

Transboundary Groundwater and the State of Current Numerical Models

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Acknowledgements:
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many, many colleagues

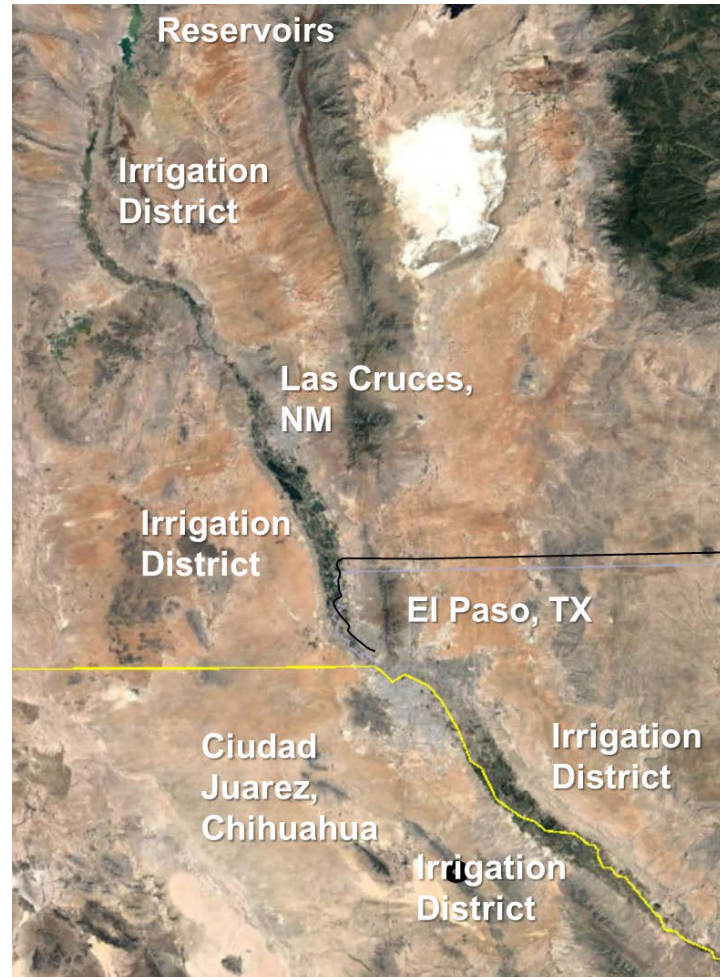


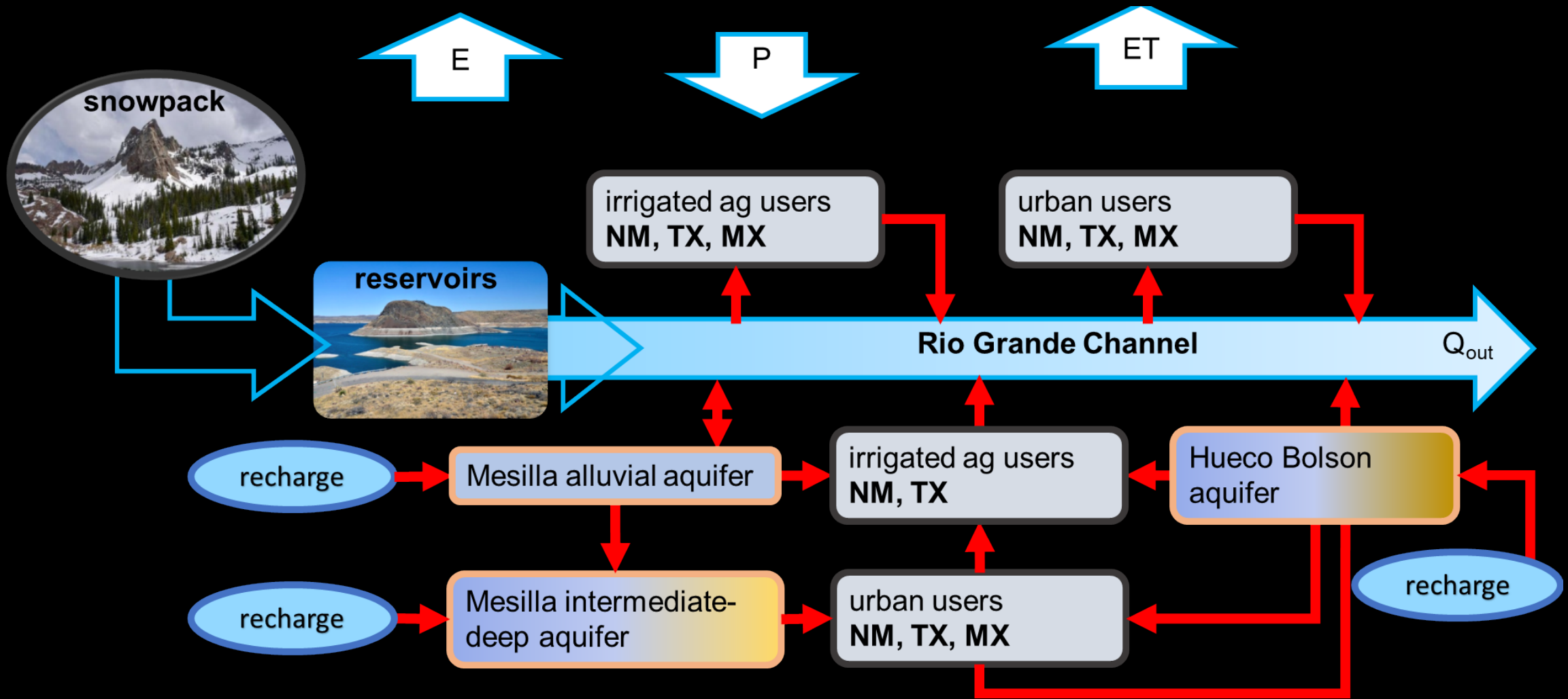
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Can hydrogeological numerical models integrate jurisdictional boundaries?

