Geophysical Research Abstracts
Vol. 21, EGU2019-4693, 2019
EGU General Assembly 2019


# Evaluating the spatio-temporal variability of water quality in a lager river system based on a dynamic water quality index

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Anthropogenic activities trigger spatio-temporal variability of water quality in a large river system (LRS). Proposing a suitable assessment method of water quality (e.g. water quality index, WQI) is essential for water resources management. The conventional WQIs (e.g. National Sanitation Foundation WQI, NSFWQI), which aggregate stationary water quality variables with pre-defined weighting values, are limited to reflect the impact of spatio-temporal region-specific polluted characteristics on overall water quality in a LRS. In this study, we introduce the min/max autocorrelation factor analysis (MAFA) to determine weighting values of water quality variables with monthly data from 24 June 2014 to April 2017 at 8 sampling sites in the middle and down streams of Han River in central China. Results show that the changeable weighting values in MAFAWQI can overcome aforementioned shortcoming, appropriately reflects polluted characteristics, and objectively evaluates water quality variability. The tributaries are seriously polluted by anthropogenic activities (i.e. domestic, industrial, and agricultural pollution). In tributaries, MAFAWQI determines high weighting values of organic and nutrient variables and shows the lowest MAFAWQI scores (i.e. the worst water quality) in the study regions. The pollutants effluxes from tributaries significantly affect water qualities at mainstream. In the downstream Han River where suffers from intensive agricultural activities, MAFAWQI highlights the impacts of nutrients (i.e. total nitrogen, ammonium-nitrogen, and orthophosphate) on overall water quality and shows low scores in autumn. The surface runoff during storm events occurred in autumn carries non-point source pollutants into the downstream Han River. Compared with NSFWQI, MAFAWQI aggregated both general variables and serious polluted variables, which ensured that MAFAWQI reflects polluted characteristics of a specific monitored region. MAFAWQI is also a flexible method that can be easily modified by applying specific water quality variables and pre-defined thresholds for multiple objectives of water resources management.