



# Hydrological Modeling Data Dashboard for the Middle Rio Grande



Lacher Hydrological Consulting

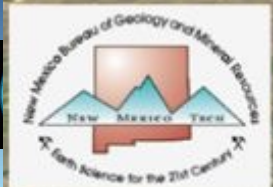


ekosource



Jet Propulsion Laboratory  
California Institute of Technology

Subcontract No. 1712029



US Army Corps of  
Engineers



Google Earth



# Project Purposes

## Improve Understanding of Rio Grande Water Systems

Diverse Rio Grande datasets on a single platform for viewing, exploring, processing, and downloading.

## Support Modeling Efforts

Quickly acquire large datasets from NASA and other sources over model domain in model-ready formats.

## Increase Access to MIKE SHE Model Inputs and Outputs

Visualize, plot, process, and download select MIKE SHE model inputs and outputs.

## Create Customizable and Transferrable Platform

User-driven data layers, flexible geography, and modular structure make dashboard easily expandable and transferrable.





**NASA Western Water Applications Office**  
The power of perspective

### Key Water Management Challenge #3:

# Better Understanding of RG Water Systems

- More efficient model development
- More accessible data
- Repository for model information



## Rio Grande Basin Needs Assessment Workshop Report

Prepared for  
NASA Western Water Applications Office  
Pasadena, California

Prepared by



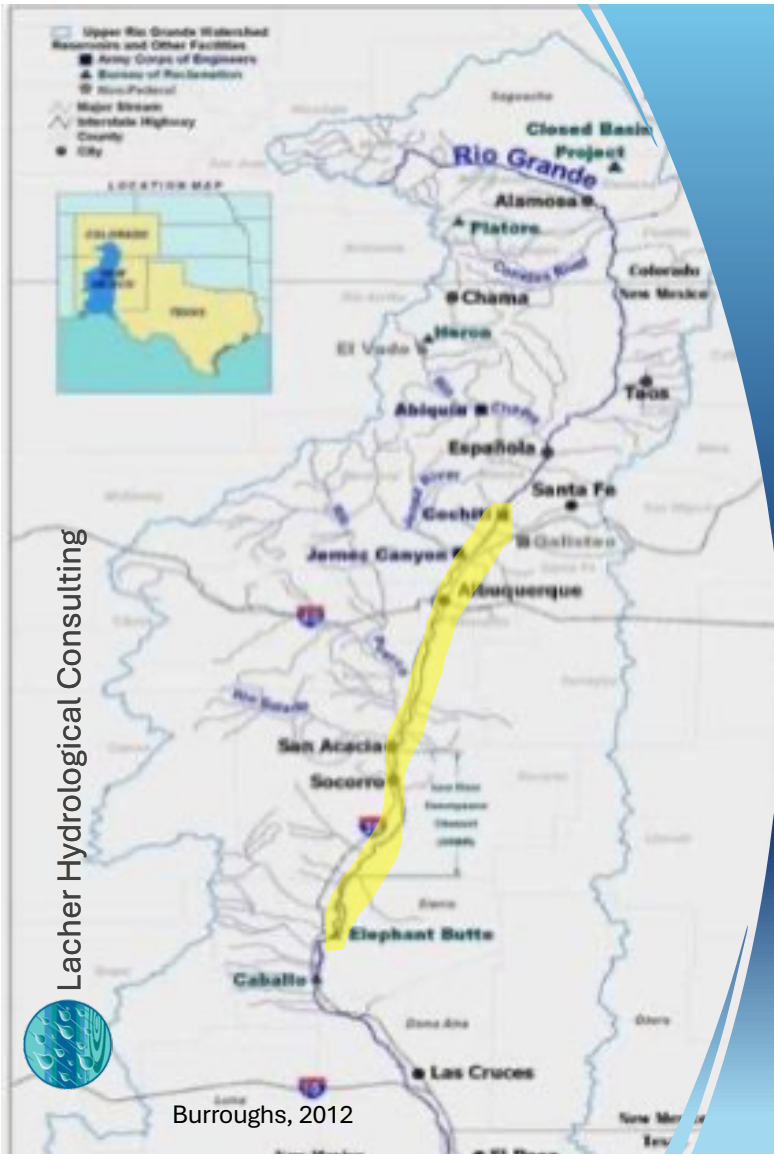
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Albuquerque, New Mexico 87109  
[www.dbstephens.com](http://www.dbstephens.com)  
DB20.1255

