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Supplement of

Coupling the ParFlow Integrated Hydrology Model within the NASA Land Information System: a case study over the Upper Colorado River Basin

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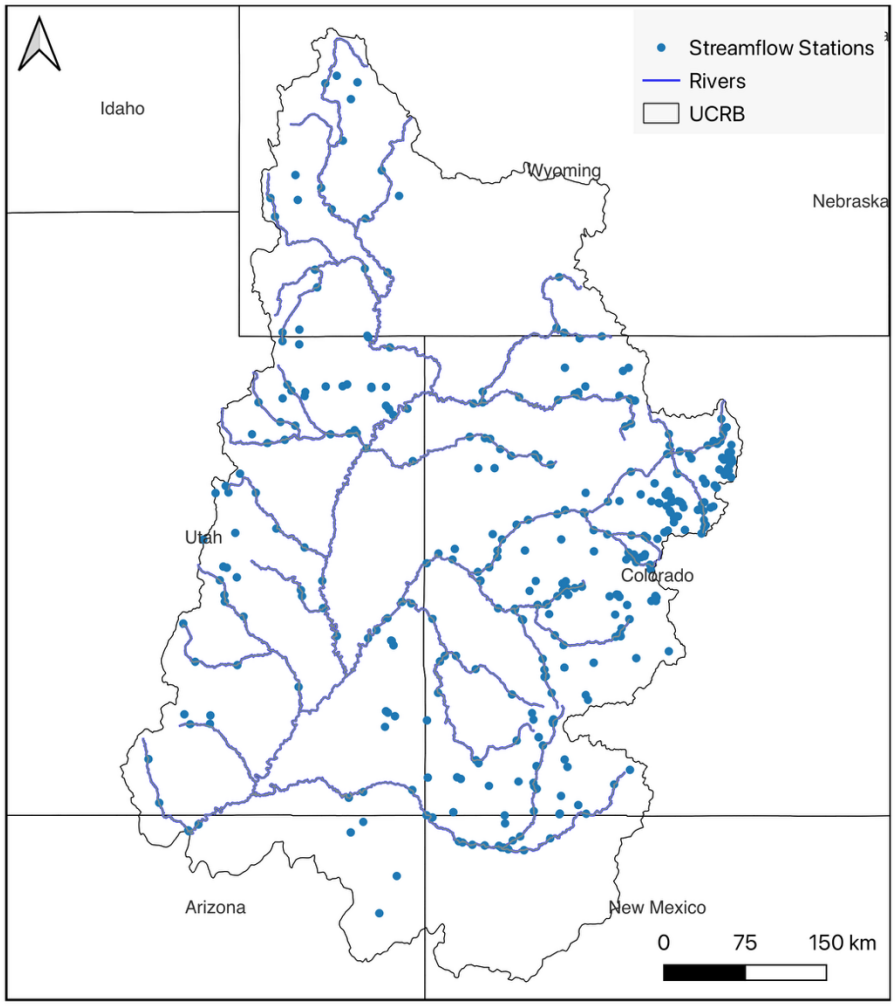

Figure S1. UCRB along with USGS streamflow stations and river networks.

