



Groundwater-born nitrogen emissions to surface waters – which areas are sensitive to manage them?

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For two Austrian catchment areas (400 km² and 1100 km²) subdivided in all together 9 subcatchments calculations on the nitrogen and phosphorus emissions to surface waters and the related emission pathways were performed. Generally, in both catchments the Wulka and the Ybbs catchment the groundwater is the main emission pathway for nitrogen.

Diffuse nitrogen emissions by groundwater were calculated to be about 5 kgN/ha*a in the Wulka catchment and about 20 kgN/ha*a in the Ybbs catchment. Related to the nitrogen surplus on the topsoil only 12% of the nitrogen surplus in the Wulka catchment is emitted to the surface water by groundwater, in the Ybbs catchment the nitrogen emission by groundwater amount 50 % as compared to the nitrogen surplus.

Water balance calculations indicated differences in hydrological conditions. Additionally, geological boundary conditions differ between the catchments resulting in a less groundwater residence time in the Ybbs catchment as compared to the Wulka catchment and thus in a lower nitrogen retention by denitrification in the groundwater. Measurements of nitrogen concentrations in groundwater support this assumption and confirm the importance of the groundwater residence time on the nitrogen retention in the groundwater by denitrification.

To determine the groundwater residence time and the retention potential for nitrogen in the groundwater a simple approach using groundwater table information, geological information and location of the river network was applied. The mean calculated groundwater residence time is 6 times higher in the Wulka catchment as compared to the Ybbs catchment and explains the higher nitrogen retention in the groundwater of the Wulka catchment.

It was found, that due to the nitrogen retention in the groundwater in both catchments the Ybbs and the Wulka catchment a high amount of the total nitrogen loads stem from areas with a groundwater residence time smaller than 1 year. This indicates the importance of the consideration of (i) the zones near the river system in terms of management strategies and (ii) the retention potential due to site specific conditions of ecosystems aiming at a reduction of diffuse nitrogen emissions to the surface waters.

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