GEOG357: Remote Sensing

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2025 class (~12):

4 Geography

2 Computer Science

2 Forest Ecology/Management

2 Integrated Science

1 Natural Resource Planning

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

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

References: online resources (websites) / library

RS: the acquisition/analysis of ground-aerial-**satellite** image data

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

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

- vector data is often quickly outdated e.g. forest cover, urban areas …. while images can be current or more recent e.g. today

- Images are not 'generalized' (pixel size apart) - shows it like it is

- Many image sources are freely downloadable

- Most GIS spatial data were created from remote sensing

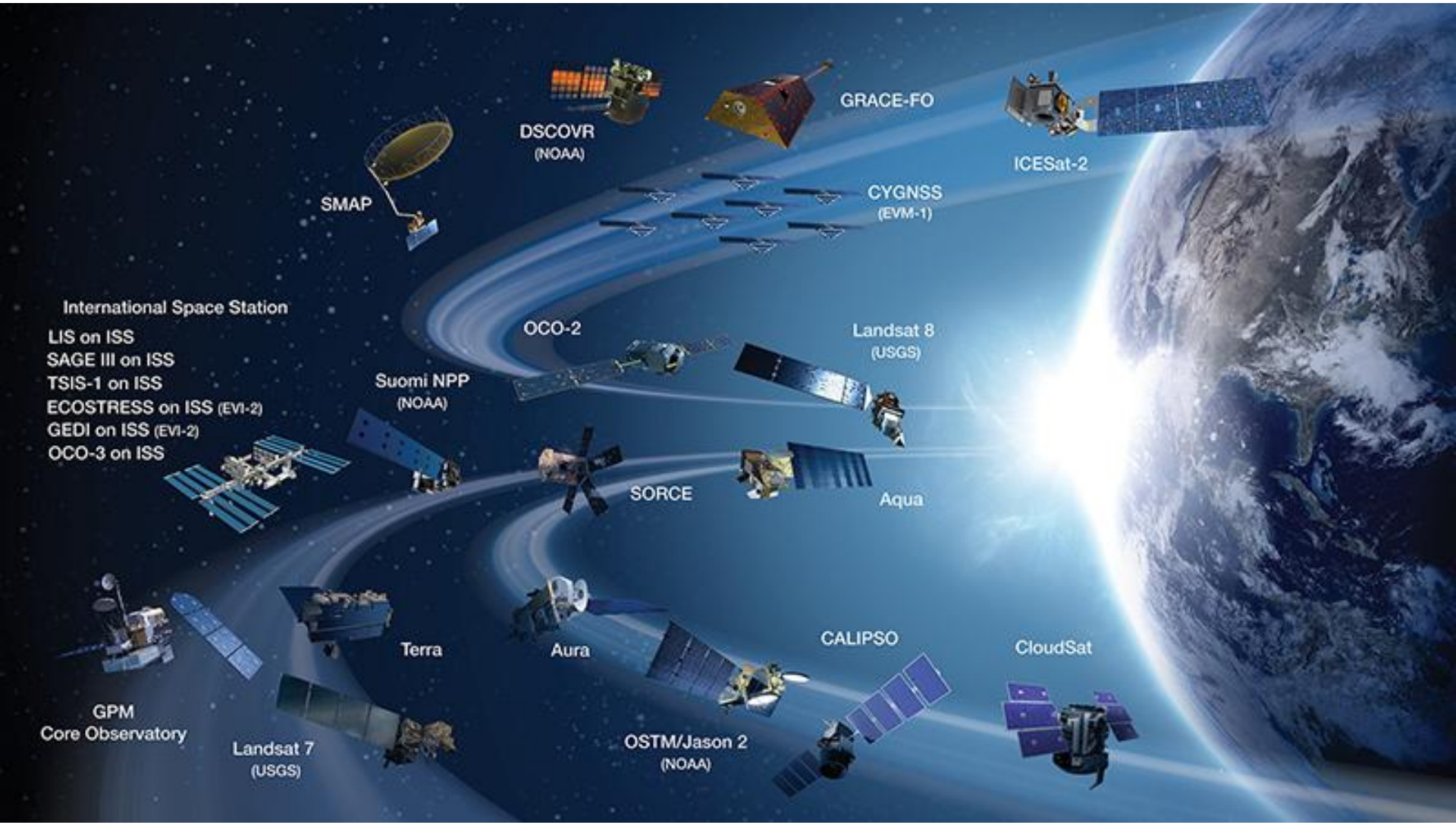
- Images cross administrative boundaries (vector data may stop) …. and with (almost) no data blackouts

