Modelling coupled emissions of carbon, nitrogen and phosphorus to surface waters in rural headwater catchments and analysis of climate effects.

Contacts:
Directrice de la thèse : chantal.gascuel@inra.fr
Co-encadrante de la thèse : ophelie.fovet@inra.fr
UMR Sol Agro-hydrosystèmes Spatialisation, 65 rue de St Brieuc, 35200 Rennes
http://www6.rennes.inra.fr/umrsas

English summary:

Catchments transfer and transform chemical species associated to water: they act as multi-scales filter (spatially and temporally) and thus control emissions of major nutrients (C, N, P) to waters and air or their storage. The emissions of these nutrients have been traditionally studied individually, their interactions being rarely taken into account and the role of climate regime on these emissions poorly studied. Stoichiometric ratio between those elements and the dynamics of such ratios in time and space are likely to be highly variable depending on their sources and on the associated transfer times and pathways. An integrated approach of these three nutrients is needed for

• Assessing and/or guiding the management of their fluxes in landscapes and identifying the potential risks of pollution transfer. Are those fluxes synchronous or asynchronous? Are they affected by climatic factors in a similar or antagonist way?
• Contributing to assess the impacts of such chemical fluxes on the ecological functions of streams, using stoichiometric ratios and their variations at different time scales

The objective of the project is: i) to analyse synchrony or asynchrony in the transfers of these 3 major nutrients to improve our understanding of stoichiometric ratios at the catchment output, and ii) to formalize them by modelling.

The analysis task will be based on multi-elemental time series (dissolved carbon, nitrate and major anions, reactive and total phosphorus concentrations) at high and nearly-continuous frequency from a research observatory: ERO AgrHyS. Those long-term time series integrate the variability of climate regime.

The flexible modelling approaches based on conceptual multi-reservoirs demonstrated to be useful for testing behaviour hypothesis when constrained by multiple signatures (that integrate multiple elements, their relationships, and time transfer concepts to represent the legacy effects). Semi-distributed approaches have also been developed for each nutrient separately and could be remobilized for comparison with global models.