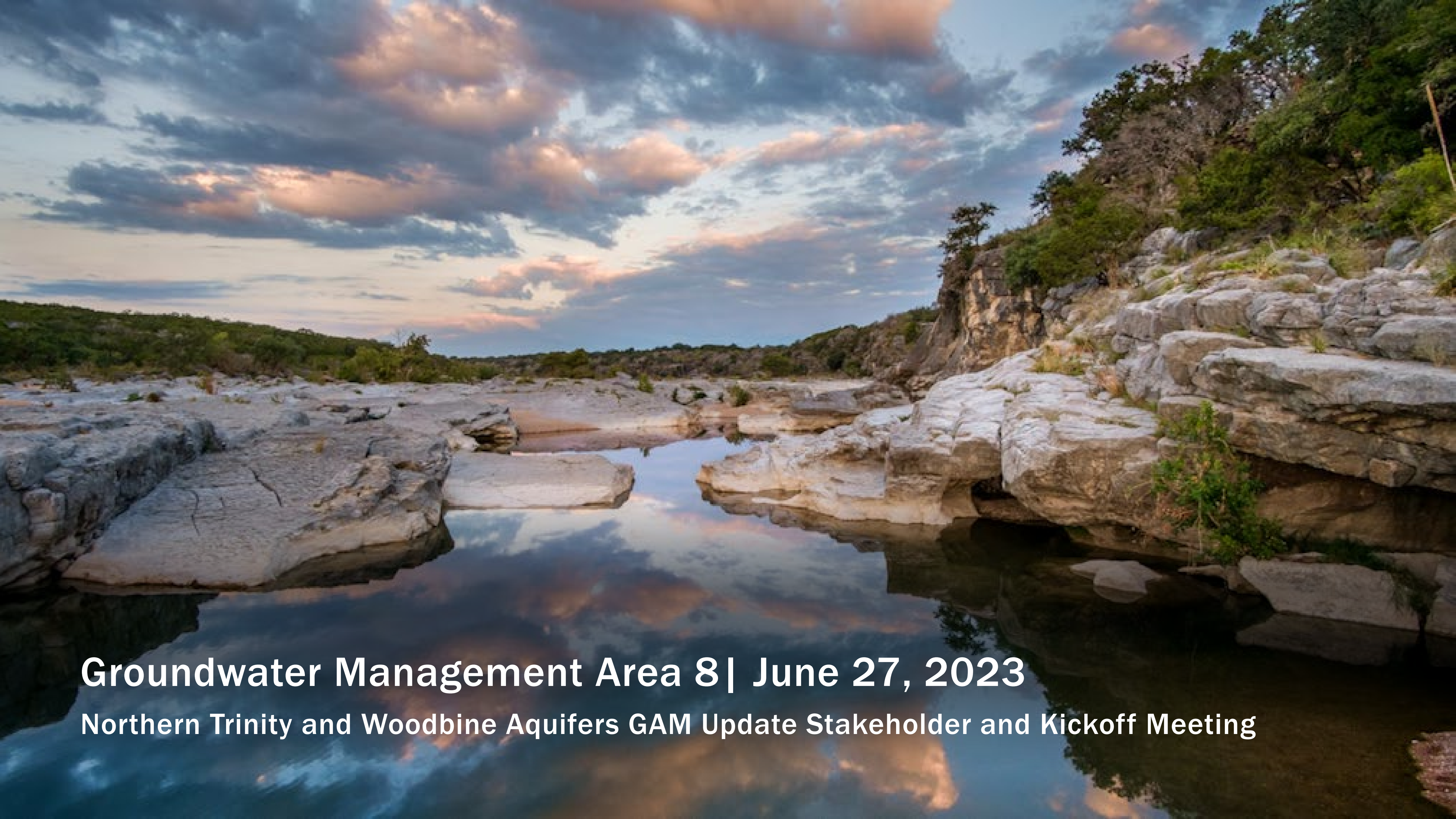
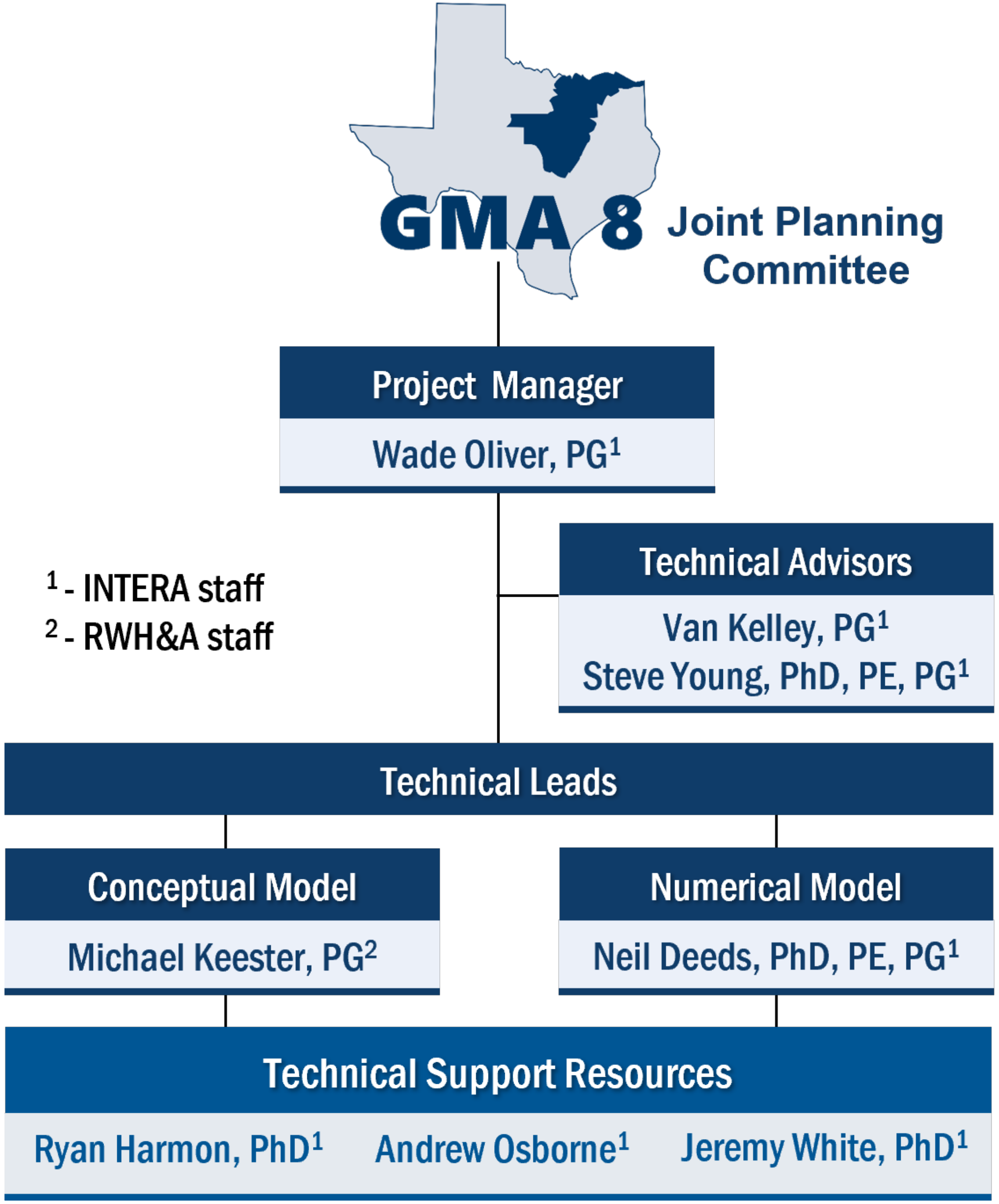


Groundwater Management Area 8| June 27, 2023

Northern Trinity and Woodbine Aquifers GAM Update Stakeholder and Kickoff Meeting

Model Objectives

- Improve conceptual understanding of flow in the Trinity and Woodbine Aquifers
- Provide up-to-date tool for use in developing desired future conditions (DFCs) and modeled available groundwater (MAG)
- Develop tool useful for water planning by both public and private entities



Workflow

Task A
Migrate NTWGAM to MODFLOW 6

- A.1 Migrate original packages
- A.2 Validate conversion by running base calibration and current MAG run
- A.3 Report to GMA 8