July 28, 2022





Burroughs, 2012



# Middle Rio Grande Hydrologic Models

- All models are data-intensive
- Integrated models require satellite-based and ground-based data at high temporal and spatial resolution



# Integrated Model Flow Conceptualizations

## Model Domain/Grid

Topography

Land Surface (soils, impervious area, vegetation LAI)

## Surface Water Stream 'Hydraulic' Network

Channels (banks, bathymetry)

Floodplains

Dams

Diversions

Boundary Conditions

## Weather Data (hourly)

Precipitation

Air temp

Reference ET

## Snowmelt

## Unsaturated Zone

## Saturated Zone

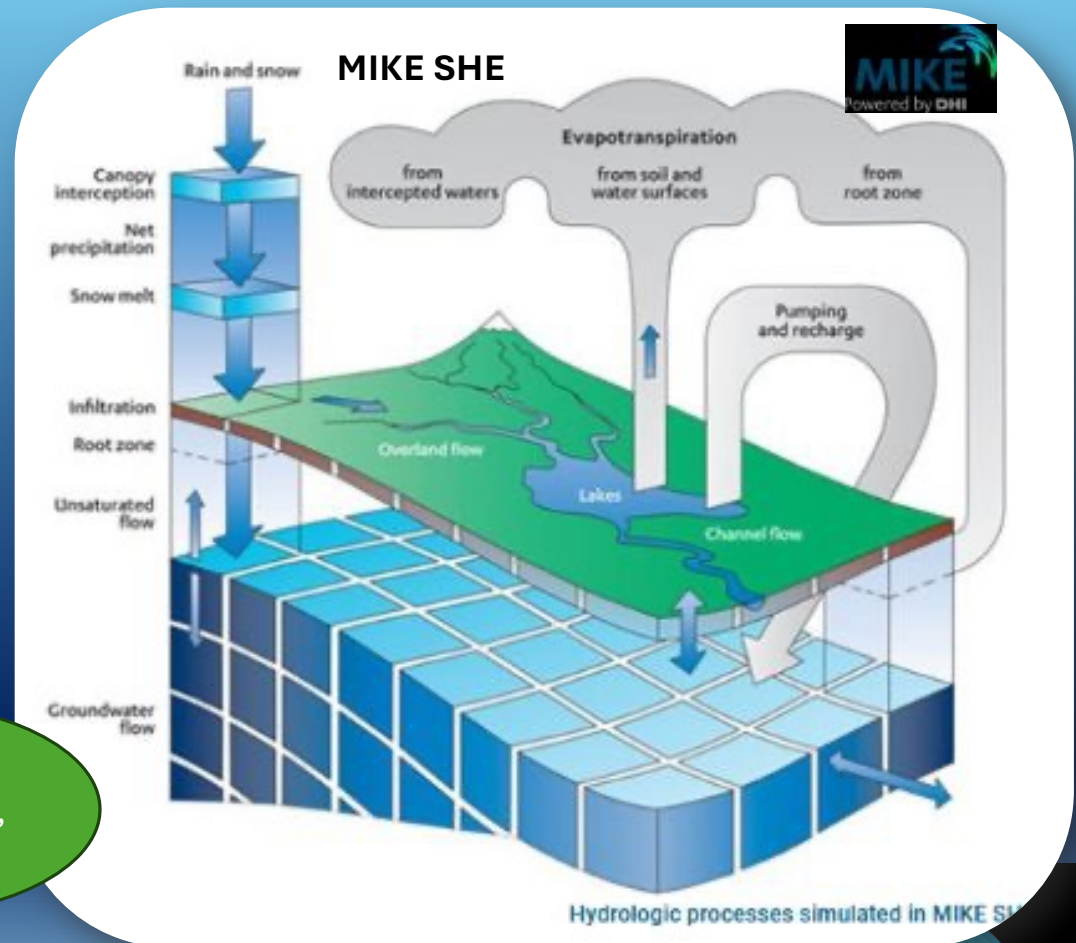
Fully-coupled 3D

## Irrigation

Crop type & demand

Rooting depth

Fully coupled,  
hydrodynamic,  
distributed



# Complex Integrated Models Require Satellite-based Data

| Model Inputs                        |                       | Model Outputs                | Current Satellite-based Calibration Data Source |
|-------------------------------------|-----------------------|------------------------------|-------------------------------------------------|
| Current Satellite-based Data Source | Data Type             |                              |                                                 |
| NLDAS2 (NASA)                       | Precipitation         | Snowcover/Snowpack           | MODIS (NASA)                                    |
|                                     | Air Temperature       | Dynamic Surface Water Extent | LANDSAT (DSWE-USGS)                             |
