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## **The use of natural isotopes for identifying the origins of groundwater flows: Drentsche Aa Brook Valley, The Netherlands.**

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This paper investigates the origin of various groundwater flows in a small brook valley reserve Drentsche Aa Valley in the northern part of the Netherlands. The aim was also to validate a hydrological model that simulated coupled particle flow in this area and also incorporated different scenarios for groundwater abstraction in order to predict future implications of groundwater abstraction on ecological values.

Water samples from various sites and depths were analysed for macro-ionic composition, stable isotopes ( $^2\text{H}$  and  $^{18}\text{O}$ ) and also  $^{14}\text{C}$ . Three sites have  $^{14}\text{C}$  activities over 100%, indicating very recent water. The main groundwater discharge areas showed inflow of old groundwater up to 5000 years. Inflow of different groundwater flows of various ages could be detected most clearly from the  $^{14}\text{C}$  data. Downstream area that were affected by groundwater abstraction showed distinct infiltration characteristics, both in macro-ionic composition and contents of natural isotopes, to a depth of 6m below surface

In the main exfiltration areas, we found that at 95 meters below the surface, the groundwater was characterized by a NaCl type groundwater facies. But the absolute concentrations were not high enough to conclude that double diffusive convection (DDC) near a salt diapir was responsible for this effect.