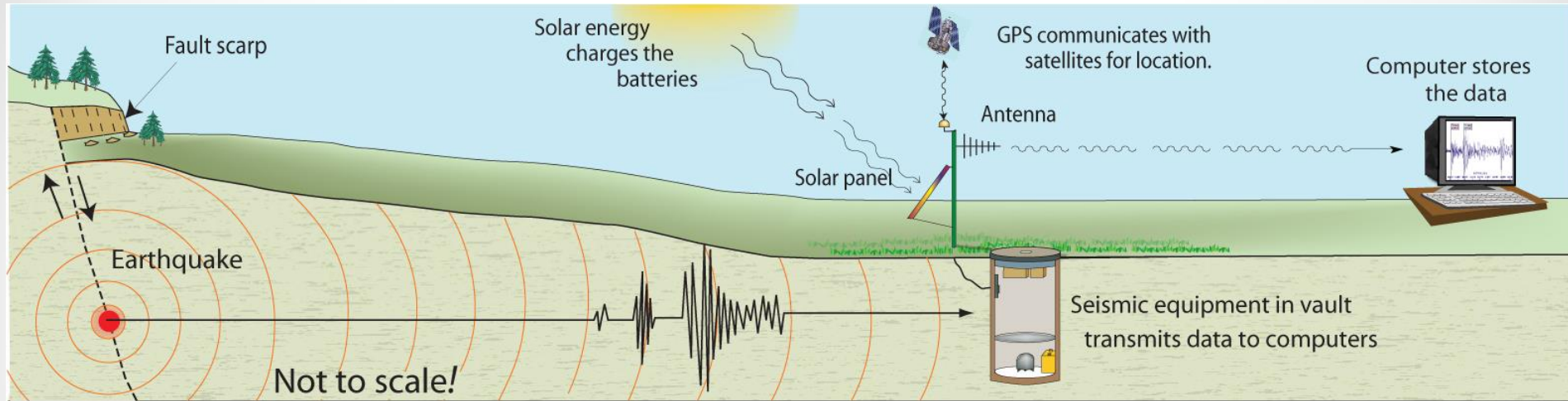# The Use of Seismological Data in Research and Hazard Applications
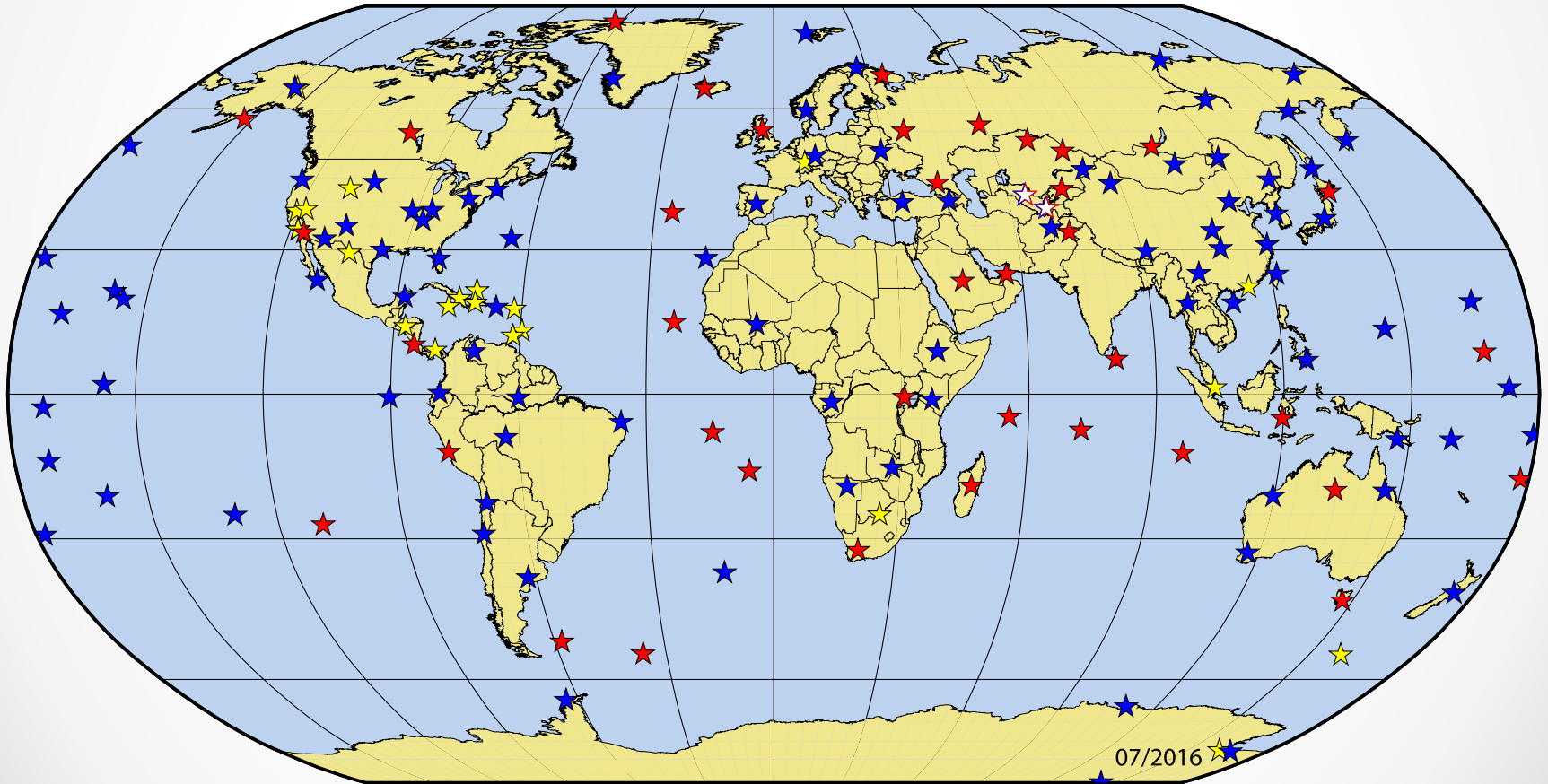
Katrin Hafner
IRIS GSN Program Manager
July 25, 2016

