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Variation of nonpoint-source nutrient concentration in interflow affected by winter processes in Shenyang, China

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Abstract In the mid-latitude climatic region (35–65°), long-term winter processes with freeze–thaw cycles (FTC) may have profound effects on nutrient transformation and soil structure, and consequently impact nonpoint-source (NPS) nutrient concentration in interflow. Under realistic soil temperature fluctuations, concentrations of nitrogen (N) and phosphorus (P) in interflow were investigated before winter and after winter. At all sites, N and P concentrations varied markedly before and after winter. TN interflow fluxes were 5 times higher after winter in arable land and grassland than before winter, whereas TP concentrations were lower. There was a consistent variation between arable and grass before and after winter. These results are mainly attributed to effects of winter processes on N and P accumulation and transformation, and soil structure. Soil frost causes a reduction in runoff and in nutrient uptake by vegetation, causing TN and TP concentrations in soils to increase during winter. Further, FTC cause the disruption of soil structure, and induce more micro-aggregates. This effect releases more N from the destroyed aggregate. In contrast, the TP concentration decreased, which is likely due to the adsorption of P on exposed new surfaces and the high adsorption capacity of dissolved P. This study suggests that NPS nutrient concentrations in interflow are impacted by winter processes in the mid-latitude climatic region, and that interflow should be considered as an important hydrological pathway of TN loss.

Key words nonpoint-source pollution; freeze–thaw cycles; nitrogen; phosphorus; interflow; Shenyang, China