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Supporting Information for

Understanding the geodetic signature of large aquifer systems: Example of the Ozark Plateaus in Central United States

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Introduction

The following files contains 9 figures and 1 table supporting the findings of the manuscript.

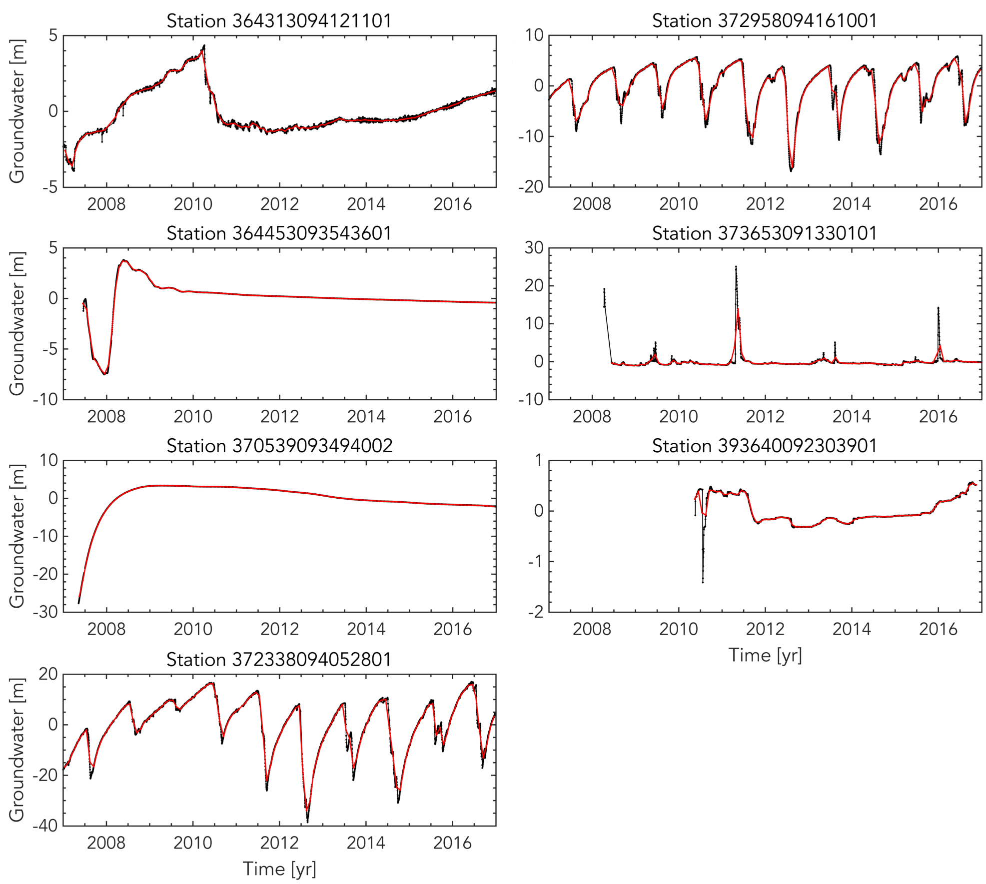
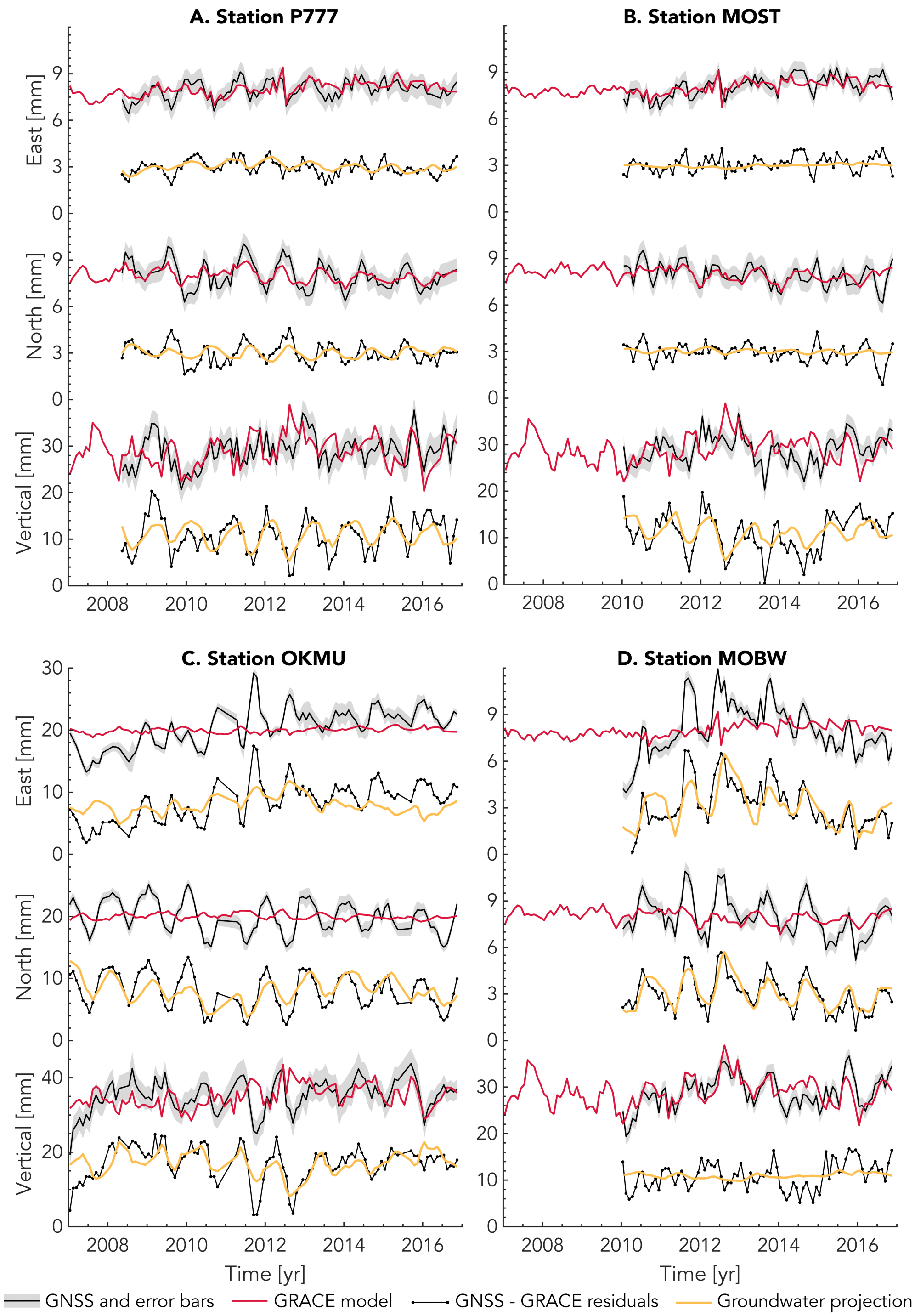


