Results of a reference-date measurement of 153 springs and creeks within the Tuxbach catchment area, Tyrol, Austria

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Extended Abstract

The Tuxertal (Tux Valley) is located in the Eastern Alps in Tyrol, Austria and is drained by the Tuxbach (Tux Creek). The catchment area comprises 135 km², with the Olperer (3,476 m) as the highest elevation point and the confluence of the Tuxbach into the Zemmbach at Gstan (645 m) as lowest point. Geologically, the Tuxertal belongs to the north-western edge of the Tauern Window and therefore exhibits a complex petrographic and tectonic structure.

In the Tuxertal, small cooperatives or private owners organise the drinking water supply and operate nearby springs. These springs are mostly fed by small catchment areas. Due to the complex geology groundwater quality can differ on a small scale. The crystalline rocks can cause an exceedance of critical values defined in Austria's drinking water ordinance (BMSG 2001), especially with respect to heavy metal concentrations. Another challenge for drinking water supply is to find springs with sufficient discharge rates, resilient to modifications induced by climate change. A regional overview of the groundwater quality and quantity is crucial to identify the most suitable springs and to replace springs with elevated metal concentrations or insufficient discharge. A reference-date measurement, covering the whole Tuxertal, served to compile hydrochemical data and to provide decision-makers with adequate information to ensure a reliable drinking water supply. During 21 and 31 August 2018 a total number of 147 springs and 6 creeks were sampled. With this publication we provide the results of the reference-date measurement as *.xlsx* and *.csv* file.

A water analysis contains up to 51 entries sorted by metadata, physical-chemical (sum-)parameters, chemical parameter analysed by ion exchange chromatography (IC), the titration for bicarbonate in-situ, as well as chemical parameters analysed by induced coupled plasma mass spectrometry (ICP-MS). Metadata contains the sample-ID, information on the spring type or creek, a classification of the dominant lithology of the catchment area, the coordinates, as well as the altitude of the measurement point. Differentiated spring types are barrier springs, contact springs, depression springs, fault springs, fissure springs, hillside springs, karst springs, talus springs, thermal springs, as well as valley springs. Special cases are creeks, one glacier and one rock glacier runoff. The dominant lithology is classified in six groups: schist (n = 17), gneiss (n = 17), phyllite (n = 19), marble (n = 25), unconsolidated rock (n = 27), as well as calcareous phyllite (n = 48). Physical-chemical (sum-)parameters contain the sampling date, water temperature, a measured and calculated electrical conductivity, pH, redox potential, oxygen content, oxygen saturation, and discharge. These parameters were measured in-situ by portable instruments (pocket meter Multi 340i by WTW, and HQd portable meter by Hach). Oxygen content and saturation could not be determined at every measuring point. The same applied to discharge and was estimated in few cases. The calculated electrical conductivity serves as a comparison to the measured values and to correct water analyses, if necessary and applicable. The calculation was done after the method by Rossum (1975) using the concentrations of the major components. Bicarbonate was determined in-situ via titration up to pH 4.3 using sulfuric acid and bromocresol green methyl orange as indicators (digital titrator by Hach). Some concentrations of molybdenum could not be analysed due to the low sample amount.

Further fields serve for a semi-automatic data evaluation, control, and interpretation. The concentration of total dissolved solids (TDS), equivalent concentrations, deviations of the electrical balance as well as the dominant ions defining the different water types are given within the section ‘evaluation’. Cations and anions are indicated, if they have an equivalent concentration of at least 20% (Michel 1997). They are listed with descending ratios, if equivalent concentrations of more than one cation or anion exceeds 20%. The electrical balance is calculated with the internationally common formula (e.g. Appelo and Postma 2007). Single ion concentrations of 13 analyses exceeded an electrical balance error of 5% and were corrected. One sample was re-analysed. These and other observations, like additional comments on the spring type or discharge measurement, can be found in the section ‘remarks’. Field with remarks are indicated with a dark grey filling.

Measured values are marked in colour, available only in the *.xlsx* version. The electrical conductivity is classified in three classes. Values <75 µs/cm appear in brown, values >500 µS/cm appear in blue, and values in between remain in black numerical digits. Ion or element concentrations and pH-values fulfilling the legal requirements are marked in green. Critical value exceedances are marked in red. This is the case with single pH, ammonium, nitrite, manganese, nickel, arsenic, antimony or uranium values. Averages values for the six lithologies, minima, medians, averages, and maxima of all 153 samples as well as the critical values defined in Austria’s drinking water ordinance (BMSG 2001) are given for a comparison at the end of the sheet.

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