**Sensor-Independent LAI/FPAR CDR Description**

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README FILE AND SCRIPTS

**1. DATA DESCRIPTION**

The Sensor-Independent LAI/FPAR climate data record (CDR) is derived from high quality LAI/FPAR from MOD15AH C6, MYD15A2H C6, and VNP15A2H C1 products. The low-quality LAI/FPARs were first removed using quality control flags. The high-quality LAI/FPARs were merged into Filtered Sensor-Independent LAI/FPAR data sets. The missing values are then gap filled by spatial-temporal tensor (ST-Tensor) completion model. The Sensor-Independent LAI/FPAR CDR is distributed in different projections and spatial/temporal resolutions. General information about the product is presented in Table 1.

**Table 1.** Data description of Sensor-Independent LAI/FPAR CDR

|  |  |
| --- | --- |
| Data Name | Sensor-Independent LAI/FPAR CDR |
| Raw Dataset | MOD15AH C6 (February 18, 2000 – December 31,20), MYD15A2H C6 (July 14, 2002 – December 31,20), VNP15A2H C1 (January 17, 2012 – December 31,20), LAI/FPAR products |
| Area | Global Vegetated Land |
| Projection | Sinusoidal/WGS1984 |
| Spatial Resolution | 500m/5km/0.05 degree |
| Temporal Resolution | 8 days/bi-monthly |
| Temporal Coverage | February 18, 2000 – December 31,2022 |
| Fill Value | 255 |
| Data Type | Uint8 |
| Valid Range | 0 ~ 70 for LAI and 0 ~ 100 for FPAR |
| Scale Factors | 0.1 for LAI and 0.01 for FPAR |
| Data Sets | First Layer for LAI and Second Layer for FPAR |
| File Format | TIFF(.tif) |

The Sensor-Independent LAI/FPAR CDR are available in two projections of different spatial/temporal resolutions (Table 2). Data sets at 500m were uploaded to Google Earth Engine for users to mix and match with other datasets and the ease of using this in Google Earth Engine. These two versions were reprojected to WGS1984 using the gdalwarp function with a crs of EPSG:4326 for ease of ingestion. The other four versions of Sensor-Independent LAI/FPAR CDR can be found in Zenodo.

**Table 2.** Projections and spatial/temporal resolutions of Sensor-Independent LAI/FPAR CDR

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Resolutions’ ID | Projection | Spatial Resolution | Temporal Resolution | Dimensions | Repository |
| 500m\_8day | WGS1984 | 500m | 8 days | 43200 x 86400 rows/columns | GEE |
| 500m\_bimonth | WGS1984 | 500m | Half month | 43200 x 86400 rows/columns | GEE |
| 5km\_8day | Sinusoidal | 5km | 8 days | 4320 x 8640 rows/columns | Zenodo |
| 5km\_bimonth | Sinusoidal | 5km | Half month | 4320 x 8640 rows/columns | Zenodo |
| 0.05degree\_8day | WGS1984 | 0.05 degree | 8 days | 3600 x 7200 rows/columns | Zenodo |
| 0.05degree\_bimonth | WGS1984 | 0.05 degree | Half month | 3600 x 7200 rows/columns | Zenodo |

**2. FILE NAMING CONVENTION**

The sensor independent LAI/FPAR product is distributed as a tif file. The file name provided by Zenodo is “SI\_LAI\_FPAR\_CDR\_Pid\_Rid\_YYYYDDD.tif”, where Pid indicates projection ID (Sin or WGS84); Rid stands for resolutions’ ID (Table 2); YYYY signifies year of data acquisition; DDD denotes either a Julian day (DDD=DOY) or month and span ID (DDD=MMss). For example, file “SI\_LAI\_FPAR\_CDR\_WGS84\_0.05degree\_bimonth\_20000302.tif” contains LAI and FPAR in WGS1984 projection at 0.05 degree spatial and bi-monthly temporal resolutions assembled from data acquired in the first half (ss=02) of March (MM=03) in year 2000 (YYYY=2000). A file name with LAI/FPAR in sinusoidal projection at 5 km spatial resolution assembled from data acquired over an 8-day period starting on Julian day 49 of year 2000 is “SI\_LAI\_FPAR\_CDR\_Sin\_5km\_8day\_2000049.tif”.

