Keeping Authorities Informed:

Available TW Decision Support Tools

Earthquakes, Sea Level,
Historical Events, Travel Times,
Hazard Assessment
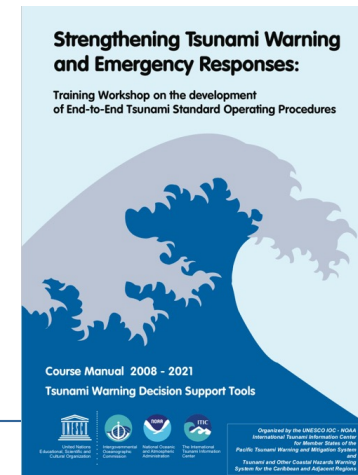
Laura Kong

UNESCO/IOC – NOAA International Tsunami Information Center

ITIC, IOC, USGS, PTWC, NCEI, WDS-Geophysics, RANET,
PMEL/NCTR

Tsunami Warning Decision Support Tools
## ITIC-distributed, supported

- **Listserv (IOC TWFP, NTWC, TNC) – TSP emerg broadcast, Other needs**
  Tsunami Bull Board (ITIC, 1995) **469** science/tsu/govt (Feb 2023)
  ADDR FOR POSTING: **tsunami_bb@list.woc.noaa.gov**

- **Real time EQ Display** (CISN, USGS / NTHMP, 2005), 346+ **v3.7.039** (Feb 2023)
  NO PTWS EQ Observatory message. NO registration code required so cannot track nbr users

- **Real-time Sea Level monitoring**
  - **Tide Tool – TWC operations monitoring** (PTWC, 2005) **v10.70**
  - **IOC Sea Level Monitoring web site** (IOC, 2008)

- **Tsunami Travel Time Software** (ITIC, NGDC, 2007) – **SDK4.0.1, with GUI for PC**

- **Tsunami Historical Database** Online (WDS-NCEI), Offline (TsuDig, NCEI, ITIC, 2009)

- **Tsunami Hazard Assessment Tools** (2017) – PMEL, ITIC
  - **ComMIT/MOST => OTGA TEMPP hybrid late 2023-2025**
  - **Tsu Coastal Assessment Tool** (TsuCAT v4.3, Feb 2023) **=> Community Exer injects**
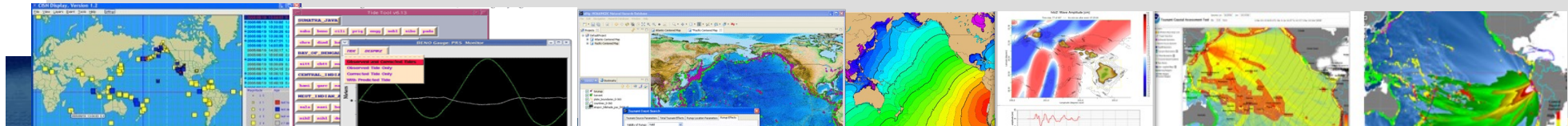
TsuCAT – Tool Applications

□ **Hazard Assessment -** worst case, or likely impact

□ **Exercise development –** scenario development, PTWC exercise messages

□ **Response Planning –** use scenarios to develop tsunami response plans, procedures (SOPs)

□ **Warning decision making –** estimate tsunami impact with nearest similar scenario (early assessment prior to receiving PTWC forecast)

❑ **Features:**
  • Database: ~5400 earthquake scenarios from active subduction zones - Pacific, Caribbean, Indian Ocean (M6.5-9.5)
  • NOAA models (MOST/SIFT (M8+), RIFT (M6.5-7.9)
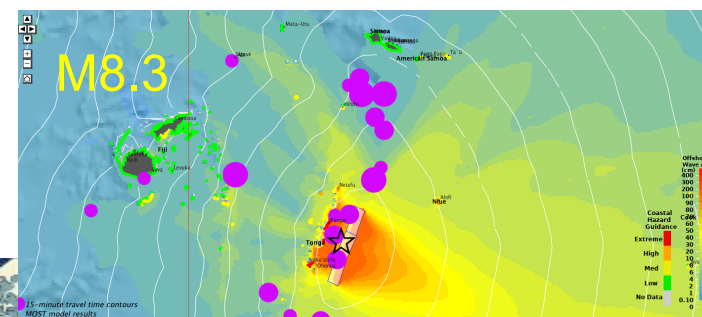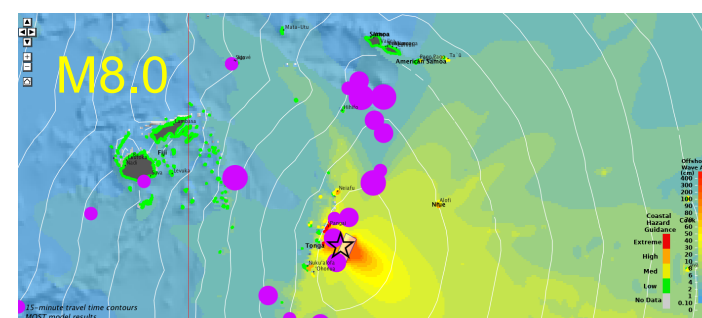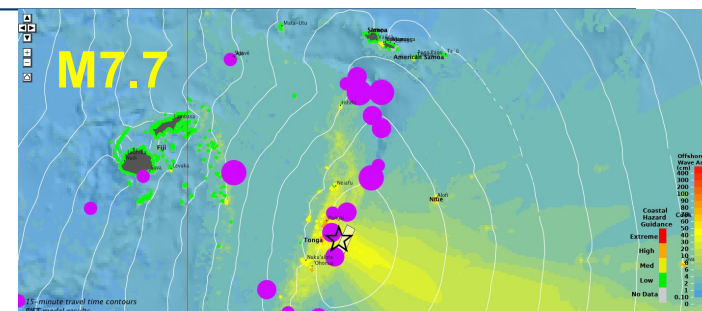
ITIC Mandate (1977) – Intersessional Activities

www.tsunamiwave.org
http://itic.ioc-unesco.org/index.php

- **Monitor, recommend improvements**
  - Events – improving warning and response
  - Tsunami Warning Decision Support Tools
- **Assist in establish/strengthen national, regional systems**
  - Capacity Building, Training
  - IOC Wave Exercises
  - UN Decade for Ocean Science for Sustainable Development
- **Information resource - preparedness / education (create, compile, share)**
  - Guides, Manuals, Best Practices, Awareness materials
- **Information resource - historical tsunamis (collect, compile, share)**
  - Database, global and regional hazard, post-event surveys

