Space Journalism!

¡Periodismo en el espacio!

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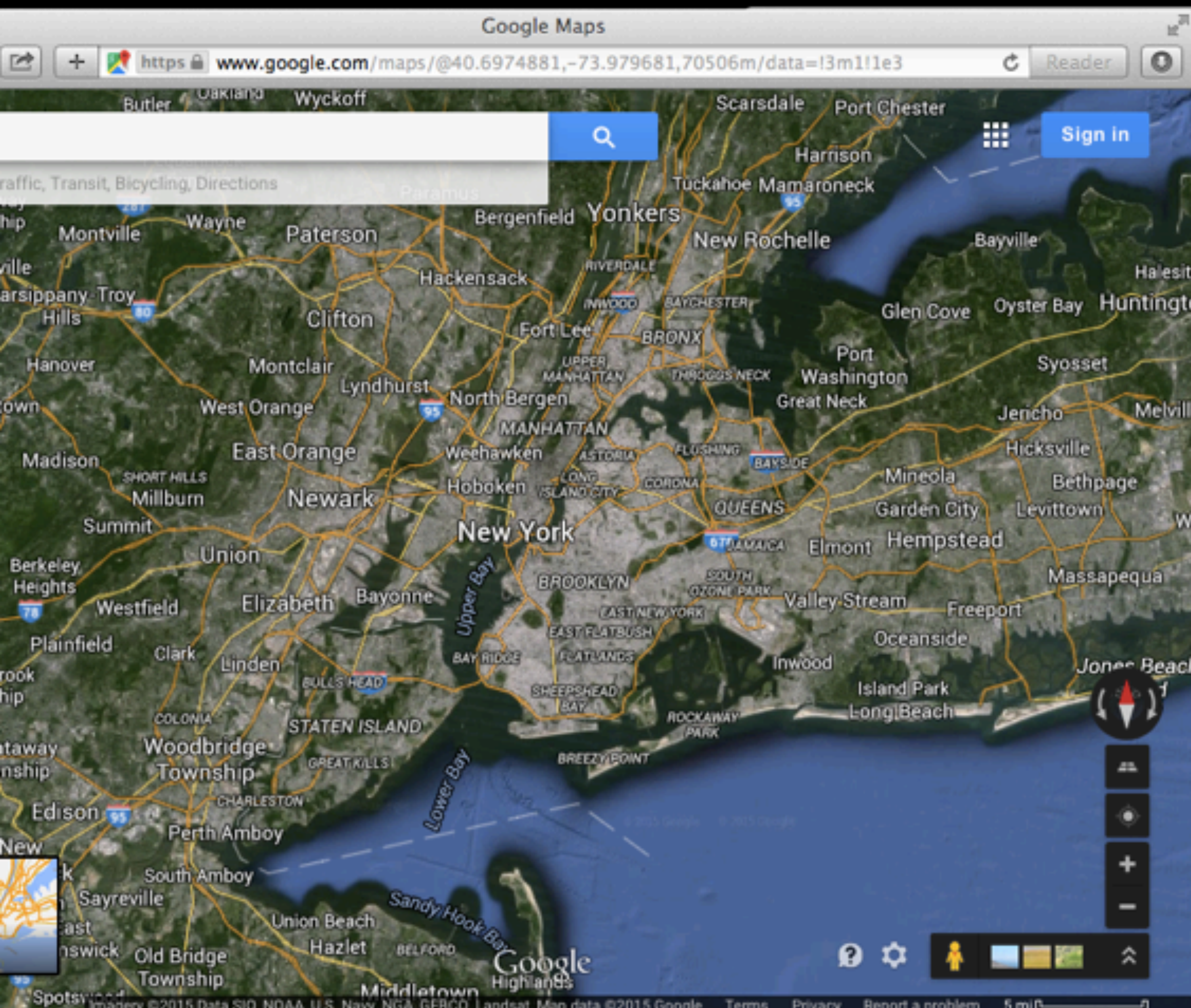
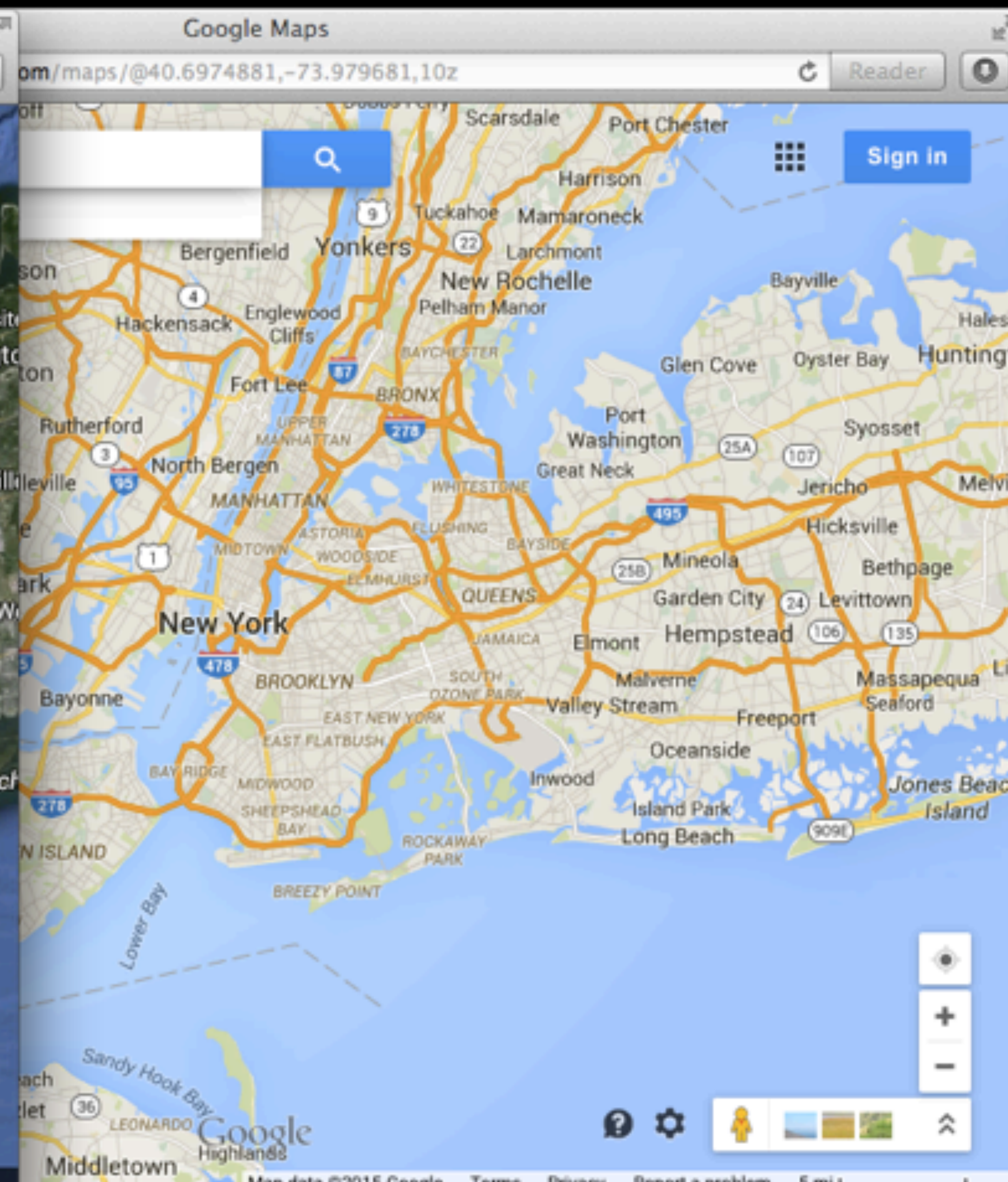
http://j.mp/jpd-spacejournalism

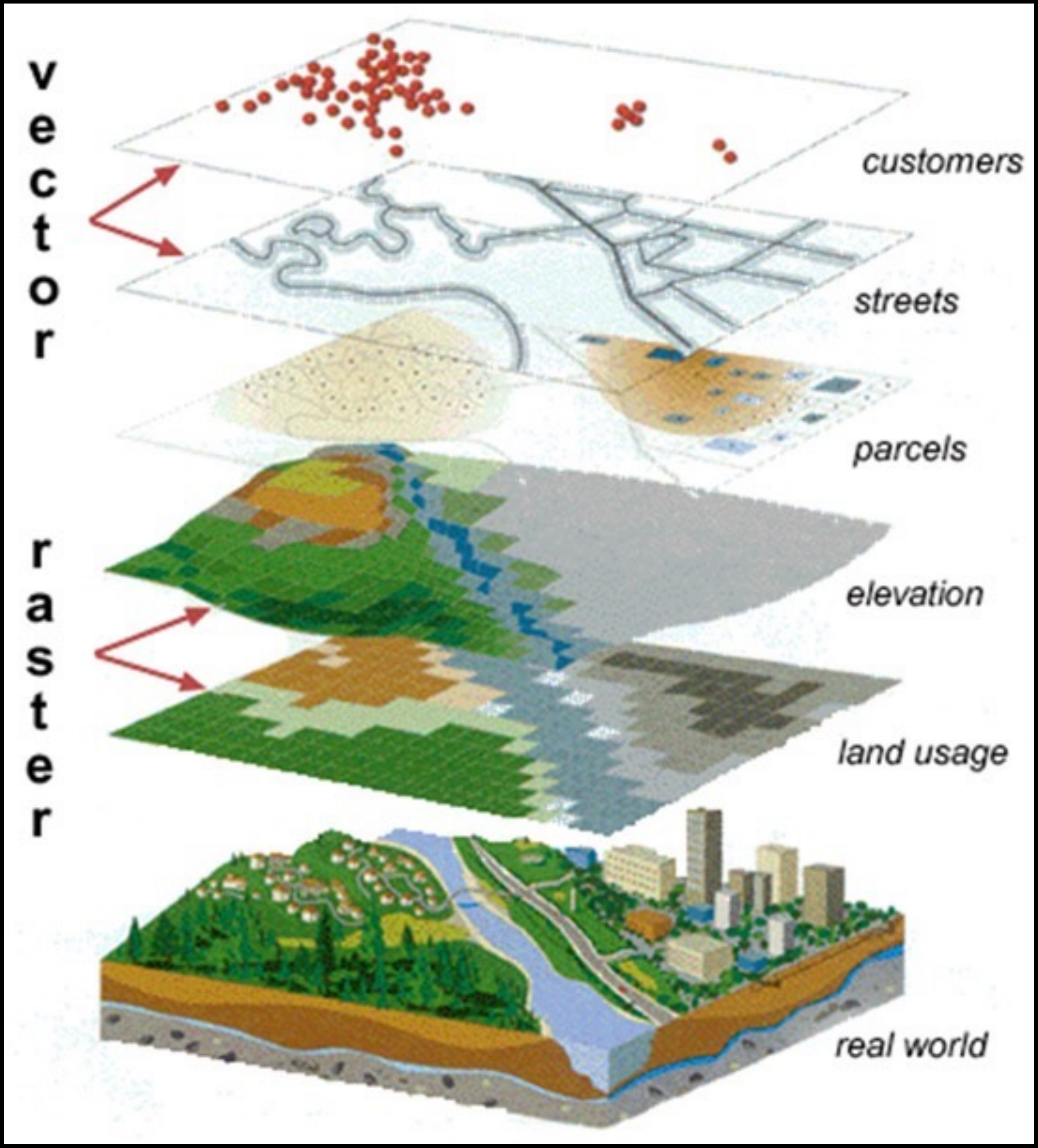
Agenda

1. **What is raster data?** *¿Qué son los datos de 'raster'?*
2. **How to get the data** *¿Como obtener los datos?*
3. **How to process the data** *¿Como procesar los datos?*
4. **Telling stories from space** *Decir historias desde el espacio*
5. **Questions** *Preguntas*

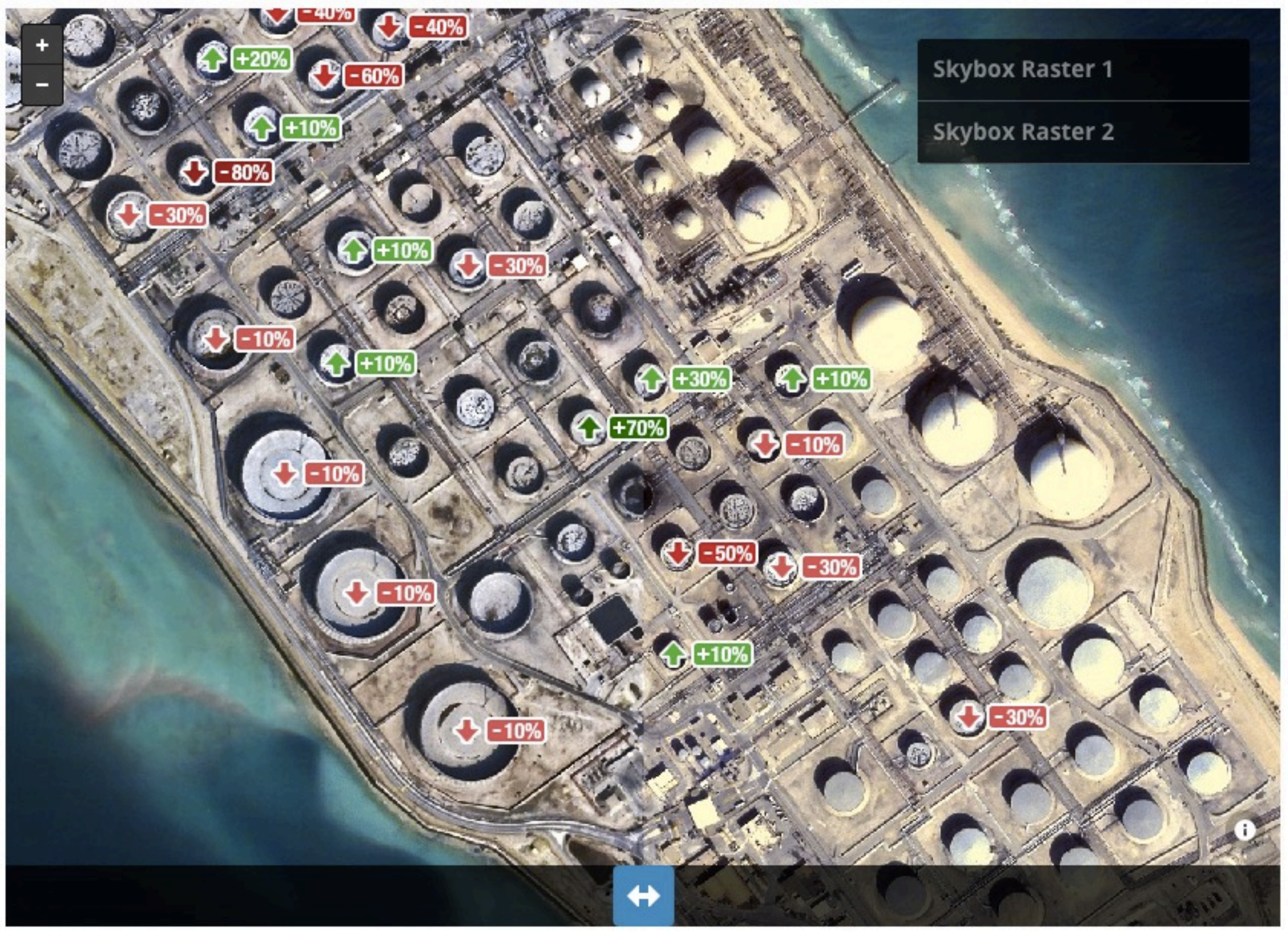
1. What is raster data? *¿Qué son los datos de 'raster'?*



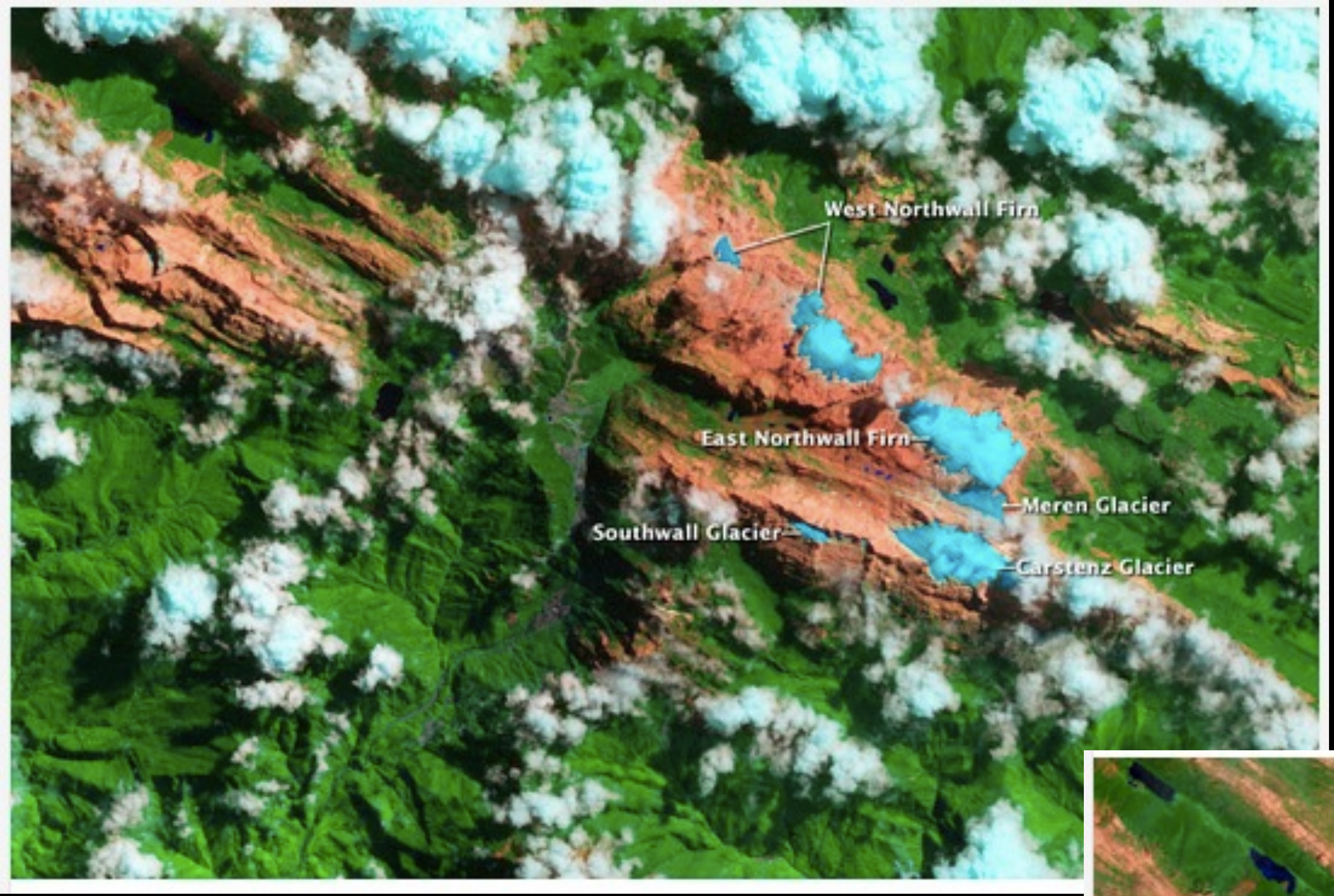



vector
customers
streets
parcels
raster
elevation
land usage
real world

http://maps.nypl.org/warper/maps/17757



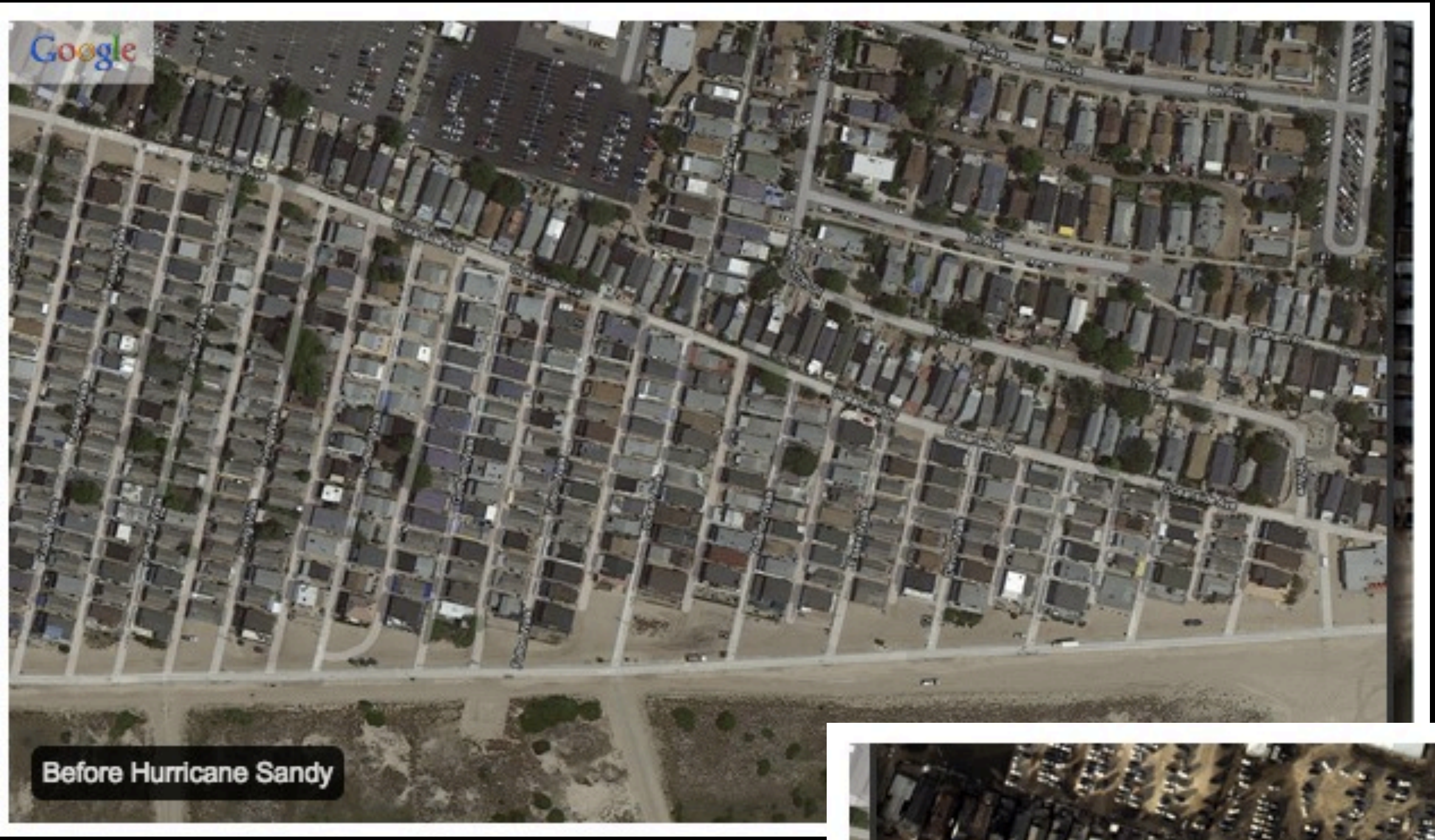
https://www.mapbox.com/blog/Monitoring-oil-reserves-from-space/