- Size and remoteness of Canada – cannot be mapped easily

- Satellite image data are collected continuously

https://earthnow.usgs.gov/observer

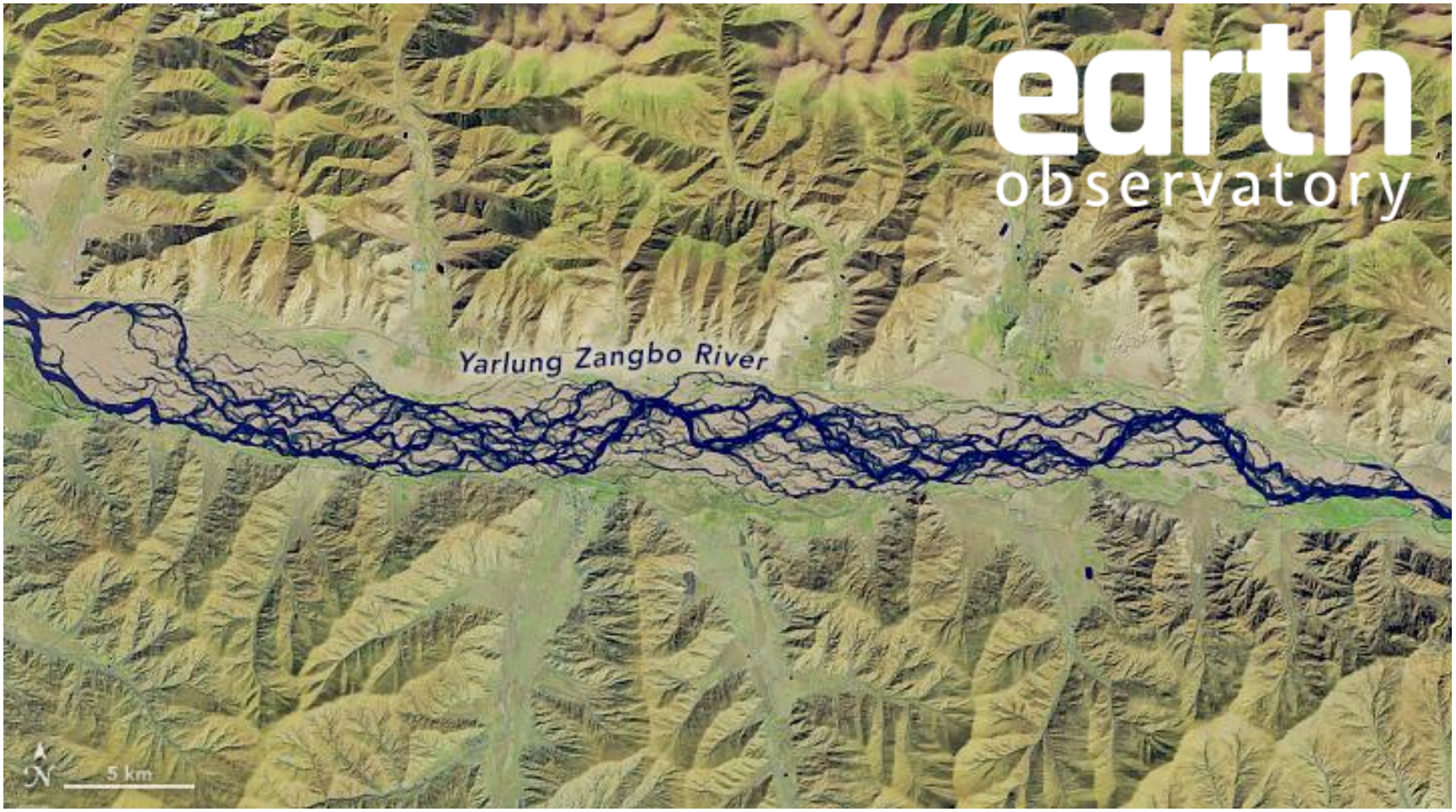
There are thousands of satellites in space, many of them for Earth Observation (EO)



15,000 satellites, 5000 for EO (some thousands no longer operational = satellite debris)
- These enable continuous monitoring of earth surface

https://earthobservatory.nasa.gov

Braided River in Tibet Redraws Its Channels



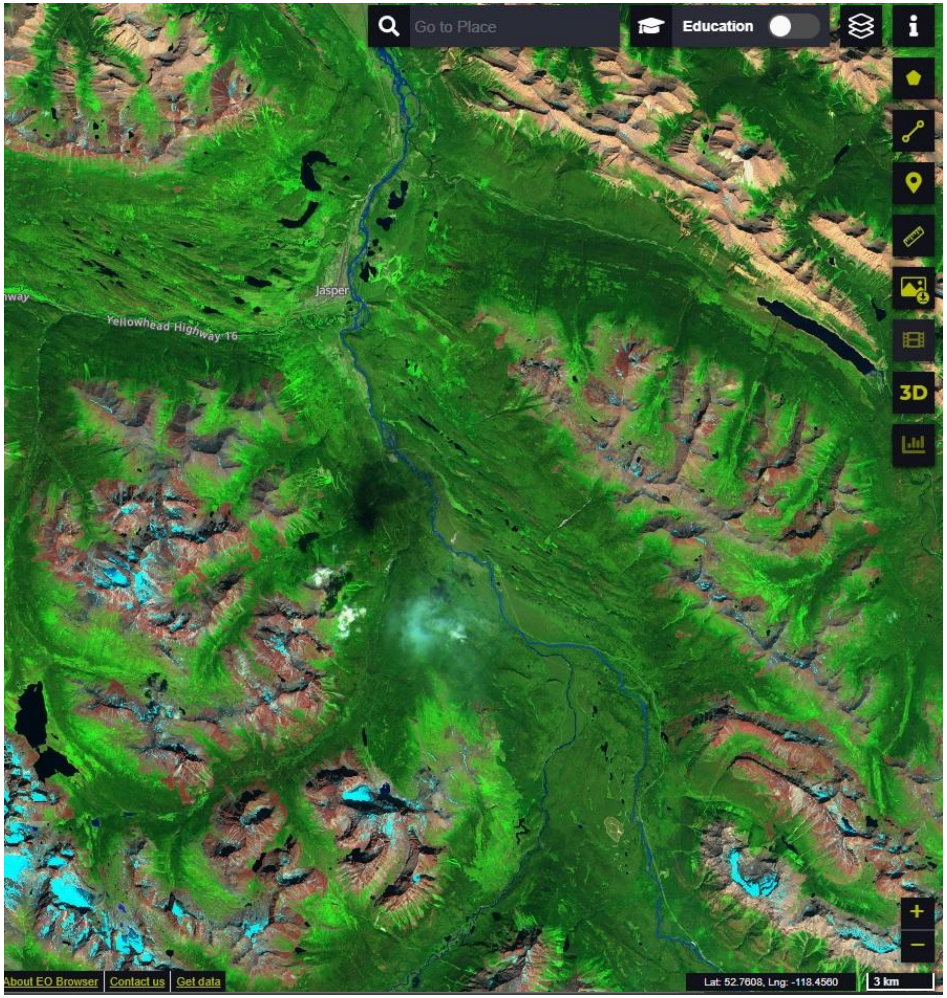
https://earthobservatory.nasa.gov/images/154724/hail-scars-alberta-farmland

