Supplementary Information

Structural control on the Tohoku earthquake rupture process investigated by 3D FEM, tsunami and geodetic data

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Supplementary Information. Note S1 –Inversion Technique.

We follow a robust joint inversion scheme adopted in several previous papers[1-6] to retrieve the coseismic slip distribution (including the slip direction, i.e. the rake angle) of the 2011 Tohoku-oki earthquake. The inverse problem is solved by using the method of Green's functions superposition and the Heat Bath algorithm[7], a particular implementation of Simulated Annealing technique[8]. Two different cost functions for tsunami and geodetic data are used. For tsunami data we use a function that results to be sensitive in matching both phases and amplitudes of the time series[9]. Instead, a standard L2 norm is used for the geodetic data set.

Previous studies on the Tohoku earthquake highlighted the importance of having tsunami and geodetic data just above the source (e.g. TM1 and TM2 sensors, and seafloor observations in Figure 1b in the Manuscript) in order to better constrain the earthquake slip distribution[6,10]. Hence, different weights are assigned to each tsunami and geodetic station. The weights of tsunami stations vary with their location, in order to take into account the spatial and azimuthal instrumental coverage, and especially the distance from the earthquake source. We also assign different weights to geodetic data paying particular attention to the seafloor geodetic stations because they are positioned just above the seismic source. In addition, due to the different behaviour of the cost functions for tsunami and geodetic data, we further assign different weights to both the entire data sets in order to avoid a possible unbalancing of the cost functions during the joint inversion. This procedure is not immediate and simple to face; therefore we chose the appropriate weight values after performing several tests.

The slip distribution is obtained through a global search technique and then the solution of this inverse problem is intrinsically non-unique. Thus, we compute and show the average slip model that we consider more representative than the best fitting solution. The average slip model is calculated as a weighted mean of a subset of the explored models. This subset consists of the models with the lowest cost functions (0.5% of the total) and which fit satisfactorily the data. The weights are the inverse of the cost function, thus the better models count more with respect to the

others. The dispersion of the model parameters around their average values is assessed by performing an a-posteriori analysis of the explored models ensemble[1-6] where the weighted standard deviation is taken as the error in the corresponding parameter. In this analysis the coefficient of variation (i.e. the standard deviation divided by the average slip value) is also computed for each subfault parameter (see Figure 3c in main text). During the global search the algorithm explores the slip values for each subfault in the range 0-60 meters at 1 meter steps. The rake is kept constant on large blocks (cyan lines in Supplementary Figure S2). The range of variation for the rake values during the inversion is 75°-110° at 5° steps. Numerical values and standard deviations for the average and best models are reported in Supplementary Table S3. Subfaults are numbered following the order shown in Supplementary Figure S2.

Supplementary Information. Note S2 – Details of Tsunami Data.

Tsunami waves generated by the Tohoku earthquake have been recorded by many instruments positioned near the Japanese coasts (GPS-buoys, coastal wave gauges, bottom pressure sensors), above the source area (bottom pressure sensors) and in the open ocean (DART buoys). In particular, GPS-buoys[11] and coastal wave gauges[12], positioned ~20 km off the coasts, are provided by Nationwide Ocean Wave information network for Ports and Harbours (NOWPHAS); bottom pressure sensors are provided by Japan Agency for Marine-Earth Science and Technology (JAMSTEC) Kushiro–Tokachi and Muroto cabled observatories[13,14], by Japan Meteorological Agency (JMA) Tokai and Boso cabled observatories[15], by the Earthquake Research Institute (ERI), University of Tokyo, Sanriku cabled observatory[16], and by Tohoku University[17]; DART buoys are acquired by National Oceanic and Atmospheric Administration (NOAA), and by Russian Far Eastern Regional Hydrometeorological Research Institute (RFERHRI). The original signals include the tide and in some cases the surface waves generated by the earthquake. Tides are removed by using a procedure based on robust LOWESS[18].

Supplementary Table S1 - Density values characterizing the layers of the 3D FEM model.

Layer	Density (kg/m^3)
Prism	2500[1,3]
Crust_sup	2500[1]
Crust_inf	2800[1]
Crust_oce	2800[1]
Mantle_con	3000[1]
Mantle_oce	3200[1,2]
Slab_sup	3000[1]
Slab_inf	3300[2]

[1] From ref. 19.
[2] From ref. 20.
[3] The density is not used to compute the elastic constants of the layer (μ= 5 GPa, Poisson ratio = 0.33)[21,22].

Supplementary Table S2 - Fault model.

	Upper Right		Upper Left		Bottom Left		Bottom Right				
Subf. #	Lon (°)	Lat (°)	Lon (°)	Lat (°)	Lon (°)	Lat (°)	Lon (°)	Lat (°)	Center Depth (km b.s.l.)	Strike (°)	Dip (°)
1A	144.33	40.23	144.27	40.08	144.15	40.11	144.21	40.26	9.458	196.1	2.3
2A	144.27	40.08	144.24	39.92	144.12	39.95	144.15	40.11	9.734	188.5	2.6
3A	144.24	39.92	144.21	39.76	144.09	39.79	144.12	39.95	9.702	188.2	2.7
4A	144.21	39.76	144.20	39.60	144.08	39.63	144.09	39.79	9.404	184.0	2.5
5A	144.20	39.60	144.20	39.44	144.08	39.47	144.08	39.63	9.018	180.1	2.2
6A	144.20	39.44	144.18	39.28	144.06	39.31	144.08	39.47	8.732	185.2	1.6
7A	144.18	39.28	144.17	39.12	144.05	39.15	144.06	39.31	8.562	182.6	1.4
8A	144.17	39.12	144.12	38.97	144.01	39.00	144.05	39.15	8.480	193.8	1.3
9A	144.12	38.97	144.06	38.81	143.95	38.84	144.01	39.00	8.495	195.8	1.7
10A	144.06	38.81	144.03	38.65	143.91	38.69	143.95	38.84	8.552	190.0	2.3
11A	144.03	38.65	143.99	38.50	143.88	38.53	143.91	38.69	8.611	190.3	2.6
12A	143.99	38.50	143.96	38.34	143.84	38.37	143.88	38.53	8.616	190.0	2.9
13A	143.96	38.34	143.91	38.18	143.80	38.21	143.84	38.37	8.550	192.3	3.0
14A	143.91	38.18	143.86	38.03	143.75	38.06	143.80	38.21	8.489	193.4	3.4
15A	143.86	38.03	143.86	37.87	143.74	37.90	143.75	38.06	8.472	182.6	3.2
16A	143.86	37.87	143.81	37.71	143.70	37.74	143.74	37.90	8.675	193.0	2.6
17A	143.81	37.71	143.76	37.55	143.65	37.59	143.70	37.74	9.094	194.5	2.2
18A	143.76	37.55	143.69	37.40	143.58	37.44	143.65	37.59	9.522	200.4	2.1
19A	143.69	37.40	143.61	37.26	143.50	37.29	143.58	37.44	10.004	203.8	2.3
20A	143.61	37.26	143.54	37.11	143.42	37.14	143.50	37.29	10.553	200.9	3.1
21A	143.54	37.11	143.45	36.96	143.34	36.99	143.42	37.14	11.085	204.3	3.8
22A	143.45	36.96	143.38	36.81	143.26	36.85	143.34	36.99	11.413	202.3	4.6
23A	143.38	36.81	143.29	36.67	143.17	36.70	143.26	36.85	11.409	207.0	4.9
24A	143.29	36.67	143.16	36.55	143.05	36.58	143.17	36.70	11.266	218.0	4.7
25A	143.16	36.55	143.06	36.41	142.95	36.44	143.05	36.58	11.028	212.0	4.9
26A	143.06	36.41	142.97	36.27	142.86	36.30	142.95	36.44	10.602	206.1	4.8
27A	142.97	36.27	142.86	36.13	142.75	36.17	142.86	36.30	10.098	213.1	4.6
28A	142.86	36.13	142.70	36.05	142.58	36.08	142.75	36.17	9.866	238.2	4.1
29A	142.70	36.05	142.55	35.94	142.44	35.97	142.58	36.08	9.865	228.3	4.4
30A	142.55	35.94	142.48	35.80	142.37	35.82	142.44	35.97	9.676	201.3	5.3
31A	142.48	35.80	142.42	35.64	142.31	35.67	142.37	35.82	9.455	195.8	5.4
1B	144.21	40.26	144.15	40.11	144.04	40.14	144.09	40.30	10.027	195.9	3.6
2B	144.15	40.11	144.12	39.95	144.00	39.98	144.04	40.14	10.347	188.7	3.8
3B	144.12	39.95	144.09	39.79	143.98	39.83	144.00	39.98	10.339	188.0	4.1
4B	144.09	39.79	144.08	39.63	143.96	39.67	143.98	39.83	10.010	183.8	4.4
5B	144.08	39.63	144.08	39.47	143.96	39.51	143.96	39.67	9.537	180.0	4.0
6B	144.08	39.47	144.06	39.31	143.95	39.35	143.96	39.51	9.167	184.6	3.4
7B	144.06	39.31	144.05	39.15	143.94	39.19	143.95	39.35	8.957	182.8	3.1

