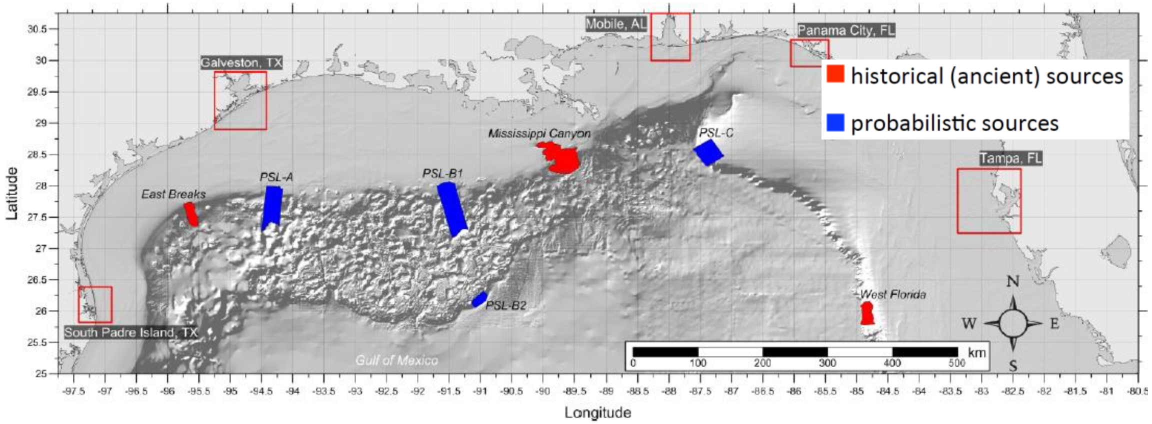
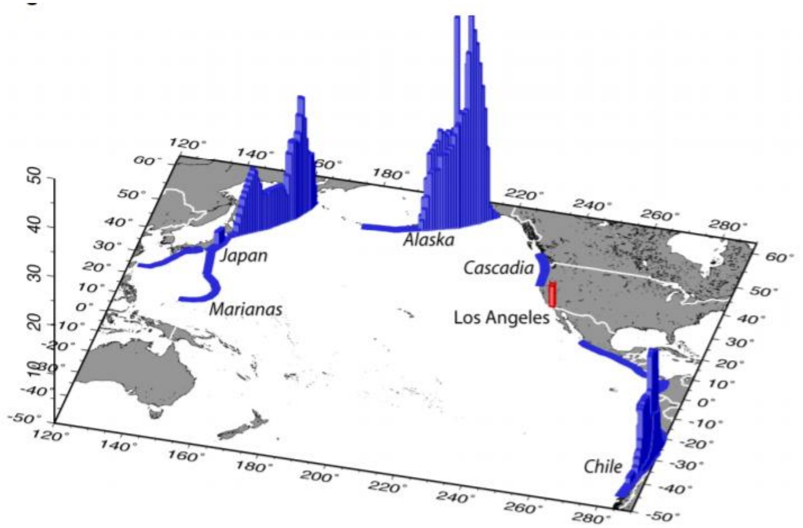
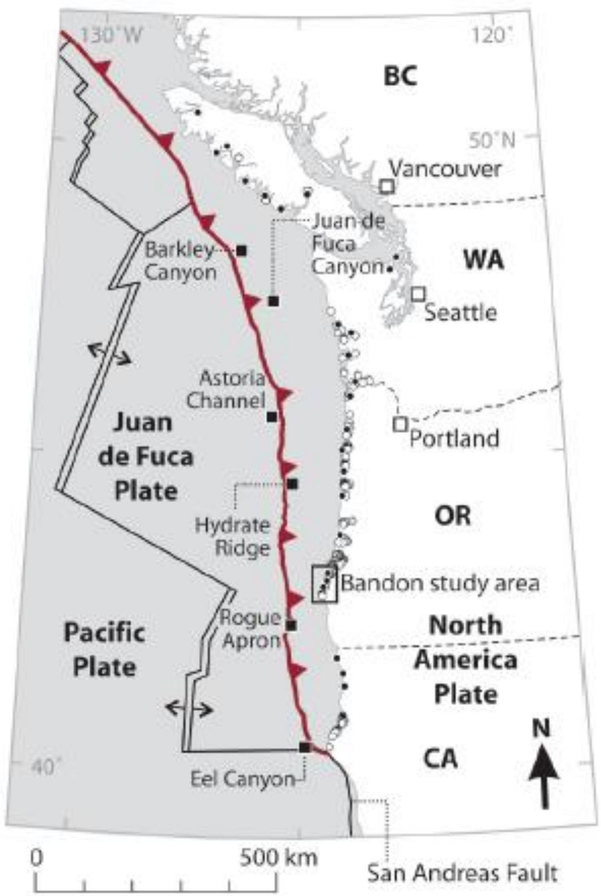
Tsunami Source Characterization – Database/Spreadsheet NTHMP MMS Project

Rick Wilson, California Geological Survey







What is needed to develop a tsunami hazard map?

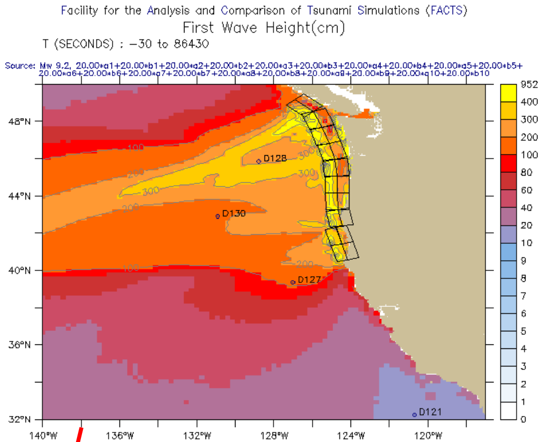
- **NTHMP Inundation Map Guidance (circa 2011, updated 2016)**
- **Evaluation of potential tsunami events**
  - Historical documents and post-tsunami field work
  - Paleoseismic and paleotsunami deposit data (states, NCEI, others)
  - Tsunami event and deposit databases (states, NCEI, others)
- **Numerical models - NTHMP benchmarking and related workshops**
  - Inundation modeling
  - Current velocity modeling
  - Landslide modeling
- **Bathymetric/Topographic grids for modeling**
  - High-res coastal Lidar and offshore geophysical data
  - DEMs developed by states and NCEI (~10m)
- **<u>Scenario source development and characterization</u>**
  - **States and NOAA/PMEL develop sources independently**
  - **Potential questions about accuracy and consistency**
  - **Inconsistent scenario recurrence intervals: 1000yrs to 10,000yrs**

Tsunami Source Characterization

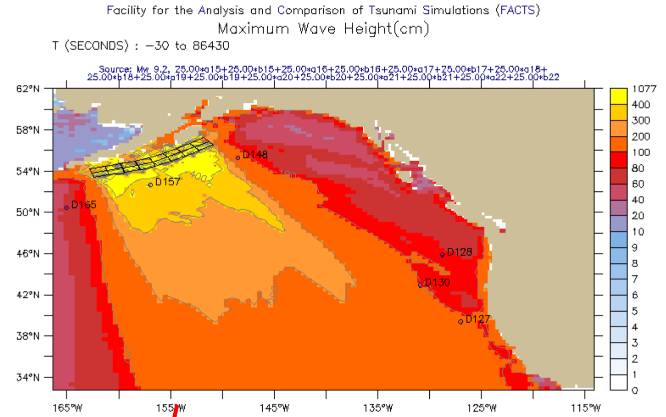
- **Consistency…**
  - By each user at state and federal level
  - Between all NTHMP member states and federal program (“across state lines”)
- **Methods of characterizing/comparison of sources and individual parameters**
  - Database/spreadsheet
  - Source references and images
  - GIS/KMLs
  - Dynamic models (deformation and/or landslides)
- **Collection of existing sources for comparison (this presentation)**
  - Various source types: subduction zones, crustal faults, and landslides
  - Simple spreadsheet: magnitude, slip, location, subfault units/methods, reference(s)
  - Simple images/GIS

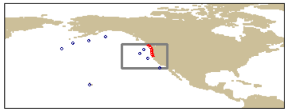
Subduction Zone - Source Name	Mw	L (km)	W (km)	Average Slip (m)	Maximum Slip (m)	Minimum Slip (m)	dip (deg)	rake (deg)	strike (deg)	depth(km)

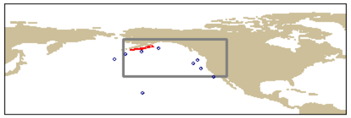
Segment start pos (Lat/Long)	Segment end pos (Lat/Long)	Sub-Fault Segment Sources	Sub-Fault Segments	Max Pos IC (m)	Max Neg IC (m)