Fagradalsfjall, Iceland: August 2022 eruption

2021-2022-2023

Jasper fire (July 22 2024): Sentinel2 July 20 - August 19

Image combines visible reflectance, Near and Shortwave Infrared;
Fire, clouds (2%), one month season difference – snow, shadows



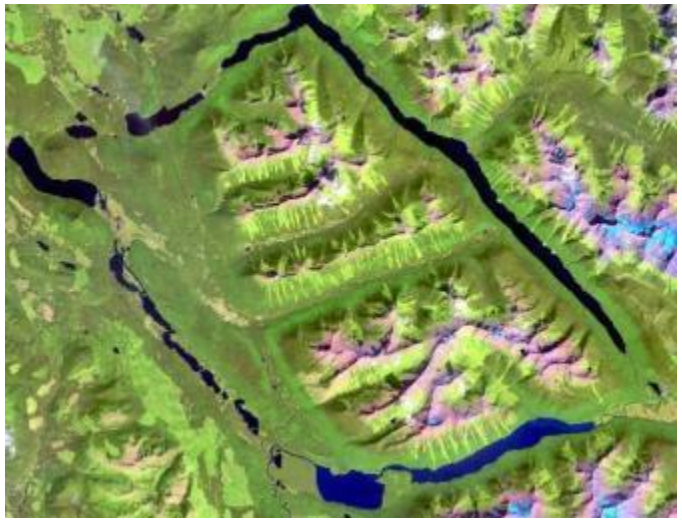
Early RS – (aerial) photography (>1840):

Balloons - US Civil war

World War 1:

Pigeon with german camera;
balloons and planes

Why did the term 'Remote Sensing' appear in 1960s ?



Advent of :

a. Satellites (Space Race)

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

i.e. extended beyond aerial photography

Remote Sensing coined by Evelyn Pruit
American geographer, 1918-2000

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 mapping programs in Canada

1950s Use of colour photography and infra-red

1960 First reconnaissance (spy) satellites: e.g. Corona

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

1970-> Remote sensing milestones

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

1980s: Landsat 4-5 – the 'next generation' imagery (1984-2011)
and first commercial software e.g. PCI (Canada)

1986: SPOT 1 (France)

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

2000: corporate high resolution (<1metre) satellites
2005: Google Maps / Earth – global Landsat mosaic
2008: Landsat data freely downloadable (others follow)

2010s: LiDAR and UAVs (Uncrewed Aerial Vehicles - drones)

2020s: Online data processing 'in the cloud' e.g. Google Earth Engine
Free online software options e.g. ESA SNAP

RS in the media myth 1:

“it’s so big, you can see it from space”

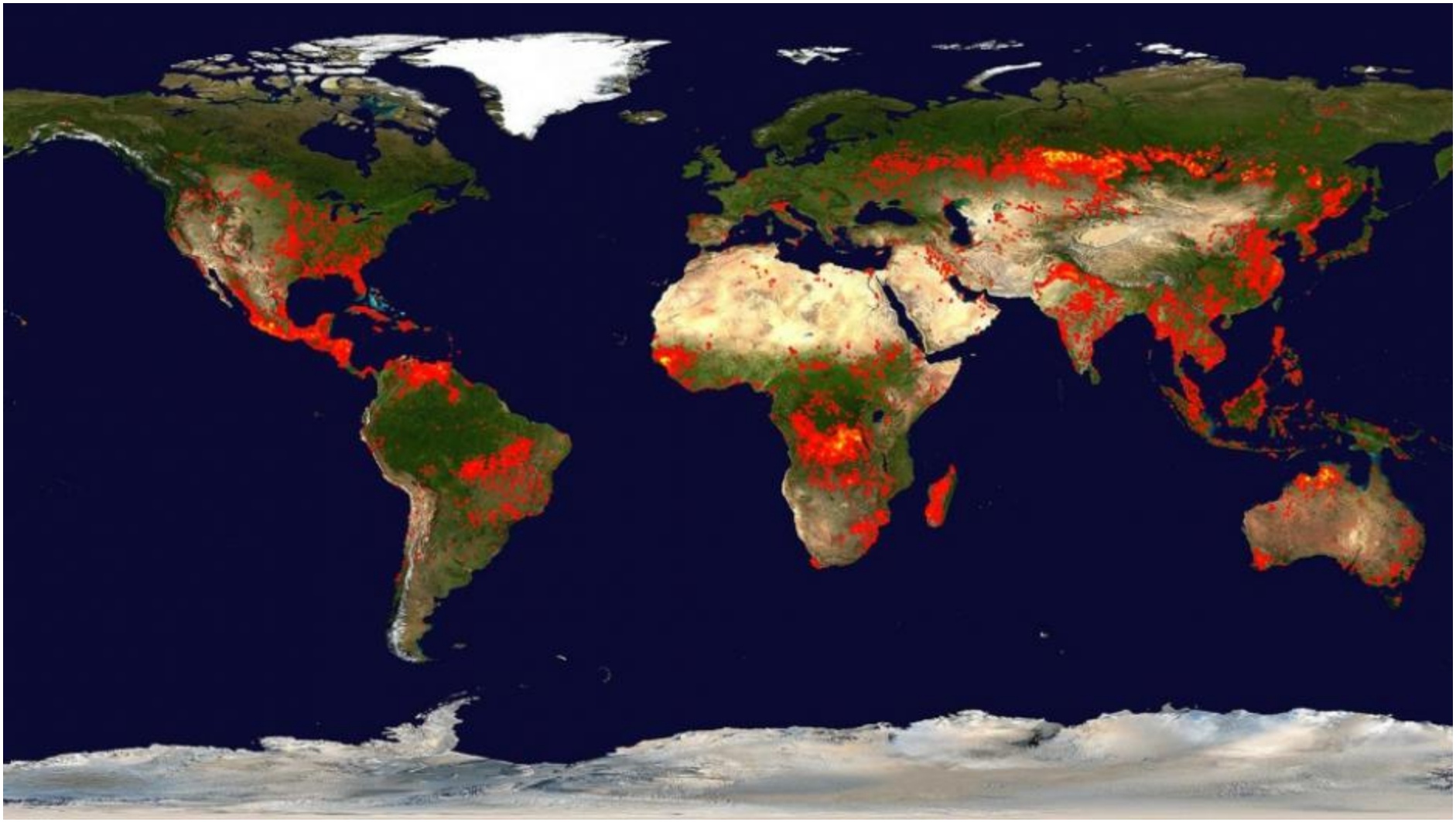
High resolution satellite imagery (Maxar), 15-30cm Feb 28, 2022; Russian tanks