Task B
Update Model Data

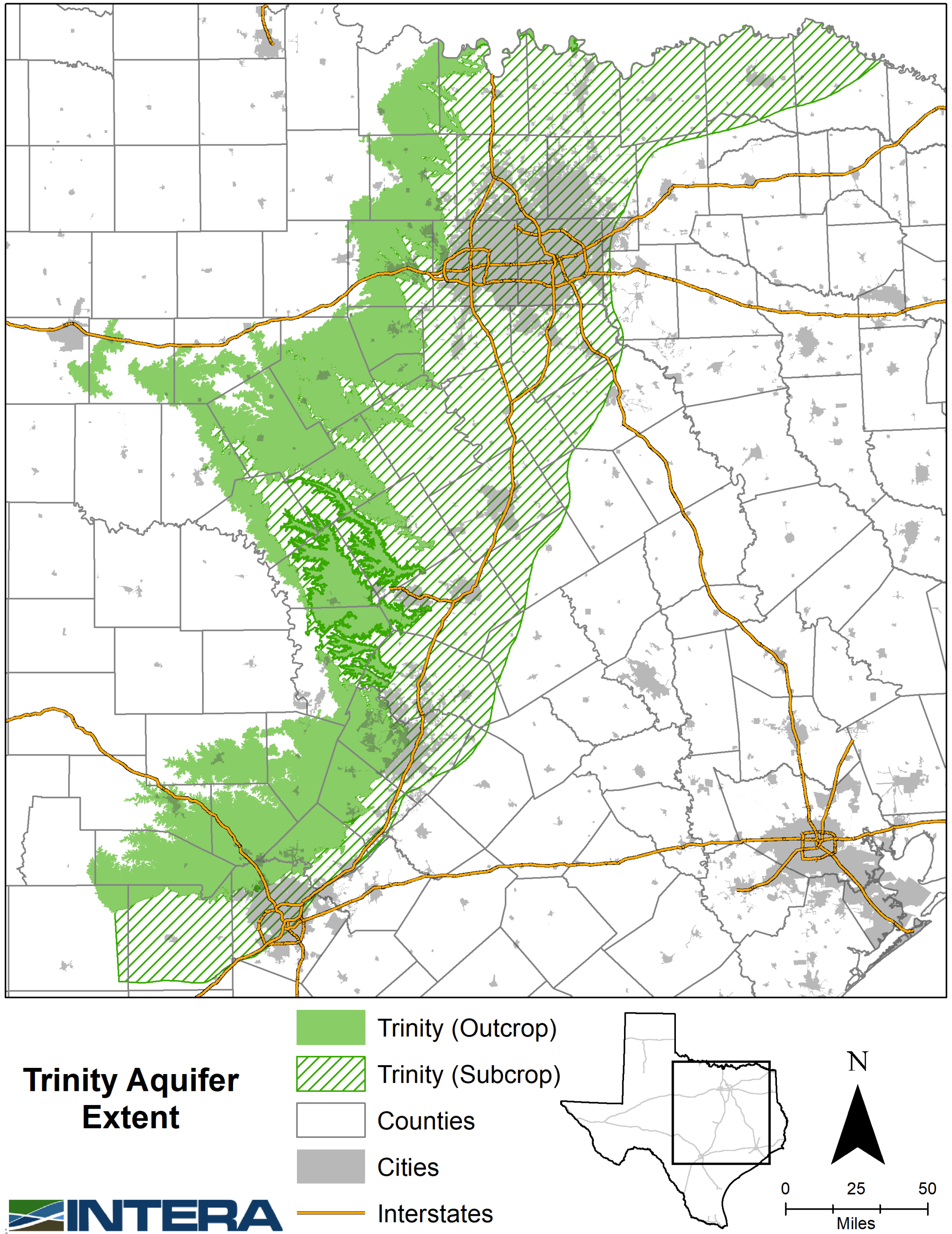
- B.1 Collect new data from GMA 8 GCDs and discuss model issues
- B.2 Collect new data from TWDB and discuss model issues
- B.3 Update structure/ faults/layering
- B.4 Update transient stresses (recharge, pumping, stream routing, ET)
- B.5 Update model properties
- B.6 Update head and flow calibration targets (2012 - 2020)
- B.7 Report to GMA 8
- B.8 Documentation

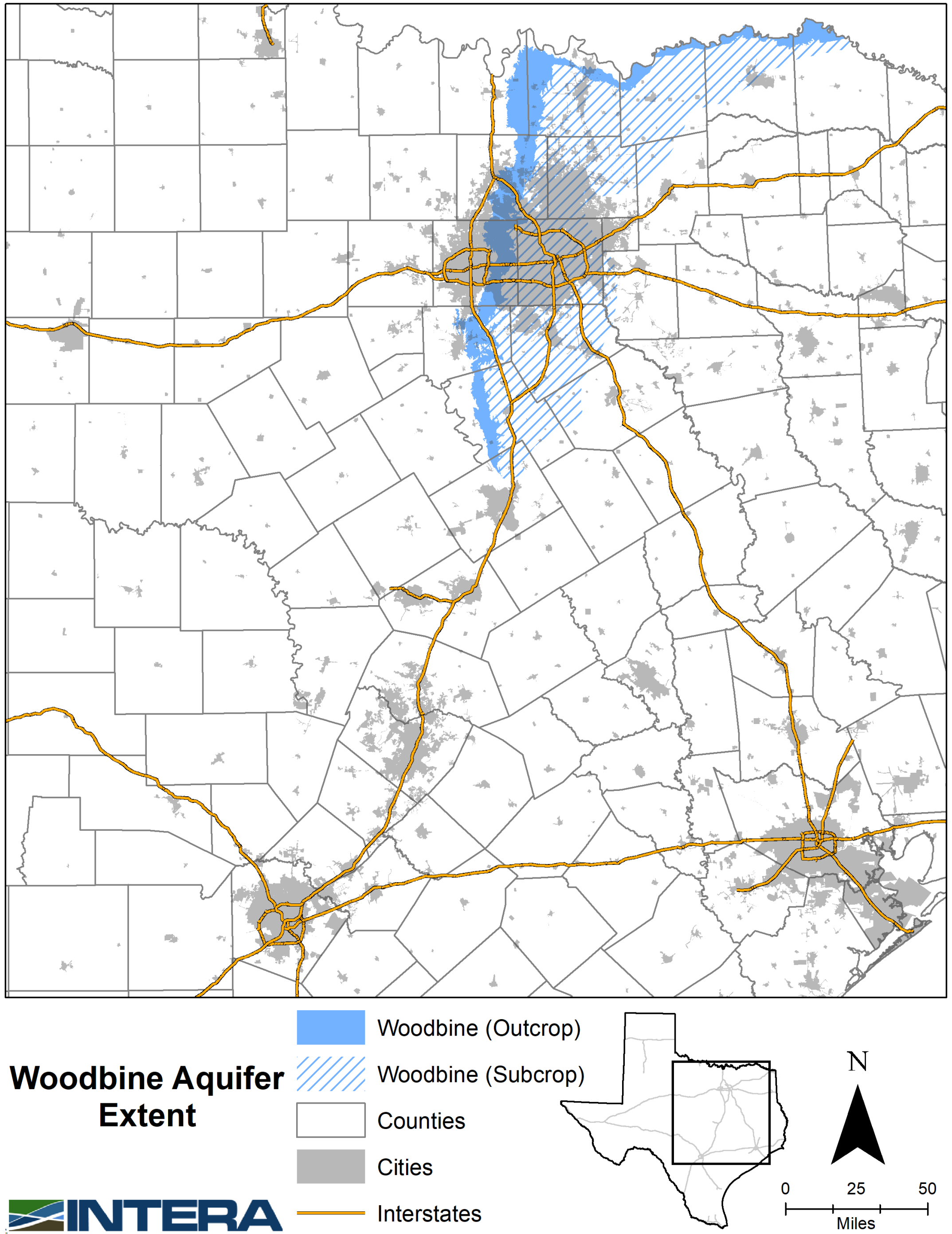
Task C
Re-calibrate NTWGAM

- C.1 Re-calibrate model
- C.2 Regularly scheduled updates to GMA 8
- C.3 Regularly scheduled updates to TWDB
- C.4 Documentation

