

# DISPONIBILIDAD DE DATOS DE LANDSAT-8 Y SU PROCESAMIENTO EN ARCGIS

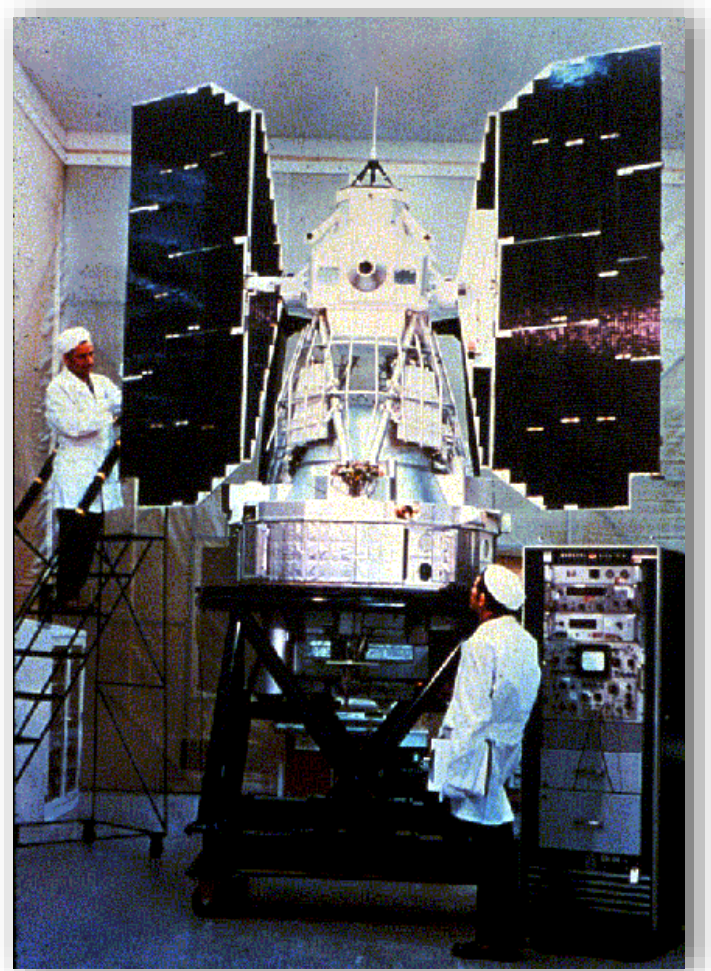


**William J. Hernández (Geographic Mapping Technologies)**  
**Fernando Gilbes (UPRM-Departamento de Geología, GERS Lab)**

