The USGS WaterSMART Initiative: Apalachicola-Chattahoochee-Flint River Basin Focus Area Study: Surface and Groundwater Component

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U.S. GEOLOGICAL SURVEY

Apalachicola, Florida, 2012

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Surface Water Flow Modeling Component

- Building off previous work
  - Southeast Regional Assessment Project (SERAP)
    - Multi-resolution set of hydrologic models simulating NATURAL flows in the ACF Basin
      - Output provided to ecological and water temperature modeling teams
      - Projections of climate and land cover change used

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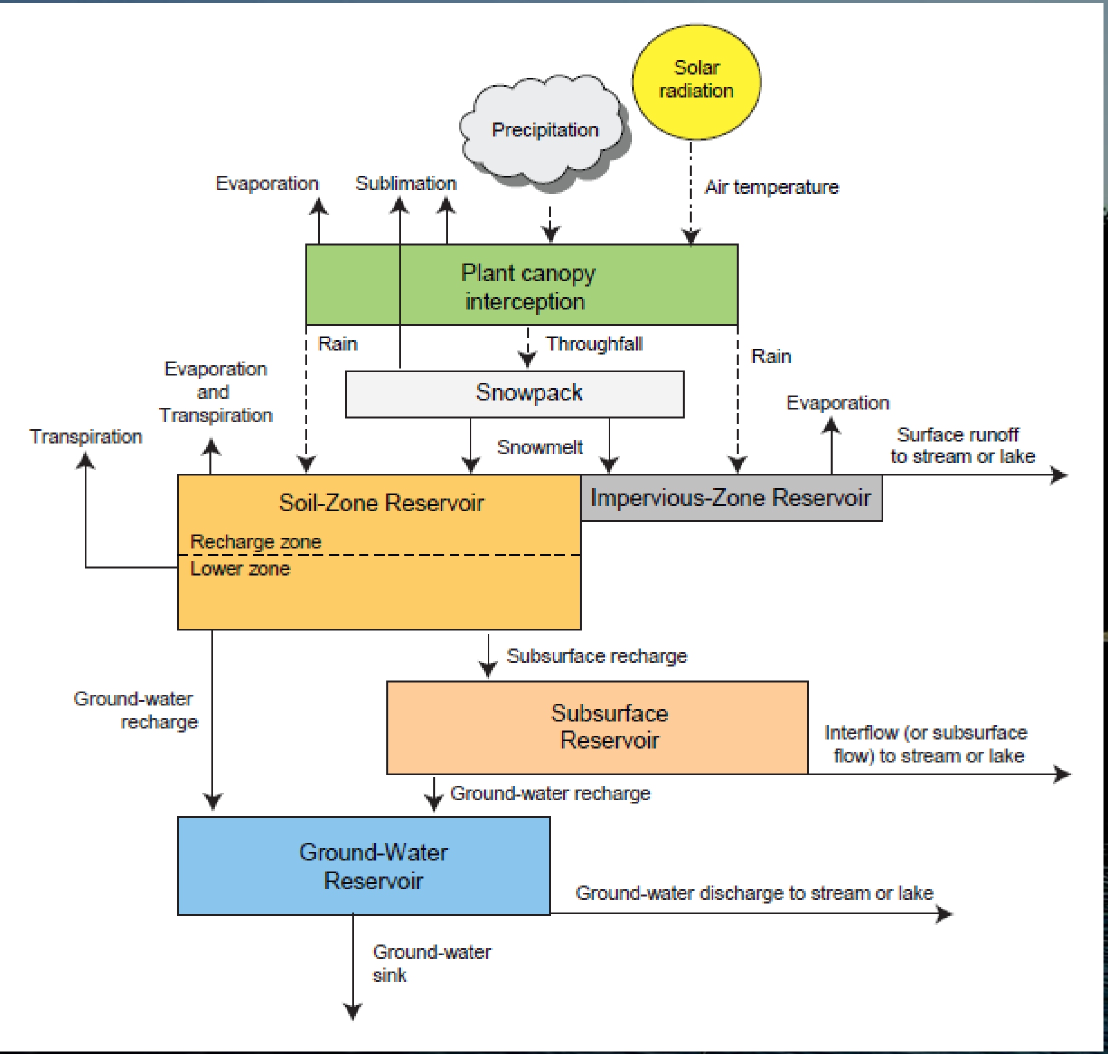
Surface Water Flow Modeling Component

- Modeling Structure

- USGS Precipitation-Runoff Modeling System (PRMS)
- Daily time step
- Deterministic
- Distributed parameters
- Physical process based



