KYOTO JAPAN 2021

THE 6TH IASPEI / IAEE INTERNATIONAL SYMPOSIUM:

THE EFFECTS OF SURFACE GEOLOGY ON SEISMIC MOTION

AUGUST, 2021 KYOTO, JAPAN

November 27th 2020

Documentation for Blind Prediction Study Step 3

We thank you for accepting our invitation to participate as an analyst in the blind prediction Step 3 for the simulation of strong motions observed at the prediction site. Your analytic contributions will be consisted of the processed data and simulation data including the relevant parametric information. For your participation, you will be acknowledged directly when the report is presented. However, your identity will remain masked from your specific analytic contributions as results will be codified. The test data are consisted of unpublished recordings. The data were collected by the local organizing committee of ESG6 with a close collaboration of the JR Kyushu Railway Co. and Kyushu University. We are currently at Step 3 of the study and your instructions are as follows :

(1) Download the ground motion data : http://sds.dpri.kyoto-u.ac.jp/esg6-bp/
In Step 2, we released 12 ground motion data at both the reference site (KU.KMP1; SEVO) and the prediction site (KUMA). We also released one target ground motion data (No.35 in Table 1) only at the reference site (KU.KMP1; SEVO). The prediction site is the same as "the target station site for Blind Prediction Study Step 1". Details of earthquakes are shown in Table 1. Locations of these earthquakes and these two stations are shown in Figure 1. See "BP2-Specifications.docx", for details of Step 2.

In Step 3, here, we release the foreshock of the 2016 Kumamoto earthquake on April 14, 2016, at 21:26 JST (Mj 6.5) and the main shock of the 2016 Kumamoto earthquake on April 16, 2016, at 1:25 JST (Mj 7.3) at the reference site (KU.KMP1; SEVO). The ground motion data is recorded by unit of m/s (in velocity). We only extracted their DC components by using the average over the 100 samples of pre-trigger data. Note that the records following the arrival of wave packets with the maximum amplitude for the main shock were lost because of technical issues with the back-up battery (Tsuno et al., 2017). For the information of source models for these two earthquakes, please check the web site of "Earthquake Source Model Database" maintained by Paul Martin Mai (http://equake-rc.info/srcmod/).

(2) Results of in situ measurements and laboratory tests, preferred velocity model and so on

We give results of in situ measurements and laboratory tests, preferred velocity model made by the local organizing committee of ESG6, Japan Integrated Velocity Structure Model (JIVSM), Geological map by AIST, as follows :

A. Results of in situ measurements and laboratory tests by Oyo (2020): See the file "Kumamoto Eq. Ground Structure Survey.pdf"

B. Preferred velocity model made by the local organizing committee of ESG6: See the file "Preferred model.xlsx"

The preferred model is simply integrated by both the model of PS logging data (A) for a shallow profile up to Vs 290 m/s and the model of Senna et al. (2018) for a deep profile.

C. Japan Integrated Velocity Structure Model (JIVSM) by Koketsu et al. (2009 & 2012): See the file "JIVSM.txt"

D. Geological map by AIST: See the web site of "Seamless Digital Geological Map of Japan (1:200,000) by National Institute of Advanced Industrial Science and Technology (AIST)" (https://gbank.gsj.jp/seamless/index_en.html?)

(3) You are requested to simulate earthquake ground motions for the target earthquakes of the main shock and the foreshock of the 2016 Kumamoto earthquake at the prediction site, by any simulation techniques such as, the 1-D method, GMPE, the empirical Green's function method, and the 2-D/3-D simulation. At least, acceleration data for a horizontal component with a sampling frequency of 100Hz and the Fourier spectrum in the reliable frequency range is requested, describing the starting time and the duration in your simulation. A submission of two or three component data is optional but preferred. Any other relevant information on the parameters used in the simulation is also requested. In case of theoretical methods, the description on the structure model used is requested. In case of non-linear analysis, the description on non-linear parameter used and shear strain estimated is requested.

