

Variation of nitrates in a small mountain catchment

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Abstract

The paper presents results of nitrate concentrations monitoring in a small mountain catchment of the Jalovecký creek, north Slovakia. Water samples from the Jalovecky creek have been collected since October 2003 at two sites. One site (denoted as "Mountains") represents mountain catchment with human activities restricted only to tourism. The second site ("Valley") is located downstream from the first site in a populated area. Concentrations of nitrates in the creek at both sites typically do not differ very much except of the snowmelt period. Leaching of nitrates from the fertilized pastures (liquid manure applied in winter) during the snowmelt appears to be the reason of large differences between the two sites during the snowmelt period. Seasonal course of nitrates concentrations shows that snowmelt is the period with largest concentrations throughout the year, too. Weekly sampling during that period can lead to biased conclusions on the variation of nitrates in the creek. Comparison of our data with the data collected during snowmelt at the end of 1980-ties and the beginning of 1990-ties (which was the time of highest atmospheric deposition rates) showed that present concentrations of nitrates in the stream have similar magintude.

KEYWORDS: nitrates in stream water, mountainous catchments

Introduction

Nitrogen is one of the main atmospheric components influencing ecosystems. Central Europe was subjected to high increase of the emissions of various nitrogen species after the World War II. Drastic changes in industry after 1990 lead to the reduction of N emissions by 30%. Kopáček et at. (2001) pointed out that published trends in water chemistry provide the only information on changes in composition relative to changing atmospheric depositions. Yet, regular monitoring of water chemistry, especially in fragile mountain ecosystems, is not very frequent.

Our contribution presents data on seasonal variation of nitrates in the Jalovecký creek, a mountain stream draining contrasting areas in the Western Tatra mountains and the Liptov valley (Fig.1). While the upper part of the catchment is mountainous (elevation up to 2178 m a.s.l.) with very restricted human activities, the downstream part of the catchment (creek mouth is at 550 m a.s.l.) is situated in rural area with villages and agriculture. Water samples are collected since October 2003 at two sites characterizing both areas (e.g. "Mountains" and "Valley"). Sampling frequency varied - water samples were collected about biweekly during the cold part of the year (October 2003 - April 2004) and weekly during the warm part of the year (May-October 2004). More frequent sampling was performed at the beginning of the snowmelt in March 2003 and during one rainfall-runoff event in August 2004. The data are collected as part of the testing program within the EU project SEWING (System for European Water Monitoring, <http://www.sewing.mixdes.org>) devoted to the development of a system for the monitoring and early warning of water pollution. Concentration of nitrates was determined by a certified methodology using colorimetry. Detection limit of the analytical method is 1 mg.l^{-1} .

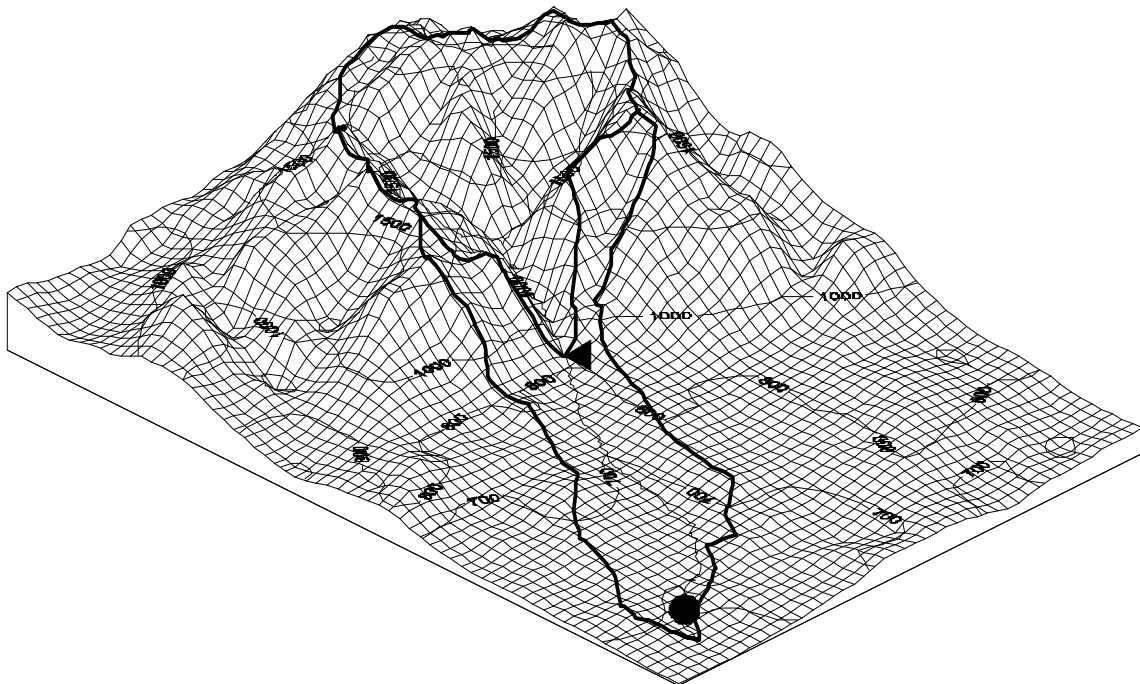


Fig. 1. The Jalovecký creek catchment and the sampling points at the outlet of the mountain part (triangle) and near the end of the whole catchment (circle).

