Geophysical Research Abstracts
Vol. 13, EGU2011-248, 2011
EGU General Assembly 2011

Detection of spatially variable groundwater inflow in rivers with geochemical tracers: Using major ion chemistry and Radon 222Rn as possible tracer: An example from the Avon and Mitchell rivers, southeast Australia.

Harald Hofmann and Ian Cartwright
School of Geosciences, Monash University, Clayton, Vic. 3800, Australia

The interaction between river water and regional groundwater has significant importance for local water management authorities. Currently basic baseflow filters are used to calculate the the amount of groundwater contributed to the river in the cause of a year's cycle. The dynamics of groundwater/surface water interactions have, furthermore, implications on ecosystems, pollutant transport, and the quality and quantity of water supply for domestic use, agriculture and recreational purposes. Chemical tracers are a valuable tool for understanding the interaction of rivers and the surrounding groundwater.
The Gippsland Basin is a significant agricultural area in Southeast Australia. Increasing population has resulted in increased demand of water resources for domestic and agricultural supply.
Despite the fact that the Gippsland area receives substantial rainfall, irrigation is still necessary to maintain agricultural production during summer and drier years. The used water resources encompass mostly shallow groundwater and surface water (reservoirs and streams). The effect on the environment range from rising water levels and soil salinisation in the case of irrigation and falling water levels with subsequent necrotization of the vegetation and land subsidence in the case of communal and industrial water extraction.
While the surface water components of the hydrological cycle are relatively well understood, groundwater has often been neglected. In particular, constraining the interaction between surface water and groundwater is required for sustainable water management. Gaining and loosing conditions in streams are subject to high temporal and spatial variability and hence, influence the amount of water accessible for agricultural purposes. Following a general assumption recharge to the aquifer occurs during the winter and spring month whereas the river receives water from the aquifer mainly during low flow (base flow) conditions in summer and autumn on a larger scale. Spatial variation, however, are a function of the hydraulic conductivity of the riverbed and the head differences between the aquifer and the river along the river banks. River banks play a major role in the discharge of groundwater to the river and function as short-term reservoirs, while the regional groundwater is influences on longer time scales.
Infiltration and exfiltration rates from changing water levels in the river based on hydraulic models are often underestimated. The hydraulic models do not take into account the complexity of the system and are purely based on discharge figures.
Radon (222Rn), stable isotopes and major ion chemistry were used to locate groundwater inputs to the Mitchell and Avon rivers. While stable isotopes and major ion chemistry are useful tracers to determine long-term variability, radon can be used to detect very localised groundwater discharge. Using hydrogeochemistry to locate and quantify groundwater discharge to rivers allows a more accurate assumption on the dynamics of the interaction between surface water and groundwater in the Gippsland area.
Radon has been used in similar applications elsewhere. Input parameters for mass balance equations, however, were often approximated and averaged. Radioisotope concentrations in groundwater has been assessed from 20 bores and 5 soil profiles to deliver a more confidential groundwater input water radon concentration by assessing spatial variability and emanation potential of the above-mentioned elements.