

Interactive comment on “On the sensitivity of urban hydrodynamic modelling to rainfall spatial and temporal resolution” by G. Bruni et al.

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We thank the reviewer for his time and effort in commenting our manuscript. Our response:

RC1: My main concern is the lack of justification of the methodological approach. In this study, simulations at the highest spatial and temporal resolutions are taken as the “reference” (e.g. Fig. 12). Why? Surely that is a widely applied approach, but I think it should better justify. The confidence usually given to models based on high resolution data is false, as accuracy is not necessarily improved by higher precision. Dottori et al. (2013) discuss exactly this point with reference to the use of detailed data in urban flood modelling (very similar to this paper) and provide many concrete examples of why

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we should prefer to be approximately right, rather than precisely wrong.

AC1: The authors are grateful to the reviewer to bring this topic in the discussion. Dot-tori et al. (2013) as well as many others (Berne and Krajewski (2013) specifically on radar data use for hydrological purposes) raise a key issue on whether higher resolution data and models provide more accuracy of results or only more complexity of tools. Our study is a first attempt in this sense to provide an answer not about the performance of the model, since we do not have any observation to compare with, but about the sensitivity of the current hydrodynamic models (the authors believe the type of model used in the study is representative of urban drainage models used nowadays) to high resolution rainfall input data. With the word “reference” we do not intend to refer to the better accuracy of X-band radar data, but only to a way to perform the sensitivity analysis: we could also have chosen the coarser one and compare the others to that. The main message of this study is to test if, with the current resolution of the models, and the current settings in terms of sewer topology, and hydrological characterisation, higher resolution input data make some difference in output. Further research is needed to assess if higher resolution means better model performance, once sewer observations and on-site high resolution radar measurements will be available.

RC2: My second concern is about the first sentence of the paper, which states: “Cities are increasingly vulnerable to floods generated by intense rainfall, because of . . . and changes in precipitation patterns due to climate change”. First, this statement is not correct from a terminological viewpoint, as precipitation patterns affect flood hazard, not the vulnerability to floods. Second, I could not find any references to peer-review papers that urban floods are increasing because of changes in precipitation patterns due to climate change. Actually, while many media often use this argument to capture attention, I have some doubts about the presence of scientific articles demonstrating that changes in patterns of extreme precipitation have led to increasing floods in urban areas (things are rather more complex, see e.g. various papers of Villarini and others...). Even the IPCC 2012 Report states: “the AR4 and the IPCC Technical Paper

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VI based on the AR4 concluded that no gauge-based evidence had been found for a climate-driven globally widespread change in the magnitude/frequency of floods during the last decades (Rosenzweig et al., 2007; Bates et al., 2008)". IPCC (2012) also review all the flood trend studies made around the world and concludes that "widespread evidence of such climate-driven changes in floods is not available. For example, there is no evidence of widespread common trends in the magnitude of floods based on the daily river discharge of 139 Russian gauge stations for the last few to several decades, though a significant shift in spring discharge to earlier dates has been found (Shiklomanov et al., 2007). Lindström and Bergström (2004) noted that it is difficult to conclude that flood levels are increasing from an analysis of runoff trends in Sweden for 1807 to 2002 [...] Di Baldassarre et al. (2010) found no evidence that the magnitude of African floods has increased during the 20th century." Things are much clearer when one looks at the vulnerability of human societies. Here, the increasing trend is widely demonstrated by the literature. The same IPCC (2012) recognises this: " Globally, the pressure for urban areas to expand onto flood plains and coastal strips has resulted in an increase in exposure of populations to riverine and coastal flood risk (McGranahan et al., 2007; Nicholls et al., 2011). For example, intensive and unplanned human settlements in flood-prone areas appear to have played a major role in increasing flood risk in Africa over the last few decades (Di Baldassarre et al., 2010)." Hence, I would rather say that: cities are increasingly vulnerable to floods because of rapid urbanization of flood prone areas, etc.

AC2: The authors agree with the comment, the first sentence will be changed into:

“Cities are increasingly vulnerable to floods generated by intense rainfall, because of rapid urbanization of flood prone areas and ongoing densification of existing areas, both contributing to fast sealing of pervious areas.”

RC3: In the conclusions, the authors discuss future perspectives and state: “more storm events should be analysed to confirm the findings of this study. Such an extension of the study would allow giving reliable recommendations on what should be

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the model and rainfall resolution in order to prioritise either the improvement on rainfall estimation or catchment hydrological characterization.” I don’t fully disagree on this point, but I think that it is not sufficient. Not only more storm events are needed, but also realworld observations of hydrological conditions to validate the results of models based on different resolution are needed. This would allow studying how both the accuracy and precision of hydrological response are affected by the temporal and spatial resolution of rainfall data.

AC3: The authors fully agree with the reviewer, please refer to AC20 in answers to reviewer #1.

RC4: There are a few typos in the paper (“form 10 to”, “Analysed are based”, etc. . .). Please, double-check the English!

AC4: The authors apologise for typo and language errors, the final version of the manuscript will be double checked before submission.

References:

Berne, A. and Krajewski, W. F.: Radar for hydrology: Unfulfilled promise or unrecognized potential?, *Advances in Water Resources*, 51, 357-366, doi:10.1016/j.advwatres.2012.05.005, 2013.

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