8B	144.05	39.15	144.01	39.00	143.89	39.03	143.94	39.19	8.892	193.6	2.9
9B	144.01	39.00	143.95	38.84	143.84	38.88	143.89	39.03	8.969	195.8	3.1
10B	143.95	38.84	143.91	38.69	143.80	38.72	143.84	38.88	9.086	190.3	3.3
11B	143.91	38.69	143.88	38.53	143.76	38.56	143.80	38.72	9.196	190.1	3.4
12B	143.88	38.53	143.84	38.37	143.73	38.40	143.76	38.56	9.252	190.1	3.7
13B	143.84	38.37	143.80	38.21	143.68	38.25	143.73	38.40	9.230	192.3	4.1
14B	143.80	38.21	143.75	38.06	143.64	38.09	143.68	38.25	9.176	192.9	4.1
15B	143.75	38.06	143.74	37.90	143.63	37.93	143.64	38.09	9.104	183.0	4.2
16B	143.74	37.90	143.70	37.74	143.59	37.77	143.63	37.93	9.222	192.5	3.7
17B	143.70	37.74	143.65	37.59	143.53	37.62	143.59	37.77	9.593	194.5	3.3
18B	143.65	37.59	143.58	37.44	143.47	37.47	143.53	37.62	10.049	200.3	3.2
19B	143.58	37.44	143.50	37.29	143.39	37.32	143.47	37.47	10.618	203.6	3.9
20B	143.50	37.29	143.42	37.14	143.31	37.17	143.39	37.32	11.285	201.0	4.2
21B	143.42	37.14	143.34	36.99	143.23	37.03	143.31	37.17	11.942	204.0	4.8
22B	143.34	36.99	143.26	36.85	143.15	36.88	143.23	37.03	12.364	202.6	5.4
23B	143.26	36.85	143.17	36.70	143.06	36.74	143.15	36.88	12.402	207.3	5.7
24B	143.17	36.70	143.05	36.58	142.94	36.61	143.06	36.74	12.257	217.1	5.9
25B	143.05	36.58	142.95	36.44	142.84	36.47	142.94	36.61	11.999	211.4	6.0
26B	142.95	36.44	142.86	36.30	142.75	36.33	142.84	36.47	11.553	206.8	6.0
27B	142.86	36.30	142.75	36.17	142.63	36.20	142.75	36.33	11.049	214.3	5.7
28B	142.75	36.17	142.58	36.08	142.47	36.11	142.63	36.20	10.840	236.7	5.7
29B	142.58	36.08	142.44	35.97	142.34	36.00	142.47	36.11	10.899	227.1	6.4
30B	142.44	35.97	142.37	35.82	142.26	35.85	142.34	36.00	10.769	202.3	7.0
31B	142.37	35.82	142.31	35.67	142.20	35.70	142.26	35.85	10.578	196.3	6.6
1C	144.09	40.30	144.04	40.14	143.92	40.17	143.98	40.33	10.852	195.5	5.2
2C	144.04	40.14	144.00	39.98	143.89	40.02	143.92	40.17	11.218	189.2	5.2
3C	144.00	39.98	143.98	39.83	143.86	39.86	143.89	40.02	11.262	187.4	5.6
4C	143.98	39.83	143.96	39.67	143.85	39.70	143.86	39.86	10.925	183.5	5.7
5C	143.96	39.67	143.96	39.51	143.85	39.54	143.85	39.70	10.375	180.2	5.7
6C	143.96	39.51	143.95	39.35	143.84	39.38	143.85	39.54	9.909	183.6	5.1
7C	143.95	39.35	143.94	39.19	143.82	39.22	143.84	39.38	9.632	183.3	4.7
8C	143.94	39.19	143.89	39.03	143.78	39.06	143.82	39.22	9.549	193.2	4.3
9C	143.89	39.03	143.84	38.88	143.72	38.91	143.78	39.06	9.644	195.8	4.2
10C	143.84	38.88	143.80	38.72	143.68	38.75	143.72	38.91	9.793	190.8	4.3
11C	143.80	38.72	143.76	38.56	143.65	38.59	143.68	38.75	9.940	189.8	4.3
12C	143.76	38.56	143.73	38.40	143.61	38.44	143.65	38.59	10.062	190.3	4.6
13C	143.73	38.40	143.68	38.25	143.57	38.28	143.61	38.44	10.100	192.4	5.1
14C	143.68	38.25	143.64	38.09	143.53	38.12	143.57	38.28	10.046	191.9	5.3
15C	143.64	38.09	143.63	37.93	143.51	37.96	143.53	38.12	9.927	183.8	5.2
16C	143.63	37.93	143.59	37.77	143.48	37.81	143.51	37.96	9.975	191.5	4.8
17C	143.59	37.77	143.53	37.62	143.42	37.65	143.48	37.81	10.314	194.6	4.5
18C	143.53	37.62	143.47	37.47	143.35	37.50	143.42	37.65	10.821	200.2	4.7
19C	143.47	37.47	143.39	37.32	143.28	37.36	143.35	37.50	11.462	203.3	5.1
20C	143.39	37.32	143.31	37.17	143.20	37.21	143.28	37.36	12.203	201.4	5.4
21C	143.31	37.17	143.23	37.03	143.12	37.06	143.20	37.21	12.947	203.4	5.7
22C	143.23	37.03	143.15	36.88	143.04	36.91	143.12	37.06	13.451	203.2	6.2
23C	143.15	36.88	143.06	36.74	142.95	36.77	143.04	36.91	13.563	208.1	6.4
24C	143.06	36.74	142.94	36.61	142.84	36.64	142.95	36.77	13.439	215.3	6.7
25C	142.94	36.61	142.84	36.47	142.74	36.50	142.84	36.64	13.145	210.4	7.0
26C	142.84	36.47	142.75	36.33	142.64	36.36	142.74	36.50	12.694	208.3	6.9

27C	142.75	36.33	142.63	36.20	142.52	36.24	142.64	36.36	12.244	216.7	6.9
28C	142.63	36.20	142.47	36.11	142.37	36.14	142.52	36.24	12.109	233.6	6.8
29C	142.47	36.11	142.34	36.00	142.23	36.02	142.37	36.14	12.194	224.7	7.9
30C	142.34	36.00	142.26	35.85	142.14	35.88	142.23	36.02	12.096	204.5	8.1
31C	142.26	35.85	142.20	35.70	142.08	35.73	142.14	35.88	11.946	197.5	8.2
1D	143.98	40.33	143.92	40.17	143.80	40.20	143.86	40.36	11.937	195.1	6.6
2D	143.92	40.17	143.89	40.02	143.77	40.05	143.80	40.20	12.326	189.7	6.5
3D	143.89	40.02	143.86	39.86	143.74	39.89	143.77	40.05	12.417	186.9	6.6
4D	143.86	39.86	143.85	39.70	143.73	39.73	143.74	39.89	12.075	183.1	6.9
5D	143.85	39.70	143.85	39.54	143.73	39.57	143.73	39.73	11.467	180.4	6.6
6D	143.85	39.54	143.84	39.38	143.73	39.41	143.73	39.57	10.913	182.4	6.3
7D	143.84	39.38	143.82	39.22	143.71	39.25	143.73	39.41	10.551	183.9	5.9
8D	143.82	39.22	143.78	39.06	143.67	39.09	143.71	39.25	10.428	192.7	5.4
9D	143.78	39.06	143.72	38.91	143.61	38.94	143.67	39.09	10.533	195.9	5.4
10D	143.72	38.91	143.68	38.75	143.57	38.78	143.61	38.94	10.703	191.5	5.7
11D	143.68	38.75	143.65	38.59	143.53	38.63	143.57	38.78	10.871	189.4	5.5
12D	143.65	38.59	143.61	38.44	143.50	38.47	143.53	38.63	11.047	190.6	5.7
13D	143.61	38.44	143.57	38.28	143.45	38.31	143.50	38.47	11.171	192.5	5.9
14D	143.57	38.28	143.53	38.12	143.42	38.16	143.45	38.31	11.150	190.8	6.6
15D	143.53	38.12	143.51	37.96	143.40	38.00	143.42	38.16	10.996	184.7	6.8
16D	143.51	37.96	143.48	37.81	143.36	37.84	143.40	38.00	10.985	190.3	6.4
17D	143.48	37.81	143.42	37.65	143.31	37.69	143.36	37.84	11.286	194.8	6.2
18D	143.42	37.65	143.35	37.50	143.24	37.54	143.31	37.69	11.812	200.0	5.9
19D	143.35	37.50	143.28	37.36	143.17	37.39	143.24	37.54	12.496	203.0	6.0
20D	143.28	37.36	143.20	37.21	143.09	37.24	143.17	37.39	13.287	201.9	6.3
21D	143.20	37.21	143.12	37.06	143.01	37.09	143.09	37.24	14.082	202.7	6.4
22D	143.12	37.06	143.04	36.91	142.93	36.95	143.01	37.09	14.663	204.0	6.6
23D	143.04	36.91	142.95	36.77	142.83	36.81	142.93	36.95	14.870	209.0	7.2
24D	142.95	36.77	142.84	36.64	142.73	36.67	142.83	36.81	14.757	213.1	7.4
25D	142.84	36.64	142.74	36.50	142.63	36.53	142.73	36.67	14.420	209.3	7.4
26D	142.74	36.50	142.64	36.36	142.53	36.40	142.63	36.53	14.011	210.0	7.6
27D	142.64	36.36	142.52	36.24	142.40	36.28	142.53	36.40	13.670	219.4	8.1
28D	142.52	36.24	142.37	36.14	142.26	36.17	142.40	36.28	13.610	230.0	8.2
29D	142.37	36.14	142.23	36.02	142.13	36.05	142.26	36.17	13.704	222.1	8.8
30D	142.23	36.02	142.14	35.88	142.03	35.91	142.13	36.05	13.645	207.0	9.4
31D	142.14	35.88	142.08	35.73	141.97	35.76	142.03	35.91	13.552	198.8	9.2
1E	143.86	40.36	143.80	40.20	143.69	40.23	143.74	40.39	13.278	194.7	8.0
2E	143.80	40.20	143.77	40.05	143.65	40.08	143.69	40.23	13.677	190.2	8.0
3E	143.77	40.05	143.74	39.89	143.63	39.92	143.65	40.08	13.810	186.4	8.2
4E	143.74	39.89	143.73	39.73	143.62	39.76	143.63	39.92	13.476	182.7	8.4
5E	143.73	39.73	143.73	39.57	143.62	39.60	143.62	39.76	12.815	180.6	8.5
6E	143.73	39.57	143.73	39.41	143.61	39.44	143.62	39.60	12.154	181.4	7.8
7E	143.73	39.41	143.71	39.25	143.60	39.28	143.61	39.44	11.698	184.4	7.1
8E	143.71	39.25	143.67	39.09	143.55	39.12	143.60	39.28	11.543	192.3	6.8
9E	143.67	39.09	143.61	38.94	143.50	38.97	143.55	39.12	11.670	196.0	6.7
10E	143.61	38.94	143.57	38.78	143.45	38.82	143.50	38.97	11.887	192.1	7.1
11E	143.57	38.78	143.53	38.63	143.42	38.66	143.45	38.82	12.069	189.1	7.5
12E	143.53	38.63	143.50	38.47	143.38	38.50	143.42	38.66	12.264	190.8	7.3
13E	143.50	38.47	143.45	38.31	143.34	38.35	143.38	38.50	12.445	192.6	7.4
14E	143.45	38.31	143.42	38.16	143.30	38.19	143.34	38.35	12.468	189.8	7.5

