GEOG357: this week

Wednesday: second exam 'similar' to midterm, fewer multiple choice

Thursday: last lab, tips on project report; demos if unable to attend Friday
Format of report and 'demo' in class will be posted on webpage (Labs)

Friday: class project demos ~ 3 minutes each, roughly as follows: e.g.

Perhaps 3- 4 slides: ppt or pdf, shared screen (or send to me)

1. area overview (colour composite)
2. enhanced image e.g. classification or threshold
3. Overlain (vector) results and expected final results

Note: many might still be works in progress – no problem !

- A nice way for everyone to get a wee glimpse of other projects.

- see outline on Labs page – lab 12

Fall 2020 - second exam: Wednesday 9.30 15%

*I will email it to everyone at 9.25am *- email back to me ~10.20am

<u>NOT</u> cumulative: only lecture material from the midterm exam:

Feature extraction; Thermal
Glaciers; DEMs
Change detection; *environmental change examples*
New millennium sensors
Microwave-RADAR; LiDAR
Planetary; Software / summary

Sample questions: (mostly ?) short answers

Explain the difference between active and passive remote sensing

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

Remote Sensing software

… Not just one that rules them all like GIS

The big three

Different options

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

ERDAS extensions for ArcGIS

http://www.erdas.com/Products/tabid/56/cdf/1139/default.aspx

Product	Description	Search: Go!
ERDAS Extensions for ArcGIS	ERDAS offers a number of solutions in various application areas for users on the ArcGIS platform. These products are geared towards image processing, feature collection and automatic feature extraction. Learn More	
Stereo Analyst for ArcGIS	With Stereo Analyst for ArcGIS, create and revise a comprehensive database of feature data. Stereo visualization improves the interpretation of images and allows for more precise collection leading to greater accuracy in your resulting layers. Learn More	
ERDAS Terrain Editor for ArcGIS	An optional extension to Stereo Analyst for ArcGIS, ERDAS Terrain Editor for ArcGIS enables you to update a Geodatabase Terrain file. The Geodatabase Terrain is decomposed into points and breaklines with triangle and contour display. Learn More	
ERDAS-Net License Manager	ERDAS-Net License Manager. With the ERDAS Software 2009 release (October 6, 2008), all ERDAS software uses the improved ERDAS-Net license manager. Learn More	
Feature Analyst for ArcGIS and ERDAS IMAGINE	Feature Analyst® provides geospatial professionals with an automated feature extraction toolset for collecting 2D and 3D features from imagery and scanned maps. Learn More	
FeatureAssist for ArcGIS	FeatureAssist for ArcGIS is an add-on to Stereo Analyst for ArcGIS for the collection of roof structures in the ESRI Multipatch format. Using templates, FeatureAssist for ArcGIS can quickly collect these features, handling varying degrees of complexity. Learn More	
Image Analysis for ArcGIS	Image Analysis™ for ArcGIS is the all-in-one solution for preparing, referencing, measuring and analyzing imagery from airborne and satellite sensors. Fully integrated with ArcGIS, it enables you to extract up-to-date information from imagery directly into a geodatabase, dramatically increasing accuracy and productivity. Learn More	
LIDAR Analyst for ArcGIS and ERDAS IMAGINE	A necessary tool for anyone working with LIDAR data, LIDAR Analyst™ automates the extraction of 3D terrain surfaces, buildings, trees and forest areas, with outstanding accuracy for both leaf-off and leaf-on	

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: Banff (2020) formerly **Geomatica**

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.”

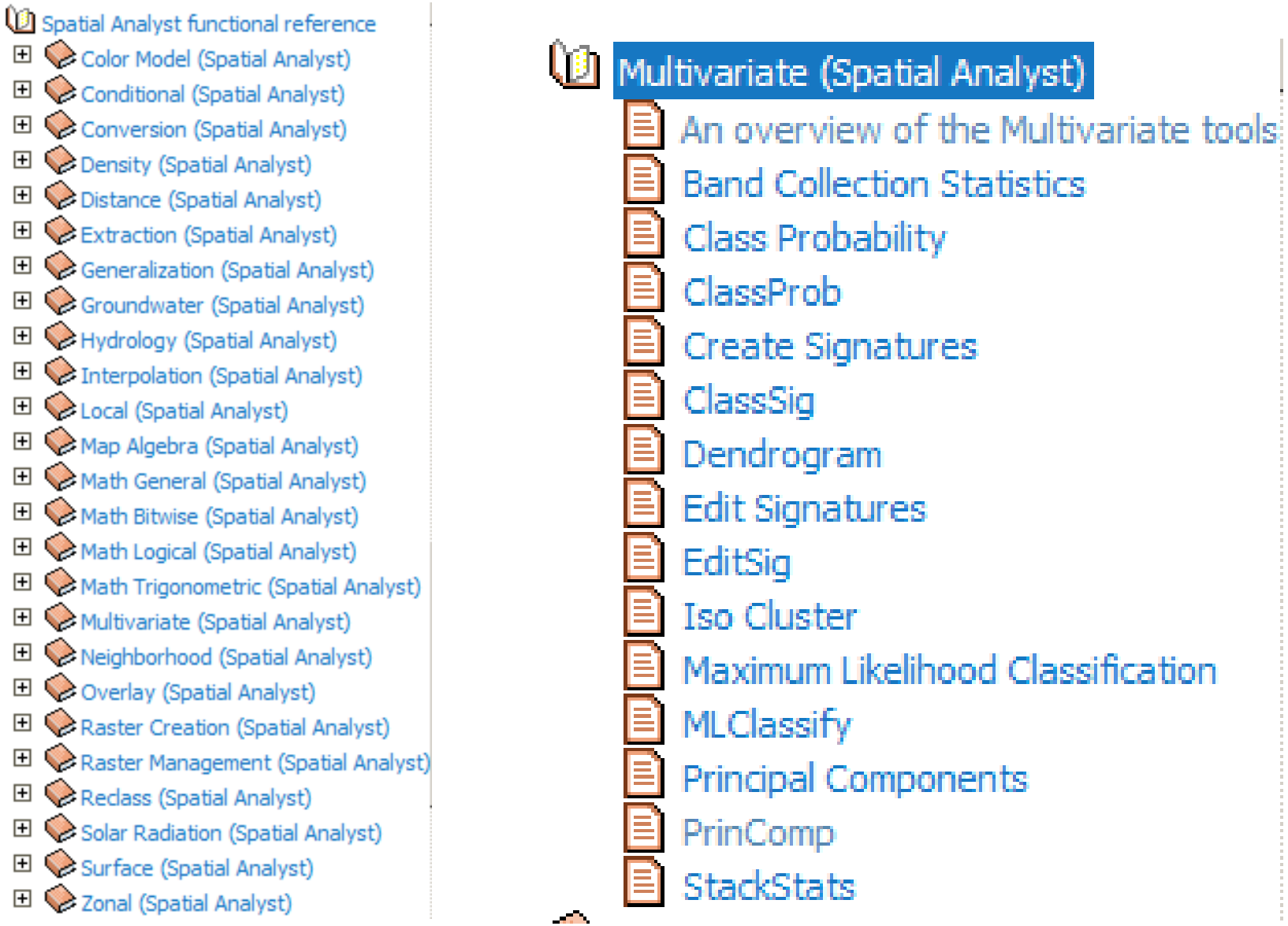
Recognised as the most extensive RS software system

