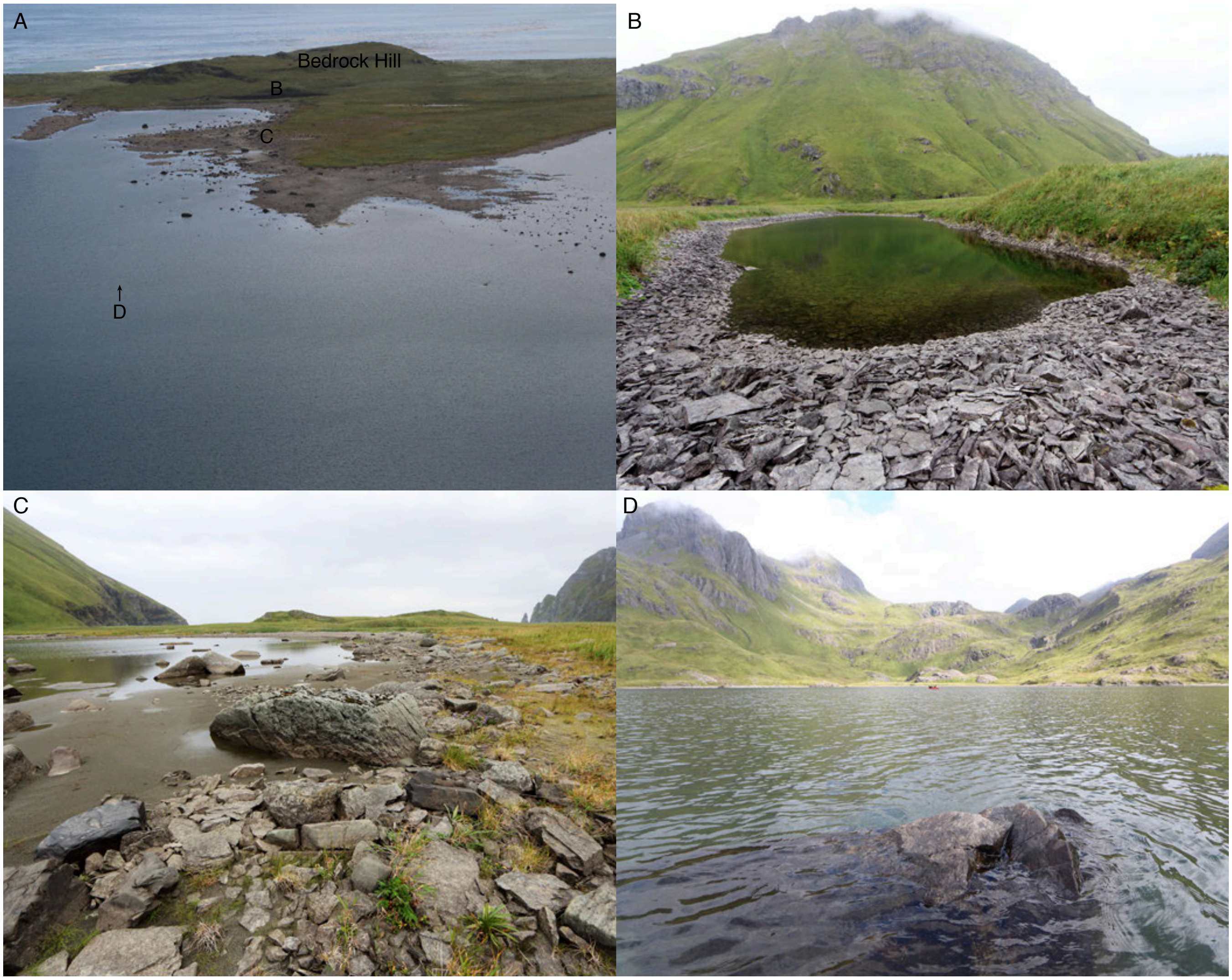
Supplemental Figure 1: Photograph of digging out the lahar in excavation 210 (See Figure 3 for stratigraphic drawing). The lahar ultimately proved too deep and boulders too large in this excavation to dig through. Photo by Tina Neal.