15E	143.42	38.16	143.40	38.00	143.28	38.03	143.30	38.19	12.307	185.5	7.8
16E	143.40	38.00	143.36	37.84	143.25	37.87	143.28	38.03	12.251	189.3	7.5
17E	143.36	37.84	143.31	37.69	143.20	37.72	143.25	37.87	12.516	194.9	7.4
18E	143.31	37.69	143.24	37.54	143.13	37.57	143.20	37.72	13.026	199.9	7.5
19E	143.24	37.54	143.17	37.39	143.06	37.42	143.13	37.57	13.711	202.8	7.2
20E	143.17	37.39	143.09	37.24	142.98	37.27	143.06	37.42	14.529	202.3	7.2
21E	143.09	37.24	143.01	37.09	142.90	37.12	142.98	37.27	15.353	202.1	7.3
22E	143.01	37.09	142.93	36.95	142.82	36.98	142.90	37.12	15.974	204.7	7.4
23E	142.93	36.95	142.83	36.81	142.72	36.84	142.82	36.98	16.263	209.8	7.3
24E	142.83	36.81	142.73	36.67	142.62	36.70	142.72	36.84	16.191	211.3	7.9
25E	142.73	36.67	142.63	36.53	142.53	36.56	142.62	36.70	15.850	208.2	8.4
26E	142.63	36.53	142.53	36.40	142.42	36.43	142.53	36.56	15.482	211.5	8.6
27E	142.53	36.40	142.40	36.28	142.29	36.31	142.42	36.43	15.267	221.8	8.4
28E	142.40	36.28	142.26	36.17	142.15	36.20	142.29	36.31	15.310	226.9	9.3
29E	142.26	36.17	142.13	36.05	142.02	36.07	142.15	36.20	15.431	219.8	9.9
30E	142.13	36.05	142.03	35.91	141.92	35.94	142.02	36.07	15.452	209.2	10.5
31E	142.03	35.91	141.97	35.76	141.85	35.79	141.92	35.94	15.406	200.0	11.2
1F	143.74	40.39	143.69	40.23	143.51	40.28	143.56	40.43	15.382	194.5	10.1
2F	143.69	40.23	143.65	40.08	143.47	40.12	143.51	40.28	15.768	190.4	9.6
3F	143.65	40.08	143.63	39.92	143.45	39.96	143.47	40.12	15.949	186.1	9.7
4F	143.63	39.92	143.62	39.76	143.44	39.80	143.45	39.96	15.625	182.5	10.0
5F	143.62	39.76	143.62	39.60	143.44	39.64	143.44	39.80	14.898	180.7	9.7
6F	143.62	39.60	143.61	39.44	143.44	39.49	143.44	39.64	14.115	180.9	9.4
7F	143.61	39.44	143.60	39.28	143.42	39.33	143.44	39.49	13.532	184.6	8.9
8F	143.60	39.28	143.55	39.12	143.38	39.17	143.42	39.33	13.342	192.1	8.2
9F	143.55	39.12	143.50	38.97	143.32	39.02	143.38	39.17	13.553	196.0	8.6
10F	143.50	38.97	143.45	38.82	143.28	38.86	143.32	39.02	13.856	192.4	9.2
11F	143.45	38.82	143.42	38.66	143.25	38.70	143.28	38.86	14.047	188.9	9.2
12F	143.42	38.66	143.38	38.50	143.21	38.55	143.25	38.70	14.206	190.8	9.2
13F	143.38	38.50	143.34	38.35	143.16	38.39	143.21	38.55	14.388	192.6	8.7
14F	143.34	38.35	143.30	38.19	143.13	38.23	143.16	38.39	14.449	189.2	9.1
15F	143.30	38.19	143.28	38.03	143.11	38.07	143.13	38.23	14.296	185.9	9.1
16F	143.28	38.03	143.25	37.87	143.08	37.92	143.11	38.07	14.220	188.7	9.1
17F	143.25	37.87	143.20	37.72	143.03	37.76	143.08	37.92	14.430	194.9	9.0
18F	143.20	37.72	143.13	37.57	142.96	37.61	143.03	37.76	14.910	199.8	8.4
19F	143.13	37.57	143.06	37.42	142.88	37.46	142.96	37.61	15.619	202.6	8.7
20F	143.06	37.42	142.98	37.27	142.80	37.32	142.88	37.46	16.438	202.5	8.9
21F	142.98	37.27	142.90	37.12	142.73	37.17	142.80	37.32	17.230	201.8	8.6
22F	142.90	37.12	142.82	36.98	142.65	37.02	142.73	37.17	17.846	205.0	8.4
23F	142.82	36.98	142.72	36.84	142.55	36.89	142.65	37.02	18.185	210.2	8.6
24F	142.72	36.84	142.62	36.70	142.45	36.75	142.55	36.89	18.205	210.3	8.8
25F	142.62	36.70	142.53	36.56	142.36	36.61	142.45	36.75	17.902	207.7	9.4
26F	142.53	36.56	142.42	36.43	142.26	36.47	142.36	36.61	17.522	212.2	9.2
27F	142.42	36.43	142.29	36.31	142.12	36.35	142.26	36.47	17.436	222.8	9.3
28F	142.29	36.31	142.15	36.20	141.98	36.24	142.12	36.35	17.637	225.3	10.4
29F	142.15	36.20	142.02	36.07	141.86	36.11	141.98	36.24	17.875	218.7	10.8
30F	142.02	36.07	141.92	35.94	141.76	35.98	141.86	36.11	18.042	210.1	11.9
31F	141.92	35.94	141.85	35.79	141.69	35.83	141.76	35.98	18.035	200.6	12.1
1G	143.56	40.43	143.51	40.28	143.32	40.33	143.38	40.48	18.521	194.5	12.2
2G	143.51	40.28	143.47	40.12	143.29	40.17	143.32	40.33	18.872	190.4	11.9

3G	143.47	40.12	143.45	39.96	143.26	40.01	143.29	40.17	19.126	186.0	11.9
4G	143.45	39.96	143.44	39.80	143.25	39.85	143.26	40.01	18.862	182.6	12.3
5G	143.44	39.80	143.44	39.64	143.25	39.69	143.25	39.85	18.051	180.7	12.6
6G	143.44	39.64	143.44	39.49	143.24	39.53	143.25	39.69	17.048	180.9	11.4
7G	143.44	39.49	143.42	39.33	143.23	39.38	143.24	39.53	16.309	184.7	10.2
8G	143.42	39.33	143.38	39.17	143.18	39.22	143.23	39.38	16.143	192.0	10.3
9G	143.38	39.17	143.32	39.02	143.13	39.07	143.18	39.22	16.496	195.8	10.6
10G	143.32	39.02	143.28	38.86	143.08	38.91	143.13	39.07	16.923	192.3	11.2
11G	143.28	38.86	143.25	38.70	143.05	38.75	143.08	38.91	17.115	188.8	11.6
12G	143.25	38.70	143.21	38.55	143.01	38.60	143.05	38.75	17.180	190.8	11.1
13G	143.21	38.55	143.16	38.39	142.97	38.44	143.01	38.60	17.306	192.6	10.8
14G	143.16	38.39	143.13	38.23	142.93	38.28	142.97	38.44	17.393	189.2	10.4
15G	143.13	38.23	143.11	38.07	142.91	38.13	142.93	38.28	17.276	186.0	10.6
16G	143.11	38.07	143.08	37.92	142.88	37.97	142.91	38.13	17.198	188.7	10.5
17G	143.08	37.92	143.03	37.76	142.83	37.81	142.88	37.97	17.393	194.9	10.3
18G	143.03	37.76	142.96	37.61	142.76	37.66	142.83	37.81	17.889	199.6	10.8
19G	142.96	37.61	142.88	37.46	142.68	37.52	142.76	37.66	18.634	202.4	10.7
20G	142.88	37.46	142.80	37.32	142.61	37.37	142.68	37.52	19.424	202.3	10.8
21G	142.80	37.32	142.73	37.17	142.54	37.22	142.61	37.37	20.105	201.4	10.5
22G	142.73	37.17	142.65	37.02	142.46	37.07	142.54	37.22	20.637	204.5	10.1
23G	142.65	37.02	142.55	36.89	142.36	36.94	142.46	37.07	20.977	209.7	9.9
24G	142.55	36.89	142.45	36.75	142.27	36.80	142.36	36.94	21.060	209.8	10.3
25G	142.45	36.75	142.36	36.61	142.18	36.65	142.27	36.80	20.780	207.2	10.5
26G	142.36	36.61	142.26	36.47	142.08	36.52	142.18	36.65	20.389	211.8	10.7
27G	142.26	36.47	142.12	36.35	141.95	36.40	142.08	36.52	20.399	222.2	10.9
28G	142.12	36.35	141.98	36.24	141.81	36.28	141.95	36.40	20.787	224.8	11.4
29G	141.98	36.24	141.86	36.11	141.69	36.16	141.81	36.28	21.253	218.1	12.8
30G	141.86	36.11	141.76	35.98	141.60	36.02	141.69	36.16	21.606	210.1	13.7
31G	141.76	35.98	141.69	35.83	141.52	35.87	141.60	36.02	21.636	200.7	14.4
1H	143.38	40.48	143.32	40.33	143.14	40.37	143.19	40.53	22.366	194.5	14.1
2H	143.32	40.33	143.29	40.17	143.10	40.22	143.14	40.37	22.725	190.6	14.1
3H	143.29	40.17	143.26	40.01	143.08	40.06	143.10	40.22	23.054	186.2	14.2
4H	143.26	40.01	143.25	39.85	143.06	39.90	143.08	40.06	22.864	182.9	14.2
5H	143.25	39.85	143.25	39.69	143.06	39.74	143.06	39.90	22.019	181.4	13.9
6H	143.25	39.69	143.24	39.53	143.05	39.58	143.06	39.74	20.833	181.2	14.1
7H	143.24	39.53	143.23	39.38	143.03	39.43	143.05	39.58	19.900	185.0	13.4
8H	143.23	39.38	143.18	39.22	142.98	39.27	143.03	39.43	19.716	192.1	12.2
9H	143.18	39.22	143.13	39.07	142.93	39.12	142.98	39.27	20.204	195.5	12.4
10H	143.13	39.07	143.08	38.91	142.89	38.96	142.93	39.12	20.779	192.2	12.9
11H	143.08	38.91	143.05	38.75	142.85	38.80	142.89	38.96	20.996	189.1	13.3
12H	143.05	38.75	143.01	38.60	142.81	38.65	142.85	38.80	20.968	190.9	13.1
13H	143.01	38.60	142.97	38.44	142.77	38.49	142.81	38.65	21.009	192.9	12.7
14H	142.97	38.44	142.93	38.28	142.73	38.34	142.77	38.49	21.084	189.6	12.4
15H	142.93	38.28	142.91	38.13	142.70	38.18	142.73	38.34	21.010	186.7	12.2
16H	142.91	38.13	142.88	37.97	142.67	38.02	142.70	38.18	20.954	189.2	12.1
17H	142.88	37.97	142.83	37.81	142.61	37.87	142.67	38.02	21.208	195.0	12.0
18H	142.83	37.81	142.76	37.66	142.55	37.72	142.61	37.87	21.774	199.6	12.1
19H	142.76	37.66	142.68	37.52	142.47	37.57	142.55	37.72	22.536	202.3	12.2
20H	142.68	37.52	142.61	37.37	142.40	37.42	142.47	37.57	23.298	201.8	12.3
21H	142.61	37.37	142.54	37.22	142.33	37.27	142.40	37.42	23.835	200.5	12.3

22H	142.54	37.22	142.46	37.07	142.26	37.13	142.33	37.27	24.172	203.3	11.8
23H	142.46	37.07	142.36	36.94	142.17	36.99	142.26	37.13	24.441	208.6	11.5
24H	142.36	36.94	142.27	36.80	142.08	36.85	142.17	36.99	24.561	208.6	11.9
25H	142.27	36.80	142.18	36.65	142.00	36.70	142.08	36.85	24.295	206.2	12.4
26H	142.18	36.65	142.08	36.52	141.90	36.56	142.00	36.70	23.871	210.7	12.7
27H	142.08	36.52	141.95	36.40	141.78	36.44	141.90	36.56	23.856	221.0	12.5
28H	141.95	36.40	141.81	36.28	141.65	36.32	141.78	36.44	24.386	223.6	12.8
29H	141.81	36.28	141.69	36.16	141.53	36.20	141.65	36.32	25.079	217.3	14.1
30H	141.69	36.16	141.60	36.02	141.43	36.06	141.53	36.20	25.595	210.0	14.7
31H	141.60	36.02	141.52	35.87	141.36	35.91	141.43	36.06	25.707	201.3	15.1
1I	143.19	40.53	143.14	40.37	142.96	40.42	143.01	40.58	26.727	194.6	15.9
2I	143.14	40.37	143.10	40.22	142.92	40.27	142.96	40.42	27.075	191.0	15.5
3I	143.10	40.22	143.08	40.06	142.89	40.11	142.92	40.27	27.495	186.9	15.2
4I	143.08	40.06	143.06	39.90	142.87	39.95	142.89	40.11	27.460	183.5	15.9
5I	143.06	39.90	143.06	39.74	142.86	39.79	142.87	39.95	26.686	181.9	16.6
6I	143.06	39.74	143.05	39.58	142.85	39.63	142.86	39.79	25.423	182.0	16.1
7I	143.05	39.58	143.03	39.43	142.83	39.48	142.85	39.63	24.329	185.6	15.4
8I	143.03	39.43	142.98	39.27	142.79	39.32	142.83	39.48	24.103	192.3	15.0
9I	142.98	39.27	142.93	39.12	142.73	39.17	142.79	39.32	24.681	195.4	15.2
10I	142.93	39.12	142.89	38.96	142.69	39.01	142.73	39.17	25.319	192.0	15.3
11I	142.89	38.96	142.85	38.80	142.65	38.85	142.69	39.01	25.576	189.5	15.0
12I	142.85	38.80	142.81	38.65	142.61	38.70	142.65	38.85	25.529	191.1	15.3
13I	142.81	38.65	142.77	38.49	142.56	38.54	142.61	38.70	25.499	193.4	14.9
14I	142.77	38.49	142.73	38.34	142.52	38.39	142.56	38.54	25.508	190.6	14.5
15I	142.73	38.34	142.70	38.18	142.49	38.23	142.52	38.39	25.428	188.1	13.8
16I	142.70	38.18	142.67	38.02	142.45	38.08	142.49	38.23	25.434	190.0	13.6
17I	142.67	38.02	142.61	37.87	142.39	37.92	142.45	38.08	25.722	195.1	13.6
18I	142.61	37.87	142.55	37.72	142.32	37.78	142.39	37.92	26.322	199.9	13.3
19I	142.55	37.72	142.47	37.57	142.25	37.63	142.32	37.78	27.116	202.1	13.5
20I	142.47	37.57	142.40	37.42	142.18	37.48	142.25	37.63	27.829	201.3	13.4
21I	142.40	37.42	142.33	37.27	142.12	37.33	142.18	37.48	28.227	199.0	13.2
22I	142.33	37.27	142.26	37.13	142.06	37.18	142.12	37.33	28.383	201.5	13.2
23I	142.26	37.13	142.17	36.99	141.98	37.04	142.06	37.18	28.548	206.5	13.3
24I	142.17	36.99	142.08	36.85	141.89	36.90	141.98	37.04	28.665	207.0	13.5
25I	142.08	36.85	142.00	36.70	141.82	36.75	141.89	36.90	28.384	204.5	13.9
26I	142.00	36.70	141.90	36.56	141.73	36.61	141.82	36.75	27.878	209.6	14.1
27I	141.90	36.56	141.78	36.44	141.61	36.49	141.73	36.61	27.795	218.6	14.2
28I	141.78	36.44	141.65	36.32	141.49	36.36	141.61	36.49	28.370	221.7	14.8
29I	141.65	36.32	141.53	36.20	141.37	36.23	141.49	36.36	29.211	216.6	15.4
30I	141.53	36.20	141.43	36.06	141.27	36.10	141.37	36.23	29.878	209.9	16.6
31I	141.43	36.06	141.36	35.91	141.20	35.95	141.27	36.10	30.092	202.1	17.1
1J	143.01	40.58	142.96	40.42	142.78	40.47	142.83	40.62	31.517	194.8	17.6
2J	142.96	40.42	142.92	40.27	142.73	40.31	142.78	40.47	31.782	191.5	16.9
3J	142.92	40.27	142.89	40.11	142.70	40.16	142.73	40.31	32.279	187.5	16.6
4J	142.89	40.11	142.87	39.95	142.68	40.00	142.70	40.16	32.487	184.3	16.6
5J	142.87	39.95	142.86	39.79	142.67	39.84	142.68	40.00	31.948	182.7	17.2
6J	142.86	39.79	142.85	39.63	142.66	39.68	142.67	39.84	30.770	182.8	18.3
7J	142.85	39.63	142.83	39.48	142.63	39.52	142.66	39.68	29.631	186.6	18.3
8J	142.83	39.48	142.79	39.32	142.58	39.37	142.63	39.52	29.338	192.5	17.8
9J	142.79	39.32	142.73	39.17	142.53	39.22	142.58	39.37	29.887	195.3	16.8