**3. DATA AVAILABLITY**

The dataset links are as follows:

1. <https://doi.org/10.5281/zenodo.8076540> (spatial resolution is 5km/0.05degree and temporal resolution is 8 days/half month)
2. <https://code.earthengine.google.com/?asset=projects/sat-io/open-datasets/BU_LAI_FPAR/wgs_500m_8d> (spatial resolution is 500m and temporal resolution is 8 days)
3. <https://code.earthengine.google.com/?asset=projects/sat-io/open-datasets/BU_LAI_FPAR/wgs_500m_bimonthly> (spatial resolution is 500m and temporal resolution is half month)

**4. DATA READ EXAMPLE (For Google Earth Engine)**

1) Here is a Google Earth Engine example for the version that spatial resolution is 500m and temporal resolution is 8 days:

//1.Get the information about the Sensor-Independent LAI/FPAR CDR

var wgs\_500m\_8d = ee.ImageCollection("projects/sat-io/open-datasets/BU\_LAI\_FPAR/wgs\_500m\_8d")

print(wgs\_500m\_8d)// Print Sensor-Independent LAI/FPAR CDR (500m and 8days) to console

////////////////////////////////////////////////////////

//2. Add Sensor-Independent LAI/FPAR CDR (Year=2010, DOY=201) As Map Layes

Map.addLayer(wgs\_500m\_8d.filterDate('2010-201').first().select('LAI').multiply(0.1),{min:0,max:6,palette: ['#a89247','#5e963b','#75b84f','#8bd162','#f3e24d','#f7eb6b','#fbe789']},'LAI sample')

Map.addLayer(wgs\_500m\_8d.filterDate('2010-201').first().select('FPAR').multiply(0.01),{min:0,max:0.9,palette:['#ff0000','#ff4500','#ff7f00','#ffa500','#ffcf00','#ffff00','#ffff66']},'FPAR sample')

////////////////////////////////////////////////////////

//3. Define a Crop Region and Generate a LAI timeseries from 2010-01-01 to 2022-12-31

var Maize = ee.Feature(

ee.Geometry.Rectangle(123.269, 48.0495, 123.272, 48.0511),

{label: 'Maize'});

var Corn = ee.Feature(

ee.Geometry.Rectangle(123.2892, 48.0599, 123.2907, 48.0582),

{label: 'Corn'});

var Soybean = ee.Feature(

ee.Geometry.Rectangle(123.2442, 48.0813, 123.2455, 48.0799),

{label: 'Soybean'});

var cropRegions = new ee.FeatureCollection([Maize,Corn,Soybean]);//Define a Crop Region

//

var CDR= wgs\_500m\_8d.filterDate('2010-01-01', '2022-12-31')

.filterBounds(cropRegions);//Define a Time Period from 2010-01-01 to 2022-12-31

var LAITimeSeries = ui.Chart.image.seriesByRegion({

imageCollection: CDR,

regions: cropRegions,

reducer: ee.Reducer.mean(),

band: 'LAI',

scale: 10,

xProperty: 'system:time\_start',

seriesProperty: 'label'

});//Generating a LAI Timeseries

var COLOR = {

SOYBEAN: '7FFF00',

MAIZE: 'ff0000',

CORN: '0000ff'

};//Define the color for three crops

LAITimeSeries.setChartType('ScatterChart');

LAITimeSeries.setOptions({

title: 'Crop Sensor-Independent LAI CDR',

vAxis: {

title: 'LAI (Scale:0.1)'

},

lineWidth: 1,

pointSize: 4,

series: {

0: {color: COLOR.MAIZE},

1: {color: COLOR.CORN},

2: {color: COLOR.SOYBEAN}

}

});//Generate One Fiugre

print(LAITimeSeries);

////////////////////////////////////////////////////////

2) Here is a Google Earth Engine example for the version that spatial resolution is 500m and temporal resolution is half month:

//1.Get the information about the Sensor-Independent LAI/FPAR CDR

var wgs\_500m\_bimonthly = ee.ImageCollection("projects/sat-io/open-datasets/BU\_LAI\_FPAR/wgs\_500m\_bimonthly")

print(wgs\_500m\_bimonthly)// Print Sensor-Independent LAI/FPAR CDR (500m and half month) to console

////////////////////////////////////////////////////////

//2. Add Sensor-Independent LAI/FPAR CDR (Year=2010, first half of July) As Map Layes

Map.addLayer(wgs\_500m\_bimonthly.filterDate('2020-07-01','2020-07-31').filter(ee.Filter.eq('month\_half',1)).first().select('LAI').multiply(0.1),{min:0,max:6,palette: ['#a89247','#5e963b','#75b84f','#8bd162','#f3e24d','#f7eb6b','#fbe789']},'LAI sample')

Map.addLayer(wgs\_500m\_bimonthly.filterDate('2020-07-01','2020-07-31').filter(ee.Filter.eq('month\_half',1)).first().select('FPAR').multiply(0.01),{min:0,max:0.9,palette:['#ff0000','#ff4500','#ff7f00','#ffa500','#ffcf00','#ffff00','#ffff66']},'FPAR sample')

////////////////////////////////////////////////////////

//3. Define a Crop Region and Generate a LAI timeseries from 2010-01-01 to 2022-12-31

var Maize = ee.Feature(

ee.Geometry.Rectangle(123.269, 48.0495, 123.272, 48.0511),

{label: 'Maize'});

var Corn = ee.Feature(

ee.Geometry.Rectangle(123.2892, 48.0599, 123.2907, 48.0582),

{label: 'Corn'});

var Soybean = ee.Feature(

ee.Geometry.Rectangle(123.2442, 48.0813, 123.2455, 48.0799),

{label: 'Soybean'});

var cropRegions = new ee.FeatureCollection([Maize,Corn,Soybean]);//Define a Crop Region

//

var CDR= wgs\_500m\_bimonthly.filterDate('2010-01-01', '2022-12-31')

.filterBounds(cropRegions);//Define a Time Period from 2010-01-01 to 2022-12-31

var LAITimeSeries = ui.Chart.image.seriesByRegion({

imageCollection: CDR,

regions: cropRegions,

reducer: ee.Reducer.mean(),

band: 'LAI',

scale: 10,

xProperty: 'system:time\_start',

seriesProperty: 'label'

});//Generating a LAI Timeseries

var COLOR = {

SOYBEAN: '7FFF00',

MAIZE: 'ff0000',

CORN: '0000ff'

};//Define the color for three crops

LAITimeSeries.setChartType('ScatterChart');

LAITimeSeries.setOptions({

title: 'Crop Sensor-Independent LAI CDR',

vAxis: {

title: 'LAI (Scale:0.1)'

},

lineWidth: 1,

pointSize: 4,

series: {

0: {color: COLOR.MAIZE},

1: {color: COLOR.CORN},

2: {color: COLOR.SOYBEAN}

}

});//Generate One Fiugre

print(LAITimeSeries);

////////////////////////////////////////////////////////

**5. DATA READ EXAMPLE (For Matlab)**

Here is a Matlab example for the version that spatial resolution is 0.05 degree and temporal resolution is 8 days:

clear;clc

% set the input dir

inpath = 'D:\SI\_LAI\_FPAR\_CDR\WGS84\_0.05degree\_8d\';

year = 2020;

for doy=161 %1:8:361

% check the prefix

prefix = 'SI\_LAI\_FPAR\_CDR\_WGS84\_0.05degree\_8day\_';

inname = strcat(inpath,prefix,num2str(year\*1000+doy),'.tif');

% read data

data = imread(inname);

data = double(data);

data(data == 255) = nan;

LAI=data(:,:,1)/10;

FPAR=data(:,:,2)/100;

% Visually check the SI\_LAI\_FPAR\_CDR

figure(1); imagesc(LAI);

figure(2); imagesc(FPAR);

end

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\* Any questions about the dataset can be corresponded to Jiabin Pu (om7759@bu.edu)