

# Map Library Usage



## This page has moved

This page has been moved to <https://nasa-gibs.github.io/gibs-api-docs/map-library-usage/>. Please update your bookmarks. This page will redirect in about 5 seconds.

There are several freely-available map libraries available to help in building your own interface to explore NASA's Earth imagery via the Global Imagery Browse Services (GIBS).

## Web-based Libraries

Please see our "[GIBS Web Examples](#)" [GitHub area](#) for code samples and live demos of using popular web mapping libraries (e.g., OpenLayers, Cesium, Mapbox GL) with GIBS.

## Desktop-based Libraries

### NASA World Wind

World Wind is a now-deprecated virtual globe developed by NASA that runs in Java. It can load GIBS imagery through either the [KML interface](#) or the [TWMS interface](#).

#### Requirements

NASA World Wind 1.3+

#### Usage (KML)

To run the World Wind client with [GIBS KML capabilities](#), load the "KML Viewer" demo application from the standalone client. To load a specific layer, select File | Open URL... and enter a URL for the layer in this format: `https://<url to kmlgen.cgi>?layers=<layername>&time=<time>` for example, [https://gibs.earthdata.nasa.gov/twms/epsg4326/best/kmlgen.cgi?layers=MODIS\\_Terra\\_CorrectedReflectance\\_TrueColor&time=2012-06-21](https://gibs.earthdata.nasa.gov/twms/epsg4326/best/kmlgen.cgi?layers=MODIS_Terra_CorrectedReflectance_TrueColor&time=2012-06-21)

To enable time adjustment on a particular layer, use the following URL parameter: `time=R10/<date>/P1D` for example, [https://gibs.earthdata.nasa.gov/twms/epsg4326/best/kmlgen.cgi?layers=MODIS\\_Terra\\_CorrectedReflectance\\_TrueColor&time=R10/2012-05-26/P1D](https://gibs.earthdata.nasa.gov/twms/epsg4326/best/kmlgen.cgi?layers=MODIS_Terra_CorrectedReflectance_TrueColor&time=R10/2012-05-26/P1D)

Limitations: The name of the layer has to be known prior to entering the URL. The list of available layers can be found [here](#).

#### Usage (TWMS)

To run the World Wind client with TWMS capabilities, load the WMS Layer Manager demo application from either the standalone client or the online demo. In the layers menu, add the [TWMS endpoint](#). This will load the list of layers available from TWMS and selecting a layer will allow it to be shown on the globe.

Limitations: World Wind will continue to zoom and try to load images even if they're beyond the depth of the highest resolution tile. When this happens, the images will go blank. In addition, this interface does not allow the selection of variables such as time.

## Script-level Access

### GDAL (Basics)

The Geospatial Data Abstraction Library ([GDAL](#)) WMS driver supports several internal 'minidrivers' that allow access to different web mapping services. Each of these services may support a different set of options in the `Service` block. Documentation for these minidrivers can be found [here](#) on the GDAL website. Two of these minidrivers in particular can be used by users to download GIBS imagery programmatically. They are the Tile Map Specification (TMS) and the OnEarth Tiled WMS (TiledWMS) minidrivers. Examples for both of these minidrivers will be included below.

#### Requirements

GDAL version 1.9.1 or greater with cURL support enabled. To check if cURL is enabled for GDAL, type "gdalinfo --format WMS". If cURL is enabled you will see information about the WMS format, if not, you will get an error message and you will need to reconfigure GDAL to support cURL.