|                                     | Reference ET          | Soil Moisture                | SMAP/SENTINEL-1 (NASA)                          |
| MODIS (NASA)                        | Leaf-area Index (LAI) | Groundwater storage          | GRACE (NASA/JPL)                                |
| GOES (NREL)                         | Net Solar Radiation   | Actual ET                    | LANDSAT/OPEN-ET/eeMETRIC                        |
| LANDSAT (USGS)                      | Land Use              | Water Quality                |                                                 |
| LANDFIRE (USFS/USGS)                | Vegetation Type/Cover |                              |                                                 |

**Problem:** satellite-based datasets are difficult to access and transform into model-friendly format



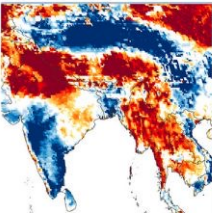
**Land Surface Data**

- Surface reflectance
- Surface temperature
- Topography



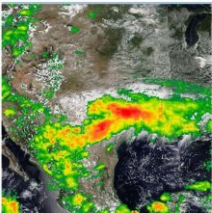
**Vegetation Data**

- Vegetation Indices
- Evapotranspiration
- Land surface reflectance
- Land cover/crop extent
- Leaf Area Index



**Water Data**

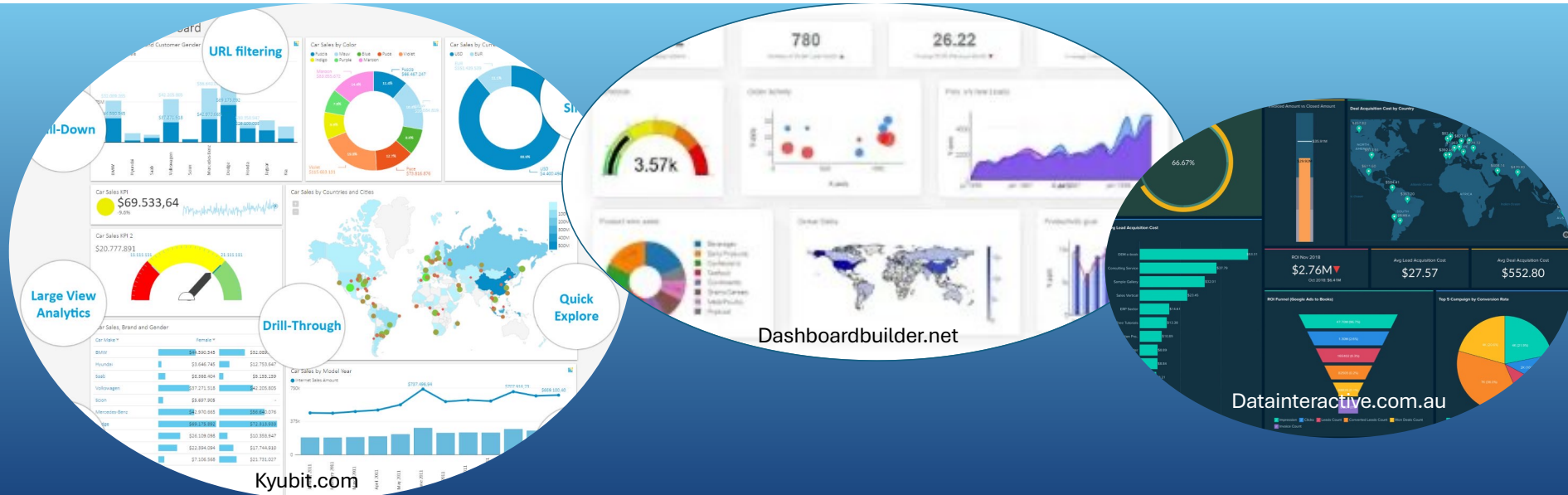
- Soil moisture
- Snow cover
- Ground water
- Runoff
- Water reservoirs



**Weather Data**

- Surface Air Temperature
- Precipitation
- Humidity
- Weather Maps





# A New Approach to Dashboards

Not just for show!