Ukraine: the new satellite war
https://www3.nhk.or.jp/nhkworld/en/shows/digitaleye


Very high-res example
Worldview3 2014
Rainbow Range
Chilcotin, BC 31cm
Google

Fires around the world, May 2019

Example of Global Remote Sensing from free satellite imagery



Alabama teenager is using this site to map fires started in Ukraine

.. ‘OSINT’ – Open Source Intelligence – helps show current Russian activity

Myth #2 about remote sensing: This is a satellite photograph, but most are NOT
e.g. the previous slide images were captured from scanners, not cameras (not 'taken')

Exceptions e.g. ISS: Alberta, BC / Rocky Mountain Trench, from International Space Station, 2014
Aerial and drone digital photography also cameras, not scanners (but some planes do use scanners)

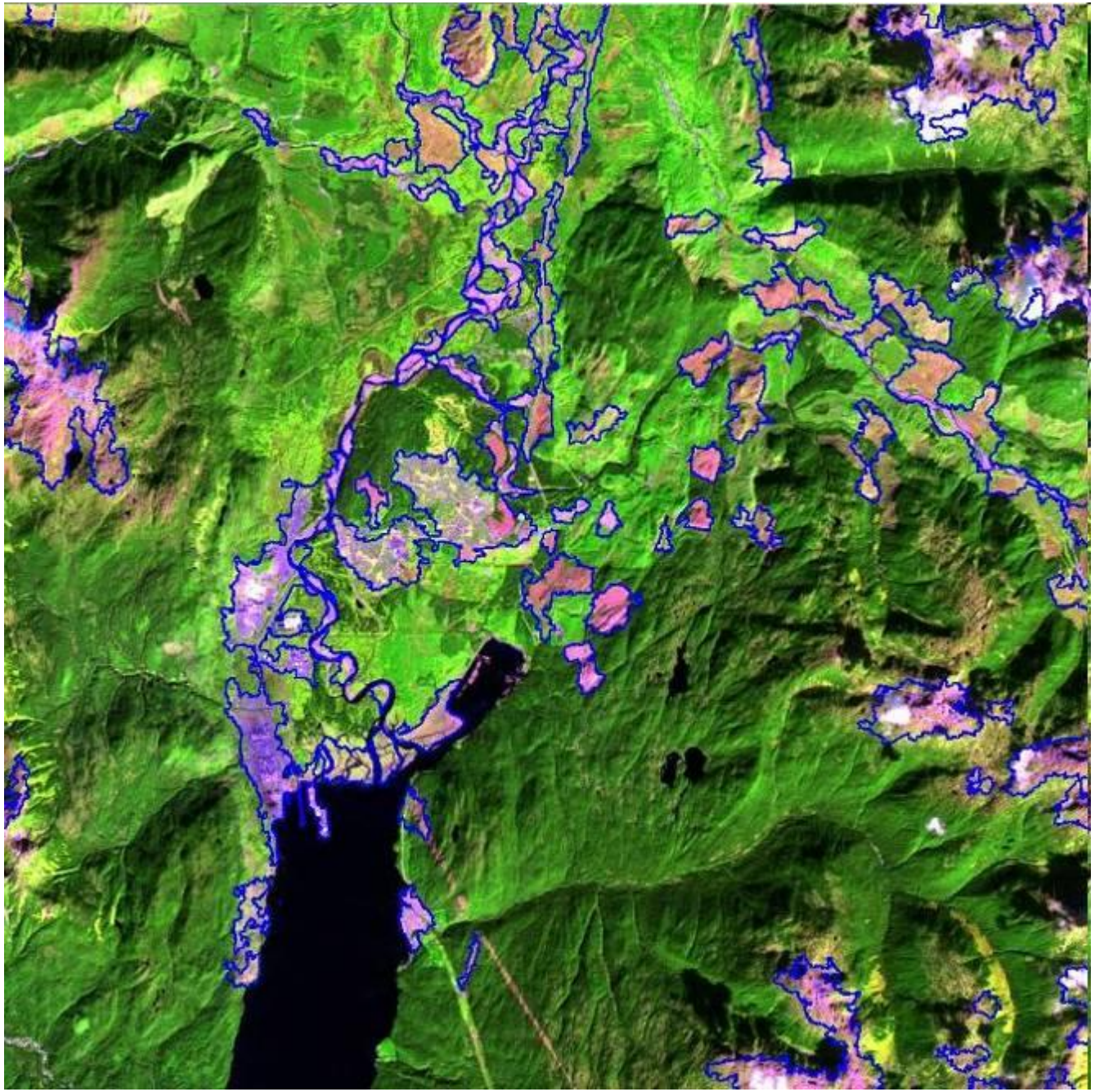
Traditional mapping from aerial photography and GIS layer creation – manual digitising

