



U.S. National Oceanic and Atmospheric Administration  
National Weather Service  
Pacific Tsunami Warning Center, Honolulu, Hawaii



# Pacific Tsunami Warning Center Operations and Tools

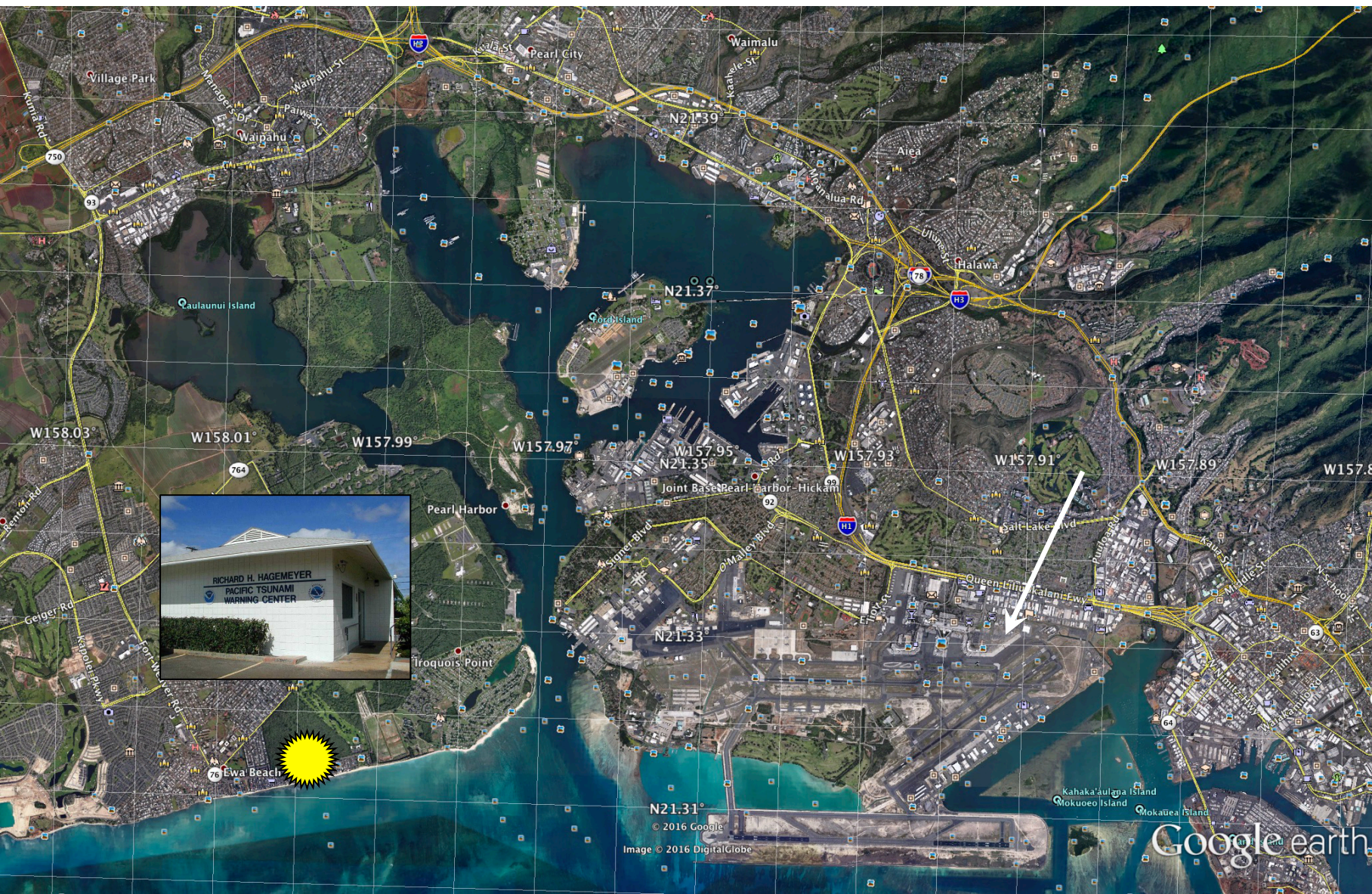
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Victor Sardina  
Geophysicist, PTWC

Antelope User's Group Meeting, Fairbanks, Alaska, August 17<sup>th</sup>, 2016



# PTWC from 1960 to 2015





# PTWC's new Location (from March 2015)





# PTWC's new Location (from March 2015)





# PTWC Operations Room





## PTWC Current Staff (13/17)

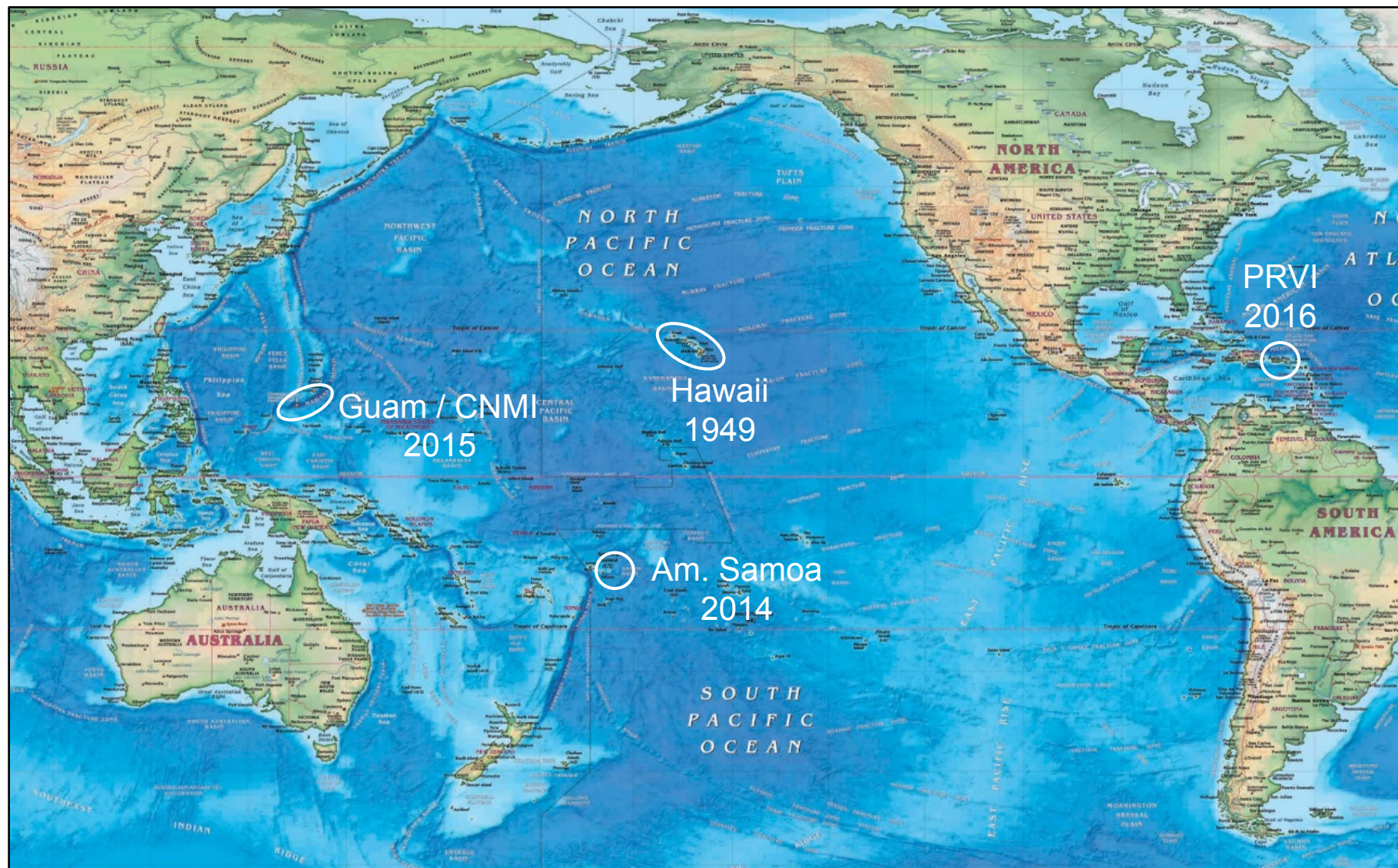
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Director:	Dr. Chip McCreery
Deputy Director:	Dr. Stuart Weinstein
Duty Scientists:	Dr. Gerard Fryer
	Dr. Vindell Hsu
	Barry Hirshorn
	Dr. Dailin Wang
	Dr. David Walsh
	Dr. Nathan Becker
	Dr. Victor Sardina
	Kanoa Koyanagi
	Vacant (2)
IT Officer:	Anthony Vandegrift
IT Contractor:	Vacant
Senior Electronics Tech:	Vacant
Electronics Tech:	Lynn Kaisan
Admin Support:	Miwako (Miki) Miyakuni

10 Duty Scientists  
2 On Duty 24 x 7

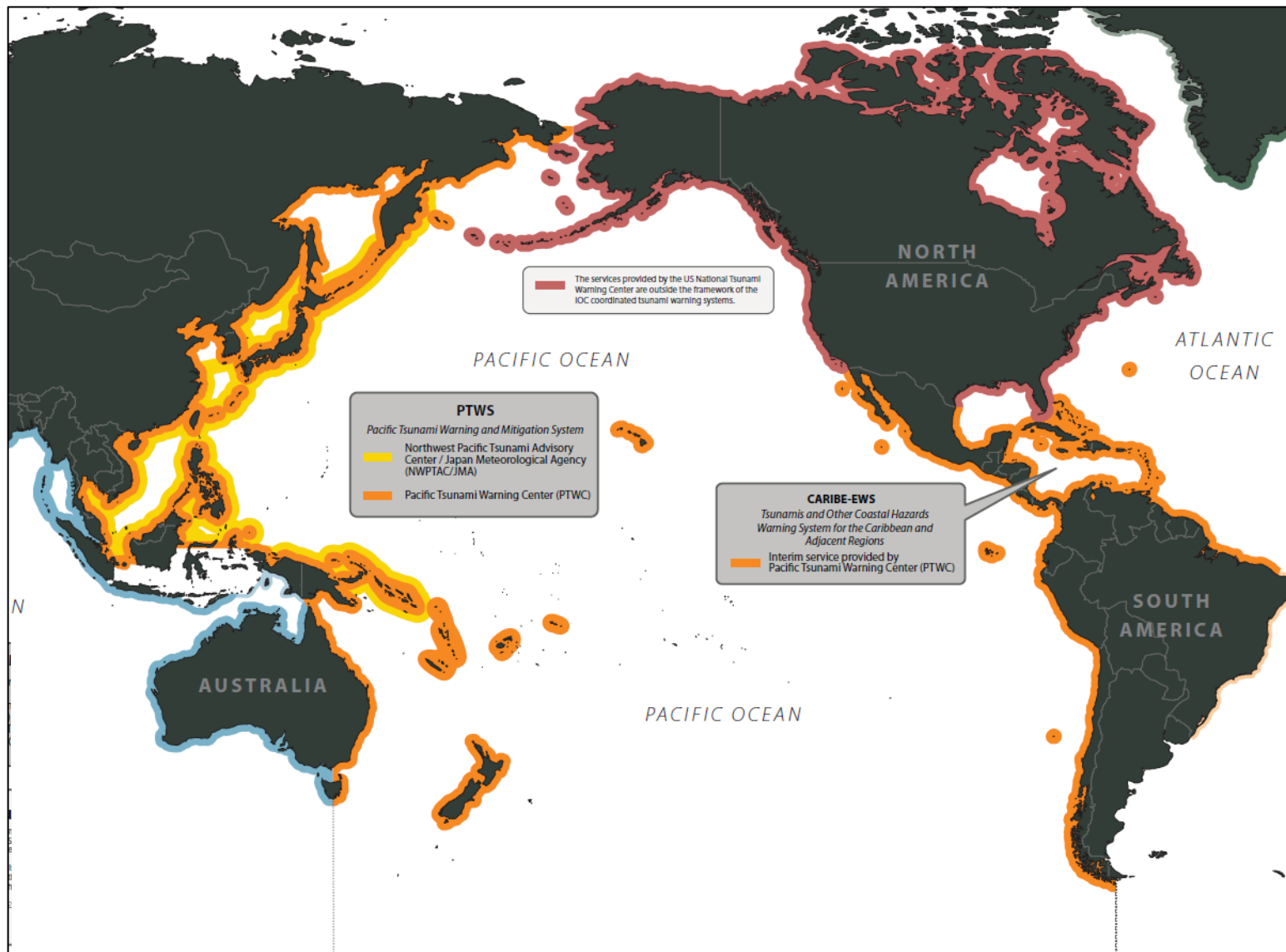


# PTWC Domestic Responsibilities





# PTWC International Responsibilities





# PTWC Organization / Governance

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## Domestic

- US DOC/NOAA Tsunami Program
- NOAA National Weather Service – Pacific Region
- National Tsunami Hazard Mitigation Program – NOAA, FEMA, USGS, US States and Territories
- Hawaii State and County Emergency Management Agencies

## International

- UNESCO/IOC Tsunami Program
- Pacific – Pacific Tsunami Warning and Mitigation System (PTWS)
- Caribbean - Tsunami and other Coastal *Hazards* Warning System for the Caribbean and Adjacent Seas (CARIBE-EWS)
- Global Coordination - Working Group on Tsunamis and Other Hazards related to Sea Level Warning and Mitigation Systems (TOWS)



# Previous Tsunami Warning Criteria

**Based on Location, EQ Magnitude and Tsunami Travel Time**

Earthquake	Product Type	Description
Magnitude 6.5-7.5 or >6.5 and >100km depth or far inland	Information Bulletin	No Tsunami Threat or only small Local Tsunami Threat
Magnitude 7.6-7.8 and <100 km depth and under sea or near sea	Regional Warning	Warning to 1000km from epicenter
Magnitude >7.8 and <100km depth and under sea or near sea	Expanding Warning	Warning if < 3 hours to impact, Watch if 3-6 hours to impact
Confirmed major tsunami	Pacific-wide Warning	Confirmed tsunami with widespread destructive threat

# Current Tsunami Threat Criteria

**Based on Location, EQ Magnitude and Tsunami Travel Time**

Earthquake	Product Type	Description
Magnitude 6.5-7.0 or >6.5 and >100km depth or far inland	Information Bulletin	No Tsunami Threat or only small Local Tsunami Threat
Magnitude 7.1 and <100 km depth and under sea or near sea	Threat Message	Threat within 300km of Epicenter
Magnitude >7.5 and <100km depth and under sea or near sea	Threat Message	Threat within 1000km of Epicenter
Magnitude >7.8 and <100km depth and under sea or near sea	Threat Message	Threat within 3 hours Tsunami Travel Time



# Current Tsunami Threat Levels

## Subsequent Products based on Tsunami Forecast

Threat Level	Forecasted Coastal Amplitude (A)
0	No Threat $A \leq .3\text{m}$
1	Marine Threat $.3\text{m} < A \leq 1\text{m}$
2	Land Threat $1\text{m} < A \leq 3\text{m}$
3	Severe Land Threat $3\text{m} < A$



# Current PTWC Message Criteria



Since October 1, 2014, the PTWC started to issue products based on a tsunami forecast.

