



**International Federation of
Digital Seismograph Networks**

**IRIS and FDSN Monitoring Network:
Current situation and vision of the earthquake
monitoring network in wide area**

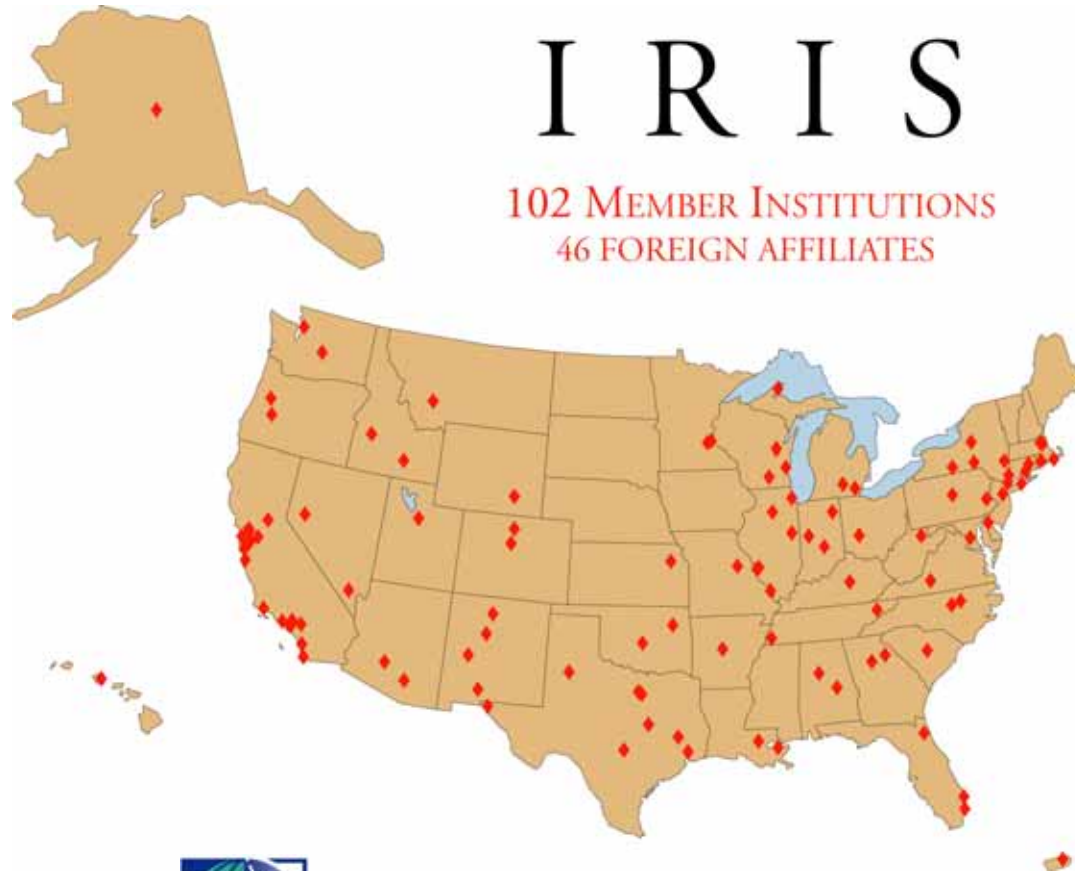
Rhett Butler, IRIS GSN Program Manager
with

Domenico Girardini (FDSN), Tim Ahern (IRIS), Winfried Hanka (Geofon),
Dave Wald (USGS), Paul Earle (USGS)

GEOSS Asia-Pacific Symposium

Tokyo, January 11, 2007

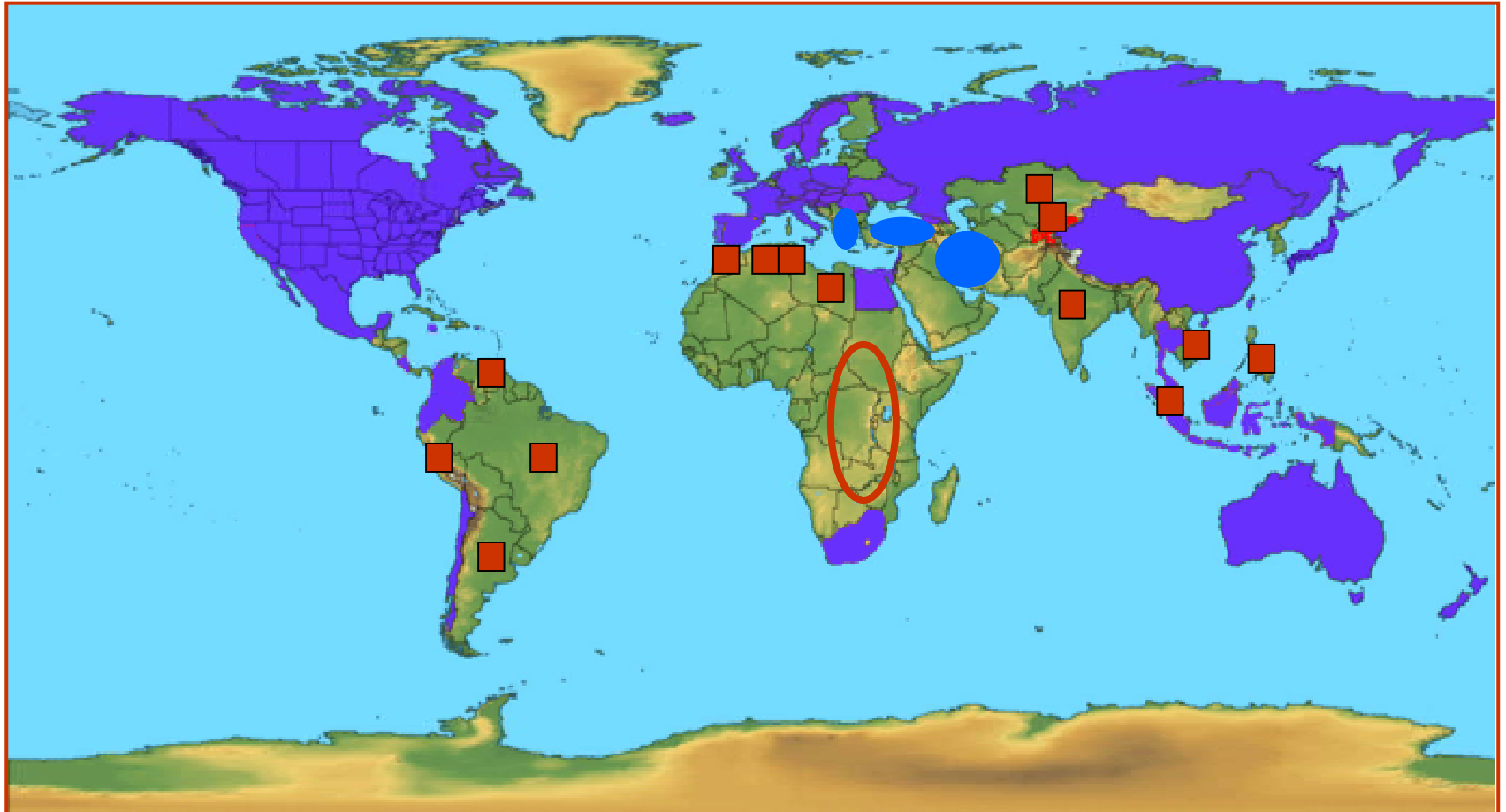
Incorporated Research Institutions for Seismology



