Reply to the reviewer comments RC2: 'modelling of hydrology and nitrate export from catchment' by Anonymous Referee #2

This manuscript by Schürz et al. gives a detailed sensitivity and uncertainty analysis for modelling of hydrology and nitrate export in two medium-size catchments. The sensitivity analysis is elaborated for three groups of input scenarios (land use, point sources, climate) and alternatives of model setup and model parameters. The uncertainty of the modelled flow and nitrate exports is done separately for these five model-specific groups, which enabled evaluations of their influence on the reliability of modelling outputs.

I like the study. It shows a well-designed example how to transparently present modelling results. The methods are sound, using contemporary approaches, and sufficiently described. The results are suitably visualized and a discussed, and support conclusions.
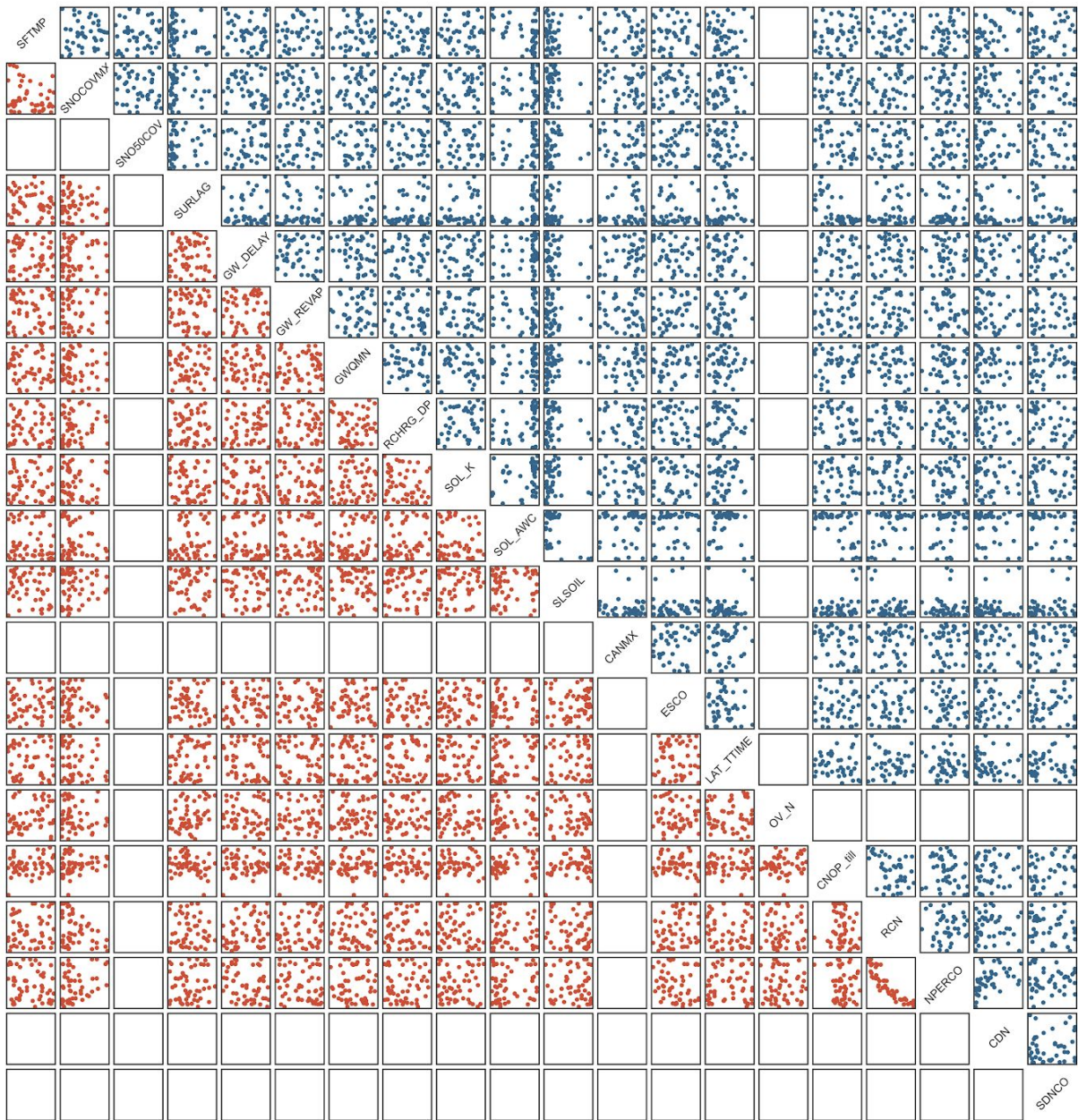
We would like to thank the Anonymous Referee #2 for their positive and supportive feedback on this manuscript. In the following, we addressed each comment made by Anonymous Referee #2. The initial comments made are printed in *serif, italic font*. Our replies to the comments are written in black, non serif font and our suggestions to revise the manuscript according to a comment are highlighted with the colors blue for insertions and red for deletions.