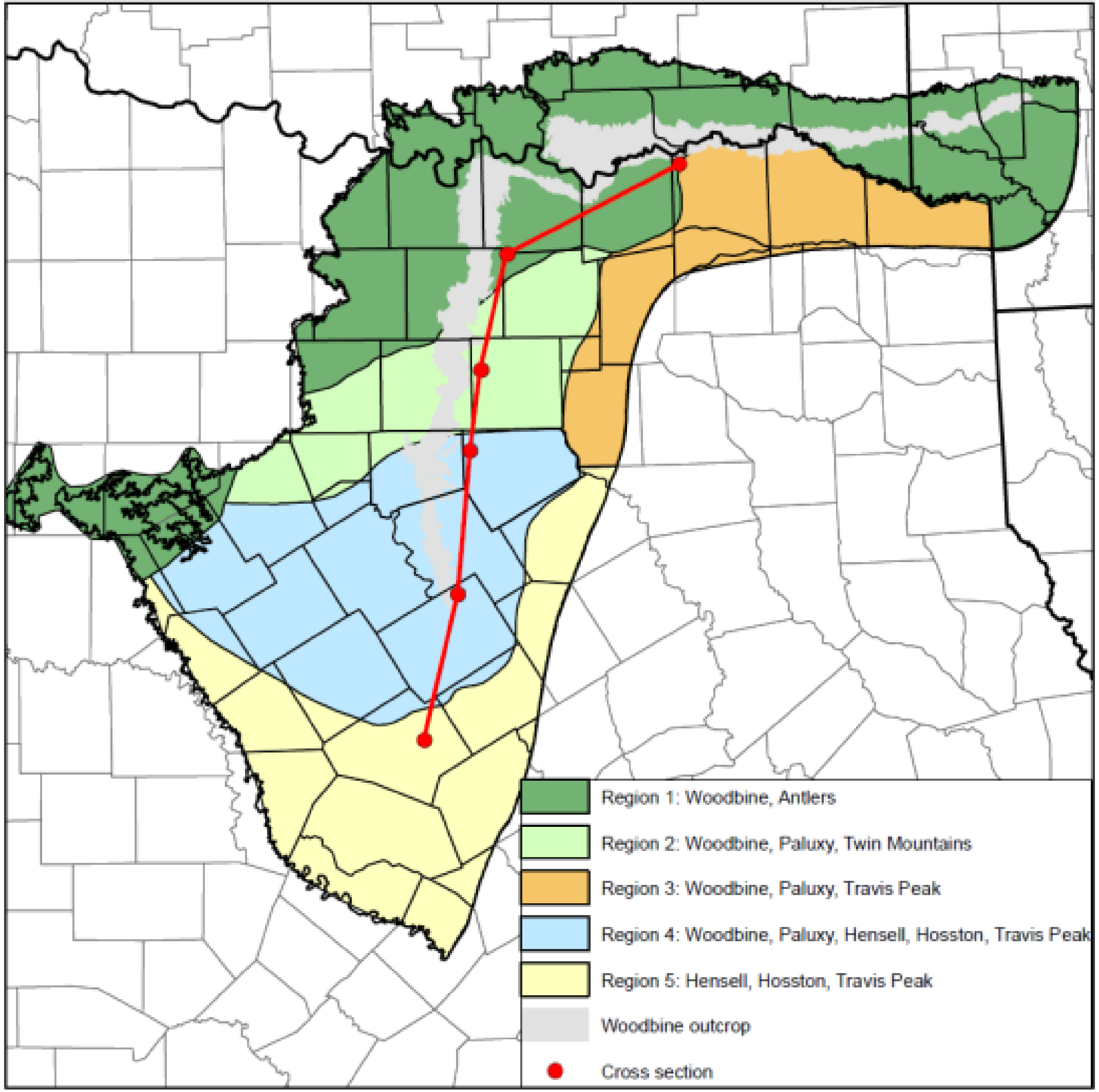
Task D
GMA 8 Predictive Simulations

- D.1 Run 1 - MAG that achieves DFC
- D.2 Run 2 - DFC that achieves MAG
- D.3 Run 3 - Sustainable production (meet with GMA 8 to define sustainable)
- D.4 Documentation

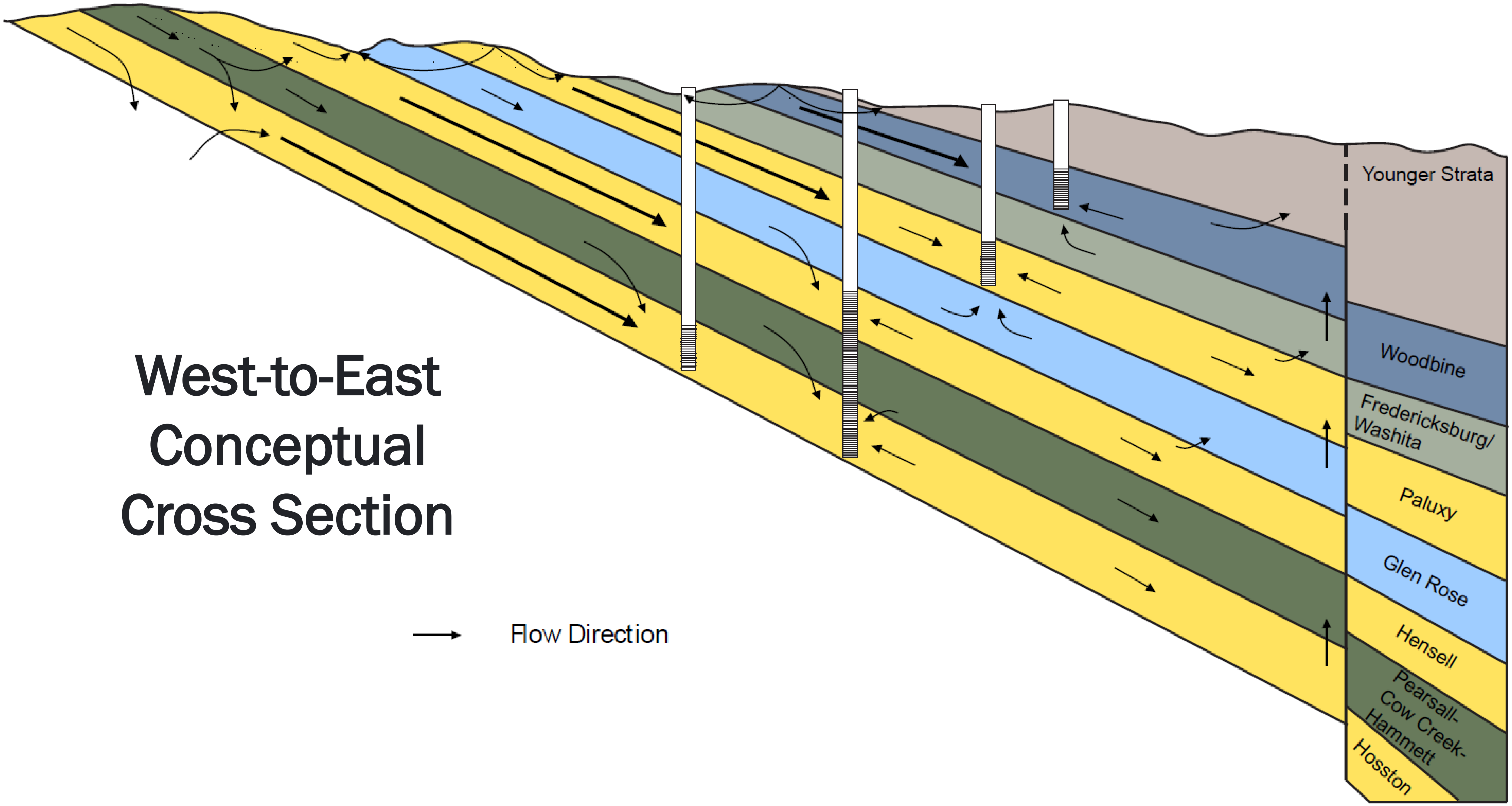

Trinity (Outcrop)
Trinity (Subcrop)
Counties
Cities
Interstates
Trinity Aquifer Extent
INTERA
N
0
25
50
Miles


Woodbine (Outcrop)
Woodbine (Subcrop)
Counties
Cities
Interstates
Woodbine Aquifer Extent
INTERA
N
0
25
50
Miles

Aquifer Regions



West-to-East Conceptual Cross Section



Groundwater Availability Modeling (GAM) Program

Dynamic tools for water planning in Texas

Purpose

To develop tools that can be used to help Groundwater Conservation Districts, Regional Water Planning Groups, and others understand and manage their groundwater resources.