(4) Document your parameters and results by filling the columns for each tab in the respective Step3-waveform_(mainshock or foreshock).KawaseH.xlsx and Step3-Fourier-spectrum_(mainshock or foreshock).KawaseH.xlsx template file provided by the same site described in (1). Please also describe your procedure of simulation in one to two page(s) of a word file within about 1000 words including up to three figures and tables. Necessary items are listed in the template file, ex. Step3-procedure_mainshock.KawaseH.docx.

(5) Attach these files and send us an e-mail with your results to esg6-bp@jaee.gr.jp (please write "BP Step3 results <Surname>" in the subject). Append your surname and first name's

initial to the files containing your results, e.g., Step3-waveform_foreshock.KawaseH.xlsx. Please note that the scheduled deadline for completion of Step 3 is ~~October 31~~November 30.

(6) The participants are encouraged to submit extended abstracts of your results to the Blind Prediction Special Session during ESG6, and present your results as posters. Please note that the one- or two- page document submitted with your simulation described above will be used only for the analysis by the working group of ESG6 LOC for this blind prediction experiment.

Table 1. Event information

	No.	JMA									F-net								
		Y.	M.	D.	H.	M.	S.	Latitude	Longitude	Depth(km)	M	Latitude	Longitude	Depth(km)	Strike (°)	Dip (°)	rake (°)	Mo (Nm)	Mw
	4	2016	4	16	1	5	42.48	32.71633	130.80483	15.46	3.3	No information							
Target EQ	35	2016	4	16	3	3	10.78	32.96383	131.08683	6.89	5.9	32.9638	131.0868	5	209 ; 116	60 ; 85	-174 ; -30	1.92E+17	5.5
	43	2016	4	16	4	5	49.2	32.79733	130.81317	12.29	4	No information							
	64	2016	4	16	7	23	54.32	32.78667	130.77383	11.93	4.8	32.7867	130.7738	5	92 ; 248	29 ; 63	-69 ; -101	8.86E+15	4.6
	80	2016	4	16	11	2	51.71	32.75833	130.77817	14.57	4.4	32.7583	130.7782	11	199 ; 34	41 ; 50	-102 ; -80	3.72E+15	4.3
	104	2016	4	17	0	14	51.69	32.96167	131.07917	8.92	4.8	32.9617	131.0792	8	241 ; 140	54 ; 75	-161 ; -38	1.18E+16	4.7
	109	2016	4	17	4	46	49.09	32.68717	130.77617	10.32	4.5	32.6872	130.7762	5	276 ; 181	60 ; 82	10 ; 150	4.52E+15	4.4
	121	2016	4	17	19	23	41.22	32.6775	130.72067	10.58	4.4	32.6775	130.7207	8	302 ; 80	39 ; 59	-55 ; -115	4.88E+15	4.4
	127	2016	4	18	8	35	43.02	32.8695	130.87333	10.2	4.2	32.8695	130.8733	8	318 ; 98	36 ; 61	-56 ; -112	2.41E+15	4.2
	161	2016	4	21	21	52	3.39	32.78533	130.83183	10.98	4	32.7853	130.8318	8	358 ; 262	65 ; 78	-167 ; -26	7.14E+14	3.9
	205	2016	5	5	10	31	30.47	33.00033	131.13417	11.16	4.6	33.0003	131.1342	8	208 ; 116	71 ; 84	-174 ; -19	8.44E+15	4.6
	206	2016	5	5	10	40	12.83	32.99283	131.12217	10.81	4.9	32.9928	131.1222	8	320 ; 228	79 ; 84	6 ; 169	1.52E+16	4.8
	227	2016	5	19	2	37	44.28	32.83133	130.81417	16.43	3.9	No information							