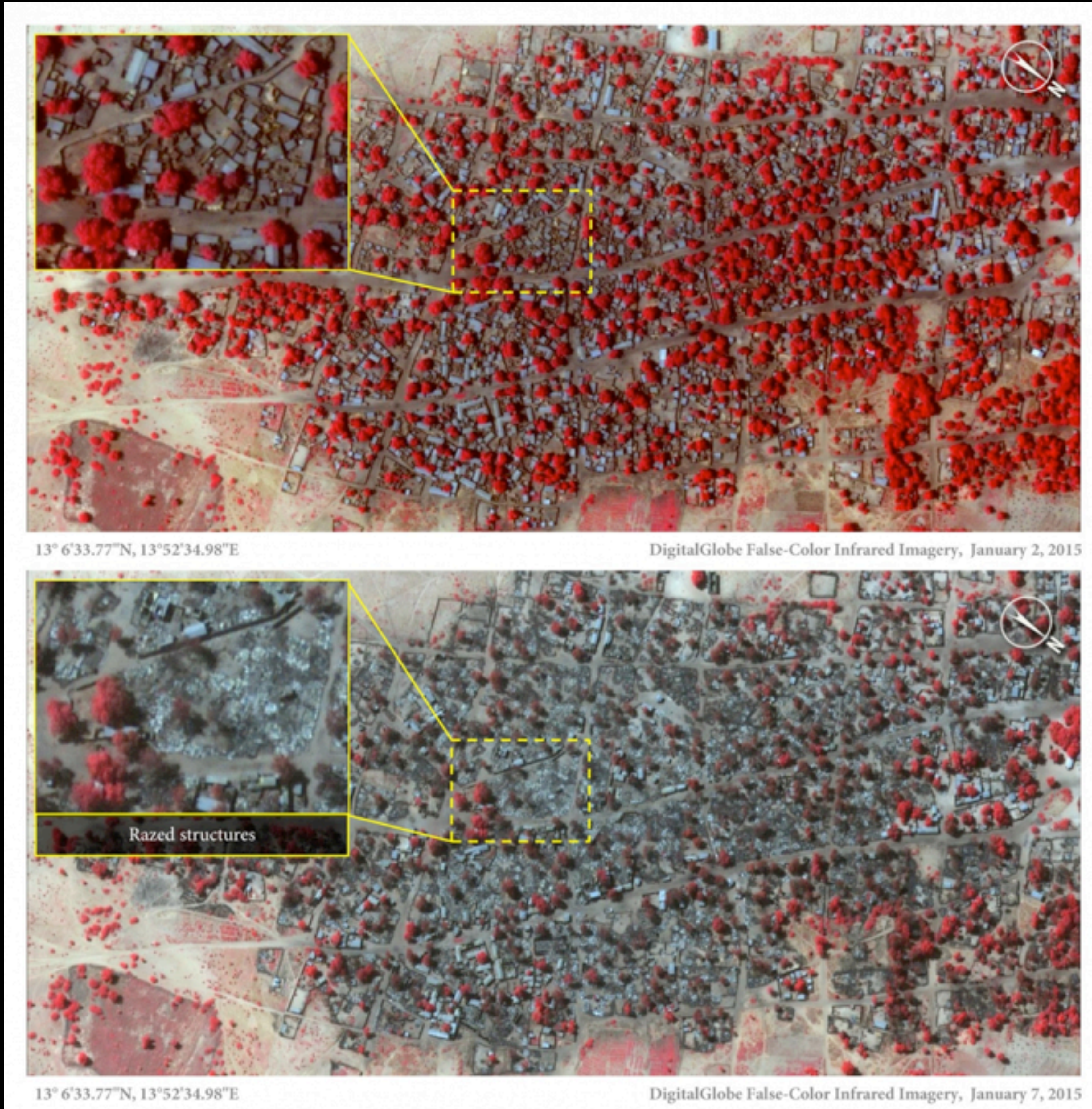
1989

2009

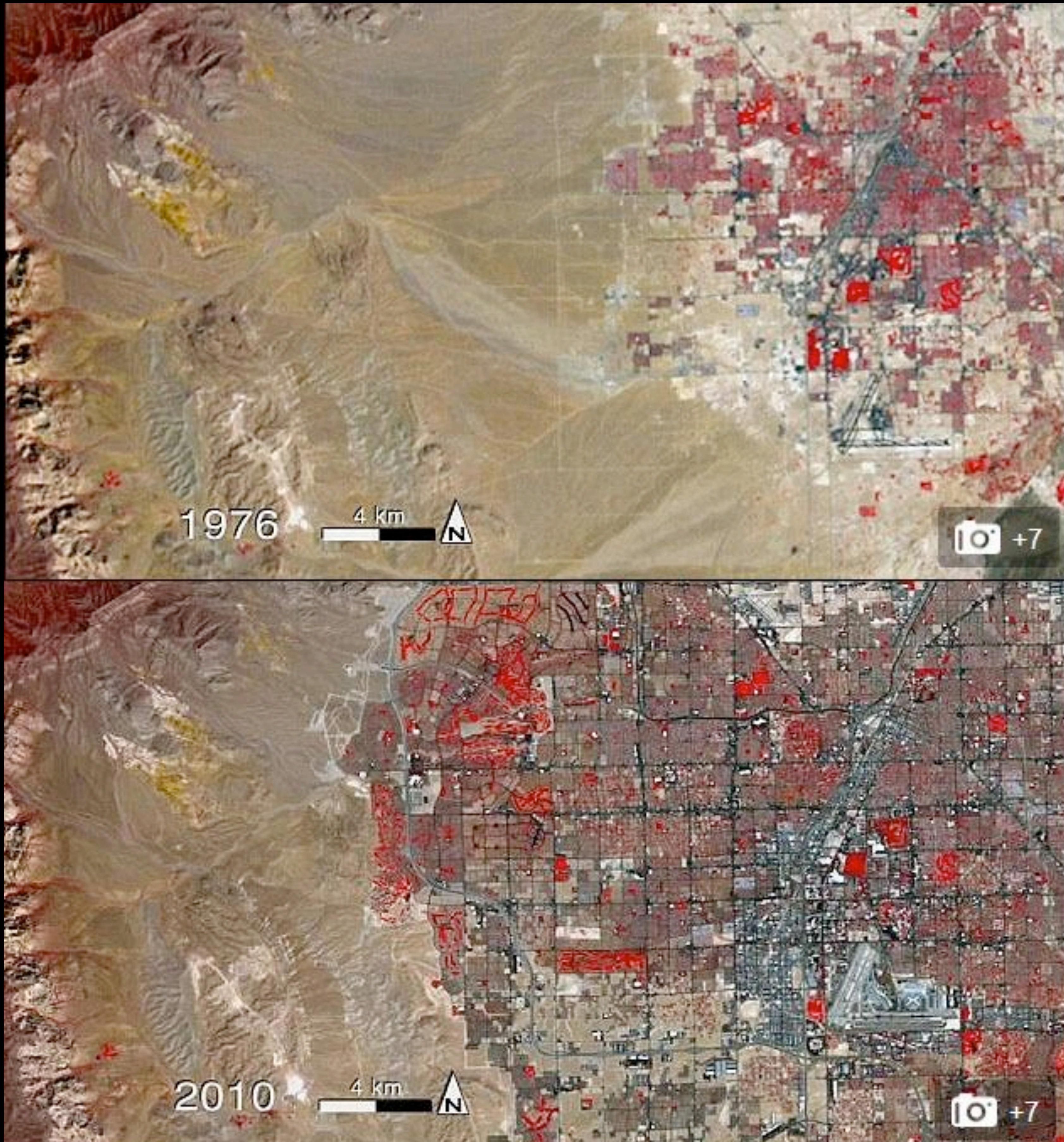
http://earthobservatory.nasa.gov/IOTD/view.php?id=79084&src=ve



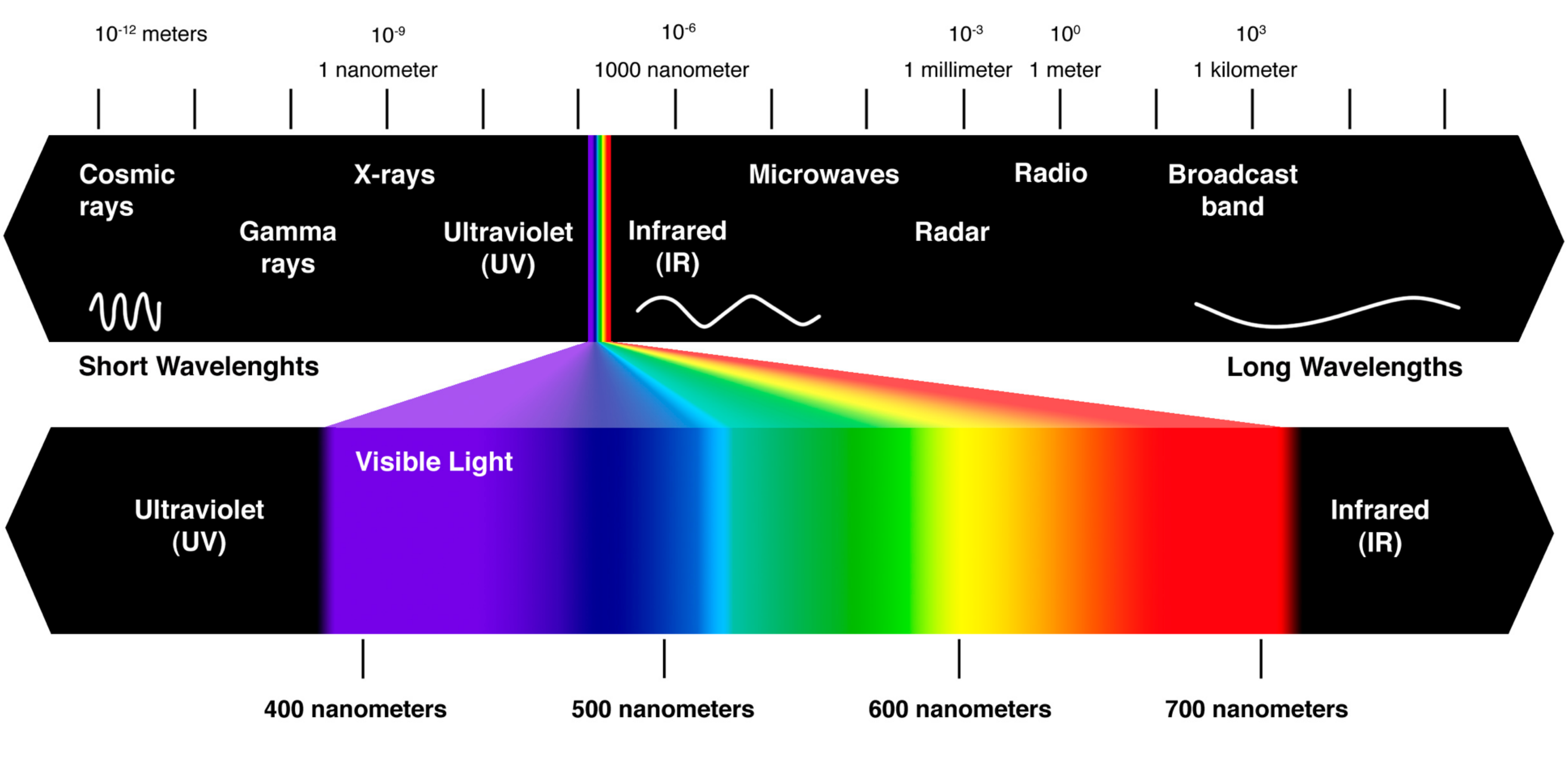
http://oceanservice.noaa.gov/news/weeklynews/nov12/ngs-sandy-imagery.html



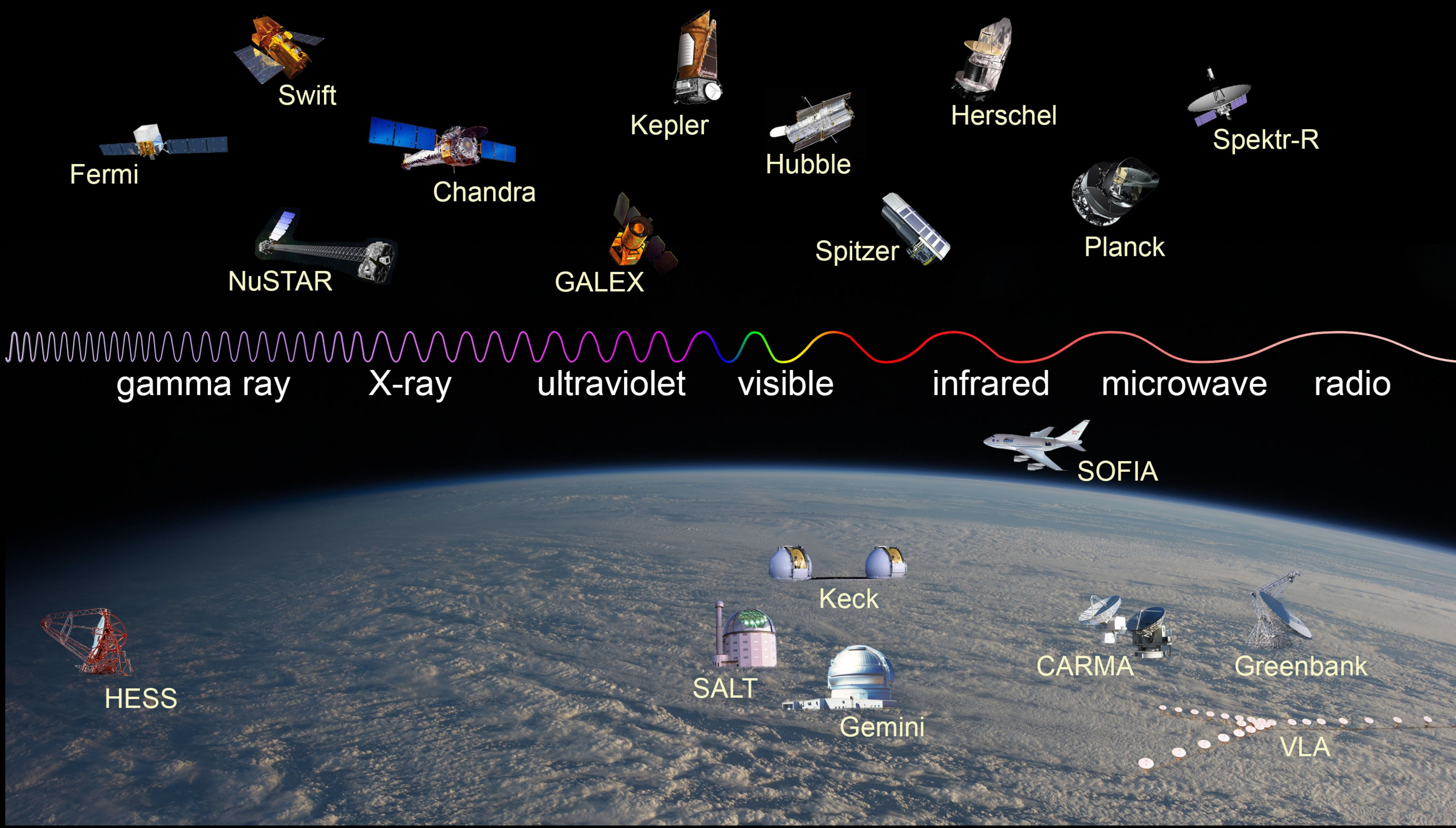
http://www.bagnewsnotes.com/2015/01/the-boko-haram-massacre-from-outer-or-is-it-inner-space/



USGS/NASA Landsat

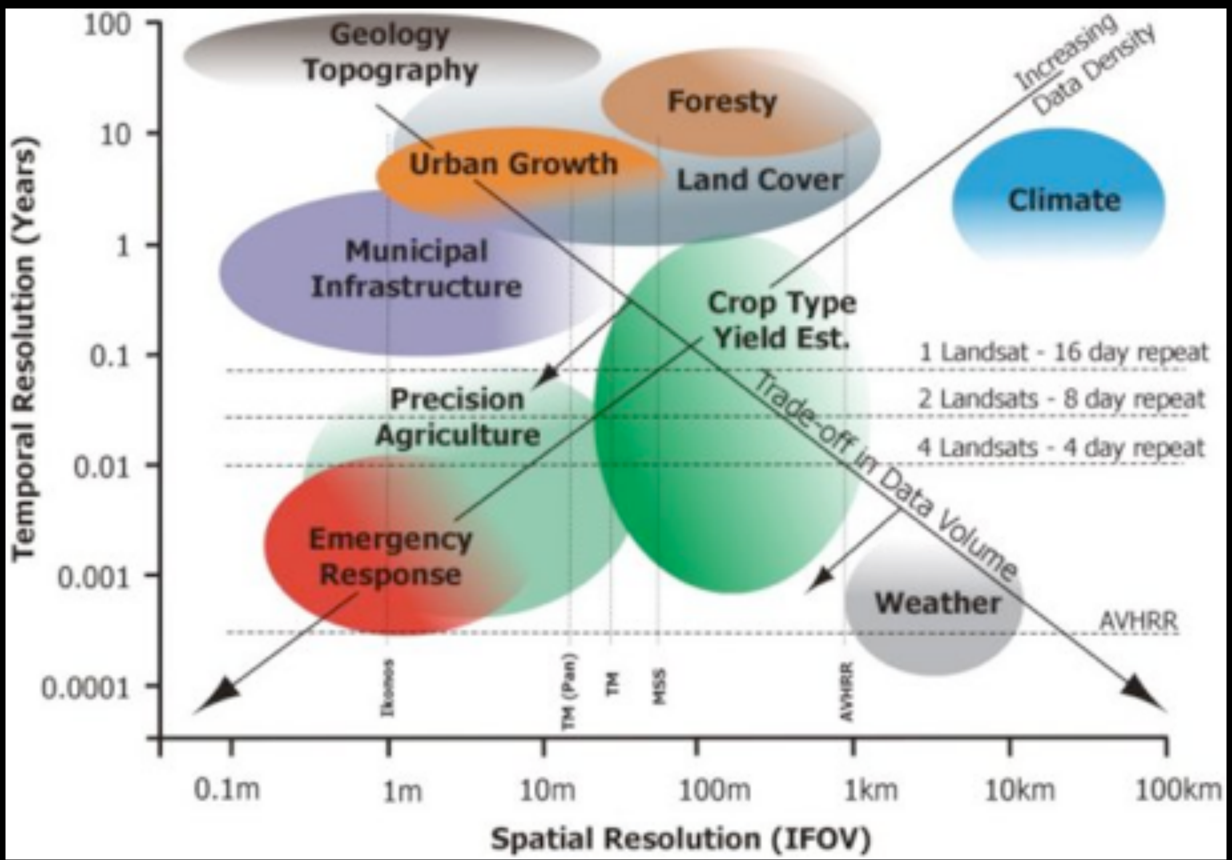


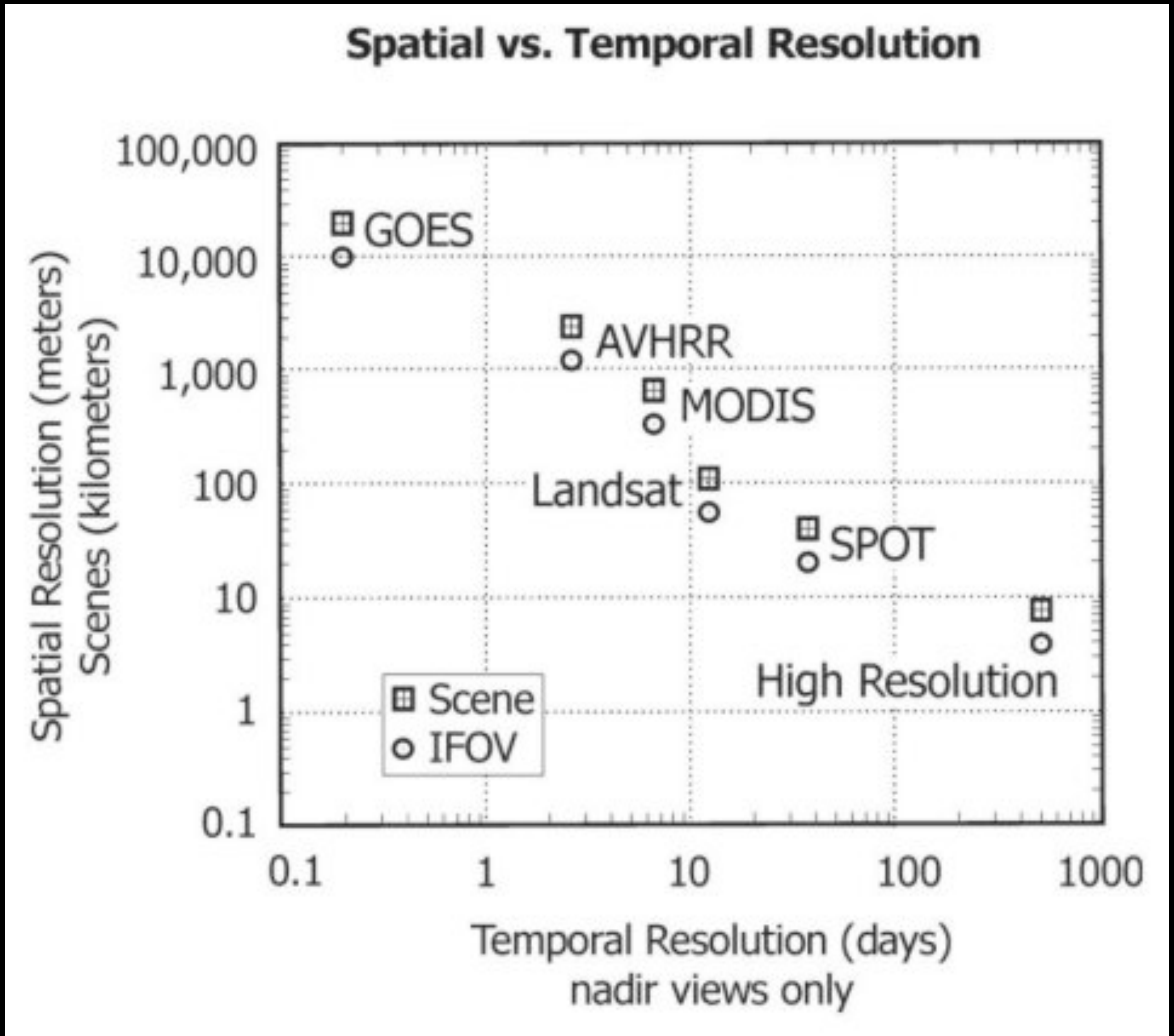
10-12 meters
10-9
1 nanometer
10-6
1000 nanometer
10-3
1 millimeter
100
1 meter
103
1 kilometer
Cosmic rays
Gamma rays
X-rays
Ultraviolet (UV)
Infrared (IR)
Microwaves
Radar
Radio
Broadcast band
Short Wavelenghts
Long Wavelengths
Visible Light
Ultraviolet (UV)
Infrared (IR)
400 nanometers
500 nanometers
600 nanometers
700 nanometers

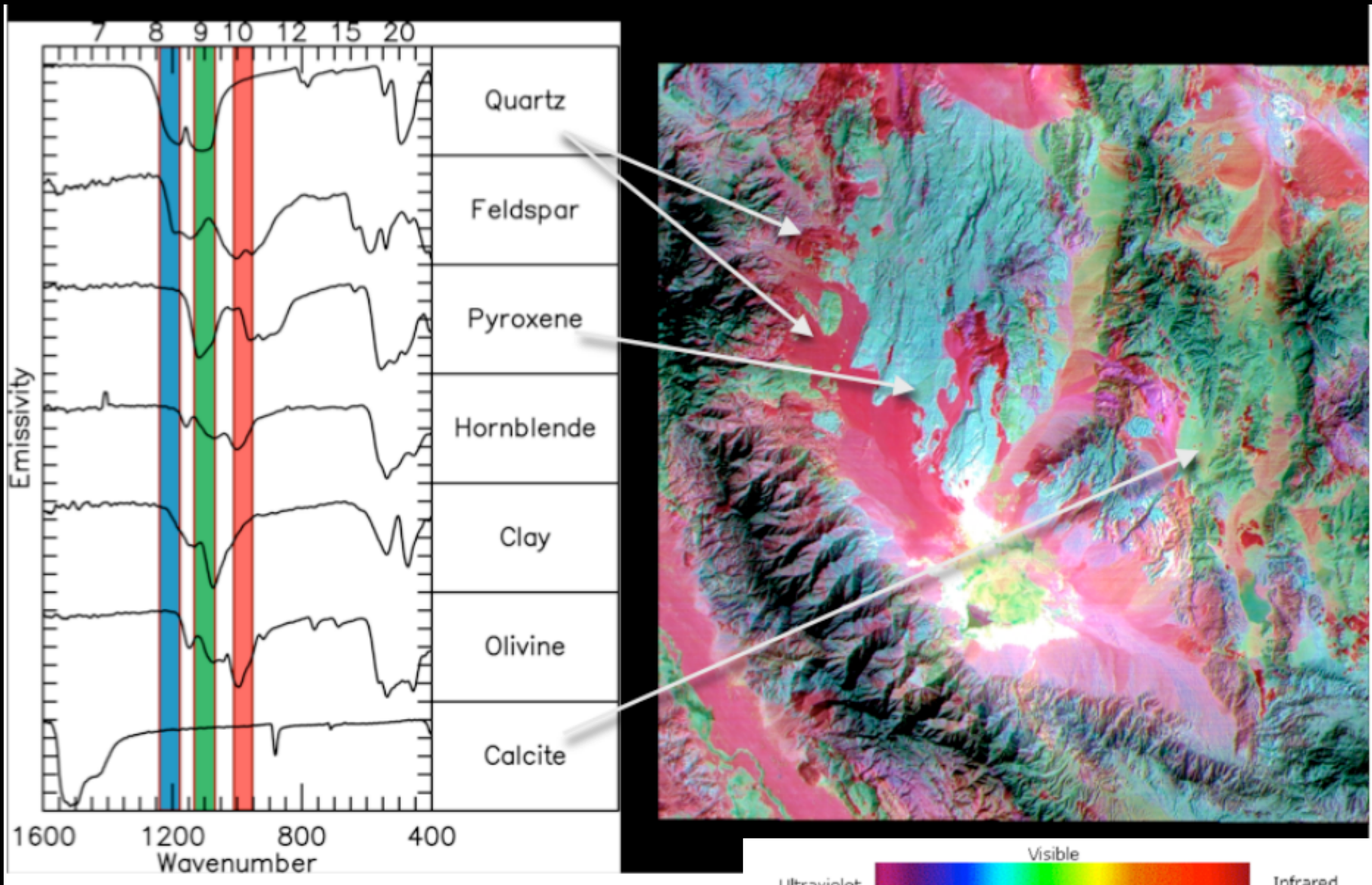

Swift
Fermi
Chandra
NuSTAR
Kepler
GALEX
Hubble
Spitzer
Herschel
Planck
Spektr-R
gamma ray
X-ray
ultraviolet
visible
infrared
microwave
radio
SOFIA
Keck
HESS
SALT
Gemini
CARMA
Greenbank
VLA

