

# **WATER MASK USING ENHANCED THEMATIC MAPPER PLUS (ETM+) LANDSAT 7 IN TOPOGRAPHIC MONITORING (LAKE URMIA, IRAN)**

Erwin Rommel C. Sta. Ana<sup>1</sup>  
Estella Regine O. Munda<sup>1</sup>  
Nesrine V. Lagonoy<sup>1</sup>  
Angelo De La Cruz<sup>1</sup>

Jason P. Punay<sup>2</sup>

<sup>1</sup> Department of Geodetic Engineering, Bicol  
University College of Engineering

<sup>2</sup>Department of Physics, Bicol University College of  
Science



# Introduction

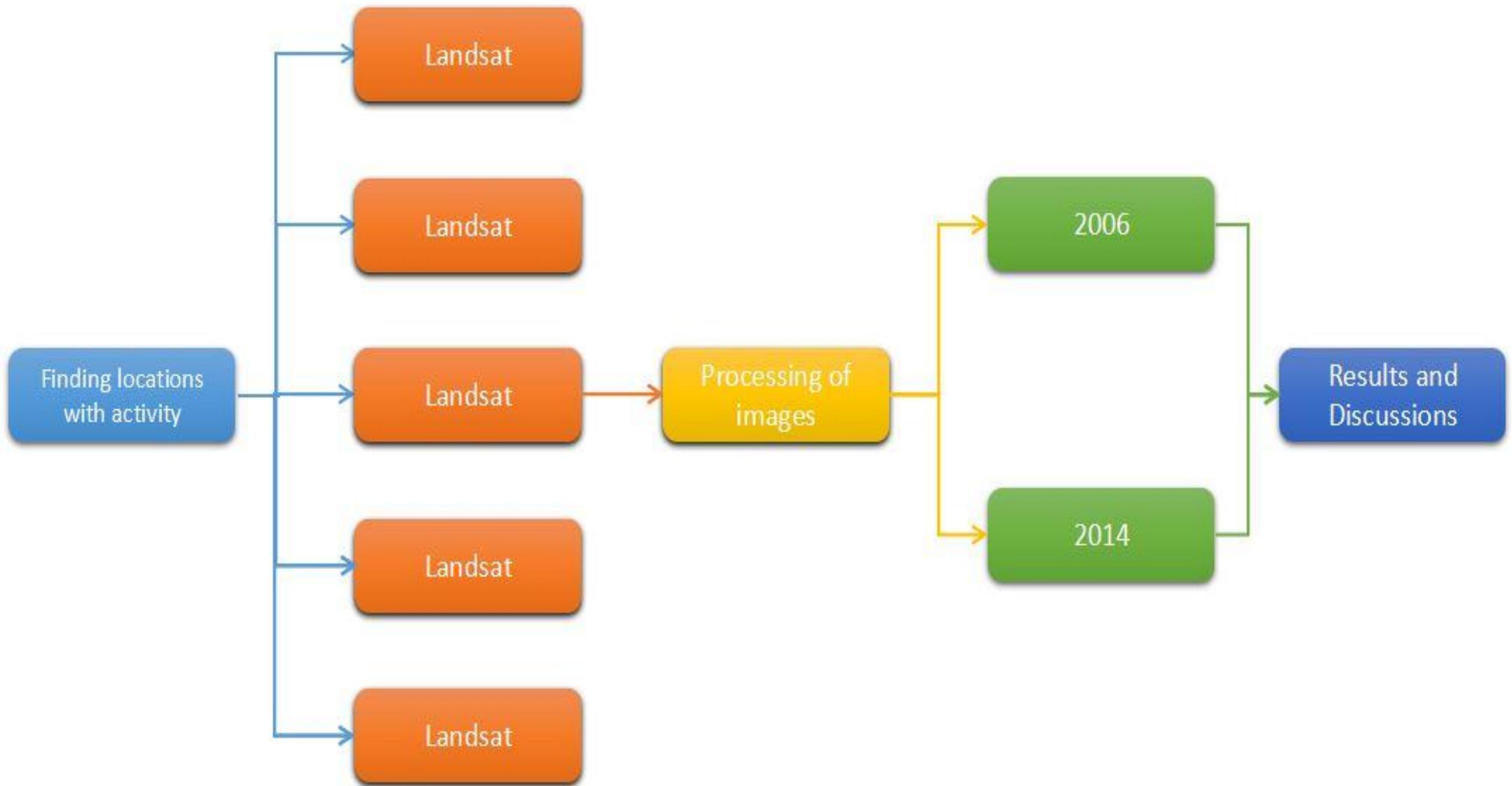
Monitoring of spatial and temporal extend of inland waters, especially in remote areas, requires constant ground measurement which is extremely difficult and rigorous. This study utilizes the Enhanced Thematic Mapper Plus(ETM+) Landsat 7 bands 5(infra-red) and 2(green) in creating water mask maps.