Modules written by leading Canadian researchers

Best for orthorectification .. Orthoengine

Most support for new sensors

ArcGIS spatial analyst (GRID)



IDRISI Worcester (Boston) $

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

What's New

IDRISI Taiga Now Shipping! Includes Innovative Earth Trends Modeler Application Segment-based Classification!
Learn More >

Focus Paper on Segmentation & Segment-Based Classification Now Available!
Download >

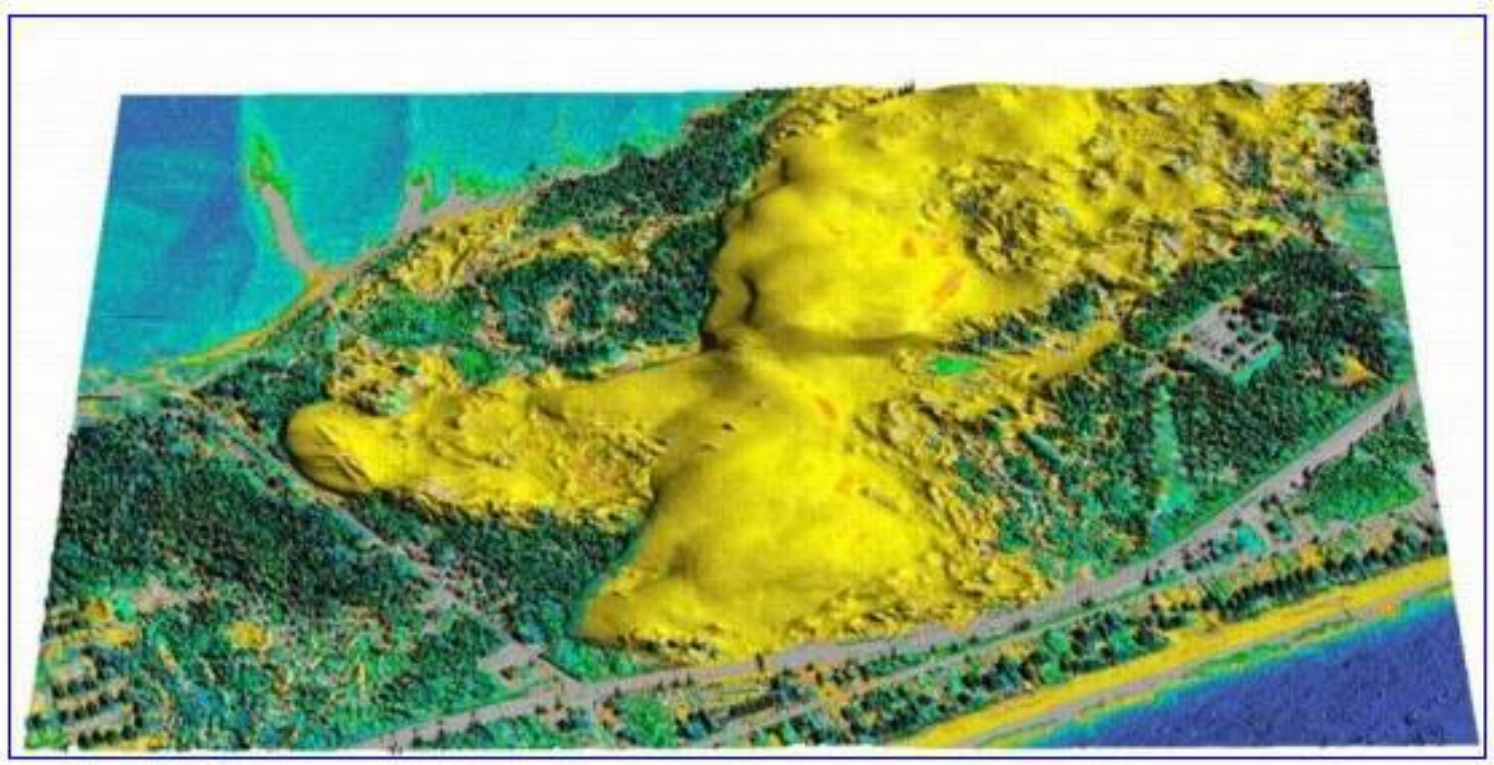
See all Focus Papers >

GRASS raster GIS (1982)