Periodically Updated

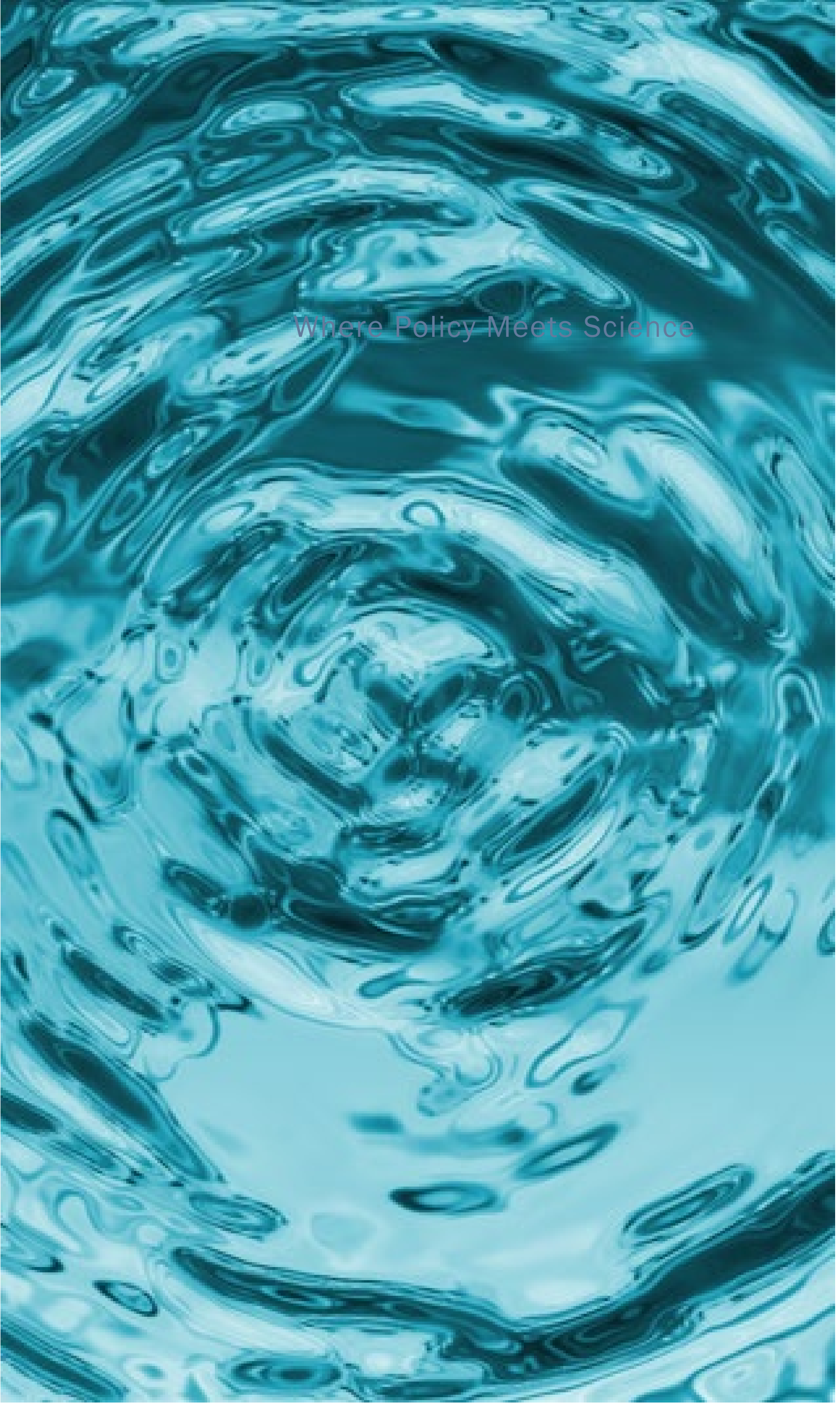
GAMs are updated when new relevant data becomes available

Freely Available

GAM reports are available online and all models are standardized and well documented

Public Process

Transparent development process where model development is recorded in steps



Groundwater Availability:

Desired Future Conditions (DFCs)

+

Groundwater Availability Model (GAM)

=

Modeled Available Groundwater (MAG)

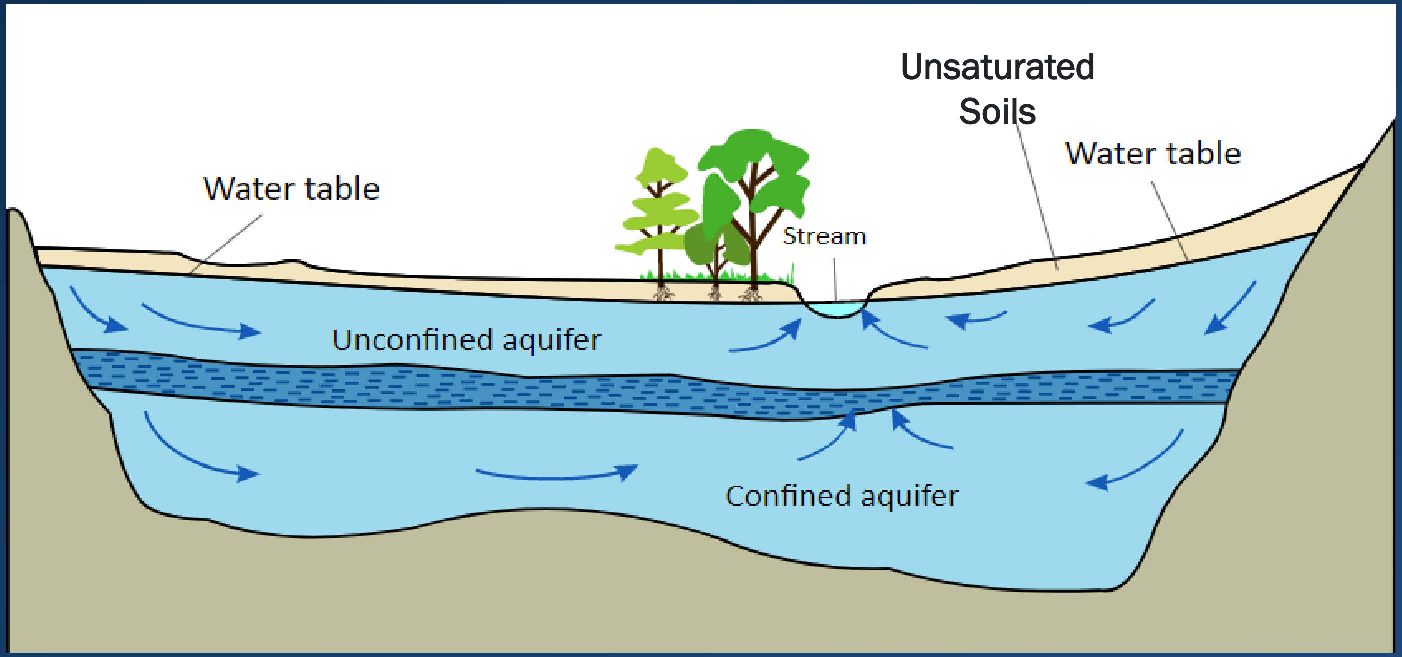
Groundwater Modeling

Aquifers and Confining Units

- An **aquifer** is a body of permeable rock which contains or transmits an economically viable quantity of groundwater

- Aquifers can be either **unconfined** (in communication with surface air pressure) or **confined** (isolated from surface air pressure)

- A **confining unit** is an impermeable rock layer which prevents flow between rock layers

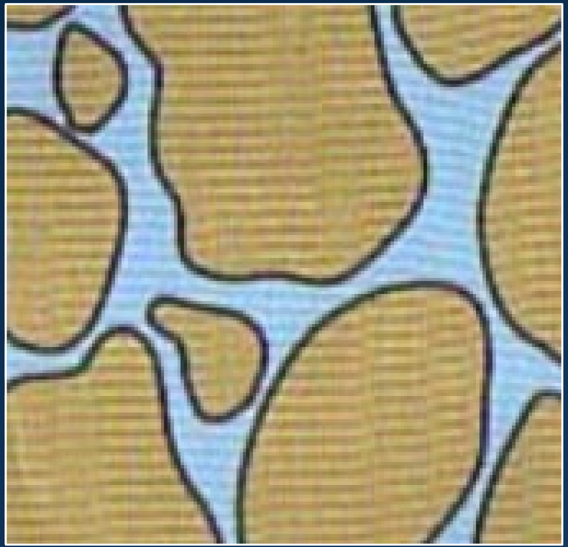


INTERA

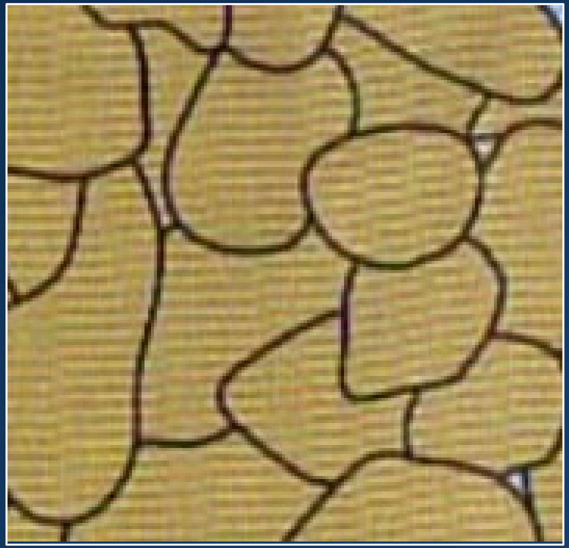
Aquifer Properties

- Hydraulic conductivity
  - the ease with which water is conducted through a porous material
  - related to permeability and transmissivity