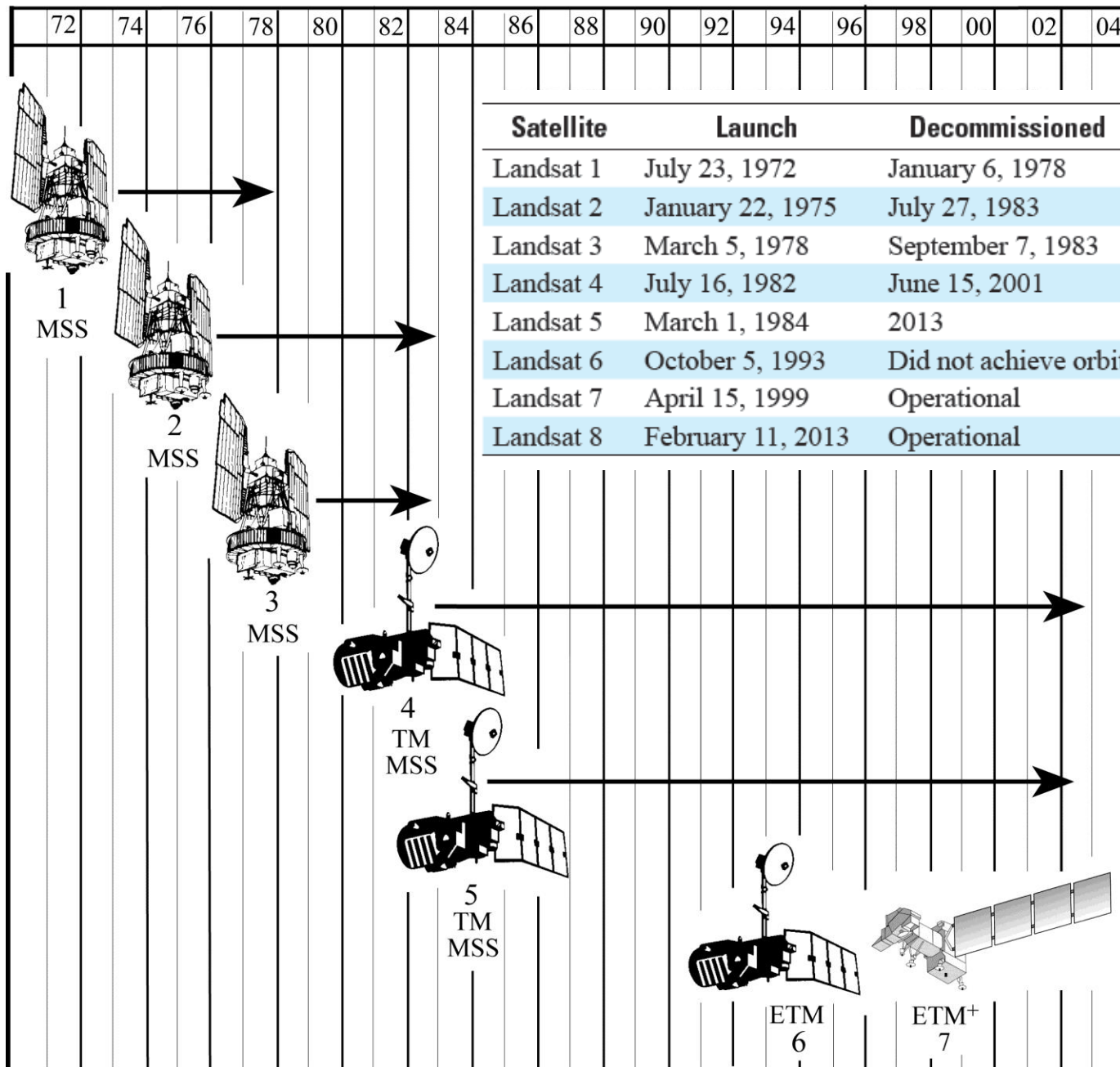


# From ERTS-1 to LANDSAT

- A finales de la década de los 60 se comenzó la planificación del primer satélite dedicado específicamente a percepción remota multiespectral.
- Diseñado y construido por NASA. El ERTS-1 (Earth Resources Technology Satellite) fue lanzado el 23 de julio de 1972.
- Más tarde su nombre cambió a LANDSAT



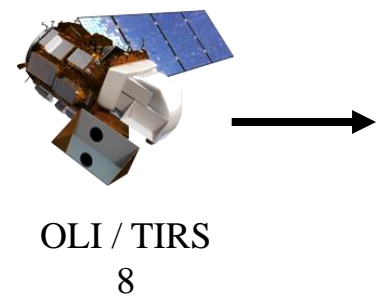
# Chronological Launch and Retirement History of the Landsat Satellites



2013

2014

Satellite	Launch	Decommissioned	Sensors
Landsat 1	July 23, 1972	January 6, 1978	MSS/RBV
Landsat 2	January 22, 1975	July 27, 1983	MSS/RBV
Landsat 3	March 5, 1978	September 7, 1983	MSS/RBV
Landsat 4	July 16, 1982	June 15, 2001	MSS/TM
Landsat 5	March 1, 1984	2013	MSS/TM
Landsat 6	October 5, 1993	Did not achieve orbit	ETM
Landsat 7	April 15, 1999	Operational	ETM+
Landsat 8	February 11, 2013	Operational	OLI/TIRS



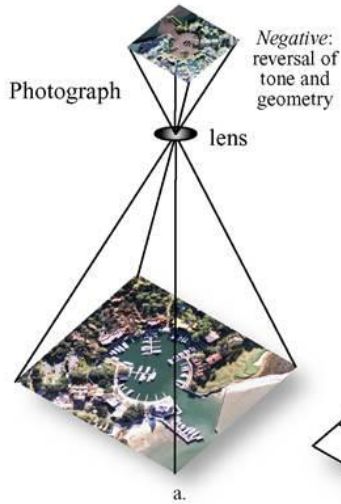
# COMPARIZON BETWEEN SENSORS

	<b>MSS</b>	<b>TM</b>	<b>ETM+</b>	<b>OLI/TIRS</b>
<b>Sensor type</b>	opto-mechanical	whiskbroom	whiskbroom	pushbroom
<b>Spatial Resolution</b>	80 m	30 m (120 m - thermal)	30 m (120 m - thermal, 15 m pan)	30 m (15 m pan, 100 m thermal)
<b>Spectral Range</b>	0.5 - 1.1 $\mu\text{m}$	0.45 - 12.5 $\mu\text{m}$	0.45 - 12.5 $\mu\text{m}$	0.43 – 12.51 $\mu\text{m}$
<b>Number of Bands</b>	4 (5 in Landsat 3)	7	8	11 (9 and 2)
<b>Temporal Resolution</b>	18 days (L1-L3) 16 days (L4 & L5)	16 days	16 days	16 days
<b>Image Size</b>	185 km X 185 km	185 km X 172 km	184 km X 185.2 km	185 km X 185 km
<b>Radiometric Resolution</b>	6 bits (64 DN)	8 bits (256 DN)	8 bits (256 DN)	12 bits (4096 DN)
<b>Programmable</b>	No	Yes	Yes	Yes

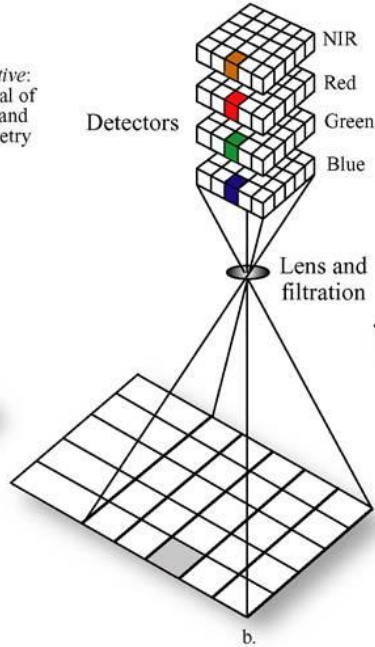
# Remote Sensing Systems Used to Collect Aerial Photography, Multispectral and Hyperspectral Imagery