ADVANCES in EARTH SCIENCE WEBINAR SERIES
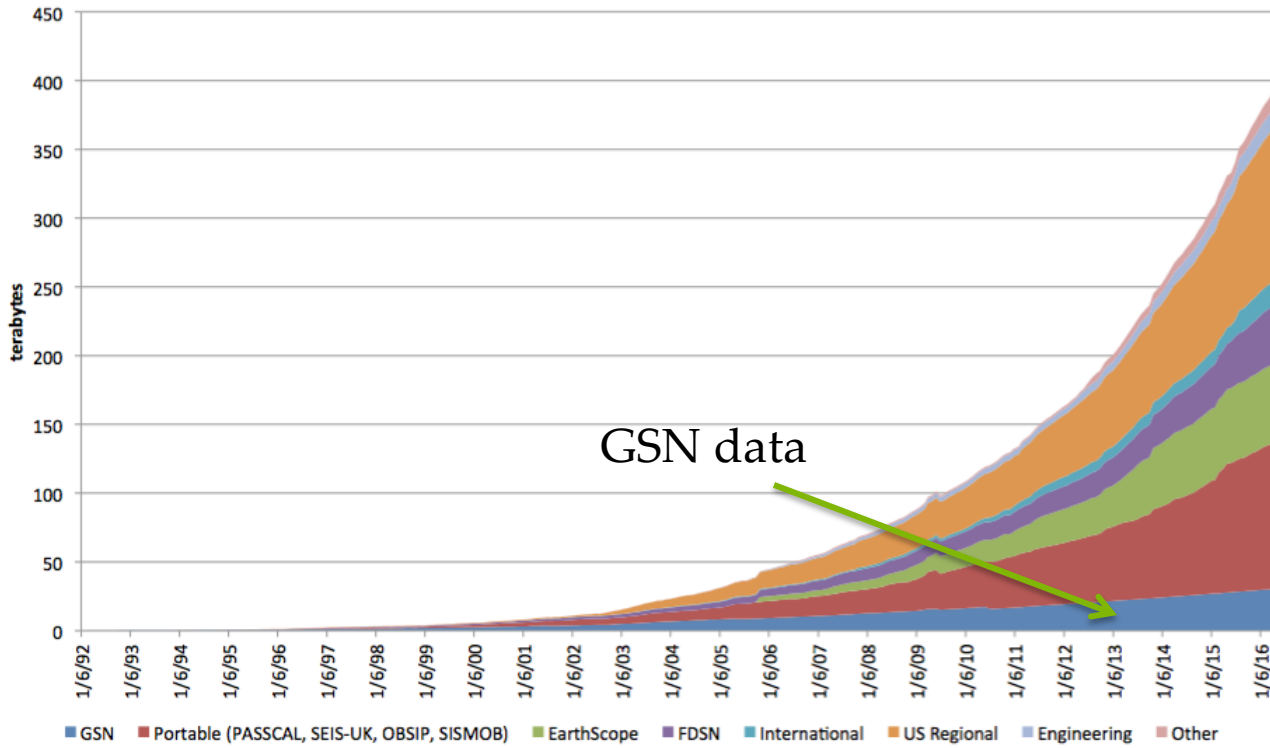
Typical Seismic Station

Global Seismographic Network (GSN)

★ IRIS/IDA Stations ★ IRIS/USGS Stations ★ Affiliate Stations

☆ Planned Stations

07/2016

IRIS Data Archive

IRIS DMC Archive
as of 1 May 2016
398.3 terabytes

GSN data

GSN   Portable (PASSCAL, SEIS-UK, OBSIP, SISMOB)   EarthScope   FDSN   International   US Regional   Engineering   Other

