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Tsunami geomorphology: erosion and deposition from the 15 November 2006 Kuril Island tsunami

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Discussion—Were all observed changes from the 2006 tsunami?

Because 10 months (September-June) passed between field observations, we must address the question of whether the 2006 tsunami was the primary cause of observed changes. Other possible agents acting during these unobserved periods include the 2007 Kuril tsunami, erosion and deposition due to storms, and seasonal beach-profile variations. We reason that 2006 did cause most observed changes, based on the smaller size of the 2007 tsunami, on the fact that the 2007 tsunami occurred when the shoreline was frozen, and on the lack of large regional storms between field seasons.

We reason that the 2007 Kuril tsunami had little impact on the coastline because of its relative size and because of the time of year (MacInnes et al., 2009). Field observations suggest that the 2007 Kuril tsunami had runup of less than 5 m (MacInnes et al., 2009), making its influence on much of the vegetated coastline negligible. Moreover, the average temperature in the central Kurils between the 2006 and 2007 tsunamis was -3 to -6 ºC[1], resulting in a frozen upper beach and coastal plain at the time of the 2007 tsunami, inhibiting marked erosion.

We also reason that all measured change above and most measured change below storm high tide (defined by the presence of dense vegetation and seaweed wracklines) resulted from the 2006 tsunami and not from storms. Storms affecting the coasts of Kurils in 2006, 2007, and 2008 were not abnormally large and therefore likely did not cause measurable changes above storm wracklines observed in 2006 or on the vegetated coastal plain. Wind speed records suggest no unusual storms occurred in the field area between the pre- and post- tsunami surveys (Fig. DR2). Also, in 2007 and 2008 surveys we observed no fresh storm effects beyond the beach on coastlines where the tsunamis also did not surpass the beach.

Below storm high tide, beaches may actively change (c.f. Shepard et al., 1950), and in our study, we did not measure winter-beach profiles, but we argue that the 2006 tsunami is also responsible for most beach-profile changes because the beaches did not recover between 2007 and 2008 (Fig. DR3).

Post-tsunami survey data—runup and inundation

A compilation of all field measurements of runup and inundation from the 2007 and 2008 (post-tsunami) field seasons is presented in Table DR1. Most measurements made in 2007 were previously reported in MacInnes et al. (2009), but with fewer columns (thus omitting some observations). The data from the 2008 field season are newly reported here.

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[1]Based on four-times daily temperature records; NCEP Reanalysis data provided by the NOAA/OAR/ESRL PSD, Boulder, Colorado, USA, from their Web site at http://www.cdc.noaa.gov/

Supplemental field observations, data and photographs

Volume of erosion and deposition. In cases where we could quantify the volume of erosion or deposition along a profile (reported as m^3 per unit width), we plotted those estimates relative to runup and to runup times inundation, the latter an approximation of onland tsunami volume (Fig. DR4). We calculated the volume of tsunami erosion along a profile by measuring the area missing in 2007/2008 below profile lines measured in or reconstructed from 2006 (e.g., Figs. 3). We calculated deposit volume along a profile by taking measured thickness of fresh tsunami deposits at survey points (as in Figure 3) and integrating between them to generate the cross-sectional area covered by tsunami deposit along a given profile. We assigned ±10% error to the calculations. There is not a robust correlation of runup to volume of erosion and deposition for runup of less than 13 m (Fig. DR4A); the higher runup in Ainu Bay clearly produced greater geomorphic change. There is a better trend shown by comparing erosion and deposition volumes to runup times inundation (Fig. DR4B), which is a better overall scale of tsunami size. In Fig. DR4B, however, there is an even larger gap between the high numbers of Ainu Bay and the rest of the data.

Additional illustrations of tsunami effects. While the Dushnaya Central profile (Fig. 3) on Simushir Island was virtually unchanged across its vegetated surface (Fig. DR5), the tsunami rearranged the beach and locally eroded the beach scarp (Fig. DR6). In northern Dushnaya Bay, runup was higher, with common stripping of turf and soil (Fig. DR7) and deposition of gravel (Fig. DR8). In southern Dushnaya Bay, a very steep, sandy profile exhibited dramatic local erosional scours and enlarged drainage (Fig. DR9). The effects on the shoreline along South Bay, Matua Island (Fig. DR10), were similar to Central Dushnaya Bay, with a greater volume of beach erosion (Figure 3; Table 1). The most dramatic tsunami effects were in Ainu Bay on Matua Island, where stratigraphic analysis suggests tsunamis may have repeatedly produced coastal erosion (Fig. DR11). In the north, young landforms from the beach to 160 m inland were removed or denuded (Fig. DR12) and a long scour developed at the boundary between older and younger landforms (Fig. DR13). In the south, erosion was also severe, especially close to the shoreline (Fig. DR14).

Discussion

In order to examine the extent to which tsunami deposits may approximate actual runup and inundation, we compiled our own data (Table 1) with other reported cases and calculated the percent of actual runup and inundation represented by the deposit (Table DR2). We also calculated the total relief (runup/inundation) over the tsunami-affected part of each profile, and the maximum relief on each profile, in order to compare Kurils cases with others where the data are available. Table DR2 shows that Kurils profiles are higher relief than the others.

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TABLE DR1: SUMMARY OF CENTRAL KURIL ISLANDS POST-TSUNAMI SURVEY OF RUNUP AND INUNDATION ORDERED BY LATITUDE

Date	Team*	Location				Method§	Runup (preferred in bold)						Higher elevation seaward of inundation (m)	Inundation	
		Island	Locality name	Latitude of profile†	Longitude of profile†		Number of runup readings	2006 runup on profile (m)	2006 runup avg. near profile (m)	Tide correction (m)	Runup with tide correction (m)	Runup avg. with tide correction (m)		Measured inundation (m)	GPS calculated inundation (m)
05/07/2007	VMK	Urup	Os'ma Bay-2	45.58223	149.45068	TL	1	**4.4**	-	-	-	-	no	170	-
05/07/2007	VMK	Urup	Os'ma Bay-1	45.58285	149.45138	TL	1	**5.0**	-	-	-	-	no	48	-
05/07/2007	JB	Urup	Os'ma Bay-1-2006	*45.58300*	*149.45350*	TL	1	**4.8**	-	-	-	-	no	50	-
21/08/2008	BTM	Urup	Kostrikum Cape-225	46.21145	150.54547	TL	4	7.6	7.7	0.3	7.9	**8.0**	no	80	79
21/08/2008	BTM	Urup	Kostrikum Cape-232	46.21520	150.54867	TL	3	5.4	5.4	-0.1	5.2	**5.2**	5.6	61	51
19/08/2008	JB	Chirpoi	Peschanaya South-V153	*46.53294*	*150.89059*	HLT	1	5.7	-	-0.3	**5.4**	-	no	70	-
19/08/2008	JB	Chirpoi	Peschanaya South-V150	46.53397	150.89264	HLT	2	10.4	10.3	0.0	10.5	**10.4**	no	91	81
19/08/2008	BTM	Chirpoi	Peschanaya-221	46.53865	150.89644	TL	1	5.6	-	-0.2	**5.5**	-	no	43	42
19/08/2008	BTM	Chirpoi	Peschanaya-217	46.54120	150.90598	TL	3	5.8	5.5	0.1	5.9	**5.6**	no	31	30
19/08/2008	BTM	Chirpoi	Peschanaya-219	46.54148	150.90152	TL	4	7.6	8.6	0.0	7.5	**8.5**	no	40	43
13/07/2007	NGR	Simushir	Spaseniya Bay-37	46.83173	151.87659	HL	1	4.3	-	-0.4	**3.9**	-	4.4	180	141
13/07/2007	NGR	Simushir	Spaseniya Bay-39	46.83411	151.87962	HL	1	2.7	-	-0.4	**2.3**	-	3.9	146	127
12/07/2007	VMK	Simushir	Spaseniya Bay-82	46.83668	151.88249	HL	1	**7.2**	-	-	-	-	-	75	51
12/07/2007	VMK	Simushir	Spaseniya Bay-77b	46.84178	151.89000	HL	1	**5.7**	-	-	-	-	-	109	54
09/08/2008	JB	Simushir	Spaseniya Bay-2	46.84244	151.89121	HLT	4	7.1	7.2	0.3	7.5	**7.5**	no	127	118
13/07/2007	NGR	Simushir	Spaseniya Bay-36	46.84520	151.89542	HL	1	2.2	-	-0.9	**1.3**	-	3.9	212	172
09/08/2008	JB	Simushir	Spaseniya Bay-1	46.84772	151.89931	HLT	5	6.7	6.8	0.2	7.0	**7.0**	7.1	111	116
19/07/2007	NGR	Simushir	Spaseniya Bay-79	46.85087	151.90409	HL	1	6.5	-	-0.3	**6.2**	-	no	80	59
19/07/2007	NGR	Simushir	Spaseniya Bay-78	46.85281	151.90750	HL	1	4.6	-	-0.2	**4.4**	-	no	140	115
18/08/2008	BTM	Simushir	Opasnaya Bay-215	46.94008	152.05510	TL	2	7.2	7.0	-0.3	6.9	**6.7**	no	79	79
18/08/2008	BTM	Simushir	Opasnaya Bay-213	46.94306	152.05847	TL	3	8.6	8.7	-0.2	8.5	**8.5**	no	98	99
18/08/2008	BTM	Simushir	Opasnaya Bay-212	46.94655	152.06214	TL	1	6.4	-	-0.1	**6.3**	-	6.7	136	131
11/07/2007	TKP	Simushir	Dushnaya Bay-1	47.04313	152.15841	TL	1	19.6	-	0.4	**20.0**	-	no	83	79
11/07/2007	TKP	Simushir	Dushnaya Bay-2	47.04530	152.15915	TL	1	12.2	-	0.2	**12.4**	-	12.7	75	92
10/07/2007	VMK	Simushir	Dushnaya Bay-57	*47.04684*	*152.15963*	HL	1	**9.3**	-	-	-	-	-	136	115
10/07/2007	VMK	Simushir	Dushnaya Bay-54	*47.04769*	*152.16070*	HL	1	**11.7**	-	-	-	-	-	44	-
11/07/2007	TKP	Simushir	Dushnaya Bay-3	47.04942	152.16235	TL	1	7.9	-	0.0	**7.9**	-	no	123	135
12/07/2007	TKP	Simushir	Dushnaya Bay-5	47.05409	152.16471	TL	1	11.0	-	0.3	**11.3**	-	no	132	128
12/07/2007	TKP	Simushir	Dushnaya Bay-6	47.05628	152.16650	TL	1	4.2	-	0.2	**4.4**	-	10.1	106	98
12/07/2007	TKP	Simushir	Dushnaya Bay-7	47.05807	152.16878	TL	1	6.3	-	0.0	**6.3**	-	7.1	139	139
13/07/2007	TKP	Simushir	Dushnaya Bay-8	47.05979	152.17162	TL	1	7.9	-	0.7	**8.6**	-	11.4	118	120
13/07/2007	TKP	Simushir	Dushnaya Bay-9	47.06094	152.17313	TL	1	6.7	-	0.6	**7.3**	-	12.0	151	154
10/07/2007	JB	Simushir	Dushnaya Bay-2-2006 (Dushnaya central)	47.06201	152.17549	TL	1	6.7	-	0.0	**6.7**	-	7.7	122	125
14/07/2007	TKP	Simushir	Dushnaya Bay-12	47.06393	152.17726	TL	1	6.6	-	0.3	**6.9**	-	no	120	115
14/07/2007	TKP	Simushir	Dushnaya Bay-11	47.06582	152.17981	TL	1	7.7	-	0.5	**8.2**	-	8.4	115	109
14/07/2007	TKP	Simushir	Dushnaya Bay-10	47.06772	152.18230	TL	1	9.3	-	0.6	**9.9**	-	no	133	121
13/07/2007	JB	Simushir	Dushnaya Bay-110	47.06960	152.18429	TL	11	10.0	8.8	0.0	10.0	**8.8**	no	114	107
14/07/2007	JB	Simushir	Dushnaya Bay-1-2006	47.06971	152.18614	TL	8	9.8	10.0	0.6	10.4	**10.6**	no	100	102
13/07/2007	JB	Simushir	Dushnaya Bay-109	47.07039	152.18792	TL	10	8.8	9.0	0.1	8.9	**9.1**	no	59	56
09/07/2007	VMK	Simushir	Dushnaya Bay-24	*47.07085*	*152.18777*	HL	1	**8.7**	-	-	-	-	-	77	-
13/07/2007	JB	Simushir	Dushnaya Bay-108	47.07124	152.19088	TL	9	11.7	11.6	0.3	12.0	**11.9**	no	61	57
13/07/2007	JB	Simushir	Dushnaya Bay-107	47.07312	152.19315	TL	12	17.9	14.8	0.5	18.4	**15.3**	no	85	74

