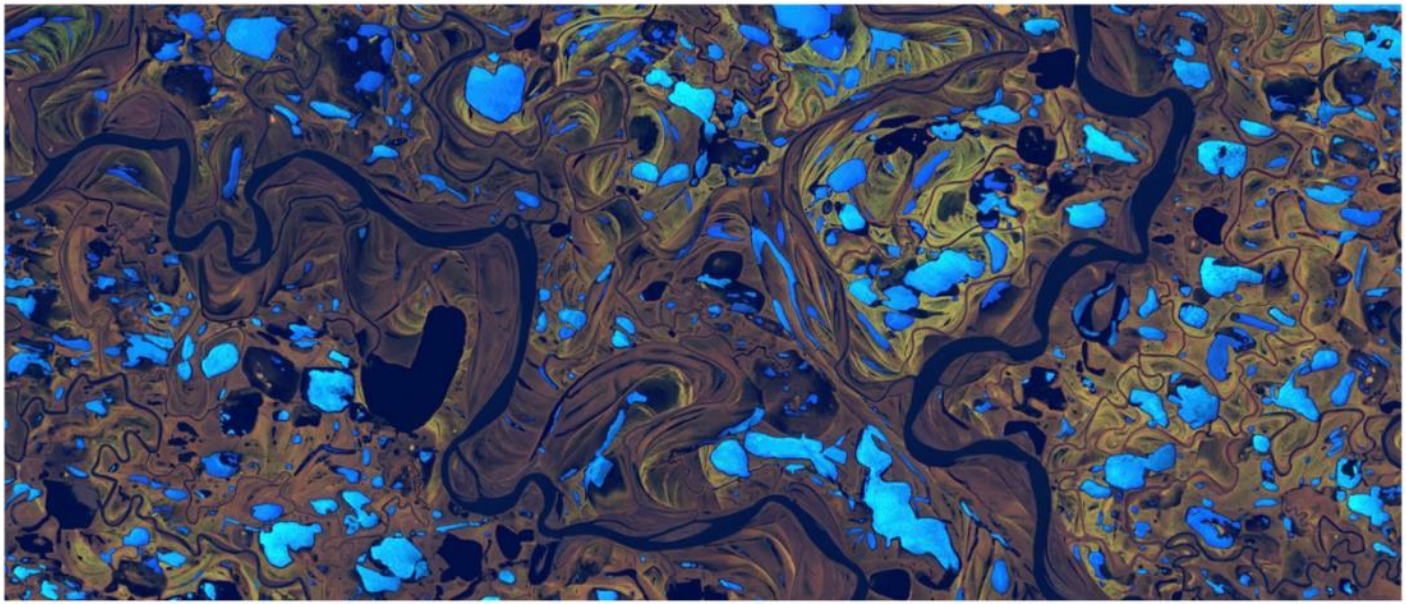
FALL 2023

GEOG 357

Introduction to Remote Sensing

Instructor: Dr. Roger Wheate



Lana River, Russia ([redacted] Sentinel imagery)

ESA

- Remote sensing of the environment and natural resources
- Satellite imagery processing, enhancement, and classification
- Lectures: Tues + Thurs, 10:30 - 11:20; Lab: Wednesday, 3:00 - 5:50 pm

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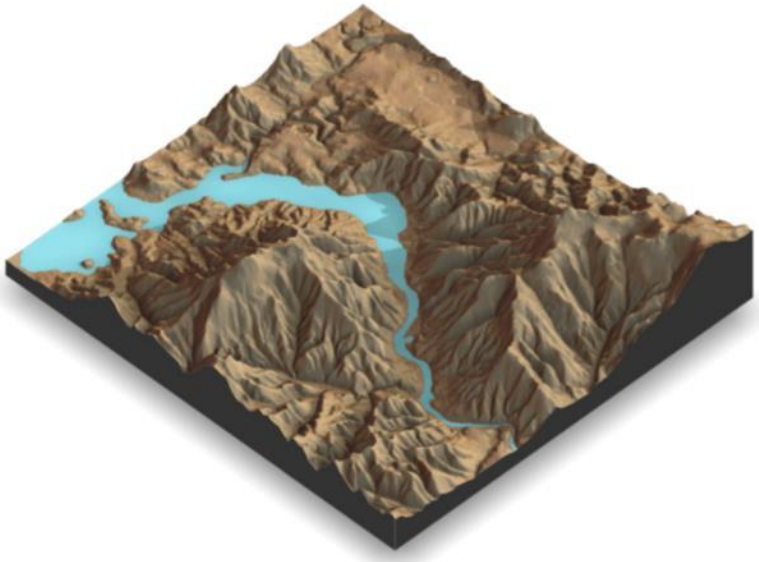
FALL 2023

GEOG 250

Introduction to Geospatial Analysis

Instructor: Matt McLean



Hillshaded image created with Python code

- Open, analyse, and visualize geospatial data with python code
- Lectures: Monday and Friday, 9:30 - 10:20 am
- Lab: Wednesday, 8:30 - 11:20 am

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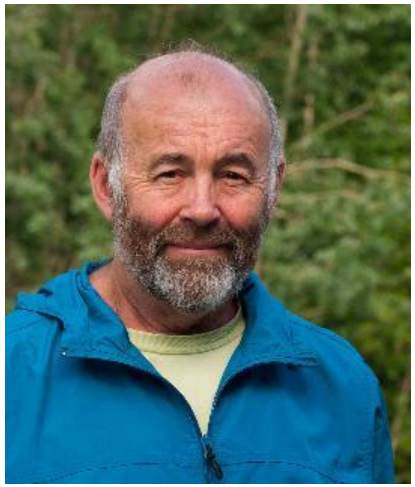
GEOG357: Remote Sensing