Figure S1: Groundwater time series excluded from the analysis. Black dots are the raw daily data and the red lines are the monthly averages. Stations 372958094161001 and 372338095042801 likely reflect local pumping effects.


A. Station P777
B. Station MOST
C. Station OKMU
D. Station MOBW
East [mm]
North [mm]
Vertical [mm]
Time [yr]
2008
2010
2012
2014
2016
GNSS and error bars
GRACE model
GNSS - GRACE residuals
Groundwater projection

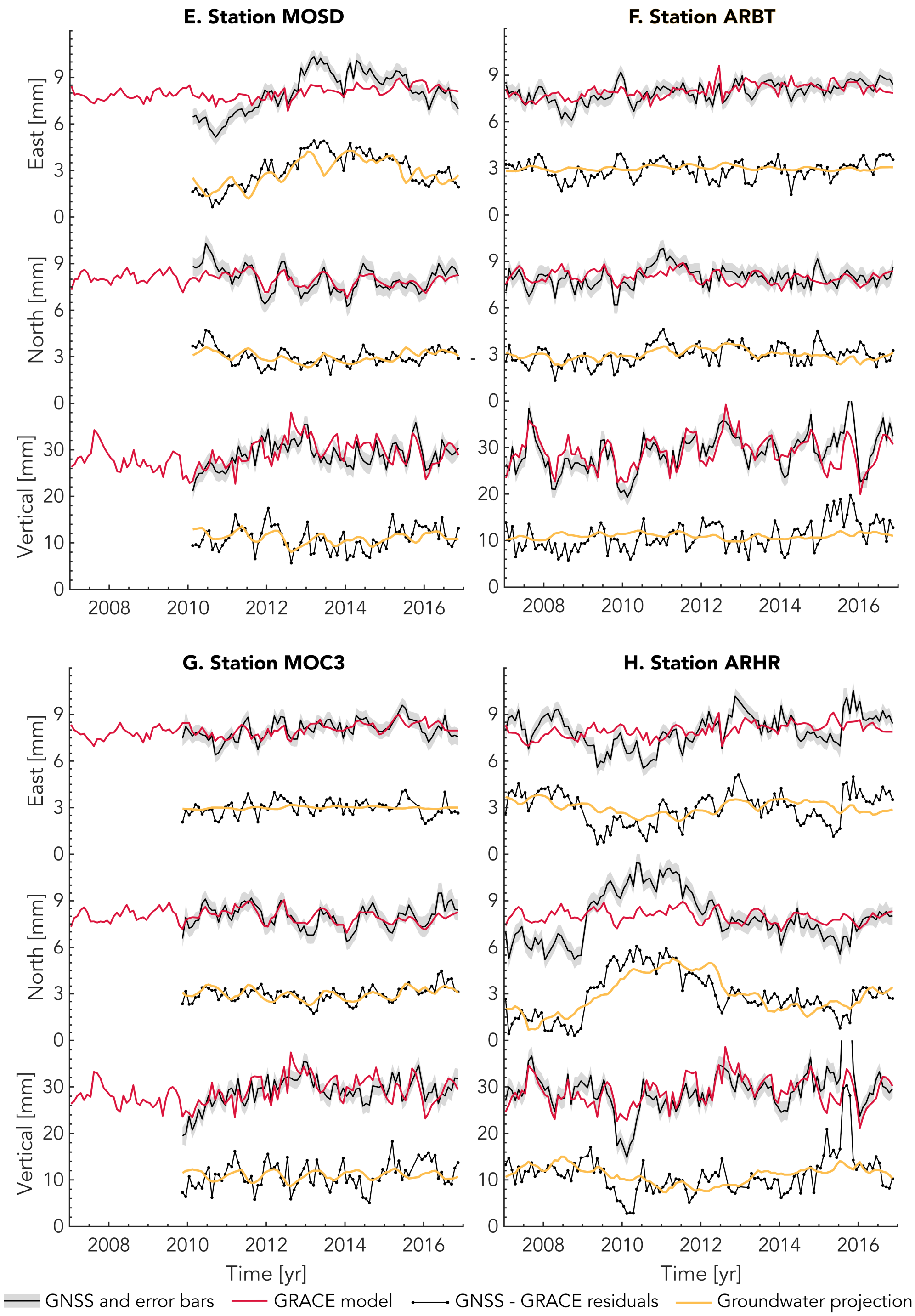


Figure S2: Additional examples of extracted poroelastic signals at different GNSS stations as in Figure 7. Note the different scales for station OKMU.