Canada was mapped this way 1945-2012 = > 13,300 map sheets at 1:50,000 scale also including thematic layers e.g. forestry, geology

Digital remote sensing imagery – auto-generation of map layers – e.g. polygons

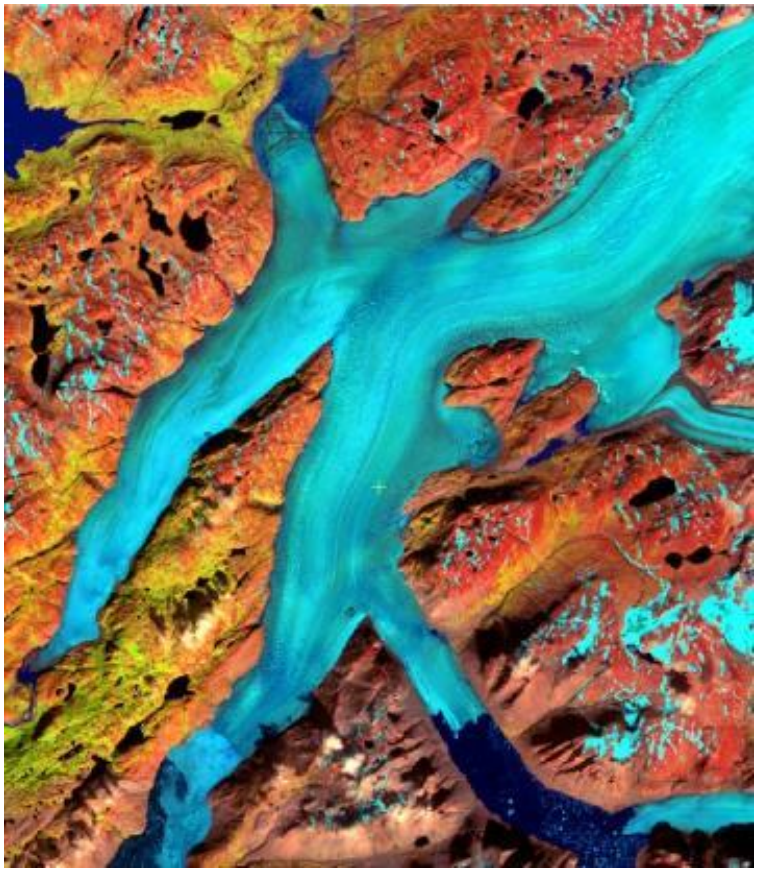
Sample from GEOG357 project: non-forested map layer

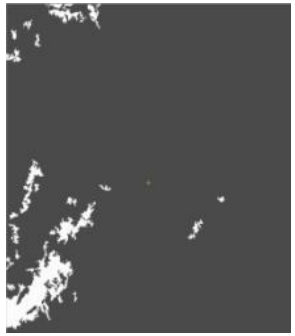
= ‘land cover classification’



