Overall comment: *The authors did a good job in developing and providing the gridded datasets for point source emissions of N and P. the manuscript is well written with good structure. Complements to the authors on balancing well between details and general descriptions. It is easy to follow the methodology. I appreciate that the authors analyzed the uncertainties in such detailed datasets. I have a few points that could improve the relevance and importance of this work:*

Reply: We thank the reviewer for their appreciation of our manuscript and for the useful comments and suggestions for improvement.

Comment 1: *1. The data sources were mainly at the NUTS-1 scale. The emissions of point sources of N and P are downscaled to grids. Uncertainties are analyzed at the river basin scale. It is an interesting choice for the scales. It would be good to reflect on this choice, especially on the choice for the gridded emissions, but uncertainties in those emissions are analyzed at the river basin. Why was that choice made? How can this basin scale uncertainty analysis build trust in modeled gridded emissions considering the data sources at the NUTS-1 level?*

Reply 1: Thank you for this comment. In Section 5.3, we analyse the uncertainties at the grid level and we acknowledge that they may be large. It is however useful to provide the data at grid level to give the flexibility to users to aggregate the point sources estimates at any spatial scale of interest. In this sense, we believe that it is interesting to examine the uncertainty at different spatial aggregation levels to guide future uses of the developed dataset. We selected river basins as the scale of aggregation because it is a scale of interest for water quality studies. To make this point clearer, in our revised manuscript we made the following changes:

- at the very end of the section 1, we now provide a better explanation of the objective of the uncertainty analyses with the following sentence: " We discuss the uncertainties of our point source estimates at grid and river basin level to guide future uses of the dataset for water quality studies.".
- in section 5.4, we modified the first sentence L779 to better link with the uncertainty analysis at grid level in section 5.3 (we report in the following the addition in bold): "**Given the substantial uncertainties in the spatial pattern of the point sources at high spatial resolution (grid level, Sect 5.3)**, we examine the uncertainties in the point source estimates at river basin level, which is of interest to water quality studies, as further discussion in Sect. 6.1. "
- in section 6.1 L884–886 we had indicated the following sentences in the first version of the manuscript: "Moreover, the uncertainties in our estimates decrease from grid level (Fig. 8) towards larger spatial aggregation units (e.g. river basins in Fig. 9). In particular, for earlier years, using the data at larger spatial scales of aggregation (above 100 km^2) is more reliable given the differences between the two downscaling schemes."
  In the revised version we added after that the following text: "Therefore, using the dataset directly at grid level (Sect. 5.3) may be prone to large uncertainties and the analysis at river basin level (Sect. 5.4) allows reflection on suitable spatial aggregation scales for water quality studies.".

Comment 2: *2. The role of rural point source emissions is important. Germany is a country with a lot of sewage systems in urban and rural areas. It would make the paper stronger if more discussion is provided on how rural emissions are considered, and the role of rural sanitation in those emissions. This might be interesting for other countries. Some countries do not have a lot of rural sewage systems. In this case: how can the proposed methods be still useful?*

Reply 2: Thank you for this comment. We agree that the emissions from the population not connected to the sewer system and/or wastewater treatment plants (WWTPs) can be an important source of N and P contamination. Our study aims at quantifying grid level urban and rural emissions that contribute to point sources, including both treated and untreated emissions as stated in Section 1 L108–110: "Our dataset encompasses emissions treated in urban WWTPs, including domestic and industial (indirect) emissions, as well as untreated domestic emissions collected in the sewer system". We also consider emissions from the population not connected to the sewer system, but whose wastewater is collected in cesspits (sealed tanks) and transported by trucks to WWTPs (see L194–195).
Furthermore, we estimated the gross emissions at NUTS-1 level for the remaining of the population which is not connected to sewer or WWTPs (this covers not only the rural population but also the urban population for earlier years, as can be seen from Supplementary Fig. S21-S24). Our dataset includes these NUTS-1 level information (`https://doi.org/10.5281/zenodo.10500535`). We see from Fig. 7 that these emissions are substantial in the past (in the 1950s), and that their importance then decline with time (as we explain in Sect. 5.2). In this respect, we recognize the importance of the emissions from disconnected population even in a country with an advanced wastewater handling system like Germany.
However, the fate of these gross emissions from disconnected population is uncertain and they can be either a diffuse or a point source. Due to a lack of detailed information on these emissions, previous studies made simplifying assumptions to account for these emissions in Germany [Fuchs et al., 2010], over Europe [Grizzetti et al., 2022, Vigiak et al., 2020, 2023] and globally [Morée et al., 2013, Van Puijenbroek et al., 2019]. Unravelling the fate of the emissions from disconnected population is beyond the scope of this study. In this regard, in Section 6.1 (L918–923) of the first version of our manuscript, we recognize that future studies should strive to improve the estimation of the emissions from disconnected population.
In our revised manuscript, we expand this discussion, as follows: "Another potentially important contributor to point sources is the domestic emissions that are not connected to the sewer system nor to WWTPs via transport from cesspits. While these emissions are overall of limited importance in the recent period, their magnitude is large in the earlier period, (Sect. 5.2). It would be therefore critical to elucidate their fate in Germany and in other countries where these emissions can be substantial for the recent period as well [Vigiak et al., 2020]. These emissions are handled in particular in septic tanks or independent wastewater systems [Vigiak et al., 2020, 2023]. They could be either a diffuse source to soils or a point source to surface waters, as documented for example in MUGV (2010) for the recent period in Germany. Due to a lack of detailed information on these emissions, previous studies made simplifying assumptions. In Germany, Fuchs et al. [2010] consider that disconnected population is equipped with septic tanks from which a part of the N and P is transported to WWTPs, while the other part is a diffuse

source. In Europe, Grizzetti et al. [2022] and Vigiak et al. [2020] consider that it is entirely a diffuse source and that N and P are reduced with the same efficiency as that of primary treatment [Vigiak et al., 2020] or possibly secondary treatment [Grizzetti et al., 2022]. Globally, Morée et al. [2013] and Van Puijenbroek et al. [2019] consider that the urine part is a point source, while the feces part is a diffuse source."