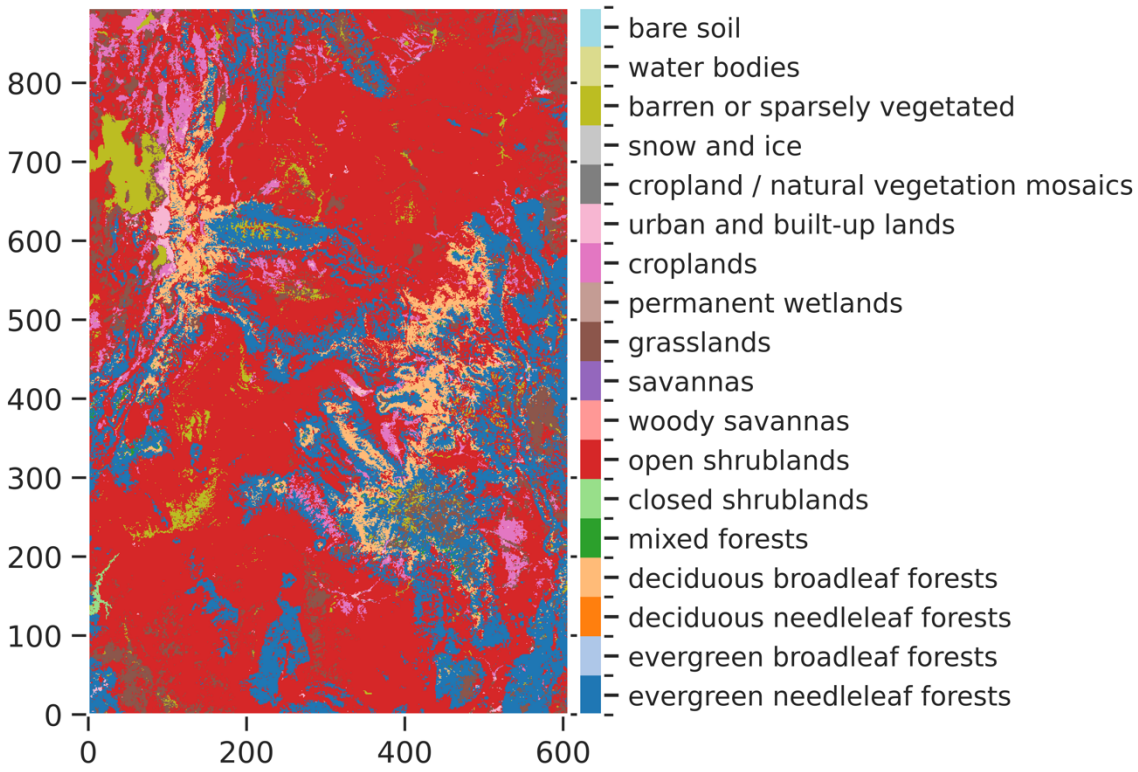

Figure S2. Land use land cover classification over the UCRB domain.