1992   2016

Archives data from over 1000 seismic networks

Size of data archive: 400 Tb and growing exponentially
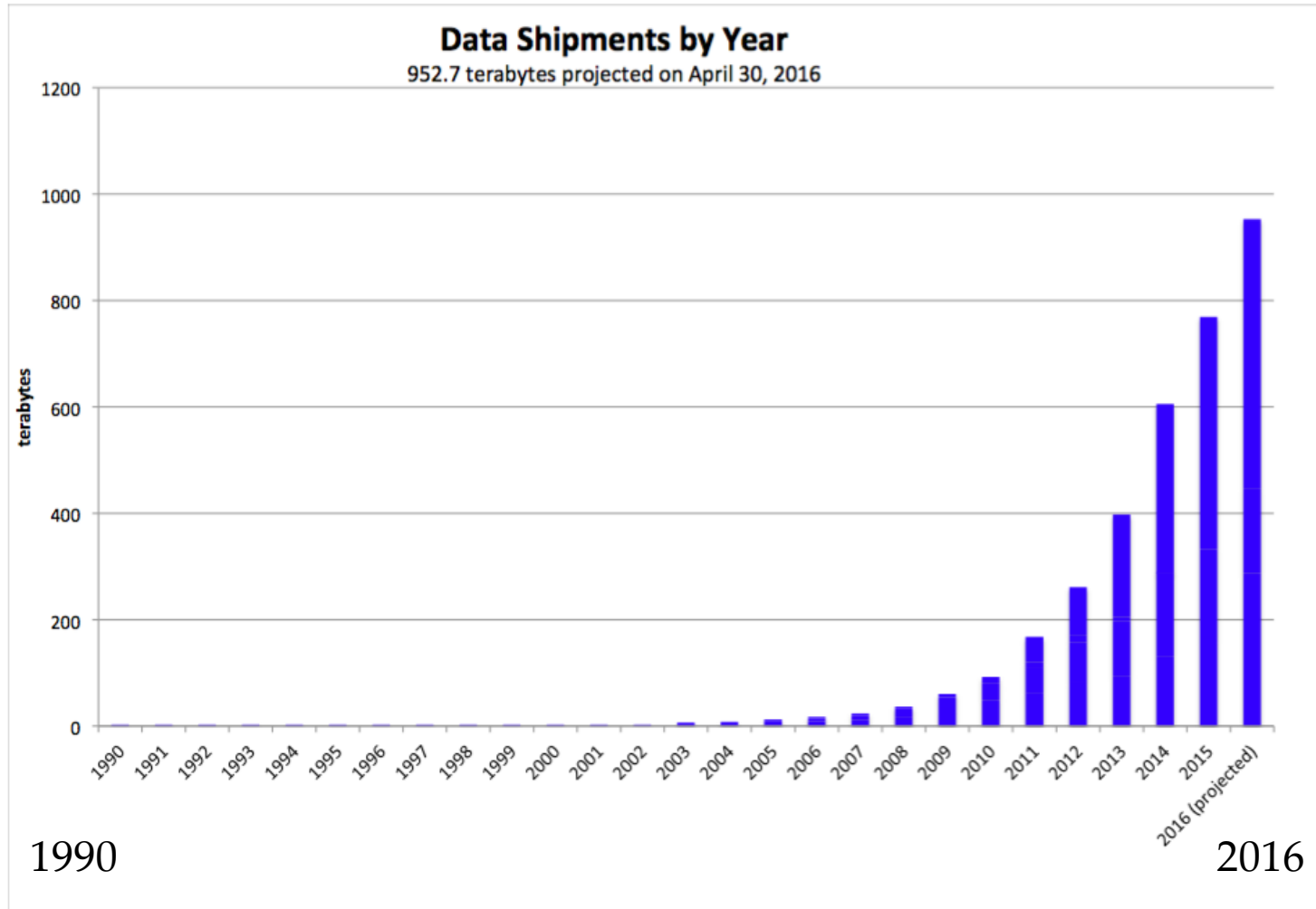
DMC receives ~192 Gb of real-time data/day

IRIS Data Distribution

In 2016, DMC expects to distribute ~1 Pb (1000 Tb) of data to users

DMC distributes data to over 19,000 unique users in 173 countries around the world

All data are free and openly available

Data Shipments by Year
952.7 terabytes projected on April 30, 2016

1990   2016

GSN Partnerships

- GSN is a partnership – NSF, USGS & IRIS
    - ✧ Other US government contributions have bolstered support and reinvestment in the GSN for its multi-use capabilities
        Dept of Defense   Dept of Energy   Dept of State

- Host country partnerships
    - ✧ MOUs between foreign governments, private entities & universities
    - ✧ Long-standing relationships between network operators and local personnel