10J	142.73	39.17	142.69	39.01	142.49	39.06	142.53	39.22	30.527	192.2	16.8
11J	142.69	39.01	142.65	38.85	142.45	38.91	142.49	39.06	30.816	189.8	17.0
12J	142.65	38.85	142.61	38.70	142.41	38.75	142.45	38.91	30.753	191.5	16.7
13J	142.61	38.70	142.56	38.54	142.36	38.60	142.41	38.75	30.610	194.4	16.3
14J	142.56	38.54	142.52	38.39	142.31	38.44	142.36	38.60	30.511	191.9	15.5
15J	142.52	38.39	142.49	38.23	142.27	38.29	142.31	38.44	30.422	189.5	15.0
16J	142.49	38.23	142.45	38.08	142.22	38.13	142.27	38.29	30.530	191.0	14.7
17J	142.45	38.08	142.39	37.92	142.17	37.98	142.22	38.13	30.883	196.0	14.9
18J	142.39	37.92	142.32	37.78	142.10	37.83	142.17	37.98	31.487	199.7	14.8
19J	142.32	37.78	142.25	37.63	142.02	37.69	142.10	37.83	32.277	201.9	14.7
20J	142.25	37.63	142.18	37.48	141.96	37.54	142.02	37.69	32.922	200.4	14.6
21J	142.18	37.48	142.12	37.33	141.91	37.38	141.96	37.54	33.176	197.2	14.6
22J	142.12	37.33	142.06	37.18	141.85	37.23	141.91	37.38	33.170	199.3	14.4
23J	142.06	37.18	141.98	37.04	141.78	37.09	141.85	37.23	33.222	204.1	14.5
24J	141.98	37.04	141.89	36.90	141.70	36.94	141.78	37.09	33.283	205.0	14.8
25J	141.89	36.90	141.82	36.75	141.64	36.80	141.70	36.94	32.929	202.4	15.2
26J	141.82	36.75	141.73	36.61	141.55	36.66	141.64	36.80	32.328	208.1	15.4
27J	141.73	36.61	141.61	36.49	141.44	36.53	141.55	36.66	32.204	216.4	15.9
28J	141.61	36.49	141.49	36.36	141.33	36.40	141.44	36.53	32.814	219.0	16.6
29J	141.49	36.36	141.37	36.23	141.22	36.27	141.33	36.40	33.772	215.2	17.6
30J	141.37	36.23	141.27	36.10	141.12	36.13	141.22	36.27	34.566	209.9	18.4
31J	141.27	36.10	141.20	35.95	141.04	35.99	141.12	36.13	34.844	203.2	18.6
1K	142.83	40.62	142.78	40.47	142.60	40.51	142.65	40.67	36.804	195.2	19.8
2K	142.78	40.47	142.73	40.31	142.55	40.36	142.60	40.51	36.932	192.0	18.6
3K	142.73	40.31	142.70	40.16	142.51	40.20	142.55	40.36	37.431	188.7	18.0
4K	142.70	40.16	142.68	40.00	142.49	40.04	142.51	40.20	37.796	185.0	17.7
5K	142.68	40.00	142.67	39.84	142.48	39.89	142.49	40.04	37.580	183.4	18.4
6K	142.67	39.84	142.66	39.68	142.46	39.73	142.48	39.89	36.659	183.8	18.9
7K	142.66	39.68	142.63	39.52	142.43	39.57	142.46	39.73	35.572	186.8	19.3
8K	142.63	39.52	142.58	39.37	142.38	39.42	142.43	39.57	35.205	193.7	18.9
9K	142.58	39.37	142.53	39.22	142.33	39.27	142.38	39.42	35.645	195.0	18.7
10K	142.53	39.22	142.49	39.06	142.29	39.11	142.33	39.27	36.262	192.4	18.0
11K	142.49	39.06	142.45	38.91	142.25	38.96	142.29	39.11	36.625	190.5	18.2
12K	142.45	38.91	142.41	38.75	142.20	38.80	142.25	38.96	36.555	191.8	18.5
13K	142.41	38.75	142.36	38.60	142.15	38.65	142.20	38.80	36.316	195.0	18.1
14K	142.36	38.60	142.31	38.44	142.09	38.50	142.15	38.65	36.098	193.8	17.7
15K	142.31	38.44	142.27	38.29	142.05	38.34	142.09	38.50	35.941	191.6	16.7
16K	142.27	38.29	142.22	38.13	142.00	38.19	142.05	38.34	36.063	192.1	15.9
17K	142.22	38.13	142.17	37.98	141.94	38.04	142.00	38.19	36.476	196.5	15.2
18K	142.17	37.98	142.10	37.83	141.87	37.89	141.94	38.04	37.131	200.0	15.5
19K	142.10	37.83	142.02	37.69	141.80	37.74	141.87	37.89	37.903	201.8	15.5
20K	142.02	37.69	141.96	37.54	141.73	37.59	141.80	37.74	38.506	199.6	15.3
21K	141.96	37.54	141.91	37.38	141.69	37.44	141.73	37.59	38.624	195.0	15.5
22K	141.91	37.38	141.85	37.23	141.64	37.29	141.69	37.44	38.406	196.2	15.4
23K	141.85	37.23	141.78	37.09	141.58	37.14	141.64	37.29	38.353	202.0	15.5
24K	141.78	37.09	141.70	36.94	141.51	37.00	141.58	37.14	38.373	202.6	16.2
25K	141.70	36.94	141.64	36.80	141.45	36.85	141.51	37.00	37.964	199.8	16.7
26K	141.64	36.80	141.55	36.66	141.38	36.70	141.45	36.85	37.337	205.3	17.3
27K	141.55	36.66	141.44	36.53	141.28	36.57	141.38	36.70	37.169	213.5	18.1
28K	141.44	36.53	141.33	36.40	141.17	36.44	141.28	36.57	37.792	217.6	18.7

29K	141.33	36.40	141.22	36.27	141.06	36.31	141.17	36.44	38.784	213.6	19.9
30K	141.22	36.27	141.12	36.13	140.97	36.17	141.06	36.31	39.587	209.9	19.8
31K	141.12	36.13	141.04	35.99	140.88	36.03	140.97	36.17	39.888	204.3	19.8
1L	142.67	40.72	142.58	40.46	142.28	40.54	142.37	40.79	44.874	194.9	21.8
2L	142.58	40.46	142.51	40.20	142.21	40.28	142.28	40.54	44.988	190.5	20.9
3L	142.51	40.20	142.49	39.94	142.17	40.02	142.21	40.28	45.448	184.7	20.1
4L	142.49	39.94	142.46	39.68	142.13	39.76	142.17	40.02	44.812	185.1	19.7
5L	142.46	39.68	142.38	39.42	142.05	39.50	142.13	39.76	43.965	192.1	20.3
6L	142.38	39.42	142.30	39.16	141.97	39.24	142.05	39.50	44.265	194.3	20.1
7L	142.30	39.16	142.23	38.90	141.90	38.99	141.97	39.24	44.930	191.3	19.3
8L	142.23	38.90	142.15	38.65	141.80	38.73	141.90	38.99	44.920	194.8	19.5
9L	142.15	38.65	142.06	38.40	141.70	38.48	141.80	38.73	44.416	194.9	19.2
10L	142.06	38.40	141.98	38.14	141.61	38.23	141.70	38.48	44.273	193.6	17.7
11L	141.98	38.14	141.87	37.89	141.49	37.98	141.61	38.23	45.026	199.3	16.8
12L	141.87	37.89	141.75	37.64	141.38	37.74	141.49	37.98	46.136	200.9	16.7
13L	141.75	37.64	141.68	37.39	141.32	37.48	141.38	37.74	46.417	193.3	16.6
14L	141.68	37.39	141.58	37.14	141.25	37.23	141.32	37.48	46.036	197.1	17.1
15L	141.58	37.14	141.47	36.90	141.17	36.97	141.25	37.23	45.687	199.0	17.3
16L	141.47	36.90	141.34	36.66	141.06	36.73	141.17	36.97	45.125	203.4	19.0
17L	141.34	36.66	141.17	36.44	140.91	36.50	141.06	36.73	45.219	212.9	20.6
18L	141.17	36.44	141.00	36.22	140.74	36.28	140.91	36.50	46.350	211.6	21.5
19L	141.00	36.22	140.86	35.98	140.59	36.04	140.74	36.28	47.015	205.9	21.3
1M	142.37	40.79	142.28	40.54	141.99	40.61	142.08	40.86	55.360	195.1	21.6
2M	142.28	40.54	142.21	40.28	141.90	40.35	141.99	40.61	55.441	192.4	22.9
3M	142.21	40.28	142.17	40.02	141.86	40.09	141.90	40.35	55.900	186.1	21.5
4M	142.17	40.02	142.13	39.76	141.81	39.83	141.86	40.09	55.614	186.8	21.5
5M	142.13	39.76	142.05	39.50	141.73	39.58	141.81	39.83	55.068	192.9	21.7
6M	142.05	39.50	141.97	39.24	141.64	39.32	141.73	39.58	55.240	194.7	21.5
7M	141.97	39.24	141.90	38.99	141.57	39.07	141.64	39.32	55.826	192.0	20.7
8M	141.90	38.99	141.80	38.73	141.47	38.81	141.57	39.07	55.957	195.8	20.6
9M	141.80	38.73	141.70	38.48	141.35	38.57	141.47	38.81	55.434	198.3	20.5
10M	141.70	38.48	141.61	38.23	141.25	38.32	141.35	38.57	55.116	195.9	19.7
11M	141.61	38.23	141.49	37.98	141.13	38.07	141.25	38.32	55.687	199.8	18.6
12M	141.49	37.98	141.38	37.74	141.02	37.83	141.13	38.07	56.706	200.3	17.9
13M	141.38	37.74	141.32	37.48	140.98	37.57	141.02	37.83	56.850	189.3	18.1
14M	141.32	37.48	141.25	37.23	140.93	37.31	140.98	37.57	56.219	192.7	18.6
15M	141.25	37.23	141.17	36.97	140.87	37.05	140.93	37.31	55.821	195.0	19.7
16M	141.17	36.97	141.06	36.73	140.79	36.80	140.87	37.05	55.341	198.6	20.9
17M	141.06	36.73	140.91	36.50	140.65	36.56	140.79	36.80	55.316	207.9	22.1
18M	140.91	36.50	140.74	36.28	140.49	36.33	140.65	36.56	56.238	210.8	23.6
19M	140.74	36.28	140.59	36.04	140.33	36.11	140.49	36.33	56.786	208.2	23.7
1N	142.08	40.86	141.99	40.61	141.70	40.68	141.78	40.93	66.313	194.7	23.3
2N	141.99	40.61	141.90	40.35	141.60	40.43	141.70	40.68	66.459	194.2	23.6
3N	141.90	40.35	141.86	40.09	141.55	40.17	141.60	40.43	66.801	187.4	22.7
4N	141.86	40.09	141.81	39.83	141.51	39.91	141.55	40.17	66.750	187.7	21.9
5N	141.81	39.83	141.73	39.58	141.42	39.65	141.51	39.91	66.466	194.0	22.6
6N	141.73	39.58	141.64	39.32	141.33	39.40	141.42	39.65	66.504	195.0	22.3
7N	141.64	39.32	141.57	39.07	141.25	39.14	141.33	39.40	66.863	192.6	21.6
8N	141.57	39.07	141.47	38.81	141.15	38.89	141.25	39.14	67.044	196.6	20.7
9N	141.47	38.81	141.35	38.57	141.03	38.65	141.15	38.89	66.754	201.0	21.1

