



February 29, 2024 | 12-1:15 PM EST | [REGISTER HERE](#)

NOAA Emergency Response Imagery Office Hours

Hosted by NOAA National Ocean Service (NOS), NOAA Open Data Dissemination (NODD), and Amazon Web Services (AWS)

- Connect with NOAA experts, Jason Woolard and Jon Sellars, on Emergency Response Imagery (ERI)
 - Share experiences on use and access of NOAA ERI data via AWS
 - Hear about open data access via NODD and cloud-optimized data formats

GoogleMeet Webinar - Recorded

Privacy Act Statement (Record Meetings and Training Sessions)

Authority: The collection of this information is authorized under 5 U.S.C. 301 (*Departmental regulations*), 5 USC 552a (*Records maintained on individuals*); 15 U.S.C. 1512 (*Powers and duties of Department*), and 44 U.S.C. 2904 (General responsibilities for records management).

Purpose: Individual's permission is required for use of photographs, video, and audio in any format, used for communications, outreach, interviews, and dissemination of mission products intended to promote an awareness and appreciation of the environment and NOAA's science, service and stewardship roles.

Routine Uses: The information is used for the purpose set forth above and may be: forwarded to another NOAA or non-NOAA user social media account; shared among NOAA staff for work-related purposes. Photographs, videos, audio recordings may be shared externally and displayed on NOAA websites and social media platforms, and as part of physical displays/exhibits. Disclosure of this information is permitted under the Privacy Act of 1974 (5 U.S.C. Section 552a) to be shared among Department staff for work-related purposes. Disclosure of this information is also subject to all of the published routine uses as identified in the Privacy Act System of Records Notice [DEPT-18](#), Employees Personnel Files Not Covered by Notices of Other Agencies.

Disclosure: Voluntary; by joining and participating in the meeting consent is being given to the recording.

- Thank you for your registration and interest.
- Only hosts and presenters are asked to turn their video on.
- If do not wish to be part of the recording, please feel free to drop off.
- Meeting summary and presentation slides will be available on the NODD website
 - [NOAA.GOV/NODD](https://www.noaa.gov/nodd)





February 29, 2024 | 12-1:15 PM EST | [REGISTER HERE](#)

NOAA Emergency Response Imagery Office Hours

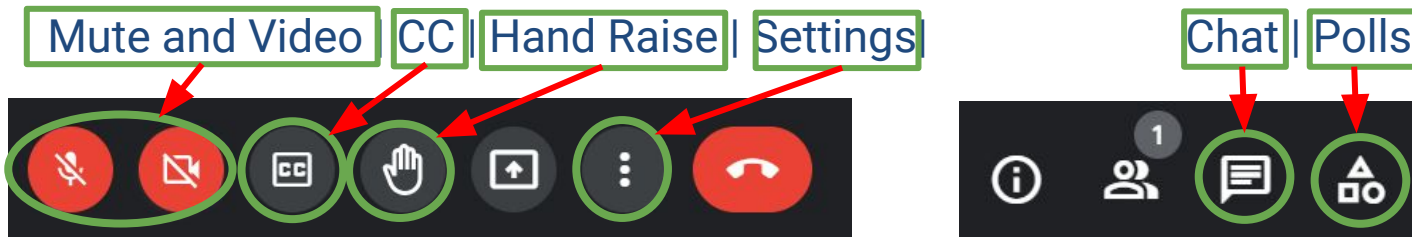
Hosted by NOAA National Ocean Service (NOS), NOAA Open Data Dissemination (NODD), and Amazon Web Services (AWS)

- Connect with NOAA experts, Jason Woolard and Jon Sellars, on Emergency Response Imagery (ERI)
 - Share experiences on use and access of NOAA ERI data via AWS
 - Hear about open data access via NODD and cloud-optimized data formats

GoogleMeet Webinar Logistics

How to join the discussion!

- Keep yourself muted throughout (for call-in participants: to mute and unmute use *6) and videos off
- Raise your hand if you have a question and we'll respond in the order of the queue
- The following features of google meet:



- This webinar will be recorded.
- You can also join by phone line only if you are having connectivity issues.
- (US) +1 240-356-1205 PIN: 638 612 110#

Guidelines for Discussion

- Keep it brief
- Keep it respectful
- Use the chat function for links, references and/or resources
- Submit questions through the chat function or raise your hand
- Identify who the question is directed to where possible



Quick Google Poll

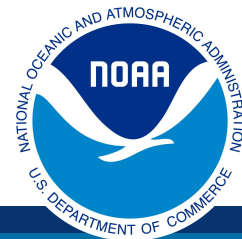
POLL1

- How do you access ERI data today?
 - On-prem via NOAA
 - Cloud
 - Both/Either
 - 3rd party/Web-based Viewer
 - None/Other

POLL2

- My primary goal for attending today is:
 - Technical use and access of ERI data
 - To learn about cloud access to data (e.g. NODD Program)
 - Meet and engage with NOAA staff scientists
 - Learn about AWS access and tools

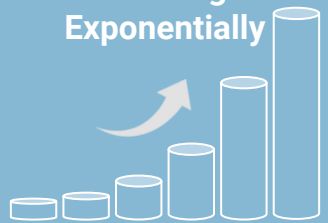
NODD Disseminates NOAA Line Office Data



Open and Free, with Value to the Public:

- From NOAA Line Offices via NODD to public cloud buckets of three CSPs =
 - An exponential number of users can access
- Harnesses the scalability of the cloud to improve data access
 - No egress costs for users or the agency
- No use restrictions or user registration
- Appropriate Metadata included

NOAA Data is Growing Exponentially



TECHNOLOGY MODERNIZATION

Reduces stress on NOAA's on-premise dissemination systems

Improves services for users



FULL & OPEN PUBLIC ACCESS

Supports Federal Data Strategy & Evidence Act Requirements

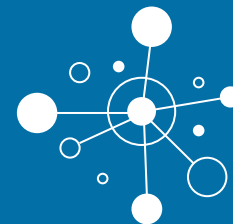
No egress costs



ENABLES & ENGAGES USERS

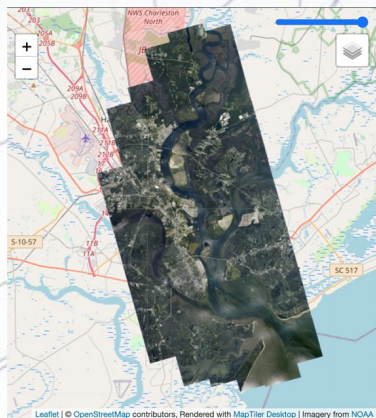
Catalyzes innovation in environmental services

Enables interoperability





Using Emergency Response and Pre-Event Imagery from NOAA's Open Data Dissemination Program with Free and Open Source Software



King Air 350



DSSV6



ER Imagery Processing Workflow

jpeg aerial imagery
raw gps/imu

AWS Virtual Machines

128 CPUs
1000 GB RAM
8 x 3750 NVMe SSD
Ubuntu Linux OS



image- orthorectification
mosaic processing
web map tiling

AWS S3 Storage

html /
javascript
viewer
xyz map tiles
WMTS support
NODD



raw gps/imu

processed nav solution



local PC/laptop for NavData / trajectory processing

NODD

CDN



In Cloud analysis

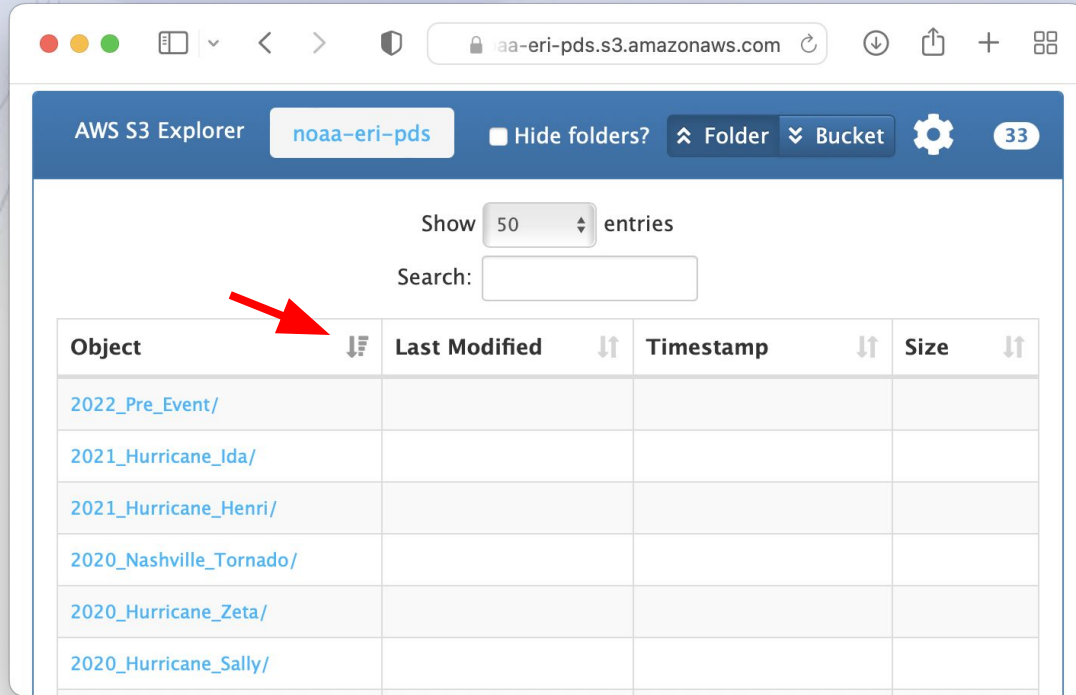


Web browsers GIS clients



Using the Bucket Browser

<https://noaa-eri-pds.s3.amazonaws.com/index.html>



AWS S3 Explorer **noaa-eri-pds** Hide folders? Folder Bucket 33

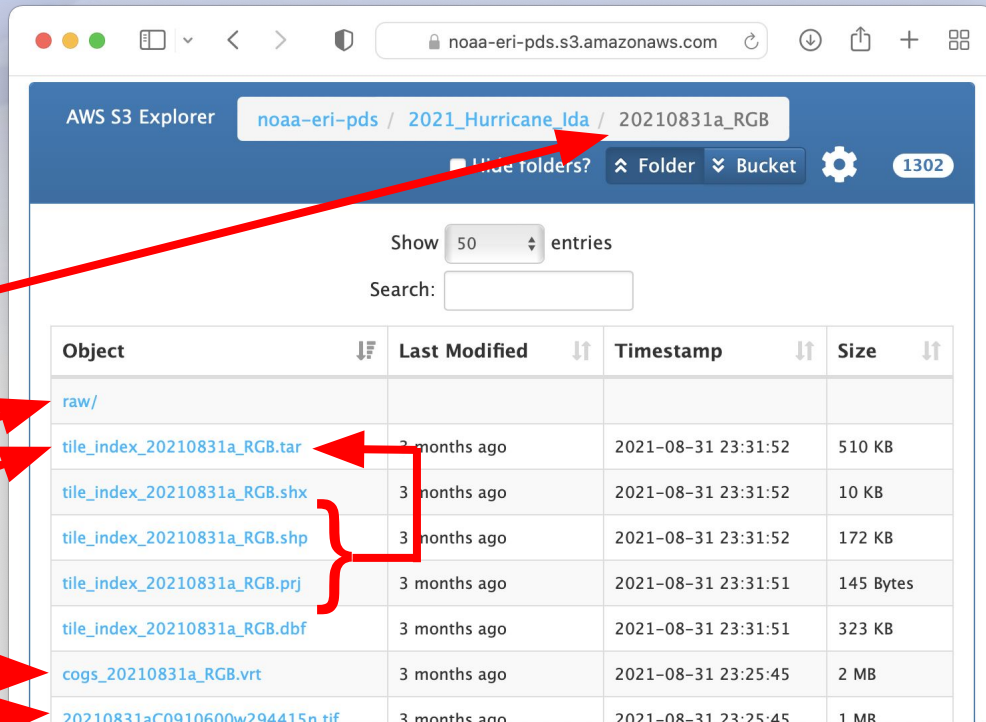
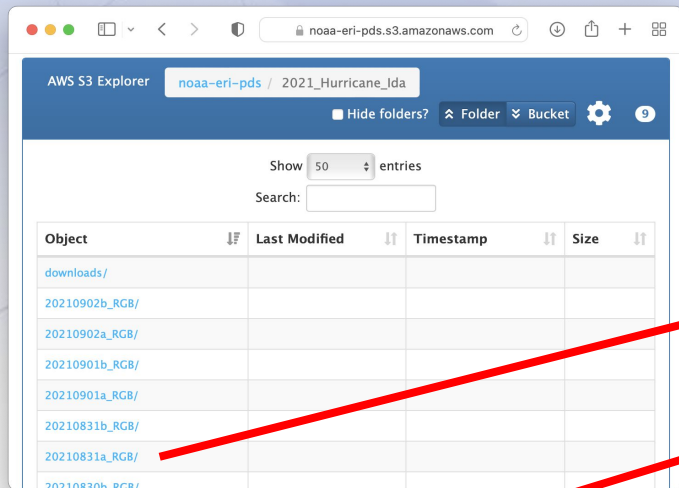
Show 50 entries