Gravel and Coarse Sand



Finer Sands



Clay and Silt

More Permeable
Higher Conductivity

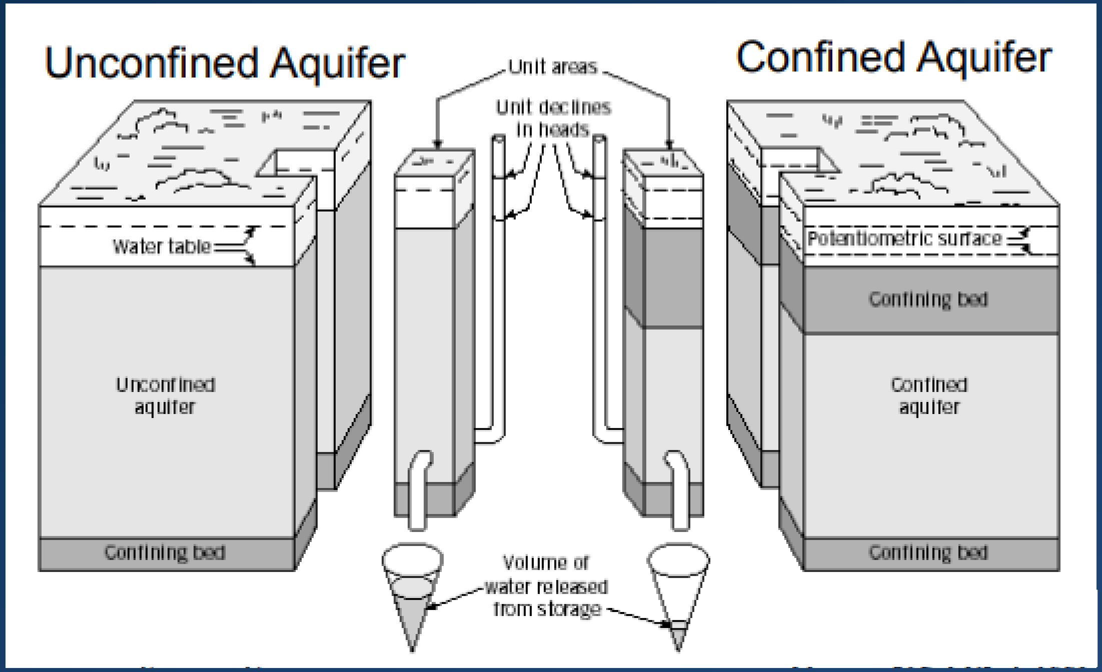
Less Permeable
Lower Conductivity

INTERA

Aquifer Properties

- Storativity
  - The volume of water released from a confined aquifer per unit area of the aquifer and per unit reduction in hydraulic head

- Specific Yield
  - The volume of water released from an unconfined aquifer per unit area of the aquifer and per unit reduction in water table elevation



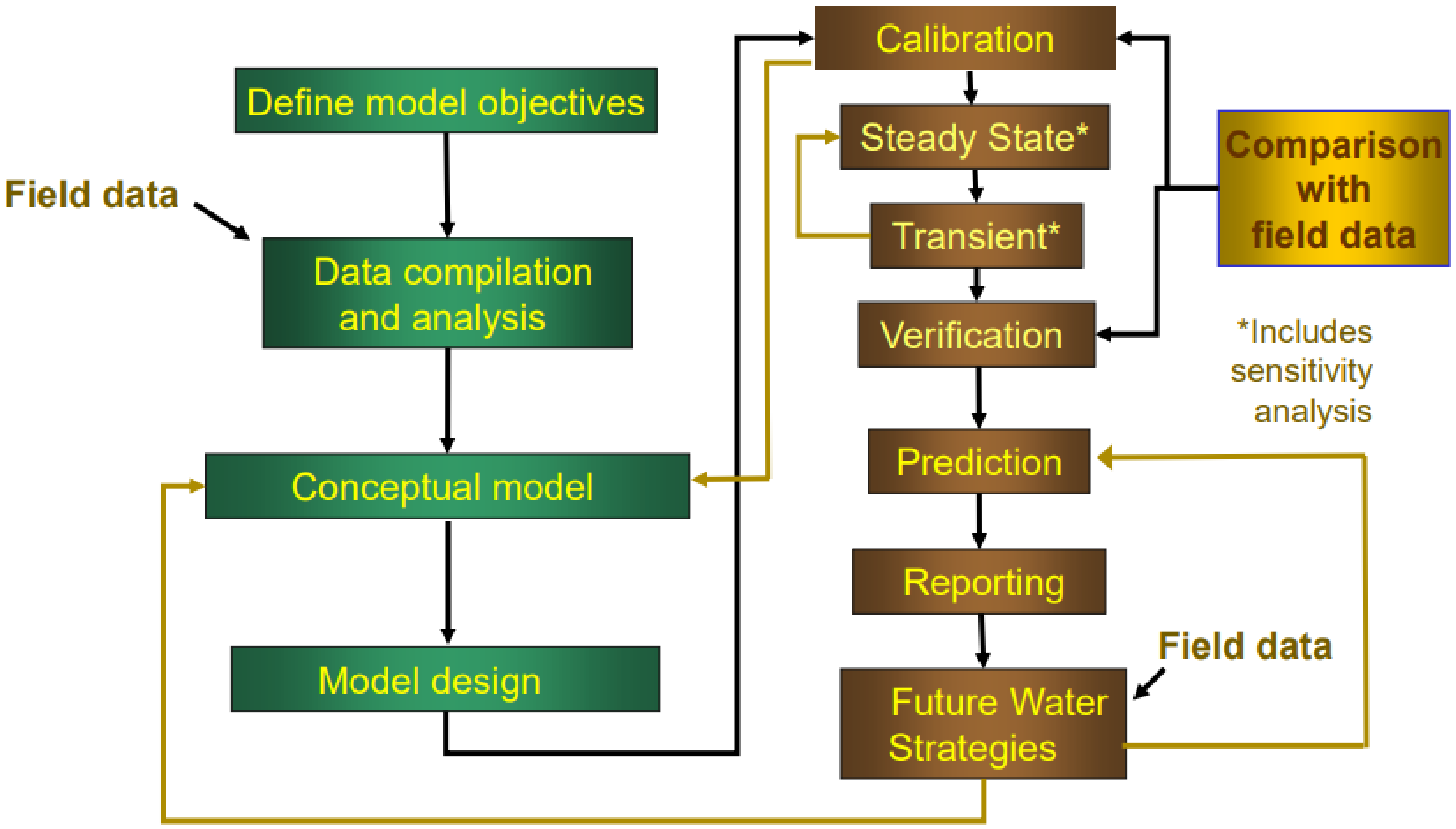
Heath (1983)

INTERA

Why Groundwater Flow Models?

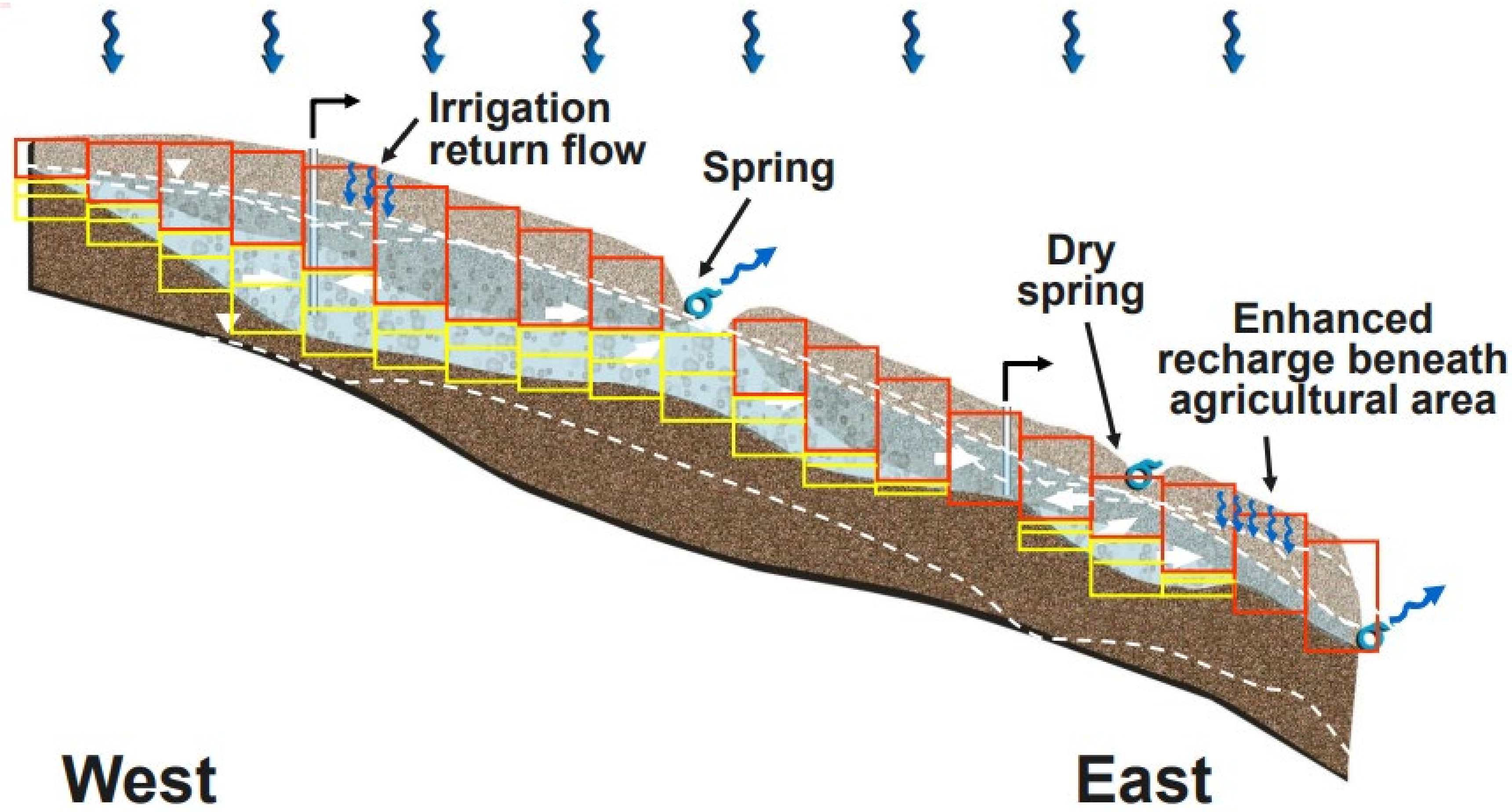
- Groundwater is more difficult to observe and measure than surface water
- Aquifers are complex, and predicting groundwater behavior depends on their physical properties
- Groundwater models are tools which aim to integrate dozens of variables dictating the flow within the aquifer(s) of interest
- The aim is to provide a comprehensive and accurate estimate of groundwater behavior through time