#### Sample Execution #1 - "TMS" Driver Configuration File Input

Create a local service description XML file and invoke `gdal_translate`. In this example, `GIBS_Aqua_MODIS_true.xml` is used to generate a true color JPEG image from Aqua MODIS of a smoke plume from western fires over the central United States. The contents of `GIBS_Aqua_MODIS_true.xml` would be:

```
<GDAL_WMS>
  <Service name="TMS">
    <ServerUrl>https://gibs.earthdata.nasa.gov/wmts/epsg4326/best
/MODIS_Aqua_CorrectedReflectance_TrueColor/default/2013-08-21/250m/{z}/{y}/{x}.jpg</ServerUrl>
  </Service>
  <DataWindow>
    <UpperLeftX>-180.0</UpperLeftX>
    <UpperLeftY>90</UpperLeftY>
    <LowerRightX>396.0</LowerRightX>
    <LowerRightY>-198</LowerRightY>
    <TileLevel>8</TileLevel>
    <TileCountX>2</TileCountX>
    <TileCountY>1</TileCountY>
    <YOrigin>top</YOrigin>
  </DataWindow>
  <Projection>EPSG:4326</Projection>
  <BlockSizeX>512</BlockSizeX>
  <BlockSizeY>512</BlockSizeY>
  <BandsCount>3</BandsCount>
</GDAL_WMS>
```

```
gdal_translate -of GTiff -outsize 1200 1000 -projwin -105 42 -93 32 GIBS_Aqua_MODIS_true.xml
GreatPlainsSmoke1.tif
gdal_translate -of JPEG GreatPlainsSmoke1.tif GreatPlainsSmoke1.jpg
```

In very limited testing, our experience has been that better image quality is obtained by using the GeoTIFF output format from the GDAL WMS, then converting this to other formats, if desired, using a second `gdal_translate` command, or other programs such as ImageMagick convert.

## Sample Execution #2 - "TMS" Driver Command Line Input

Invoke `gdal_translate` with the content of the local service description XML file embedded into the command. This approach is useful for automated scripting to download various layers, dates, etc. To generate the same image as above:

```
gdal_translate -of GTiff -outsize 1200 1000 -projwin -105 42 -93 32 '<GDAL_WMS><Service name="TMS"
><ServerUrl>https://gibs.earthdata.nasa.gov/wmts/epsg4326/best/MODIS_Aqua_CorrectedReflectance_TrueColor
/default/2013-08-21/250m/{z}/{y}/{x}.jpg</ServerUrl></Service><DataWindow><UpperLeftX>-180.0<
/UpperLeftX><UpperLeftY>90</UpperLeftY><LowerRightX>396.0</LowerRightX><LowerRightY>-198<
/LowerRightY><TileLevel>8</TileLevel><TileCountX>2</TileCountX><TileCountY>1</TileCountY><YOrigin>top<
/YOrigin></DataWindow><Projection>EPSG:4326</Projection><BlockSizeX>512</BlockSizeX><BlockSizeY>512<
/BlockSizeY><BandsCount>3</BandsCount></GDAL_WMS>' GreatPlainsSmoke2.tif
gdal_translate -of JPEG GreatPlainsSmoke2.tif GreatPlainsSmoke2.jpg
```

For both options, the information needed to create the local service description XML can be found in the large table on the [GIBS Available Imagery Products](#) page.

Items that may need to be changed include:

1) `<ServerUrl>https://gibs.earthdata.nasa.gov/wmts/epsgcode/best/layer_name/default/date/resolution/{z}/{y}/{x}.format</ServerUrl>`

**layer\_name** - use "Layer Name on Server" from Products page. Note that only one layer can be retrieved per `gdal_translate` call.

**date** - use the desired date in YYYY-MM-DD format

**epsgcode** - use "epsg" followed by the appropriate EPSG code from [Footnote 4](#) on the [GIBS Available Imagery Products](#) page

**resolution** - use the "Resolution" in the format #####m from the "Imagery Resolution" column on the [GIBS Available Imagery Products](#) page, or GoogleMapsCompatible\_Level# resolution from table below

**format** - use jpg or png extension based on the "Format"

2) **Bounding box** - use -180.0, 90, 396.0, -198 for Geographic projection and -4194304, 4194304, 4194304, -4194304 for the Polar projections. This is the bounding box of the topmost tile, which matches the bounding box of the actual imagery for Polar but not for Geographic.

3) **<TileLevel>** - select from the table below based on "Resolution" and "Projection". Note that the TileLevel in the table below is the maximum for that resolution. You can specify a lower value of TileLevel to force GDAL to use coarser resolution input tiles. This can be used to speed up projection, for example during development and testing.