ITIC - IOC TSUNAMI CAPACITY BUILDING (2005-2021, >130 trainings)

Legend:
- ▲ 2017-20
- ● 2005-20
- ☆ 2021 - hybrid
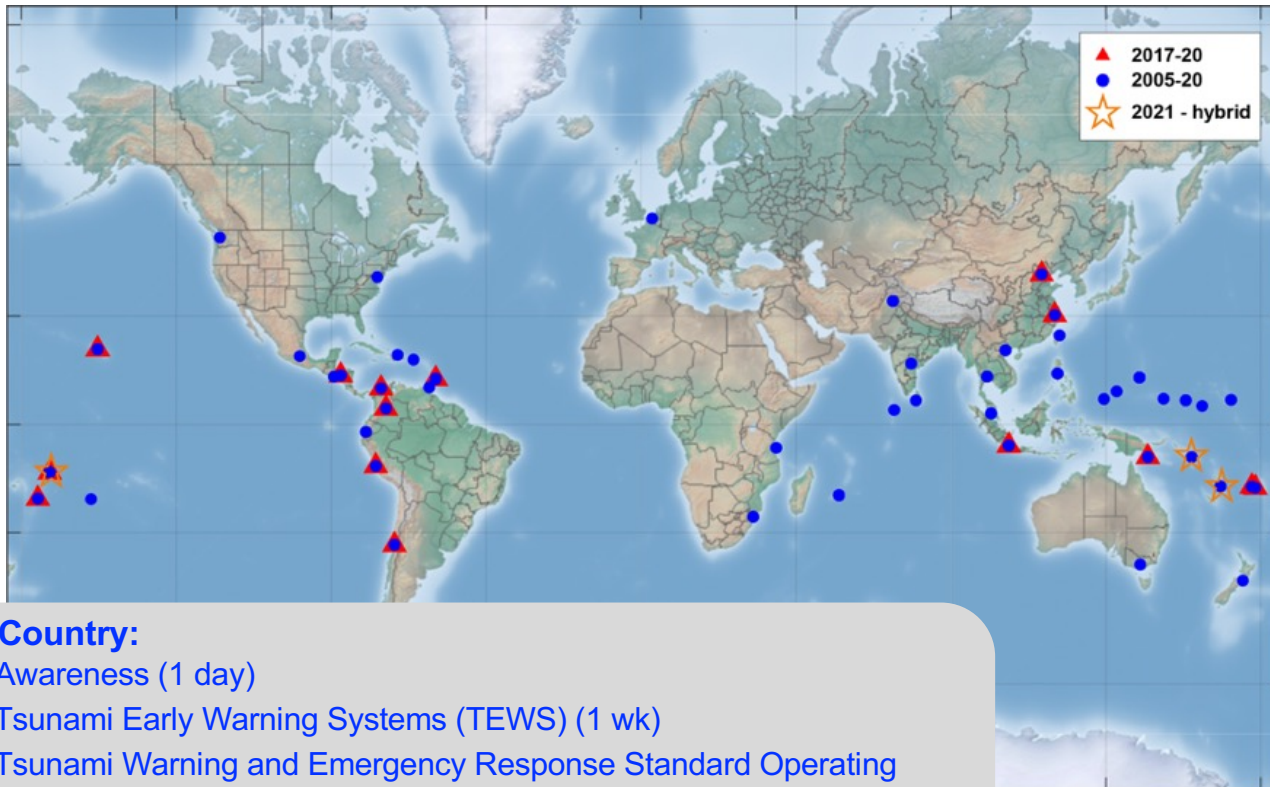
For example, Tonga

- In-Country (5) - 2009, 2010, 2015, 2019
- ITP-Hawaii – 2006, 2009, 2011, 2014, 2016, 2018, 2019 (14 total)

ITIC main challenge

- **Staff turnover, so continual request from Countries**
- **Limited resources**

In Country:
- Awareness (1 day)
- Tsunami Early Warning Systems (TEWS) (1 wk)
- Tsunami Warning and Emergency Response Standard Operating Procedures (SOPs), Tsunami Decision Support Tools (TWTools) (1wk)
- Tsunami Evacuation Maps, Plans, Procredures (TEMPP (5 1-wk)

At ITIC/PTWC: ITP-Hawaii (TEWS, 2-wk)

ITP-HAWAII IN CHILE, 2018 | 2018 ITP International Tsunami Information Center Training Programme Valparaiso, Chile, 1 August 2018 | PEACE CORPS, SUVA | ITP-FIJI, 2017 | ITP-PNG, 2018 | ITP-TONGA, 2019 | ITP-INDONESIA, 2020 | & TWC SOPs, SOLOMONS, 2021