Search:

Object	Last Modified	Timestamp	Size
2022_Pre_Event/			
2021_Hurricane_Ida/			
2021_Hurricane_Henri/			
2020_Nashville_Tornado/			
2020_Hurricane_Zeta/			
2020_Hurricane_Sally/			

Pro tip: If you just want to view the imagery visit <https://storms.ngs.noaa.gov/> for storm viewers and links to Web Map Tile Services (WMTS)

Directory Structure for Hurricane Laura 2020 to Present*



RAW data for this group

Tile index for this group

GDAL Virtual Format¹

Cloud Optimized Geotiff (COG)²

¹<https://gdal.org/drivers/raster/vrt.html#vrt-gdal-virtual-format>

²<https://www.cogeo.org>

*Prior to 2020 only the Cloud Optimized Geotiff data are available via this portal.

RAW Data

Exterior Orientation

- may not be available for all flights
- may contain references to data not in this group

Footprint index and tile schema

JPEG image

Geometry file (next slide)

AWS S3 Explorer

noaa-eri-pds / 2021_Hurricane_Ida / 20210831a_RGB / raw

Hide folders? Folder Bucket 2353

Show 50 entries

Search:

Object	Last Modified	Timestamp	Size
243_batch_RGB_2_Oblique_EO.txt	3 months ago	2021-08-31 23:31:51	96 KB
243_batch_RGB_1_Oblique_EO.txt	3 months ago	2021-08-31 23:31:51	95 KB
20210831a.sqlite	3 months ago	2021-08-31 23:31:51	1 MB
022654-0831212053032-RGB2.jpg	3 months ago	2021-08-31 23:31:51	37 MB
022654-0831212053032-RGB2.geom	3 months ago	2021-08-31 23:31:51	3 KB
022653-0831212052548-RGB2.jpg	3 months ago	2021-08-31 23:31:51	37 MB
022653-0831212052548-RGB2.geom	3 months ago	2021-08-31 23:31:51	3 KB
022652-0831212052464-RGB2.jpg	3 months ago	2021-08-31 23:31:50	40 MB

Geometry file

The OSSIM³ geometry file (.geom) is used during orthorectification of the imagery. It contains all of the interior and exterior orientation parameters for the camera. Each directory may contain images from multiple cameras. Some parameters that may be useful to advanced users are shown.

```
...
distortion.center: 0 0
distortion.convergence_threshold: 1e-05
distortion.dxdy: 0.0052 0.0052
distortion.k0: -2.88559891337079e-08
distortion.k1: -1.39659435252217e-05
distortion.k2: 3.8231137376565e-09
distortion.k3: -1.04476955995087e-13
distortion.max_iterations: 10
distortion.type: ossimMeanRadialLensDistortion
ecef_platform_position: -194257.970578342 -5511483.02673332 3194679.9333477
focal_length: 51.588
image_id: C28570029
kappa: 101.45834
latlonh_platform_position: 30.250081405699 -92.0186139175529 651.074 WGE
ll_lat: 30.2479079361336
ll_lon: -92.0152570619964
lr_lat: 30.2540936817812
lr_lon: -92.0164591284596
meters_per_pixel_x: 0.0658892609459362
meters_per_pixel_y: 0.0658892609459362
number_lines: 7760
number_of_adjustments: 1
number_samples: 10328
omega: 3.48179
phi: -0.69092
pixel_size: 0.0052 0.0052
principal_point: -0.133 0.266
...
```

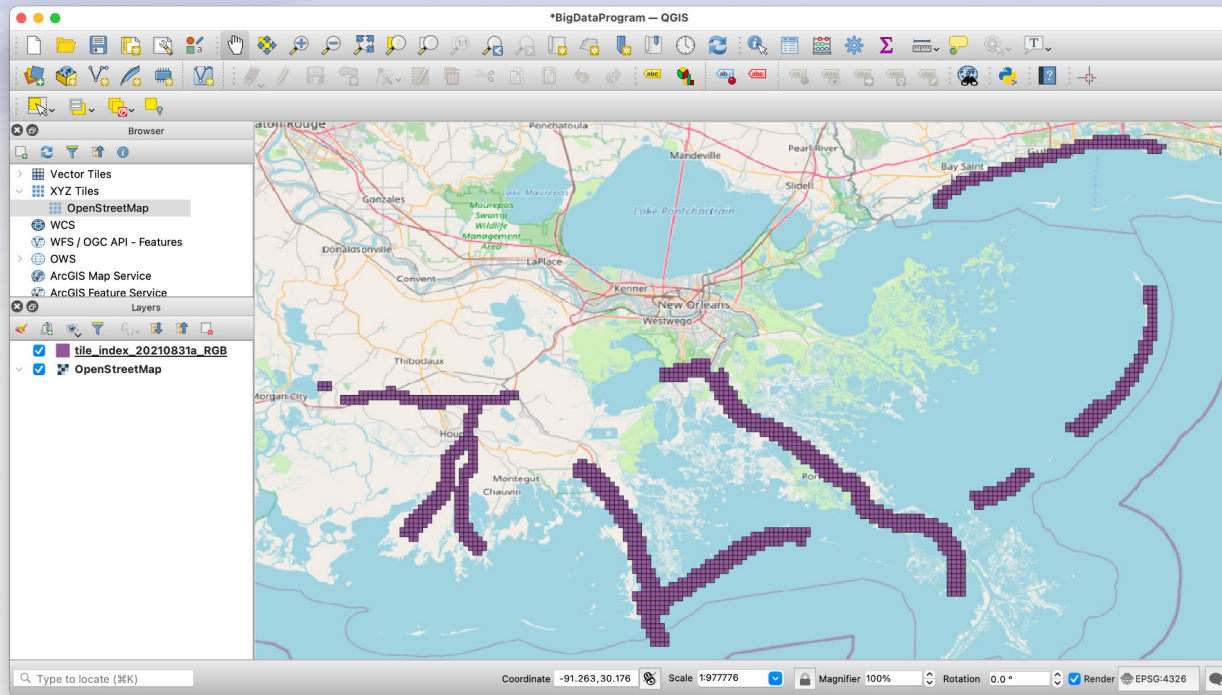
³<https://github.com/ossimlabs/ossim>

Using the data in Quantum GIS⁴

Download the tile index tar file
(mentioned previously)

Drag and drop into QGIS
- Or extract and load the SHP

Load the OpenStreetMap layer for
reference (available by default) or
other basemap data



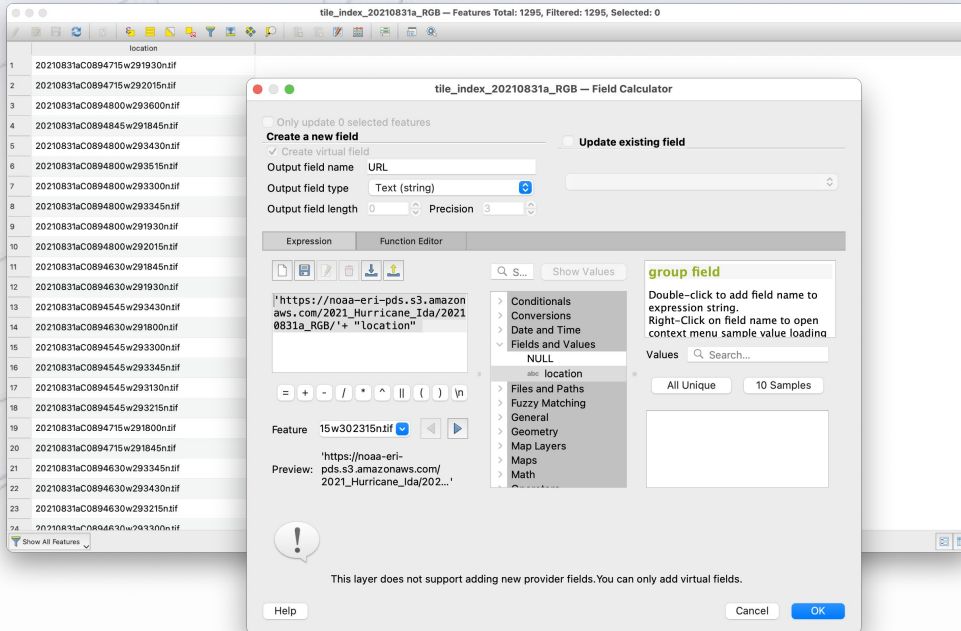
⁴<https://qgis.org/en/site/>

Edit the attributes to create download URLs

Use the “Field Calculator” to create a virtual field containing download links.

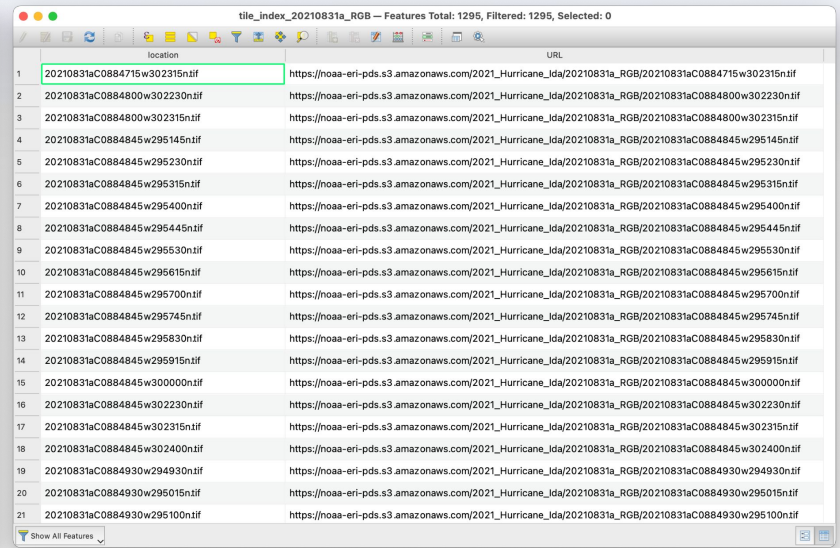
Be sure to use the correct path (unique for each group) and note the single quotes vs double quotes.

