

Response to comments of reviewer 2

Manuscript: essd-2020-156
Original title: Spatially-explicit estimates of global wastewater production, collection, treatment and re-use.
Revised title: Country-level and gridded estimates of wastewater production, collected, treatment and re-use.
Authors: Edward R. Jones, Michelle T.H. van Vliet, Manzoor Qadir, Marc F. P. Bierkens

General comments from reviewer

This study provided the comprehensive and consistent global outlook on the state of wastewater production collection treatment and reuse. And the country level wastewater data are downscaled and validated at 5 arc- minute resolution. Its results represent the first efforts to global wastewater collection treatment and reuse at the subnational level. It is a very interesting and useful work for the wastewater research. And the quality of the data set as submitted is high. The data analysis and discussions are sufficient. So I think it prepared well for publication. It analyzed the relationship among the production, collection, treatment and reuse of wastewater, the income level and the population.

We thank the reviewer for reading the manuscript and providing their feedback. We were very pleased to read that the reviewer thinks the dataset is of high quality and useful for wastewater research.

However, I think the influence from the pollution of agriculture, especially for the global grain production areas, cannot be ignored. So I suggest the author to add the analysis or discussion of this part. It may be more perfect.

We agree that agricultural runoff is a very important source of water pollution, and that we should reflect more upon this in the Discussion section of the manuscript. Whilst a more detailed analysis of diffuse and point source pollution from the agricultural sector would be beneficial for the water quality modelling community, this is outside the scope of this study, which solely focuses on municipal wastewater (i.e. domestic and industrial sources) for a number of reasons.

Firstly, country-level data is much more readily available for the municipal sector. This makes our (data-driven) approach more applicable for these sectors. Return flows from agricultural activities at the global scale are more typically quantified by modelling of irrigation water demand (net and gross) and withdrawal.

Secondly, agricultural runoff, which is an important source of pollution by the agricultural sector, is rarely collected or treated (e.g. WWAP, 2017) and hence far less applicable to this study. Conversely, collection (particularly sewers) and treatment infrastructure are very important for determining the fate of pollutants generated by municipal activities (e.g. collection and treatment infrastructure as point sources of pollutants, abatement of pollutant levels via treatment processes).

To address this comment, we propose to add the following lines to the discussion section of the manuscript:

While agricultural runoff is also a substantial source of pollution, this is outside the scope of this study. Country-level data on agricultural runoff is sparse, necessitating modelling approaches to quantify irrigation return flow by calculating net demand (e.g. based on crop composition and irrigated area per grid cell), gross irrigation demand (to account for irrigation efficiency and losses) and water withdrawals (Sutanudjaja et al., 2018). Agricultural runoff is also rarely collected or treated (UNEP, 2016), hence is less applicable for inclusion in this study.

References

Sutanudjaja, E., Beek, R., Wanders, N., Wada, Y., Bosmans, J., Drost, N., Ent, R., de Graaf, I., Hoch, J., de Jong, K., Karssenber, D., López, P., Pessenteiner, S., Schmitz, O., Straatsma, M., Vannamete, E., Wisser, D., and Bierkens, M.: PCR-GLOBWB 2: A 5 arcmin global hydrological and water resources model, *Geoscientific Model Development*, 11, 2429-2453, 10.5194/gmd-11-2429-2018, 2018.

UNEP: A Snapshot of the World's Water Quality: Towards a global assessment, United Nations Environment Programme, Nairobi, Kenya, 162pp, 2016.

WWAP: The United Nations World Water Development Report 2017. Wastewater: The Untapped Resource, Paris, UNESCO, 2017.