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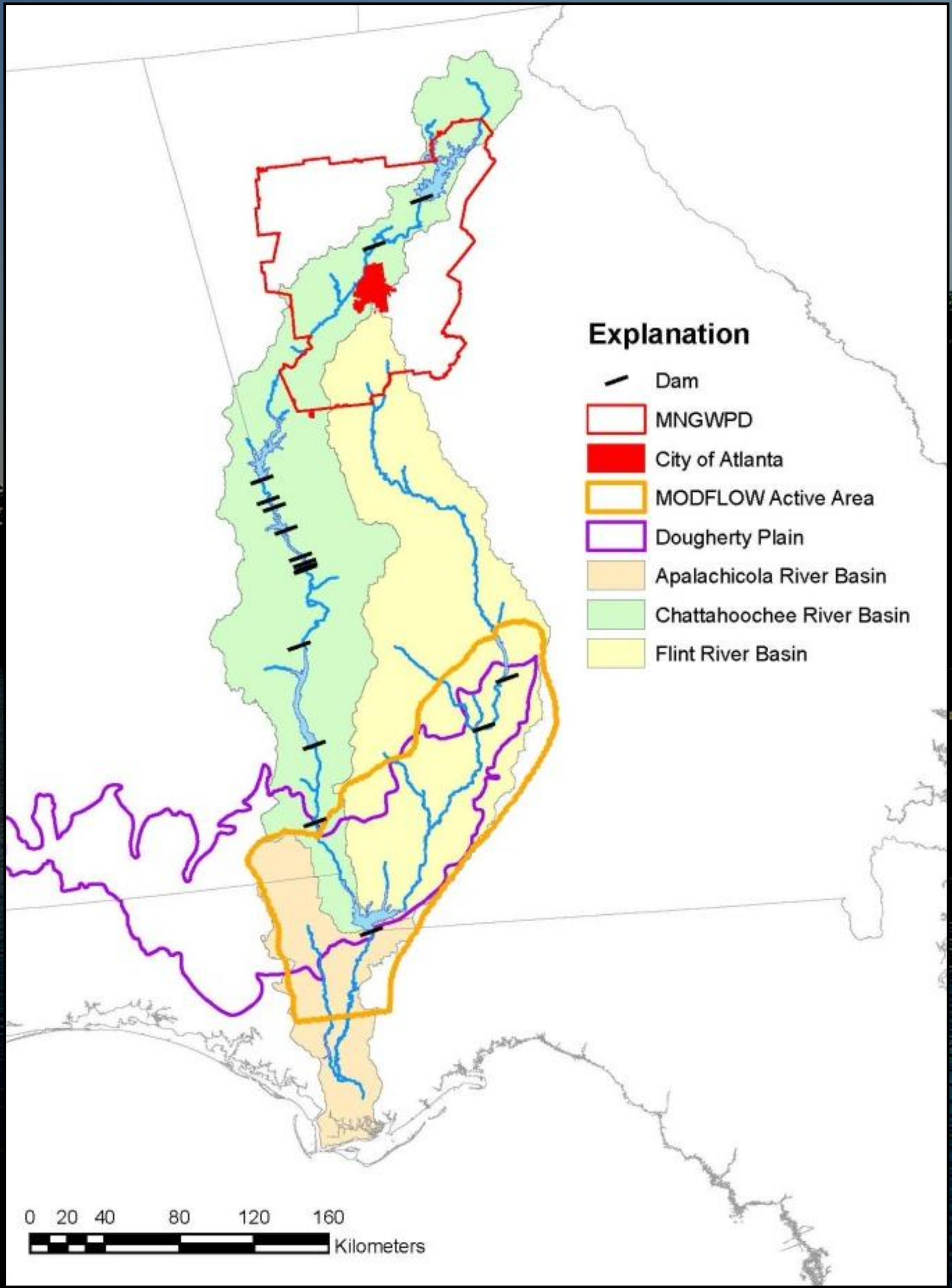
Surface Water Flow Modeling Component

