Individual introduction – Izabela Bujak

I hold a Master degree in Environmental Protection from the AGH University of Science and Technology, Cracow (Poland). During my studies, I specialized in hydrogeology. Currently, I work as an Early Stage Researcher at Helmholtz Centre for Environmental Research – UFZ in Halle (Germany), where, as a part of INSPIRATION project, I investigate large (regional) scale N dynamics in river catchments impacted by agriculture.

Several environmental problems motivate me to conduct my research. In the last decades, the N-balance has been altered due to the extensive agricultural and urban development, leading to the elevated inorganic nitrogen concentrations, deteriorating water quality, and causing eutrophication. Appropriate nitrogen assessment and management is still challenging for water resource managers and policymakers especially in the agricultural watersheds. A crucial issue in order to improve nutrient management and to prevent eutrophication of ecosystems is an accurate quantification of N and water fluxes, which is problematic especially in large (regional) scale. Many former studies deduce information about N sources and N transformation processes in river catchments using nitrate concentrations and corresponding isotopic signatures ($\delta^{15}N$, $\delta^{18}O$). Although multi-isotope approach opened the opportunity to better estimate large-scale N and water fluxes, this approach is still not widely used. Therefore, the challenge of my project is to characterize and compare large (regional) scale N dynamics in three river catchments impacted by agriculture using multi-isotope approach, coupled with hydrological modelling and statistical methods.

For purposes of this research, I selected for further investigations three mesoscale river catchments across Europe. The largest one (3200km^2) is Bode River catchment located in Harz Mountains in Germany, followed by Erlauf River catchment (595km^2) in alpine foothills in Austria, and highly agricultural Geer River catchment (480km^2) in Belgium. During last months, I established monitoring programmes for Erlauf and Geer catchments, including surface water and precipitation samples collection. Surface water sampling campaigns are conducted every two months including in-field measurements (EC, T, pH, Eh, DO, alkalinity), and further laboratory analysis of major ions and stable isotopes of nitrate ($\delta^{15}N$, $\delta^{18}O$), water ($\delta^{2}H$, $\delta^{18}O$), sulphate ($\delta^{34}S$, $\delta^{18}O$), and dissolved inorganic carbon ($\delta^{13}C$). Data sets obtained during conducted sampling campaigns can be further compiled with vast data set already available for Bode catchment. Except my laboratory and field activities, I am continuously working on statistical analyses of temporal and spatial isotope distribution patterns with respect to the available area data (e.g. soil type, land use, geology). One of the statistical approaches which I apply is the usage of Stable Isotope Bayesian Mixing Models (e.g. MixSIAR, SIBER). There is still a room for improvement in the application of such models in catchment-scale investigations and I hope my research will contribute to it. Besides, a lot of valuable information can be obtained by interpreting stable isotope data along with a current river discharge - it is why my further activities involve hydrological modelling.

This research focuses on N dynamics in agricultural catchments and it is designed to contribute to the refinement of multi-isotope techniques for large-scale applications. Moreover, knowledge and valuable

datasets gained in respective study catchments can be taken into account by water resource managers and policymakers and serve as the hints for appropriate nitrogen assessment and management.