Date	Team*	Location				Method[§]	Runup (preferred in bold)						Higher elevation seaward of inundation (m)	Inundation	
		Island	Locality name	Latitude of profile[†]	Longitude of profile[†]		Number of runup readings	2006 runup on profile (m)	2006 runup avg. near profile (m)	Tide correction (m)	Runup with tide correction (m)	Runup avg. with tide correction (m)		Measured inundation (m)	GPS calculated inundation (m)
12/07/2007	JB	Simushir	Dushnaya Bay-106	47.07537	152.19476	TL	10	11.5	13.1	-0.1	11.4	**13.0**	no	70	66
12/07/2007	JB	Simushir	Dushnaya Bay-105	47.07754	152.19528	TL	10	14.9	15.1	0.4	15.3	**15.5**	no	93	102
11/07/2007	JB	Simushir	Dushnaya Bay-104	47.07809	152.19888	TL	7	13.3	13.2	-0.2	13.1	**13.0**	no	52	52
11/07/2007	JB	Simushir	Dushnaya Bay-103	47.07818	152.20214	TL	10	10.4	10.9	-0.1	10.3	**10.8**	no	49	46
11/07/2007	JB	Simushir	Dushnaya Bay-102	47.07835	152.20566	TL	8	7.5	7.7	0.0	7.5	**7.7**	no	51	50
11/07/2007	JB	Simushir	Dushnaya Bay-101	47.07880	152.20884	TL	5	8.5	8.5	0.3	8.8	**8.8**	no	44	39
11/07/2007	JB	Simushir	Dushnaya Bay-100	47.07971	152.21016	TL,HLT	1	12.9	-	0.4	**13.3**	-	no	68	-
08/07/2007	JB	Ketoi	Yuzhni Bay-3	47.29640	152.49141	HLT	9	6.8	6.5	0.0	6.8	**6.5**	no	44	27
08/07/2007	VMK	Ketoi	Yuzhni Bay-10c	47.29659	152.49009	HL	1	6.7	-	0.0	**6.7**	-	no	79	38
08/07/2007	VMK	Ketoi	Yuzhni Bay-13	*47.29774*	*152.48760*	HL	1	9.2	-	0.0	**9.2**	-	no	67	43
10/08/2008	JB	Ketoi	SE coast-V111	47.29801	152.50985	HL	1	10.8	-	0.4	**11.2**	-	no	44	46
08/07/2007	JB	Ketoi	Yuzhni Bay-2	47.29807	152.48616	HLT	9	7.3	7.4	0.0	7.3	**7.4**	no	58	54
10/08/2008	JB	Ketoi	SE coast-V109	47.29816	152.50784	HL	1	10.1	-	0.1	**10.2**	-	no	80	49
08/07/2007	JB	Ketoi	Yuzhni Bay-1c	47.29834	152.48416	HLT	16	7.5	6.7	0.0	7.5	**6.7**	no	55	51
10/08/2008	JB	Ketoi	SE coast-V114	47.29867	152.51329	HL	1	9.6	-	0.5	**10.1**	-	no	47	42
08/07/2007	JB	Ketoi	Yuzhni Bay-1b	47.29868	152.48257	HL	9	7.1	6.9	0.0	7.1	**6.9**	no	-	75
10/08/2008	JB	Ketoi	SE coast-V116	47.29893	152.51373	HL	1	10.0	-	0.5	**10.5**	-	no	30	28
08/07/2007	JB	Ketoi	Yuzhni Bay-1a	47.29924	152.48283	HLT	7	6.6	6.5	0.0	6.6	**6.5**	no	52	39
11/07/2007	VMK	Ketoi	Yuzhni Bay-73	47.29960	152.47238	HL	1	6.8	-	0.0	**6.8**	-	-	37	23
11/07/2007	VMK	Ketoi	Yuzhni Bay-10b	47.29966	152.47368	HL	1	6.2	-	0.0	**6.2**	-	-	37	-
11/07/2007	VMK	Ketoi	Yuzhni Bay-71	*47.29966*	*152.47368*	HL	1	6.2	-	0.0	**6.2**	-	-	37	-
11/07/2007	VMK	Ketoi	Yuzhni Bay-69	47.29968	152.47460	HL	1	7.9	-	0.0	**7.9**	-	-	54	35
11/08/2008	JB	Ketoi	SE coast-V121	47.29972	152.51536	HL	1	8.6	-	0.0	**8.6**	-	no	26	27
08/07/2007	VMK	Ketoi	Yuzhni Bay-3b	47.29979	152.48218	HL	1	10.6	-	0.0	**10.6**	-	no	63	47
11/07/2007	VMK	Ketoi	Yuzhni Bay-62	47.30022	152.47934	HL	1	6.0	-	0.0	**6.0**	-	-	37	18
11/07/2007	VMK	Ketoi	Yuzhni Bay-67	47.30025	152.47754	HL	1	9.7	-	0.0	**9.7**	-	-	34	-
11/07/2007	VMK	Ketoi	Yuzhni Bay-64	47.30033	152.47762	HL	1	10.4	-	0.0	**10.4**	-	-	42	22
11/07/2007	VMK	Ketoi	Yuzhni Bay-61	*47.30043*	*152.48006*	HL	1	6.3	-	0.0	**6.3**	-	-	52	-
11/07/2007	VMK	Ketoi	Yuzhni Bay-59	47.30047	152.48114	HL	1	6.8	-	0.0	**6.8**	-	-	67	37
11/08/2008	JB	Ketoi	SE coast-V122	47.30130	152.51790	HL	1	11.8	-	0.1	**11.9**	-	no	41	45
11/08/2008	JB	Ketoi	SE coast-V124	47.30271	152.52079	HL	1	11.0	-	0.1	**11.1**	-	no	55	63
11/08/2008	JB	Ketoi	SE coast-V126	47.30438	152.52267	HL	1	11.2	-	0.3	**11.5**	-	no	72	60
11/08/2008	JB	Ketoi	SE coast-V128	47.30534	152.52402	HLT	1	10.1	-	0.4	**10.6**	-	no	80	72
10/08/2007	TKP	Ushishir	Yankicha-257	47.52596	152.82620	TL	2	12.8	12.7	0.8	13.6	**13.5**	no	57	70
09/08/2007	TKP	Ushishir	Ryponkicha-238	47.53181	152.82719	TL	4	9.4	11.0	0.7	10.1	**11.7**	no	52	50
12/08/2008	JB	Ushishir	Ryponkicha-V135	47.53207	152.82801	HLT	1	9.0	-	0.2	**9.2**	-	no	47	-
09/08/2007	TKP	Ushishir	Ryponkicha-245	47.53244	152.82906	TL	5	10.8	10.6	0.6	11.4	**11.2**	no	56	55
09/08/2007	NGR	Ushishir	Ryponkicha-285	47.53287	152.82868	HL	1	9.9	-	0.2	**10.1**	-	no	60	48
09/08/2007	TKP	Ushishir	Ryponkicha-249	47.53324	152.83098	TL	3	11.2	10.8	0.4	11.6	**11.2**	no	46	42
09/08/2007	TKP	Ushishir	Ryponkicha-251	47.53508	152.83231	TL	1	11.8	-	0.2	**12.0**	-	no	45	55
09/08/2007	TKP	Ushishir	Ryponkicha-253	47.53632	152.83617	TL	5	12.2	11.1	-0.1	12.1	**11.0**	no	50	47
09/08/2007	TKP	Ushishir	Ryponkicha-255	47.53742	152.84057	TL	3	7.4	7.7	-0.3	7.1	**7.4**	no	25	30
09/08/2007	NGR	Ushishir	Ryponkicha-180	47.54934	152.85081	HL	1	6.5	-	-0.8	**5.7**	-	no	54	47
09/08/2008	BTM	Rasshua	SE coast-187	47.68511	152.97311	TL	3	10.2	10.5	0.0	10.3	**10.5**	no	46	48