- Entire ACF Basin with outlet located at most downstream USGS streamgage

  - Apalachicola River at Sumatra, FL

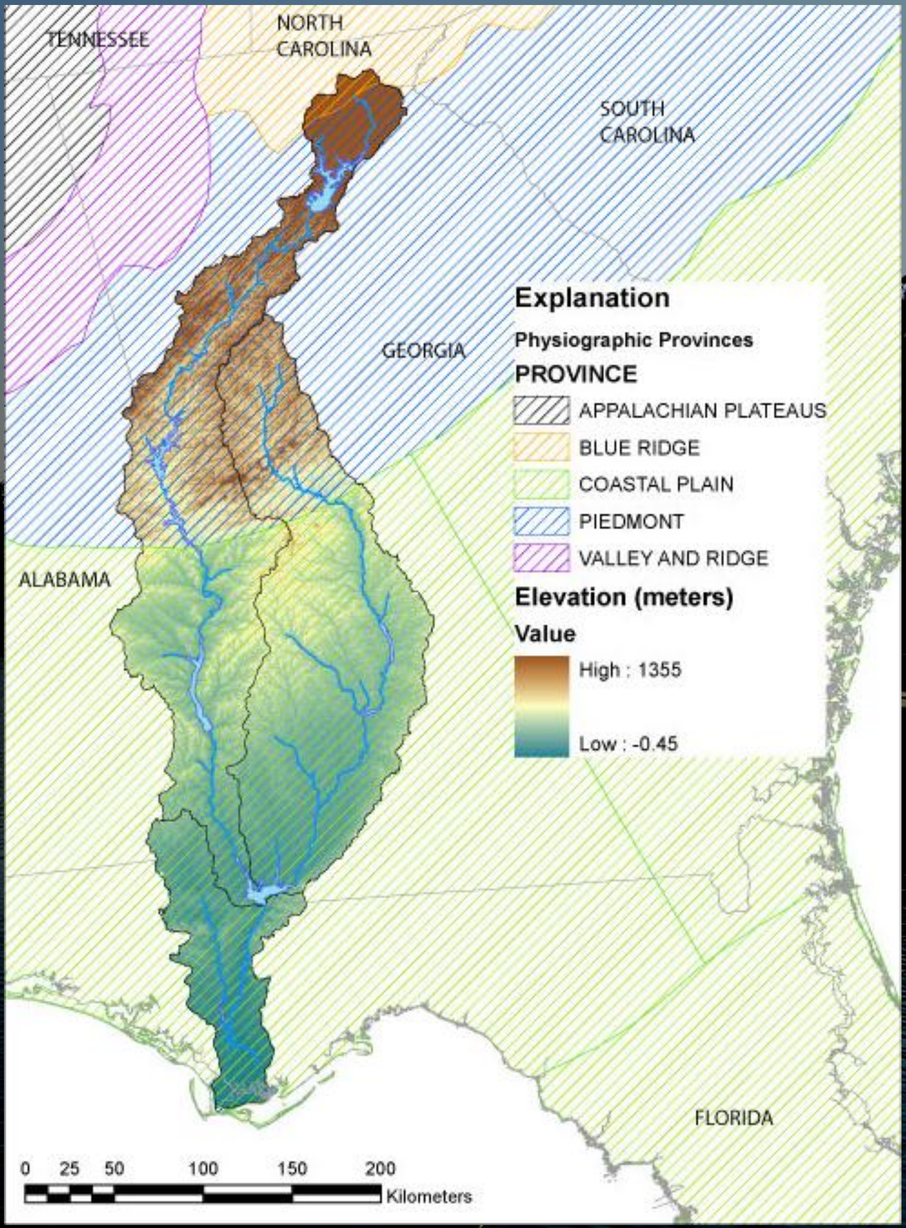


Surface Water Flow Modeling Component

- **Basin Delineation**

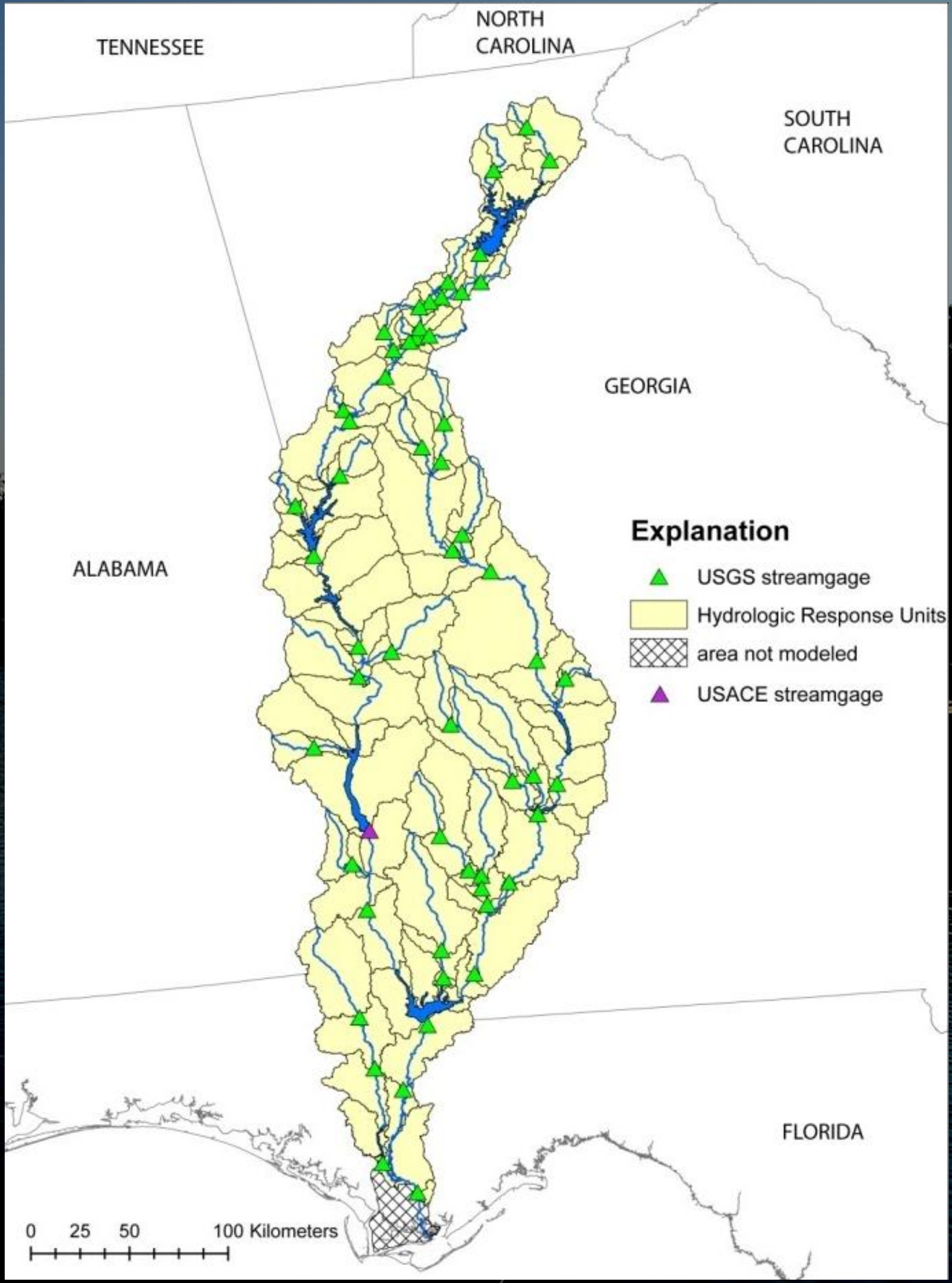
  - **In past applications, used raw Digital Elevation Model (DEM) to delineate and subdivide basin into modeling units.**

  - **Now using NHD Plus catchments as base layer to create modeling units.**



Surface Water Flow Modeling Component

- Coarse resolution model
- Initially based on available USGS streamgages and large mainstem reservoirs
- New version will use aggregated NHD Plus catchments and points of interest
  - Streamgages
  - Reservoir inlets/outlets
  - WaterSMART reporting units
  - Other modeling nodes