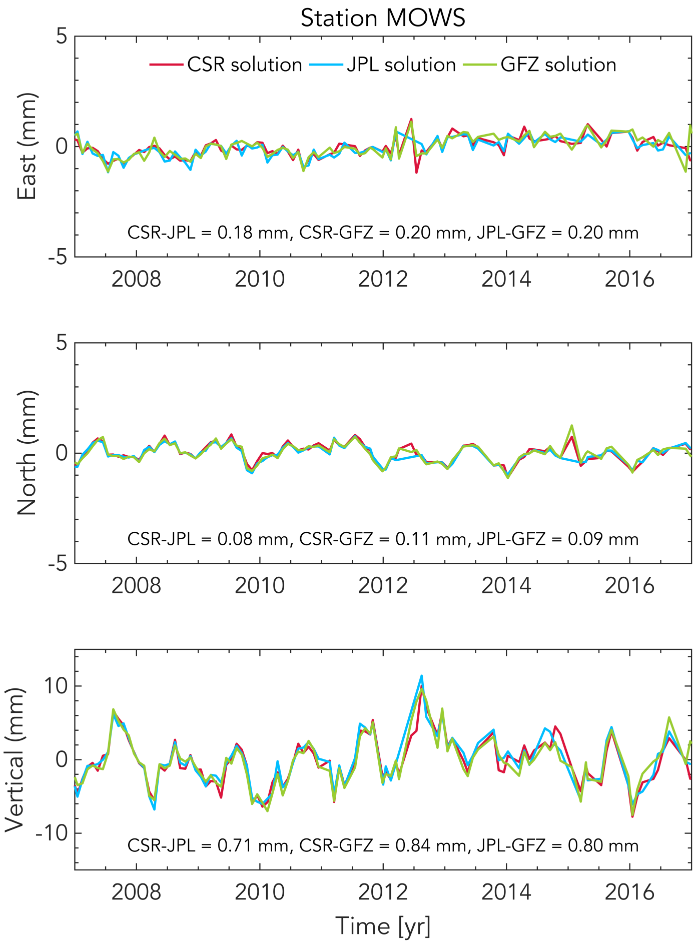


Figure S3: Modeled hydrological elastic loading displacements with different GRACE solutions. The mean absolute deviation between the different solutions are indicated in each subplot.

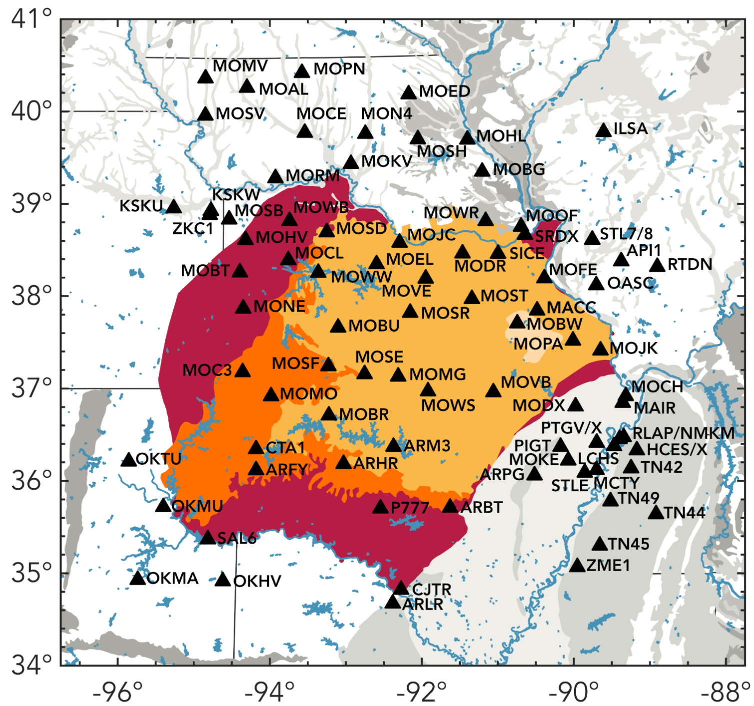


Figure S4: Names of the 86 GNSS stations retained for the analysis.

