Selection of representative groundwater monitoring wells – A compromise between site characteristics, data history, stakeholder interests and technological limitations

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In this presentation we provide a brief overview on the strategic selection of representative groundwater wells and lessons learned.

The inter-disciplinary project “Integrative Groundwater Assessment”, looks into the effects of extreme hydro-meteorological events on the quantity and the chemical and biological quality of groundwater. Focus is on the Austrian Mur catchment, an area reaching from its alpine spring (~2000 m asl) down to the Slovenian border (~200 m asl). More than 500 state operated groundwater observation wells are available over the 400 km of the river’s course, taking private wells not into account. For state operated wells, time series for water levels are publicly available which allows for simply using all the data i.e. using big data approaches [1, 2, 3] – albeit with some issues [4].

However, for water quality, such time series rarely exist and if so, they often do not cover all specific parameters one needs, asking for targeted sampling campaigns. The availability of hundreds of wells seems like a benefit. However, the identification of wells that are representative and suitable for sampling regarding both chemical and biological parameters is a challenging task.

In consequence, we went through a multi-step process of planning a sampling campaign that should fulfill the following requirements:

- Coverage of the entire stream section from alpine to lowland regions
- Coverage of different land uses in the river valley
- Realization of well transects from the river through the complete local aquifer
- Wells allow sampling of groundwater for the analysis of physical-chemical and biological parameters
- Historical data of groundwater quantity and quality aspects are available
Assessing the available metadata and taking into account the very helpful advice of stakeholders, already reduced the number of representative wells considerably. In order to obtain a consistent data set, another set of wells had to be dismissed, to allow for the same sampling and monitoring procedures at every location. Finally, out in the field, wells that were found damaged or out of order, led to a further reduction. Thus we ended up with only 45 wells suitable for our specific purposes, <10% of what seemed available at the beginning.

However, using specific strategies for data analysis as outlined in [3] and [4] and application of a novel groundwater ecological assessment scheme (D-A-C Index [5]) showed that even the substantially reduced number of wells provides a very good coverage of the various regions in the Mur catchment. In a further step, the results from two sampling campaigns and subsequent data analysis will be used to select an even smaller subset of wells where novel multi-parameter spectral dataloggers are going to be installed, enabling us to monitor various quality data in an very high temporal resolution.

References:
[1] https://doi.org/10.5194/egusphere-egu2020-8148
[3] https://doi.org/10.1007/s12665-018-7469-4
Tiny steps towards Big Data - Freud und Leid der Arbeit mit großen Grundwasserdatensätzen.