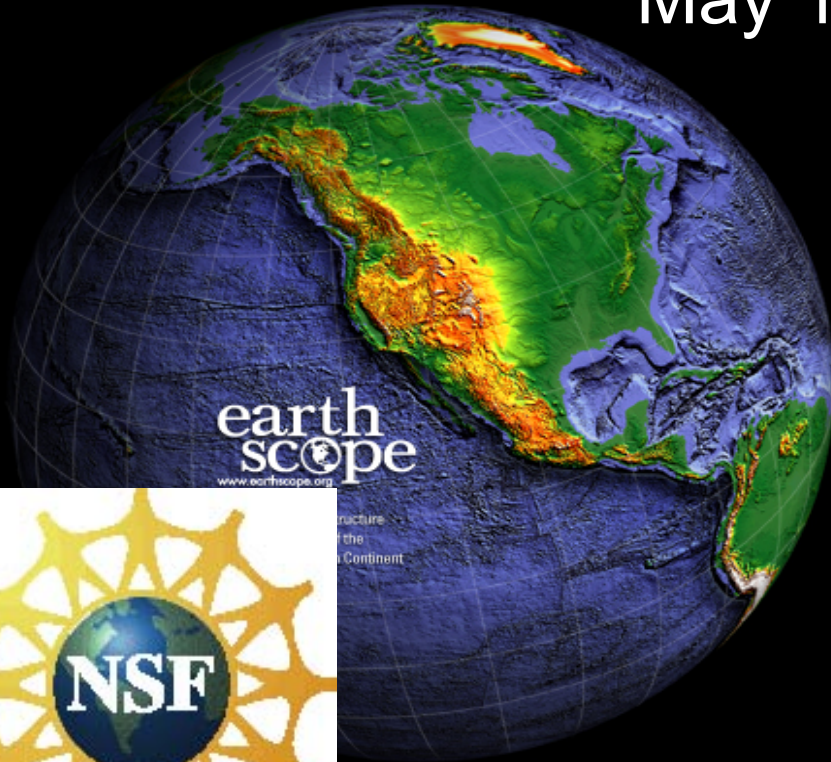


USArray – Northwest Canada + Alaska

ABOVE Workshop
Whitehorse, YT
May 16, 2016



Michael Schmidt on behalf of TA Team

Michael.Schmidt@UCalgary.ca



The EarthScope Observatories

San Andreas Fault Observatory at Depth (SAFOD)

Drilling and Core
Repository

Downhole Observatory

Operated by
Stanford & later
UNAVCO

Plate Boundary Observatory (PBO)

Permanent GPS

Borehole Strainmeter

Laser Strainmeter

Campaign GPS

LIDAR

Operated by UNAVCO



USArray

Transportable Array
(TA)

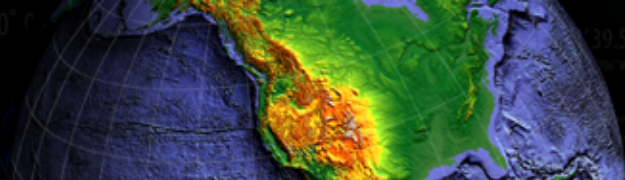
Flexible Array (FA)

Reference Network
(RefNet)

Magnetotellurics (MT)

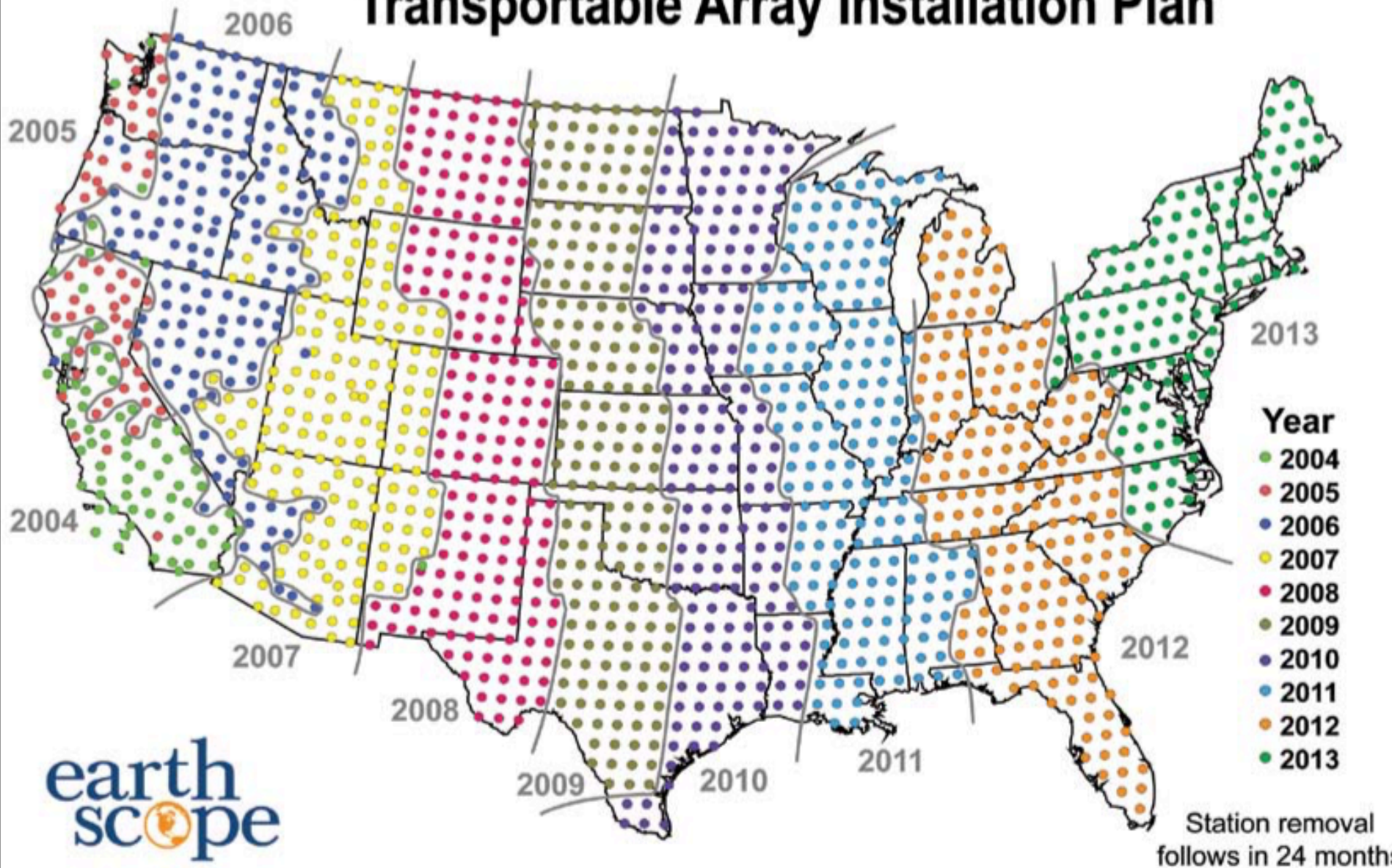
Operated by IRIS



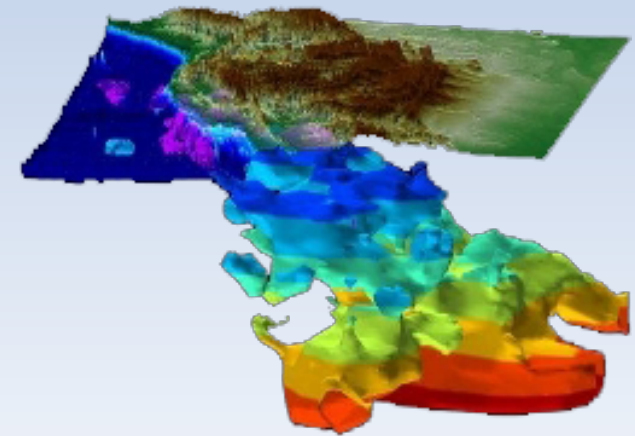
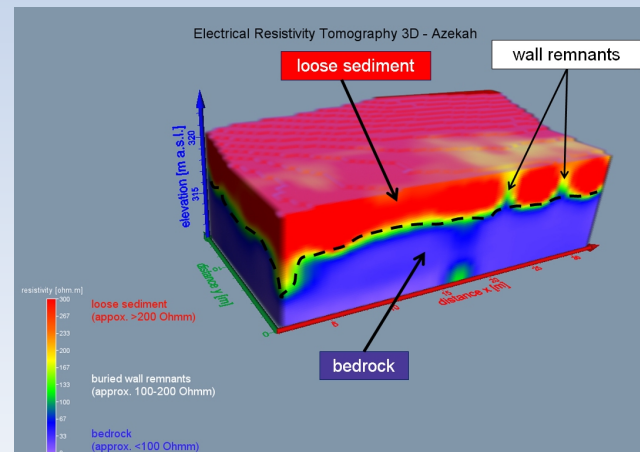