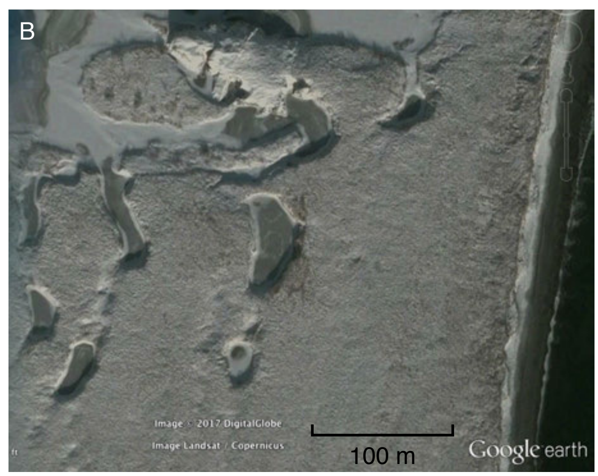
Supplemental Figure 2: A lightly vegetated deposit of comingled boulders, cobbles, pebbles, and sand extends 700 m inland from the shore into a coastal lake at about 53.687° N, 166.346° W. We interpret this deposit as a tsunami deposit because it appears young despite being sheltered behind a long-established beach barrier, because it lacks typical beach forms such as beach ridges, and because it incorporates abundant angular clasts with no noticeable rounding (Fig. S3), but also includes a few well-rounded beach clasts. Given the location separated from slope processes and flowing water, wind wave and tsunami wave deposition seem to be the only plausible mechanisms for forming this deposit. It is most likely formed by the 1957 tsunami - the only extreme wave event in this area known to have occurred in the recent past.

Photo **A** shows an overview of the site, looking down from a mountain inland of the site. Immediately behind a small bedrock hill the deposit is mostly composed of relatively well-sorted platy angular cobbles, presumably derived from the hill (**B**). An elongate pond draped in these cobbles is situated immediately behind the hill - possibly some sort of scour feature (**B**, See also Supplemental Figure 4). Further into the lake from the angular cobbles in **B**, scattered boulders, cobbles, and pebbles are surrounded by sand (**C**). Some boulders can be seen protruding from the water well into the lake (**D**).

Supplemental Figure 3: The deposit we interpret as deposited by the 1957 tsunami includes contrasting boulders such as shown in photo **A**, 550 m from the shore, where a well rounded boulder sits next to an angular boulder of similar composition. Nearer the shore, 230 m inland (**B**), the deposit is almost entirely composed of angular cobbles. Even under the uppermost layer of cobbles (light rocks in **B**) there is only a dusting of sand. Patches of cobble and pebble gravel around 500 m inland (**C**, **D**) include mixed angular and rounded grains. One of the largest boulders, approximately 1.5 x 1.5 x 2.5 m, sits about 500 m inland (**E**.) A 0.5 m diameter boulder next to it has surfaces that are worn smooth, but a large fragment is broken off (**F**, same boulder visible in **E**). The red water bottle used for scale in all images is about 20 cm tall and 9 cm in diameter.

A

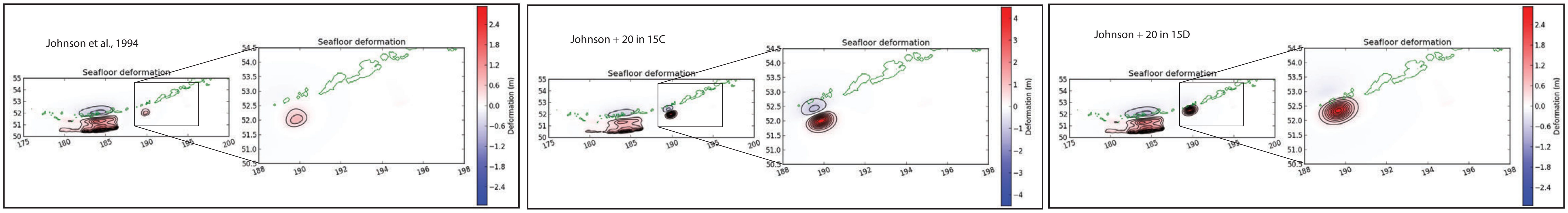
Supplemental Figure 4: A gravelly shore-parallel pond at 53.6884° N, 166.3785° W (**A**) and another nearby at 53.6889° N, 166.377° W bear a striking resemblance to the pond found in the possible 1957 tsunami deposit 2 km further east (Supplemental Figure 2B). These ponds are unusual in that they are deeper and terminate more abruptly along-shore than typical low points between beach ridges found in other beach plains. We know of no case where similar features are documented in other tsunami deposits either. It may be that they are tsunami scour features, and their unusual geometry reflects the process of scouring through the thick grass root mat typical of Aleutian coastlines. Similar features further west at 53.62° N, 166.56° W, visible on Google Earth (**B**) also might be tsunami scour.



