

## **A framework and a set of tools called Nutting models to estimate retention capacities and loads of nitrogen and phosphorus in rivers at catchment and national level (France)**

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The Nutting-N and Nutting-P models (Dupas et al., 2013, 2015) have been developed to estimate Nitrogen and Phosphorus nonpoint-source emissions to surface water, using readily available data. These models were inspired from US model SPARROW (Smith et al., 1997) and European model GREEN (Grizzetti et al., 2008), i.e. statistical approaches consisting of linking nitrogen and phosphorus surplus to catchment's land and rivers characteristics to find the catchment relative retention capacities.

The nutrient load (L) at the outlet of each catchment is expressed as:

$$L=R*(B*DS+PS) [1]$$

where DS is diffuse sources (i.e. surplus in kg.ha-1/yr-1 for N, P storage in soil for P), PS is point sources from domestic and industrial origin (kg.ha-1.yr-1), R and B are the river system and basin reduction factor, respectively and they combine observed variables and calibrated parameters.

The model was calibrated on independent catchments for the 2005-2009 and 2008-2012 periods. Variables were selected according to Bayesian Information Criterion (BIC) in order to optimize the predictive performance of the models.

From these basic models, different improvements have been realized to build a framework and a set of tools: 1) a routing module has been added in order to improve estimations on 4 or 5 stream order, i.e. upscaling the basic Nutting approach; 2) a territorial module, in order to test the models at local scale (from 500 to 5000 km<sup>2</sup>); 3) a seasonal estimation has been investigated. The basic approach as well territorial application will be illustrated. These tools allow water manager to identify areas at risk where high nutrients loads are estimated, as well areas where retention is potentially high and can buffer high nutrient sources.

### References

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