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		Island	Locality name	Latitude of profile†	Longitude of profile†		Number of runup readings	2006 runup on profile (m)	2006 runup avg. near profile (m)	Tide correction (m)	Runup with tide correction (m)	Runup avg. with tide correction (m)		Measured inundation (m)	GPS calculated inundation (m)
08/08/2008	BTM	Rasshua	SW coast-177	47.68617	152.96642	TL	1	7.1	-	-0.2	**6.9**	-	no	38	57
08/08/2008	BTM	Rasshua	SW coast-179	47.69037	152.96786	TL	1	7.5	-	0.1	**7.6**	-	no	42	41
09/08/2008	BTM	Rasshua	SE coast-189	47.69040	152.97519	TL	3	9.4	9.8	0.2	9.6	**10.0**	no	99	93
09/08/2008	BTM	Rasshua	SE coast-191	47.69449	152.97826	TL	5	10.8	10.8	0.4	11.2	**11.2**	no	84	75
08/08/2008	BTM	Rasshua	SW coast-181	47.69501	152.96827	TL	4	6.8	7.1	0.3	7.1	**7.4**	no	50	52
09/08/2008	BTM	Rasshua	SE coast-193	47.69648	152.98709	TL	1	10.5	-	0.4	**10.9**	-	no	57	53
11/08/2007	NGR	Rasshua	SW coast-198	47.69893	152.96575	HL	1	4.7	-	0.3	**5.0**	-	no	66	-
11/08/2007	NGR	Rasshua	SW coast-196	47.69963	152.96543	HL	1	3.9	-	0.3	**4.2**	-	no	64	-
08/08/2008	BTM	Rasshua	SW coast-183	47.70066	152.96200	TL	1	4.7	-	0.3	**5.0**	-	no	73	74
11/08/2007	JB	Rasshua	Landing cove-507	47.70630	152.96405	HL	1	9.7	-	-0.3	**9.4**	-	no	56	53
10/08/2008	BTM	Rasshua	Nepristupnaya Bay-195	47.70983	153.02418	TL	3	10.9	11.8	-0.3	10.7	**11.5**	no	43	36
10/08/2008	BTM	Rasshua	Nepristupnaya Bay-central	*47.71077*	*153.02597*	A	1	22	-	0.1	**22**	-	no	-	-
10/08/2008	BTM	Rasshua	Nepristupnaya Bay-north	47.71166	153.02907	A	3	-	11	0.1	-	**11**	no	-	50
15/08/2008	ACR	Rasshua	IMGG cove-V144	47.71964	152.97135	HLT	1	8.7	-	-0.5	**8.2**	-	no	63	64
15/08/2008	ACR	Rasshua	IMGG cove-V142	47.72330	152.97303	HLT	1	9.0	-	-0.5	**8.5**	-	no	33	40
14/08/2008	BTM	Rasshua	Severniy Cape-205	47.79095	153.04941	TL	4	10.9	11.0	-0.4	10.5	**10.6**	no	51	34
11/08/2008	BTM	Rasshua	Severniy Cape-201	47.79513	153.05030	TL	2	11.2	11.3	0.1	11.3	**11.4**	no	111	107
14/08/2008	BTM	Rasshua	Severniy Cape-209	47.80009	153.04924	TL	3	12.3	12.5	-0.1	12.2	**12.4**	no	75	78
11/08/2008	BTM	Rasshua	Severniy Cape-203	47.80408	153.04496	TL	3	19.7	19.8	0.4	20.1	**20.2**	no	71	57
06/08/2007	NGR	Matua	South Bay-153	48.03749	153.27090	HL	1	7.8	-	0.1	**7.8**	-	no	254	129
07/08/2007	TKP	Matua	South Bay-222	48.03976	153.23971	TL	2	6.9	7.4	-0.1	6.8	**7.3**	7.0	174	170
04/08/2007	NGR	Matua	Ainu Bay-142	48.03980	153.22876	HL	1	13.0	-	-0.1	**12.9**	-	no	164	128
07/08/2007	TKP	Matua	South Bay-224	48.04023	153.24302	TL	1	5.8	-	-0.1	**5.7**	-	5.9	215	219
06/08/2007	NGR	Matua	South Bay-152	48.04034	153.26773	HL	1	7.8	-	0.1	**7.8**	-	no	147	126
07/08/2007	NGR	Matua	Sarychevo-160	48.04124	153.27865	HL	1	7.3	-	0.0	**7.3**	-	no	56	55
07/08/2007	TKP	Matua	South Bay-228	48.04127	153.24595	TL	1	7.3	-	-0.2	**7.1**	-	no	233	205
02/08/2007	NGR	Matua	Ainu Bay-126	48.04154	153.22731	HL	1	21.2	-	-0.5	**20.8**	-	no	436	315
07/08/2007	NGR	Matua	Sarychevo-161	48.04193	153.27764	HL	1	6.1	-	0.0	**6.1**	-	no	108	92
06/08/2007	TKP	Matua	South Bay-216 (central)	48.04199	153.24922	TL	1	5.8	-	-0.1	**5.7**	-	7.6	223	221
06/08/2007	NGR	Matua	South Bay-151	48.04202	153.26372	HL	1	7.9	-	0.0	**7.9**	-	8.1	95	60
06/08/2007	NGR	Matua	South Bay-148	48.04234	153.25296	HL	1	4.9	-	0.1	**4.9**	-	9.9	174	139
06/08/2007	NGR	Matua	South Bay-149	48.04244	153.25585	HL	1	6.4	-	0.1	**6.4**	-	8.2	134	101
03/08/2007	NGR	Matua	Ainu Bay-133	48.04266	153.22644	HL	1	20.4	-	-0.2	**20.2**	-	no	503	417
06/08/2007	NGR	Matua	South Bay-150	48.04267	153.25930	HL	1	5.6	-	0.0	**5.7**	-	6.4	176	146
06/08/2007	BTM	Matua	Ainu Bay-2-2006 (south)	48.04269	153.22650	TL	6	18.3	18.2	-0.1	18.2	**18.1**	no	432	411
03/08/2007	NGR	Matua	Ainu Bay-132	48.04284	153.22588	HL	1	18.5	-	-0.3	**18.3**	-	no	398	376
07/08/2007	NGR	Matua	Sarychevo-162	48.04349	153.27506	HL	1	8.0	-	0.0	**8.1**	-	no	109	116
04/08/2007	BTM	Matua	Ainu Bay-1-2006 (north)	48.04412	153.22497	TL	1	17.3	-	-0.2	**17.1**	-	no	327	313
03/08/2007	NGR	Matua	Ainu Bay-130	48.04444	153.22463	HL	1	17.3	-	-0.1	**17.1**	-	no	356	315
07/08/2007	NGR	Matua	Sarychevo-164	48.04504	153.27429	HL	1	8.5	-	0.0	**8.6**	-	no	124	110
04/08/2007	NGR	Matua	Ainu Bay-139	48.04537	153.22430	HL	1	18.4	-	-0.2	**18.1**	-	no	315	288
05/08/2007	NGR	Matua	Ainu Bay-143	48.04599	153.22315	HL	1	17.2	-	-0.1	**17.1**	-	no	244	200
07/08/2007	NGR	Matua	Sarychevo-165	48.04660	153.27397	HL	1	8.5	-	0.1	**8.6**	-	no	122	101
04/08/2007	NGR	Matua	Ainu Bay-144	48.04707	153.22058	HL	1	14.2	-	-0.1	**14.0**	-	no	120	119

