GEOG357 wrap-up

Tuesday 12.30 (now): RS software and course Summary

Thursday 12.30: 2nd exam in lecture time

Monday 11.30: lab time for project

Tuesday 12.30: 'project demos' – a few slides / 5 minutes each: e.g.

1: goal – type of application, study area, image data used and year(s)

2: colour composite image of area (clipped) with date

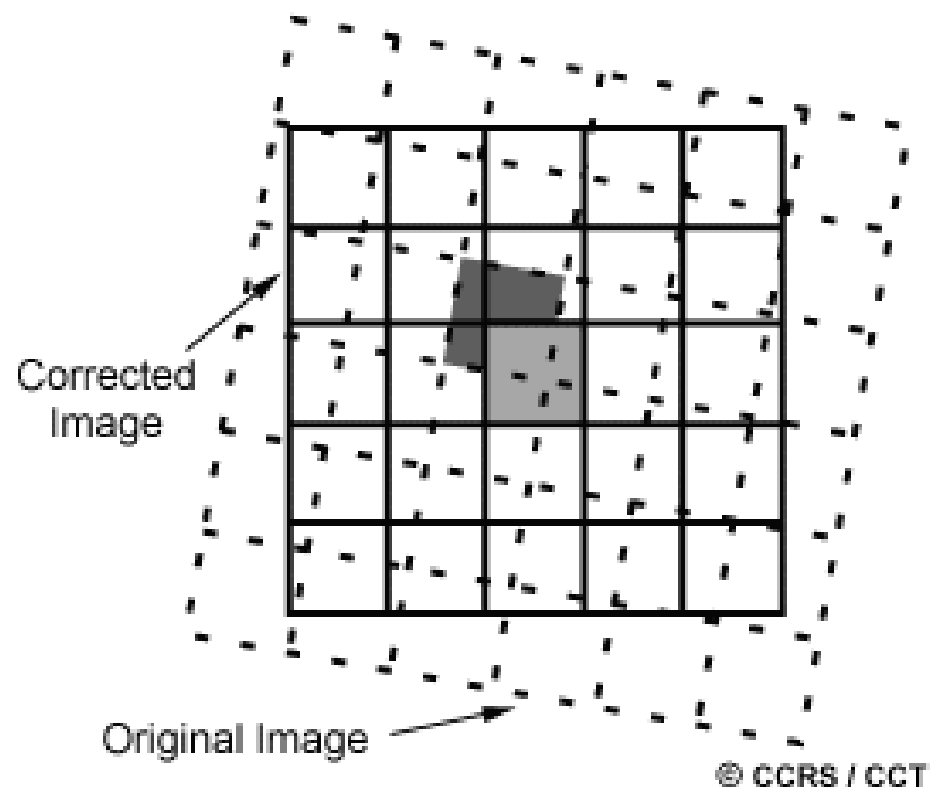3-4: processing: e.g. classification, ratios, bitmaps etc.

5: summary results

- Could be extra slide(s) showing some challenging issues

Please: no first slide with just your name and student ID ☺

Course review and software summary

Pre-processing:

Geometric correction

e.g. 'nearest neighbour correction'

Radiometric correction

Mosaic without Radiometric correction

Canada's remote sensing satellite platform/sensor

This RADARSAT-2 image of Vancouver was acquired May 16, 2011 using the Fine Quad-Pol beam mode (8m resolution). This image represents volume scattering of various surface types:

unruffled = blue, double bounce = red and diffuse = green.

http://www.asc-csa.gc.ca/eng/satellites/radarsat2

GIS software

ArcGIS (1981) dominates as industry standard

Idrisi (1986) alternative for education / research

QGIS (2002) open source - free download

Others …. (fewer since 1995)
1994: BC Gov used PAMAP (Victoria) and Terrasoft (Nanaimo)

Remote Sensing software

... Not just one that rules them all like GIS

➤The big three

➤Less expensive options

➤Free download options

Remote Sensing software: the big 3

Software, HQ   **special strength**

ERDAS (Atlanta, USA: 1978)   – vector integration

PCI (Toronto, **Canada**: 1982)   – orthoimages / breadth

ENVI (Boulder, USA: 1991)   - hyperspectral

Earth Resources Data Analysis System (ERDAS)

The first version of ERDAS was launched in 1978 on Cromemco microcomputers running the CDOS - OS.

