Coupling urban event-based and catchment continuous modelling for combined sewer overflow river impact assessment

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Response to Referee Comment RC-C1547 – Anonymous Referee #1

On behalf of co-authors, I thank gratefully Anonymous Referee #1 for his review and useful comments. Then, here are the responses for specific referred issues.

MAJOR COMMENTS

M1. Introduction

We agree that more references dealing with integrated urban drainage systems could be provided in the introduction. Also, the results and efficiencies achieved with the analysed system could be compared with other design ratios provided by the literature, as those referred in the paper (p.3287, l.2-6). Both aspects will be implemented in the revised manuscript.

M2. English

The English grammar, vocabulary and style will be carefully revised when rewriting the revised version of the manuscript.

M3. Time scales

The selected time scales are defined according to the characteristic response times of the different phenomena involved. For this reason it was necessary to implement a urban model with a high temporal resolution, while the response time of the basin of a few hours made

necessary to implement the basin model with a hourly time step. However, restrictions in the observed streamflow and rainfall series forced us to first calibrate a daily model from which we could learn about the functioning of the basin, and then we proceed to perform the downscaling process, wich is described in the paper. On the other hand, the downscaling process of rainfall data to be used as input in the hourly model was made in a previous study. These explanations will be added in the final version.

M4. Case study

The waste water treatment plant is out of the scope of this study. The WWTP is located near the estuary of the Saja-Besaya river, where the impacts of possible overflows are different of those produced into the river. The aim of the study presented in the paper is to analyse overflow impacts into the river from the storm tanks. The WWTP was a part of the actual case study, but give more details in this paper will need much more space without adding anything important from the paper objectives point of view.

M5. Urban drainage model calibration

The urban drainage model was not calibrated in this study. The calibration process was performed on previous studies developed by the water district authorities between 1993 and 1997 (*Estudio ambiental de las alternativas de saneamiento del Saja-Besaya, CHN, 1997*). In order to be consistent with these previous studies, the same parameters of the hydraulic model were adopted. Besides, there is not quality submodel in the urban drainage model. Mean CSO pollutant concentrations are adopted from other studies and measures undertaken in the area. These explanations will be added in the final version.

<u>OTHER REMARKS</u>

(1) P.3282, l.2. "Protection" could be substituted by "conservation".

(2) P.3282, l.5. "CSO cannot be accepted!" could be substituted by "we cannot accept CSO…"

(3) P.3282, l.8. The sentence will be rewritten: "Consequently, both, the urban system and the receiving one must be jointly analysed to evaluate the environmental impact generated on the latter".

(4) P.3282, l.26. We completely agree with this comment and although it can be understood as implicit in the text, it will be added in the revised version of the manuscript.

(5) P.3283, l.1. The sentence will be rewritten: "In combined sewer systems, …".

(6) P.3283, l.22. We completely agree with this comment. A comment on Best Management Practices or the so called Sustainable Urban Drainage Systems will be added in the revised version of the manuscript.

(7) P.3284, l.6-7. The referred statement is pointed out with the due precaution, and in any case, it is a reference to another author (Lau et al., 2002). Besides, we agree with the essence of the comment, as the original manuscript states "*Nevertheless, coming back to the Framework Directive, it becomes imperative to characterise the alteration generated by a CSO on the receiving water bodies, i.e., to consider the interaction produced between both elements*" (p. 3284, l.9-11). Anyway, the first idea will be emphasized in the revised version of the manuscript taking into account and incorporating the referred reference.

(8) P.3284, l.14. The acronym of waste water treatment plant (WWTP) is defined the first time it appears in the text (p. 3283, l.2).

(9) P.3284, l.27-29. This idea will be better explained in the revised version of the manuscript. We want to point out the fact that methods based on design rules have the advantage of being very simple and allow to quickly screening a wide range of design possibilities or alternatives. Conversely, simulation procedures are more time consuming. They can be used to refine the solution by exploring with more details a few number of final alternatives.

(10) P.3285, l.20. In this paragraph we are describing the generalities of the hydrological model implemented to take into account the moisture and base flow initial state in the basin that influence the basin response to a storm, and of course we had no intention of reproducing the effect of shock load with a daily time resolution.

(11) P.3287, l.1. As stated previously, the WWTP is out of the scope of the study presented in the paper.

(12) P.3288, l.25-26. This variable is of less relevance if compared against Mediterranean torrential rainfall regimes where interevent times are larger and so the pollutant build-up period heavier.

(13) P.3289, l.8-12. We agree that time response in urban areas could be very low, and the statement in the original manuscript aims to underline this fact. Besides, a reference to Freni et al., 2010 (*The influence of rainfall time resolution for urban water quality modelling*) will be done in the revised version of the manuscript, underlying the importance of this fact on urban drainage quantity and quality modelling.

(14) P.3289, l.27. The details of the methodology and the final value of 14 h for the critical interevent separation are detailed in the referred references (Andrés-Doménech and Marco, 2008; Andrés-Doménech et al., 2010), which will be summarized and incorporated in line P.3289, l.27 in the revised manuscript.

(15) P.3291, Eq.1. Variables definition will be revised and amended in the final version of the manuscript.

(16) P.3292, l.20-21. Reported values refer to runoff coefficients. A more precise statement will be incorporated in the revised manuscript: "*values of 0.90 for densely populated and very impervious areas, 0.70 for industrial areas with some green areas, and finally, 0.40 for sparsely populated and more pervious areas are used*"

(17) P.3292, l.26-28. Although the original temporal resolution of rainfall data is 5 minutes, from the continuous expression fitted for i(t) (Eq. 1), rainfall inputs were time stepped with 1-minute resolution to be used as input of the hydraulic model.

(18) P.3293, l.2. An absolute 0 value cannot be considered because instabilities of the calculation scheme for very low flow values could distort results. Given the order of magnitude of base flow in the RWB, a CSO with a peak flow of 10^{-4} m^3/s is considered to be small enough to not produce a relevant impact on it.

(19) P.3293, Eq.6-7. References to equations 6 and 7 will be added in the revised manuscript.

(20) P.3298, l.14. The referred reference is (Vélez J.I., 2001). It will be added in the revised manuscript.

(21) P.3298. There is not quality model in the urban drainage model. Mean pollutant concentrations are adopted from previous studies and measures undertaken in the studied area. This fact will be better explained in the final manuscript.