tile numbers separated by space

EXAMPLES

```
tilecenter   09 05
tilecenter   11009005
tilecenter   12 04
tilecenter   11012004
```

AUTHOR

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Version 3.6 02/12/2020

tileid

NAME

tileid - Compute the tile id (horizontal vertical tile number)

SYNOPSIS

tileid [-help]

tile <longitude> <latitude>

DESCRIPTION

This routine computes the horizontal and the vertical
tile number corresponding to the user specified geolocation in longitude and latitude.

ARGUMENTS

-help	display this help message
longitude	longitude in degrees (-180 to + 180)
latitude	latitude in degrees (-90 to +90)

EXAMPLES

tileid -110 45
tileid -45.0 45.0

AUTHOR

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Documentation: S. Devadiga, X. Zhang, M. Zhao, and B. Pfarr

Version 3.6 02/12/2020

transpose_sds

NAME

transpose_sds - Transpose SDS in an HDP file

SYNOPSIS

transpose_sds -help

transpose -sds=[SDS1[,SDS2 [,.]]] -of=output_file [-meta] filename

DESCRIPTION

Transpose one or more SDS in an HDF file. Output is an HDF file containing one or more transposed SDS. The tool supports 3D and 4D SDSs. All SDSs are output in the original dimension and format, i.e. a 3D/4D SDS is output as 3D/4D SDS. A 2D slice of a 3D/4D SDS cannot be selected to output. SDS attributes are copied from input to output. User can optionally select to output the metadata.

ARGUMENTS

-help	Display this help message
-sds=<SDS names>	SDS names separated by comma
-of=filename	Output file
-meta	Copy metadata from input file to output

EXAMPLES

transpose_sds -meta -sds=SurfReflect_I2 -of=trans_h5.hdf
VNP09H1.A2016241.h11v08.001.2017180175130.h5

transpose_sds -sds=SurfReflect_I2 -of=trans_hdf.hdf
VNP09H1.A2016241.h11v08.001.2017180175130.hdf

trans_sds –sds=sur_refl_b01 -of=transpose_sur_refl_bo1.hdf
-meta MOD09.A2010015.0015.2010020231418.hdf

AUTHOR

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Documentation: S. Devadiga, X. Zhang, M. Zhao, and B. Pfarr

Version 3.6 02/12/2020

unpack_sds_bits

NAME

unpack_sds_bits - unpack specified bits from one or more SDS of a MODIS/VIIRS Land HDF-EOS data product.

SYNOPSIS

unpack_sds_bits -help [filename]

unpack_sds_bits -of=<output filename> [-sds=<SDSname1>[<, SDSname2>...] -bn=<Bit numbers> -meta filename

DESCRIPTION

The MODIS/VIIRS Land per-pixel QA information and other information, such as the land-sea mask, logical criteria used by the algorithm, and cloud state, are stored in an efficient bit encoded manner. This tool decodes requested bit fields and writes them to an output HDF file. The output SDS data type is uint8, uint16 or uint32 depending on the number of unpacked bits.

Note that the unpacked bits are stored in the least significant bits of the output SDS. Refer to the MODIS/VIIRS product file specifications for information on which bits to select for unpacking.

This tool supports 2D/3D/4D SDSs.

The tool command arguments can be specified in any order.

ARGUMENTS

-help [filename]	Display this help message.
-of=<filename>	Output filename. If the input filename is specified with this option, then the names of all the SDS in the file are displayed.
-sds=<SDS list>	List of SDSs to process. SDS names are separated by commas with no space. By default all SDSs are processed maintaining the input SDS interleaving. To process a specific layer of a 3D SDSs specify the element number of the third dimension as a dot extension of the SDS name: sds_name.n (e.g., sur_refl_b02.1 = the layer defined by the 1st element of the 3rd dimension of the 3D SDS sur_refl_b02).