10N	141.35	38.57	141.25	38.32	140.91	38.40	141.03	38.65	66.441	198.1	21.5
11N	141.25	38.32	141.13	38.07	140.79	38.15	140.91	38.40	66.691	200.5	20.6
12N	141.13	38.07	141.02	37.83	140.68	37.91	140.79	38.15	67.415	199.6	19.5
13N	141.02	37.83	140.98	37.57	140.66	37.64	140.68	37.91	67.523	186.0	18.8
14N	140.98	37.57	140.93	37.31	140.63	37.38	140.66	37.64	67.018	188.3	20.3
15N	140.93	37.31	140.87	37.05	140.58	37.12	140.63	37.38	66.635	191.3	21.8
16N	140.87	37.05	140.79	36.80	140.51	36.87	140.58	37.12	66.187	195.0	22.5
17N	140.79	36.80	140.65	36.56	140.39	36.62	140.51	36.87	66.119	204.0	23.9
18N	140.65	36.56	140.49	36.33	140.23	36.39	140.39	36.62	66.758	209.8	24.1
19N	140.49	36.33	140.33	36.11	140.06	36.17	140.23	36.39	67.104	210.4	23.2

Supplementary Table S3 - Slip distribution and errors.

	Average Model		Best Model	
Subf. #	Slip (m)	Rake (°)	Slip (m)	Rake (°)
1A	7.2 ± 4.5	85.0 ± 9.4	5	80
2A	5.6 ± 3.8	85.0 ± 9.4	0	80
3A	4.8 ± 3.7	85.0 ± 9.4	2	80
4A	5.0 ± 3.7	75.3 ± 1.1	4	75
5A	9.0 ± 5.3	75.3 ± 1.1	1	75
6A	12.8 ± 5.1	75.3 ± 1.1	7	75
7A	22.4 ± 6.9	75.3 ± 1.1	29	75
8A	21.3 ± 7.2	75.3 ± 1.1	30	75
9A	17.8 ± 6.0	75.1 ± 0.6	17	75
10A	23.8 ± 6.0	75.1 ± 0.6	27	75
11A	25.4 ± 6.7	75.1 ± 0.6	24	75
12A	12.7 ± 5.8	75.1 ± 0.6	14	75
13A	10.8 ± 5.9	75.1 ± 0.6	10	75
14A	18.5 ± 7.7	105.0 ± 2.8	15	105
15A	23.6 ± 7.5	105.0 ± 2.8	23	105
16A	21.4 ± 7.9	105.0 ± 2.8	29	105
17A	20.9 ± 8.1	105.0 ± 2.8	25	105
18A	18.6 ± 6.7	105.0 ± 2.8	21	105
19A	18.7 ± 7.2	106.3 ± 3.9	19	100
20A	15.9 ± 7.9	106.3 ± 3.9	11	100
21A	11.1 ± 7.0	106.3 ± 3.9	12	100
22A	12.6 ± 6.4	106.3 ± 3.9	17	100
23A	15.3 ± 8.4	106.3 ± 3.9	9	100
24A	11.5 ± 6.0	93.1 ± 12.2	9	110
25A	8.2 ± 5.1	93.1 ± 12.2	9	110
26A	5.4 ± 4.6	93.1 ± 12.2	14	110
27A	6.0 ± 5.2	93.1 ± 12.2	9	110
28A	6.3 ± 5.1	93.1 ± 12.2	4	110
29A	4.1 ± 3.2	87.8 ± 9.3	0	90
30A	5.6 ± 4.6	87.8 ± 9.3	1	90
31A	5.1 ± 3.9	87.8 ± 9.3	0	90
1B	7.5 ± 4.4	85.0 ± 9.4	13	80
2B	6.9 ± 4.1	85.0 ± 9.4	5	80
3B	6.8 ± 3.8	85.0 ± 9.4	2	80
4B	9.2 ± 5.4	75.3 ± 1.1	8	75
5B	11.3 ± 4.5	75.3 ± 1.1	14	75
6B	9.6 ± 4.4	75.3 ± 1.1	6	75
7B	21.3 ± 4.8	75.3 ± 1.1	25	75
8B	21.8 ± 5.2	75.3 ± 1.1	27	75
9B	25.9 ± 6.0	75.1 ± 0.6	22	75
10B	22.1 ± 6.8	75.1 ± 0.6	25	75
11B	23.0 ± 4.7	75.1 ± 0.6	23	75
12B	21.8 ± 5.5	75.1 ± 0.6	19	75
13B	26.1 ± 6.3	75.1 ± 0.6	29	75
14B	28.0 ± 6.1	105.0 ± 2.8	29	105
15B	36.5 ± 7.1	105.0 ± 2.8	44	105
16B	34.2 ± 7.9	105.0 ± 2.8	36	105
17B	30.8 ± 8.6	105.0 ± 2.8	36	105
18B	26.5 ± 7.4	105.0 ± 2.8	28	105
19B	23.2 ± 7.4	106.3 ± 3.9	18	100
20B	20.4 ± 7.4	106.3 ± 3.9	22	100

21B	15.0 ± 7.5	106.3 ± 3.9	12	100
22B	14.4 ± 7.4	106.3 ± 3.9	20	100
23B	10.6 ± 6.1	106.3 ± 3.9	11	100
24B	7.2 ± 5.4	93.1 ± 12.2	12	110
25B	8.5 ± 5.7	93.1 ± 12.2	5	110
26B	6.1 ± 4.8	93.1 ± 12.2	18	110
27B	6.7 ± 5.0	93.1 ± 12.2	7	110
28B	7.5 ± 5.3	93.1 ± 12.2	12	110
29B	5.7 ± 4.5	87.8 ± 9.3	9	90
30B	5.1 ± 3.8	87.8 ± 9.3	5	90
31B	4.6 ± 4.0	87.8 ± 9.3	8	90
1C	6.2 ± 4.1	85.0 ± 9.4	0	80
2C	4.4 ± 3.8	85.0 ± 9.4	1	80
3C	3.2 ± 2.4	85.0 ± 9.4	1	80
4C	11.0 ± 5.8	75.3 ± 1.1	15	75
5C	8.3 ± 4.6	75.3 ± 1.1	12	75
6C	9.6 ± 4.5	75.3 ± 1.1	12	75
7C	8.4 ± 4.9	75.3 ± 1.1	6	75
8C	8.9 ± 4.1	75.3 ± 1.1	15	75
9C	18.5 ± 6.4	75.1 ± 0.6	17	75
10C	17.9 ± 5.5	75.1 ± 0.6	16	75
11C	17.2 ± 4.9	75.1 ± 0.6	23	75
12C	19.5 ± 5.0	75.1 ± 0.6	20	75
13C	28.3 ± 5.0	75.1 ± 0.6	29	75
14C	27.7 ± 4.5	105.0 ± 2.8	25	105
15C	31.8 ± 5.8	105.0 ± 2.8	29	105
16C	35.8 ± 6.3	105.0 ± 2.8	42	105
17C	24.3 ± 6.5	105.0 ± 2.8	24	105
18C	17.1 ± 6.9	105.0 ± 2.8	27	105
19C	15.9 ± 6.8	106.3 ± 3.9	16	100
20C	21.9 ± 7.2	106.3 ± 3.9	27	100
21C	21.7 ± 7.2	106.3 ± 3.9	23	100
22C	15.1 ± 6.4	106.3 ± 3.9	3	100
23C	8.6 ± 6.7	106.3 ± 3.9	5	100
24C	6.9 ± 5.3	93.1 ± 12.2	6	110
25C	9.0 ± 5.8	93.1 ± 12.2	3	110
26C	7.1 ± 5.3	93.1 ± 12.2	13	110
27C	6.1 ± 4.8	93.1 ± 12.2	19	110
28C	8.1 ± 5.1	93.1 ± 12.2	10	110
29C	7.3 ± 4.6	87.8 ± 9.3	6	90
30C	5.1 ± 4.2	87.8 ± 9.3	1	90
31C	4.5 ± 4.1	87.8 ± 9.3	2	90
1D	2.9 ± 2.3	85.0 ± 9.4	7	80
2D	1.7 ± 2.1	85.0 ± 9.4	0	80
3D	2.9 ± 2.4	85.0 ± 9.4	4	80
4D	4.8 ± 3.3	75.3 ± 1.1	0	75
5D	2.9 ± 2.7	75.3 ± 1.1	2	75
6D	3.1 ± 2.5	75.3 ± 1.1	3	75
7D	3.4 ± 2.7	75.3 ± 1.1	4	75
8D	7.7 ± 4.7	75.3 ± 1.1	5	75
9D	12.5 ± 5.0	75.1 ± 0.6	18	75
10D	12.6 ± 4.1	75.1 ± 0.6	11	75
11D	8.5 ± 4.4	75.1 ± 0.6	21	75
12D	18.7 ± 4.8	75.1 ± 0.6	8	75
13D	35.8 ± 4.2	75.1 ± 0.6	33	75
14D	26.7 ± 4.8	105.0 ± 2.8	27	105
15D	31.5 ± 5.9	105.0 ± 2.8	29	105
16D	44.7 ± 6.3	105.0 ± 2.8	45	105
17D	38.6 ± 6.9	105.0 ± 2.8	33	105