https://grass.osgeo.org/

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

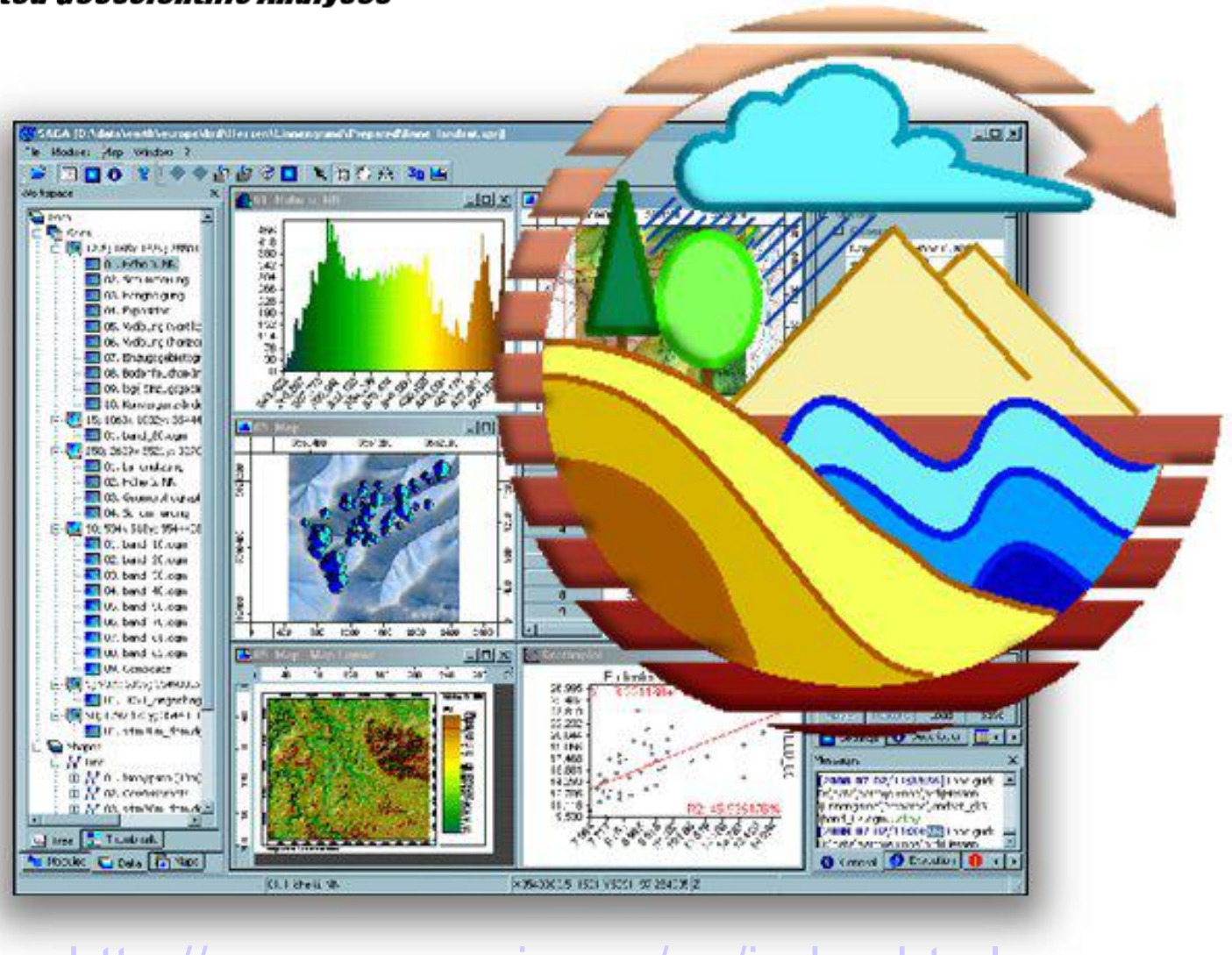
SAGA

System for Automated Geoscientific Analyses

Raster GIS, Germany, 2004

FREE

Now integrated into QGIS



http://www.saga-gis.org/en/index.html

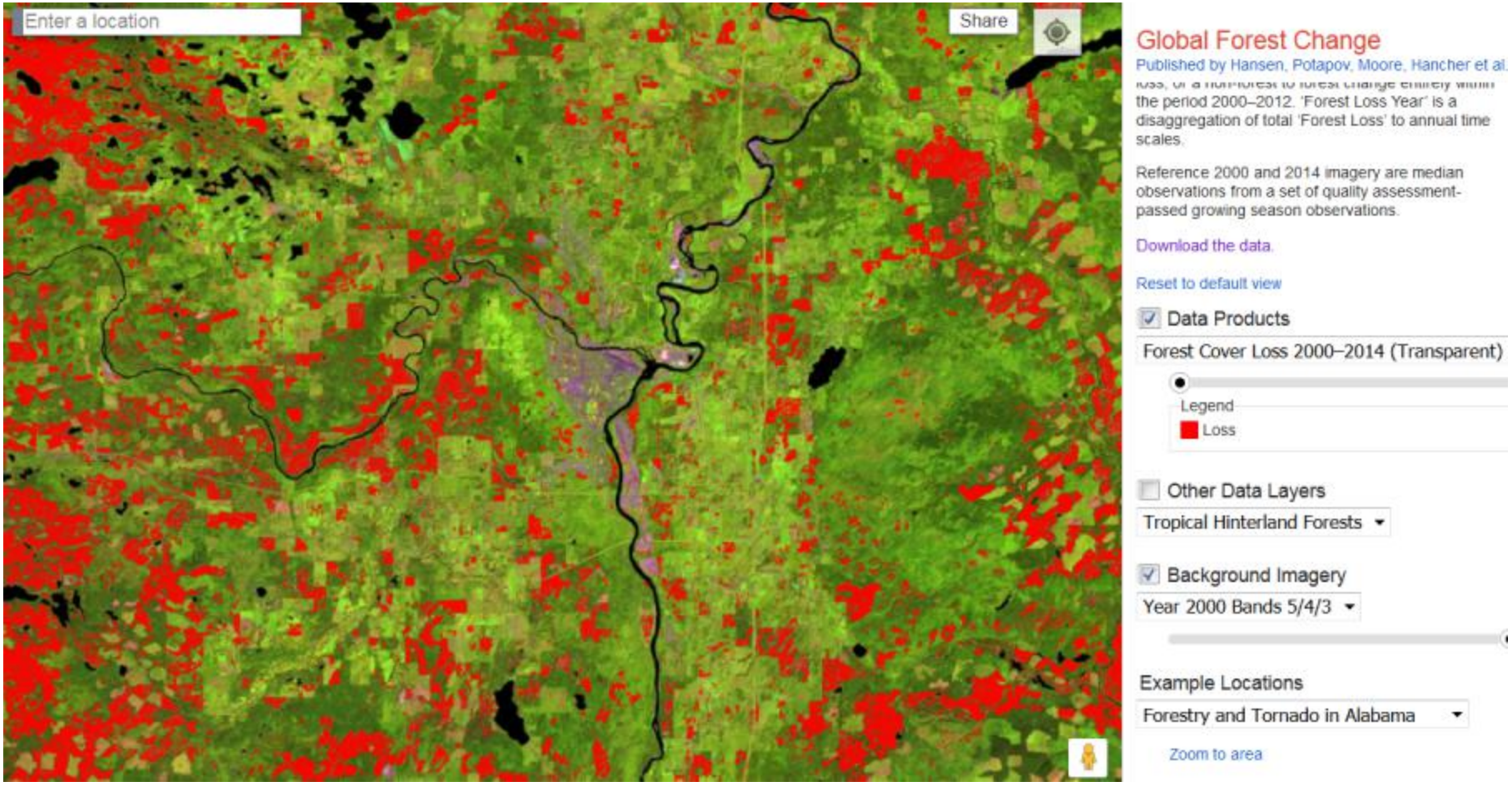
Free image processing software

http://www.maproom.ruc.dk/software/remote-sensing

	Windows	Macintosh	Solaris	Linux	other
MultiSpec Purdue Research Foundation http://dynamo.ecn.purdue.edu/~biehl/MultiSpec/	Yes	Yes			
MicroMSI Scott Loomer, U.S. Military Academy at West Point http://www.nima.mil/micromsi	Yes	*http://micromsi-for-windows.software.informer.com/*			
SAMS Spectral Analysis and Management System http://www.cstars.ucdavis.edu/	Yes	Yes	Yes	Yes	Yes
HyperCube U.S. Army Corps of Engineers Topographic Engineering Center http://www.tec.army.mil/Hypercube/	Yes	Yes			
SPRING Brazil's National Institute for Space Research http://www.dpi.inpe.br/spring/english/	Yes		Yes	Yes	
GRASS GIS - Geographic Resource Analysis Support System GRASS is a public-domain raster-based GIS, vector GIS, image processing system, graphics production system, and spatial modeling system http://grass.itc.it/	Yes		Yes	Yes	Yes
tclSADIE - System at Arizona for Digital Image Experimentation http://www.ece.arizona.edu/~dial/ece533/ece533.html http://www.ece.arizona.edu/~dial/tclsadie/	Yes		Yes	Yes	
XBit http://geocities.com/~chengye/	Yes			Yes	
USGS MIPS - Mini Image Processing Software http://terraweb.wr.usgs.gov/TRS/software/mips/			Yes		Yes

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

20th century: remote sensing

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

1920s Development of photogrammetry for mapping

1945 Military use of radar (World War II)

1950s Use of colour photography and infra-red
Term 'remote sensing' first appeared (Evelyn Pruit)

1960 Cold War: First reconnaissance satellites: Corona

1960s First weather satellites: Tiros (1960); Nimbus (1964)

1970s First Earth Observation satellites (Landsat)

Planetary mapping / exploration missions

1980s First use of mid-IR wavelengths (Landsat / SPOT)