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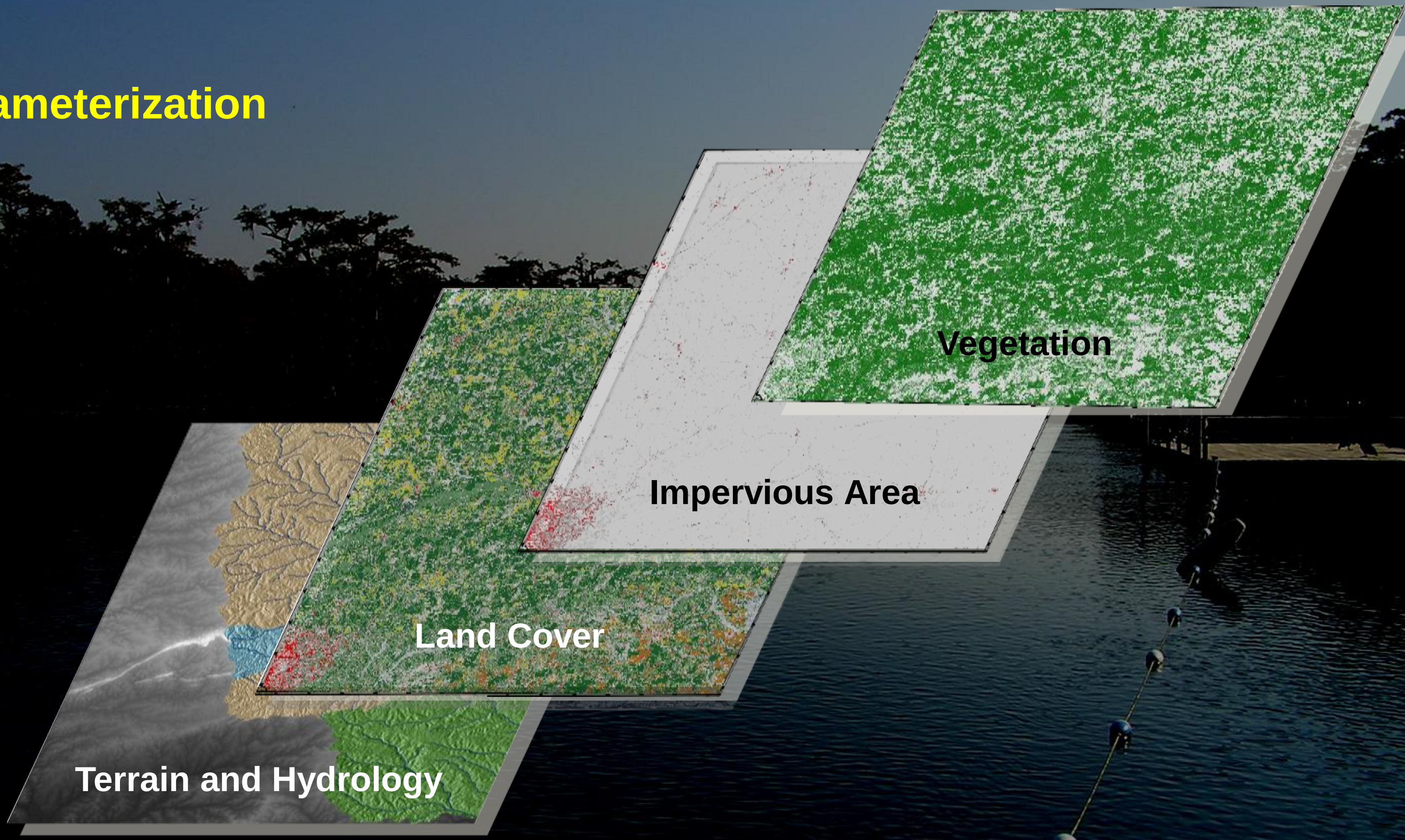
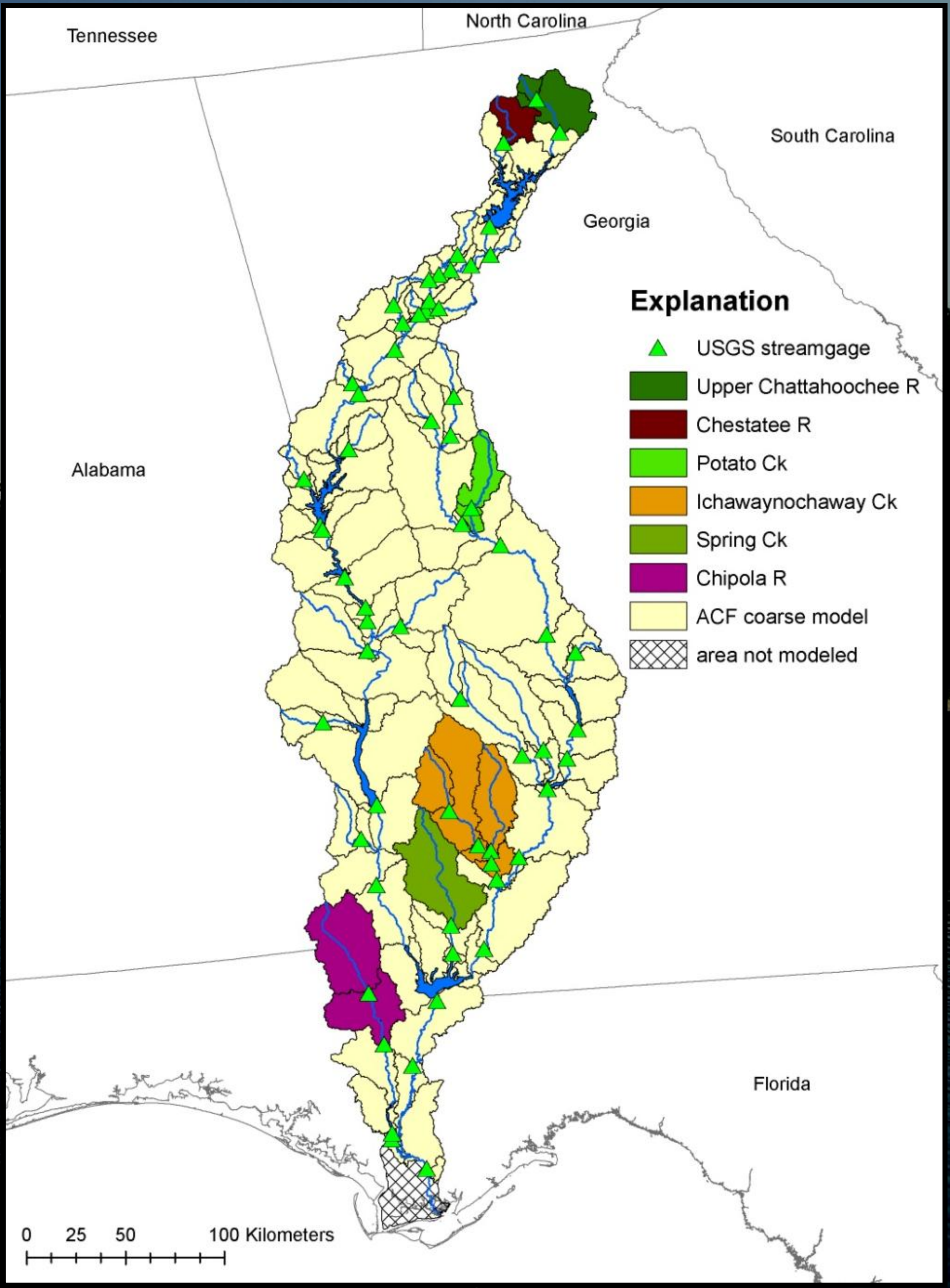
Surface Water Flow Modeling Component