Supplemental Table 1: All parameters for each subfault.

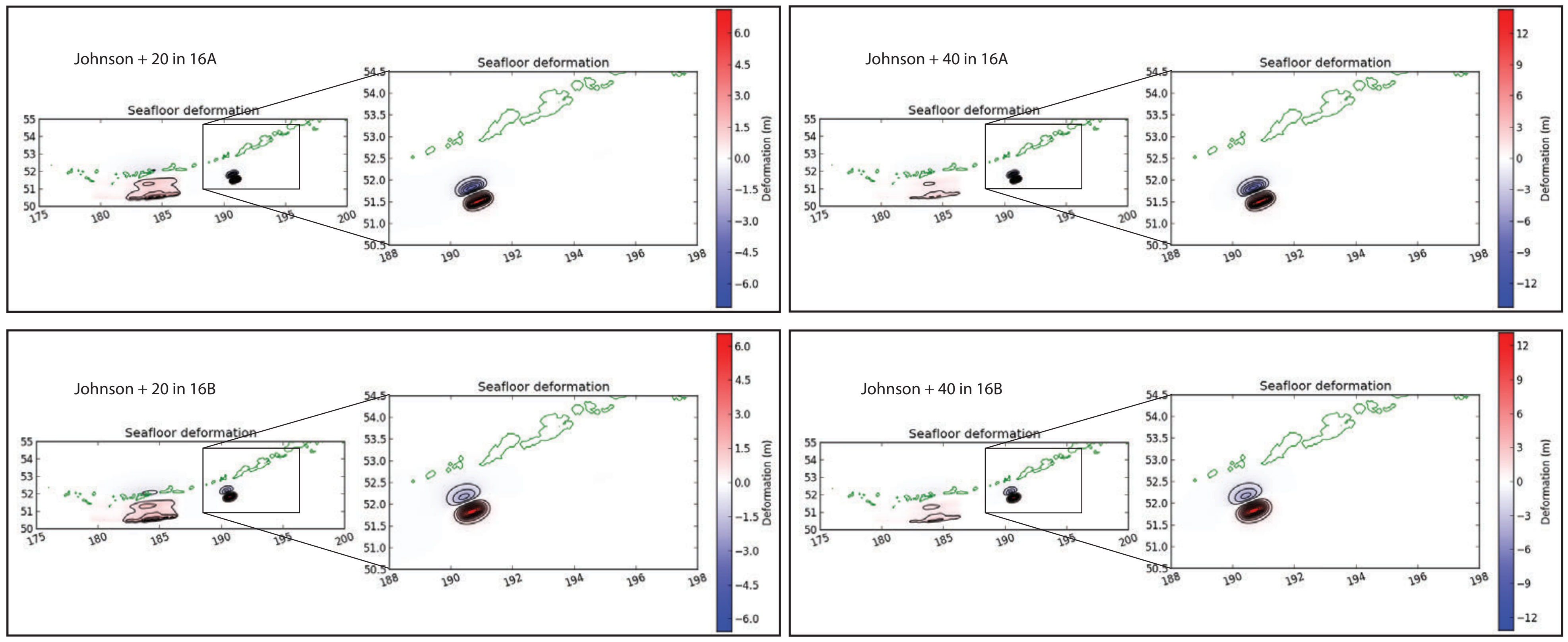
subfault number	subfault row	top center location latitude	longitude	depth (km)	length (km)	width (km)	strike	dip	rake	slip
1	A	50.50247	179.66831	12.1	50	75	267.7	18.3	90	1.5
1	C	51.17605	179.72380	35.6	50	75	267.7	46.5	90	1.5
2	A	50.48115	180.38380	10.9	50	75	263.0	16.2	90	1.5
2	C	51.15470	180.44007	31.8	50	75	263.0	45.2	90	1.5
3	A	50.47045	181.08988	10.9	50	75	263.0	13.8	90	1.3
3	C	51.14494	181.08988	28.8	50	75	263.0	35.2	90	1.3
4	A	50.47264	181.80665	10.7	50	75	266.3	13.5	90	1.3
4	C	51.14713	181.80665	28.3	50	75	266.3	23.8	90	1.3
5	A	50.47254	182.51312	10.9	50	75	264.0	14.2	90	4
5	C	51.14693	182.49462	29.2	50	75	264.0	21.8	90	4
6	A	50.48258	183.23008	9.1	50	75	258.0	13.3	90	4
6	C	51.15697	183.21131	26.3	50	75	258.0	25.4	90	4
7	A	50.51496	183.93410	8.7	50	75	260.8	13.1	90	6.9
7	C	51.18450	183.80483	25.8	50	75	260.8	25.9	90	6.9
8	A	50.57207	184.64817	9.7	50	75	262.0	14.4	90	6.9
8	C	51.24146	184.51687	28.4	50	75	262.0	23.3	90	6.9
9	A	50.63465	185.35011	8.7	50	75	256.0	14.5	90	4.8
9	C	51.30071	185.18136	27.5	50	75	256.0	24.8	90	4.8
10	A	50.70260	186.05935	8.9	50	75	254.0	14.4	90	4.8
10	C	51.36890	185.89276	27.5	50	75	254.0	28.3	90	4.8
11	A	50.78347	186.75806	9.3	50	75	253.5	13.0	90	0
11	C	51.44301	186.53308	26.2	50	75	253.5	25.9	90	0
12	A	50.87441	187.46240	9.6	50	75	255.0	12.6	90	0
12	C	51.53437	187.24017	26.0	50	75	255.0	22.8	90	0
13	A	50.97069	188.15914	9.8	50	75	254.5	13.0	90	0
13	C	51.62765	187.91473	26.7	50	75	254.5	25.6	90	0