A Ten Year Plan

Transportable Array Installation Plan



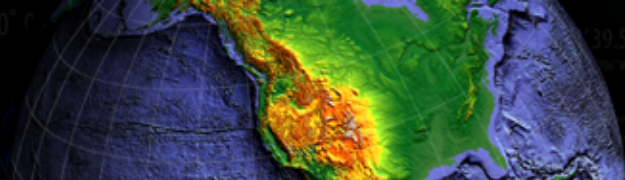
- Array of Seismometers used to build 3D images of the structure in the deep crust and mantle of the Earth
 - A “telescope” that looks inside the earth
 - Uses imaging techniques identical to sonograms or CAT scans in medical imaging



Sonograms or CAT scans
Medical imaging Tomography
Wikipedia

Electrical Resistivity
Tomography (Archeology)
*Stefan Hecht, Institute of Geography,
Heidelberg University*

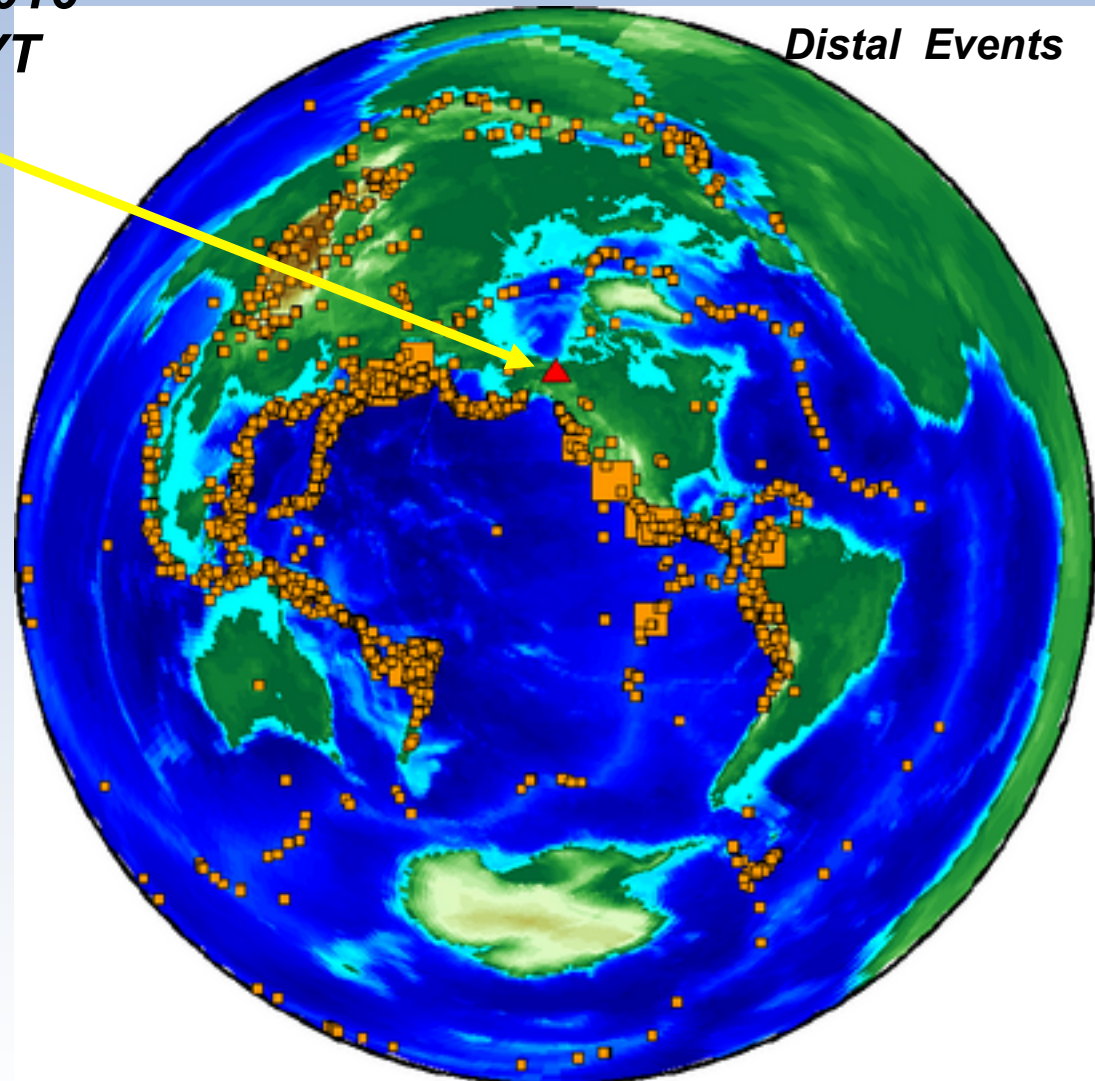
Earthquake Tomography
(USArray)
Sigloch, K., and Mihalynuk, M.G



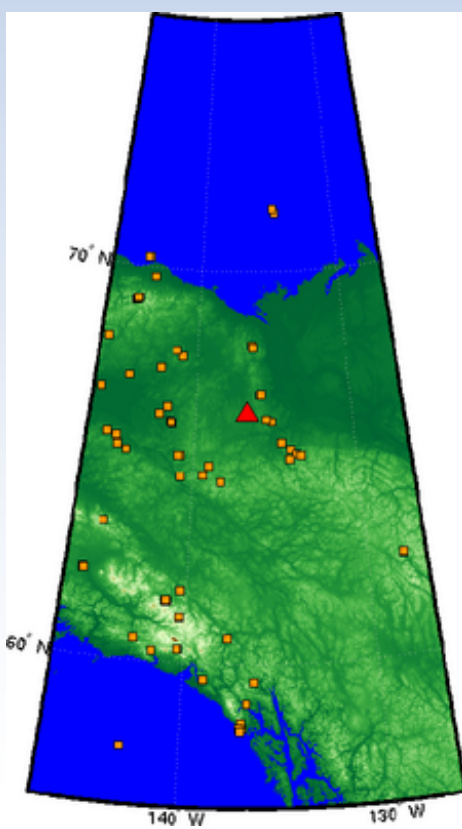
Eagle Plains - EPYK

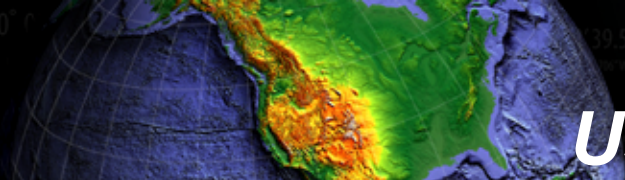
October 2013 – February 2016
Recorded at Eagle Plains YT