## TM and ETM+

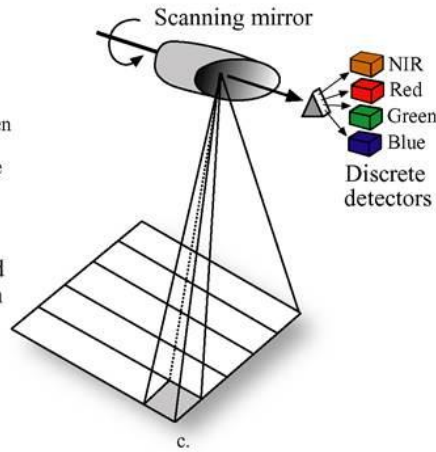
**Analog Frame Camera and Film (silver halide crystals)**



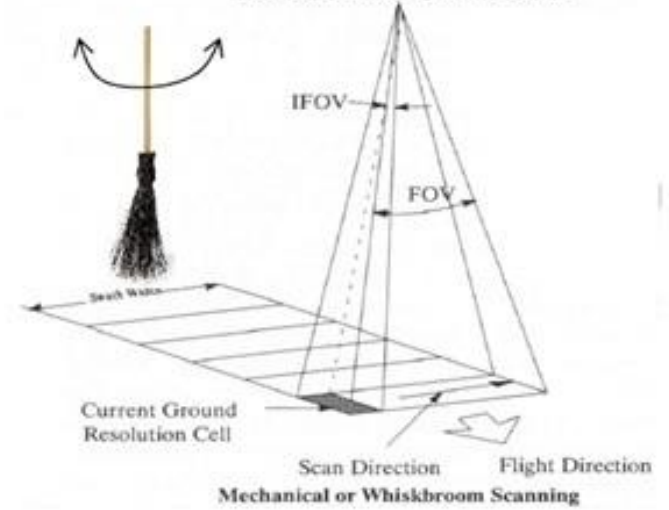
**Digital Frame Camera Area Arrays**



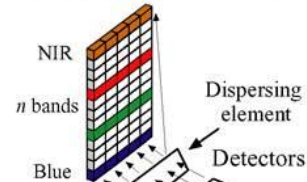
**Scanner**



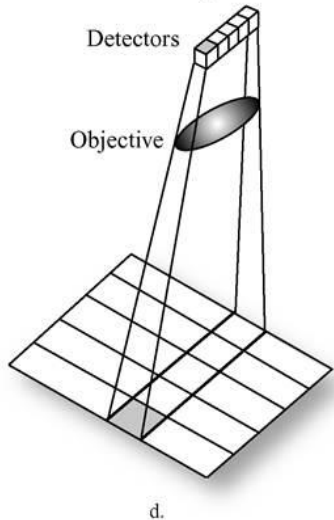
**Electromechanical Satellite Sensor**



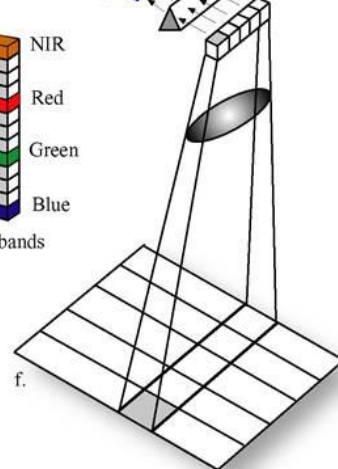
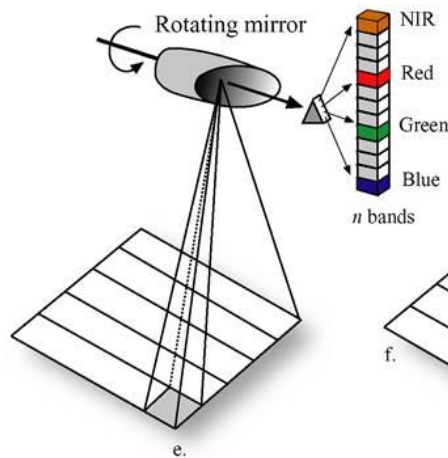
**Hyperspectral Area Array**