'https://noaa-eri-pds.s3.amazonaws.com/2021_Hurricane_Ida/20210831a_RGB/'+ "location"



The screenshot shows the QGIS Field Calculator dialog box. The 'Create a new field' section is active. The 'Output field name' is 'URL', the 'Output field type' is 'Text (string)', and the 'Output field length' is 0 and 'Precision' is 3. The 'Expression' field contains the following text: `'https://noaa-eri-pds.s3.amazonaws.com/2021_Hurricane_Ida/20210831a_RGB/'+ "location"`. The 'Function Editor' shows a 'group field' with a description: 'Double-click to add field name to expression string. Right-Click on field name to open context menu sample value loadin'. The 'Values' section shows 'All Unique' and '10 Samples'. A warning icon is visible at the bottom left of the dialog box.

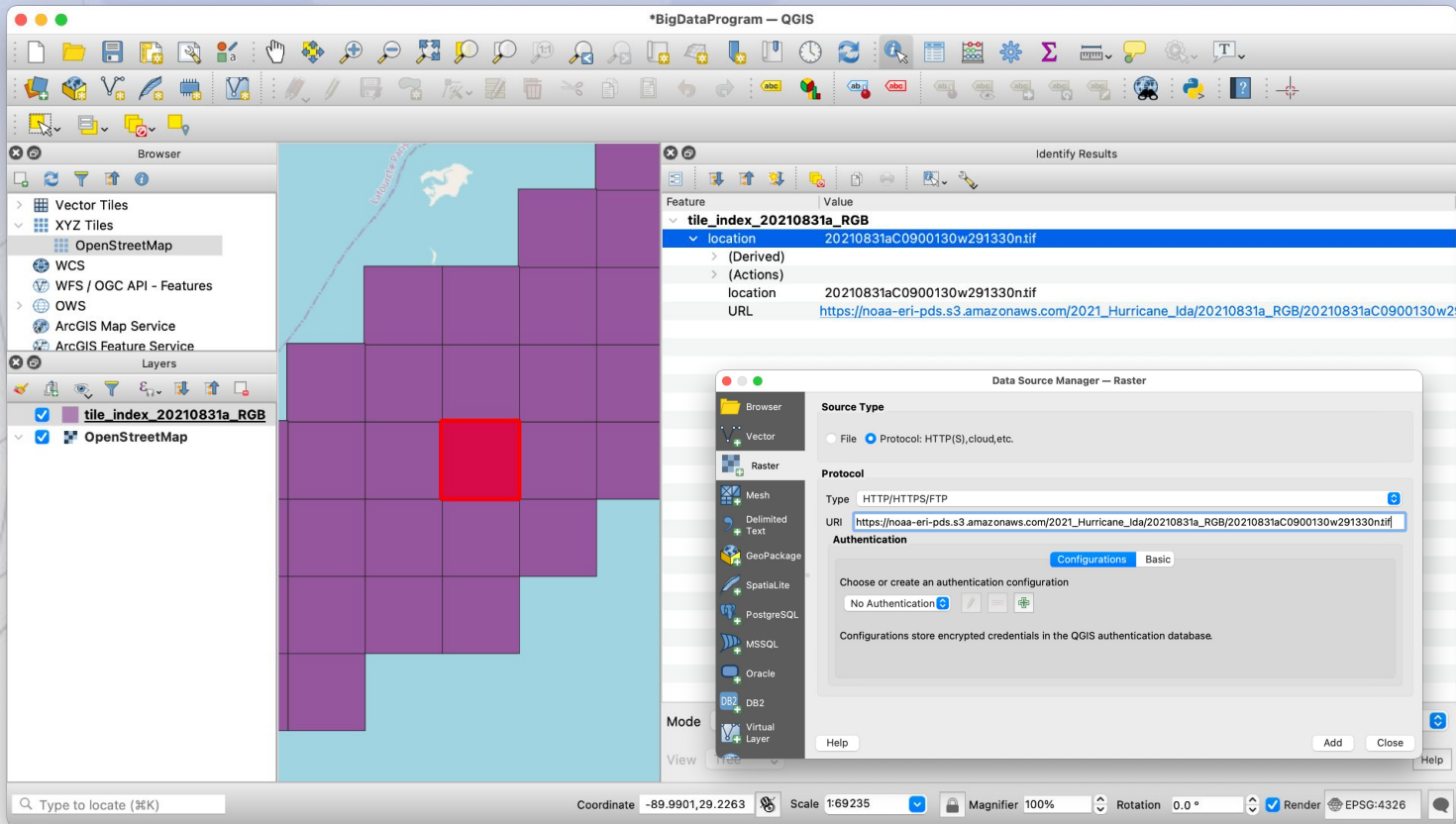
Warning: This layer does not support adding new provider fields. You can only add virtual fields.



The screenshot shows the QGIS attribute table for the 'tile_index_20210831a_RGB' layer. The 'URL' column is highlighted in green. The table contains 24 rows of data, each with a unique tile ID in the 'location' column and the corresponding download URL in the 'URL' column. The URLs are constructed by concatenating the tile ID with the path `'https://noaa-eri-pds.s3.amazonaws.com/2021_Hurricane_Ida/20210831a_RGB/'`.

location	URL
20210831aC0894715w291930.tif	https://noaa-eri-pds.s3.amazonaws.com/2021_Hurricane_Ida/20210831a_RGB/20210831aC0894715w302315.tif
20210831aC0894715w292015.tif	https://noaa-eri-pds.s3.amazonaws.com/2021_Hurricane_Ida/20210831a_RGB/20210831aC0894800w302230.tif
20210831aC0894800w293600.tif	https://noaa-eri-pds.s3.amazonaws.com/2021_Hurricane_Ida/20210831a_RGB/20210831aC0894800w302315.tif
20210831aC0894845w291845.tif	https://noaa-eri-pds.s3.amazonaws.com/2021_Hurricane_Ida/20210831a_RGB/20210831aC0894845w295145.tif
20210831aC0894800w293430.tif	https://noaa-eri-pds.s3.amazonaws.com/2021_Hurricane_Ida/20210831a_RGB/20210831aC0894845w295230.tif
20210831aC0894800w293515.tif	https://noaa-eri-pds.s3.amazonaws.com/2021_Hurricane_Ida/20210831a_RGB/20210831aC0894845w295315.tif
20210831aC0894800w293300.tif	https://noaa-eri-pds.s3.amazonaws.com/2021_Hurricane_Ida/20210831a_RGB/20210831aC0894845w295315.tif
20210831aC0894800w293345.tif	https://noaa-eri-pds.s3.amazonaws.com/2021_Hurricane_Ida/20210831a_RGB/20210831aC0894845w295400.tif
20210831aC0894800w291930.tif	https://noaa-eri-pds.s3.amazonaws.com/2021_Hurricane_Ida/20210831a_RGB/20210831aC0894845w295445.tif
20210831aC0894800w292015.tif	https://noaa-eri-pds.s3.amazonaws.com/2021_Hurricane_Ida/20210831a_RGB/20210831aC0894845w295530.tif
20210831aC0894630w291845.tif	https://noaa-eri-pds.s3.amazonaws.com/2021_Hurricane_Ida/20210831a_RGB/20210831aC0894845w295615.tif
20210831aC0894630w291930.tif	https://noaa-eri-pds.s3.amazonaws.com/2021_Hurricane_Ida/20210831a_RGB/20210831aC0894845w295700.tif
20210831aC0894545w293430.tif	https://noaa-eri-pds.s3.amazonaws.com/2021_Hurricane_Ida/20210831a_RGB/20210831aC0894845w295745.tif
20210831aC0894630w291800.tif	https://noaa-eri-pds.s3.amazonaws.com/2021_Hurricane_Ida/20210831a_RGB/20210831aC0894845w295830.tif
20210831aC0894545w293300.tif	https://noaa-eri-pds.s3.amazonaws.com/2021_Hurricane_Ida/20210831a_RGB/20210831aC0894845w295915.tif
20210831aC0894545w293345.tif	https://noaa-eri-pds.s3.amazonaws.com/2021_Hurricane_Ida/20210831a_RGB/20210831aC0894845w300000.tif
20210831aC0894545w293130.tif	https://noaa-eri-pds.s3.amazonaws.com/2021_Hurricane_Ida/20210831a_RGB/20210831aC0894845w302230.tif
20210831aC0894545w293215.tif	https://noaa-eri-pds.s3.amazonaws.com/2021_Hurricane_Ida/20210831a_RGB/20210831aC0894845w302315.tif
20210831aC0894715w291800.tif	https://noaa-eri-pds.s3.amazonaws.com/2021_Hurricane_Ida/20210831a_RGB/20210831aC0894845w302400.tif
20210831aC0894715w291845.tif	https://noaa-eri-pds.s3.amazonaws.com/2021_Hurricane_Ida/20210831a_RGB/20210831aC0894845w302400.tif
20210831aC0894630w293430.tif	https://noaa-eri-pds.s3.amazonaws.com/2021_Hurricane_Ida/20210831a_RGB/20210831aC0894845w302493.tif
20210831aC0894630w293430.tif	https://noaa-eri-pds.s3.amazonaws.com/2021_Hurricane_Ida/20210831a_RGB/20210831aC0894845w302501.tif
20210831aC0894630w293215.tif	https://noaa-eri-pds.s3.amazonaws.com/2021_Hurricane_Ida/20210831a_RGB/20210831aC0894845w302501.tif
20210831aC0894630w293215.tif	https://noaa-eri-pds.s3.amazonaws.com/2021_Hurricane_Ida/20210831a_RGB/20210831aC0894845w302501.tif
20210831aC0894630w293215.tif	https://noaa-eri-pds.s3.amazonaws.com/2021_Hurricane_Ida/20210831a_RGB/20210831aC0894845w302501.tif
20210831aC0894630w293215.tif	https://noaa-eri-pds.s3.amazonaws.com/2021_Hurricane_Ida/20210831a_RGB/20210831aC0894845w302501.tif

Using the COGs in Quantum GIS



Pro tip: The WMTS will load faster and provide full coverage. The individual COGs are better for users that want to analyze or save the image. Ida WMTS: <https://storms.ngs.noaa.gov/storms/ida/services/WMTSCapabilities.xml> See: <https://storms.ngs.noaa.gov> for a list of all storms.



