Sensitivity of covered and confined aquifers to large- and local-scale climate variability over metropolitan France

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Résumé

While confined or covered aquifers (CAqs) are typically considered isolated and hence resilient to external pressures, they can still sometimes display significant hydraulic head variations on annual to decadal scales, suggesting some degree of responsiveness to climate variability. Within the framework of the France 2030 OneWater DEESAC project (Durabilité et Exploitabilité des Eaux Souterraines des Aquifères Captifs ou sous couverture), we investigate the sensitivity of such aquifers across metropolitan France to both large-scale and local-scale climate patterns using transfer entropy analysis on groundwater level (GWL) time series spanning a minimum of 25 years. Transfer entropy is used to quantify the information flow from climate variables to GWL in terms of causal relationships and associated lag times. Climate indices are used to assess the links between large-scale climate teleconnection patterns and GWL, while ERA5 and SAFRAN precipitation and temperature allow for assessing the connection to local climate inputs. By quantifying directed information flow between climate variables and GWL variations, we examine how spatial resolution and local climate heterogeneity influence CAqs: identifying areas involved in information flow from precipitation may help to identify recharge or pressure pulse transfer pathways controlling groundwater level. In addition, the quantification of information flow from climate indices to GWL provides an assessment of the impact of large-scale/global climate variability on CAqs.

Mots-Clés: DEESAC, Confined and covered aquifers, Transfer Entropy, Climate variability, Groundwater

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