	To process a specific layer of a 4D SDS, specify the higher dimension element number(s) as a dot extension of the SDS name: sds_name.n.m (e.g., Surface_Refl.1.2 = the layer defined by the 1st element of the 3rd dimension and the 2nd element of the 4th dimension of the 4D SDS Surface_Refl). Note that wild cards and ranges of element values may be specified as sds_name.* and as sds_name.n1-n2.m respectively.
-bn=<Bit numbers>	List of bit numbers separated by commas. A range of bit numbers may be specified using '-' between the starting and ending bit numbers, e.g., -bn=4-8. Note the bit numbers are zero-based and bits are numbered from right (least significant bit) to left (most significant bit), e.g., in the 8 bit number 10101110 the value of bit 2-4 when unpacked is 011.
-meta	Copy metadata from input file to output file.
filename	Input filename.

EXAMPLES

```
unpack_sds_bits -of=VNP13A1_QC_unpack.hdf
        -sds=”500 m 16 days VI Quality"
        -bn=0-1,2-5,6-7,8,9,10,11-13,14,15
        VNP13A1.A2016201.h11v08.001.2017289210012.h5

unpack_sds_bits -sds=Cloud_Mask.1 -bn=1-2 -of=cloud_bits.hdf
        MYD35_L2.A2002189.2040.003.2002191125354.hdf

        {Note: This example unpacks bits 1 and 2 of the layer defined by
        the 1st element of the 3rd dimension of the SDS Cloud_Mask.}

unpack_sds_bits -sds=sur_refl_qc_500m -bn=10-13 -of=srefl_qc_bits.hdf
        MOD09A1.A2001193.h09v05.004.2002200065231.hdf

unpack_sds_bits -sds=sur_refl_qc_500m –bn=10-13,14-17,18-21
        -of=srefl_qc_bits.hdf
        MOD09A1.A2001193.h09v05.004.2002200065231.hdf
```

```
unpack_sds_bits -sds="most confident detected fire" -bn=0-3
        -of=fire_bits.hdf
        MOD14A1.A2002185.h30v11.003.2002204204451.hdf
```

AUTHOR

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Version 3.6 02/12/2020

Contacts

The EROS Data Center is the main support facility for the LDOPE Tools. Please do not contact the developers directly.

SOFTWARE INSTALLATION, BUG REPORTS, AND OTHER COMMENTS SHOULD BE SENT TO:

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Appendix A: Installation Instructions

Requirements

These tools have been successfully compiled, linked and have worked on Linux (Centos 7.4) Operating System, terminal of MacBook Air OS X El Capitan Version 10.11.6, and 32-bit Cygwin on a 64-bit WIN 7 laptop. The tools need four libraries HDF4.2.13, HDF-EOS_2.19, HDF5-1.8, and HDFEOS_5.1.15. To install these four libraries, they also require the third party libraries including JPEG and Zlib (see below Appendix B).

Below are the steps to install LDOPE QA tools and the required support libraries. The instructions provided assume the shell is set to bash.

Install HDF4

Note: *JPEG and zlib libraries should be installed before installing HDF4.*

export CC=gcc
export F77=gfortran
./configure --prefix=path_HDF4 --with-jpeg=path_JPEG --with-zlib=path_zlib --enable-hdf4-xdr

path_HDF4 is the destination path where the user wants the library to be installed.
path_JPEG and path_zlib are the paths, which contain the *include* and *lib* paths for JPEG and zlib, respectively.

Note: "--enable-hdf4-xdr" flag is only applied when in a cygwin prompt and not in a Linux or Mac terminal. For cygwin, use the setup-x86.exe command to search and install libtirpc before running the configure command above as the libtirpc library is required for enabling hdf4 xdr. If the libtirpc is successfully installed, a file named libtirpc.dll.a will be listed under /usr/lib path.

make
make check
make install

For cygwin, when running make check, if there is an error notification regarding support for xdr on a 64-bit system, cygwin32 should be used instead of cygwin64. Additionally, for cygwin, copy the head files (*.h) and lib files (*.a) from the xdr path to the specified path_HDF4 (*include* and *lib* paths) as cygwin needs xdr library to compile and link LDOPE QA tools.

Install HDFEOS2

Note: *The two QA tools (geolocation and geolocation_image) call the GCTP function sininvint. Because the latest version of HDFEOS2 changes the arguments of the function, users are advised to install version HDFEOS2.19 or earlier, which does not introduce these changes.*

export CC=<path_HDF4>/bin/h4cc
where path_HDF4 should be absolute not relative.