Resolution	TileLevel (Geographic)	TileLevel (Polar)	Resolution (Web Mercator)	TileLevel (Web Mercator)
2km	5	2	GoogleMapsCompatible_Level6	6
1km	6	3	GoogleMapsCompatible_Level7	7
500m	7	4	GoogleMapsCompatible_Level8	8
250m	8	5	GoogleMapsCompatible_Level9	9
125m	9	-	GoogleMapsCompatible_Level10	10
62.5m	10	-	GoogleMapsCompatible_Level11	11
31.25m	11	-	GoogleMapsCompatible_Level12	12
15.625m	12	-	GoogleMapsCompatible_Level13	13

4) **<TileCountX><TileCountY>** - use 2, 1 for Geographic projection and 2, 2 for Polar projections

5) **<Projection>** - use the appropriate EPSG code from [Footnote 4](#) on the [GIBS Available Imagery Products](#) page.

6) **<Bands>** - use 3 for .jpg (except use 1 for ASTER\_GDEM\_Greyscale\_Shaded\_Relief) and 4 for .png

Note that the values for <YOrigin>, <BlockSizeX>, and <BlockSizeY> are constant for all GIBS layers.

More information on GDAL\_WMS can be found [here](#) (note the "TMS" section).

### Sample Execution #3 - "TiledWMS" Driver Configuration File Input

The TiledWMS GDAL minidriver relies on a simplified set of XML configuration from the user, pulling all other information from the TWMS *WMS\_Tile\_Service* document at runtime. The following example requests the same image as was requested in Sample Execution #1, but you will notice how much simpler the XML configuration is. The primary difference is that requests through TWMS utilize a *TiledGroupName* value instead of the *WMTS Identifier* utilized by WMTS requests. The *TiledGroupName* can be generated by replacing all underscores in a WMTS layer's *Identifier* with spaces and appending "tileset". For example, a WMTS Layer *Identifier* of SMAP\_L1\_Passive\_Faraday\_Rotation\_Aft becomes the TWMS *TiledGroupName* "SMAP L1 Passive Faraday Rotation Aft tileset".

```
<GDAL_WMS>
  <Service name="TiledWMS">
    <ServerUrl>https://gibs.earthdata.nasa.gov/twms/epsg4326/best/twms.cgi?</ServerUrl>
    <TiledGroupName>MODIS Aqua CorrectedReflectance TrueColor tileset</TiledGroupName>
    <Change key="{time}">2013-08-21</Change>
  </Service>
</GDAL_WMS>
```

```
gdal_translate -of GTiff -outsize 1200 1000 -projwin -105 42 -93 32 GIBS_Aqua_MODIS_true.xml
GreatPlainsSmokel.tif
gdal_translate -of JPEG GreatPlainsSmokel.tif GreatPlainsSmokel.jpg
```

### Sample Execution #4 - "TiledWMS" Driver Command Line Input

This example invokes `gdal_translate` with the content of the TileWMS local service description XML file embedded as a command line argument. This approach is useful for automated scripting to download various layers, dates, etc. To generate the same image as above, run the following:

```
gdal_translate -of GTiff -outsize 1200 1000 -projwin -105 42 -93 32 '<GDAL_WMS><Service name="TiledWMS"
><ServerUrl>https://gibs.earthdata.nasa.gov/twms/epsg4326/best/twms.cgi?</ServerUrl><TiledGroupName>MODIS
Aqua CorrectedReflectance TrueColor tileset</TiledGroupName><Change key="{time}">2013-08-21</Change><
/Service></GDAL_WMS>' GreatPlainsSmoke2.tif
gdal_translate -of JPEG GreatPlainsSmoke2.tif GreatPlainsSmoke2.jpg
```