Modeling Protocol



INTERA

Start with Conceptual Model, Divide into Cells



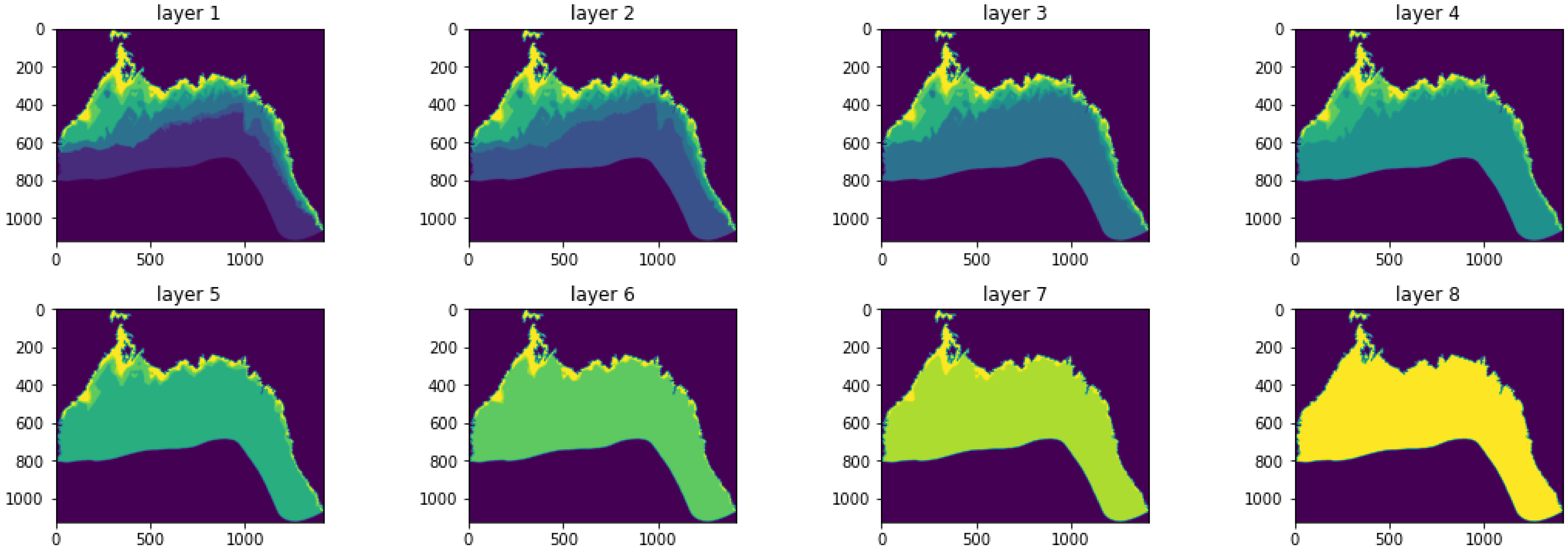
Progress Update

- The NWT model was converted to MF6 and the properties match.
- The pass-through layers were changed to -1 in MF6 IDOMAIN.
- The NWT calibrated model runtime is ~3hrs. The MF6 model runtime is 1.7 hr with the -1s in IDOMAIN.
- Currently working on generating simulated observations corresponding to NWT calibration targets.
- Simulated heads with MF6 are not identical to NWT but head maps do look identical.
- Both the “total water in” and “total water out” is different by only 0.41% between MF6/NWT. The greatest difference is in the RIV inflows by 2%