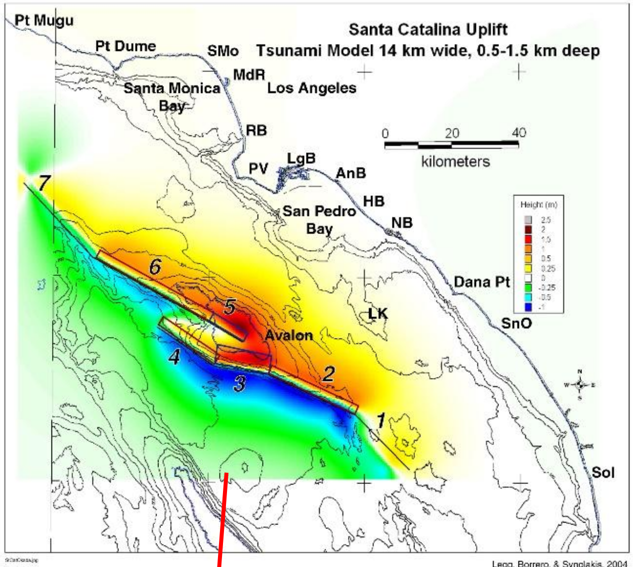
California Subduction Zone Sources





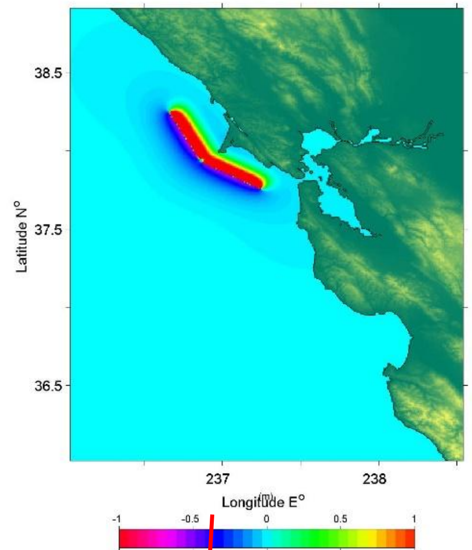


Subduction Zone - Source Name	Mw	L (km)	W (km)	Average Slip (m)	Maximum Slip (m)	Minimum Slip (m)	dip (deg)	rake (deg)	strike (deg)	depth(km)	Segment start pos (Lat/Long)	Segment end pos (Lat/Long)	Sub-Fault Segment Sources	Sub-Fault Segments	Max Pos IC (m)	Max Neg IC (m)	
Cascadia N - Juan de Fuca Segments	8.95	800	100	10	11	8	n/a	90	n/a	5			NOAA FACTS Segments	AB:1-8			
Cascadia L - Full Rupture+Little Salmon	9.02	1040	100	10	11	7	n/a	90		5			NOAA FACTS Segments	AB:1-10			USC (2009); Uslu et al (2007)
Segment 1		800	100	11	11	11	15	90	n/a	5			NOAA FACTS Segments				USC (2009); Uslu et al (2007)
Segment 2		240	100	7	7	7	10	90	n/a	5			NOAA FACTS Segments				USC (2009); Uslu et al (2007)
Cascadia SP1 - Gorda-Little Salmon 1	8.48	720	36.7	5.3	8	4	10	90		6.67			NOAA FACTS Segments	AB: 9+LSF			USC (2009); Uslu et al (2007)
Segment 1		150	30	4	4	4	10	90	350	5			NOAA FACTS Segments				USC (2009); Uslu et al (2007)
Segment 2		150	10	4	4	4	30	90	350	5			NOAA FACTS Segments				USC (2009); Uslu et al (2007)
Segment 3		150	70	8	8	8	10	90	350	10			NOAA FACTS Segments				USC (2009); Uslu et al (2007)
Segment 4		90	30	4	4	4	10	90	340	5			NOAA FACTS Segments				USC (2009); Uslu et al (2007)
Segment 5		90	70	8	8	8	8	90	340	10			NOAA FACTS Segments				USC (2009); Uslu et al (2007)
Segment 6		90	10	4	4	4	20	90	310	5			NOAA FACTS Segments				USC (2009); Uslu et al (2007)
Cascadia SP2 - Gorda-Little Salmon 2	8.5	420	52.5	6	8	4	10	90		6.25			NOAA FACTS Segments	AB: 9+LSF			USC (2009); Borrero et al (2006)
Segment 1		150	100	8	8	8	10	90	350	5			NOAA FACTS Segments				USC (2009); Borrero et al (2006)
Segment 2		90	30	4	4	4	10	90	340	5			NOAA FACTS Segments				USC (2009); Borrero et al (2006)
Segment 3		90	70	8	8	8	10	90	340	10			NOAA FACTS Segments				USC (2009); Borrero et al (2006)
Segment 4		90	10	4	4	4	20	90	310	5			NOAA FACTS Segments				USC (2009); Borrero et al (2006)
Cascadia SN - Gorda Segment Narrow	8.44	240	80	8	8	8	10	90		5			NOAA FACTS Segments	AB: 9-10			USC (2009); Borrero et al (2006)
Segment 1		150	80	8	8	8	10	90	350	5			NOAA FACTS Segments				USC (2009); Borrero et al (2006)
Segment 2		90	80	8	8	8	10	90	340	5			NOAA FACTS Segments				USC (2009); Borrero et al (2006)
Cascadia SW - Gorda Segment Wide	8.51	240	100	8	8	8	10	90		5			NOAA FACTS Segments	AB: 9-10			USC (2009); Borrero et al (2006)
Segment 1		150	100	8	8	8	10	90	350	5			NOAA FACTS Segments				USC (2009); Borrero et al (2006)
Segment 2		90	100	8	8	8	10	90	340	5			NOAA FACTS Segments				USC (2009); Borrero et al (2006)
Alaska 1964	9.26	700	500	15	20	10	9.5	n/a	n/a	10			NOAA FACTS Segments	ABxyz: 21-28			USC (2009); Borrero et al (2006)
Segment 1		400	200	10	10	10	10	90	218	5			NOAA FACTS Segments				USC (2009); Borrero et al (2006)
Segment 2		300	300	20	20	20	9	75	241	15			NOAA FACTS Segments				USC (2009); Borrero et al (2006)
Central Aleutians I	8.9	600	100	10	10	10	15	90	n/a	5			NOAA FACTS Segments	AB: 17-22			USC (2009); Borrero et al (2006)
Central Aleutians II	8.9	600	100	10	10	10	15	90	n/a	5			NOAA FACTS Segments	[illegible]			USC (2009); Borrero et al (2006)
Central Aleutians III	9.2	800	100	25	25	25	15	90	n/a	5			NOAA FACTS Segments	AB: 15-22			USC (2009); Borrero et al (2006)
Chile 1960	9.5	1000	100	20	20	20	15	90	n/a	5			NOAA FACTS Segments	AB: 37-47?			USC (2009); Borrero et al (2006)
Chile North	9.4	1400	100	25	25	25	15	90	n/a	5			NOAA FACTS Segments	AB: 18-31			USC (2009); Borrero et al (2006)
Japan II	8.8	400	100	10	10	10	15	90	n/a	5			NOAA FACTS Segments	AB: 23-31			USC (2009); Borrero et al (2006)
Kuril Islands II	8.8	400	100	10	10	10	15	90	n/a	5			NOAA FACTS Segments	AB: 7-10			USC (2009); Borrero et al (2006)
Kuril Islands III	8.8	400	100	10	10	10	15	90	n/a	5			NOAA FACTS Segments	AB: 11-14			USC (2009); Borrero et al (2006)
Kuril Islands IV	8.8	400	100	10	10	10	15	90	n/a	5			NOAA FACTS Segments	AB: 15-18			USC (2009); Borrero et al (2006)
Mariana Trench M8.6	8.6	500	100	5	5	5	n/a	n/a	n/a	5			NOAA FACTS Segments	n/a			USC (2009); Borrero et al (2006)
Mariana Trench M8.8	8.8	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a			NOAA FACTS Segments	n/a			USC (2009); Borrero et al (2006)



California

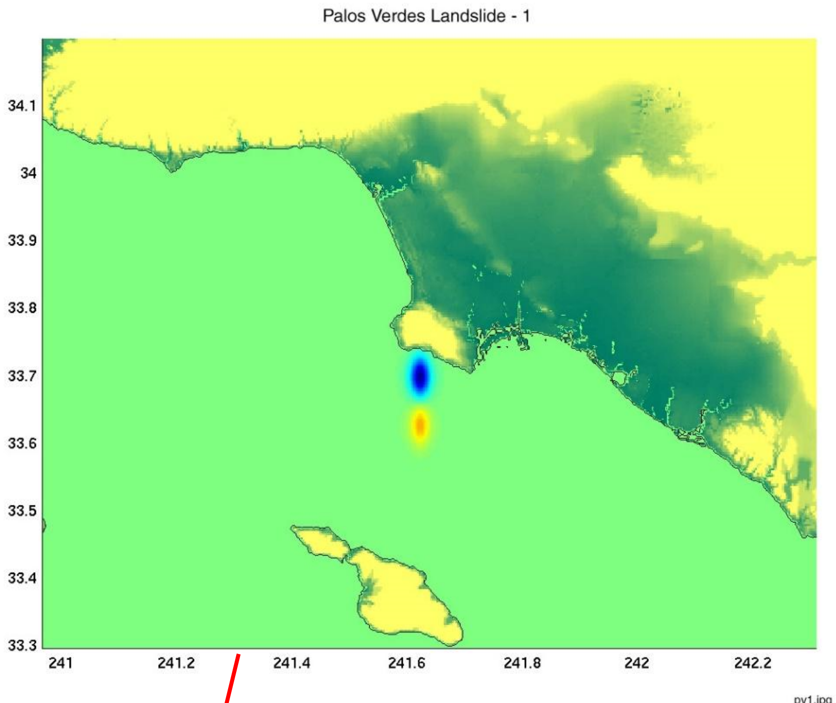
Crustal Fault Sources

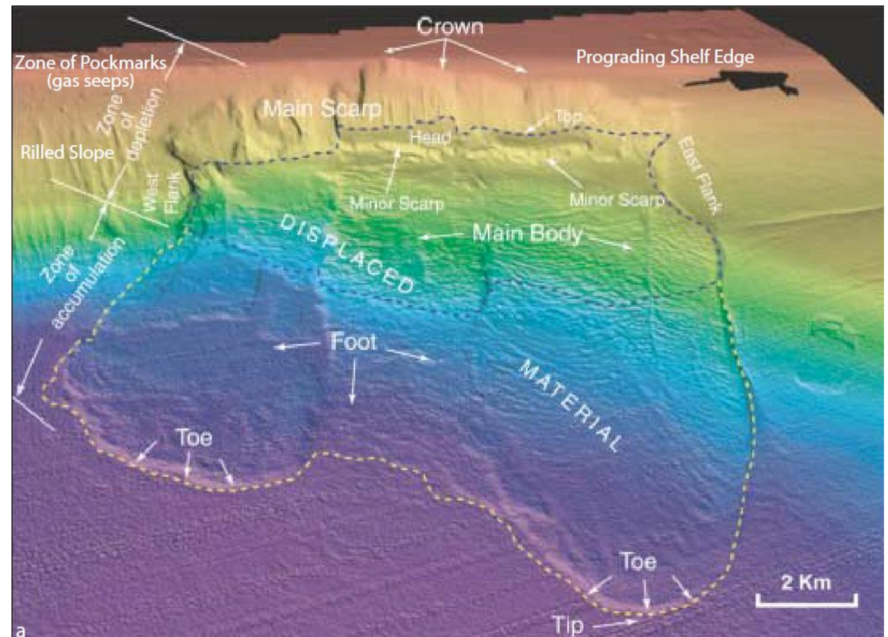


Fault or Event (in light brown) Name	Mw	Fault Length (km)	Fault Width (km)	Average Slip (m)	Maximum Slip (m)	Minimum Slip (m)	Fault Dip (deg)	Fault Rake (deg)	Fault Strike (deg)	Focal Depth(km)	Segment start pos	Segment end pos	Max Pos IC (m)	Max Neg IC (m)	References
1927 Point Arguello Earthquake	7	28	14	2.5	2.5	2.5	66	95	340	3	N34.232, W120.848	N34.468, W120.952	1.06	-0.35	Satake and Somerville (1992)
Anacapa-Dume Fault	7.15	40	18	2.5	2.5	2.5	55	90	270	5	N34.030, W118.653	N34.030, W119.087	1.06	-0.19	Legg (personal commun. 2007)
Catalina Fault	7.66	164	14	4.46	6.4	4	n/a	n/a	n/a	n/a			2.17	-1.17	Legg et al (2004), Borrero et al (2004)
Segment 1		21.9	14	4	4	4	89	172.9	313	0.5	N33.032, W117.857	N33.166, W118.029	0.47	-0.45	Legg et al (2004), Borrero et al (2004)
Segment 2		28.2	14	5	5	5	85	143.1	293	1	N33.166, W118.030	N33.265, W118.309	1.32	-1.07	Legg et al (2004), Borrero et al (2004)
Segment 3		16.1	14.9	4.8	4.8	4.8	70	123.7	277	1	N33.263, W118.310	N33.281, W118.482	2.05	-0.89	Legg et al (2004), Borrero et al (2004)
Segment 4		20.2	14	3.6	3.6	3.6	80	146.3	303	1	N33.279, W118.482	N33.378, W118.665	0.96	-0.62	Legg et al (2004), Borrero et al (2004)
Segment 5		8.1	14	6.4	6.4	6.4	80	149	300	1.5	N33.343, W118.397	N33.379, W118.473	1.33	-0.8	Legg et al (2004), Borrero et al (2004)
Segment 6		40.2	14	4.5	4.5	4.5	80	153.4	297	1	N33.378, W118.473	N33.542, W118.860	1.05	-0.65	Legg et al (2004), Borrero et al (2004)
Segment 7		29.7	14	4.1	4.1	4.1	89	166	315	0.5	N33.535, W118.863	N33.724, W119.090	0.62	-0.57	Legg et al (2004), Borrero et al (2004)
Catalina Thrust Fault															
Channel Islands Thrust Fault	7.5	56	34	3.6	3.6	3.6	20	90	280	17	N34.256,W119.200	N34.343, W119.800	1.11	-0.32	Borrero, Dolan & Synolakis (2001)
Coronado Bank Fault	7.34														Barberopoulou et al (2008)
Segment 1		39.56	10	2.4	2.4	2.4	80	153.4	328.3	0.5					Barberopoulou et al (2008)
Segment 2		24.55	10	4.2	4.2	4.2	80	135	327.6	0.5					Barberopoulou et al (2008)
Segment 3		29.66	10	2.8	2.8	2.8	80	135	337	0.5					Barberopoulou et al (2008)
Palos Verdes, Lasuen Knoll Fault	7	26.7	12.5	3.25	3.25	3.25	n/a	n/a	n/a	0.5			1.74	-1.2	Borrero et al (2004)
Segment 1		8.8	12.8	1.5	1.5	1.5	70	135	290	0.5	N33.351, W117.816	N33.379, W117.905	0.58	-0.25	Borrero et al (2004)
Segment 2		7.9	12.2	3	3	3	80	135	318	0.5	N33.354, W117.907	N33.396, W117.973	1	-0.66	Borrero et al (2004)
Segment 3		10	12.2	5	5	5	80	135	316	0.5	N33.387, W117.968	N33.443, W118.052	1.72	-1.14	Borrero et al (2004)
Newport Inglewood Fault	7	30	8	4	4	4	70	10	315	10	N33.605, W118.085	N33.795, W118.315	0.23	-0.12	Borrero et al (2001)
Point Reyes Thrust Fault	7.3	77	12	3.4	3.4	3.4	50	90?		0.38					Ryan et al (2008)
Segment 1		42		3.4	3.4	3.4	50		333		N38.032, W123.008	N38.348, W123.213			Ryan et al (2008)
Segment 2		35		3.4	3.4	3.4	50		300		N37.865, W122.655	N38.026, W123.034			Ryan et al (2008)
Hayward-Rodgers Creek Fault	6.81	10	18	1.5	1.5	1.5	70	-90	40	5	N38.006, W122.407	N38.074, W122.333	0.12	[illegible]	Borrero et al (2006)?
San Clemente Fault Bend Region		97	10	2.2	2.2	2.2							2.2	-0.5	Legg and Borrero (2001)
shallow (surface)		30	8				70	162	305	7.6					Legg and Borrero (2001)
deep (blind)		25	14				48	134	270	16					Legg and Borrero (2001)
San Clemente Island Fault	7.54	30	8	8	8	8	70	162	305	7.6	N33.077, W118.582	N21.923, W118.318	2.03	-0.71	Borrero?
San Gregorio Fault	7.1	50	15	2	2	2	60	90	320	5	N37.628, W122.397	N37.972, W122.763	0.78	-0.19	Borrero et al (2006)?
San Mateo Thrust	7.1	27.75	12	4	4	4				0.5			2.43	-0.32	Borrero et al (2004)
Segment 1		5.5	12	4	4	4	45	120	293	0.5	N33.212, W117.552	N33.228, W117.608	2.02	-0.18	Borrero et al (2004)
Segment 2		11.4	12	4	4	4	45	120	322	0.5	N33.212, W117.599	N33.288, W117.681	2.1	-0.25	Borrero et al (2004)
Segment 3		15	12	4	4	4	45	120	350	0.5	N33.279, W117.688	N33.361, W117.752	2.21	-0.24	Borrero et al (2004)
Santa Monica Bay Fault	7.14	40	18	2.4	2.4	2.4	55	90	260	15	N34.106, W118.376	N34.044, W118.804	0.54	-0.07	