18D	24.9 ± 6.1	105.0 ± 2.8	27	105
19D	13.6 ± 7.0	106.3 ± 3.9	13	100
20D	12.8 ± 6.4	106.3 ± 3.9	7	100
21D	17.3 ± 5.7	106.3 ± 3.9	14	100
22D	11.5 ± 5.9	106.3 ± 3.9	12	100
23D	7.1 ± 5.3	106.3 ± 3.9	2	100
24D	5.7 ± 5.1	93.1 ± 12.2	1	110
25D	5.5 ± 4.3	93.1 ± 12.2	5	110
26D	3.9 ± 3.6	93.1 ± 12.2	2	110
27D	3.9 ± 3.7	93.1 ± 12.2	13	110
28D	5.5 ± 3.9	93.1 ± 12.2	6	110
29D	4.3 ± 4.0	87.8 ± 9.3	1	90
30D	5.5 ± 4.5	87.8 ± 9.3	8	90
31D	6.0 ± 4.2	87.8 ± 9.3	4	90
1E	2.4 ± 2.6	85.0 ± 9.4	2	80
2E	3.8 ± 3.3	85.0 ± 9.4	0	80
3E	6.2 ± 3.5	85.0 ± 9.4	4	80
4E	3.5 ± 3.2	75.3 ± 1.1	4	75
5E	3.9 ± 3.2	75.3 ± 1.1	2	75
6E	4.9 ± 3.5	75.3 ± 1.1	0	75
7E	4.1 ± 3.3	75.3 ± 1.1	4	75
8E	12.3 ± 4.7	75.3 ± 1.1	17	75
9E	12.8 ± 5.0	75.1 ± 0.6	16	75
10E	12.6 ± 3.5	75.1 ± 0.6	8	75
11E	8.8 ± 4.2	75.1 ± 0.6	16	75
12E	24.0 ± 4.3	75.1 ± 0.6	23	75
13E	31.4 ± 5.1	75.1 ± 0.6	42	75
14E	11.6 ± 3.6	105.0 ± 2.8	10	105
15E	18.9 ± 5.4	105.0 ± 2.8	17	105
16E	32.9 ± 5.9	105.0 ± 2.8	32	105
17E	31.5 ± 5.9	105.0 ± 2.8	31	105
18E	29.4 ± 6.5	105.0 ± 2.8	32	105
19E	19.6 ± 7.4	106.3 ± 3.9	25	100
20E	11.2 ± 5.3	106.3 ± 3.9	13	100
21E	10.8 ± 5.1	106.3 ± 3.9	12	100
22E	9.4 ± 5.7	106.3 ± 3.9	3	100
23E	6.5 ± 4.5	106.3 ± 3.9	4	100
24E	4.4 ± 3.5	93.1 ± 12.2	9	110
25E	4.0 ± 3.7	93.1 ± 12.2	2	110
26E	3.8 ± 3.2	93.1 ± 12.2	1	110
27E	3.1 ± 2.8	93.1 ± 12.2	3	110
28E	4.5 ± 3.6	93.1 ± 12.2	1	110
29E	5.3 ± 4.0	87.8 ± 9.3	6	90
30E	4.8 ± 3.2	87.8 ± 9.3	3	90
31E	4.9 ± 4.1	87.8 ± 9.3	4	90
1F	1.4 ± 1.5	85.0 ± 9.4	1	80
2F	2.9 ± 2.3	85.0 ± 9.4	2	80
3F	2.9 ± 2.0	85.0 ± 9.4	1	80
4F	2.4 ± 2.3	75.3 ± 1.1	4	75
5F	4.8 ± 3.3	75.3 ± 1.1	5	75
6F	5.0 ± 3.1	75.3 ± 1.1	2	75
7F	3.6 ± 2.5	75.3 ± 1.1	2	75
8F	8.7 ± 3.6	75.3 ± 1.1	8	75
9F	7.8 ± 3.9	75.1 ± 0.6	12	75
10F	10.8 ± 3.4	75.1 ± 0.6	7	75
11F	10.2 ± 3.5	75.1 ± 0.6	11	75
12F	19.3 ± 3.3	75.1 ± 0.6	17	75
13F	13.6 ± 3.7	75.1 ± 0.6	13	75
14F	8.7 ± 3.4	105.0 ± 2.8	4	105

15F	13.1 ± 4.0	105.0 ± 2.8	22	105
16F	23.4 ± 3.5	105.0 ± 2.8	22	105
17F	23.7 ± 4.6	105.0 ± 2.8	29	105
18F	30.1 ± 4.4	105.0 ± 2.8	32	105
19F	18.4 ± 4.2	106.3 ± 3.9	22	100
20F	9.1 ± 4.8	106.3 ± 3.9	15	100
21F	4.4 ± 3.8	106.3 ± 3.9	3	100
22F	5.6 ± 4.4	106.3 ± 3.9	2	100
23F	4.1 ± 3.4	106.3 ± 3.9	3	100
24F	2.2 ± 2.1	93.1 ± 12.2	3	110
25F	2.6 ± 2.7	93.1 ± 12.2	1	110
26F	3.2 ± 2.7	93.1 ± 12.2	0	110
27F	2.5 ± 2.5	93.1 ± 12.2	2	110
28F	3.4 ± 2.8	93.1 ± 12.2	7	110
29F	2.5 ± 2.4	87.8 ± 9.3	0	90
30F	2.9 ± 2.2	87.8 ± 9.3	0	90
31F	3.2 ± 2.9	87.8 ± 9.3	0	90
1G	1.6 ± 1.4	85.2 ± 10.5	2	75
2G	3.4 ± 2.7	85.2 ± 10.5	0	75
3G	2.6 ± 2.1	85.2 ± 10.5	8	75
4G	2.9 ± 2.7	80.5 ± 7.6	1	80
5G	3.0 ± 2.4	80.5 ± 7.6	1	80
6G	1.6 ± 1.8	80.5 ± 7.6	0	80
7G	3.8 ± 2.4	80.5 ± 7.6	5	80
8G	5.8 ± 3.2	80.5 ± 7.6	5	80
9G	3.8 ± 2.8	77.3 ± 2.9	6	75
10G	7.4 ± 3.5	77.3 ± 2.9	9	75
11G	10.7 ± 3.5	77.3 ± 2.9	15	75
12G	15.1 ± 2.8	77.3 ± 2.9	15	75
13G	14.5 ± 3.7	77.3 ± 2.9	12	75
14G	8.7 ± 4.1	75.0 ± 0.5	9	75
15G	18.6 ± 3.8	75.0 ± 0.5	16	75
16G	24.6 ± 3.6	75.0 ± 0.5	22	75
17G	24.2 ± 4.2	75.0 ± 0.5	21	75
18G	23.9 ± 4.9	75.0 ± 0.5	26	75
19G	20.0 ± 4.9	107.2 ± 4.0	17	110
20G	13.3 ± 4.9	107.2 ± 4.0	17	110
21G	5.9 ± 4.3	107.2 ± 4.0	11	110
22G	5.8 ± 4.7	107.2 ± 4.0	20	110
23G	4.8 ± 3.3	107.2 ± 4.0	3	110
24G	3.0 ± 2.8	96.0 ± 10.5	0	85
25G	2.0 ± 2.0	96.0 ± 10.5	1	85
26G	2.2 ± 2.1	96.0 ± 10.5	1	85
27G	3.4 ± 2.8	96.0 ± 10.5	5	85
28G	2.7 ± 2.4	96.0 ± 10.5	2	85
29G	1.9 ± 1.8	100.1 ± 10.9	2	105
30G	3.0 ± 2.9	100.1 ± 10.9	3	105
31G	3.3 ± 3.0	100.1 ± 10.9	1	105
1H	1.5 ± 1.6	85.2 ± 10.5	1	75
2H	2.6 ± 2.3	85.2 ± 10.5	2	75
3H	1.6 ± 2.0	85.2 ± 10.5	1	75
4H	1.5 ± 1.5	80.5 ± 7.6	2	80
5H	0.7 ± 1.0	80.5 ± 7.6	1	80
6H	1.9 ± 1.8	80.5 ± 7.6	0	80
7H	4.1 ± 3.4	80.5 ± 7.6	4	80
8H	6.4 ± 3.4	80.5 ± 7.6	6	80
9H	6.6 ± 2.9	77.3 ± 2.9	8	75
10H	4.4 ± 3.6	77.3 ± 2.9	1	75
11H	8.9 ± 3.7	77.3 ± 2.9	8	75

12H	10.8 ± 3.6	77.3 ± 2.9	9	75
13H	7.7 ± 3.9	77.3 ± 2.9	6	75
14H	7.9 ± 3.2	75.0 ± 0.5	6	75
15H	16.7 ± 4.4	75.0 ± 0.5	13	75
16H	22.8 ± 3.1	75.0 ± 0.5	28	75
17H	23.0 ± 4.5	75.0 ± 0.5	25	75
18H	13.8 ± 5.9	75.0 ± 0.5	21	75
19H	19.2 ± 5.6	107.2 ± 4.0	14	110
20H	16.5 ± 6.2	107.2 ± 4.0	6	110
21H	4.4 ± 3.3	107.2 ± 4.0	1	110
22H	4.6 ± 3.0	107.2 ± 4.0	4	110
23H	5.0 ± 3.7	107.2 ± 4.0	2	110
24H	3.3 ± 3.2	96.0 ± 10.5	6	85
25H	2.2 ± 2.2	96.0 ± 10.5	1	85
26H	2.7 ± 2.6	96.0 ± 10.5	0	85
27H	3.1 ± 2.8	96.0 ± 10.5	3	85
28H	2.2 ± 2.4	96.0 ± 10.5	5	85
29H	2.9 ± 3.3	100.1 ± 10.9	4	105
30H	4.2 ± 3.8	100.1 ± 10.9	4	105
31H	3.9 ± 3.3	100.1 ± 10.9	2	105
1I	1.7 ± 1.7	85.2 ± 10.5	1	75
2I	1.6 ± 1.8	85.2 ± 10.5	2 7	5
3I	1.2 ± 1.3	85.2 ± 10.5	1	75
4I	1.3 ± 1.6	80.5 ± 7.6	0	80
5I	1.8 ± 1.9	80.5 ± 7.6	1	80
6I	1.8 ± 1.8	80.5 ± 7.6	4	80
7I	2.4 ± 2.3	80.5 ± 7.6	2	80
8I	2.0 ± 2.2	80.5 ± 7.6	1	80
9I	3.4 ± 2.5	77.3 ± 2.9	4	75
10I	3.2 ± 2.6	77.3 ± 2.9	3	75
11I	6.2 ± 3.9	77.3 ± 2.9	10	75
12I	10.5 ± 4.8	77.3 ± 2.9	9	75
13I	7.9 ± 3.9	77.3 ± 2.9	4	75
14I	10.6 ± 4.0	75.0 ± 0.5	5	75
15I	15.7 ± 5.2	75.0 ± 0.5	19	75
16I	21.7 ± 6.0	75.0 ± 0.5	21	75
17I	19.8 ± 4.8	75.0 ± 0.5	12	75
18I	12.0 ± 4.8	75.0 ± 0.5	16	75
19I	19.2 ± 5.8	107.2 ± 4.0	26	110
20I	15.7 ± 4.9	107.2 ± 4.0	14	110
21I	3.4 ± 3.3	107.2 ± 4.0	1	110
22I	4.4 ± 3.5	107.2 ± 4.0	3	110
23I	5.4 ± 3.4	107.2 ± 4.0	8	110
24I	3.2 ± 2.4	96.0 ± 10.5	3	85
25I	3.5 ± 3.1	96.0 ± 10.5	3	85
26I	3.4 ± 2.7	96.0 ± 10.5	0	85
27I	3.1 ± 2.5	96.0 ± 10.5	3	85
28I	2.7 ± 2.5	96.0 ± 10.5	4	85
29I	4.2 ± 3.4	100.1 ± 10.9	2	105
30I	5.0 ± 4.5	100.1 ± 10.9	7	105
31I	3.5 ± 2.8	100.1 ± 10.9	2	105
1J	1.4 ± 1.7	85.2 ± 10.5	0	75
2J	1.7 ± 1.8	85.2 ± 10.5	0	75
3J	2.1 ± 2.0	85.2 ± 10.5	1	75
4J	1.4 ± 1.5	80.5 ± 7.6	1	80
5J	1.1 ± 1.3	80.5 ± 7.6	0	80
6J	1.6 ± 1.9	80.5 ± 7.6	0	80
7J	1.1 ± 1.3	80.5 ± 7.6	0	80
8J	0.8 ± 1.2	80.5 ± 7.6	0	80

