



A multidisciplinary, multiscale approach to understand the sources and fate of veterinary pharmaceutical products in a mesoscale Mediterranean watershed

Nico Hachgenei, Lorenzo Spadini, Guillaume Nord, Céline Duwig, Cédric Legout, Jean Martins, and Marie-Christine Morel

IGE, Université Grenoble Alpes, France (nico.hachgenei@univ-grenoble-alpes.fr)

The widespread presence of pharmaceutical products (PP) in terrestrial water reservoirs (surface water, ground-water, soil water) is at present established. The two main sources are urban discharges and agricultural inputs. While urban discharges are point sources that enter rivers mainly via waste water treatment plants (WWTP), agricultural inputs can be point sources (e.g. leaching from manure storage) but are mostly diffuse (animals kept outside, application of manure). Many studies have investigated the input of PP through WWTP. However, the diffuse input through livestock farming is much less understood. The spatial distribution of PP input, the soils reactivity with those molecules and the dominating hydrological processes are key factors to better understand the PP transfer and fate on a plot- to catchment-scale. The overall goal of the ongoing PhD thesis is the establishment of a catchment-scale conceptual model for the prediction of the fate of PP and the closure of a catchment PP mass balance.

The Claduègne catchment (42 km²) is an agricultural Mediterranean catchment part of the OHMC observatory and the OZCAR research infrastructure. The basin is instrumented for hydrological monitoring on a high temporal frequency of river water and suspended sediment and a study on the dominant hydrological processes has been conducted. Interviews with livestock breeders have been conducted in the catchment to identify the PP applied by farmers, estimate the quantities and determine the surfaces where the cattle are kept. This allowed a spatially and temporally distributed quantification of the sources of some PP.

The interviews revealed that the veterinary PP (VPP) primarily used in the catchment do not correspond to the molecules that are most frequently analysed in natural waterways. This highlights the need to adapt the monitoring and analysis methods in order to be able to understand the fate of PP within agricultural watersheds.

Analysis methods for the primarily used VPP in that watershed will be tested and evaluated to be able to follow the outflow of these PP in the watershed during base flow and floods. A literature review of sorption studies of PP in different soil types has been conducted and will be complemented with laboratory experiments in order to identify the most important soil properties for predicting different PP retention and mobility coefficients. Soil sampling campaigns are targeted in order to obtain the spatial distribution of those soil properties. Field experiments will be conducted, to determine the dominant PP flow pathways at the hillslope scale and close the scale-gap between laboratory batch experiments and the catchment-scale.