- **Words like Warning/Watch eliminated**
- **Still conservative but should greatly reduce over-warning**
- **Provides estimated level of impact**
- **Includes graphical as well as text products**
- **Includes “kmz” file of forecast points to facilitate going to finer spatial resolution**
- **Real-time model can handle earthquake locations and mechanisms anywhere, not just shallow-thrust events in subduction zones**

# Current PTWC Message Products

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- **Initial Products:**
  - Based on preliminary earthquake parameters (hypocenter, magnitude)
  - Issued  $< 10$  min, so helpful for local threat
- **Later based on improved forecasts constrained by earthquake mechanism (W-CMT) and sea level readings**
- **No Alert levels. Instead, 3 THREAT LEVELS based on maximum forecast wave amplitudes:**
  - 0.3 to less than 1 m
  - 1 to less than 3 m
  - 3 m or more
  - Other: Forecast not yet computed
  - No Threat - 0 to less than 0.3 m



# PTWC Operational Activities

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## Seismic Monitoring

- Teleseismic earthquakes around the world
- Local Hawaii earthquakes

## Tsunami Wave Forecasting

- RIFT (Real Time Inundation Forecasting for Tsunamis)
- SIFT (Short-term Inundation Forecasting for Tsunamis)
- ATFM (Alaska Tsunami Forecast Model)

## Sea Level Data Monitoring

- Tide gauges
- DARTs

## Tsunami Message Generation and Dissemination

- AFTN, GTS, email, FAX
- Social media (Facebook, Twitter, YouTube)

# PTWC Operational Activities

---

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- DARTs

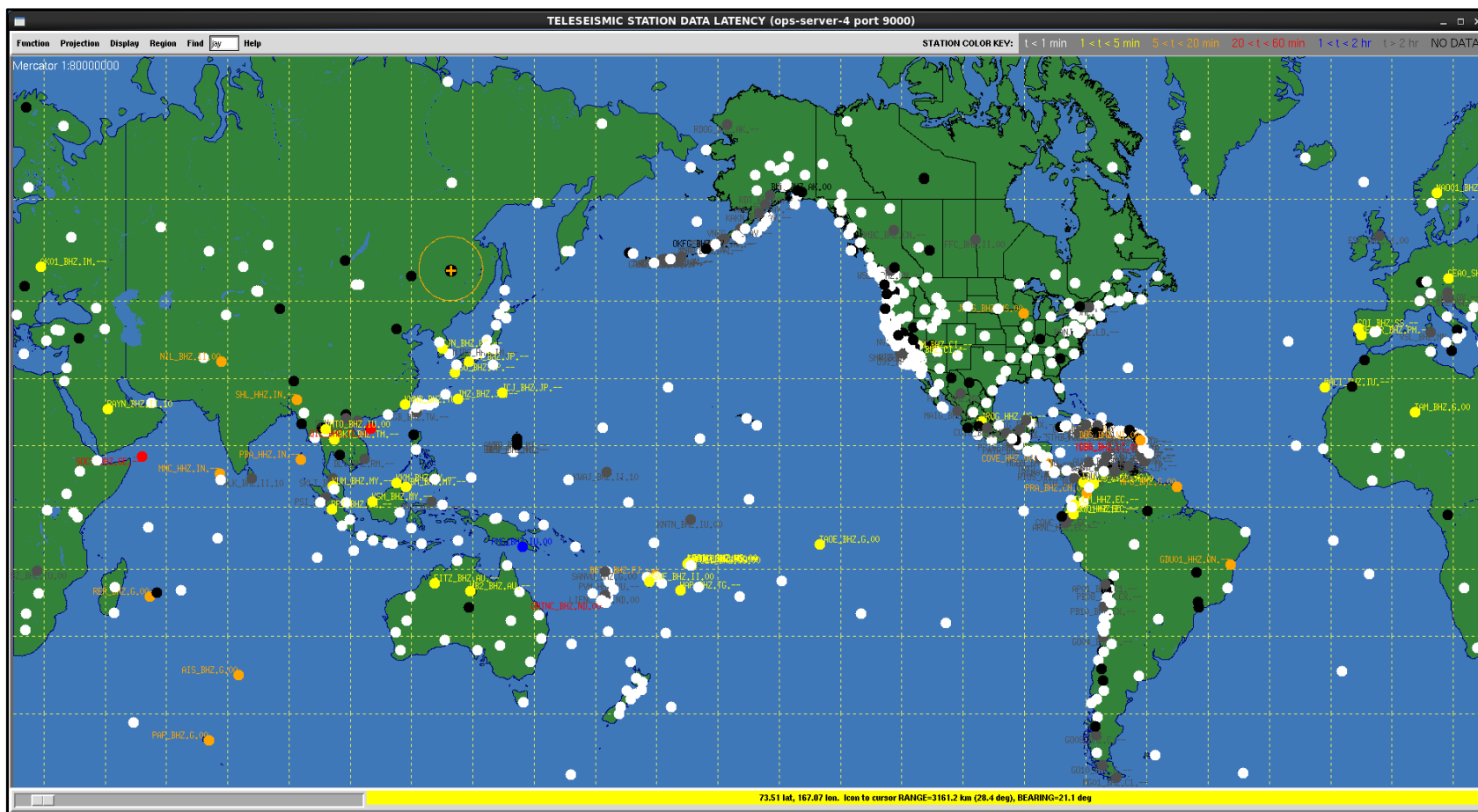
## Tsunami Message Generation and Dissemination

- FAA, GTS, email, FAX
- Social media (Facebook, Twitter)



# Seismic Monitoring

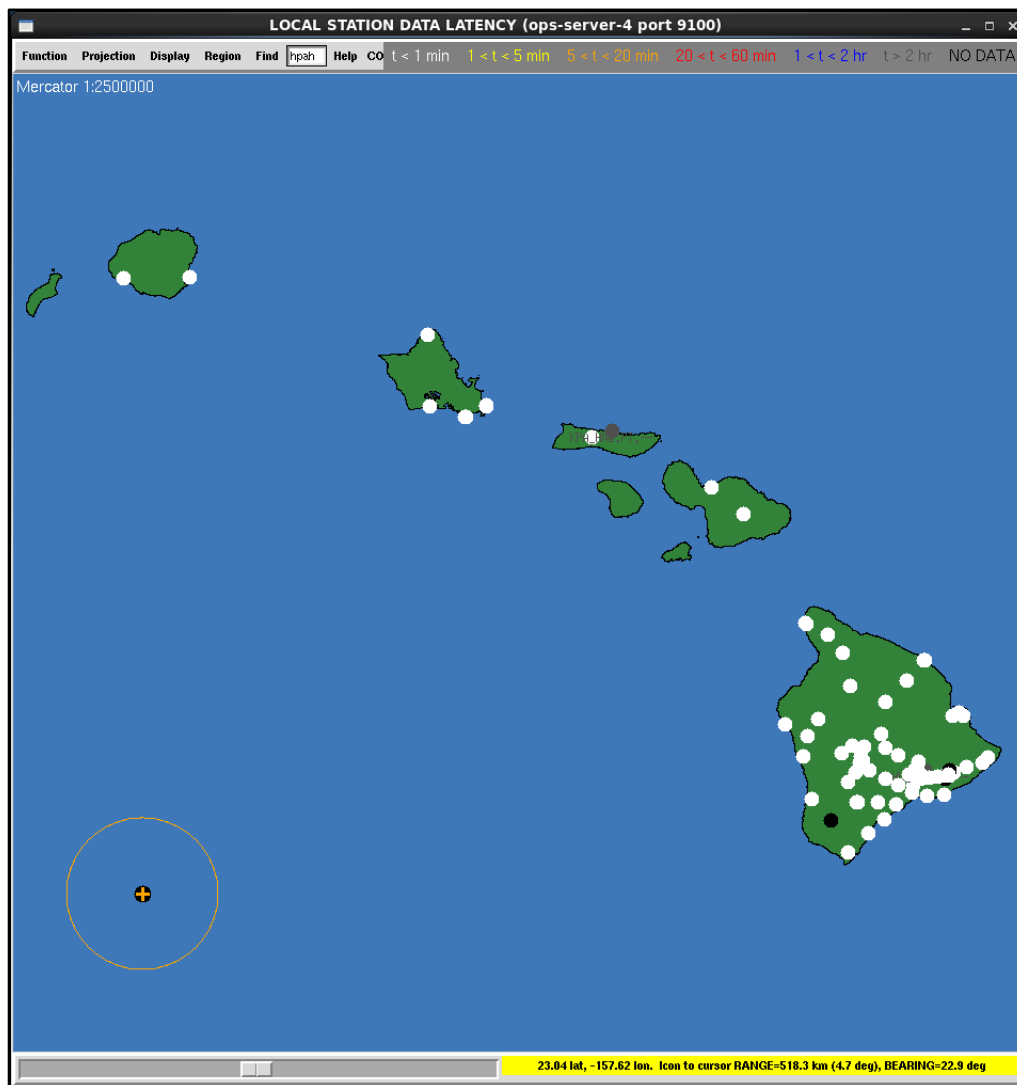
## Global Seismic Network (over 580 stations)