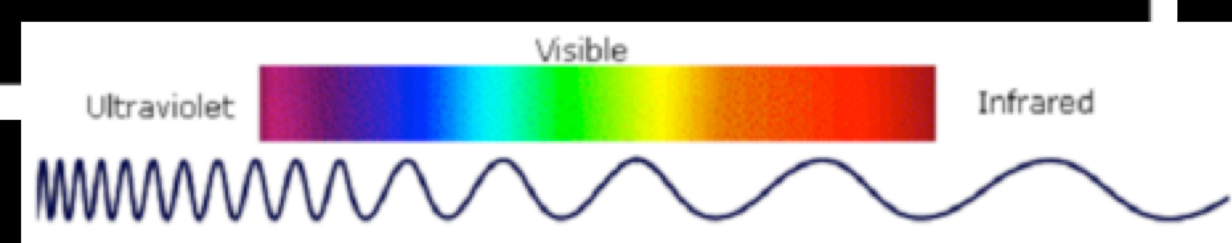
Resolution
Spectral, Spatial, Temporal

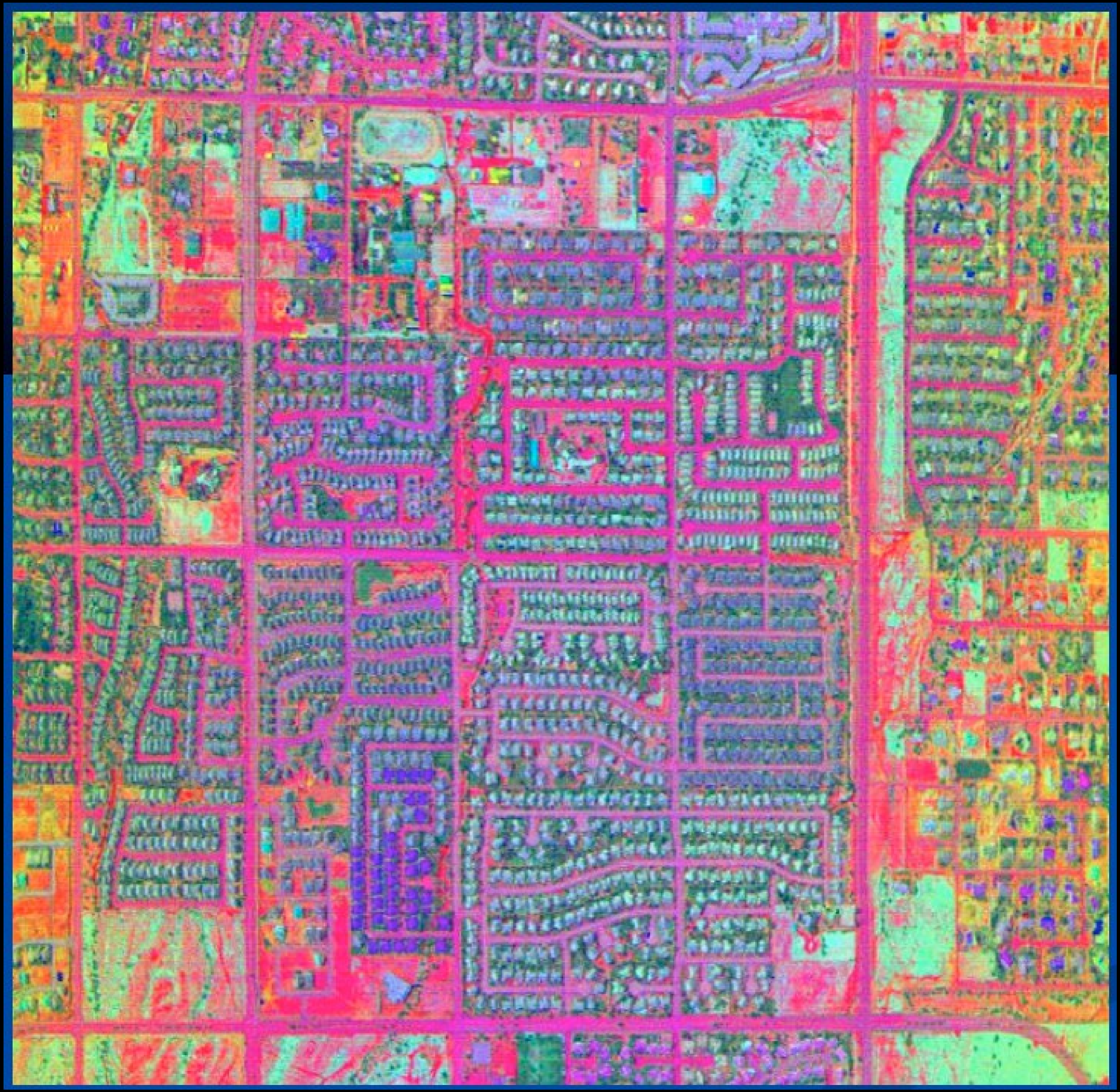
Resolución
Espectral, Espacial, Temporal






7 8 9 10 12 15 20
Emissivity
Quartz
Feldspar
Pyroxene
Hornblende
Clay
Olivine
Calcite
1600 1200 800 400
Wavenumber


Visible
Ultraviolet
Infrared



Red: concrete

Green: grass

Blue: water

Pink: asphalt

Brown & tan: bare soil and gravel

Dark green: trees

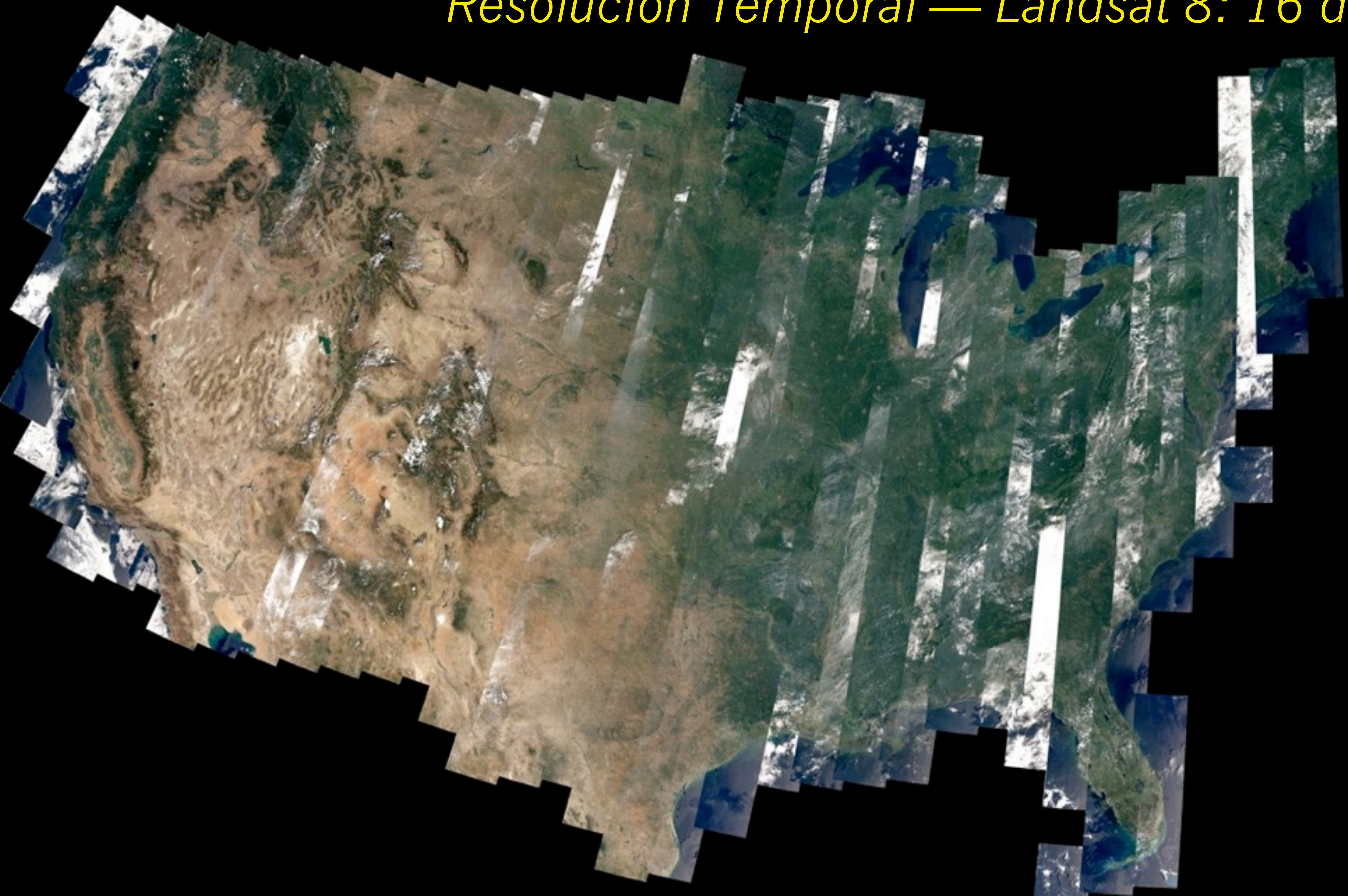
Cyan: roofing materials

MODIS: 250m resolution

Landsat 8: 15-30m resolution

Temporal Resolution — Landsat 8: 16 days

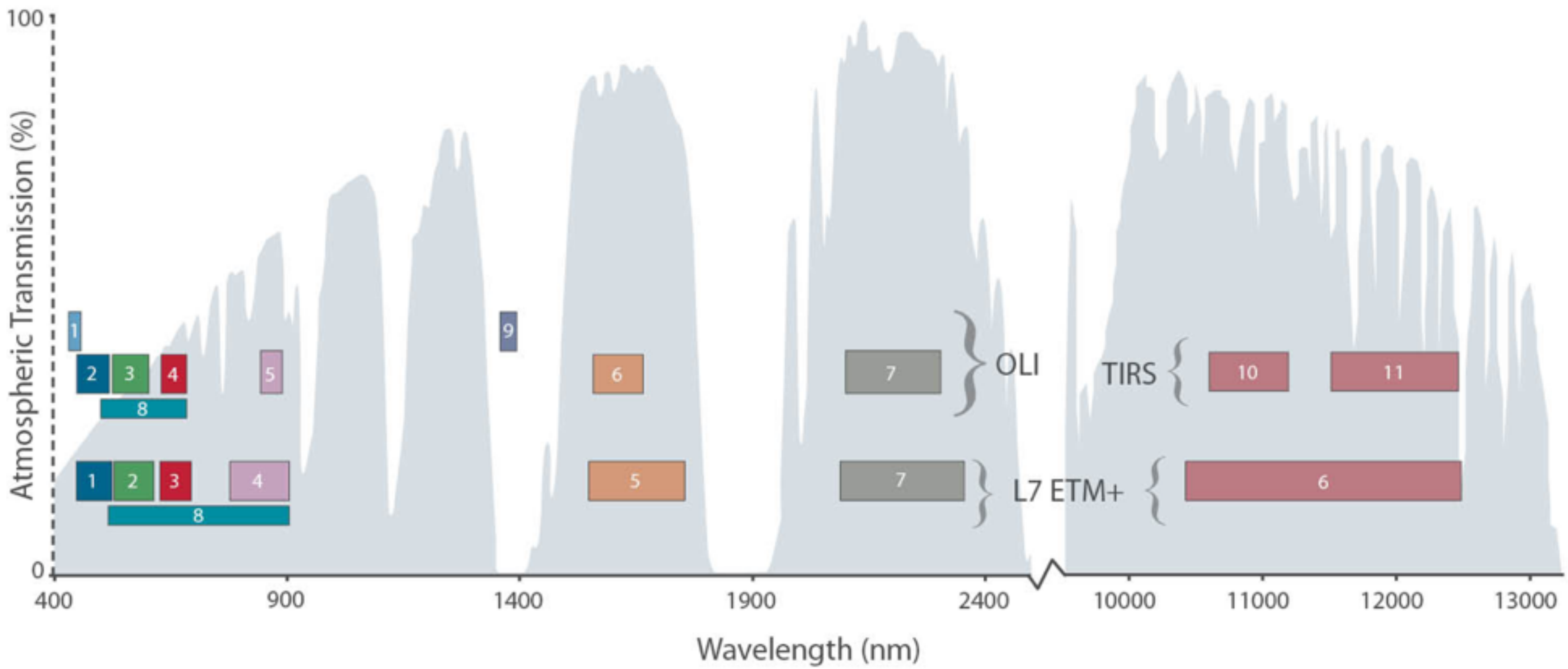
Resolución Temporal — Landsat 8: 16 días



http://earthobservatory.nasa.gov/IOTD/view.php?id=83099

Spectral Resolution: Landsat 8

Resolución Espectral — Landsat 8



Spectral Resolution: Landsat 8

Resolución Espectral — Landsat 8

Landsat 8 Operational Land Imager (OLI) and Thermal Infrared Sensor (TIRS) Launched February 11, 2013	Bands	Wavelength (micrometers)	Resolution (meters)
	Band 1 - Coastal aerosol	0.43 - 0.45	30
	Band 2 - Blue	0.45 - 0.51	30
	Band 3 - Green	0.53 - 0.59	30
	Band 4 - Red	0.64 - 0.67	30
	Band 5 - Near Infrared (NIR)	0.85 - 0.88	30
	Band 6 - SWIR 1	1.57 - 1.65	30
	Band 7 - SWIR 2	2.11 - 2.29	30
	Band 8 - Panchromatic	0.50 - 0.68	15
	Band 9 - Cirrus	1.36 - 1.38	30
	Band 10 - Thermal Infrared (TIRS) 1	10.60 - 11.19	100 * (30)
	Band 11 - Thermal Infrared (TIRS) 2	11.50 - 12.51	100 * (30)

Landsat 8 Band Combinations

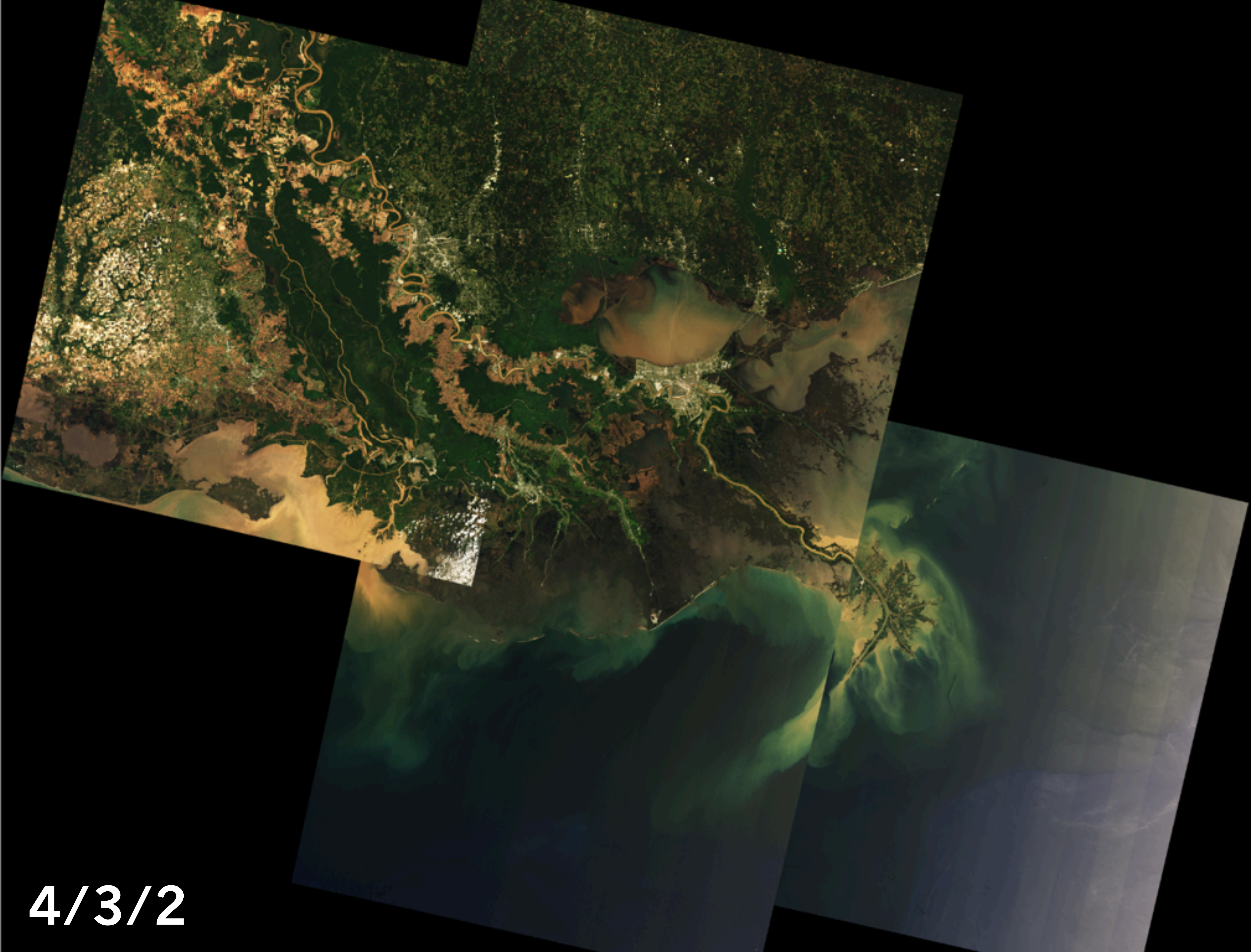
Combinaciones de bandas en Landsat 8

Natural Color	4 3 2
False Color (urban)	7 6 4
Color Infrared (vegetation)	5 4 3
Agriculture	6 5 2
Atmospheric Penetration	7 6 5
Healthy Vegetation	5 6 2
Land/Water	5 6 4
Natural With Atmospheric Removal	7 5 3
Shortwave Infrared	7 5 4
Vegetation Analysis	6 5 4

http://blogs.esri.com/esri/arcgis/2013/07/24/band-combinations-for-landsat-8/

Example: ‘‘Losing Ground’’

Ejemplo: “Losing Ground”



4/3/2

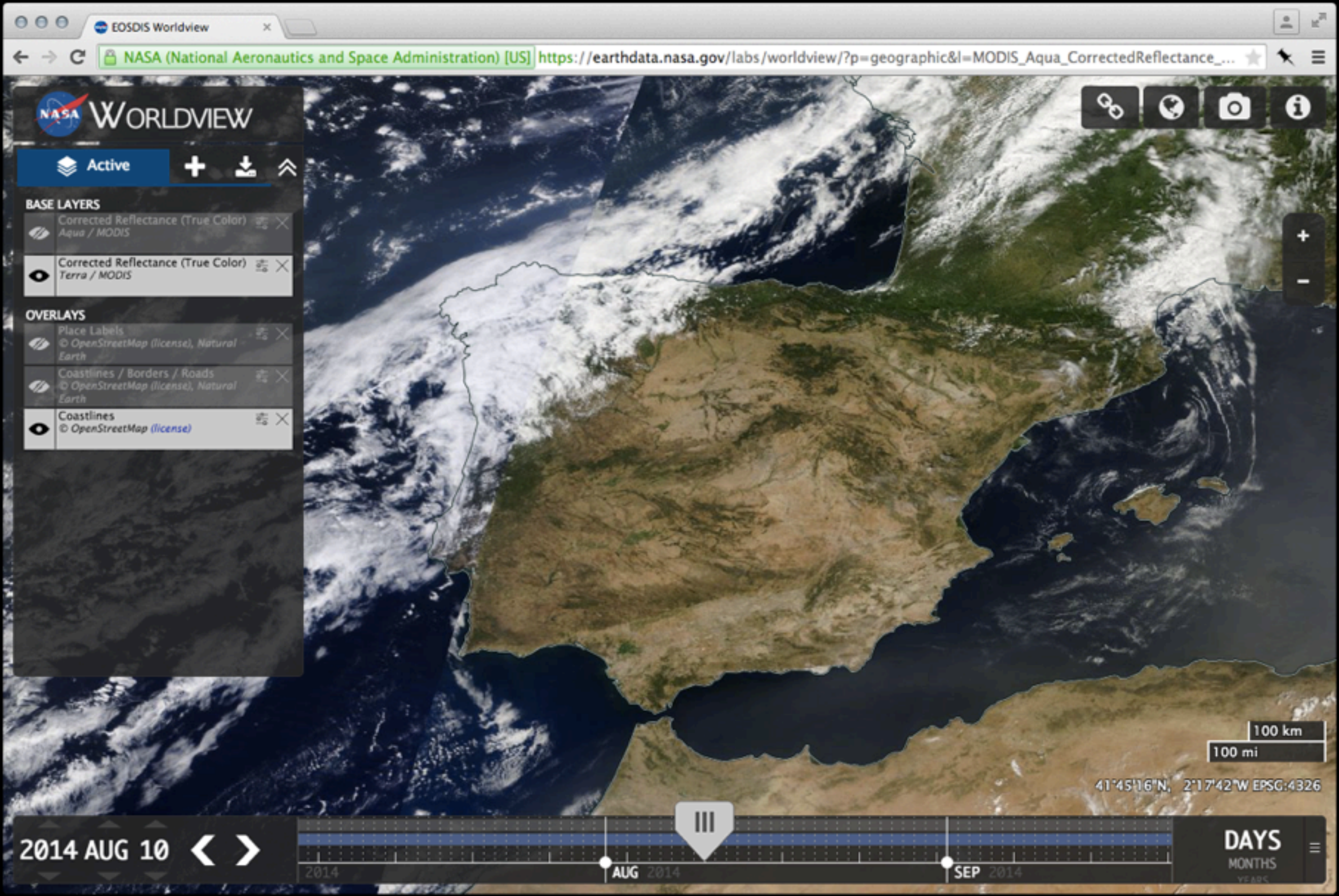

7/5/3


4/3/2 + 5 mask

2. How to get the data

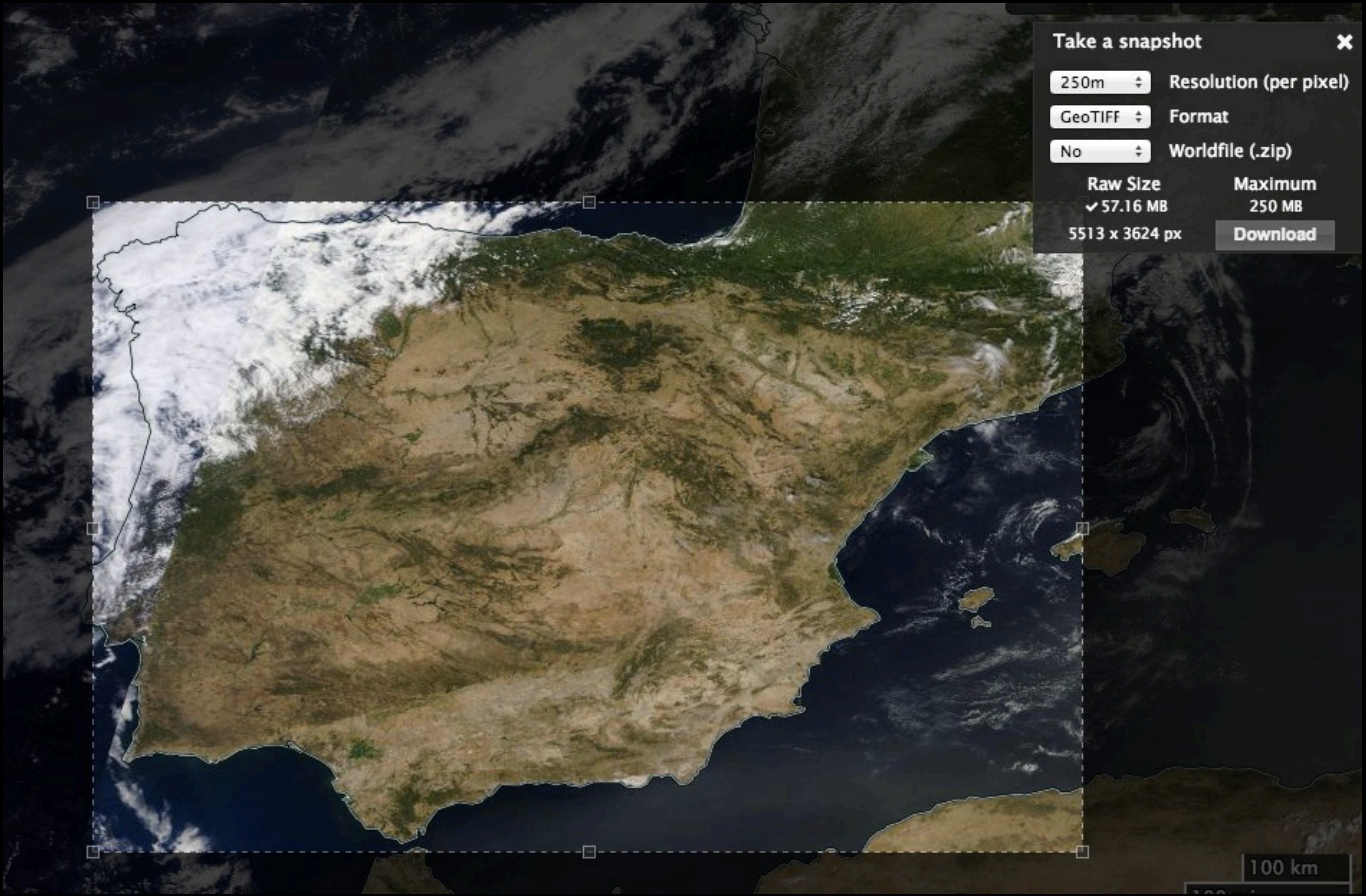
¿Como obtener los datos?