GEOG357 project to extract polygon layers

Extraction of Glaciers, Water, and Vegetation - the Southeast Coast of Greenland



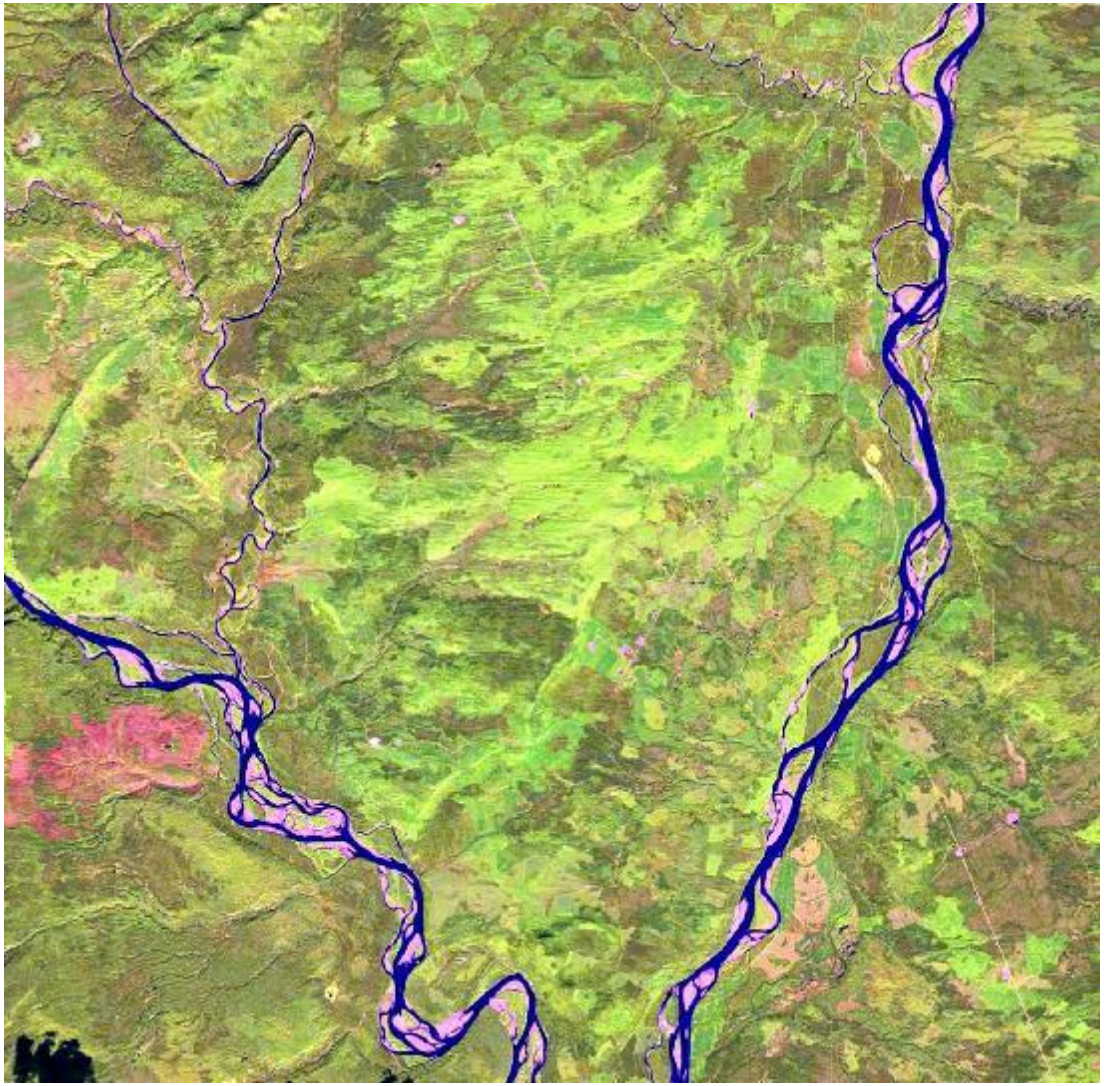


Threshold images for ice, water and vegetation derived from digital band ratios

Ice, water, veg.

GEOG357 environmental change assignment example- before / after

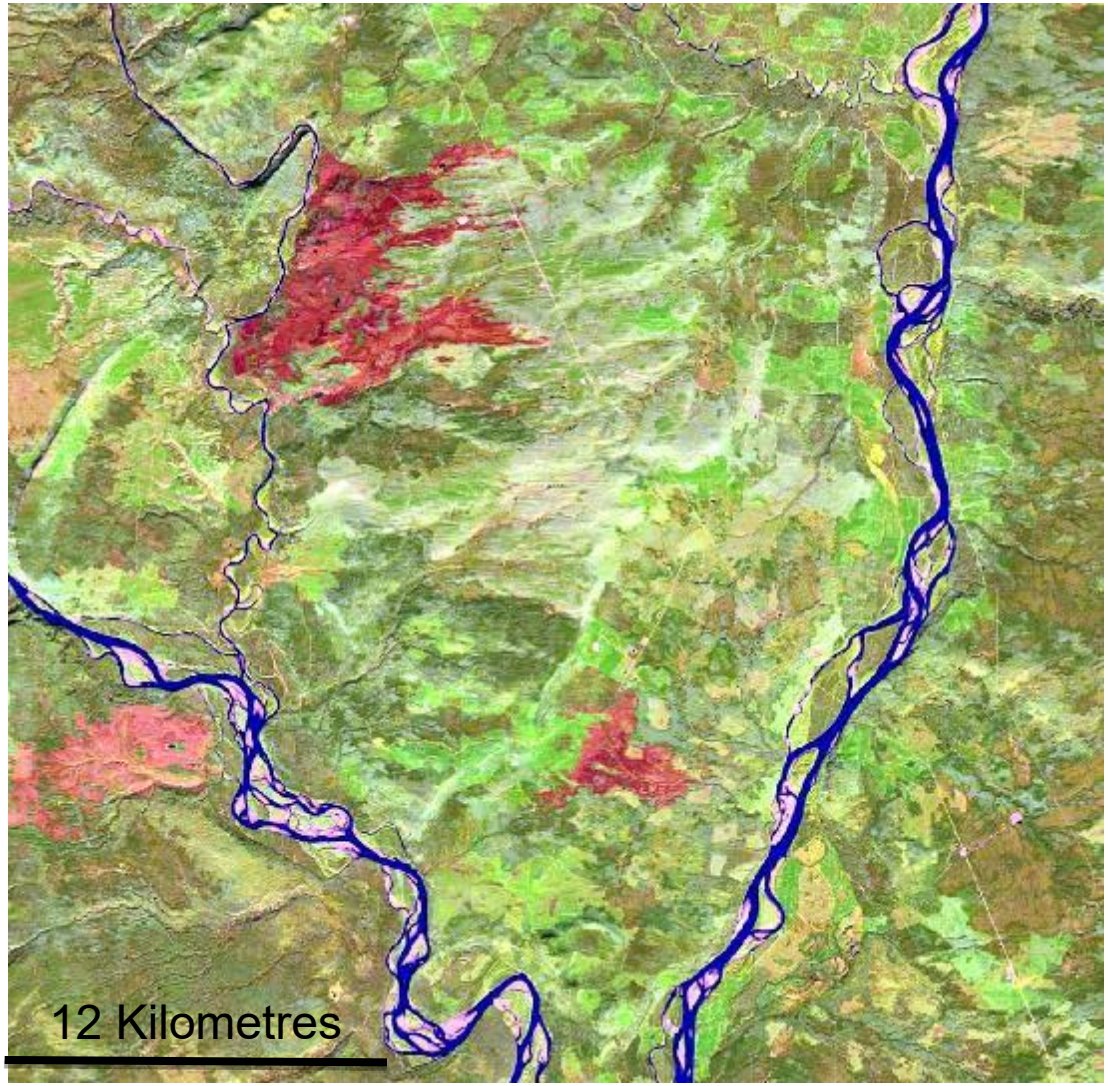
Nelson Forks
September
3rd 2017



For 10% mark you select/download / interpret two images showing change

Nelson Forks
September
9th, 2019

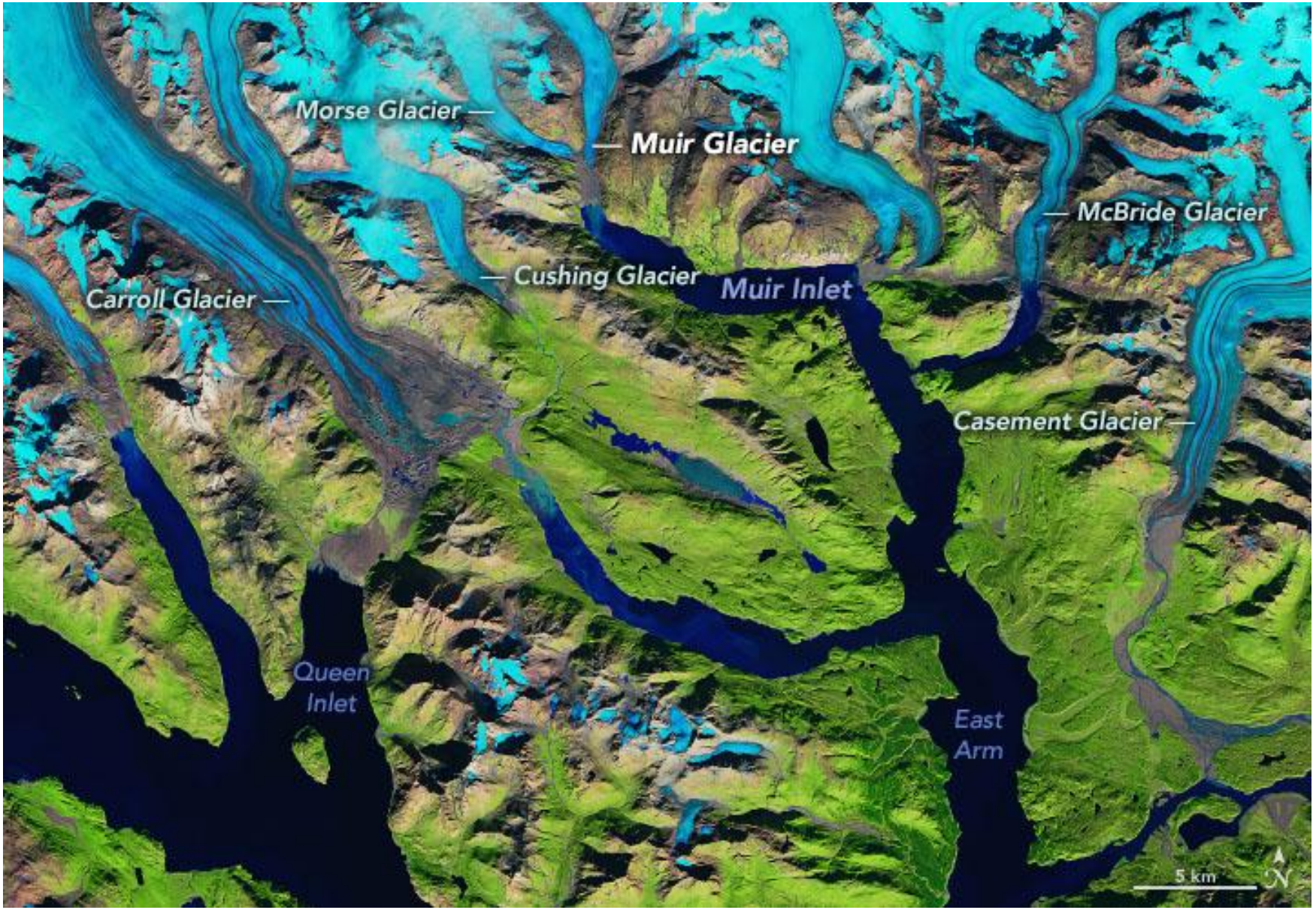
Note perfect registration between the two image dates