- Parameterization



Surface Water Flow Modeling Component

- **Fine-resolution models**
- **Six watersheds selected as part of SERAP**
  - Upper Chattahoochee River
  - Chestatee River
  - Chipola River
  - Ichawaynochaway Creek
  - Potato Creek
  - Spring Creek



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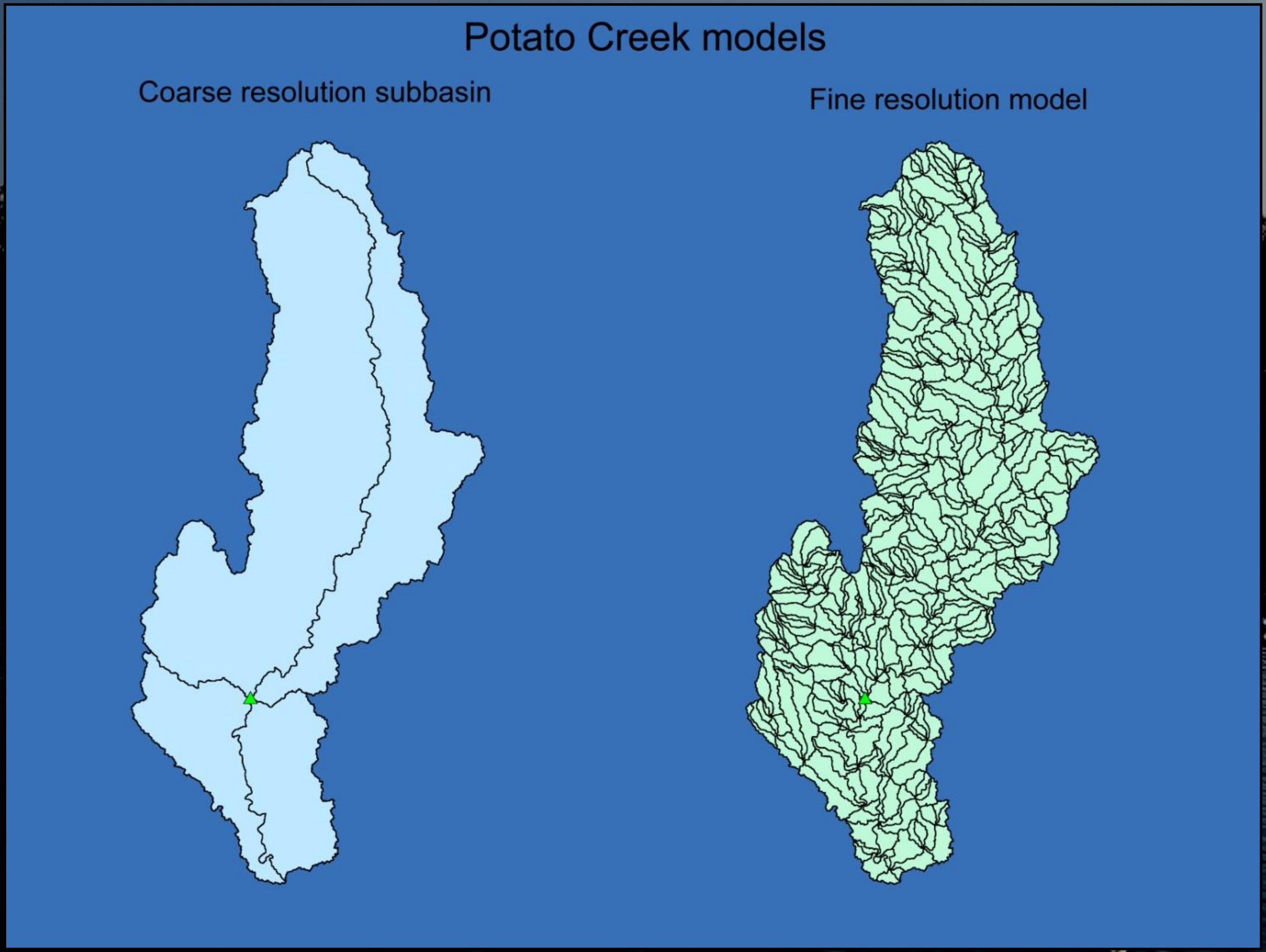
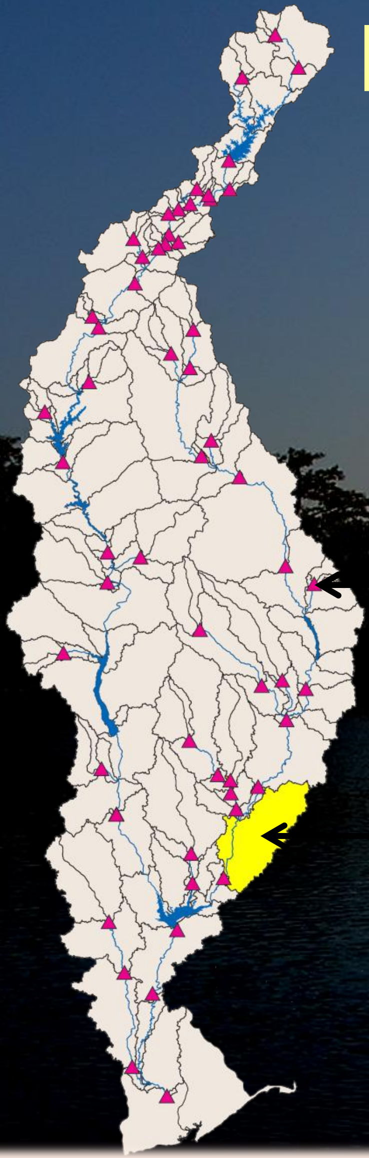
Surface-Water Modeling at multiple resolutions