Roger Wheate, 8-307
wheate@unbc.ca



Lectures: Tues/Thurs 10.30-11.20

Labs: 8-125: Wednesday 15.00 – 17.50

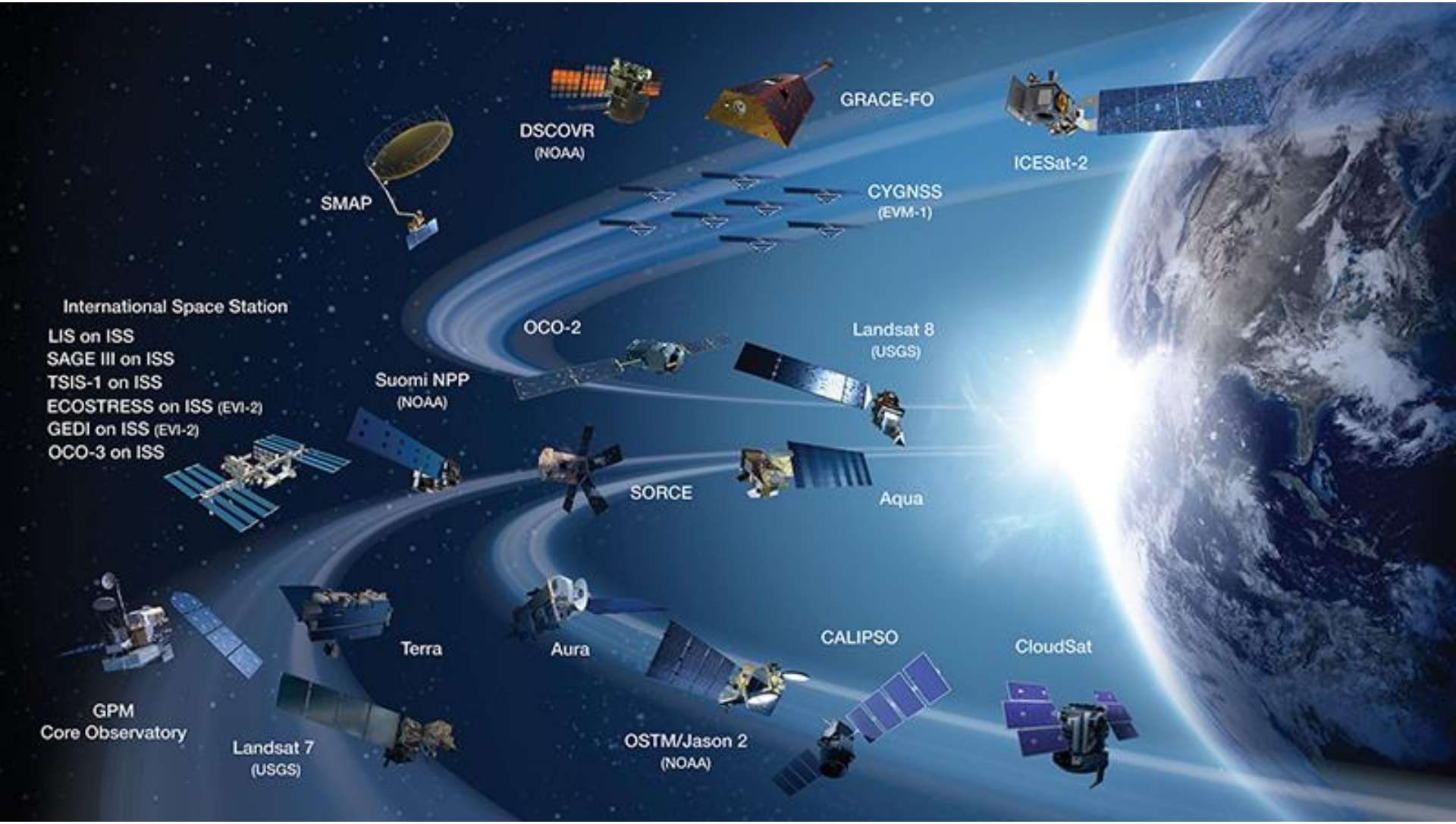
Outline, lectures, labs: http://gis.unbc.ca

Lab assignments / grades: https://moodle.unbc.ca

RS: … the acquisition and analysis of aerial / satellite images

Textbook definition: acquiring information from a distance (no physical contact)

There are thousands of satellites in space, many of them for Earth Observation (EO)



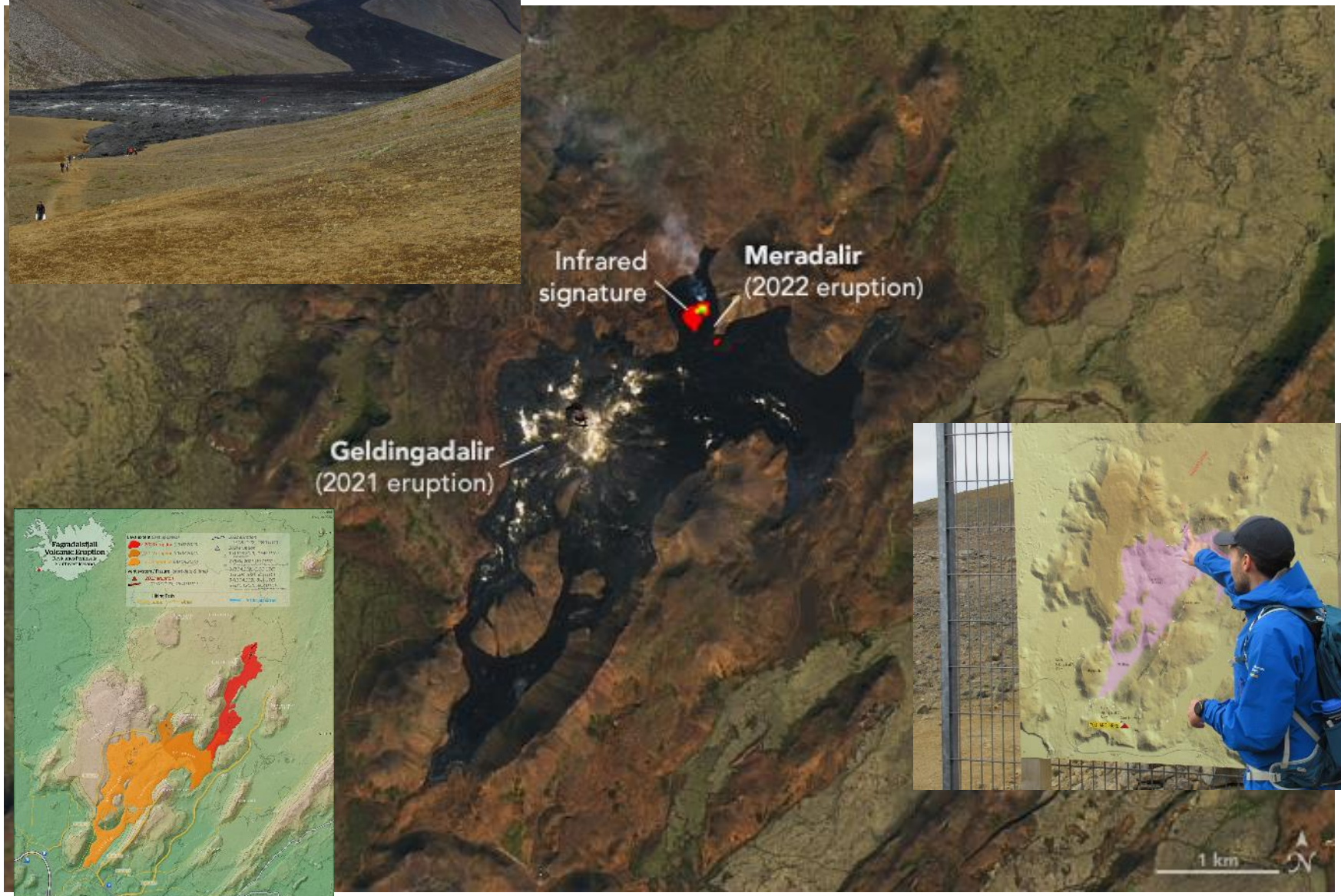
e.g. As of ~2018: Satellite launches 8650, still in space 4700, operational 1700

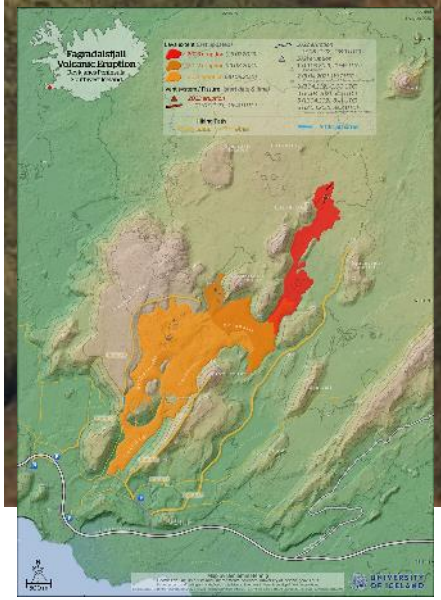
https://earthobservatory.nasa.gov/

Why Remote sensing may be more 'important' than GIS, especially in Canada ?