- National Organizations
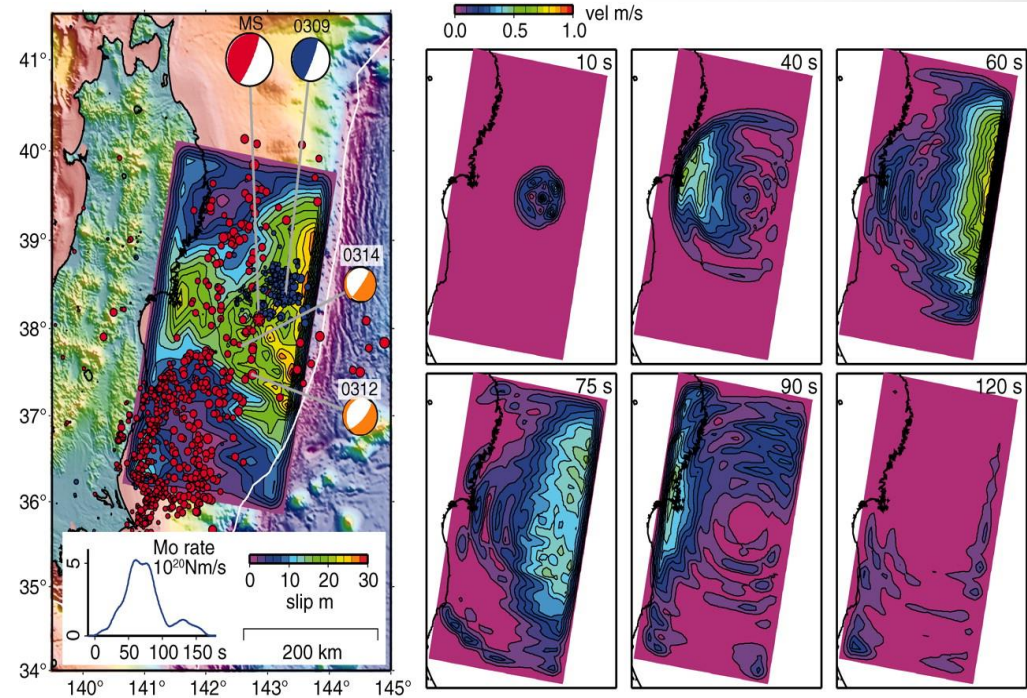   - ✧ NOAA Tsunami Warning Centers & NEIC,– assist with data flow & delivery

Global Earth Structure

Understanding Great Earthquakes
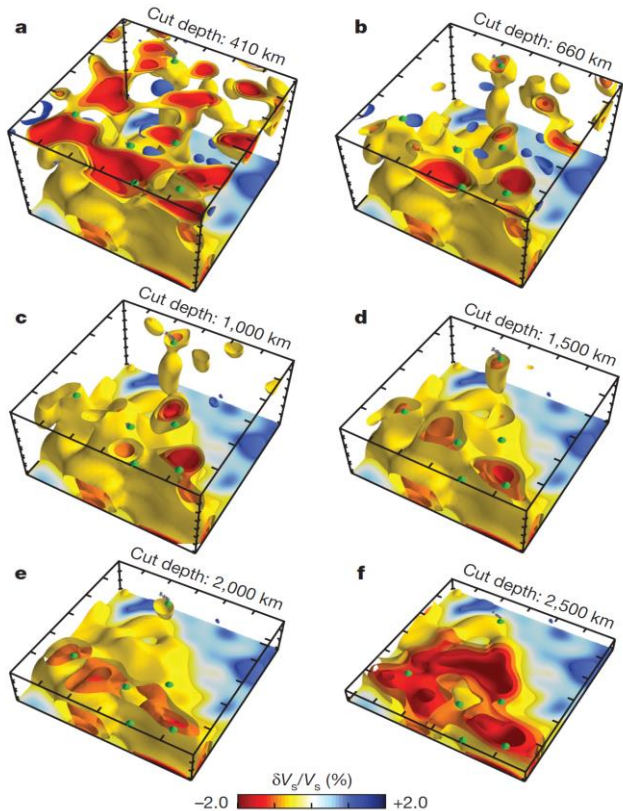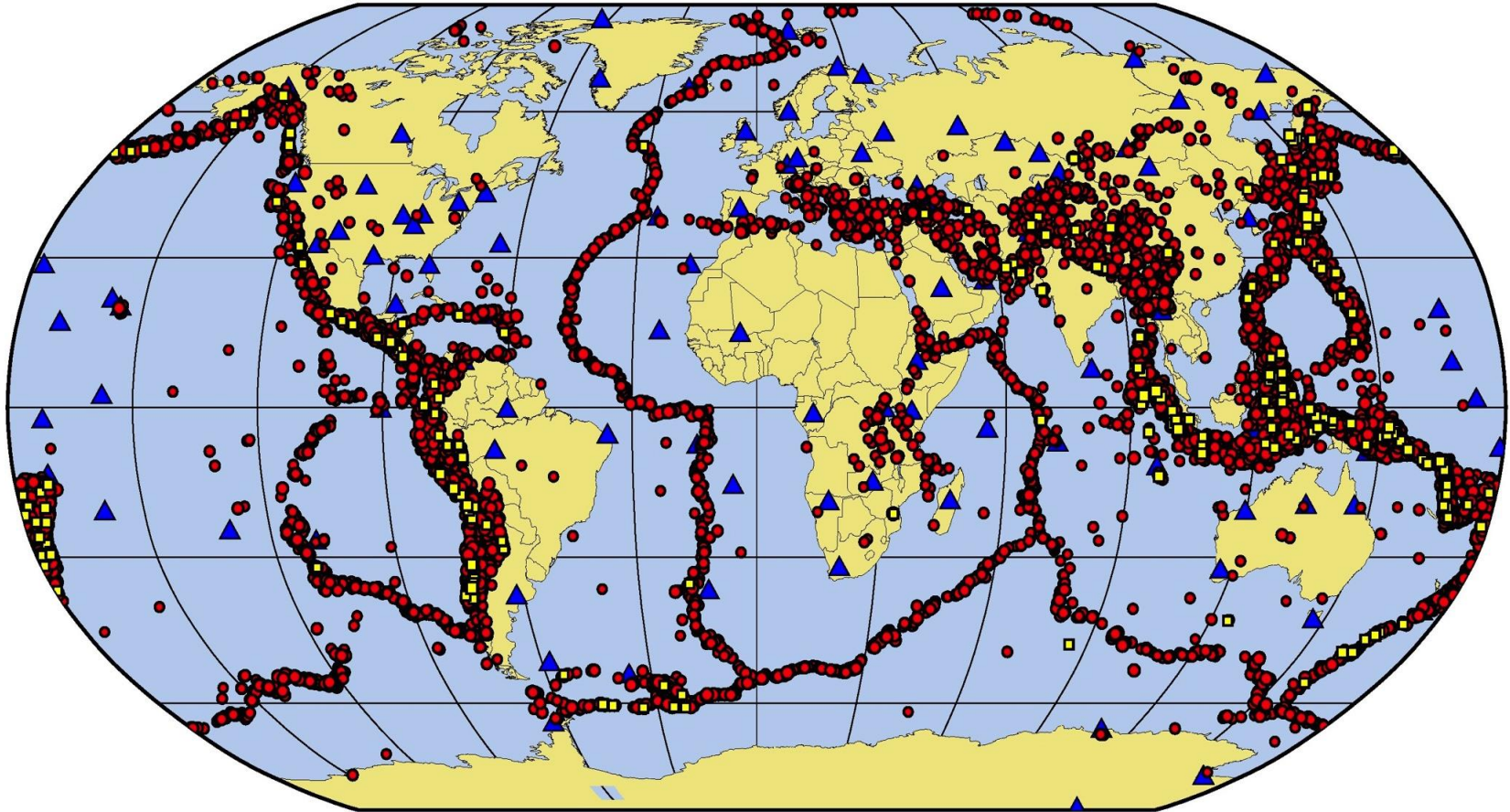

