Modelling of agricultural diffuse pollution and mitigation measures effectiveness on water quality in Wallonia (Southern Region of Belgium)

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1. Context

New European directives in the environmental field (Nitrate Directive, Water Framework Directive, ...)

In Wallonia ...

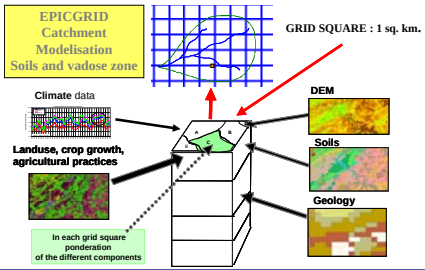
"Walloon action plan for nitrogen sustainable management in agriculture"
(PGDA1 (2002) and PGDA2 (2007))

request for **news tools** able to evaluate impact of measures token in order to reduce pressures on ecosystems.

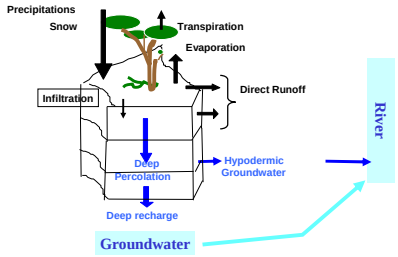
In Wallonia ...

- Use of a "soil and vadose" hydrological model : the EPICgrid model
- APL control

2. EPICgrid model

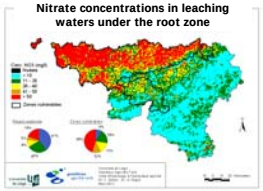


The EPICgrid model has been developed at catchment scale with an original modular concept on the basis of the field scale "water-soil-plant" EPIC model (Williams et al., 1984). The model calculates for each calculation unit identified into a grid of 1 square kilometer water and nutrients flows into the plant-soil-vadose zone system (Sohier et al., 2009).



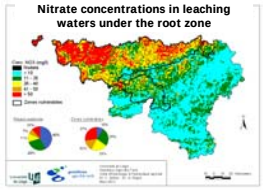
3. Modelling of the EU Nitrates Directive Actions Program

The model was used to make actual and prospective simulations in order to evaluate the impact, at regional scale, of measures currently performed to reduce the effect of diffuse pollution on water surface quality and groundwater quality. Response of the soil-vadose zone to agricultural practices modification is analyzed for the deadlines of the Water Framework Directive : 2015, 2021 and 2027, for two climatic scenarios. Simulations results showed that actual measures are not sufficient in some areas and that new actions are necessary.



1994 – 1999

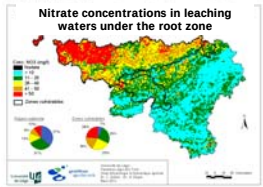
Decrease of nitrate concentrations (effect of action's program that induces a modification of agricultural practices)



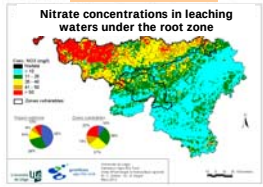
2004 - 2009

PROSPECTIVE SIMULATIONS

CLIMATE UNCERTAINTIES



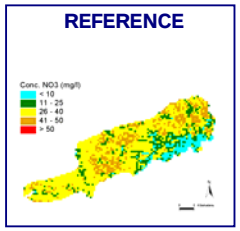
2016 - 2027

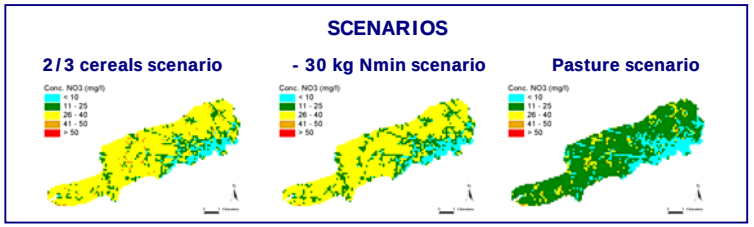


Stabilisation of nitrate concentrations

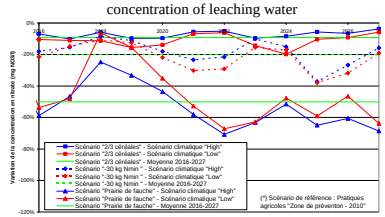
4. Modelling of further measures

The EPICgrid model was then used to evaluate effectiveness of further measures that can be implemented in order to reduce agricultural diffuse pollution. The increasing of catch crops from 75% to 100% in vulnerable zones has showed a limited impact. The modifications of agricultural practices such as crop rotations or mineral fertilizing amounts have showed a more significant impact on water quality.





Effect of agricultural practices scenarios on nitrate concentration of leaching water



5. APL control

In parallel to this modelling, the respect of the PGDA application by farmers is evaluated each year by a measuring campaign of the autumn nitrogen content in the soil profile. The confrontation of these measurements with the model results allows us to improve the representativeness of the EPICgrid model in areas in witch agricultural practices can't be correctly defined on the basis of regional statistics.

Acknowledgements

The model's development was carried out with the financial support of the Walloon Region and the public society of water management (Société Publique de Gestion de l'Eau).

European Geosciences Union General Assembly 2012
Vienna, Austria, 22-27 April 2012

References :

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Sohier C., Degré A., Dautrebande S. (2009). From root zone modelling to regional forecasting of nitrate concentration in recharge flows – The case of the Walloon Region (Belgium). Journal of Hydrology, Volume 369, Issues 3-4, 15 May 2009, Pages 350-359.