➢ Unix / Windows / Mac

➢ Live link raster-vector 1988

➢ Partnered with ESRI 2000

➢ Owned by Leica (2001) -> Intergraph -> Hexagon

➢ Current version: Imagine - filetype: .img

PCI Geomatics, Canada 1982

... formed as Perceptron Computing Inc.
   (NOT MANY PEOPLE KNOW THIS)

➤Windows and Linux

➤First versions (FORTRAN) were command line:
    EASI : 'Engineering Analysis and Scientific Interface'
   (NOT MANY PEOPLE KNOW THIS)

➤Current version: **Catalyst (2022)** – previously Geomatica Banff

➤File type **.pix**

"PCI Geomatics, is the world leader in geo-imaging products and solutions. PCI Geomatics offers customized solutions to the geomatics community in over 135 countries."

➢Recognised as the most extensive RS software system

➢Modules written by leading Canadian researchers

➢Best for orthorectification .. Orthoengine

➢Most support for new sensors

🔵 Toutin's Model

ASTER, AVNIR, CARTOSAT, CBERS, DEIMOS, DMC, DUBAISAT, EOC, EROS, FORMOSAT, GEOEYE, GF
GOKTURK, GOSAT, HJ, IKONOS, IRS, KAZEOSAT, KOMPSAT, LANDSAT, MERIS, ORBVIEW, PLEIADES, PRISM
QUICKBIRD, RAPIDEYE, RASAT, SJ9, SPOT, SSOT, TH, THAICHOTE, WORLDVIEW, YG, ZY

ENVI: Boulder, CO 1991

"ENvironment for Visualizing Images"

http://www.exelisvis.com/ProductsServices/ENVIProducts.aspx
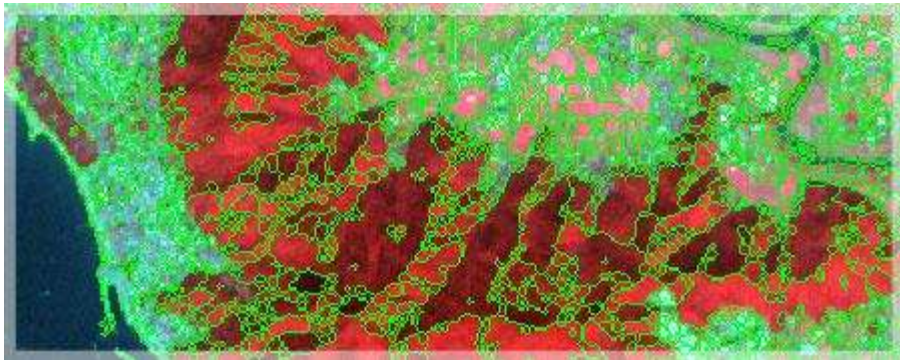
Find and extract specific objects with the ENVI Feature Extraction Module (ENVI FX). User-friendly tools to extract features from geospatial imagery based on the object's spatial, spectral, and texture characteristics and identify them as objects like vehicles, buildings, roads, coastlines, rivers, lakes, and fields.

ArcGIS spatial analyst (formerly GRID)

Spatial Analyst functional reference
- ⊞ Color Model (Spatial Analyst)
- ⊞ Conditional (Spatial Analyst)
- ⊞ Conversion (Spatial Analyst)
- ⊞ Density (Spatial Analyst)
- ⊞ Distance (Spatial Analyst)
- ⊞ Extraction (Spatial Analyst)
- ⊞ Generalization (Spatial Analyst)
- ⊞ Groundwater (Spatial Analyst)
- ⊞ Hydrology (Spatial Analyst)
- ⊞ Interpolation (Spatial Analyst)
- ⊞ Local (Spatial Analyst)
- ⊞ Map Algebra (Spatial Analyst)
- ⊞ Math General (Spatial Analyst)
- ⊞ Math Bitwise (Spatial Analyst)
- ⊞ Math Logical (Spatial Analyst)
- ⊞ Math Trigonometric (Spatial Analyst)
- ⊞ Multivariate (Spatial Analyst)
- ⊞ Neighborhood (Spatial Analyst)
- ⊞ Overlay (Spatial Analyst)
- ⊞ Raster Creation (Spatial Analyst)
- ⊞ Raster Management (Spatial Analyst)
- ⊞ Reclass (Spatial Analyst)
- ⊞ Solar Radiation (Spatial Analyst)
- ⊞ Surface (Spatial Analyst)
- ⊞ Zonal (Spatial Analyst)