Date	Team*	Location				Method[§]	Runup (preferred in bold)						Higher elevation seaward of inundation (m)	Inundation	
		Island	Locality name	Latitude of profile[†]	Longitude of profile[†]		Number of runup readings	2006 runup on profile (m)	2006 runup avg. near profile (m)	Tide correction (m)	Runup with tide correction (m)	Runup avg. with tide correction (m)		Measured inundation (m)	GPS calculated inundation (m)
07/08/2007	NGR	Matua	Sarychevo-166	48.04751	153.27489	HL	1	9.5	-	0.1	**9.6**	-	no	56	56
04/08/2007	NGR	Matua	Ainu Bay-145	48.04786	153.21894	HL	1	13.6	-	0.0	**13.6**	-	no	121	68
07/08/2007	NGR	Matua	Sarychevo-167	48.04854	153.27534	HL	1	10.3	-	0.1	**10.4**	-	no	71	67
07/08/2007	NGR	Matua	Sarychevo-170	48.04985	153.27407	HL	1	9.8	-	0.1	**9.9**	-	no	55	48
03/08/2007	TKP	Matua	Sarychevo-142	48.05172	153.27181	TL	3	13.8	14.0	0.3	14.1	**14.3**	no	51	54
03/08/2007	TKP	Matua	Sarychevo-145	48.05310	153.26861	TL	3	11.2	11.8	0.4	11.6	**12.2**	no	62	55
03/08/2007	TKP	Matua	Sarychevo-147	48.05498	153.26675	TL	1	16.8	-	0.2	**17.0**	-	no	49	48
03/08/2007	TKP	Matua	Sarychevo-149	48.05728	153.26618	TL	1	15.4	-	-0.1	**15.3**	-	no	60	56
04/08/2007	TKP	Matua	Sarychevo-152	48.05941	153.26706	TL	1	21.7	-	0.2	**21.9**	-	no	48	41
04/08/2007	TKP	Matua	Sarychevo-154	48.06177	153.26918	TL	1	16.7	-	0.0	**16.7**	-	no	46	26
04/08/2007	TKP	Matua	Sarychevo-157	48.06401	153.26918	TL	3	12.0	12.3	-0.2	11.8	**12.1**	no	69	79
03/08/2007	BTM	Matua	Sarychevo-86	48.06642	153.26921	TL,HLT	3	-	15.5	0.2	15.7	**15.7**	no	56	52
03/08/2007	BTM	Matua	Sarychevo-83	48.06911	153.26872	TL	4	16.9	16.7	0.1	17.0	**16.8**	no	38	35
03/08/2007	BTM	Matua	Sarychevo-79	48.07098	153.26668	TL	4	19.6	18.8	0.2	19.8	**19.0**	no	50	45
08/08/2007	JB	Matua	Toporkov-231	48.07213	153.28239	HLT	2	9.4	9.4	-0.1	9.3	**9.3**	no	40	40
08/08/2007	JB	Matua	Toporkov-234	48.07238	153.28224	HLT	1	>8.1	-	-0.1	**>8.0**	-	no	37	42
03/08/2007	BTM	Matua	Sarychevo-73	48.07340	153.26681	TL	1	17.7	-	0.4	**18.1**	-	no	93	106
08/08/2007	JB	Matua	Toporkov-230	48.07375	153.28205	HLT	2	10.0	9.8	0.1	10.1	**9.9**	no	42	27
03/08/2007	BTM	Matua	Sarychevo-69	48.07510	153.26518	TL	1	12.4	-	0.2	**12.6**	-	no	59	94
08/08/2007	JB	Matua	Toporkov-235	48.07510	153.28164	HLT	1	11.4	-	-0.1	**11.3**	-	no	28	26
08/08/2007	JB	Matua	Toporkov-237	48.07637	153.28168	HLT	4	10.5	10.2	-0.2	10.3	**10.0**	no	41	-
02/08/2007	BTM	Matua	Sarychevo-136	48.07707	153.26329	TL	4	10.6	10.7	0.0	10.6	**10.7**	no	36	34
02/08/2007	BTM	Matua	Sarychevo-133	48.07906	153.26357	TL	1	12.3	-	0.2	**12.5**	-	no	38	44
02/08/2007	BTM	Matua	Sarychevo-129	48.08123	153.26444	TL	3	10.2	10.3	0.3	10.5	**10.6**	no	54	42
02/08/2007	BTM	Matua	Sarychevo-125	48.08323	153.26612	TL	4	11.3	11.3	0.5	11.8	**11.8**	no	118	103
02/08/2007	BTM	Matua	Sarychevo-120	48.08416	153.26740	TL	6	12.6	11.5	0.5	13.1	**12.0**	no	70	68
05/08/2008	BTM	Matua	NE Bay-5	48.09483	153.24565	A	1	18.5	-	-0.1	**18**	-	no	-	56
05/08/2008	BTM	Matua	NE Bay-4	48.09620	153.24276	A	2	-	16	-0.1	-	**16**	no	-	43
05/08/2008	BTM	Matua	NE Bay-3	48.09751	153.24232	HL	3	-	14	-0.1	-	**14**	no	-	36
05/08/2008	BTM	Matua	NE Bay-2	48.09776	153.24250	A	3	-	13	-0.1	-	**13**	no	-	47
05/08/2008	BTM	Matua	NE Bay-1	48.09836	153.24240	A	1	10	-	-0.1	**10**	-	no	-	43
22/07/2008	BTM	Shiashkotan	Voskhodnaya Bay	*48.78556*	*154.08406*	A	20	-	6	-0.3	-	**5.5**	no	-	60
22/07/2008	JB	Shiashkotan	Voskhodnaya Bay-1	*48.78817*	*154.08586*	TL	1	7.4	-	-0.3	**7.1**	-	no	56	-
23/07/2008	BTM	Kharimkotan	1933 Landslide	*49.12374*	*154.60002*	A	7	-	4	-0.2	-	**3**	7.3	-	400
31/07/2008	BTM	Kharimkotan	Severgina Bay-south	49.16001	154.49450	A	3	-	5	-0.1	-	**5**	no	-	556
31/07/2008	BTM	Kharimkotan	Severgina Bay-north	49.16329	154.48074	A	2	-	7	-0.5	-	**6**	no	-	66
27/07/2008	BTM	Onekotan	Mussel Bay-south	49.38688	154.82825	A	4	-	5	0.0	-	**5**	no	-	36
27/07/2008	BTM	Onekotan	Mussel Bay-central-A	49.38814	154.82450	A	3	-	5	-0.4	-	**4**	no	-	127
27/07/2008	BTM	Onekotan	Mussel Bay-central-B	49.38814	154.82450	A	1	8.5	-	-0.4	**8**	-	no	-	41
27/07/2008	BTM	Onekotan	Mussel Bay-north-A	49.38891	154.82392	A	1	4	-	-0.2	**4**	-	no	-	180
27/07/2008	BTM	Onekotan	Mussel Bay-north-B	49.38891	154.82392	A	3	-	7	-0.2	-	**6**	no	-	123
26/07/2008	BTM	Onekotan	Cape Lissii Bay-south	49.39499	154.82517	A	2	-	7	0.1	-	**7**	no	-	38
26/07/2008	BTM	Onekotan	Cape Lissii Bay-central-A	49.39749	154.82366	A	1	4.5	-	0.1	**5**	-	no	-	125
26/07/2008	BTM	Onekotan	Cape Lissii Bay-central-B	49.39749	154.82366	A	3	6	-	0.1	**6**	-	no	-	63

Date	Team*	Location				Method§	Runup (preferred in bold)						Higher elevation seaward of inundation (m)	Inundation	
		Island	Locality name	Latitude of profile†	Longitude of profile†		Number of runup readings	2006 runup on profile (m)	2006 runup avg. near profile (m)	Tide correction (m)	Runup with tide correction (m)	Runup avg. with tide correction (m)		Measured inundation (m)	GPS calculated inundation (m)
28/07/2008	BTM	Onekotan	Cape Lissii Bay-north	49.40006	154.82539	A	1	8	-	0.4	**8**	-	no	-	27
30/07/2008	BTM	Onekotan	Cape Lisii-lighthouse	49.40051	154.82888	A	3	-	7	-0.3	-	**7**	no	-	38
28/07/2008	BTM	Onekotan	Blakiston Bay-8	49.40144	154.81968	A	1	10	-	0.4	**10**	-	no	-	39
29/07/2008	BTM	Onekotan	Blakiston Bay-9-A	49.40588	154.81512	A	1	5	-	0.4	**5**	-	no	-	158
29/07/2008	BTM	Onekotan	Blakiston Bay-9-B	49.40588	154.81512	A	2	-	10	0.4	-	**10**	no	-	89
29/07/2008	BTM	Onekotan	Blakiston Bay-9-C	49.40588	154.81512	HLT	1	8.0	-	0.5	**8.5**	-	no	83	89
28/07/2008	BTM	Onekotan	Blakiston Bay-7-A	49.41474	154.81187	A	2	-	5	0.4	-	**5**	no	-	223
28/07/2008	BTM	Onekotan	Blakiston Bay-7-B	49.41474	154.81187	A	2	-	11	0.4	-	**11**	no	-	114
28/07/2008	BTM	Onekotan	Blakiston Bay-6-A	49.42438	154.81009	A	1	5	-	0.4	**5**	-	no	-	200
28/07/2008	BTM	Onekotan	Blakiston Bay-6-B	49.42438	154.81009	A	2	-	10	0.4	-	**10**	no	-	99
28/07/2008	BTM	Onekotan	Blakiston Bay-5-A	49.43465	154.80873	A	4	-	8	0.3	-	**8**	no	-	159
28/07/2008	BTM	Onekotan	Blakiston Bay-5-B	49.43465	154.80873	A	1	11	-	0.3	**11**	-	no	-	57
28/07/2008	BTM	Onekotan	Blakiston Bay-4-A	49.44043	154.80874	A	4	-	5	-0.2	-	**5**	no	-	430
28/07/2008	BTM	Onekotan	Blakiston Bay-4-B	49.44043	154.80874	A	1	10	-	-0.2	**10**	-	no	-	105
25/07/2008	BTM	Onekotan	Blakiston Bay-3	49.45092	154.80956	A	4	-	4	-0.1	-	**4**	no	-	311
25/07/2008	BTM	Onekotan	Blakiston Bay-2-A	49.46020	154.81065	A	1	4	-	0.0	**4**	-	no	-	162
25/07/2008	BTM	Onekotan	Blakiston Bay-2-B	49.46020	154.81065	A	1	6	-	0.0	**6**	-	no	-	77
25/07/2008	BTM	Onekotan	Blakiston Bay-1	49.47269	154.81434	A	1	7	-	0.0	**7**	-	no	-	103

* Initials of team leaders: NGR (Nadezhda Razhigaeva), VMK (Viktor Kaistrenko), JB (Joanne Bourgeois), TKP (Tatiana Pinegina), BTM (Breanyn MacInnes)

† Lat/Long at sea level unless italic

§ Method: TL (transit level and rod), HLT (hand level, rod and tape), HL (hand level, rod for elevation and distance), A (altimeter (+/- 1 m error) and GPS)

