



# Fostering the Use of Scientific Water Models from Different Stakeholder Perspectives through the **Sustainable Water Through Integrated Modeling (SWIM) Platform**

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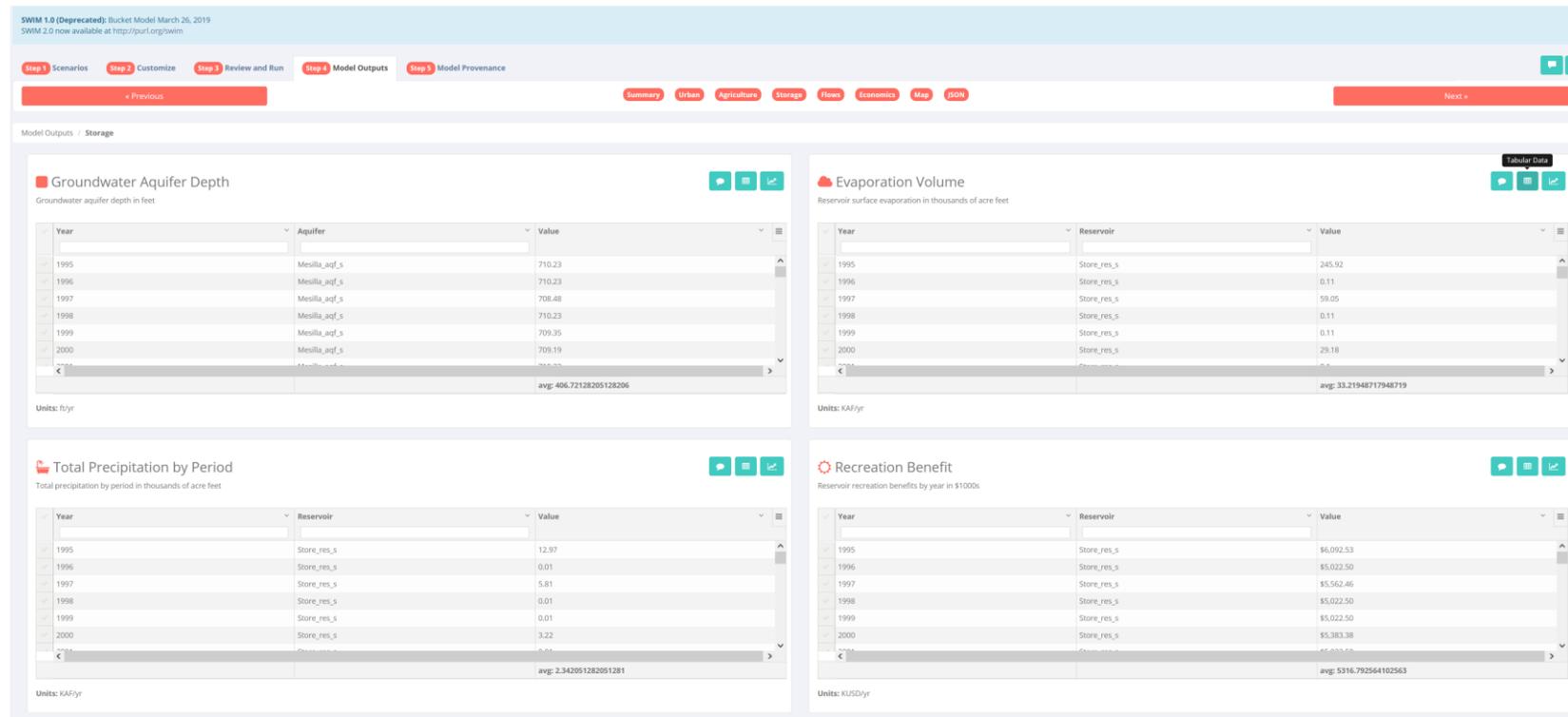
# Challenges of using and understanding Water-related scientific models

Information Overload

Complexity

Uncertainty

Different Perspectives



United States Department of Agriculture  
National Institute of Food and Agriculture