- Size and remoteness of Canada – cannot be mapped easily
- vector data is often quickly outdated e.g. forest cover, urban areas …. while images can be current or more recent
- Images are not 'generalized' (pixel size apart) - shows it like it is
- Images cross administrative boundaries (vector data may stop) – …. and (almost) no data blackouts
- Many image sources are freely downloadable
- Most GIS spatial data were created from remote sensing

Fagradalsfjall, Iceland: August 2022 eruption





2021-2022-2023

Early RS - aerial photography (>1840):

Balloons, US Civil war

World War 1:

Pigeon with german camera;

balloons and planes

Early to mid- 20th century RS milestones

~ 1840: Invention of camera / photography

1910s First use of aerial photography from planes
(World War I: photo interpretation)

1920s Development of photogrammetry for mapping

1940 Military use of RADAR (World War II)

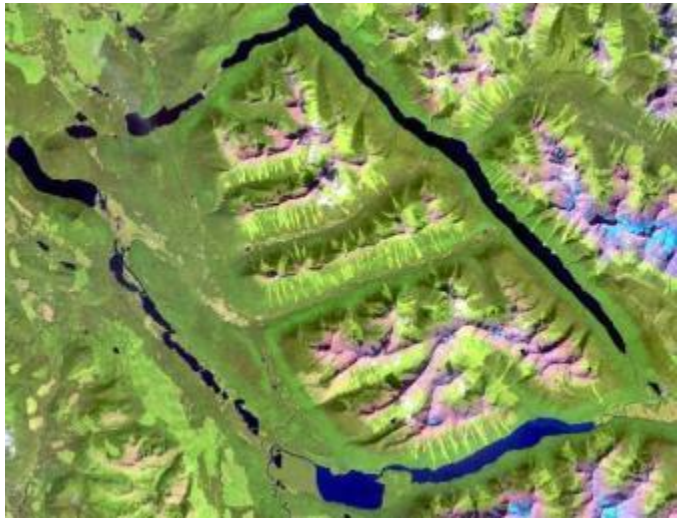
1945-> Main aerial photo programs in Canada

1950s Use of colour photography and infra-red

1960 First reconnaissance satellites: Corona

1960s First weather satellites: Tiros (1960); Nimbus (1964)
(and first digital data transmission from space)

Why did 'RS' appear in 1960s ?



Advent of :

a. Satellites (Space Race)

b. Use of non-visible energy
e.g. infra-red, RADAR

- extended beyond aerial photography

attributed to Evelyn Pruit, technician

1970-present RS milestones

1970s: Landsat 1-3 (NASA) – first Earth Observation (EO) satellites

1980s: Landsat 4-5 – the 'next generation' imagery (1984-2011)
First commercial software

1986: SPOT 1 (France)

1990s: more satellites from various countries / Europe (ESA)

2000s: corporate high resolution (<1metre) satellites
2008: Landsat data freely downloadable (others follow)

2010s: LiDAR and UAVs

2020s: Online data processing 'in the cloud' e.g Google Earth Engine


Worldview3 2014
Rainbow Range
Chilcotin, BC 31cm

High resolution satellite imagery (Maxar), 15-30cm
Feb 28, 2022
Russian tanks

RS myth 1:
“it’s so big, you can see it from space” ☺

Myth #2 about remote sensing: This is a satellite photograph, but most are NOT
e.g. the previous slide images were produced from scanners, not a camera

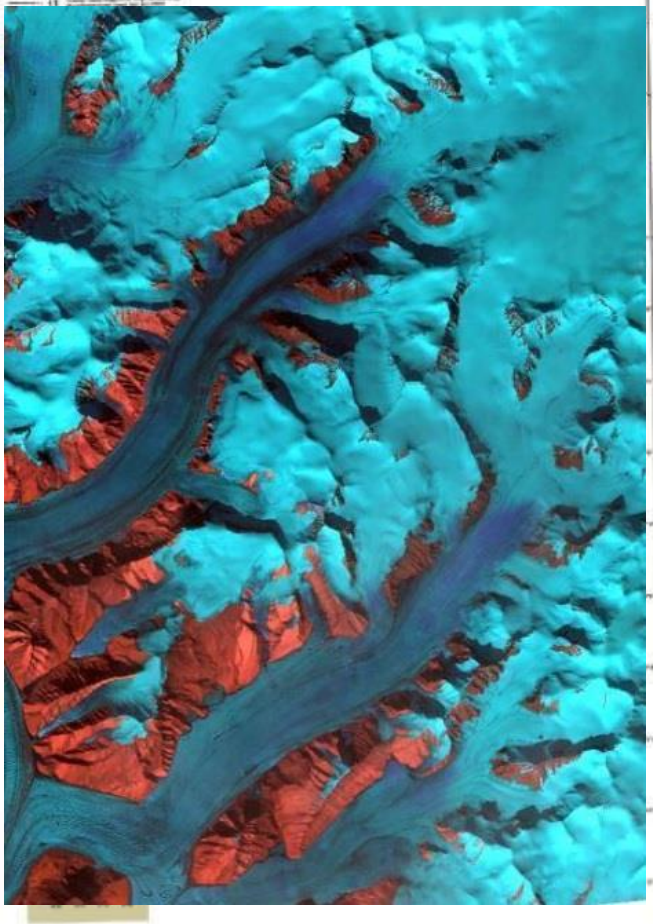
Exceptions e.g. ISS: Alberta, BC and Rocky Mountain Trench, from International Space Station, 2014