Multivariate (Spatial Analyst)
- An overview of the Multivariate tools
- Band Collection Statistics
- Class Probability
- ClassProb
- Create Signatures
- ClassSig
- Dendrogram
- Edit Signatures
- EditSig
- Iso Cluster
- Maximum Likelihood Classification
- MLClassify
- Principal Components
- PrinComp
- StackStats

Remote Sensing in QGIS: Basics of Satellite Image Analysis

Become proficient in applied Remote Sensing in QGIS & spatial analysis / project analysis & fundamental concepts in QGIS

4.4 ★★★★☆ (145 ratings) 2,084 students

Created by Kate Alison

🔔 Last updated 11/2022 ⊕ English ▦ English [Auto]

CA$13.99 ~~CA$99.99~~ 86% off

⏰ **2 hours** left at this price!

Add to cart

Buy now

30-Day Money-Back Guarantee

This course includes:

- ▶ 5 hours on-demand video
- 📄 1 article
- 🗇 24 downloadable resources
- ∞ Full lifetime access
- 📱 Access on mobile and TV
- 🏆 Certificate of completion

What you'll learn

✓ Acquire a thorough understanding of satellite remote sensing principles

✓ Learn how to apply satellite remote sensing principles in practice

✓ Learn the most popular open-source GIS and Remote Sensing software tools (QGIS) and Semi-automated classification (SCP) plugin

✓ Create your first GIS maps for your reports/presentations in QGIS

✓ Learn how to obtain satellite data, apply Remote Sensing image preprocessing, create training and validation data in QGIS

✓ Learn abouit open source Remote Sensing software tools and data portals

✓ Apply Land use and Land Cover (LULC) Mapping and Change Detection in QGIS

✓ Learn how to plan and practise to implement your first geospatial project based on Remote Sensing data

SAGA — System for Automated Geoscientific Analyses

Raster GIS, Germany, 2004   **FREE**

integrated into QGIS

http://www.saga-gis.org/en/index.html
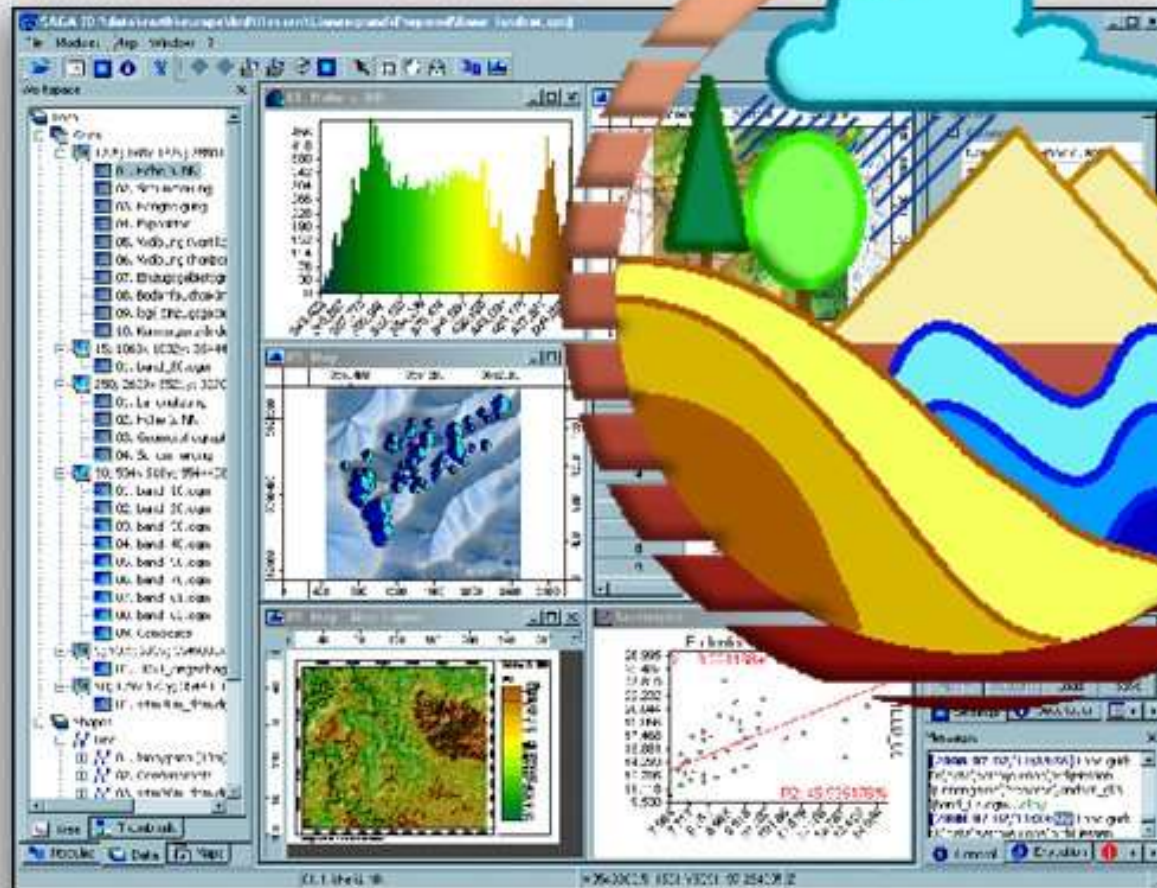
GRASS raster GIS (1982)