- = unknown, not measured, or not applicable

TABLE DR2. DATA FROM SURVEYS RELATING TSUNAMI SEDIMENT DISTRIBUTION TO TSUNAMI RUNUP AND ELEVATION

Ref	Tsunami	Name of profile or transect	Water inundation (m)	Water runup (m)	Sediment inundation (m)	Sediment runup (m)	% Sed inundation	% Sed runup*	Total relief † (m/m)	Max relief (m/m)	Max elevation (m)
1	1998 PNG	Waipo	320	1.25	280	1.5	88	120	0.004	0.150	3.2
1	1998 PNG	Arop	720	1.5	680	2	94	133	0.002	0.010	2.5
1	1998 PNG	Otto	160	-0.2	130	0.25	81	125	-0.001	0.150	0.75
1	1998 PNG	Sissano	575	1	575	1	100	100	0.002	0.027	3.1
2	2004 Indian Oc.	Jantang 3	665	19.7	628	4	94	20	0.030	0.432	19.7
3	1993 Hokkaido	Miyano, Taisei A	445	4.75	370	4	83	84	0.011	0.050	4.75
3	1993 Hokkaido	Miyano, Taisei B	460	5	420	4.5	91	90	0.011	0.050	5
5	1992 Nicaragua	Salina	425	2.2	425	2.2	100	100	0.005	0.110	2.75
5	1992 Nicaragua	Yellow house	380	2.5	320	2.4	84	96	0.007	0.067	3
5	1992 Nicaragua	Mangrove	300	1.8	230	1.75	77	97	0.006	0.081	3.25
5	1992 Nicaragua	Beach rock	362	2.2	300	2.15	83	98	0.006	0.107	3.5
4	2004 Indian Oc.	Thiruvidandai	330	6	300	4	91	67	0.0182	0.0917	6
4	2004 Indian Oc.	Vadanemmeli	220	3.75	220	3.75	100	100	0.0170	0.0170	3.75
4	2004 Indian Oc.	Kalpakkam	445	4	445	4	100	100	0.0090	0.0250	4
4	2004 Indian Oc.	Mamallapuram§	650	4.3	620	5	95	116	0.0066	0.0800	5
4	2004 Indian Oc.	Kadalore	70	4.2	70	4.2	100	100	0.0600	0.1500	4.2
6	1992 Flores Is.	Lato#	140	3.5	75	1.75	54	50	0.0250	0.1000	3.5
7	*2006 Kuril Is.*	*Dushnaya 2006-2*	*122*	*6.7*	*120*	*6.6*	*98*	*99*	*0.0549*	*1.50*	*6.7*
7	*2006 Kuril Is.*	*Dushnaya Bay 2*	*75*	*12.4*	*72*	*12.1*	*96*	*98*	*0.1653*	*4.84*	*12.4*
7	*2006 Kuril Is.*	*South Bay-211*	*223*	*5.7*	*217*	*5*	*97*	*88*	*0.0256*	*1.29*	*7.6*
7	*2006 Kuril Is.*	*Ainu Bay 2006-1*	*327*	*17.1*	*305*	*14.8*	*93*	*87*	*0.0523*	*1.04*	*17.1*
7	*2006 Kuril Is.*	*Ainu Bay 2006-2*	*432*	*18.1*	*422*	*17.3*	*98*	*96*	*0.0419*	*0.81*	*18.1*
7	*2006 Kuril Is.*	*Dushnaya Bay-102*	*51*	*7.7*	*46*	*6.7*	*90*	*87*	*0.1510*	*5.49*	*7.7*

Ref	Tsunami	Name of profile or transect	Water inundation (m)	Water runup (m)	Sediment inundation (m)	Sediment runup (m)	% Sed inundation	% Sed runup*	Total relief † (m/m)	Max relief (m/m)	Max elevation (m)
7	*2006 Kuril Is.*	*Dushnaya Bay-6*	*106*	*4.4*	*106*	*4.4*	*100*	*100*	*0.0415*	*0.66*	*10.3*
7	*2006 Kuril Is.*	*Dushnaya Bay-109*	*59*	*9.1*	*49*	*7.5*	*83*	*82*	*0.1542*	*2.48*	*9.1*
7	*2006 Kuril Is.*	*Dushnaya Bay-12*	*120*	*6.9*	*112*	*5.8*	*93*	*84*	*0.0575*	*0.64*	*6.9*
7	*2006 Kuril Is.*	*Dushnaya Bay-7*	*139*	*6.3*	*139*	*6.3*	*100*	*100*	*0.0453*	*1.87*	*6.3*
7	*2006 Kuril Is.*	*Dushnaya Bay-9*	*151*	*7.3*	*151*	*7.3*	*100*	*100*	*0.0483*	*1.05*	*12.6*
7	*2006 Kuril Is.*	*Sarychevo-125*	*118*	*11.8*	*97*	*8.4*	*82*	*71*	*0.1000*	*1.01*	*11.8*
7	*2006 Kuril Is.*	*NE Rasshua-201*	*111*	*11.4*	*109*	*10.2*	*98*	*89*	*0.1023*	*0.52*	*11.4*
2	2004 Indian Oc.	Jantang, L1-2	517.5	14.9	512.5	--**	99	--	--	--	--
2	2004 Indian Oc.	Lhok Kruet 1	376.4	12.6	275.1	--	73	--	--	--	--
2	2004 Indian Oc.	Lhok Kruet L1-4	414.8	17.4	334.1	--	81	--	--	--	--
2	2004 Indian Oc.	Lhok Leupung	903.3	12.2	856	--	95	--	--	--	--
2	2004 Indian Oc.	Kuala Meurisi	1820	12.9	1803.3	--	99	--	--	--	--
2	2004 Indian Oc.	Langi Island	524.4	--	492.6	--	94	--	--	--	--
2	2004 Indian Oc.	Langi field	441.4	3	234.9	--	53	--	--	--	--
2	2004 Indian Oc.	Langi village	294.2	10.9	276.8	--	94	--	--	--	--
2	2004 Indian Oc.	Langi 102	334.7	7.3	330.8	--	99	--	--	--	--
2	2004 Indian Oc.	Busung 2	82	3.1	67.9	--	83	--	--	--	--
2	2004 Indian Oc.	Busung 1	130	4.1	109.3	--	84	--	--	--	--

*Numbers >100% are cases where slope goes down at end

† "total relief" = runup/inundation

§Disagreement between text and figure; profile plot may be in error

Fringing reef

**Not reported

References: 1. Gelfenbaum and Jaffe, 2003; 2. Jaffe et al., 2006; 3. Nanayama et al., 2003; 4. Srinivasalu et al., 2007; 5. J. Bourgeois, unpublished field notes, see also Higman and Bourgeois, 2008; 6. Shi et al., 1996; *7. This study*

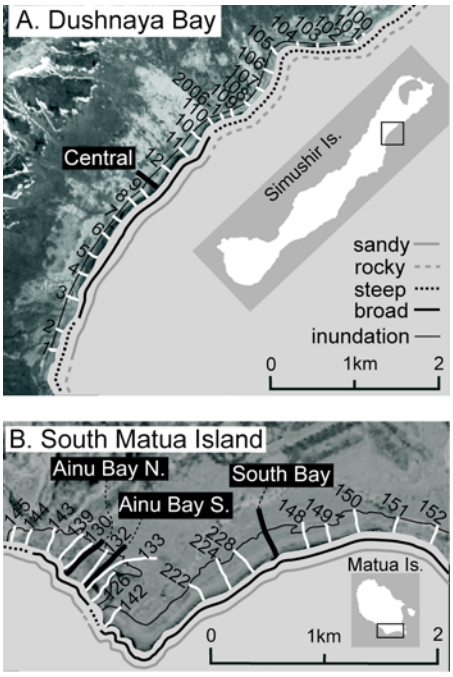

Figure DR1. Location of topographic profiles and mapped inundation limits in Dushnaya Bay, Simushir, and Ainu and South bays, Matua Island. Profiles measured both in 2006 and 2007 are named. **A**. Digital Globe image. **B.** ASTER image.

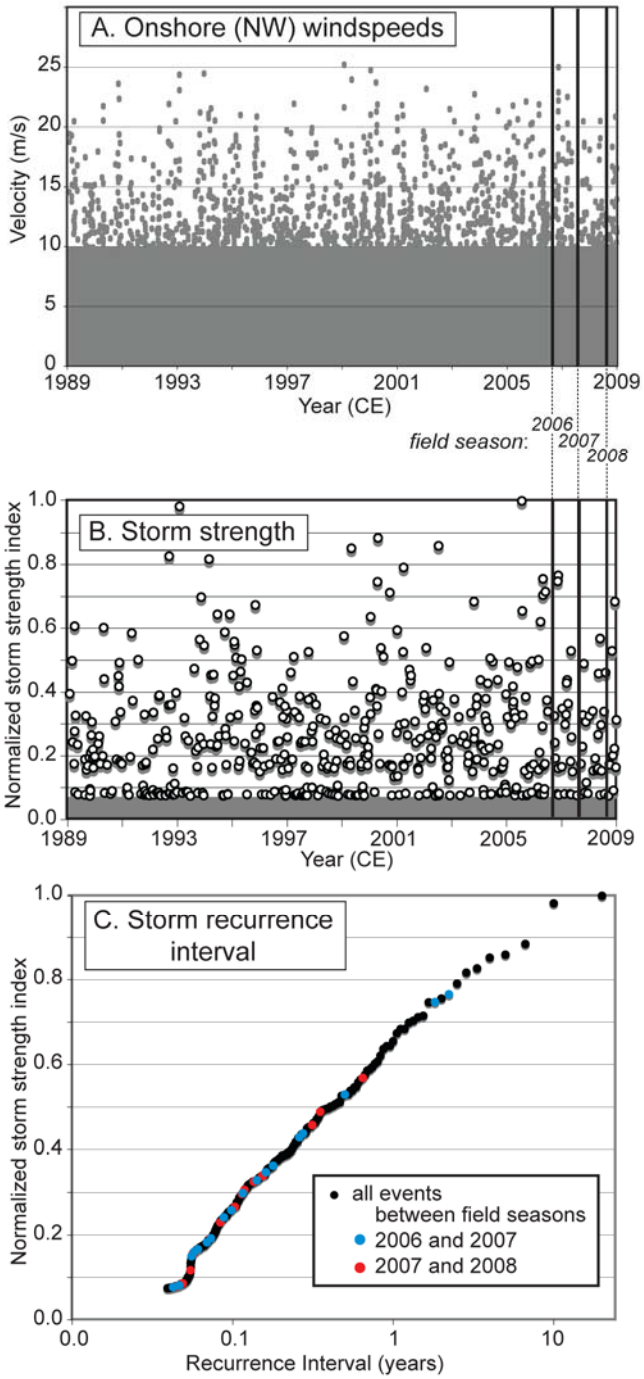

Figure DR2: **A**. Calculated wind speed >10 m/s in the onshore (NW) direction in the central Kuril Islands from Jan 1989-Dec 2008. Data are averaged over 2.5° latitude and longitude centered on 45° N, 150° E and 47.5° N, 152.5° E, derived from 4-times-daily surface winds from NCEP Reanalysis data provided by NOAA/OAR/ESRL PSD, Boulder, Colorado, USA, http://www.cdc.noaa.gov/. The three vertical lines represent the three summer field seasons of KBP. **B**. Same data as in **A** normalized to a comparative index of storm strength to account for storm duration. Wind speeds (in m/s) are multiplied by the length (in days) of sustained >10 m/s wind speeds. Two large events (index = 0.75) occurred in early November 2006 (6-7 Nov and 11-12 Nov), but nothing as large since then. **C**. Recurrence interval for all events with >10 m/s onshore wind speeds between January 1989 and December 2008. The two largest events between field seasons have recurrences of 1.8 and 2.2 years and occurred in 2006 before the tsunami.