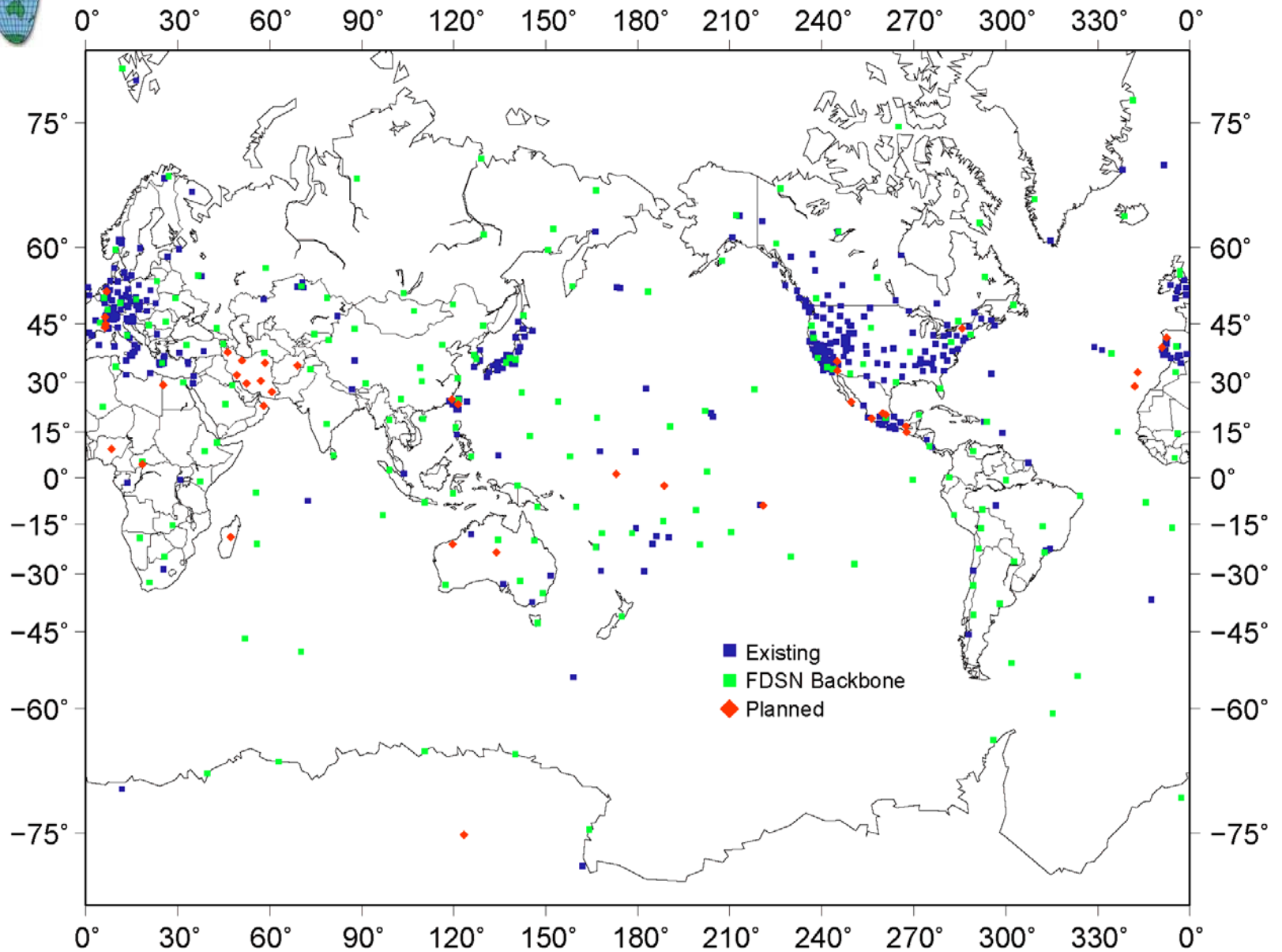
& Data Management System



FDSN expanding coverage in 2006-2007



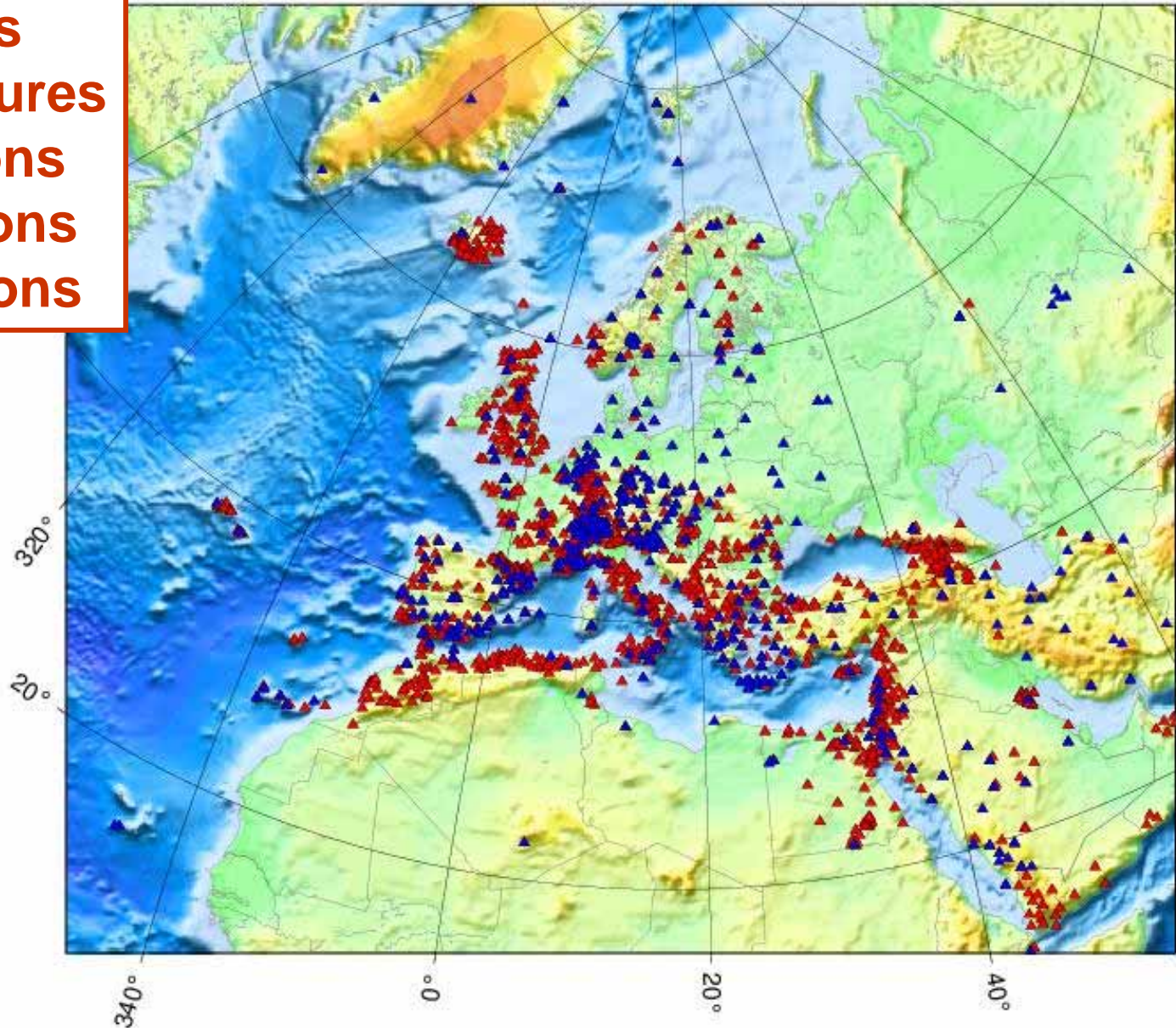
> 50 Networks





Seismic stations in the Euro-Mediterranean

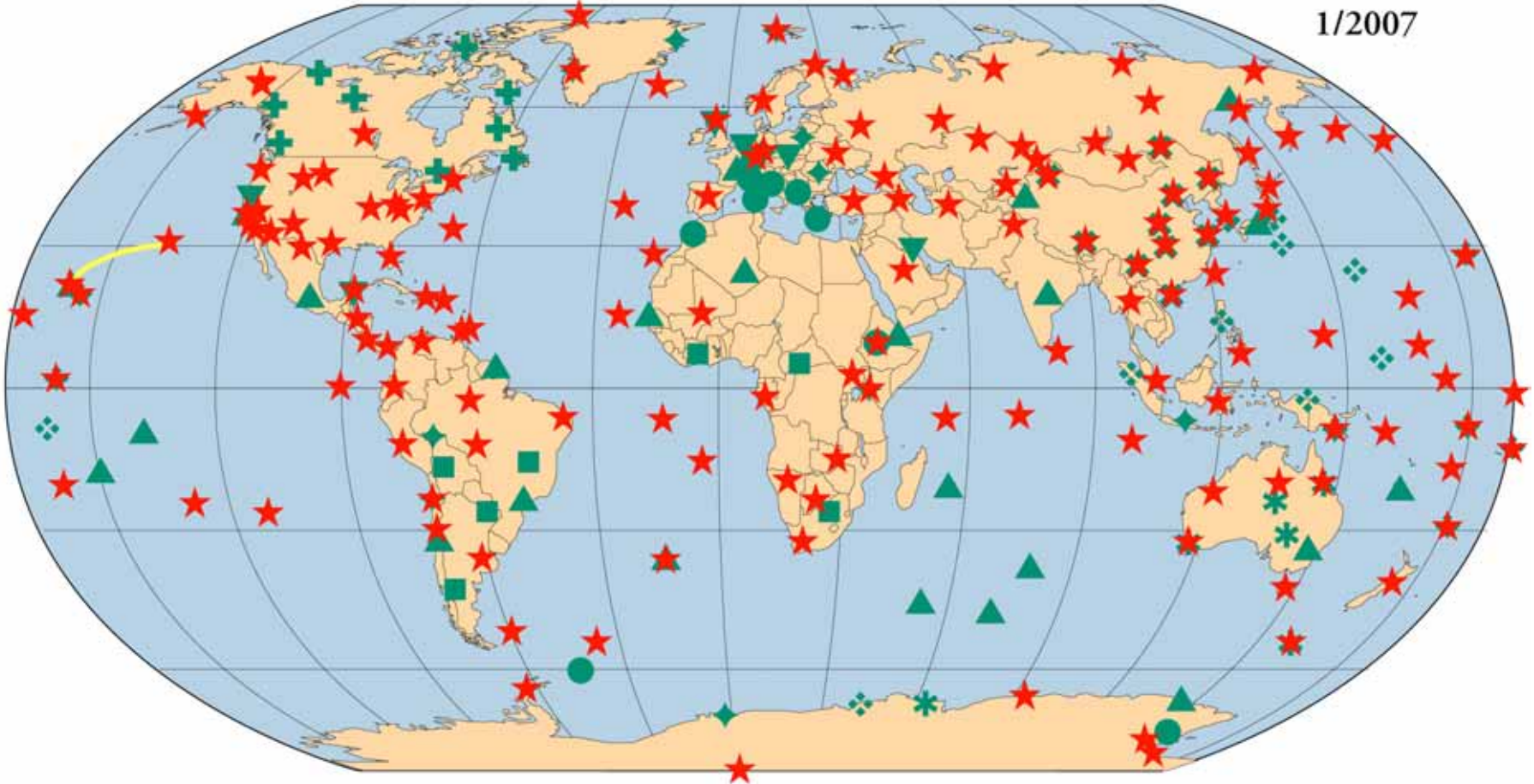
46 countries
150 infrastructures
800 BB stations
1800 SP stations
3000 SM stations





International Federation of Digital Seismograph Networks

1/2007



IRIS GSN



Australia



Canada



France



Germany



Italy



Japan



U.S.