French & Romanowicz Nature 2015

Three-dimensional shear-wave-velocity
Structure in the Pacific Region

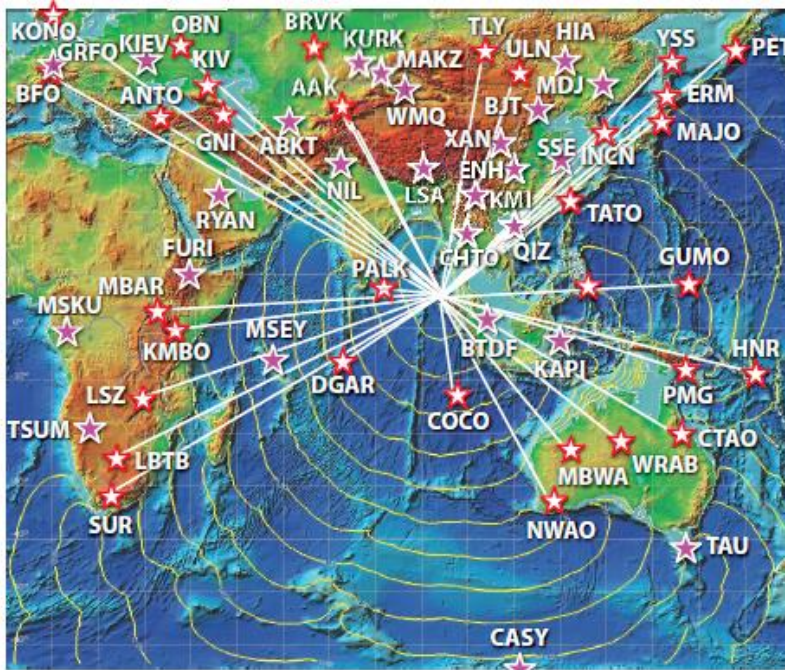*Ide, Baltay & Beroza – Science 2011*

Slip Distribution Images for 2011 M9.0
Tohoku-Oki Earthquake

Global Earthquake Monitoring 2008-2016

Large earthquakes (circles) recorded by the GSN stations
(black – magnitude 5-5.9; red-magnitude 6.0 – 6.9; yellow magnitude 7+
*Triangles are the GSN stations*

8

Other Monitoring Applications

GSN stations used in real-time Tsunami Warning for the Magnitude 9.1 Sumatra-Andaman Earthquake.

