



Interaction of Surface Water and Groundwater

Many issues of hydrogeological and water management can be clarified by analyzing natural and anthropogenic tracers. The stable isotopes of water ($^2\text{H}/^1\text{H}$, $^{18}\text{O}/^{16}\text{O}$), tritium (^3H), helium isotopes (^3He , ^4He), carbon-14 (^{14}C) and anthropogenic trace substances such as fluorocarbons CFC/SF₆, sweeteners (acesulfame, saccharine) or krypton (^{85}Kr) provide specific information about the entry of surface water (e.g. treated/untreated sewage, rainwater, irrigation, roof drain, flushing water from boreholes, infiltration of river or lake water) into the subsoil. Each tracer shows a specific, often time-periodic input behavior that allows conclusions to be drawn about the period and the amount of surface water inflow. In addition to groundwater dating, abstraction quantities, protection and catchment areas of groundwater bodies can be evaluated.



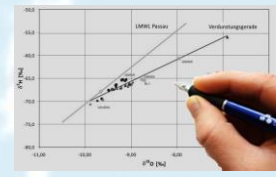
Sampling



Preparation



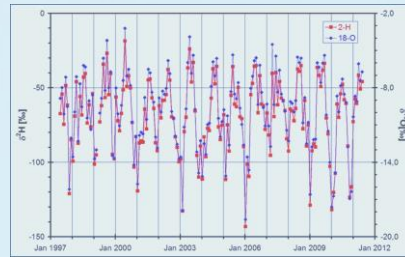
Analysis



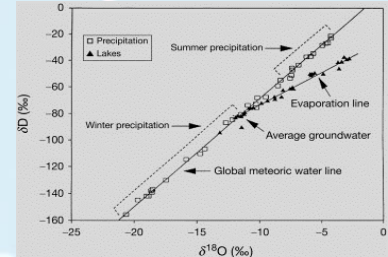
Expertise



The influx of surface water into groundwater can be determined by natural and anthropogenic tracers.



Time series of stable water isotopes ($^2\text{H}/^1\text{H}$, $^{18}\text{O}/^{16}\text{O}$) in river and lake water show a significant seasonal effect due to evaporation.



Based on the change in stable isotope values ($^2\text{H}/^1\text{H}$, $^{18}\text{O}/^{16}\text{O}$), the infiltration of river or lake water into groundwater can be determined.

Workflow

- We develop an investigation concept regarding local conditions.
- We provide sampling flasks and protocols.
- We determine anthropogenic and isotope tracers.
- We evaluate and quantify the interactions between surface water and groundwater.

Costs

$^2\text{H}/^1\text{H}$, $^{18}\text{O}/^{16}\text{O}$: 35 – 55 € per sample
 Tritium ^3H : 140 – 180 € per sample
 CFC/SF₆: 360 – 440 € per sample
 Sweeteners: 180 – 220 € per sample
 ^{14}C incl. $^{13}\text{C}/^{12}\text{C}$: 390 – 490 € per sample

Benefit

- Water origin and composition of dynamic aquifers
- Mixing ratio of surface and groundwater
- Dating of river or lake water infiltration
- Forensic assessment of groundwater inputs

References

Leibundgut CH, Maloszewski P, Külls CH (2009) Tracers in Hydrology. John Wiley & Sons, 415 S.
 Mook WG (2000) Environmental isotopes in the hydrological cycle. Principles and applications. IHP-V Technical Documents in Hydrology, N° 39. UNESCO – IAEA.
 Cook P (2020) Introduction to isotopes and environmental tracers as indicators of groundwater flow. Published by the Groundwater Project.

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