

EarthScope and GeoPRISMS



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Oregon State University and
EarthScope National Office

With contributions from:

Greg Anderson (NSF)

Mike Jackson (PBO/SAFOD)

Bob Woodward (USArray)

GeoPRISMS SCD workshop

January 5-7, 2011

Austin TX

A program to explore the structure, dynamics and history of the North American Continent, the physical properties and processes that control earthquakes and volcanoes, and their impact on climate and environment.

EarthScope is funded by the National Science Foundation with contributions from USGS and NASA.

Started as a community-driven NSF MREFC (Major Research Equipment and Facilities Construction) project (FY 2004-2008) with a small science budget (funding mostly workshops in the early years).

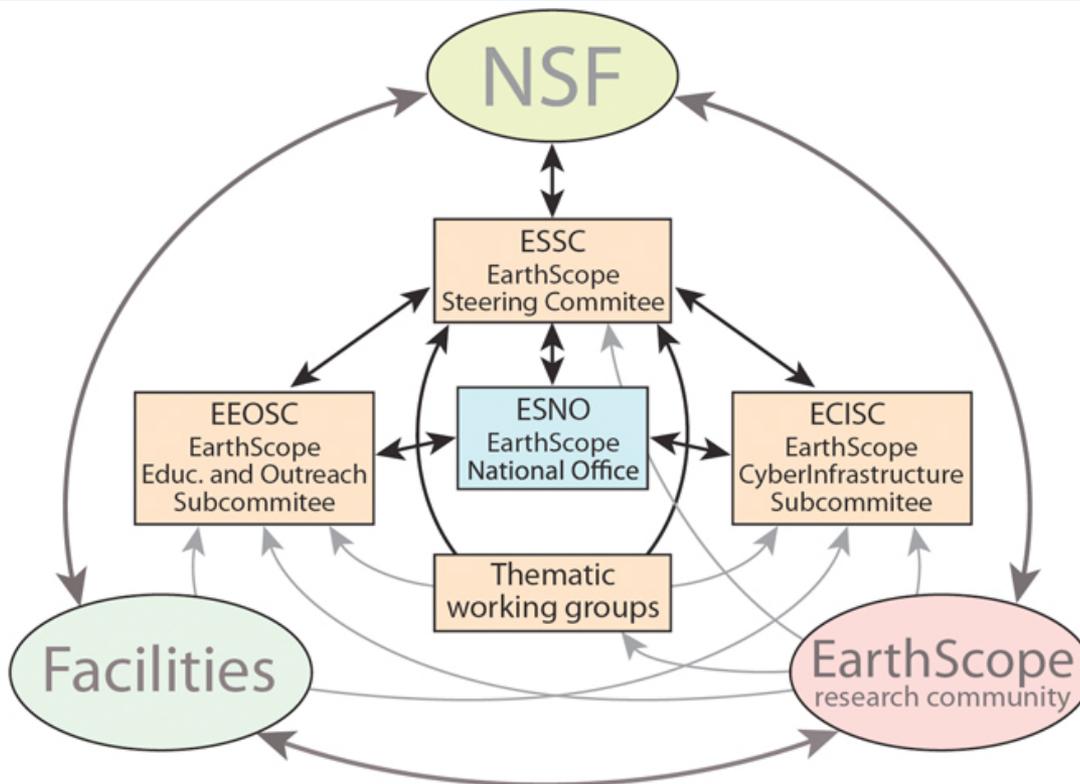
EarthScope is now in O&M phase with some new instrumentation initiatives.



WESP workshop:
Snowbird, October 2009

Science plan, January 2010

Science plan and WESP talks available
at www.earthscope.org/ESSP



Steering committee: Goran Ekstrom (chair), Terry Plank, Mike Williams, Anne Trehu, Howard Zebker, Steve Whitmeyer (chair of EEOC), Mike Gurnis (chair of ECISC).

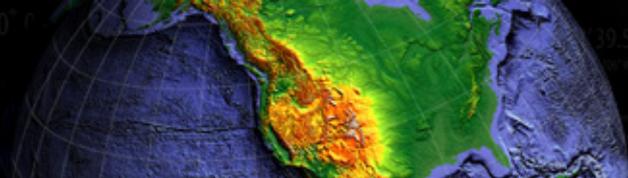
Several rotations planned for 2010. Look for a call for nominations. Nominate yourselves or your colleagues to cross-fertilize.

Overlap between science objectives.

Overlap between EarthScope and GeoPRISMS research communities.

Research communities and NSF program managers need to coordinate long-term planning to leverage facilities and resources and avoid duplication.

Includes establishment and maintenance of Data Bases and Data Products!



- At NSF - Kaye Shedlock sheperded EarthScope through the planning and MREFC phases and retired in March 2009.
- EarthScope program manager Greg Anderson started in April 2009. Greg is also the program manager for SCEC. Chuck Estabrook joined NSF in fall 2010 (replacing Linda Warren).
- NSF funding for EarthScope science/MREFC/O&M (in millions):
 - FY03 - 0.0 / 29.8 / 3.2
 - FY04 - 4.7 / 43.2 / 1.7
 - FY05 - 3.7 / 47.0 / 4.7
 - FY06 - 5.1 / 50.0 / 6.7
 - FY07 - 5.6 / 27.4 / 11.6
 - FY08 - 5.5 / 0.0 / 23.5
 - FY09 - 9.0 (with ARRA) / 0.0 / 24.3
 - FY10 – 6.0/ 0.0 / 25.0

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Funding for EarthScope science is highly leveraged.

Many projects are co-funded by other programs at NSF.

See www.earthscope.org for a listing and links to all projects funded by the EarthScope program.