**Linear Array "Pushbroom"**



**Linear Array "Whiskbroom"**



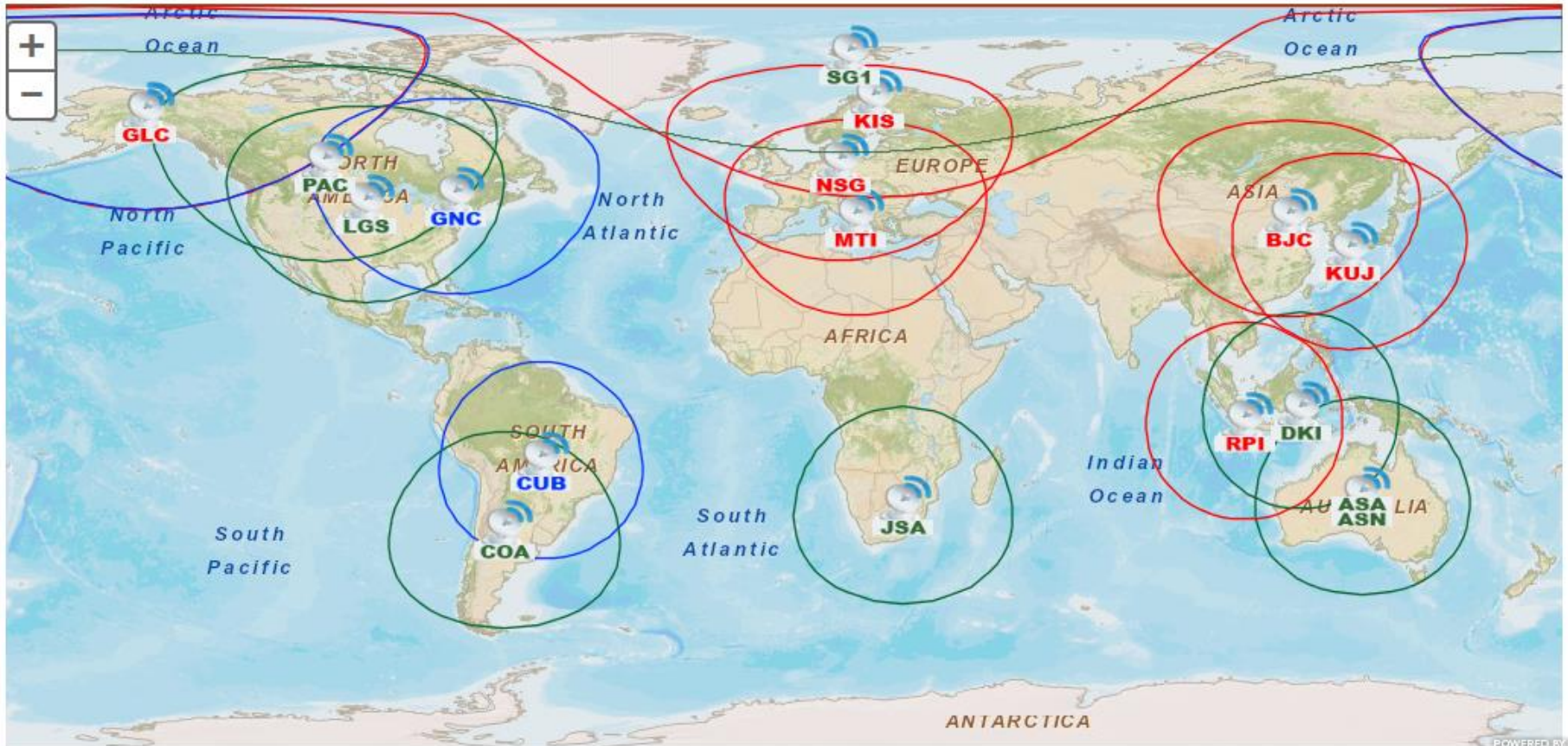
## OLI and TIRS

**Electronic Satellite Sensor**

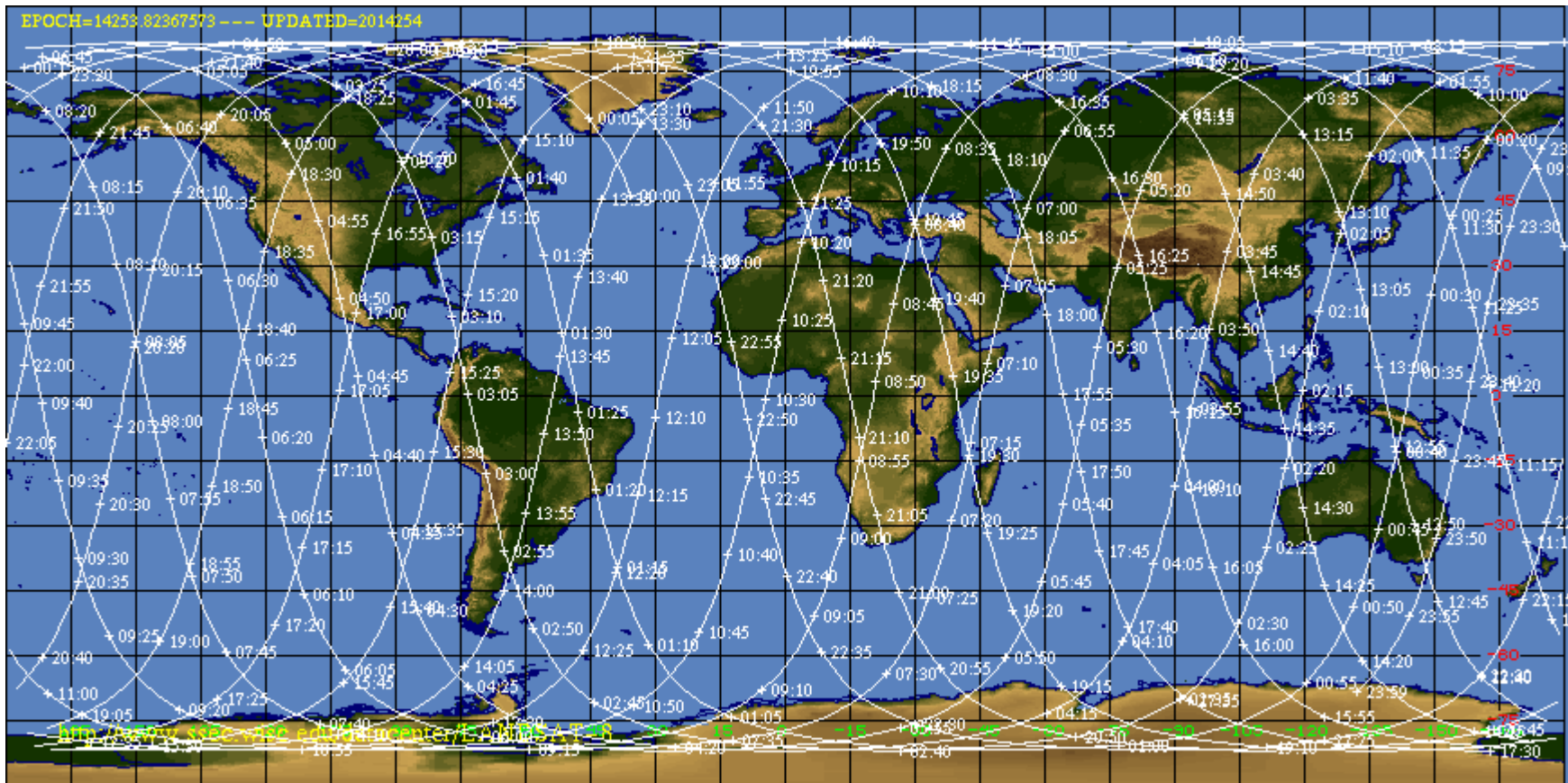


# International Ground Station (IGS) Network

Key: L7 Stations L8 Stations L7 & L8 Stations (5 degree station masks)



EPOCH=14253.82367573 --- UPDATED=2014254





# LANDSAT-8

## Launch: February 11, 2013

### Operational Land Imager (OLI)

### Thermal Infrared Sensor (TIRS)

OLI and TIRS band designations.

Spectral bands	Wavelength (micrometers)	Resolution (meters)	Use
Band 1—coastal/aerosol	0.43–0.45	30	Increased coastal zone observations.
Band 2—blue	0.45–0.51	30	Bathymetric mapping; distinguishes soil from vegetation; deciduous from coniferous vegetation.
Band 3—green	0.53–0.59	30	Emphasizes peak vegetation, which is useful for assessing plant vigor.
Band 4—red	0.64–0.67	30	Emphasizes vegetation slopes.
Band 5—near IR	0.85–0.88	30	Emphasizes vegetation boundary between land and water, and landforms.
Band 6—SWIR 1	1.57–1.65	30	Used in detecting plant drought stress and delineating burnt areas and fire-affected vegetation, and is also sensitive to the thermal radiation emitted by intense fires; can be used to detect active fires, especially during nighttime when the background interference from SWIR in reflected sunlight is absent.
Band 7—SWIR-1	2.11–2.29	30	Used in detecting drought stress, burnt and fire-affected areas, and can be used to detect active fires, especially at nighttime.
Band 8—panchromatic	0.50–0.68	15	Useful in ‘sharpening’ multispectral images.
Band 9—cirrus	1.36–1.38	30	Useful in detecting cirrus clouds.
Band 10—TIRS 1	10.60–11.19	100	Useful for mapping thermal differences in water currents, monitoring fires and other night studies, and estimating soil moisture.
Band 11—TIRS 2	11.50–12.51	100	Same as band 10.

Instrument-specific relative spectral response functions may be viewed and compared using the Spectral Viewer tool: [http://landsat.usgs.gov/tools\\_spectralViewer.php](http://landsat.usgs.gov/tools_spectralViewer.php).