# Seismic Monitoring



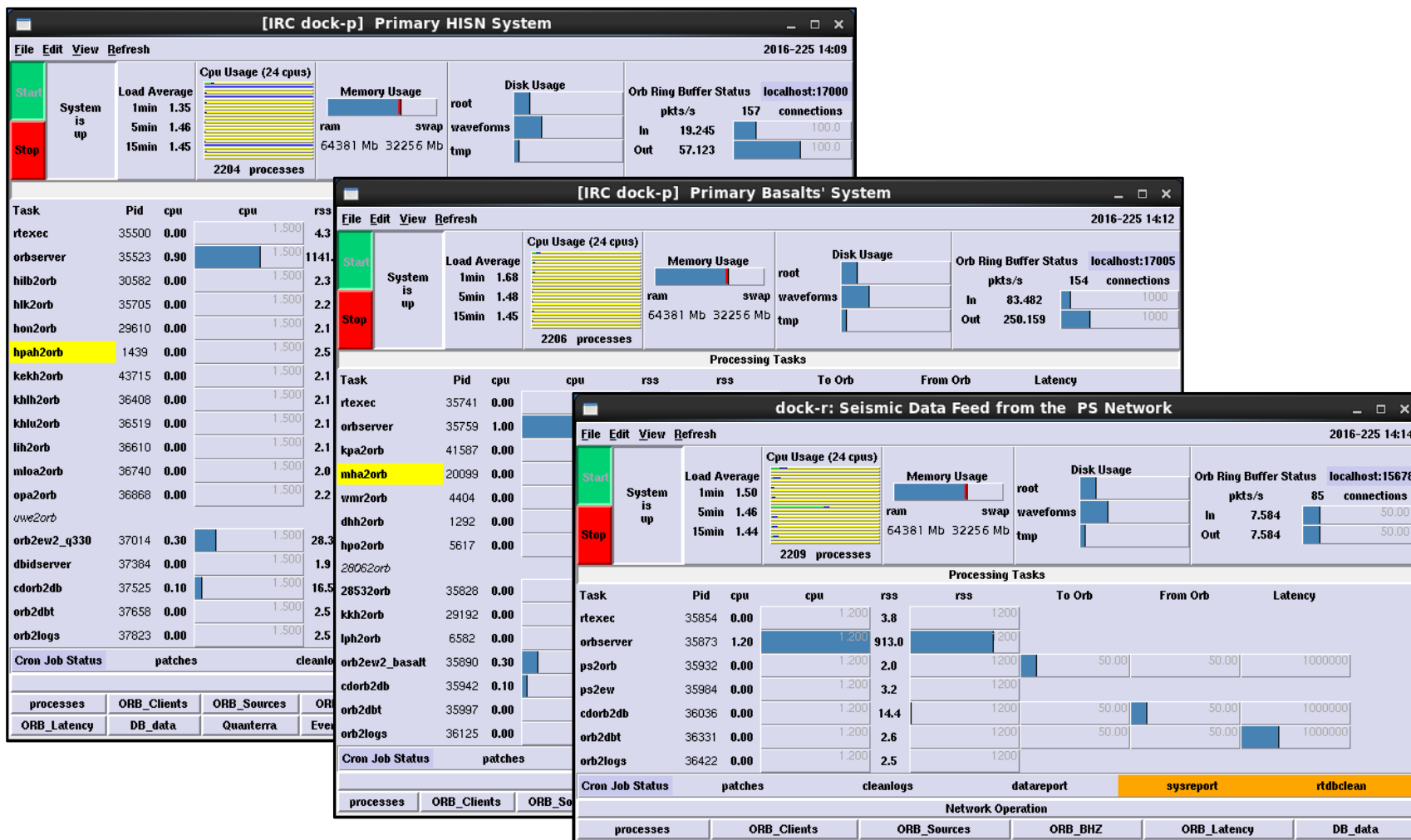
## Local Seismic Network





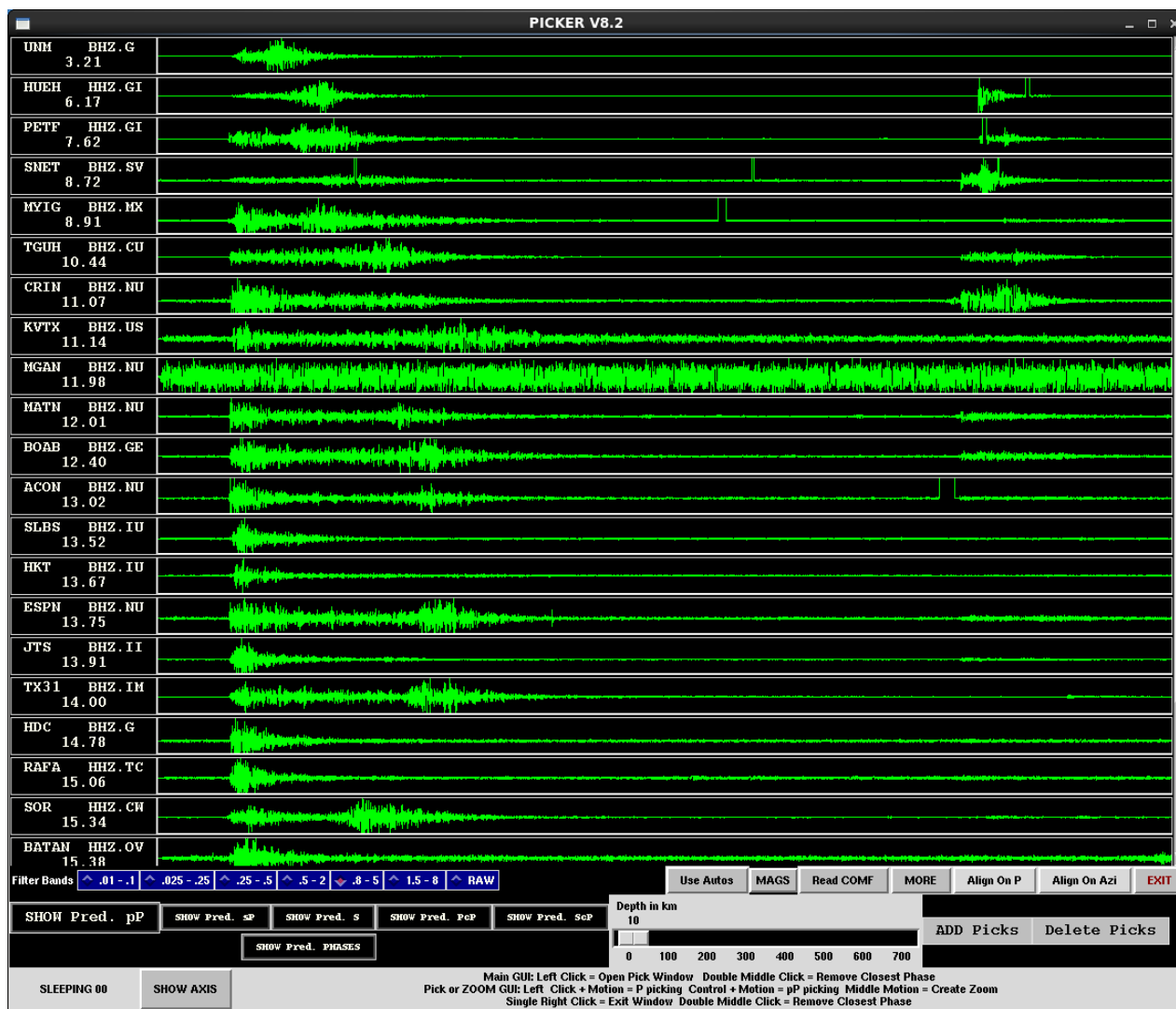
# Seismic Monitoring

## Antelope Systems



# Seismic Monitoring

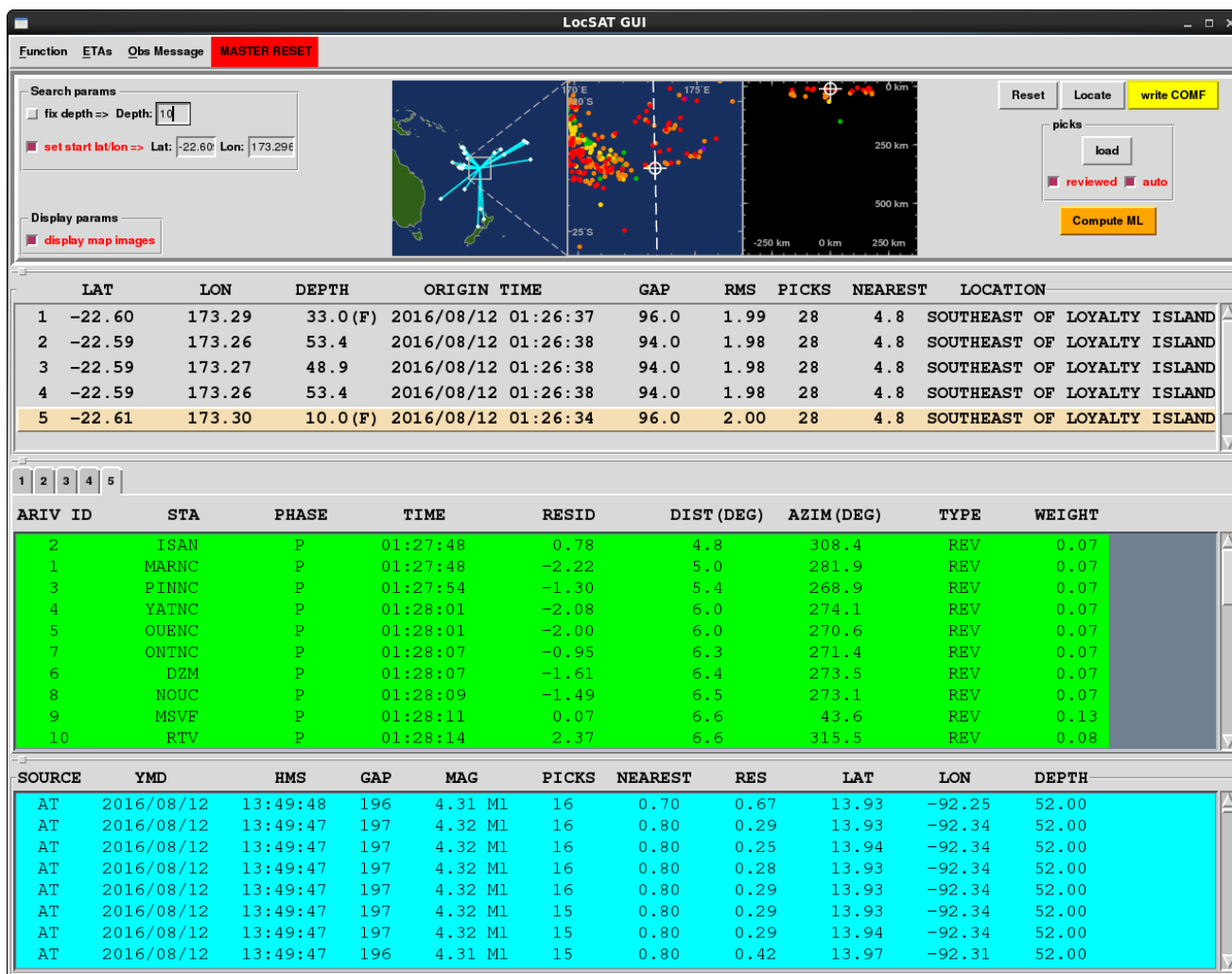
## Pick Arrival Times for Seismic Phases (P, S, pP)





# Seismic Monitoring

## Hypocentral Determination via the LocSAT GUI



# Seismic Monitoring

## Mwp Magnitude Estimation

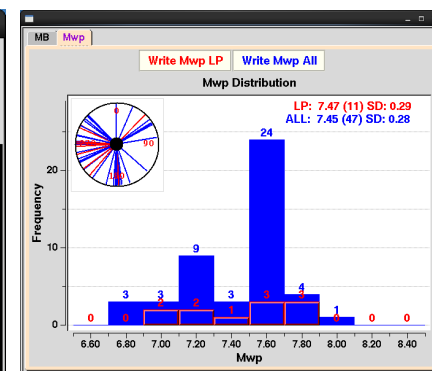
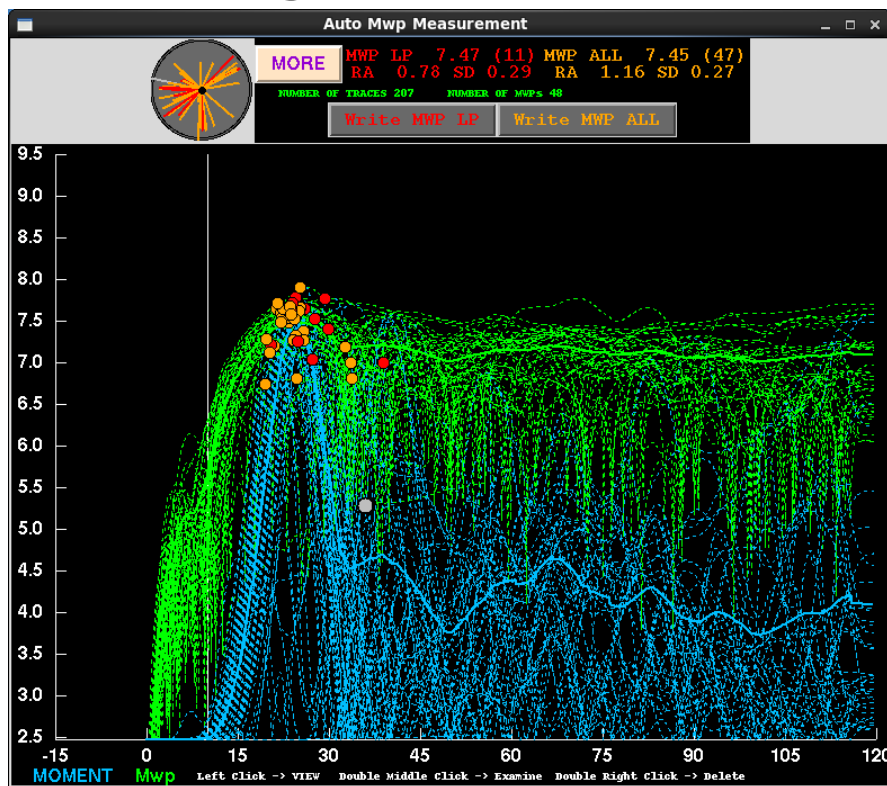
BMAG/Mwp V5.0

Mwp: LP 7.47(11) ALL 7.45(47) Mb: 6.69(171) Done 6.69(171)

**MWP** MWP ALL 01:26:35 08/12 EXIT

STA	STATUS	ETA	aMwp	Mwp	DELTA
MARNC Tr11	OUTL	----	5.31	0.00	4
PINNC Tr11	DONE	----	7.63	0.00	5
LIFNC Tr11	TIME	NA	----	----	5
YATNC Tr11	DONE	----	7.54	0.00	5
OUENC Tr11	DONE	----	7.61	0.00	5
ONTNC Tr11	DONE	----	7.58	0.00	6
DZM STS-2	DONE	----	7.57	0.00	6
NOUC STS-1	DONE	----	7.66	0.00	6
PVM CMG-6	DONE	----	7.19	0.00	6
MSVF KS540	DONE	----	7.79	0.00	6
NEK STS-2	DONE	----	7.50	0.00	7
KOUNC Tr11	DONE	----	7.39	0.00	8
SANVU STS-2	TIME	NA	----	----	9
RAO Tr112	DONE	----	7.68	0.00	10
OUZ STS-2	DONE	----	7.58	0.00	12
FUNA Tr112	DONE	----	7.29	0.00	15
LHI STS-2	DONE	----	7.64	0.00	15
HIZ STS-2	DONE	----	7.62	0.00	15
NIUE STS-2	DONE	----	7.55	0.00	16
ASAU UNKNO	DONE	----	7.67	0.00	16
VAIAA UNKNO	DONE	----	7.66	0.00	16
AFI STS-1	DONE	----	7.74	0.00	16
BKZ STS-2	TIME	NA	----	----	16
AFULI UNKNO	DONE	----	7.61	0.00	16
QRZ STS-2	DONE	----	7.55	0.00	18
BFZ STS-2	DONE	----	7.64	0.00	18
HNR STS-2	DONE	----	7.50	0.00	18
SNZO KS540	DONE	----	7.65	0.00	18
KHZ STS-2	DONE	----	7.54	0.00	19
EIDS STS-2	DONE	----	7.66	0.00	20

SLEEPING 02 Mwp: LP 7.47(11) ALL 7.45(47) PRINT





# Seismic Monitoring

- PTWC Wphase magnitude
- USGS Wphase magnitude
- Mantle Magnitude (Mm)
- Theta Slowness Coefficient
- Surface waves' magnitude (Ms)

[illegible]

# Seismic Monitoring Statistics

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- Respond to 10+ earthquakes per day
- Results to USGS about once a day for magnitude 5.8+ (CISN display and NEIC website)
- Tsunami Information Statements about once a week for magnitude 6.5+ Pacific and 6.0+ Caribbean
- Tsunami Threat Messages and/or Tsunami Watches, Advisories or Warnings a few times each year for magnitude 7+

# PTWC Operational Activities

---

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## Water Level Data Monitoring

- Tide gauges
- DARTs

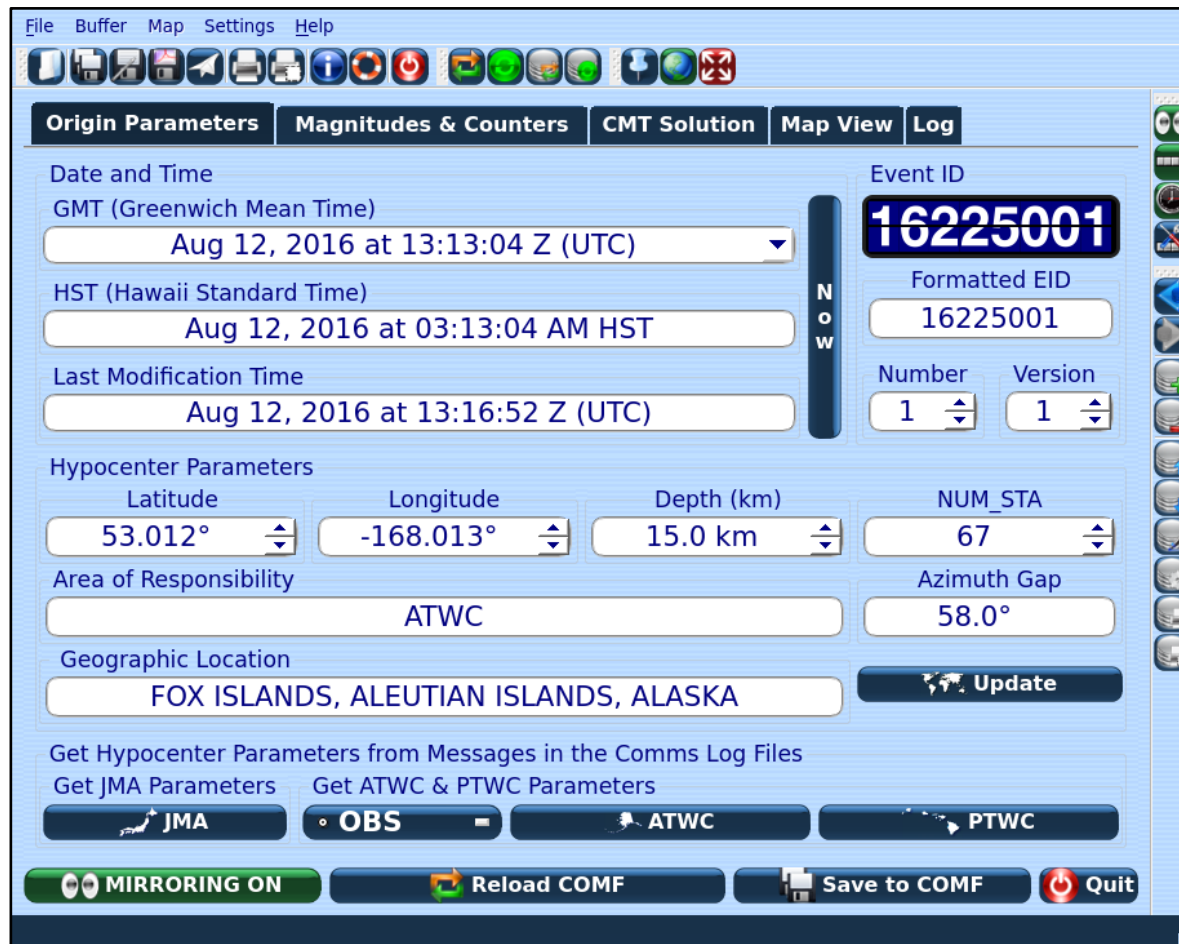
## Tsunami Message Generation and Dissemination