Other



Backbone Network

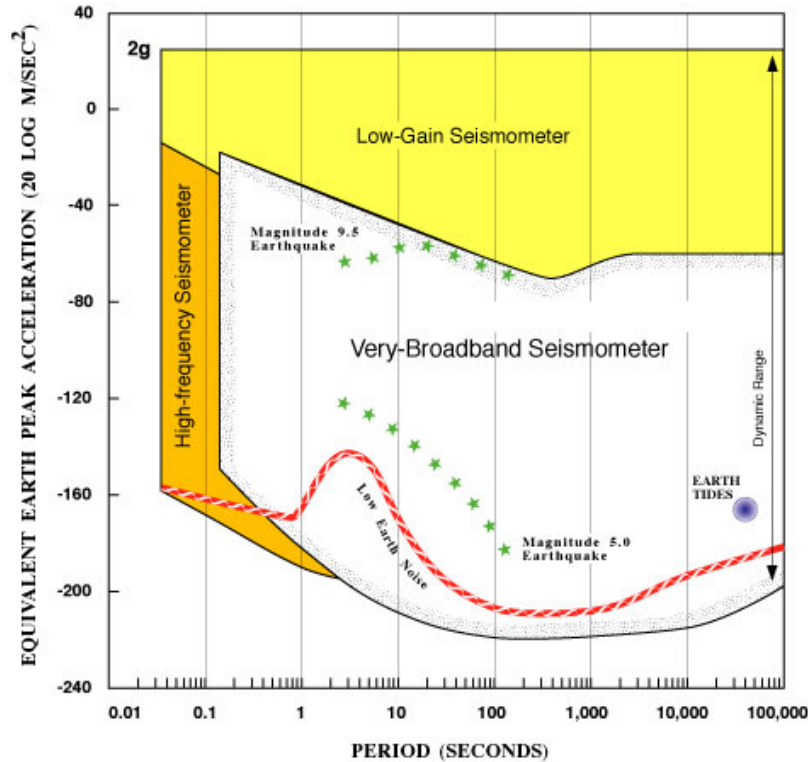


A Multi-Use, Inter-agency, International Facility

- ❖ National and International Scientific Research
 - Earth Structure & Earthquakes
- ❖ Earthquake and Tsunami Hazards
 - Earthquake Reporting — USGS NEIC
 - Tsunami Warning
 - NOAA — PTWC & WC/ATWC
 - JMA
- ❖ Nuclear Monitoring
 - Research data
 - Contribution to International Monitoring System
 - 26 Stations currently, 50 eventually
- ❖ Global Earth Observing System of Systems (GEOSS)