Browser

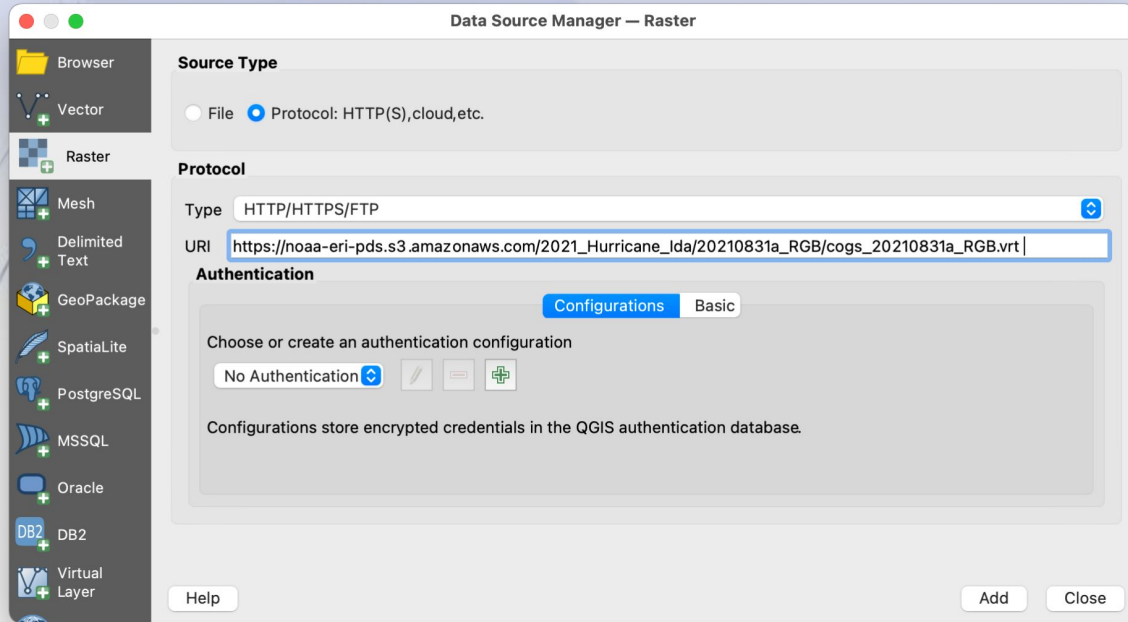
- Vector Tiles
- XYZ Tiles
- OpenStreetMap
- WCS
- WFS / OGC API - Features
- OWS
- ArcGIS Map Service
- ArcGIS Feature Service

Layers

- 20210831aC0900130w291330n
- tile_index_20210831a_RGB
- OpenStreetMap



Using the COG VRTs* in Quantum GIS



* Zoom into scales of 1:10,000 or larger prior to loading for optimal performance

Using the COG VRTs* in Quantum GIS



* Zoom into scales of 1:10,000 or larger prior to loading for optimal performance

Using the COG VRTs* in Quantum GIS



COG



WMTS

1:250
~400% zoom

* Zoom into scales of 1:10,000 or larger prior to loading for optimal performance

Using the GDAL Command Line Interface (CLI)⁵

Get information about a particular COG (note the /vsicurl/ prefix*):

```
gdalinfo /vsicurl/https://noaa-eri-pds.s3.amazonaws.com/2021_Hurricane_Ida/20210831a_RGB/20210831aCOG910045w294200n.tif
Driver: GTiff/GeoTIFF
Files: /vsicurl/https://noaa-eri-pds.s3.amazonaws.com/2021_Hurricane_Ida/20210831a_RGB/20210831aCOG910045w294200n.tif
Size is 9415, 9415
Coordinate System is:
GEOGCRS["WGS 84",
  DATUM["World Geodetic System 1984",
    ELLIPSOID["WGS 84",6378137,298.257223563,
      LENGTHUNIT["metre",1]],
    PRIMEM["Greenwich",0,
      ANGLEUNIT["degree",0.0174532925199433]],
    CS[ellipsoidal,2],
    AXIS["geodetic latitude (Lat)",north,
      ORDER[1],
      ANGLEUNIT["degree",0.0174532925199433]],
    AXIS["geodetic longitude (Lon)",east,
      ORDER[2],
      ANGLEUNIT["degree",0.0174532925199433]],
    ID["EPSG",4326]]
Data axis to CRS axis mapping: 2,1
Origin = (-91.01260000000006,29.700099999999999)
Pixel Size = (0.000001348911312,-0.000001348911312)
Metadata:
  AREA_OR_POINT=Point
  TIFFTAG_DATETIME=2021:08:31 23:59:59
  TIFFTAG_MAXSAMPLEVALUE=0
  TIFFTAG_MINSAMPLEVALUE=1
Image Structure Metadata:
  COMPRESSION=LZW
  INTERLEAVE=PIXEL
```

Corner Coordinates:

```
Upper Left ( -91.0126000, 29.7001000) ( 91d 0'45.36"W, 29d42' 0.36"N)
Lower Left ( -91.0126000, 29.6874000) ( 91d 0'45.36"W, 29d41'14.64"N)
Upper Right ( -90.9999000, 29.7001000) ( 90d59'59.64"W, 29d42' 0.36"N)
Lower Right ( -90.9999000, 29.6874000) ( 90d59'59.64"W, 29d41'14.64"N)
Center ( -91.0062500, 29.6937500) ( 91d 0'22.50"W, 29d4'137.50"N)
Band 1 Block=512x512 Type=Byte, ColorInterp=Red
  Overviews: 4707x4707, 2353x2353, 1176x1176, 588x588, 294x294
  Mask Flags: PER_DATASET ALPHA
  Overviews of mask band: 4707x4707, 2353x2353, 1176x1176, 588x588, 294x294
Band 2 Block=512x512 Type=Byte, ColorInterp=Green
  Overviews: 4707x4707, 2353x2353, 1176x1176, 588x588, 294x294
  Mask Flags: PER_DATASET ALPHA
  Overviews of mask band: 4707x4707, 2353x2353, 1176x1176, 588x588, 294x294
Band 3 Block=512x512 Type=Byte, ColorInterp=Blue
  Overviews: 4707x4707, 2353x2353, 1176x1176, 588x588, 294x294
  Mask Flags: PER_DATASET ALPHA
  Overviews of mask band: 4707x4707, 2353x2353, 1176x1176, 588x588, 294x294
Band 4 Block=512x512 Type=Byte, ColorInterp=Alpha
  Overviews: 4707x4707, 2353x2353, 1176x1176, 588x588, 294x294
```

⁵<https://gdal.org/programs/index.html#raster-programs>

GDAL is available for Linux, Mac and Windows. Ubuntu Linux 20.04 was used for this demo.

*The /vsicurl/ prefix tells GDAL to use its built in Virtual File System driver

*This driver may also allow you to access the data using programs with GDAL raster support such as ESRI

<https://doc.arcgis.com/en/imagery/workflows/best-practices/storing-imagery-in-the-cloud.htm>

Using the GDAL CLI

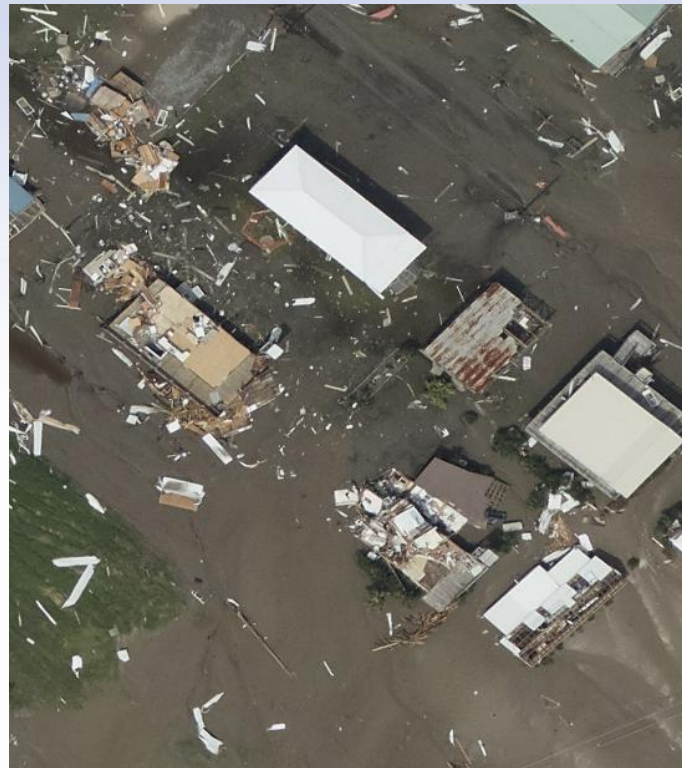
Get information about a particular COG VRT:

```
gdalinfo /vsicurl/https://noaa-eri-pds.s3.amazonaws.com/2021_Hurricane_Ida/20210831a_RGB/cogs_20210831a_RGB.vrt
Driver: VRT/Virtual Raster
Files: /vsicurl/https://noaa-eri-pds.s3.amazonaws.com/2021_Hurricane_Ida/20210831a_RGB/cogs_20210831a_RGB.vrt
       /vsicurl/https://noaa-eri-pds.s3.amazonaws.com/2021_Hurricane_Ida/20210831a_RGB/20210831aC0884715w302315n.tif
...
<1293 tif files>
...
/vsicurl/https://noaa-eri-pds.s3.amazonaws.com/2021_Hurricane_Ida/20210831a_RGB/20210831aC0910600w294415n.tif
Size is 1723760, 1038022
Coordinate System is:
GEOGCRS["WGS 84",
  DATUM["World Geodetic System 1984",
    ELLIPSOID["WGS 84",6378137,298.257223563,
      LENGTHUNIT["metre",1]],
    PRIMEM["Greenwich",0,
      ANGLEUNIT["degree",0.0174532925199433]],
  CS[ellipsoidal,2],
  AXIS["geodetic latitude (Lat)",north,
    ORDER[1],
    ANGLEUNIT["degree",0.0174532925199433]],
  AXIS["geodetic longitude (Lon)",east,
    ORDER[2],
    ANGLEUNIT["degree",0.0174532925199433]],
  ID["EPSG",4326]]
Data axis to CRS axis mapping: 2,1
Origin = (-91.1000999999999998,30.4126000000000001)
Pixel Size = (0.000001348911312,-0.000001348911312)
Corner Coordinates:
Upper Left ( -91.1001000, 30.4126000) ( 91d 6' 0.36"W, 30d24'45.36"N)
Lower Left ( -91.1001000, 29.0124004) ( 91d 6' 0.36"W, 29d 0'44.64"N)
Upper Right ( -88.7749006, 30.4126000) ( 88d46'29.64"W, 30d24'45.36"N)
Lower Right ( -88.7749006, 29.0124004) ( 88d46'29.64"W, 29d 0'44.64"N)
Center ( -89.9375003, 29.7125002) ( 89d56'15.00"W, 29d42'45.00"N)
Band 1 Block=128x128 Type=Byte, ColorInterp=Red
  Mask Flags: PER_DATASET
Band 2 Block=128x128 Type=Byte, ColorInterp=Green
  Mask Flags: PER_DATASET
Band 3 Block=128x128 Type=Byte, ColorInterp=Blue
  Mask Flags: PER_DATASET
```

Using the GDAL CLI

The VRT file allows you to treat the 1295 mosaic COGs (~210 GB of data!) in this group as a single file without having to download the entire dataset. This facilitates some interesting possibilities. For example, the following command will subset a section of Grand Isle, LA in a couple of seconds

```
gdal_translate -projwin -90.02114 29.21892 -90.02040 29.21809  
"/vsicurl/https://noaa-eri-pds.s3.amazonaws.com/2021_Hurricane_Ida/2021083  
1a_RGB/cogs_20210831a_RGB.vrt" 20210831a_subset.jpg  
Input file size is 1723760, 1038022  
0...10...20...30...40...50...60...70...80...90...100 - done.
```



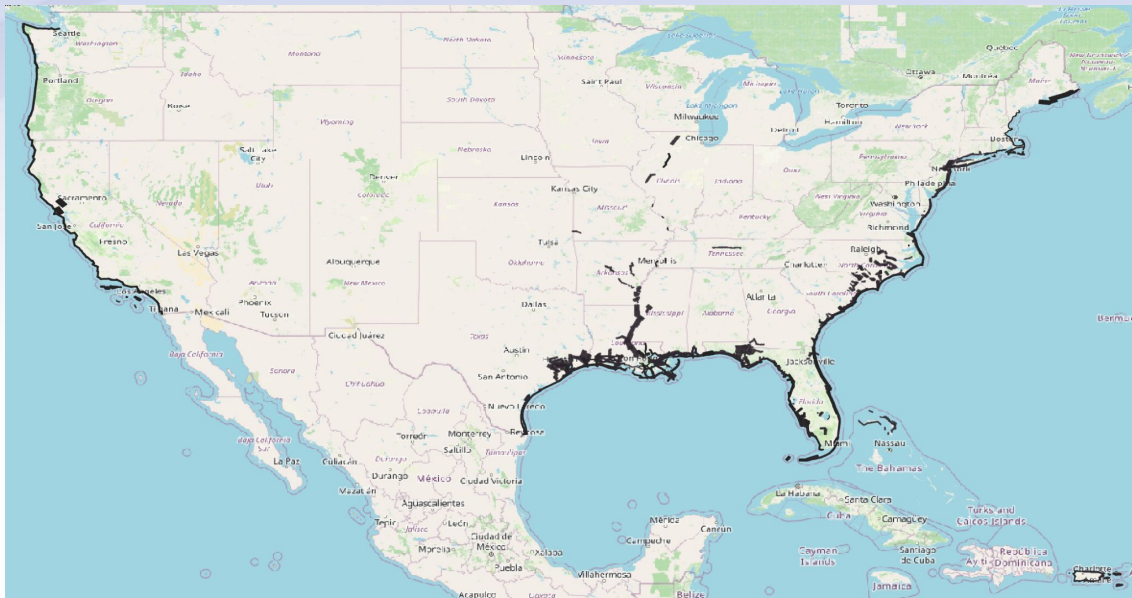
The output image can be any supported GDAL format. JPG was selected as an example.