- FAA, GTS, email, FAX
- Social media (Facebook, Twitter)



# Tsunami Forecasting

## Earthquake Parameters for Tsunami Modeling

The screenshot shows a software interface for tsunami forecasting. It has a menu bar at the top with "File", "Buffer", "Map", "Settings", and "Help". Below the menu is a toolbar with various icons. The main window is divided into several sections. The "Origin Parameters" section is active, showing "Date and Time" (GMT, HST, Last Modification Time), "Hypocenter Parameters" (Latitude, Longitude, Depth, NUM\_STA), "Area of Responsibility" (ATWC), and "Geographic Location" (FOX ISLANDS, ALEUTIAN ISLANDS, ALASKA). The "Event ID" section shows "16225001". The "Map View" section shows a map of the Pacific Ocean. The "Log" section shows a list of messages. The "Status" bar at the bottom shows "MIRRORING ON", "Reload COMF", "Save to COMF", and "Quit".

File Buffer Map Settings Help

Origin Parameters Magnitudes & Counters CMT Solution Map View Log

Date and Time  
GMT (Greenwich Mean Time)  
Aug 12, 2016 at 13:13:04 Z (UTC)  
HST (Hawaii Standard Time)  
Aug 12, 2016 at 03:13:04 AM HST  
Last Modification Time  
Aug 12, 2016 at 13:16:52 Z (UTC)

Event ID  
**16225001**  
Formatted EID  
16225001  
Number 1 Version 1

Hypocenter Parameters  
Latitude 53.012° Longitude -168.013° Depth (km) 15.0 km NUM\_STA 67  
Area of Responsibility ATWC Azimuth Gap 58.0°  
Geographic Location FOX ISLANDS, ALEUTIAN ISLANDS, ALASKA

Get Hypocenter Parameters from Messages in the Comms Log Files  
Get JMA Parameters Get ATWC & PTWC Parameters  
JMA OBS ATWC PTWC

MIRRORING ON Reload COMF Save to COMF Quit

# Tsunami Forecasting

## RIFT GUI

Functions
Basins
Settings
Tools
Send Result
Annotation
EQ\_info
Models
Help

Status: Standby
Basin: Pacific New Product
COMF
Start
Stop
Reset

EID: 16225001
Clear EQs
Edit EQs
Curved Source
Show Source
☒ Map
☒ Moment
☒ Slip
☒ Uplift
☒ SlowEQ
Clear fault params

Lat	Lon	Depth	Mag	Origin	Moment	Strike	Dip	Rake	Length	Width	Slip	Mu
53.012	-168.013	15.0	8.8	2016/08/12 13:13:04	1.995e+22							

Reset Basin
Edit Basin
☒ PAC Maps
☒ CAR Maps
☒ Global Maps
☒ Custom Maps
☒ Default Maps
☒ Old Maps
☒ No Maps

Xwest
Xeast
Ysouth
Ynorth
Resolution
Tmax

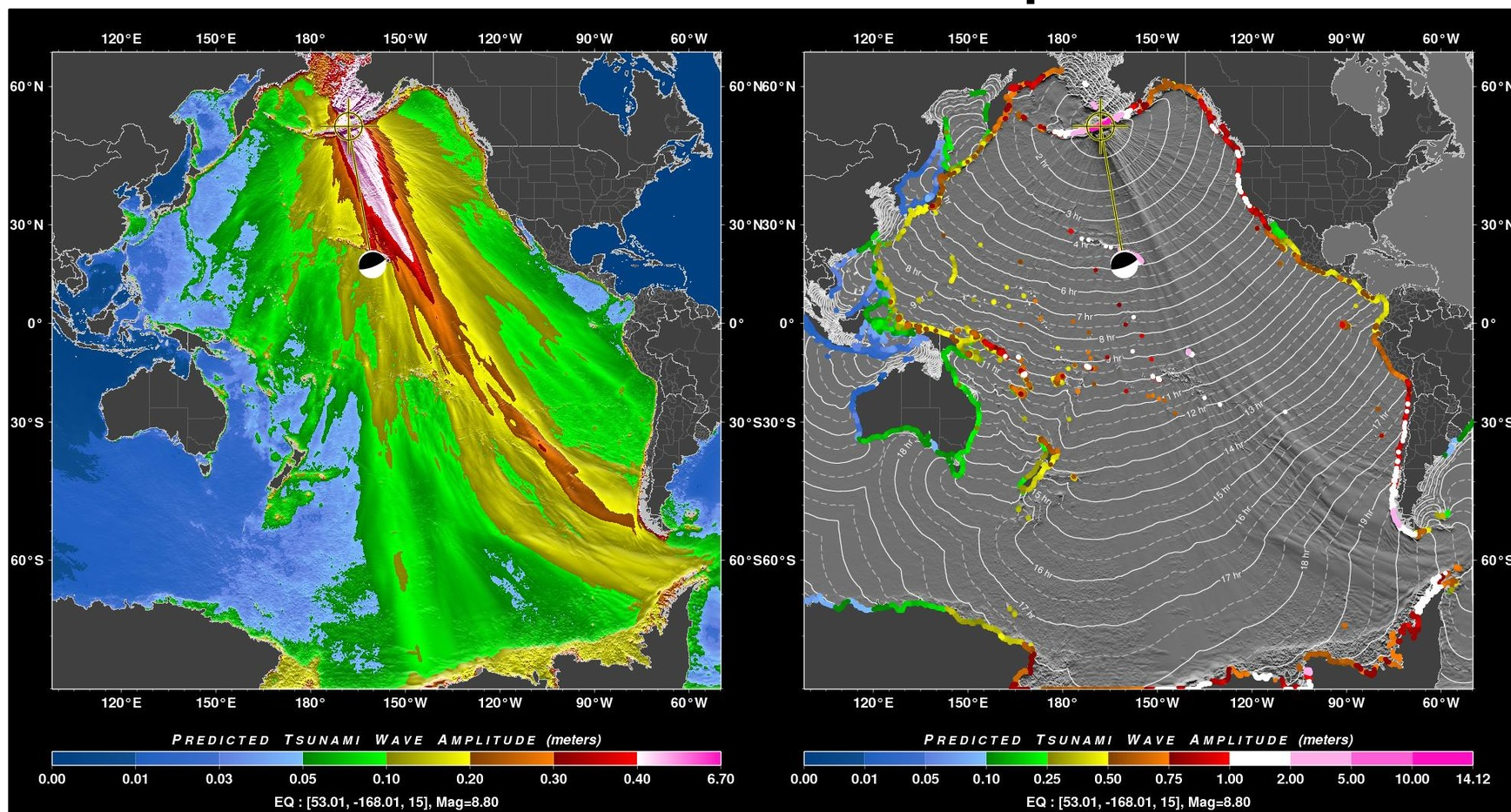
Results

No.	Time Started	EID	Origin Time	Lat	Lon	Z	Mw	strike	dip	rake	L	W	Mu	M/D	M/D basin	resol	tmax	Run-Status
000:	20160812131813	16225001	20160812131304	53.01N	168.01W	015	M8.80	s249	d15	r0090	I0469	W100	Mu44	D.D	pac	04.00m	36hr	Finished
001:	20160812092747	16225001	20160812081534	19.24N	155.45W	010	M8.10	s230	d15	r0090	I0192	W051	Mu44	M.M	haw	01.00m	04hr	Finished
002:	20160812082503	16225001	20160812081534	19.24N	155.45W	010	M8.10	s230	d15	r0090	I0192	W051	Mu44	M.M	pac	04.00m	36hr	Finished

Show
Show All
Show Archive
Hide
Hide All
Hide All Maps
Delete
Undelete
Archive
Refresh
Scale
Mark Best
unMark Best

# Tsunami Forecasting

## RIFT Tsunami Waves Amplitude





# Tsunami Forecasting

## RIFT Tsunami Forecast

**Functions**   **Help**

number of sources = 1  
 source no. 1, [ 53.01,-168.01, 18 km], Mw= 8.80, strike=249, dip=15, rake= 90, L= 469, W=100, Mu= 44, ct= 0, slip= 9.695m, Mo=1.995E+22

Sealevel Stations, time = 36.00 (hours)
 
☐ Match case   ☐ Match All   
☐ PLOT OBS   ☐ OTF TIDE COEF   ☐ PERM TIDE COEF

Amp_g	Amp_ng	Code	Lat	Lon	Depth	Hmax	tmax	Hmin	tmin	Dist	Gfac	d2eq	R	Name	Country
4.2904	0.7603	kala	21.2292	-156.9625	1014.27	4.2002	0431	-4.3807	0441	2.80	5.64	3660	H	Kalaupapa_HI	USA_Hawaii
4.2904	0.7603	KALA	21.2292	-156.9625	1014.27	4.2002	0431	-4.3807	0441	2.80	5.64	3660	H	Kalaupapa_HI	USA_Hawaii
3.8490	2.0419	niko	52.9625	-168.9625	75.59	3.2833	0206	-4.4148	0009	29.53	5.75	58	A	Nikolski_AK	USA-Alaska
3.6906	0.8637	HANL	22.2292	-159.4958	429.65	4.6586	0421	-2.7225	0434	9.27	6.10	3500	H	Hanalei_HI	USA_Hawaii
3.4224	1.0333	HALE	21.6292	-158.0958	122.22	3.7137	0430	-3.1311	0443	17.15	5.87	3594	H	Haleiwa_HI	USA_Hawaii
3.2850	0.7859	LAUP	20.0292	-155.2292	732.54	3.9892	0446	-2.5808	0505	9.08	6.26	3832	H	Laupahoehoe_HI	USA_Hawaii
3.1407	0.7868	maka	21.2958	-157.6292	152.78	3.4021	0434	-2.8794	0448	19.98	5.79	3633	O	Makai_Pier_Waimanalo_HI	USA_Hawaii(reef)
3.1407	0.7868	MAKA	21.2958	-157.6292	152.78	3.4021	0434	-2.8794	0448	19.99	5.79	3633	H	Makapuu_HI	USA_Hawaii(reef)
3.0469	2.1122	spak	57.0958	-170.3625	20.56	1.7193	0140	-4.3744	0116	112.44	5.79	480	O	St_Paul_island_AK	USA
2.9150	0.9749	hilo	19.7625	-155.0292	182.58	3.4293	0450	-2.4007	0506	17.07	6.50	3865	H	Hilo_Hawaii	USA_Hawaii(resonant)

Warning Points, time = 36.00 (hours)
 