Started in 1982 by U.S. Army - Construction Engineering Research Laboratory (USA-CERL) in Champaign, Illinois. USA-CERL completed its last release of GRASS in 1992. GRASS development was assumed by academia in 1997, and became an OS project – an international team manages the source code. **FREE**

Now part of QGIS

Dune Migration at Jockey's Ridge State Park, North Carolina
Infrared photo draped on USGS LIDAR data

IDRISI Worcester (Boston) $

http://www.clarklabs.org   Idrisi Canada: http://www.idrisi.ca

Raster based GIS and remote sensing since 1986

Feature / segment classification (instead of per pixel) is now part of all GIS/RS software:
    or …. Object-based image analysis (OBIA)   .. See Advanced RS (GEOG457)

Free viewers

Basic viewer & conversion utilities

	Windows	Macintosh	Solaris	Linux	other
ERDAS Viewfinder http://gis.leica-geosystems.com/products/imagine/downloads/viewfinder.asp	Yes				
ENVI FreeLook Viewer http://rsinc.com/pr/detail.asp?PRID=16 ftp://ftp.rsinc.com/pub/freelook/	Yes	Yes	Yes	Yes	Yes
ER Viewer http://ermapper.com/downloads/download_view.aspx?PRODUCT_VERSION_ID=48	Yes				
PCI Geomatica FreeView http://pcigeomatics.com/product_ind/freeview.html	Yes				
TNTlite - free version of TNTmips. http://microimages.com/tntlite/	Yes	Yes	Yes	Yes	Yes
ESRI ArcExplorer http://esri.com/software/arcexplorer/	Yes		Yes	Yes	Yes

https://www.microimages.com/products/tntmips.htm

See also for more remote sensing software:
http://archeologiamedievale.unisi.it/NewPages/REMOTESENS/REMOTE11.html

Software:

Scripting e.g. using R, Python, GDAL
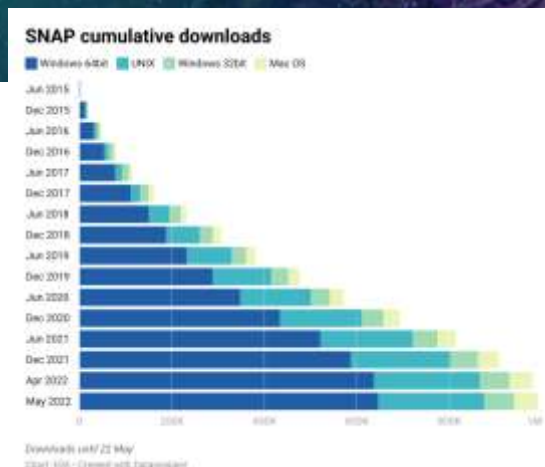
Google Earth Engine is a cloud computing platform for processing satellite imagery and other Earth observation data. It provides access to a large warehouse of satellite imagery and the computational power to analyze those images.

