Paper : B-flood 1.0: an open-source Saint-Venant model for flash flood simulation using adaptive refinement

Authors : Geoffroy Kirstetter, Olivier Delestre, Pierre-Yves Lagrée, Stéphane Popinet, and Christophe Josserand

Review : The paper deals with the numerical simulation of flash floods using a numerical software based on the two dimensional shallow water equations. The paper is well presented. The equations, the numerical scheme and the adaptative mesh refinement strategy are presented in Section 2. In Section 3, the outputs of the software are compared first to analytical solutions and then to laboratory experiments. Eventually, in the last section of the paper, the authors reproduce a flash food event that occured in south-east France in October 2015. It results from this study that the software is able to give reasonably accurate results in a CPU time that is compatible with online use. It seems to me that the paper could be accepted for publication in GMD wtih minor modifications.

Comments and questions :

- On the CFL condition (Section 2.1, equation 8 in the manuscript) :
  - First, I'm not sure that the velocity $u = q/h$ has been introduced before.
  - Why do the authors not use the less restrictive CFL condition
$$\Delta t \leq 0,5 \min_i \frac{(\Delta x)_i}{a_i} \, ?$$
  - What motivates the choice
$$(a_p)_i = \max_{j=i-1,i,i+1} (u_i + g h_j),$$
instead of the classical choice $(a_p)_i = u_i + g h_i$?
  - What is the form of the CFL condition for the 2d computations ?
- On the computation of the source term (Section 2.2 in the manuscript) :
  - The authors propose a second order accurate (in time and space) discretisation of the flux term but a first order in time discretization of the source term. Would it be possible to propose a stable second order in time discretisation of the source term, especially for the friction term, and then to obtain global second order accuracy in Figure 4 ?
  - Rain and infiltration source terms are added in the mass equation only. How do the authors justify that they have no impact on the momentum equation ?

- Equations (13) and (15) should be rewritten. The equality is valid in a code where we assign a value but not in a mathematical sense.

- On the comparison with analytical solutions and laboratory experiments (Section 3 in the manuscript) :
  - Since it happens in flash flood events, it would be interesting to test the software agains an analyicial solution with dry areas, as the well known Thacker test case.
  - I do not understand what the sentence "For adaptive refinement, the error threshold is set at 5 mm on the water level field" means. Doesit mean that there is only two level of refinement, one for value of h lower than the threshold and one for value of h greater than the threshold ? It does not seem to be the case on the numerical results, Figure 9.
  - "Errors" defined by (17)-(18) are not errors since they can vanish for nonidentical solutions. The only errors here are the L2 errors defined by (19)-(20). Another word has to be used.
  - The words "and the presence of houses" at the end of Section 3.2.1 sshould be removed since the houses are introduced in the next section.

- On the flash flood simulation (Section 4 in the manuscript) :
  - It would be interesting to give some snapshots of the meh at different times to see the effect of the AMR strategy.
  - "We record the maximal value of the water depth field during the entire event, as shown on figure 18 highlighting the flood extent." Is it possible to have acces to a map of the flood as it happens in October 2015 or at least to some data at certain location that could be used for comparison with the numerical results ?
  - I know it is a huge work (probably out of the scope of this paper), but it would be interesting to analyse the sensibility of the results to the friction and infiltration coefficients. In particular, a first attempt could be to reproduce the same event but with a larger high vegetation zone and to see if the results are significantly different or not.