California

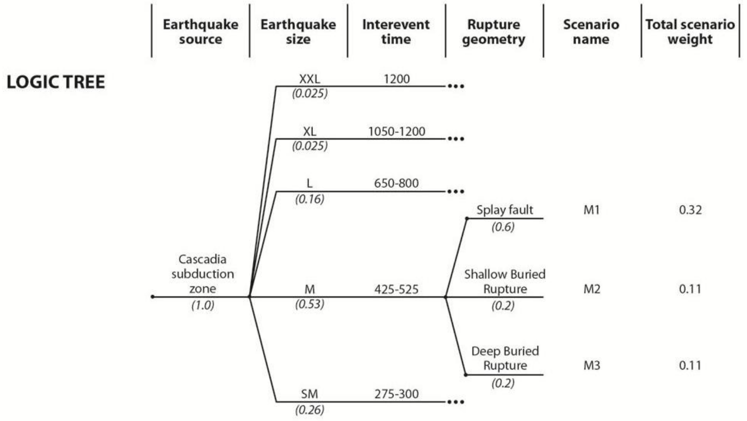
Landslide Sources





Landslide Source Name	Slide mass area	Slide mass volume	Depth to top of slide	Vert displace distance	Center Latitude	Center Longitude	Max Pos Initial Conditions (m)	Max Neg Initial Conditions (m)	LS Peak (m)	LS Trough (m)	References
Goleta Landslide Case 1							3	-7	6	-18	Greene et al (2006)
Goleta Landslide Case 2							3	-7	6	-18	Greene et al (2006)
Monterey Canyon Landslide									2	-4	Barberopoulou et al (2009)
Palos Verdes Landslide 1									3	-7	Barberopoulou et al (2009)
Palos Verdes Landslide 2									3	-7	Barberopoulou et al (2009)

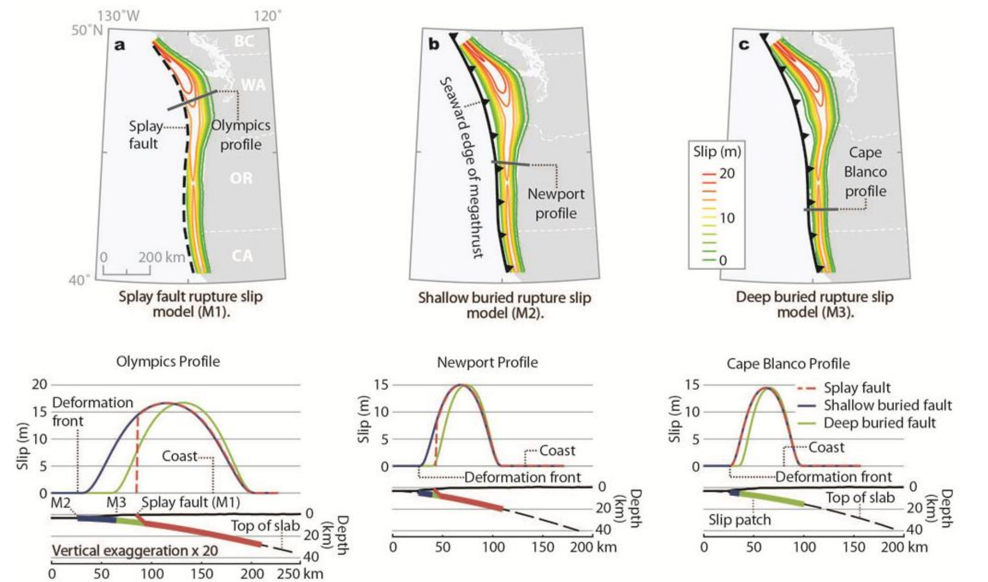
Oregon
Subduction Zone Sources



Cascadia earthquake source parameters used to define 15 rupture scenarios. Logic tree branch weights shown in parentheses. Total scenario weight listed in right column.

Earthquake Size	Interevent Time (yrs)	Fault Geometry	Slip Range (m) Maximum	Slip Range (m) Average	M_w	Scenario Name	Total Weight
Extra Extra Large (0.025)	1,200	Splay fault (0.8)	36–44	18–22	~9.1	XXL 1	0.02
		Shallow buried rupture (0.1)	36–44	18–22	~9.2	XXL 2	0.0025
		Deep buried rupture (0.1)	36–44	18–22	~9.1	XXL 3	0.0025
Extra Large (0.025)	1,050–1,200	Splay fault (0.8)	35–44	17–22	~9.1	XXL 1	0.02
		Shallow buried rupture (0.1)	35–44	17–22	~9.2	XXL 2	0.0025
		Deep buried rupture (0.1)	35–44	17–22	~9.1	XXL 3	0.0025
Large (0.16)	650–800	Splay fault (0.8)	22–30	11–15	~9.0	L 1	0.128
		Shallow buried rupture (0.1)	22–30	11–15	~9.1	L 2	0.016
		Deep buried rupture (0.1)	22–30	11–15	~9.0	L 3	0.016
Medium (0.53)	425–525	Splay fault (0.6)	14–19	7–9	~8.9	M 1	0.318*
		Shallow buried rupture (0.2)	14–19	7–9	~9.0	M 2	0.106
		Deep buried rupture (0.2)	14–19	7–9	~8.9	M 3	0.106
Small (0.26)	275–300	Splay fault (0.4)	9–11	4–5	~8.7	S 1	0.104
		Shallow buried rupture (0.3)	9–11	4–5	~8.8	S 2	0.078
		Deep buried rupture (0.3)	9–11	4–5	~8.7	S 3	0.078

*Scenario M1 carries the highest weight and represents the "most likely" event in our analysis.



Figures from Witter et al, 2011

Subduction Zone - Source Name	Mw	L (km)	W (km)	Average Slip (m)	Maximum Slip (m)	Minimum Slip (m)	dip (deg)	rake (deg)	strike (deg)	depth(km)	Segment start pos (Lat/Long)	Segment end pos (Lat/Long)	Sub-Fault Segment Sources	Sub-Fault Segments	Max Pos IC (m)	Max Neg IC (m)	
Cascadia XXL1 - Full rupture/splay fau	9.1	1000	83	20	41		**	**	**	<20	N40.0, W124.470	N48.381, W126.005	Goldfinger et al. (2012)				Witter et al. (2011); Priest et al. (2013)
Cascadia XL1 - Full rupture/splay fault	9.1	1000	83	20	41		**	**	**	<20	N40.0, W124.470	N48.381, W126.005	Goldfinger et al. (2012)				Witter et al. (2011); Priest et al. (2013)
Cascadia L1 - Full rupture/splay fault	9	1000	83	13	27		**	**	**	<20	N40.0, W124.470	N48.381, W126.005	Goldfinger et al. (2012)				Witter et al. (2011); Priest et al. (2013)
Cascadia M1 - Full rupture/splay fault	8.9	1000	83	9	18		**	**	**	<20	N40.0, W124.470	N48.381, W126.005	Goldfinger et al. (2012)				Witter et al. (2011); Priest et al. (2013)
Cascadia SM1 - Full rupture/splay faul	8.7	1000	83	5	10		**	**	**	<20	N40.0, W124.470	N48.381, W126.005	Goldfinger et al. (2012)				Witter et al. (2011); Priest et al. (2013)
AK64	9.2	650	280	8.6	22.1		**	**	**		N59.997 W145.583	N54.527, W160.807	Gonzalez et al. (2006)				Witter et al. (2011); Priest et al. (2013)
AKMAX	9.2	600	100		30		**	**	**		N59.997 W145.583	N54.527, W160.807	Gonzalez et al. (2006)				Witter et al. (2011); Priest et al. (2013)

Notes:

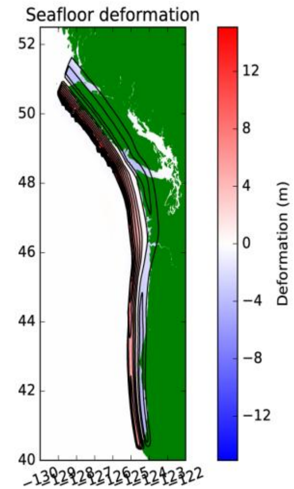
Oregon's CSZ simulations reflect three models of earthquake deformation: splay (1), shallow buried (2), deep buried (3) rupture.

** variable

Witter, R. et al., 2011. Simulating tsunami inundation at Bandon, Coos County, Oregon, using hypothetical Cascadia and Alaska earthquake scenarios. Special Paper 43, Oregon Department of Geology and Mineral Industries, Portland, Oregon.
Priest, G.R. et al., 2013. Tsunami inundation scenarios for Oregon. Open file report O-13-19, Oregon Department of Geology and Mineral Industries, Portland, Oregon.
TPSWG, 2006. Seaside, Oregon tsunami pilot study—modernization of FEMA flood hazard maps. NOAA OAR Special Report, NOAA/OAR/PMEL, Seattle, WA, 94 pp.+ 7 appendices.

