FOOTPRINT

Modelling and meta-modelling

Kick-off meeting
Friday 24 February 2006

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Modelling and risk assessment

> Objectives:
- parameterise and run MACRO and PRZM for the defined scenarios
- develop meta-models of MACRO and PRZM
- provide algorithms to calculate PEC in surface water and groundwater at the three different scales
- perform aquatic risk assessment

> Pesticide input paths to be considered for surface water:
- diffuse sources: runoff, erosion, tile drainage, spray drift
- point sources: farmyard runoff

> Pesticide input paths to be considered for groundwater:
- leaching to depth from the fields

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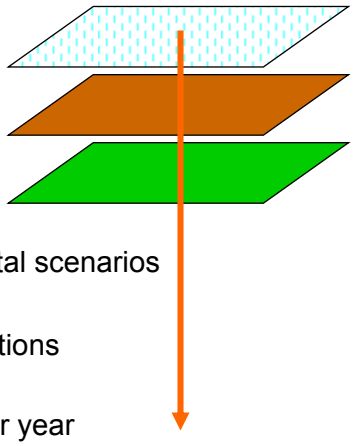
Parameterisation of MACRO and PRZM

- Based on literature review, available data and results from WP2 (soil hydrological classes)
- Use of existing pedotransfer functions (HYPRES; PRZM Manual)
- Development of improved function for parameters regulating macropore flow in MACRO
- Uncertainty analysis

Modelling strategy

Climate zones	ca. 30
	x
Soil groups	ca. 30
	x
Cropping systems	ca. 15



> 10,000 agro-environmental scenarios

x

80 DT50/K_{oc}-combinations

x

1 ... 10 applications per year

> 10^6 simulation runs per model
Development of a dedicated modelling architecture

Meta-models of MACRO and PRZM

- Leaching to groundwater, subsurface drainage, runoff/erosion
- Based on simulations of the agro-environmental scenarios identified in WP 2
- Input: half-life and soil organic carbon sorption coefficient
- Look-up tables, statistical methods
- Meta-model target variables:
  - groundwater assessments: long-term average concentration percolating to groundwater
  - surface water: maximum daily pesticide losses over the simulation period (under discussion)

Transfer of end-of-model losses to PEC in surface water (1)

- Still under discussion
- PEC_{sw} in **edge-of-field water bodies**: simple dilution calculations considering
  - size and discharge of the water body
  - the water volumes associated with runoff and drainage inputs
  - the presence of bed sediment

Transfer of end-of-model losses to PEC in surface water (2)

> PEC_{sw} at the **catchment scale:** The processes and fluxes affecting pesticide fate in the field and also those related to pesticide storage and handling have to be integrated from the field scale to larger areas. Additional variables have to be considered:

- proportions of the catchment area covered by arable land and by the respective crop
- proportion of the crop area treated with the pesticide of concern
- presence of buffer zones (on-site and at river banks)
- tile-drained proportion of the arable land
- dilution, dispersion, degradation, sorption in the river network

Risk assessment for surface water

> Compare PEC with ecotoxicological thresholds for acute toxicity → calculation of Toxicity/ Exposure Ratios (TER).

> For acute exposure, the risk assessment is based on maximum daily concentrations.

> For comparison with chronic effect data, additionally time-weighted averages (TWA) of the PEC are calculated.

Risk assessment for groundwater

- Leachate flux concentrations (annual averages) at 1 m depth for regulatory purposes
- Account for vulnerability of groundwater bodies (catchment scale)
- Since we cannot afford to run complex ground-water models, risk assessment will be based on decision rules and simple calculations.

Point-source inputs

- Only consider agricultural use of pesticides → leaves farmyards as main sources of contamination from hard surfaces
- Model HardSPEC for calculating losses from hard surfaces (still under discussion)
- Regions where farmyards are connected to the sewer system → predicted losses from farmyards enter the rivers as sewage plant outflow
- Regions where farmyards are not connected to the sewer system → predicted losses from farm-yards are treated like diffuse surface runoff losses.

Accounting for uncertainty

- Decision to include an uncertainty processor to be discussed with the Advisory Committee
- Uncertainty in model outputs:
  - real-time models:
    - run MACRO and PRZM for several different weather years
    - include uncertainty processor for sensitive model input parameters?
  - meta-models: extensive reliability check: comparison of meta-model and real-time model results
- Uncertainty in scenarios:
  - representativity and realism of the scenarios shouldn‘t be an issue
  - risk of wrong user input must be minimised