**OLI Image of  
Mayaguez Bay  
May 1, 2013**

**Resolutions  
of OLI:**

**Spatial=  
30 m, 15 pan**

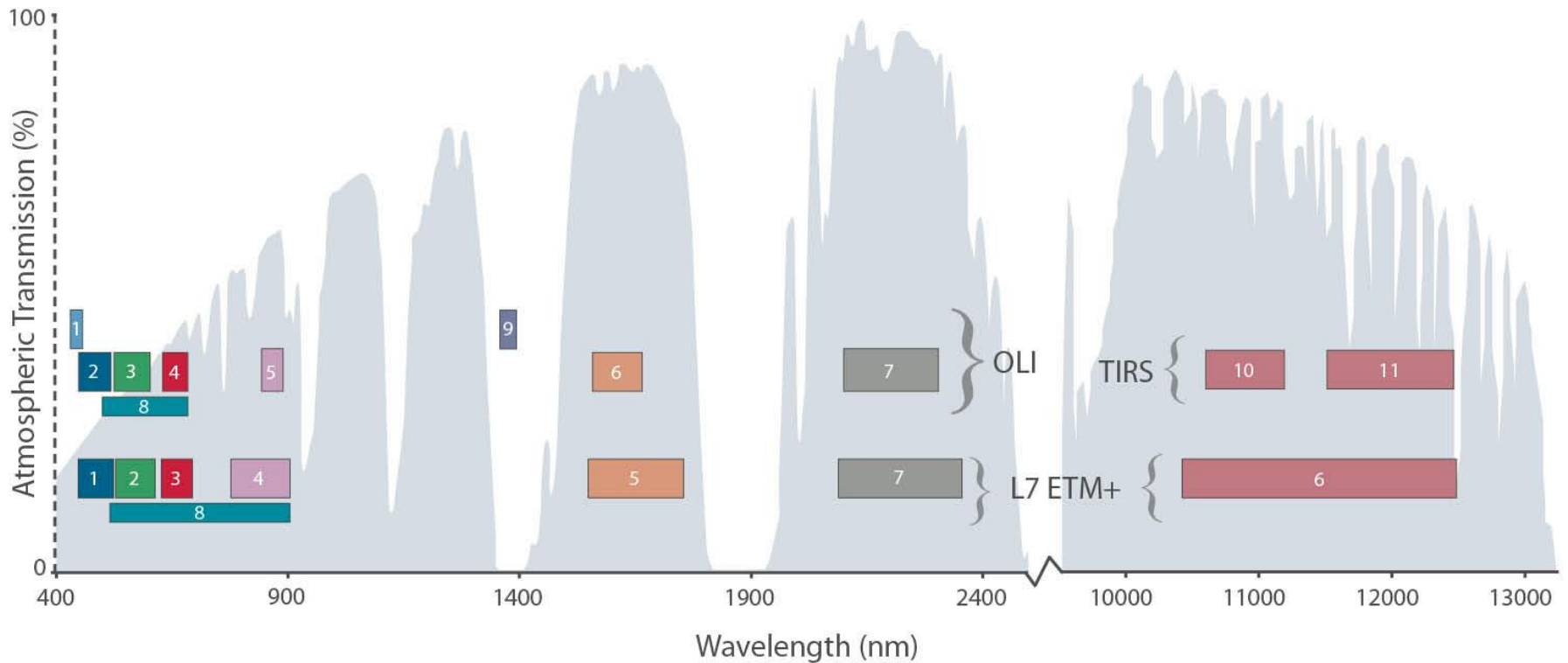
**Spectral=  
9 bands**

**Radiometric=  
12 bits**

**Temporal=  
16 days**



# Bands of Landsat 7 and 8



# Bands of Landsat 7 and 8

Landsat-7 ETM+ Bands ( $\mu\text{m}$ )			Landsat-8 OLI and <i>TIRS</i> Bands ( $\mu\text{m}$ )		
			30 m Coastal/Aerosol	0.435 - 0.451	Band 1
Band 1	30 m Blue	0.441 - 0.514	30 m Blue	0.452 - 0.512	Band 2
Band 2	30 m Green	0.519 - 0.601	30 m Green	0.533 - 0.590	Band 3
Band 3	30 m Red	0.631 - 0.692	30 m Red	0.636 - 0.673	Band 4
Band 4	30 m NIR	0.772 - 0.898	30 m NIR	0.851 - 0.879	Band 5
Band 5	30 m SWIR-1	1.547 - 1.749	30 m SWIR-1	1.566 - 1.651	Band 6
Band 6	60 m TIR	10.31 - 12.36	<i>100 m TIR-1</i>	<i>10.60 - 11.19</i>	Band 10
			<i>100 m TIR-2</i>	<i>11.50 - 12.51</i>	Band 11
Band 7	30 m SWIR-2	2.064 - 2.345	30 m SWIR-2	2.107 - 2.294	Band 7
Band 8	15 m Pan	0.515 - 0.896	15 m Pan	0.503 - 0.676	Band 8
			30 m Cirrus	1.363 - 1.384	Band 9

# Processing parameters for Landsat 8 standard data products

[UTM, Universal Transverse Mecator; WGS, World Geodetic System; OLI, Operational Land Imager; TIRS, Thermal Infrared Sensor]

<b>Product Type</b>	Level 1T (terrain corrected)
<b>Data type</b>	16-bit unsigned integer
<b>Output format</b>	GeoTIFF
<b>Pixel size</b>	15 meters/30 meters/100 meters (panchromatic/multispectral/thermal)
<b>Map projection</b>	UTM (Polar Stereographic for Antarctica)
<b>Datum</b>	WGS 84
<b>Orientation</b>	North-up (map)
<b>Resampling</b>	Cubic convolution
<b>Accuracy</b>	OLI: 12 meters circular error, 90 percent confidence TIRS: 41 meters circular error, 90 percent confidence

# <http://landsatlook.usgs.gov/>

The image shows a screenshot of the LandsatLook Viewer web application. The main area is a satellite-style map of the Americas, including parts of North America, Central America, and South America. The map is labeled with various countries and regions, such as Texas, Florida, Mexico, and the Caribbean Sea. A search bar at the top right contains the text "search for a location". Below the search bar are buttons for "Labels", "Basemaps", and "Bookmarks".

The interface includes a top navigation bar with the USGS logo and "LandsatLook Viewer" text, along with links for "Welcome!", "About", "Quick Guide", "Contact Us", and "Help".

On the right side, there is a control panel titled "Display". It features a search bar with the text "Zoom-in to 1:1M to select scenes". Below this are sections for "Time" (Slider Date), "Enhancements" (radio buttons for "Only One", "Current & Older", "None", "Percent Clip", "Stretch 3SD"), "Transparency" (slider from "off" to "visible"), and "Tools" (buttons for "Metadata", "Table", "Measure", "Export Display").