WorldView: MODIS (preprocessed)

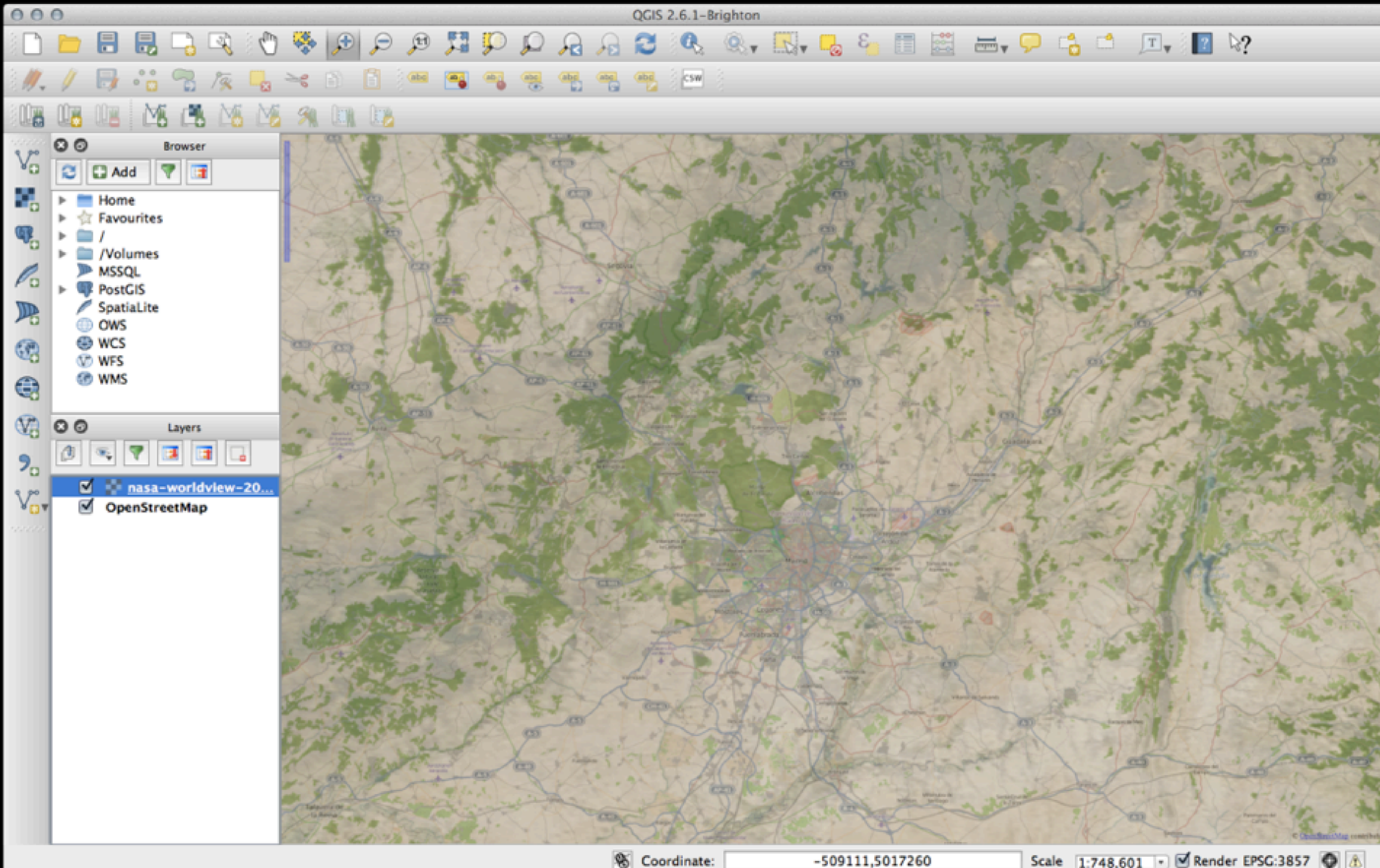


https://earthdata.nasa.gov/labs/worldview/

WorldView: MODIS (preprocessed)

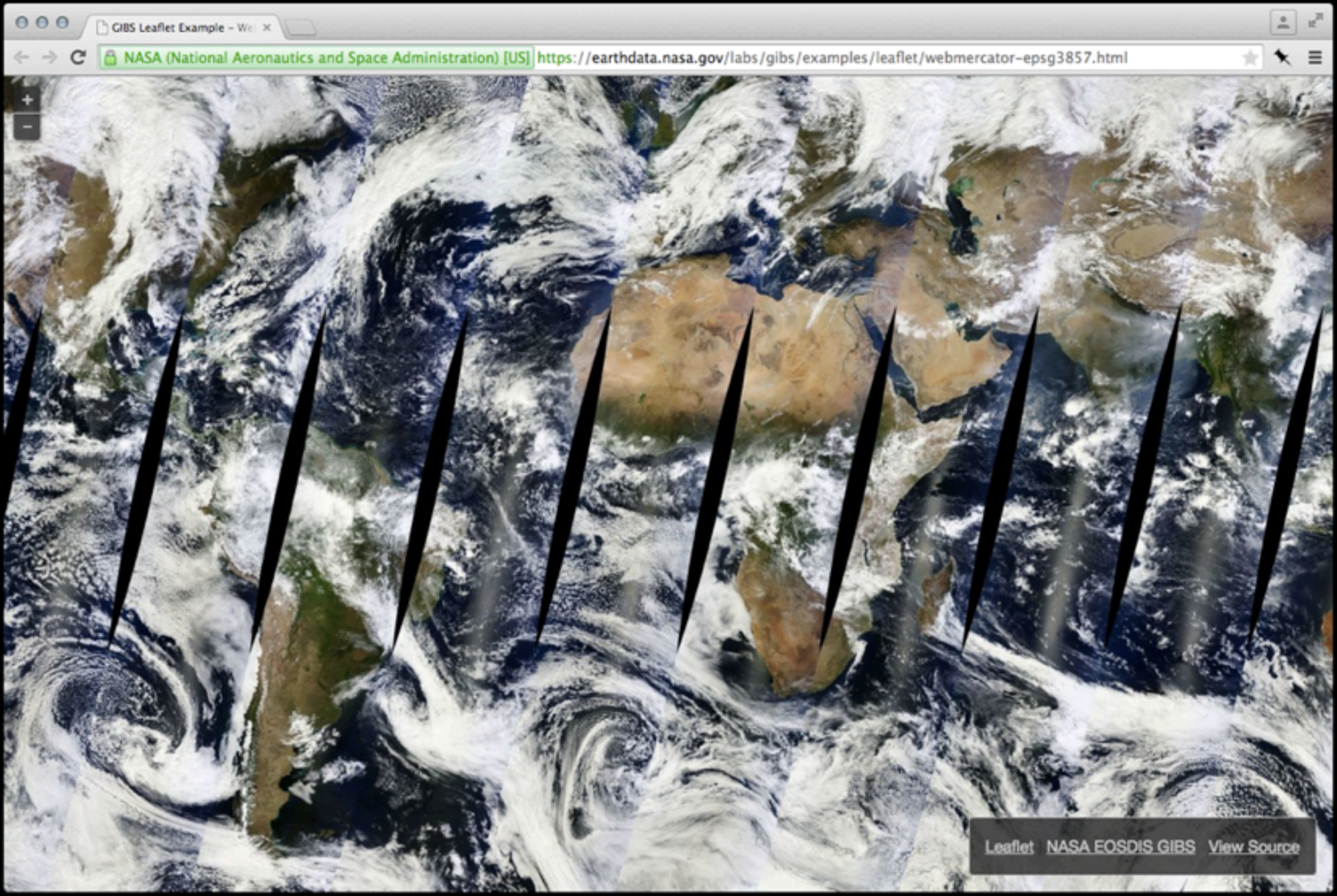



nasa-worldview-2014-08-10.tiff


QGIS 2.6.1-Brighton
Browser
Add
Home
Favourites
/
/Volumes
MSSQL
PostGIS
SpatiaLite
OWS
WCS
WFS
WMS
Layers
nasa-worldview-20...
OpenStreetMap
Coordinate:
-509111,5017260
Scale
1:748,601
Render EPSG:3857

Use Directly In Your Own Leaflet/Google Maps

Utilizar en sus propios mapas de Leaflet o Google



https://github.com/nasa-gibs/gibs-web-examples

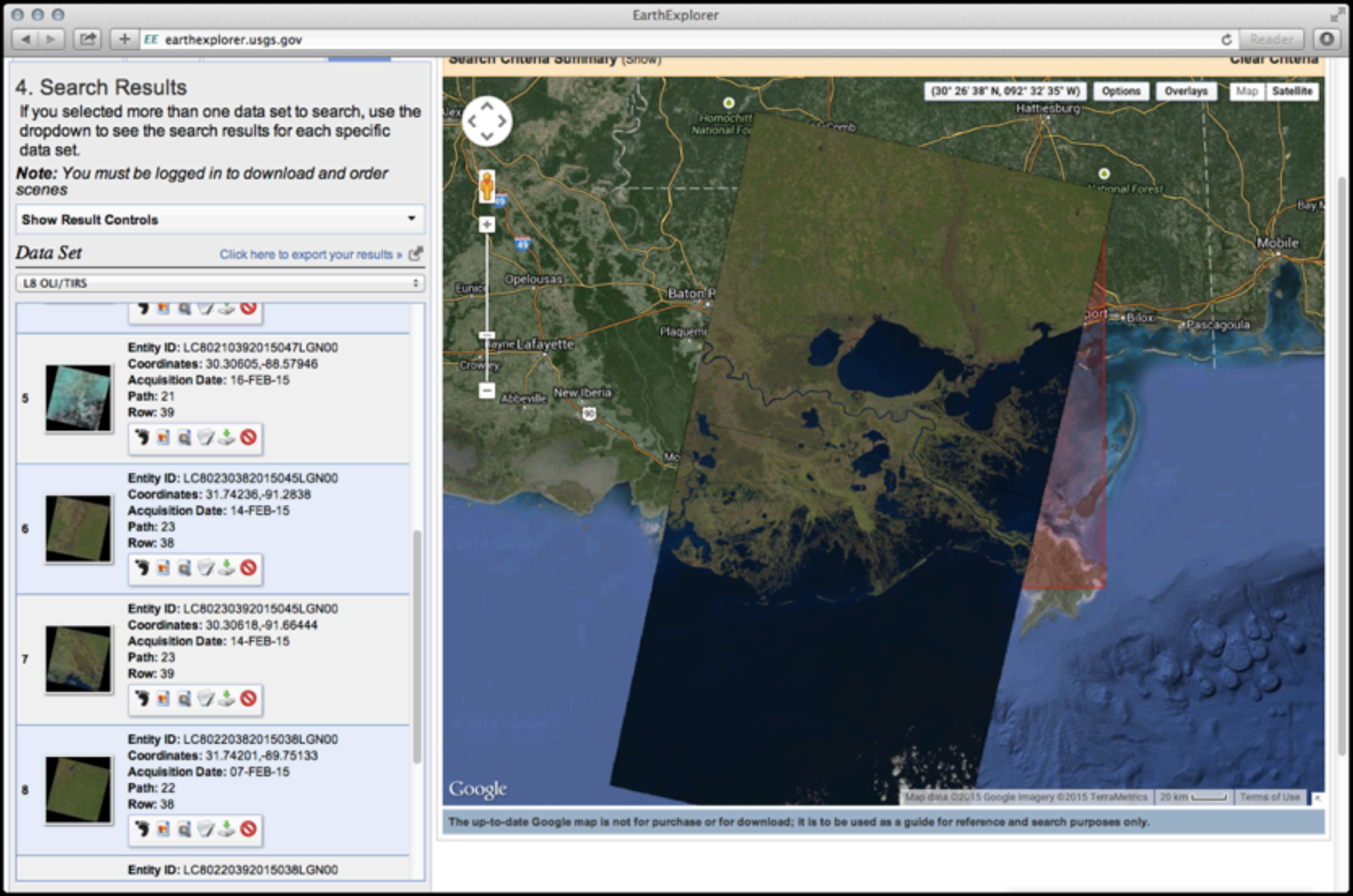
Use Directly In Your Own Leaflet/Google Maps

Utilizar en sus propios mapas de Leaflet o Google

```
"http://map1{s}.vis.earthdata.nasa.gov/wmts-webmerc/" +
"{layer}/default/{time}/{tileMatrixSet}/{z}/{y}/{x}.jpg";
```

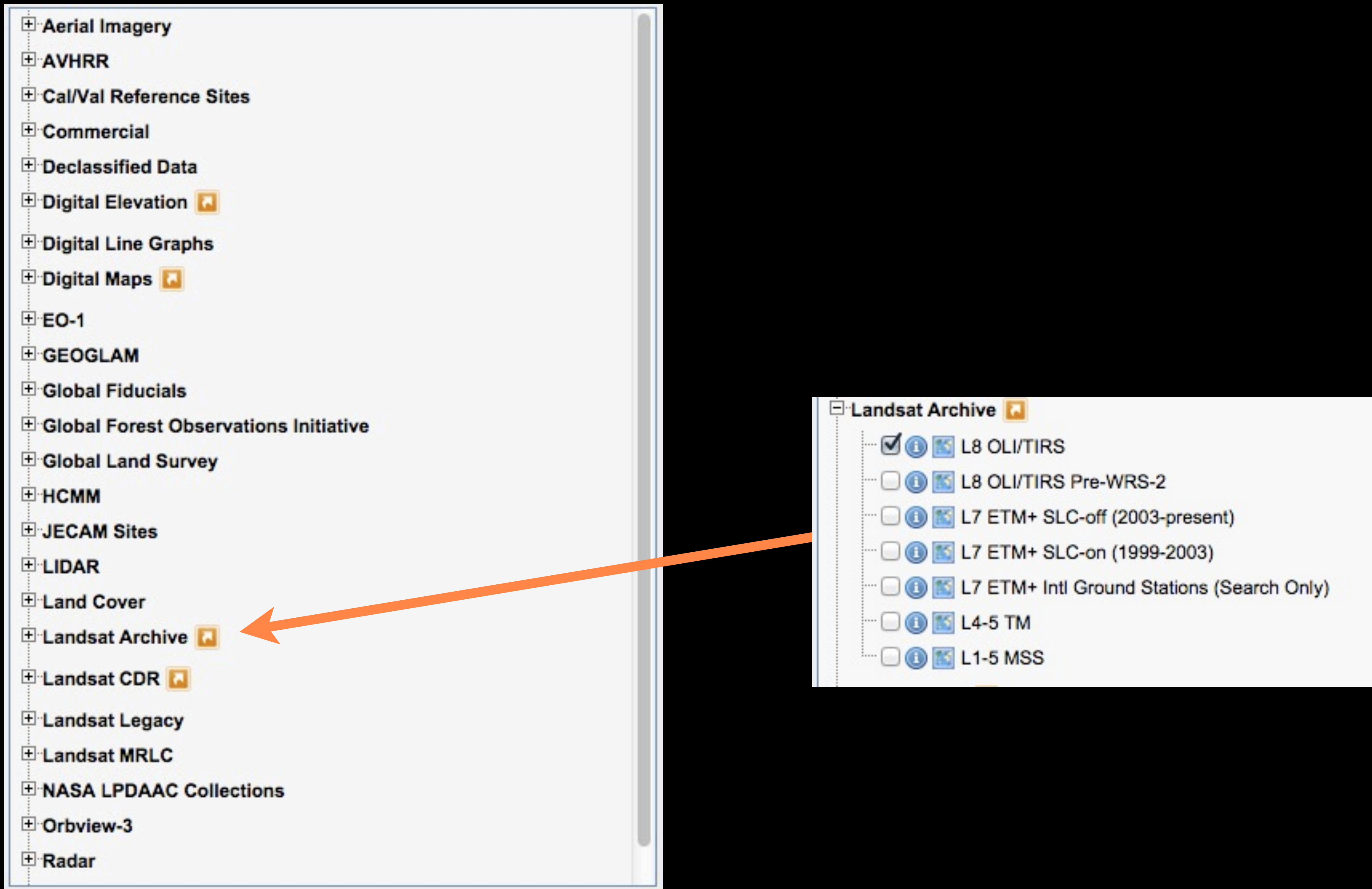
https://github.com/nasa-gibs/gibs-web-examples

EarthExplorer (raw data) *EarthExplorer (datos crudo)*



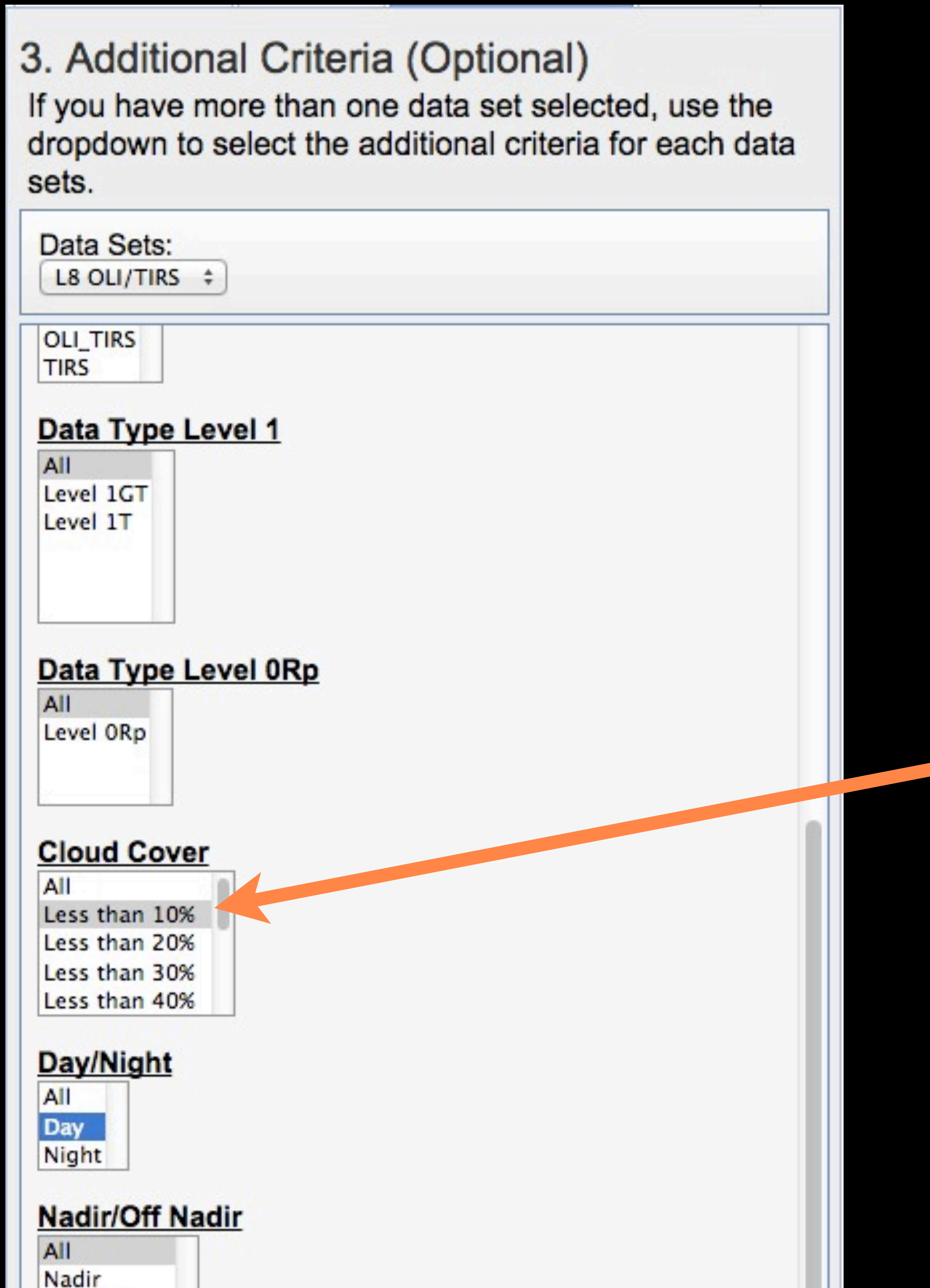
http://earthexplorer.usgs.gov

EarthExplorer

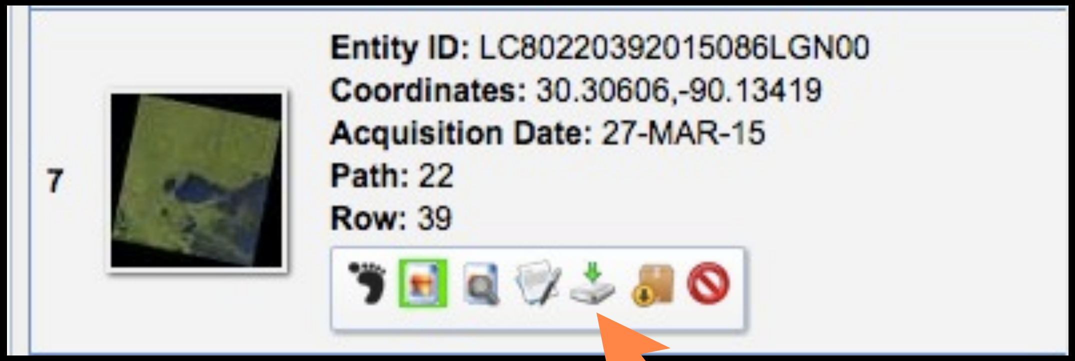


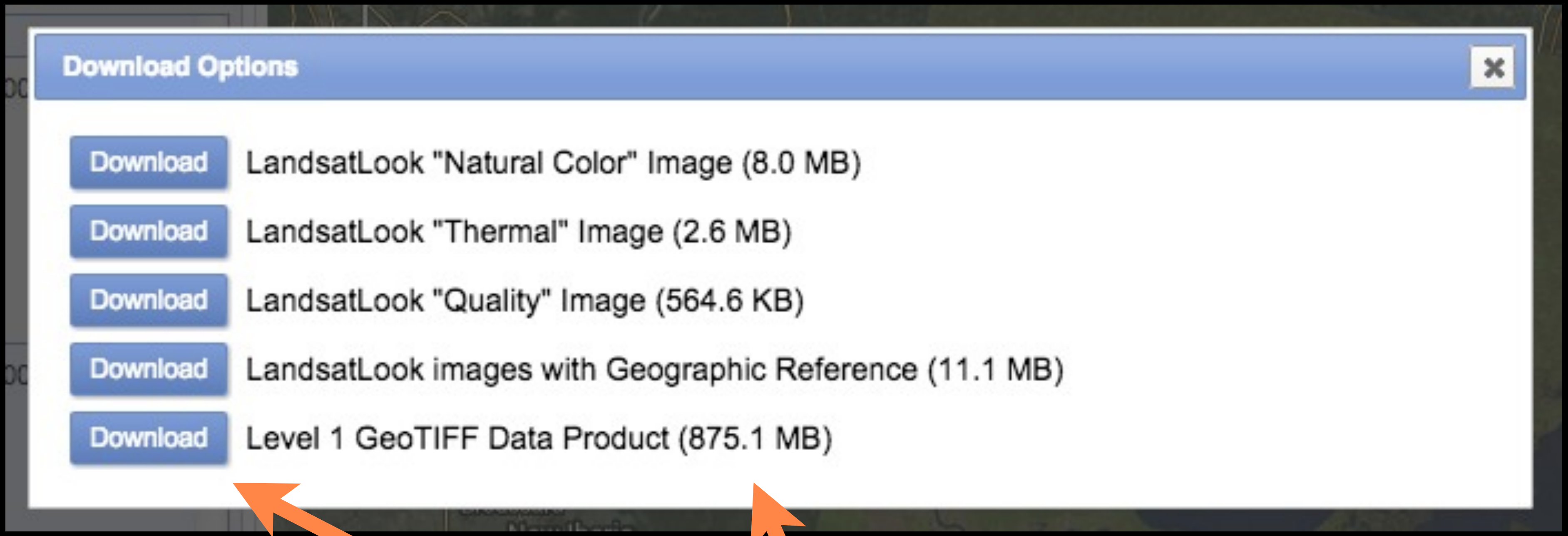
http://earthexplorer.usgs.gov

EarthExplorer

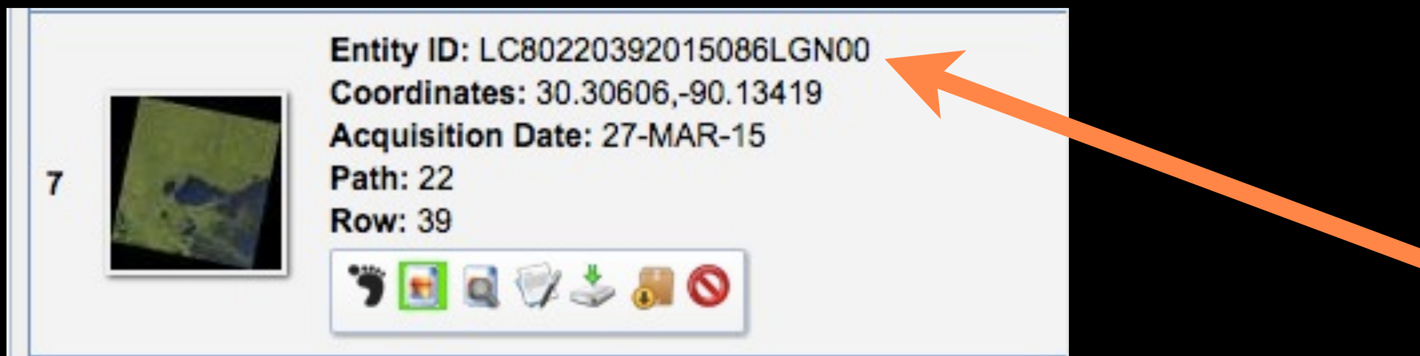


EarthExplorer





Hint! *¡Consejo!*



landsat-util
https://github.com/developmentseed/landsat-util

```
> pip install landsat-util

> landsat download LC80220392015086LGN00
```

