

Towards high resolution (~1 km) global surface water quality modelling: Developing test beds for some small river basins in the world

Department: Physical Geography

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Project description

DynQual (<https://github.com/UU-Hydro/DynQual>) is a newly developed large scale **DYN**amical surface water **QUAL**ity model for simulating surface water temperature and salinity, pathogen and organic pollution levels (Jones et al, 2022, <https://doi.org/10.1038/s43247-022-00554-y>). The current version of DynQual is already available for the global extent at 5 arc-minute (~10 km at the equator) spatial resolution. In this work, we aim to further develop the DynQual model at a much more locally relevant resolution of 1 km grid cell size. While running DynQual at such high resolution may not yet be feasible for the global extent (e.g. due to limited computational power), we intend to develop some test beds for relatively small river basins (i.e. < 20,000 km²) to explore the potential of DynQual for simulating surface water quality at more locally relevant scale. For such tests beds, we intend to focus on river basins in the United Kingdom, Japan, and Java island of Indonesia.

The main activities of this project are split into two phases. The first part is to prepare the 1 km model input data for the test beds. We will prepare such input data in two ways, by collecting the local data at the test bed river basins and by downscaling the global datasets that are often only available at the resolution coarser than 1 km. The second part of the project is to use both input datasets (local and downscaled global-based) for running the DynQual model for the period 1980-2019. Here we will investigate the following research questions, which are relevant from both the hydrological and water quality perspective, 1) What are the advantages and challenges of running DynQual at 1 km compared to its original 10 km resolution model?; 2) To what extent will the model results improve if locally-specific input data are used (compared to the downscaled input data from coarser resolution global datasets)?

The project is mainly study desk for doing computer modelling. In the first part of the project, there will be weekly regular meetings (either in person or online), and this frequency may reduce when you become more independent within this project. You will be involved in writing scientific publications resulting from this work. We will also explore the opportunity for you to present this work at scientific conferences (subject to funding).

Job requirements

We are looking for a student who has followed courses in hydrology and knows scientific programming, e.g. Python, R or Matlab. Knowledge of DynQual, PCR-GLOBWB, or PCRaster is **NOT** a prerequisite.