Distal Events



Regional Events





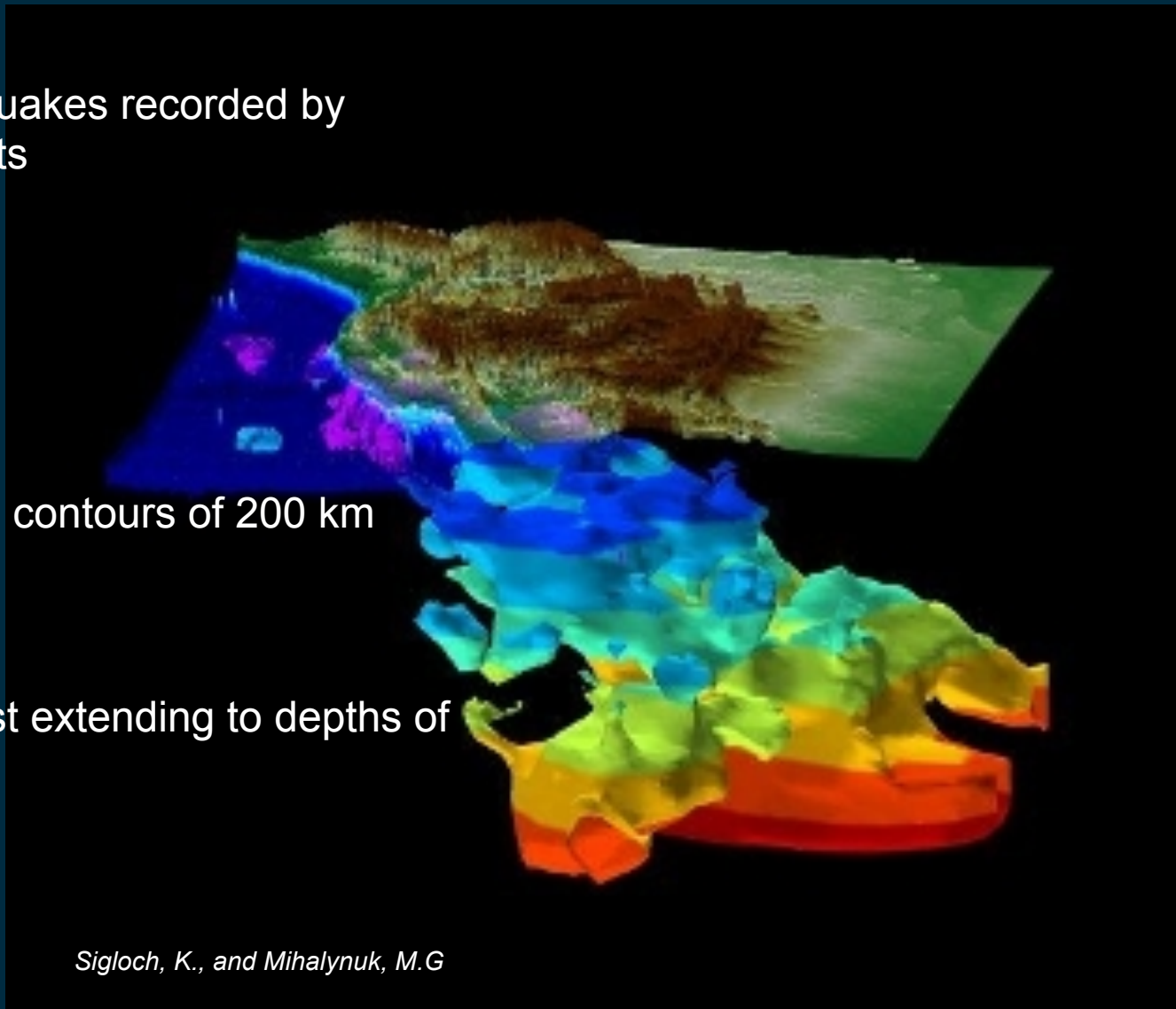
USArray – Using Earthquakes

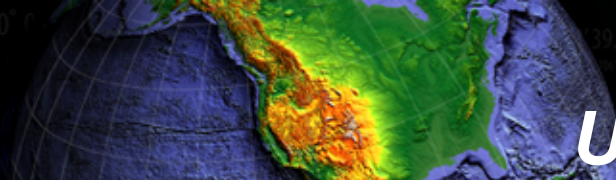
Mantle Structure

Data from over 600 earthquakes recorded by more than 1000 instruments

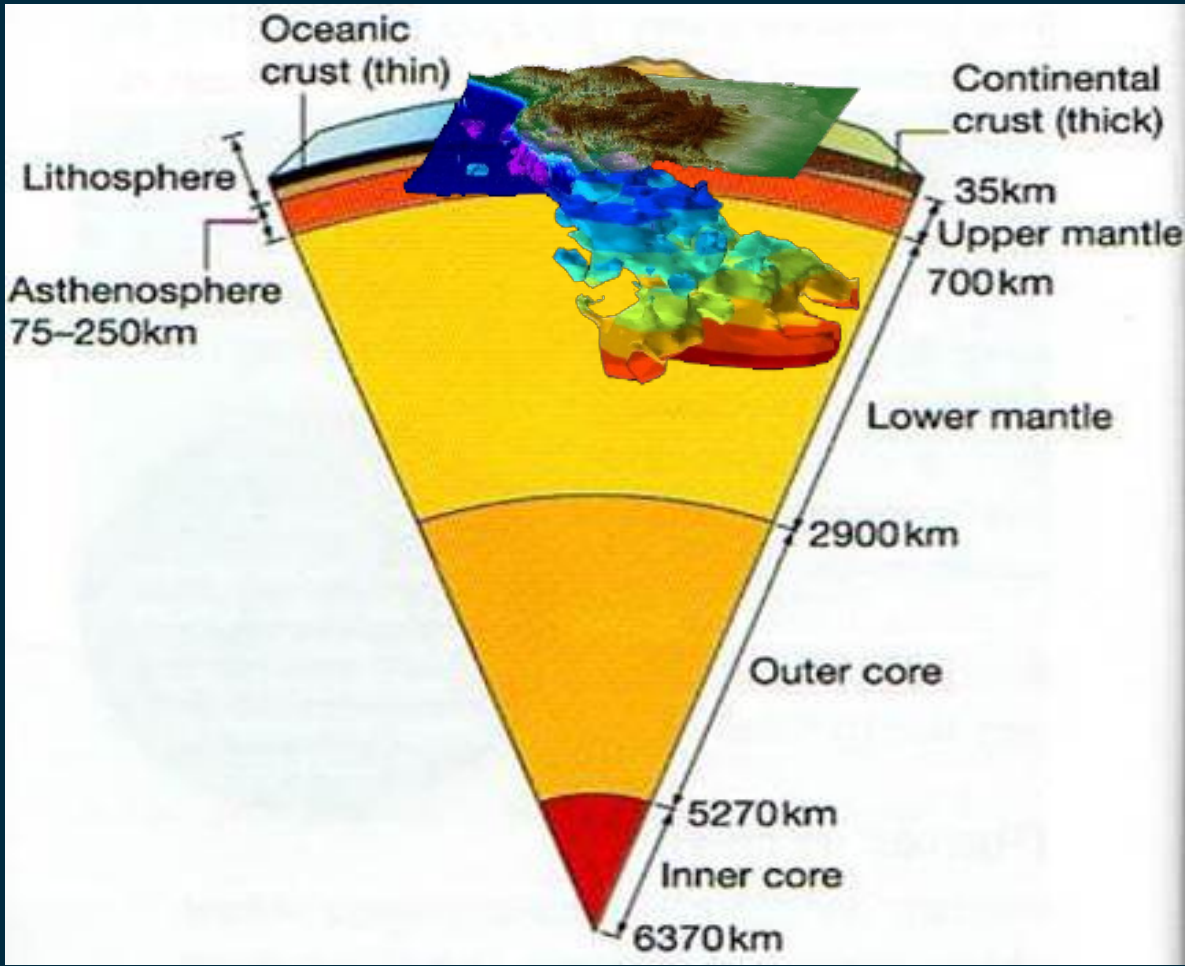
Colour boundaries = depth contours of 200 km

Ancient Pacific Ocean crust extending to depths of 1,800 km (Farallon Plate).

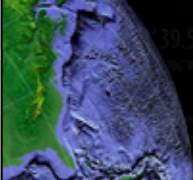
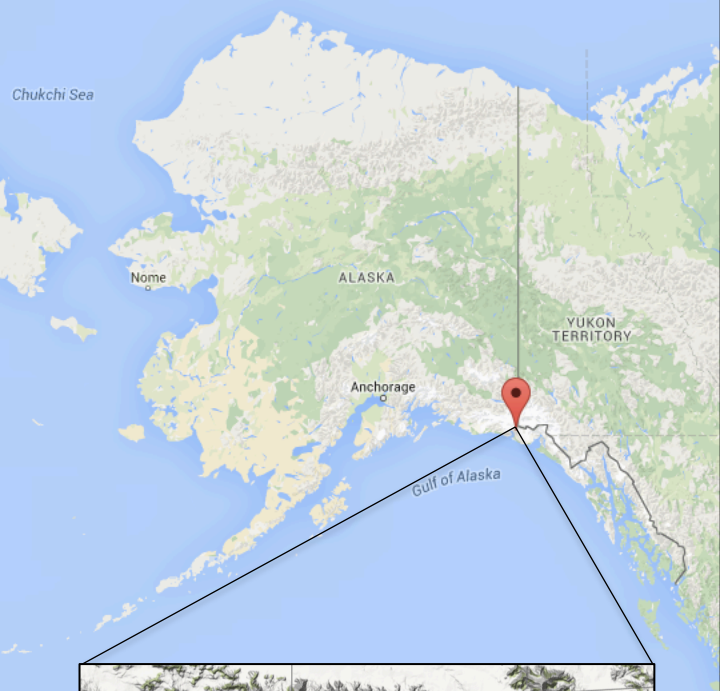