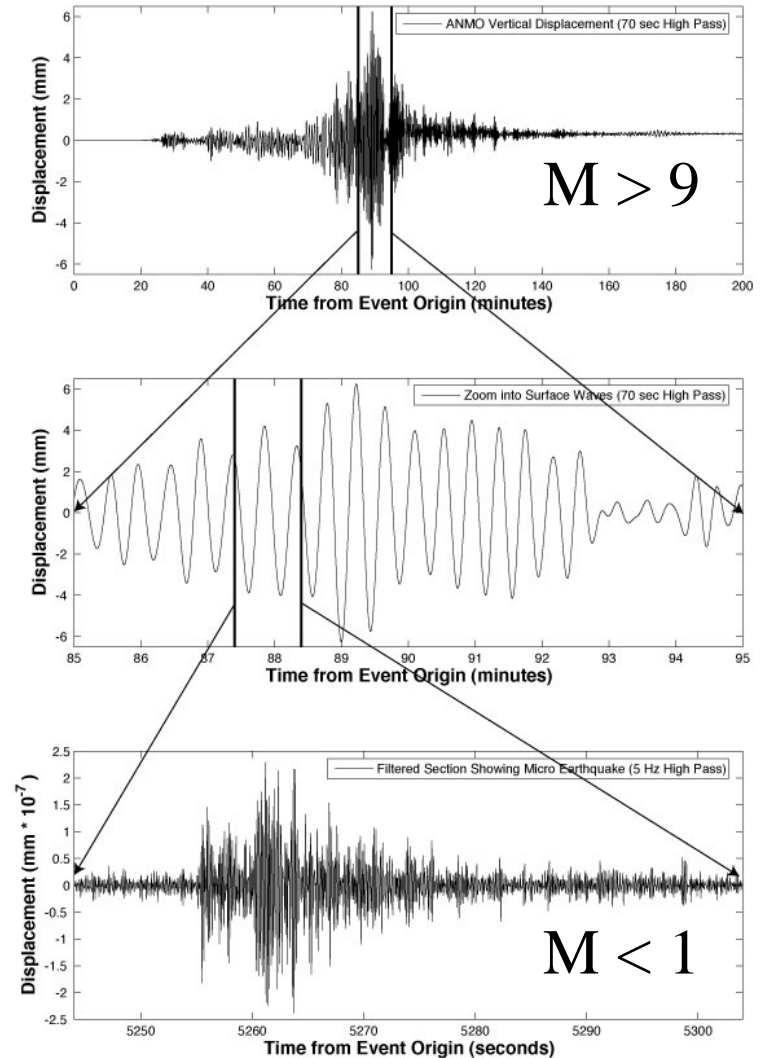


GSN Technical Design Goals



- Broadband
- 3-Component
- Low Noise
- Full fidelity

Sumatra-Andaman Earthquake



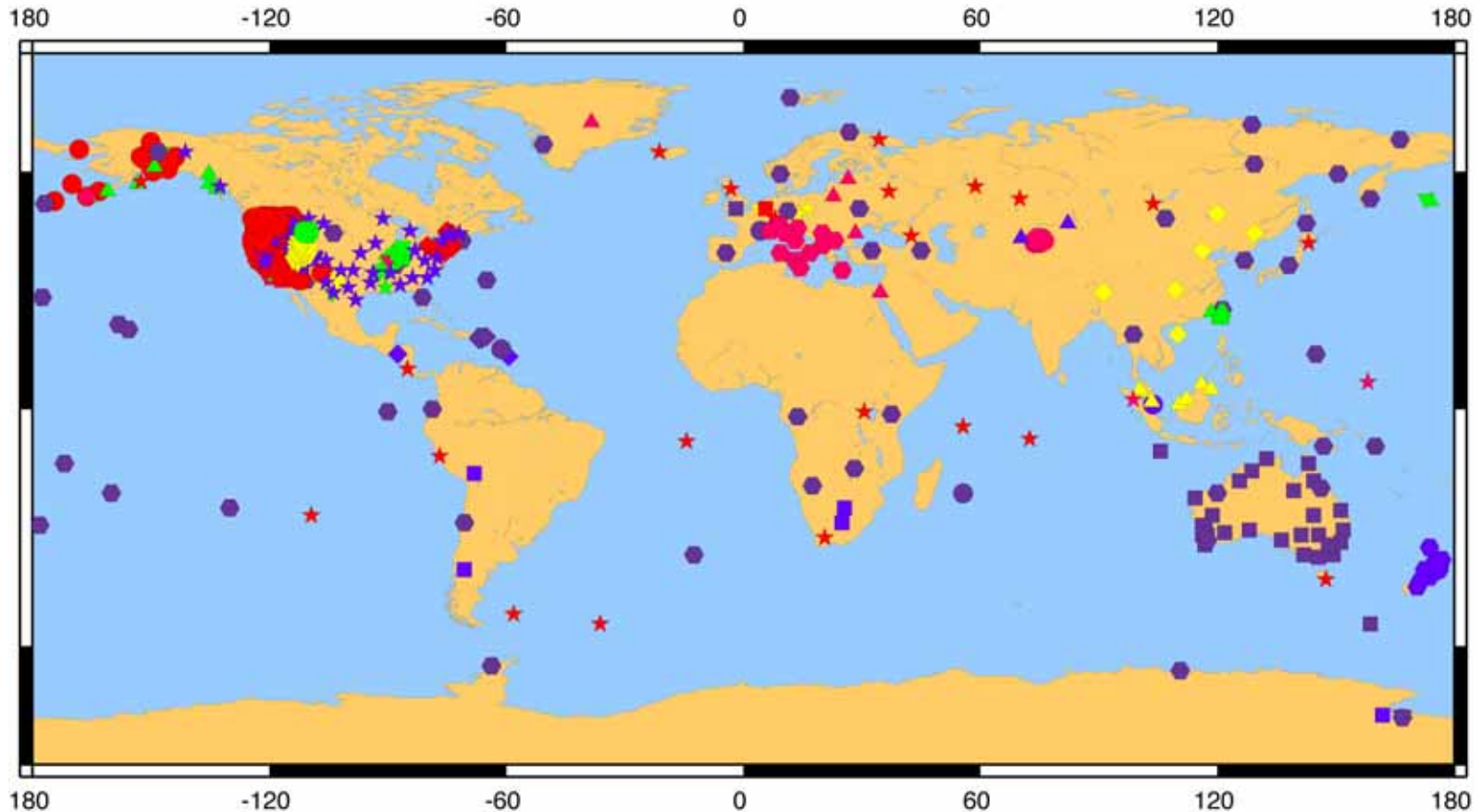


Performance Goals

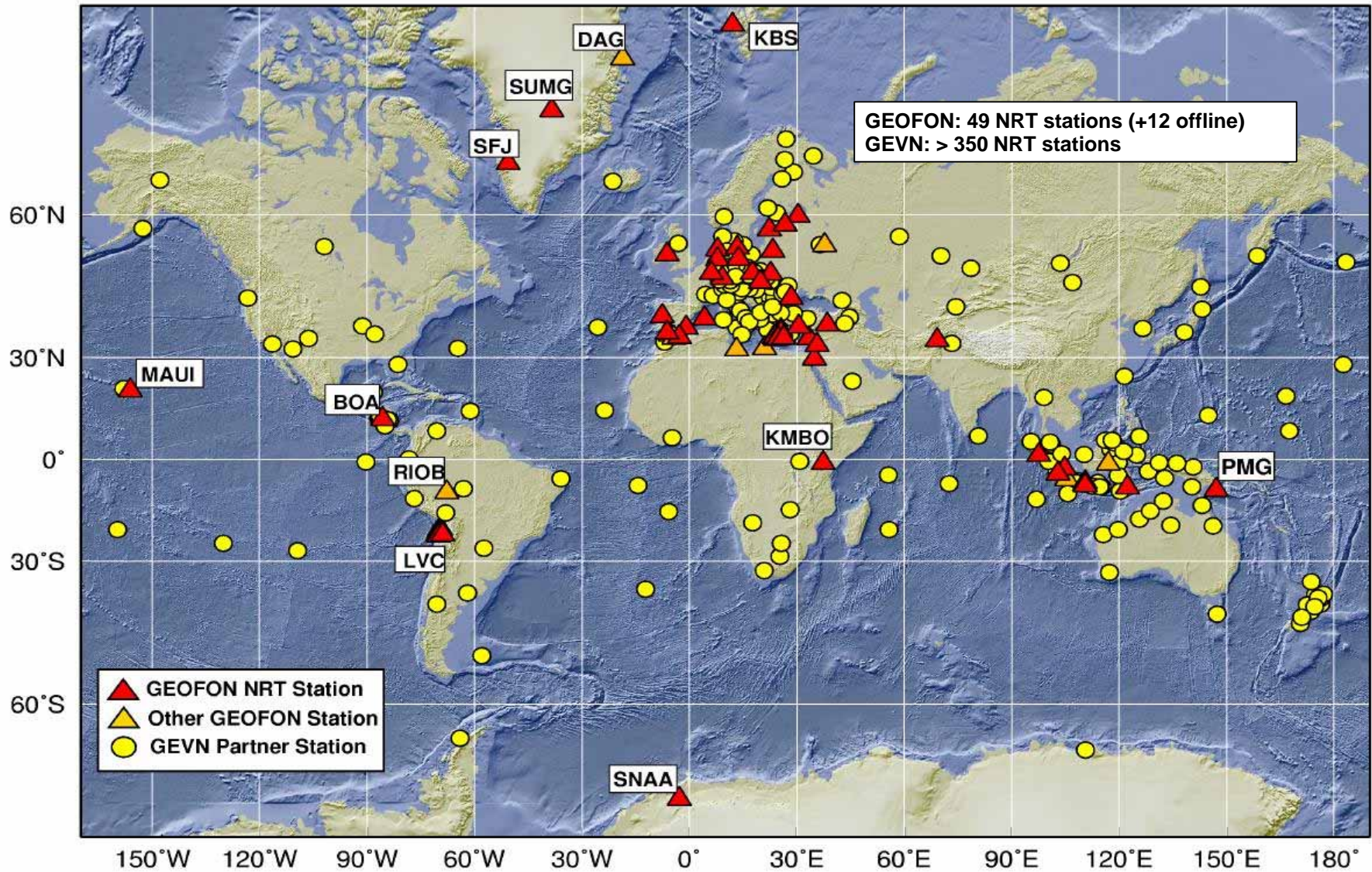
- Free and Open Access to Data via Internet
- Real-time Data Availability without Delay or Restriction
- Continuous & Complete Archive
- Quality Control
- High data return

Real-time, Open Data available via FDSN Archive at IRIS

Buffer of Uniform Data (BUD)



> 1400 real-time stations



> 120 real-time stations



GSN TELEMETRY ACCESS

1/2007



IRIS/NSF NWS USGS China Australia Russia AFTAC/DoD CTBTO GSN Host

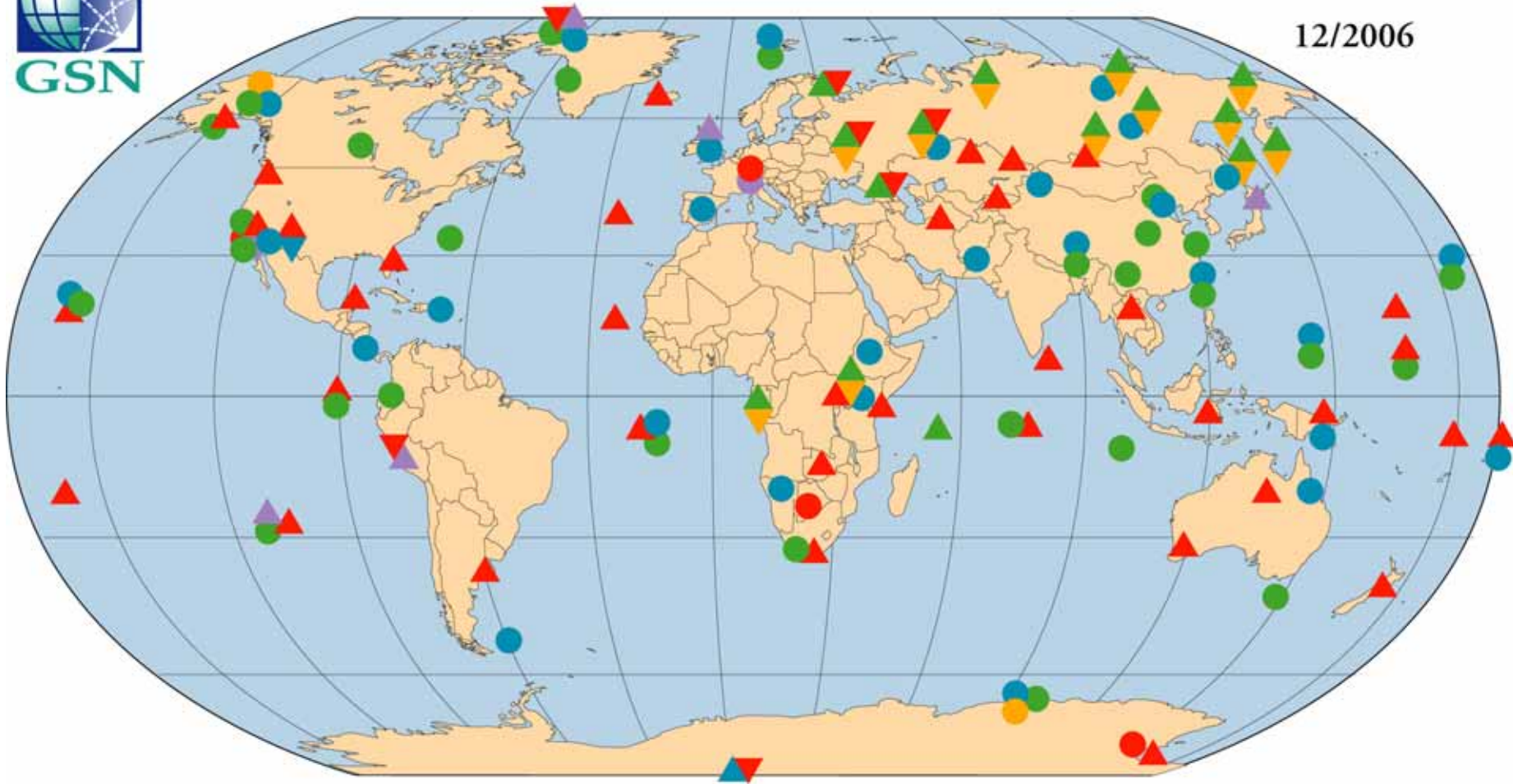
VSAT
Internet

VSAT								
Internet								



GSN & GEOPHYSICAL OBSERVATORIES

12/2006



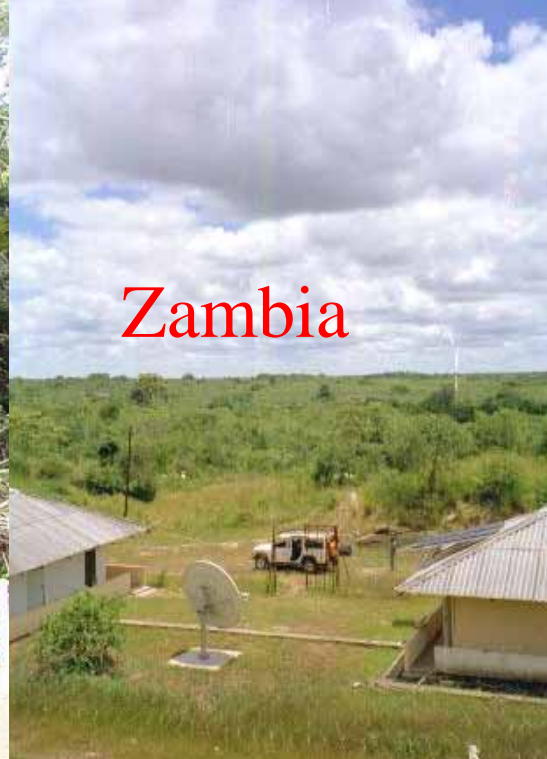
- | | | | |
|---------------------|----------------|------------------|-------------|
| ● Co-located sensor | ▲ Gravimeter | ▲ GPS | ▲ Barograph |
| ▲ GSN sensor | ▲ Magnetometer | ▲ Meteorological | |