## Unique Functionality



Data processing without GIS

Customizable charts and data layers

Routine updating and formatting of datasets from NASA, USGS, others

Build and save your own Data Story!

# Target AudienceS

- Hydrologists and Engineers
- Natural resource managers
- Utilities
- Irrigation districts
- Researchers
- Attorneys



# Sample Use Cases by Target Audience

| Modelers<br>(consultants,<br>researchers,<br>state)                                 | State Water<br>Planners and<br>Managers;<br>Water Resources<br>and Climate<br>Researchers             | Water Rights<br>Attorneys;<br>Irrigation Districts                                                                                               | Irrigation<br>Districts, State<br>Water<br>Planners;<br>Researchers;<br>Modelers (fed<br>and state) |
|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------|
| Extract Hourly<br>NLDAS Air<br>Temp, Precip,<br>and Pot ET for<br>a model<br>domain | Compare large-<br>scale groundwater<br>storage trends with<br>Rio Grande flows<br>and Air Temperature | Compare simulated<br>crop ET to simulated<br>irrigation water<br>applied to farm over<br>time to estimate<br>potential<br>supplemental GW<br>use | Plot and<br>download<br>simulated canal<br>and river<br>seepage over<br>time                        |



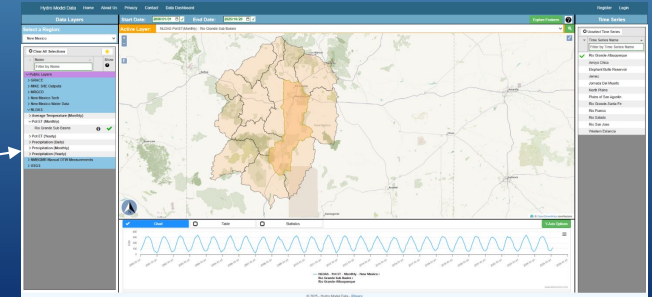
# Dashboard Structure

Source Data:  
NLDAS  
USGS  
MRGCD  
New Mexico  
Tech

Backend processes  
to download and  
import data

PostgreSQL  
Database on  
Server

Web interface

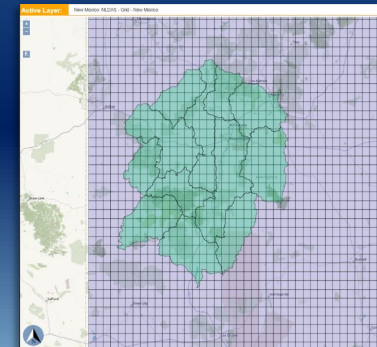
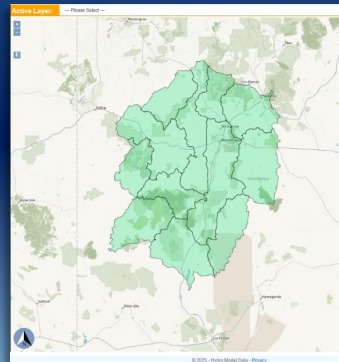
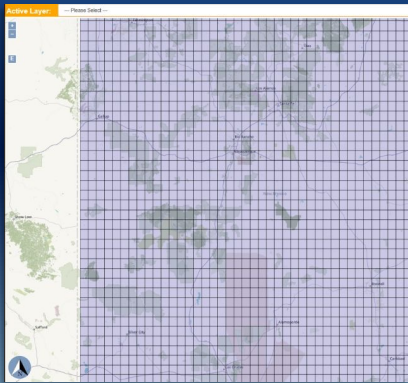
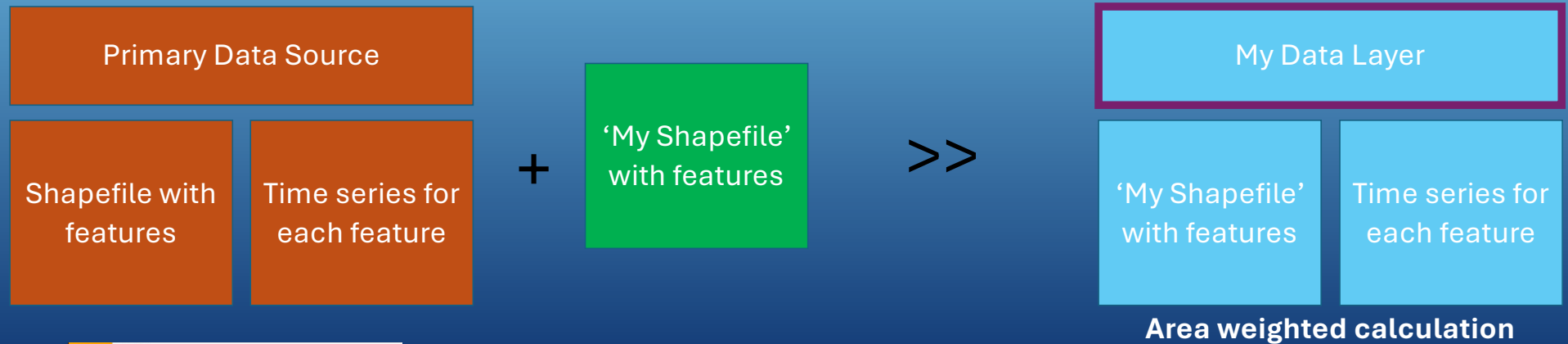