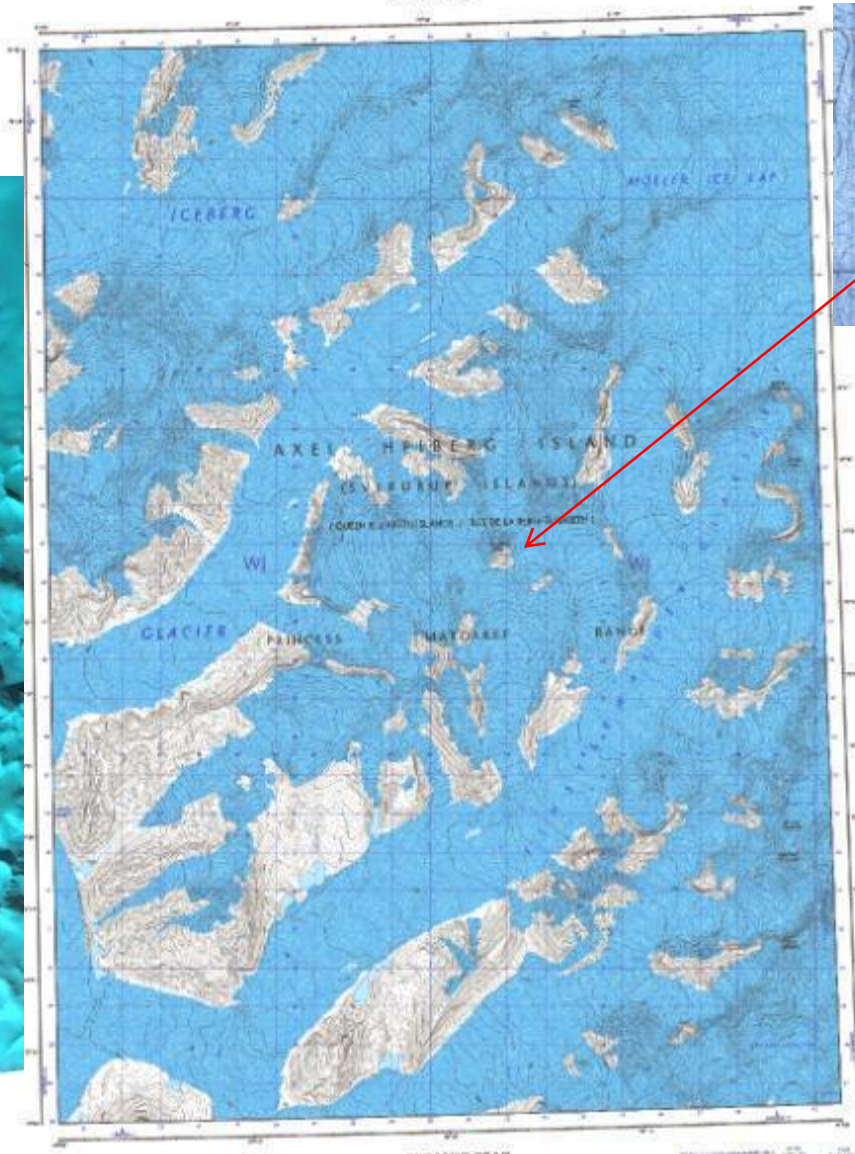
Traditional mapping from aerial photography and GIS layer creation – manual digitising

All Canada was mapped this way 1945-1995 = > 13,000 map sheets at 1:50,000 scale including many thematic layers e.g. forestry, geology

Pyramid Peak, Axel Heiberg Island

Landsat 7 (2000)





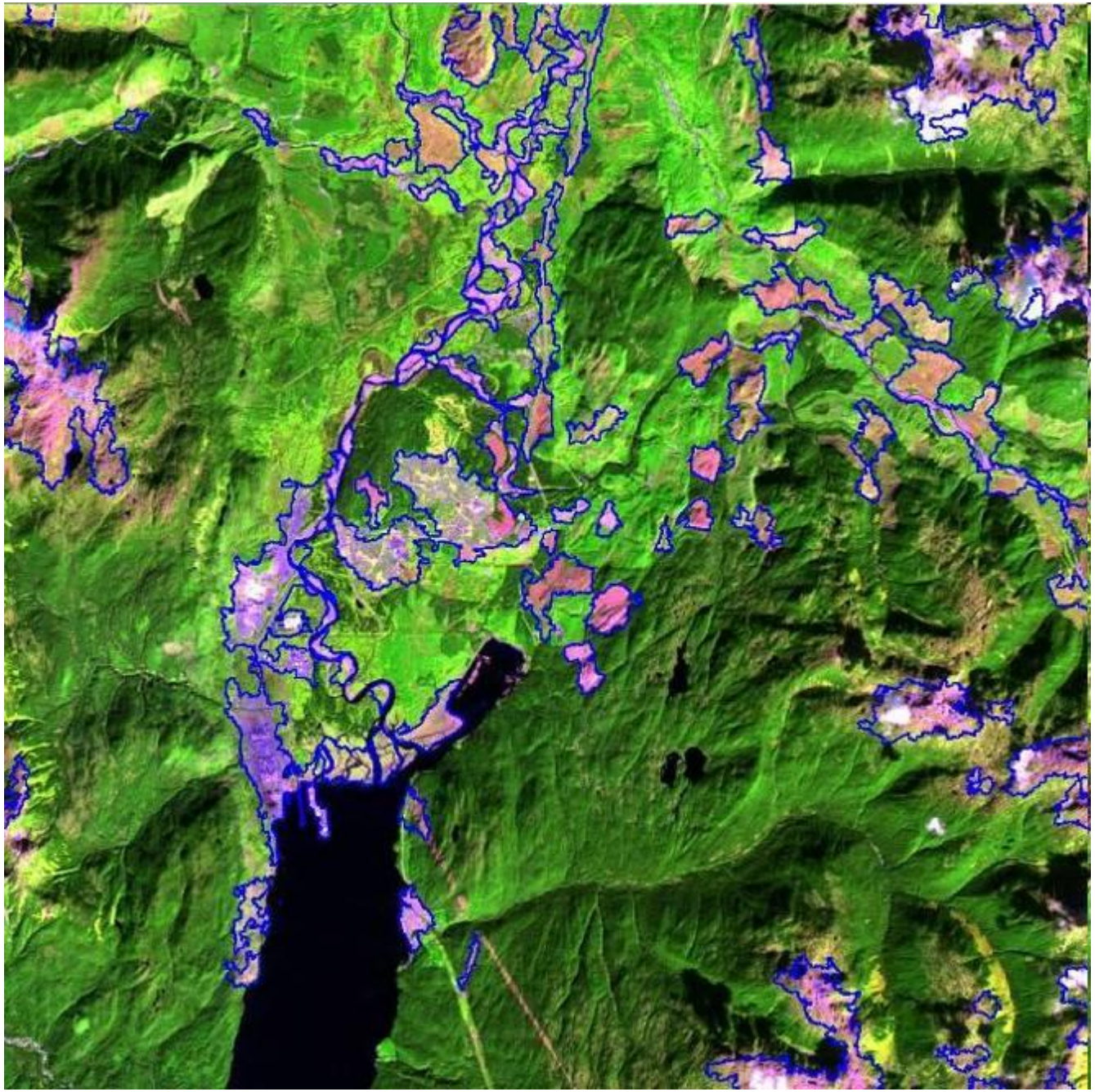
NTS map 059H12 (2012)

Our final map sheet to complete the 1:50,000 topo series

Canadian Topographic Maps/Cartes topographiques du Canada

Digital remote sensing imagery – auto-generation of GIS layers – e.g. polygon data