☐ Match case   ☐ Match All

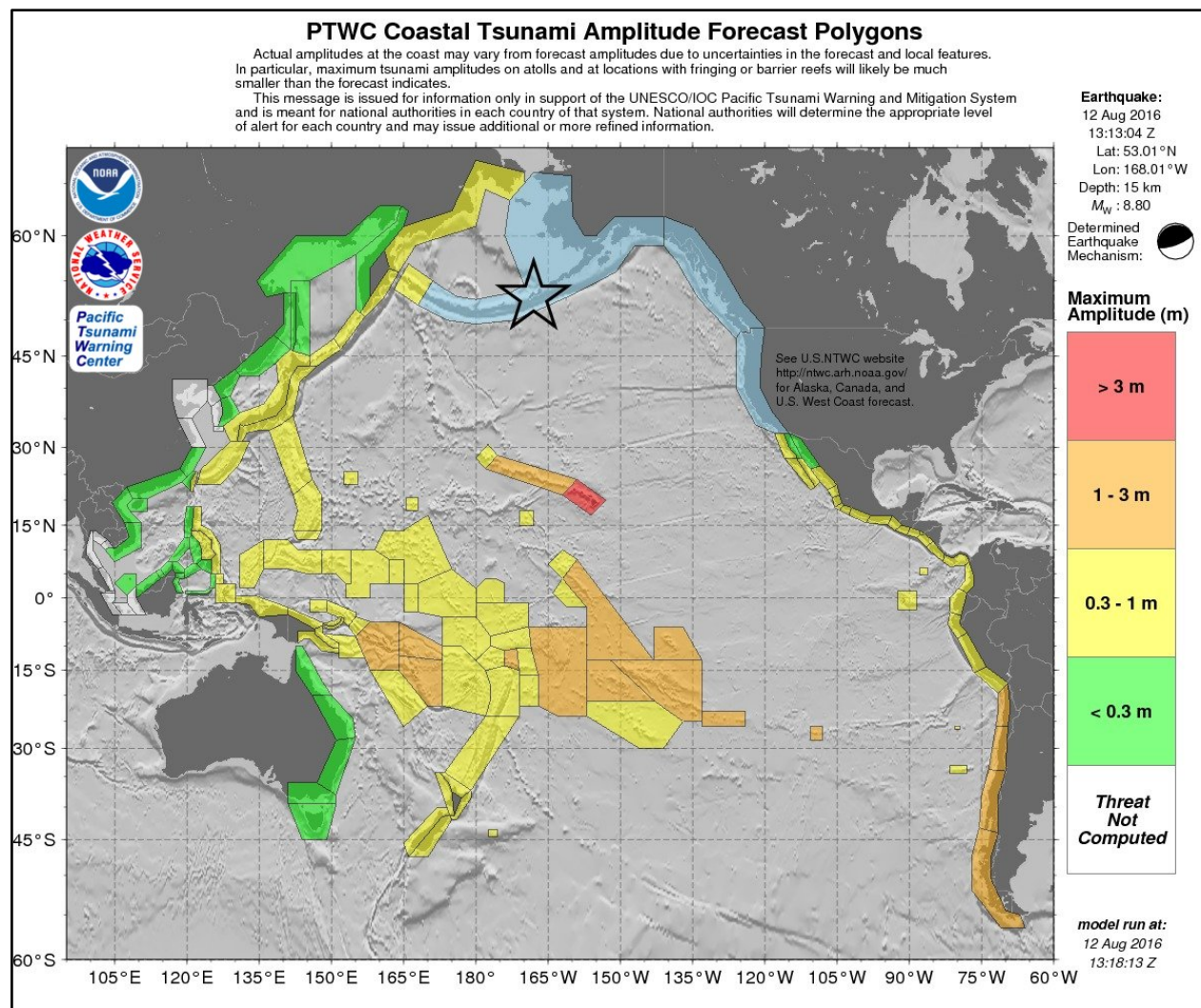
Amp_g	Amp_ng	Code	Lat	Lon	Depth	Hmax	tmax	Hmin	tmin	Dist	Gfac	d2eq	R	Name	Country
14.1182	3.6960	sumn	52.8292	-168.8958	31.90	17.7157	0011	-10.5208	0021	29.39	6.01	61	A	South_Umnak_I._ATFM	USA_Alaska
13.8720	3.2303	sama	52.7625	-169.2292	35.40	16.6150	0012	-11.1290	0032	30.49	5.65	85	A	Samalga_Island_ATFM	USA_Alaska
11.4705	1.3680	avat	54.0958	-165.3625	46.90	14.9421	0025	-7.9989	0027	64.79	5.62	213	A	Avatanak_Island_ATFM	USA_Alaska
4.4637	2.6141	summ	53.8958	-166.4958	20.80	3.1162	0111	-5.8113	0008	26.18	5.68	144	A	Summer_Bay_ATFM	USA_Alaska
4.4637	0.9988	J025	54.0292	-166.6292	246.10	3.1162	0106	-5.8113	0003	10.57	5.68	143	O	DUTCH_HARBOR	JTWC
4.2904	0.9088	MO51	21.1625	-156.8958	131.50	4.2002	0434	-4.3807	0444	10.91	5.64	3667	H	Pelekunu_Bay_Molokai	Hawaii_USA(Z-10:00)
4.2904	0.7603	MO41	21.2292	-156.9625	1014.30	4.2002	0431	-4.3807	0441	2.28	5.64	3659	H	Airport_Molokai	Hawaii_USA(Z-10:00)
4.2904	0.8790	MO31	21.1625	-156.9625	133.70	4.2002	0432	-4.3807	0442	4.84	5.64	3662	H	Kalaupapa_Molokai	Hawaii_USA(Z-10:00)
4.2904	0.7603	KLP1	21.2292	-156.9625	1014.30	4.2002	0431	-4.3807	0441	2.80	5.64	3660	G	KALAUPAPA	MOLOKAI
4.2904	0.7603	kala	21.2292	-156.9625	1014.30	4.2002	0432	-4.3807	0442	3.72	5.64	3661	H	Kalaupapa_ATFM	USA_Hawaii

Coastal Points, time = 36.00 (hours)
 
☐ Match case   ☐ Lat/Lon   ☐ HI   ☐ AKw   ☐ AKe   ☐ WC   ☐ AS   ☐ NM   ☐ PR   ☐ VI   ☐ GMF   ☐ EC

Amp_g	Amp_ng	Lat	Lon	Depth	Hmax	tmax	Hmin	tmin	Dist	Gfac	d2eq	Country
14.1182	3.1991	52.8292	-168.8292	57.10	17.7157	0009	-10.5208	0019	22.69	6.01	58	Alaska
14.1182	3.6960	52.8292	-168.8958	31.90	17.7157	0009	-10.5208	0019	23.98	6.01	63	Alaska
14.1182	2.6975	52.7625	-168.9625	52.60	17.7157	0008	-10.5208	0018	20.04	6.01	69	Alaska
14.1182	3.3445	52.7625	-169.0292	30.10	17.7157	0009	-10.5208	0019	23.30	6.01	74	Alaska
14.0488	3.4265	52.8292	-168.7625	65.10	16.7878	0009	-11.3098	0024	20.02	5.78	54	Alaska
13.8720	3.2303	52.7625	-169.2292	35.40	16.6150	0012	-11.1290	0032	30.49	5.65	86	Alaska
12.9955	3.5208	53.7625	-166.0292	74.90	15.8329	0018	-10.1581	0029	43.10	5.65	156	Alaska
12.9955	2.7535	53.6958	-166.0958	67.90	15.8329	0016	-10.1581	0027	39.71	5.65	148	Alaska
12.9955	2.2177	53.6292	-166.1625	81.70	15.8329	0016	-10.1581	0027	38.03	5.65	141	Alaska
12.9955	2.4525	53.6292	-166.2292	76.20	15.8329	0017	-10.1581	0028	41.68	5.65	137	Alaska

# Tsunami Forecasting

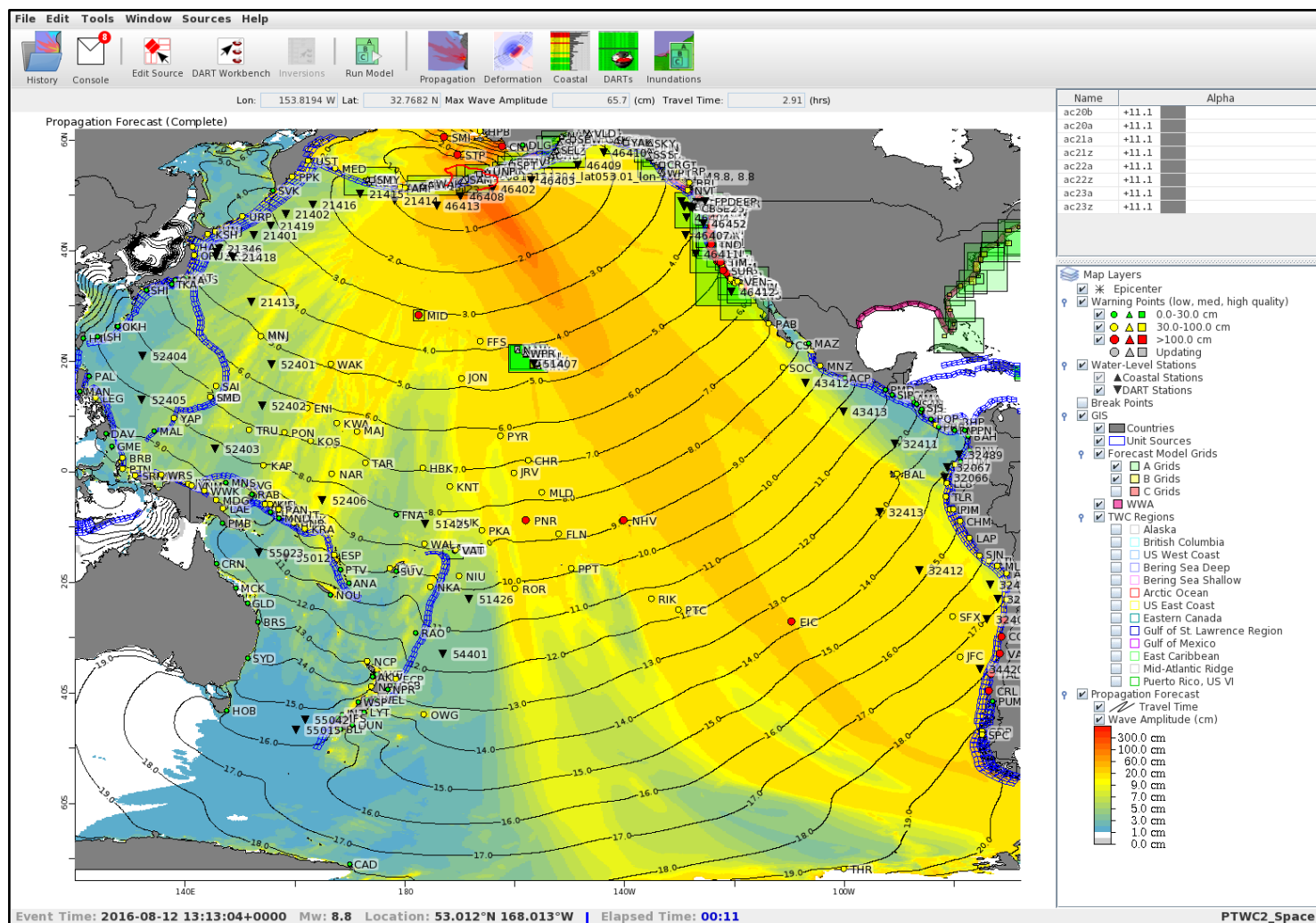
## RIFT Tsunami Forecast Polygons



- Threat level for designated forecast zones (based on geography, geopolitics)
- Threat level for the polygons based on the largest coastal amplitude within each polygon

# Tsunami Forecasting

## SIFT Model







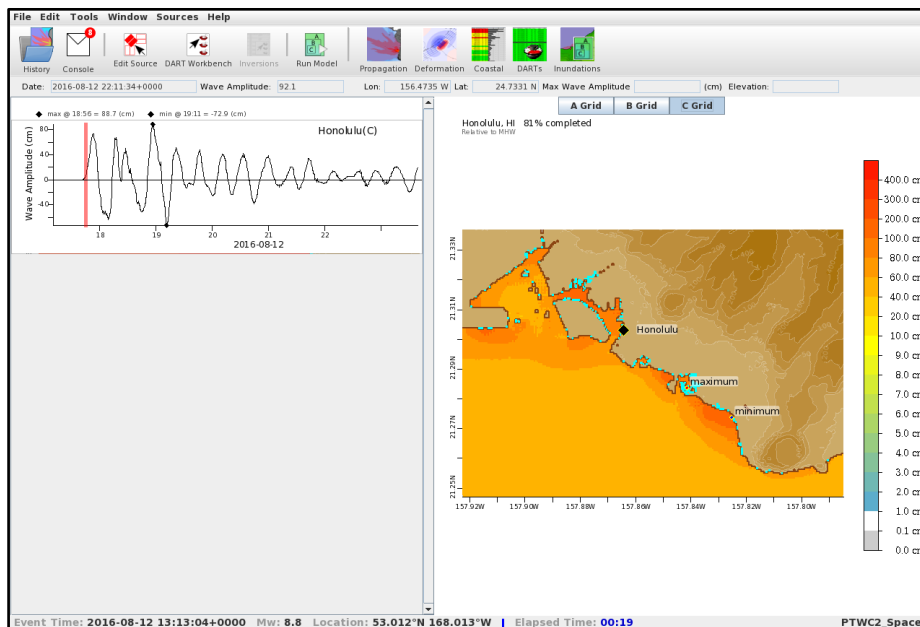
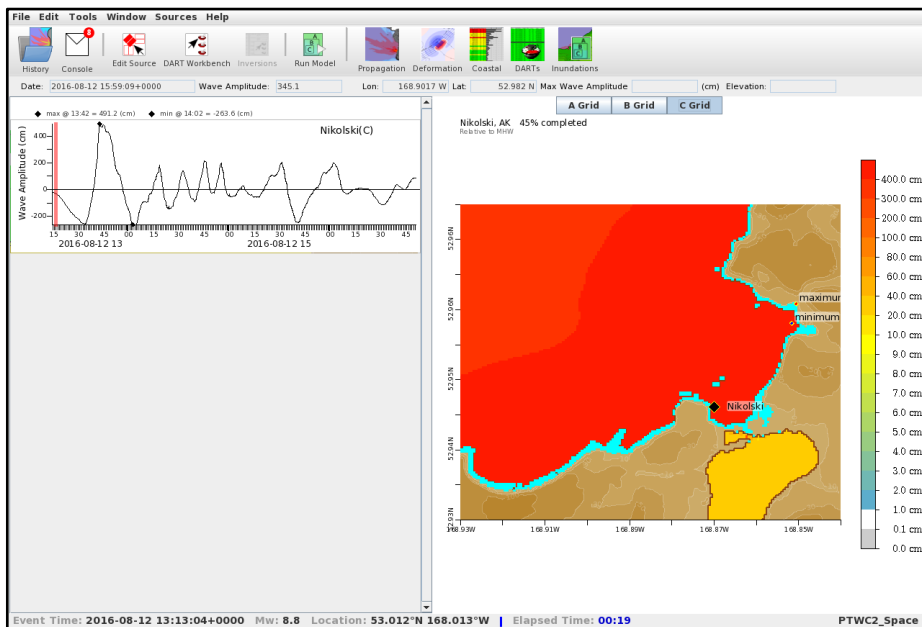
The screenshot displays the PTWC2\_Space software interface. At the top is a menu bar with options: File, Edit, Tools, Window, Sources, Help. Below the menu is a toolbar with icons for History, Console, Edit Source, DART Workbench, Inversions, Run Model, Propagation, Deformation, Coastal, DARTs, and Inundations. The main window contains a table with columns: Model, Region, Arrival Time (UTC), C Min (cm), C Max (cm), Gauge Min (cm), Gauge Max (cm), Flooding, Flooded Area, and Model Ended. The table lists tsunami arrival data for various locations, including Alaska, Hawaii, and the West Coast. The bottom status bar shows the Event Time: 2016-08-12 13:13:04+0000, Mw: 8.8, Location: 53.012°N 168.013°W, Elapsed Time: 00:17, and PTWC2\_Space.