Pitcairn Island



Brazil



Zambia



Iceland



Falkland Islands

GSN Telemetry & National Weather Service



**Pitcairn Island VSAT
(shared locally)**

**GSN Pacific Hub at the
Pacific Tsunami Warning Center**

Network Challenges

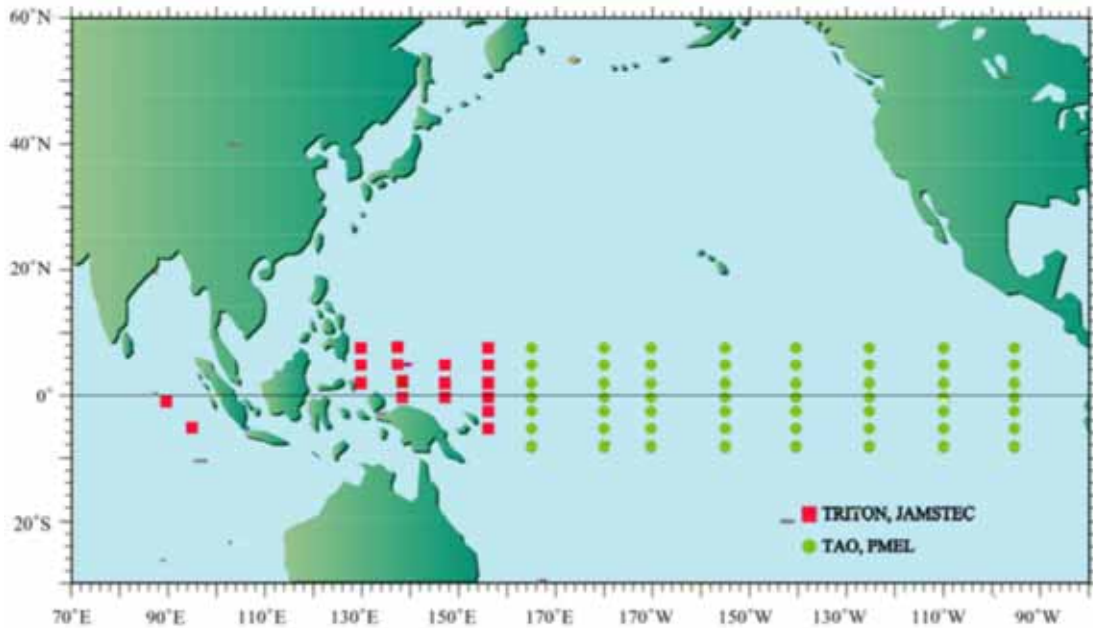
- Sustaining the State of the Art
- New Instrumentation
- Filling Gaps in Coverage
 - Oceans

STS-1s: The Best Sensors of the 20th Century



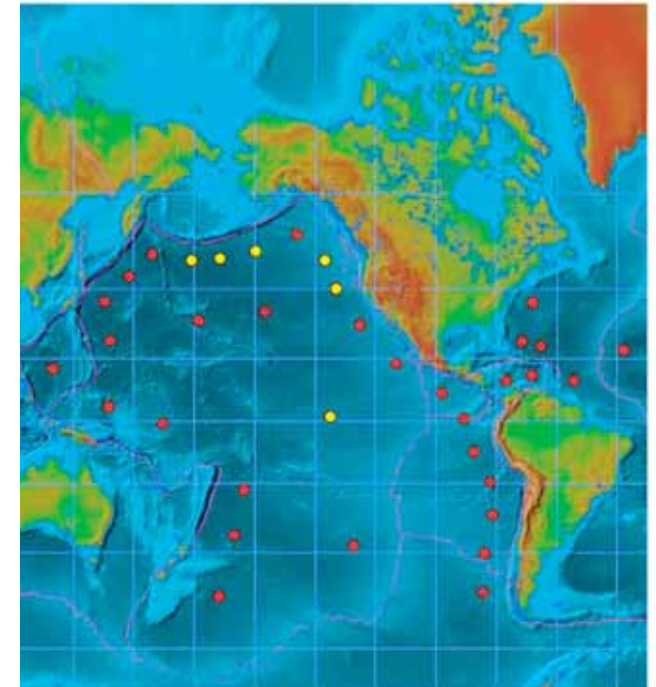
No Longer Manufactured

NEEDED: Seismological Oceanic Coverage



TAO/TRITON Buoys

Proposed DART Buoy System



Yellow square: In place, Red square: Proposed

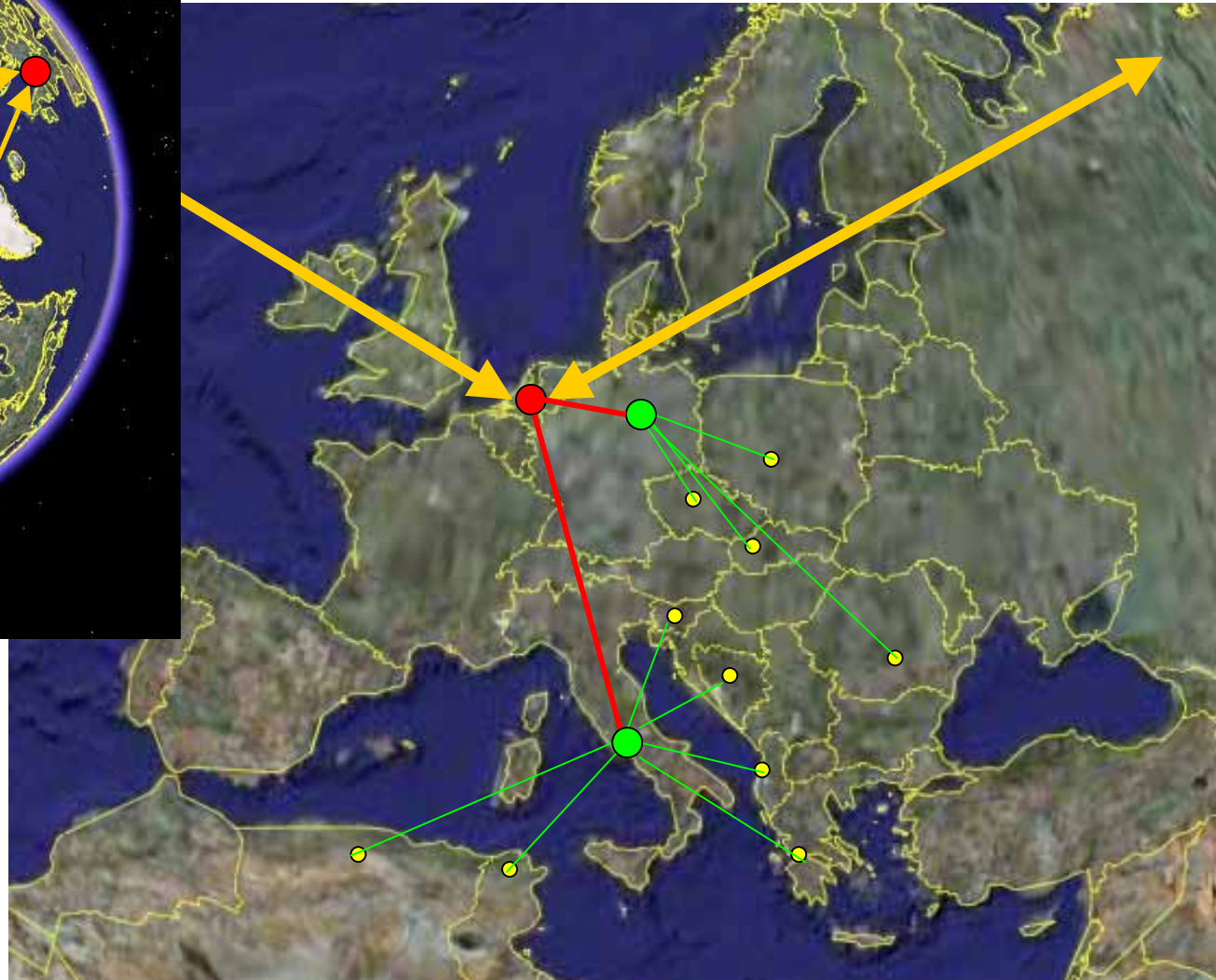
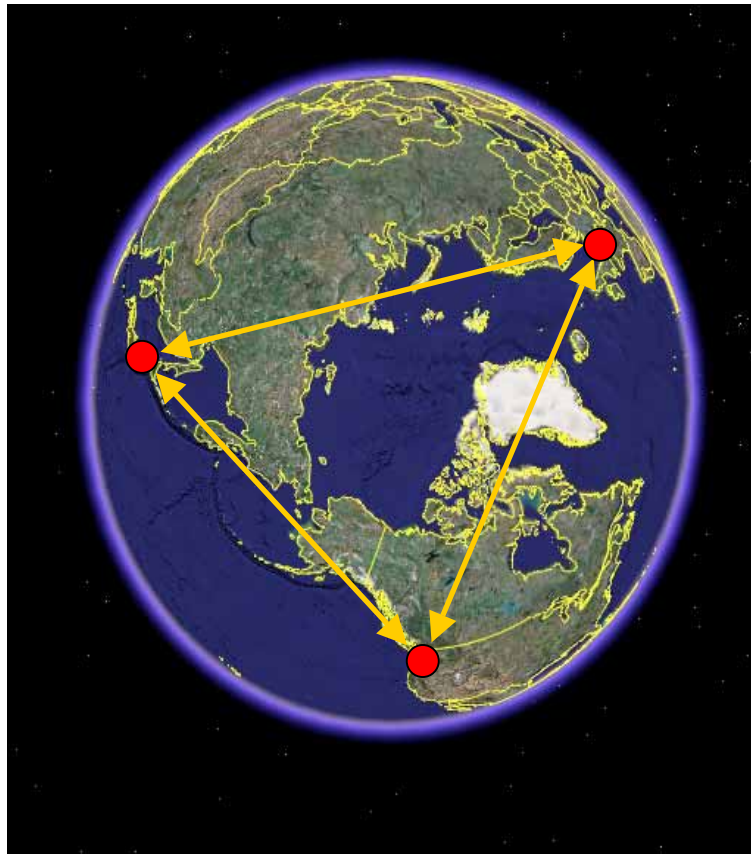