Washington

Subduction Zone Sources



													SIFT units			nitial Conditions at Surfac			Source Faul
Subduction Z	Mw	L (km)	W (km)	Average Slip (m)	Maximum Slip (m)	Minimum Slip (m)	dip (deg)	rake (deg)	strike (deg)	depth(km)	Segment start pos (Lat/Long)	Segment end pos (Lat/Long)	NOAA SIFT tsunami unit sources*	NOAA FACTS database segments (pre-dates SIFT)	Mean interevent time (yr)	Max Pos IC (m)	Max Neg IC (m)	References (full citation	
XXL1	9.1	1000	83	20	41		n/a	n/a	n/a	n/a			n/a	n/a				Witter et al., 2013	
XXL2	9.2	1000	105	20	41		n/a	n/a	n/a	n/a			n/a	n/a				Witter et al., 2013	
XXL3	9.1	1000	83	20	41		n/a	n/a	n/a	n/a			n/a	n/a				Witter et al., 2013	
XL1	9.1	1000	83	20	41		n/a	n/a	n/a	n/a			n/a	n/a				Witter et al., 2013	
XL2	9.2	1000	105	20	41		n/a	n/a	n/a	n/a			n/a	n/a				Witter et al., 2013	
XL3	9.1	1000	83	20	41		n/a	n/a	n/a	n/a			n/a	n/a				Witter et al., 2013	
L1	9.0	1000	83	13	27		n/a	n/a	n/a	n/a			n/a	n/a				Witter et al., 2013	
L1 north	9.0	1000	83	13	27		n/a	n/a	n/a	n/a			n/a	n/a				Witter et a	Image: L1
L1 north	9.0	1000	83	13	27		n/a	n/a	n/a	n/a			n/a	n/a				Witter et al., 2013	
L2	9.1	1000	105	13	27		n/a	n/a	n/a	n/a			n/a	n/a				Witter et al., 2013	
L3	9.0	1000	83	13	27		n/a	n/a	n/a	n/a			n/a	n/a				Witter et al., 2013	
M1	8.9	1000	83	9	18		n/a	n/a	n/a	n/a			n/a	n/a				Witter et al., 2013	
M2	9.0	1000	105	9	18		n/a	n/a	n/a	n/a			n/a	n/a				Witter et al., 2013	
M3	8.9	1000	83	9	18		n/a	n/a	n/a	n/a			n/a	n/a				Witter et al., 2013	
SM1	8.7	1000	83	5	10		n/a	n/a	n/a	n/a			n/a	n/a				Witter et al., 2013	
SM2	8.8	1000	105	5	10		n/a	n/a	n/a	n/a			n/a	n/a				Witter et al., 2013	
SM3	8.7	1000	83	5	10		n/a	n/a	n/a	n/a			n/a	n/a				Witter et al., 2013	
Cascadia																			
1A	9.1	1050	70	17.5	n/a		n/a	n/a	n/a	n/a			n/a	n/a				Priest et al., 1997	
1A with a	9.1	1050	70	5* at asperi	n/a		n/a	n/a	n/a	n/a			n/a	n/a				Priest et al., 1997	
Alaska-Aleutian																			
AASZ1	9.2	1000	100	17.7	n/a								acsza11-20, acszb11-20	A0-A9 & B0-B9	1313			González et al., 2009	
AASZ2	9.2	1000	100	17.7	n/a								acsza21-30, acszb21-30	A10-A19 & B10-	750				
AASZ3	9.2	600	100	distributed	n/a								acsza31-36, acszb31-36	Distributed sli	750				Image AAS
AASZ4	9.2	1200	100	14.8	n/a								acsza11-22, acszb11-22	A0-A11 & B0-B1	1133				
AASZ5	9.2	1200	100	14.8	n/a								acsza23-34, acszb23-34	A12-A23 & B12-	750				
AASZ6	8.2	300	100	2.1	n/a								acsza28-30, acszb28-30	A17-A19 & B17-	875				
AASZ7	8.2	300	100	2.1	n/a								acsza31-33, acszb31-33	A20-A22 & B20-	661				
AASZ8	8.2	300	100	2.1	n/a								acsza34-36, acszb34-36	A23-A25 & B23-	661				

Washington

Crustal Fault Sources

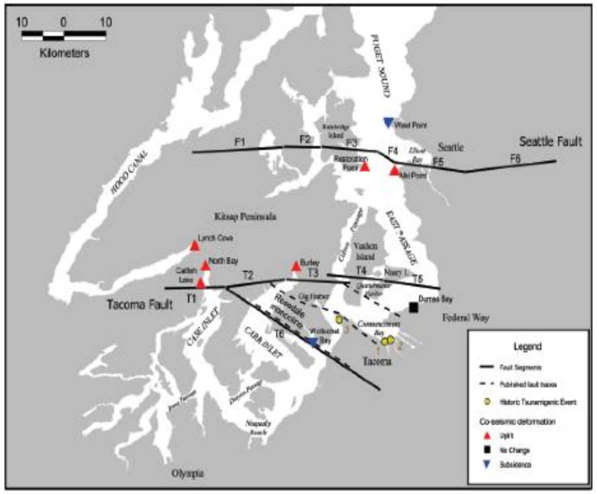


Figure 1: Seattle and Tacoma fault segments used for the study (Brocher *et al.*, 2004). Published fault traces, co-seismic deformation, and known historic tsunami events are also displayed (Sherrod *et al.*, 2004; Johnson *et al.*, 1999, 2004; González *et al.*, 2003; Gardner *et al.*, 2001).

WAv3											MOST models		
Fault	Mw	L (km)	W (km)	Slip (m)	dip (deg)	rake (deg)	strike (deg)	depth(km)	References (full citations below)	Source Fault Reference File (GIS, H	Lat bottom center	Long bottom center	htop(km)
Seattle fault	7.3								Original segments defined by Titov et al., 2003				
Segment 1 (F1 Titov, Venturato, A1 Chamberlin)		15.2	35.0	1.0	60.0	90.0	87.9	0.5	From Titov, with wider fault zone (35 km) by Venturato et al., 2007, Chamberlin et al., 2015		47.4516	237.24898	0.5
Segment 2 (F2 Titov, Venturato, A2 Chamberlin)		6.3	35.0	1.0	60.0	90.0	86.6	0.5			47.455954	237.39723	0.5
Segment 3 (F3 Titov, Venturato, A3 Chamberlin)		8.9	35.0	12.0	60.0	90.0	96.0	0.5			47.454058	237.46001	0.5
Segment 4 (F4 Titov, Venturato, A4 Chamberlin)		3.2	35.0	11.0	60.0	90.0	128.8	0.5			47.474577	237.41401	0.5
Segment 5 (F5 Titov, Venturato, A5 Chamberlin)		11.5	35.0	4.0	60.0	90.0	99.3	0.5			47.424457	237.614811	0.5
Segment 6 (F6 Titov, Venturato, A6 Chamberlin)		14.9	35.0	1.0	60.0	90.0	81.0	0.5			47.4264185	237.868219	0.5
Seattle fault	6.7												
Segment 1 (B1, Chamberlin)		6.3	35.0	2.8	45.0	90.0	86.6	15.0	Chamberlin et al., 2015, using scenario of Seattle Fault Earthquake Scenario Project Team, 2005		47.455954	237.39723	15.0
Segment 2 (B2, Chamberlin)		8.9	35.0	2.8	45.0	90.0	96.0	15.0	original fault segments defined by Brocher et al., 2004)		47.454058	237.46001	15.0
Segment 3 (B3, Chamberlin)		3.2	35.0	2.8	45.0	90.0	128.8	15.0			47.474577	237.41401	15.0
Segment 4 (B4, Chamberlin)		5.8	35.0	2.8	45.0	90.0	99.3	15.0			47.42864	237.577048	15.0
Tacoma fault	7.3												
Segment 1 (T1)		10.0	14.1	5.6	45.0	90.0	268.9	0.5	Venturato et al., 2007		47.45397	237.15199	0.5
Segment 2 (T2)		10.0	14.1	4.2	45.0	90.0	260.8	0.5	(using segments defined by Brocher et al., 2004)		47.46071	237.26315	0.5
Segment 3 (T3)		10.0	14.1	2.8	45.0	90.0	274.0	0.5			47.4653	237.42744	0.5
Segment 4 (T4)		8.0	13.4	1.4	45.0	90.0	276.3	0.5	note: different rupture width values than in original publication		47.46782	237.51048	0.5
Segment 5 (T5)		8.0	12.7	1.4	45.0	90.0	279.5	1.0	note: different rupture width values than in original publication		47.44932	237.63809	1.0
Tacoma fault Rosedale dominant	7.3								Venturato et al., 2007				
Segment 1 (T1)		10.0	14.1	5.6	45.0	90.0	268.9	0.5	original fault segments defined by Brocher et al., 2004)		47.45397	237.15199	0.5
Segment 6 (T6)		33.0	11.3	3.0	45.0	90.0	129.2	4.0	note: different rupture width values than in original publication		47.21541	237.31924	4.0

Brocher, T., Blakely, R., & Wells, R. (2004). Interpretation of the Seattle Uplift, Washington, as a passive-roof duplex. *Bulletin of the Seismological Society of America,94* (4), 1379-1401.

Chamberlin, C., Arcas, Diego Rodriguez, & Pacific Marine Environmental Laboratory. (2015). *Modeling tsunami inundation for hazard mapping at Everett, Washington, from the Seattle Fault* (NOAA technical memorandum OAR PMEL ; 147).

Seattle Fault Earthquake Scenario Project Team. (2005). Scenario for a magnitude 6.7 earthquake on the Seattle Fault (1st ed.). Oakland, CA: Earthquake Engineering Research Institute.

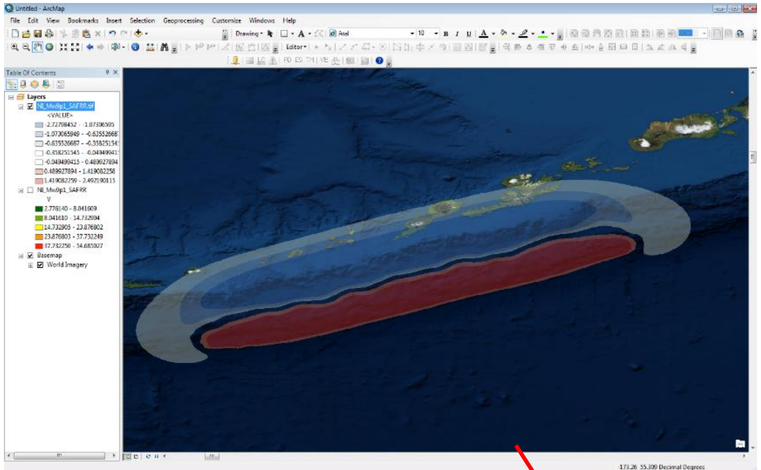
Titov, V.V., F.I. Gonz´alez, H.O. Mofjeld, and A.J. Venturato (2003): NOAA TIME Seattle Tsunami Mapping Project: Procedures, Data Sources, and Products. NOAA Tech. Memo. OAR PMEL-124, 21 pp.

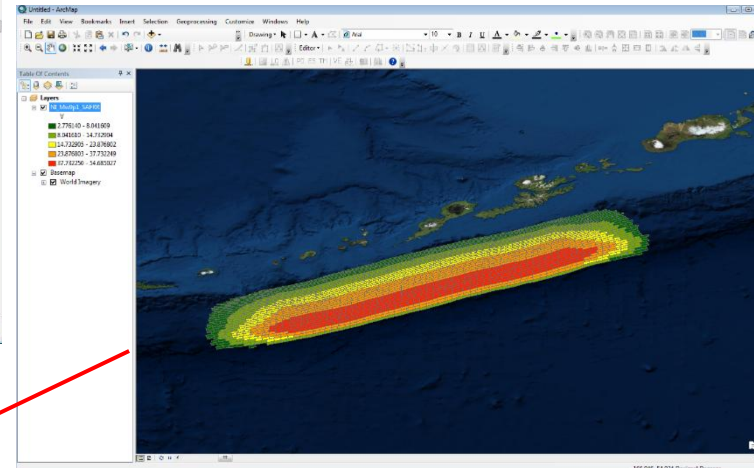
Venturato, A., D. Arcas, V. Titov, H. Mofjeld, C. Chamberlin, and F. González (2007). Tacoma, Washington, tsunami hazard mapping project: Modeling tsunami inundation from Tacoma and Seattle fault earthquakes, NOAA Tech. Memo. OAR PMEL-132 , 27 pp.