21st century

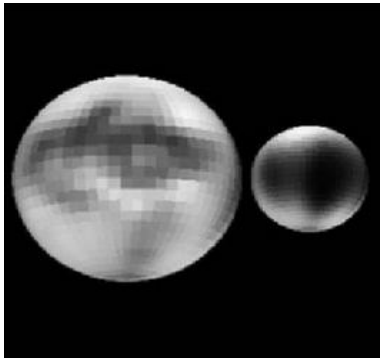
2000s/ Many new satellites, including high resolution

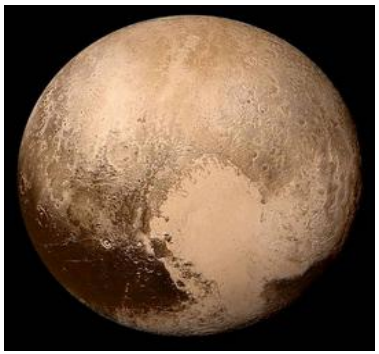
2010s Free image archives

Google Earth and 3D viewing (Iraq War / Terror ?)

LiDAR

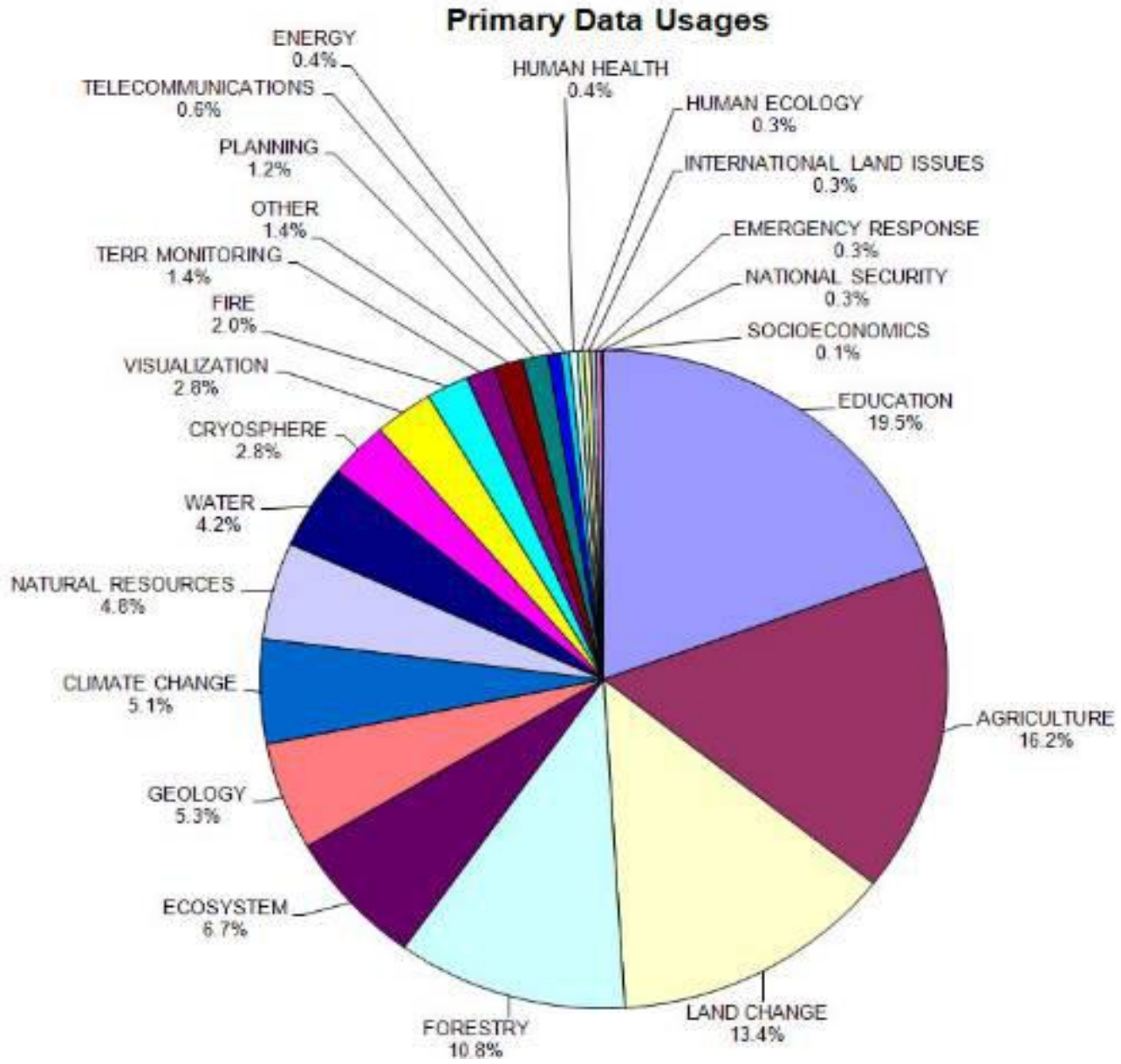
Cloud computing





Landsat Free Archive – How Landsat Data are Being Used

Statistics as of August 31, 2009



Landsat 9:
September 2021 - same as Landsat 8

Landsat 10 (NEXT)

Different- 'superspectral'

'3rd generation'

Includes glacier bands and stereo capability (like ASTER)