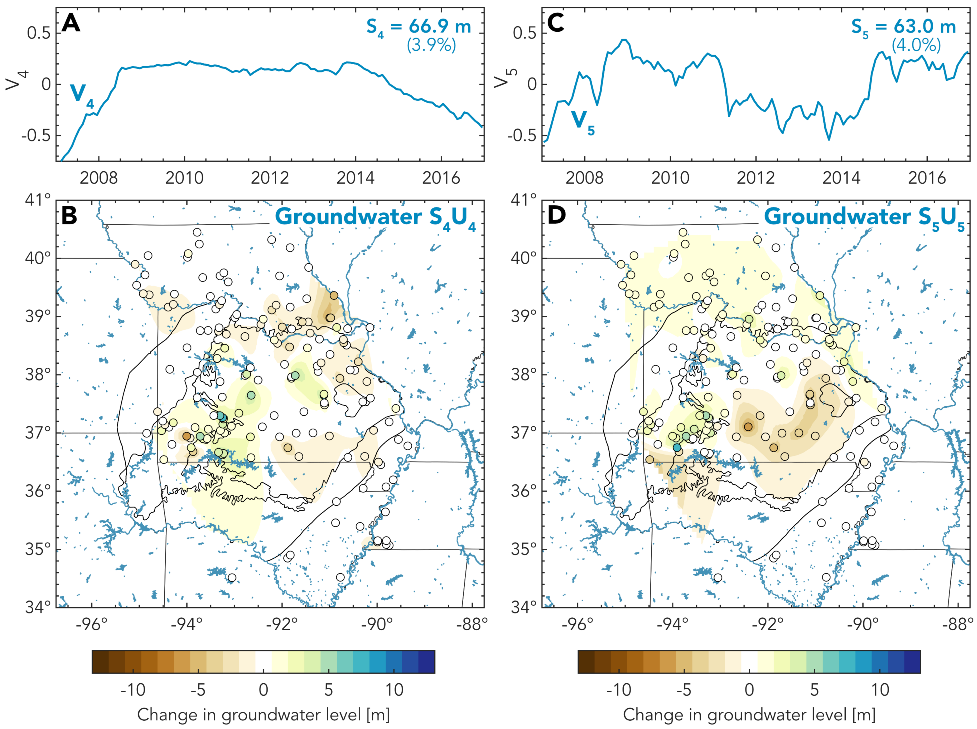


Figure S5: IC4 and IC5 of a 5-components groundwater ICA. IC1, IC2 and IC3 are similar to the 3-components ICA in Figure 5.

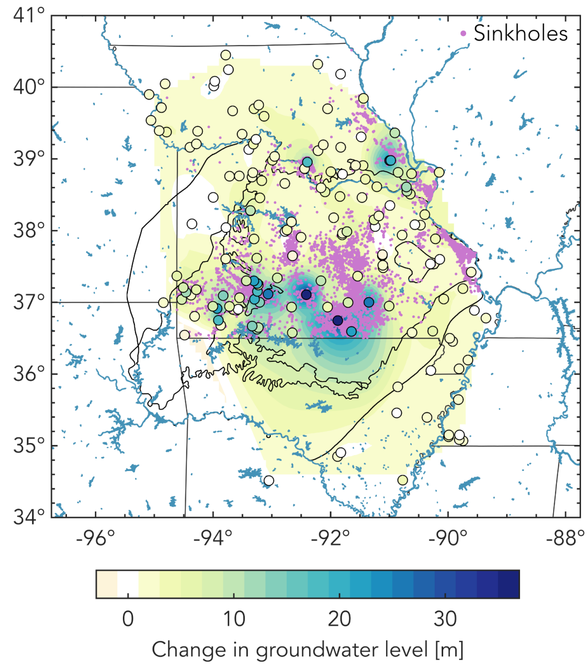


Figure S6: Comparison between the spatial distributions of sinkholes (proxy for karstification) and groundwater IC1. Purple dots indicate the location of known sinkholes in Missouri as reported by the Missouri Geological Survey (https://dnr.mo.gov/geology/geosrv/envgeo/sinkholes.htm). The spatial distribution of IC1 groundwater (same as Figure 4B) is shown for comparison.