Alaska

Subduction Zone Sources

- 2010_Seward
- 2011_Whittier
- 2013_Sitka
- 2013_Valdez
- 2014_Chenega
- 2014_Cordova
- 2015_Unalaska
- 2016_Chignik
- 2016_KingCove_ColdBay
- 2016_Nikolski
- 2016_Yakutat
- 2017_Kodiak
- 2017_SandPoint
- 2018_Homer

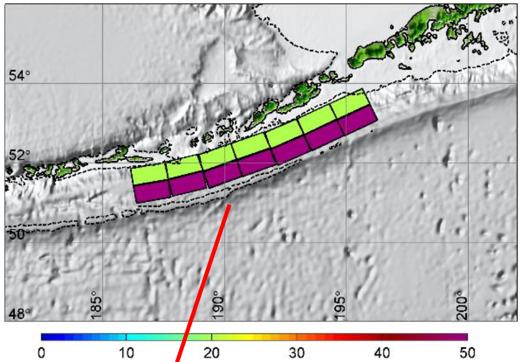


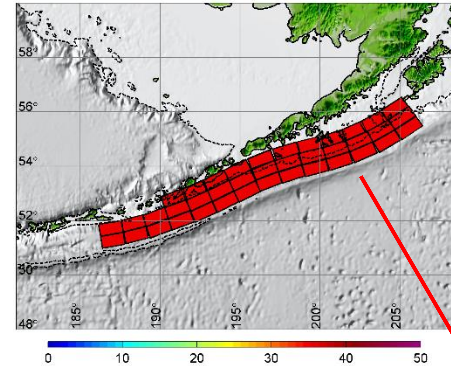


1	9.1	37	19	75000	840	8	39	NI_Mw9p1	1638	Mw 9.1 earthquake in the Fox Islands region, based on hypothetical cases C and D
2	9.1	37	19	79000	840	6	38	NI_Mw9p1_v2	1637	Mw 9.1 earthquake in the Fox Islands region, based on hypothetical cases D and E
3	9.1	37	19	76000	840	8	40	NI_Mw9p1_v3	1646	Mw 9.1 earthquake in the Fox Islands region, based on hypothetical case C
4	9.0	65	19	73000	380	1.5	58	**2015_Unalaska/sc04/KirbyAlaskaPeni**	1651	Mw 9.0 earthquake according to the SAFRR project
5	9.0	55	20	57000	520	3	40	NI_Mw9p1_SAFRR	1650	Mw 9.0 SAFRR-type earthquake in the Samalga Pass region
6	9.2	44	31	72000	640	6	48	**2015_Unalaska/sc07/Mw9p2_Aleutiar**	1635	Mw 9.2 East Aleutian earthquake
7	9.2	50	35	60000	700	5	31	**2015_Unalaska/sc08/Mw9p3_Aleutiar**	1639	Mw 9.25 East Aleutian earthquake
8	9.1	37	15	110000	820	8	60	**2015_Unalaska/sc01/Mw9p1**	1455	Mw 9.1 earthquake, Fox Islands region
9	9.0	36			1100			**2011_Whittier/sc05/Cascadia**	1457	Mw9.0–9.1 earthquake, Cascadia subduction zone
10	8.6	25	25	11000	500	2	17	OuterRiseN	1456	Mw 8.6 outer-rise earthquake in the Umnak Island region

Hawaii

Subduction Zone Sources

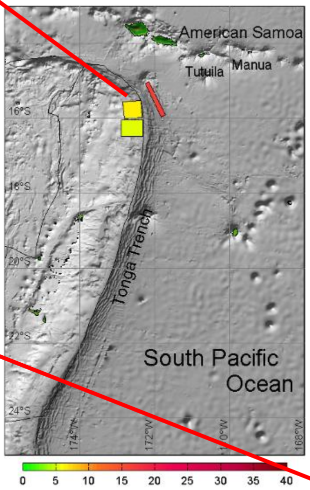


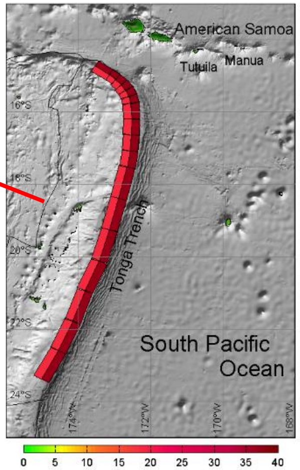


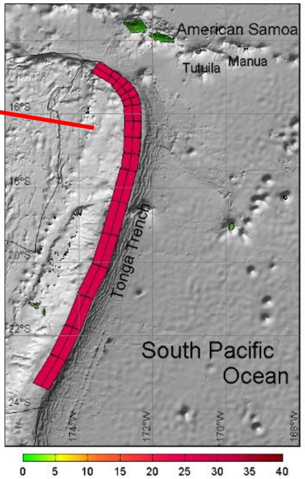
Subduction Zone - Source Name	Mw	L (km)	W (km)	Average Slip (m)	Maximum Slip (m)	Minimum Slip (m)	dip (deg)	rake (deg)	strike (deg)	depth(km)	Segment start pos (Lat/Long)	me nt	Fau lt	Fau lt	Max Pos IC (m)	Max Neg IC (m)	
Great Aleutian Hypothetical I	9.29	700	100	35	50	20	15	90	n/a	n/a							Butler et al. (2014 GRL)
Segment 1		100	50	20	20	20	15	90	261	17.9	-172.30812 51.58013						Bai et al. (2018 Ocean Modelling)
Segment 2		100	50	50	50	50	15	90	261	5	-172.20306 51.13617						
Segment 3		100	50	20	20	20	15	90	257	17.9	-170.89078 51.80371						
Segment 4		100	50	50	50	50	15	90	257	5	-170.73609 51.36575						
Segment 5		100	50	20	20	20	15	90	251	17.9	-169.49765 52.08847						
Segment 6		100	50	50	50	50	15	90	251	5	-169.26930 51.66351						
Segment 7		100	50	20	20	20	15	90	251	17.9	-168.11558 52.38045						
Segment 8		100	50	50	50	50	15	90	251	5	-167.88538 51.95548						
Segment 9		100	50	20	20	20	15	90	247	17.9	-166.74364 52.71660						
Segment 10		100	50	50	50	50	15	90	247	5	-166.46463 52.30363						
Segment 11		100	50	20	20	20	15	90	245	17.9	-165.38984 53.10107						
Segment 12		100	50	50	50	50	15	90	245	5	-165.08501 52.69411						
Segment 13		100	50	20	20	20	15	90	245	17.9	-164.03407 53.48104						
Segment 14		100	50	50	50	50	15	90	245	5	-163.72645 53.07407						
Great Aleutian Hypothetical II	9.6	1400	100~150	36	36	36	15	90	n/a	n/a							Butler et al. (2014 GRL)
Segment 1		100	50	36	36	36	15	90	261	17.9	-172.30812 51.58013						
Segment 2		100	50	36	36	36	15	90	261	5	-172.20306 51.13617						
Segment 3		100	50	36	36	36	15	90	257	17.9	-170.89078 51.80371						
Segment 4		100	50	36	36	36	15	90	257	5	-170.73609 51.36575						
Segment 5		100	50	36	36	36	15	90	251	17.9	-169.49765 52.08847						
Segment 6		100	50	36	36	36	15	90	251	5	-169.26930 51.66351						
Segment 7		100	50	36	36	36	15	90	251	17.9	-168.11558 52.38045						
Segment 8		100	50	36	36	36	15	90	251	5	-167.88538 51.95548						
Segment 9		100	50	36	36	36	15	90	250.8	30.9	-168.32270 52.77970						
Segment 10		100	50	36	36	36	15	90	247	17.9	-166.74364 52.71660						
Segment 11		100	50	36	36	36	15	90	247	5	-166.46463 52.30363						
Segment 12		100	50	36	36	36	15	90	247.8	30.9	-167.02693 53.10013						
Segment 13		100	50	36	36	36	15	90	245	17.9	-165.38984 53.10107						
Segment 14		100	50	36	36	36	15	90	245	5	-165.08501 52.69411						
Segment 15		100	50	36	36	36	15	90	244.6	30.9	-165.70679 53.47497						
Segment 16		100	50	36	36	36	15	90	245	17.9	-164.03407 53.48104						
Segment 17		100	50	36	36	36	15	90	245	5	-163.72645 53.07407						
Segment 18		100	50	36	36	36	15	90	244.6	30.9	-164.31735 53.86554						
Segment 19		100	50	36	36	36	15	90	250	17.9	-162.59949 53.81926						
Segment 20		100	50	36	36	36	15	90	250	5	-162.35008 53.39759						
Segment 21		100	50	36	36	36	15	90	248.1	30.9	-162.83443 54.21590						
Segment 22		100	50	36	36	36	15	90	253	17.9	-161.15435 54.07369						
Segment 23		100	50	36	36	36	15	90	253	5	-160.94104 53.64373						
Segment 24		100	50	36	36	36	15	90	253.3	30.9	-161.28233 54.48774						
Segment 25		100	50	36	36	36	15	90	256	17.9	-159.63913 54.28090						
Segment 26		100	50	36	36	36	15	90	256	5	-159.46280 53.84494						
Segment 27		100	50	36	36	36	15	90	256.8	30.9	-159.75781 54.69434						
Segment 28		100	50	36	36	36	15	90	253	17.9	-158.15847 54.54365						
Segment 29		100	50	36	36	36	15	90	253	5	-157.94244 54.11369						
Segment 30		100	50	36	36	36	15	90	252.9	30.9	-158.39420 54.93948						
Segment 31		100	50	36	36	36	15	90	247	17.9	-156.72510 54.90640						
Segment 32		100	50	36	36	36	15	90	247	5	-156.43135 54.49344						
Segment 33		100	50	36	36	36	15	90	246.2	30.9	-157.09179 55.27234						
Segment 34		100	50	36	36	36	15	90	240	17.9	-155.33111 55.35518						
Segment 35		100	50	36	36	36	15	90	240	5	-154.94841 54.96621						
Segment 36		100	50	36	36	36	15	90	240.5	30.9	-155.77614 55.69426						
Segment 37		100	50	36	36	36	15	90	236	17.9	-154.01077 55.85882						
Segment 38		100	50	36	36	36	15	90	236	5	-153.57608 55.48686						
Segment 39		100	50	36	36	36	15	90	235.7	30.9	-154.46381 56.19362						