# SIGNIFICANCE OF THE STUDY

Water mask is a process that highlights water and distinguishes it from soil therefore revealing small bodies of water unseen at some satellite images.

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This study uses water masking in topographic monitoring, specifically at Lake Urmia, Iran. This study aims to show the changes that occurred in the past eight(8) years and to be a solution to topographic monitoring making it cheaper and easier to produce images.



# METHODOLOGY

1. Researching for places that shows activity or changes that occurred for the past years.



**2.** Selection of Landsat images from 5 different places according to the quality and completeness of data.

**3.** Landsat Images w

The image displays a global satellite map of the world, focusing on Europe and Africa. A red location marker is placed over the Black Sea region. To the left of the map is a screenshot of a web-based data viewer interface titled "Landsat Surface Reflectance - L7 ETM+". The interface shows a list of four Landsat images, each with a thumbnail preview, entity ID, acquisition date, path, row, and download/copy/share options. The images are:

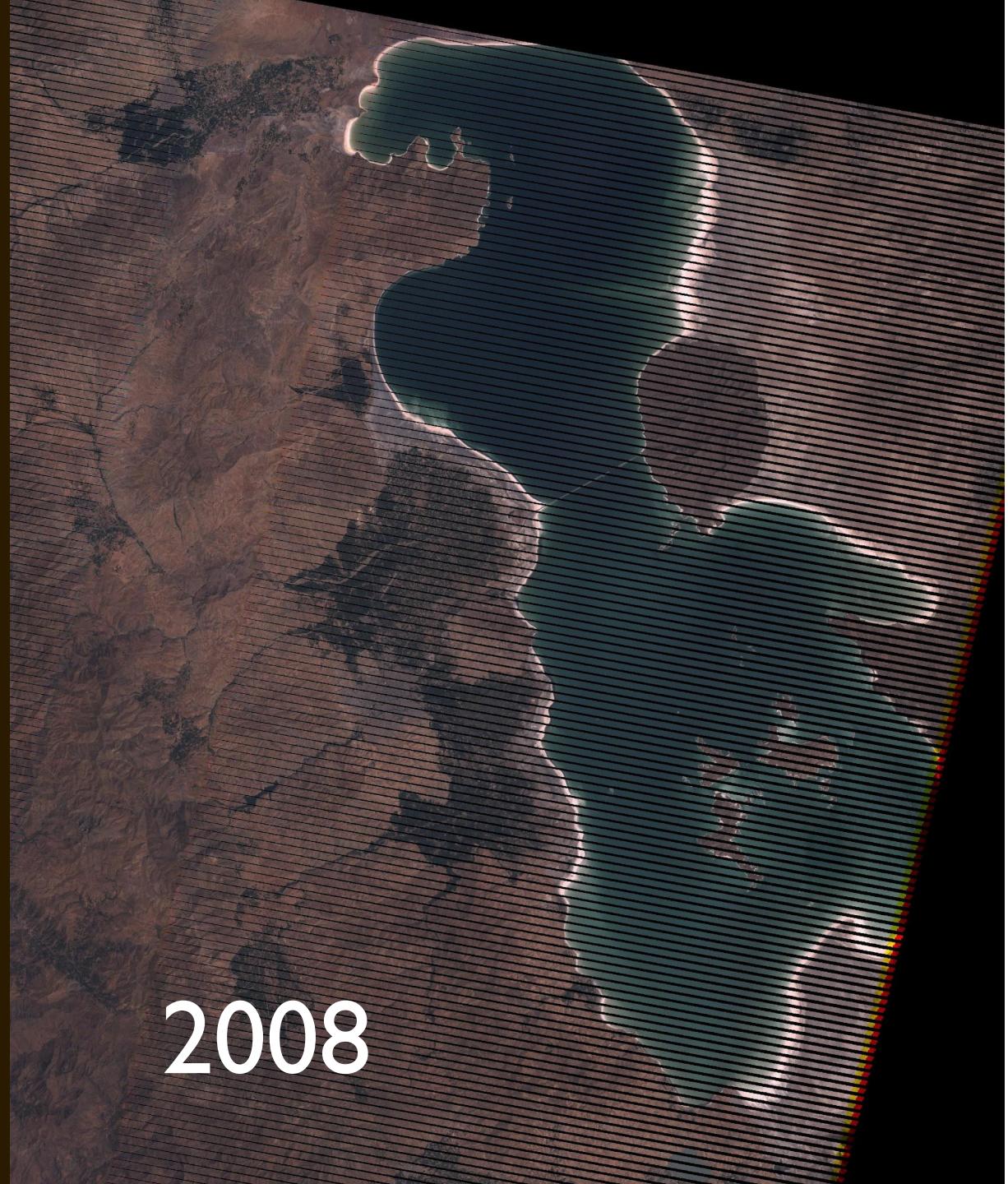
- Entity ID: LE71690342014001SG100, Acquisition Date: 01-JAN-14, Path: 169, Row: 34
- Entity ID: LE7168034201359SG100, Acquisition Date: 25-DEC-13, Path: 168, Row: 34
- Entity ID: LE7169034201350SG100, Acquisition Date: 16-DEC-13, Path: 169, Row: 34
- Entity ID: LE7168034201334SG100, Acquisition Date: 09-DEC-13, Path: 168, Row: 34