./configure --prefix=path_HDFEOS2

make
make check
make install

You may copy the *include* path to the path_HDFEOS2 if it is not under path_HDFEOS2 using the command below.
cp -r include path_ HDFEOS2

Install HDF5

Note*: Cygwin may not support the new feature SWMR (HDF5 Single-writer/Multiple-reader) for HDF5.1.10 and beyond. In this case, the user may install an earlier version of HDF5 such as HDF5.1.8*

For cygwin, first, user may modify H5private.h as below:
change ./src/H5private.h by adding the below lines under the line #define _H5private_H

#define _GNU_SOURCE
#include <stdio.h>
#include <stdlib.h>
#include <setjmp.h>

export CC=gcc
export FC=gfortran

./configure --prefix=path_HDF5 --with-zlib=path_zlib

make
make check
make install

Install HDFEOS5

Note: *The two QA tools (geolocation and geolocation_image) call the GCTP function sininvint. Because the latest version of HDFEOS5 changes the*

arguments of the function, users are advised to install version HDFEOS5.1.15 or earlier, which does not introduce these changes.

export CC=<path_HDF5>/bin/h5cc
where path_HDF5 should be absolute not relative.

./configure --prefix=path_HDFEOS5

If the user does not install the SZIP library, then the EHapi.c file, which is under the src path, may need to be modified as below to stop the error information of SZIP when running *make check* later.

move the line number 11512
#endif /* H5_HAVE_FILTER_SZIP */
to line number 11382

make
make check
make install

The user may need to copy the *include* path to the path_HDFEOS5 if it is not under path_HDFEOS5 using the below command.
cp -r include path_HDFEOS5

Install LDOPE QA Tools

add the below lines to the .bashrc file and then source it for all terminal windows.

export HDF_INC=<path_HDF4>/include
export HDF_LIB=<path_HDF4>/lib
export HDF5_INC=<path_HDF5>/include
export HDF5_LIB=<path_HDF5>/lib
export HDFEOS_INC=<path_HDFEOS2>/include
export HDFEOS_LIB=<path_HDFEOS2>/lib
export HDFEOS5_INC=<path_HDFEOS5>/include
export HDFEOS5_LIB=<path_HDFEOS5>/lib
export PATH=$PATH:<path_HDF4>/bin
export PATH=$PATH:<path_HDF5>/bin
export PATH=$PATH:<path_QA_tools>/LDOPE_tools_V3.6/bin
export ANCPATH=<path_QA_tools>/LDOPE_tools_V3.6/ANCILLARY

source ~/.bashrc

under the src path of the LDOPE_tools_V3.6
run the below command for Linux or Mac,
make

run the below command for cygwin,
make -f Makefile_cygwin

The binary executable tools will be copied to the *bin* directory.

Test LDOPE QA Tools with Test Package

Decompressing the test package, LDOPE_tools_V3.6_test_pkg.tar.gz, by running
tar -zxvf LDOPE_tools_V3.6_test_pkg.tar.gz

change all batch file to be executable by running
chmod 777 *.bat

and finally run each batch file. For example,
./test_cp_hdfeos.bat

The input_data and output_data paths contain all the input and output HDF4, HDF5 or NetCDF4 files for the examples in each batch file.

Please refer to Appendix C and Appendix D for more details.

Contact

LP DAAC Customer Support Center:
https://lpdaac.usgs.gov/tools/ldope_tools
LP DAAC Home Page:
https://lpdaac.usgs.gov

Appendix B: Information on HDF/HDFEOS Distribution

Obtaining the latest version

The libraries of HDF4 and HDF5 can be obtained from the HDF group via this website, https://support.hdfgroup.org/downloads/

The libraries of HDFEOS2 and HDFEOS5 can be obtained at
ftp://edhs1.gsfc.nasa.gov/edhs/hdfeos/previous_releases/
ftp://edhs1.gsfc.nasa.gov/edhs/hdfeos5/previous_releases/

Third Party Software Requirements:

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1. IJPEG distribution release 6b(libjpeg.a). The "official" installation source file is jpegsrc.v6b.tar.gz, which is freely available at www.ijg.org/files/

2. ZLIB 1.2.11(libz.a) distribution is at https://zlib.net

System Requirements

To build both HDF and netCDF library from source, you need:

an ANSI C compiler. The native ANSI compilers on the above platforms are supported. On platforms where no ANSI compiler was available the free GNU ANSI compiler GCC was used.

a Fortran 77 compiler if you want Fortran support. In most cases, use F77=gfortran when you run configure file to install the libraries.