- Oceanic *in situ* infrastructure (ships, buoys, telemetry) needed to enhance seismological coverage of megathrust tsunamigenic zones



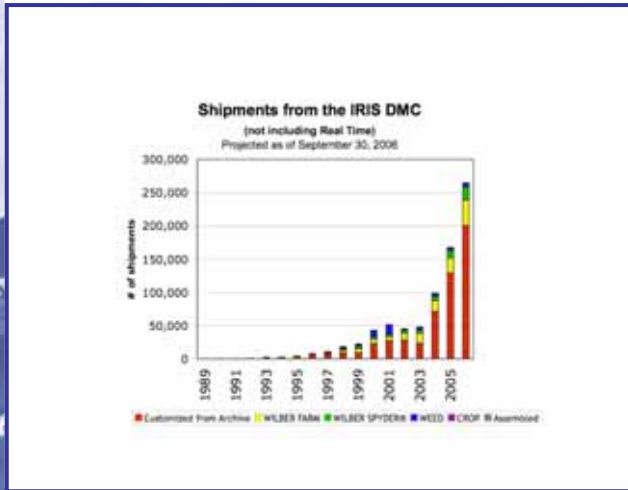
Data Management

Global Hierarchical Net.DC

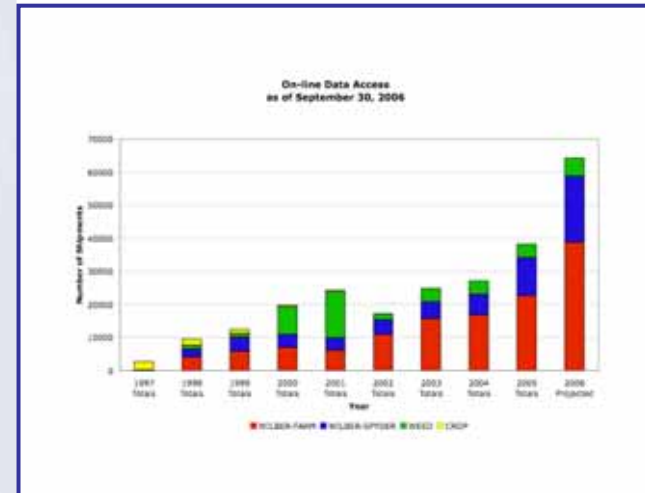


Shipments from the FDSN Archive

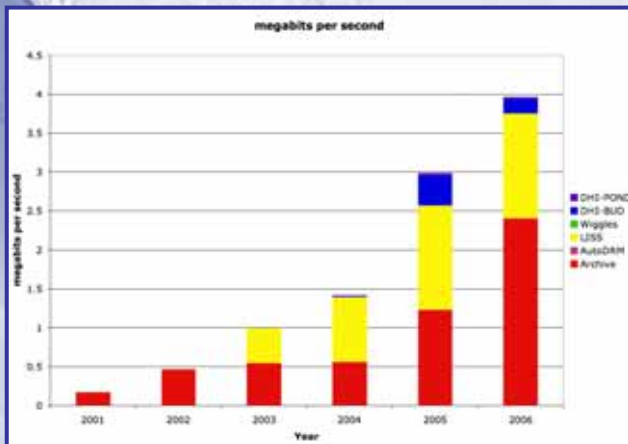
260,000 customized shipments



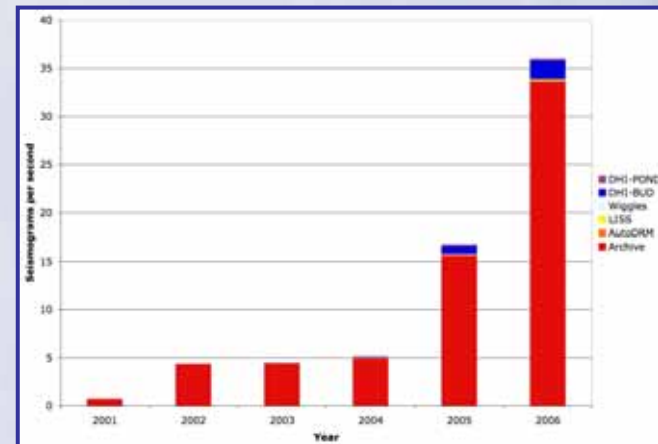
65,000 on-line shipments



15.7 terabytes of observational data
(4.0 megabits/second)



1.13 billion time series
(36 per second)



FDSN's Guiding Principles

- ✧ Open data access
 - ✧ Requests serviced at same priority for all
- ✧ No charge for services
- ✧ Timely access to data
 - ✧ Real-time data is the goal
- ✧ International Coordination
 - ✧ ~50 members of the FDSN



Data Products: Societal Benefits

From: PTWC <ptwc@ptwc.noaa.gov>
Subject: **Fixed Regional Warning - Initial**
Date: November 15, 2006 11:30:48 AM HST
To: bulletin@ptwc.noaa.gov

(T+16m 31s)

TSUNAMI BULLETIN NUMBER 001
PACIFIC TSUNAMI WARNING CENTER/NOAA/NWS
ISSUED AT 1130Z 15 NOV 2006

THIS BULLETIN IS FOR ALL AREAS OF THE PACIFIC BASIN EXCEPT
ALASKA - BRITISH COLUMBIA - WASHINGTON - OREGON - CALIFORNIA.

... A TSUNAMI WARNING IS IN EFFECT ...

A TSUNAMI WARNING IS IN EFFECT FOR

RUSSIA / JAPAN

FOR ALL OTHER PACIFIC AREAS, THIS MESSAGE IS AN ADVISORY ONLY.

AN EARTHQUAKE HAS OCCURRED WITH THESE PRELIMINARY PARAMETERS

ORIGIN TIME - 1114Z 15 NOV 2006
COORDINATES - 46.7 NORTH 153.5 EAST
LOCATION - KURIL ISLANDS
MAGNITUDE - 7.7

EVALUATION

IT IS NOT KNOWN THAT A TSUNAMI WAS GENERATED. THIS WARNING IS
BASED ONLY ON THE EARTHQUAKE EVALUATION. AN EARTHQUAKE OF THIS
SIZE HAS THE POTENTIAL TO GENERATE A DESTRUCTIVE TSUNAMI THAT CAN
STRIKE COASTLINES IN THE REGION NEAR THE EPICENTER WITHIN MINUTES
TO HOURS. AUTHORITIES IN THE REGION SHOULD TAKE APPROPRIATE
ACTION IN RESPONSE TO THIS POSSIBILITY. THIS CENTER WILL MONITOR
SEA LEVEL GAUGES NEAREST THE REGION AND REPORT IF ANY TSUNAMI
WAVE ACTIVITY IS OBSERVED. THE WARNING WILL NOT EXPAND TO OTHER
AREAS OF THE PACIFIC UNLESS ADDITIONAL DATA ARE RECEIVED TO
WARRANT SUCH AN EXPANSION.

(T+13m 12s)

From: PTWC <ptwc@ptwc.noaa.gov>
Subject: **PTWC P-TIME MESSAGE**
Date: November 15, 2006 11:27:29 AM HST
To: obs_email@ptwc.noaa.gov

FROM PACIFIC TSUNAMI WARNING CENTER

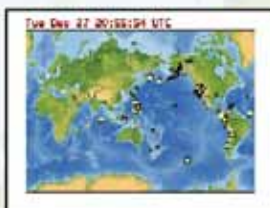
THIS IS PRELIMINARY DATA, NOT FOR PUBLIC DISSEMINATION.
COMPLETE INFORMATION CAN BE OBTAINED FROM THE USGS/NEIC
TELEPHONE (303) 273-8500.

H 11:14:17Z NOV 15 06 LAT 46.7N LONG 153.5E MWP 7.8 (21 STATIONS)
KURIL ISLANDS

PET P 111600.6 SMY P 111739.4 YAK P 111852.6 INCN P 111906.4
BILL P 111912.3 KDAK P 112056.9 PMR P 112111.2 COLA P 112116.2
EYAK P 112126.3 CHTO P 112326.8 NEW P 112401.0



ANSS Earthquake Information Products & Tools



Latest Earthquakes

Maps and information for U.S. and worldwide earthquakes within minutes after they occur.
<http://earthquake.usgs.gov/eqcenter/>



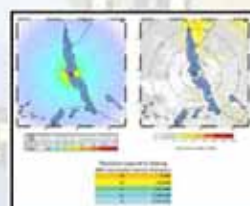
Earthquake Notification

Customizable earthquake information automatically sent to your wireless device or email account.
<http://earthquake.usgs.gov/ens/>



ShakeMaps

Distribution of shaking from an earthquake anywhere in the world within minutes.
<http://earthquake.usgs.gov/shakemap/>



PAGER

Estimates of population exposure to significant earthquake shaking anywhere in the world within minutes.
<http://earthquake.usgs.gov/pager/>



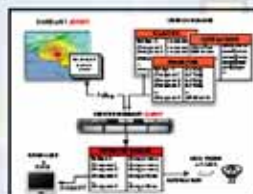
Realtime Feeds & Data

Real-time earthquake data in a variety of formats including RSS, CAP, CSV, and KML.
http://earthquake.usgs.gov/eqcenter/feeds_data.php



Did You Feel It?