- Naïve answer: of course!
- Real answer: it's challenging! (see following slides)
- Place-based research: Paso del Norte region





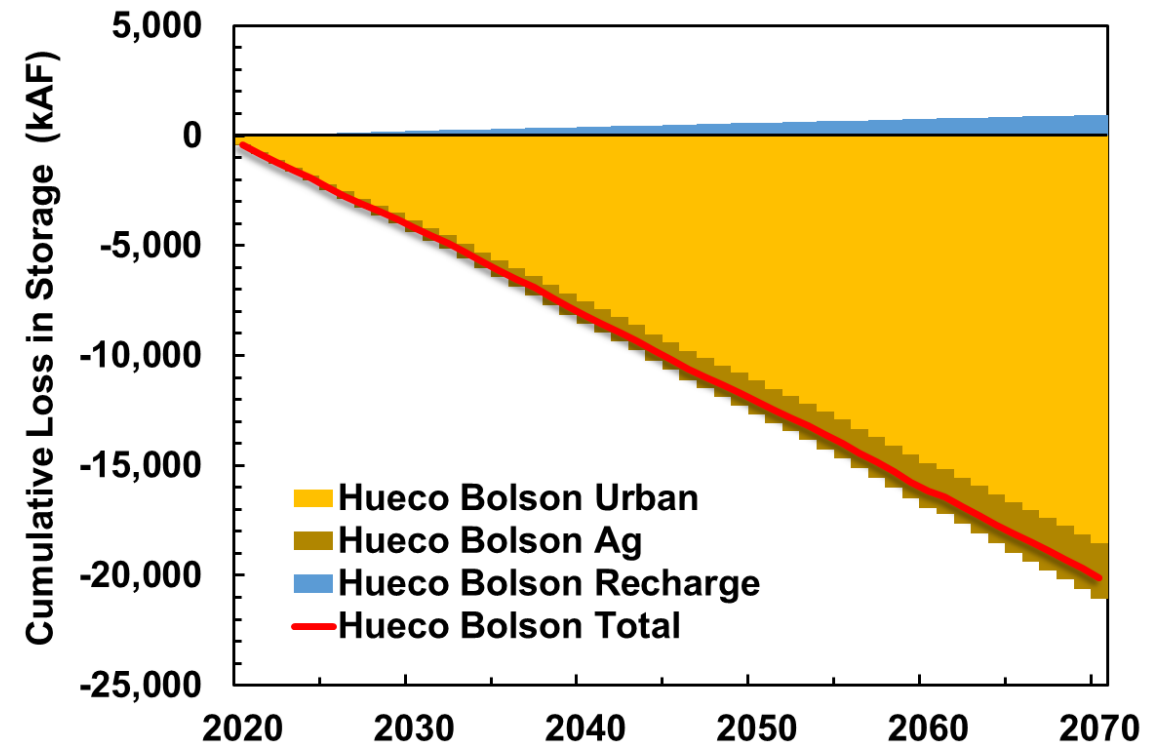
Hydrologic systems model

Top three challenges encountered in building a numerical model of an aquifer shared by two or more countries

- Information asymmetry/accuracy
 - water demand/pumping
 - recharge
 - storage
 - monitoring
- Management
 - fragmented governance
- Predictions
 - agreement on future demand, climate
 - policy changes

climate scenario: very dry

demand scenario: medium population increase & per capita use



What physical-chemical processes should be modeled specific to transboundary aquifers & shared management?