Middle Rio Grande Basin Hydro-economic Model



Fig. 1. Screenshot of SWIM 1.0 – Custom Model Scenario Results

<https://water.cybershare.utep.edu>

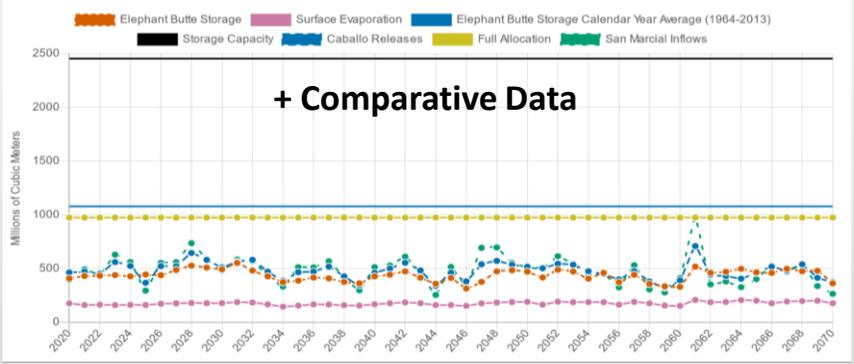
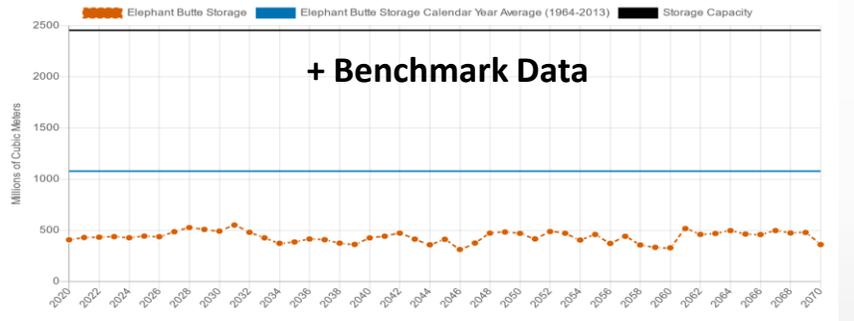
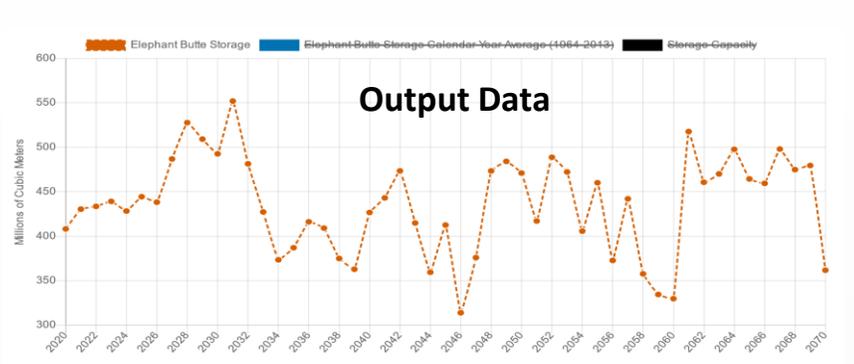
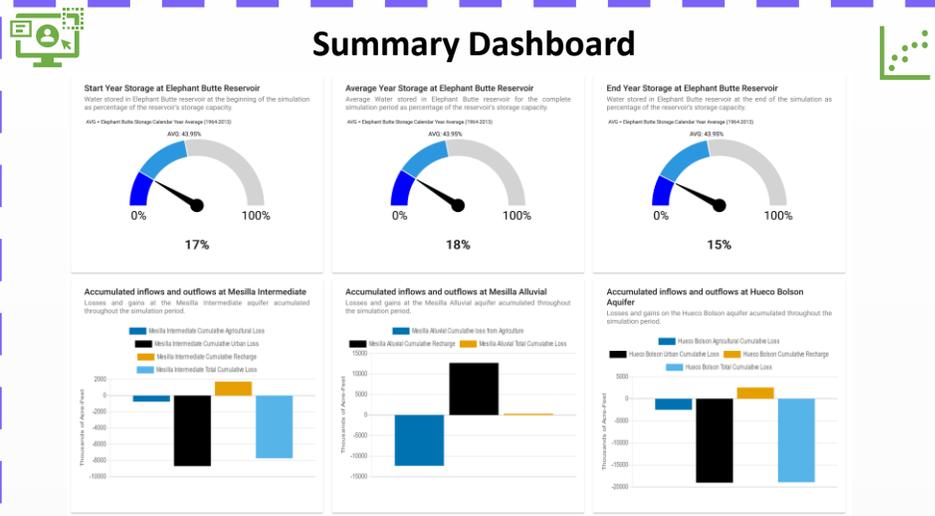
# Mitigation of Information Overload and Complexity



