



IsoGW: groundwater isoscapes for Germany

Aixala Gaillard¹, Andreas Wagner², Andreas Neuner², Dominik Kremer², Blake Walker², Jessica Landgraf³, Axel Schmidt³, Paul Königer⁴, Stephan Braune⁴, Michael Heidinger⁵, Heinrich Eisenmann⁶, Philip Schuler⁷, Robert van Geldern¹, and Johannes A. C. Barth¹

¹Geozentrum Nordbayern, Friedrich-Alexander-Universität Erlangen Nürnberg, Erlangen, Germany

²DHSS, Friedrich-Alexander-Universität Erlangen Nürnberg, Erlangen, Germany

³Bundesanstalt für Gewässerkunde (BfG), Koblenz, Germany

⁴Bundesanstalt für Geowissenschaften und Rohstoffe (BGR), Berlin-Spandau, Germany

⁵Hydrolsotop GmbH, Schweitenkirchen, Germany

⁶Isodetect GmbH, Leipzig, Germany

⁷CDM Smith Consult GmbH, Berlin, Germany

Landuse and climate change alter hydrological processes and affect drinking water resources. Practical tools for understanding and quantifying these processes becomes increasingly important, for example to sustainably manage groundwater reservoirs. Analyses of the water isotopes deuterium ($\delta^2\text{H}$), oxygen ($\delta^{18}\text{O}$), and tritium (^3H) provide useful tools, which can be applied to determine groundwater ages, assess bank filtration quantities, identify mixings of groundwater aquifers or long-term climate-induced changes. The objective of the IsoGW-project (2023-2026) is to create nation-wide interpolated isotope maps (i.e., isoscapes) of $\delta^2\text{H}$, $\delta^{18}\text{O}$ and of ^3H concentrations in German groundwaters. Aiming to provide public access to the data, an online map service and portal are set to present both the interpolated and interpreted maps as well as harmonised isotope data across the 16 German states in all relevant hydrologic compartments (groundwater, precipitation and surface waters). This work, based on an exceptional density of data points, provides new opportunities for a systematic and large-scale assessment of interactions between different compartments of the water cycle such as surface water-groundwater interactions and groundwater renewal. By establishing such a service for the first time, Germany is following its European partners, which have already published some preliminary work on the matter.

Existing data has been collected from German state offices, literature, companies and is being completed by new sampling campaigns within the project until a satisfying spacial point distribution and density is reached. Additionally, several interpolation algorithms for $\delta^2\text{H}$ and $\delta^{18}\text{O}$, as well as different methods accounting for the ^3H half-life of 12.3 years, are compared. Here, we present the latest updates regarding data research, sampling and analyses, interpolation algorithms, as well as database and web tool development. Overall, we are confident that this database and online portal will enable large-scale assessments of the water cycle and provide an important basis also for local studies. This work will be accompanied by a practice guide that will allow researchers and practitioners to use the data and tools for all these assessments.