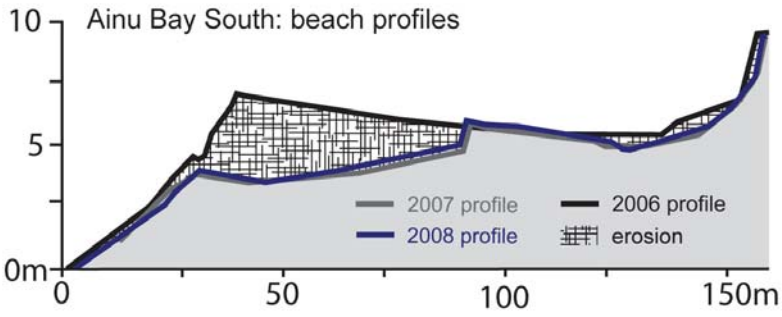

Figure DR3: Topography of the beach on the Ainu Bay south profile from surveys in 2006, 2007, and 2008. That the 2007 and 2008 profiles remain nearly identical (within measurement error) suggests that the large difference from 2006 to 2007/8 is due to tsunami erosion removing sediment entirely from the littoral zone.

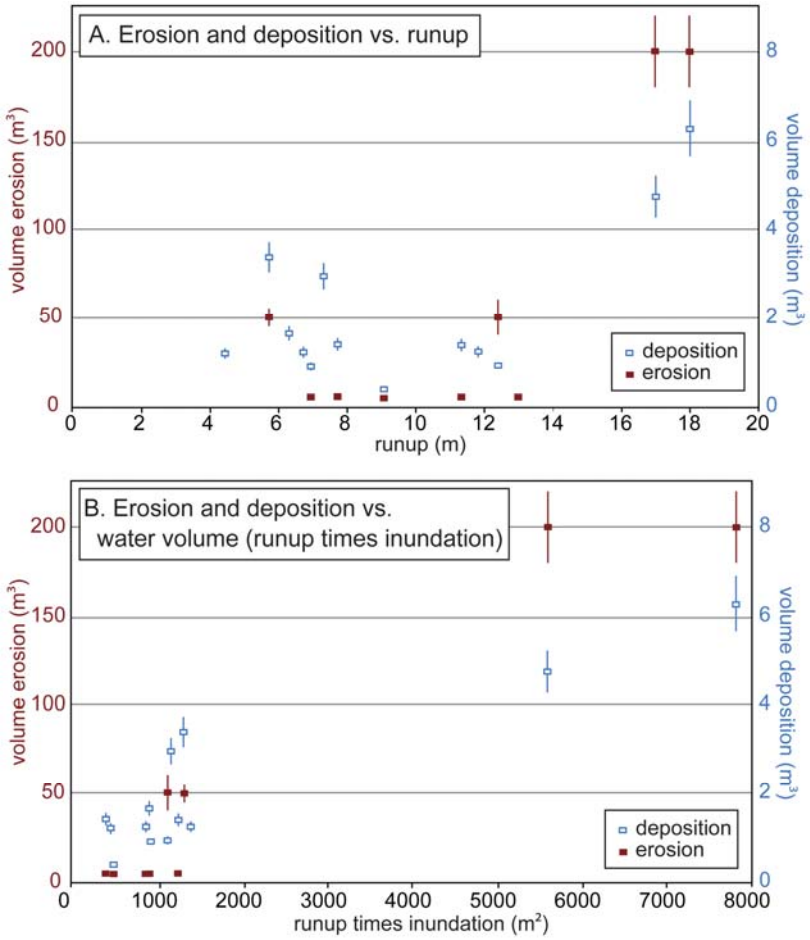

Figure DR4. Calculated and estimated volumes of tsunami erosion and deposition plotted against **A**-runup and **B**-runup times inundation. Plotted data are given in Table 1.

Figure DR5. Stitched panorama centered on Dushnaya Bay Central profile (located in Figure 2, illustrated in Figure 3). Photographer Bourgeois is on high ridge at the back of the profile; the three people are landward of 2006 runup and inundation; some tsunami transported wood is visible near right edge, center. Person in center background is along the profile track. No significant erosion occurred on this profile landward of the backbeach scarp; see Figure DR6. A thin sand layer extended almost to the limit of runup and inundation (Fig. 3; Table 1).

Figure DR6: Before (summer 2006) and after (summer 2007) photoset- Central Dushnaya Bay, near Profile 10 (see Figure 2). A red circle identifies approximately the same point in each photo. The 2007 photo shows evidence of some backbeach cliff retreat—hanging and fallen fresh turf. Also, between photos, the beach has been rearranged so that the backbeach valley has been filled in (as in Dushnaya Central profile, Figure 3). 2006 photo: Dena Berkey; 2007 photo: MacInnes.

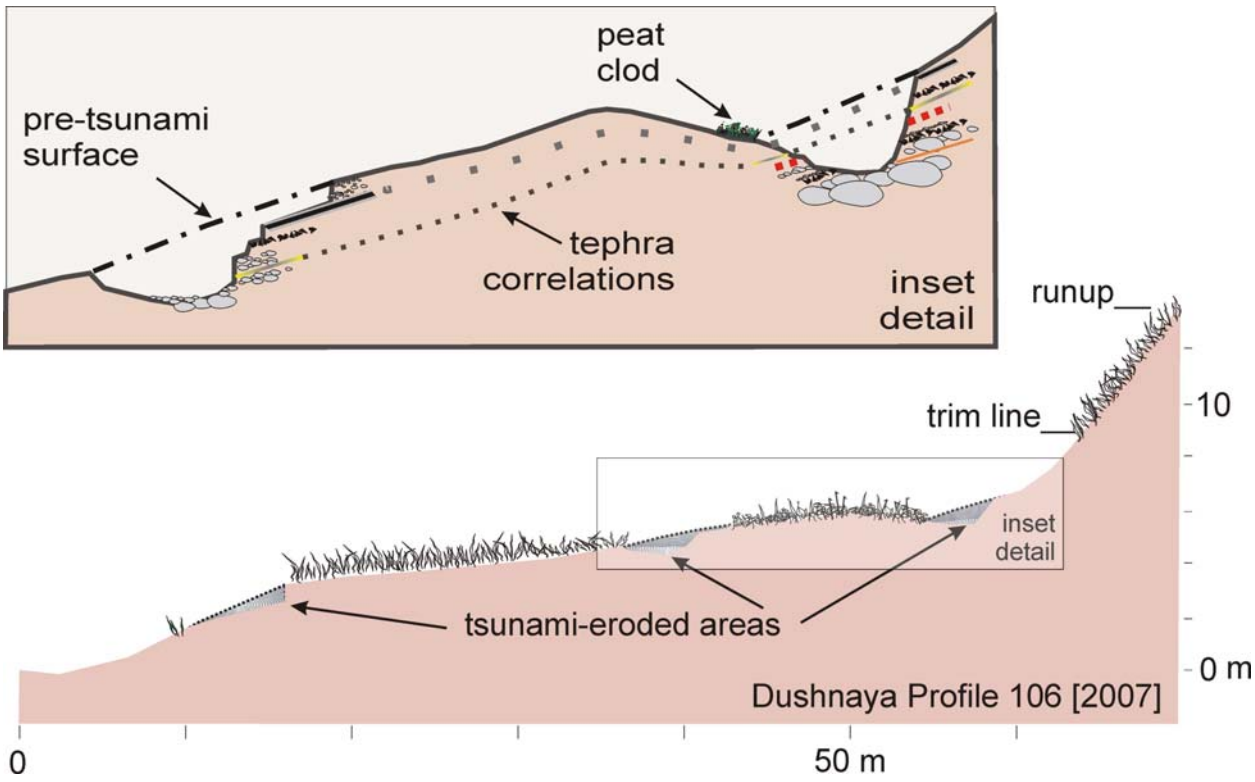

Figure DR7. A steep, well-vegetated profile measured in 2007 from northern Dushnaya Bay, Simushir (2:1 vertical exaggeration). The former surface was inferred from the current surface and the location of soil stripping; also, in erosion zones, remaining root rhizomes often indicated original soil elevation. The soil was cohesive and eroded mainly through block removal, preferentially along certain tephra layers – cinders in particular (see inset). Tephra correlations also show that the surface is progressively younger toward the sea, indicating net progradation since about 2000 – 3000 years ago (from preliminary radiocarbon dates in peat). Photos in Figure DR8 were taken near this profile.

Figure DR8. Before (summer 2006) and after (summer 2007) photoset from northern Dushnaya Bay near profile 106 (between 105 and 106; see Figure 2 for location; see Figure DR6 for a profile near this spot). Our team in 2006 chose a convenient but foolish spot for one overnight. 2006 photo: Beth Martin; 2007 photo: MacInnes.