INTERA

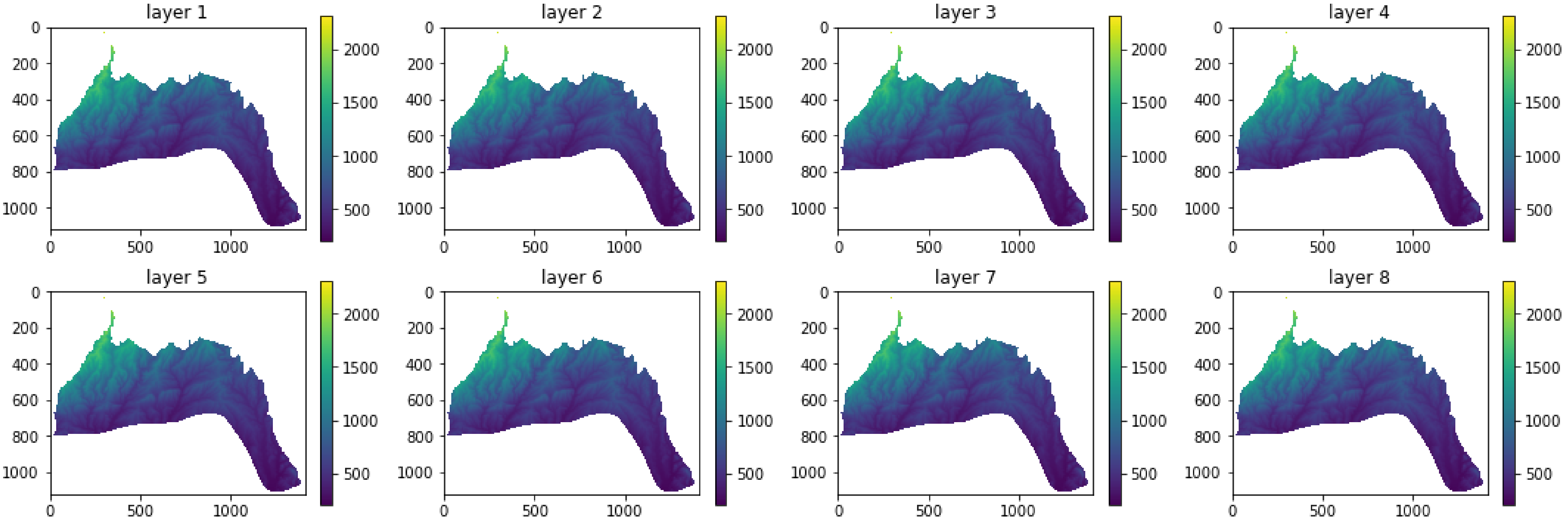
MODFLOW NWT to MODFLOW 6 Conversion

MODFLOW NWT - IBOUNDS

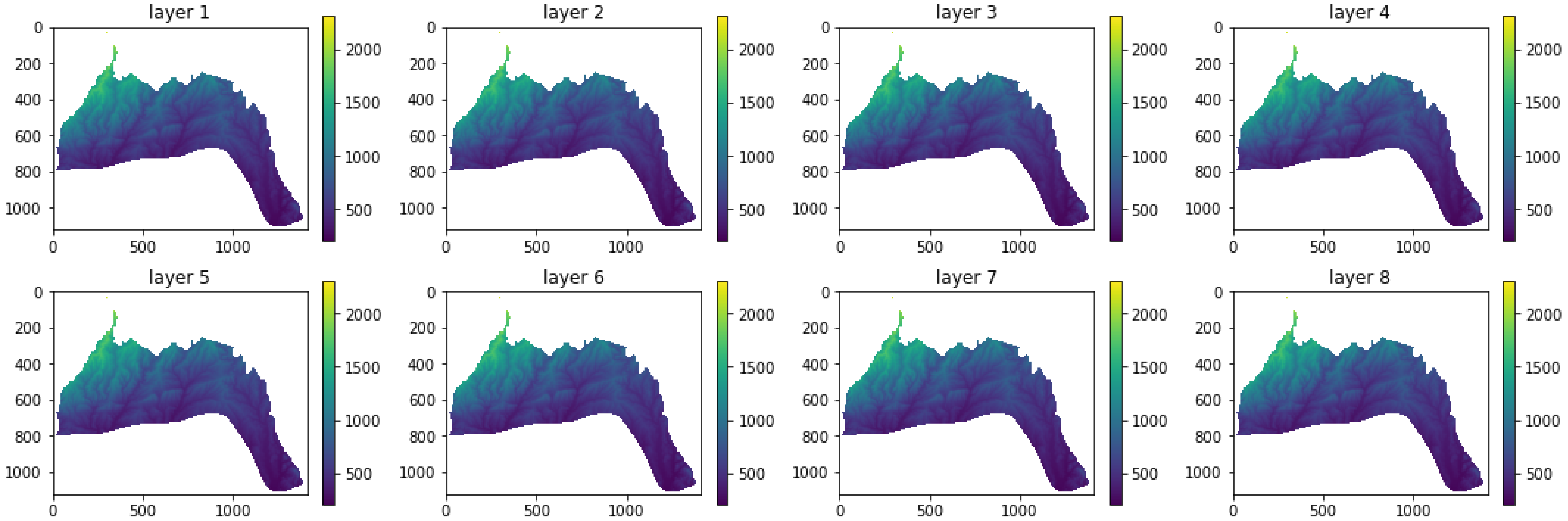


INTERA

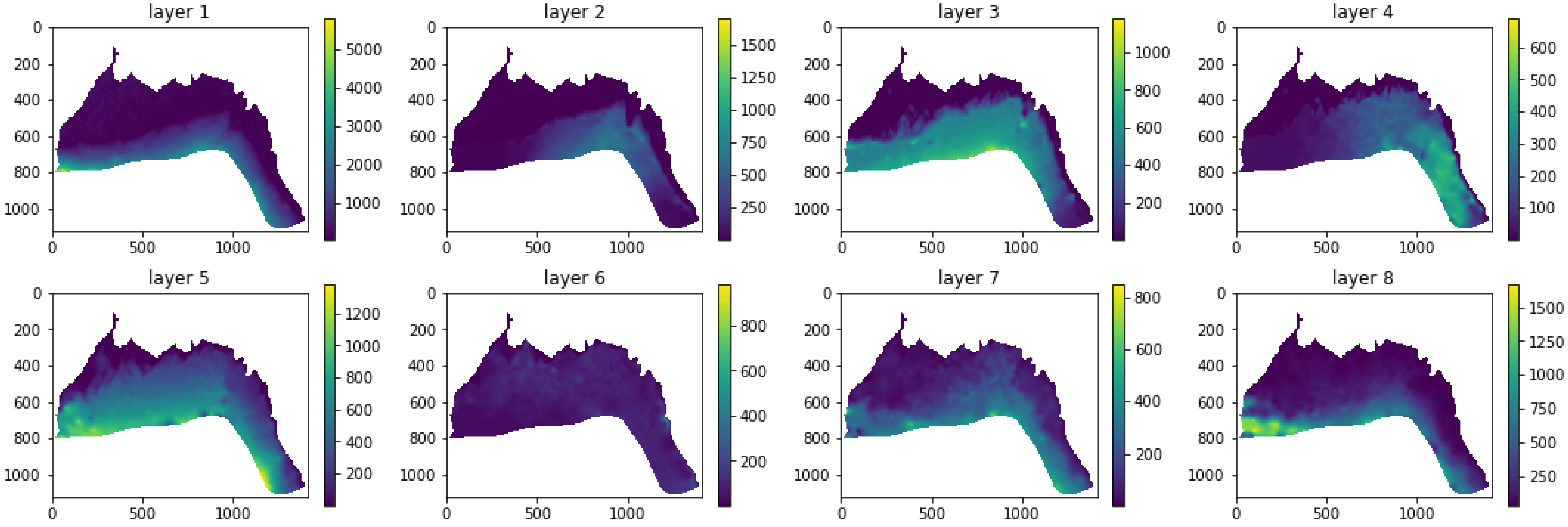
MODFLOW NWT – Starting Heads



MODFLOW 6 – Starting Heads

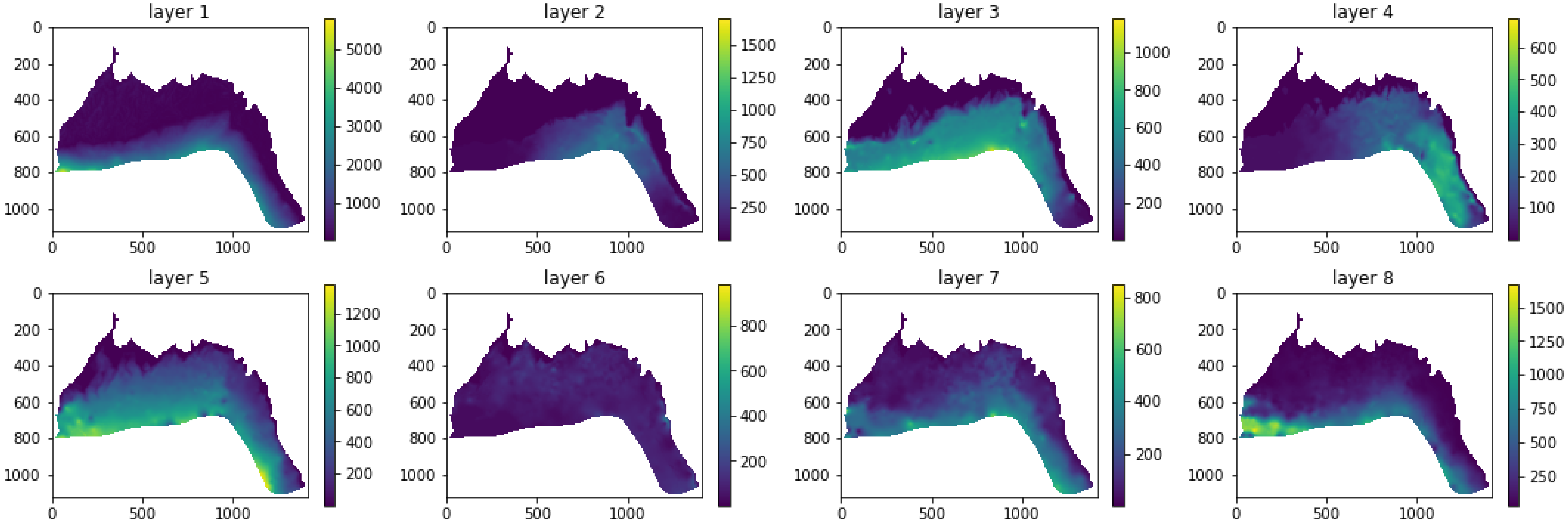


MODFLOW NWT – Thickness

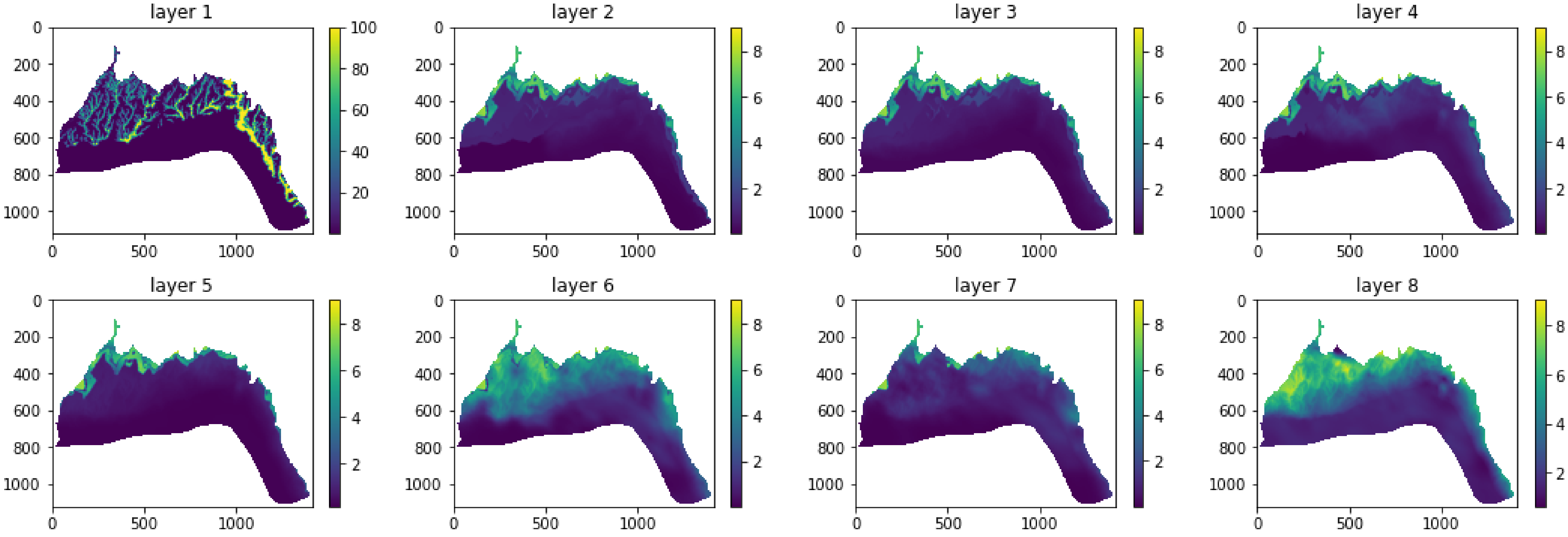


INTERA

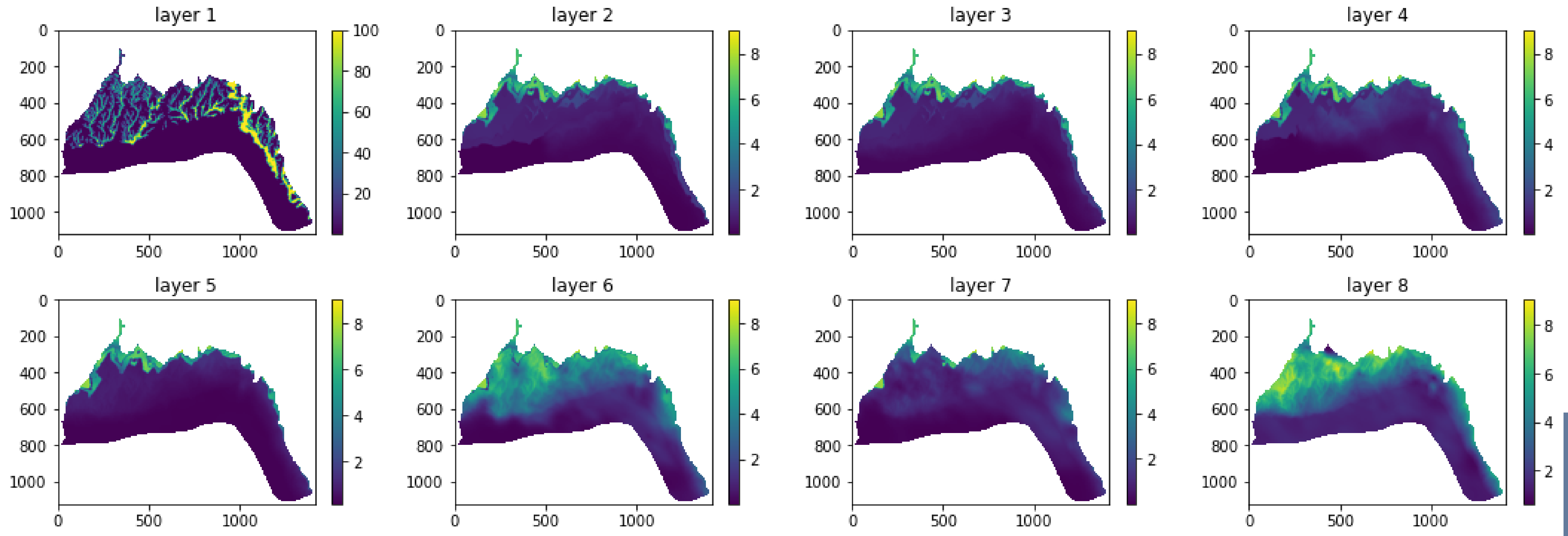
MODFLOW 6 – Thickness



MODFLOW NWT – Horiz. Hydraulic Conductivity



MODFLOW 6 – Horiz. Hydraulic Conductivity



Data Request – Need by July 31st

- **Measured water levels** – if you have any that are not available through the TWDB Groundwater Database
- **Geophysical logs** – LAS format is best, but images work as well.
- **Pumping records** – This is one of the most difficult items in model development.
- **Aquifer test data** – This includes single or multiple-well tests.