Observatories (www.earthscope.org):

- SAFOD (San Andreas Fault Observatory at Depth)
- PBO (Plate Boundary Observatory)
- USArray (Backbone plus migrating seismic arrays)

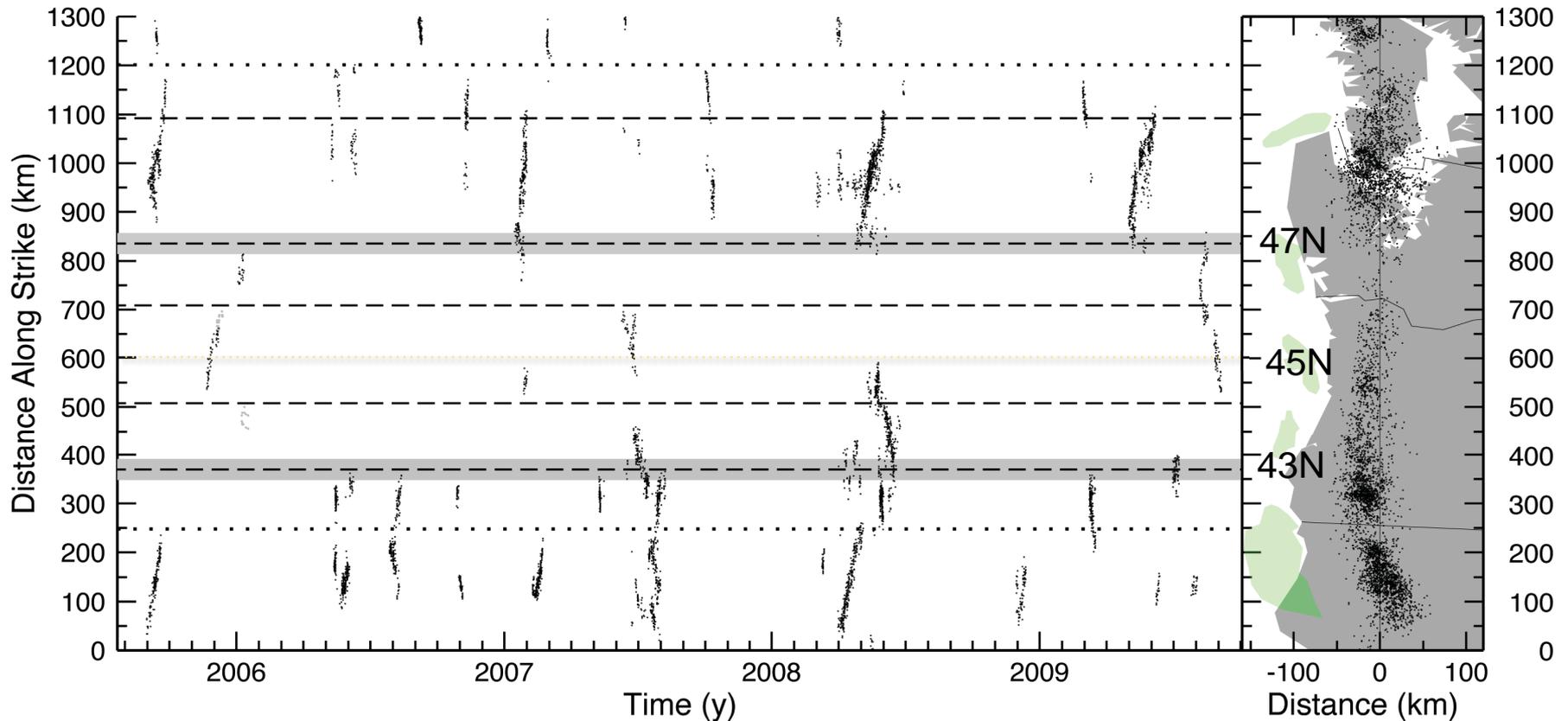
Currently the facilities are maintained and operated as a collaborative effort with UNAVCO and IRIS. Stanford and USGS led SAFOD during the MREFC phase, but have passed O&M on to UNAVCO.

GeoEarthScope (seeded with a one-shot purchase of data in 2007):

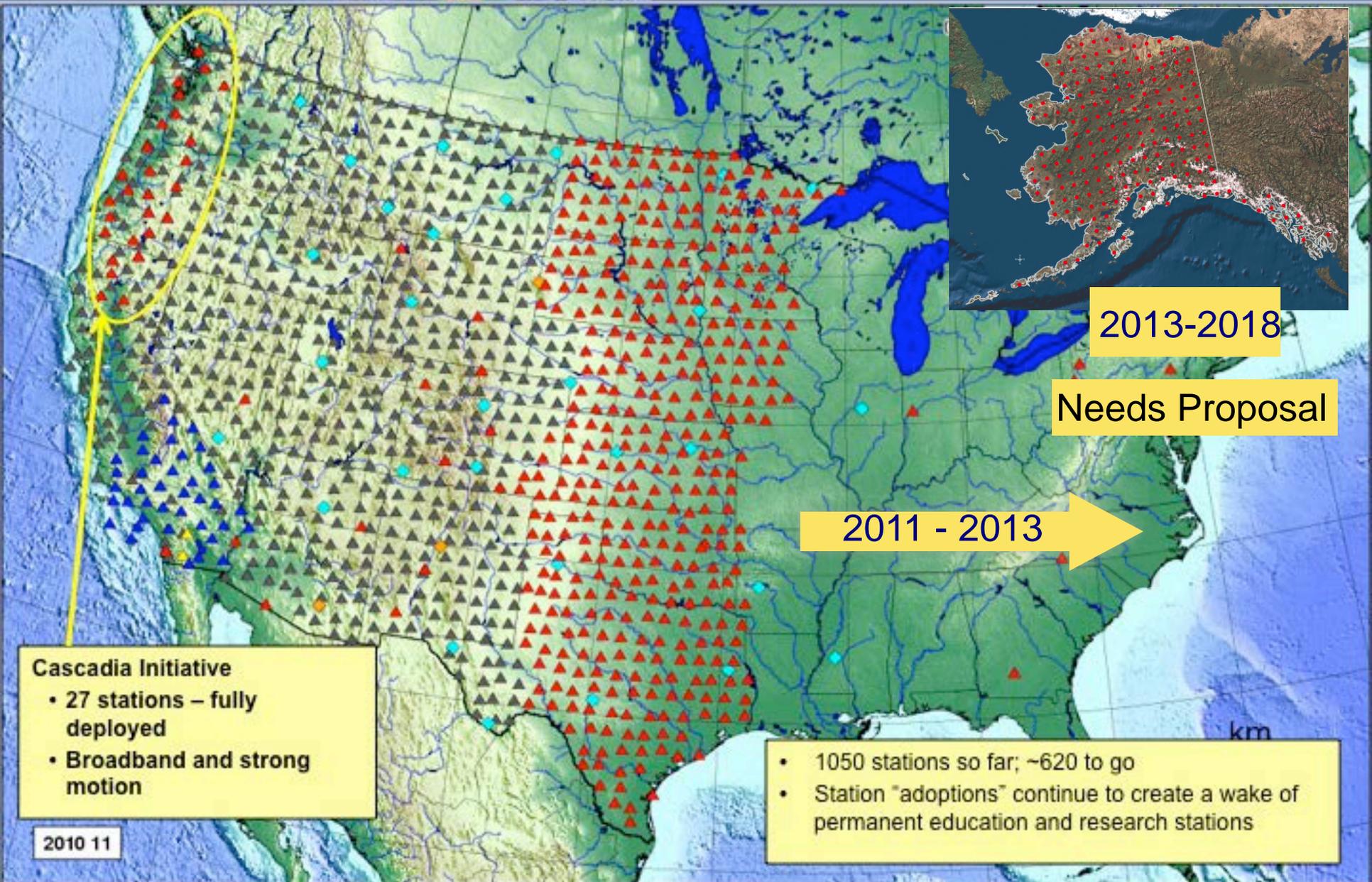
- LiDAR (www.opentopography.com)
- Geochronology
- InSAR (winsar.unavco.org)

Many of the exciting results presented yesterday morning were enabled by PBO, USArray and SAFOD.

Along strike segmentation of ETS – Boyarski, Brudzinski, and others, in prep.



Transportable Array



2013-2018

Needs Proposal

2011 - 2013

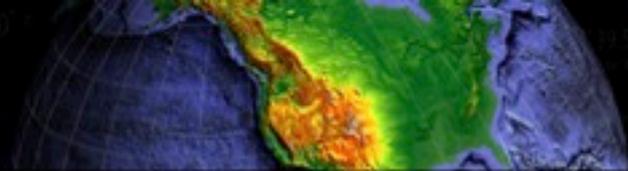
Cascadia Initiative

- 27 stations – fully deployed
- Broadband and strong motion

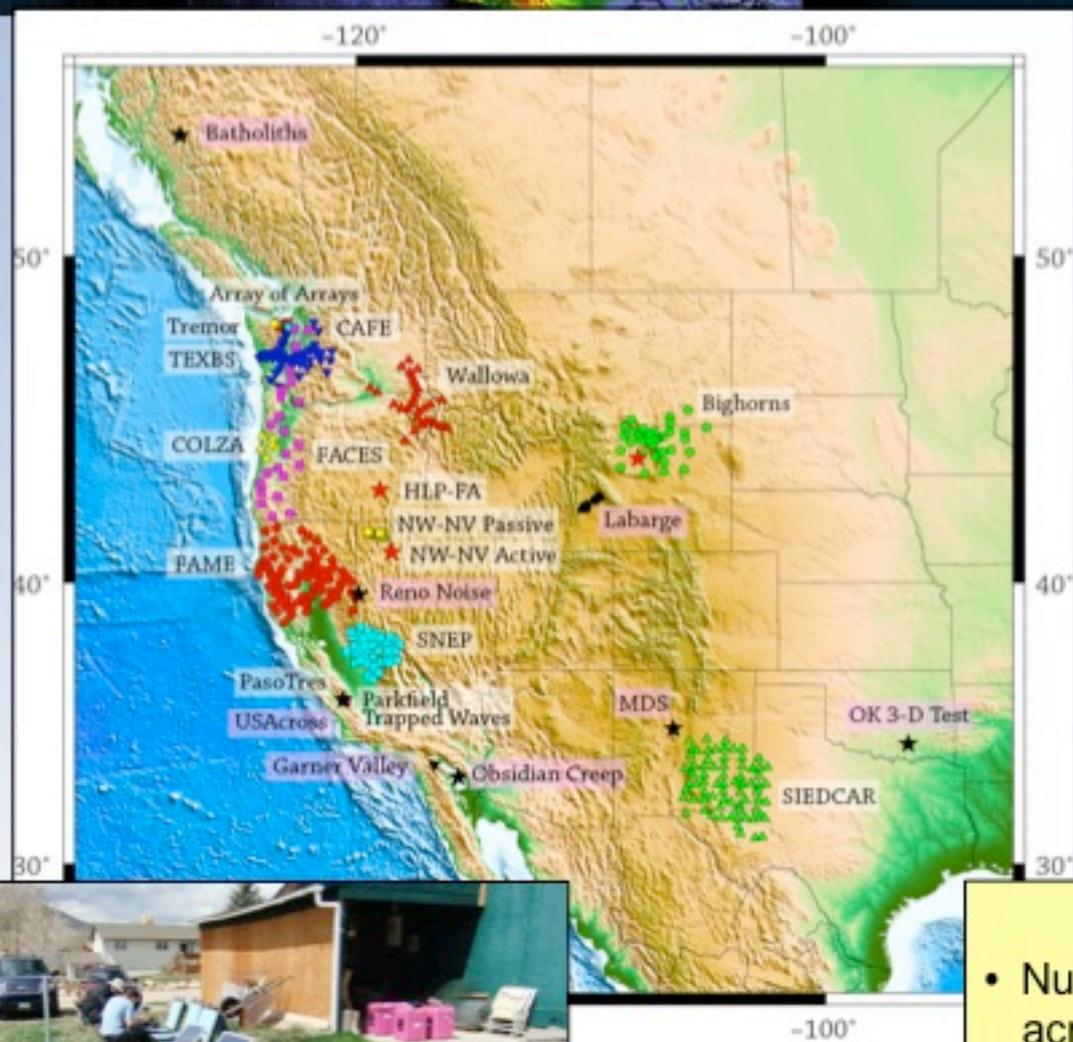
2010 11

- 1050 stations so far; ~620 to go
- Station "adoptions" continue to create a wake of permanent education and research stations