American Samoa
Subduction Zone Sources

Subduction Zone - Source Name	Mw	L (km)	W (km)	Average Slip (m)	Maximum Slip (m)	Minimum Slip (m)	dip (deg)	rake (deg)	strike (deg)	depth(km)	Segment start pos (Lat/Long)	
2009 Samoa	8.1	n/a	n/a	6.95	16.5	5.4	n/a	n/a	n/a	n/a		Modified from Lay et al. (2010 Nature)
Fault 1	7.8	110.0	15.0	16.5	16.5	16.5	35.00	265.0	335.00	0.0	S15.96440,W171.82640	To reproduce the south Pacific DART
Fault 2 Segment 1	7.7	50.0	55.0	6.3	6.3	6.3	20.00	90.0	175.00	5.0	S15.52600,W172.37030	and American Samoa runup records.
Fault 2 Segment 2	7.7	50.0	65.0	5.44	5.4	5.4	20.00	90.0	180.00	5.0	S16.04020,W172.32500	
Maximum Probable Tonga 1	9.05	1100.0	50.0	27.8	37.1	18.5	n/a	90	n/a	n/a		Berrymore et al. (2015 GEM)
Segment 1		50.0	25.0	37.1	37.1	37.1	39.38	90.00	122.00	5.0	S14.58000, W173.44690	
Segment 2		25.0	25.0	37.1	37.1	37.1	39.38	90.00	125.00	5.0	S14.82000, W173.04900	
Segment 3		25.0	25.0	37.1	37.1	37.1	31.60	90.00	133.00	5.0	S14.96000,W172.84000	
Segment 4		25.0	25.0	37.1	37.1	37.1	16.03	90.00	139.00	5.0	S15.11000, W172.65000	
Segment 5		25.0	25.0	37.1	37.1	37.1	8.24	90.00	153.00	5.0	S15.29000, W172.49000	
Segment 6		25.0	25.0	37.1	37.1	37.1	8.24	90.00	165.00	5.0	S15.50000,W172.38000	
Segment 7		50.0	25.0	37.1	37.1	37.1	8.96	90.00	177.00	5.0	S15.73000, W172.32000	
Segment 8		50.0	25.0	37.1	37.1	37.1	9.68	90.00	182.00	5.0	S16.19000,W172.29550	
Segment 9		50.0	25.0	37.1	37.1	37.1	18.56	90.00	185.00	5.0	S16.64500,W172.31190	
Segment 10		50.0	25.0	37.1	37.1	37.1	21.52	90.00	189.00	5.0	S17.11000,W172.35290	
Segment 11		100.0	25.0	37.1	37.1	37.1	16.40	90.00	195.00	5.0	S17.57000,W172.43000	
Segment 12		100.0	25.0	37.1	37.1	37.1	18.89	90.00	195.00	5.0	S18.43850, W172.67530	
Segment 13		100.0	25.0	37.1	37.1	37.1	20.44	90.00	197.00	5.0	S19.32000,W172.93000	
Segment 14		100.0	25.0	37.1	37.1	37.1	17.94	90.00	204.00	5.0	S20.20000,W173.21500	
Segment 15		100.0	25.0	37.1	37.1	37.1	19.58	90.00	200.48	5.0	S21.02110,W173.60690	
Segment 16		100.0	25.0	37.1	37.1	37.1	18.27	90.00	204.00	5.0	S21.86320, W173.94590	
Segment 17		100.0	25.0	37.1	37.1	37.1	16.78	90.00	209.00	5.0	S22.70000, W174.35000	
Segment 18		50.0	25.0	18.5	18.5	18.5	39.38	90.00	122.00	20.9	S14.72736,W173.54212	
Segment 19		23.0	25.0	18.5	18.5	18.5	39.38	90.00	125.00	20.9	S14.96750, W173.14460	
Segment 20		22.0	25.0	18.5	18.5	18.5	31.60	90.00	133.00	18.1	S15.10610,W172.96850	
Segment 21		19.0	25.0	18.5	18.5	18.5	16.03	90.00	139.00	11.9	S15.25170,W172.81904	
Segment 22		20.0	25.0	18.5	18.5	18.5	8.24	90.00	153.00	8.6	S15.40690, W172.68720	
Segment 23		20.0	25.0	18.5	18.5	18.5	8.24	90.00	165.00	8.6	S15.57490, W172.59830	
Segment 24		46.0	25.0	18.5	18.5	18.5	8.96	90.00	177.00	8.9	S15.75950, W172.54940	
Segment 25		50.0	25.0	18.5	18.5	18.5	9.68	90.00	182.00	9.2	S16.18214, W172.52613	
Segment 26		50.0	25.0	18.5	18.5	18.5	18.56	90.00	185.00	13.0	S16.62631, W172.53349	
Segment 27		50.0	25.0	18.5	18.5	18.5	21.52	90.00	189.00	14.2	S17.07717, W172.56901	
Segment 28		100.0	25.0	18.5	18.5	18.5	16.40	90.00	195.00	12.1	S17.51406, W172.64846	
Segment 29		100.0	25.0	18.5	18.5	18.5	18.89	90.00	195.00	13.1	S18.38332,W172.89182	
Segment 30		100.0	25.0	18.5	18.5	18.5	20.44	90.00	197.00	13.7	S19.25828, W173.14341	
Segment 31		100.0	25.0	18.5	18.5	18.5	17.94	90.00	204.00	12.7	S20.11288,W173.42310	
Segment 32		100.0	25.0	18.5	18.5	18.5	19.58	90.00	200.48	13.4	S20.94685,W173.81938	
Segment 33		100.0	25.0	18.5	18.5	18.5	18.27	90.00	204.00	12.8	S21.77623,W174.15593	
Segment 34		100.0	25.0	18.5	18.5	18.5	16.78	90.00	209.00	12.2	S22.59551,W174.55392	
Maximum Probable Tonga 2	9.05	1100.0	50.0	27.8	27.8	27.8	n/a	90	n/a	n/a		Berrymore et al. (2015 GEM)
Segment 1		50.0	25.0	27.8	27.8	27.8	39.38	90.00	122.00	5.0	S14.58000,W173.44690	
Segment 2		25.0	25.0	27.8	27.8	27.8	39.38	90.00	125.00	5.0	S14.82000,W173.04900	
Segment 3		25.0	25.0	27.8	27.8	27.8	31.60	90.00	133.00	5.0	S14.96000,W172.84000	
Segment 4		25.0	25.0	27.8	27.8	27.8	16.03	90.00	139.00	5.0	S15.11000,W172.65000	
Segment 5		25.0	25.0	27.8	27.8	27.8	8.24	90.00	153.00	5.0	S15.29000,W172.49000	
Segment 6		25.0	25.0	27.8	27.8	27.8	8.24	90.00	165.00	5.0	S15.50000, W172.38000	
Segment 7		50.0	25.0	27.8	27.8	27.8	8.96	90.00	177.00	5.0	S15.73000,W172.32000	
Segment 8		50.0	25.0	27.8	27.8	27.8	9.68	90.00	182.00	5.0	S16.19000, W172.29550	
Segment 9		50.0	25.0	27.8	27.8	27.8	18.56	90.00	185.00	5.0	S16.64500, W172.31190	
Segment 10		50.0	25.0	27.8	27.8	27.8	21.52	90.00	189.00	5.0	S17.11000, W172.35290	
Segment 11		100.0	25.0	27.8	27.8	27.8	16.40	90.00	195.00	5.0	S17.57000,W172.43000	
Segment 12		100.0	25.0	27.8	27.8	27.8	18.89	90.00	195.00	5.0	S18.43850, W172.67530	
Segment 13		100.0	25.0	27.8	27.8	27.8	20.44	90.00	197.00	5.0	S19.32000, W172.93000	
Segment 14		100.0	25.0	27.8	27.8	27.8	17.94	90.00	204.00	5.0	S20.20000,W173.21500	
Segment 15		100.0	25.0	27.8	27.8	27.8	19.58	90.00	200.48	5.0	S21.02110, W173.60690	
Segment 16		100.0	25.0	27.8	27.8	27.8	18.27	90.00	204.00	5.0	S21.86320,W173.94590	
Segment 17		100.0	25.0	27.8	27.8	27.8	16.78	90.00	209.00	5.0	S22.70000,W174.35000	
Segment 18		50.0	25.0	27.8	27.8	27.8	39.38	90.00	122.00	20.9	S14.72736,W173.54212	
Segment 19		23.0	25.0	27.8	27.8	27.8	39.38	90.00	125.00	20.9	S14.96750, W173.14460	
Segment 20		22.0	25.0	27.8	27.8	27.8	31.60	90.00	133.00	18.1	S15.10610,W172.96850	
Segment 21		19.0	25.0	27.8	27.8	27.8	16.03	90.00	139.00	11.9	S15.25170,W172.81904	
Segment 22		20.0	25.0	27.8	27.8	27.8	8.24	90.00	153.00	8.6	S15.40690, W172.68720	
Segment 23		20.0	25.0	27.8	27.8	27.8	8.24	90.00	165.00	8.6	S15.57490, W172.59830	
Segment 24		46.0	25.0	27.8	27.8	27.8	8.96	90.00	177.00	8.9	S15.75950,W172.54940	
Segment 25		50.0	25.0	27.8	27.8	27.8	9.68	90.00	182.00	9.2	S16.18214,W172.52613	
Segment 26		50.0	25.0	27.8	27.8	27.8	18.56	90.00	185.00	13.0	S16.62631,W172.53349	
Segment 27		50.0	25.0	27.8	27.8	27.8	21.52	90.00	189.00	14.2	S17.07717,W172.56901	
Segment 28		100.0	25.0	27.8	27.8	27.8	16.40	90.00	195.00	12.1	S17.51406, W172.64846	
Segment 29		100.0	25.0	27.8	27.8	27.8	18.89	90.00	195.00	13.1	S18.38332, W172.89182	
Segment 30		100.0	25.0	27.8	27.8	27.8	20.44	90.00	197.00	13.7	S19.25828,W173.14341	
Segment 31		100.0	25.0	27.8	27.8	27.8	17.94	90.00	204.00	12.7	S20.11288, W173.42310	
Segment 32		100.0	25.0	27.8	27.8	27.8	19.58	90.00	200.48	13.4	S20.94685, W173.81938	
Segment 33		100.0	25.0	27.8	27.8	27.8	18.27	90.00	204.00	12.8	S21.77623,W174.15593	
Segment 34		100.0	25.0	27.8	27.8	27.8	16.78	90.00	209.00	12.2	S22.59551,W174.55392	