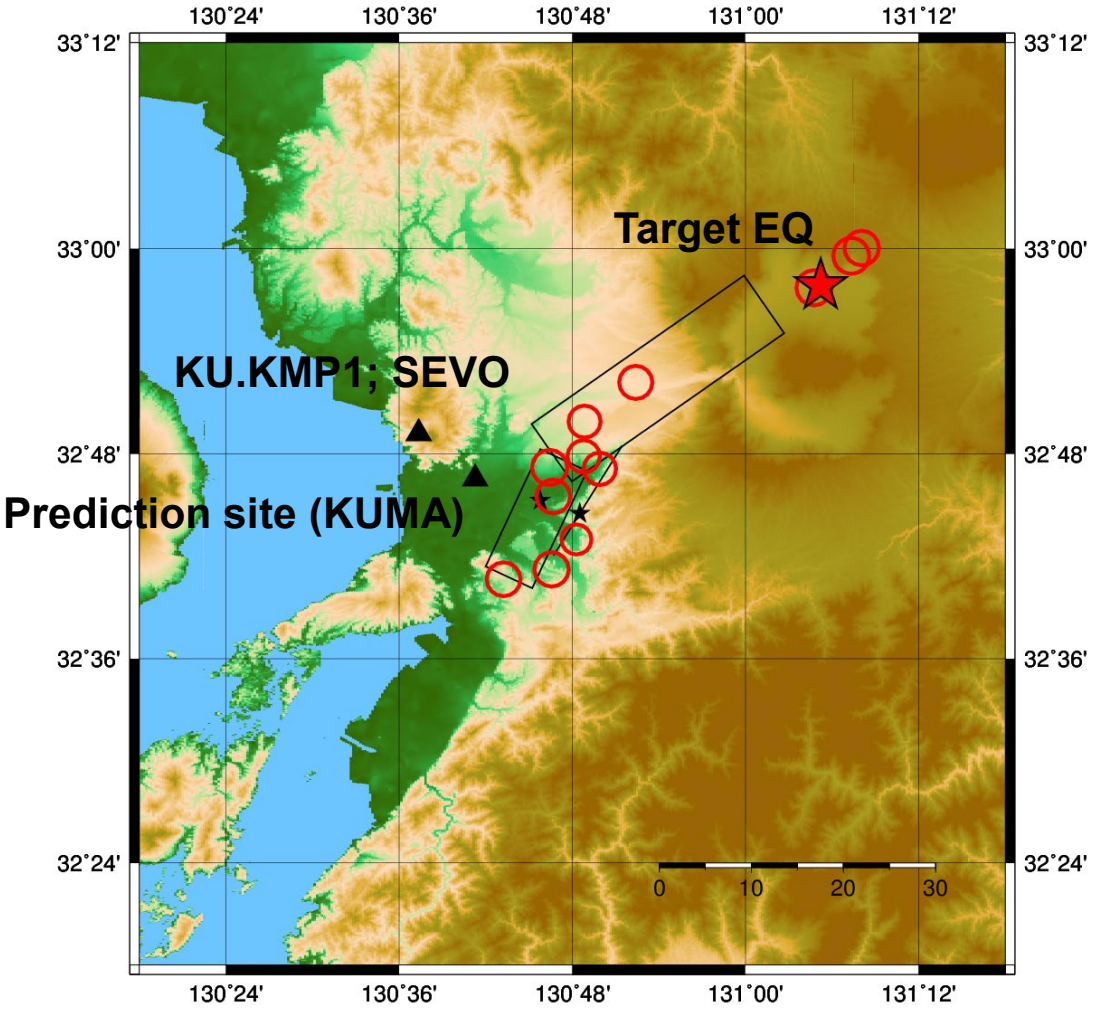

Figure 1. Locations of earthquakes and stations (Red star indicate the epicenter of the target earthquake in Step 2. Black stars denote epicenters of foreshock and mainshock of the 2016 Kumamoto earthquake. Source fault planes of foreshock and mainshock by Asano and Iwata [2016] are also projected on the surface.)

References

Advanced Industrial Science and Technology (AIST) Seamless Digital Geological Map of Japan (1:200,000), https://gbank.gsj.jp/seamless/index_en.html?

Asano, K. and Iwata, T. (2016) Source rupture processes of the foreshock and mainshock in the 2016 Kumamoto earthquake sequence estimated from the kinematic waveform inversion of strong motion data, Earth, Planets and Space, 68:147, https://doi.org/10.1186/s40623016-0519-9.