## GDAL (Advanced)

### Configuration File Input w/ Transparent PNG

In this example, GIBS\_OMI\_AI.xml is used to generate a transparent PNG image from the OMI Aerosol Index over the same region as the first two examples. The "Layer Name on Server" and EPSG/resolution in <ServerURL>, the <TileLevel>, and the <BandsCount> have changed from the first examples. The contents of GIBS\_OMI\_AI.xml would be:

```
<GDAL_WMS>
  <Service name="TMS">
    <ServerUrl>https://gibs.earthdata.nasa.gov/wmts/epsg4326/best/OMI_Aerosol_Index/default/2013-08-21
/2km/{z}/{y}/{x}.png</ServerUrl>
  </Service>
  <DataWindow>
    <UpperLeftX>-180.0</UpperLeftX>
    <UpperLeftY>90</UpperLeftY>
    <LowerRightX>396.0</LowerRightX>
    <LowerRightY>-198</LowerRightY>
    <TileLevel>5</TileLevel>
    <TileCountX>2</TileCountX>
    <TileCountY>1</TileCountY>
    <YOrigin>top</YOrigin>
  </DataWindow>
  <Projection>EPSG:4326</Projection>
  <BlockSizeX>512</BlockSizeX>
  <BlockSizeY>512</BlockSizeY>
  <BandsCount>4</BandsCount>
</GDAL_WMS>
```

```
gdal_translate -of GTiff -outsize 1200 1000 -projwin -105 42 -93 32 GIBS_OMI_AI.xml GreatPlainsSmokeAI.tif
gdal_translate -of PNG GreatPlainsSmokeAI.tif GreatPlainsSmokeAI.png
```

### Polar Imagery

In this example, GIBS\_Terra\_MODIS\_Arctic.xml is used to generate a true color JPEG image from Terra MODIS of a phytoplankton bloom in the Barents Sea. The "Layer Name on Server" and EPSG/resolution in <Serverurl>, the <DataWindow> elements, and the <Projection> have changed from the first examples. The contents of GIBS\_Terra\_MODIS\_Arctic.xml would be:

```
<GDAL_WMS>
  <Service name="TMS">
    <ServerUrl>https://gibs.earthdata.nasa.gov/wmts/epsg3413/best
/MODIS_Terra_CorrectedReflectance_TrueColor/default/2013-08-01/250m/{z}/{y}/{x}.jpg</ServerUrl>
  </Service>
  <DataWindow>
    <UpperLeftX>-4194304</UpperLeftX>
    <UpperLeftY>4194304</UpperLeftY>
    <LowerRightX>4194304</LowerRightX>
    <LowerRightY>-4194304</LowerRightY>
    <TileLevel>5</TileLevel>
    <TileCountX>2</TileCountX>
    <TileCountY>2</TileCountY>
    <YOrigin>top</YOrigin>
  </DataWindow>
  <Projection>EPSG:3413</Projection>
  <BlockSizeX>512</BlockSizeX>
  <BlockSizeY>512</BlockSizeY>
  <BandsCount>3</BandsCount>
</GDAL_WMS>
```

GeoTIFF files created by GDAL using the default tags for the GIBS polar projections do not work correctly in some GIS programs. So we recommend specifying the output projection in PROJ4 format:

```
gdal_translate -of GTiff -outsize 980 940 -a_srs "+proj=stere +lat_0=90 +lat_ts=70 +lon_0=-45 +k=1 +x_0=0
+y_0=0 +ellps=WGS84 +datum=WGS84 +units=m +no_defs" -projwin 1520000 240000 2500000 -700000
GIBS_Terra_MODIS_Arctic.xml BarentsSea.tif
gdal_translate -of JPEG BarentsSea.tif BarentsSea.jpg
```

The projection string for the GIBS Antarctic projection is "+proj=stere +lat\_0=-90 +lat\_ts=-71 +lon\_0=0 +k=1 +x\_0=0 +y\_0=0 +ellps=WGS84 +datum=WGS84 +units=m +no\_defs". Here are the links for the [Arctic](#) or [Antarctic](#) PROJ4 definitions. Some other workarounds are:

- 1) Use a ".aux.xml" file with the ".tif" file. Download the sample [Arctic](#) or [Antarctic](#) XML file and rename it to match the GeoTIFF file.

```
gdal_translate -of GTiff -outsize 980 940 -projwin 1520000 240000 2500000 -700000 GIBS_Terra_MODIS_Arctic.
xml BarentsSea.tif
"copy" GIBS_Arctic_3413.tif.aux.xml "to" BarentsSea.tif.aux.xml
gdal_translate -of JPEG BarentsSea.tif BarentsSea.jpg
```

- 2) Use JPEG format instead. This will create a .jpg.aux.xml file in addition to the .jpg file.

```
gdal_translate -of JPEG -outsize 980 940 -projwin 1520000 240000 2500000 -700000 GIBS_Terra_MODIS_Arctic.xml
BarentsSea.jpg
```