Using the GDAL CLI

In 2024, we created a GeoParquet* index for the ERI data holdings. The GeoParquet 1.0.0 format is supported at GDAL 3.8.0. Newer versions of QGIS can load the index directly from the Cloud as can the GDAL CLI tools.

Note that the 'datetime' field has 12:00:00+00 as the time. The majority of the available data are mosaics of multiple images and 12:00 UTC is a reasonable estimate of the earliest time data would have been collected.

Pre-Event 'datetime' has be set to the beginning of the year in which it was collected.



This index is available at:

https://noaa-eri-pds.s3.amazonaws.com/noaa_eri_pds.parquet

* <https://gdal.org/drivers/vector/parquet.html#vector-parquet>

Using the GDAL CLI*

Query the index for available collections:

```
ogrinfo -ro -dialect SQLITE -sql "SELECT DISTINCT collection from noaa_eri_pds ORDER BY collection"  
/vsicurl/https://noaa-eri-pds.s3.amazonaws.com/noaa_eri_pds.parquet | grep -e "(S" | awk '{print $4}'
```

2005_Hurricane_Katrina
2006_Tropical_Storm_Ernesto
2007_Hurricane_Humberto
2008_Hurricane_Gustav
2008_Hurricane_Ike
2009_NorEaster
2011_Hurricane_Irene
2011_Joplin_Tornado
2012_Hurricane_Isaac
2012_Hurricane_Sandy
2014_Hurricane_Arthur
2015_Illinois_Tornadoes
2015_Midwest_Flood
2016_Hurricane_Matthew
2016_Louisiana_Flooding
2017_Hurricane_Harvey
2017_Hurricane_Irma
2017_Hurricane_Maria
2017_Hurricane_Nate

2018_Hurricane_Florence
2018_Hurricane_Michael
2018_Tropical_Storm_Gordon
2019_Hurricane_Barry
2019_Hurricane_Dorian
2020_Hurricane_Delta
2020_Hurricane_Laura
2020_Hurricane_Sally
2020_Hurricane_Zeta
2020_Nashville_Tornado
2021_Hurricane_Henri
2021_Hurricane_Ida
2022_Hurricane_Ian
2022_Hurricane_Nicole
2022_Pre_Event
2023_California
2023_Hurricane_Idalia
2023_Hurricane_Lee
2023_Pre_Event

Using the GDAL CLI*

Query the index for available data in an area:

```
ogrinfo -ro -spat -90.02114 29.21892 -90.02040 29.21809 -dialect SQLITE -sql "SELECT * from noaa_eri_pds ORDER BY datetime"  
/vsicurl/https://noaa-eri-pds.s3.amazonaws.com/noaa_eri_pds.parquet | grep -e "location (St" | awk '{print $4}'
```

https://noaa-eri-pds.s3.amazonaws.com/2005_Hurricane_Katrina/aug31JpegTiles_GCS_NAD83/aug31C0900130w291330n.tif

https://noaa-eri-pds.s3.amazonaws.com/2008_Hurricane_Gustav/GUSTAVC24974234_3_1/geo-C24974351.tif

https://noaa-eri-pds.s3.amazonaws.com/2008_Hurricane_Gustav/GUSTAVC24974234_3_1/geo-C24982257.tif

https://noaa-eri-pds.s3.amazonaws.com/2008_Hurricane_Gustav/GUSTAVC24974234_3_1/geo-C24982269.tif

https://noaa-eri-pds.s3.amazonaws.com/2008_Hurricane_Gustav/GUSTAVC24974234_3_1/geo-C24982280.tif

https://noaa-eri-pds.s3.amazonaws.com/2012_Hurricane_Isaac/sep02aJpegTiles_GCS_NAD83/sep02aC0900130w291330n.tif

https://noaa-eri-pds.s3.amazonaws.com/2019_Hurricane_Barry/20190719a_RGB/20190719aC0900130w291330n.tif

https://noaa-eri-pds.s3.amazonaws.com/2020_Hurricane_Zeta/20201029a_RGB/20201029aC0900130w291330n.tif

https://noaa-eri-pds.s3.amazonaws.com/2021_Hurricane_Ida/20210831a_RGB/20210831aC0900130w291330n.tif

https://noaa-eri-pds.s3.amazonaws.com/2022_Pre_Event/GC2201b_OB_N_RGB/GC2201b_OB_N_C0900130w291330n.tif

https://noaa-eri-pds.s3.amazonaws.com/2023_Pre_Event/GC2301a_OB_N_RGB/GC2301a_OB_N_C0900130w291330n.tif

Using the GDAL CLI*

Save most recent data for a location to a file:

```
ogrinfo -ro -spat -90.02114 29.21892 -90.02040 29.21809  
-dialect SQLITE -sql "SELECT * from noaa_eri_pds ORDER BY  
datetime DESC LIMIT 1"  
/vsicurl/https://noaa-eri-pds.s3.amazonaws.com/noaa_eri_pds.p  
arquet | grep -e "location (St)" | awk '{print "/vsicurl/"$4}' |  
gdal_translate -b 1 -b 2 -b 3 -of JPEG -projwin -90.02114  
29.21892 -90.02040 29.21809 --optfile /vsistdin/ most_recent.jpg
```



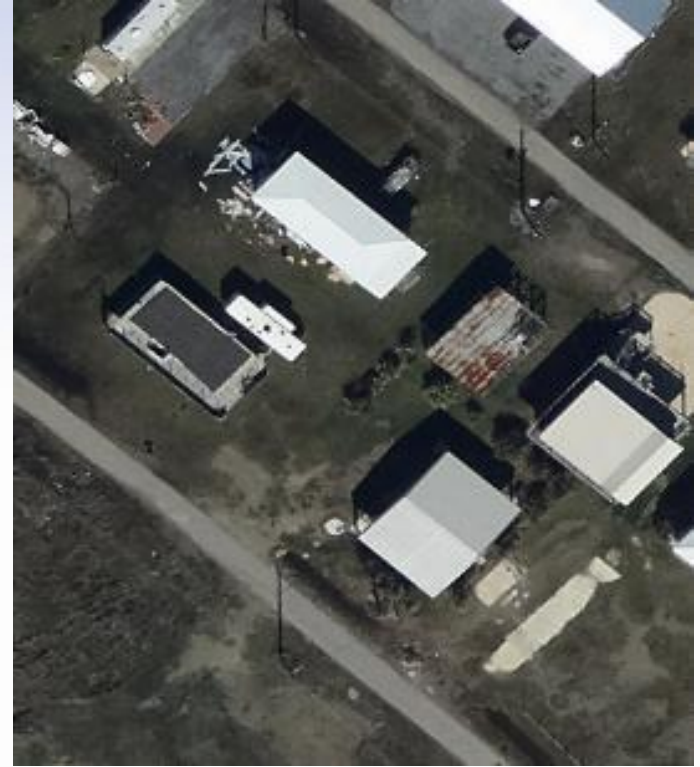
Note this is the same area from an earlier example.