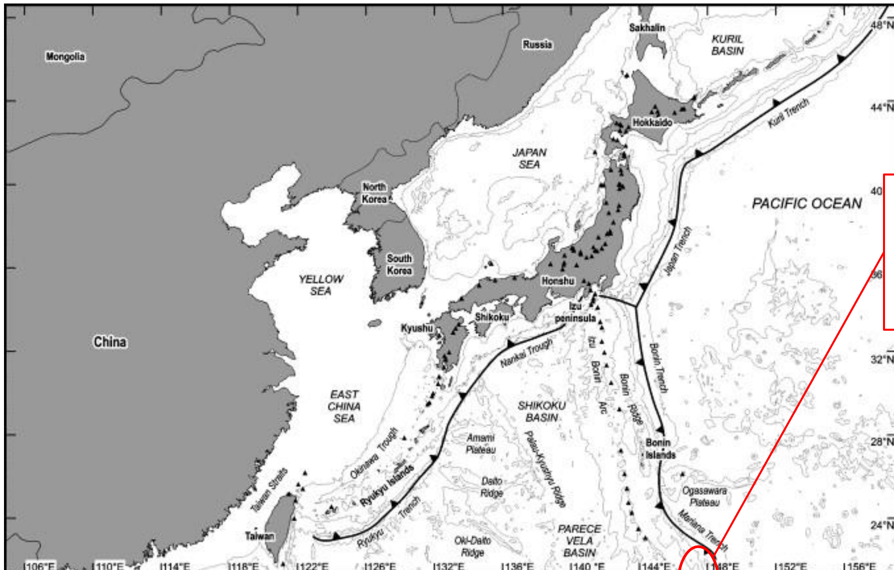


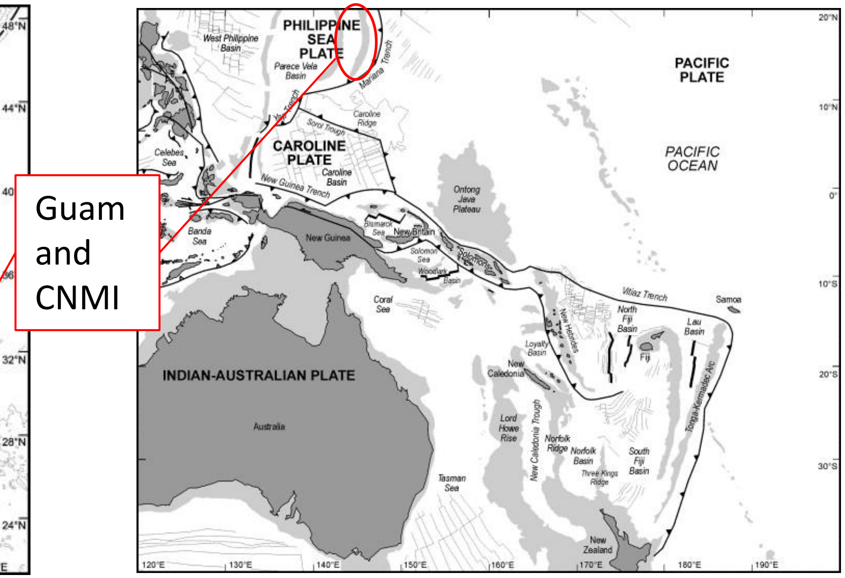




Guam/CNMI

Subduction Zone Sources



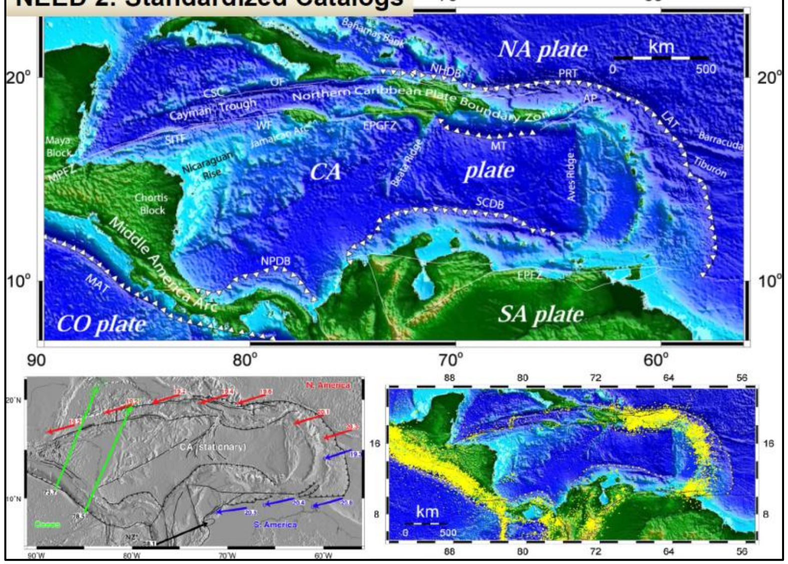


Maps from: http://plate-tectonic.narod.ru/aziaSEphotoalbum.html

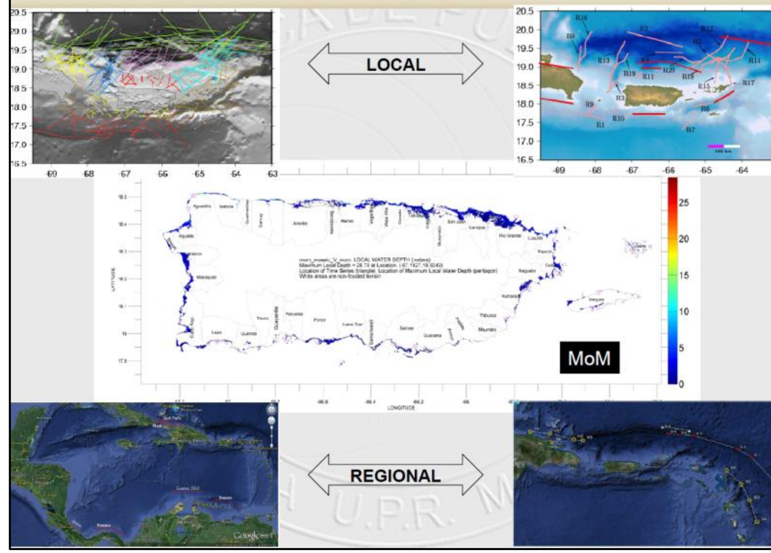
Subduction Zone - Source Name	Mw	L (km)	W (km)	Average Slip (m)	Maximum Slip (m)	Minimum Slip (m)	dip (deg)	rake (deg)	strike (deg)	depth(km)	Segment start pos (Lat/Long)	Segment end pos (Lat/Long)	Sub-Fault Segment Sources
For Guam and the CNMI													
Marianas Trenchsegments 50-60							15-35		172-245	18-21	19.4212/147.0846	11.9788/143.5355	PMEL
Mariana Trench 1993	8.1	166								59			PMEL
Mariana Trench 1909	8									100			PMEL
Eastern Philippines segments 7-8-9							45-57		163-176	43-46	7.4711/126.6578	9.1801/164.1	PMEL
Mindanao Trench 1924	8.3									60			PMEL
Ryukyu-Nankai Zone segments 16-17-18							7.19-10.99		220-245	14-Oct	33.1488/134.6416	31.6179/132.9546	PMEL; Kwok Fai Cheung
Nankai Trough 1906	8.3									340			PMEL; Kwok Fai Cheung
Nankai Trough 1944	8.1									25			PMEL; Kwok Fai Cheung
Nankai Trough 1946	8.1									30			PMEL; Kwok Fai Cheung
Japan segments 25-27							19-21		185-198	21-57	39.4541/142.8839	37.6534/143.0357	
Tohoku 2011	9.1									32			PMEL; PTWC; Kwok Fai Cheung
Ryukyu-Nankai Zone segments 1-14							22-Aug		195-262	20-Mar	30.8899/132.3235	23.6696/122.6672	
Ryukyu Islands 1911	8.7									160			PMEL
Taiwan 1910	8.3									200			PMEL
Taiwan 1920	8.3									10			PMEL

Puerto Rico/USVI
Subduction Zone Sources

NEED 2: Standardized Catalogs



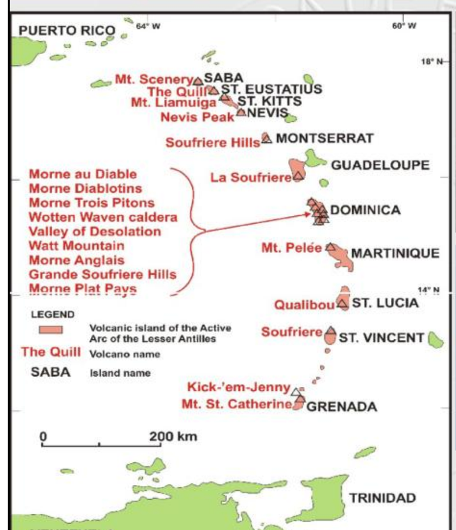
Tsunami Scenarios



NEED 4: Probabilistic Landslide Tsunami Hazard Analysis

A new modeling approach using 3D-2D coupled methodology:
- TSUNAMI3D (submarine landslide generation)
- NEOWAVE (propagation and inundation)
- Higher bathymetry resolution (1 -1/3 arcsecond)

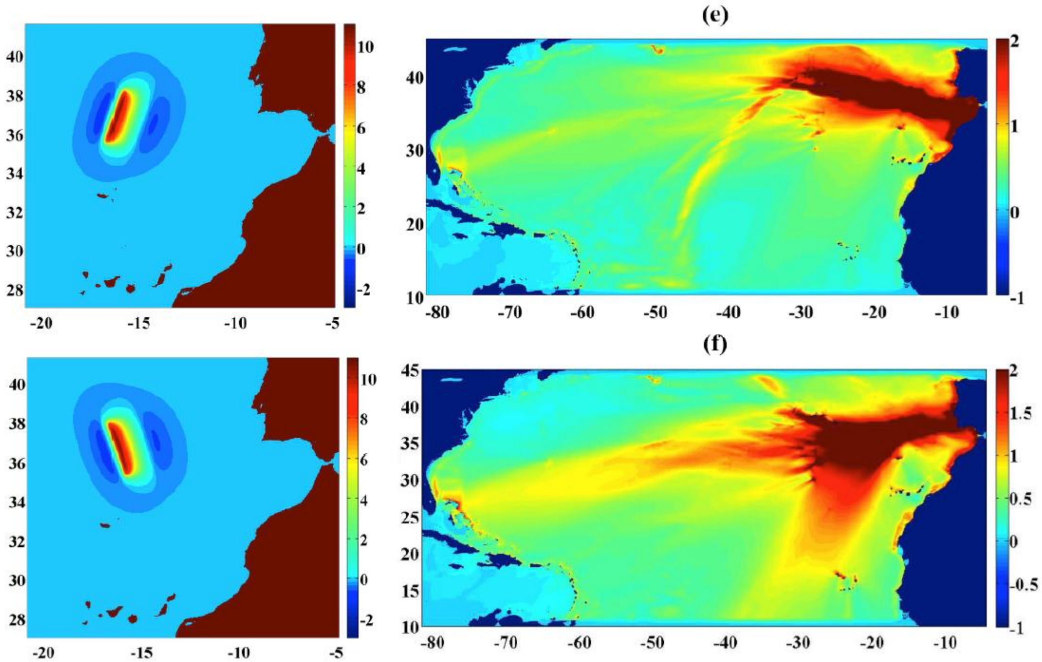
NEED 5: Tsunami – Volcanic Hazard

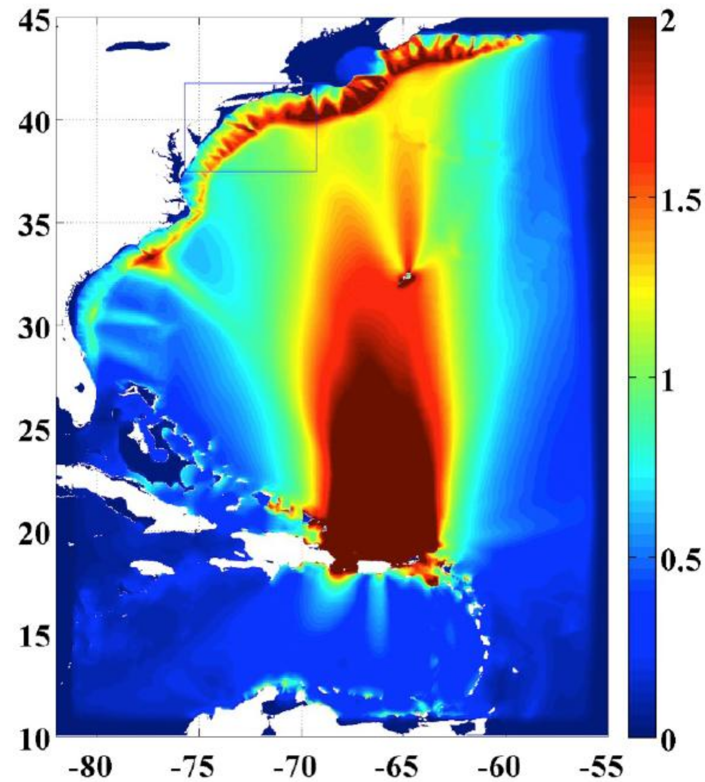


MONTSERRAT/Soufriere Hill Volcano

East Coast

Subduction Zone Sources

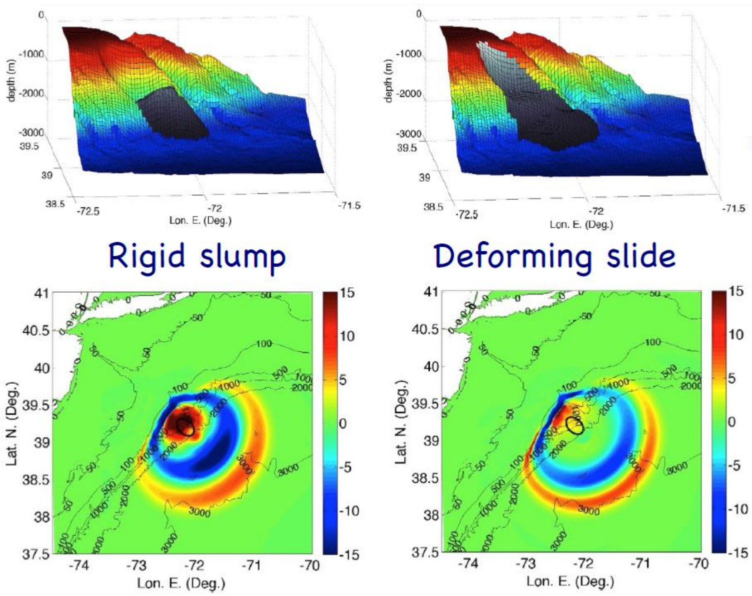


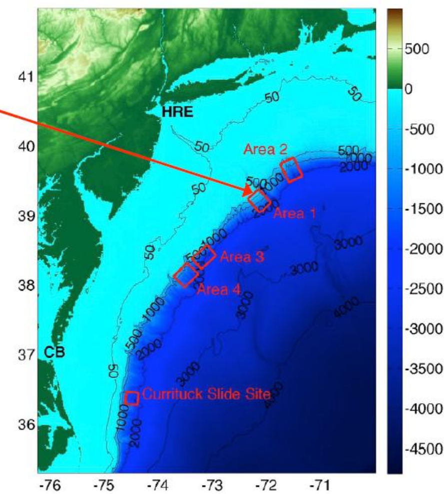


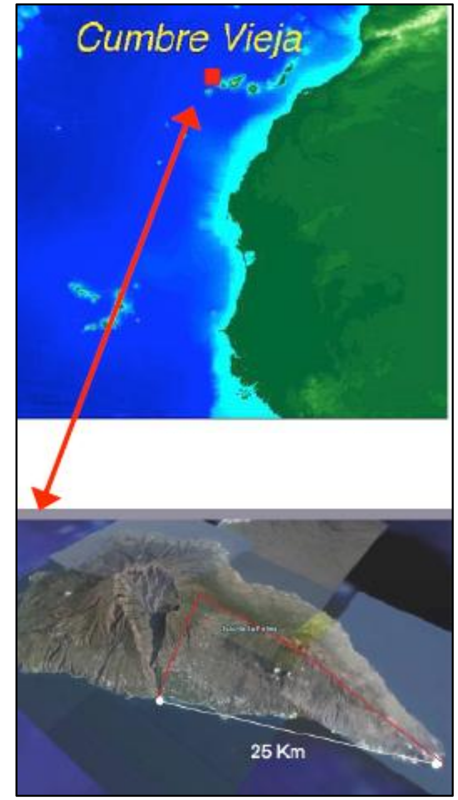
Subduction Zone - Source Name	Mw	L (km)	W (km)	Average Slip (m)	Maximum Slip (m)	Minimum Slip (m)	dip (deg)	rake (deg)	strike (deg)	depth(km)	Segment start pos (Lat/Long)	e g	b-Fault Segment Sourc	S	a x	a x	
EAST COAST																	
Puerto Rico Trench	9	100	50		14.8		20	90	95.37	21.1	18.887/63.88 N/W		NOAA SIFT segments				
		100	50		14.8		20	90	95.37	5	19.307/63.838						
		100	50		14.8		20	90	94.34	21.1	18.965/64.815						
		100	50		14.8		20	90	94.34	5	19.386/64.781						
		100	50		14.8		20	90	89.59	21.1	18.985/65.692						
		100	50		14.8		20	90	89.59	5	19.407/65.695						
		100	50		14.8		20	90	84.98	21.1	18.948/66.574						
		100	50		14.8		20	90	84.98	5	19.369/66.613						
		100	50		14.8		20	90	85.87	21.1	18.874/67.541						
		100	50		14.8		20	90	85.87	5	19.295/67.573						
		100	50		14.8		20	90	83.64	21.1	18.785/68.455						
		100	50		14.8		20	90	83.64	5	19.205/68.504						
Azores Convergence Zone (Lisbon 1755)	9																
		317	126		20		40	90	15	5	36.042N/10.753W (center)						Barkan et al (2009)
Azores Convergence Zone (Lisbon 1755)	9																
		317	126		20		40	90	345	5	36.042N/10.753W (center)						