## Polar Layer w/ Reprojection

In this example, GIBS\_Aqua\_MODIS\_Arctic.xml is used to generate a true color JPEG image from Aqua MODIS of the Beaufort Sea reprojected to have 145W down. The "Layer Name on Server" and EPSG/resolution in <Serverurl>, the <DataWindow> elements, and the <Projection> have changed from the first examples. The contents of GIBS\_Aqua\_MODIS\_Arctic.xml would be:

```
<GDAL_WMS>
  <Service name="TMS">
    <ServerUrl>https://gibs.earthdata.nasa.gov/wmts/epsg3413/best
/MODIS_Aqua_CorrectedReflectance_TrueColor/default/2013-06-20/250m/{z}/{y}/{x}.jpg</ServerUrl>
  </Service>
  <DataWindow>
    <UpperLeftX>-4194304</UpperLeftX>
    <UpperLeftY>4194304</UpperLeftY>
    <LowerRightX>4194304</LowerRightX>
    <LowerRightY>-4194304</LowerRightY>
    <TileLevel>5</TileLevel>
    <TileCountX>2</TileCountX>
    <TileCountY>2</TileCountY>
    <YOrigin>top</YOrigin>
  </DataWindow>
  <Projection>EPSG:3413</Projection>
  <BlockSizeX>512</BlockSizeX>
  <BlockSizeY>512</BlockSizeY>
  <BandsCount>3</BandsCount>
</GDAL_WMS>
```

```
gdalwarp -t_srs '+proj=stere +lat_0=90 +lat_ts=70 +lon_0=-145 +k=1 +x_0=0 +y_0=0 +datum=WGS84 +units=m
+no_defs' -te -1600000 -2500000 1200000 -400000 -tr 1000 1000 GIBS_Aqua_MODIS_Arctic.xml
Beaufort_neg145down_1km.tif
gdal_translate -of JPEG Beaufort_neg145down_1km.tif Beaufort_neg145down_1km.jpg
```

## Reprojecting GIBS Geographic layer into Polar Stereographic

Only a subset of layers are available from GIBS in the polar projections. This is an example of how to project a geographic layer into a polar projection. The contents of GIBS\_Terra\_Cloud\_Fraction.xml would be:

```
<GDAL_WMS>
  <Service name="TMS">
    <ServerUrl>https://gibs.earthdata.nasa.gov/wmts/epsg4326/best/MODIS_Terra_Cloud_Fraction_Day/default
/2017-05-16/2km/{z}/{y}/{x}.png</ServerUrl>
  </Service>
  <DataWindow>
    <UpperLeftX>-180.0</UpperLeftX>
    <UpperLeftY>90</UpperLeftY>
    <LowerRightX>396.0</LowerRightX>
    <LowerRightY>-198</LowerRightY>
    <TileLevel>5</TileLevel>
    <TileCountX>2</TileCountX>
    <TileCountY>1</TileCountY>
    <YOrigin>top</YOrigin>
  </DataWindow>
  <Projection>EPSG:4326</Projection>
  <BlockSizeX>512</BlockSizeX>
  <BlockSizeY>512</BlockSizeY>
  <BandsCount>4</BandsCount>
  <ZeroBlockHttpCodes>204,404,400</ZeroBlockHttpCodes>
</GDAL_WMS>
```

```
gdalwarp -wo SOURCE_EXTRA=100 -wo SAMPLE_GRID=YES -of GTiff -t_srs "+proj=stere +lat_0=90 +lat_ts=70 +lon_0=-
45 +k=1 +x_0=0 +y_0=0 +ellps=WGS84 +datum=WGS84 +units=m +no_defs" -ts 4096 4096 -te -4194304 -4194304
4194304 4194304 GIBS_Terra_Cloud_Fraction.xml Terra_Cloud_Fraction_Arctic.tif
```

The "-wo SOURCE\_EXTRA=100 -wo SAMPLE\_GRID=YES" arguments are needed to ensure that the output region is completely filled. The "-wo SOURCE\_EXTRA=100" caused GDAL to request tiles outside of input bounding region. Normally GDAL would halt when it receives these errors so the <ZeroBlockHttpCodes> includes the 400 error to allow GDAL to continue. Note that this command may take a long time to complete, especially at higher input and output resolutions.

## GIS Client Access

Geographic Information System (GIS) and Google Earth users: [go here for instructions](#).