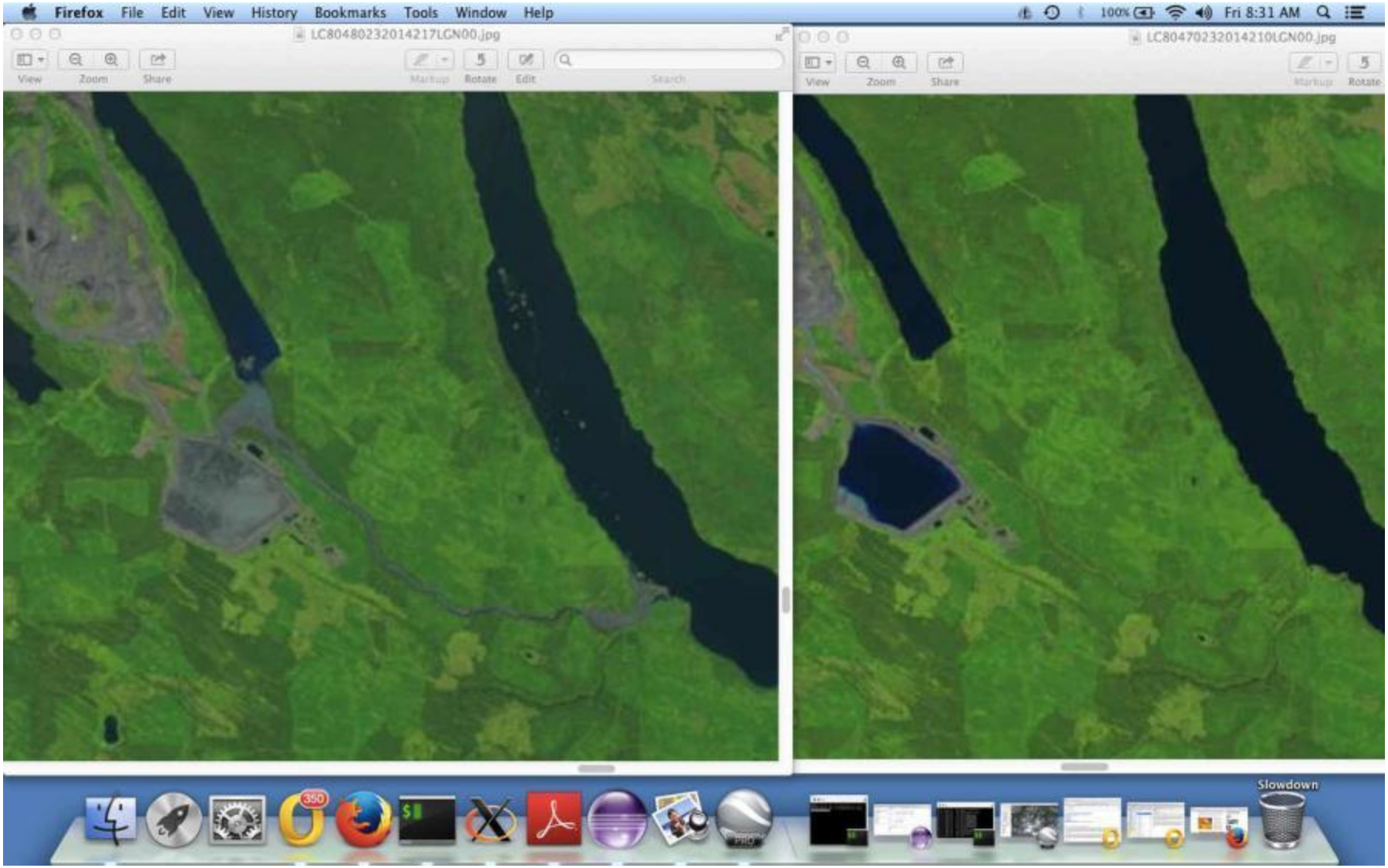
Sample from GEOG357 project: non-forested layer



Local environmental change example from satellite imagery

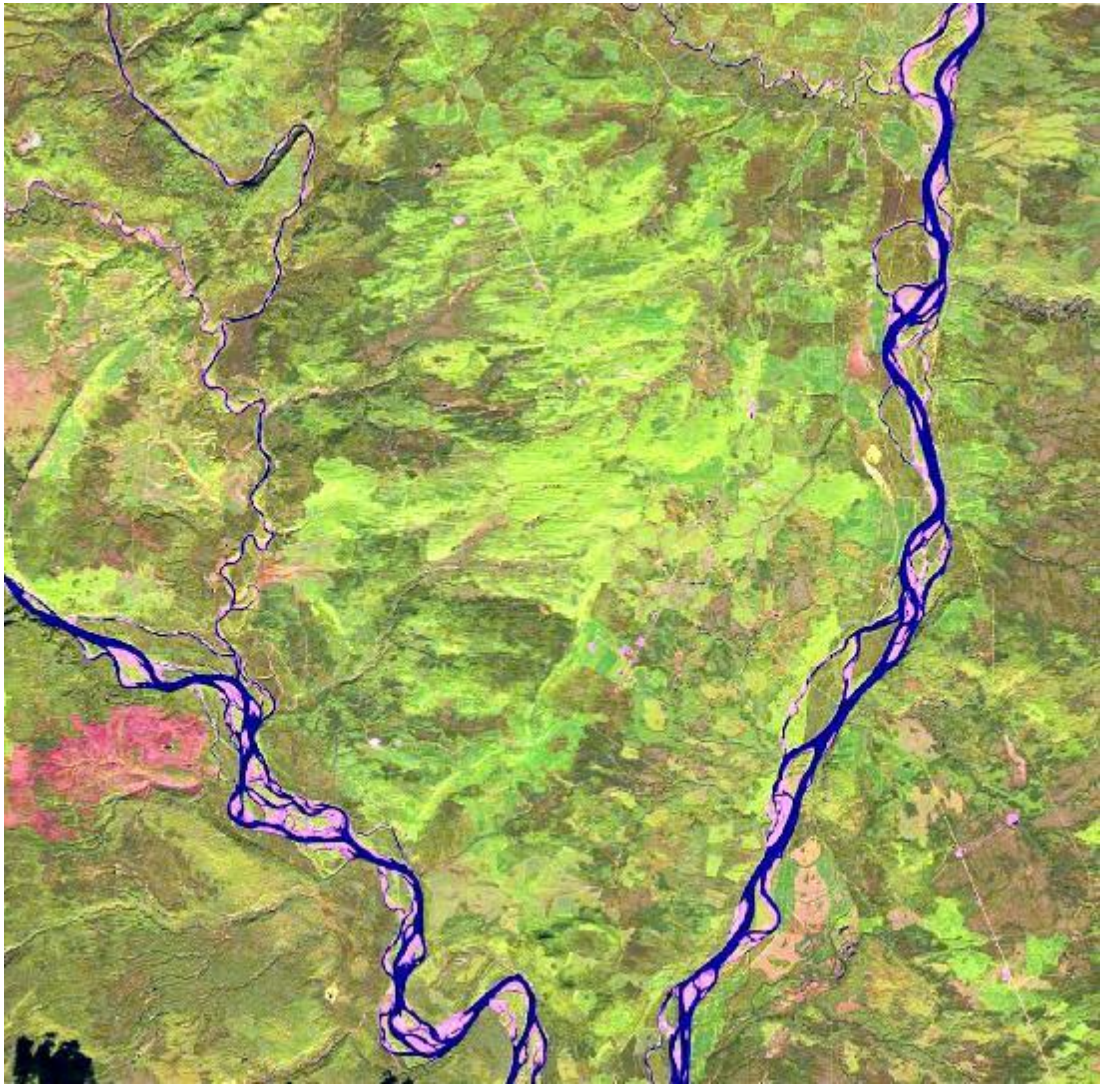
http://earthobservatory.nasa.gov/IOTD/view.php?id=84202