Tsunami Warning Decision Support Tools
ITIC-distributed, supported

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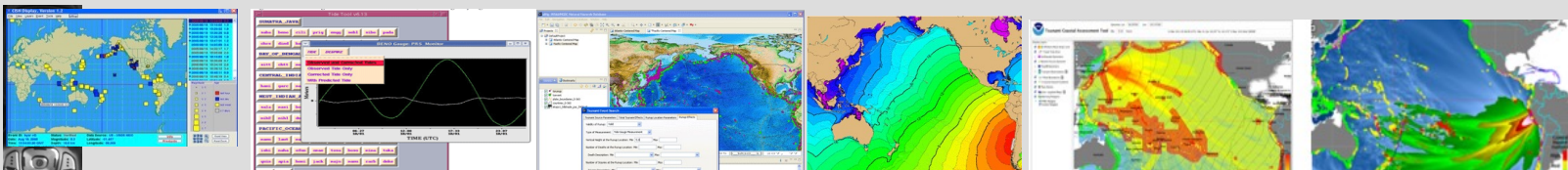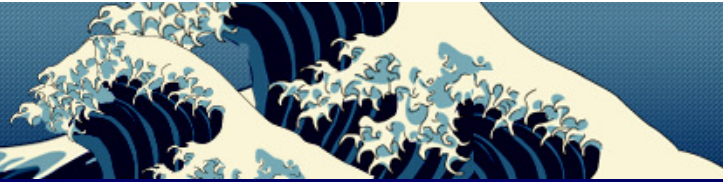
Tsunami Bulletin Board

Email List-serve, Currently, ~470 (Feb 2023)

Membership: Scientists, Tsunami prof, govt,
   NO MEDIA - NO PUBLIC

Features
1. Immediate delivery
2. No censureship
3. Forum for sharing science and early results -
    NOT peer-reviewed
4. PTWC, US NTWC tsunami messages

Contact: itic.tsunami@noaa.gov

CISN – Quick Info – 'Emergency' version

- **CISN will receive / post PTWC and US NTWC EQ observatory messages;**
  - preliminary, unofficial products - earliest notification sizeable earthquake occurred
  - issued few minutes before official TWC message
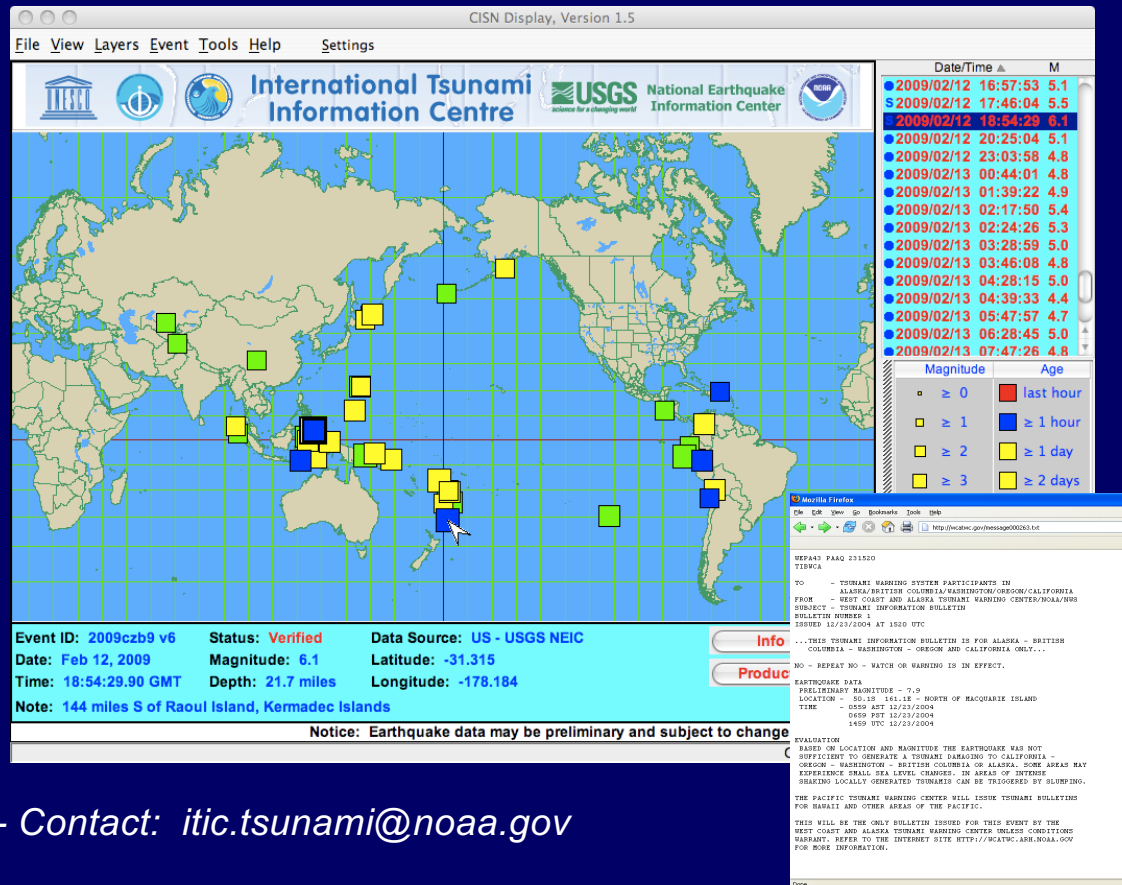 - only TWC product issued when small earthquake occurs below reporting threshold.

- ***Must use CISN 'Emergency version***
  - *CISN v1.72 should be installed. Then update to latest (v2.0.x, currently 2.3.8).*
  - *Allows "Internal" messages (rapid, preliminary locations of large earthquakes). While PTWC and US NTWC messages reviewed by Duty Staff, other "Internal" reports may be computer-generated automatic solutions (may have large errors).*