East Coast

Landslide Sources



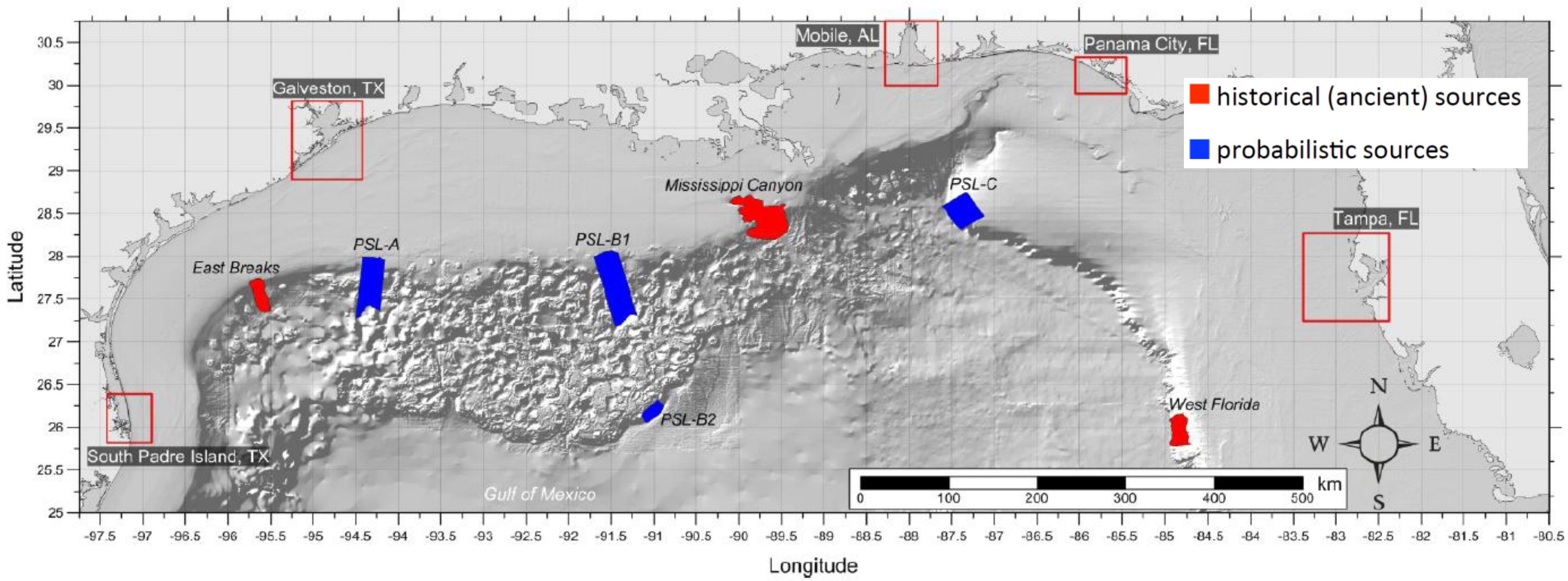




Landslide Source Name	Slide mass area	Slide mass volume	Depth to top of slide	Vert displace	Center Latitude	Center Longitude	Max Pos	Max Neg	LS Peak	LS Trough	References	Landslide Source Reference File (GIS, KML, PDF, image)	Notes						
EAST COAST:													east Coast continental margin slides are elliptical in plan. Relationship between downslope slide length, along-slope slide width, and slide maximum thickness taken from Enet and Grilli (2007).						
Currituck		134 km3	500 m (shoreward end)		36.39N	74.61W					Grilli et al (2013), Locat et al (2009)	Model accepts parameters x0, y0, T, b, w, theta as inputs)		750 m	30000 m	20000 m	0		
Study Area 1		134 km3	500 m (")		39.19N	72.19W					Grilli et al (2013)	"		750 m	30000 m	20000 m	46		
Study Area 2		134 km3	500 m (")		39.76N	71.49W					Grilli et al (2013)	"		750 m	30000 m	20000 m	63		
Study Area 3		134 km3	500 m (")		38.41N	73.19W					Grilli et al (2013)	"		750 m	30000 m	20000 m	50		
Study Area 4		134 km3	500 m (")		38.09N	73.60W					Grilli et al (2013)	"		750 m	30000 m	20000 m	36		
Cape Fear Slide		67 km3	800 m (")		33.19N	76.16W					Grilli et al. 2013)	"		375 m	30000 m	20000 m	28		
Bahama Bank (partial)		0.50 km3	600 m		24.91N	79.25W					Schnyder et al (2016)	"		150 m	3500 m	3700 m	-180		
Bahama Bank (single)		1.41 km3	600 m		24.91N	79.25W					Schnyder eta l (2016)	"		150 m	3500 m	9000 m	-180		
Bahama Bank (future)		5.73 km3	430-450 m		24.86N	79.22W					Schnyder et al (2016)	"		80 m	6000 m	40000 m	-180		
Cumbre Vieja Volcano (1)		450 km^3	subaerial		28.37N	17.49W					Abadie et al (2012), Grilli & Grilli (2013	Modeled as failure of a shape constructed from topographic/bathymetric data		T	b	w	runout direction (clockwise from East)		
Cumbre Vieja Volcano (2)		80 km^3	subaerial		28.37N	17.49W						(viscous flow)							

Gulf of Mexico

Landslide Sources



New Columns														itial Conditions at Surfac				
type	Geology Setting	Age (Years)	Length (km)	Width (km)	Thickness (m)	Run-out distance (km)	Landslide Source Name	Slide mass area	Slide mass volume	Depth to top of slide	Vert displace distance	Center Latitude	Center Longitude	Max Pos Initial Conditions (m)	Max N	LSP ea	LST	References
							GOM											
Historical (Ancient Submarine Landslide)	Shelf Break Edge	10000 - 25000	30	14	160	91	EASTBREAKS	519 km^2	21.95 km^3	100 m	160 m	27.65N	95.65W	Dynamic forcing	ng	ing	ng	ten Brink, et al (2009)
Historical (Ancient Submarine Landslide)	Shelf Break Edge	7500 -11000	80	38	300	297	MISSISSIPPI CANYON	3687 km^2	425 km^3	100 m	300 m	28.50N	89.80W	Dynamic forcing	ng	ing	ng	ten Brink, et al (2009)
Historical (Ancient Submarine Landslide)	Edge carbonate platform	>10000	38	15	150	Uncertain	WEST FLORIDA	647 km^2	16.2 km^3	800 m	150 m	25.90N	84.80W	Dynamic forcing	ng	ing	ng	ten Brink, et al (2009)
Probabilistic Submarine landslide	Shelf Break Edge	7800	68	25	67	Uncertain	PSL-A	1686 km^2	57 km^3	100 m	67 m	27.80N	94.30W	Dynamic forcing	ng	ing	ng	Horrillo et al (2015)
Probabilistic Submarine landslide	Shelf Break Edge	5500	96	32	44	Uncertain	PSL-B1	3118 km^2	69 km^3	150 m	44 m	27.80N	91.50W	Dynamic forcing	ng	ing	ng	Horrillo et al (2015)
Probabilistic Submarine landslide	Escarpment edge	4800	13	22	323	Uncertain	PSL-B2	282 km^2	45 km^3	2250 m	323 m	26.12N	91.00N	Dynamic forcing	ng	ing	ng	Horrillo et al (2015)
Probabilistic Submarine landslide	Shelf Slope	650	34	46	404	Uncertain	PSL-C	1529 km^2	315 km^3	1100 m	404 m	28.55N	87.40W	Dynamic forcing	ng	ing	ng	Horrillo et al (2015)
										Excavation Depth or thickness?								
Reference:																		
ten Brink, U., Twichel, D., Lynett, P., Geist. E., Chaytor, J., Lee. H., Buczkowski, B., Flores, C., 2009. Regional Assessment of Tsuami Potential in the Gulf of Mexico. OpenFile Report. U.S. Geological Survey.																		
Horrillo, J., Pampell-Manis, A., Sweetman, B., Sparagowski, C., Parambath, L. and Shigihara, Y. 2015. Construction of Five Additional Tsunami Inundation Maps and A Probabilistic Methodology for Hazard Assessment Generated by Submarine Landslides in the Gulf of Mexico. Tech. Rep.																		

Comparison

Examples: Alaska-Aleutian and Cascadia Sources

USER	Subduction Zone - Source Name	Mw	L (km)	W (km)	Average Slip (m)	Maximum Slip (m)	Minimum Slip (m)	dip (deg)	rake (deg)	strike (deg)	depth(km)	Segment start pos (Lat/Long)	Segment end pos (Lat/Long)	Sub-Fault Segment Sources	Sub-Fault Segments	x Pos	x Ne	
AK	Kodiak_Mw9p2_USGS	9.2	400		30	44												
AK	Kodiak_Mw9p2_Butler	9.2	400		35	58												
CA	Central Aleutians III	9.2	800	100	25	25	25	15	90	n/a	5	53.80000 -162.50000	57.00000 -151.50000	NOAA FACTS Segments	AB: 15-22			USC (2009); Borrero et al (2006)
OR	AKMAX	9.2	600	100		30		**	**	**		59.99700 -145.58300	54.52700 -160.80700	Gonzalez				Gonzalez et al. (2006); Witter et al. (2011);
WA	AASZ1	9.2	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a			NOAA FACTS Segments	AB:0-9			
HI	Great Aleutian Hypothetical I	9.29	700	100	35	50	20	15	90	n/a	n/a	51.58013 -172.30812	53.07407 -163.72645					Butler et al. (2014 GRL); Bai et al. (2018 Oc
HI	Great Aleutian Hypothetical II	9.6	1400	100~150	36	36	36	15	90	n/a	n/a	51.58013 -172.30812	56.19362 -154.46381					
WA	Cascadia XXL2	9.2	1000	105	20	41	n/a	n/a	n/a	n/a	n/a	n/a	n/a					
OR	Cascadia XXL1 - Full rupture/splay fault	9.1	1000	83	20	41		**	**	**	<20	40.00000 -124.47000	48.38100 -126.00500	Goldfinger				Goldfinger et al. (2012); Witter et al. (2011
CA	Cascadia L - Full Rupture+Little Salmon	9.02	1040	100	10	11	7	n/a	90		5	40.50000 -124.20000	49.00000 -127.00000	NOAA FACTS Segments	AB:1-10			USC (2009); Borrero et al (2006)
AK	2011_Whittier/sc05/Cascadia	9.2	1100			36												

Tsunami Source Characterization: Next Steps

- Combine all individual spreadsheets into one
- Create definitions in supporting documentation
- Consider if simple spreadsheet with links to images/GIS data sufficient
- Consider alternative database formats
- Incorporate results/logic-tree data from Powell Center work
- Other considerations???

Subduction Zone - Source Name	Mw	L (km)	W (km)	Average Slip (m)	Maximum Slip (m)	Minimum Slip (m)	dip (deg)	rake (deg)	strike (deg)	depth(km)

Segment start pos (Lat/Long)	Segment end pos (Lat/Long)	Sub-Fault Segment Sources	Sub-Fault Segments	Max Pos IC (m)	Max Neg IC (m)