14	A	51.06922	188.86353	9.3	50	75	252.5	13.7	90	0
14	C	51.72668	188.62208	27.1	50	75	252.5	31.7	90	0
15	A	51.19569	189.54967	9.3	50	37.5	248.4	9.3	90	variable
15	B	51.51231	189.36303	15.4	50	37.5	248.4	19.4	90	variable
15	C	51.82892	189.17640	27.8	50	37.5	248.4	24.9	90	variable
15	D	52.14553	188.98976	43.6	50	37.5	248.4	38.0	90	variable
16	A	51.34632	190.23176	8.8	50	37.5	244.9	10.3	90	variable
16	B	51.66352	190.04710	15.5	50	37.5	244.9	16.7	90	variable
16	C	51.98072	189.86244	26.3	50	37.5	244.9	22.8	90	variable
16	D	52.29792	189.67777	40.8	50	37.5	244.9	36.3	90	variable

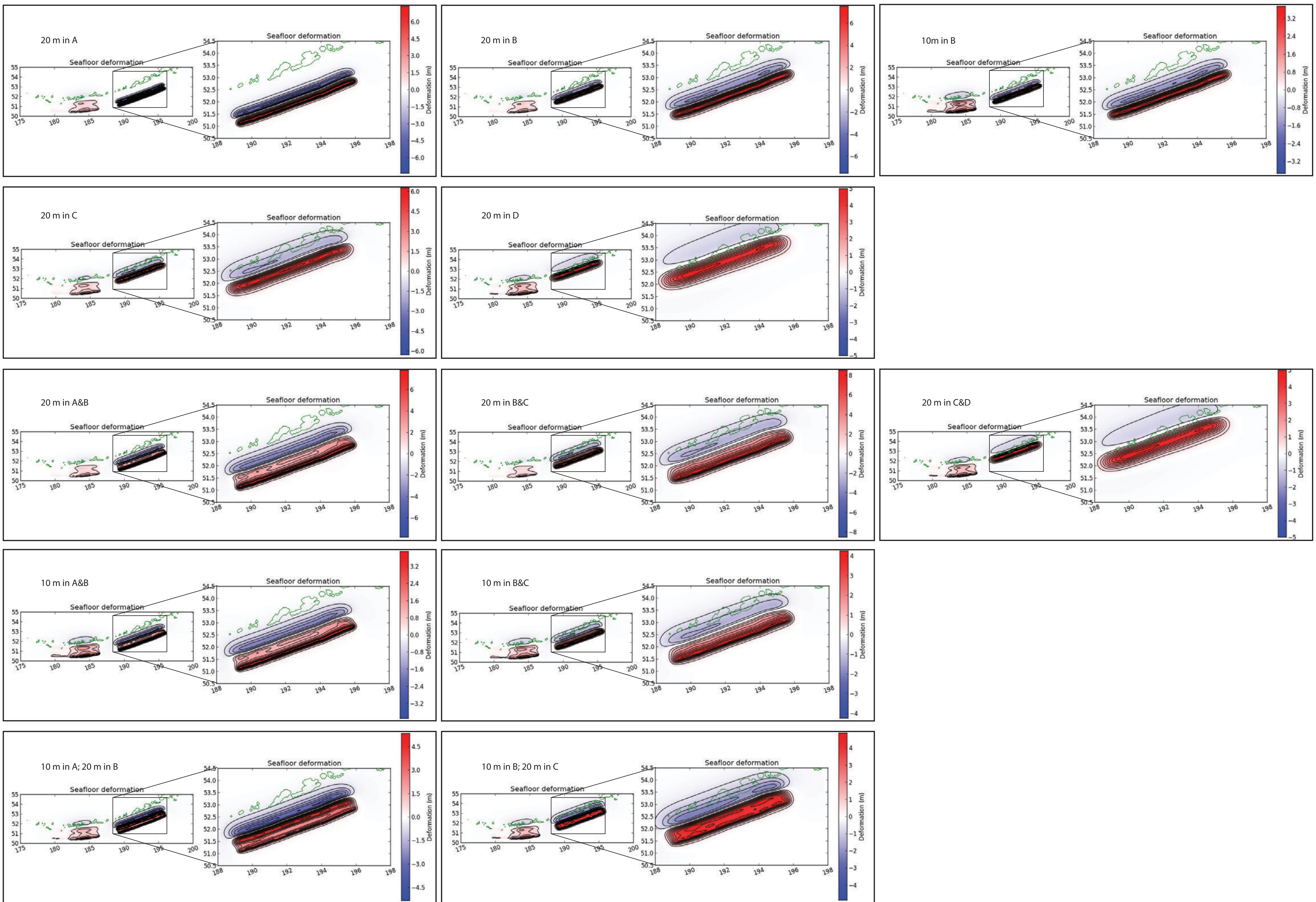
subfault number	subfault row	top center location latitude	longitude	depth (km)	length (km)	width (km)	strike	dip	rake	slip
17	A	51.51011	190.90310	8.7	50	37.5	245.1	9.4	90	variable
17	B	51.82016	190.68845	14.8	50	37.5	245.1	17.1	90	variable
17	C	52.13021	190.47379	25.9	50	37.5	245.1	22.1	90	variable
17	D	52.44026	190.25914	40.0	50	37.5	245.1	35.0	90	variable
18	A	51.68233	191.57577	9.4	50	37.5	245.9	8.1	90	variable
18	B	51.99315	191.36324	14.7	50	37.5	245.9	15.7	90	variable
18	C	52.30397	191.15072	24.8	50	37.5	245.9	23.9	90	variable
18	D	52.61479	190.93819	40.0	50	37.5	245.9	30.4	90	variable
19	A	51.85708	192.24529	8.6	50	37.5	246.1	8.4	90	variable
19	B	52.16712	192.02895	14.0	50	37.5	246.1	18.9	90	variable
19	C	52.47716	191.81260	26.1	50	37.5	246.1	22.5	90	variable
19	D	52.78721	191.59626	40.5	50	37.5	246.1	35.0	90	variable
20	A	52.02925	192.92323	8.8	50	37.5	246.9	8.9	90	variable