https://earthenginepartners.appspot.com/science-2013-global-forest

Global Forest cover loss 2000-2016

Updated site: https://glad.earthengine.app/view/global-forest-change

Landsat Free Archive - How Landsat Data are Being Used
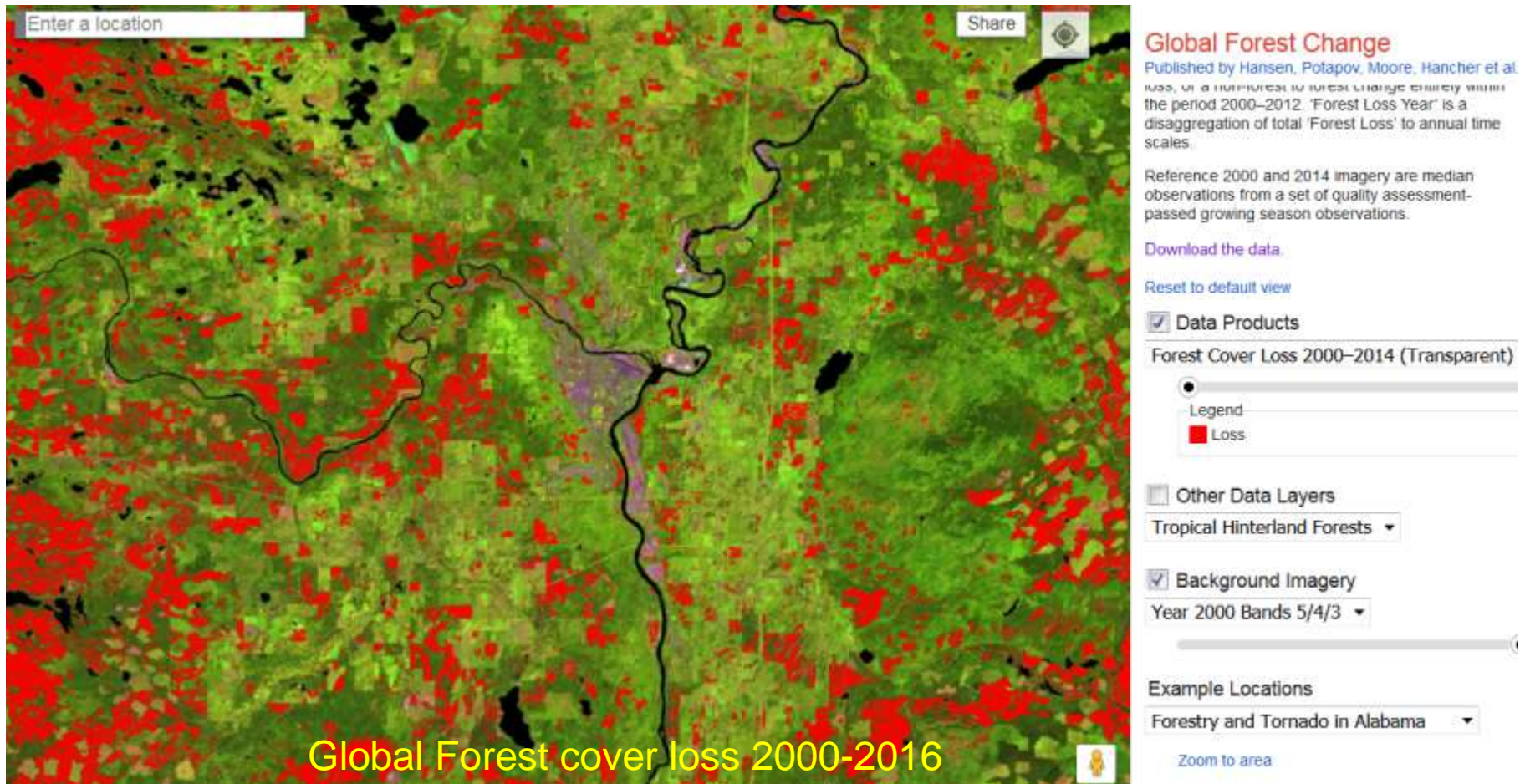
Statistics as of August 31, 2009