Mount Polley Dam Breach, central BC, August 2014



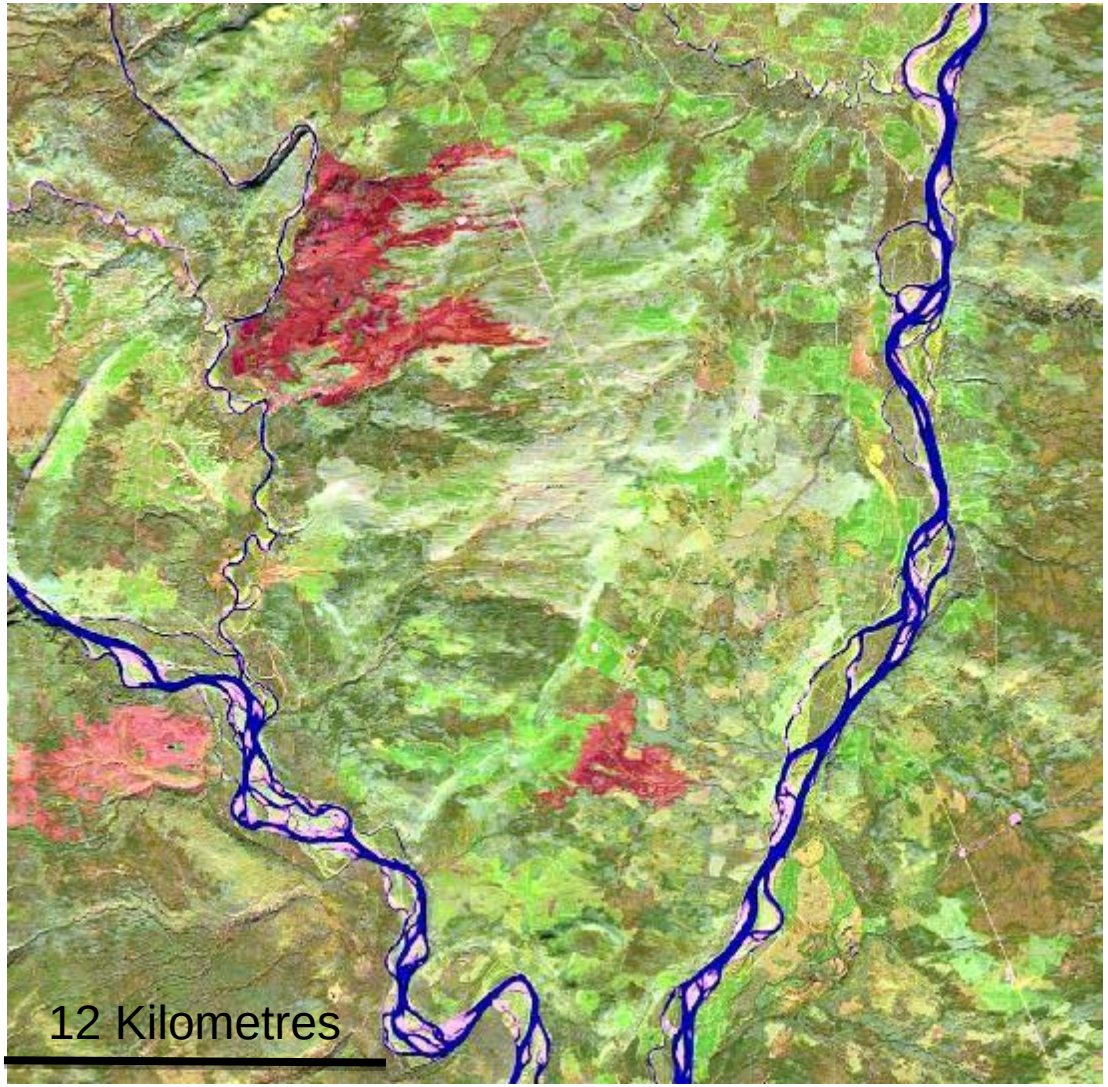
GEOG357 assignment example- before / after

Nelson Forks September 3rd 2017



This is the first graded assignment – you select/download two images showing change