Appendix C: LDOPE Tools Command-line Syntax

A LDOPE tool command consists of a command name followed by one or more arguments. There are two types of arguments: arguments indicating certain processing parameters and arguments that are input filenames.

command_name -argument_name=argument_value filename(s)

Arguments that indicate processing options or parameters start with a – sign. Such arguments have argument name and one or more values separated by comma with no space. Argument values may not be allowed if they are implied by the argument name. In cases where argument value is required but is not input, default value is used. Arguments can be input in any order following the command name.

- **Use of various brackets in the command syntax**

<argx or xval>	argument 'argx' or argument value 'xval' is required.
[argy or yval]	argument 'argy' or argument value 'yval' is optional.
{argz or zval}	argument 'argz' or argument value 'zval' is repeatable.

- **Command line arguments and values**

-argx	argument 'argx' is used without any value.
-argy=<yval>	argument 'argy' is used with a value 'yval'. Argument value is required. 'yval' can be string or numeric.

- **Common arguments and meaning**

-help	Print help message for the command.
-help filename	Print valid values for the various command line arguments of this command.
-sds	Input SDS names. For input HDF5/NetCDF4 file format, the "true" name without HDF5 group prefix should be used (see below Note for details).
-of	Output filename.
-meta	Copy metadata from the input file to the output file.
-xy	Pixel location in sample and line number.
-bn	band numbers.

Note for the flag of "-sds=": For input files in HDF5/NetCDF4 format, SDS name for "-sds=" flag refers to "true" name without the HDF5 group prefix. For example, the true SDS name of NDVI in VIIRS VNP13A1 data product saved in HDF5 file format is "500 m 16 days NDVI" not "/HDFEOS/GRIDS/NPP_Grid_16Day_VI_500m/Data Field/500 m 16 days NDVI". Here, the HDF5 group prefix refers to "/HDFEOS/GRIDS/NPP_Grid_16Day_VI_500m/Data Field/"

- **MODIS/VIIRS Land data product file specification**

Specification for MODIS/VIIRS Land data product is available on the web:
https://lpdaac.usgs.gov/dataset_discovery/MODIS/MODIS_products_table
https://viirsland.gsfc.nasa.gov/Products/NASA/NASAprod.html

Appendix D: QA Tool Test Package

If you want to test the tools and/or want to see how they work, you may need to download the test package. There is a README file detailing the procedure to use the package. If a tool requires an HDF file as input, there are at least two tests, with one for the input HDF4 and the other for the input HDF5. The output format for the HDF will be always in HDF4 for this V3.6 release. We plan to support HDF5 output in our next release of Version 4.0.

After decompressing the test package by running

```
tar -zxvf LDOPE_tools_V3.6_test_pkg.tar.gz
```

User is advised to read the "README" file under the "LDOPE_tools_V3.6_test_pkg" directory to follow the procedure to run the test batch file.

Please note that the test command lines and input/output files may not be the same as these examples shown in the previous examples of using each tool. These testing batch files have been successfully run on the developers' Linux system. User may run any of these batch files to get real feelings of how to use the tool for their purposes together with more information on each argument flag explained above.

Appendix E: Understanding unpack_sds_bits

All of the MODIS/VIIRS Land products store quality assessment and other important information at the bit level within certain Science Data Sets (SDS). Most basic computer text books describe how numbers are stored in bytes which are composed of 8, 16, 32 bits, with each bit storing a binary (0 or 1) value.

The MODIS/VIIRS Land products store quality assessment and other information, such as the land-sea mask, logical criteria used by the algorithm, and cloud state, in an efficient bit encoded manner for each pixel. The unpack_sds_bits tool decodes requested bit fields and writes them to an output HDF file containing a new SDS that can be viewed with software supporting the HDF or HDF-EOS data formats.