Japan Meteorological Agency (JMA), JMA unified hypocenter catalog, https://www.data.jma.go.jp/svd/eqev/data/bulletin/index_e.html.

National Research Institute for Earth Science and Disaster Resilience (NIED), F-net (Full Range Seismograph Network of Japan), http://www.fnet.bosai.go.jp/top.php?LANG=en

Koketsu, K., Miyake, H., Afnimar, and Tanaka, Y. (2009) A proposal for a standard procedure of modeling 3-D velocity structures and its application to the Tokyo metropolitan area, Japan, Tectonophysics, 472, 290-300.

Koketsu, K., Miyake, H., and Suzuki, H. (2012) Japan Integrated Velocity Structure Model Version 1, Proc. World Conf. Earthq. Eng., Paper No. 1773.

Mai, P. M. Earthquake Source Model Database, http://equake-rc.info/srcmod/

Senna, S., Wakai, A., Suzuki, H., Yatagai, A., Matsuyama, H., and Fujiwara, H. (2018) Modeling of the Subsurface Structure from the Seismic Bedrock to the Ground Surface for a Broadband Strong Motion Evaluation in Kumamoto Plain, J. Disaster Res., Vol.13, No.5, pp. 917-927.

Oyo Corporation (2020) Kumamoto Eq. Ground Structure Survey Report (Draft)

Tsuno, S., Korenaga, M., Okamoto, K., Yamanaka, H., Chimoto, K., and Matsushima, T. (2017) Local site effects in Kumamoto City revealed by the 2016 Kumamoto earthquake, Earth, Planets and Space, 69:37, https://doi.org/10.1186/s40623-017-0622-6.

Acknowledgements

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Ground motion data file

File format for ground motion data (e.g. 20160414212634.43_SEVO.txt)

Origin Time	2016/04/14 21:26:34.43
Latitude	32.7417 N
Longitude	130.8087 E
Depth	11.39 km
Mag.	6.5
Station Code	KU.KMP1
Institute	SEVO
Sta.Lat.	32.8198 N
Sta.Long.	130.6227 E
Height	175.00 m
Sampling Freq.	100 Hz
Duration	234.00 sec
No. of Data	23400
Unit	m/sec
Record Time	2016/04/14 21:25:50
Memo.	

Time(sec)	NS	EW	UD
0.000	0.2167986E-02	0.2192048E-02	0.2103981E-02
0.010	0.2167024E-02	0.2193973E-02	0.2102538E-02
0.020	0.2167024E-02	0.2193492E-02	0.2102538E-02
0.030	0.2167024E-02	0.2193492E-02	0.2102056E-02
0.040	0.2166061E-02	0.2193973E-02	0.2100613E-02
0.050	0.2167505E-02	0.2192530E-02	0.2103500E-02

…continue until the end of record…

Terms of the use of the distributed data

We do not take any responsibility for any loss or disadvantage caused by using the data. The data shall not be distributed to a third-party and must be downloaded by the registered participants from the specified URL for their own use solely for this experiment. All participants need to wait to use the distributed data for your specific study until the end of the symposium or until the distributed data is made open to the society by means of a

publication or DOI registration.

Report of results for the Blind Prediction exercise

We plan to compile and present results and facilitate discussions for all the three steps at the ESG6 Symposium during ~~15-17 March~~ 30 August to 1 (or 2) September 2021 in Kyoto, Japan.

Deadline for submission of your results for STEP 2 and STEP 3

Please note that the deadline for submitting your results is ~~October 31, 2020~~ January 6, 2021.

Deadline for abstract submission for STEP 2 and STEP 3

Please note that the deadline for submitting your extended abstracts of the simulation for Step 2 and STEP 3 is ~~December 18, 2020~~ January 31, 2021.

We thank you for your interest and participation in this blind prediction study.

With much appreciation,

ESG6 Chair for Blind Prediction Step 2/3, KAWASE Hiroshi on behalf of
ESG6 Local organizing committee
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