Since 2009

Primary Data Usages

- ENERGY 0.4%
- TELECOMMUNICATIONS 0.6%
- PLANNING 1.2%
- OTHER 1.4%
- TERR MONITORING 1.4%
- FIRE 2.0%
- VISUALIZATION 2.8%
- CRYOSPHERE 2.8%
- WATER 4.2%
- NATURAL RESOURCES 4.8%
- CLIMATE CHANGE 5.1%
- GEOLOGY 5.3%
- ECOSYSTEM 6.7%
- FORESTRY 10.8%
- LAND CHANGE 13.4%
- AGRICULTURE 16.2%
- EDUCATION 19.5%
- SOCIOECONOMICS 0.1%
- NATIONAL SECURITY 0.3%
- EMERGENCY RESPONSE 0.3%
- INTERNATIONAL LAND ISSUES 0.3%
- HUMAN ECOLOGY 0.3%
- HUMAN HEALTH 0.4%

Diomede Islands

Little   Big

Neat images

Attu (MODIS)

Aleutian Islands

Westernmost

(and easternmost?)
point of North
America

50 km
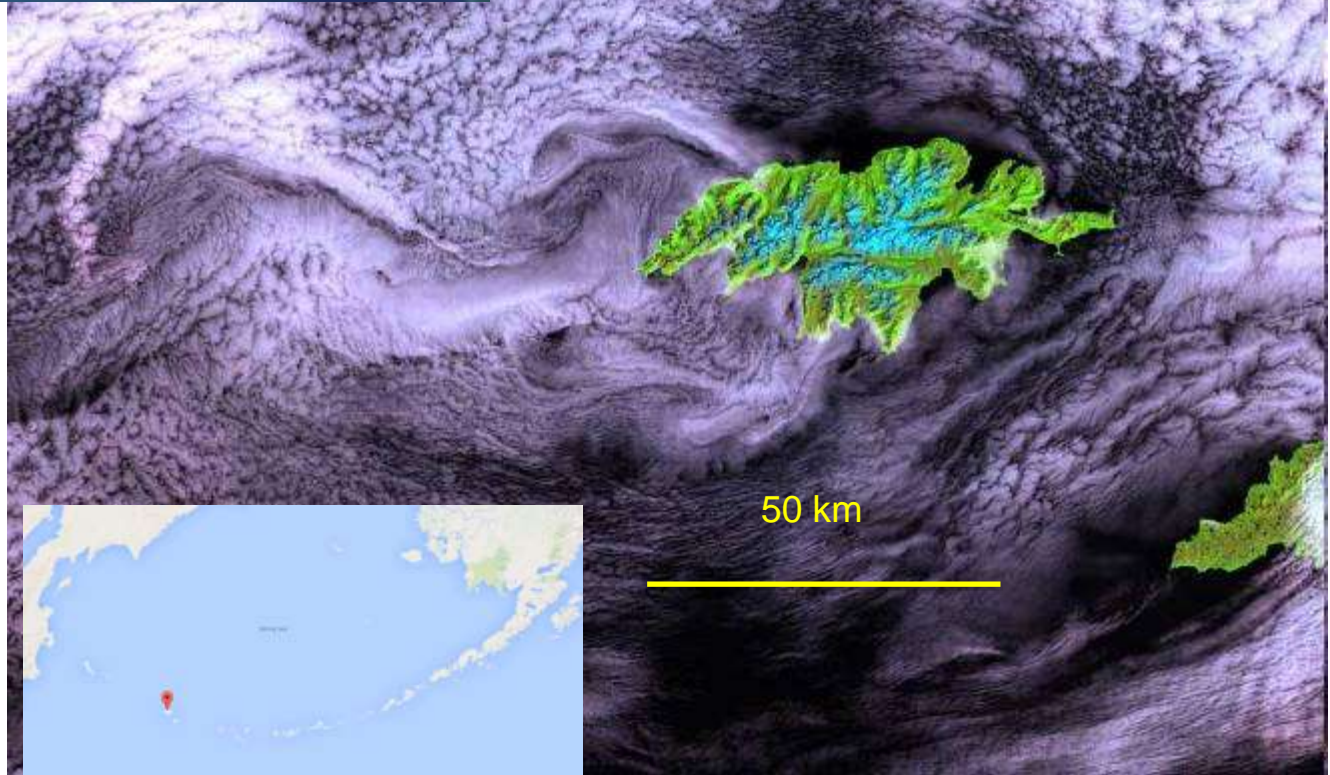
Did Aliens create Indian Head with an iPod ?