Landsat on AWS
http://aws.amazon.com/public-data-sets/landsat/

3. How to process the data *¿Como procesar los datos?*

Two Methods *¿Como procesar los datos?*

1. **Open Source Software + Command Line Tools**
2. **Photoshop**

Landsat 8 scene / bands

File	Band Name	Bandwidth (µm)	Resolution (m)
LC80140322014139LGN00_B1.TIF	Coastal	.43 – 0.45	30
LC80140322014139LGN00_B2.TIF	Blue	0.45 – 0.51	30
LC80140322014139LGN00_B3.TIF	Green	0.53 – 0.59	30
LC80140322014139LGN00_B4.TIF	Red	0.64 – 0.67	30
LC80140322014139LGN00_B5.TIF	NIR	0.85 – 0.88	30
LC80140322014139LGN00_B6.TIF	SWIR 1	1.57 – 1.65	30
LC80140322014139LGN00_B7.TIF	SWIR 2	2.11 – 2.29	30
LC80140322014139LGN00_B8.TIF	Pan	0.50 – 0.68	15
LC80140322014139LGN00_B9.TIF	Cirrus	1.36 – 1.38	30
LC80140322014139LGN00_B10.TIF	TIRS 1	10.6 – 11.19	100
LC80140322014139LGN00_B11.TIF	TIRS 2	11.5 – 12.51	100
LC80140322014139LGN00_BQA.TIF			
LC80140322014139LGN00_MTL.txt	metadata		

GDAL

```
> brew install gdal
> sudo apt-get install gdal-bin
```

Windows: http://trac.osgeo.org/osgeo4w/wiki

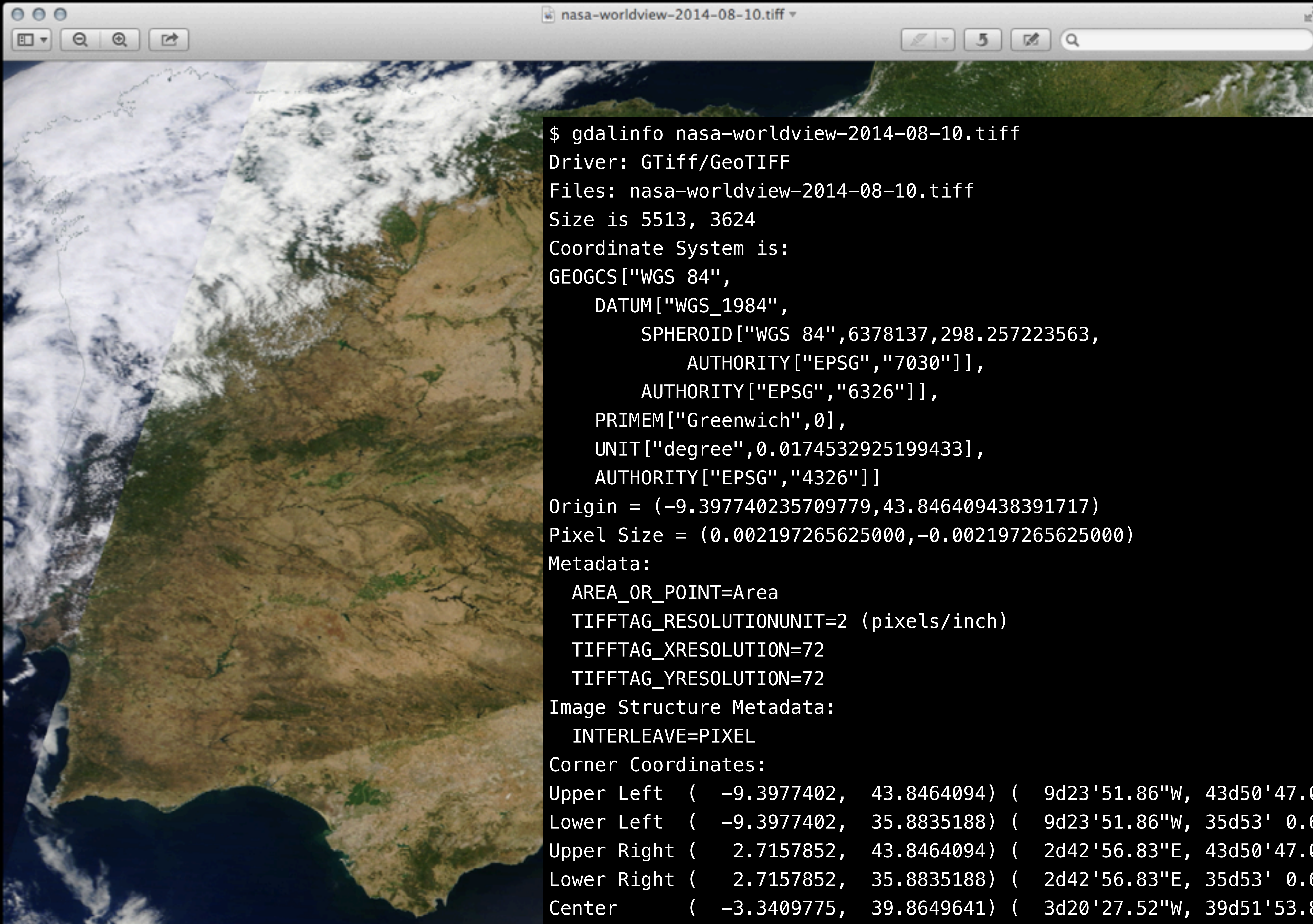
ImageMagick/convert (Photoshop of the command line)

```
> brew install --with-libtiff imagemagick
> sudo apt-get install --with-libtiff imagemagick
```

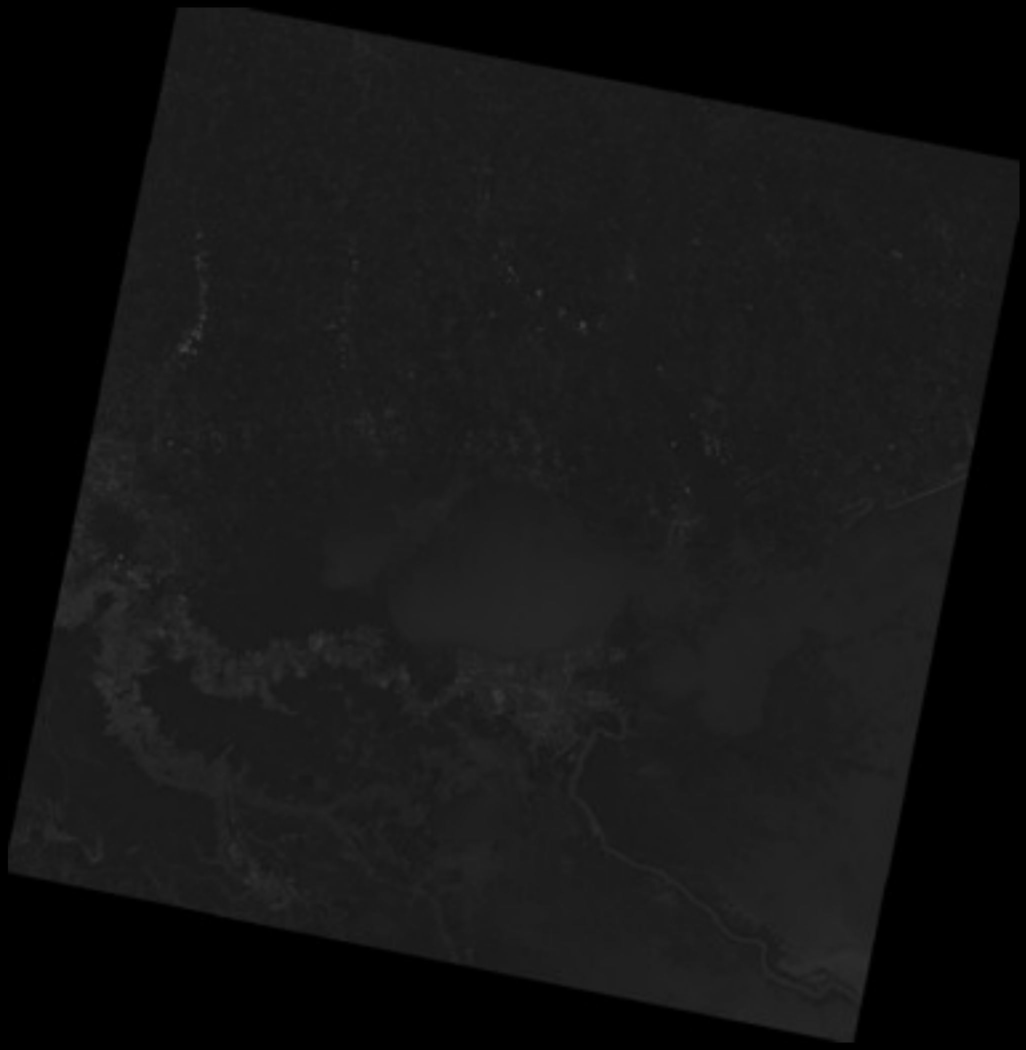
Windows: http://www.imagemagick.org/script/binary-releases.php

```
gdalinfo - report information about a file.
gdal_translate - Copy a raster file, with control of output format.
gdaladdo - Add overviews to a file.
gdalwarp - Warp an image into a new coordinate system.
gdaltindex - Build a MapServer raster tileindex.
gdalbuildvrt - Build a VRT from a list of datasets.
gdal_contour - Contours from DEM.
gdaldem - Tools to analyze and visualize DEMs.
rgb2pct.py - Convert a 24bit RGB image to 8bit paletted.
pct2rgb.py - Convert an 8bit paletted image to 24bit RGB.
gdal_merge.py - Build a quick mosaic from a set of images.
gdal2tiles.py - Create a TMS tile structure, KML and simple web viewer.
gdal_rasterize - Rasterize vectors into raster file.
gdaltransform - Transform coordinates.
nearblack - Convert nearly black/white borders to exact value.
gdal_retile.py - Retiles a set of tiles and/or build tiled pyramid levels.
gdal_grid - Create raster from the scattered data.
gdal_proximity.py - Compute a raster proximity map.
gdal_polygonize.py - Generate polygons from raster.
gdal_sieve.py - Raster Sieve filter.
gdal_fillnodata.py - Interpolate in nodata regions.
gdallocationinfo - Query raster at a location.
gdalsrsinfo - Report a given SRS in different formats. (GDAL >= 1.9.0)
gdalmove.py - Transform the coordinate system of a file (GDAL >= 1.10)
gdal_edit.py - Edit in place various information of an existing GDAL dataset (projection,
geotransform, nodata, metadata)
gdal_calc.py - Command line raster calculator with numpy syntax
gdal-config - Get options required to build software using GDAL.
gdalmanage - Identify, copy, rename and delete raster.
gdalcompare.py - Compare two images and report on differences.
```

http://www.gdal.org/gdal_utilities.html




```
$ gdalinfo nasa-worldview-2014-08-10.tiff
Driver: GTiff/GeoTIFF
Files: nasa-worldview-2014-08-10.tiff
Size is 5513, 3624
Coordinate System is:
GEOGCS["WGS 84",
    DATUM["WGS_1984",
        SPHEROID["WGS 84",6378137,298.257223563,
            AUTHORITY["EPSG","7030"]],
        AUTHORITY["EPSG","6326"]],
    PRIMEM["Greenwich",0],
    UNIT["degree",0.0174532925199433],
    AUTHORITY["EPSG","4326"]]
Origin = (-9.397740235709779,43.846409438391717)
Pixel Size = (0.002197265625000,-0.002197265625000)
Metadata:
  AREA_OR_POINT=Area
  TIFFTAG_RESOLUTIONUNIT=2 (pixels/inch)
  TIFFTAG_XRESOLUTION=72
  TIFFTAG_YRESOLUTION=72
Image Structure Metadata:
  INTERLEAVE=PIXEL
Corner Coordinates:
Upper Left  (  -9.3977402,  43.8464094) (  9d23'51.86"W, 43d50'47.07"N)
Lower Left  (  -9.3977402,  35.8835188) (  9d23'51.86"W, 35d53' 0.67"N)
Upper Right (   2.7157852,  43.8464094) (  2d42'56.83"E, 43d50'47.07"N)
Lower Right (   2.7157852,  35.8835188) (  2d42'56.83"E, 35d53' 0.67"N)
Center      (  -3.3409775,  39.8649641) (  3d20'27.52"W, 39d51'53.87"N)
Band 1 Block=5513x1 Type=Byte, ColorInterp=Red
Band 2 Block=5513x1 Type=Byte, ColorInterp=Green
Band 3 Block=5513x1 Type=Byte, ColorInterp=Blue
```



```
$ gdalinfo LC80220392015086LGN00_B4.TIF
Driver: GTiff/GeoTIFF
Files: LC80220392015086LGN00_B4.TIF
Size is 7541, 7701
Coordinate System is:
PROJCS["WGS 84 / UTM zone 15N",
    GEOGCS["WGS 84",
        DATUM["WGS_1984",
            SPHEROID["WGS 84",6378137,298.257223563,
                AUTHORITY["EPSG","7030"]],
            AUTHORITY["EPSG","6326"]],
        PRIMEM["Greenwich",0],
        UNIT["degree",0.0174532925199433],
        AUTHORITY["EPSG","4326"]],
    PROJECTION["Transverse_Mercator"],
    PARAMETER["latitude_of_origin",0],
    PARAMETER["central_meridian",-93],
    PARAMETER["scale_factor",0.9996],
    PARAMETER["false_easting",500000],
    PARAMETER["false_northing",0],
    UNIT["metre",1,
        AUTHORITY["EPSG","9001"]],
    AUTHORITY["EPSG","32615"]]
Origin = (662385.000000000000000,3471015.000000000000000)
Pixel Size = (30.000000000000000,-30.000000000000000)
Metadata:
  AREA_OR_POINT=Point
Image Structure Metadata:
  INTERLEAVE=BAND
Corner Coordinates:
Upper Left  (  662385.000, 3471015.000) ( 91d17'33.56"W, 31d21'44.30"N)
Lower Left  (  662385.000, 3239985.000) ( 91d19'42.34"W, 29d16'42.10"N)
Upper Right (  888615.000, 3471015.000) ( 88d55' 3.62"W, 31d18'31.28"N)
Lower Right (  888615.000, 3239985.000) ( 89d 0'10.70"W, 29d13'44.46"N)
Center      (  775500.000, 3355500.000) ( 90d 8' 7.67"W, 30d17'59.84"N)
Band 1 Block=7541x1 Type=UInt16, ColorInterp=Gray
```

Let's use GDAL tools to combine band files to make our satellite map.

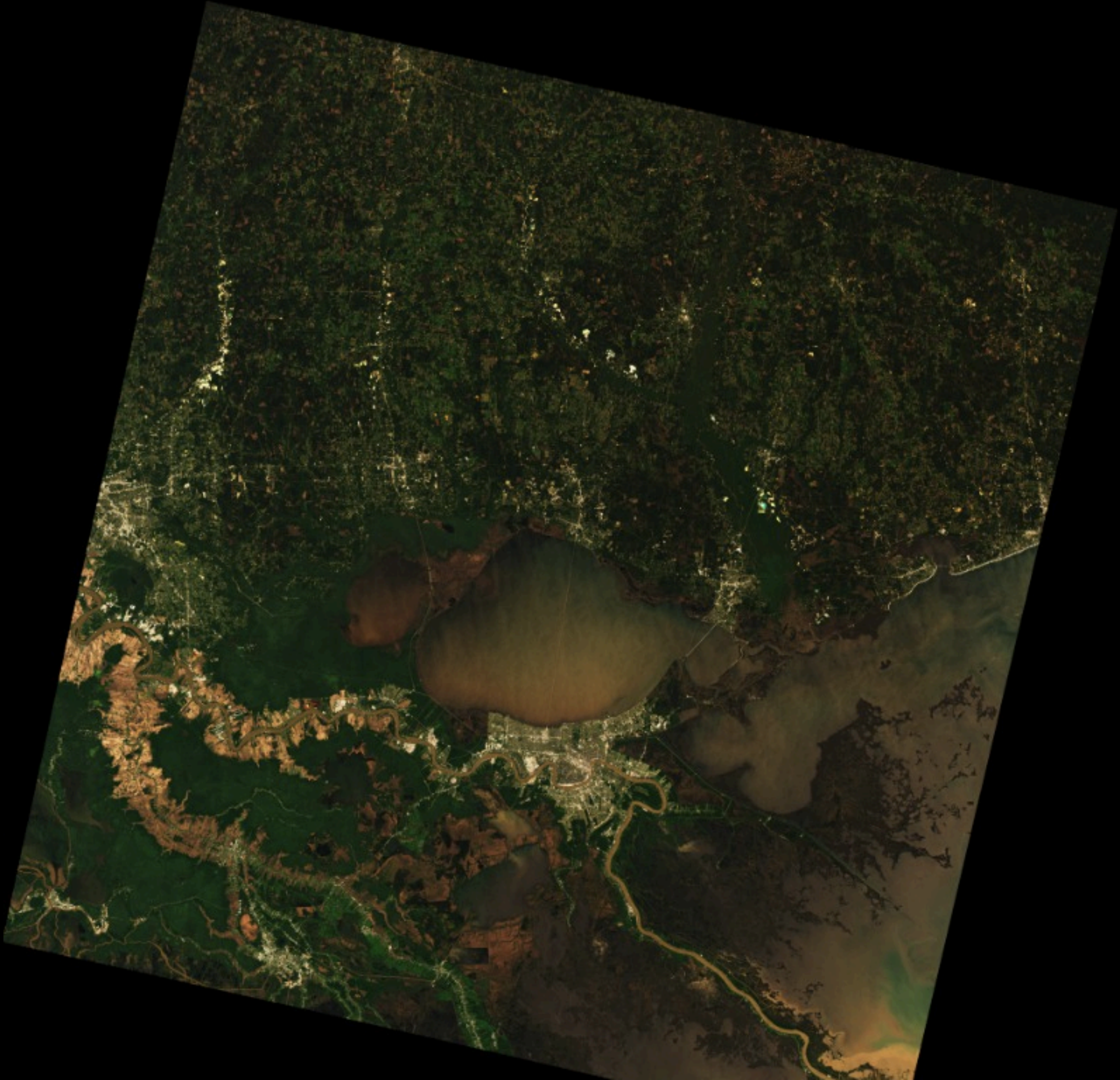
Usamos instrumentos GDAL para combinar bandas y hacer una mapa satélite

1. Reproject to 3857 *Reproyectar a 3857*

```
> for band in {4,3,2}
do
gdalwarp -t_srs EPSG:3857 LC80220392015086LGN00_B$band.TIF
LC80220392015086LGN00_B$band-projected.tif
done
```

2. Combine & Adjust *Combinar y Ajustar*

```
> convert -combine LC80220392015086LGN00_B{4,3,2}-projected.tif
LC80220392015086LGN00_RGB-projected.tif

> convert -channel B -gamma 0.925 -channel R -gamma 1.03 -channel
RGB -sigmoidal-contrast 50x16% LC80220392015086LGN00_RGB-
projected.tif LC80220392015086LGN00_RGB-projected-corrected.tif

> convert -depth 8 LC80220392015086LGN00_RGB-projected-corrected.tif
LC80220392015086LGN00_RGB-projected-corrected-8bit.tif
```

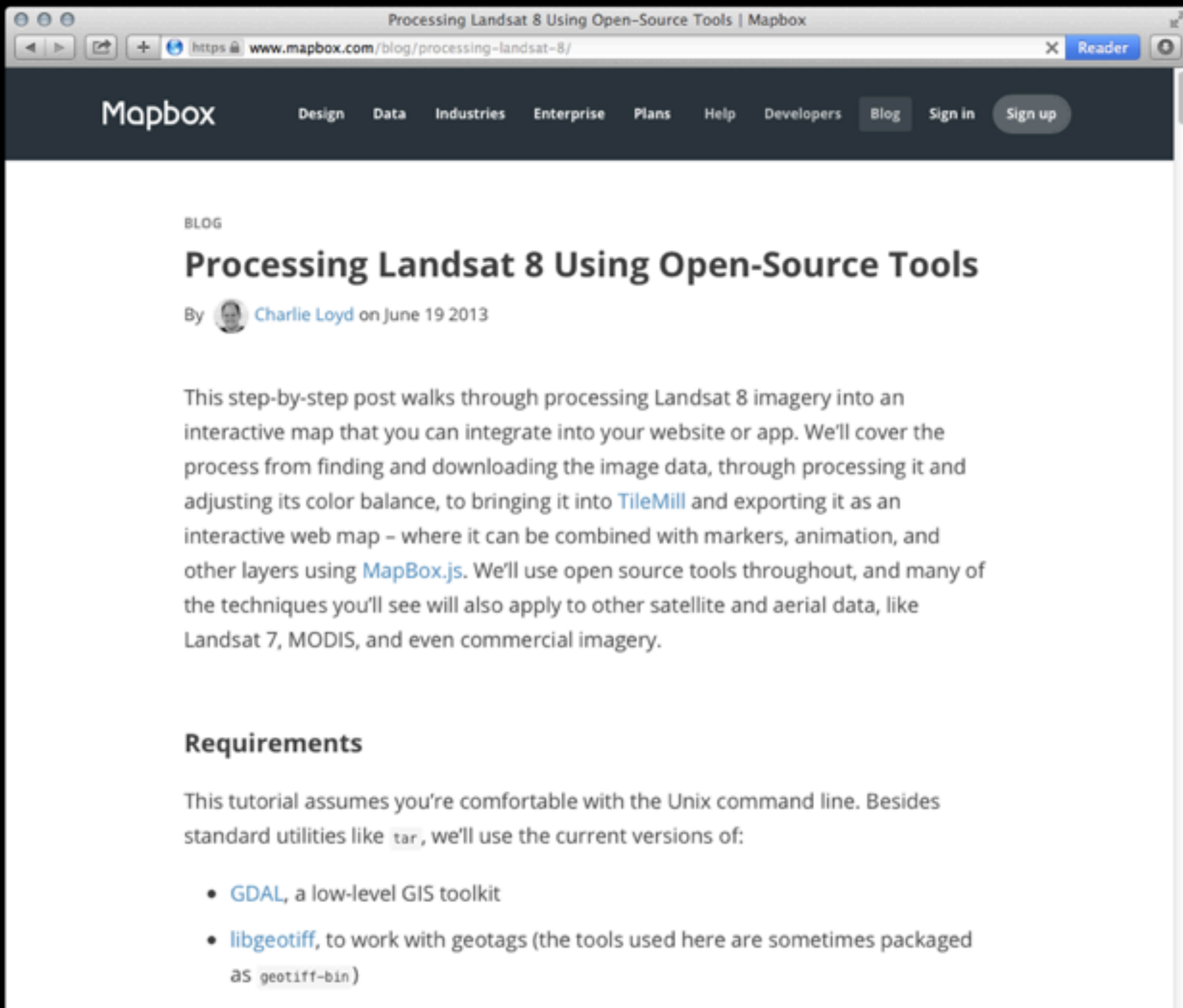


3. Rescue geo headers *Rescatar "geo headers"*

```
> listgeo -tfw LC80220392015086LGN00_B4-projected.tif

> mv LC80220392015086LGN00_B4-projected.tfw
LC80220392015086LGN00_RGB-projected-corrected-8bit.tfw

> gdal_edit.py -a_srs EPSG:3857 LC80220392015086LGN00_RGB-projected-
corrected-8bit.tif

> gdal_translate -a_nodata 0 LC80220392015086LGN00_RGB-projected-
corrected-8bit.tif LC80220392015086LGN00_RGB-projected-
corrected-8bit-nodata.tif
```

What we just did *Lo que acabamos de hacer*

https://www.mapbox.com/blog/processing-landsat-8/



Processing Landsat 8 Using Open-Source Tools | Mapbox

https www.mapbox.com/blog/processing-landsat-8/

Mapbox Design Data Industries Enterprise Plans Help Developers Blog Sign in Sign up

BLOG

Processing Landsat 8 Using Open-Source Tools

By Charlie Loyd on June 19 2013

This step-by-step post walks through processing Landsat 8 imagery into an interactive map that you can integrate into your website or app. We'll cover the process from finding and downloading the image data, through processing it and adjusting its color balance, to bringing it into TileMill and exporting it as an interactive web map – where it can be combined with markers, animation, and other layers using MapBox.js. We'll use open source tools throughout, and many of the techniques you'll see will also apply to other satellite and aerial data, like Landsat 7, MODIS, and even commercial imagery.