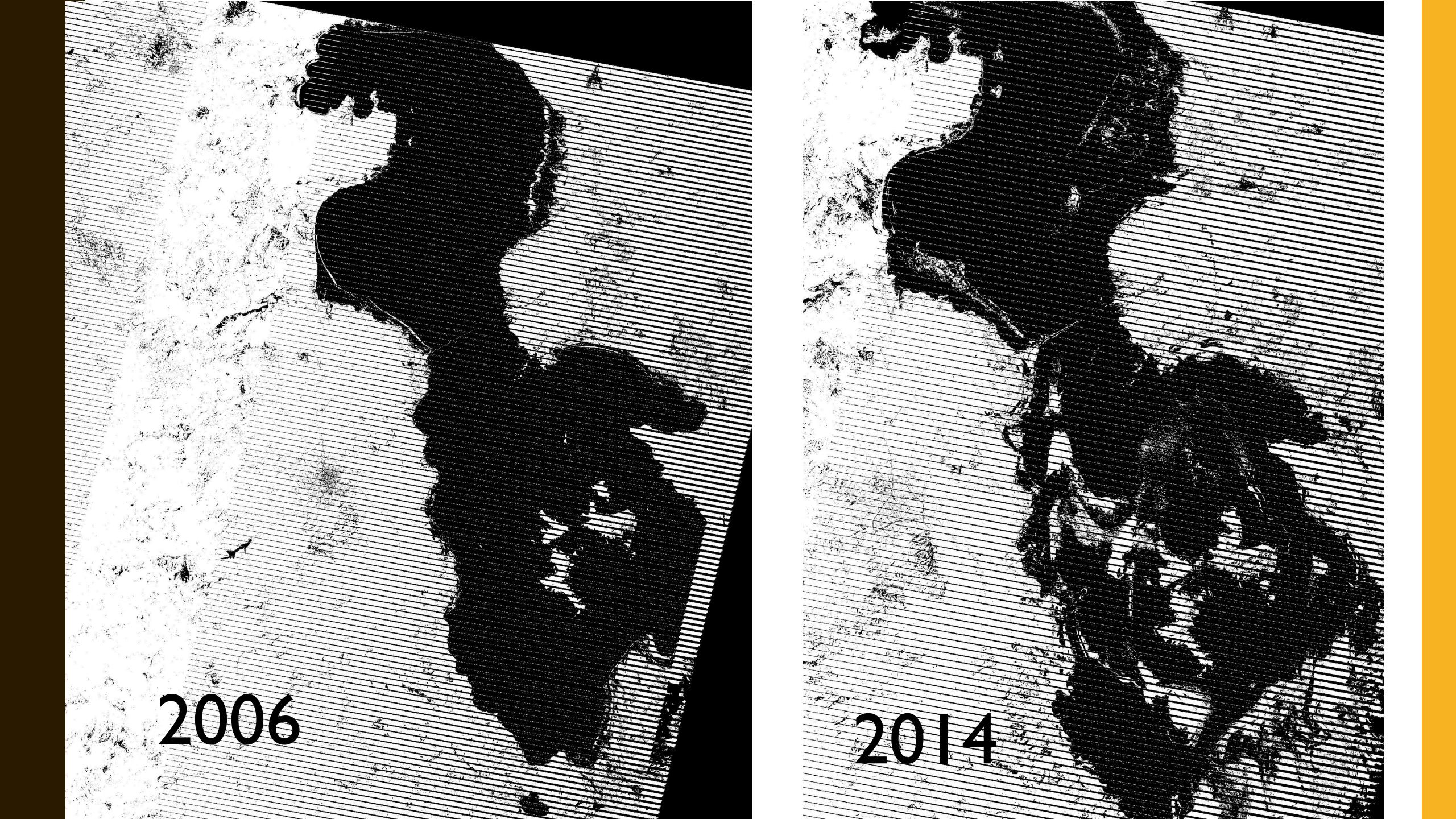
The interface also includes "Show Result Controls" and "Data Set" dropdown menus, and a "Click here to export your results" button.

