Stochastic rainfall analysis for storm tank performance evaluation

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Response to Referee Comment RC464 – Anonymous Referee #2

On behalf of co-authors, I thank gratefully Anonymous Referee #2 for his positive and useful comments. Then, here are the responses for specific referred issues.

1. Case study description

The analysed tank does not exist. The Municipality of Valencia is now planning storm tanks, and, for this reason, preliminary performance analysis are being undertaken in order to size their main parameters (volume and emptying flow rate).

2. Rainfall data and stochastic model

We agree with this comment, especially for volumetric and overflow reduction performance evaluation. As interevent times are clearly expected to be greater than 1 hour, widely available hourly records are completely useful for this purpose.

There is nevertheless an additional reason of why we dealt with high resolution data. A parallel objective of the rainfall model was also to describe event peak intensities to tackle, in a second stage, its implications in the catchment pollutant build-up and wash-off processes.

3. Rainfall-runoff model

In the analytical model, the rainfall-runoff model is aggregated over the catchment because of maintaining simplicity in the formulation. Besides, as an event volumetric response is considered, no time step considerations are taken into account.

However, in the detailed urban drainage model built in Infoworks, SCS-CN model is distributed over the catchment, with one subcatchment per node in the network. With regard to the calculation scheme, a minimum 60 seconds time step is set.

4. Tank overflow model

We also absolutely agree with this issue. The complete analytical model to achieve tank performance has been developed taken into account implications of both time variables, event duration D (related to considering the emptying flow rate) and interevent time S (related to considering the emptying time) [*Andrés-Doménech, I.: Evaluación probabilística de indicadores de eficiencia para el dimensionamiento volumétrico de tanques de tormenta para el control de la contaminación de escorrentías urbanas. PhD Thesis. Universidad Politécnica de Valencia, Valencia, 2010*]. However, results presented in the paper correspond to the most precautionary case, with Q_V set to zero. When the temporal sequence is considered, if the tank emptying time is shorter than the critical interevent time (s_{crit}=22 hours at Valencia) notice that results are unchanged because each tank cycle is independent from the next. Nevertheless, for larger emptying times, tank efficiencies will drop because of increase in the probability of having a not completely emptied tank at the beginning of the storm. Consequently, a key issue is to set an appropriate emptying time according to interevent time in order to maintain performances at highest levels.

5. Detailed InfoWorks

The model is completely distributed with the same number of nodes referred in the case study description (565 nodes). The number of subcatchments equals the number of nodes, and there are 562 pipes.

The model, as referred in the paper, was calibrated in a previous work [*González, J.: Metodología para la modelación y diseño de redes de saneamiento urbano aplicada a la ciudad de Valencia. Technical dissertation. Universidad Politécnica de Valencia, Valencia, 2001*]. Calibration was done in a distributed way, in a monitored catchment of the city (Malvarrossa catchment). Infiltration parameters of the SCS-CN model and roughness coefficients of pipes according to its material were calibrated.

6. About tank data for calibration

As referred above, the Municipality of Valencia is nowadays planning storm tanks. The first one to be constructed (Neptuno storm tank) is hardly since a few months into operation, so there are still not enough data to calibrate this kind of models.