Seasonal variations of nitrates

Concentrations of nitrates in the Jalovecký creek are shown in Fig. 2. Concentrations at both sites were rather similar for about 7 months (May to November). Autumn concentrations (between September and mid October) were rather often below the detection limit. Highest

concentrations of nitrates occurred during snowmelt, especially at its beginning. The differences between the two profiles at that time were remarkable. Very high concentrations of nitrates at the "Valley" profile in February and end of March were probably caused by leaching from the fertilizers applied on the pastures during the winter. Concentrations of nitrates at the "Mountain" site varied between less than 1 mg.l⁻¹ and 3.09 mg.l⁻¹. Concentrations at the "Valley site varied from less than 1 mg.l⁻¹ to 22.8 mg.l⁻¹.

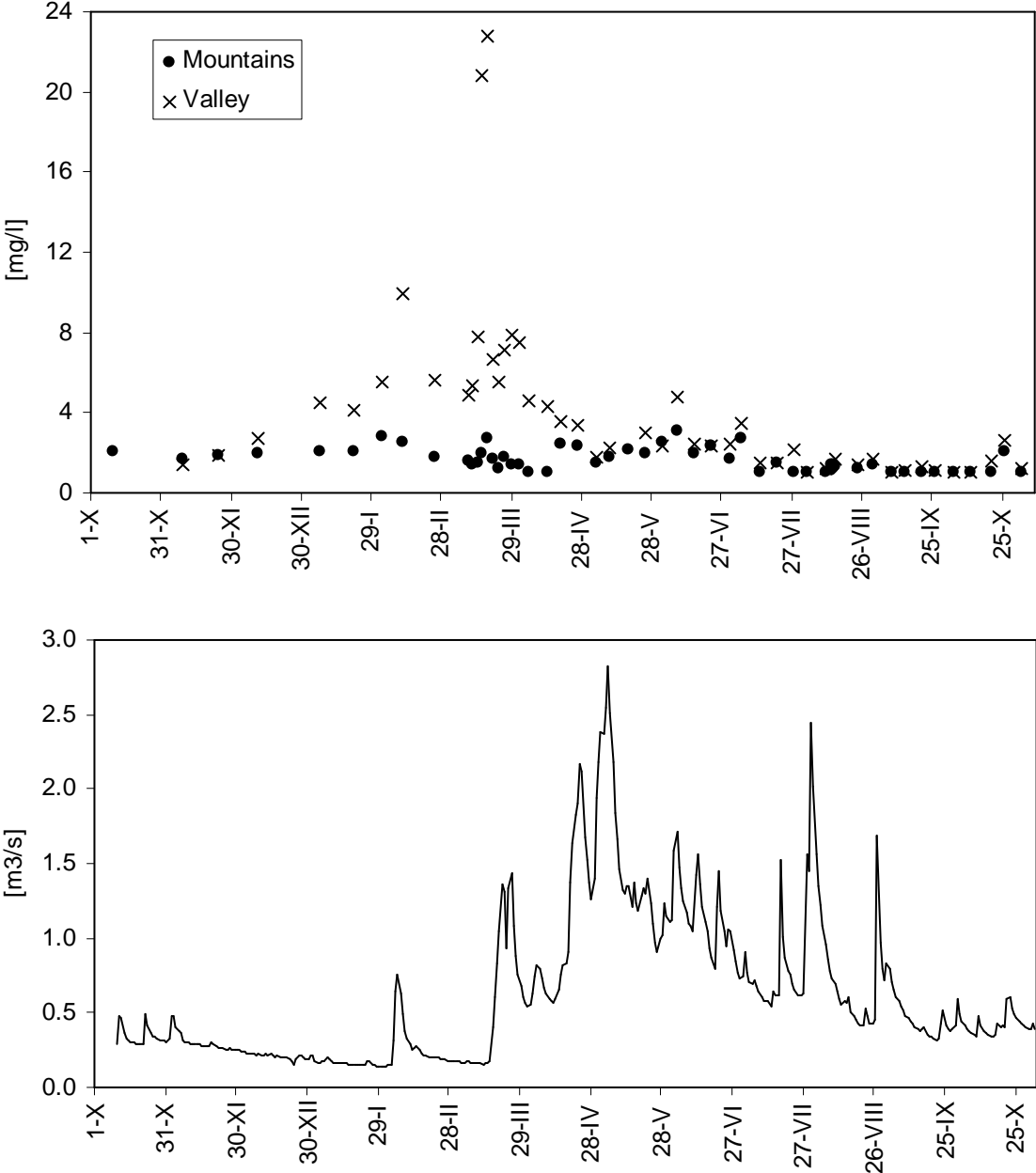


Fig. 2. Concentrations of nitrates in the Jalovecky creek since autumn 2004 at two sampling points [mg.l⁻¹] and discharge at the point representing the outlet of the mountain part of the catchment [m³.s⁻¹].