9J	0.4 ± 0.6	77.3 ± 2.9	1	75
10J	0.9 ± 1.1	77.3 ± 2.9	2	75
11J	3.3 ± 2.8	77.3 ± 2.9	5	75
12J	3.2 ± 2.6	77.3 ± 2.9	0	75
13J	4.6 ± 3.0	77.3 ± 2.9	5	75
14J	8.2 ± 3.9	75.0 ± 0.5	2	75
15J	11.3 ± 4.4	75.0 ± 0.5	22	75
16J	14.3 ± 4.4	75.0 ± 0.5	16	75
17J	9.5 ± 5.0	75.0 ± 0.5	8	75
18J	3.2 ± 2.8	75.0 ± 0.5	3	75
19J	6.8 ± 4.8	107.2 ± 4.0	0	110
20J	7.3 ± 5.3	107.2 ± 4.0	13	110
21J	3.9 ± 3.1	107.2 ± 4.0	3	110
22J	5.4 ± 4.2	107.2 ± 4.0	11	110
23J	4.0 ± 3.1	107.2 ± 4.0	1	110
24J	2.9 ± 2.5	96.0 ± 10.5	5	85
25J	3.6 ± 3.2	96.0 ± 10.5	7	85
26J	4.8 ± 3.5	96.0 ± 10.5	8	85
27J	4.6 ± 4.0	96.0 ± 10.5	6	85
28J	5.4 ± 3.7	96.0 ± 10.5	1	85
29J	5.9 ± 3.7	100.1 ± 10.9	2	105
30J	5.4 ± 4.2	100.1 ± 10.9	2	105
31J	3.5 ± 3.4	100.1 ± 10.9	5	105
1K	1.9 ± 1.9	85.2 ± 10.5	2	75
2K	2.3 ± 2.1	85.2 ± 10.5	3	75
3K	3.1 ± 2.8	85.2 ± 10.5	7	75
4K	2.4 ± 1.9	80.5 ± 7.6	2	80
5K	1.2 ± 1.5	80.5 ± 7.6	0	80
6K	1.4 ± 1.6	80.5 ± 7.6	4	80
7K	1.6 ± 1.7	80.5 ± 7.6	5	80
8K	1.4 ± 1.6	80.5 ± 7.6	1	80
9K	0.8 ± 0.9	77.3 ± 2.9	0	75
10K	0.9 ± 1.1	77.3 ± 2.9	0	75
11K	2.1 ± 1.9	77.3 ± 2.9	2	75
12K	2.7 ± 3.1	77.3 ± 2.9	0	75
13K	2.9 ± 2.8	77.3 ± 2.9	1	75
14K	4.1 ± 3.2	75.0 ± 0.5	5	75
15K	6.9 ± 4.6	75.0 ± 0.5	8	75
16K	13.4 ± 4.9	75.0 ± 0.5	12	75
17K	15.2 ± 5.2	75.0 ± 0.5	11	75
18K	7.2 ± 4.3	75.0 ± 0.5	10	75
19K	7.8 ± 4.9	107.2 ± 4.0	4	110
20K	3.3 ± 3.1	107.2 ± 4.0	1	110
21K	2.7 ± 3.0	107.2 ± 4.0	4	110
22K	5.5 ± 4.3	107.2 ± 4.0	9	110
23K	5.2 ± 4.3	107.2 ± 4.0	2	110
24K	5.5 ± 3.8	96.0 ± 10.5	4	85
25K	4.3 ± 3.3	96.0 ± 10.5	8	85
26K	5.6 ± 4.3	96.0 ± 10.5	5	85
27K	4.9 ± 4.1	96.0 ± 10.5	7	85
28K	5.6 ± 4.5	96.0 ± 10.5	6	85
29K	4.6 ± 3.9	100.1 ± 10.9	3	105
30K	3.7 ± 3.3	100.1 ± 10.9	2	105
31K	1.5 ± 1.7	100.1 ± 10.9	1	105
1L	1.1 ± 1.4	97.1 ± 11.5	1	80
2L	1.6 ± 1.7	97.1 ± 11.5	1	80
3L	1.2 ± 1.1	90.2 ± 11.1	1	100
4L	0.3 ± 0.6	90.2 ± 11.1	0	100
5L	0.4 ± 0.6	90.2 ± 11.1	2	100

6L	0.1 ± 0.3	88.6 ± 11.2	0	105
7L	0.4 ± 0.7	88.6 ± 11.2	0	105
8L	0.3 ± 0.7	88.6 ± 11.2	0	105
9L	1.1 ± 1.4	84.8 ± 9.6	0	75
10L	2.5 ± 2.4	84.8 ± 9.6	1	75
11L	3.3 ± 2.8	84.8 ± 9.6	9	75
12L	1.3 ± 1.6	96.3 ± 11.6	0	110
13L	1.0 ± 1.1	96.3 ± 11.6	1	110
14L	3.4 ± 3.1	96.3 ± 11.6	6	110
15L	2.1 ± 2.1	88.9 ± 11.6	4	105
16L	1.8 ± 2.3	88.9 ± 11.6	1	105
17L	1.9 ± 2.3	88.9 ± 11.6	1	105
18L	0.8 ± 1.0	88.1 ± 10.4	0	95
19L	1.4 ± 1.7	88.1 ± 10.4	0	95
1M	1.6 ± 1.6	97.1 ± 11.5	0	80
2M	1.3 ± 1.6	97.1 ± 11.5	1	80
3M	0.5 ± 0.7	90.2 ± 11.1	0	100
4M	0.4 ± 0.7	90.2 ± 11.1	0	100
5M	0.4 ± 0.7	90.2 ± 11.1	0	100
6M	0.4 ± 0.6	88.6 ± 11.2	0	105
7M	0.7 ± 1.1	88.6 ± 11.2	2	105
8M	0.6 ± 0.8	88.6 ± 11.2	0	105
9M	0.9 ± 1.1	84.8 ± 9.6	1	75
10M	0.9 ± 1.1	84.8 ± 9.6	0	75
11M	0.7 ± 1.1	84.8 ± 9.6	1	75
12M	1.0 ± 1.2	96.3 ± 11.6	2	110
13M	1.0 ± 1.6	96.3 ± 11.6	1	110
14M	0.9 ± 1.4	96.3 ± 11.6	3	110
15M	0.9 ± 0.9	88.9 ± 11.6	1	105
16M	0.8 ± 1.0	88.9 ± 11.6	3	105
17M	1.2 ± 1.5	88.9 ± 11.6	3	105
18M	1.5 ± 1.6	88.1 ± 10.4	2	95
19M	1.8 ± 2.5	88.1 ± 10.4	1	95
1N	1.4 ± 1.5	97.1 ± 11.5	0	80
2N	0.7 ± 1.0	97.1 ± 11.5	1	80
3N	0.6 ± 0.9	90.2 ± 11.1	2	100
4N	0.6 ± 0.8	90.2 ± 11.1	0	100
5N	0.5 ± 0.8	90.2 ± 11.1	0	100
6N	0.9 ± 1.3	88.6 ± 11.2	0	105
7N	1.5 ± 1.8	88.6 ± 11.2	1	105
8N	1.8 ± 1.9	88.6 ± 11.2	1	105
9N	1.1 ± 1.3	84.8 ± 9.6	1	75
10N	2.5 ± 2.7	84.8 ± 9.6	2	75
11N	2.1 ± 2.0	84.8 ± 9.6	2	75
12N	2.5 ± 2.7	96.3 ± 11.6	0	110
13N	1.8 ± 2.2	96.3 ± 11.6	1	110
14N	1.8 ± 2.1	96.3 ± 11.6	2	110
15N	0.8 ± 1.1	88.9 ± 11.6	1	105
16N	1.3 ± 1.5	88.9 ± 11.6	2	105
17N	1.4 ± 1.5	88.9 ± 11.6	1	105
18N	1.6 ± 2.0	88.1 ± 10.4	1	95
19N	2.4 ± 2.3	88.1 ± 10.4	6	95

Supplementary Table S4 - Tsunami Stations.

Station	Lon (°E)	Lat (°N)	Sampling (min)	Weight	Source	Abbrev.
DART 21419	155.736	44.455	1	2	a	D21419
DART 21401	152.583	42.617	1	2	b	D21401
DART 21418	148.694	38.711	1	2.5	a	D21418
DART 21413	152.117	30.515	1	2	a	D21413
Tsunami Sensor PG1 Off Kushiro-Tokachi	144.4375	41.7040	0.5	1	c	KPG1
Tsunami Sensor PG2 Off Kushiro-Tokachi	144.8485	42.2365	0.5	1	c	KPG2
Coastal Wave Gauge 602	141.446111	42.544167	0.5	0.75	d	C602
Coastal Wave Gauge 202	141.424167	40.925	0.5	1	d	C202
GPS-Buoy 807	142.066666	40.116666	0.5	1.5	d	G807
GPS-Buoy 804	142.186666	39.627222	0.5	1.5	d	G804
GPS-Buoy 802	142.096944	39.258611	0.5	1.5	d	G802
Tsunameter 1 off Kamaishi	142.768	39.232	0.5	2	e*	TM1
Tsunameter 2 off Kamaishi	142.445	39.250	0.5	2	e*	TM2
GPS-Buoy 803	141.894444	38.857777	0.5	1.5	d	G803
Tsunami Sensor P06	142.5838	38.634	0.5	2.0	e*	P06
Tsunami Sensor P02	142.5016	38.5002	0.5	2.0	e*	P02
Coastal Wave Gauge 205	141.066111	38.25	0.5	1	d	C205
GPS-Buoy 801	141.683611	38.2325	0.5	1.5	d	G801
GPS-Buoy 806	141.18555	36.971388	0.5	1.5	d	G806
Boso	140.76	34.75	1	1.5	f	Boso
Tokai	137.59	33.77	1	0.75	f	Tokai
Tsunami Sensor PG1 Off Muroto Cape	134.4753	32.3907	0.5	0.75	c	MPG1
Tsunami Sensor PG2 Off Muroto Cape	134.3712	32.6431	0.5	0.75	c	MPG2

a) *National Oceanic and Atmospheric Administration (NOAA)*

b) *Russian Far Eastern Regional Hydrometeorological Research Institute (RFERHRI)*

c) *Japan Agency for Marine-Earth Science and Technology (JAMSTEC)*

d) *Nationwide Ocean Wave information network for Ports and Harbours (NOWPHAS)*

e) *Earthquake Research Institute (ERI) at the University of Tokyo*

f) *Japan Meteorological Agency (JMA)*

* Data digitized (http://outreach.eri.u-tokyo.ac.jp/eqvolc/201103_tohoku/eng/#sealevel)

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Supplementary Figure Legend.

Supplementary Figure S1. Density model.