Table 1. Landsat Next Image Data Spectral Bands

	Band name	Center wavelength (nm)	Band width (nm)
1	Violet	410	20
2	Coastal Aerosol	443	20
3	Blue	490	65
4	Green	560	35
5	Orange	620	20
6	Red 1	650	20
7	Red 2	665	30
8	Red Edge 1	705	15
9	Red Edge 2	740	15
10	NIR_Broad	842	115
11	NIR1	865	20
12	Water Vapor	945	20
13a	Liquid Water	985	20
13	Snow/Ice 1	1035	20
13b	Snow/Ice 2	1090	20
14	Cirrus	1375	30
15	SWIR 1	1610	90
16a	SWIR 2a	2100	30
16b	SWIR 2b	2210	40
16c	SWIR 2c	2260	40
17	TIR 1	8300	250
18	TIR 2	8600	350
19	TIR 3	9100	350
20	TIR 4	11300	550
21	TIR 5	12000	550

Sept 2011: Iunctus (=> Blackbridge) of Lethbridge, Alberta, purchased Germany-based RapidEye for ~13 million euros (Cdn $19 million) – including 5 satellites : 5m resolution: **RGB,NIR Red Edge bands**

Google Earth discoveries

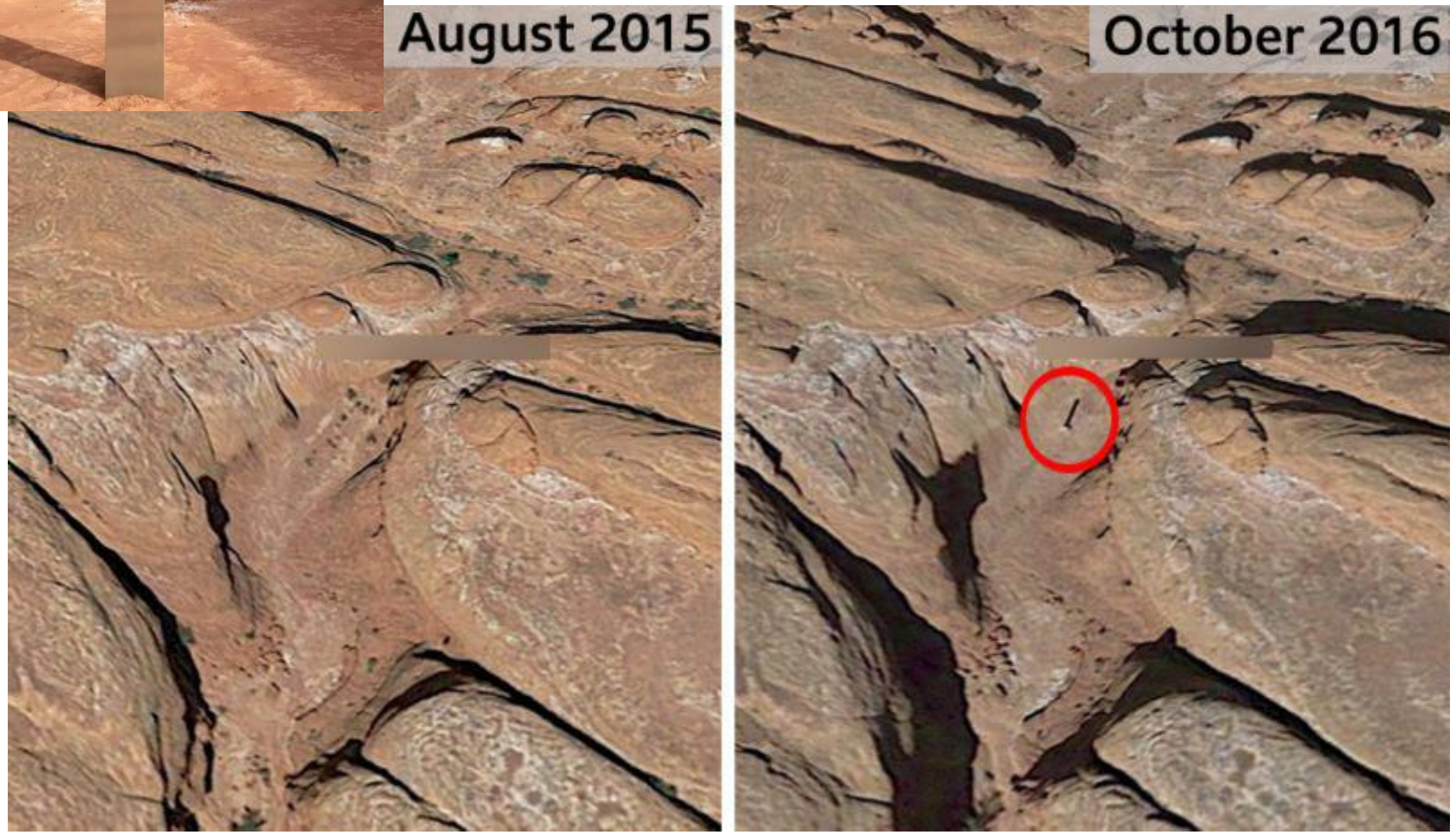
Did Aliens create Indian Head with an iPod ?