Citizen science webpage where shaking intensity maps are created by the people who felt the earthquake.
<http://earthquake.usgs.gov/dyfi/>



ShakeCast

Automated ShakeMap delivery, damage assessment, and notification for critical lifeline operators.
<http://earthquake.usgs.gov/resources/software/shakecast/>



CISEN Display

Downloadable software to visualize and receive notifications for seismicity anywhere in the world on your computer.
<http://www.cisn.org/software/cisndisplay.html>

USGS Earthquake Hazards Program | Earthquake Center | Earthquake Notification Service | Earthquake Notification Service: Customi...

[USGS Home](#)
[Contact USGS](#)
[Search USGS](#)

http://earthquake.usgs.gov - Mozilla Firefox

Click on the map to define your polygon boundary. You may have up to 50 points in your polygon. Click 'Done' when finished.

Back up one point Number of points:

USGS ENS Map Input

Map data ©2006 TeleAtlas - Terms of Use

Learning & Education Research & Monitoring Additional Resources

service » Earthquake Notification Service: Customizable Earthquake Alerts

Notification Service: Customizable Earthquake

Welcome waldjd!

[Log Out](#)

[Recent Events Sent to Me](#)

[Map of Recent Events](#)

[My Email Addresses](#)

- [3036386000@mmode.com \(short\)](mailto:3036386000@mmode.com)
- [3036386000@vtext.com \(short\)](mailto:3036386000@vtext.com)
- [wald@usgs.gov \(long\)](mailto:wald@usgs.gov)

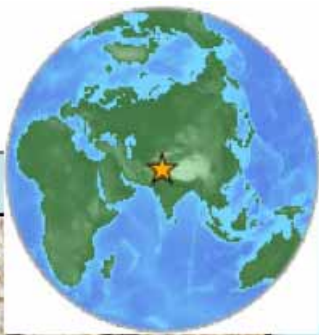
[Add New Email Address](#)

[Add New Profile](#)

- [Predefined Profile](#)
- [Rectangle Profile](#)
- [Circle Profile](#)
- [Polygon Profile](#)

Admin Functions

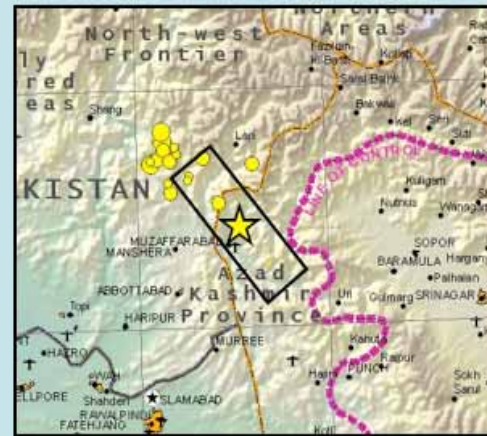
Determining the Shaking Hazard



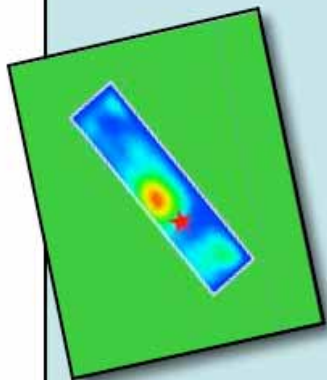
Magnitude & Epicenter



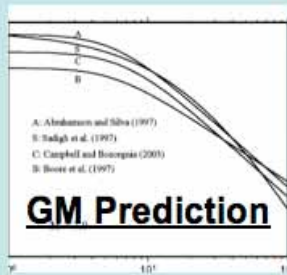
Faulting Mechanism



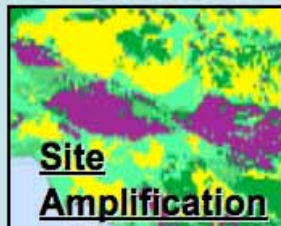
Aftershocks --> Dimensions



Fault Slip Model

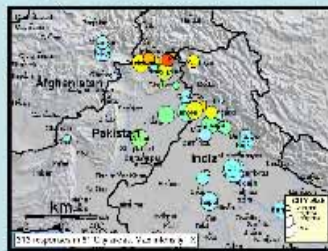


GM Prediction



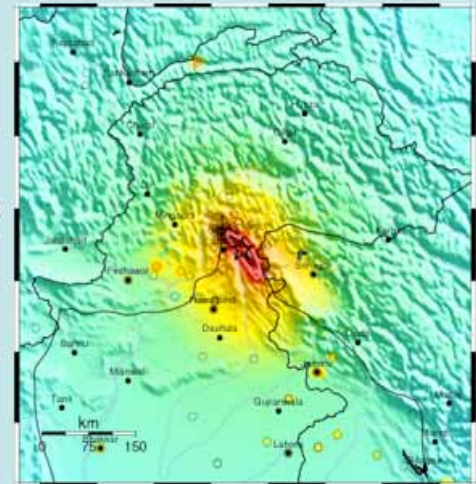
Site Amplification

Reported Intensities



Recorded Ground Motion Amplitudes

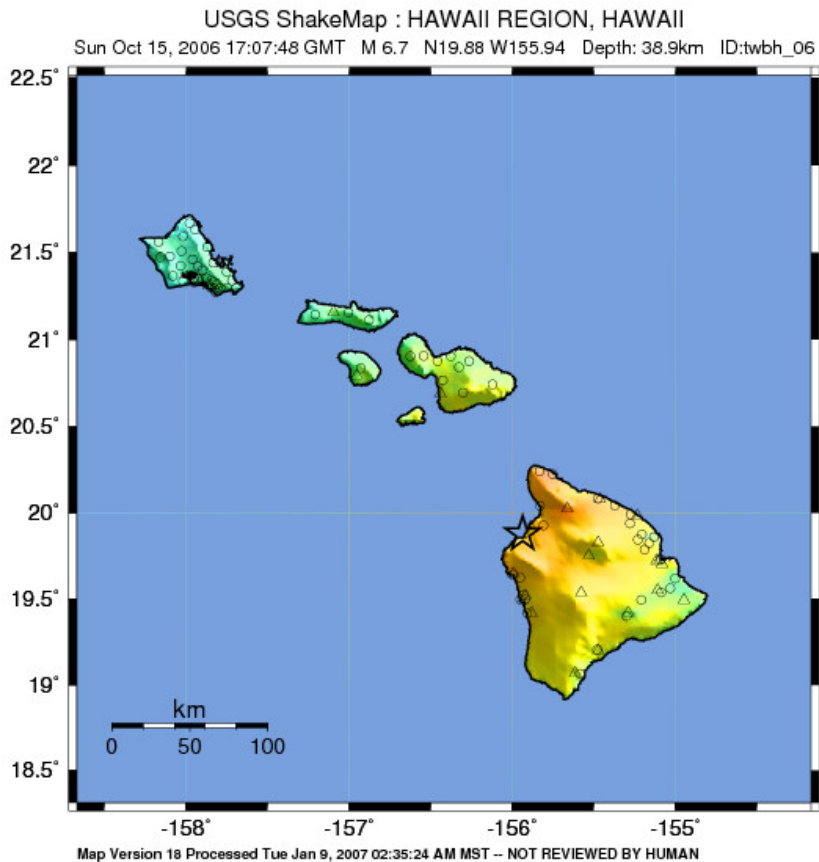
ShakeMap



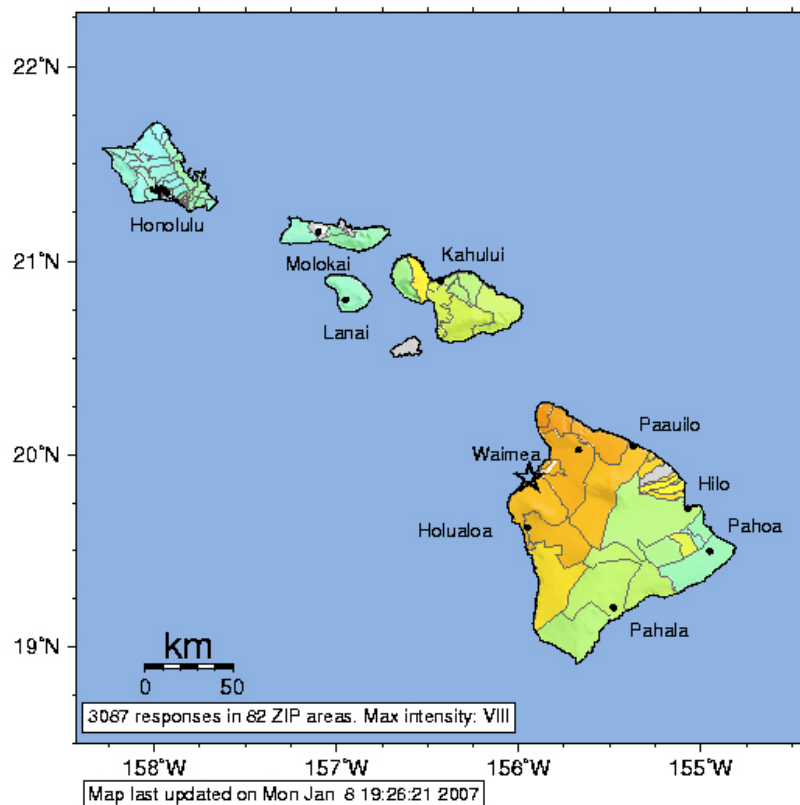
ShakeMap & “Did You Feel It?”