- **Spring flow measurements** –Please include flow rate, date, location, and spring name (if applicable).
- **Relevant district-scale reports** – If your District has completed or funded studies that pertain to the Trinity and/or Woodbine aquifers since the last model was developed, please share these.
- **Other relevant information**

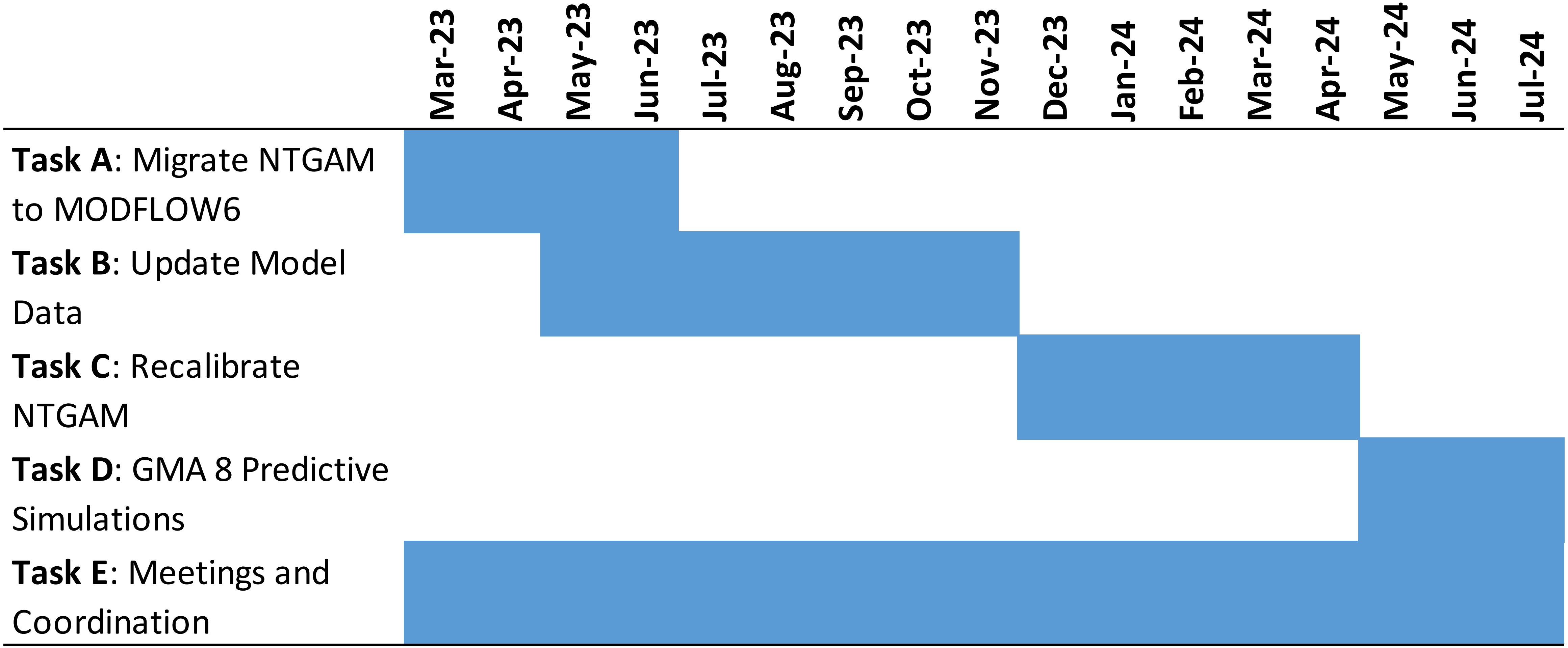
Timeline Driver – Joint Planning

Not later than May 1, 2021, and every five years thereafter, the districts shall consider groundwater availability models and other data or information for the management area and shall propose for adoption desired future conditions for the relevant aquifers within the management area. (TWC 36.108(d))

Relevant Dates for Last Round of Joint Planning

- October 27, 2020: Proposed DFCs for adoption
- July 6, 2022: Adopted by GMA 8 (modified)

Model Update Schedule




Questions?