

Reply on RC2

Chaogui Lei et al.

Author comment on "Influences of land use changes on the dynamics of water quantity and quality in the German lowland catchment of the Stör" by Chaogui Lei et al., Hydrol. Earth Syst. Sci. Discuss., <https://doi.org/10.5194/hess-2021-476-AC2>, 2021

Response to general comments:

1) We thank the reviewer for this very constructive comment. We agree that we can broaden the introduction to highlight the suitability of SWAT for this study. Specifically, we will shorten the first and second paragraph about the importance of LULC and add a new paragraph, which will introduce the importance and suitability of using SWAT to assess the impacts of land use changes on hydrology and water quality. We will also highlight the high capability of the enhanced SWAT version (with two active groundwater aquifers) of modeling groundwater process and associated water quality components in lowland catchments.

2) Thank you very much. We believe that it is important to show that the model is capable of accurately representing water quality and quantity. We therefore include an evaluation on a daily time step. We will however re-evaluate which parts are most important for our study and to make the manuscript more concise, we would agree to move part of the results of model calibration and validation (section 3.1) to the supplementary materials.

3) We use the land use map of 2019 (detailed land use classes) for the SWAT calibration and validation for streamflow. The other land use data have been used for land use scenario model runs.

Following the reviewer's comment, we will remove the descriptions and instead provide a table to summarize which data has been incorporated into SWAT.

4) Thank you very much. There are a few findings related to lowland characteristics in the dynamics of water quality loads (in Figure 7). E.g., due to land use change between 1987 and 2019, sediment, TP, and TN loads decreased least in the central part of the catchment with a lower topography (lowland). This may be related to the more intense exchange between groundwater and surface water and a higher contribution of nutrients from groundwater to stream in lowlands. We would like to follow the reviewer's suggestion and add a few statements regarding this to better highlight findings related to lowland characteristics.

5) We will consider these comments and improve abstract and conclusion.

6) We thank the reviewer for this constructive comment! We will add comparisons to other watersheds in the discussion part.

Response to other specific comments:

- 1) Thank you. We will delete some details and shorten the abstract properly.
- 2) Thank you for pointing this out. In L41 it should indeed be land use changes. We will work on and improve the first paragraph of the introduction.
- 3) We will rephrase it. Thank you!
- 4) We will provide a paragraph for the SWAT model in the introduction to improve this.
- 5) As stated in L163 only the land use map of 2019 was used for model setup, model calibration and validation. We will rework section 2.3.3 to make this very clear.
- 6) Thank you very much for this helpful comment. The daily sediment load (in L107) is calculated based on daily concentration of total suspended sediment concentration (in L181) and measured daily streamflow. We will provide this information somewhere applicable.
- 7) Actually, we calibrated TP, TN, and sediment in the same years (2009-2011) as we stated in L196. But specifically, we calibrated TP and TN during the period of 08/08/2009-10/08/2011, and sediment during the period of 30/10/2009-07/08/2011, which differs slightly due to the availability of measurements.
- 8) Yes, we agree to move Table 2 to the supplementary material.
- 9) Yes, we will include more details in this regard.
- 10) Here we wanted to state respective changes between 1987 and 2010, between 2010 and 2019, and between 198 and 2019. We will follow the reviewer's advice and clarify it.
- 11) "Wold criterion" is a common terminology in PLSR method proposed by Svante Wold (Wold et al., 2001). It is often referred as a criterion for assessing the variable importance for projection (VIP) statistic. "by word's criterion" means "according to word's criterion". We will change "by word's criterion" to "according to word's criterion".
- 12) Thank you! In fact, we did not evaluate the performance of the model for the monthly data in this case, because there are only 24 (calibration) or 12 (validation) monthly water quality observations, which is not a reliable basis for model evaluation. However, it can be expected that the model performance is better on a monthly scale, as over- and underestimations tend to balance out. This statement is in agreement with our modeling experience and the literature. We will provide references to support our statement.
- 13) We will modify the color scheme in Fig.3.
- 14) "agricultural grasses" indicates grasses grown on fields by farmers for feeding livestock.
- 15) We will add a legend for the box plots.
- 16) We chose to show absolute changes, as these absolute changes are used in the PLSR approach. We believe that it is better to keep the response variables (changes of water quality and quantity) and explanatory variables (changes of land use indicators) consistently in absolute values. Moreover, the absolute change allows the reader to better

compare changes for different variables (e.g. if evapotranspiration is increased by a certain absolute value, water yield is probably decreased by the same absolute value). We would therefore prefer to keep showing absolute changes.

17) Thank you for spotting this. The term may be confusing. We suggest to change it to "changes of the rural landscape", as about 75% variations in sediment, TP, TN are explained by the changes of this rural landscape, which means the change of rural land use plays a key role in influencing water quality variations.

18) Yes, we will denote the meaning of "AIa", "CONTIGAWa" right before them, respectively.

19) We agree with the reviewer, and will remove the sentence in L448-449.

20) We agree and will not highlight the methodology here.