Geophysical Research Abstracts
Vol. 20, EGU2018-16783, 2018
EGU General Assembly 2018

Bank filtration affects shallow lake ecosystems: evidence from model scenarios

Mikael Gillefalk (1), Sabine Hilt (1), Sven Teurlincx (2), Annette Janssen (3), Jan Janse (2), Manqi Chang (2), and Wolf Mooij (2)

(1) Leibniz-Institute of Freshwater Ecology and Inland Fisheries (IGB), Germany (gillefalk@igb-berlin.de), (2) Netherlands Institute of Ecology (NIOO-KNAW), (3) Water Systems and Global Change Group, Wageningen University & Research, The Netherlands

Bank filtration is a water abstraction technology using different natural infiltration systems for groundwater recharge, such as river banks and lake shores. It is a widely used method in many regions worldwide, predominantly in urban areas, where drinking water production is crucial. Until now, research concerning bank filtration has almost exclusively focussed on the purification efficiency and infiltration capacity. Consequently, knowledge about effects on lake ecosystems is lacking, although bank filtration cuts off any groundwater seepage and thus may significantly affect nutrient loading, lake water temperature variation and the supply of CO_2 to macrophytes. Using the aquatic ecosystem model PCLake we show that bank filtration in most simulated scenarios had adverse effects on shallow lake water quality. Threshold levels for critical nutrient loading inducing regime shifts to the turbid state were lower with bank filtration indicating a lower resilience of the lakes to eutrophication. Only in the case of very high nutrient concentrations in the groundwater bank filtration can improve the lake water quality by cutting of the nutrient-rich seepage. Our results also suggest significant changes in sediment characteristics; notably the oxygen penetration depth increases with bank filtration. This may have consequences for important ecosystem processes such as carbon burial and greenhouse gas emissions. Lake depth and size influence the effect of bank filtration, which is strongest in shallower and smaller lakes. Underlying assumptions used during the simulations regarding groundwater nutrient concentrations, surface water and groundwater CO_2 concentrations and groundwater seepage and infiltration were well within values found in literature and the connection between increased CO_2 concentrations in water and macrophyte growth which is used in the model is supported by earlier research. In the future, an increasing number of water bodies is expected to be affected by bank filtration and its potential adverse effects. Our model results underline the need of a more comprehensive ecosystem perspective when planning a sustainable drinking water supply.