



Hydraulic shortcuts: An important but ignored pesticide transport pathway?

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Agricultural plant protection products (PPPs) can enter surface waters through various pathways and impair the water quality. In the past, numerous studies were conducted for certain entry paths such as surface runoff, direct drift into water bodies or preferential flow to drainage systems. Man-made hydraulic shortcuts (e.g. road storm drains collecting drift and surface runoff onto roads, or manholes of tile drainage systems) might also play a major role for PPP inputs into surface waters. However, they have been largely overlooked in the past.

In this study we investigated the relevance of such shortcuts for the PPP transport from arable land to surface waters in Switzerland. 20 small catchments throughout the Swiss midlands were selected as study areas by performing a weighted random selection on a nation-wide hydrological catchment stratification dataset. On average they have an area of 3.5 km² with a fraction of 44 % of arable land. In the agricultural areas of these catchments we mapped potential hydraulic shortcuts using different data sources: Field surveys, high resolution aerial images captured by a fixed-wing drone as well as plans of the road storm drains and the tile drainage systems. Subsequently, we modelled the hydrological connectivity of arable areas to surface water bodies using a digital elevation model and a D-infinity flow direction algorithm. Within this model we distinguished between areas with a direct and indirect (i.e. via shortcuts) surface water body connectivity.

We will present model results on the fractions of arable land areas connected directly and indirectly to surface water bodies for each of the studied catchments. Preliminary analyses in seven catchments show that between 9 and 51 % (on average: 43 %) of the arable land is connected via shortcuts to surface water bodies.

In a next step we will create a model predicting shortcut density, as well as the fraction of arable land connected to shortcuts within a catchment, depending on auxiliary quantities (i.e. length of roads of a certain type, land use, slope, ...). Using these auxiliary quantities we will extrapolate the shortcut density to a nationwide scale.