Tsunami warning ~100 GSN stations are used for real-time analyses by the NTWC; coverage in oceans and international areas is key – sparse coverage by other networks
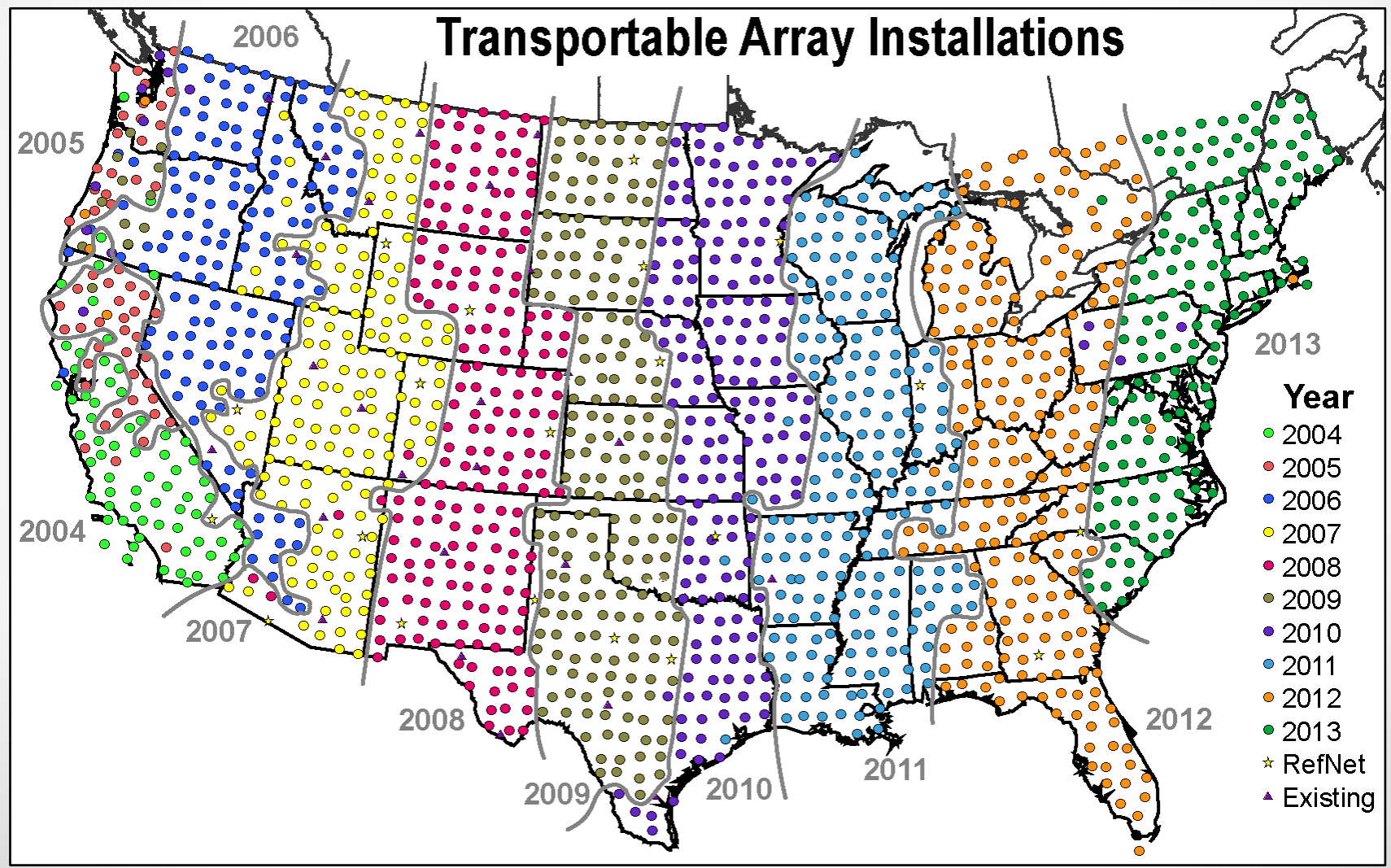
Verification seismology (CTBTO)