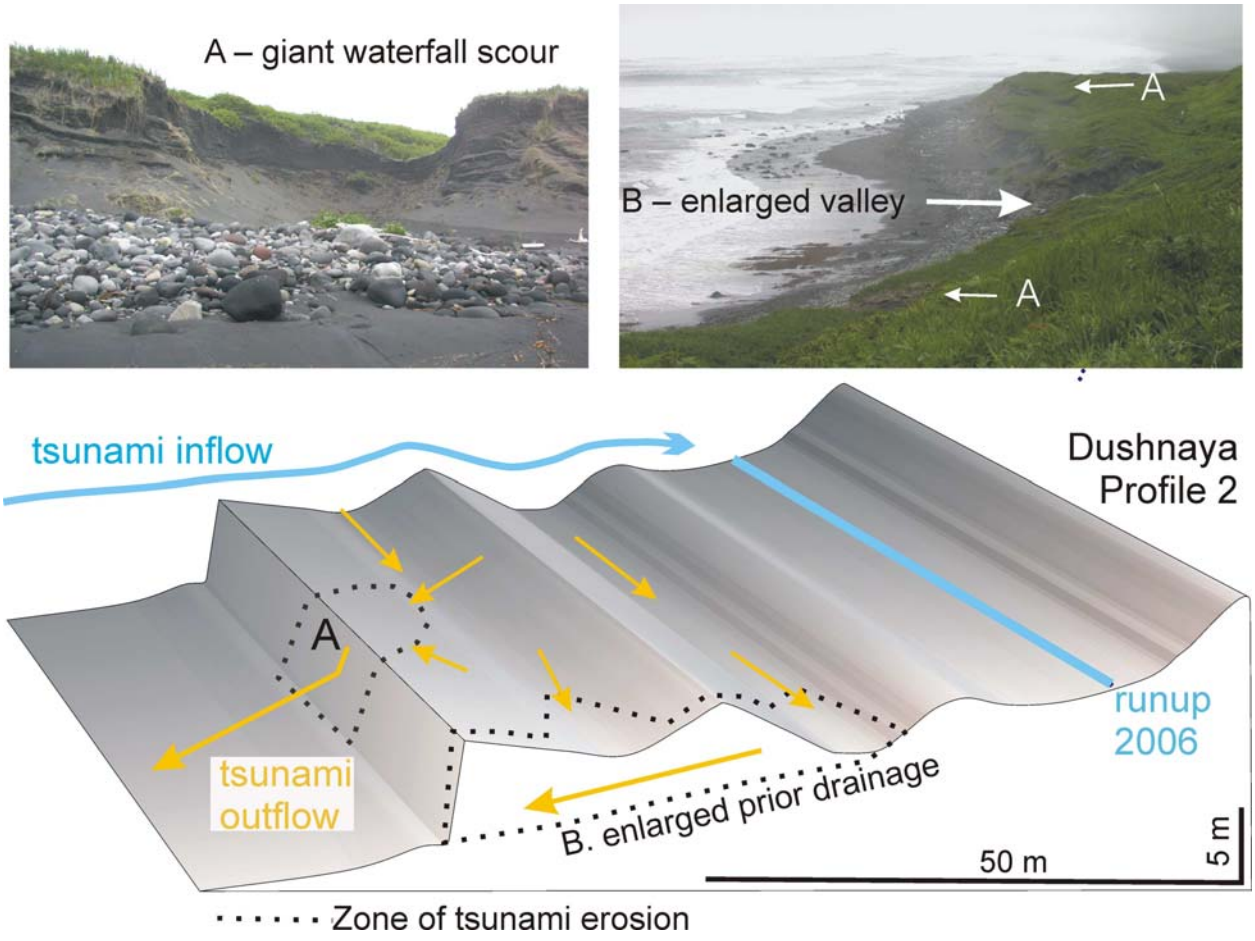

Figure DR9. A steep, short, sandy profile from southern Dushnaya Bay measured in 2007, extruded to show schematically the 3-D tsunami effects. This profile is located on Figure 2, with some data given in Table 1 (runup 12.4 m). Recreated tsunami inflow shown in blue, outflow in orange. Near this profile, the outgoing tsunami removed sand during outflow over the back-beach scarp, creating at least two giant scour/waterfalls about 7 m high. The left picture views one of the scours from the beach, the right picture shows the location of the two scours from the ridge behind and above the scours. In the middle of the right picture is an enlarged prior drainage valley. The outgoing (and possibly also incoming) tsunami enlarged steep stream valleys already cut through the beach ridges. Both photos: Pinegina; right photo is reversed to look similar to profile perspective.

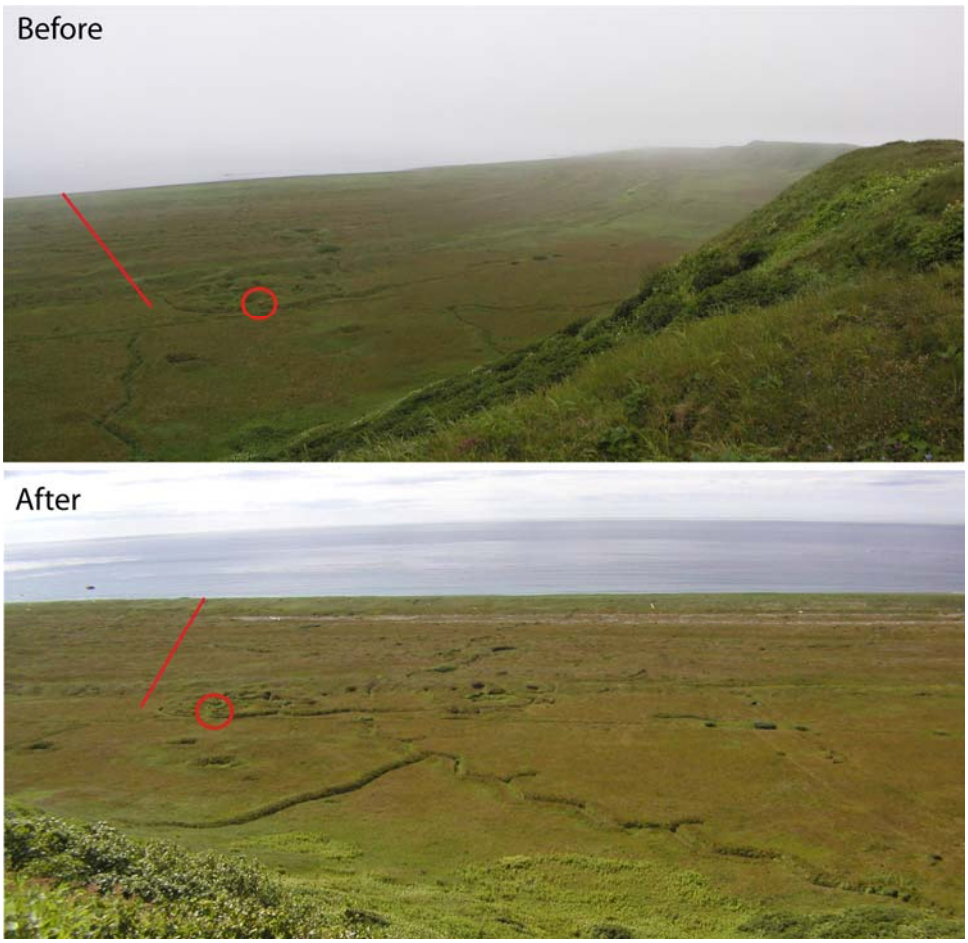

Figure DR10. Before (summer 2006) and after (summer 2007) photoset – South Bay profile on Matua (see Figure 2 for location; Fig 3 for profile). The approximate location of the profile is shown by a red line; a red circle identifies approximately the same point in each photo. Trenches and other excavations from WWII can be seen on both photos, especially well on 2007. On the 2007 (after) photo, the tsunami inundation is visible as gray lines of driftwood, near the top of the picture. The (unseen) unvegetated beach was rearranged between 2006 and 2007 (see Fig. 3), but other erosion was not dramatic. A thin sheet of tsunami sand was deposited almost to the limit of runup and inundation. Both photos: Pinegina.