Concentrations of nitrates in precipitation collected in the highest part of the catchment in summer 2003 (mid June- mid October) varied between 0.7 and 4.8 mg.l⁻¹. Maximum concentration of nitrates in snow samples collected in the middle of March and at the beginning of April 2004 was 1.63 mg.l⁻¹; the concentrations for most of 15 samples were below the detection limit. However, it is not known if the concentrations were not influenced during melting of snow samples.

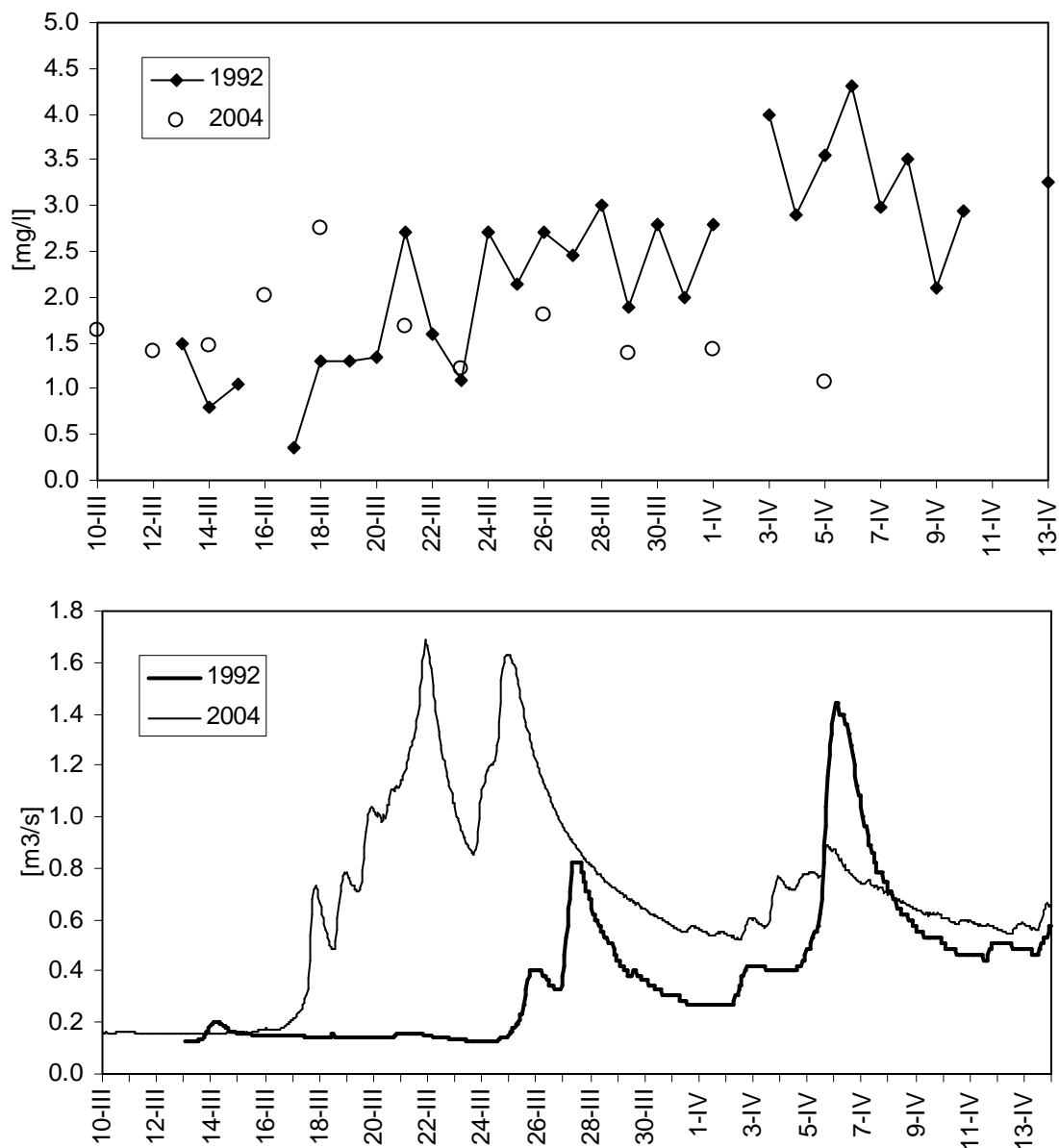


Fig. 3. Concentration of nitrates in the Jalovecky creek at site "Mountains" in springs 1992 and 2004 autumn 2004 [mg.l⁻¹] and stream discharge [m³.s⁻¹].

Comparison of our data with the older data from the cold period of the year collected at the end of 1980-ies (Babiaková et al., 1990) and at the beginning of 1990-ties has shown that the concentrations of nitrates at the "Mountains" site were quite similar (Fig. 3). Although the

variation of nitrates in the mountains is not very high, all data series indicate that weekly sampling during the snowmelt events may lead to biased conclusions. Proper estimation of transport of nitrates in the valley should certainly be based on the daily data.

Acknowledgement

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