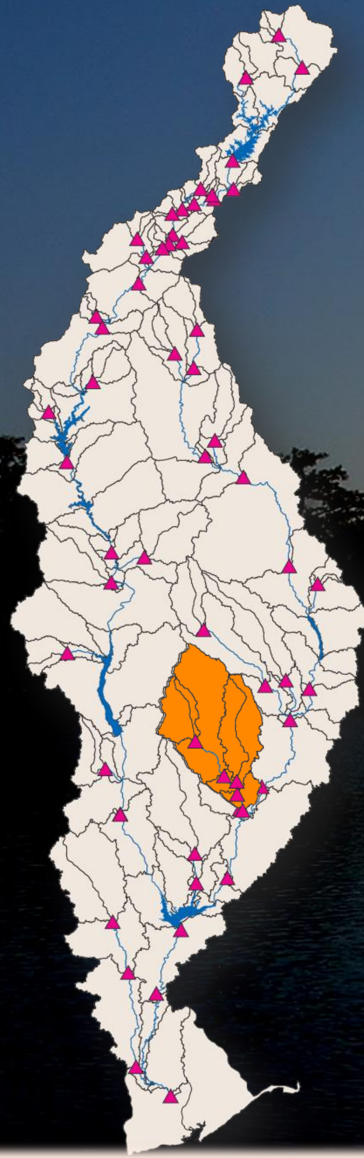
Nested Hydrologic Models



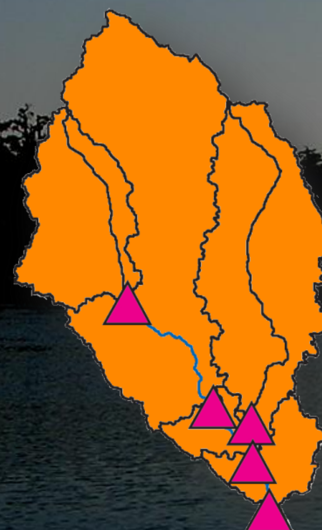
Coarse resolution HRUs based on stream gages and real-world geographic locations to ensure consistency when nesting models

Nested Hydrologic Models

Coarse Resolution Hydrologic Model



Pull a stand-alone coarse resolution model from the larger one



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Nested Hydrologic Models

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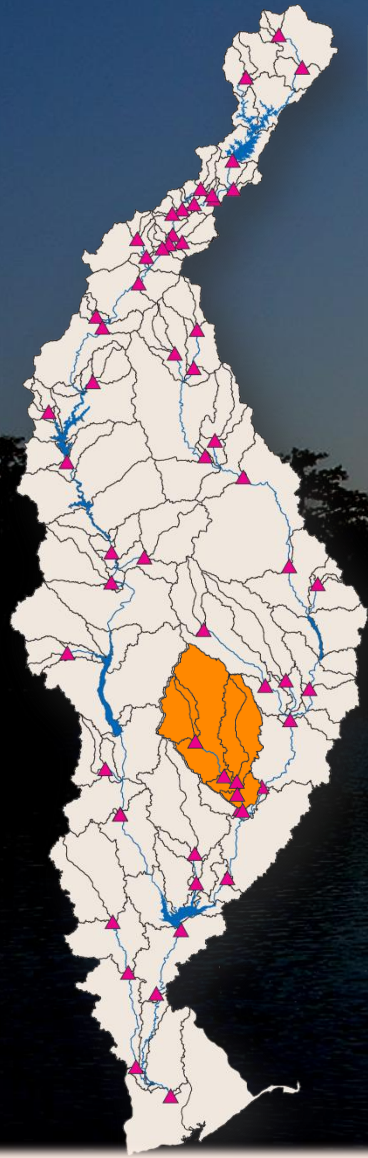

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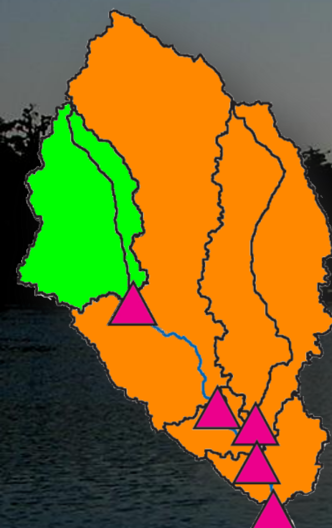
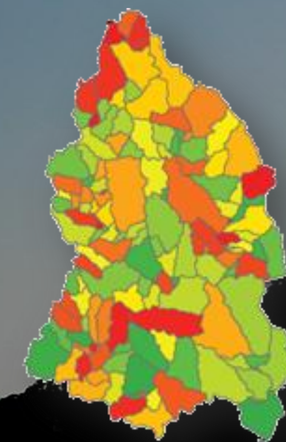


