

Report on *B-flood 1.0: an open-source Saint-Venant model for flash flood simulation using adaptative refinement*,
by G. Kirstetter, O. Delestre, P.-Y. Lagrée, S. Popinet, C. Josserand

This article presents the b-flood software, subset of the Basilisk library, that solves the Shallow-Water equations with an adaptative mesh refinement. The software is tested against analytical solutions and is confronted to experimental datas in cases of flash flood.

General comments

The b-flood software solves the Shallow-Water equations with a finite volume approach, on a square grid. The HLLC solver and a MUSCL-type reconstruction are implemented, as well as the hydrostatic reconstruction to preserve the positivity and equilibrium states. Two points must be underlined:

- thanks to a second order reconstruction, the software can deal with very steep topographies,
- a threshold is introduces on the velocity to avoid large values due to some buildings. These large values could generate very small time steps.

These modifications are key tools to be able to simulate urban cases under flash flood.

After describing the software, the authors give two examples of classical analytical solutions that are well reproduced by b-flood. Convergence orders are shown. Then two experimentations on the Toce model are simulated: a reproduction of the Toce river valley (Italy) was built at the scale 1:100 and several experiments were performed. The authors chose a fluvial case and a urban, torrential case, and they confront their results to the measurements: there is a good fit. The last part of the article is devoted to the simulation of a real case, the flood of October 2015 in Cannes. They obtain a good qualitative behavior of the software.

I suggest to accept the publication of this article after minor corrections and answers to the following questions.

Specific comments

- section 2.3.4 velocity threshold: could you justify the threshold ? Do you have a reference ? Could you explain more this choice ?
- section 2.4 AMR line 8: why do you choose $2/3$? Is it usual / your choice ?
- Fig 8 and 13: To avoid the difference between the experimental and b-flood results, why don't you add the outlet volume of water ? It should then fit the red curve ?
- Fig 10 and 15: what is the use of the time delay ? You did not comment on these results.
- page 13 lines 1-2, and page 14 lines 18-19: One can say that b-flood is able to reproduce this Toce example, it cannot be generalized to all the floods on impermeable soil with houses.
- page 14 line 22: could you explain the limit to small watersheds (less than 100 km^2)?
- page 17 lines 1-8: is it usefull to have a DMT with a resolution of 1 m when the space step is of several meters ?
How do you consider a river that is smaller than the space step ? How can the flow be continuous if the river is "crossing" the mesh ?

- Fig 18: you claim a "good qualitative behavior" but no measurements are shown to compare the simulated results and what happened.

Could you explain the differences with the results of:

G. Kirstetter, F. Bourgin, P. Brigode, O. Delestre. *Real-Time Inundation Mapping with a 2D Hydraulic Modelling Tool Based on Adaptive Grid Refinement: The Case of the October 2015 French Riviera Flood*. Advances in Hydroinformatics, pp. 335-346, 2020 (Simhydro2019), obtained with Basilisk ?

This reference should be added and explained in the article.

Technical corrections

- Is there a capital letter in the name of the software ? Homogenize the title and the rest of the paper.
- page 1 line 13: in the Gard region, the flood occurred in September, not June 2002.
- page 3 line 24: () are forgotten in the equation number.
- page 4 line 9 : $\forall i. \Delta x_{min}$ could be misunderstood, add a word at the beginning of the last sentence.
- page 9 line 6 : I don't understand the "missing numbers", each gauge has a number ... ?
- Fig 7: Impossible to read the legend when the article is printed, enlarge the figure ?
What are the meanings of P, S ?
- Fig 8: the volume is not mentioned in the caption.
- Fig 9: no legend: values of the water height and of the mesh refinement ?
- Fig 10: Impossible to read the values when the article is printed, enlarge the figure ?
Typo : "ant" in the caption.
- page 12 line 6: "time delay" instead of "delay time".
- Fig 12 : the names of the gauges are the same as fig 7 but they are not located at the same places.
- Fig 13: the volume is not mentioned in the caption.
- page 13 line 15: sentence which does not contain a verb.
- page 14 line 1: refer to section 2.2 for the abrupt topography.
- page 14 line 4: a "s" is missing in "figures" or change "these".
- page 14 line 27: the euros (dollars ?) symbol must be changed twice.
- Fig 14: no legend: values of the water height and of the mesh refinement ?
- Fig 15: Impossible to read the values when the article is printed, enlarge the figure ?
The time delay is not mentioned in the caption.
- Fig 17: Impossible to read the legend when the article is printed, enlarge the figure ?
- page 17 line 18 : refer to section 2.3.4 for the threshold.
- page 22 line 5 : "B-flood" to change into "b-flood" ?
The link is not correct, one must change the B to the lower case.
Also add the first names of the authors.