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Towards Estimating the Nutrient Balance of the Hydrologic Open Air Laboratory (HOAL) Catchment, Lower Austria

Michael Exner-Kittridge (1), Matthias Zessner (2), Martine Broer (3), Alexander Eder (4), Peter Strauss (5), and Günter Blöschl (6)

(1) Vienna University of Technology, Centre for Water Resource Systems, Vienna, Austria (exner@waterresources.at), (2) Vienna University of Technology, Institute of Water Quality, Resources and Waste Management, Vienna, Austria (m.zessner@iwag.tuwien.ac.at), (3) Vienna University of Technology, Centre for Water Resource Systems, Vienna, Austria (Broer@waterresources.at), (4) Institute for Land and Water Management Research, Petzenkirchen, Austria (alexander.eder@baw.at), (5) Institute for Land and Water Management Research, Petzenkirchen, Austria (peter.strauss@baw.at), (6) Vienna University of Technology, Centre for Water Resource Systems, Vienna, Austria (bloeschl@hydro.tuwien.ac.at)

The fate of nutrients introduced by human activities have significant impacts on both nature and our civilization. Excessive nutrients can contaminate our drinking water as well as promote algae blooms that deplete the surrounding waters of oxygen for aquatic life. It is estimated that agriculture in Austria contributes approximately 60% to the total discharge of nitrogen and 40% to the total discharge of phosphorus. Understanding the specific pathways and sources of nitrogen and phosphorus from agriculture land could greatly improve our ability to mitigate for excessive discharges if the problems can be targeted more precisely.

The objective of our research is to determine the complete nitrogen and phosphorous balance within a 66.7 hectare catchment in Lower Austria. The Hydrologic Open Air Laboratory (HOAL) catchment is located in Lower Austria approximately 100 km west of Vienna. The HOAL catchment was established in 2009 through funding by the Austrian Science Foundation to be used for multidisciplinary hydrologic research for understanding water flow and transport processes in catchments. The catchment land cover is characterized as 90% agriculture, 5% impermeable surface, and 3% forest. The predominant soil type is a clayey silt loam and a section of the catchment contain a subsurface tile drainage network that extend approximately 5.5 km. Nitrogen and phosphorus are the two primary nutrients assessed in this study. To accomplish the nutrient balance, the research is divided into three different scales: Field Scale, Subcatchment Scale, and Catchment Scale. The Catchment scale encompasses the entirety of the catchment, the subcatchment scale encompasses a 6.4 hectare area within the catchment that is completely underlain by the tile drainage network, and the field scale studies are performed on several square meter plots within the subcatchment. Each scale attempts to determine different parts of the total nutrient budget.

The initial phase of the research focused on the identification of the magnitude of the contributing sources of nutrients within the catchment. Water quality data from the catchment outlet have been assessed and preliminary estimates of the spatial and temporal nature of the nutrient pathways have been determined. With estimates of source contribution, we have devised methodologies at every scale within the catchment to accurately estimate the nutrient fluxes and techniques to upscale from the field scale to the catchment scale.