Requirements

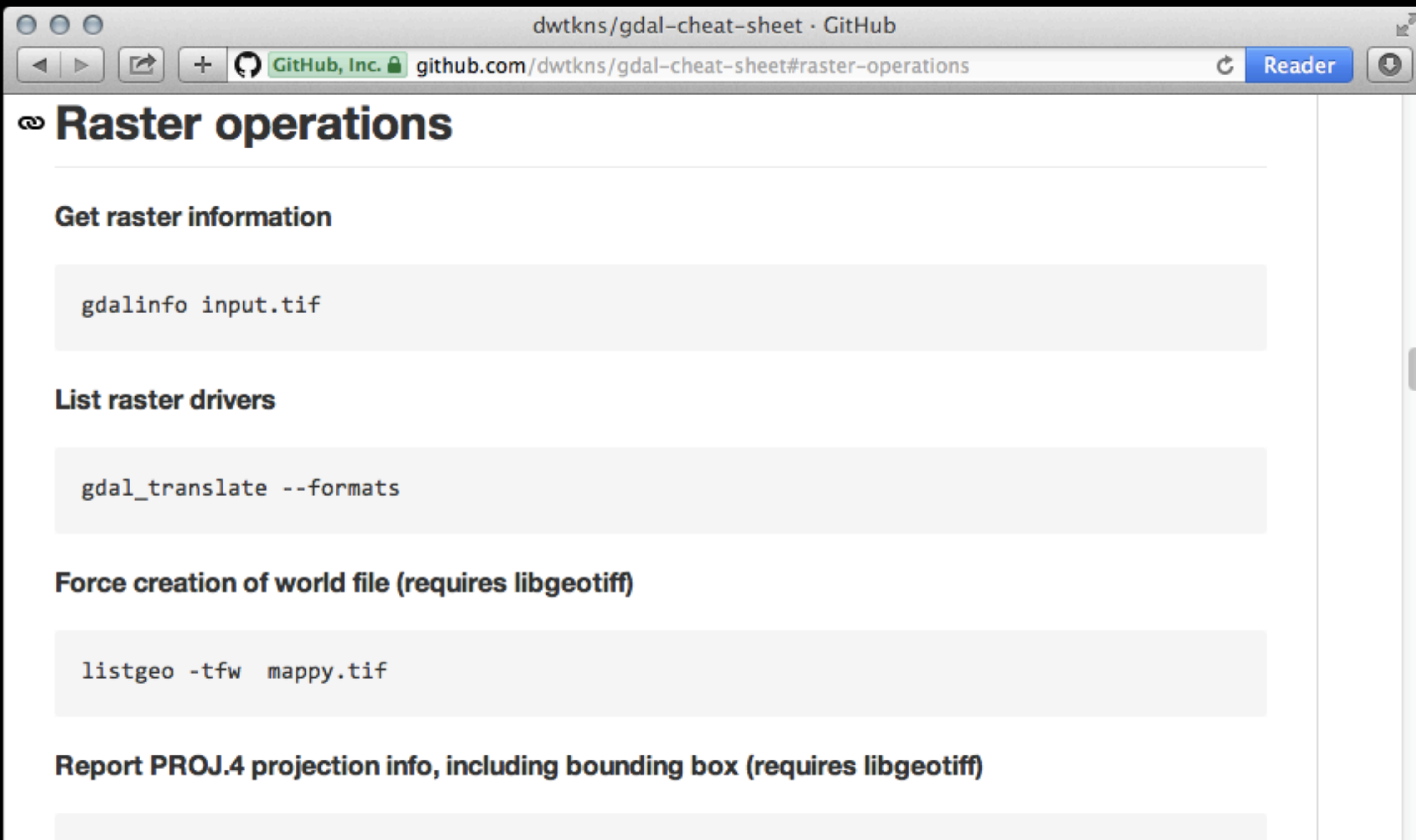
This tutorial assumes you're comfortable with the Unix command line. Besides standard utilities like `tar`, we'll use the current versions of:

- GDAL, a low-level GIS toolkit
- libgeotiff, to work with geotags (the tools used here are sometimes packaged as `geotiff-bin`)

Derek Watkins' GDAL cheat sheet

Consejos 'GDAL' de Derek Watkins

https://github.com/dwtkns/gdal-cheat-sheet#raster-operations

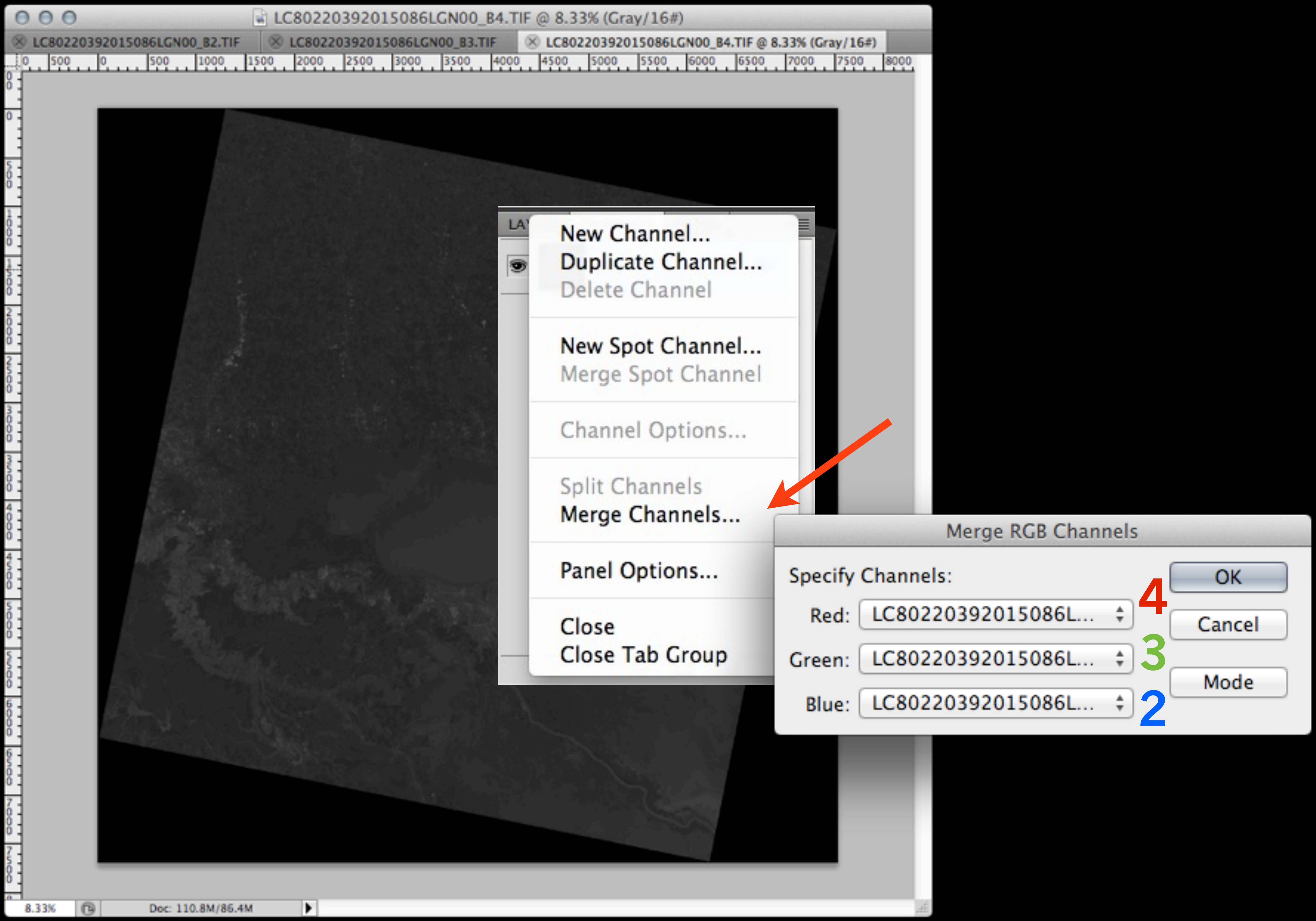


Or, with landsat-util

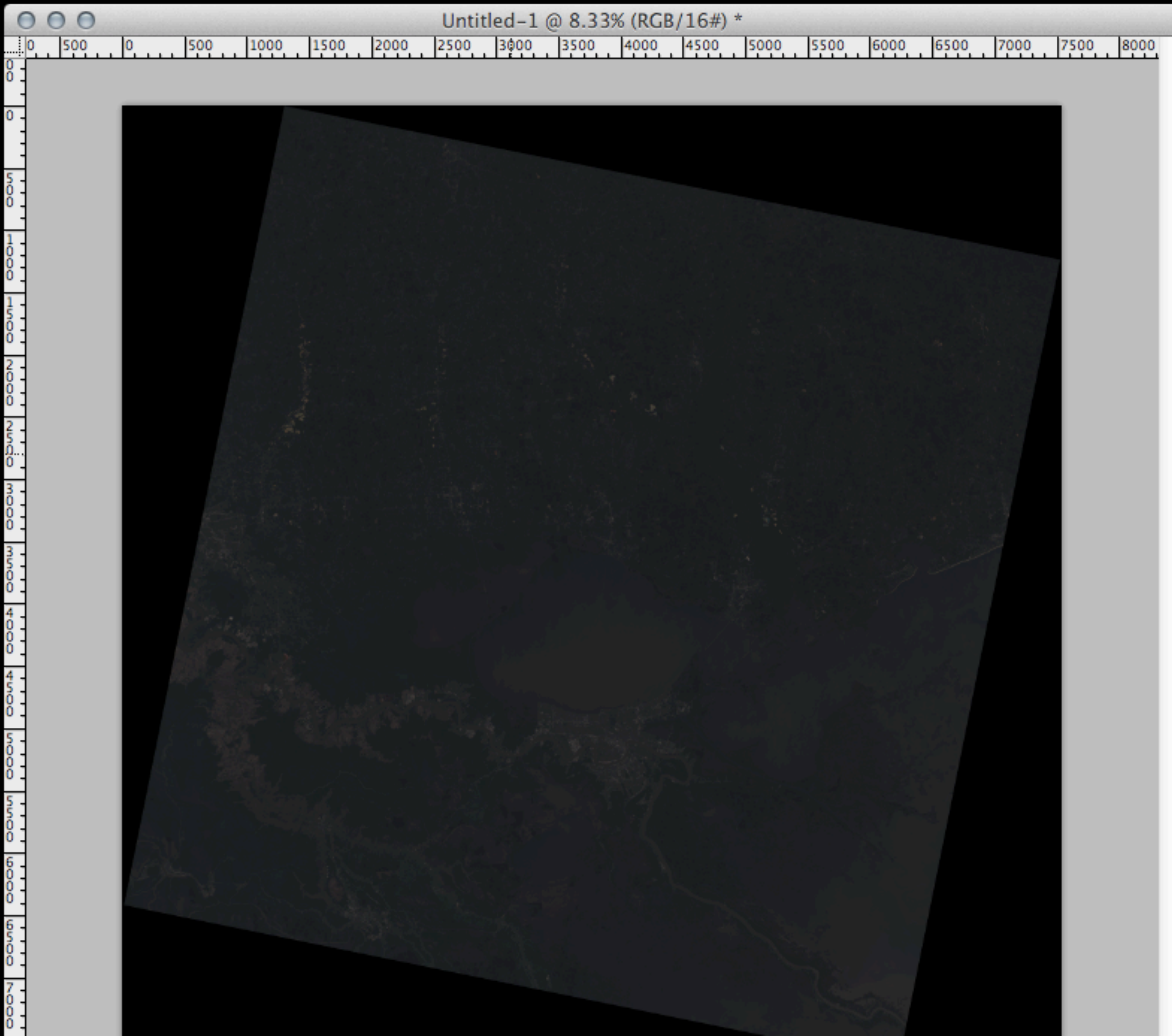
Con 'landsat-util'

```
> landsat process LC80220392015086LGN00
```

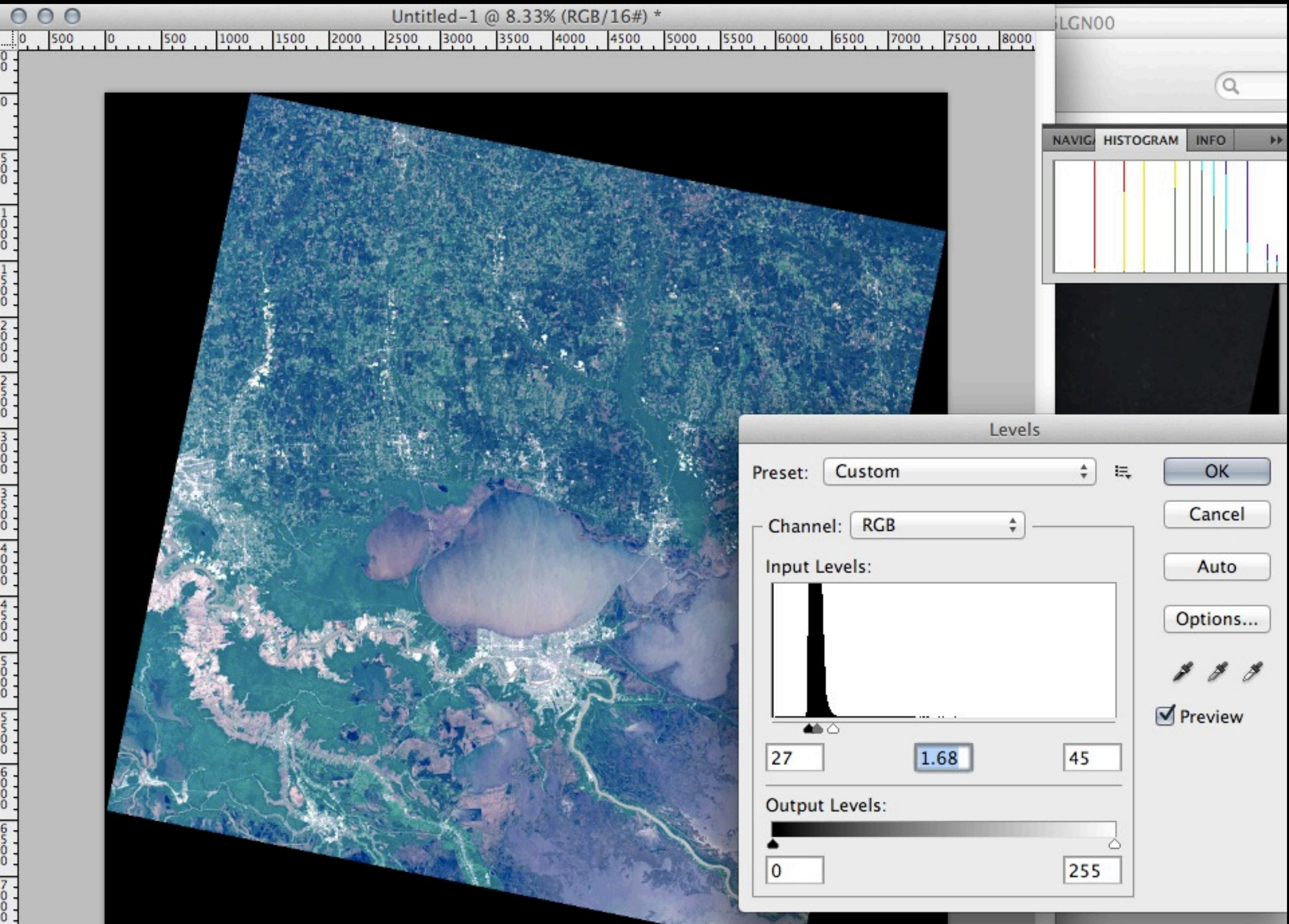
Or, with Photoshop *Con "Photoshop"*



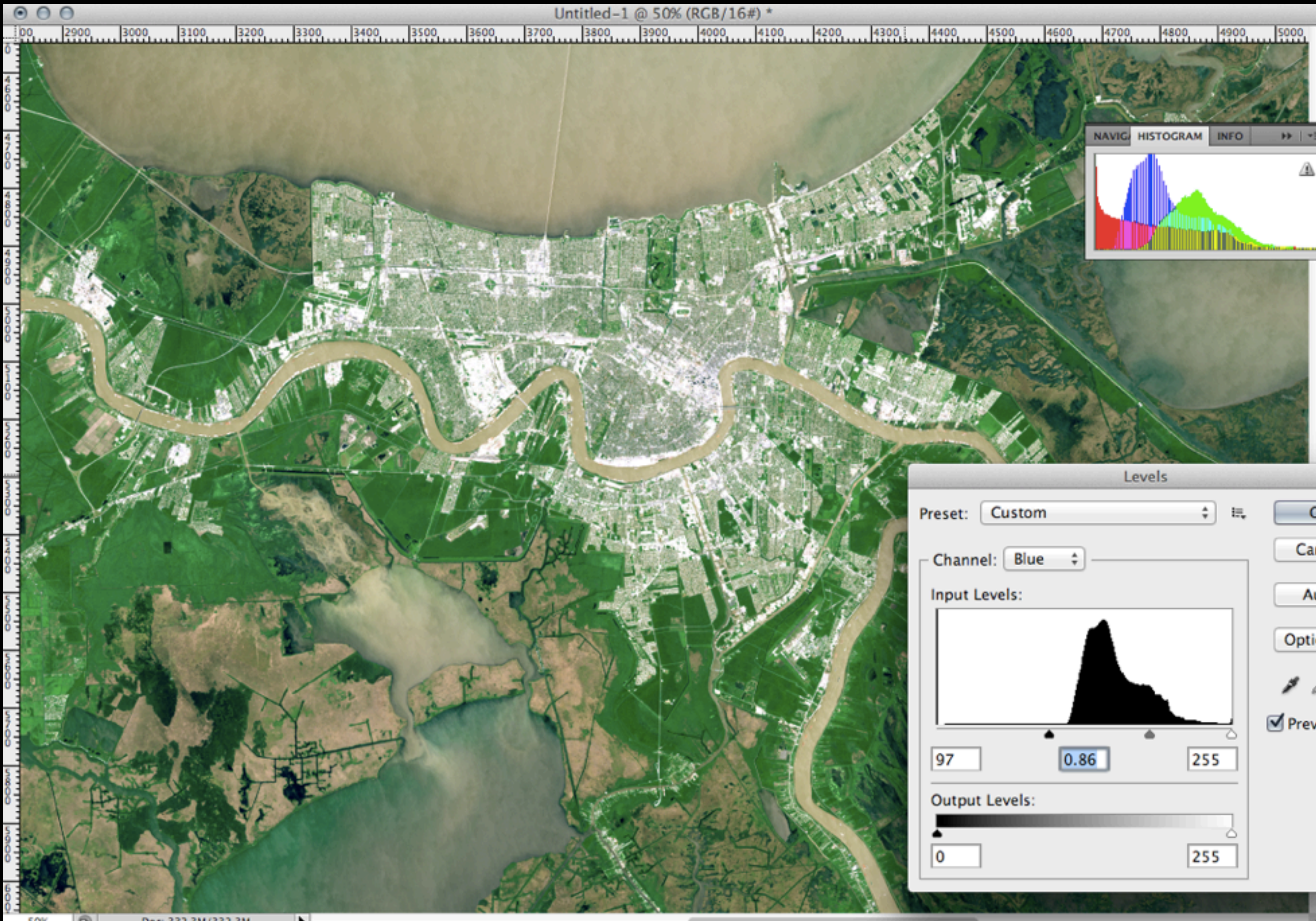
Or, with Photoshop *Con "Photoshop"*



Or, with Photoshop *Con "Photoshop"*



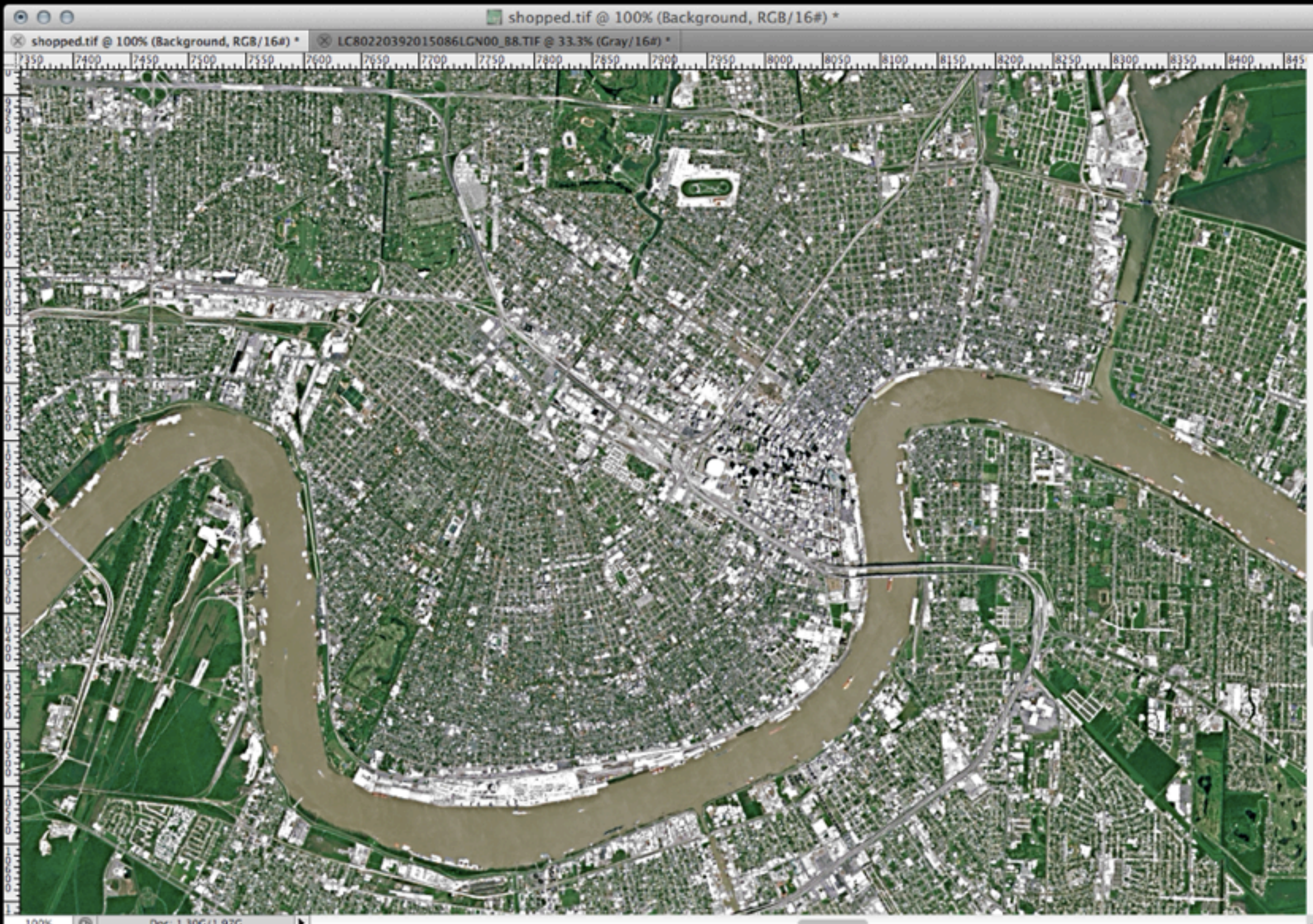
Or, with Photoshop *Con "Photoshop"*



Or, with Photoshop *Con "Photoshop"*

Pansharpening: 15m resolution with Landsat using band 8

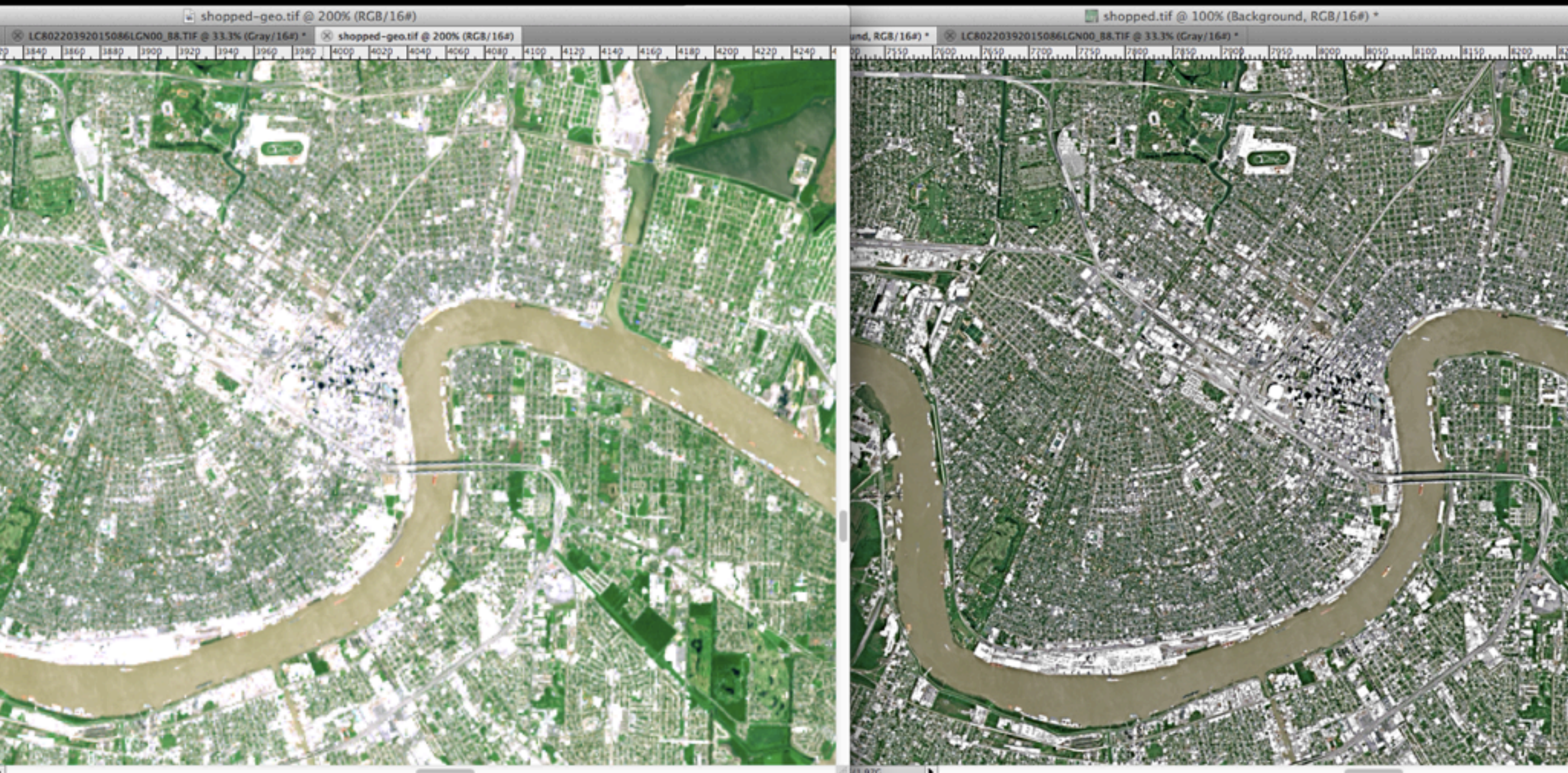
"Pansharpening": Resolución 15m con Landsat banda 8