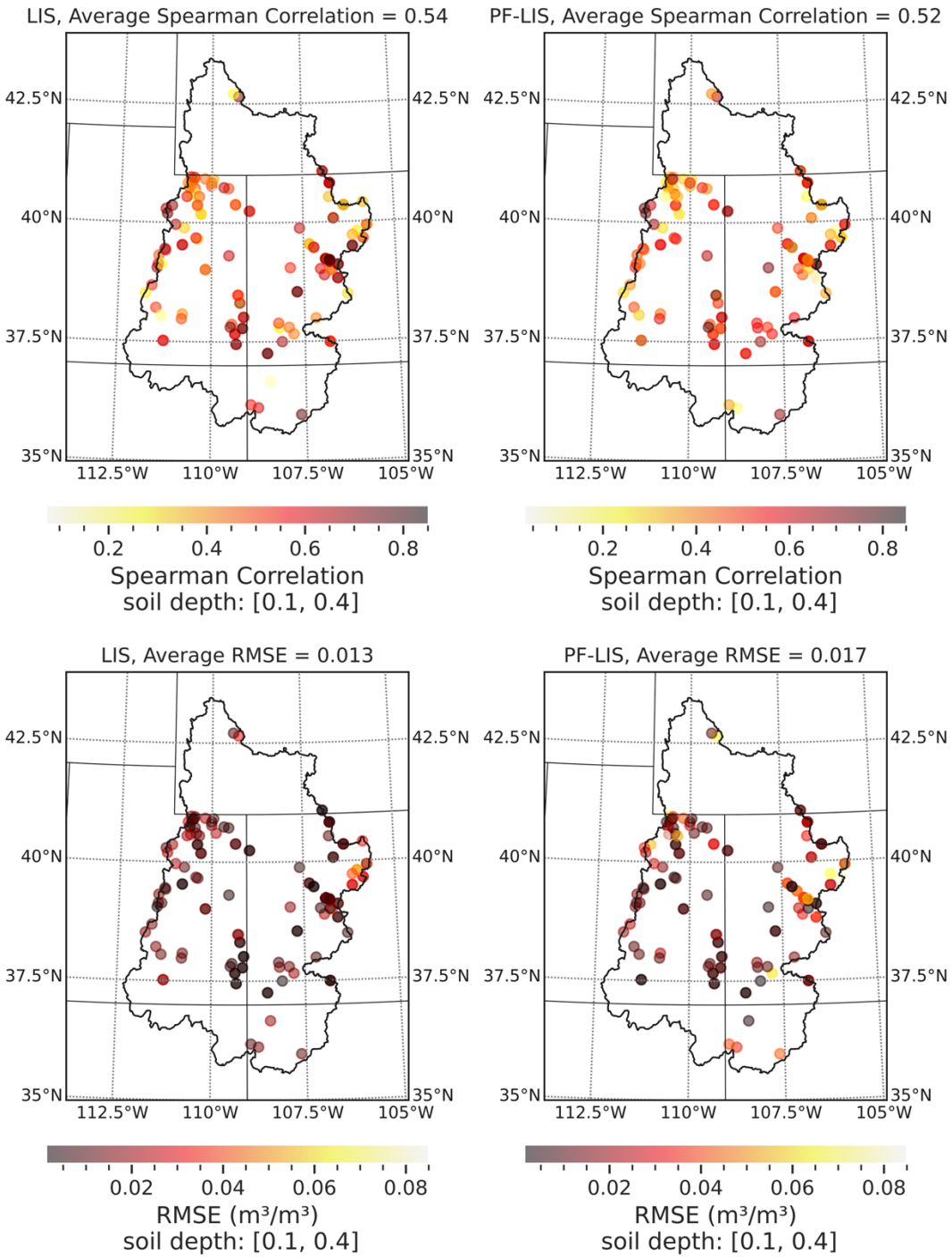

Figure S3. The Spearman's correlation coefficient and RMSE between the simulated and observed soil moisture at the soil depth of 0.1-0.4 m (30 cm). This result is reported based on 20-year model simulation and observation data, from January 2002 to December 2022. At each station, performance metrics were calculated using 20 years of observations and model simulations. These metrics were then averaged across all stations to obtain a regional mean performance measure, which is reported in each plot.