- **CISN earthquake information displayed is that of US Geological Survey**
  - Updates as more information received (iterates)
  - Authoritative agency for earthquakes in the US.
  - USGS hypocenter / magnitude likely differ (by small amt) from PTWC / US NTWC.
  - During tsunami event, PTWC / US NTWC work together, but independently from USGS. PTWC / US NTWC use their own locations in their tsunami products.
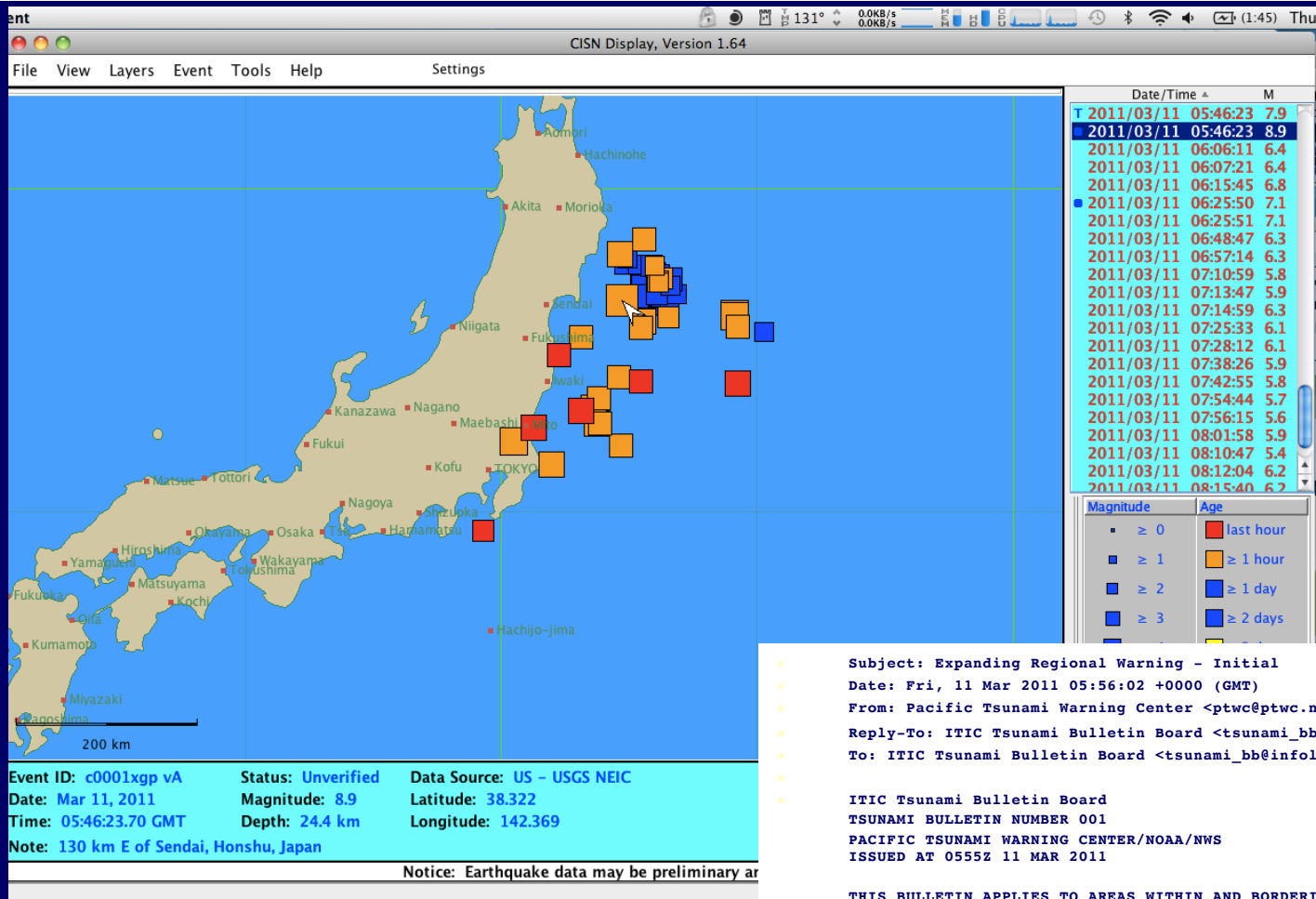
- ***ITIC and PTWC recommend CISN for displaying real-time EQ info, and for alerting duty staff that PTWC has issued a tsunami message.***

Real-Time Earthquake Display and Alert System (CISN)

- **Internet**
- **Passive (automatic receive)**
- **Multi-platform**
- **EQ broadcast**
- **Alert system (SMS, email)**
- **GIS layers**
- **Tsunami Warning msgs**

Sign-up - Contact: itic.tsunami@noaa.gov

CISN Display, Version 1.64

File　View　Layers　Event　Tools　Help　　　Settings

Aomori
Hachinohe
Akita　Morioka
Sendai
Niigata
Fukushima
Iwaki
Kanazawa　Nagano
Maebashi　Mito
Fukui
Kofu
TOKYO
Matsue　Tottori
Nagoya
Shizuoka
Okayama　Osaka　Hamamatsu
Hiroshima
Yamaguchi
Matsuyama　Wakayama
Fukuoka　Kochi
Oita
Kumamoto
Miyazaki
Kagoshima

Hachijo-jima

200 km

Date/Time ▲	M
T 2011/03/11 05:46:23	7.9
2011/03/11 05:46:23	8.9
2011/03/11 06:06:11	6.4
2011/03/11 06:07:21	6.4
2011/03/11 06:15:45	6.8
2011/03/11 06:25:50	7.1
2011/03/11 06:25:51	7.1
2011/03/11 06:48:47	6.3
2011/03/11 06:57:14	6.3
2011/03/11 07:10:59	5.8
2011/03/11 07:13:47	5.9
2011/03/11 07:14:59	6.3
2011/03/11 07:25:33	6.1
2011/03/11 07:28:12	6.1
2011/03/11 07:38:26	5.9
2011/03/11 07:42:55	5.8
2011/03/11 07:54:44	5.7
2011/03/11 07:56:15	5.6
2011/03/11 08:01:58	5.9
2011/03/11 08:10:47	5.4
2011/03/11 08:12:04	6.2
2011/03/11 08:15:40	6.2