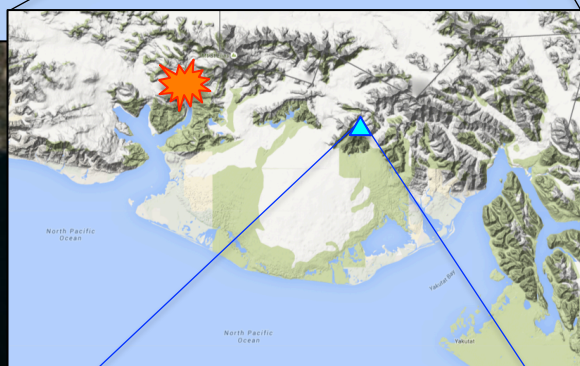
USArray – Using Earthquakes Mantle Structure



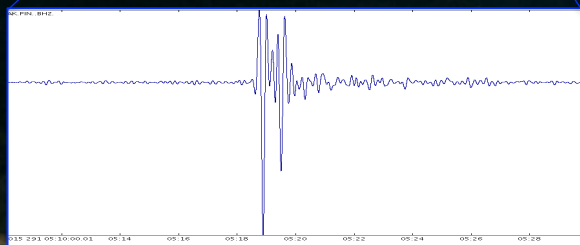
Seismometers can detect landslides in remote areas



200 million ton landslide on Tyndall Glacier
Seismic data discerns time, location, size, direction, velocity

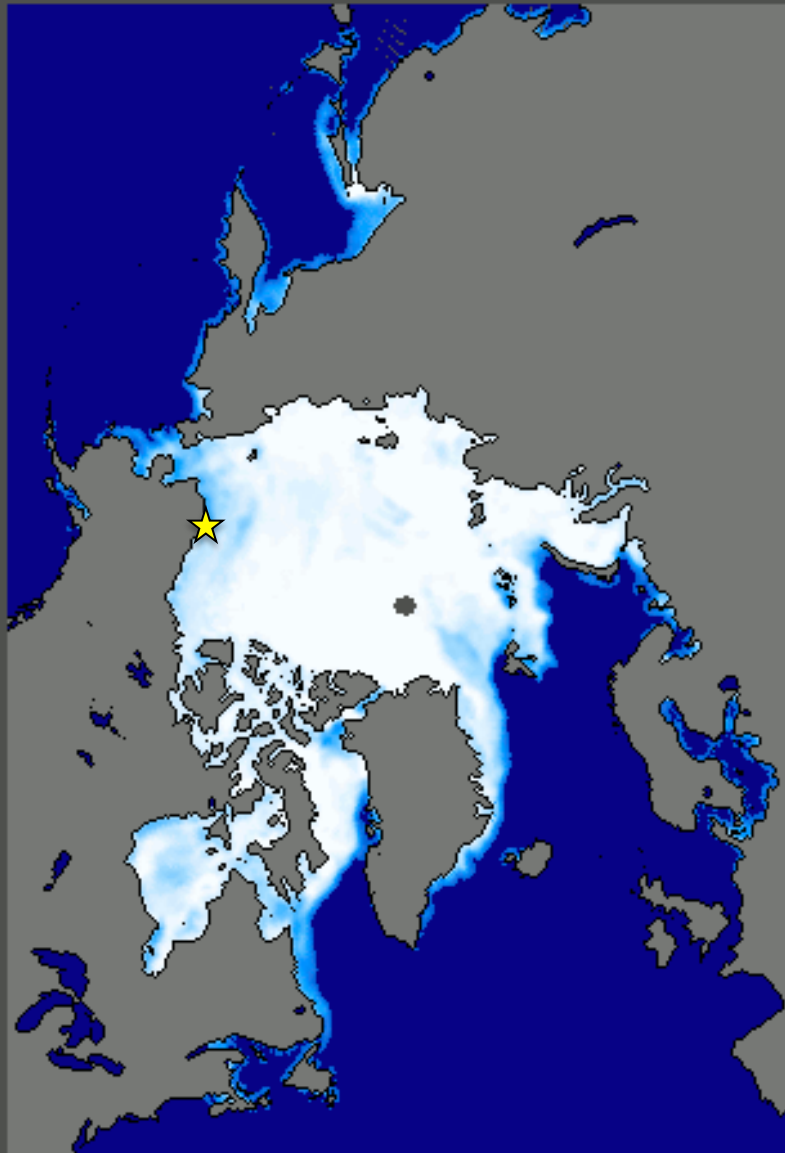


AK.PIN ~70km away

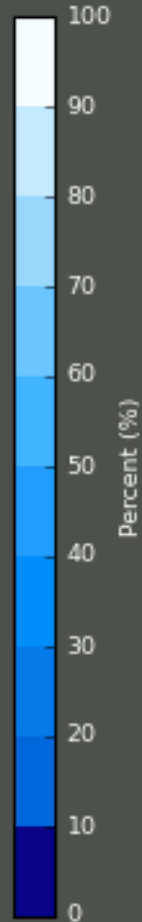


Seismometers can track the status of sea ice extent in northern Alaska
High noise (red) corresponds to open water after the peak of summer