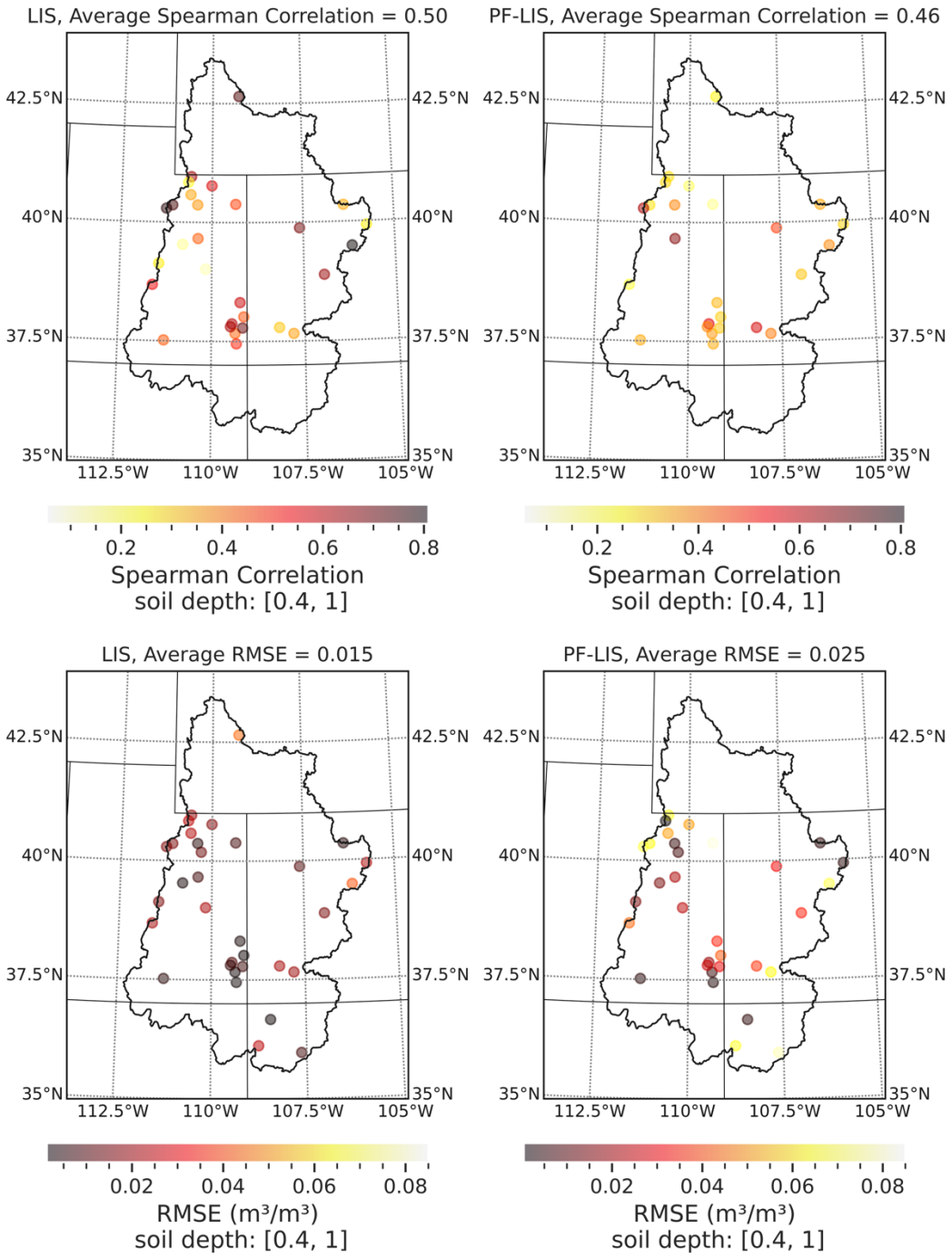

Figure S4. The Spearman's correlation coefficient and RMSE between the simulated and observed soil moisture at the soil depth of 0.4-1 m (60 cm). This result is reported based on 20-year model simulation and observation data, from January 2002 to December 2022. At each station, performance metrics were calculated using 20 years of observations and model simulations. These metrics were then averaged across all stations to obtain a regional mean performance measure, which is reported in each plot.

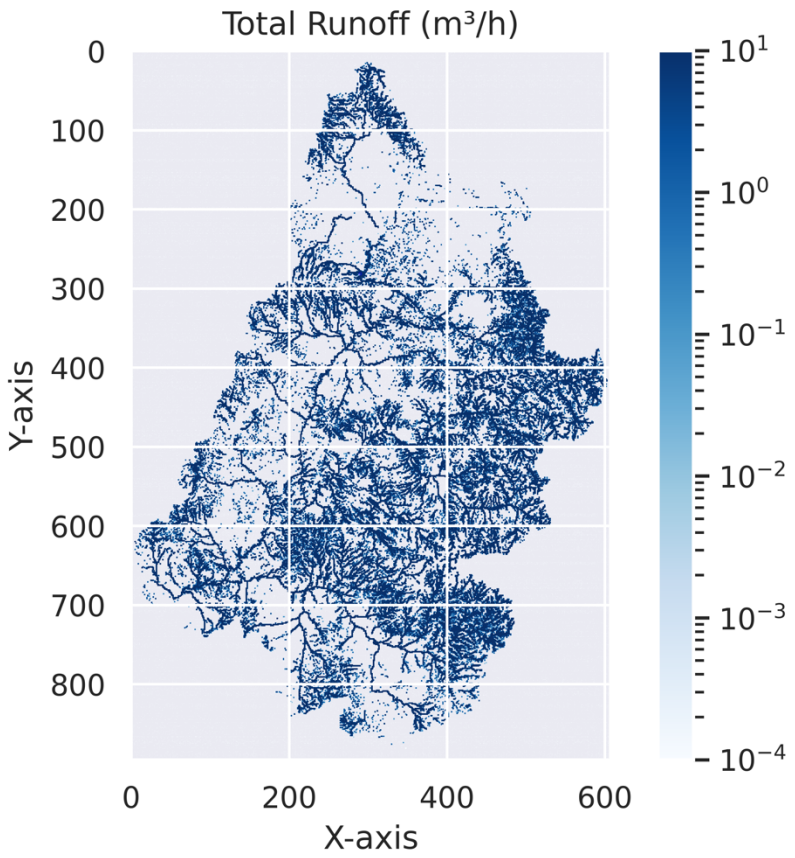

Figure S5. An example of total runoff data calculated over the UCRB.