- 4.** Processing of data collected with the use of IDL.
  - a.** Inputting the proper codes to read the bands selected (bands 5 and 2)
  - b.** Applying the formula to extract water from land.
  - c.** Imaged produced, black for water and white for land.
- 5.** Comparing and constructing ideas based on the results acquired.

```
1 band1 = read_tiff('C:\Users\Erwin\Desktop\LE71690342006219ASN01\LE71690342006219ASN01_B1.tif')
2 band1im = rotate(band1, 7)
3
4 band2 = read_tiff('C:\Users\Erwin\Desktop\LE71690342006219ASN01\LE71690342006219ASN01_B2.tif')
5 band2im = rotate(band2, 7)
6
7 band3 = read_tiff('C:\Users\Erwin\Desktop\LE71690342006219ASN01\LE71690342006219ASN01_B3.tif')
8 band3im = rotate(band3, 7)
9
10 band5 = read_tiff('C:\Users\Erwin\Desktop\LE71690342006219ASN01\LE71690342006219ASN01_B5.tif')
11 band5im = rotate(band5, 7)
12
13 band1x = read_tiff('C:\Users\Erwin\Desktop\LE71690342014225SG100\LE71690342014225SG100_B1.tif')
14 band1im14 = rotate(band1x, 7)
15
16 band2x = read_tiff('C:\Users\Erwin\Desktop\LE71690342014225SG100\LE71690342014225SG100_B2.tif')
17 band2im14 = rotate(band2x, 7)
18
19 band3x = read_tiff('C:\Users\Erwin\Desktop\LE71690342014225SG100\LE71690342014225SG100_B3.tif')
20 band3im14 = rotate(band3x, 7)
21
22 band5x = read_tiff('C:\Users\Erwin\Desktop\LE71690342014225SG100\LE71690342014225SG100_B5.tif')
23 band5im14 = rotate(band5x, 7)
24
25 filename = 'NaturalColor.jpg'
26 NC = fltarr(3, 3967, 4729)
27 NC(0,*,*) = band3im[3478:7444, 1916:6644] ;RED
28 NC(1,*,*) = band2im[3478:7444, 1916:6644] ;GREEN
29 NC(2,*,*) = band1im[3478:7444, 1916:6644] ;BLUE
30 write_jpeg, filename, NC, quality=100, /true
```

```
31
32 filename = 'NaturalColor14.jpg'
33 NC14 = fltarr(3, 2738, 3859)
34 NC14(0,*,*) = band3im14[4590:7327, 2388:6246] ;RED
35 NC14(1,*,*) = band2im14[4590:7327, 2388:6246] ;GREEN
36 NC14(2,*,*) = band1im14[4590:7327, 2388:6246] ;BLUE
37 write_jpeg, filename, NC14, quality=100, /true
38
39 x = (band2im-band5im) / (band2im+band5im)
40 y = x[3478:7444, 1916:6644]
41
42
43 x14 = (band2im14-band5im14) / (band2im14+band5im14)
44 y14 = x14[4590:7327, 2388:6246]
45
46 end
```



A black and white composite photograph showing two versions of a man's face side-by-side. The left side of the image shows the man's face in profile, facing right, with a dark, textured background. The right side shows a frontal view of his face, also with a dark, textured background. The man has short, dark hair and appears to be middle-aged.

2006

2014

# RESULTS

The study successfully used the enhanced thematic mapper plus (ETM+) Landsat7's bands 5(infra-red) and 2(green) in creating water mask, which delineates the inland bodies of water. This is clearly showed in the changes that occurred in Lake Urmia when water mask and natural color maps are compared.

The study offered a more cost effective and time efficient way to constantly monitor the inland waters.

# RECOMMENDATIONS

The use of ETM+ Landsat7 as water mask should be studied further especially for rapid flood monitoring, to show the extent of flood affected cities after a typhoon or tsunami.

# **FLOOD MONITORING**

# **CLOUD MASK PROCESSING**



200% ▾

A \ □ ○ ⊖ ⊕

Image

ROIs:

Pixel Location:  
[5625, 5902]