20	B	52.34008	192.70906	14.6	50	37.5	246.9	18.0	90	variable
20	C	52.65090	192.49489	26.2	50	37.5	246.9	24.9	90	variable
20	D	52.96173	192.28071	42.0	50	37.5	246.9	32.2	90	variable
21	A	52.20398	193.59796	9.0	50	37.5	245.4	9.1	90	variable
21	B	52.51402	193.37989	14.9	50	37.5	245.4	19.1	90	variable
21	C	52.82406	193.16182	27.2	50	37.5	245.4	26.6	90	variable
21	D	53.13410	192.94376	44.0	50	37.5	245.4	32.2	90	variable
22	A	52.37611	194.28127	8.4	50	37.5	241.9	9.8	90	variable
22	B	52.68695	194.06542	14.8	50	37.5	241.9	17.4	90	variable
22	C	52.99778	193.84957	26.0	50	37.5	241.9	26.8	90	variable
22	D	53.30861	193.63373	43.0	50	37.5	241.9	32.3	90	variable
23	A	52.58542	194.93474	8.8	50	37.5	243.8	10.6	90	variable
23	B	52.89308	194.70575	15.7	50	37.5	243.8	14.9	90	variable
23	C	53.20073	194.47676	25.3	50	37.5	243.8	23.0	90	variable
23	D	53.50838	194.24777	40.0	50	37.5	243.8	27.0	90	variable
24	A	52.78067	195.60291	9.1	50	37.5	248.8	10.1	90	variable
24	B	53.06470	195.39487	15.7	50	37.5	248.8	16.8	90	variable
24	C	53.34872	195.18683	26.5	50	37.5	248.8	17.8	90	variable
24	D	53.63275	194.97879	38.0	50	37.5	248.8	26.1	90	variable



Supplemental Figure 5:
Seafloor deformation for all source models tested in this study, created from slip and subfault parameters using the Okada (1985) equations. See Figure 5 for subfault names (A, B, C, D) and Supplemental Table 1 for subfault parameters. Slip amount is noted in the source model name. The seafloor deformation is instantaneous and is assumed to be the same as the sea-surface deformation that initiates the tsunami.