* and Linux bash

Compare to example from earlier

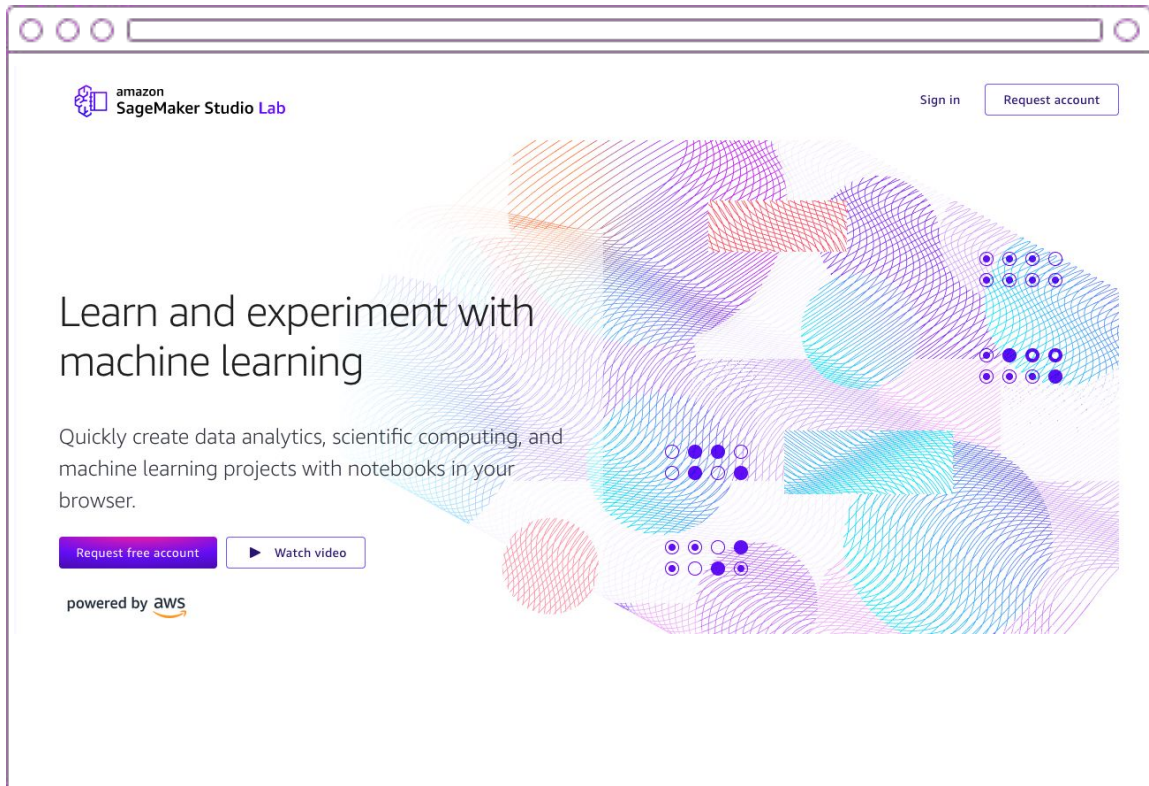


Post Hurricane Ida 2021



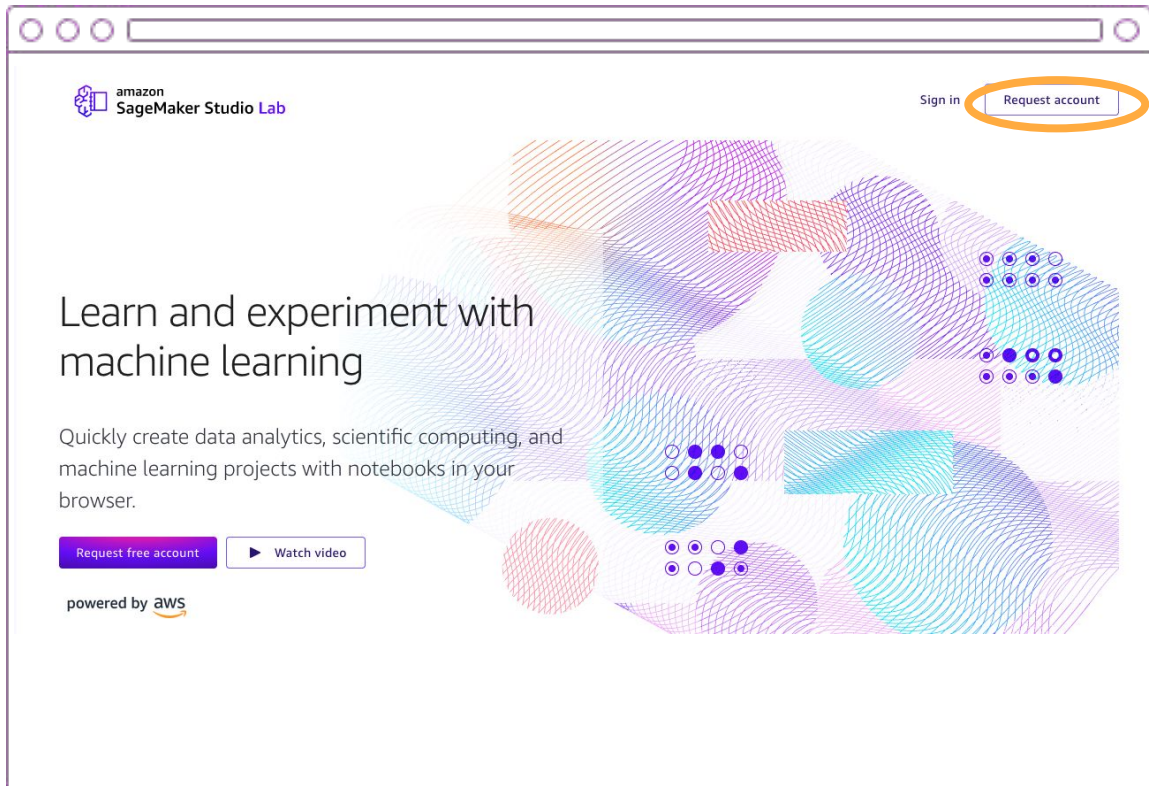
Pre-Event 2023

Step 1: Create a SageMaker StudioLab account



<https://studiolab.sagemaker.aws>

Step 1a: Request account




amazon SageMaker Studio Lab

Sign in **Request account**

Learn and experiment with machine learning

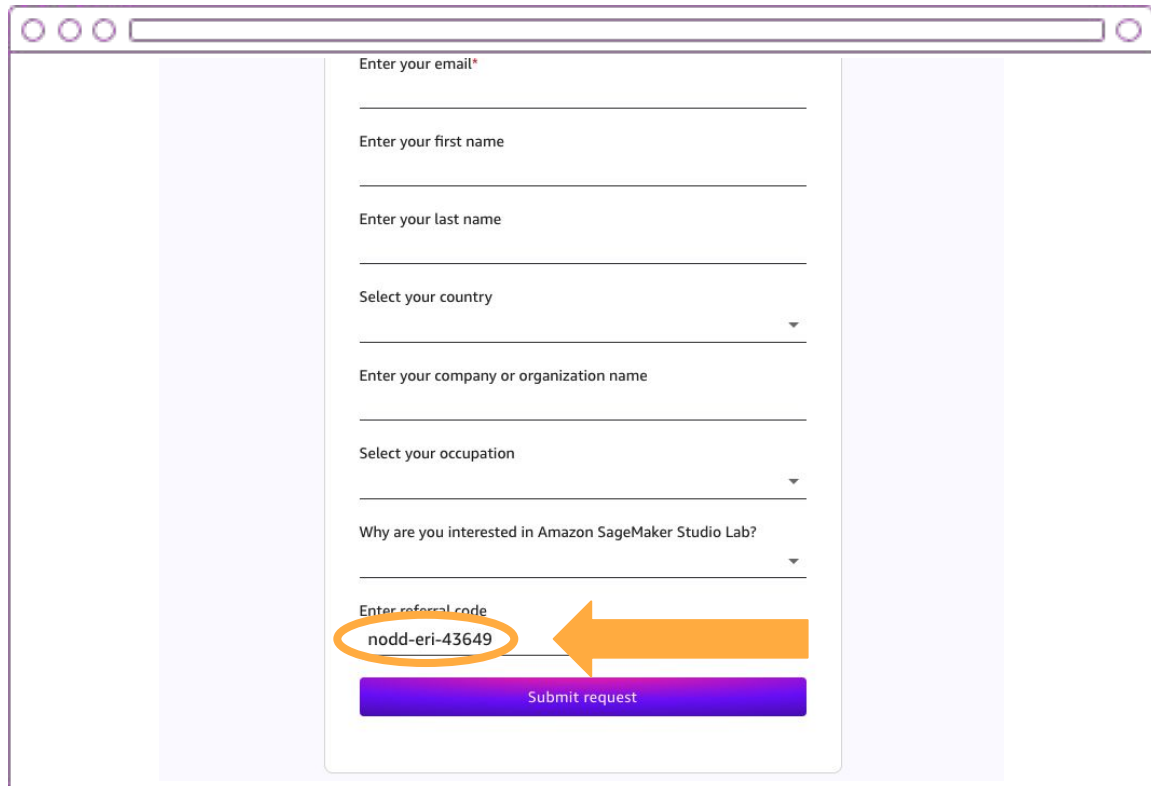
Quickly create data analytics, scientific computing, and machine learning projects with notebooks in your browser.

[Request free account](#) [▶ Watch video](#)

powered by 

<https://studiolab.sagemaker.aws>

Step 1b: Use Referral Code



A screenshot of a web registration form for Amazon SageMaker Studio Lab. The form is contained within a browser window frame. It features several input fields: 'Enter your email*', 'Enter your first name', 'Enter your last name', 'Select your country' (a dropdown menu), 'Enter your company or organization name', 'Select your occupation' (a dropdown menu), and 'Why are you interested in Amazon SageMaker Studio Lab?' (a dropdown menu). At the bottom, there is a field labeled 'Enter referral code' containing the text 'nodd-eri-43649'. This text is circled in orange, and a large orange arrow points from the right towards it. Below the referral code field is a purple 'Submit request' button.

NOTE: If you are watching the recording, do **not** use the Referral Code as it will have expired. But you can still create an account without it.

nodd-eri-43649

Step 2: “Account request Approved” email

Account request approved

We've approved your request for an Amazon SageMaker Studio Lab account. Click the button below to complete your registration.

Create account



You can also click on this link or copy and paste it into your browser:

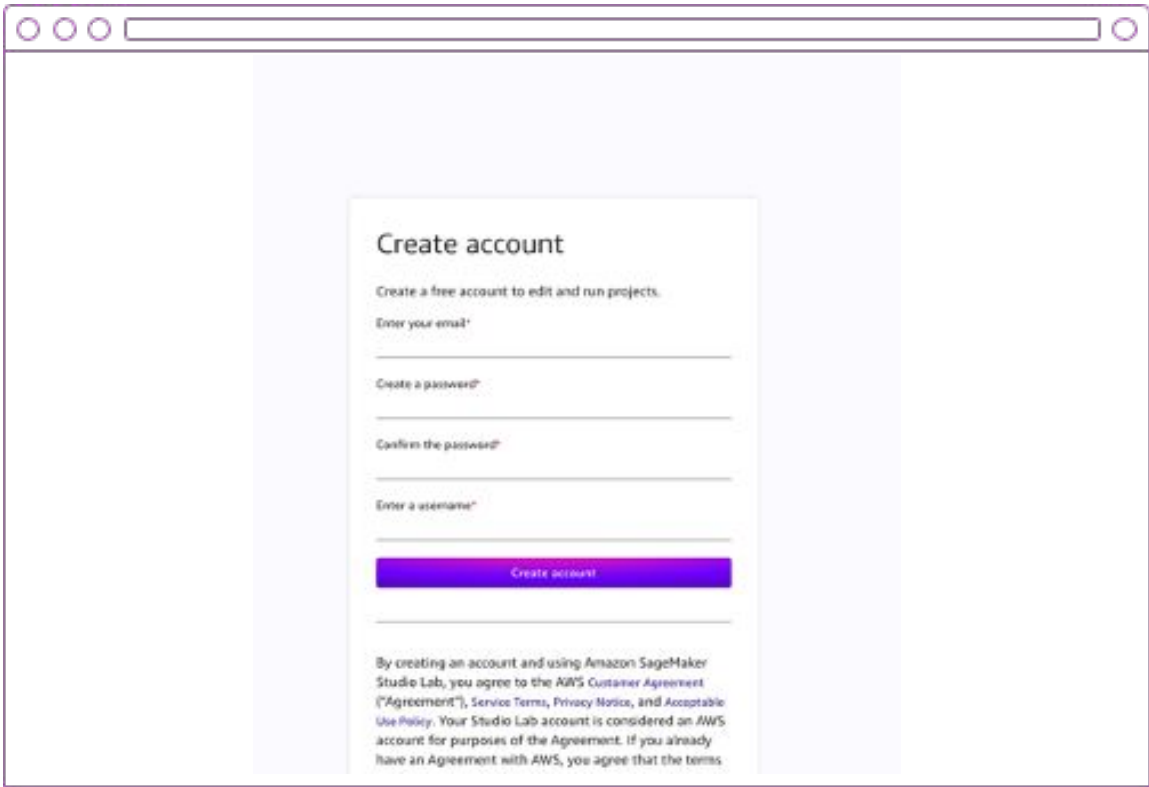
<https://studiolab.sagemaker.aws/signup>

This approval will expire in 7 days.

Sincerely,

— The Amazon SageMaker Studio Lab team

Step 3: Create Account



The image shows a browser window with a 'Create account' form. The form is centered on a light blue background. It includes a title, a sub-header, and four input fields: 'Enter your email*', 'Create a password*', 'Confirm the password*', and 'Enter a username*'. A blue 'Create account' button is positioned below the fields. At the bottom, there is a paragraph of legal text regarding the AWS Customer Agreement and Studio Lab account terms.

Create account

Create a free account to edit and run projects.

Enter your email*

Create a password*

Confirm the password*

Enter a username*

Create account


By creating an account and using Amazon SageMaker Studio Lab, you agree to the [AWS Customer Agreement \("Agreement"\)](#), [Service Terms](#), [Privacy Notice](#), and [Acceptable Use Policy](#). Your Studio Lab account is considered an *AWS* account for purposes of the Agreement. If you already have an Agreement with AWS, you agree that the terms

Step 4: Verify email

Verify your email

You're almost done with Amazon SageMaker Studio Lab account registration. Please verify your email within 24 hours by clicking the button below.