Pixel Value:  
V: 27

Pixel Scale:  
X:257% Y:257%

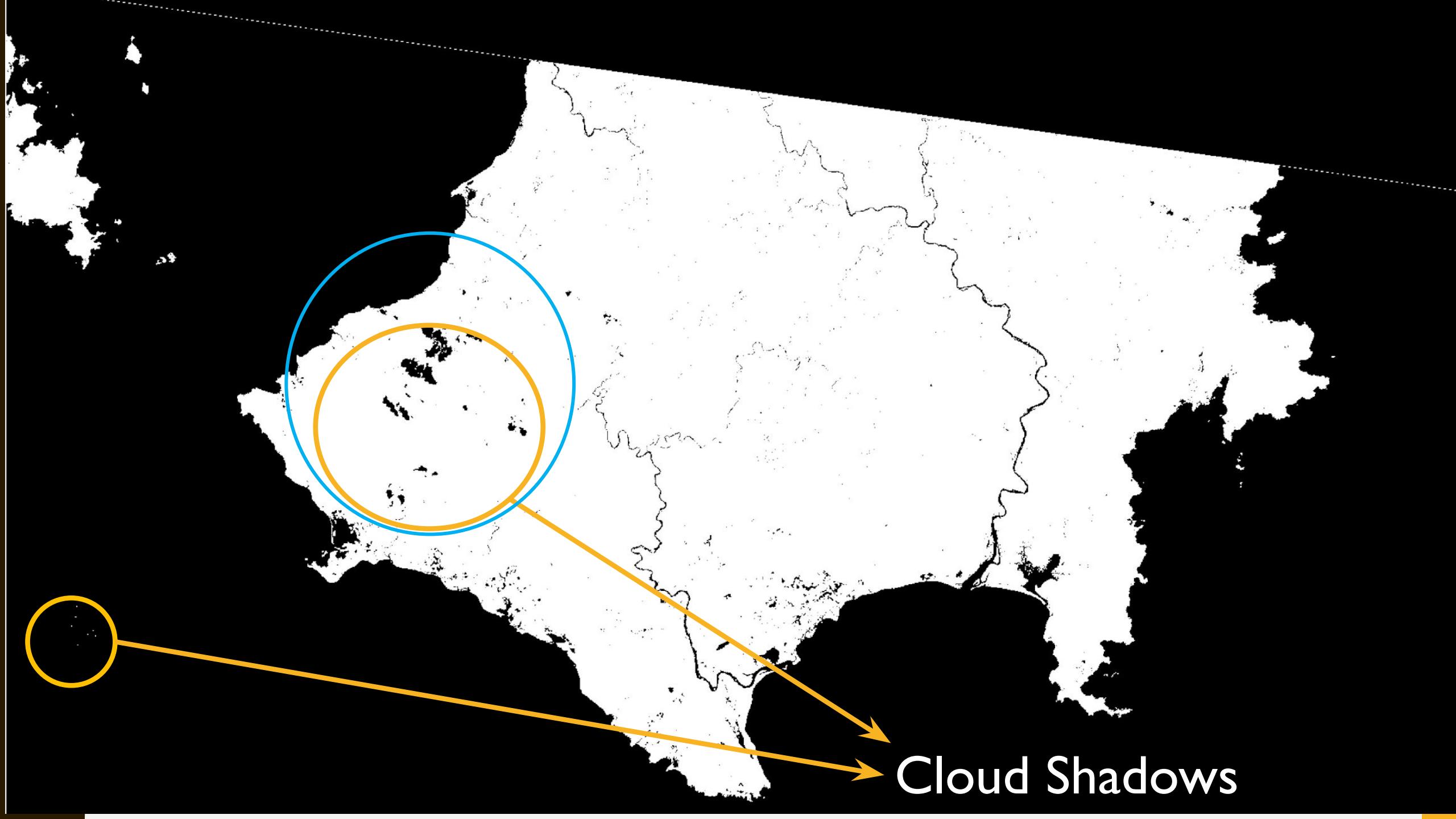
Edit Palette...

Channel: Gray ▾

Link All

Max: 255

Min: 0



Cloud Shadows

# CHALLENGES

- Images with clouds
- Connection to the internet

Thank you

- The Enhanced Thematic Mapper Plus (ETM+) instrument is a fixed eight-band, multispectral scanning radiometer capable of providing high-resolution imaging information of the Earth's surface at an altitude of 705 km.
- Landsat 7 collects data in accordance with the [World Wide Reference System](#) 2, which has catalogued the world's land mass into 57,784 scenes, each 183 km wide by 170 km long. The ETM+ produces approximately 3.8 gigabits of data for each scene. An ETM+ scene has an Instantaneous Field Of View (IFOV) of 30 meters x 30 meters in bands 1-5 and 7 while band 6 has an IFOV of 60 meters x 60 meters on the ground and the band 8 an IFOV of 15 meters. Please visit the L7 Science Data Users Handbook for a detailed description of ETM+ [spatial characteristics](#).