

Tracing the carbon cycle in river systems using the isotopic composition of dissolved inorganic carbon

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It is of particular importance in fragile catchments to understand the carbon cycle within the catchment. Fragility of a catchment is increased by human activities, as well as interaction between surface and groundwater. Organic matter is one of the most important impurities in such catchments and it can cause unwanted microbial growth in the water. The stable isotopic composition of dissolved inorganic carbon (DIC) is a useful tool in studying the decomposition of organic material within a river system. In the case of the Vantaanjoki River, located in one of the most densely populated areas in southern Finland, studying the evolution of contaminants in the river system is of particular importance, because previous studies have shown the river having a considerable amount of groundwater - surface water interaction (Korkka-Niemi et al. 2012, Niinikoski et al. 2015). This increases the vulnerability of the local groundwater, which is used as a drinking water source. Possible sources of contaminants in the area are water purification facilities, a saw mill and agricultural areas. In this study the isotopic composition of DIC was studied, along with the concentration of DIC in the river water. We were looking for traces of human induced changes in the carbon balance of the river, but also trying to establish the naturally occurring annual fluctuations in both DIC contents and isotopic composition in the river. The highest $\delta^{13}\text{C}_{\text{DIC}}$ values were found in the summer, and the lowest ones in the spring. Similar trends have been reported in other studies and are most likely the result of naturally occurring organic material formation and decay in the river water. Locations of the water purification facilities or fields along the flow path did not show on the $\delta^{13}\text{C}_{\text{DIC}}$ values, nor in the DIC contents of the water.

References:

Korkka-Niemi K., Kivimäki, A.-L., Lahti K., Nygård, M., Rautio, A., Salonen, V.-P. & Pellikka, P. 2012. Observations on groundwater-surface water interactions at River Vantaa, Finland. *Management of Environmental Quality: An International Journal*. 23, 222-231.

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