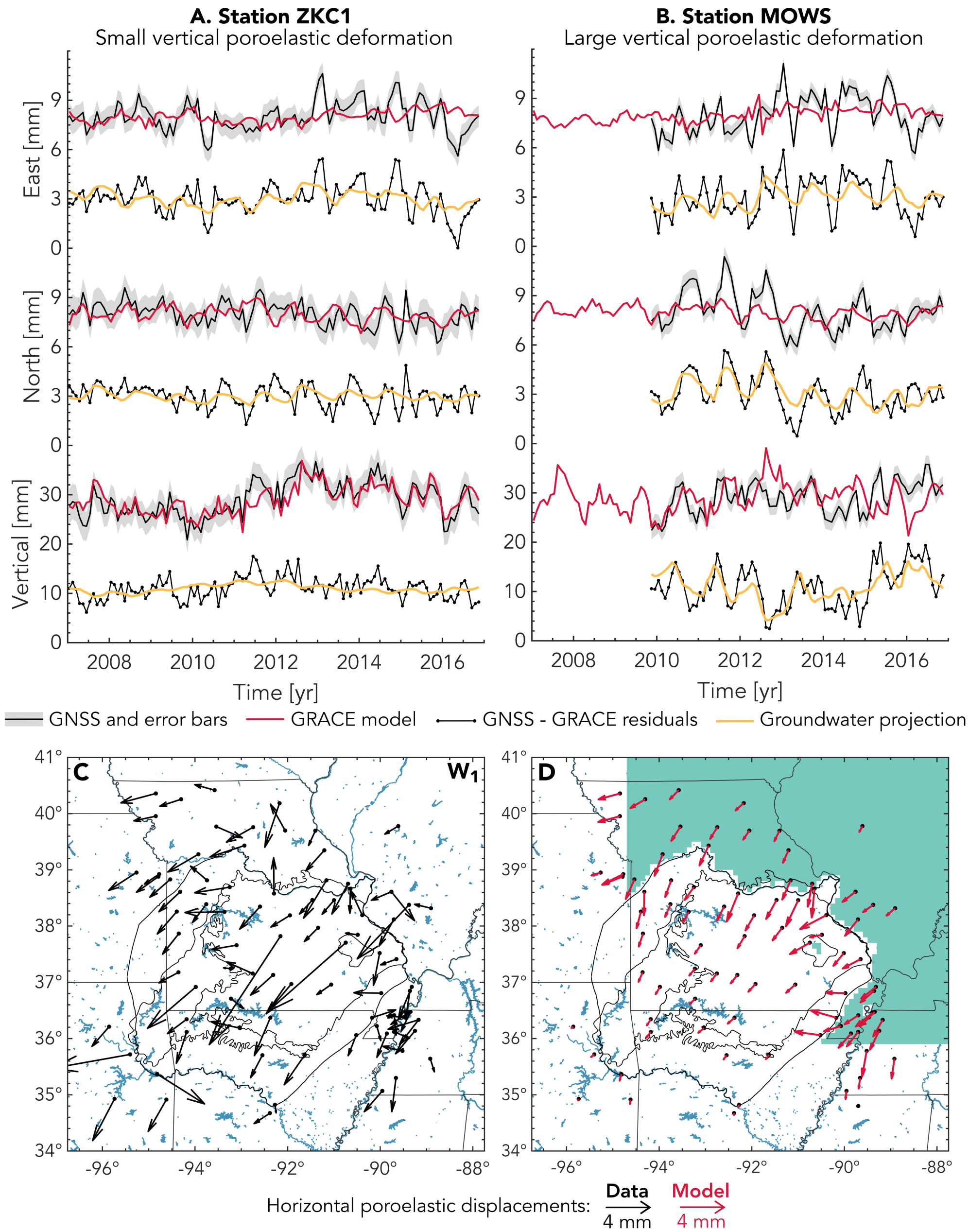


Figure S7: Common mode poroelastic signal from neighbouring aquifers. (A,B) Similar to Figure 7 but without removing horizontal common mode. (C) Horizontal poroelastic displacements inferred by projecting onto W_1 without removing common mode. (D) Modeled horizontal displacements due to poroelastic eigenstrains outside OPAS in turquoise ($\Delta h = 10$m, $b = 1000$m).

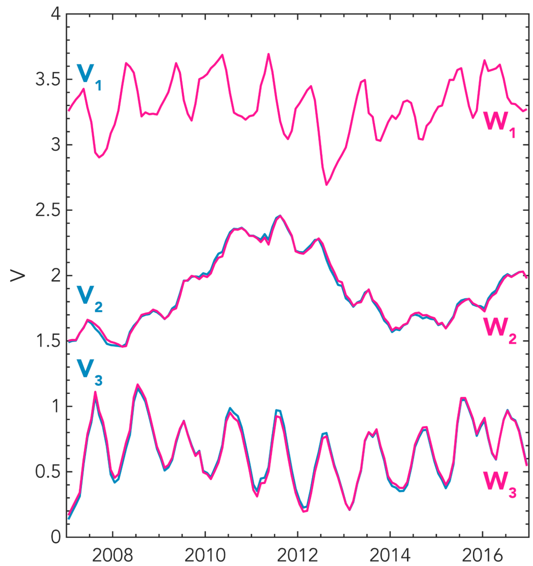


Figure S8: Original groundwater V's vs orthogonalized W's.