http://www.shadedrelief.com/landsat8/landsat8panchrom.html

Pansharpening: 15m resolution with Landsat using band 8

"Pansharpening": Resolución 15m con Landsat banda 8



http://www.shadedrelief.com/landsat8/landsat8panchrom.html

Save the geodata! *Rescatar datos geográficos*

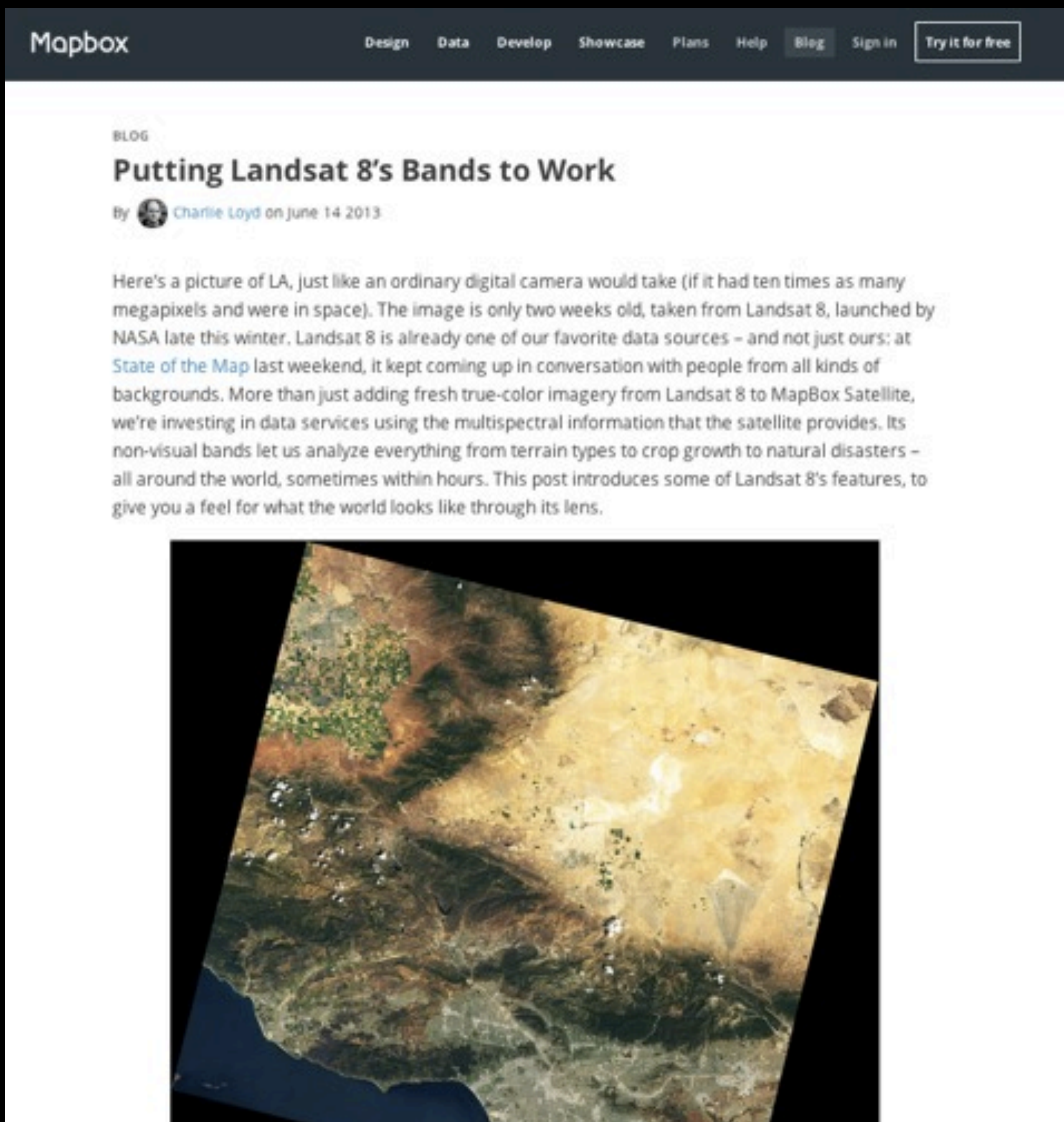
```
> listgeo -no_norm LC80220392015086LGN00_B4.TIF > shopped.geo

> geotifcp -g shopped.geo shopped.tif shopped-geo.tif
```

```
$ gdalinfo shopped-geo.tif
Driver: GTiff/GeoTIFF
Files: shopped-geo.tif
Size is 7541, 7701
Coordinate System is:
PROJCS["WGS 84 / UTM zone 15N",
    GEOGCS["WGS 84",
        DATUM["WGS_1984",
            SPHEROID["WGS 84",6378137,298.257223563,
                AUTHORITY["EPSG","7030"]],
            AUTHORITY["EPSG","6326"]],
        PRIMEM["Greenwich",0],
        UNIT["degree",0.0174532925199433],
        AUTHORITY["EPSG","4326"]],
    PROJECTION["Transverse_Mercator"],
    PARAMETER["latitude_of_origin",0],
    PARAMETER["central_meridian",-93],
    PARAMETER["scale_factor",0.9996],
    PARAMETER["false_easting",500000],
    PARAMETER["false_northing",0],
    UNIT["metre",1,
        AUTHORITY["EPSG","9001"]],
    AUTHORITY["EPSG","32615"]]
Origin = (662385.000000000000000,3471015.000000000000000)
Pixel Size = (30.000000000000000,-30.000000000000000)
Metadata:
```

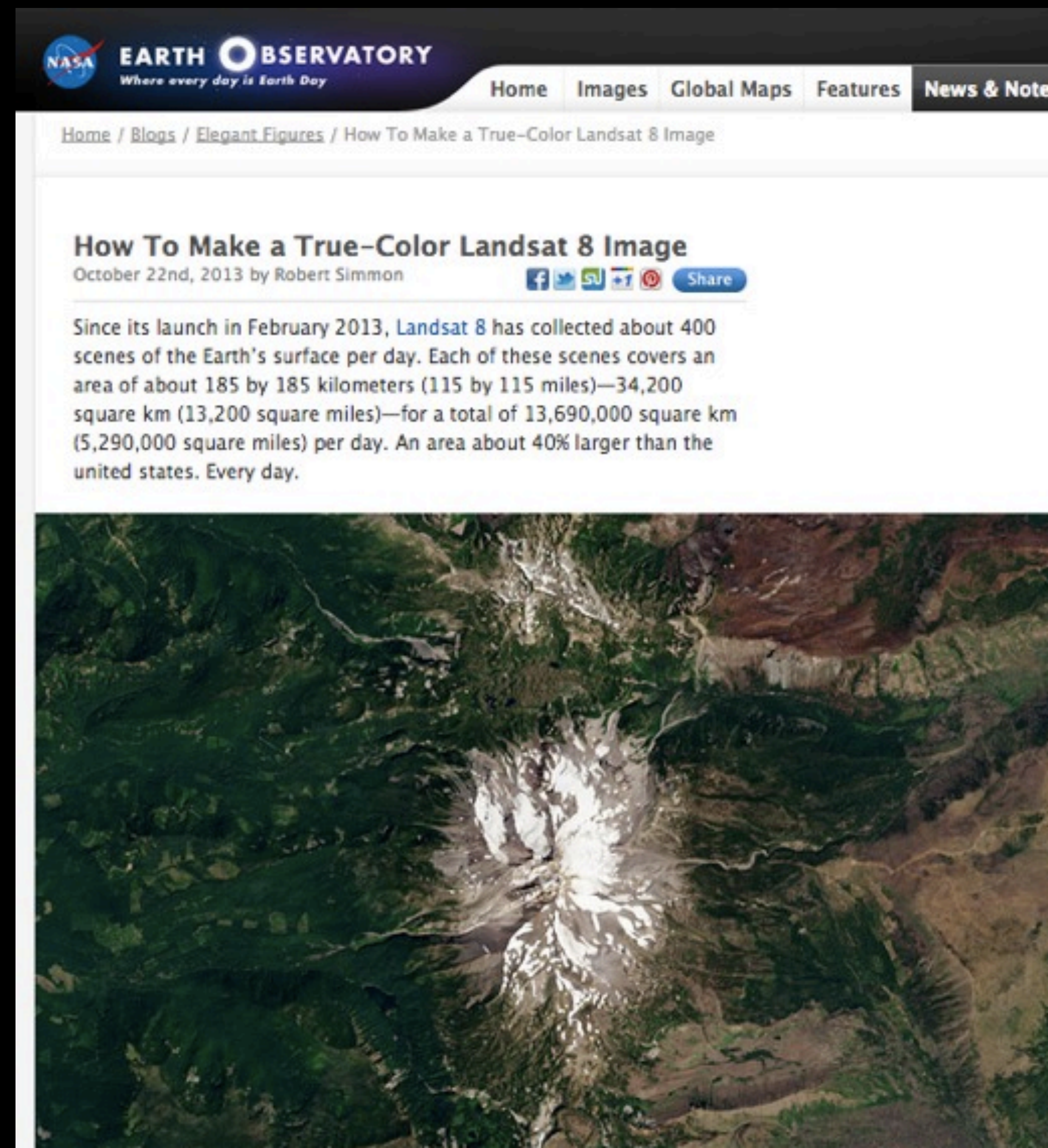
Or, use Geographic Imager ($700)

More *Más*

http://j.mp/mapbox-landsat8



http://j.mp/eo-truecolor



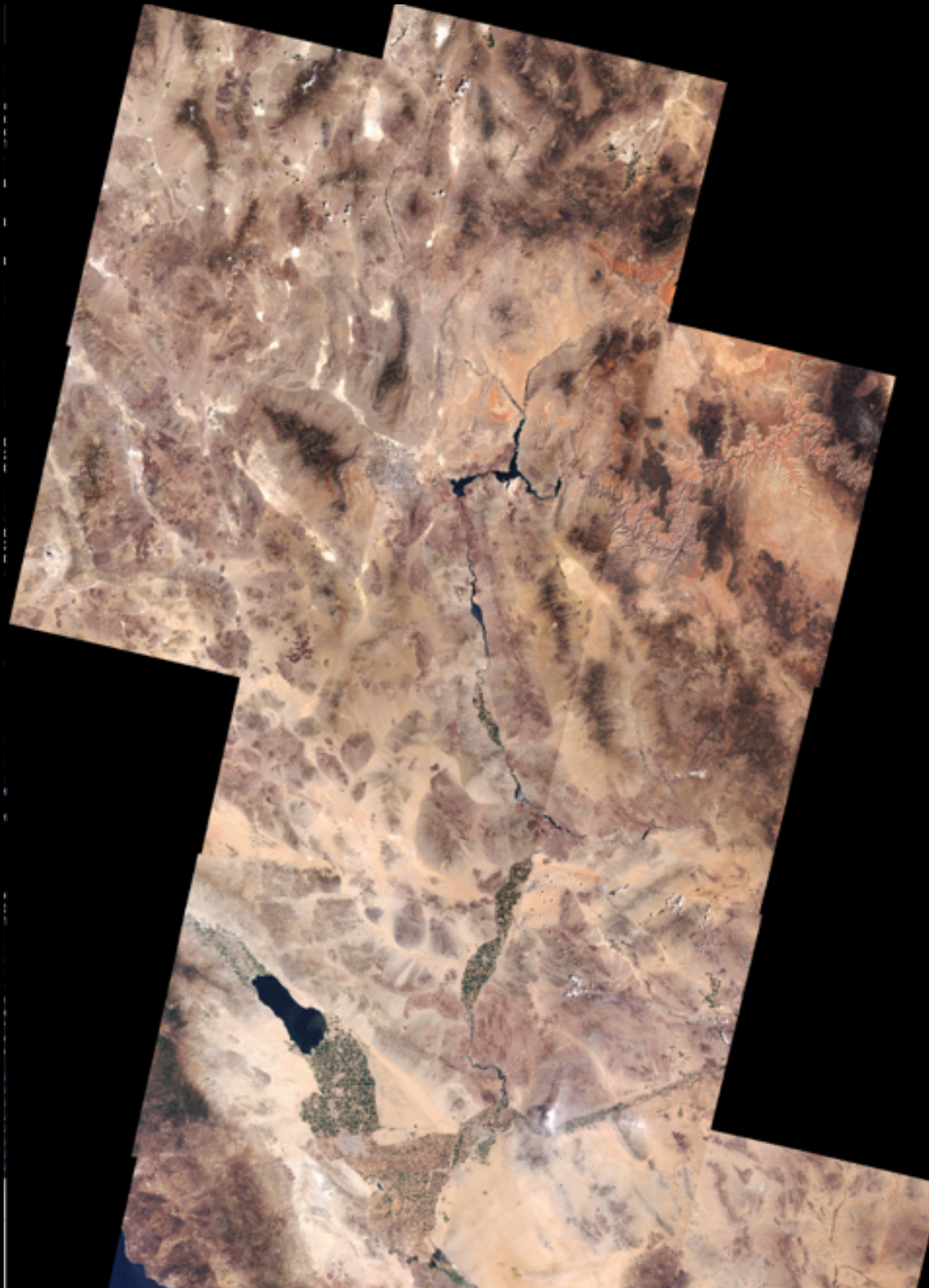
More *Más*

Make your own queryable landsat scene dataset!

Hacer su propio base de datos de escenas “Landsat”

http://j.mp/landsatdb

```
LandsatDB.query("
 select
  sceneid
 from
  landsat8
 where sensor = 'OLI_TIRS'
  and cloudcoverfull < 5
  and dayornight = 'DAY'
  and sunelevation > 30
  and cloudcoverfull < 60
  and st_intersects(
   st_makeenvelope(#{bb[1]}, #{bb[0]}, #{bb[3]}, #{bb[2]}, 4326),
the_geom)")
```



More *Más*

schooner-tk
https://github.com/propublica/schooner-tk

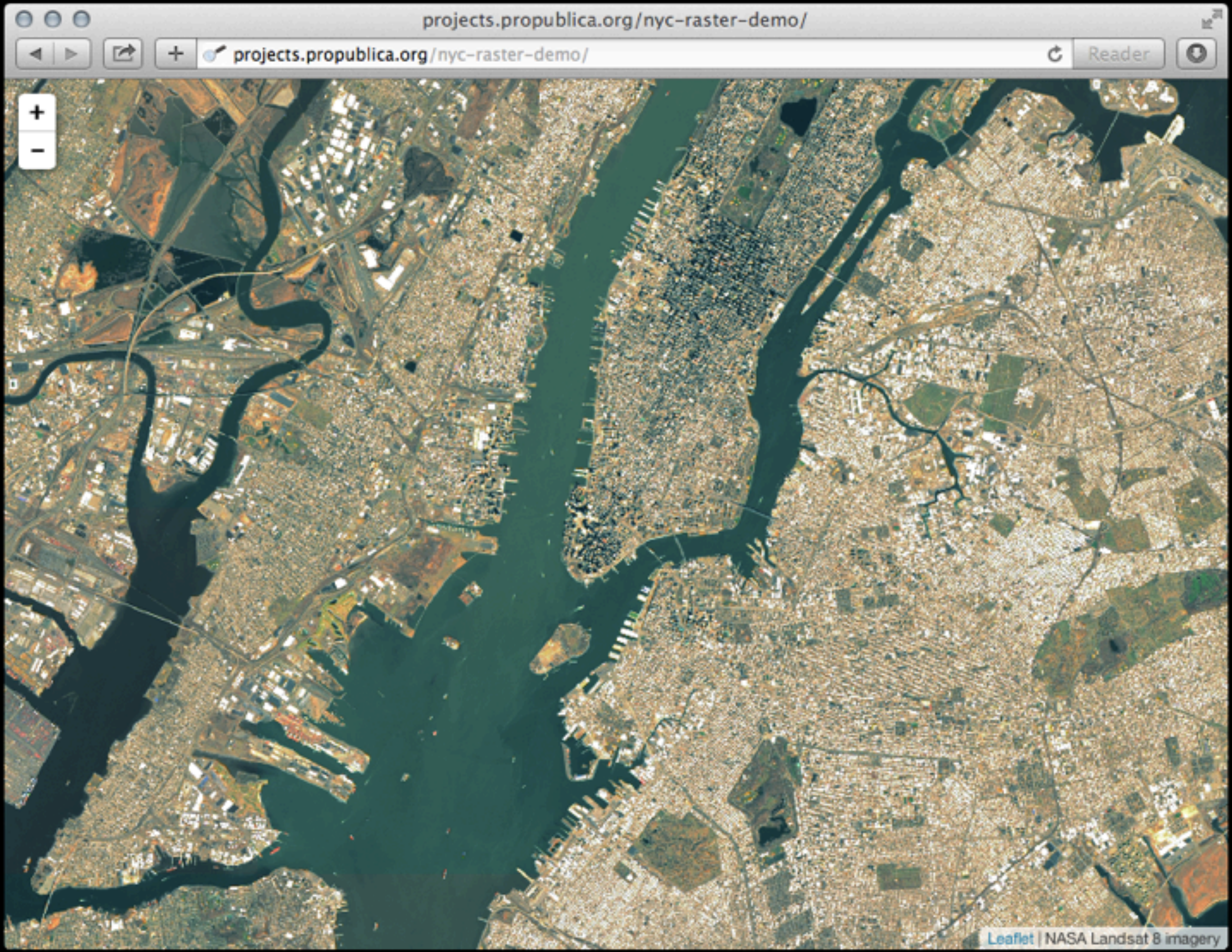
schooner-blend
schooner-cloud
schooner-contrast
schooner-multibalance
schooner-stitch

Using the data *Usar los datos*

Mapbox

https://www.mapbox.com/blog/one-step-raster-imagery-mapboxcom/

SimpleTiles (ProPublica)



http://www.propublica.org/nerds/item/announcing-raster-support-for-simple-tiles

4. Telling stories from space *Decir historias desde el espacio*

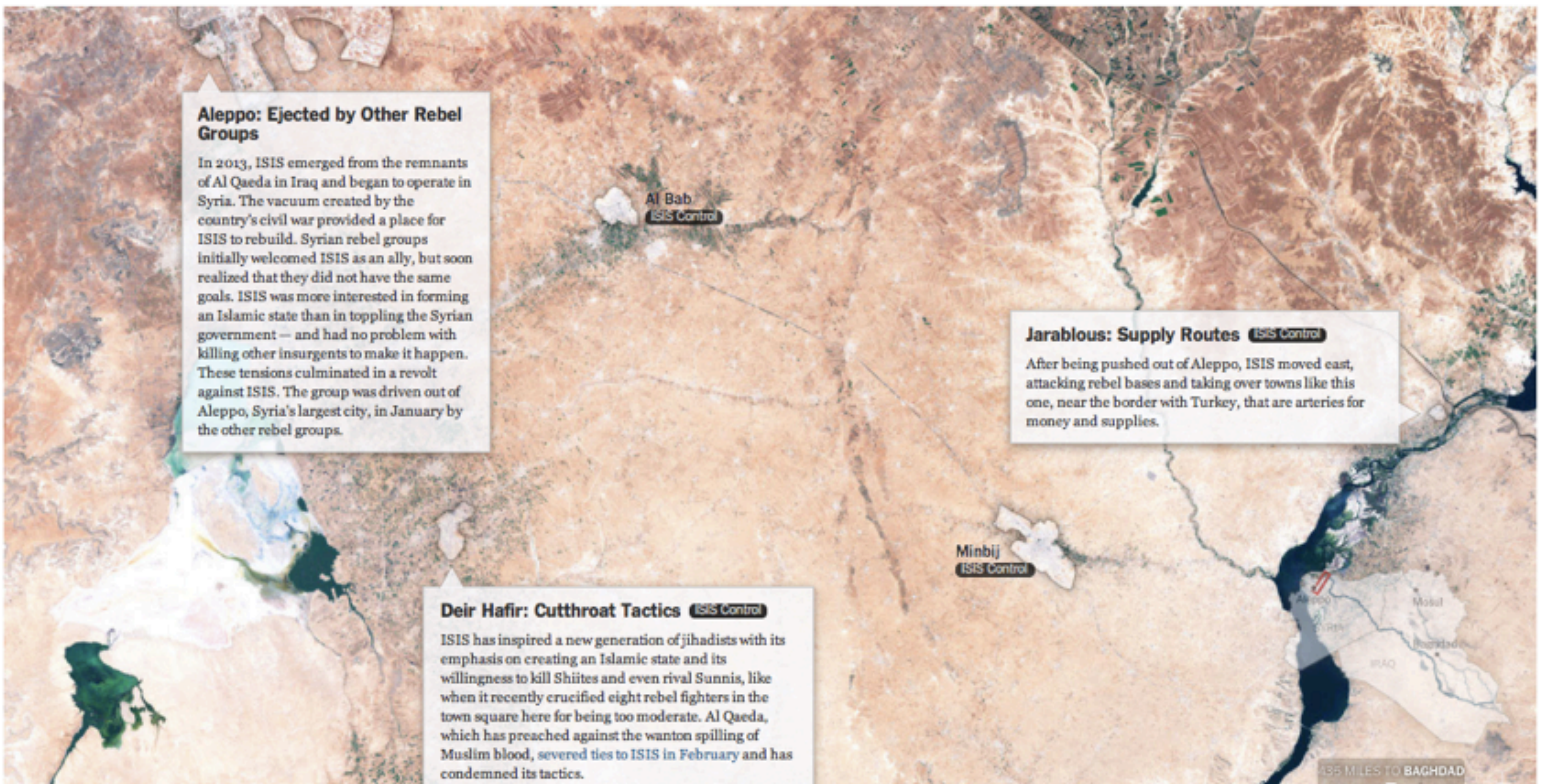
A Rogue State Along Two Rivers

How ISIS Came to Control Large Portions of Syria and Iraq

By JEREMY ASHKENAS, ARCHIE TSE, DEREK WATKINS and KAREN YOURISH July 3, 2014

The militant group called the Islamic State in Iraq and Syria, or ISIS, seemed to surprise many American and Iraqi officials with the recent gains it made in its violent campaign to create a new religious state. But the rapid-fire victories achieved over a few weeks in June were built on months of maneuvering along the Tigris and Euphrates Rivers.