Badlands Guardian (CBC)

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

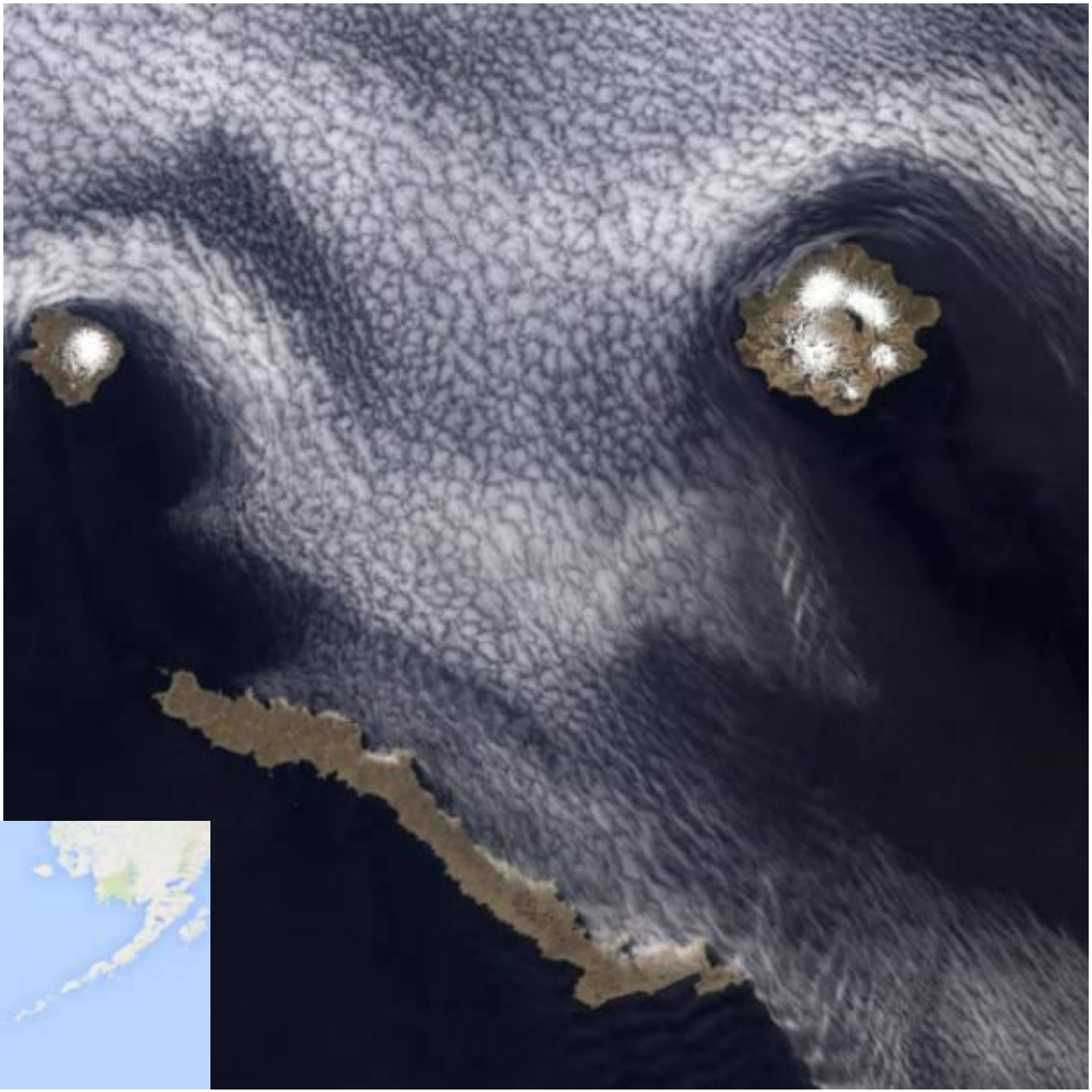
Identified from Google Maps/Earth by morning light / sun angle

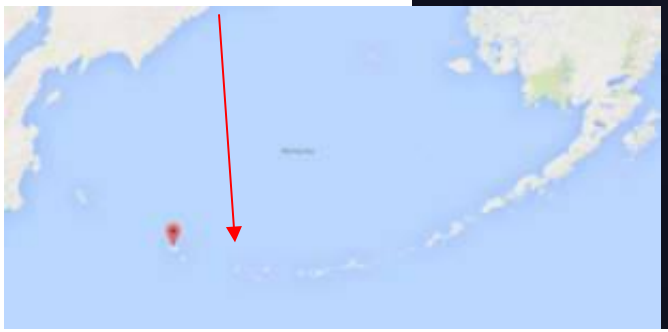
Nov 2020: mystery metal monolith found in Utah by bighorn sheep researchers, from helicopter