Model	Region	Arrival Time (UTC)	C Min (cm)	C Max (cm)	Gauge Min (cm)	Gauge Max (cm)	Flooding	Flooded Area	Model Ended
Nikolski, AK	Alaska	13:17 2016-08-12	-446.2	711.2	-263.6	491.2	Yes	0.671	34% in 6 mins.
Hanalei, HI	Hawaii	17:25 2016-08-12	-959.4	721.6	-148.4	399.7	Yes	2.463	54% in 6 mins.
Haleiwa, HI	Hawaii	17:33 2016-08-12	-501.9	367.1	-127.8	261.0	Yes	7.757	12% in 6 mins.
Atka, AK	Alaska	14:04 2016-08-12	-343.5	297.9	-251.0	246.2	Yes	0.512	23% in 6 mins.
Kahului, HI	Hawaii	17:48 2016-08-12	-770.1	492.3	-196.9	225.6	Yes	3.223	40% in 6 mins.
Hilo, HI	Hawaii	17:58 2016-08-12	-598.0	412.5	-412.3	214.7	Yes	3.017	37% in 6 mins.
Unalaska, AK	Alaska	13:30 2016-08-12	-442.5	284.6	-231.3	183.4	Yes	1.654	45% in 6 mins.
Adak, AK	Alaska	14:08 2016-08-12	-156.5	172.9	-144.0	143.4	Yes	0.346	73% in 6 mins.
Kawaihae, HI	Hawaii	17:55 2016-08-12	-157.1	207.7	-110.5	105.3	Yes	0.400	25% in 6 mins.
Sand Point, AK	Alaska	14:44 2016-08-12	-101.0	105.8	-80.0	94.9	Yes	0.349	38% in 6 mins.
Chignik Bay, AK	Alaska	15:33 2016-08-12	-89.5	115.7	-75.6	94.8	Yes	0.057	30% in 6 mins.
Honolulu, HI	Hawaii	17:45 2016-08-12	-150.4	184.1	-72.9	88.7	Yes	0.884	55% in 6 mins.
King Cove, AK	Alaska	14:45 2016-08-12	-41.8	77.1	-37.9	75.3	Yes	0.030	29% in 6 mins.
Kodiak Island, AK	Alaska	15:49 2016-08-12	-58.8	98.1	-53.0	73.6	Yes	0.594	51% in 6 mins.
Craig, AK	Alaska	16:52 2016-08-12	-90.1	117.5	-67.0	61.7	Yes	0.414	54% in 6 mins.
Sitka, AK	Alaska	16:19 2016-08-12	-70.0	66.4	-58.2	50.5	Yes	0.232	13:28 2016-08-12
Seward, AK	Alaska	16:08 2016-08-12	-38.5	48.2	-31.8	32.9	Yes	0.077	13:28 2016-08-12
Yakutat, AK	Alaska	16:16 2016-08-12	-186.2	117.9	-45.2	29.5	Yes	0.108	29% in 6 mins.
Lahaina, HI	Hawaii	17:51 2016-08-12	-0.8	54.1	-0.6	29.0	No	0.018	9% in 1 mins.
Elfin Cove, AK	Alaska	16:08 2016-08-12	-23.7	23.9	-23.0	23.2	No	0.000	30% in 6 mins.
Kailua-Kona, HI	Hawaii	17:57 2016-08-12	-78.9	45.8	-21.8	20.7	No	0.029	27% in 6 mins.
Port Alexander, AK	Alaska	16:15 2016-08-12	-18.0	21.6	-15.6	19.2	Yes	0.010	36% in 6 mins.
Shemva, AK	Alaska	14:46 2016-08-12	-24.3	19.0	-22.5	16.3	Yes	0.026	24% in 6 mins.

Event Time: 2016-08-12 13:13:04+0000 Mw: 8.8 Location: 53.012°N 168.013°W Elapsed Time: 00:17 PTWC2\_Space

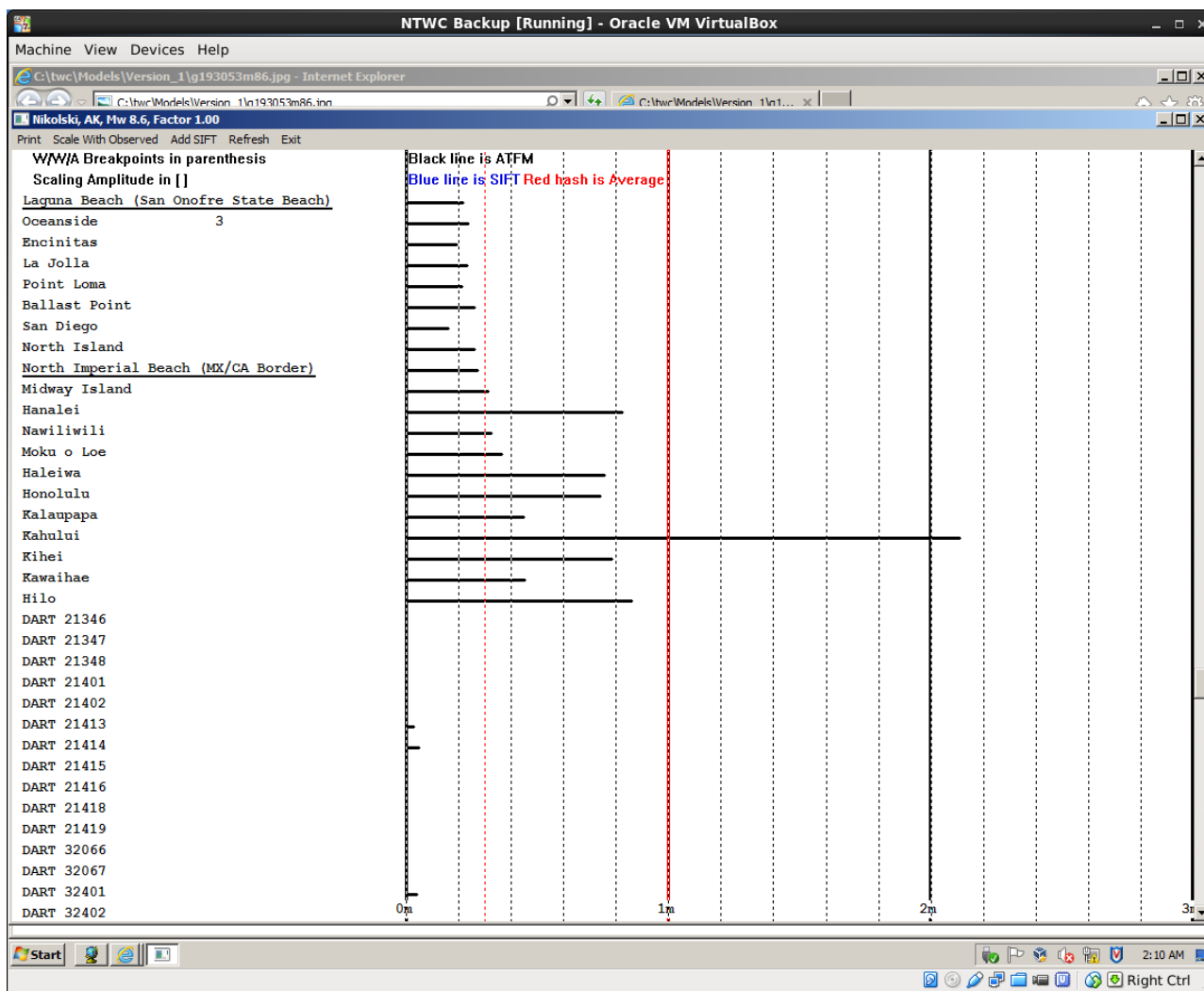
# Tsunami Forecasting

## SIFT Forecast: Inundation Models



# Tsunami Forecasting

## ATFM Forecast Model





# PTWC Operational Activities

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## Seismic Monitoring

- Teleseismic earthquakes around the world
- Local Hawaii earthquakes

## Tsunami Wave Forecasting

- RIFT (Real Time Inundation Forecasting for Tsunamis)
- SIFT (Short-term Inundation Forecasting for Tsunamis)
- ATFM (Alaska Tsunami Forecast Model)

## Sea Level Data Monitoring

- Tide gauges
- DARTs

## Tsunami Message Generation and Dissemination

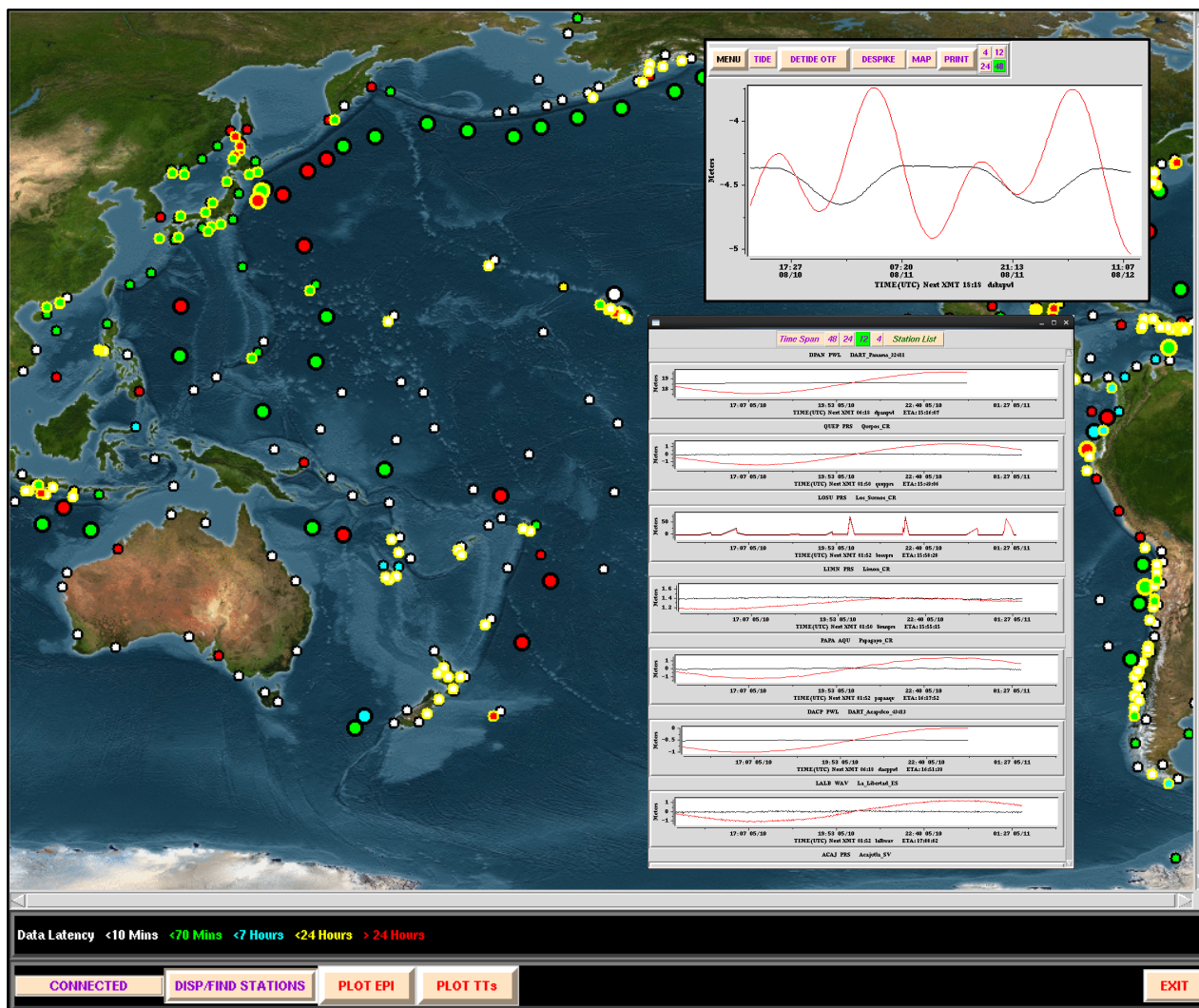
- AFTN, GTS, email, FAX
- Social media (Facebook, Twitter, YouTube)

The screenshot shows the Tide Tool v7.0 interface. The main window displays a word search grid with the following words highlighted:

- SUMATRA\_JAVA** (row 1, column 1)
- BAY\_OF\_BENK** (row 4, column 1)
- CENTRAL\_INDIAN\_OCEAN** (row 5, column 1)
- NEST\_INDIAN\_AND\_AFRICA** (row 6, column 1)
- PACIFIC\_OCEAN** (row 7, column 1)

The grid also contains other words like 'saba', 'meul', 'cili', 'prig', 'engg', 'tanj', 'ambo', 'sehl', 'sibo', 'teda', 'bity', 'pada', 'sam', 'lokk', 'vaik', 'chrs', 'dind', 'djvw', 'djve', 'kota', 'komi', 'lang', 'tamp', 'coco', 'enc', 'Info', 'Mess', 'sitt', 'chtt', 'noul', 'trna', 'colo', 'colb', 'krna', 'dnic', 'hani', 'garc', 'nale', 'garn', 'laru', 'agal', 'blue', 'rodr', 'ptlu', 'sala', 'masi', 'hout', 'aden', 'chab', 'kara', 'zanz', 'nomb', 'penb', 'inha', 'durb', 'sitr', 'prte', 'lanu'. A red box highlights the word 'brna' and a green box highlights 'ars'.

