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The impact of surface water - groundwater interactions on nitrate cycling assessed by means of hydrogeologic and isotopic techniques in the Alento river basin (Italy)

Luisa Stellato (1), Brunella Di Rienzo (1), Egidio Di Fusco (1), Mauro Rubino (1), Fabio Marzaioli (1), Filippo Terrasi (1), Antonio D'Onofrio (1), Pantaleone De Vita (2), Vincenzo Allocca (2), Antonio Salluzzo (3), Juri Rimauro (3), Nunzio Romano (4), and Fulvio Celico (5)

(1) Seconda Università degli Studi di Napoli, Dept. Mathematics and Physics, Caserta, Italy (luisa.stellato@unina2.it), (2) Dipartimento di Scienze della Terra, dell'Ambiente e delle Risorse (DiSTAR), Università di Napoli Federico II,Via Mezzocannone, 8, 80134, Napoli, Italy, (3) ENEA - Research Center of Portici, UTTP-CHIA, Environmental Chemistry Laboratory, Piazzale E. Fermi, 1, 80055 Portici (Napoli), Italy, (4) Dept. of Agriculture, Division of Agricultural, Forest and Biosystems Engineering, Università di Napoli Federico II, Via Università, 100, 80055, Portici (Napoli), Italy, (5) Interdisciplinary Centre for Studies on Water Resources, Department of Physics and Earth Sciences "Macedonio Melloni", University of Parma, Parco Area delle Scienze, 157/A, 43124, Parma, Italy

Currently a major concern of water resources managers is to understand the fate and dynamics of nutrients in riverine ecosystems because of their potential impacts on both river quality and human health (e.g., European Council Directive 91/676/EEC). Nutrients are released within a catchment (or river basin) mainly by agricultural practices and urban/industrial activities, in addition to natural sources such as soils and organic matter. They are discharged into surface water bodies by means of nutrient-rich groundwater inflows and/or overland flow pathways, which can be important controls on hot moment/hot spot type biogeochemical behaviors. Groundwater has been recognized to have a major role in controlling stream ecosystem health since it influences stream ecology when surface and subsurface water are hydraulically connected. In particular, processes occurring at the reach or sub-reach scale more directly influence nutrient transport to rivers than larger scale processes.
In this general context, the main scope of this study, within the framework of the IAEA Coordinated Research Project (CRP) "Environmental Isotopes and Age Dating Methods to Assess Nitrogen Pollution and Other Quality Issues in Rivers", was to spatially and temporally quantify groundwater inflows to the Alento river (Southern Italy) to characterize sw-gw interactions in the catchment in order to finally assess nitrates contamination of a groundwater dependent river ecosystem.
Four sampling campaigns have been carried out in July and October 2014, in April 2015 and in June 2016 during which 1 spring, rain water, 17 surface water and 27 groundwater points were sampled all over the plain. The piezometric reconstruction has been realized by means of the monitoring of groundwater levels in 43 domestic and agricultural wells (10-15 m deep).
The preliminary hydrogeological (water table morphology and stream discharge measurements), physico-chemical (T and EC), hydrochemical and isotopic (222Rn, δD and δ18O) data evidence a gaining river in the northern part of the plain. Moreover, δD and δ18O data evidence a fast recharge from seasonal precipitations originating from evaporated and re-evaporated air masses. Finally, even though chemical data evidence no groundwater nitrate pollution (< 50 mg L-1) in the study area, δ15N and δ18O of dissolved nitrates have been used to infer possible nitrate sources in the study area.