✧ ~50 auxiliary seismic stations are contributed by GSN to nuclear explosion monitoring
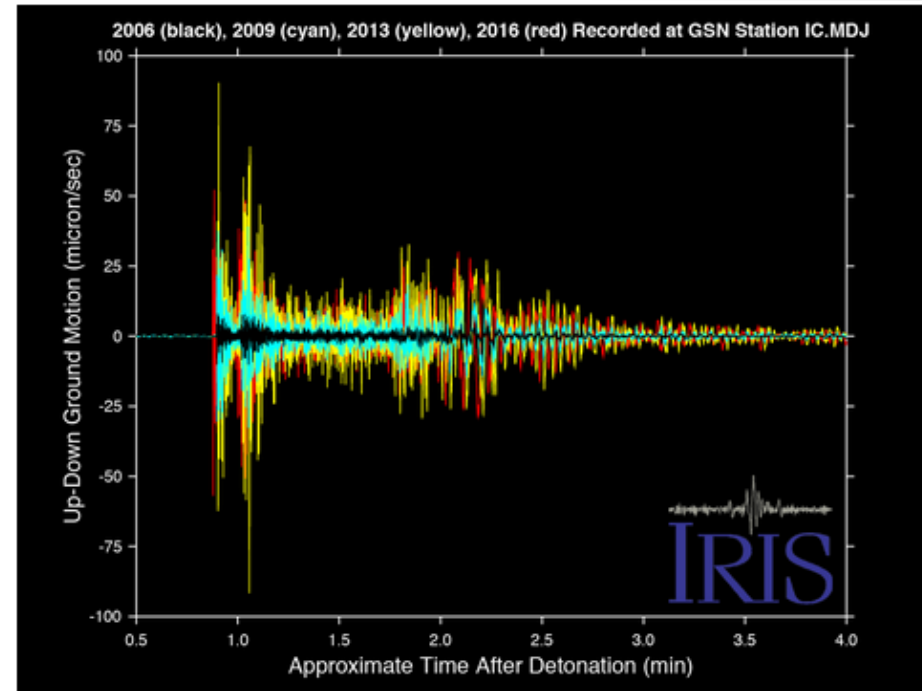
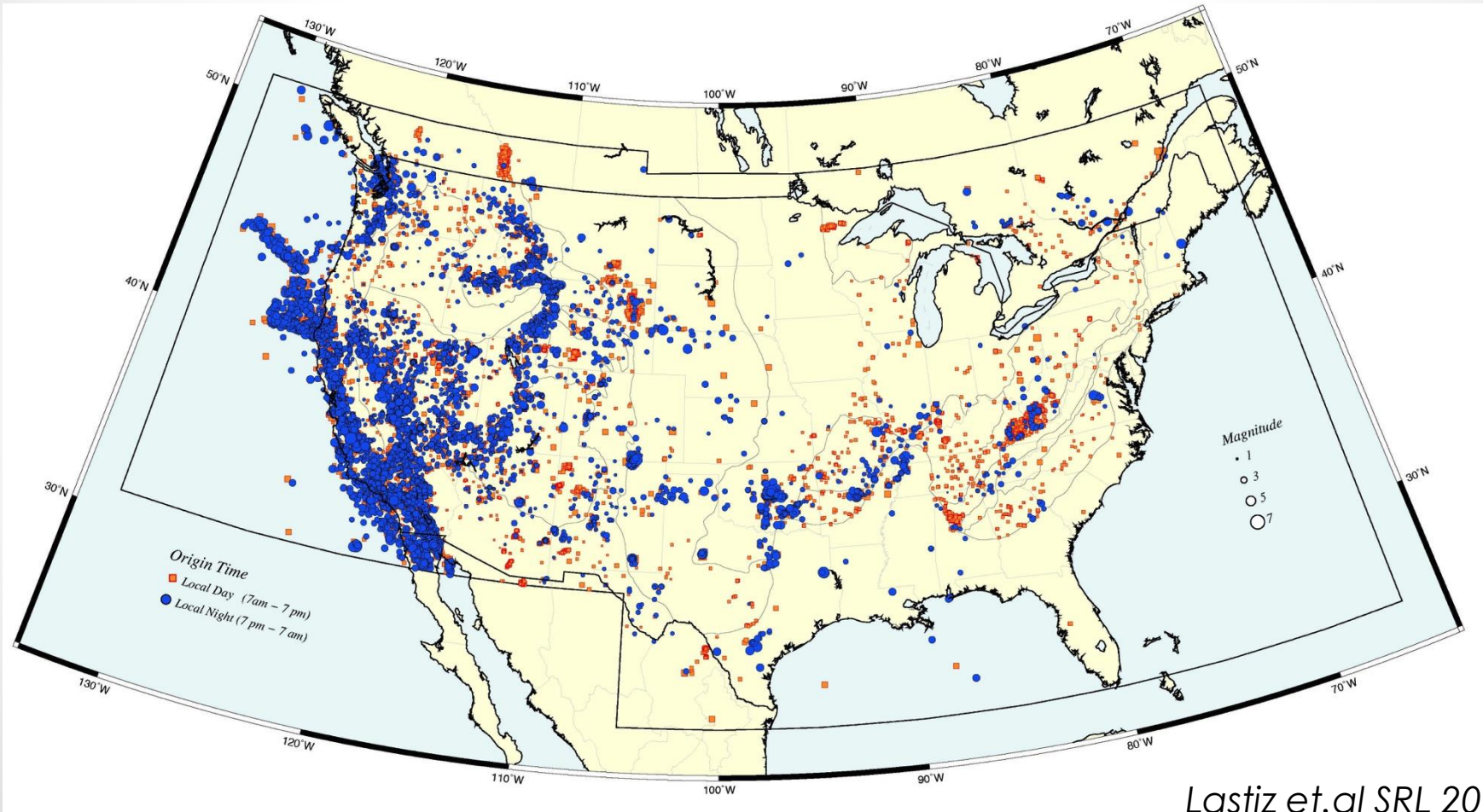*Seismograms of Korean nuclear explosions recorded on GSN station MDJ*

