Tracing the carbon cycle in a boreal river with a seasonal base flow component

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Studying the carbon balance in surface waters gives information on the annual cycles of photosynthesis and decay, but also on the water body's capability to serve as a carbon sink for atmospheric carbon, which may be essential in evaluating the effects of climate change [1]. Organic matter is one of the impurities in catchments. The stable isotopic composition of dissolved inorganic carbon (DIC) is used for studying the decomposition of organic material within a river system. The Vantaanjoki River, in southern Finland, is located in one of the most densely populated areas in Finland. There are agricultural areas, water purification facilities and urban areas in the catchment, all possible sources of carbon for the river. In previous studies it was concluded that the river has a considerable amount of groundwater - surface water interaction which makes local groundwater more vulnerable to contaminants [2]. The proportion of base flow is highest in the winter and almost non-existent during the spring flooding caused by snowmelt [3]. In this study the isotopic composition, and the overall contents, of DIC were studied, to determine the major influences on the carbon balance in the river water. This was done to see if human induced changes in the environment are affecting the carbon cycle. Another aim was to study the effects of the annual biological cycles of production and decay, and theseasonally varying base flow component on the carbon budget. It was evident from the results that the human activities do not disturb the inorganic carbon balance of the river system, except for the spring flooding period, when there is a significant input of carbon originated in the liming product used in agriculture. largest changes in the carbon budget seem to be due to changes in surface flow / base flow ratio, but there is also some evidence of the annual production/decay cycle. The river as a whole serves as a source of carbon, not a sink.

[1] Telmer & Veizer (1999) Chem. Geol. **159**, 61-86. [2] Korkka-Niemi *et al.*(2012) Man. Environ. Qual. **23**, 222-231. [3] Niinikoski *et al.* (2016) Isot. Environ. Health S. in press.