Reviewing our options: How can we address climate change impacts in hydrogeological studies?

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Arguably, the groundwater community has responded more slowly to the challenges posed by climate change than other fields of (hydrological) science. However, in recent years a strong increase in studies addressing climate change impacts on groundwater is observed, and recommendations on the methodology of such studies have been developed and discussed (e.g. Holman et al., Hydrogeology Journal, 2012). Following the common practice in other fields of climate change research, it was suggested that assessments of climate change impacts on groundwater should be based on multiple emission scenarios and a range of global and regional climate models. This scenario-based, top-down approach involves the propagation of multi-model ensembles through a model chain starting from emission scenarios to global and regional climate models to impact models such as hydrological and groundwater models. However, as the uncertainty increases at each step of the model chain, the uncertainty in the assessment of local climate change impacts and the resulting recommendations for adaptation options likely are very high and thus of little use in practice. A vulnerability-based, bottom-up approach starting from the identification and analysis of the factors that are relevant for coping with climate change in a given system, therefore, was proposed as a complementary approach (e.g. Wilby and Dessai, Weather, 2010). “Storylines” (Shephard et al., Climatic Change, 2018) that aim at representing uncertainty in physical aspects of climate change in an event-based rather than probabilistic way appear to be consistent with the latter concept. In this poster we relate these concepts of climate change research to methodological frameworks established in hydrogeological research (e.g. multi-model approaches). We present an overview of potential tools, such as trading-space-for-time, historical data analysis, sensitivity analysis, climate projections and controlled experiments, that can be used to study climate change impacts, and we discuss their role and applicability within more general methodological frameworks.