9

Transportable Array (TA) - 10 year Experiment

Transportable Array Installations

US Earthquakes Recorded by TA


Lastiz et.al SRL 2014

April 2004 to November 2013

Central and Eastern US Network (CEUSN)

- Left 158 TA seismic stations for:
  - Research
  - Hazards assessment
  - Critical facilities

- Multi-agency collaboration
  - NSF
  - USGS
  - US NRC
  - DOE

- "Good government"
  - A unique opportunity to address multiple missions / needs

CEUSN
- operating (N4, TA)
- contributing (USGS, state, univ., et al.)
- strong motion sensor
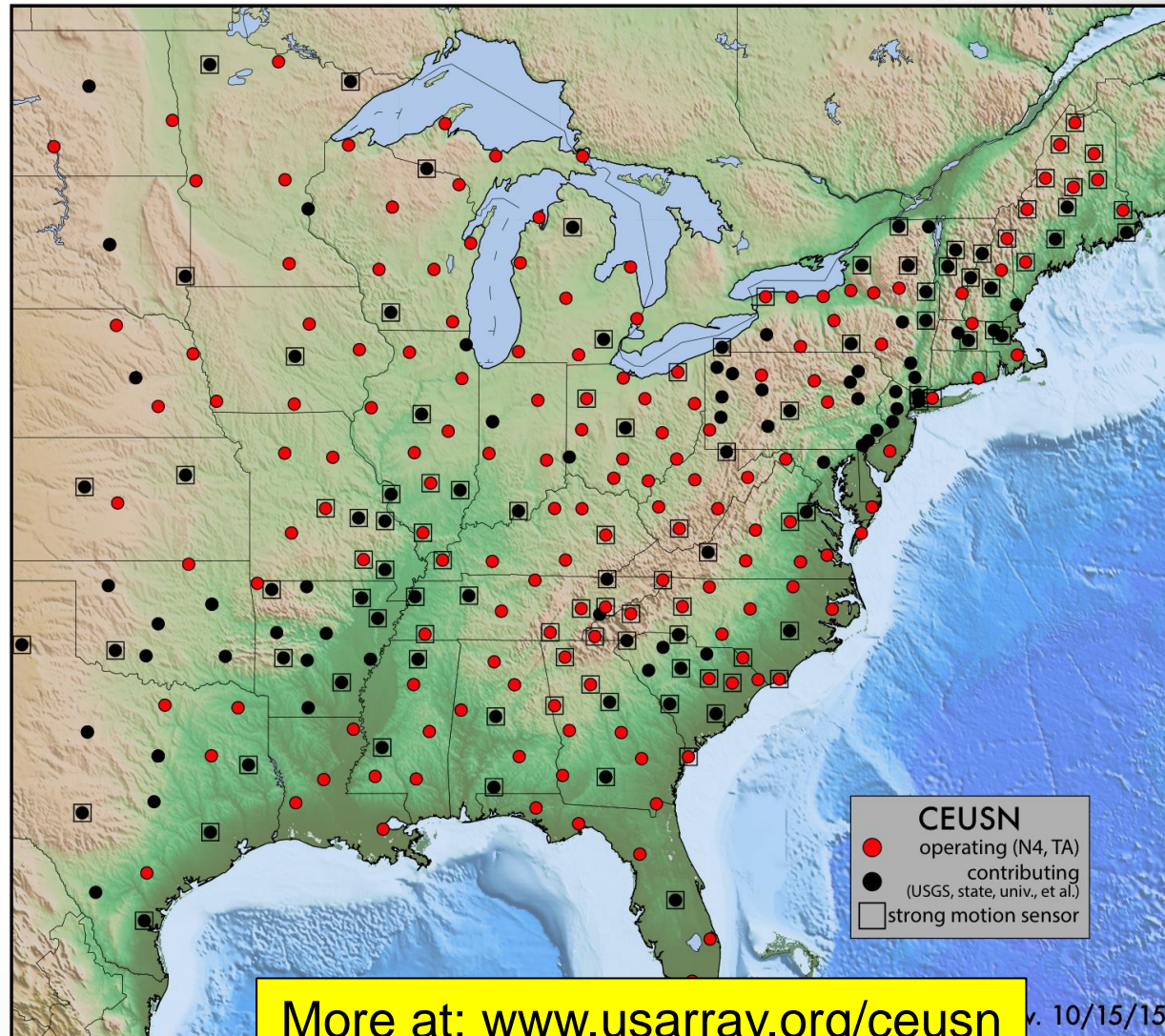
More at: www.usarray.org/ceusn

v. 10/15/15

Seismological Data as National Asset

- A long-term, continuous archive that contributes to Fundamental and Innovative Research on how the Earth works, e.g. subduction zones, internal structure

- Provides the Framework for Understanding the Processes that cause Earthquakes.

- Used for monitoring the Location, Magnitude and Distribution of Earthquakes on local, regional and global scales

- Used for Tsunami Warning (NOAA) and Monitoring for Nuclear Explosions (CTBTO)

- Unexpected Applications (e.g. mine collapses, "ice quakes" associated with glacier movements, rock falls, episodic tremor and slip (ETS))

Thank you!