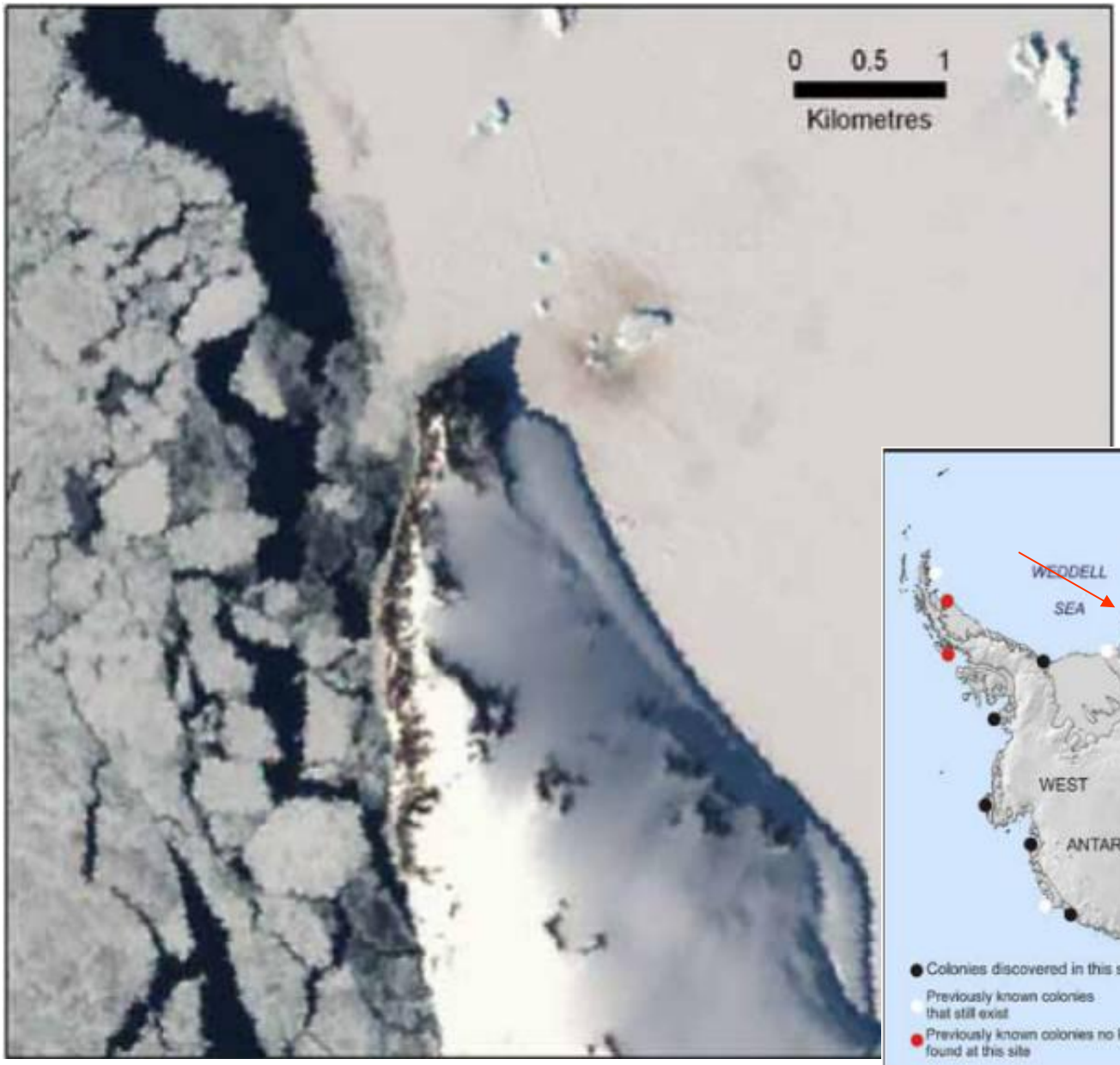
Remote sensing
Neat images:
Aleutian Islands

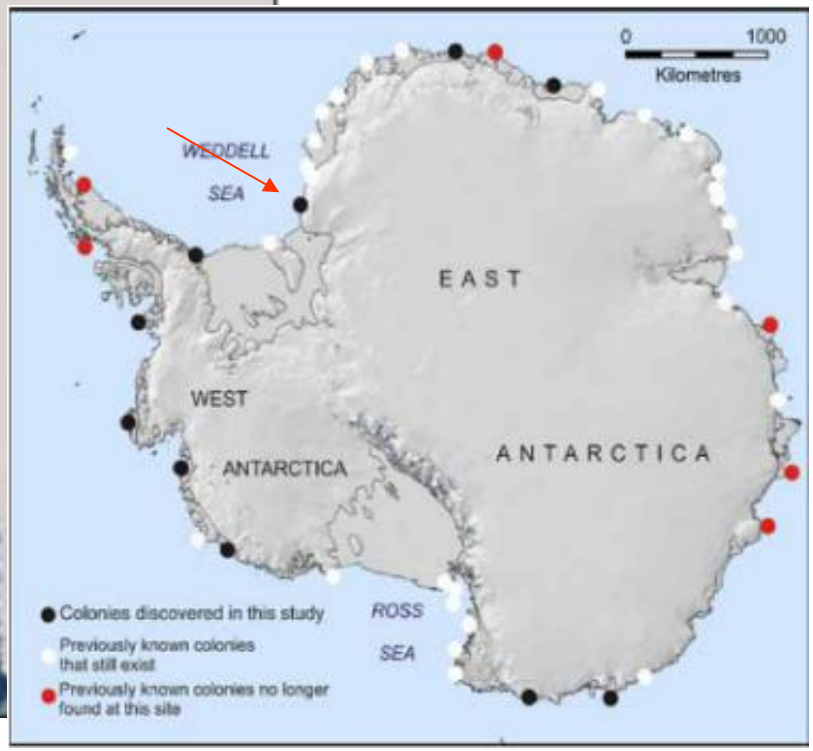
Amchitka Island





My favourite RS image of all: Penguin Poop (Landsat 5)





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

- Imaging from space
- Understanding of imagery and wavelengths
- The power of multispectral sensing to extract features
- Contribution of remote sensing to Geomatics / GIS
- Public education and media e.g. Google Earth
- Data availability and extent
- Possible applications and new developments

More remote sensing ?

GEOG457: Advanced RS – next in January 2022

Also possible:

GEOG499: Independent Studies (1-6)

Self directed focus on a GEOG357 topics or experience

e.g. Thermal, Sentinel, Glaciers, Planetary, QGIS / ArcGIS?

NRES430: Undergraduate thesis (6 credits) winter/spring

your choice of RS topic (good if you might do a Masters)