01/01/2015

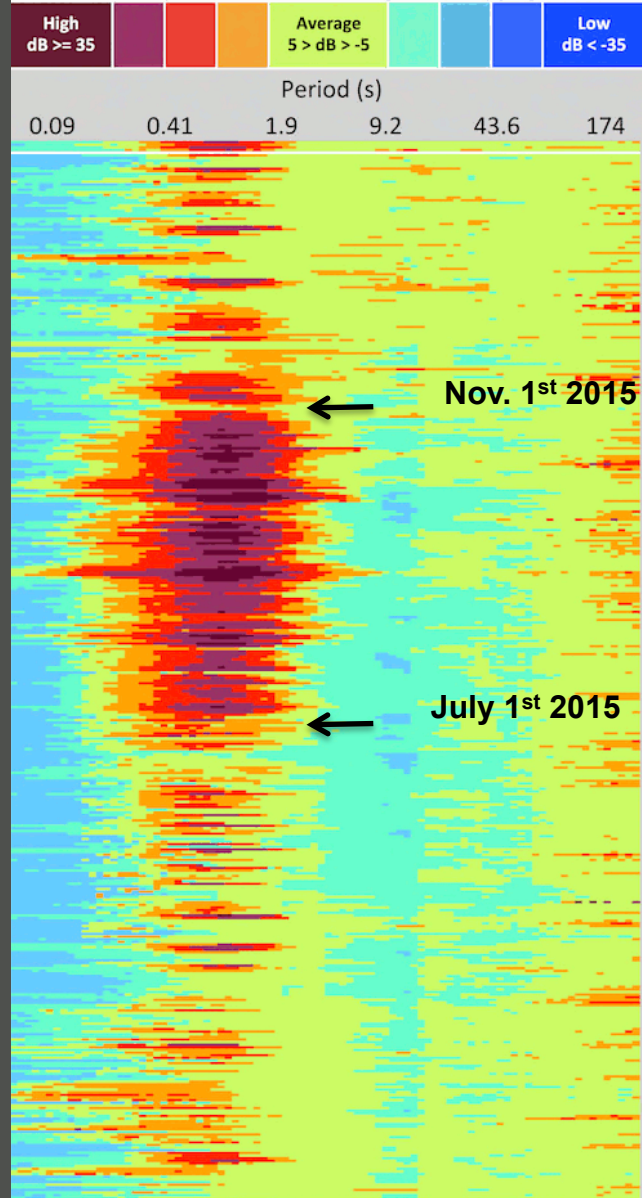


National Snow and Ice Data Center, Boulder, CO

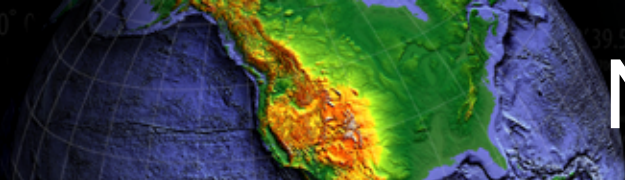


Near-Real-Time DMSP SSM/I-SSMIS Daily Polar Gridded Sea Ice Concentrations

Relative Daily Noise – Barrow, AK – TA.A21K.BHZ

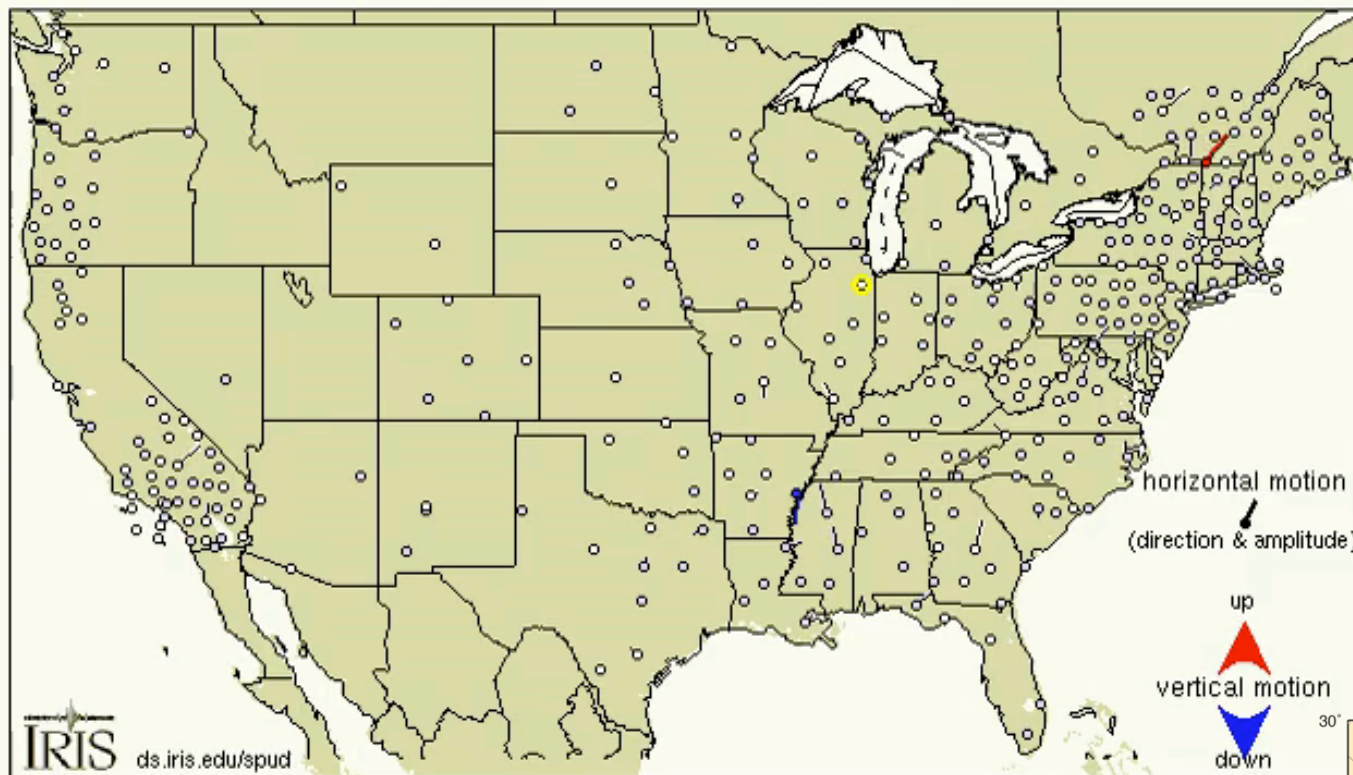


Data Available at IRIS DMC

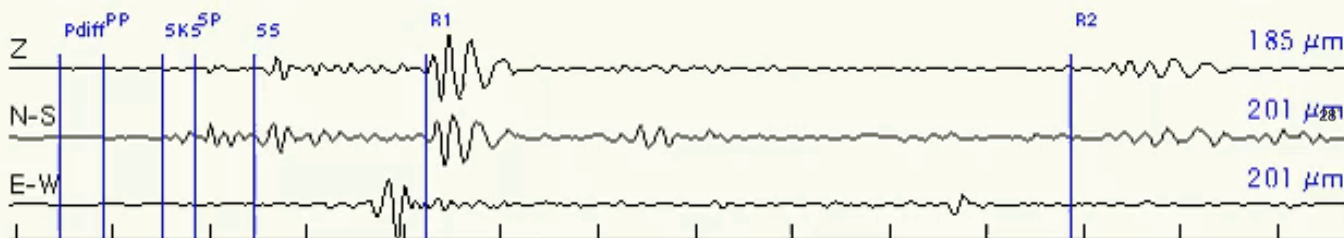


Nepal, April 25, 2015

April 25, 2015, NEPAL, M=7.9

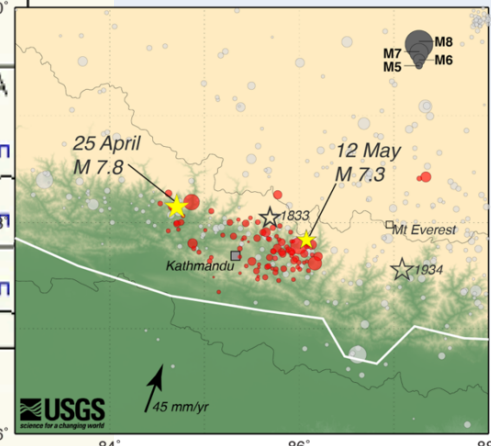


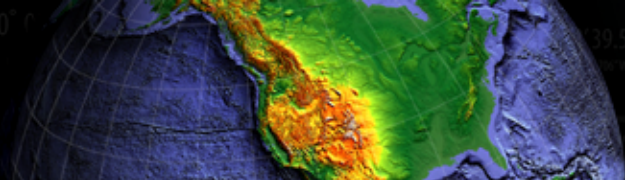
2015/04/25 06:20:41 UTC (556 s) Distance 110.0°/12231 km Azimuth 354.2° Reference M44A



00:10:00 00:30:00 00:50:00 01:10:00 01:30:00 01:50:00 02:10:00

Time Since Earthquake (hh:mm:ss)

