Geophysical Research Abstracts
Vol. 13, EGU2011-6542, 2011
EGU General Assembly 2011
© Author(s) 2011

Climatic factors controlling the variations of chloride and nitrate concentrations in agricultural headwater catchments: preliminary results

Alice Aubert (1,2), Philippe Mérot (1,2), Chantal Gascuel-Odoux (1,2), and Gérard Gruau (3)

(1) INRA, UMR 1069, Soil Agro and hydroSystem, Rennes, France (alice.aubert@rennes.inra.fr), (2) Agrocampus Ouest, UMR 1069, Soil Agro and hydroSystem, Rennes, France, (3) CNRS-Université de Rennes I, UMR 6118, Géosciences Rennes, Rennes, France

The effect of climate change on water quality is so far poorly studied. Reversely to the water fluxes which directly answer to the climate variations, water quality response to climate is more complex. First, complexity relies on the integration of many climatic parameters, naming not only rainfall but also temperature, global radiation, wind speed, ... which act on biological processes. It is also complex as several time scales interact: direct response, as well as long term response due to storage in soils or groundwater. Water quality modelling is therefore not as developed as water fluxes modelling. However, some papers can be found (Gascuel-Odoux, Aurousseau et al. 2010) which suggest that long term monitoring is one of the requirements to better distinguish the effect of climate. Other authors (for instance (Reynolds 1995), (Burt and Worrall 2009)) emphasize the need for long term time series to study the effect of climate on water quality.

The present work focuses on the role of climate on the variability of chloride and nitrate concentrations in stream water of a headwater catchment, the Kervidy-Naizin catchment which benefits from a relatively long term monitoring starting in 1993. It is part of the French network of catchments for environmental research (ORE). It is an intensive agricultural catchment located in a temperate climate in Western France, Brittany, which presents shallow aquifers due to impervious bedrock. Both hydrology and water chemistry are monitored.

Two phenomena are observed from the time series and are presented here: (1) each hydrological year resumes with a drastic flash decrease in chloride concentration, more or less pronounced according to the year; (2) whereas nitrate concentration abruptly increase in winter due to the connection of the hillslope groundwater to the stream (Molenat, Gascuel-Odoux et al. 2008), the nitrate concentrations decrease slowly in spring and present high variability from year to year. In the first case, we test a hypothesis of dryness conditions in the previous summer to explain the variations in chloride concentrations. In the second case, we test a hypothesis of biological processes, linked to the temperature in spring. Statistical analyses are implemented in order to verify our hypotheses and explain those variations regarding climatic conditions.

Burt, T. P. and F. Worrall (2009). "Stream nitrate levels in a small catchment in south west England over a period of 35 years (1970-2005)." Hydrological Processes 23(14): 2056-2068.
Gascuel-Odoux, C., P. Aurousseau, et al. (2010). "The role of climate on inter-annual variation in stream nitrate fluxes and concentrations." Sci Total Environ 408(23): 5657-5666.
Molenat, J., C. Gascuel-Odoux, et al. (2008). "Role of water table dynamics on stream nitrate export and concentration. in agricultural headwater catchment (France)." Journal of Hydrology 348(3-4): 363-378.
Reynolds, B., Edwards, A. (1995). "Factors influencing dissolved nitrogen concentrations and loadings in upland streams of the UK." Agricultural Water Management 27: 181-202.