At the bottom left, there is a scale bar and coordinates: "Scale: 1 : 18 M | Lat: 34.69°N Lon: -50.81°W | Format: png". At the bottom right, there is a scale bar from 0 to 400 km and the text "POWERED BY esri".

# http://glovis.usgs.gov



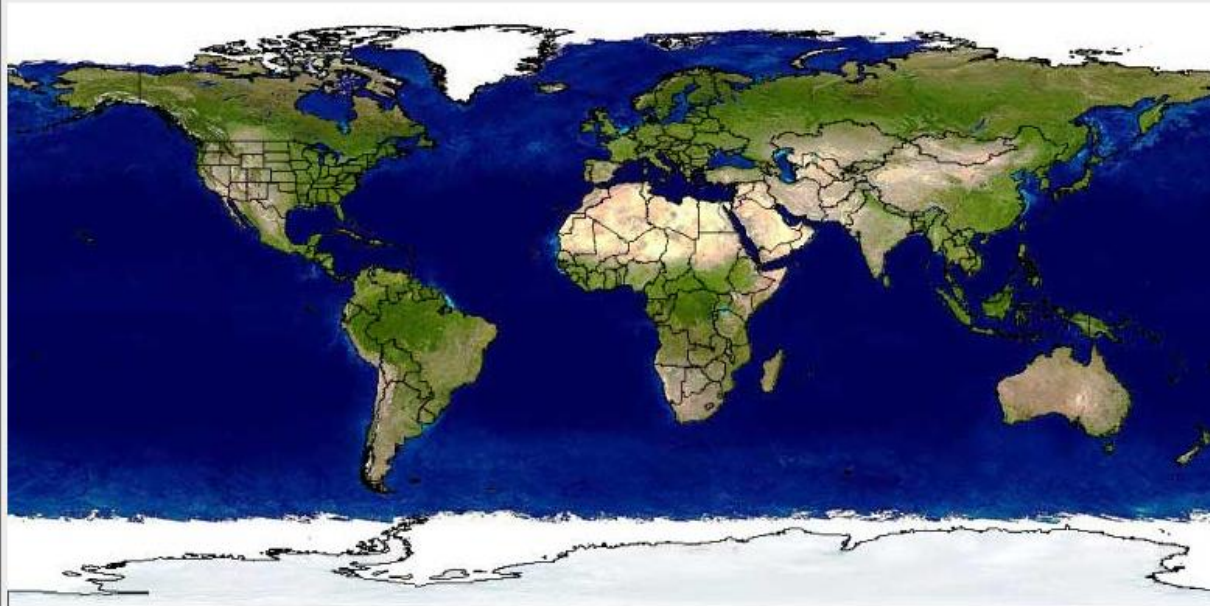
Earth Resources Observation and Science Center (EROS)

## USGS Global Visualization Viewer

Select a collection, then click on the Global Locator Map to view satellite browse images in that area.

Select Collection

Latitude  Longitude



<a href="#">What's New!</a>	<a href="#">Browser Requirements</a>	<a href="#">Help</a>	<a href="#">Download Source Code</a>
<a href="#">Quick Start Guide</a>	<a href="#">About Browse Images</a>		

<a href="#">DOI</a>	<a href="#">USGS HOME</a>	<a href="#">Biology</a>	<a href="#">Geography</a>	<a href="#">Geology</a>	<a href="#">Water</a>
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U.S. Department of the Interior | U.S. Geological Survey