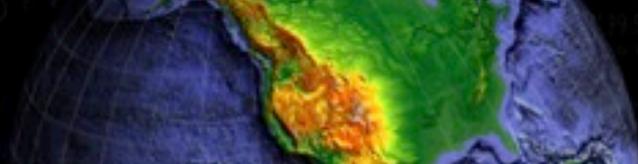
km



Flexible Array

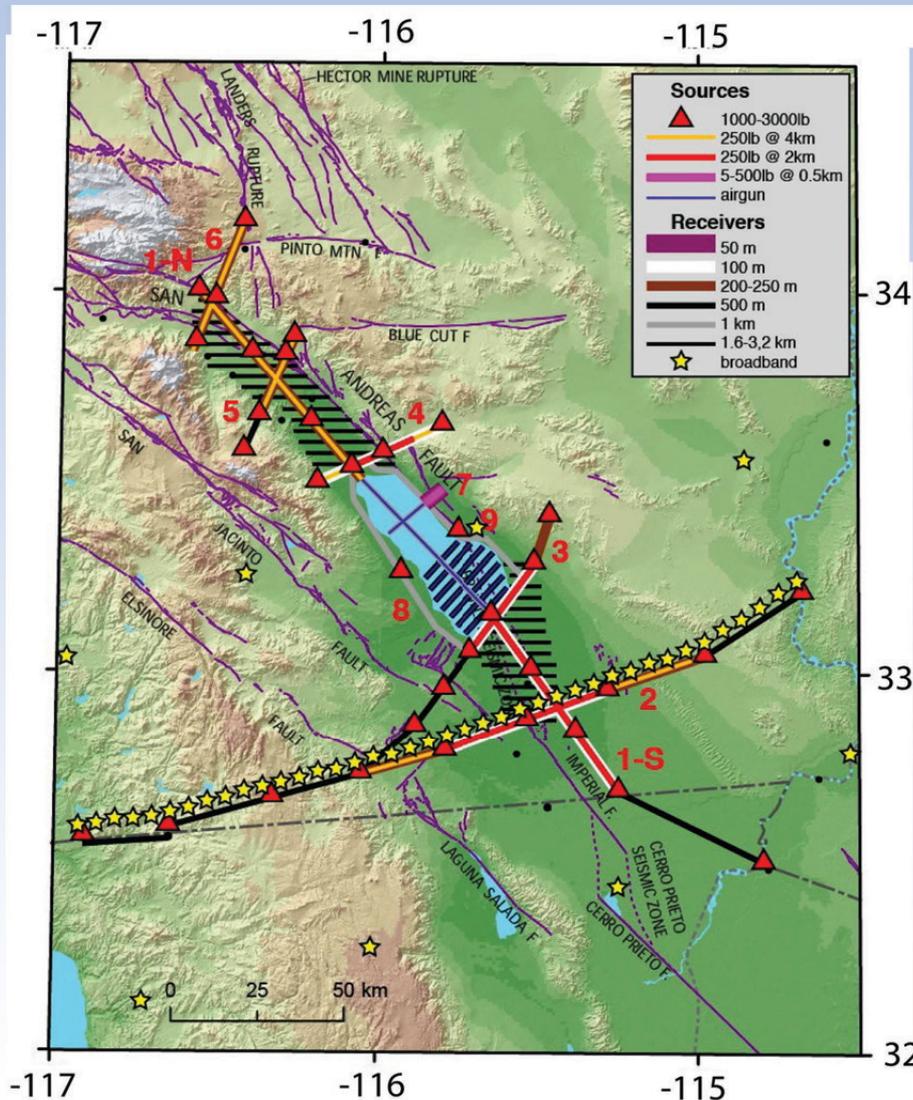


- USArray Flexible Array**
- Numerous active experiments across US
 - Large, fully-utilized equipment pool



- Fifteen EarthScope experiments completed or ongoing
- Instruments used in nine other experiments

Name	PI	Institution	Equipment	Time
Salton Trough	Hole, Stock	Virginia Tech Caltech	2700 Texans 300 short period	Winter 2011
Big Horns	Anderson, Sheehan, Miller, Siddoway, Harder	Colorado C. U. Colorado UTEP	30 broadband 220 short period 1600 Texans	6/2009 - 11/2010 5/2010 - 11/2010 7/2010 - 8/2010
W. Idaho Shear Zone	Russo, Hole, Tikoff, Vervoort	U. Florida Virginia Tech	87 broadband 2700 Texans	5/2011 – 4/2013 7/2011 – 9/2011
SEAM	Fischer, Forsyth, Wagner, Hawman	Brown U.	85 broadband	4/2011 - 8/2014
NE NV	Klemperer	Stanford U.	40 broadband	Summer 2010
Chile	Collaborative	IRIS	50 broadband (sensors only)	Summer 2010
Basin and Range	Nabelek	Oregon State U.	33 broadband	2011
SPREE	van der Lee, Revenaugh, Wiens, Wysession	Northwestern	~80 broadband	Spring 2011
Array of Arrays	Creager, Vidale, Houston	U of Washington	200 Texans 7 broadband 102 short period	? 10