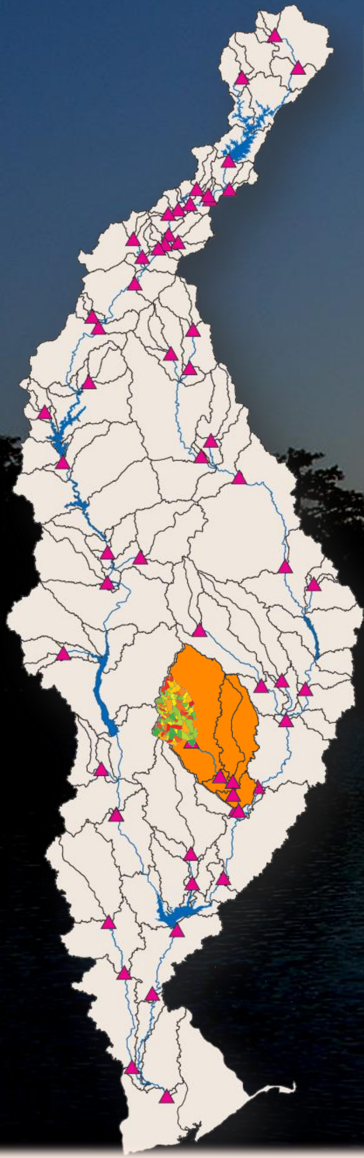


Nest a stand-alone fine resolution model

Coarse resolution HRUs based on stream gages and real-world geographic locations to ensure consistency when nesting models

Nested Hydrologic Models

Coarse Resolution Hydrologic Model



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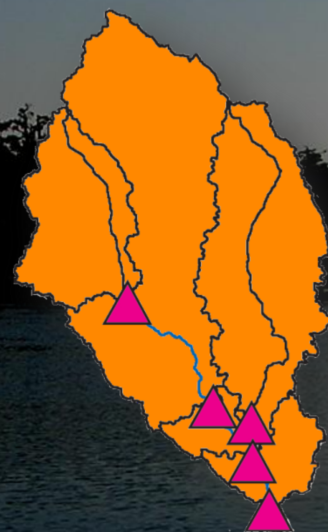
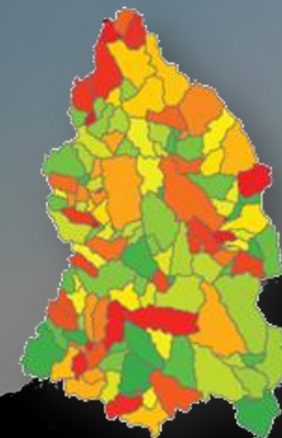




Nest a stand-alone fine resolution model

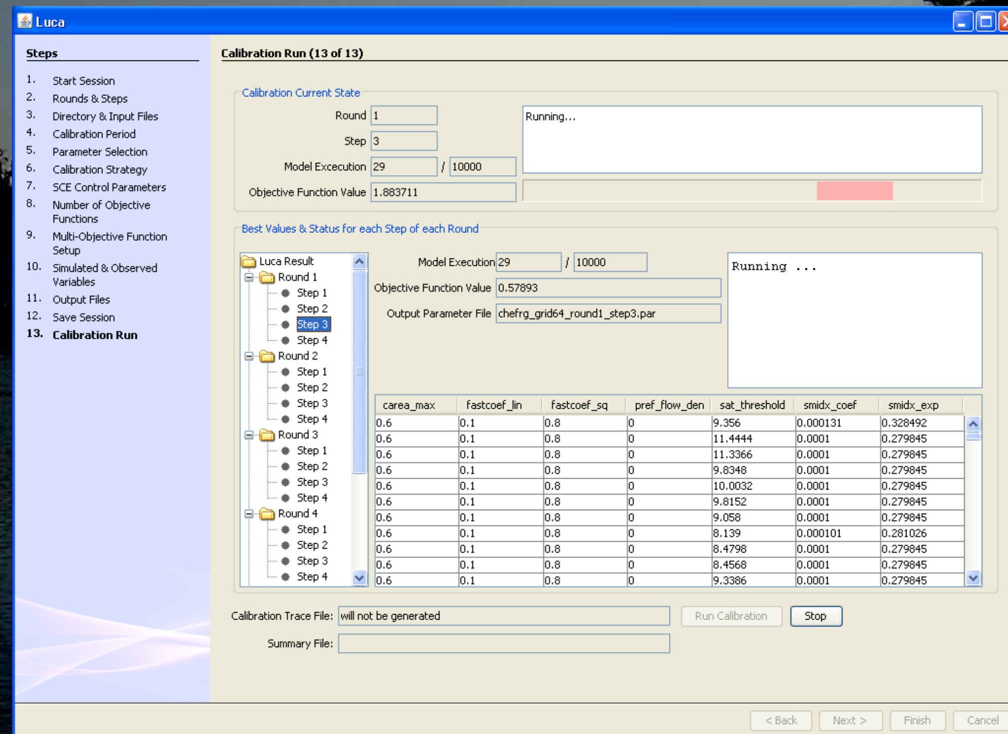
Coarse resolution HRUs based on stream gages and real-world geographic locations to ensure consistency when nesting models

Stand-alone models can be re-calibrated and nested back into the coarse resolution model

