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Drinking Water Engineering and Science Discussions

Interactive comment on "WaterMet^2: a tool for integrated analysis of sustainability-based performance of urban water systems" *by* K. Behzadian et al.

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Reply to referee #1 comments

The authors would like to thank the anonymous referee for reviewing the paper and making constructive comments. Please note our responses below. Also, please note that we will add/clarify the points mentioned below in the revised paper.

Comment #1: . . .It is not clear, at least to me, the role played in the criteria evaluation by the WTWs, service connections, trunk mains and distribution mains, on which the model is built. Similar considerations apply for the sewer system. Indeed, it seems

that the hydraulic evaluation criteria 3, 4, 5 and 6 are computed just according to the mass balance, being all function of the water supplied and water consumption; in such a case what is the role of the model structure and elements characterizing WaterMet2?
Reply: Each of the integrated urban water system (UWS) components used in the WaterMet2 simulation model (e.g. WTWs, trunk main, etc.) is pre-defined in terms of its specific characteristics (e.g. WTWs capacity, trunk main flow capacity and specific energy used for conveying water, etc.). When a specific case study model (e.g. Oslo UWS) is being built, the required UWS components are selected and interlinked together in a suitable configuration which represents best (in an approximate way) the analysed UWS. Simulation model run is then performed by calculating the water flows in the UWS for a pre-specified duration and driven by the pre-specified system load (water demand and rainfall). This is done in a simplified way, based on the principles of mass balance (but by respecting relevant capacities and other characteristics of the modelled UWS components). Once this is done, other fluxes (such as energy, GHG emissions, etc.) are derived from the previously estimated water flows by using suitable component characteristics (e.g. specific energy consumption for pumping, etc.). The detailed WaterMet2 model outputs are then simply aggregated (spatially and/or temporally) to estimate the quantitative evaluation criteria values. More specifically, criteria 3 (reliability of water supply) and 4 (leakage) values are related to the performance of the water supply system components, criterion 5 (GHG emissions) is dependent on the performance of all UWS components and finally, criterion 6 (CSO volume) is dependent on the performance of the wastewater system components. Also, note that the aforementioned criteria values are likely to change when UWS system modifications are introduced by means of different interventions analysed (as these modify the UWS component characteristics). Please note the added text in pages 5, 7 and 9.

Comment #2: Assumptions for leakage evaluation according to water consumption is somewhat questionable. In fact, the authors assume that leakages are simply a constant percentage of water supply and thus, being the water system the same, a reduction of water consumption leads to a leakage reduction. Indeed, it is generally the opposite: for example, at daily level, during night hours the water consumptions (and thus the water supplied) are lower but leakages are typically higher. Reply: We agree with the above statement made by the reviewer. However, the WaterMet2 model is a conceptual, mass balance based simulation model and as such, it simply cannot model variations in pressure heads and hence cannot calculate the leakage variations at the daily level. As a compromise, the model assumes the total leakage can be expressed as a percentage of water demand. This can be considered as a reasonable approximation for the long-term, strategic level assessment of the UWS performance. This assumption can be considered as a reasonable approximation for the long-term, strategic level assessment of the UWS performance and was made by other similar models such as UVQ (Mitchell and Diaper 2010), UWOT (Makropoulos et al. 2008) and (Mackay and Last 2010). Please note the added text in page 5.

References: âĂć Makropoulos, C. K., Natsis, K., Liu, S., Mittas, K., and Butler, D. (2008). "Decision support for sustainable option selection in integrated urban water management." Environmental Modelling & Software, 23(12), 1448–1460. âĂć Mitchell, V. G., and Diaper, C.: UVQ User Manual: (urban water balance and contaminant balance analysis tool), CSIRO, 2010. âĂć Mackay, R., and Last, E.: SWITCH city water balance: a scoping model for integrated urban water management, Reviews in Environmental Science and Bio/Technology, 9, 291-296, 10.1007/s11157-010-9225-4, 2010.

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