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

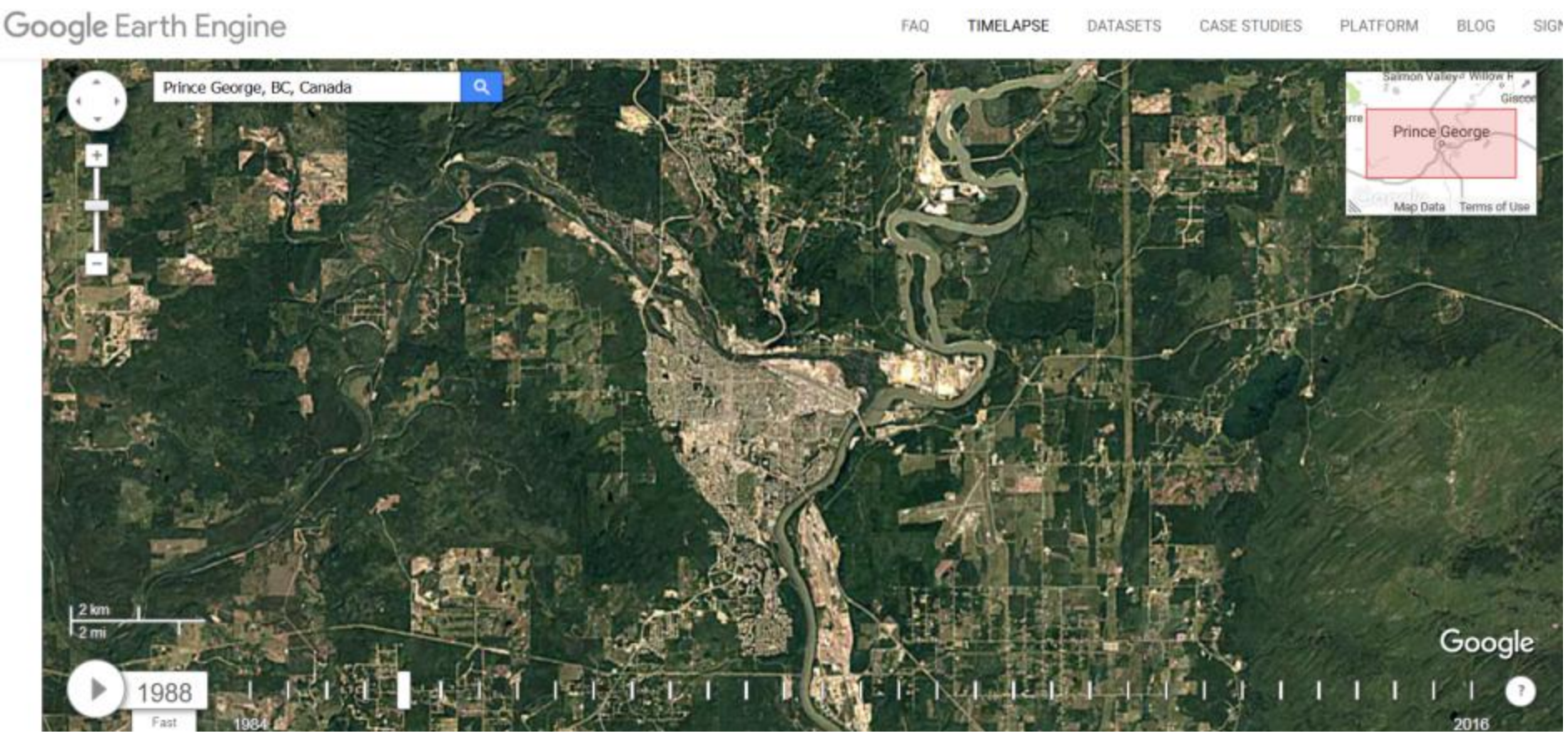
Here's an example showing glacier change 1986-2019

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



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

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



Google earth engine now shows ~40 years of change around the world.
You can use this link to review where there might be interesting changes

GEOG357 Syllabus Fall 2025 (draft)

Date	*Lecture Topics*	*Lab*
Sept 2025		
3	Introduction	
8-12	Electro-Magnetic Spectrum / Image data-display	*Lab 1: Image display / software*
15-19	Unsupervised / supervised classification	*Lab 2: Unsupervised Classification*
22-26	Sensors-platforms / Thermal / Microwave	*Lab 3: Supervised Classification*
October		
S29-Oct3	Band ratios / Indices-Transforms	No Lab – Truth-Reconciliation day
6-10	Feature extraction / Environmental Change	*Lab 4: Ratios and indices*
14-17	Thanksgiving / *Mid-Term Exam (15%)*	*Lab 5: Feature extraction*
20-24	Glaciers / Change detection	*Lab 6: Glaciers*
27-31	Env. Change class demos / DEMs	*Lab 7: Change detection*

November

3 – 7 RADAR - LiDAR / Projects *Lab 8: DEMs*

10-14 '*mid-semester break'*

17-21 High resolution sensors / Planetary RS *Lab 9: Projects-data*

24-28 Future trends / RS Software; course review *Lab 10: Data processing*

Dec 1-5 *Exam2 (10%)* Project demos (5 minutes each) *Lab 11: project write-up*

Dec 9-19 exam period (no final exam in this course)

Holidays: September 30 (Tuesday), Oct 13 (Monday), Nov 10-14 (reading week)

Syllabus/Lectures slides/labs: *gis.unbc.ca* Lab assignments: *moodle.unbc.ca*

References: online / webpages; textbooks in library

Evaluation 100%

- Exams: Oct 15, Dec 2 25%
- Lab exercises 8 x 5% 40%
- Environmental Change exercise 10%
- Final project, due Dec 8 25%

Course goals, you should develop / gain:

- Understanding of imagery and wavelengths
- Digital imagery to map selected features
- Role of remote sensing in Geomatics / GIS
- Public education and media e.g. Google Earth
- Data availability for a range of applications
- Ongoing developments in current technology
- Methods to monitor our earth .. and other planets