The bottom status bar shows: Read 10514963 Bytes /data/logs/nmc/sr09909.log



# PTWC Operational Activities

---

## Seismic Monitoring

- Teleseismic earthquakes around the world
- Local Hawaii earthquakes

## Tsunami Wave Forecasting

- RIFT (Real Time Inundation Forecasting for Tsunamis)
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## Sea Level Data Monitoring

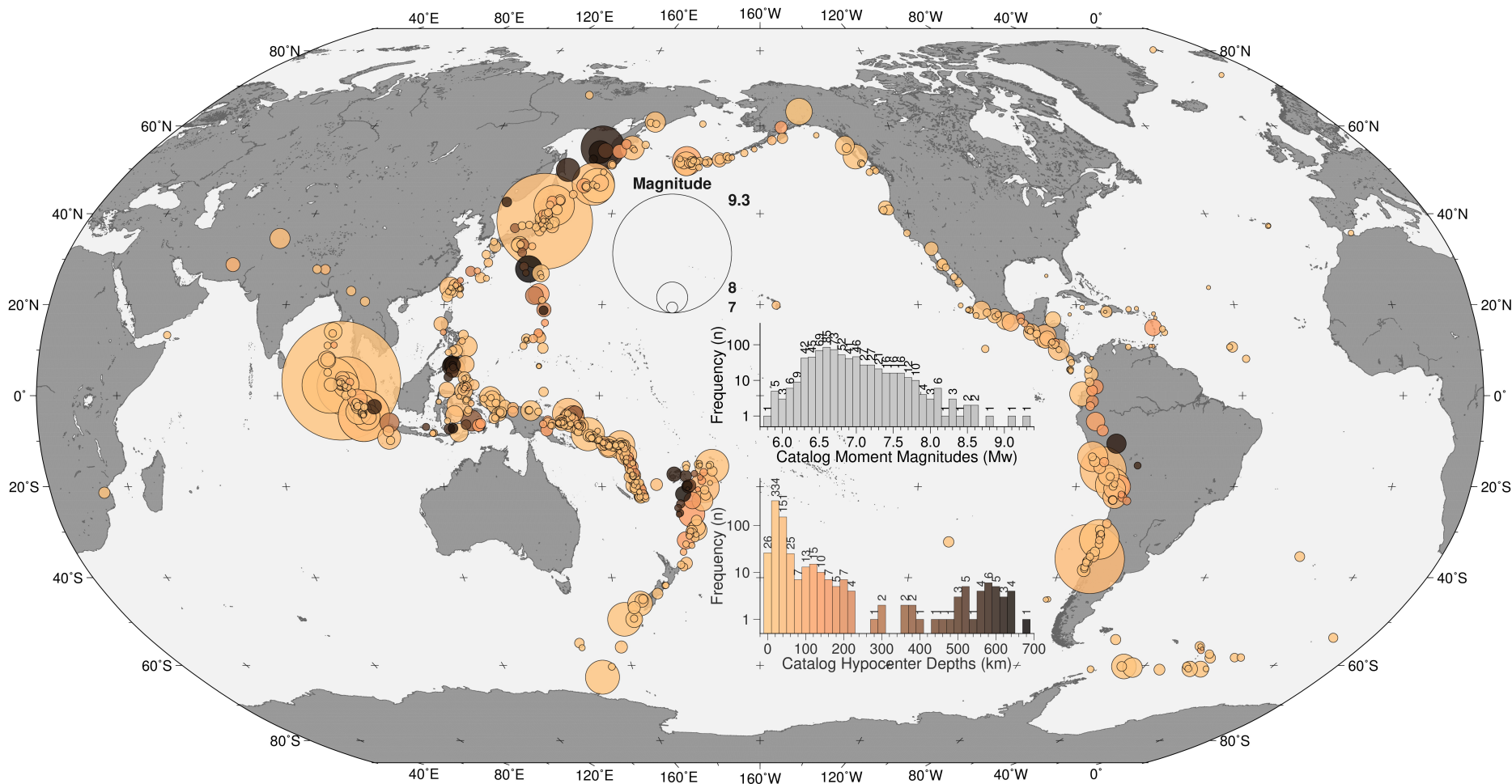
- Tide gauges
- DARTs

## Tsunami Message Generation and Dissemination

- AFTN, GTS, email, FAX
- Social media (Facebook, Twitter, YouTube)

# Tsunami Message Statistics (1998~04/2016)

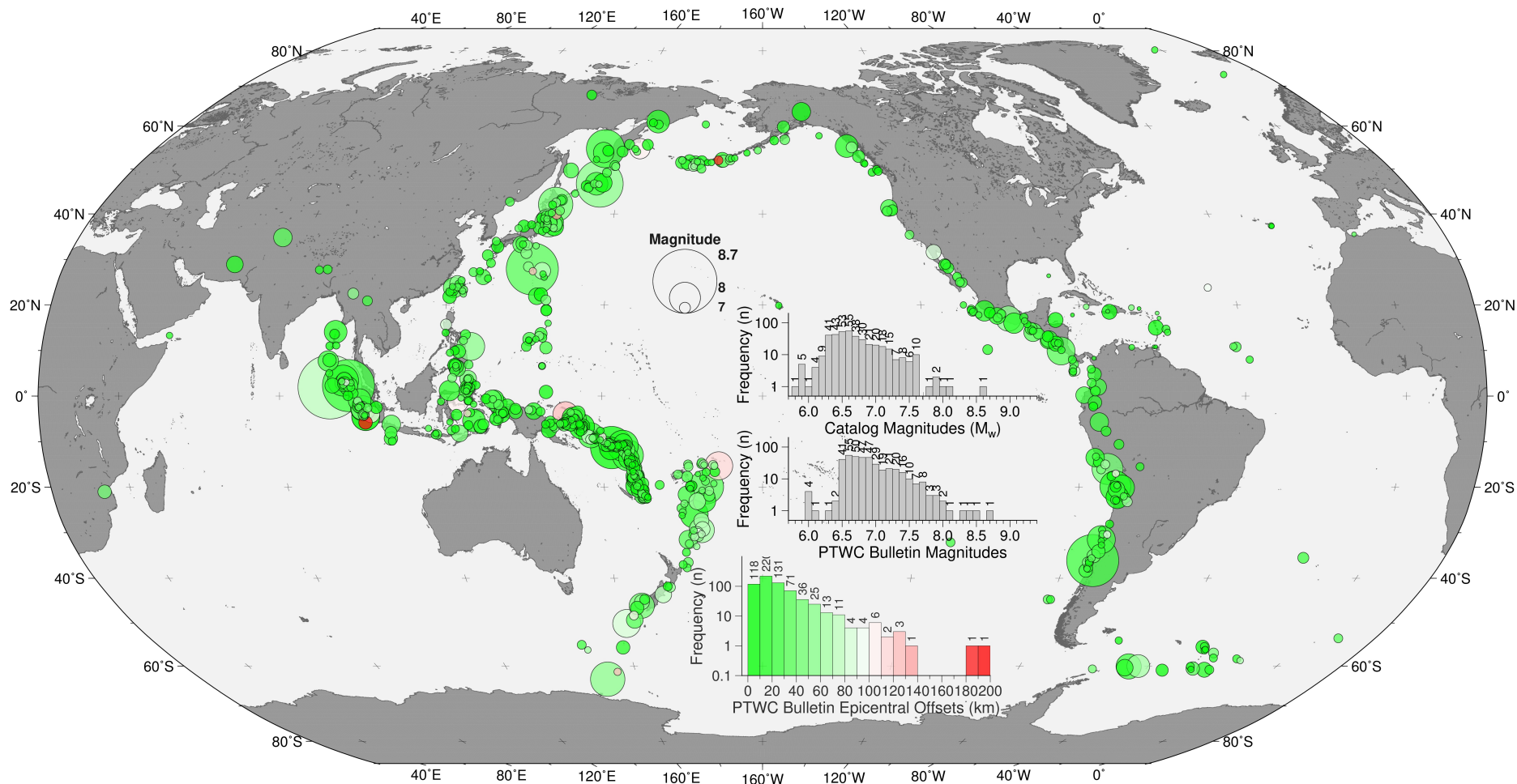
## Tsunami Bulletins for 647 Earthquakes (NEIC/GCMT)





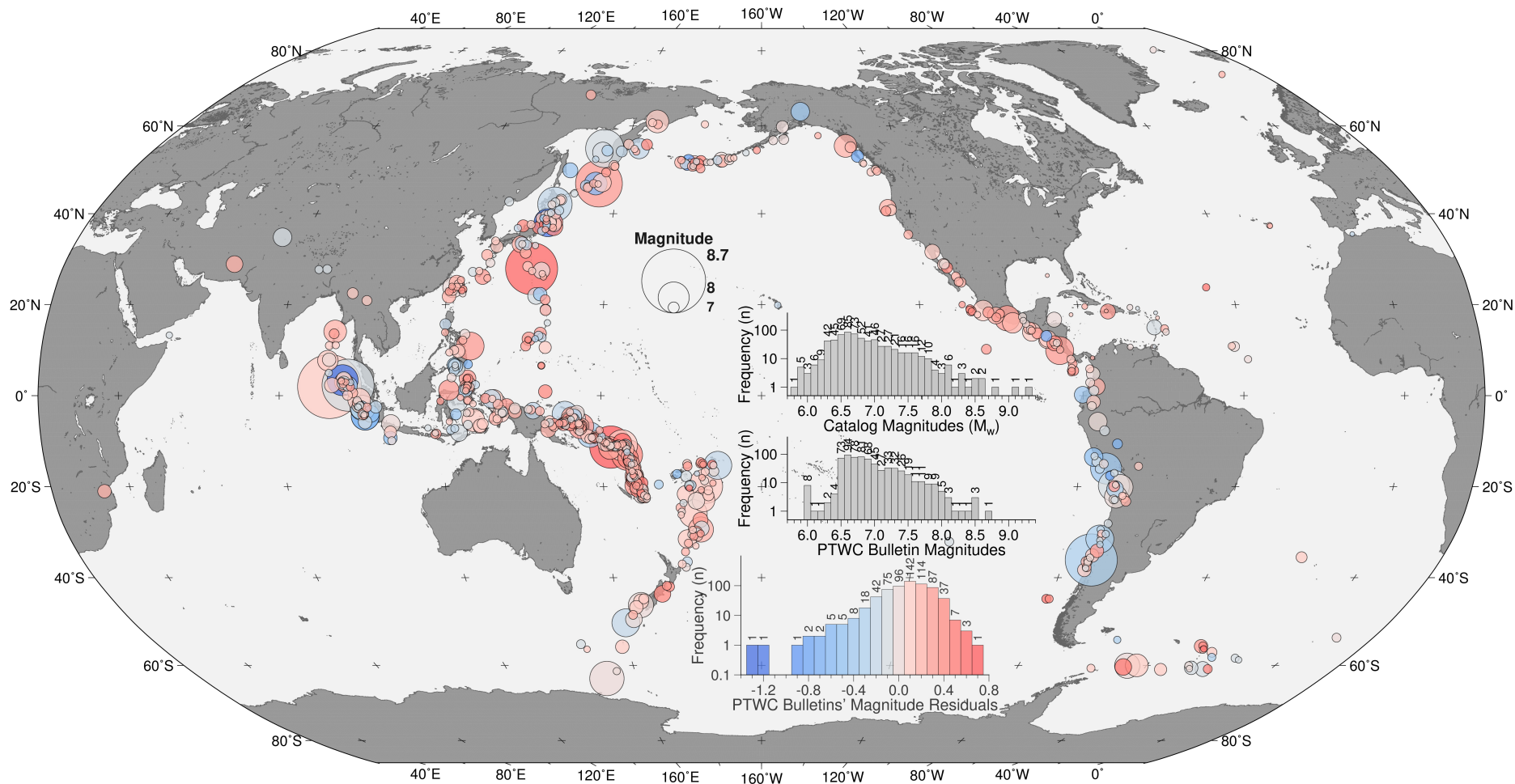
# Tsunami Message Statistics (1998~04/2016)

## Epicentral Offsets when compared to Catalog (NEIC) Locations



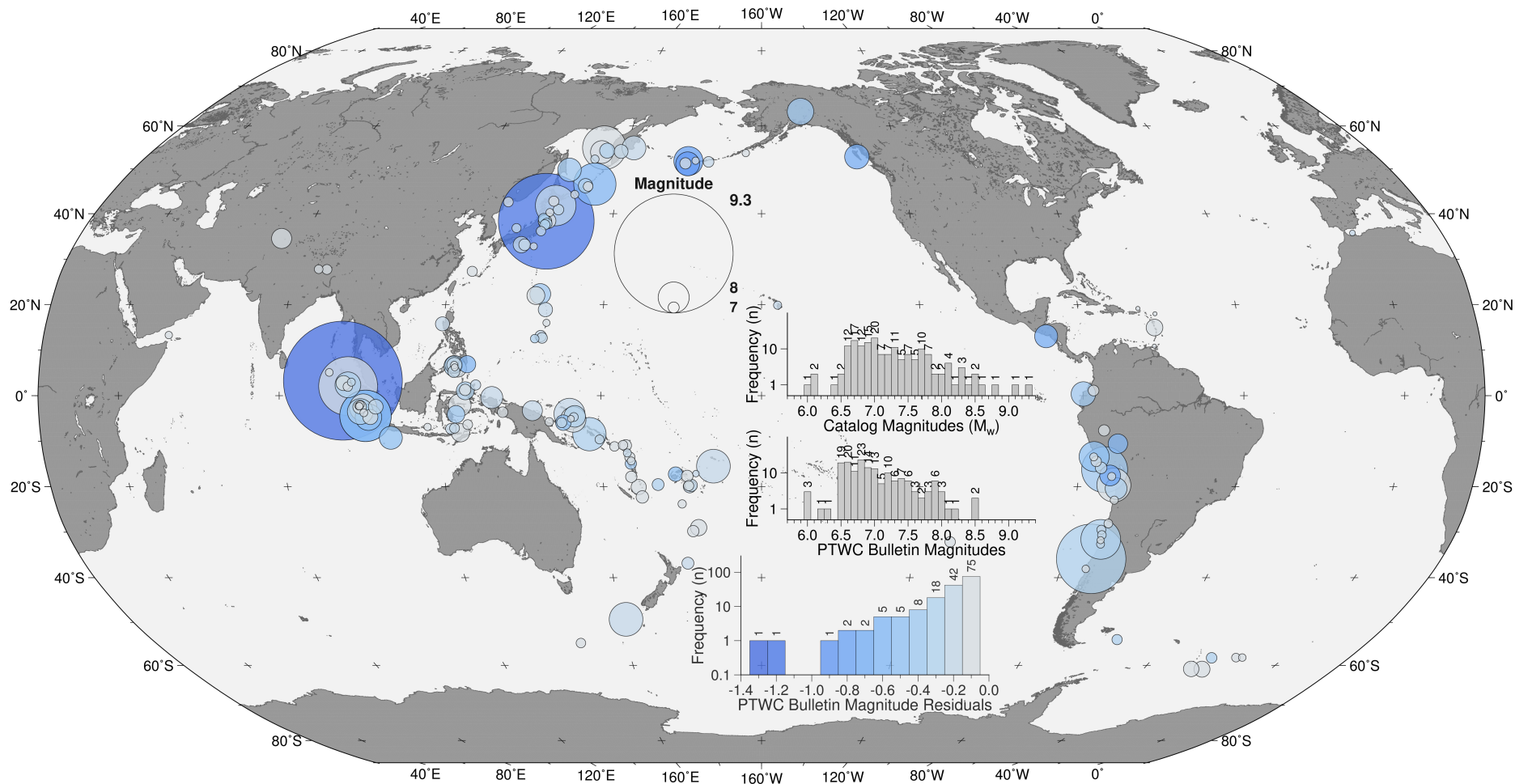
# Tsunami Message Statistics (1998~04/2016)