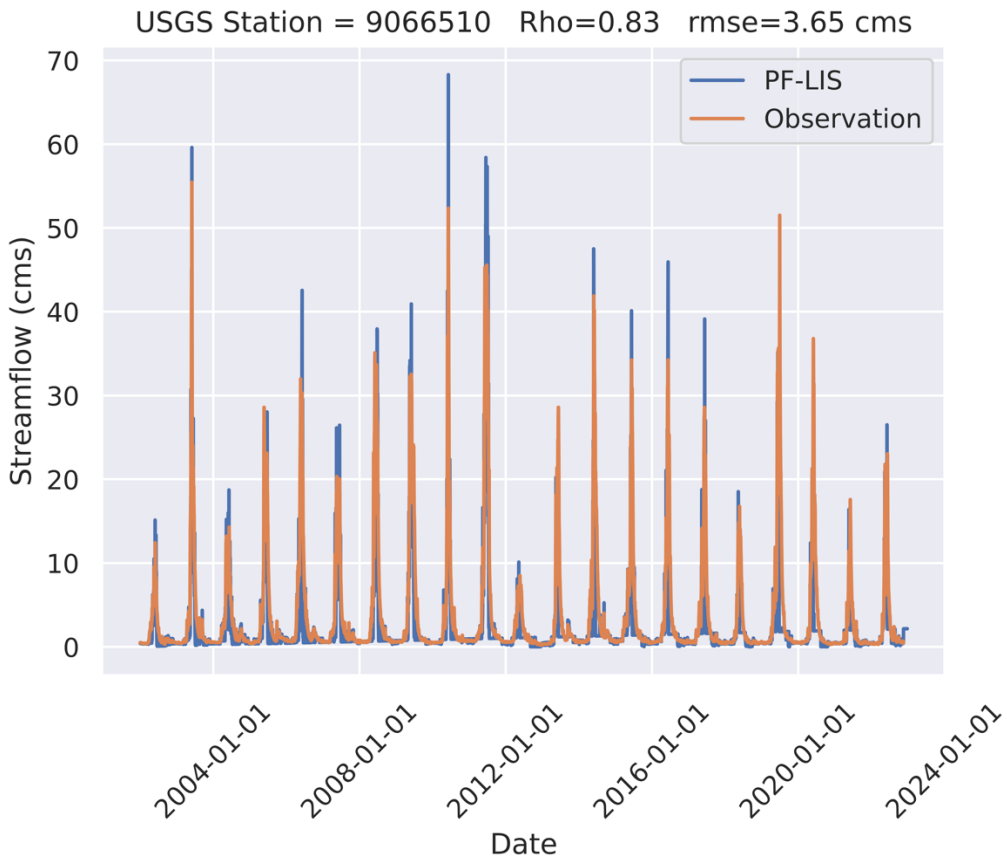

Figure S6. Streamflow simulation from PF-LIS model against streamflow observation from USGS 9066510 Gore Creek at Mouth Near Minturn, CO, over the period of 20 years.

