Geophysical Research Abstracts
Vol. 13, EGU2011-3637, 2011
EGU General Assembly 2011


# Spatial heterogeneity of herbicide pollution at field and catchment scale

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During rain events, herbicides can be transported from their point of application to surface waters where they can have harmful effects on aquatic species. Since the spatial pattern of mobilization and transport is heterogeneous, the contributions of different fields to the herbicide load in the stream may differ considerably within one catchment. Furthermore, herbicide pollution varies between catchments. Therefore, the prediction of contributing areas could help to efficiently reduce herbicide pollution.
In spring 2009, a controlled herbicide application was performed on corn fields in a small catchment (ca 1 km2) with intensive crop production in the Swiss Plateau. For two months after application, water samples were taken at different locations in the catchment (tile drains and open channel) with a high temporal resolution during rain events.
Several rain events with varying intensities and magnitudes occurred in the study period. Infiltration excess and saturation excess overland flow were both observed, but most of the overland flow did not reach the channel directly, it ponded in small sinks in the catchment. From the sinks, it reached the channel via macropores and tile drains.
The observed herbicide loss rates (fraction of the applied amount that reaches the channel) were low for Swiss conditions (0.29 %, 0.27 % and 0.18 % for Atrazine, Sulcotrione and Metolachlor, respectively). Compared to a similar study in the Swiss Plateau (Leu et al 2004) the loss rates were more than 2 times lower, even though the weather conditions were wetter (333 mm of rainfall in the two month after application compared to 260 mm) and the most important discharge event occurred at day 7 after application compared to day 23.
Furthermore, the variability of loss rates within the catchment was small as compared to this previous study. For the within-catchment variability the connectivity of the fields with the channel seems to play a more important role than soil hydrology. On the other hand, soil hydrology can be an important factor to explain the variability between catchments.
Despite the low loss rates, high concentrations were reached during rain events (maximum concentrations were 13.0 $\mu$g/l, 7.4 $\mu$g/l and 10.0 $\mu$g/l for Atrazine, Sulcotrione and Metolachlor, respectively). Atrazine concentration remained above 1 $\mu$g/l for more than 24 hours. These maximum concentrations were higher than the ones measured in the abovementioned study despite the lower loss rates. One reason for this is the higher areal fraction of treated cornfields in the catchment.