CHALLENGES IN MODELING IMPACTS TO WATER RIGHTS ON EPHEMERAL STREAMS.

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In arid regions of the western United States, models are used to evaluate the impact water wells have on surface flows. States like Colorado allocate water rights according to a priority system. Surface rights often have priorities much senior to wells. To evaluate the extent to which well pumping has injured senior surface rights, it is necessary to construct a groundwater model that incorporates stream-aquifer interaction.

A unique challenge to, for example, the Rio Grande Decision Support System Groundwater Model (the RGDSS model), is that in addition to major rivers like the Rio Grande, there are water rights on small ephemeral streams. These streams may flow only during the spring snow melt and the surface flows disappear inside the modeled domain.

Calibrating a model to reliably predict impacts to such water rights presents unique practical challenges. Using HPC techniques combined with parameter estimation programs such as BeoPEST, we can use highly parameterized inversion techniques to estimate aquifer and stream parameters. However, synthesizing appropriate calibration targets from historical data such as diversion records and anecdotal information regarding the extent of live flow poses unique challenges. In addition, the goal is to reliably predict how the system would have been different absent, for example, well pumping.

We describe how we approached this problem in the construction and calibration of the RGDSS model and its application to predicting impacts to stream depletions. The predictions of the RGDSS model is used by the State of Colorado in administering the San Luis Valley which is an important agricultural community relying heavily on irrigated agriculture. As such, predictions by the RGDSS model has a profound impact on the community.

Nonlinearities in the system modeled, senior water rights on small streams and the importance of irrigated agriculture combine to make this an unusually challenging modeling application. We describe how we applied high performance computational techniques to solve unique challenges.