Selected Model and Role

Output Recommendations

Interaction and Ranking Feedback



### Output Catalog

Water Balance Model

Scenario: business as usual scenario

Output Categories: All, Allocation, Flows, Storage

Select/Output Variable	Category	Description	Units
<input type="checkbox"/> Hueco Bolson Agricultural Cumulative Loss	Flows	Annual consumptive use of water from the Hueco Bolson aquifer for agricultural use	Thousands of Acre-Feet
<input type="checkbox"/> Full Allocation	Allocation	Full allocation from Caballo Reservoir to downstream users according to the 2008 Rio Grande Project Operating Agreement	Acre-Feet
<input type="checkbox"/> Caballo Reservoir Releases	Flows	Annual surface water volume released for regional consumption from Caballo Reservoir located upstream of the city of Las Cruces and the Elephant Butte irrigation district, release volumes are directed by the 2008 Rio Grande Project Operating Agreement	Acre-Feet
<input type="checkbox"/> Elephant Butte Reservoir Storage	Storage	Projected volume of surface water stored in Elephant Butte reservoir by the end of each year	Acre-Feet
<input type="checkbox"/> Hueco Bolson Urban Cumulative Loss	Flows	Annual consumptive use of water from the Hueco Bolson aquifer for urban use	Thousands of Acre-Feet
<input type="checkbox"/> Hueco Bolson Cumulative Recharge	Flows	Annual water recharge to the Hueco Bolson	Thousands of Acre-Feet
<input type="checkbox"/> Mesilla Alluvial Total Cumulative Loss	Storage	Total consumptive water use from the Mesilla shallow depth aquifer from both urban and agricultural sectors	Thousands of Acre-Feet

Third-Party Libraries:  
LightFM. Kula, M. (2015). <https://github.com/lyst/lightfm>  
Optuna. Akiba T., et al. (2019). <https://optuna.org>