As we discussed in Section 6.2, other N and P emission pathways would also require further investigation in future studies. We propose the use of sensitivity analysis as a way of assessing the impact of different assumptions in water quality assessments. To further reflect on this aspect, we add the following text at the end of Section 6.2 in the revised manuscript: "Overall, we propose that future water quality studies could perform sensitivity analysis to better understand the impact of different possible assumptions on the N and P pathways discussed in this section. For Germany, such investigation is facilitated as we provide all data that we produced along with our model code (see code and data availability section)".

Comment 3: *3. This point is a bit also related to the previous: the manuscript would benefit from a discussion the applicability of the proposed methods for other regions and countries. countries differ in their urban and rural waste management. On top of this, not all countries have such detailed datasets at the NUTS-1 levels. This is especially true for developing countries. Can the proposed methods be used for those developing countries, if yes, what needs to be adjusted? if not, why? what would be alternatives?*

Reply 3: We build on a methodology for point sources estimation that was used at a large scale, namely over Europe [Vigiak et al., 2020] and globally [IPCC, 2019, Morée et al., 2013, Van Drecht et al., 2009]. We take the opportunity of having detailed data for Germany (sub-national statistics and observational data of wastewater treatment plant emissions) to improve these previous large-scale point sources estimations. This is stated in section 1 at L106–108: "We use a modelling approach that builds in particular on Morée et al. [2013], Van Drecht et al. [2009], Vigiak et al. [2020] and IPCC [2019], while we make use of observational data of WWTP N and P emissions to constrain our modeled estimates and check their plausibility.".

In this respect, we modified the last sentence of the revised manuscript (L966–968) where we call for the collection and processing of further data where available to improve point sources estimation, similar to our study. The text now reads as follows: "A similar approach could be adopted by other researchers to develop other national and regional datasets where sub-national and observational point sources datasets are available. This would contribute to improve large-scale understanding of nutrient point sources and their impact on the (aquatic) environment."

Comment 4: *4. Some detailed comments: - Please clarify the forms of N and p that are modeled. Please also justify the choice for those forms.*

Reply 4: Thank you for this remark. We consider total N and P and do not model specific N forms, similar to previous studies [Morée et al., 2013, Van Drecht et al., 2009, UBA, 2020, Vigiak et al., 2020, 2023]. Although separating the different N and P species would be highly valuable, it would also require substantial additional work, which is beyond the scope of this study. In section 6.2 (L934–941) of the first version of our manuscript, we discussed the limits of this simplification and gave some first insights on how this could be addressed in future studies. To make clearer the fact that we consider total N and P in our revised manuscript, we added the following sentence in this introduction: "As in previous studies [Morée et al., 2013, Van Drecht et al., 2009, UBA, 2020, Vigiak et al., 2020, 2023], we assess total N and P without distinction between the different forms of N and P."

Comment 5: *- Table 1 has lower and upper bound. it would also good to add mean or median*

Reply 5: We actually sampled the parameters from a uniform distribution, as stated in Section 4. This implies that the mean/median values can be simply retrieved as the mean of the lower and upper values reported in Table 1. Therefore, we think it would be redundant to add the mean/median values in the table. In our revised manuscript, we added a note in the caption of Table 1 to make this clearer: "The parameters are sampled from a uniform distribution".

Comment 6: *- Why point sources? Diffuse sources are as important as point sources and are more difficult to control.*

Reply 6: As we state in the introduction section (L57–58), both N and P point and diffuse sources are important as far as water quality is concerned. Since we cannot treat the two sources in a single paper, we chose here to focus on point sources. Note that, in previous studies, we made available data of N diffuse sources (N surplus) for Germany at river basin level [Ebeling et al., 2022] and over Europe at grid level [Batool et al., 2022]. In our revised manuscript, we now explicitly mention in Section 6.1 that our dataset complements these existing diffuse sources datasets.

Comment 7: *- Why Germany? Can we learn from this exercise for other countries?*

Reply 7: In the first version of our manuscript, we explained in the introduction section about the importance of developing a long-term consistent point sources dataset for Germany (L97–100): "This is crucial to inform water quality strategies in Germany where the majority of the national monitoring sites for flowing surface water have shown nitrate and phosphorus concentrations above a limit that would ensure a good ecological status, for instance 81 % for nitrate and 70 % for phosphorus in 2015 (Arle et al., 2017), and where N and P emissions have contributed to the eutrophication of the North and Baltic Sea since the mid-twentieth century (EEA et al., 2019; Arle et al., 2017)."
With our study, we demonstrate how detailed data can be used to provide improved point sources estimates. We refer to our reply to Comment 3 above, where we explain that we take the opportunity of having detailed data for Germany (sub-national statistics and observational data of wastewater treatment plant emissions) to improve previous large-scale point sources estimations. We call for the collection and processing of further data where available to improve point sources estimation, similar to our study.

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