February 18th 2020

Documentation for Blind Prediction Study Step 2

We thank you for accepting our invitation to participate as an analyst in the blind prediction Step 2 for the simulation of weak 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 The test data are consisted of unpublished recordings.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 2 of the study and your instructions are as follows :

(1) Download the ground motion data : http://sds.dpri.kyoto-u.ac.jp/esg6-bp/
We release 12 ground motion data at both the reference site (KU.KMP1; SEVO) and the prediction site (KUMA). We also release 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. The hypocenter information is from the Japan Meteorological Agency (JMA) unified hypocenter catalog, published as the Seismological Bulletin of Japan by JMA in collaboration with the Ministry of Education, Culture, Sports, Science, and Technology. Although the original JMA format uses degrees and minutes, the distributed latitude and longitude units are set to degrees by Dr. Tsuno. You can see the original JMA unified hypocenter catalog via the HP address in the following reference list. The source mechanisms in Table 1 were determined by F-net of NIED. Locations of these earthquakes and these two stations are shown in Figure 1. Note that the ground motion data at the reference site (KU.KMP1; SEVO) is recorded by unit of m/s (in velocity) and the ground motion data at the prediction site (KUMA) is recorded by unit of cm/s/s (in acceleration), to offer the raw data without any corrections. We only extracted their DC components by using the average over the whole duration of each record.

(2) You are requested to simulate earthquake ground motion for the target 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.

(3) Document your parameters and results by filling the columns for each tab in the respective Step2-waveform_r1.xlsx and Step2-Fourier spectrum_r1.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.Step2-procedure.KawaseH_r1.docx.

(4) Attach these files and send us an e-mail with your results to esg6-bp@jaee.gr.jp (please write "BP Step2 results <Surname>" in the subject). Append your surname and first name's initial to the files containing your results, e.g., Step2-waveform.KawaseH.xlsx. Please note that the scheduled deadline for completion of Step 2 is August 31.

(5) 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. Details of earthquakes

| | No. | Y. | M. | D. | H. | M. | S. | Latitude | Longitude | Depth(km) | M | F-net | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | 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 | 33.000333 | 131.134167 | 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 | 32.992833 | 131.122167 | 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 | | | | | | | |