Note that the scalebar is different for each source model.





Supplemental Table 2: Simulated runup, difference between simulation and observation, and percent difference for every site.

Site # from Table 1		1	2	3	4	5	6	7	8	9	10	11	13	16	18	19	20	21	22
Location		Sweepers Cove	Sand Bay	Nazan Cove	N Cleveland	W Applegate	Corwin Rock	SE Cleveland	South cove	Isthmus	Concord Point	Cape Sagak	Driftwood	E of Riding Cove	Stardust	Dutch Harbor	Scotch Cap	Hanalei	Anahola
Runup observation		3.8	4	9	9	6.7	7.3	14.9	13.0	15.3	17.6	10	23	32	18.5	0.69	12	5.8	4.9
Johnson et al., 1994	simulated runup (m)	1.5	1.9	0.6	0.7	0.8	0.2	1.1	1.3	1.3	0.6	0.9	0.6	1.6	0.5	0.0	0.0	1.8	2.4
	difference (m)	-2.3	-2.1	-8.4	-8.3	-5.9	-7.1	-13.8	-11.7	-14.0	-17.0	-9.1	-22.4	-30.4	-18.0	-0.7	-12.0	-4.0	-2.5
	% difference	-61%	-53%	-93%	-92%	-87%	-98%	-93%	-90%	-91%	-96%	-91%	-97%	-95%	-97%	-99%	-100%	-69%	-51%
Johnson + 20 m in 15C	simulated runup (m)	1.5	1.9	1.1	1.5	1.4	0.9	4.8	6.6	6.9	2.8	2.2	2.5	1.6	1.7	0.2	0.2		
	difference (m)	-2.3	-2.1	-7.9	-7.5	-5.3	-6.4	-10.1	-6.4	-8.4	-14.8	-7.8	-20.5	-30.4	-16.8	-0.5	-11.8		
	% difference	-61%	-53%	-88%	-84%	-80%	-88%	-68%	-50%	-55%	-84%	-78%	-89%	-95%	-91%	-71%	-98%		
Johnson + 20 m in 15D	simulated runup (m)	1.6	1.9	1.1	2.0	2.3	1.5	2.4	2.6	2.6	2.1	1.4	1.1	1.6	0.9	0.2	0.2		
	difference (m)	-2.2	-2.1	-7.9	-7.0	-4.4	-5.8	-12.5	-10.4	-12.7	-15.5	-8.6	-21.9	-30.4	-17.6	-0.5	-11.8		
	% difference	-57%	-53%	-88%	-77%	-65%	-80%	-84%	-80%	-83%	-88%	-86%	-95%	-95%	-95%	-67%	-99%		
Johnson + 20 m in 16A	simulated runup (m)	1.4	1.9	0.4	0.4	0.6	0.6	4.7	5.7	6.0	2.8	4.2	2.3	1.6	0.9	0.0	0.0		
	difference (m)	-2.4	-2.1	-8.6	-8.6	-6.1	-6.7	-10.2	-7.3	-9.3	-14.8	-5.8	-20.7	-30.4	-17.6	-0.7	-12.0		
	% difference	-62%	-53%	-96%	-96%	-91%	-92%	-68%	-56%	-61%	-84%	-58%	-90%	-95%	-95%	-100%	-100%		
Johnson + 20 m in 16B	simulated runup (m)	1.4	1.9	0.4	0.8	1.1	1.1	7.0	8.4	8.6	5.3	4.8	2.7	1.6	1.5	0.0	0.1		
	difference (m)	-2.4	-2.1	-8.6	-8.2	-5.6	-6.2	-7.9	-4.6	-6.7	-12.3	-5.2	-20.3	-30.4	-17.0	-0.7	-11.9		
	% difference	-63%	-53%	-96%	-91%	-83%	-85%	-53%	-36%	-44%	-70%	-52%	-88%	-95%	-92%	-100%	-99%		
