Climate change vs. human impact. A look into Austrian groundwater

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Climate change is mostly associated with the term of “global warming” and thus conjures images of a hotter and dryer future. Indeed, the Alpine region already has seen much higher warming compared to the average of the northern hemisphere [1]. However, because of the impact of other climate variables (e.g. precipitation) and vegetation responses, warming does not necessarily have to mean higher evapotranspiration and dryer conditions [2]. This matter is further complicated as groundwater is closely interlinked with surface water. While surface water is of course related to precipitation, it is also one of the major pathways for humans to have a large and direct impact on the water cycle, e.g. by the construction of run-of-river powerplants. A further direct human impact is the abstraction of groundwater. For this factor, it is generally understood that water use increased with economic activity until the rise of environmentalism in the 1980s and more efficient water use stopped this trend and turned it into a decrease in many industrialized countries.

Assessing impacts of climate change on groundwater resources therefore is a challenging task. In order to assess these, as well as direct human impacts on groundwater, we analyzed a large dataset (1017 groundwater level-, 426 stream stage- and 646 precipitation time series) covering Austria from earlier than 1930 until 2015, with the majority of the data from the 1970s on.

It is shown that groundwater shows a strong falling trend, followed by a rise, fitting the human water use, whereas precipitation shows a more moderate trend. River stages show a completely deviating behavior before the 1980s but also follow the rising trend afterwards [3]. While this does not yet prove a causal link, it does highlight the possibility that human use could affect groundwater levels more than the climate, especially since Austria almost exclusively uses groundwater for human use and the wells in the dataset are all located in the populated lowlands.

Going beyond [3], we take a closer look at the history and future of the human factor, namely water abstraction for public water supply and the effects of humans on rivers. We show that Austria has a very particular form of water supply, mainly due to the special role of the capital,
Vienna, whose history could see a repeat in the near future. Under a changing climate, there is also a possibility for further changes in Austria’s rivers. In addition to effects of such changes on groundwater levels, we try to address potential impacts on the chemical quality and ecological status of groundwater.

References:

