Geophysical Research Abstracts, Vol. 8, 08249, 2006
SRef-ID: 1607-7962/gra/EGU06-A-08249

The Importance of a Measuring Campaign for Model Development: Modifications to SWAT for Pesticides

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Pesticides are known for their ecotoxicity, their potential bio-accumulating properties and their hormone disrupting effects. To gain more insight in the processes affecting the fate of pesticides and to differentiate in effectiveness of possible measures that can be taken for pollution reduction, a dynamic model is a helpful tool.

We used SWAT (Soil and Water Assessment Tool), a physically based, continuous model. As an example, the Nil, a small, hilly basin situated in the central part of Belgium, was modelled. The catchment was studied in detail in terms of pesticide applications by interviewing local farmers and monitoring averaged daily pesticide concentrations in surface waters. In the Nil, it was demonstrated that 50 to 70% of the pesticide load could be attributed to direct losses. Direct losses to surface water result from the cleaning of spraying equipment, the leaking of components and from drift.

Comparison of the modelling results with the measured pesticide concentrations revealed that there were some shortcomings in the source code of SWAT for direct losses. Therefore, the source code was extended for these direct losses. A fraction of the application dose is considered as a direct loss and is in the source code immediately sent to the corresponding river reach. If one assumes the whole application dose as a direct loss, mass balances of processes in the river can be checked. By doing so, some additional shortcomings and creation of mass in the routing part could be detected. Consequently, a new routing calculation was introduced. Step by step, different adaptations to the SWAT2000 model were made, in order to result in reliable predictions for pesticide concentrations in river systems. Finally, a good approximation between modelling results and measured concentrations could be obtained. Also mass balances became realistic.