Johnson + 40 m in 16A	simulated runup (m)	1.4	1.9	0.3	0.7	1.2	1.2	9.1	11.0	10.2	6.0	7.6	4.6	1.6	1.4	0.0	0.0		
	difference (m)	-2.4	-2.1	-8.7	-8.3	-5.5	-6.1	-5.8	-2.0	-5.1	-11.6	-2.4	-18.4	-30.4	-17.1	-0.7	-12.0		
	% difference	-63%	-53%	-96%	-92%	-81%	-83%	-39%	-16%	-33%	-66%	-24%	-80%	-95%	-92%	-100%	-100%		
Johnson + 40 m in 16B	simulated runup (m)	1.4	1.9	0.4	1.3	2.3	2.3	14.5	16.2	15.1	11.4	8.8	5.4	1.6	2.8	0.1	0.3		
	difference (m)	-2.4	-2.1	-8.6	-7.7	-4.4	-5.0	-0.4	3.2	-0.2	-6.2	-1.2	-17.6	-30.4	-15.7	-0.6	-11.7		
	% difference	-64%	-53%	-95%	-85%	-66%	-68%	-2%	25%	-2%	-35%	-12%	-77%	-95%	-85%	-86%	-97%		
20 in A	simulated runup (m)	1.4	1.9	0.5	1.2	1.8	1.8	14.0	17.5	17.1	8.3	11.1	14.5	5.9	13.2	0.2	0.8	7.2	5.6
	difference (m)	-2.4	-2.1	-8.5	-7.8	-4.9	-5.5	-0.9	4.5	1.8	-9.3	1.1	-8.5	-26.1	-5.3	-0.5	-11.2	1.4	0.7
	% difference	-63%	-53%	-95%	-87%	-74%	-76%	-6%	35%	12%	-53%	11%	-37%	-82%	-28%	-76%	-93%	24%	14%
20 in B	simulated runup (m)	1.5	1.9	1.3	2.1	2.7	3.3	18.8	22.9	22.0	13.6	14.9	18.5	9.2	18.3	0.5	1.4	8.6	7.5
	difference (m)	-2.3	-2.1	-7.7	-6.9	-4.0	-4.0	3.9	9.9	6.7	-4.0	4.9	-4.5	-22.8	-0.2	-0.2	-10.6	2.8	2.6
	% difference	-61%	-53%	-86%	-77%	-59%	-55%	26%	76%	44%	-23%	49%	-19%	-71%	-1%	-29%	-89%	48%	53%
20 in C	simulated runup (m)	1.7	1.9	2.3	2.8	3.3	4.0	18.5	20.9	20.8	11.7	13.5	18.2	8.8	17.0	1.3	2.0	10.6	4.4
	difference (m)	-2.1	-2.1	-6.7	-6.2	-3.4	-3.3	3.6	7.9	5.5	-5.9	3.5	-4.8	-23.2	-1.5	0.6	-10.0	4.8	-0.5
	% difference	-56%	-53%	-75%	-68%	-51%	-46%	24%	61%	36%	-34%	35%	-21%	-72%	-8%	87%	-84%	83%	-10%
20 in D	simulated runup (m)	1.8	1.9	1.5	5.9	6.5	3.8	5.5	6.7	6.8	5.0	5.1	5.1	4.6	3.9	1.5	0.9	7.2	4.4
	difference (m)	-2.0	-2.1	-7.5	-3.1	-0.2	-3.5	-9.4	-6.3	-8.5	-12.6	-4.9	-17.9	-27.4	-14.6	0.8	-11.1	1.4	-0.5
	% difference	-54%	-53%	-84%	-35%	-3%	-48%	-63%	-49%	-55%	-71%	-49%	-78%	-86%	-79%	111%	-92%	24%	-11%
20 in A&B	simulated runup (m)	1.5	1.9	1.7	2.7	3.0	3.8	22.6	27.3	27.6	13.3	14.4	16.8	10.3	21.9	0.6	2.0	9.8	3.3
	difference (m)	-2.3	-2.1	-7.3	-6.3	-3.7	-3.5	7.7	14.3	12.3	-4.3	4.4	-6.2	-21.7	3.4	0.0	-10.0	4.0	-1.6
	% difference	-61%	-53%	-81%	-71%	-55%	-48%	52%	110%	81%	-25%	44%	-27%	-68%	19%	-6%	-83%	69%	-33%