Verify your email



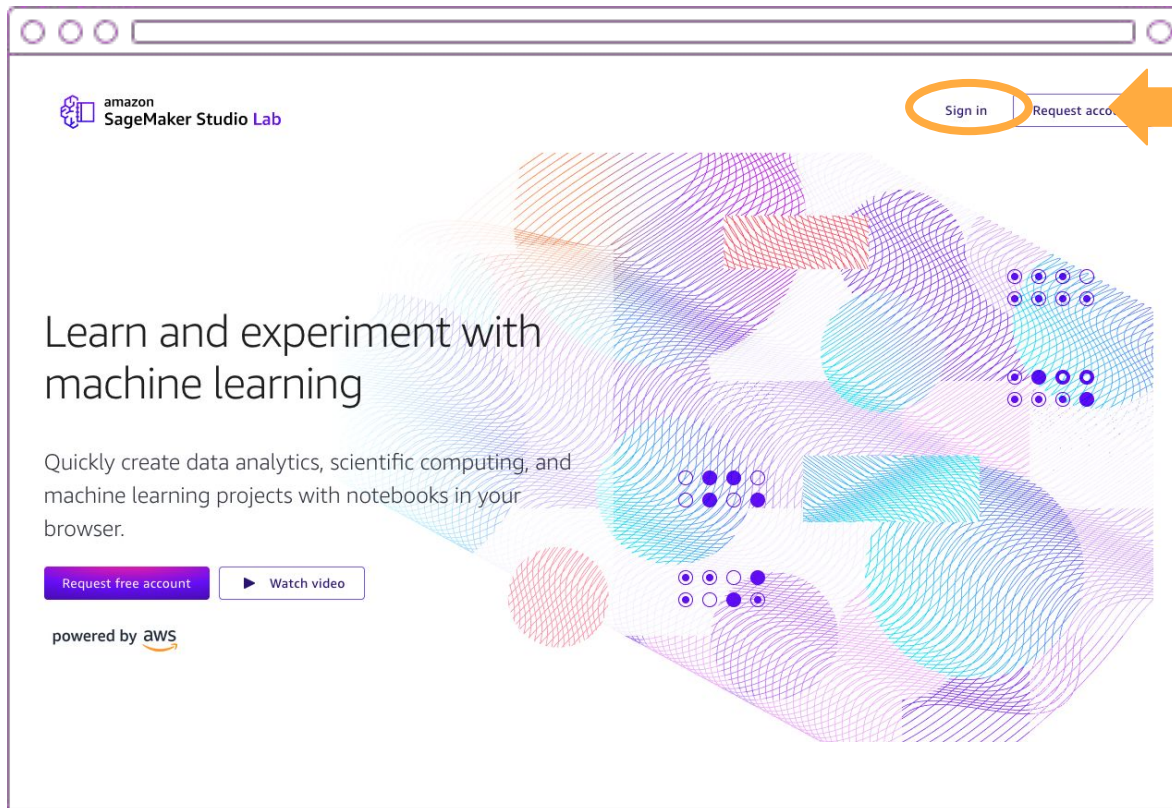
You can also click on this link or copy and paste it into your browser:

<https://studiolab.sagemaker.aws/signup/?confirmation-token=924310&user-id=b6fbfe15-3873-4cce-8d0a-2227b2e45770>

Sincerely,

— The Amazon SageMaker Studio Lab team

Step 5: Sign In




<https://studiolab.sagemaker.aws>

Step 6: Start CPU runtime

My project

CPU and GPU runtime limits have changed.

i You can use CPU for up to 4 hours at a time with a limit of 8 hours in a 24-hour period.
You can use GPU for up to 4 hours at a time with a limit of 4 hours in a 24-hour period. ✕

Runtime status	Runtime remaining ?	Compute type ?	▶ Start runtime	
Idle	Session: — Today: 8 h 0 m	<input checked="" type="radio"/> CPU <input type="radio"/> GPU		

Step 7: Open Project

My project

Runtime status

Running

Runtime remaining 

Session: 3 h 59 m

Today: 7 h 59 m

Compute type 

CPU GPU

 Stop runtime

 Open project



Step 8a: Github Repo

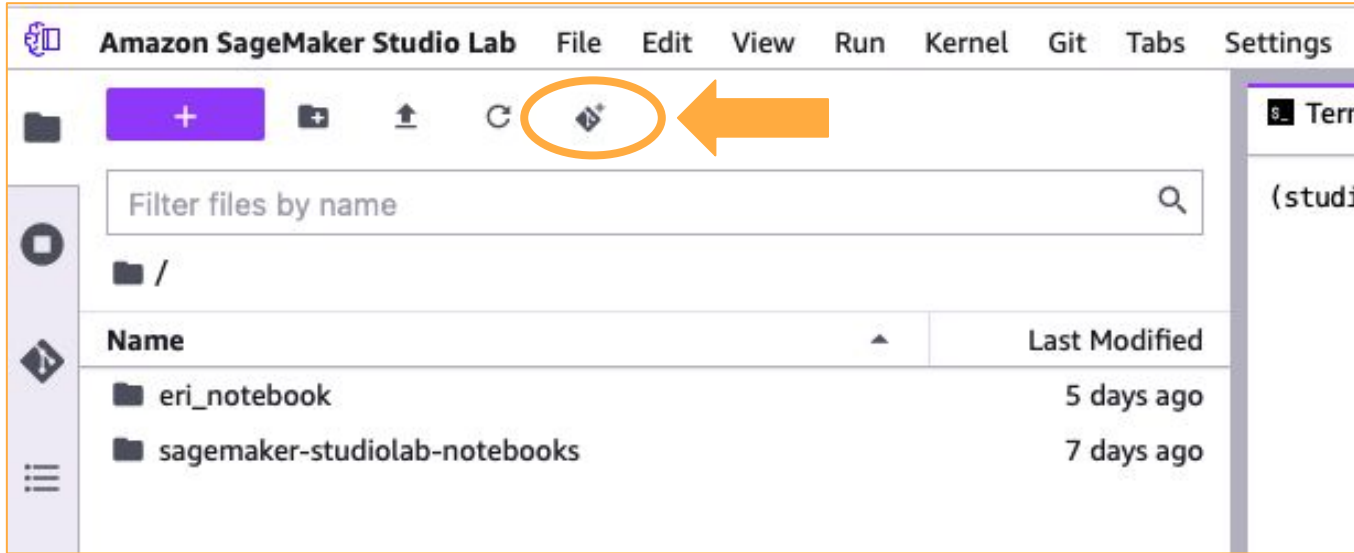
The screenshot shows the GitLab interface for the repository 'ERI_notebook'. At the top, it displays '5 Commits', '1 Branch', and '0 Tags'. A recent commit by Mya Sears is shown with the message 'Update README.md'. Below this, the repository structure is visible, including a 'main' branch and a file named 'README'. A table lists the repository's files and their commit history:

Name	Last commit	Last update
ERI_laws.ipynb	Add README and change event selection	22 hours ago
README.md	Update README.md	22 hours ago
environment.yml	Adding .yml file, removing requirements file.	4 days ago

This close-up highlights the 'Clone with HTTPS' section. It shows the URL `https://gitlab.cicsnc.org/workshop-` followed by a clipboard icon. An orange circle and arrow point to this icon. Below this, the 'Open in your IDE' section is visible, showing a commit hash '07421e79' and another clipboard icon, also circled in orange with an arrow pointing to it.

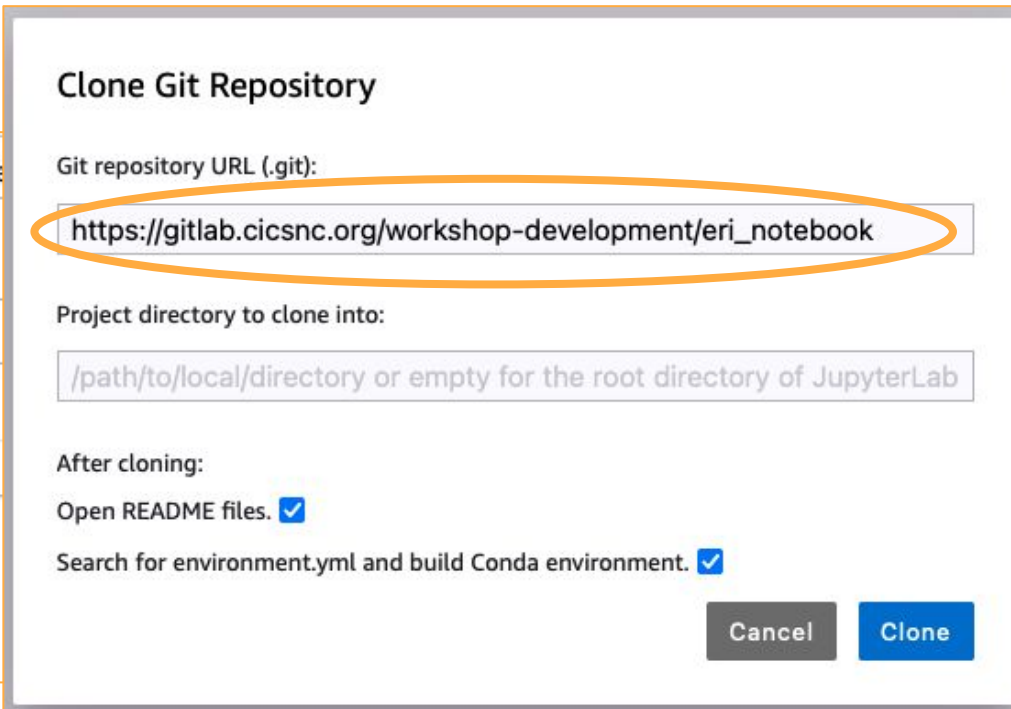
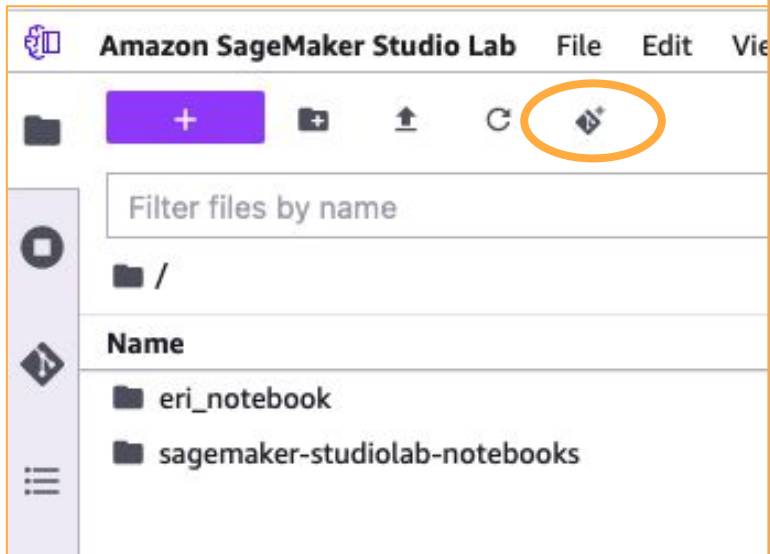
https://gitlab.cicsnc.org/workshop-development/eri_notebook