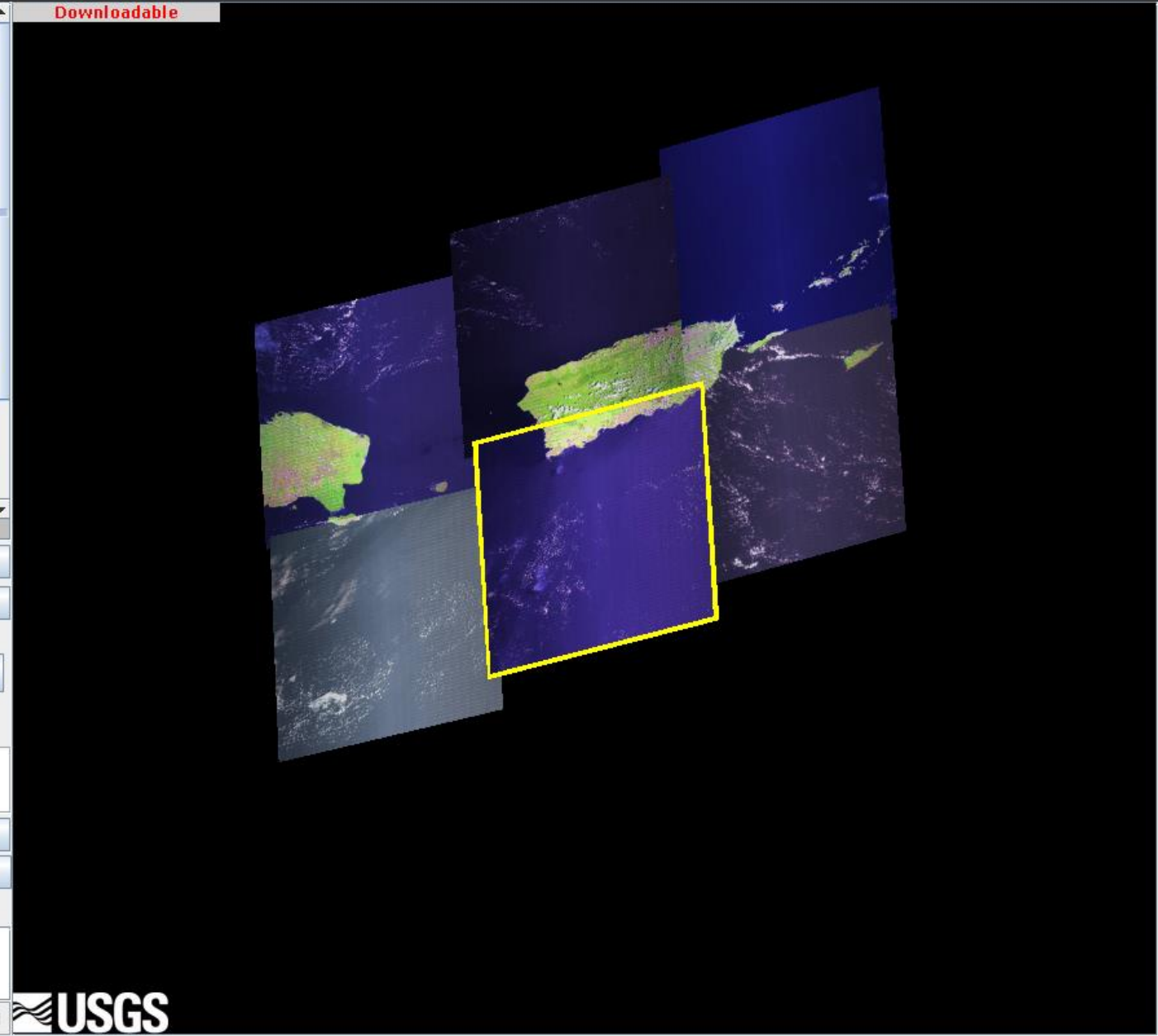
URL: <http://glovis.usgs.gov/BrowseBrowser.shtml>

Contact Information: [custserv@usgs.gov](mailto:custserv@usgs.gov) | ASTER and MODIS questions: [lpdaac@eos.nasa.gov](mailto:lpdaac@eos.nasa.gov)

Page Last Modified: 08/06/09



Downloadable



WRS-2 Path /Row: 5 48 Go

Lat/ Long: 17.3 -67.0 Go

Max Cloud: 100% [Navigation arrows]

Scene Information:  
ID: LE70050482004217ASN01  
Cloud Cover: 0% Qlty: 9  
Date: 2004/8/4

Aug 2004 Go

Prev Scene Next Scene

L7 SLC-off (2003->) List

Add Del Submit Download



1000m No Limits Set

# http://earthexplorer.usgs.gov/

**USGS**  
science for a changing world

**EarthExplorer**

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Home Login Register Feedback Help

Search Criteria Data Sets Additional Criteria Results

### 1. Enter Search Criteria

To narrow your search area: type in an address or place name, enter coordinates or click the map to define your search area (for advanced map tools, view the [help documentation](#)), and/or choose a date range.

Address/Place Path/Row Feature Circle

Show Clear

Coordinates Predefined Area Shapefile KML

Degree/Minute/Second Decimal

No coordinates selected.

Use Map Add Coordinate Clear Coordinates

Date Range Result Options

Search from: 01/01/1920 to: 02/09/2014

Search months: (all)

Data Sets » Additional Criteria » Results »

### Search Criteria Summary (Show)

Clear Criteria

(13° 55' 24" S, 106° 10' 18" W) Options Overlays Map Satellite

Google

Map data ©2014 INEGI Imagery ©2014 NASA, TerraMetrics 1000 km Terms of Use



## Taller: Análisis de Imágenes de Landsat8 usando ArcGIS Desktop

### PRYSIG 2014

En este taller se aprenderá como hacer búsquedas temporales y espaciales de los datos de Landsat 8 y obtener las imágenes crudas (sin procesamiento) de OLI y TIRS. Además, se utilizará la plataforma de ArcGIS Desktop para procesamiento y extracción de información de este tipo de imágenes para Puerto Rico. Se utilizarán herramientas para mejorar la visualización, combinación de bandas y se obtendrán productos de las imágenes tales como NDVI, y mapas de cobertura de terreno mediante clasificaciones.

#### Añadir Datos de Landsat 8

1. Usando archivo extensión .MTL
2. Bandas individuales

#### Image Analysis window

- Selección
  - Seleccionar/Deseleccionar imagen
  - Layer Properties
- Display
  - Contrast, Brightness, Gamma,
  - Swipe tool
- Processing
  - Clip
  - Mask
  - Functions
  - Export

#### Proceso:

1. Anadir bandas individuales, crear Composites
  - a. Natural Color (432)
  - b. False Color (543)
  - c. Landcover 1 (541)
  - d. Landcover 2 (415)
  - e. Bathymetry (321)
2. NDVI
3. Filter
4. Mosaic
5. Pan-sharpening
  - a. Anadir banda de mejor resolución (15m) banda 8.
6. Image Classification
  - a. Training samples
  - b. Classification
    - i. Máximum likelihood