The Euphrates



Assessing the Damage and Destruction in Gaza - NYTimes.com

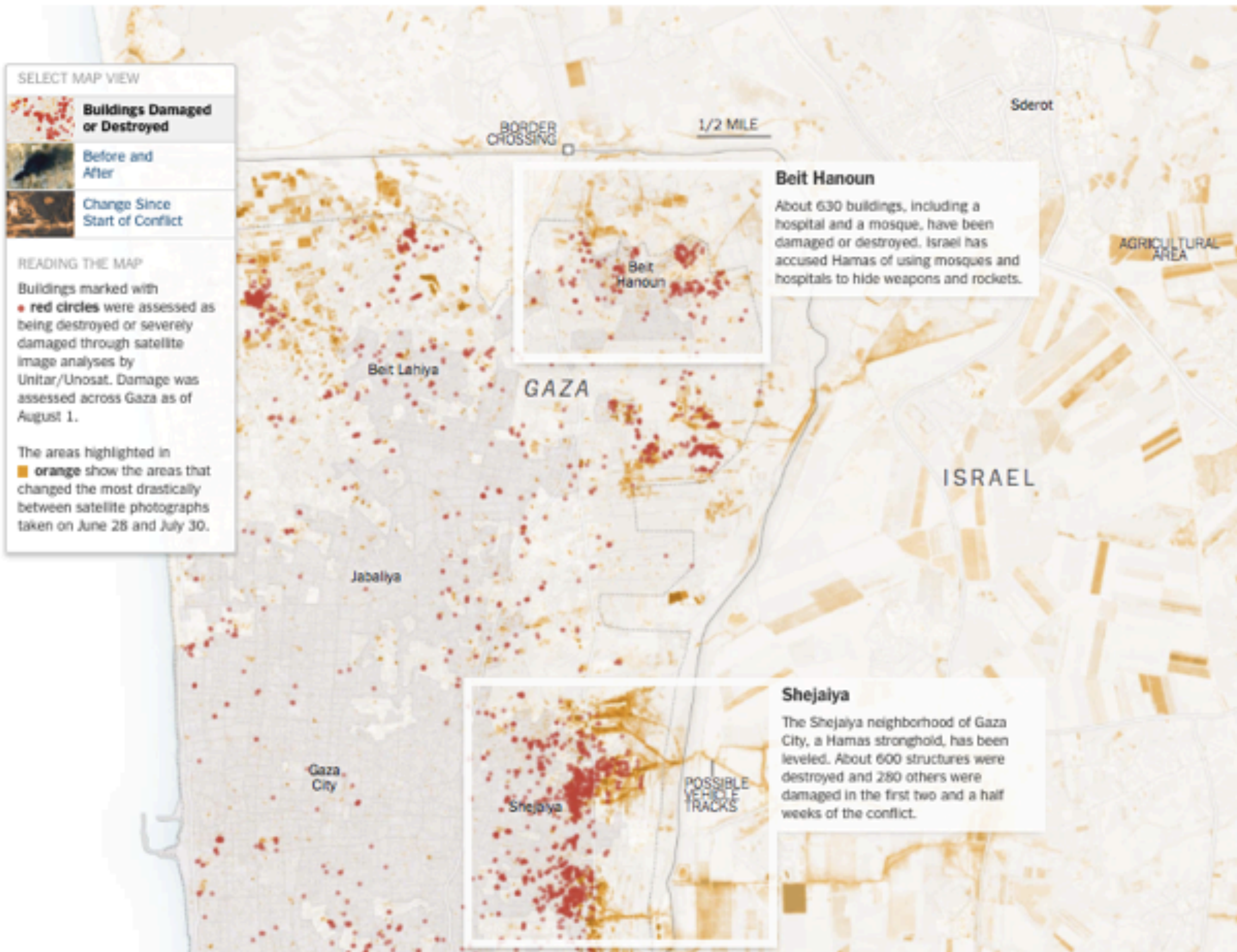
www.nytimes.com/interactive/2014/08/03/world/middleeast/assessing-the-damage-and-destruction-in-gaza.html

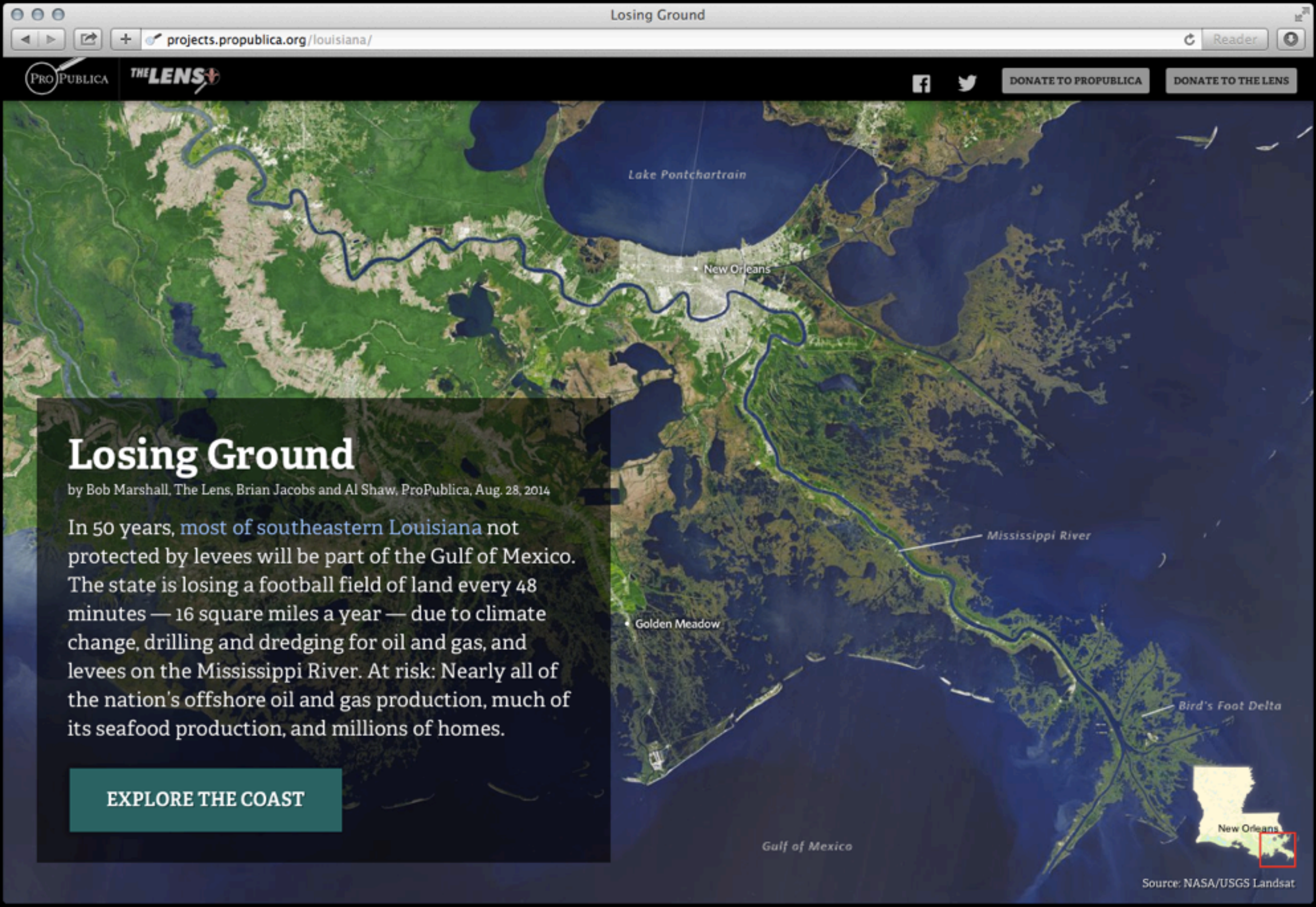
MIDDLE EAST

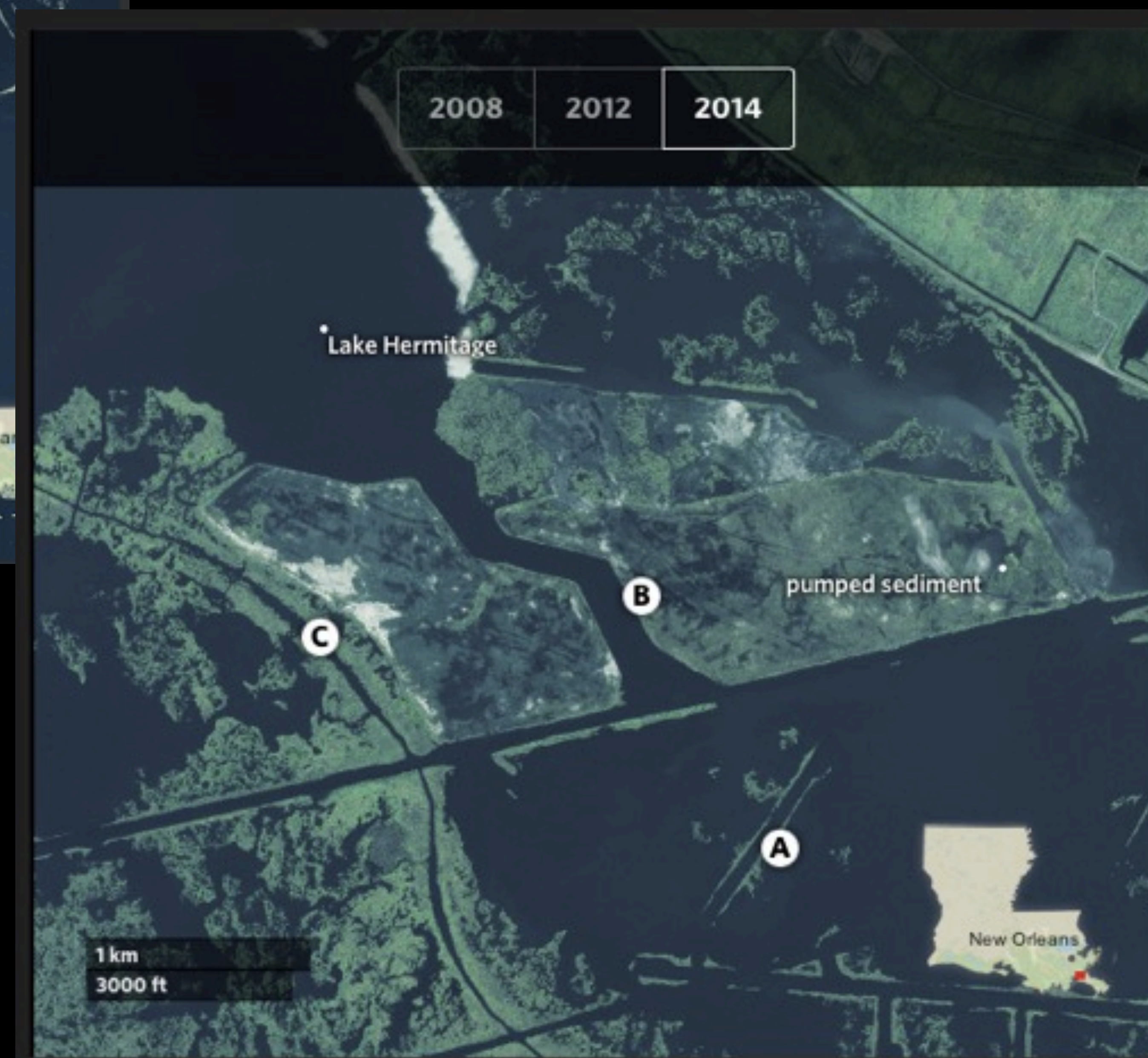
SHARE

Assessing the Damage and Destruction in Gaza

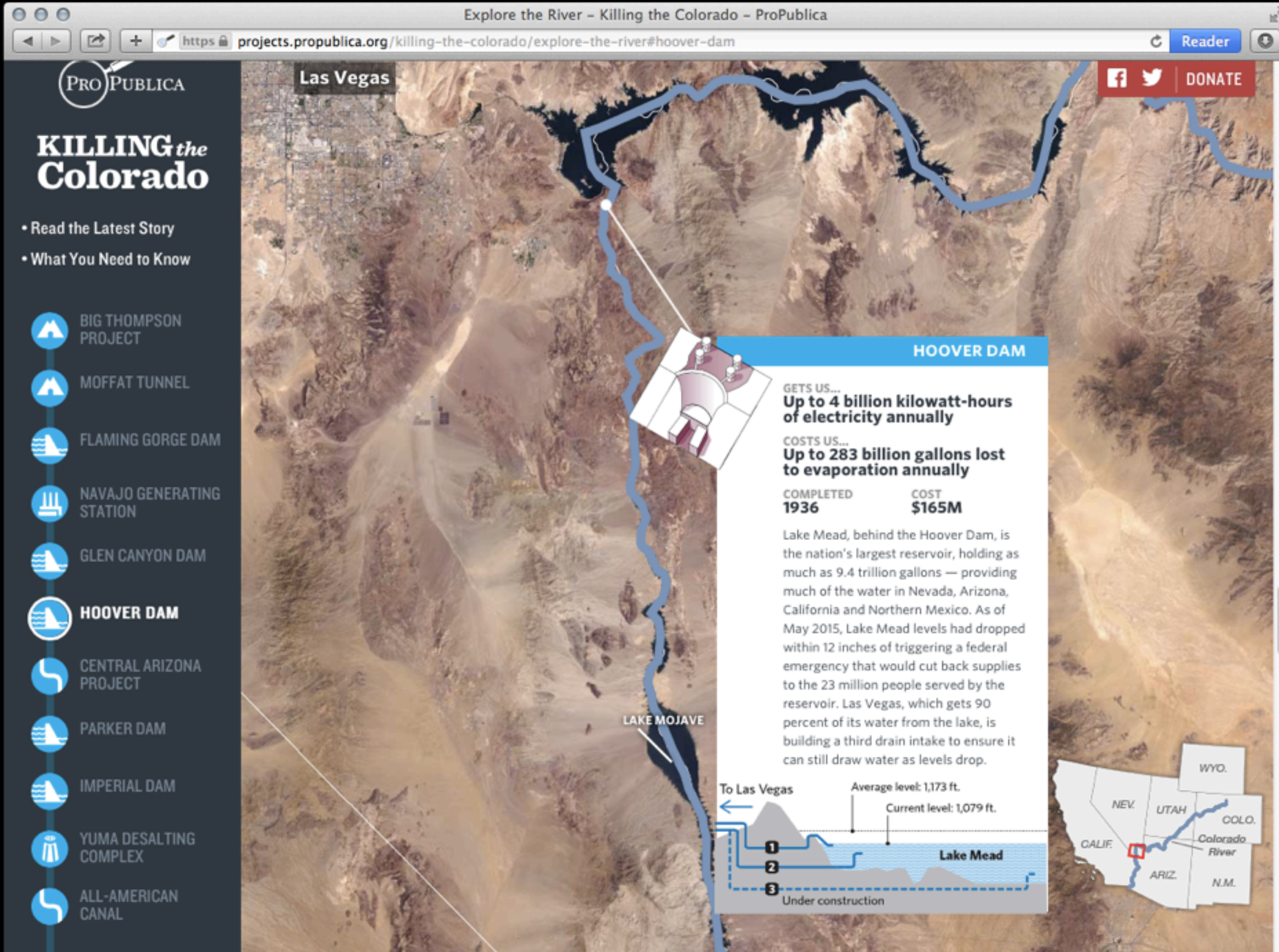
The damage to Gaza's infrastructure from the current conflict is more severe than the destruction caused by either of the last two Gaza wars, according to the United Nations Relief and Works Agency (Unrwa) and other organizations with staff on the ground, like Oxfam and Human Rights Watch. The fighting has displaced about a fourth of Gaza's population. Nearly 60,000 people have lost their homes, and the number of people taking shelter in Unrwa schools is nearly five times as many as in 2009. The cost to Gaza's already fragile economy will be significant: the 2009 conflict caused losses estimated at $4 billion — almost three times the size of Gaza's annual gross domestic product. UPDATED August 15, 2014



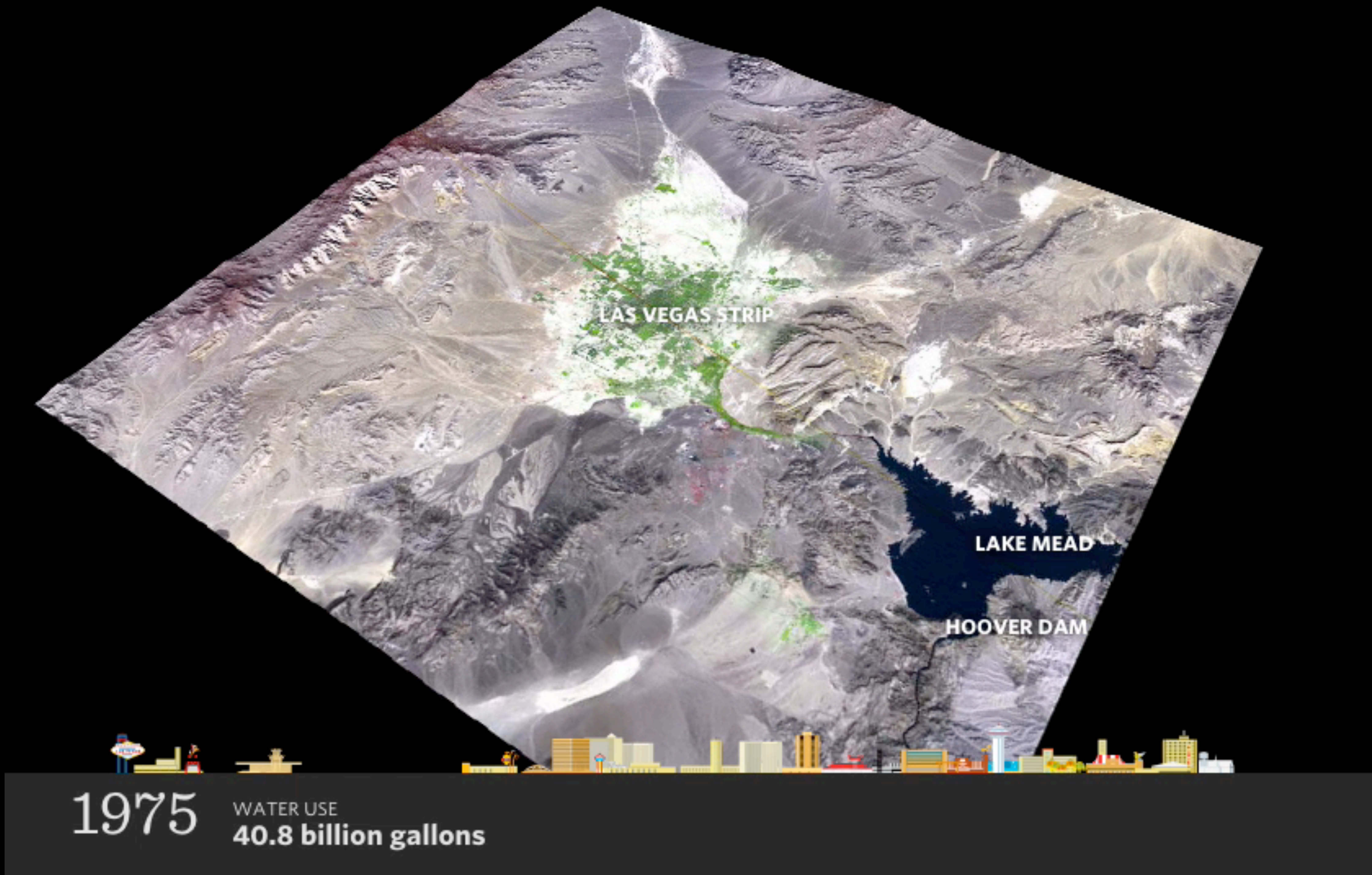

Losing Ground
projects.propublica.org/louisiana/
Reader
ProPublica
The Lens
DONATE TO PROPUBLICA
DONATE TO THE LENS
Lake Pontchartrain
New Orleans
Mississippi River
Golden Meadow
Bird's Foot Delta
Gulf of Mexico
New Orleans
Source: NASA/USGS Landsat
Losing Ground
by Bob Marshall, The Lens, Brian Jacobs and Al Shaw, ProPublica, Aug. 28, 2014
In 50 years, most of southeastern Louisiana not protected by levees will be part of the Gulf of Mexico. The state is losing a football field of land every 48 minutes — 16 square miles a year — due to climate change, drilling and dredging for oil and gas, and levees on the Mississippi River. At risk: Nearly all of the nation's offshore oil and gas production, much of its seafood production, and millions of homes.
EXPLORE THE COAST



http://projects.propublica.org/larestoration



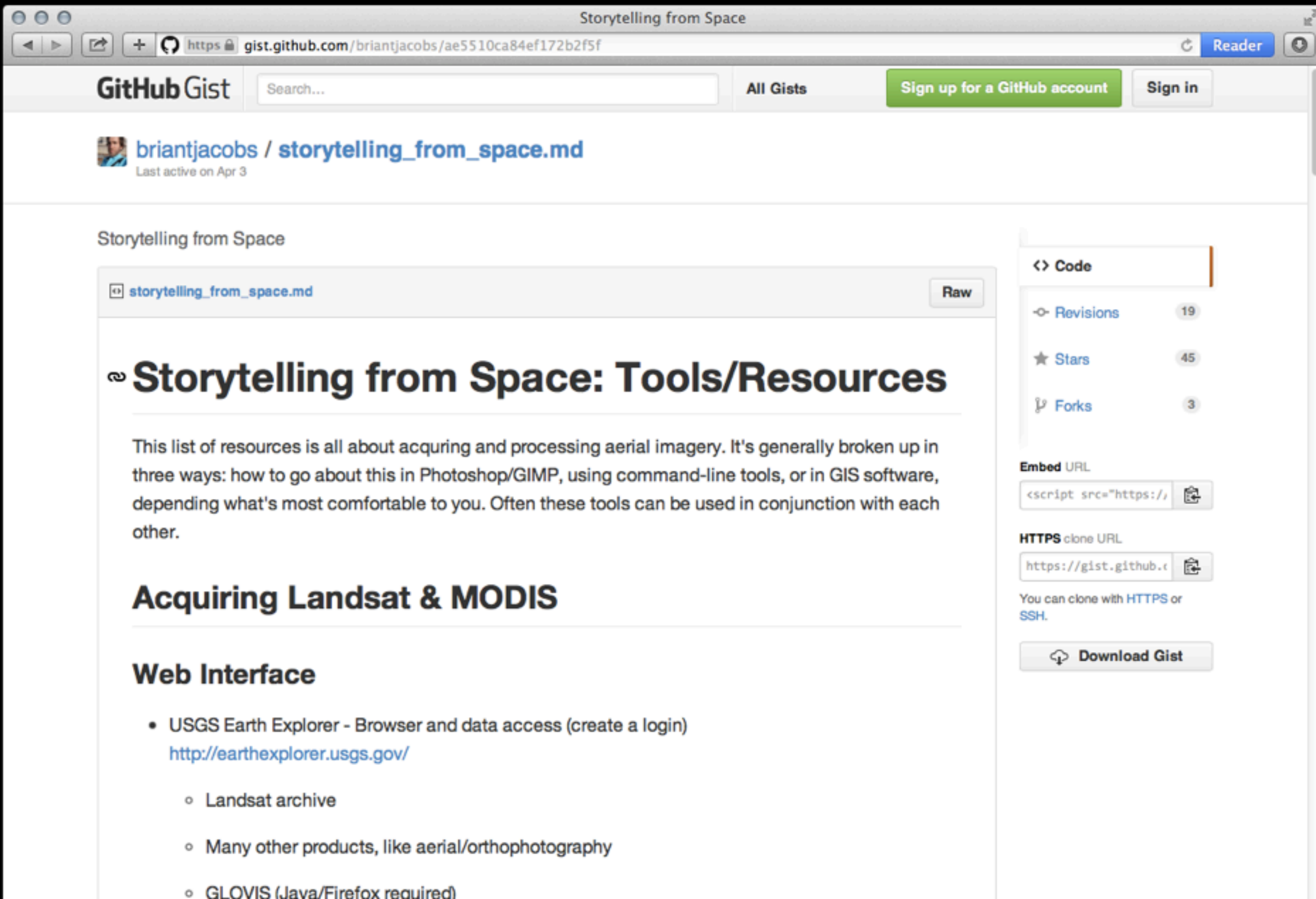
http://j.mp/robot-river



http://j.mp/vegas-water

More, more, more http://j.mp/spacejournalism

Mas y mas y mas



Storytelling from Space

https gist.github.com/briantjacobs/ae5510ca84ef172b2f5f

Reader

GitHub Gist | Search... | All Gists | Sign up for a GitHub account | Sign in

briantjacobs / storytelling_from_space.md

Last active on Apr 3

Storytelling from Space

storytelling_from_space.md | Raw

Storytelling from Space: Tools/Resources

This list of resources is all about acquring and processing aerial imagery. It's generally broken up in three ways: how to go about this in Photoshop/GIMP, using command-line tools, or in GIS software, depending what's most comfortable to you. Often these tools can be used in conjunction with each other.

Acquiring Landsat & MODIS

Web Interface

- USGS Earth Explorer - Browser and data access (create a login)
  http://earthexplorer.usgs.gov/
  - Landsat archive
  - Many other products, like aerial/orthophotography
  - GLOVIS (Java/Firefox required)

Code

Revisions 19

Stars 45

Forks 3

Embed URL

<script src="https:/,

HTTPS clone URL

https://gist.github.c

You can clone with HTTPS or SSH.

Download Gist

Thank you!

¡Gracias!

al.shaw@propublica.org @A_L