



OFFRE DE STAGE INGENIEUR



Pesticide risk assessment :

Testing FOCUS models on their effectiveness to simulate the leaching of metribuzin herbicide under conventional cropping practices in Norway

Context

In the frame of the revision of the new EU groundwater directive and the water framework directive, the GENESIS project¹ is based on several scientific issues related to groundwater dynamics, re-charge and water balance, leaching to groundwater aquifers from different land-uses, groundwater-surface water interaction and impacts on groundwater dependent ecosystems, modelling processes in groundwater systems, and proposing concepts and scenarios in order to improve risk assessment.

Work package 3 (WP3) of GENESIS is focused on contaminant fluxes and environmental concentrations at the interface between unsaturated subsoil and groundwater. Based on different case studies, with specific threats and vulnerabilities for aquifers, WP3 comprises the simulation of water flow and solute transport in the root zone and unsaturated sub-soil and will provide quantitative and qualitative information about the net groundwater recharge. This WP gives information for the definition of cost-effective measures to achieve the good quantitative and chemical status in the water bodies, for the assessments of "resource cost" of aquifer overexploitation, allowing the development of management strategies.

A task is to assess modelling tools with regard to their scale of application, ability to describe the relevant processes and practices, type of output that can be generated, data requirement and pre-processing methods. For pesticide leaching assessment at plot scale, a selection of tools is already proposed by FOCUS² group (MACRO, PEARL, PRZM3) and the idea is to identify key variables on calibration, validation, sensitivity and uncertainty in using this kind of simulation models with the final objective to simulate impacts of land-use and climate changes on pesticide losses. An important objective of this task is also to set up quality control procedure for modeling in order to guarantee the quality simulation for different scenarios.

One case study of GENESIS Project is located in Southern Norway. It is representative of cropping systems, soil types and climate conditions of Northern Europe. Close to Glomma, the biggest river of Norway, relatively large areas with intensive agriculture and potato production can be found. Since 1995 several investigations on risk assessment of leaching of pesticides and nitrate to groundwater have been conducted in a research area at Grue, where more than 90 per cent of area is used for grain and potato production. Permeable soil types cover the major part of the area. The thickness of the unsaturated zone in observation wells has varied between 1.8 and 5.9 m. In 2000, the measured mean depth to the groundwater surface was 3.75 m. The mean groundwater recharge is estimated to be at a size of 300 mm year⁻¹. Average annual temperature and precipitation in this area is 3.3 degrees and 635 mm, respectively. Metribuzin, an herbicide used on potatoe and barley crops, was monitored in the period 2001 to 2003 at the plot scale (1,30 m soil profiles) and different pesticide dissipation parameters were obtained during a former collaborative research Programm between Bioforsk and INRA (see related refs).

¹ **GENESIS** for Groundwater and Dependent Ecosystems: New Scientific and Technical Basis for Assessing Climate Change and Land-use Impacts on Groundwater Systems - Large-scale integrating project FP7, <http://www.thegenesisproject.eu> - 2009-2014

² **FOCUS** Forum of the Co-ordination of Pesticide Fate Models and their Use . <http://focus.jrc.ec.europa.eu>

Objective

The main objective of the work is to define a common procedure for GENESIS project concerning « good » modelling practices and pesticide leaching assessment, with regard to the type of output that can be generated, data requirement and pre-processing methods to meet the input demands. A second important objective is to assess and compare modelling tools with regard to their ability to describe the herbicide leaching processes and the crop practices at Grue site.

Working plan

The student will share the Grue dataset and prepare input files for the 3 FOCUS models. A common procedure to calibrate and validate the models will be defined and applied by testing PRZM, MACRO and PEARL Models. A single dataset (climate, soil physical parameters, bromide tracer concentration, pesticide concentration profiles) will be used to calibrate. For the calibration step, the 2001 year data set will be used. Then validation will be carried on the 2002-2003 data set.

Dissemination

The results for the calibration step will be presented at the next GENESIS meeting in October 2011. The training report will serve as basis for the reporting on pesticide models benchmarking activity of GENESIS project included in the deliverable D3.2 due for December 2011.

Skills

The student should be autonomous, interested by modelling approaches and motivated by environmental impact assessment. Skills in modelling are not mandatory but a strong interest in numerical tools will be welcome. Sufficient knowledge in soil science and agronomy is required. A good level of English is required (oral and written).

Period: from January to July 2012 ≈ 418 €/month - travel and accommodation expenses will be covered.

Location: First period at Bioforsk (Ås, Norway) for PRZM training and calibration, second period at UCSC (Piacenza, Italy) for MACRO training and calibration and third at INRA Grignon for PEARL training and calibration and final reporting.

Send a CV and + letter of motivation.

Responsables

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Related publications :

Benoit P., Perceval J., Stenrød M., Moni C., Eklo O.M., Barriuso E., Sveistrup T., Kværner J. 2007. Availability and biodegradation of metribuzin in sandy loam soils as affected by temperature and soil properties. *Weed Research*, 47, 517-526.

Stenrød M., Perceval J., Benoit P., Almvik M., Bolli R.I., Eklo O.M., Sveistrup T., Kværner J. 2008. Cold climatic conditions; effects on bioavailability and leaching of the mobile pesticide metribuzin in a silt loam soil in Norway. *Cold Regions Science and Technology*, 53, 4-15.

Pot V, Benoit P, Menn ML, Eklo OM, Sveistrup T, Kvaerner J. 2011. Metribuzin transport in undisturbed soil cores under controlled water potential conditions: experiments and modelling to evaluate the risk of leaching in a sandy loam soil profile. *Pesticide Management Science*;67(4):397-407.

FOCUS – 2009. Assessing Potential for Movements of Active Substances and their Metabolites to Ground Waters in the EU " - Report of the FOCUS Ground Water Work Group, Version 1 of 13 June 2009. EC Document Reference Sanco/13144/2010 version 1, 604pp.