Magnitude	Age
≥ 0	last hour
≥ 1	≥ 1 hour
≥ 2	≥ 1 day
≥ 3	≥ 2 days

Event ID: c0001xgp vA　　Status: Unverified　　Data Source: US - USGS NEIC
Date: Mar 11, 2011　　Magnitude: 8.9　　Latitude: 38.322
Time: 05:46:23.70 GMT　　Depth: 24.4 km　　Longitude: 142.369
Note: 130 km E of Sendai, Honshu, Japan

Notice: Earthquake data may be preliminary an

CISN: 11 March 2011

Subject: Expanding Regional Warning - Initial
Date: Fri, 11 Mar 2011 05:56:02 +0000 (GMT)
From: Pacific Tsunami Warning Center <ptwc@ptwc.noaa.gov>
Reply-To: ITIC Tsunami Bulletin Board <tsunami_bb@infolist.nws.noaa.gov>
To: ITIC Tsunami Bulletin Board <tsunami_bb@infolist.nws.noaa.gov>

ITIC Tsunami Bulletin Board
TSUNAMI BULLETIN NUMBER 001
PACIFIC TSUNAMI WARNING CENTER/NOAA/NWS
ISSUED AT 0555Z 11 MAR 2011

THIS BULLETIN APPLIES TO AREAS WITHIN AND BORDERING THE PACIFIC
OCEAN AND ADJACENT SEAS...EXCEPT ALASKA...BRITISH COLUMBIA...
WASHINGTON...OREGON AND CALIFORNIA.

... A TSUNAMI WARNING AND WATCH ARE IN EFFECT ...

A TSUNAMI WARNING IS IN EFFECT FOR

 JAPAN / RUSSIA / MARCUS IS. / N. MARIANAS

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TideTool - Interactive Sea Level Monitoring
## *(OPERATIONAL Tool for Tsunami Warning Centres)*

- **PTWC-received sea level stations** (GLOSS, non-GLOSS)

- **Decode, Display, Manipulate** (expand, measure period/amplitude) satellite-transmitted sea level data

- **Open-source** shell programming, graphics (Tcl/Tk, BLT extension), PC, Linux, Unix

- **Continuously decodes:** expand time series, remove tide, pick amplitude, metadata, msg Downloads data from GTS (Met Svc) Also by ftp from NOAA NWS gateway