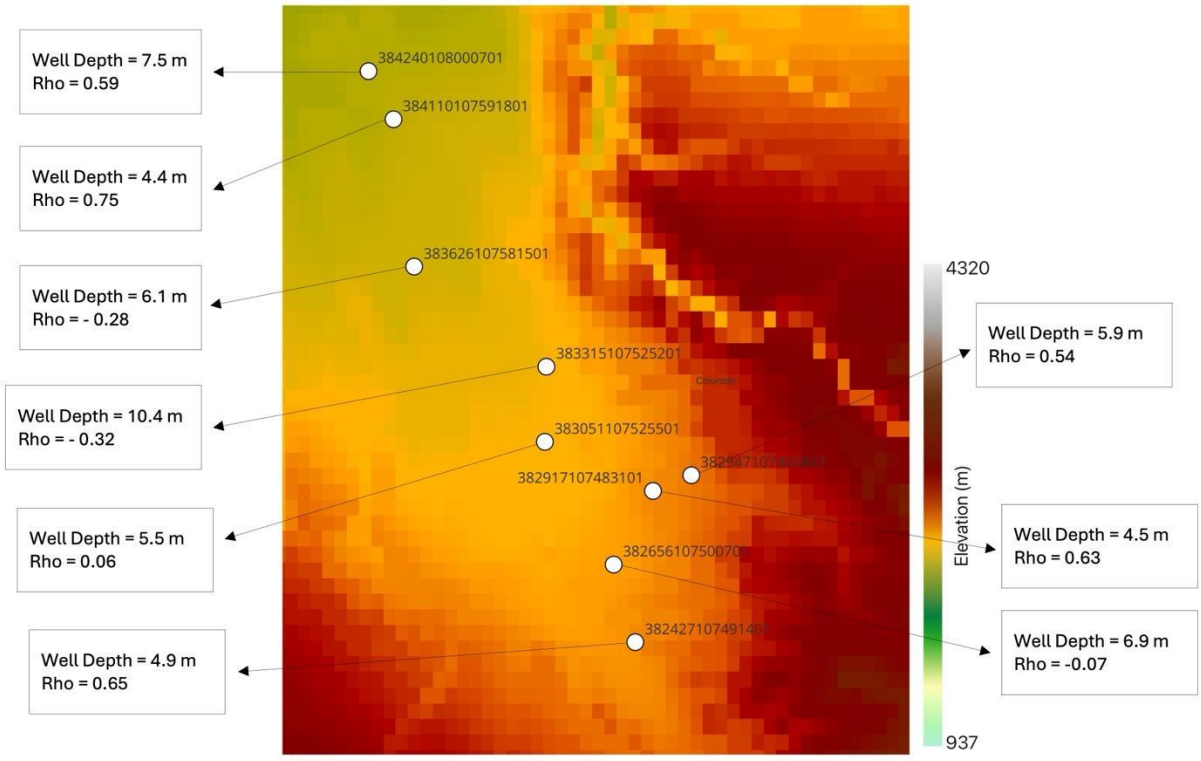

Figure S7. Spatial distribution of the estimated WTD and its comparison with well observations across various locations featuring different land characteristics.