Selected Role and Output

Text Narratives

Fig. 2. Screenshot of SWIM 2.0 –Model Scenario Results



# The SWIM 2.0 Stack for Modeling as a Service

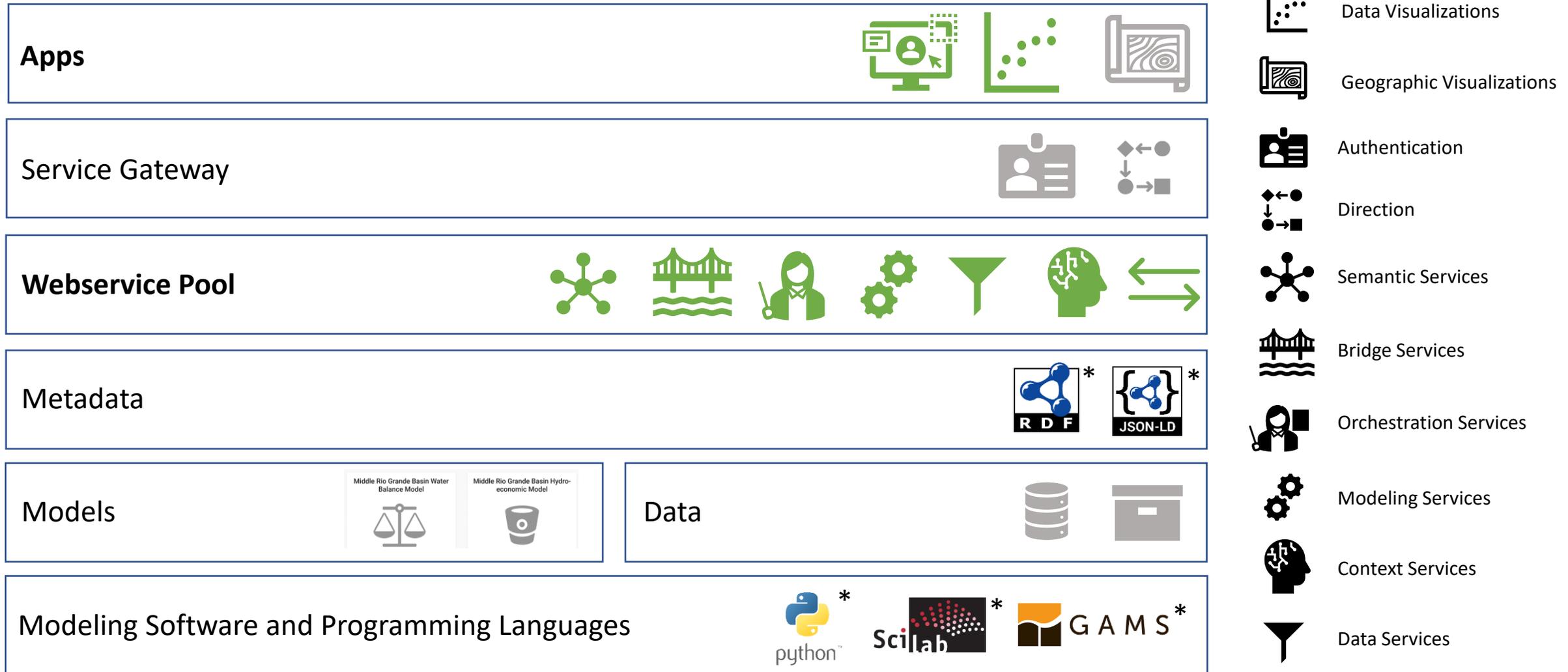


Fig. 3. The SWIM 2.0 Stack

Notes: Key elements of this talk are highlighted in green.

\*Third party tools or languages leveraged.

# Interoperability



## SWIM Broker Service (Modeling)

- Single Model Execution
- Model-to-model Integration
  - Automated workflow composition
  - Data Transformation
  - Workflow Provenance
- OpenAPI Specification 3.0



SWIM Broker Endpoints



## SWIM API (Data)

- Models, inputs, outputs, catalogs.
- Scenario results
- Cross-scenario comparison
- OpenAPI Specification 3.0



SWIM API Endpoints



## HydroShare Bridge (Sharing)

- Integration with third-party CUAHSI HS services.
- Model Instance publication as a HS resource
- Seamless integration from the SWIM Web Interface
- Additional Metadata Capture



Hydroshare. Horsburgh, J. S, et al., (2016).

<https://hydroshare.org>

# SWIM - First Splash



Thoughts about SWIM?

Contact us at [swim@utep.edu](mailto:swim@utep.edu)



<http://purl.org/swim/splash>



# Acknowledgements



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Any opinions, findings, and conclusions or recommendations expressed in this material are those of the author(s) and do not necessarily reflect the views of the National Science Foundation.



Cyber-ShARE





## References

Kula, M. (2015). Metadata Embeddings for User and Item Cold-start Recommendations. In T. Bogers & M. Koolen (Eds.), *Proceedings of the 2nd Workshop on New Trends on Content-Based Recommender Systems co-located with 9th ACM Conference on Recommender Systems (RecSys 2015), Vienna, Austria, September 16-20, 2015*. (Vol. 1448, pp. 14–21). CEUR-WS.org. <http://ceur-ws.org/Vol-1448/paper4.pdf>

Akiba, T., Sano, S., Yanase, T., Ohta, T., & Koyama, M. (2019). Optuna: A Next-generation Hyperparameter Optimization Framework (arXiv:1907.10902). arXiv. <https://doi.org/10.48550/arXiv.1907.10902>

Horsburgh, J. S., Morsy, M. M., Castronova, A. M., Goodall, J. L., Gan, T., Yi, H., Stealey, M. J., & Tarboton, D. G. (2016). HydroShare: Sharing Diverse Environmental Data Types and Models as Social Objects with Application to the Hydrology Domain. *JAWRA Journal of the American Water Resources Association*, 52(4), 873–889. <https://doi.org/10.1111/1752-1688.12363>