

# ***Interactive comment on “Multivariate autoregressive modelling and conditional simulation for temporal uncertainty propagation in urban water systems” by Jairo Arturo Torres-Matallana et al.***

## **Anonymous Referee #2**

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\* General

This manuscript presents a detailed case study on uncertainty propagation through a water quality model. The authors propose the use of auto-regressive models to describe the dynamic of the input time-series.

For the reader it is currently unclear if the focus is on the method ("this paper introduces an uncertainty analysis framework") or the application case. My suggestion is to focus on the case study, as the methodological contribution is rather limited. In any case, the

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focus should be set clearer in the introduction. In general, focusing more on the key points by moving some material to the supporting information would help.

The authors use AR(1) processes to model dynamical inputs. However, it needs also to be shown that these models captures the characteristics of the inputs correctly, for example that the auto-correlation function and other statistics match.

'Uncertainty analysis' is an umbrella term. Therefore I would encourage to use always the more specific terms 'uncertainty propagation' and 'sensitivity analysis' (SA) when referring to these concepts. SA is a well established term for calculating the "contributions of input variables to total uncertainty".

While hinted a several places, I think it would be beneficial to distinguish the kind of uncertainty that one tries to model more explicitly. Some inputs are intrinsically stochastic (e.g. precipitation), while others the uncertainty expresses our lack of knowledge about a parameter value.

\* Specific points

\*\* Abstract L4: the paper does not introduce a framework (which would be a theory about how to deal with uncertainties).

\*\* Introduction

L54: "determinism" is the absence of uncertainty, hence it cannot "represent uncertainty"

\*\* Material and methods

L115, eq2: Maybe I missed something, but is there no delay? The rain is transformed immediately to runoff?

L160: "Some variable" - which one?

Table 1: I would remove all irrelevant "inputs", such as ID, name of structure, ...

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Table 2: What are "flow time structure" and "curve level"? They do not show up in the model equations

L165: This is an example where "uncertainty propagation" should be used instead of "uncertainty analysis"

L165ff: Why was the selection of inputs needed at all for the uncertainty propagation? The computational efforts do not change with the number of inputs (they do for the SA). Also there is not needed that the model is sensitive to an input. If it is not, than we will just get smaller uncertainties.

L179: the equation is for the cdf, not the pdf. Also emphasize on 'marginal' implies that you want to model a joint distribution.

L188ff: how did you determine the order of the AR process (seems always to be 1)?

L199: Not the uncertainties are correlated, but the values themselves

L211: Precipitation lot of zeros. It is not clear how the presented model can describe the dry periods.

L215-255: Remove the description as the model is already described in Torres-Matallana et al. (2017)

L257-260: Remove or move to introduction.

L 304: This is sensitive analysis and does not belong under the section "uncertainty propagation"

L317: How did you aggregate for the whole year? Is it a problem that the individual indices are not independent due to the auto-correlation?

L340: "may be computed" - did you do so?

\*\* Results

L397: The wording is a bit confusing here: "evaluation of model output sensitivities"

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sounds like a SA, but you are referring to the "manual" analysis of the model.

L415: was the COD modeled independently of the precipitation?

Figure3: Please mention in the caption which density you used of the uncertainty propagation. Also, maybe move figure to supporting information (SI).

L435: Please show some evidence for that.

L444-465: I propose to move this and figure 4 to the SI

\*\* Discussion

L560: "we start with the accuracy..." - this topic comes second.

L637: This is an important suggestions. I'm a bit confused why you did not considered the correlation if the model is apparently able to do so ("We used the latest version of EmiStat R (version 1.2.2.0), which considers this kind of patterns.")

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