Step 8b: Clone Repo



https://gitlab.cicsnc.org/workshop-development/eri_notebook

Step 8b: Clone Repo



https://gitlab.cicsnc.org/workshop-development/eri_notebook

Step 8b: Clone Repo

The screenshot shows the Amazon SageMaker Studio Lab interface. The top menu bar includes 'Amazon SageMaker Studio Lab', 'File', 'Edit', and 'View'. Below the menu is a toolbar with icons for file operations, including a Git icon circled in orange. The left sidebar shows a file explorer with a search bar 'Filter files by name' and a list of folders: '/', 'eri_notebook', and 'sagemaker-studio'. The main area displays a 'Clone Git Repository' dialog box. The 'Git repository URL (.git):' field contains the URL 'https://gitlab.cicsnc.org/workshop-development/eri_notebook', which is circled in orange. Below this is the 'Project directory to clone into:' field, which contains 'directory of JupyterLab'. A confirmation dialog box is overlaid on top, titled 'Confirm you want to build Conda environment'. It contains the text: 'Please confirm that you would like to build the Conda environment found at the location: eri_notebook/environment.yml. After you confirm, a terminal will open and the environment will be built using the Conda command line.' The 'Ok' button in this dialog is circled in orange. The 'Clone' button in the background dialog is also visible.

https://gitlab.cicsnc.org/workshop-development/eri_notebook

Step 9: Wait

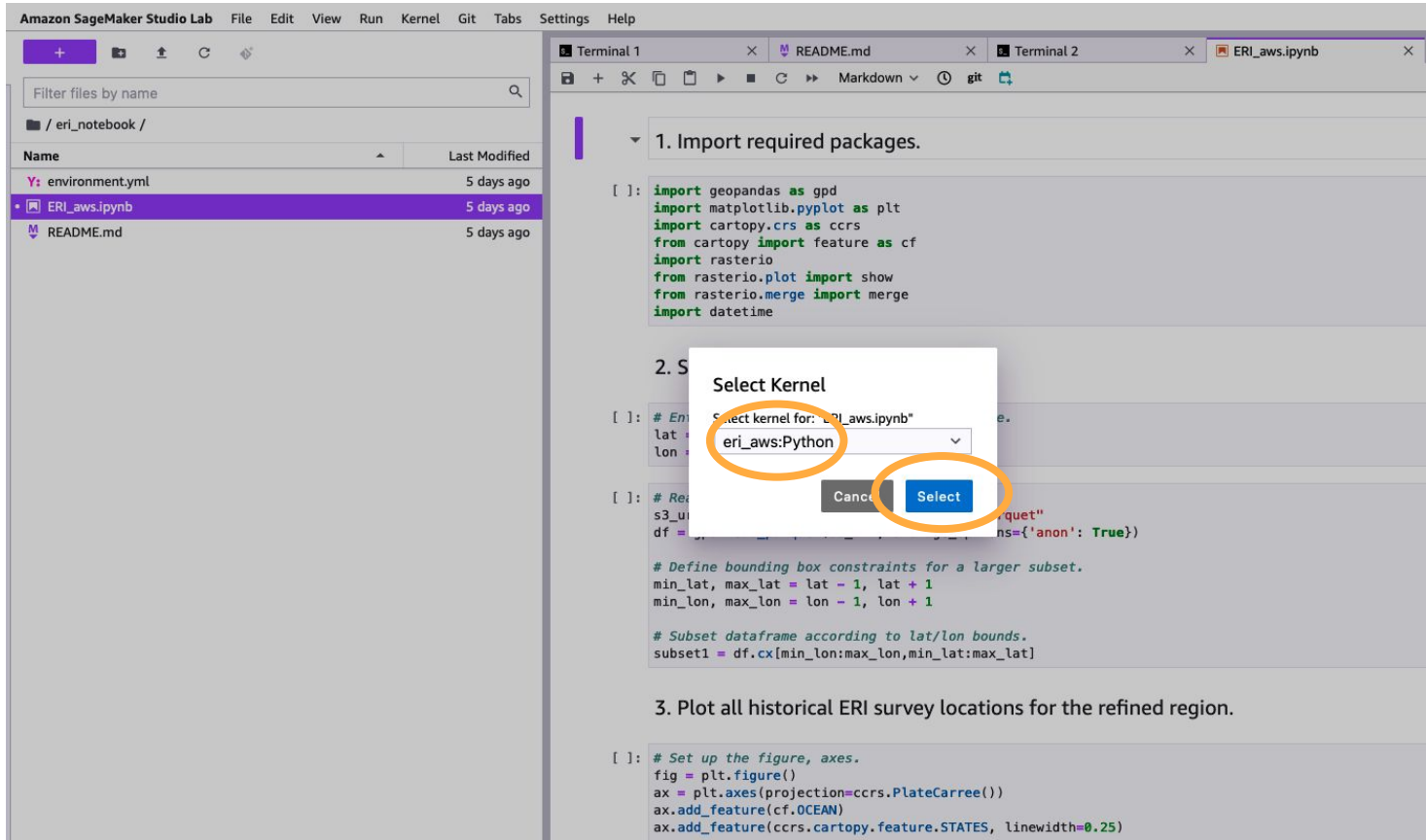
```
Downloading and Extracting Packages
orc-1.9.2 | 995 KB | ##### | 100%
libprotobuf-4.25.2 | 2.7 MB | ##### | 100%
libpgp-error-1.48 | 260 KB | ##### | 100%
ipython-8.22.1 | 579 KB | ##### | 100%
libarrow-flight-sql- | 190 KB | ##### | 100%
libarrow-gandiva-15. | 875 KB | ##### | 100%
libgrpc-1.61.1 | 7.3 MB | ##### | 100%
libarrow-flight-15.0 | 493 KB | ##### | 100%
c-ares-1.27.0 | 160 KB | ##### | 100%
setuptools-69.1.1 | 459 KB | ##### | 100%
libgoogle-cloud-2.21 | 1.2 MB | ##### | 100%
libarrow-dataset-15. | 571 KB | ##### | 100%
pyarrow-15.0.0 | 4.3 MB | ##### | 100%
libarrow-substrait-1 | 507 KB | ##### | 100%
libre2-11-2023.09.01 | 227 KB | ##### | 100%
libabseil-20240116.1 | 1.2 MB | ##### | 100%
libparquet-15.0.0 | 1.1 MB | ##### | 100%
re2-2023.09.01 | 26 KB | ##### | 100%
pandas-2.2.1 | 14.7 MB | ##### | 100%
libgoogle-cloud-stor | 732 KB | ##### | 100%
glog-0.7.0 | 140 KB | ##### | 100%
libarrow-acero-15.0. | 584 KB | ##### | 100%
libarrow-15.0.0 | 7.8 MB | ##### | 100%
Preparing transaction: done
Verifying transaction: done
Executing transaction: done
#
# To activate this environment, use
#
# $ conda activate eri_aws
#
# To deactivate an active environment, use
#
# $ conda deactivate

(studiolab) studio-lab-user@default:~/eri_notebooks
```

🔗 Launcher

cd eri_notebook && con
(studiolab) studio-lab
Collecting package met

Step 10: Launch Notebook



The screenshot displays the Amazon SageMaker Studio Lab interface. On the left, a file explorer shows the directory structure for the notebook, with 'ERI_aws.ipynb' selected. The main workspace contains a code editor with Python code for importing packages and plotting data. A 'Select Kernel' dialog box is overlaid on the code, with 'eri_aws:Python' selected in the dropdown menu and the 'Select' button highlighted.

Amazon SageMaker Studio Lab File Edit View Run Kernel Git Tabs Settings Help

Filter files by name

/ eri_notebook /

Name	Last Modified
environment.yml	5 days ago
ERI_aws.ipynb	5 days ago
README.md	5 days ago

Terminal 1 x README.md x Terminal 2 x ERI_aws.ipynb

1. Import required packages.

```
[ ]: import geopandas as gpd
import matplotlib.pyplot as plt
import cartopy.crs as ccrs
from cartopy import feature as cf
import rasterio
from rasterio.plot import show
from rasterio.merge import merge
import datetime
```

2. S

```
[ ]: # En
lat =
lon =
```

Select Kernel

Select kernel for: "ERI_aws.ipynb"

eri_aws:Python

Cancel Select

```
[ ]: # Re
s3_u
df =
```

```
# Define bounding box constraints for a larger subset.
min_lat, max_lat = lat - 1, lat + 1
min_lon, max_lon = lon - 1, lon + 1

# Subset dataframe according to lat/lon bounds.
subset1 = df.cx[min_lon:max_lon,min_lat:max_lat]
```

3. Plot all historical ERI survey locations for the refined region.

```
[ ]: # Set up the figure, axes.
fig = plt.figure()
ax = plt.axes(projection=ccrs.PlateCarree())
ax.add_feature(cf.OCEAN)
ax.add_feature(ccrs.cartopy.feature.STATES, linewidth=0.25)
```

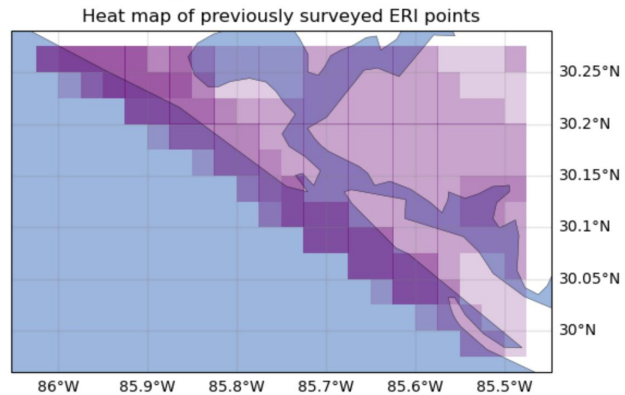
Jupyter Notebook Demo



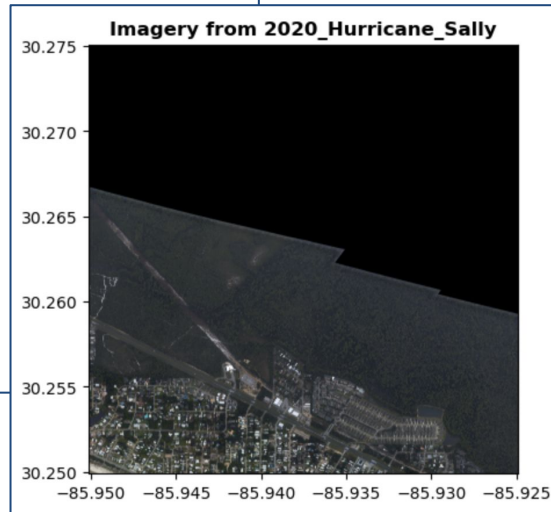
```
gl = ax.gridlines(draw_labels=True, linewidth=1, color='gray', alpha=0.2, linestyle='-')
gl.top_labels = False
gl.left_labels = False

plt.title("Heat map of previously surveyed ERI points");
```

Contributing events:
2020_Hurricane_Sally
2018_Tropical_Storm_Gordon
2018_Hurricane_Michael



4. Select one of the region's historical events for further exploration.



Questions and Discussion

- Please be brief in your questions / comments
- Use the chat or raise your hand for questions
- Identify who the question is directed to where possible
 - As questions are answered, we will go to the next in the chat queue and call on you to unmute yourself and ask your question.
 - We appreciate there may be questions that cannot be answered immediately and even those that we won't have an opportunity to get to: please be patient as we build our understanding and summary responses.



Resources

We invite you to stay engaged with NOAA!

- **NOAA Emergency Response Imagery:**
 - <https://storms.ngs.noaa.gov/>
- **NOAA Open Data Dissemination:**
 - noaa.gov/nodd
 - Email: NODD@noaa.gov
- **AWS Emergency Response Imagery:**
 - <https://registry.opendata.aws/noaa-eri/>

