Supplementary material

Table S1 Computational periods for the sensitivity analysis of the numerical parameters in the RRI model. Ten cases including Typhoon Bualoi in 2019 (No. 10) were selected. The durations are displayed in JST.

No.	Time period	Total rainfall [mm]
1	0:00 on Oct. 5, 2006 to 0:00 on Oct. 8, 2006	164.4
2	0:00 on Sep. 11, 2007 to 0:00 on Sep. 13, 2007	72.9
3	0:00 on Aug. 9, 2009 to 0:00 on Aug. 12, 2009	130.1
4	0:00 on Oct. 5, 2009 to 0:00 on Oct. 9, 2009	115.9
5	0:00 on Sep. 26, 2010 to 0:00 on Sep. 29, 2010	134.3
6	0:00 on Oct. 30, 2010 to 0:00 on Nov. 2, 2010	123.2
7	0:00 on Aug. 11, 2012 to 0:00 on Aug. 13, 2012	40.3
8	0:00 on Oct. 2, 2012 to 0:00 on Oct. 6, 2012	107.8
9	0:00 on Oct. 15, 2013 to 0:00 on Oct. 17, 2013	282.7
10	0:00 on Oct. 25, 2019 to 0:00 on Oct. 27, 2019	260.4

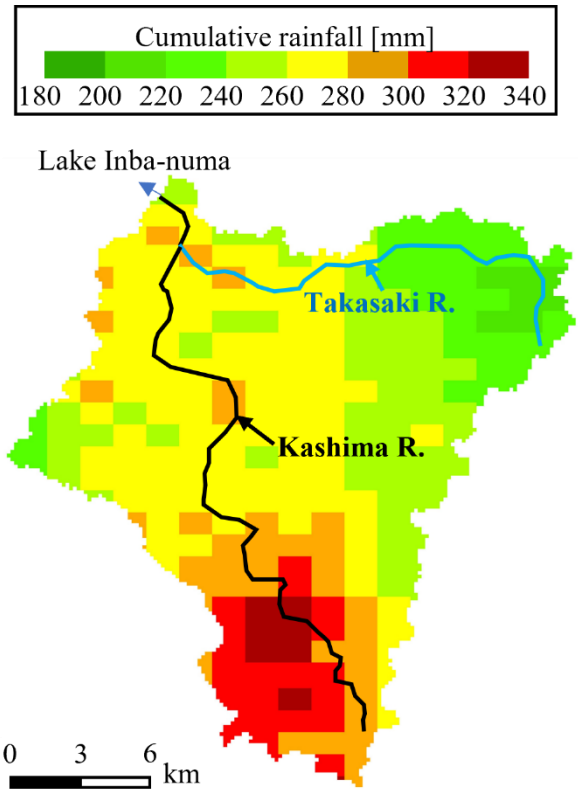

Figure S1. Contour map of the cumulative precipitation in 2009 in the Kashima River basin caused by Typhoon Bualoi. The rainfall data were obtained using RRAP with a grid resolution of 1 km from 0:00 on Oct. 25, 2019, to 0:00 on Oct. 27, 2019.

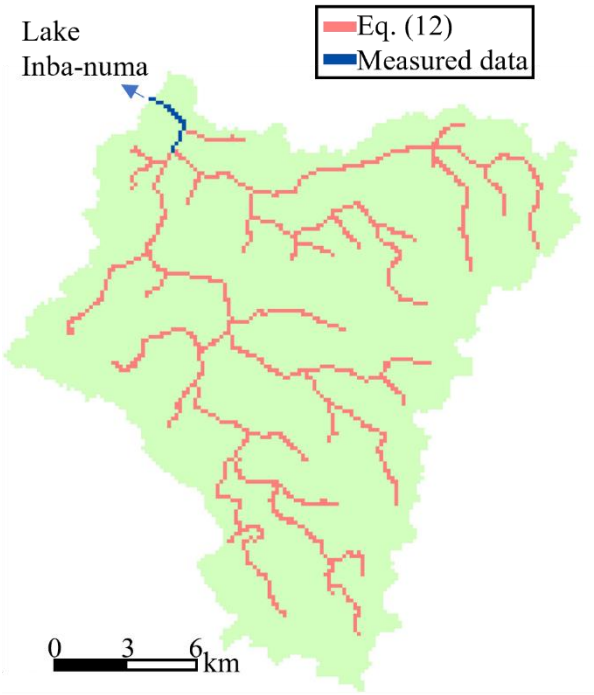

Figure S2. Location of the river channel for the simulation of the Kashima River basin. The cross-sectional data were provided using the survey data obtained from the local government and using Eq. (12) and are represented by red and blue lines, respectively.

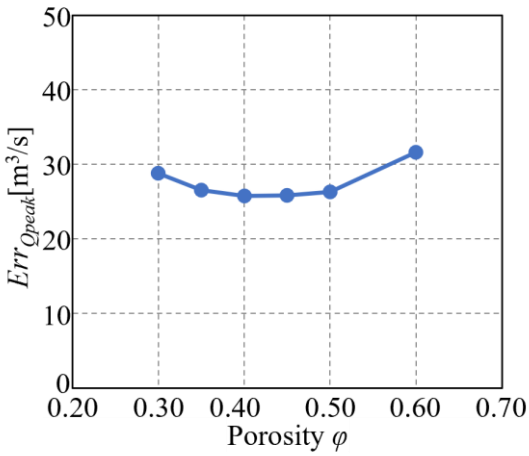

Figure S3. Error values Err_{Qpeak} for the peak discharge calculated for each porosity. Err_{Qpeak} was calculated as the RMS value of the difference between the observed and calculated peak discharge at Takaoka bridge on the Takasaki River for all ten flood events.