(seismometers)

(people)



USGS Community Internet Intensity Map (10 miles NNW of Kailua Kona, Hawaii, Hawaii)
 ID:twbh_06 07:07:48 HST OCT 15 2006 Mag=6.7 Latitude=N19.88 Longitude=W155.94



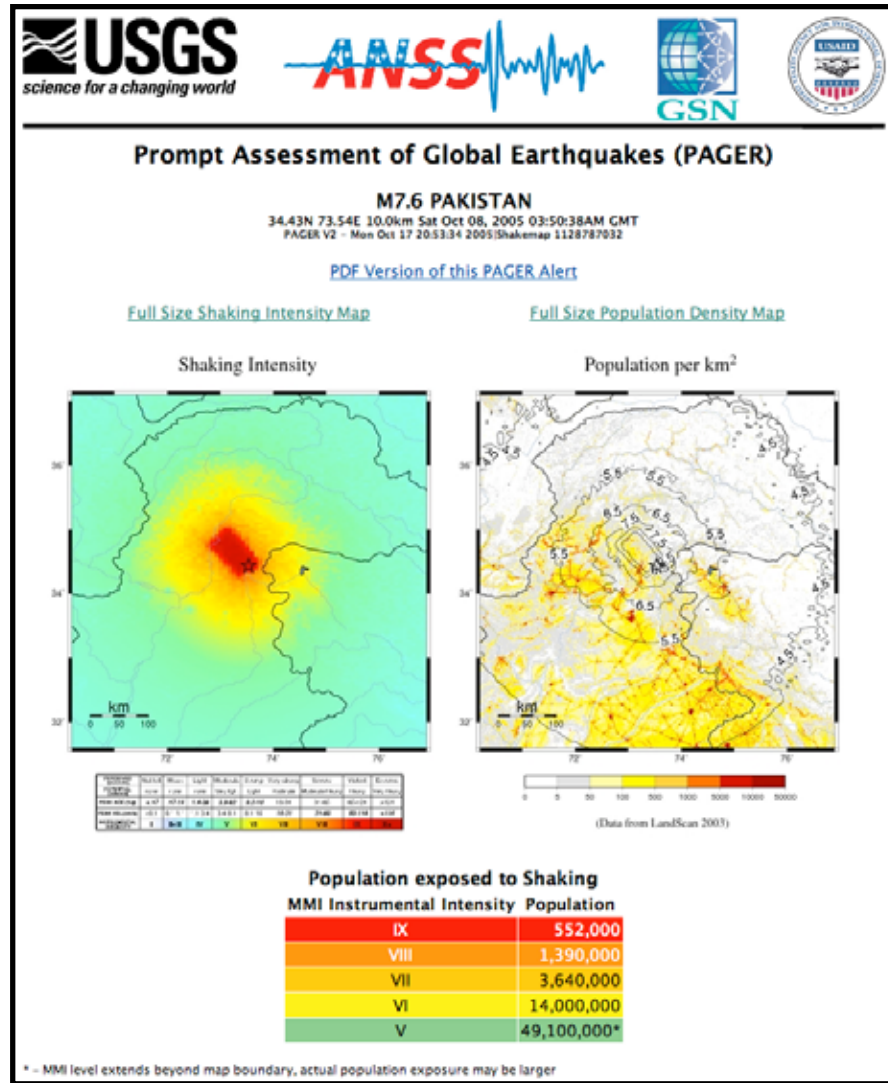
PERCEIVED SHAKING	Not felt	Weak	Light	Moderate	Strong	Very strong	Severe	Violent	Extreme
POTENTIAL DAMAGE Resistant Structures	none	none	none	V. Light	Light	Moderate	Moderate/Heavy	Heavy	V. Heavy
POTENTIAL DAMAGE Vulnerable Structures	none	none	none	Light	Moderate	Moderate/Heavy	Heavy	V. Heavy	V. Heavy
PEAK ACC.(%g)	<.17	.17-1.4	1.4-3.9	3.9-9.2	9.2-18	18-34	34-65	65-124	>124
PEAK VEL.(cm/s)	<0.1	0.1-1.1	1.1-3.4	3.4-8.1	8.1-16	16-31	31-60	60-116	>116
ESTIMATED INTENSITY	I	II-III	IV	V	VI	VII	VIII	IX	X+

INTENSITY	I	II-III	IV	V	VI	VII	VIII	IX	X+
SHAKING	Not felt	Weak	Light	Moderate	Strong	Very strong	Severe	Violent	Extreme
DAMAGE	none	none	none	Very light	Light	Moderate	Moderate/Heavy	Heavy	Very Heavy

2005 PAKISTAN (Magnitude 7.6):

IX: 70,000 killed in 600,000 (1/10 or **10% fatalities**)

> **VIII**: 50,000 killed in 1500,000 (1/30 or 3.3%)



Magnitude 6.3 - JAVA, INDONESIA

Time: 2006-05-28 22:54:01 GMT (07:54:01 Local)

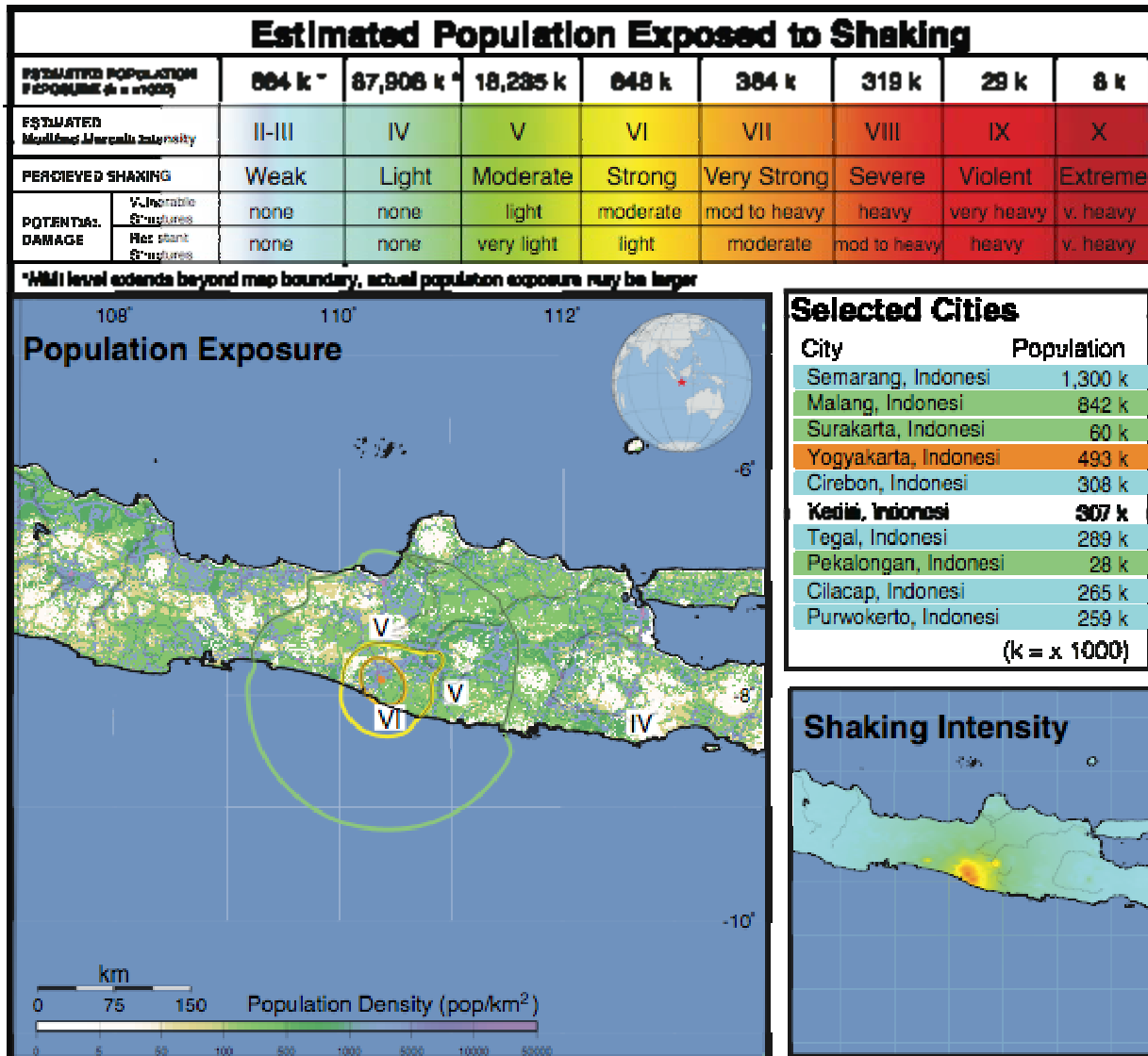
Location: -7.96°S/ 110.43°E Depth : 17.1 km

PAGER Version 8

Created: XX hrs - XX mins after earthquake

For more information and latest version see

<http://earthquake.usgs.gov/pager/>



These shaking estimates have been reviewed by a seismologist and are constrained by observations from people in the affected region. However, the estimates are not constrained by instrumental recordings.



Thank You