## Magnitude Offsets when compared to GCMT Mw



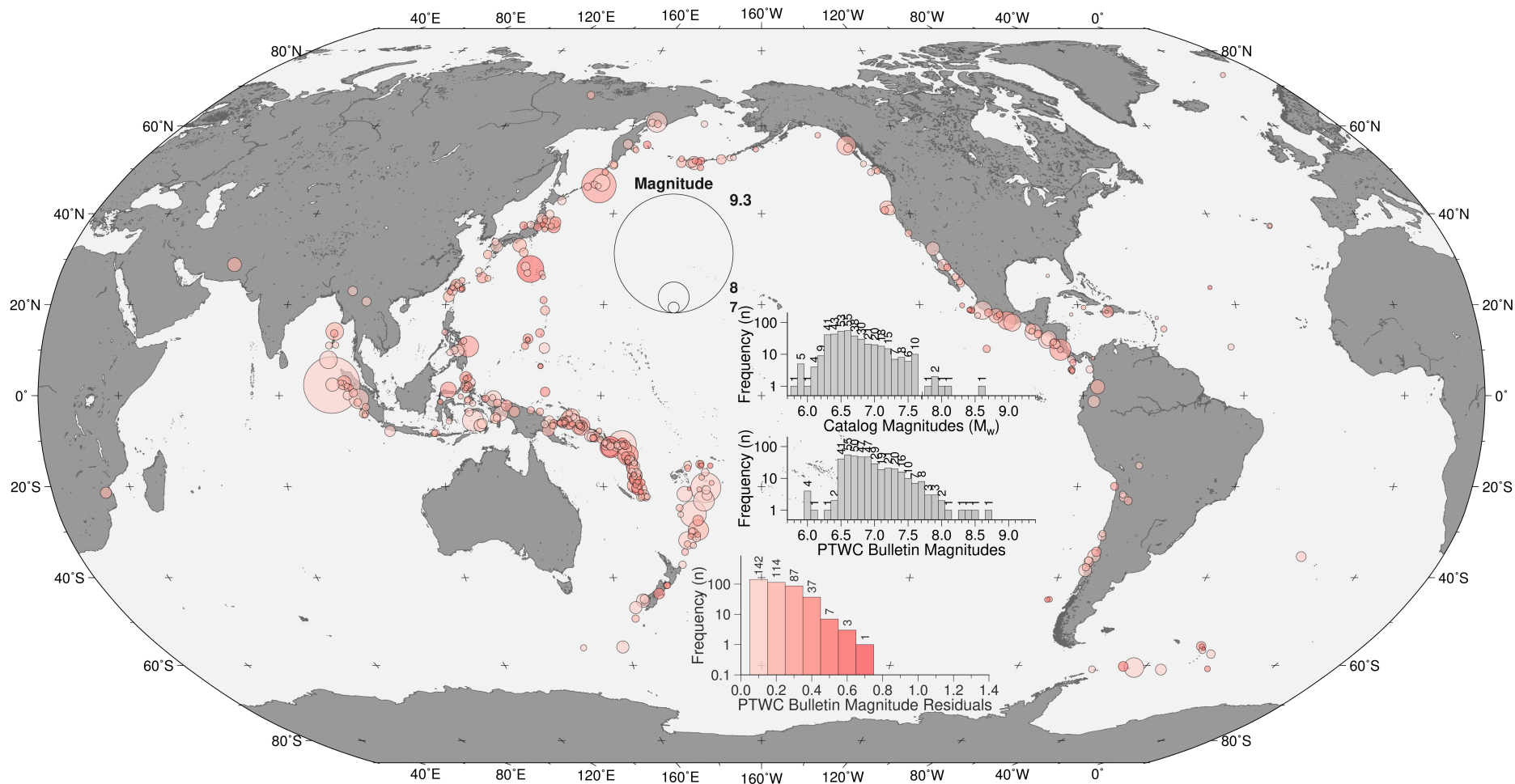
# Tsunami Message Statistics (1998~04/2016)

## Magnitude Underestimations when compared to GCMT Mw



# Tsunami Message Statistics (1998~04/2016)

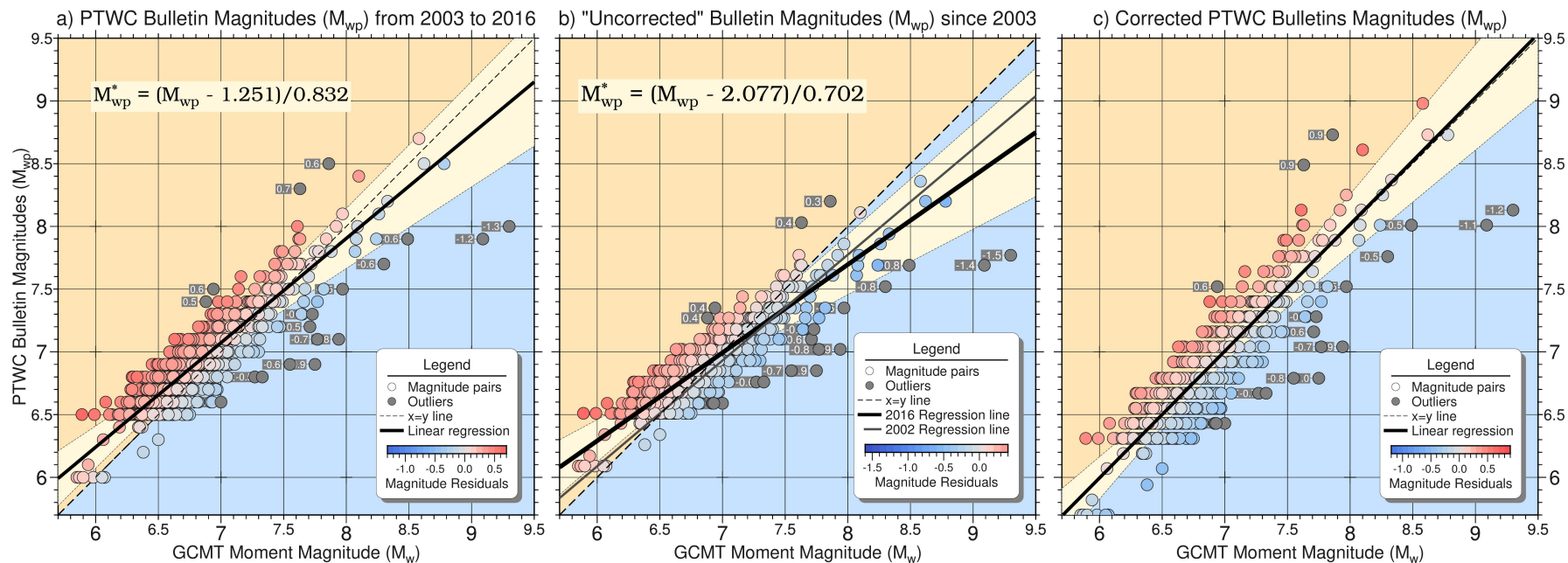
## Magnitude Overestimations when compared to GCMT Mw





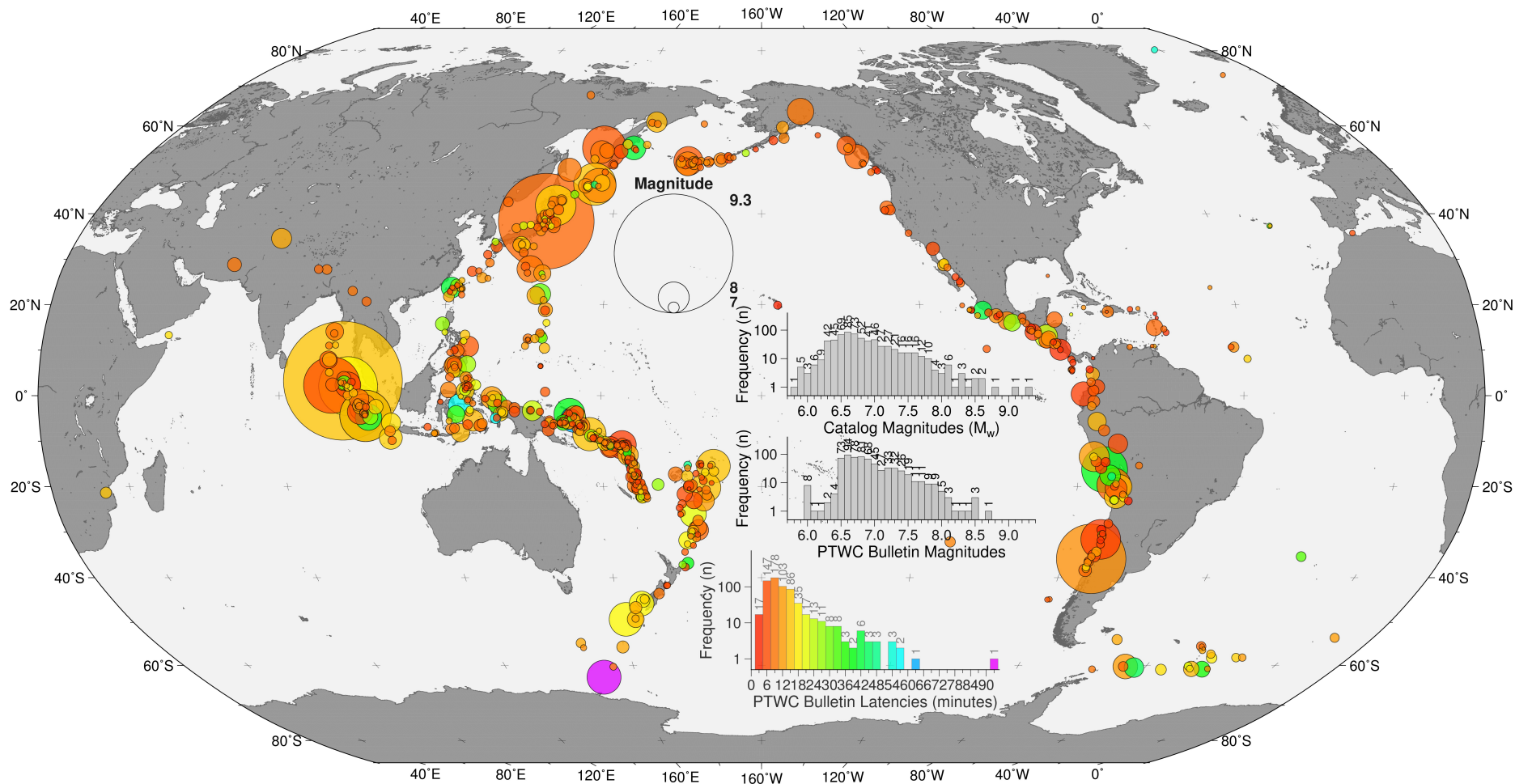
# Tsunami Message Statistics (1998~04/2016)

## PTWC Mwp vs GCMT Mw



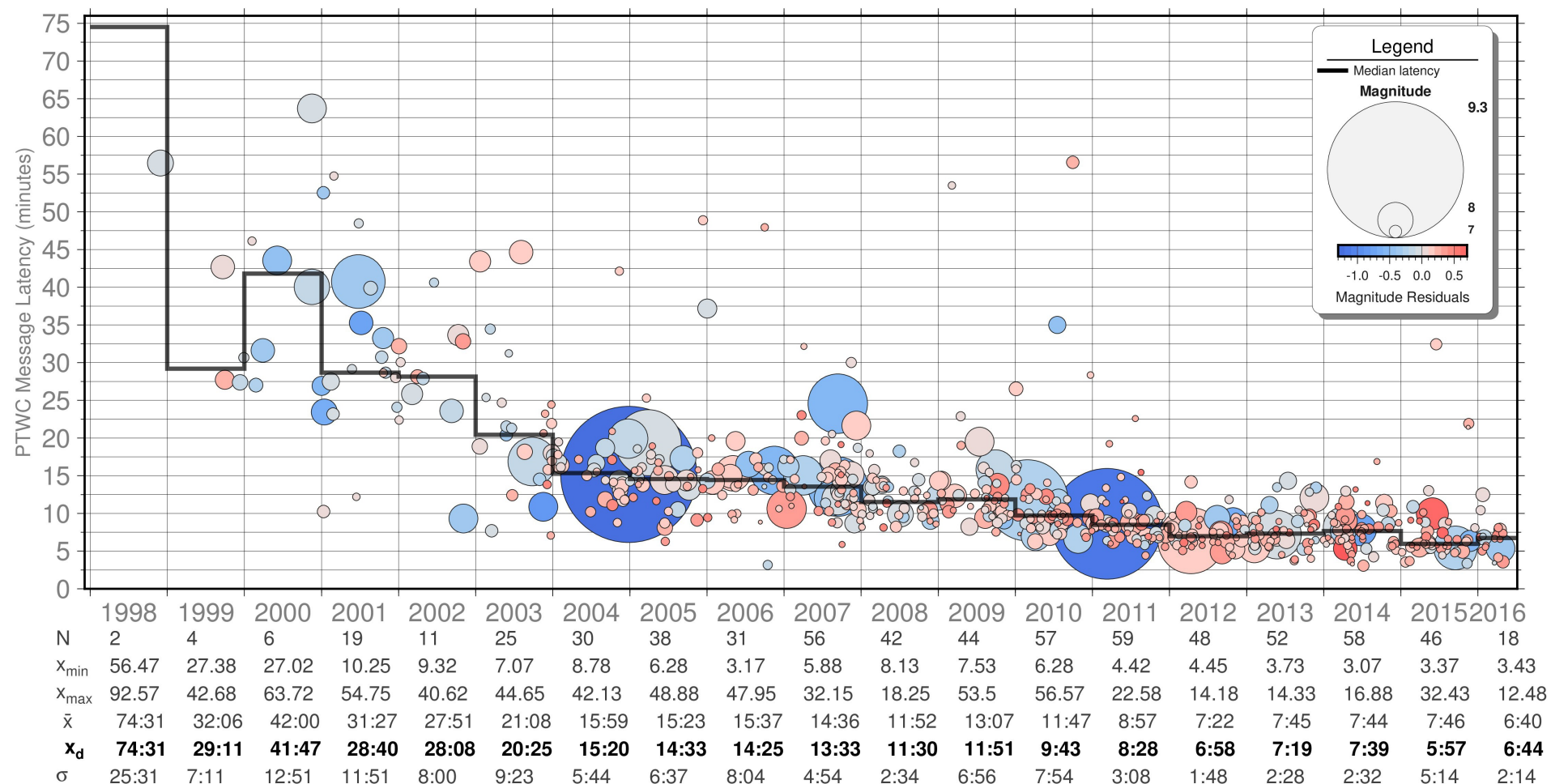
# Tsunami Message Statistics (1998~04/2016)

## Magnitude Overestimations when compared to GCMT Mw



# Tsunami Message Statistics (1998~04/2016)

## PTWC Bulletin Latencies along the Years





U.S. National Oceanic and Atmospheric Administration  
National Weather Service  
Pacific Tsunami Warning Center, Honolulu, Hawaii



# Thank you

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Antelope Users's Group Meeting, Fairbanks, Alaska, August 17<sup>th</sup>, 2016