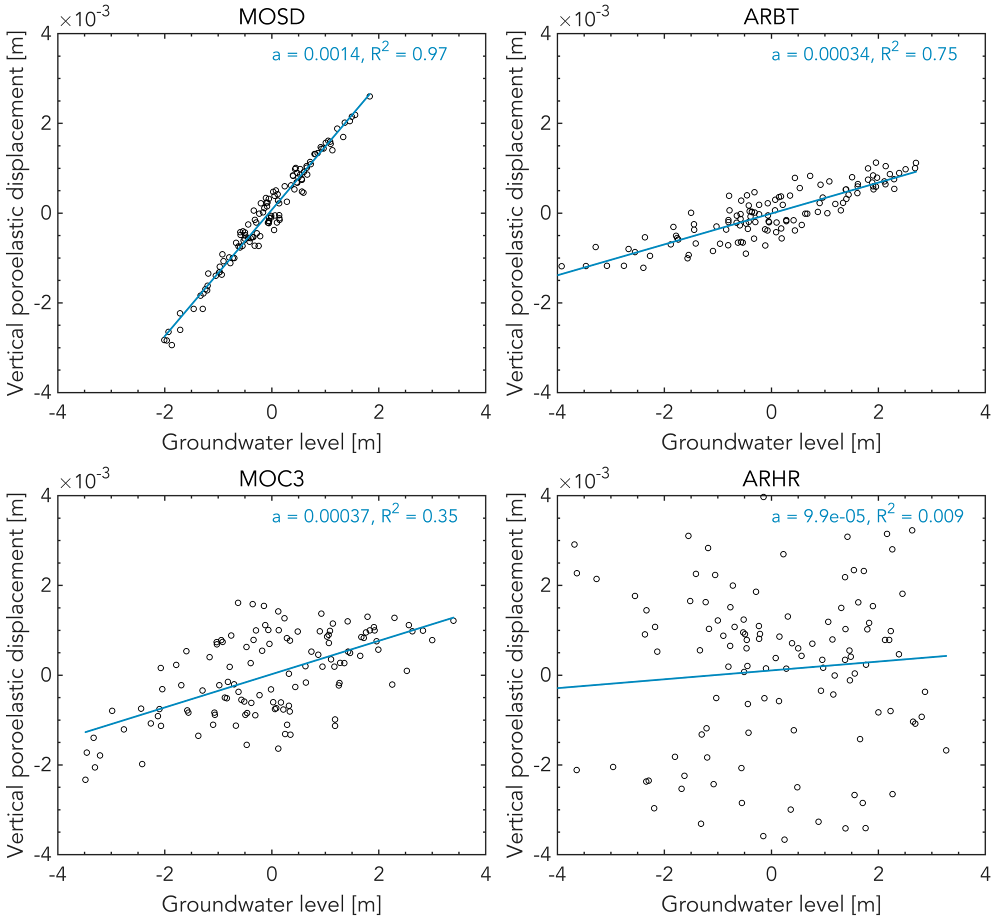


Figure S9: Coefficient of determination for stations shown in Figure 10. a is the slope of the best-fit line.

Rock	Confining stress [MPa]	Poisson ratio	Matrix bulk modulus [MPa]	Young modulus [MPa]
Blair Dolomite	0	0.25	83	125
Maxville Limestone	0	0.23	42	68
Berea Sandstone	10	0.25	6	9
Chattanooga Shale	0	0.16	5	11

Table S1: Elastic properties from Ge & Garven (1992). Note that the Young moduli were computed from the reported values of Poisson ratio and bulk modulus.