Assessing uncertainties in hydrological modelling of discharge and NO_3^--N under future climate change conditions

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1. Aim

The **UnLoadC³** project quantifies the contribution of the model set-up, the parameters and the input data to the model sensitivity and uncertainty when simulating the impacts of global and regional changes on hydrological outputs.

Two Austrian watersheds were modelled. The sensitivities of simulated discharge and NO_3^--N were evaluated with respect to:

- the complexity of the hydrological model set-up;
- the parameter sets that fit a given objective criteria;
- the point-sources from wastewater treatment plants;
- a suite of future climate change simulations.

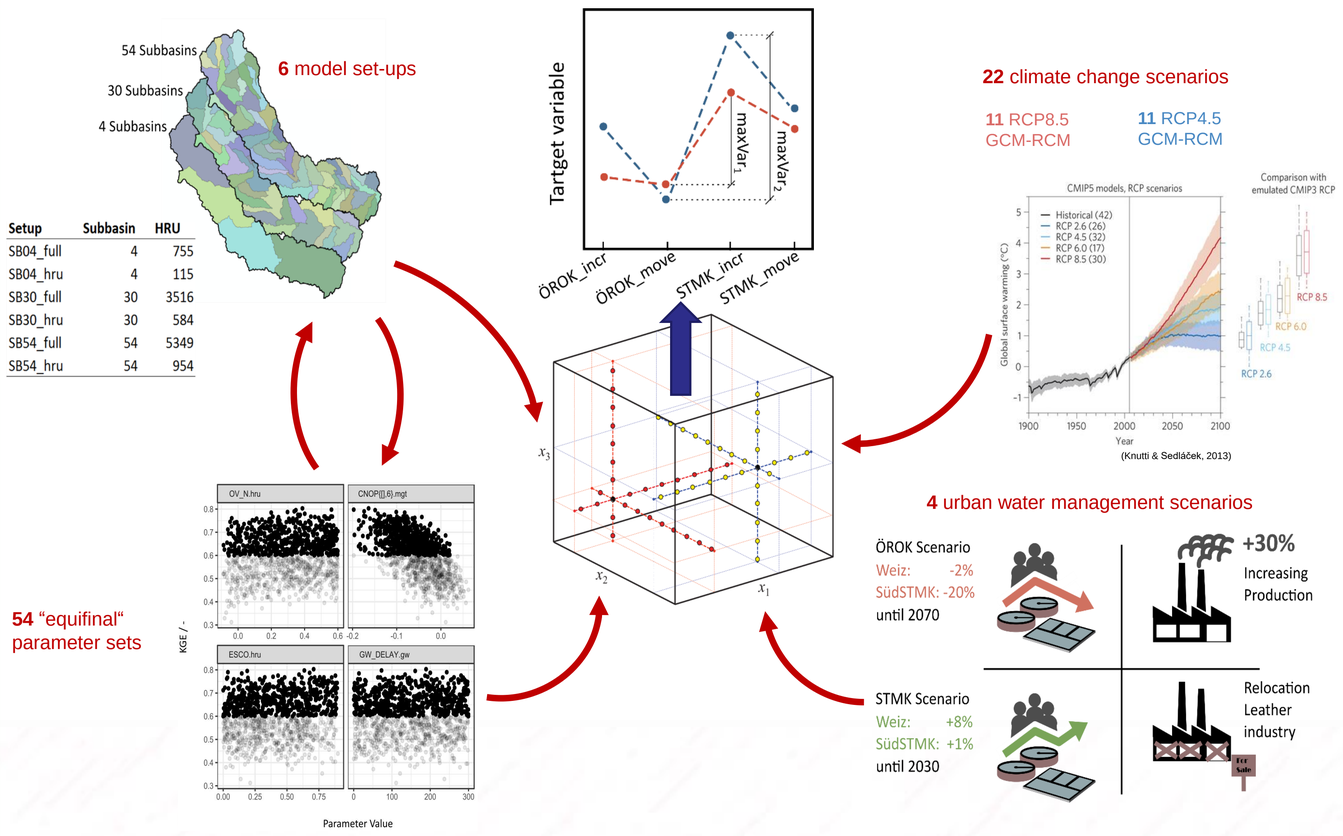

Figure 1. The Raab watershed case study showing the inputs into the global sensitivity framework STARVARS 2.0

2. Methods

- The SWAT model (Arnold et al., 1998) was applied to the Schwechat and Raab watersheds to simulate discharge and NO_3^--N.
- An ensemble of climate simulations from EURO-CORDEX was downscaled to a 1 km grid for the periods 2021-2050 & 2071-2100.
- Urban wastewater treatment plant effluent discharges were increased incrementally to develop future point-source pollution loads.
- Using STAR sampling (Razavi & Gupta, 2016) in a global sensitivity analysis framework, the dominant sources of uncertainty were evaluated via the sensitivity to the modelled outputs.