NW-SE cross section of the 3D FE model in proximity of the hypocenter, showing the layer subdivision. It must be noted that the layering is associated only to the density (see Table S1). The elastic parameters of the FE model are computed from the velocities of the seismic tomographic model[23] without layering approximation, using the defined density structure. The arrows indicate the depth of the interface between each layer and the slab, which is not constant due to the irregular shape of the slab itself. The thick black line is the active fault. The topographic/bathymetric profile is shown on the top, with vertical exaggeration. Figure S1 is created using GMT software.

Supplementary Figure S2. Fault model.

The fault plane built with the FE model is tessellated with 398 quadrangular subfaults of variable size along dip: 155 subfaults of 24km x 14km (length x width) close to the trench (up to ~15km depth), 186 of 24km side in the central part up to ~40km depth (corresponding to more than 2/3 of the fault surface) and 57 of 35km side in the deeper part. The subfaults are progressively ordered from the northernmost shallowest to the southernmost deepest. The subfaults numbering follows that in Table S2, in order to associate the position on the map to the slip values. Cyan larger quadrilateral identify the zones in which we kept the rake constant. Colorbar indicates the depth variation along the fault surface. Red star indicates the epicentre position. The map is created using GMT software.

Supplementary Figure S3. Contribution to tsunami amplitudes due to the horizontal seafloor deformation. Comparison between the observed (black) and predicted tsunami waveforms, including (red) or not including (blue) the contribution of the horizontal seafloor deformation. The figure is created using MATLAB (http://www.mathworks.it/products/matlab/).

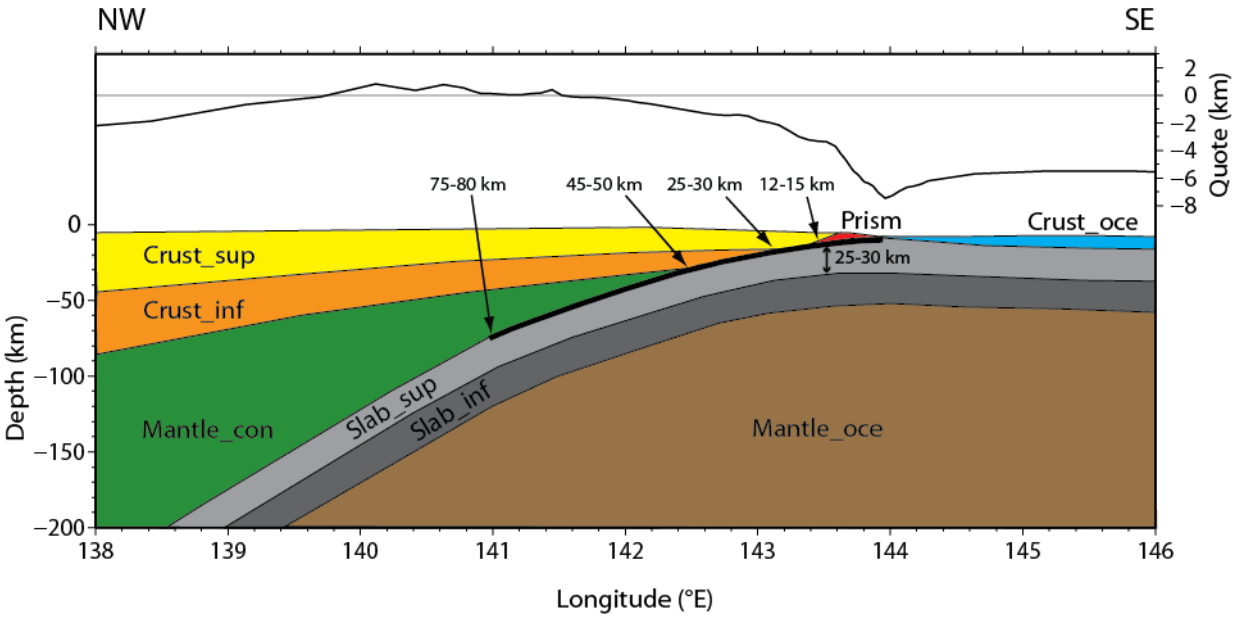
NW
SE
2
0
−2
−4
−6
−8
Quote (km)
75-80 km
45-50 km
25-30 km
12-15 km
Prism
Crust_oce
25-30 km
0
−50
−100
−150
−200
Depth (km)
Crust_sup
Crust_inf
Mantle_con
Slab_sup
Slab_inf
Mantle_oce
138
139
140
141
142
143
144
145
146
Longitude (°E)

Figure S1

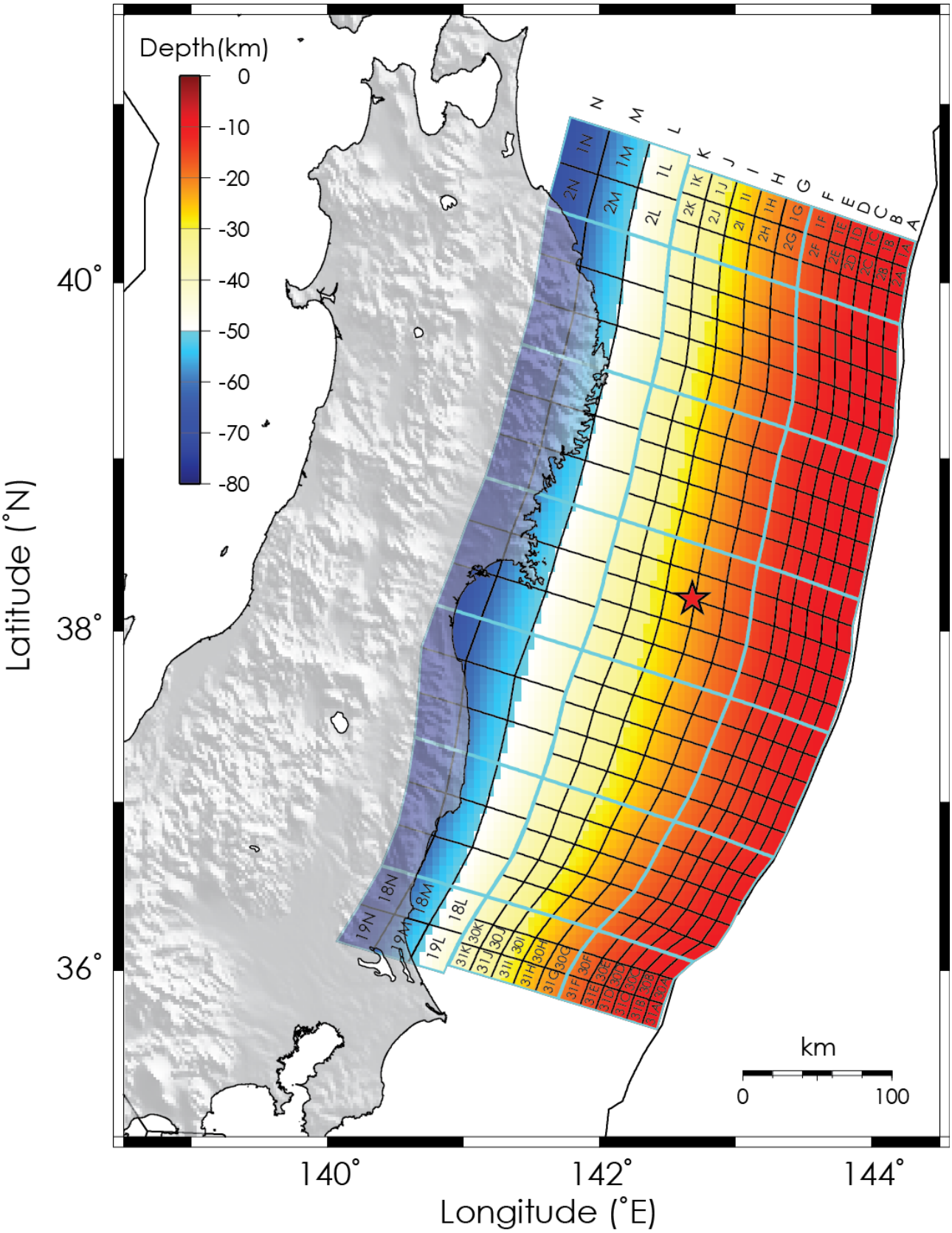
Depth(km)
0
-10
-20
-30
-40
-50
-60
-70
-80
40°
38°
36°
Latitude (°N)
140°
142°
144°
Longitude (°E)
km
0
100

Figure S2

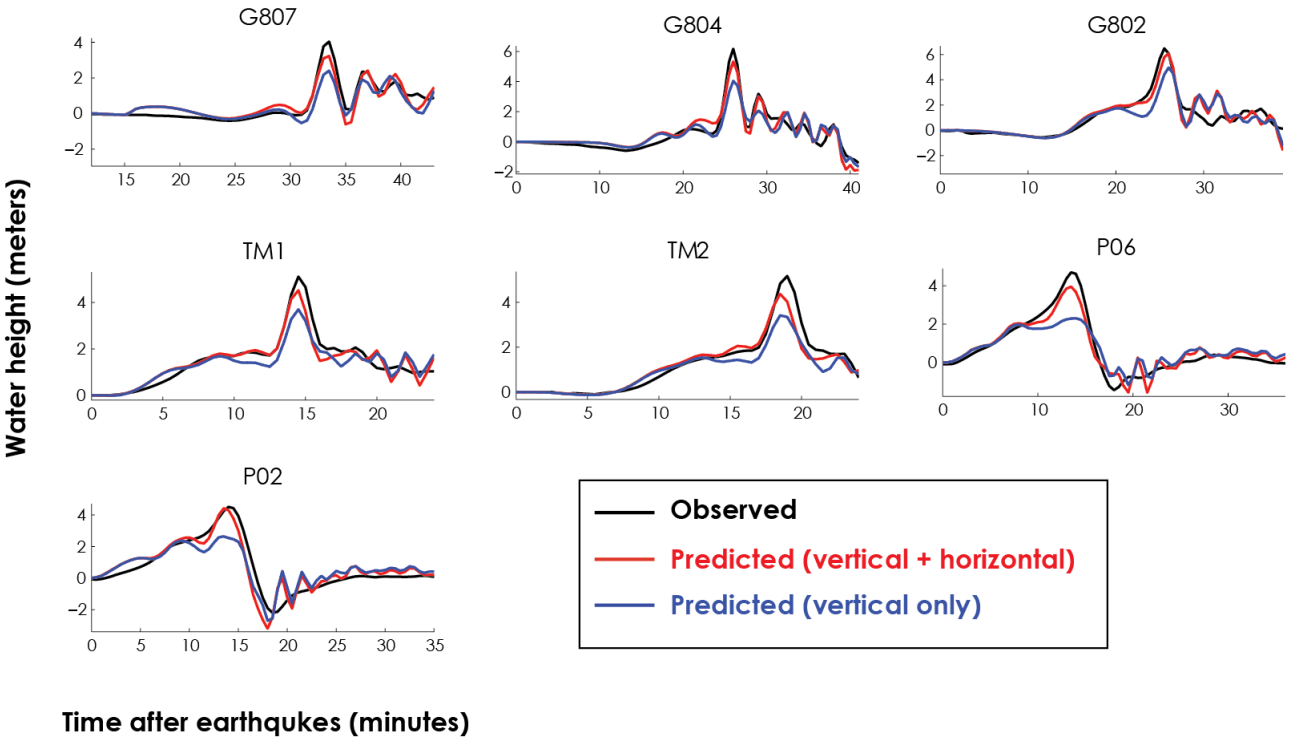
G807
G804
G802
TM1
TM2
P06
P02
Water height (meters)
Observed
Predicted (vertical + horizontal)
Predicted (vertical only)
Time after earthqukes (minutes)

Figure S3