Prior to unpacking the bits, it is important to consult the product User Guide or File Specification to determine the SDS names and the range and definition of the bits for unpacking. Each product will vary in its SDS names and its bit coding and content. The User Guides and File Specifications are available on the internet and may be updated periodically and users are encouraged to google the relevant information.

Example of unpacking file:
MOD13A1.A2016209.h11v08.006.2016229083040.hdf

1. Analyze the NDVI quality for MOD13A1, the 500m 16-day MODIS VI product.

2. Reference the MOD13A1 User Guide (https://lpdaac.usgs.gov/sites/default/files/public/product_documentation/mod13_user_guide.pdf) or File Specification listing (https://ladsweb.modaps.eosdis.nasa.gov/api/v1/filespec/collection=6&product=MOD13A1) for SDS names and bit information:

3. To get list of SDS names in the input file use
unpack_sds_bits –help MOD13A1.A2016209.h11v08.006.2016229083040.hdf

500m 16 days NDVI (2400 x 2400) INT16
500m 16 days EVI (2400 x 2400) INT16
500m 16 days VI Quality (2400 x 2400) UINT16
500m 16 days red reflectance (2400 x 2400) INT16
500m 16 days NIR reflectance (2400 x 2400) INT16
500m 16 days blue reflectance (2400 x 2400) INT16
500m 16 days MIR reflectance (2400 x 2400) INT16
500m 16 days view zenith angle (2400 x 2400) INT16
500m 16 days sun zenith angle (2400 x 2400) INT16

500m 16 days relative azimuth angle (2400 x 2400) INT16
500m 16 days composite day of the year (2400 x 2400) INT16
500m 16 days pixel reliability (2400 x 2400) INT8

4. Referencing the User Guide
(https://lpdaac.usgs.gov/sites/default/files/public/product_documentation/mod13_user_guide.pdf)
Get explanation for values of bits 0-1 and 2-5 for the SDS name '500m 16 days VI Quality' from table 5 in the VI User Guide

Bit Descriptions:

0-1 NDVI Quality
00 VI produced with good quality
01 VI produced, but check other QA
10 Pixel produced, but most probably cloudy
11 Pixel not produced due to other reasons than clouds

Unpacking bits 0-1 would create a SDS band with the values 0, 1, 2, 3 Bit value 00=0, bit value 01=1, bit value 10=2, bit value 11=3. The digital value of 0 indicates good quality.

Note: Binary conversion is read from right to left. If the bit value was 00011001, the decimal value would be 25. In another example related to the 500m Surface Reflectance QC bits, the bit value of 00001111 converts to a decimal value of 15.

2-5 VI Usefulness

0000 Highest quality
0001 Lower quality
0010 Decreasing quality
0100 Decreasing quality
1000 Decreasing quality
1001 Decreasing quality
1010 Decreasing quality
1100 Lowest quality
1101 Quality so low that it is not useful
1110 L1B data faulty
1111 Not useful for any other reason/not processed

Four-bit range
0= highest quality
12= maximum threshold of acceptable quality

Unpacking bits 2-5 would create a SDS band with the values 0 to 15.

This description already defines the decimal representation and not the binary value.

Note: The User Guide bit descriptions will vary in their definitions and can reflect binary values or decimal values.

5. unpack_sds_bits -sds='500m 16 days VI Quality' -bn=0-1,2-5 -of=unpack_MOD13A1.A2016209.h11v08.006.2016229083040.hdf MOD13A1.A2016209.h11v08.006.2016229083040.hdf

   ** Important to use correct SDS name and bit ranges.

6. 'unpack_MOD13A1.A2016209.h11v08.006.2016229083040.hdf' is the output HDF file and can be imported into software supporting HDF or HDF-EOS data formats. There will be two separate SDS names:
   500m 16 days VI Quality_bits_0-1
   500m 16 days VI Quality_bits_2-5

The SDS bands can be viewed and used for analysis such as computing statistics, masking or overlaying in conjunction with other SDS layers, i.e. the NDVI band.