Processes/state variables/interpretations important in Paso del Norte region

Salinity

- fresh and brackish water hydro-stratigraphy
- flow/transport patterns in response to pumping and recharge

Impacts related to US-Mexico pumping

- cross-border flow magnitudes and directions
- contributions to aquifer depletion

Surface water-groundwater interactions

- conjunctive use
- impacts of pumping in New Mexico on seepage from Rio Grande/Rio Bravo channel

Opinion of the Court

NOTICE: This opinion is subject to formal revision before publication in the preliminary print of the United States Reports. Readers are requested to notify the Reporter of Decisions, Supreme Court of the United States, Washington, D. C. 20543, of any typographical or other formal errors, in order that corrections may be made before the preliminary print goes to press.

SUPREME COURT OF THE UNITED STATES

No. 141, Orig.

STATE OF TEXAS, PLAINTIFF *v.* STATE OF
NEW MEXICO AND STATE OF COLORADO

ON EXCEPTIONS TO REPORT OF SPECIAL MASTER

[March 5, 2018]

JUSTICE GORSUCH delivered the opinion of the Court.

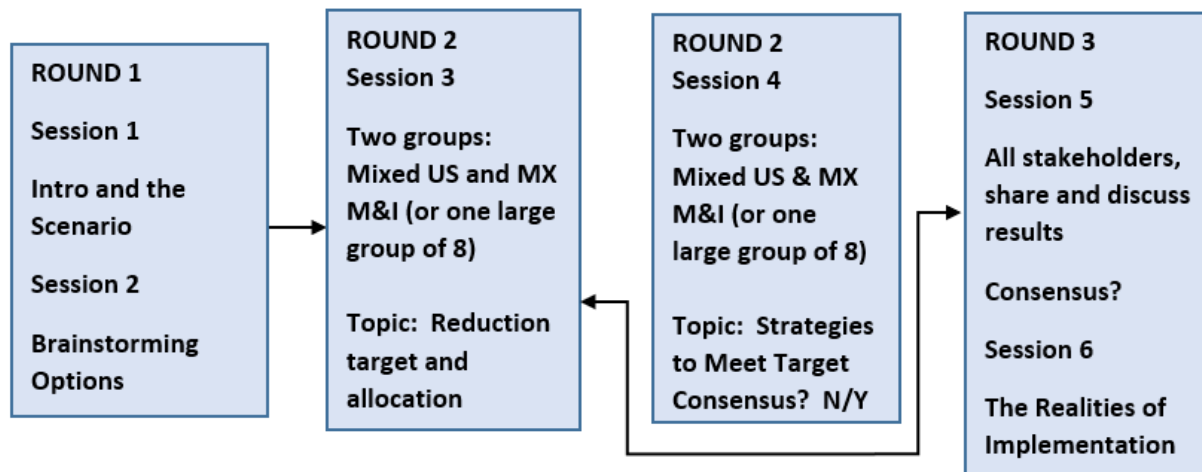
Will Rogers reportedly called the Rio Grande “the only river I ever saw that needed irrigation.” In its long journey from the Colorado Rockies to the Gulf of Mexico, many and sometimes competing demands are made on the river’s resources. In an effort to reconcile some of those demands, Colorado, New Mexico, and Texas, acting with the federal government’s assent, signed the Rio Grande Compact in the 1930s. In today’s lawsuit, Texas claims that New Mexico has defied the Compact. But at this stage in the proceedings we face only a preliminary and narrow question: May the United States, as an intervenor, assert essentially the same claims Texas already has? We believe it may.

Example of a transboundary aquifer model that has been successful

“Serious Groundwater Game”

- The purpose of the game is to engage stakeholders in clear, open discussions of the future of the Hueco Bolson.
- The goal of these discussions is to explore new cooperative management solutions to prolong the life of the Hueco Bolson.