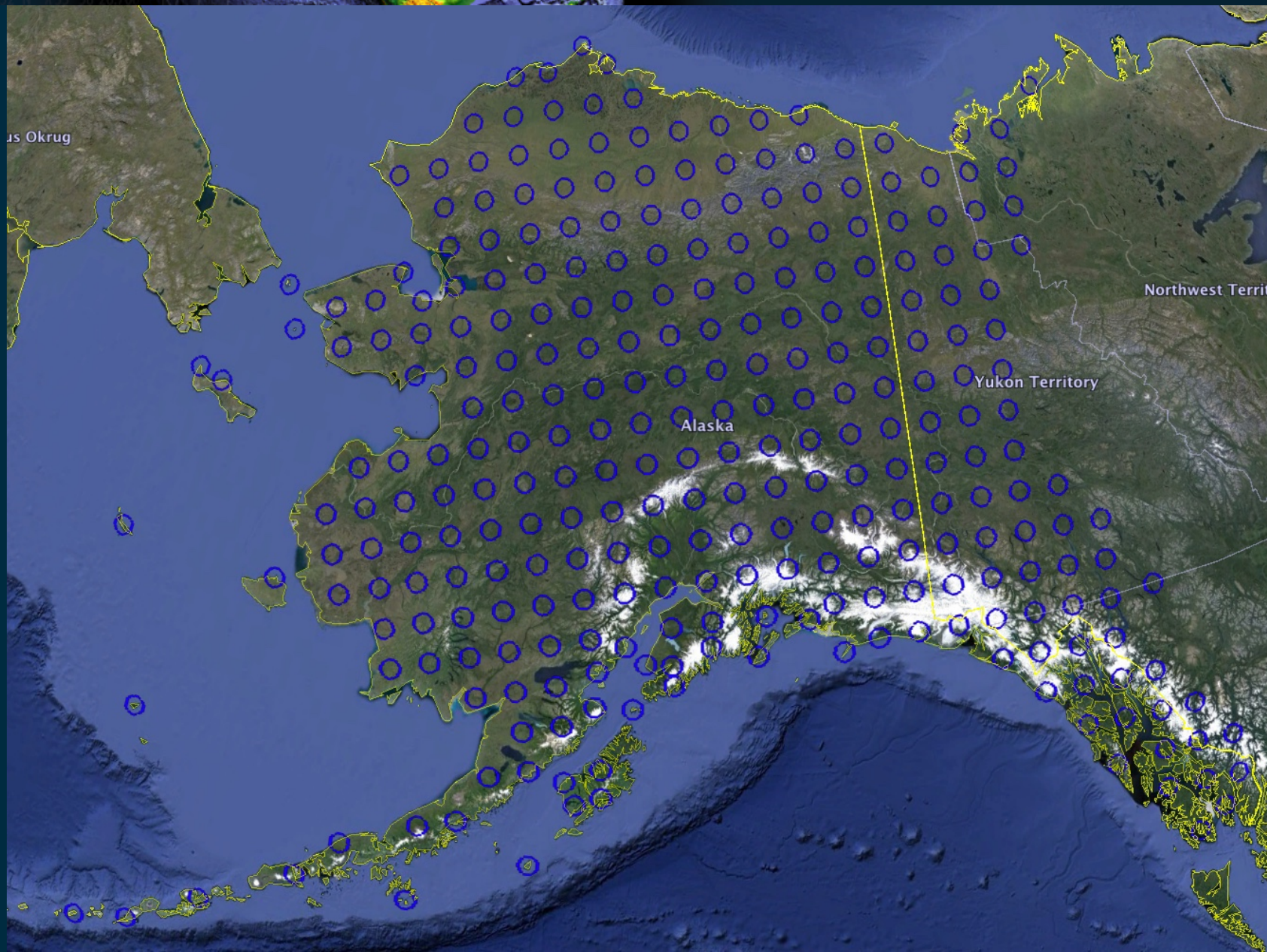




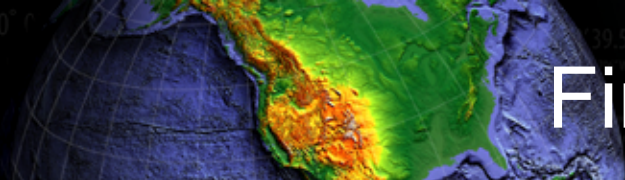
39.53° N 105° 12' 20.02" W
0° 15' 25.414952000" N 139° 20' 30.5752000" W
46.644° N 146° 8' 43.08" W

So Where Are We Now?

2012 - 2013: We Had a Plan

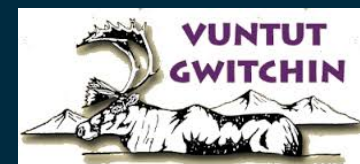


- 
- **Initial Consultation + Permitting**
 - **Reconnaissance + ID Existing Sites**
 - **Consultation + Permitting**
 - **Budget Cuts**
 - **Adjustments**
 - **Installations (9 total as of 2015)**
 - **Permitting Continues into 2016**
 - ***Outreach***



First Nations Consultation

TA Project has to date consulted
and permitted with First Nations in:
Yukon - 14
NWT - 2
BC - 1



Carcross/Tagish First Nation

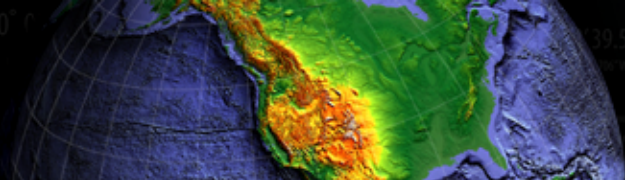


Inuvialuit
Regional
Corporation



Kaska Dena Council





Collaborations

Yukon Government

- Yukon Geological Survey
 - Pre-purchased one site (EPYK)
 - Continuing support (scientific and logistical)
 - New 5 Station Network
- Yukon Highways
- Yukon Parks
- Office of Chief Science Advisor to Yukon Government (Executive Council)

University of Calgary / Arctic Institute of North America

- Permitting, Consultation, Outreach, Reconnaissance, Installation
- David Eaton, et al + students

Aurora Research Institute (Inuvik, NT) - GNWT

- Continuing support (scientific, logistical, technical)

Yukon College

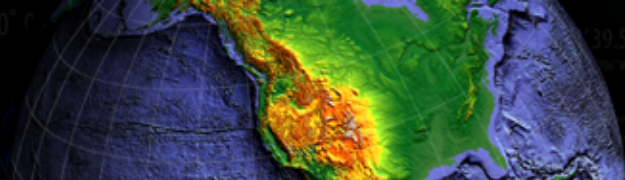
- Outreach
- Scientific Collaboration
- Yukon Research Centre

University of Ottawa

- YNSN Network
- Pascal Audet, students

Geological Survey of Canada (NRCan)

- YUK sites (8) operational during TA time span
- CNSN Data
- Pre-purchased 2 sites (A36M, C36M)



Permitting

YESSA

Yukon Environmental and Socio-economic Assessment Act

Yukon Science and Explorers Licence (YG)

Yukon Lands (YG)

Multiple stages (internal review, First Nation, adjacent land owners, internal committee)
= 3 to 12+ months;

(Other) YG Departments

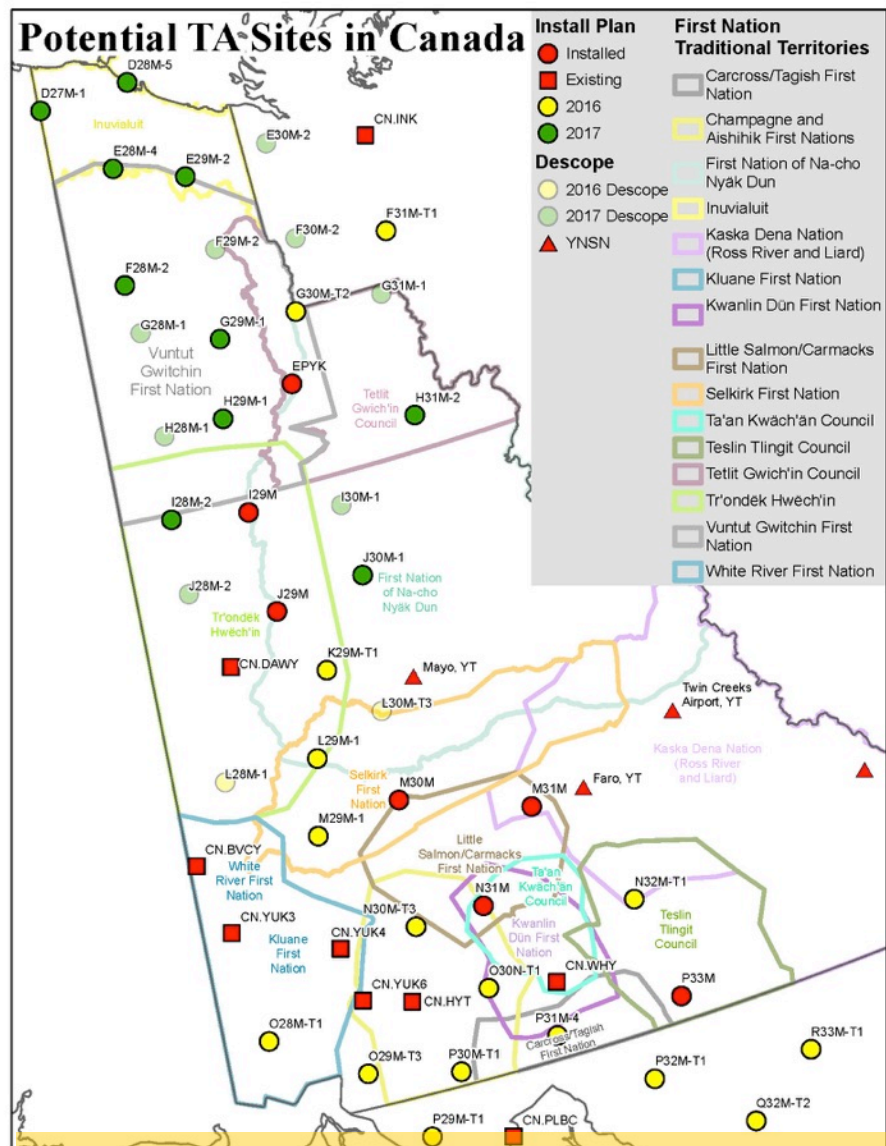
First Nations

Direct Consultation

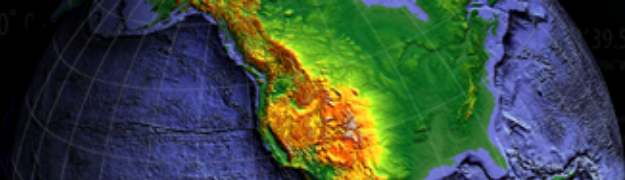
Direct Permitting on Cat. A & B Lands

Under the land claim agreements FN lands are one of:

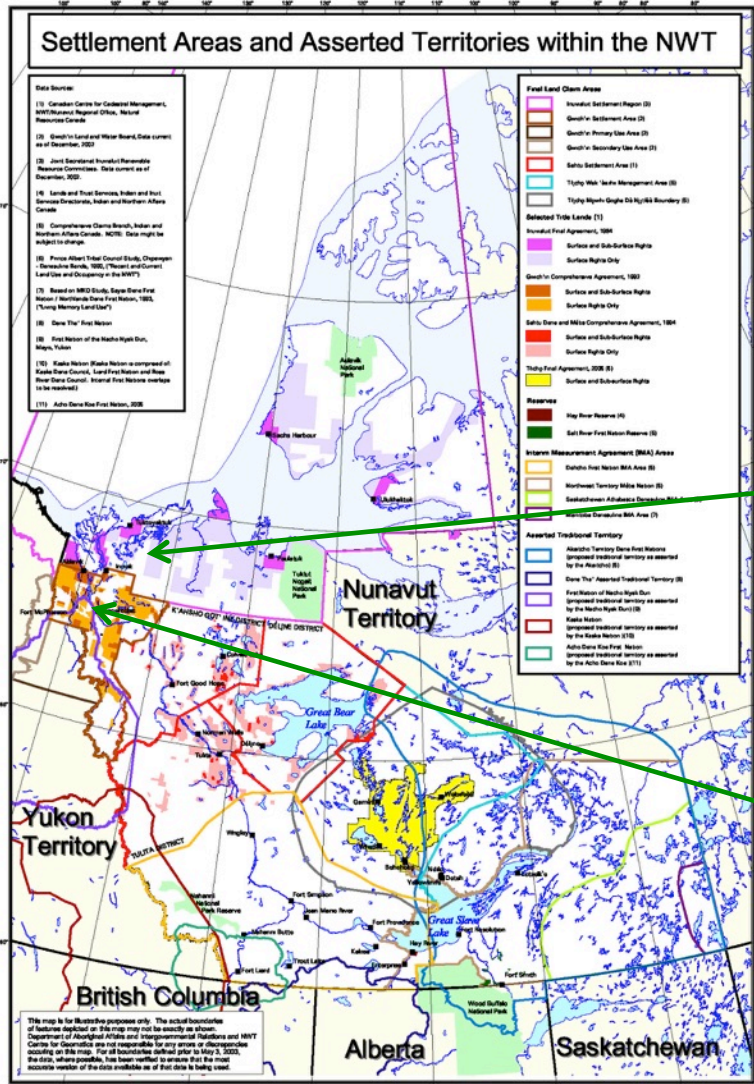
- Category A (surface and subsurface rights)
- Category B (surface rights)
- Yukon "Crown" Lands



NB overlapping jurisdictions between FN's



First Nations – NWT

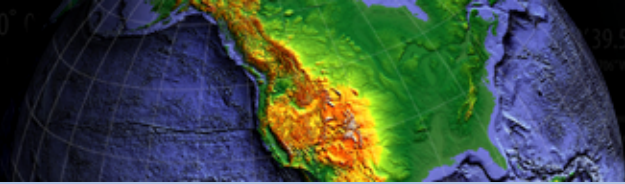


NWT:

- Science Permitting – Aurora Research Institute (Inuvik)
- First Nation (e.g. F31M – Tsiigehtchic)

Inuvialuit
(extends into Yukon)

Gwitchin



Outreach

Yukon College (*Joel Cubley & Mary Samolczyk*)

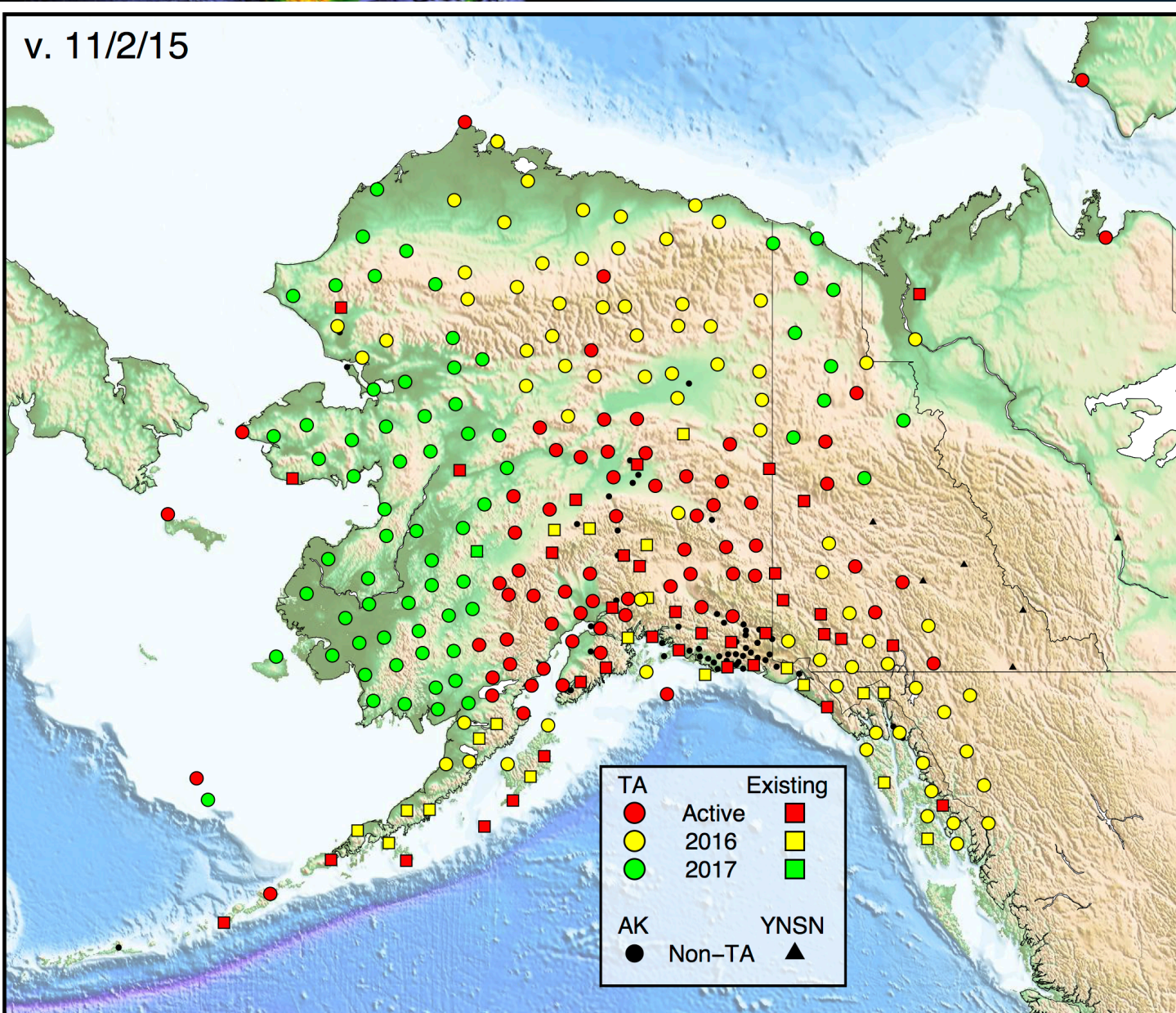
- Outreach presentations in 9 communities across Yukon
- YC Community Campuses
- Local organization
- Food, Coffee, etc. served