Badlands Guardian (CBC)

This feature can be found 300 KMs SE of Calgary.
50° 1' N   110° 7' W

Identified from Google Maps/Earth by morning light / sun angle

Discoveries from aerial photography:
Nov 2020: mystery metal monolith found in Utah by bighorn sheep researchers, from helicopter

August 2015

October 2016

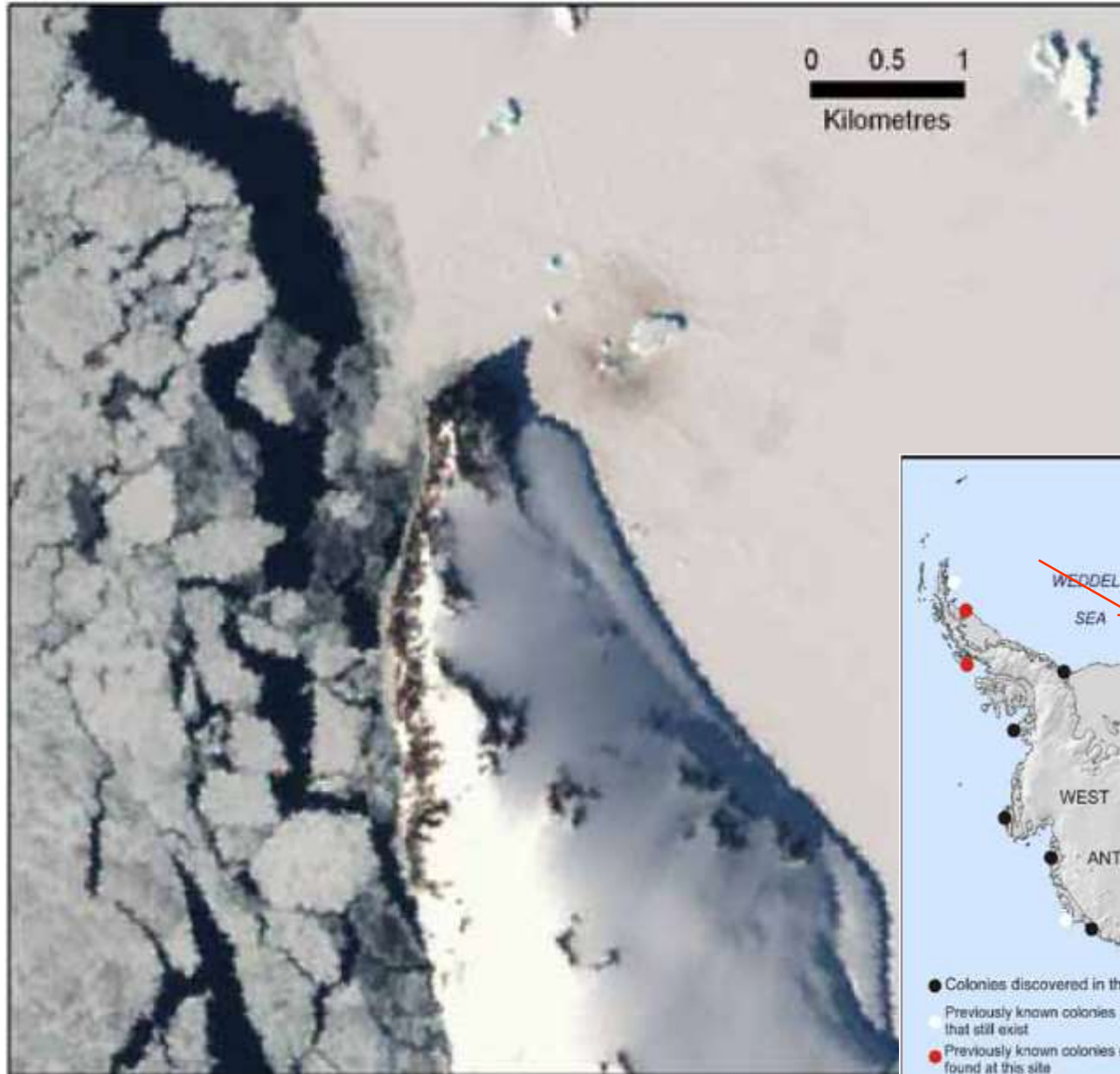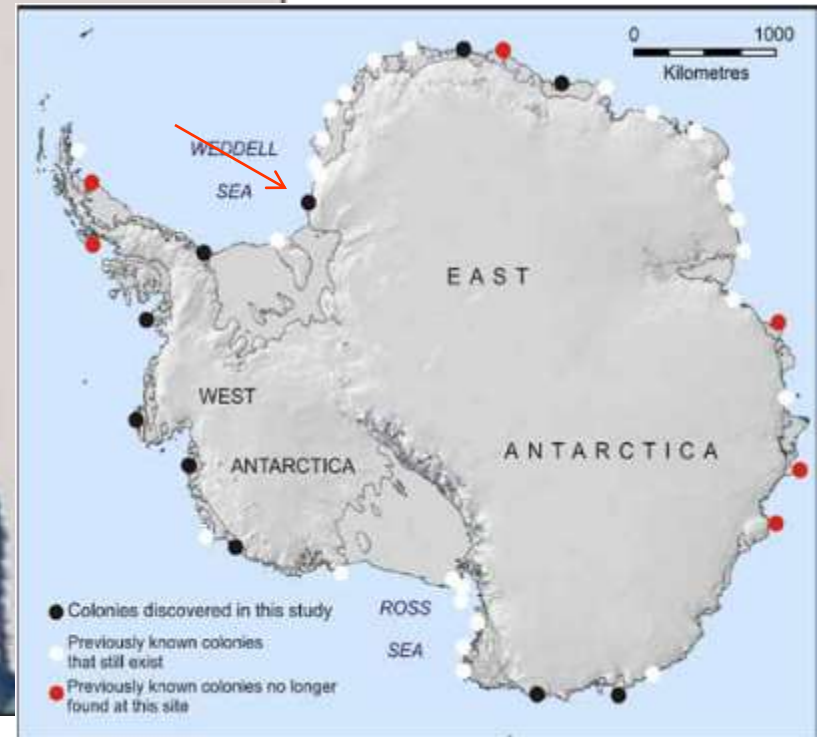# Mapping Penguins from space – using penguin poop

Landsat TM image showing guano stains of an emperor penguin colony in Halley Bay, Antarctica

Course summary / review

In this course, you should have gained a sense of:

➤ Understanding of imagery and wavelengths

➤ Potential of digital imaging to extract selected features

➤ The potential power of multispectral sensing

➤ Contribution of remote sensing to Geomatics / GIS

➤ Public education and media e.g. Google Earth

➤ Data availability

➤ Many possible applications

Recent and future EOS launches

https://www.n2yo.com/satellites/?c=latest-launches

https://en.wikipedia.org/wiki/2022_in_spaceflight

https://www.space.com/china-earth-observation-gaofen-satellite-launch-november-16

Fall 2022 – second exam: Thursday 12.30: 15%

NOT cumulative: lecture material since the midterm exam:

- Thermal Imaging
- Change detection; *environmental change*
- Feature extraction; Microwave/RADAR
- Remote sensing of glaciers: DEMs
- LiDAR / LiDAR – Glacier applications (guest)
- High resolution sensors / hyperspectral; Planetary RS
- Software summary / review

Sample questions: short answers

➢ *Explain the difference between active and passive remote sensing*

➢ *What does the term 'feature extraction' mean in remote sensing ?*