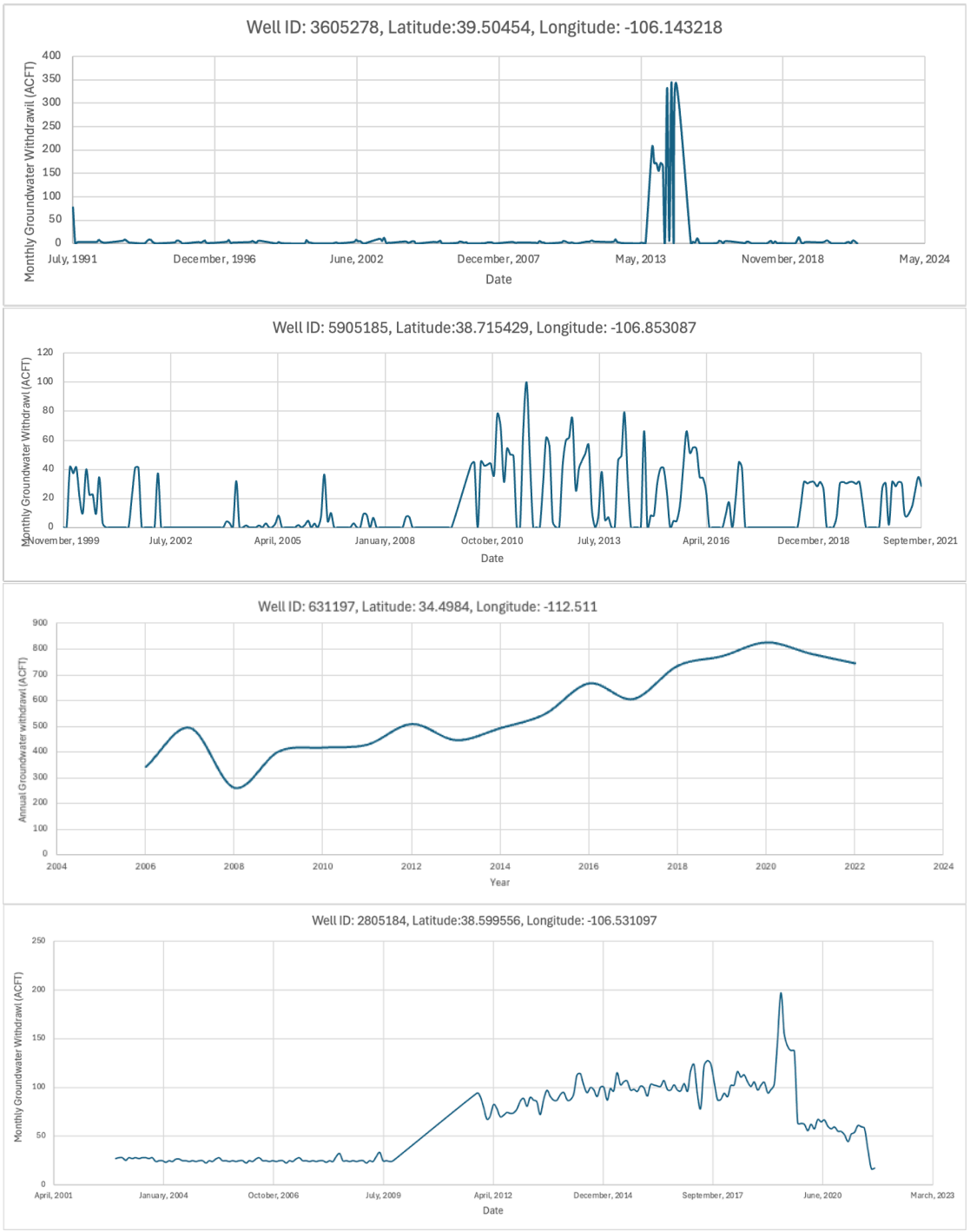

Figure S8. Annual and monthly groundwater withdrawal time series data from four stations within the UCRB, collected over a period of more than 20 years, highlighting the impact of human activities on groundwater extraction before and after 2012. ACFT stands for Acre-Feet.

Table S1. Descriptive characteristics of the Parflow-LIS/Noah-MP output dataset.

Characteristic	*Variables*
Model outputs	*Pressure; Saturation; Noah-MP outputs*
Spatial Coverage	*35–44; 112.5–105.5*
Spatial Resolution	*1 km × 1 km*
Temporal Coverage	*October 1, 2002 to September 31, 2022*
Temporal Resolution	*1 hour*

Table S2. Hourly NLDAS inputs for the simulation.

Variable	*Abbreviation*	*Unit*	*Spatial Resolution*
Visible or short-wave radiation	*DSWR*	*W/m2*	*1km*
Long wave radiation	*DLWR*	*W/m2*	*1km*
Precipitation	*APCP*	*mm/s*	*1km*
Air Temperature	*Temp*	*K*	*1km*
East-West wind speed	*UGRD*	*m/s*	*1km*
South-North wind speed	*VGRD*	*m/s*	*1km*
Atmospheric pressure	*Press*	*pa*	*1km*
Specific humidity	*SPFH*	*kg/kg*	*1km*

Table S3. Files that contain the model input parameters for the simulation.

Topographic slopes in x and y directions
Initial pressure after the spin up process
3-D indicator file of different soil, geology and bedrock types
3-D solid file of the model domain
Parameters of Noah-MP model
Vegetation type, cartesian coordinates for each grid of the domain
Vegetation parameters for the IGBP classification