20 in B&C	simulated runup (m)	1.7	1.9	3.0	4.1	4.0	5.7	23.6	26.6	27.6	15.6	15.5	20.9	13.5	24.8	1.6	3.1	8.0	7.2
	difference (m)	-2.1	-2.1	-6.0	-4.9	-2.7	-1.6	8.7	13.6	12.3	-2.0	5.5	-2.1	-18.5	6.3	0.9	-8.9	2.2	2.3
	% difference	-54%	-53%	-66%	-54%	-40%	-23%	58%	105%	80%	-12%	55%	-9%	-58%	34%	135%	-74%	38%	46%
20 in C&D	simulated runup (m)	1.9	1.9	2.9	5.5	7.4	5.2	8.4	9.9	10.1	7.8	11.5	14.4	8.8	11.5	2.3	2.0	10.8	4.2
	difference (m)	-1.9	-2.2	-6.1	-3.5	0.7	-2.1	-6.5	-3.1	-5.2	-9.8	1.5	-8.6	-23.2	-7.0	1.6	-10.0	5.0	-0.7
	% difference	-49%	-54%	-68%	-39%	10%	-29%	-44%	-24%	-34%	-56%	15%	-37%	-73%	-38%	233%	-83%	86%	-14%
10 in B	simulated runup (m)	1.5	1.9	0.8	1.0	1.4	1.6	9.5	11.8	11.0	6.2	9.4	10.0	4.5	11.2	0.2	0.7	5.3	2.1
	difference (m)	-2.3	-2.1	-8.2	-8.0	-5.3	-5.7	-5.4	-1.2	-4.3	-11.4	-0.6	-13.0	-27.5	-7.3	-0.4	-11.3	-0.5	-2.9
	% difference	-61%	-53%	-91%	-89%	-79%	-78%	-36%	-9%	-28%	-65%	-6%	-57%	-86%	-40%	-64%	-94%	-9%	-58%
10 in A&B	simulated runup (m)	1.4	1.9	0.8	1.3	1.6	1.8	11.6	14.2	14.2	6.2	8.8	8.8	4.9	12.5	0.3	1.0	6.9	5.0
	difference (m)	-2.4	-2.1	-8.2	-7.7	-5.1	-5.5	-3.3	1.2	-1.1	-11.4	-1.2	-14.2	-27.1	-6.0	-0.4	-11.0	1.1	0.1
	% difference	-62%	-53%	-91%	-86%	-76%	-75%	-22%	9%	-7%	-65%	-12%	-62%	-85%	-32%	-52%	-91%	18%	2%
10 in B&C	simulated runup (m)	1.6	1.9	1.7	2.0	1.9	2.7	11.6	13.2	13.9	7.9	9.1	11.4	6.7	12.2	0.7	1.6	9.7	3.6
	difference (m)	-2.2	-2.1	-7.3	-7.0	-4.8	-4.6	-3.3	0.2	-1.4	-9.7	-0.9	-11.6	-25.3	-6.3	0.0	-10.4	3.9	-1.3
	% difference	-58%	-53%	-81%	-78%	-72%	-63%	-22%	2%	-9%	-55%	-9%	-51%	-79%	-34%	-3%	-87%	67%	-27%
10 in A; 20 in B	simulated runup (m)	1.5	1.9	1.4	2.3	2.7	3.2	19.8	24.2	24.2	11.9	13.4	16.1	8.6	18.7	0.6	1.7	8.1	3.3
	difference (m)	-2.3	-2.1	-7.6	-6.7	-4.0	-4.1	4.9	11.2	8.9	-5.7	3.4	-6.9	-23.4	0.2	-0.1	-10.3	2.3	-1.6
	% difference	-61%	-53%	-84%	-75%	-60%	-56%	33%	86%	58%	-32%	34%	-30%	-73%	1%	-17%	-86%	40%	-32%
10 in B; 20 in C	simulated runup (m)	1.7	1.9	2.6	3.4	3.7	4.4	19.7	22.1	22.6	11.4	12.4	16.9	10.7	18.3	1.4	2.5	9.7	3.6
	difference (m)	-2.1	-2.1	-6.4	-5.6	-3.0	-2.9	4.8	9.1	7.3	-6.2	2.4	-6.1	-21.3	-0.2	0.7	-9.5	3.9	-1.3
	% difference	-55%	-53%	-71%	-63%	-45%	-40%	32%	70%	47%	-35%	24%	-27%	-67%	-1%	103%	-79%	67%	-27%