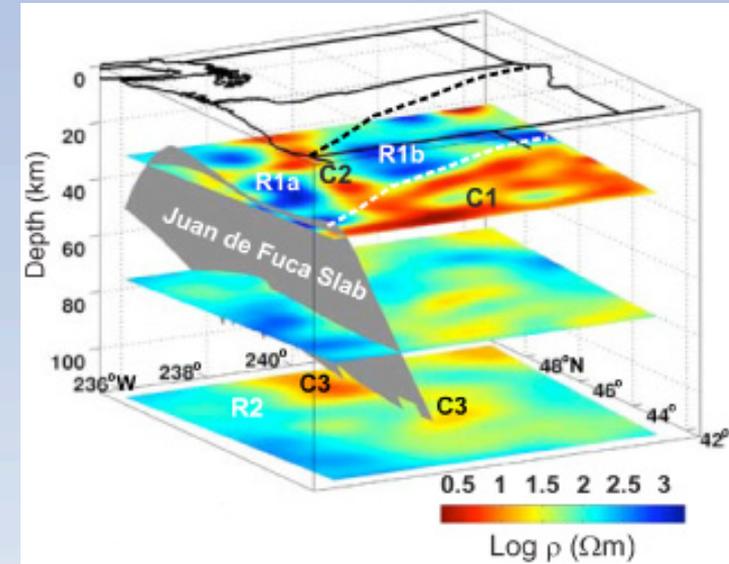
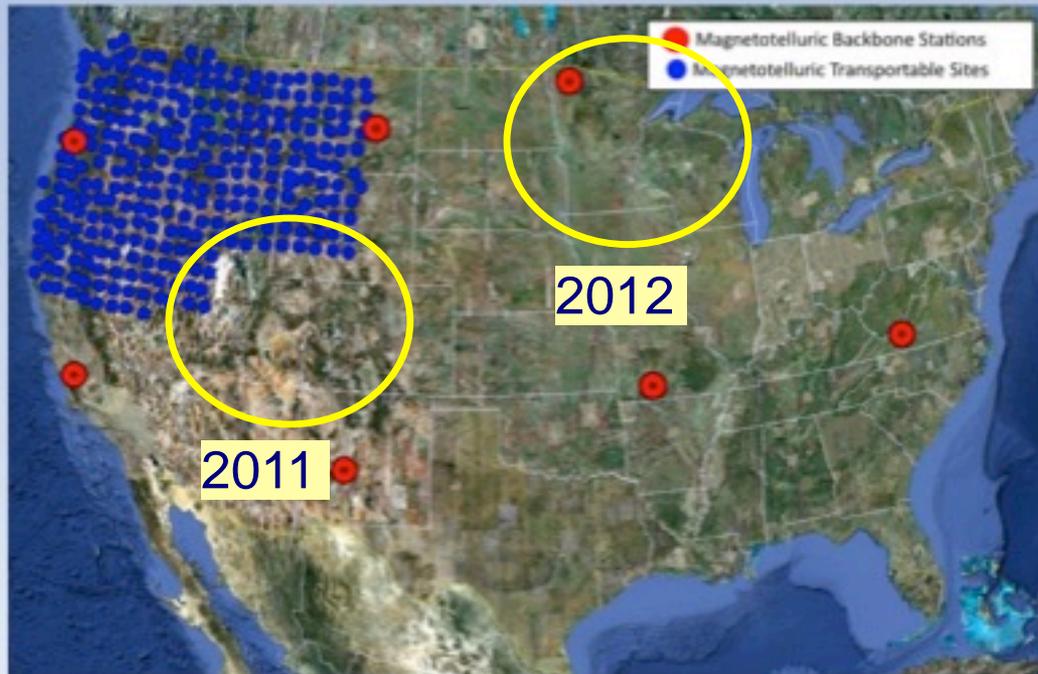
Several active source experiments funded in the past 2 years.

e.g. Salton Seismic Imaging Project (SSIP) – John Hole, Joann Stock, Gary Fuis, and others.