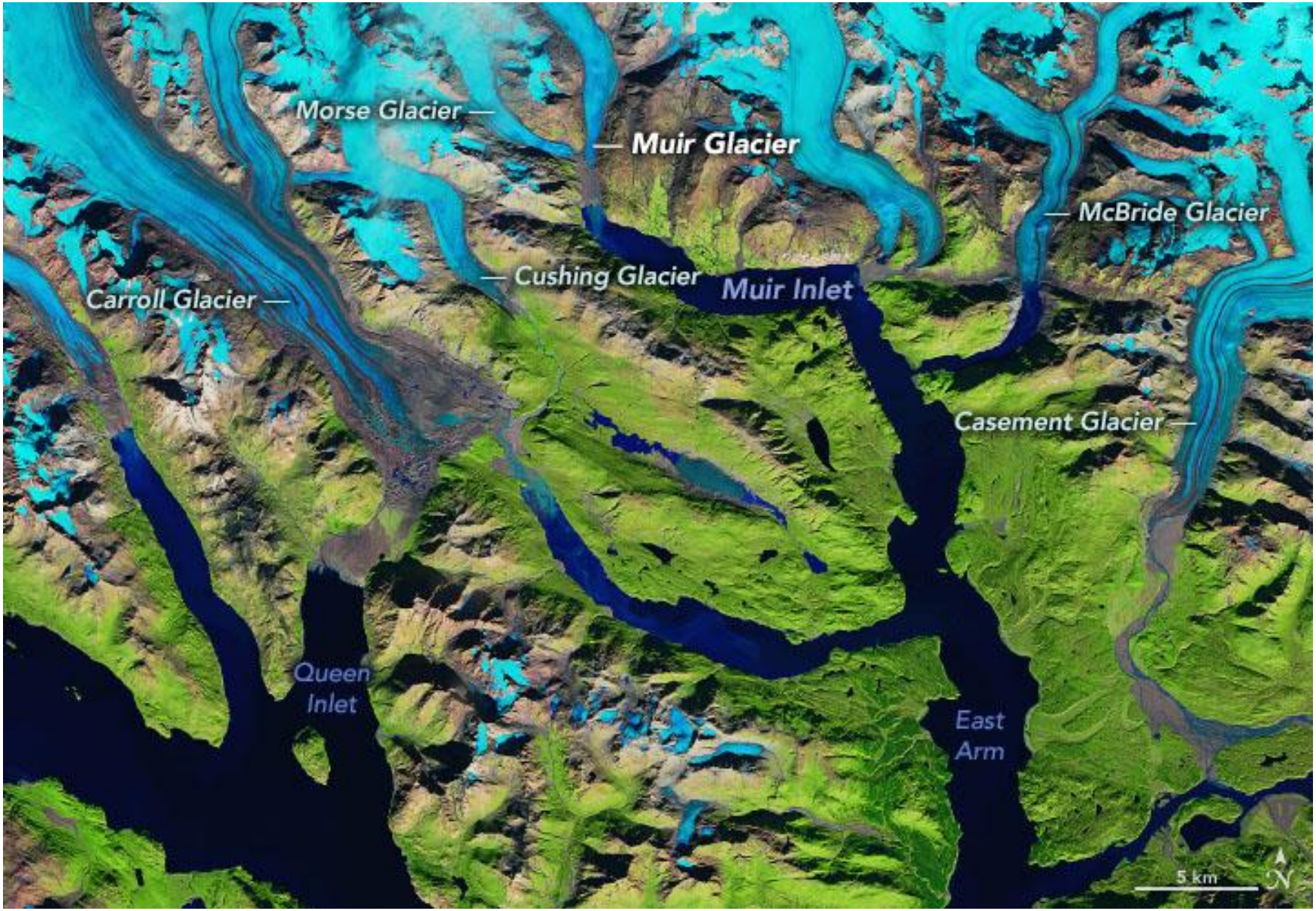
Nelson Forks September 9th, 2019



This was one of the student's last year, showing an area close to his home
Your project too should cover an area and topic of interest to you and your studies

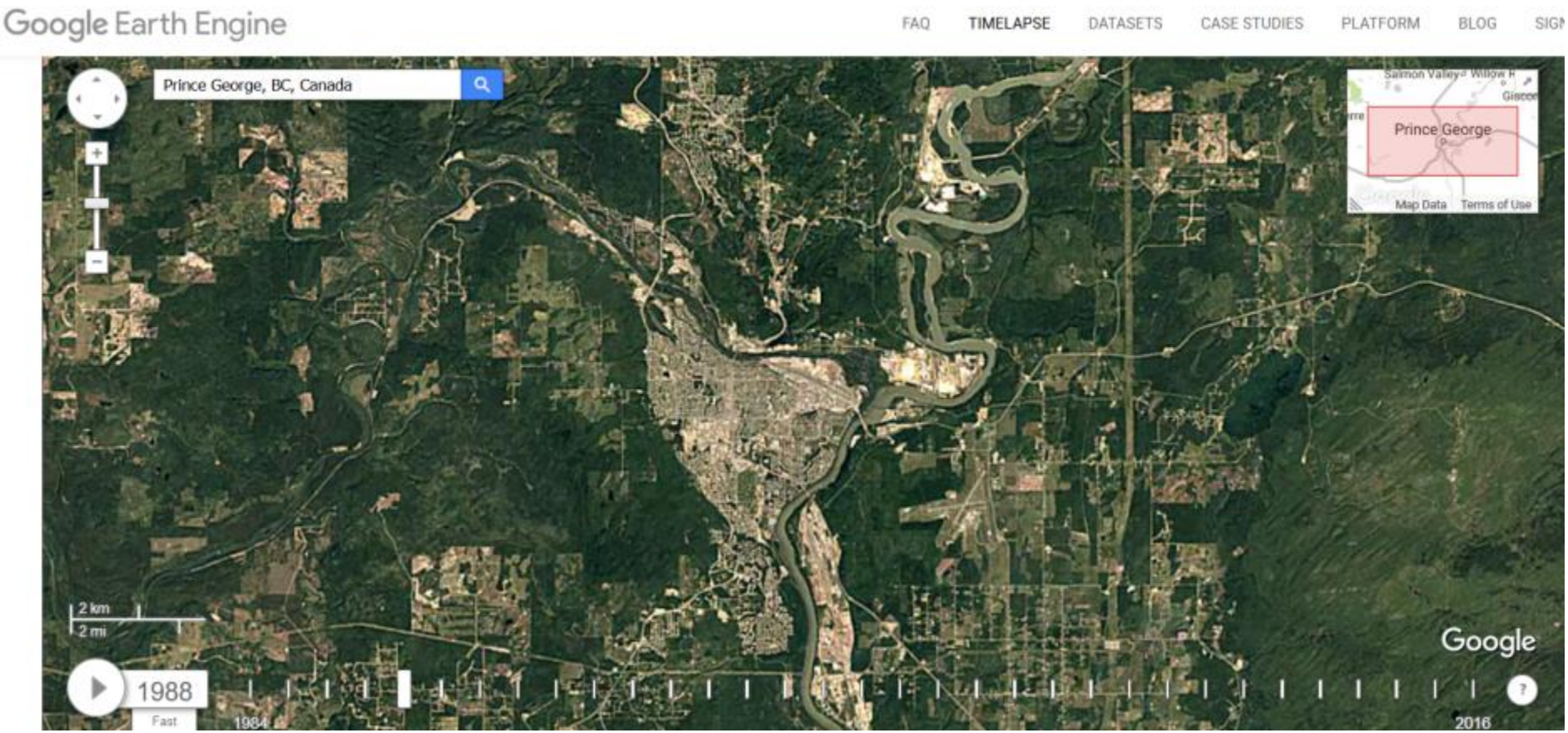
Here's another example showing glacier change 1986-2019

https://earthobservatory.nasa.gov/images/147171/inlets-iceberg-maker-is-nearly-gone?src=eoa-iotd