- **Runs locally (data, software)**

- **Dynamic, interactive, customize**
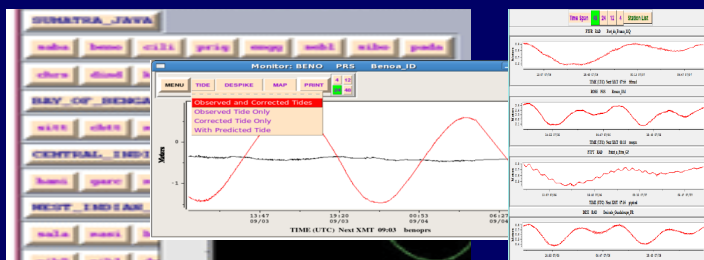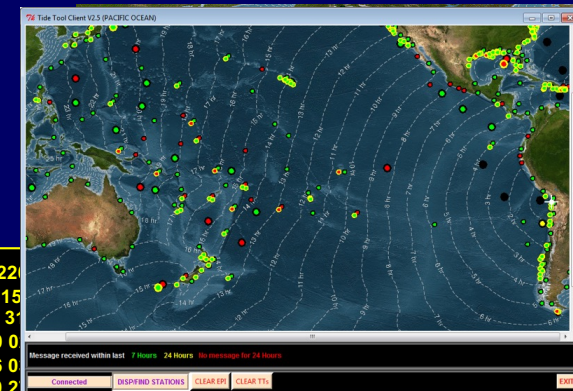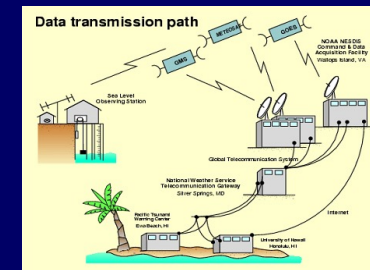
91642 46/// /1205 10296 40080 222
555 77744 A0102 516`3 60029 6315
24520 2400A 13025 90036 00297 3
B2102 37103 100A2 50266 50330 0
8318B 33022 92026 00A37 02736 0
00299 319B4 50222 50230 0A490 2
20380 02983 19B57 02163 03200 BV289 134S1 41249 C0501 22080 00070 23677 44777=
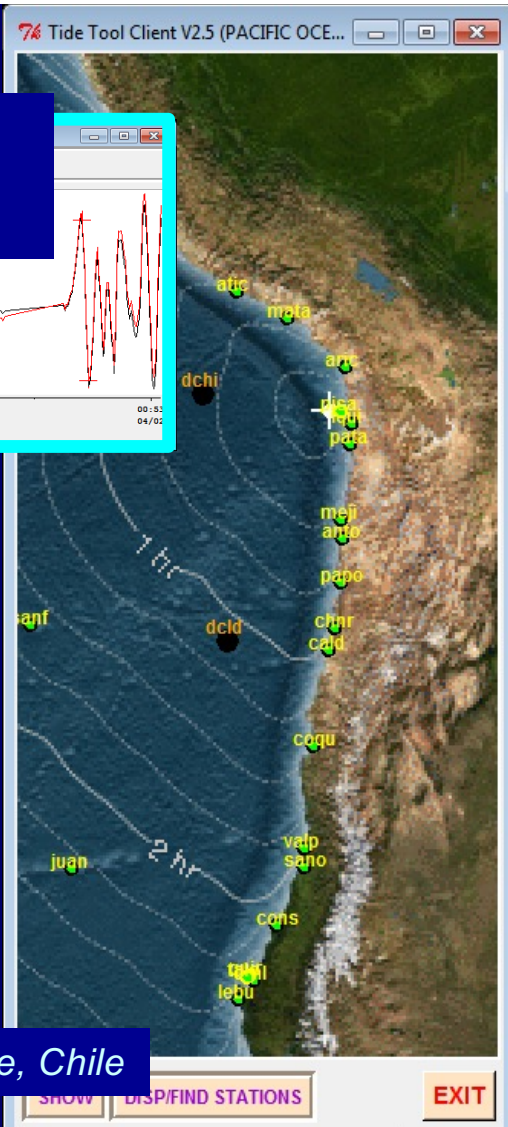
Contact: stuart.weinstein@noaa.gov, laura.kong@noaa.gov
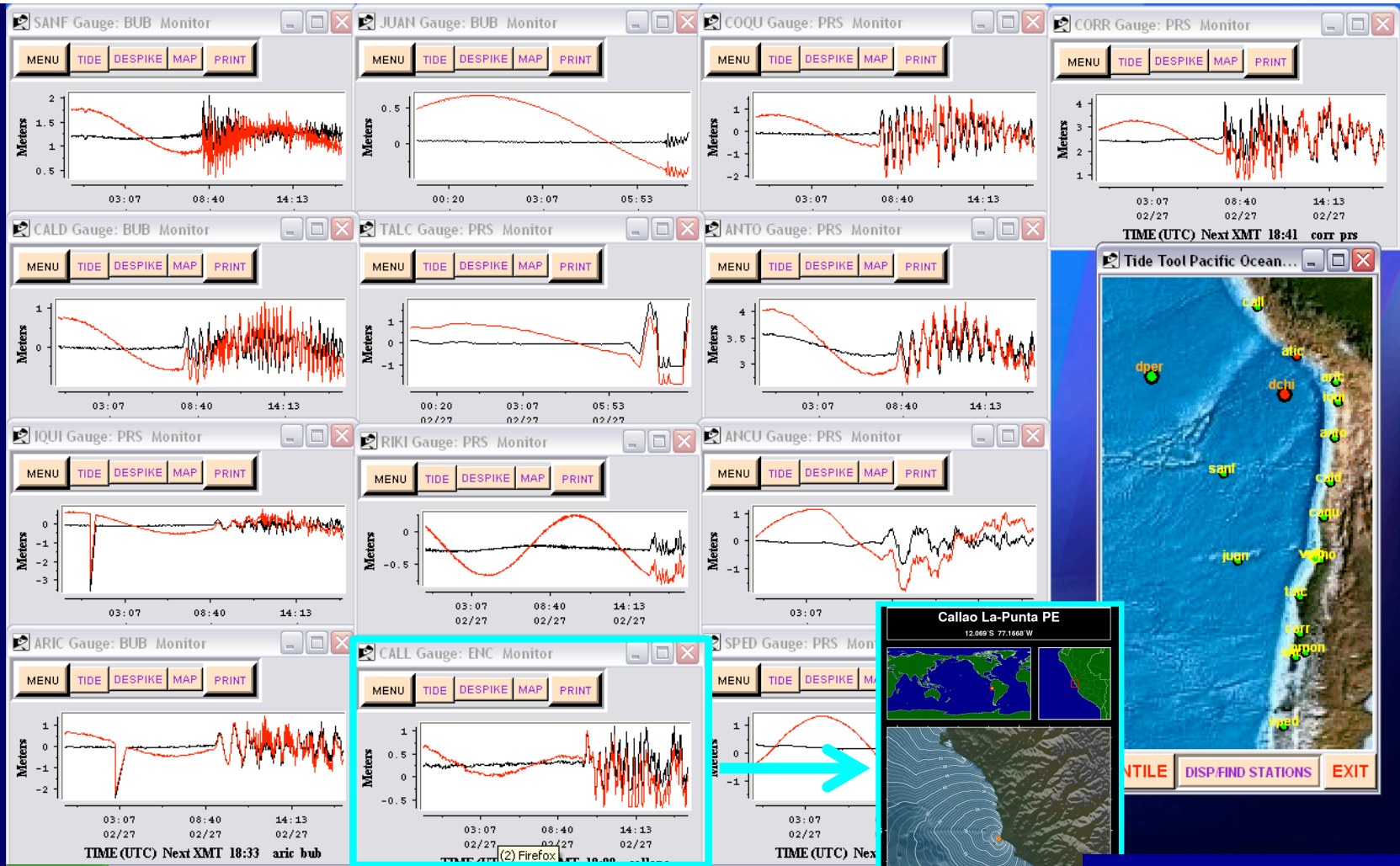
11
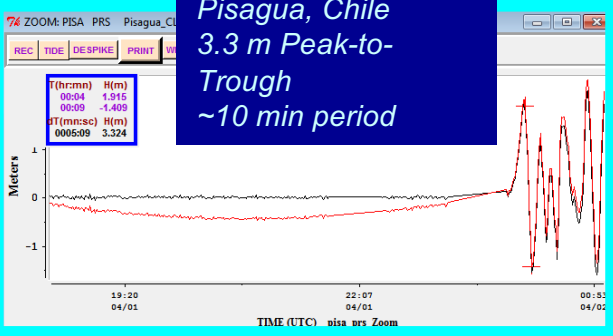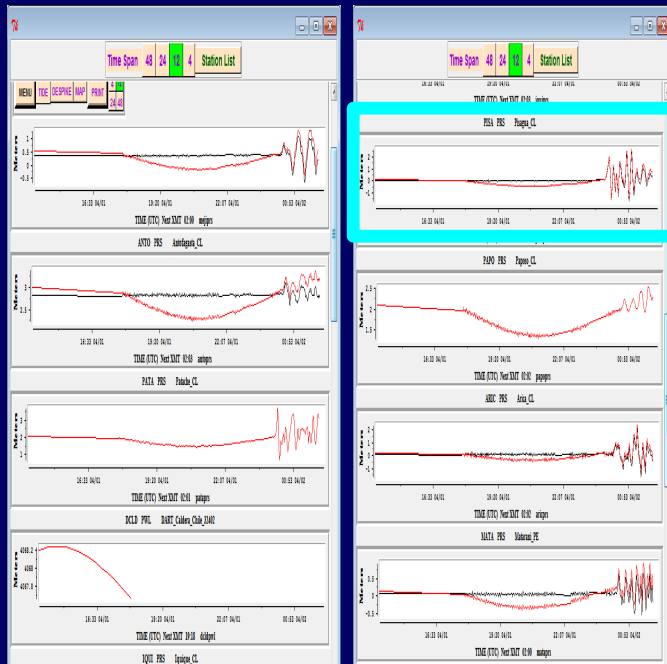
Pisagua, Chile
3.3 m Peak-to-Trough
~10 min period
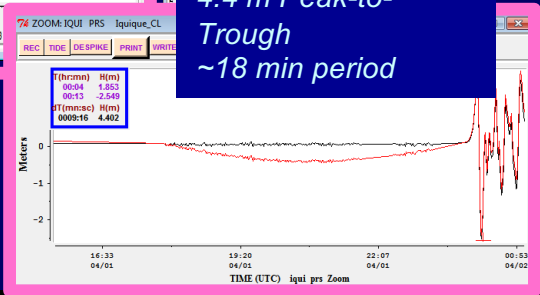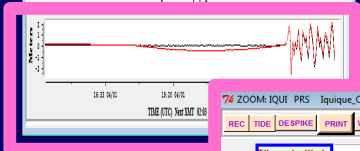
Iquique, Chile
4.4 m Peak-to-Trough
~18 min period
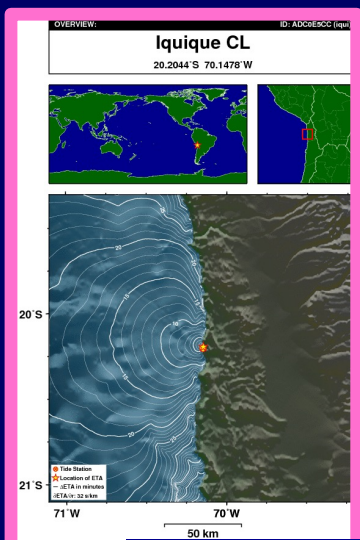
TTT to Iquique, Chile