Co-funded by EarthScope, MARGINS, other NSF programs, USGS



Magnetotellurics

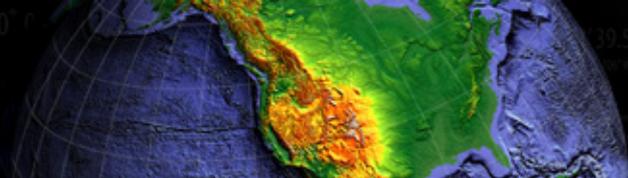


Patro and Egbert, 2008

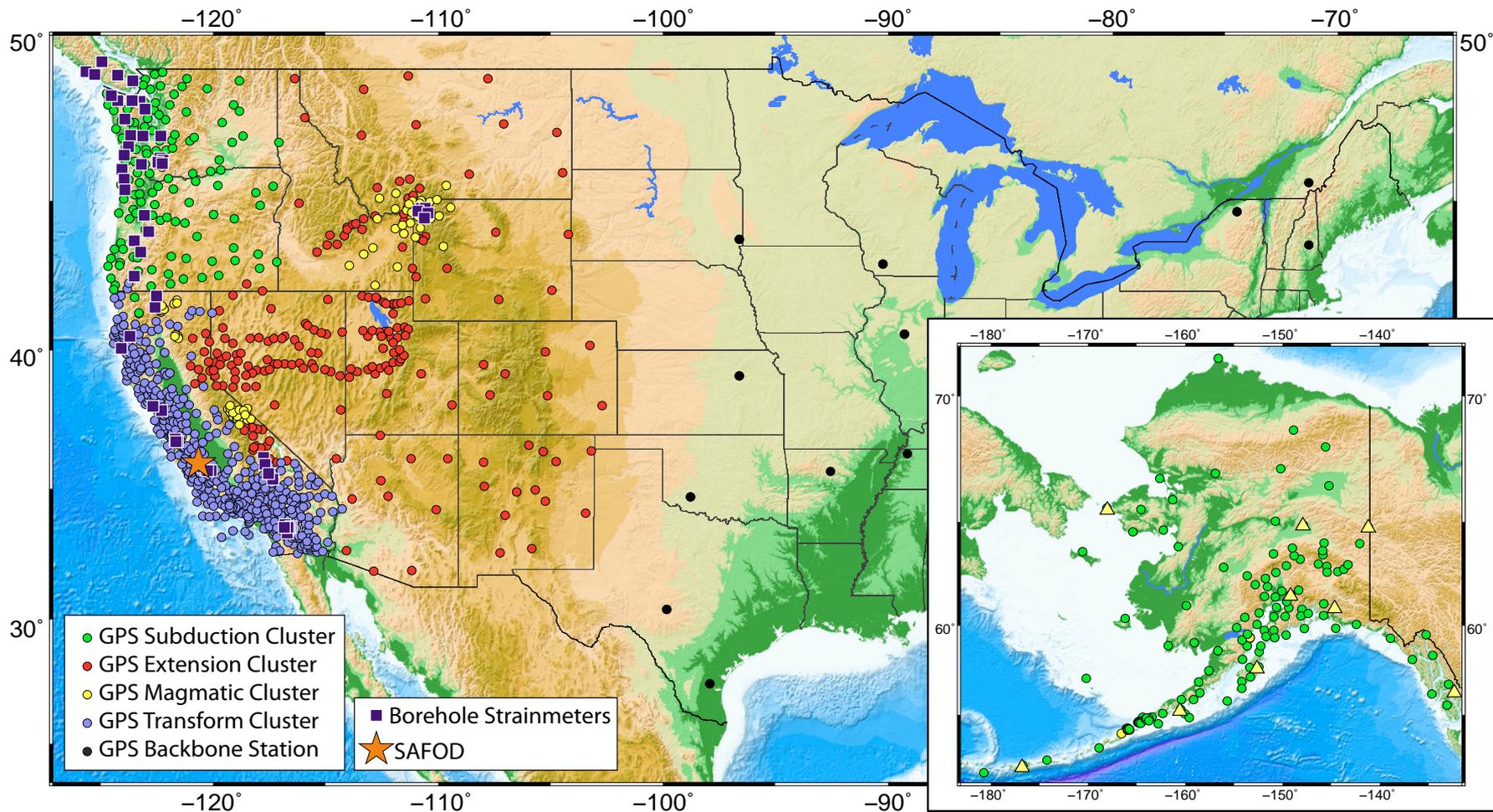


USArray Magnetotellurics

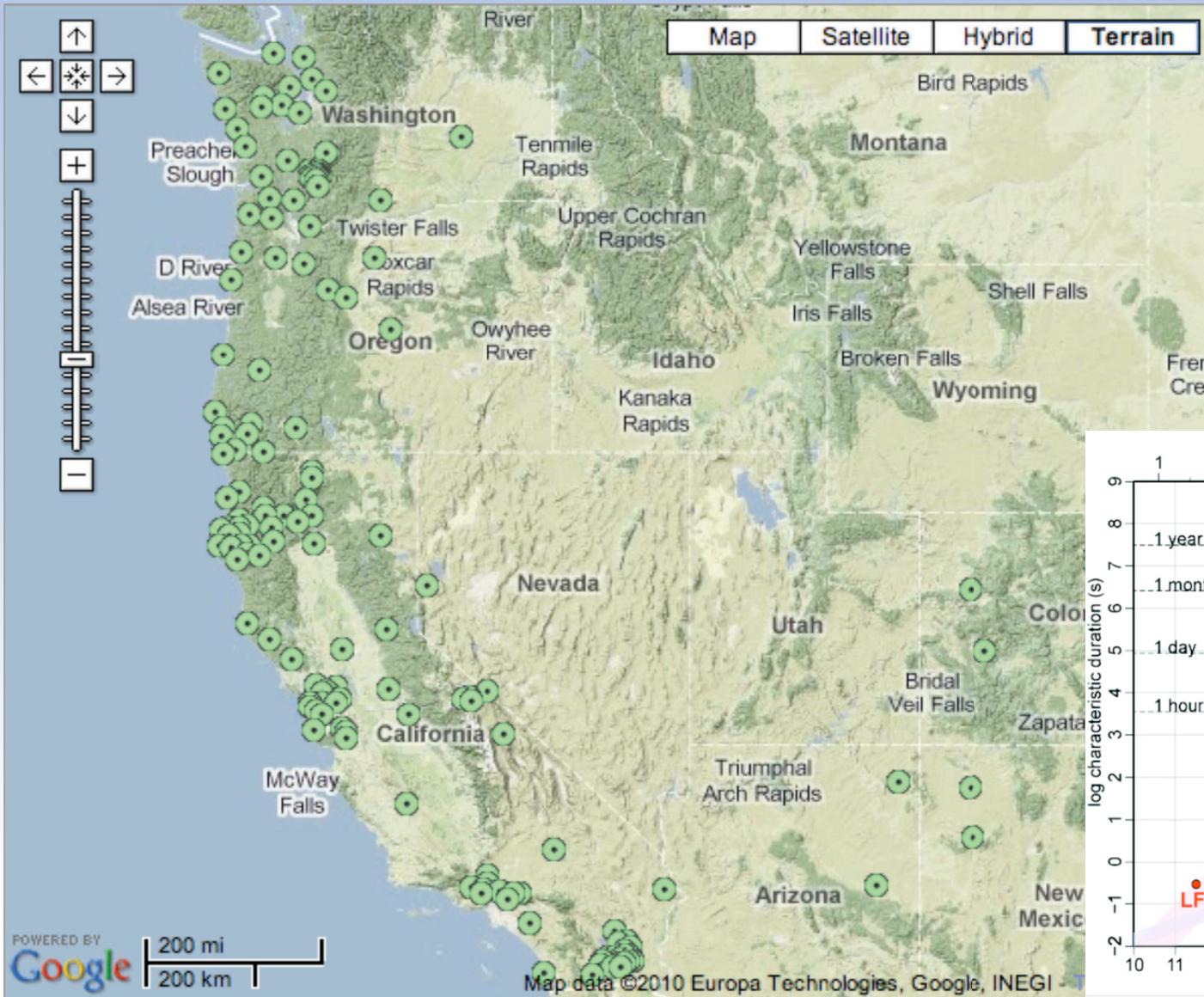
- ~270 temporary sites occupied to-date
- 7 backbone stations
- After 2011 MT will head to the mid-continent rift



SAFOD AND PBO STATION LOCATIONS

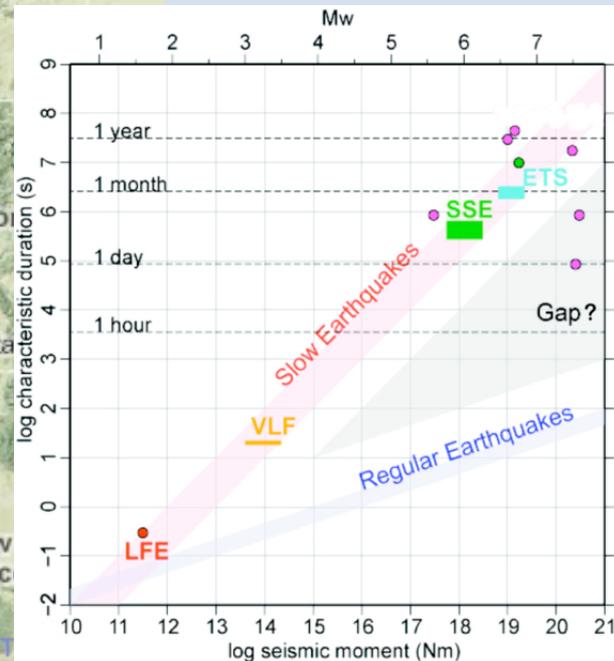


PBO – real-time, high rate GPS



Fills observational gap between BB seismometers and GPS.

