



Simulation of in-stream water quality on global scale under changing climate and anthropogenic conditions

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Although catchment scale modelling of water and solute transport and transformations is a widely used technique to study pollution pathways and effects of natural changes, policies and mitigation measures there are only a few examples of global water quality modelling. This work will provide a description of the new continental-scale model of water quality WorldQual and the analysis of model simulations under changed climate and anthropogenic conditions with respect to changes in diffuse and point loading as well as surface water quality. BOD is used as an indicator of the level of organic pollution and its oxygen-depleting potential, and for the overall health of aquatic ecosystems. The first application of this new water quality model is to river systems of Europe. The model itself is being developed as part of the EU-funded SCENES Project which has the principal goal of developing new scenarios of the future of freshwater resources in Europe.

The aim of the model is to determine chemical fluxes in different pathways combining analysis of water quantity with water quality. Simple equations, consistent with the availability of data on the continental scale, are used to simulate the response of in-stream BOD concentrations to diffuse and anthropogenic point loadings as well as flow dilution. Point sources are divided into manufacturing, domestic and urban loadings, whereas diffuse loadings come from scattered settlements, agricultural input (for instance livestock farming), and also from natural background sources. The model is tested against measured longitudinal gradients and time series data at specific river locations with different loading characteristics like the Thames that is driven by domestic loading and Ebro with relative high share of diffuse loading.

With scenario studies the influence of climate and anthropogenic changes on European water resources shall be investigated with the following questions: 1. What percentage of river systems will have degraded water quality due to different driving forces? 2. How will climate change and changes in wastewater discharges affect water quality? For the analysis these scenario aspects are included: 1. climate with changed runoff (affecting diffuse pollution and loading from sealed areas), river discharge (causing dilution or concentration of point source pollution) and water temperature (affecting BOD degradation). 2. Point sources with changed population (affecting domestic pollution), connectivity to treatment plants (influencing domestic and manufacturing pollution as well as input from sealed areas and scattered settlements).