Tide Tool: 1 April 2014

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Tide Tool: 27 February 2010

TTT to Callao, Peru

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Tide Tool Quick Info

Update Widget

Tide Tool Update Widget
To facilitate the easy update of Tide Tool, a Widget is available.

The Update folder must be placed in the directoryC:\Tcl\TideTool\

Steps:
1. Open the Update folder and create a shortcut to the Update_Tide_Tool.vbs file and move it to the Desktop.

2. Before performing an Update, stop Tide Tool and any of the Map Clients that are running.
   The get_data.tcl process does not need to be stopped unless it is being updated.

3. After the Tide Tool processes have been killed, you can start updating
   Click the shortcut to start the Update widget:

4. To update the software, click the button with the name of the file that is to be updated. It will turn green.

   Tide.tcl – script that decodes binary data
   Client.tcl – script that enables maps
   get_data.tcl – script the retrieves binary data
   Update.tcl – script retrieves latest Update widge
   COMP_META – station data
   Maps – sea level station travel time maps
   Tide Coeffs – Tide coefficients for detiding sea level stations

Tide Tool Update V2.0	— □ ✕
Update Tide.tcl	**Update COMP_META**
Update Client.tcl	**Update Maps**
Update get_data.tcl	**Update Tide Coeffs**
Update Update.tcl	
Start Update	
EXIT	

5. Click the "Start Update" button and the update will commence.
   The "Start Update" will change to "Update Starting."
   When it is finished, that will change to "Update Finished."
   At this point, the Update(s) is complete.
   Click the "EXIT" button to quit the Update widget and then restart Tide Tool.
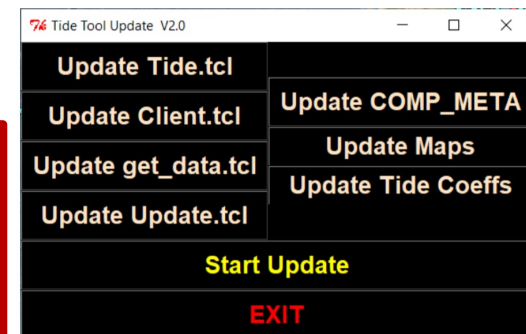
IOC Sea Level Monitoring Facility
http://www.ioc-sealevelmonitoring.org/map.php

- **Global Monitoring** of satellite-transmitted data (Station health)

- **Easy-to-use** Web tool (runs in Belgium, not locally) Uses Internet (could become clogged during real event)