Iterative process for reaching consensus on implementable actions



The Genevese transboundary aquifer (Switzerland-France): The secret of 40 years of successful management[☆]

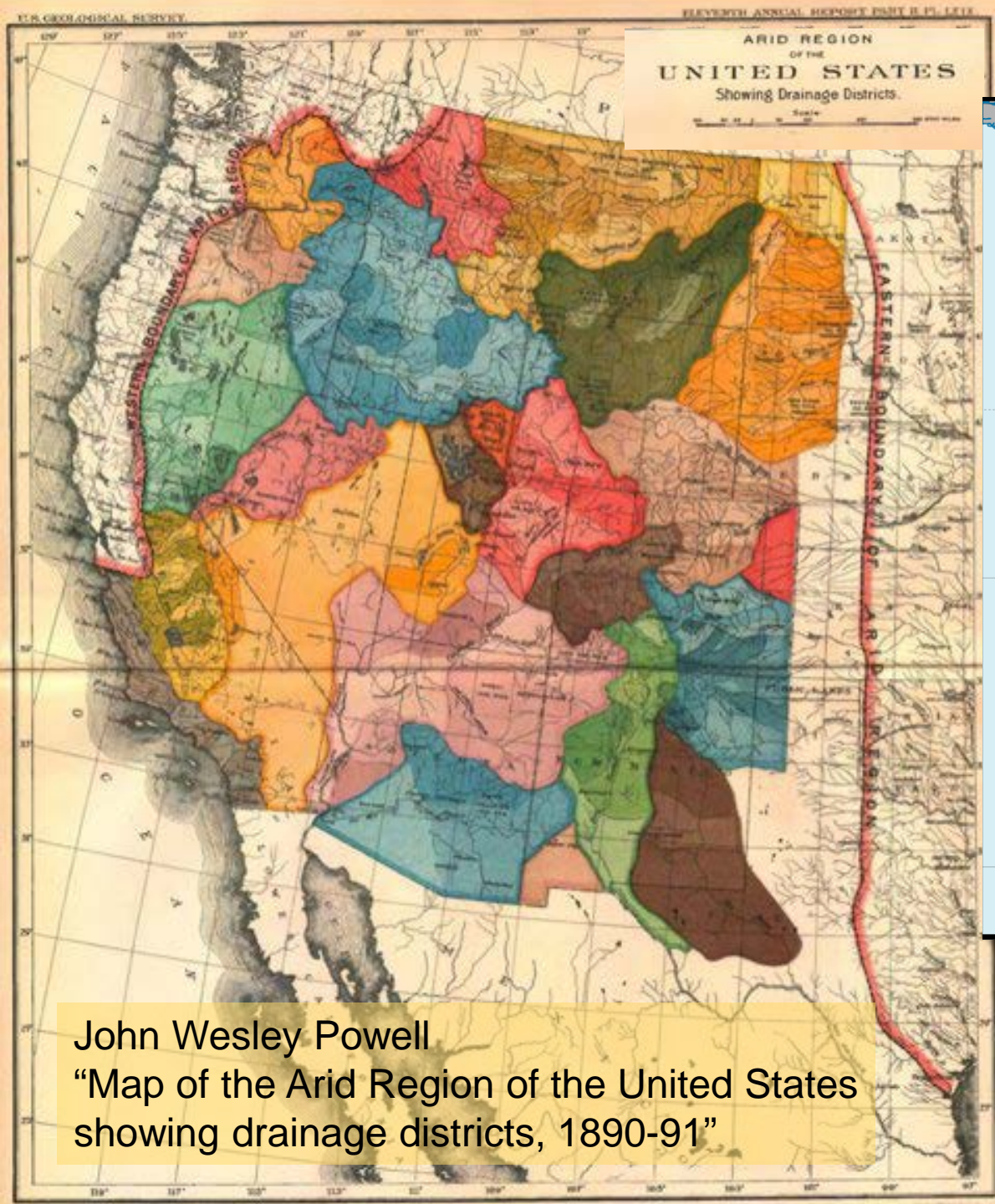
Gabriel de los Cobos

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[Journal of Hydrology: Regional Studies 20 \(2018\) 116–127](#)

- Solution to groundwater depletion: Geneva (Switzerland) operates a groundwater recharge installation
- Cost per m³ to France is calculated based on
 - the costs of operating the plant (SIG expense): E
 - depreciation: A
 - total pumping (Swiss + French): VE
 - share in natural recharge (7.5 Mm³/yr): AN
 - volume pumped by the French authorities minus the quota: $Vefp$

$$\text{French participation: } Pf = (A + E) * Vefp/VE - AN$$



John Wesley Powell
 “Map of the Arid Region of the United States
 showing drainage districts, 1890-91”