Implications for earthquake early warning.

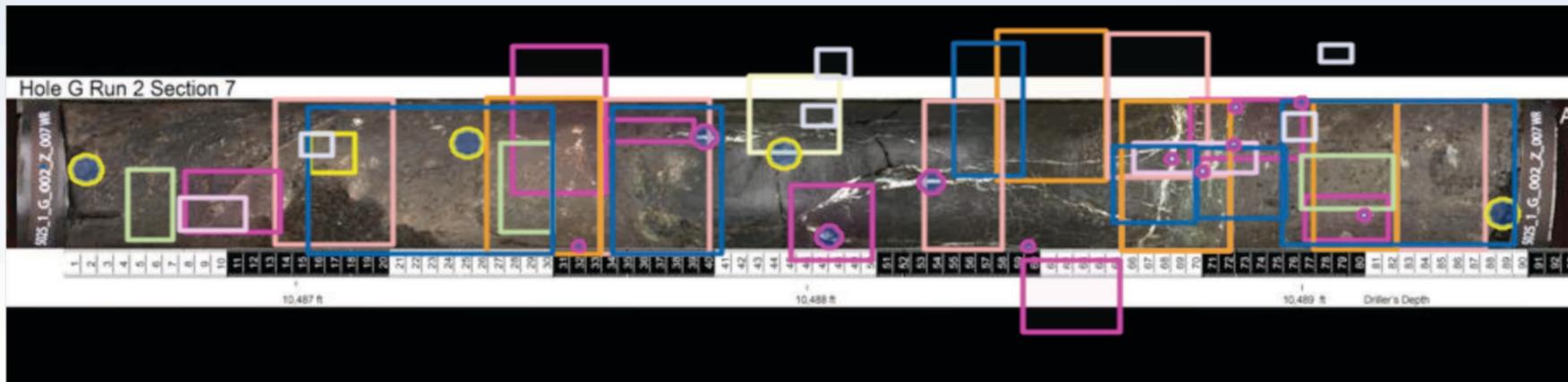


O&M transferred from Stanford/USGS to UNAVCO (includes sample archiving and distribution).

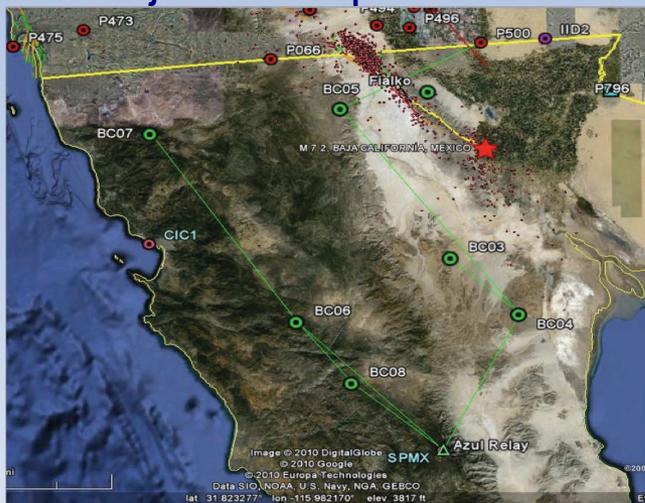
Coring complete. Crossed fault at almost 3 km depth. High demand for core. Special session at AGU. Focus topic for the spring 2011 inSight newsletter.

Borehole observatory failed after a few days. It was recovered in October 2010 and postmortem analysis is underway by an investigative panel appointed by NSF: Tom Henyey (USC, retired), Alan Linde (Carnegie), Joe Henfling (Sandia), Jamie Steidl (UCSB), Donald DePaolo (Berkeley)

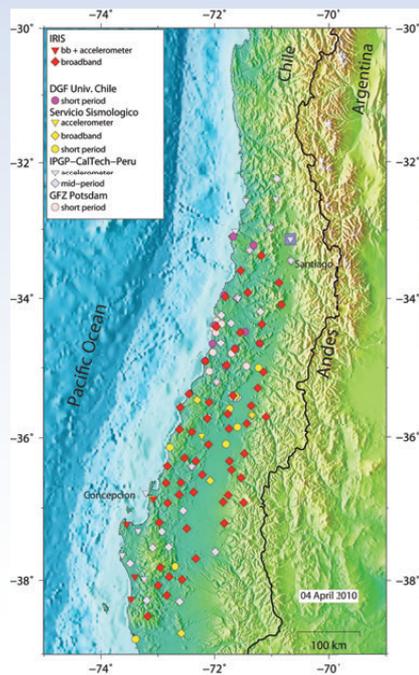
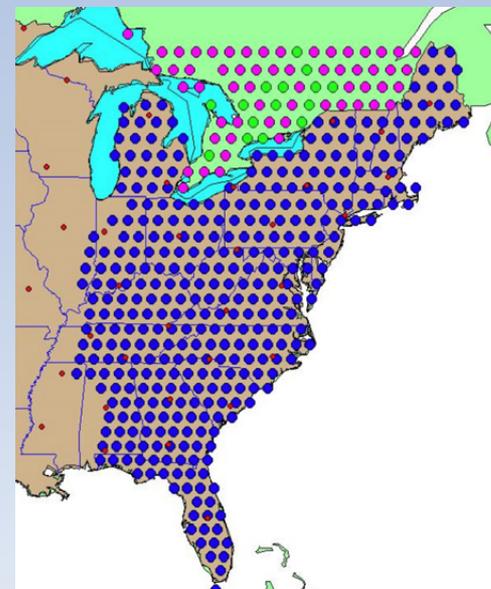
USGS and NSF have an MOU to deploy a repaired analog borehole instrument while an evaluation of what went wrong with the full observatory is underway.