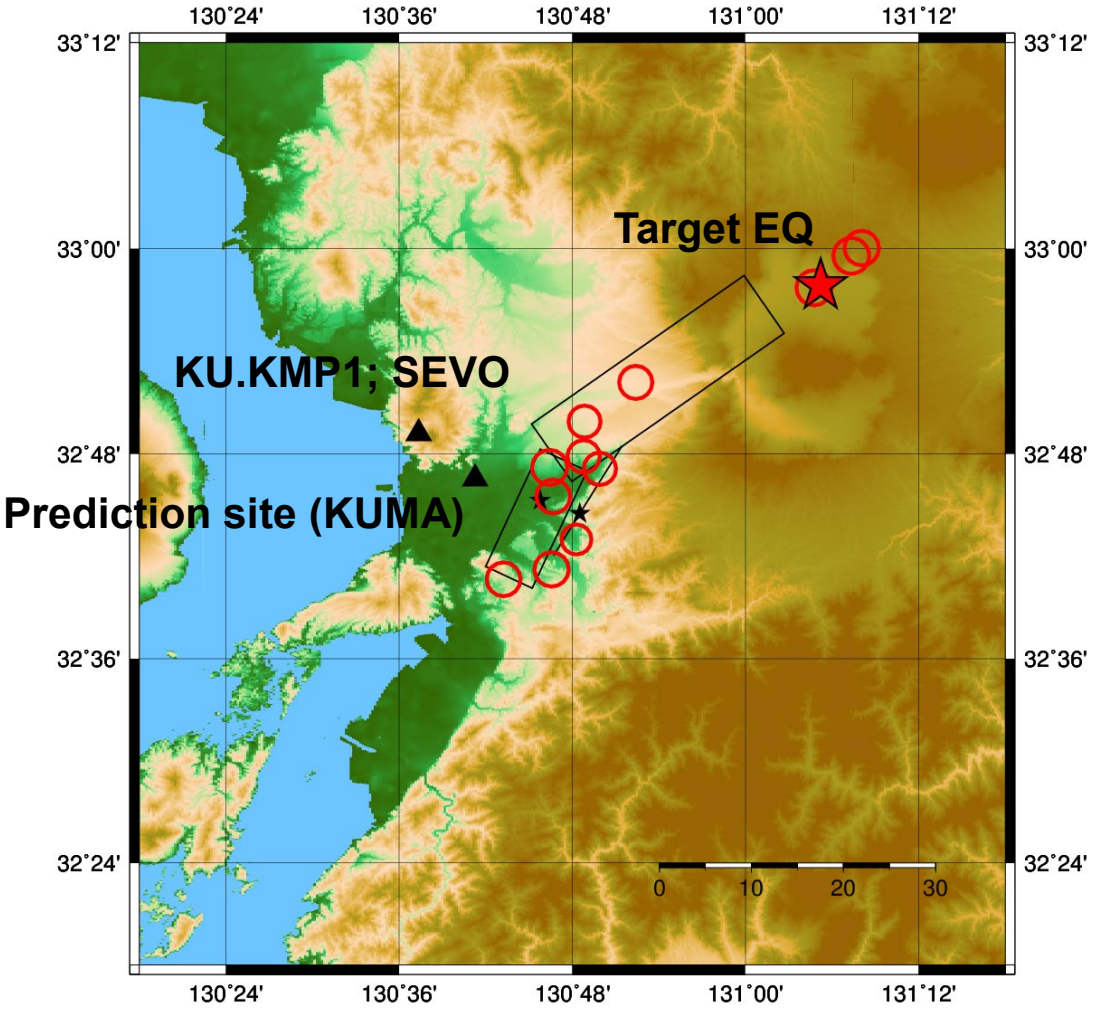


Figure 1. Locations of earthquakes and stations
(Stars denote epicenters of foreshock and mainshock of the 2016 Kumamoto earthquake. Source fault planes of foreshock and mainshock by Asano and Iwata [2016] are also projected.)

References

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/s40623-016-0519-9.

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.

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

Acknowledgements

We profoundly thank to Institute of Seismology and Volcanology, Faculty of Science, Kyushu University, for providing us with seismic records of KU.KMP1.

Ground motion data file

File format for ground motion data (e.g. 20160416010542.48_KUMA.txt)

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```
Origin Time  2016/04/16 01:05:42.48
 Latitude       32.7163 N
 Longitude     130.8048 E
 Depth           15.46 km
 Mag.                3.3
 Station Code
 Institute
 Sta.Lat.       32.7756 N
 Sta.Long.     130.6879 E
 Height           10.00 m
 Sampling Freq.    100 Hz
 Duration       60.00 sec
 No. of Data         6000
 Unit          cm/sec/sec
 Record Time         2016/04/16 01:05:30
 Memo.
```

```
 Time(sec)              NS              EW              UD
     0.000 -0.2243042E-01 -0.2492269E-01 -0.3738404E-02
     0.010  0.6230673E-03  0.8099875E-02  0.1246135E-02
     0.020  0.4984539E-02 -0.1869202E-02  0.0000000E+00
     0.030  0.3738404E-02 -0.8099875E-02 -0.2056122E-01
     0.040  0.1557668E-01  0.1495362E-01 -0.1993815E-01
     0.050  0.3364564E-01  0.2616883E-01  0.1495362E-01
…continue until the end of record…
```

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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.

Additional data for your reference

We will release additional data such as, subsurface velocity profiles and a geological map in and around Kumamoto Prefecture, boring data at the prediction site, the result of the laboratory test, and the preferred velocity model made by the local organizing committee of ESG6, on the same timing of data release for the blind prediction Step 3, which is scheduled to be April 1, 2020.

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 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 August 31, 2020.

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.

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
esg6-bp@jaee.gr.jp