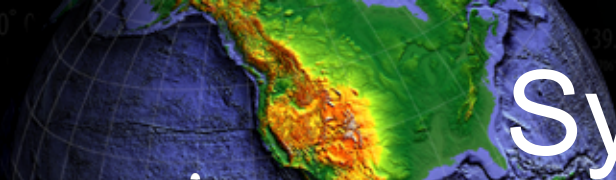


Mayo

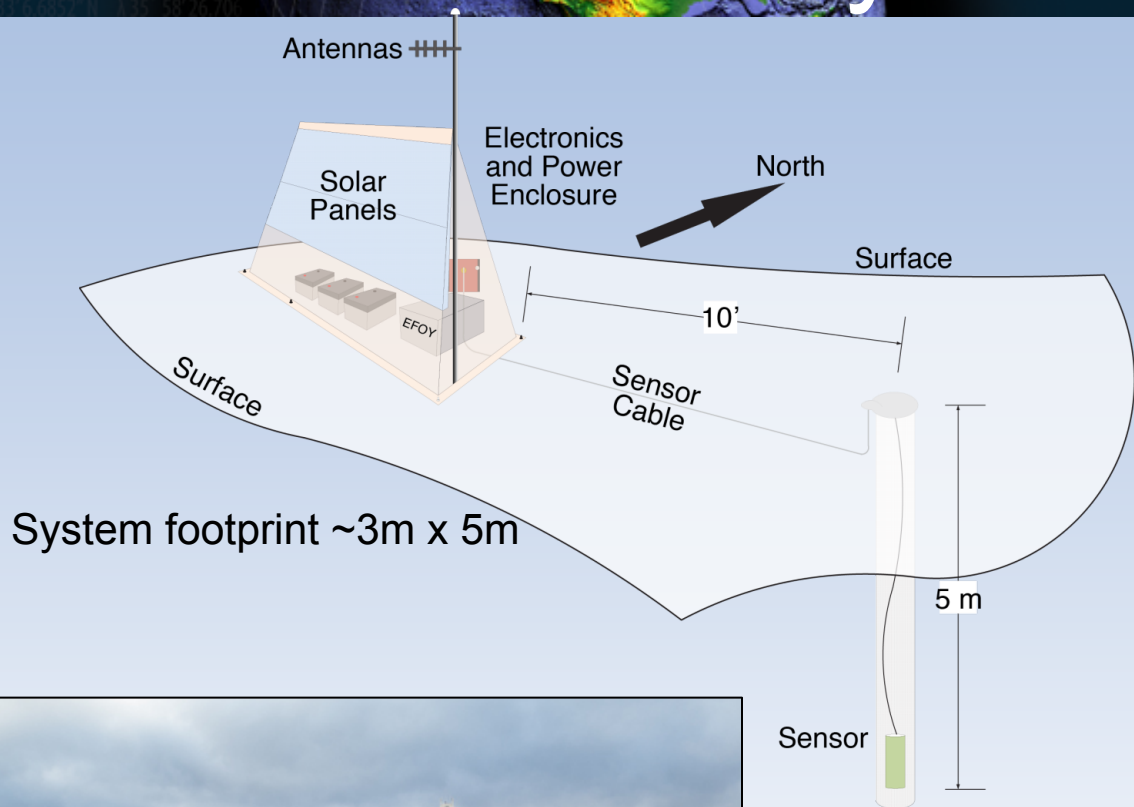


Haines Jct.





System Components



System footprint ~3m x 5m



Sensor is installed in a borehole 1 – 5 m deep



Eagle Plains Station (EPYK)

Met Sensor (T, RH, P, WS, WD, Precip.)

Fiberglass box enclosure with solar panels to charge batteries and house electronics

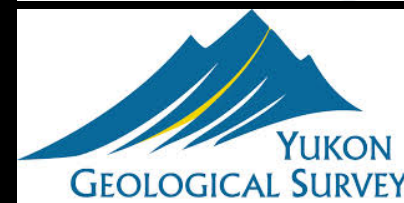
Data transmitted in real time to IRIS data centre

Collaborative multi-agency project

- Reconnaissance: 2014-2015
- Installations: 2015, 2016, 2017
- Operation: 2017 – 2019
- Site Decommission: 2019 – 2020 - TBC



All data open and freely available



Discussion:

- ABoVE Collaboration
 - Met Sensors?
 - Cameras?
 - GPS?
 - Other?



EarthsCAN

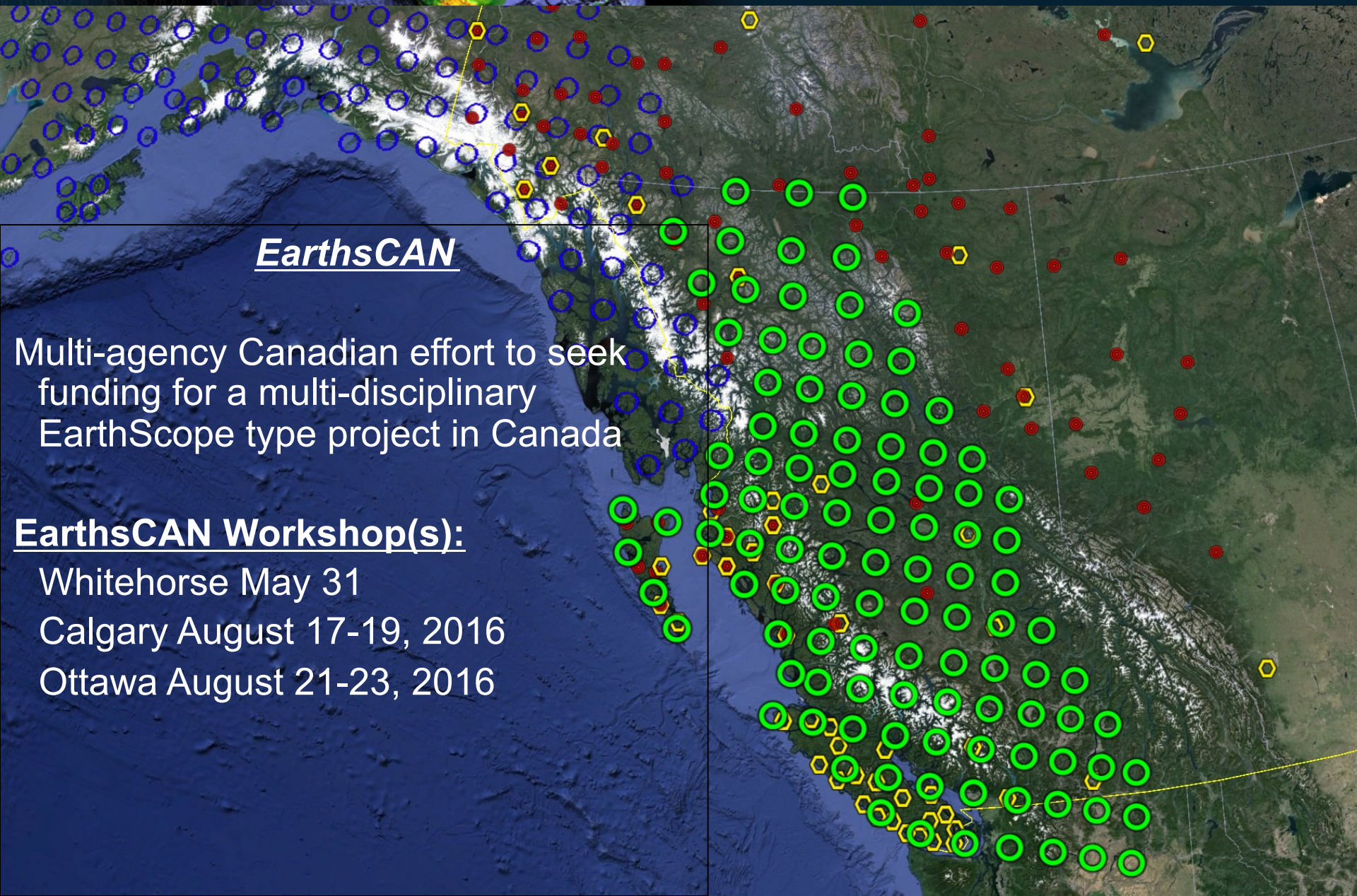
Multi-agency Canadian effort to seek funding for a multi-disciplinary EarthScope type project in Canada

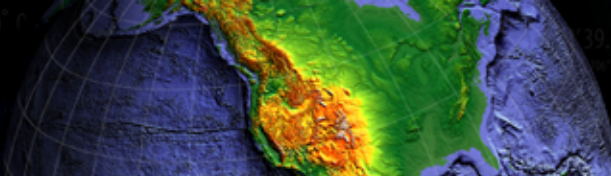
EarthsCAN Workshop(s):

Whitehorse May 31

Calgary August 17-19, 2016

Ottawa August 21-23, 2016





Thank you



Questions?

Go ahead – make my day