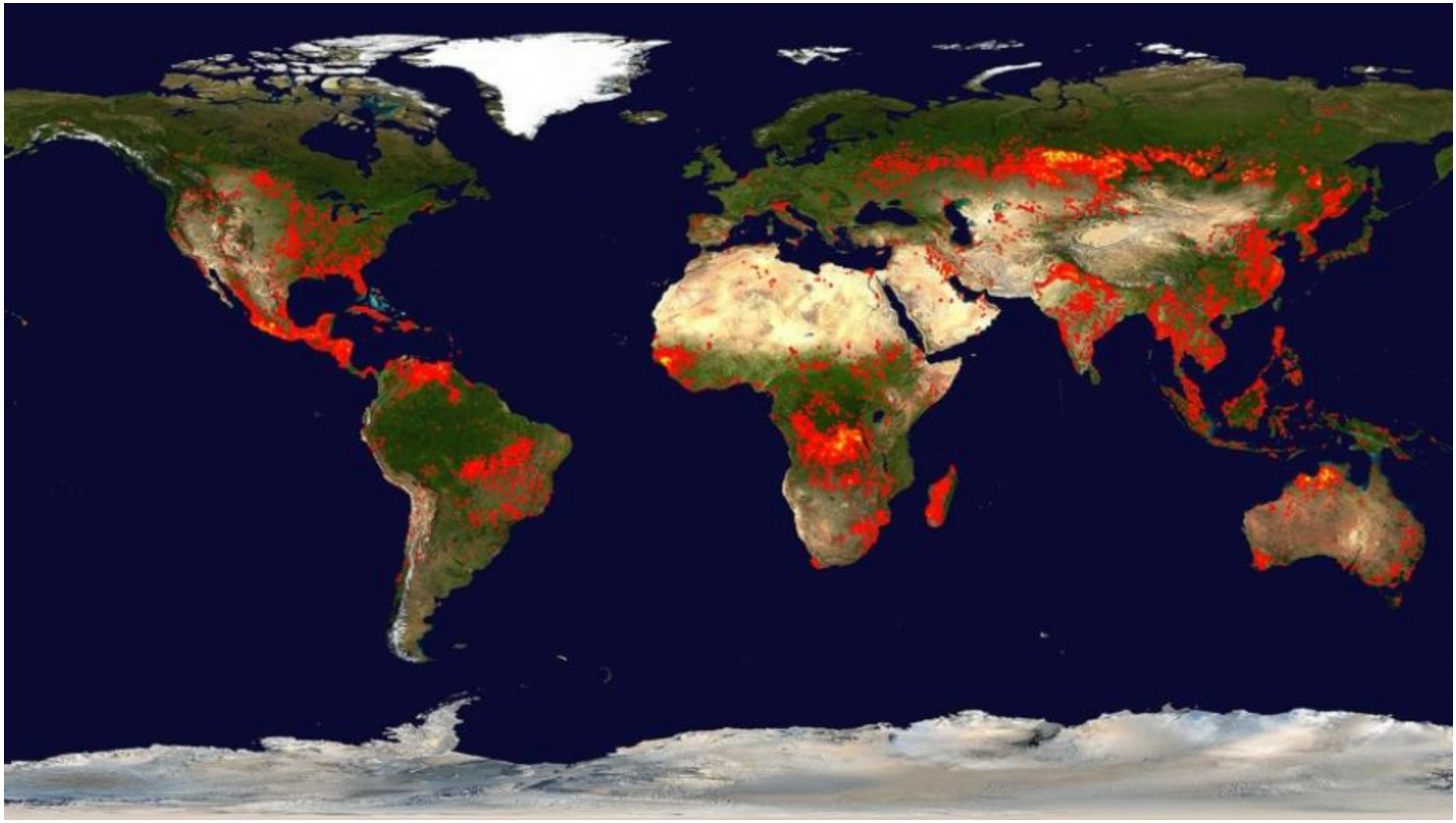
Mapping and showing change
Landsat images 1984 - 2022 (30m res.)

https://earthengine.google.com/timelapse/

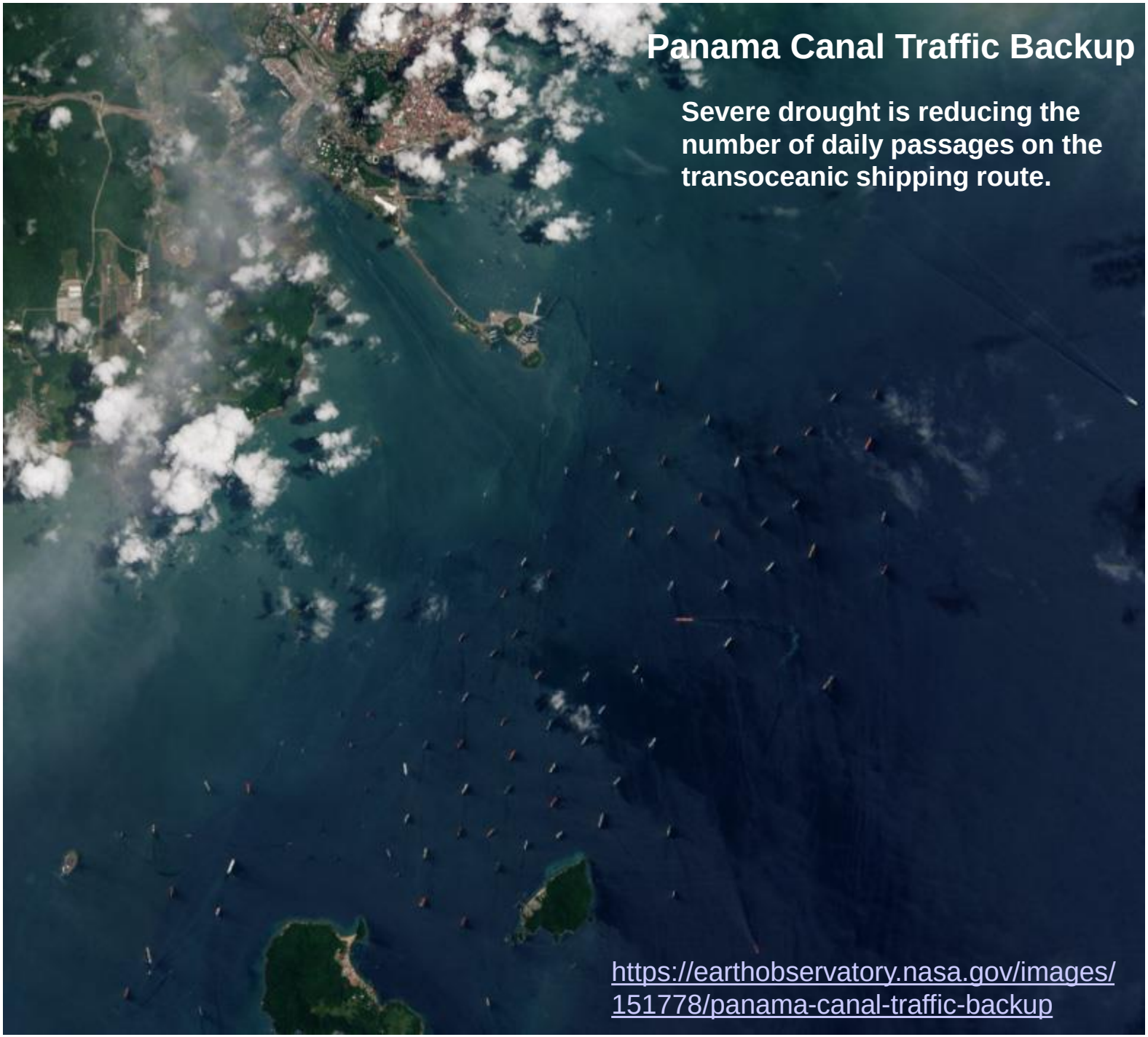


The google earth engine now shows ~40 years of change around the world, though the images chosen are not always the best – they will be in your work !.. You can use the link above to review where they might be interesting changes (quite subtle in Prince George)

Fires around the world, May 2019



Example of Global Remote Sensing from free satellite imagery


Panama Canal Traffic Backup
Severe drought is reducing the number of daily passages on the transoceanic shipping route.
https://earthobservatory.nasa.gov/images/151778/panama-canal-traffic-backup

References: online webpages

http://gis.unbc.ca/courses lecture/lab notes

Many textbooks available in library: G70.4 ....

Evaluation:

60% labs/project/practical

25% project

25% lab exercises

10% environmental change exercise

40% written /exams

30% exams and quiz

10 % article 'critique'