3. Results

Figure 2 shows the influence of the climate scenario, the model set-up, the parameter sets, and the point source scenarios on selected hydrological output variables and statistics.

The approach identified the inputs, parameters and factors that influenced the simulated outputs the most (and the least).

The framework allows for a comparison of the inputs to each other to compute a relative ranking of their contribution to model sensitivity.

When the dominant contributions to the model sensitivity are identified, these can be further examined to reduce the causes of uncertainty.

The results show a proof-of-concept for the sensitivity framework and demonstrate an efficient tool to evaluate the sensitivity and relevance of specific model inputs using SWAT.

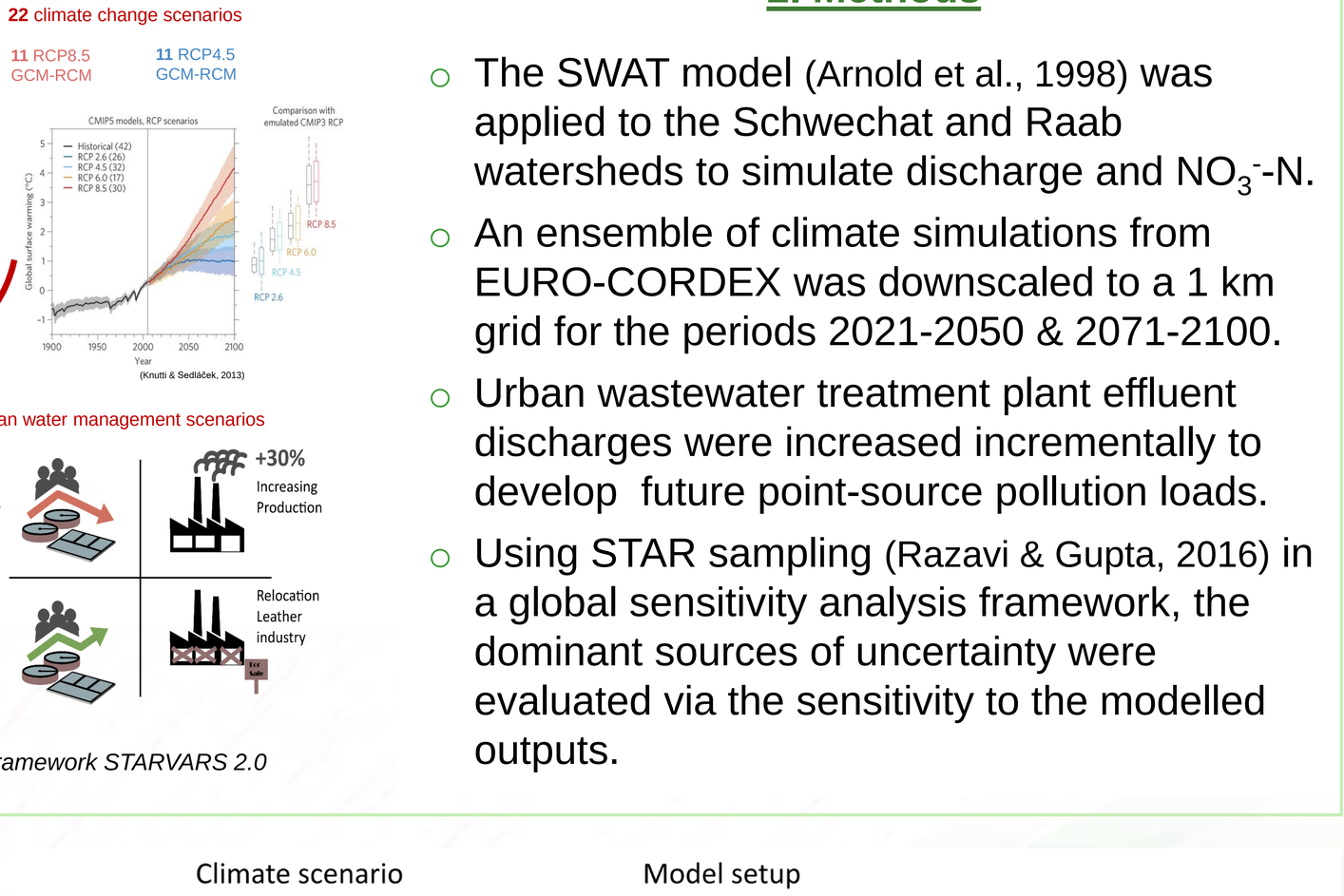

Figure 2. The relative contribution of each input, parameter or factor uncertainty to the modelled discharge and NO_3^--N

4. Outcome

A framework to assess the contribution of the inputs, parameters and factors to the modelled uncertainty.

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Arnold, J. et al., 1998. J. Am. Water Resour. Assoc. 34, 73-89
Knutti, R. & Sedláček, J. 2012. Nature Climate Change. 3, 369-373
Razavi, S. & Gupta, H. V. 2016. Water Resour. Res. 52, 423–439

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