<u>Major comments</u>

From my view, more credibility can be given to the parametrization of model (which shows very high impact to simulated results and uncertainty) when the selected parameter values that were used in the uncertainty analysis are given, at least in the Appendix.

Based on this comment and comments made by other reviewers, we propose to add the following information to provide further detail on the model parameters used.
To show a clustering of model parameter values of the selected parameters and to identify parameter interactions we add the following figure in the Appendix of the manuscript:

Catchment ● Schwechat ● Raab

Figure caption:

Coordinate plot of the 43 and 52 behavioral SWAT model parameters that were used with the model setups of the Schwechat and the Raab, respectively. Each panel illustrates the connection of two model parameters for the Schwechat in red (below the diagonal) and the Raab in blue (above the diagonal). The x and y axes of each panel show the range of the respective parameter plotted along the x or y dimension. The corresponding parameter ranges for all illustrated parameters are provided in Table XX (Reference to table below).

Due to the limited space in the figure we avoided plotting axes and axis labels. The figure however illustrates the clustering and interaction of model parameters. We additionally suggest to add parameter ranges and the type of change of the model parameters in an additional table:

Table caption:
SWAT model parameters calibrated in the model setups of the Schwechat and the Raab catchments. The type of change indicates whether the model parameters were replaced by absolute values, modified by adding absolute values to the predefined model parameters or, changed by a relative fraction of the predefined model parameter. Illustrated are the initial ranges of the model parameters and the ranges of the final behavioral parameter sets of the model setups of the Schwechat and the Raab catchments.

Parameter	Type of change	Initial parameter range	Parameter change range Schwechat	Raab
SFTMP	replace value	[-1.00, 1.00]	[-0.69, 0.93]	[-0.98, 0.88]
SNOCOVMX	replace value	[100.0, 500.0]	[0.9, 177.0]	[100.8, 447.5]
SNO50COV	replace value	[0.20, 0.50]	[0.21, 0.49]	
SURLAG	replace value	[0.00, 0.50]	[0.02, 0.99]	[0, 0.1]
GW_DELAY	replace value	[0.0, 300.0]	[5.5, 25.0]	[2.1, 283.3]
GW_REVAP	replace value	[0.02, 0.20]	[0.05, 0.15]	[0.02, 0.20]
GWQMN	replace value	[0, 3000]	[566, 2472]	[109, 2925]
RCHRG_DP	replace value	[0.00, 1.00]	[0.31, 0.69]	[0.13, 0.97]
SOL_K	relative change	[-0.90, 10.00]	[0, 0.97]	[-0.79, 9.76]
SOL_AWC	relative change	[-0.90, 2.00]	[-0.86, 1.49]	[0, 1.98]
SLSOIL	replace value	[0.0, 150.0]	[0.9, 27.6]	[14.7, 148.2]
CANMX	relative change	[0.00, 0.25]	[0.34, 2.40]	
ESCO	replace value	[0.00, 0.90]	[0.05, 0.90]	[0.05, 0.89]
LAT_TTIME	replace value	[0.0, 180.0]	[0.8, 6.8]	[5.5, 176.3]
OV_N	absolute change	[-0.09, 0.60]		[0.07, 0.58]
CNOP_till	relative change	[-0.20, 0.10]	[-0.29, -0.06]	[-0.18, 0.01]
RCN	replace value	[2.00, 10.00]	[5.05, 9.97]	[2.3, 8.45]
NPERCO	replace value	[0.00, 1.00]	[0.24, 0.99]	[0.18, 0.7]
CDN	replace value	[0.00, 1.50]	[0.01, 1.44]	
SDNCO	replace value	[0.00, 0.50]	[0.02, 0.49]	

Specific comments

p.5, l. 25: Shouldn't be the Raab catchment area 988 km2?

Thank you for identifying that typo. According to Table A2 p.32 the total delineated area of the Raab catchment is 98815.9 ha. The value in the text on p.5 L25 will be changed accordingly from 998 km2 to 988 km2.

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p.19, l. 12-13: I suggest to join the sentences: "While a grouping of the individual climate scenarios with respect to their temperature anomalies shows a more indefinite picture, all climate scenarios simulated an increase in temperature."

This will be changed accordingly.