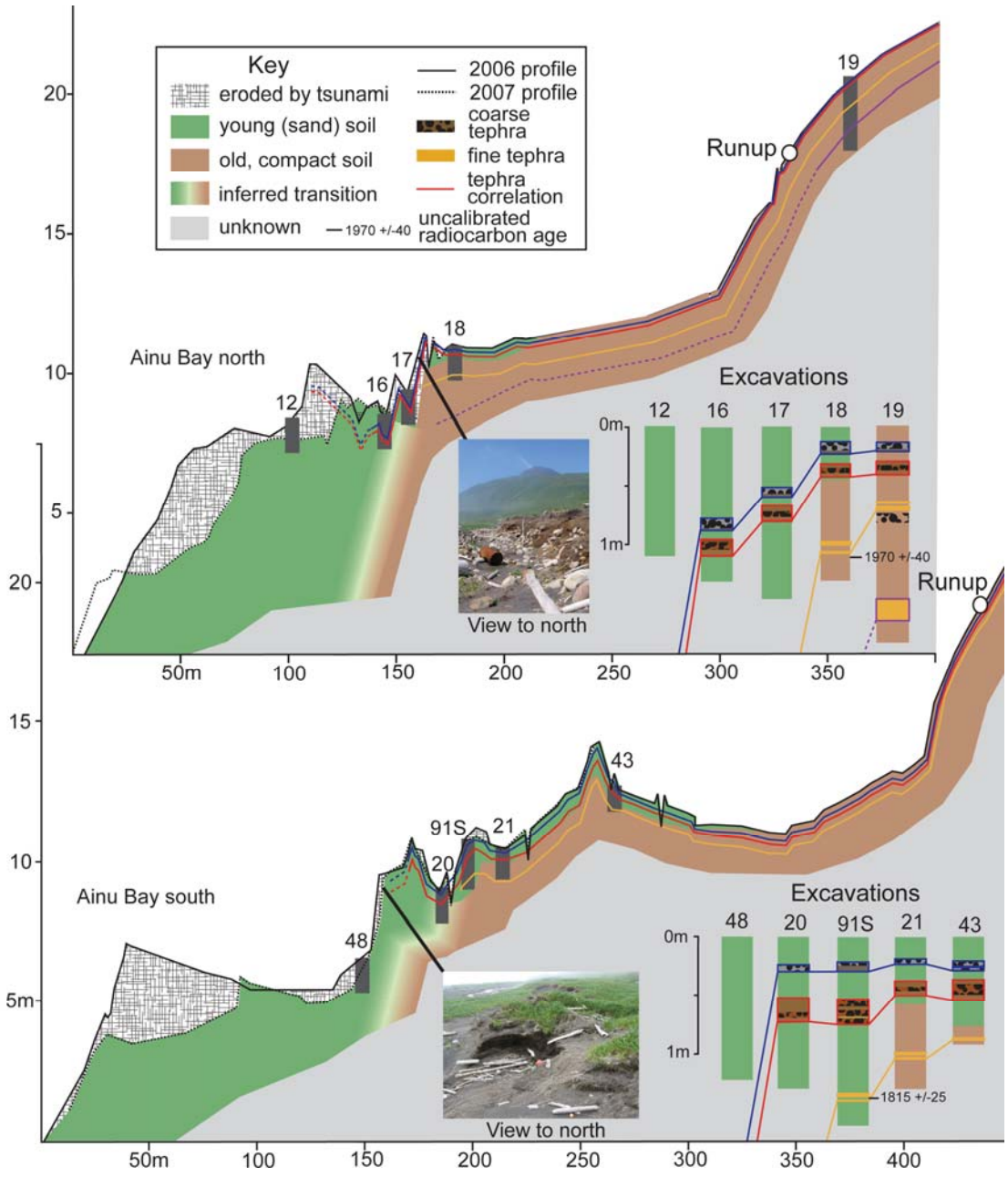

Figure DR11: Profiles and stratigraphy from Ainu Bay, Matua (Figures 2 and 3). The transition between older, well-developed soil (brown) and young sandy stratigraphy (green) is interpreted from excavations and post-tsunami exposures. **Top**. Ainu Bay north--the 2006 tsunami removed a sizable amount of the sandy proximal coastline (Figure DR12). The sharp vertical contact (or paleo-scarp) juxtaposing young sandy soil and older compact soil between excavations 17 and 18 indicates that either large-volume erosional events on the scale of the 2006 tsunami have occurred in Ainu Bay in the past, or that the bay has transitioned from eroding to prograding in the recent past. The scarp (inset) is also detailed in Fig. DR 12. **Bottom**. Ainu Bay south profile (Figure DR14) and stratigraphy are similar, though 91S is thickened by eolian sand. A distinct difference in landscape age between excavations 20 and 21 can be seen in tephra stratigraphy, and 21 is a tundra soil, while 20 is a grassy sandy soil. Inset: scarp with gulley-like scour. Both photo insets: MacInnes.

Figure DR12. Before (summer 2006) and after (summer 2007) photoset – Ainu Bay North profile on Matua (see Figure 2 for location; Fig 3 for profile; also see Figure DR11, DR13). The approximate location of the profile is shown by a red line, and a red circle identifies approximately the same point in each photo. The after perspective is hard to match because of the severe erosion, lowering the surface on which the group camped for two nights in 2006. Both photos: Misty Nikula.

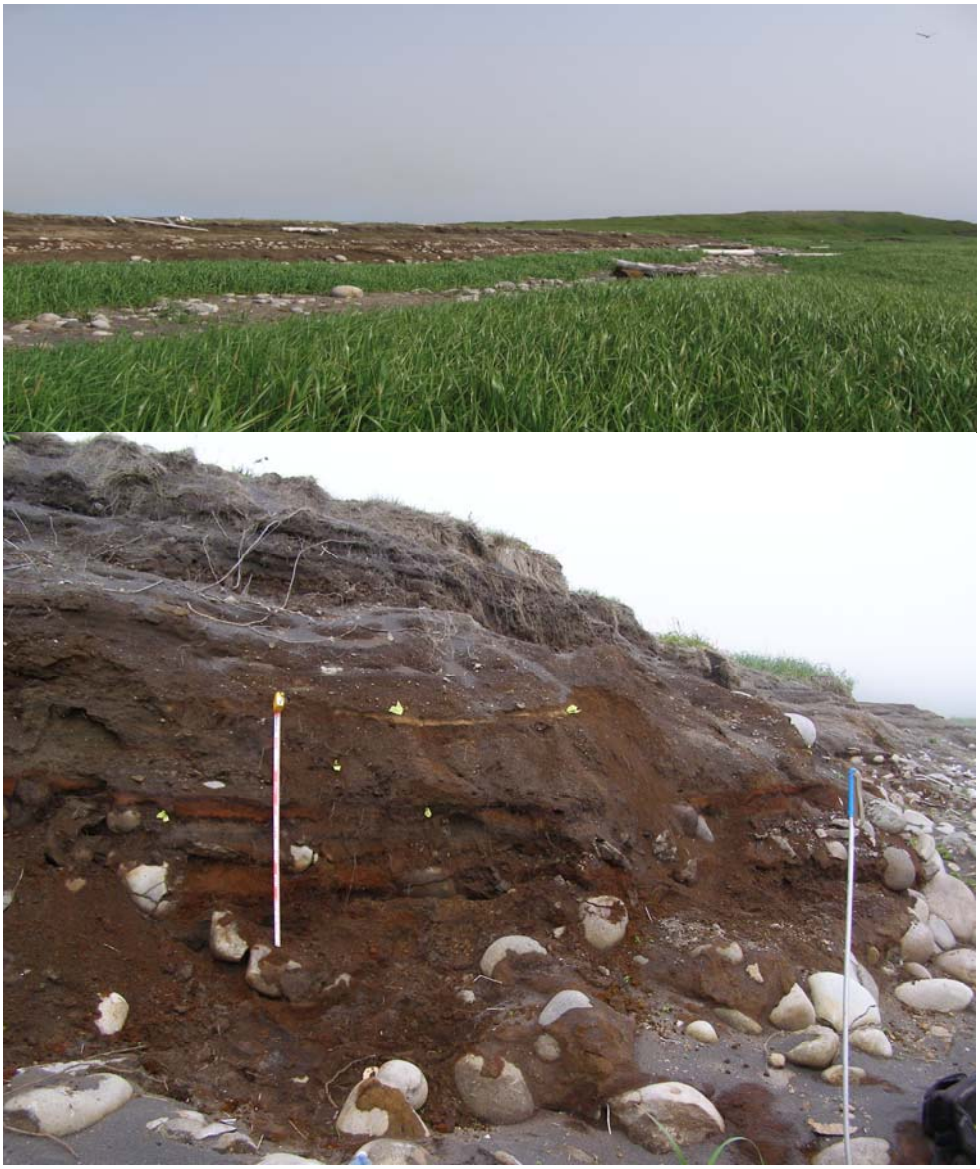

Figure DR13. **Top**: View in 2007 of 100-m-long, tsunami-generated scarp crossed by Ainu Bay North profile (Figs. 3, DR11). Line of bouldery sand in the foreground is another surface stripped of turf by the tsunami. **Bottom**: Close-up of the eroded scarp, with exposed soils and tephra. Tape on outcrop is extended to 100 cm. A light-colored tan tephra in the middle of the scarp (marked at either end by yellow flagging tape) is about 2000 years old.

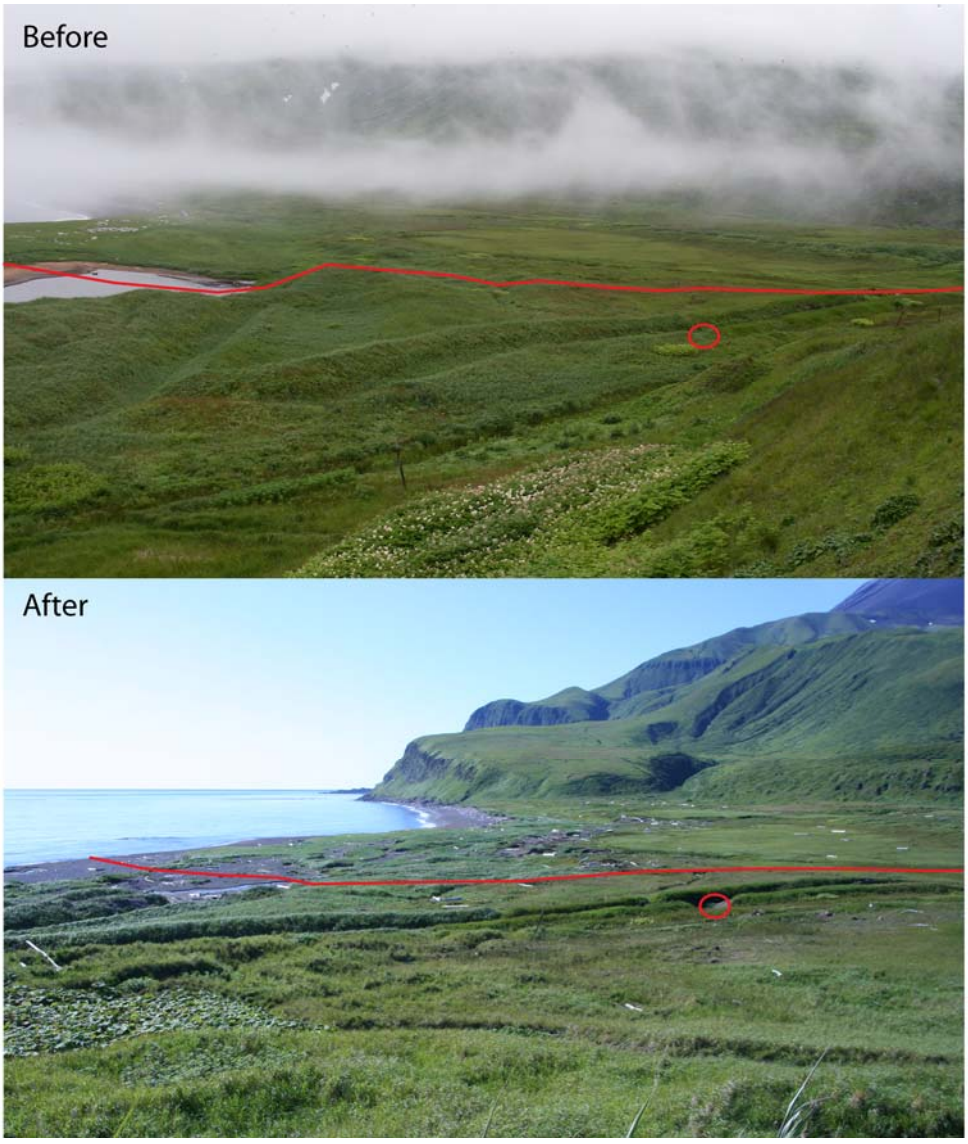

Figure DR14. Before (summer 2006) and after (summer 2007) photoset – Ainu Bay South profile on Matua (see Figure 2 for location; Fig 3 for profile; also see Figure DR11). The approximate location of the profile is shown by a red line, and a red circle identifies approximately the same point in each photo. The beach and proximal vegetated region suffered severe erosion, and the lake was breached, drained and filled with sand. Both photos: Misty Nikula