- **Continuously downloads to site:** from GTS and other sites

- **Continuously decodes:** displays / expand time series, station metadata, messages
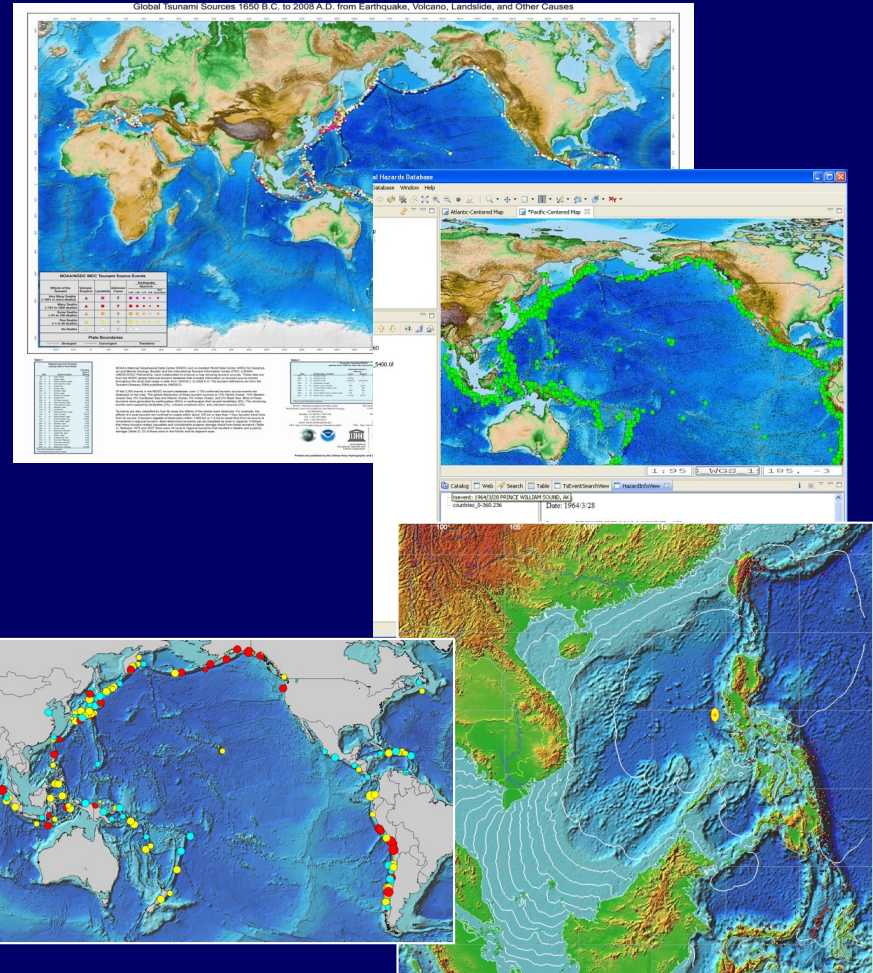
- **Data download** manually
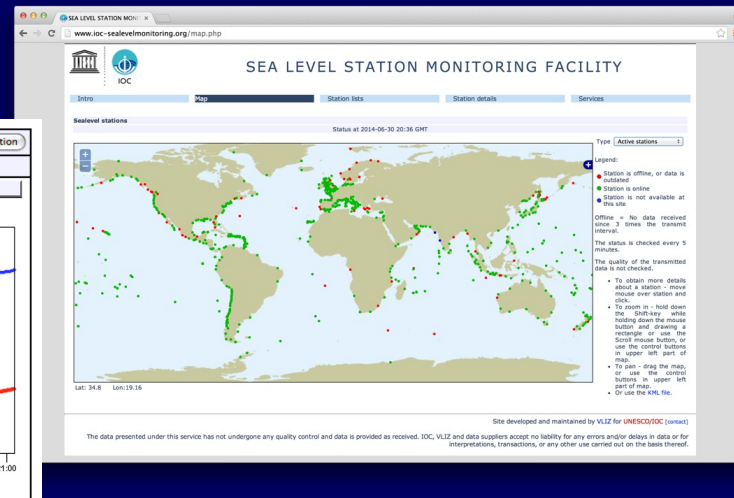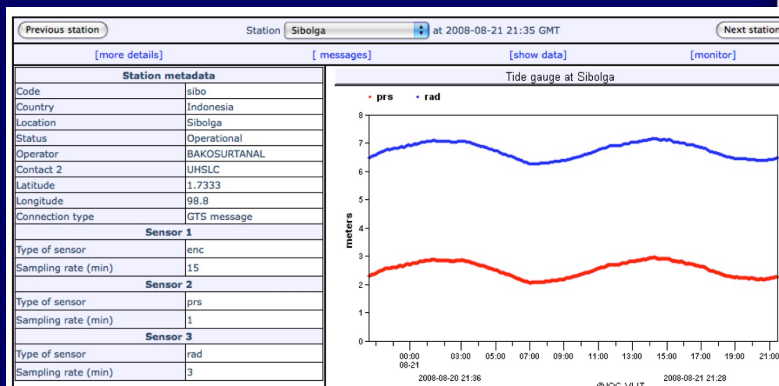
Global Historical Databases

- **WDS-Geophysics/NCEI**
  online - Web online
  offline – TsuDig (2009)
- **ITDB – Russia**
  offline (1990s)

Features:

- **GIS display**
- **EQ, Tsunamis, Run-ups**
- **Seismic, Sea Level networks**
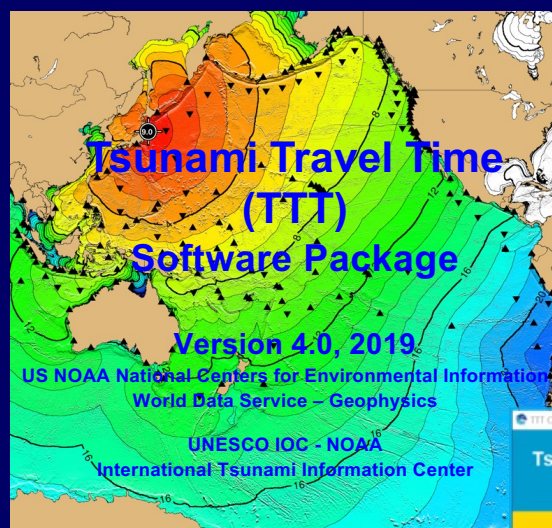- **Event sorting**
- **Travel Times**

Contact: itic.tsunami@noaa.gov

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Tsunami Travel Time Calculation and Map Display

- **PC-Windows, Linux, Unix, Mac OSX**

- **Calculation**

- **Map display (GMT)**

- **Used by PTWC**

- **Examples, Simple scripts**

- **Accuracy on bathymetry Etopo1 (1-min) and coarser grids**

- **Available to TWFP / govt agencies**

- **TTT GUI for easy use (2021)**

Contact: paula.dunbar@noaa.gov, laura.kong@noaa.gov

Tsunami Travel Time (TTT) Software Package

Version 4.0, 2019
US NOAA National Centers for Environmental Information
World Data Service – Geophysics

UNESCO IOC - NOAA
International Tsunami Information Center

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