Functionality:

- Browse existing data
- Upload data
- Process and download data



# Extracting / processing existing data



# Demo Video

Compute average monthly Air Temp over model domain area for 2000-2025 and compare to same value in individual NLDAS grid cells.

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## Data Layers

## Select a Region:

Arizona ▾

✚ Clear All Selections



Show



Name

Filter by Name

## ▼ Public Layers

## &gt; NLDAS

## ▼ My Layers

## &gt; NLDAS

Start Date:

01/01/2000



End Date:

10/19/2025



Explore Features



## Time Series

✚ Unselect Time Series

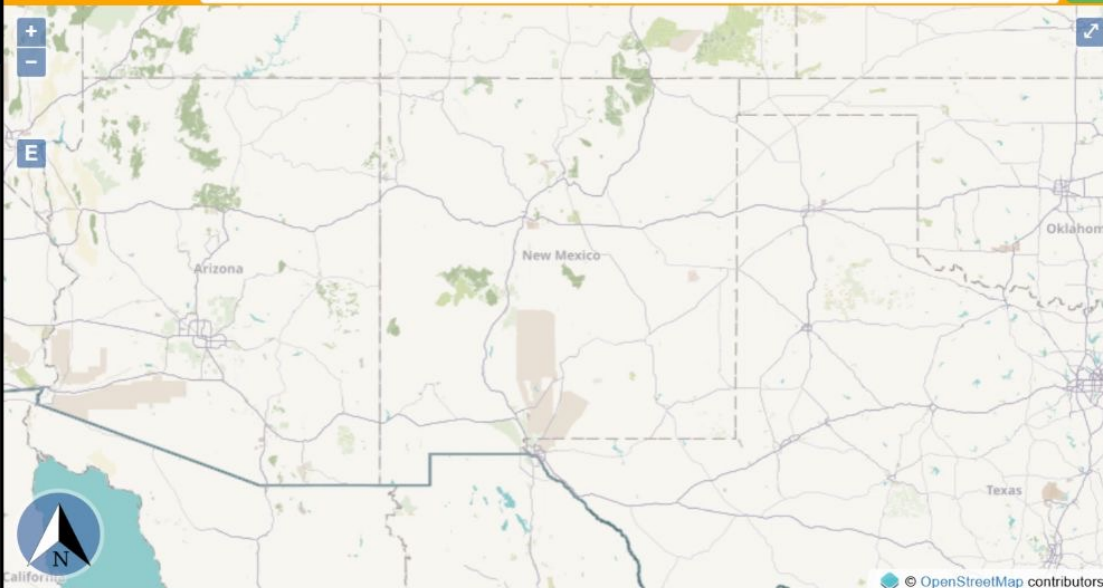
## ▼ Time Series Name

Filter by Time Series Name

No Data

## Active Layer:

--- Please Select ---

☒ Chart☐ Table☐ Statistics

Y-Axis Options



# Thank you!

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