EGU23-2361, updated on 25 Apr 2024
https://doi.org/10.5194/egusphere-egu23-2361
EGU General Assembly 2023

River water quality under climate change and extremes: a synthesis of impacts for river basins globally (Invited)

Michelle T.H. van Vliet
Department of Physical Geography, Utrecht University, The Netherlands (m.t.h.vanvliet@uu.nl)

Long-term climate change and increased frequency and intensity of hydroclimatic extremes (e.g. droughts, heatwaves, floods) pose serious challenges for water management, not only in terms of water quantity, but also for securing suitable water quality for human use and ecosystems. Recent droughts, heatwaves and floods have been illustrative in showing major challenges due to exceeded water quality thresholds for sectoral use (e.g. inlet stops for drinking water production, irrigation). However, compared to water quantity, a limited number of studies have focused on water quality impacts, which are prevalent in many river basins of the world.

This presentation provides a synthesis of the potential impacts of climate change and extremes (droughts, heatwaves and floods) on global river water quality considering various water quality constituents relevant for different sectoral uses and ecosystems. This synthesis is based on: 1) an extensive literature review of local, regional to global river water quality studies; 2) statistical analyses of water quality monitoring data in various river basins over the last 40 years; and 3) global river water quality projections generated by process-based global water quality models forced with bias-corrected climate change scenarios. Comparison of results over various river basins show overall consistent responses for some general water quality constituents (e.g. water temperature, dissolved oxygen, salinity) due to the predominance of generic mechanisms (e.g. lower dissolved oxygen solubility under warming). However, mixed responses are overall found for nutrients, pathogens and pharmaceuticals due to different counterbalancing mechanisms. In addition, water quality responses vary due to differences in constituent forms (e.g. dissolved vs. particulate nutrient forms) and persistence in surface waters (e.g. for pharmaceuticals). Furthermore, geographic, environmental and socio-economic (e.g. pollution management and infrastructure) conditions conspire, showing substantial impacts on the magnitude of water quality responses under climatic change and extreme events.