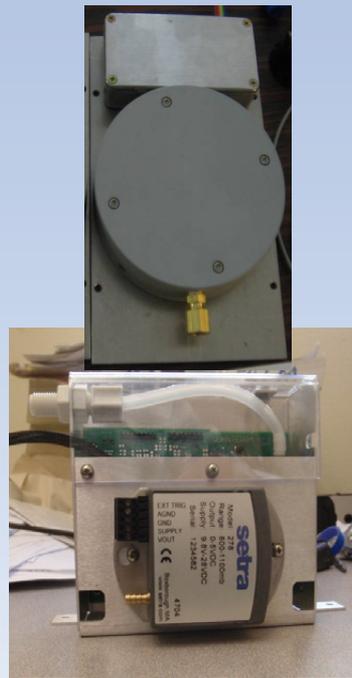
Baja EQ response



TA-Canada



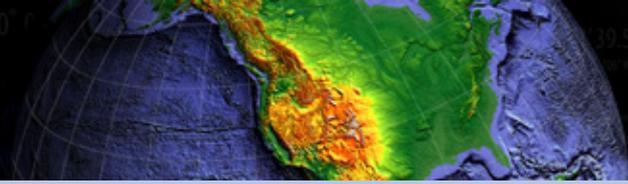
Chile response



Infrasound

TA-Alaska





EarthScope National Office (ESNO): role is to facilitate communication between the facilities, NSF, the scientific community and the public.

- Office will migrate in spring 2011.

Current activities: Quarterly “inSights” newsletter. Web highlights. Publication and funded project listings. Links to data products and other resources. Workshops for informal educators in parks in museums.

Recent new initiatives:

- First “EarthScope Institute” on the “Spectrum of Fault Slip Behaviors” – well attended. All talks on the web site. Currently building tools for community communications.
- Next Institute – Lithosphere/Asthenosphere Boundary (LAB) – funded and will be held next September. Details TBD soon.
- Focused push to develop a plan for cyberinfrastructure and data products.

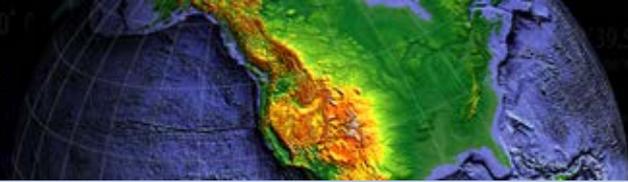
AT&T conference center, Austin TX, May 17-20, 2011

Planning committee: John Hole, Mike Jackson, Rowena Lohman, Ben van der Pluijm, Jay Pulliam, Anne Trehu, Steve Whitmeyer, Bob Woodward, Howard Zebker

- Session 1: Reconstructing the Evolution of a Continent
- Session 2: Processes at Active Plate Boundaries
- Session 3: Exploration and Unexpected Discoveries
- Session 4: EarthScope's Broader Impacts
- Session 5: Key targets for the future
- Lunchtime “EarthScope Cafes” – cross-disciplinary “tutorials”
- Pre-meeting mini-workshops



See the web site for a preliminary agenda, deadlines and detailed session descriptions. Registration opens Feb. 1



Concluding comments:

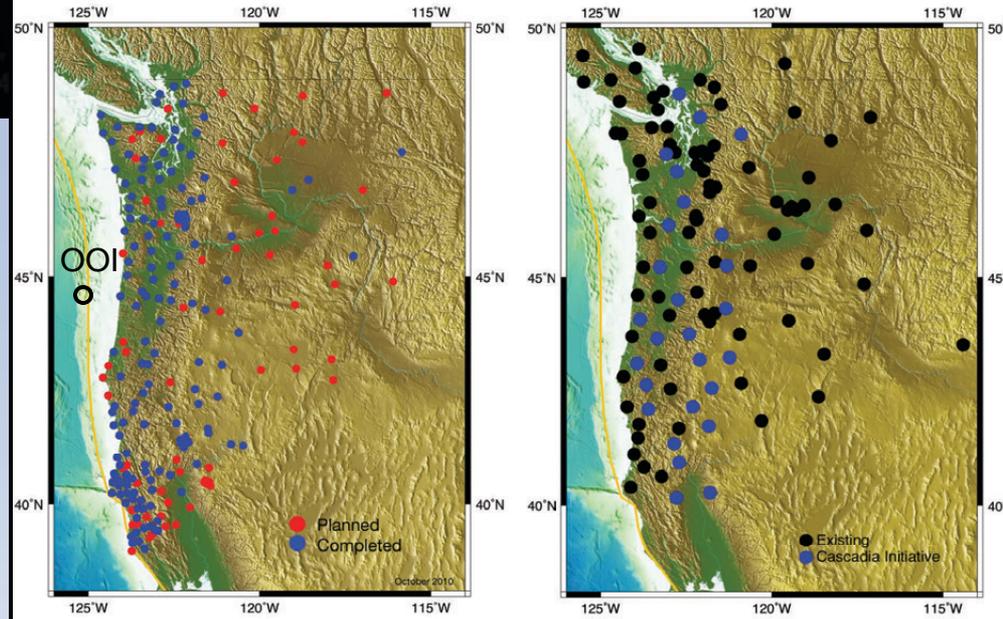
EarthScope and GeoPRISMS have many similar science objectives.

EarthScope provides infrastructure for addressing each of the 7 SCD priorities for sites in North America.

Funding for TA in Alaska will require broad community support.

EAR, OCE and the EarthScope and GeoPRISMS science communities must work together to coordinate data acquisition, archiving and synthesis across the ocean/continent boundary.

Cascadia Initiative



Major Research Problems in Alaska

Alaska includes normal subduction, flat slab subduction, major strike-slip faults, the highest topography in North America, the largest temperate glaciers on Earth, and one of the greatest rates of change in the modern climate! From Alaska breakout group at WESP

