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Combined use of N and O isotopes in nitrate and B isotopes to identify sources of nitrate pollution in surface water in Flanders.

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Different policy measures have been taken to reduce nitrate pollution originating from agriculture in surface and groundwater in Flanders (e.g. the Manure Action Plan or MAP) for the implementation of the Nitrates Directive (91/976/EEC). The extensive MAP monitoring network was established in agricultural areas by the Flemish Environment Agency (VMM) since 1999 in order to evaluate the effectiveness of the policy measures taken by monitoring nitrate concentrations. In order to establish more effective source-oriented remediation, identification of the different nitrate pollution sources and assessment of their contribution is needed. Recent studies have demonstrated that stable isotope analysis of nitrate (δ^{15}N and δ^{18}O) and boron (δ^{11}B) can be successfully used for nitrate source apportionment.

In this study six MAP points located in the northern region of Flanders were monitored on a monthly basis during one year (February 2006-March 2007). These MAP points regularly showed elevated nitrate concentrations, which were assumed to originate mainly from excess animal manure application. The objective of this study was to investigate whether other potential nitrogen sources (greenhouse or domestic wastewater discharges, mineral fertilizers, atmospheric deposition, soil N) significantly contribute to the observed nitrate pollution.

The isotopic composition of the potential nitrate sources in the study area has been characterised and surface water samples were selected for analysis of δ^{15}N and δ^{18}O in nitrate and δ^{11}B. Combined δ^{15}N and δ^{18}O analysis of nitrate in water samples confirmed that in four MAP points nitrate pollution could be almost completely attributed to animal manure application or domestic wastewater discharges. We will evaluate the potential of additional δ^{11}B analyses to discriminate between these two sources and to verify if there was a significant contribution from domestic wastewater discharges. In two MAP points, the nitrate isotope data indicated a significant contribution of mineral fertilizers or greenhouse discharges next to animal manure at several sampling dates. The nitrate isotope data showed that nitrate sampled in the summer period (May-July 2006) had probably been subject to denitrification, which complicates interpretation of δ^{15}N and δ^{18}O data for source apportionment.