Surface-Water Model calibration

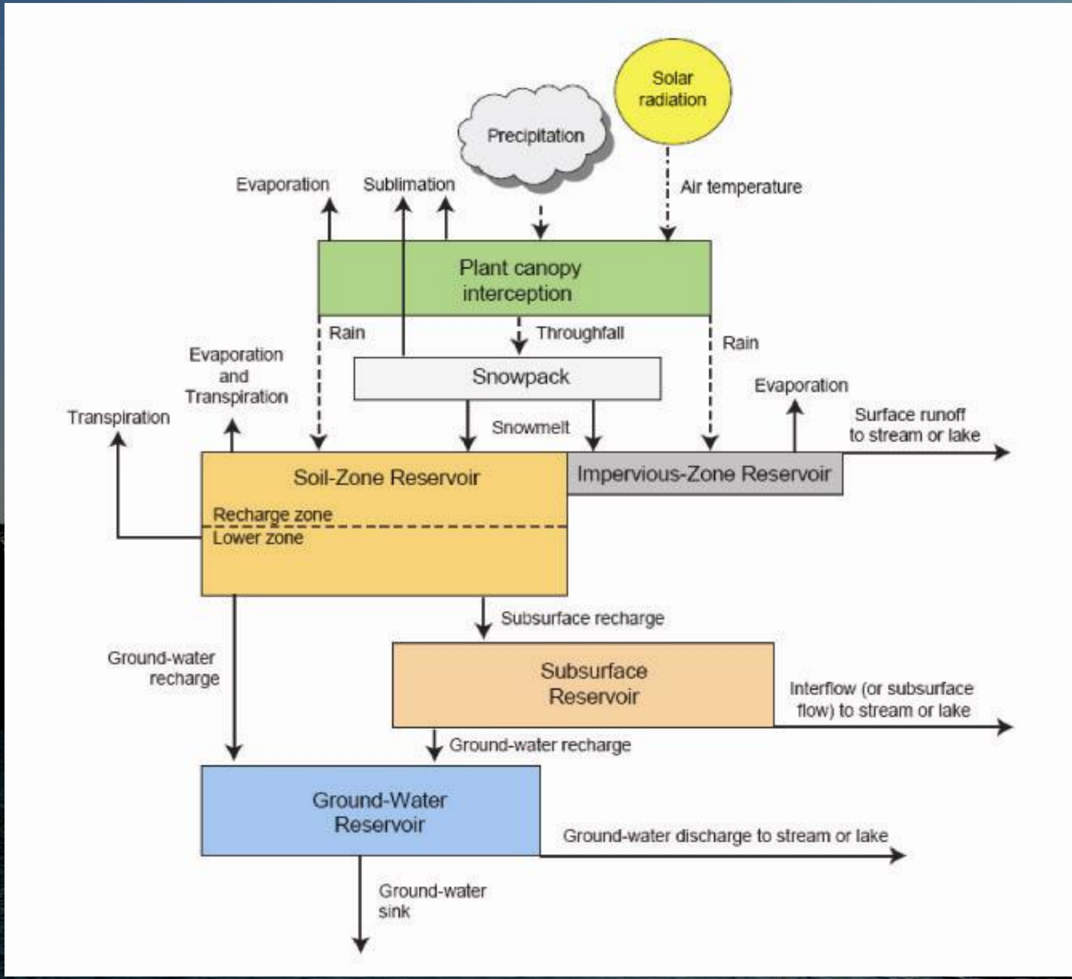
- Luca Software

- Step-wise procedure
  - Solar Radiation
  - Potential ET
  - Water Balance
  - Flow Timing



Surface-Water Groundwater Link

- Model Coupling
  - Develop PRMS simulation



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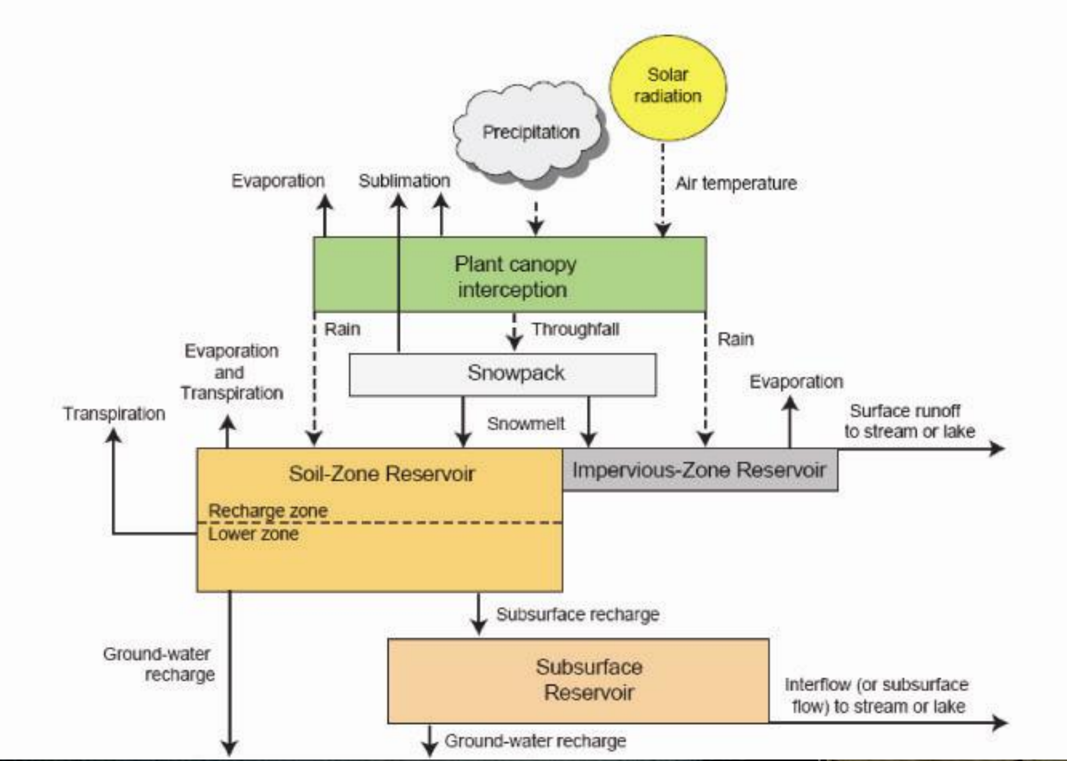
Surface-Water Groundwater Link

- Model Coupling
  - Develop PRMS simulation
  - Output "Recharge" from PRMS



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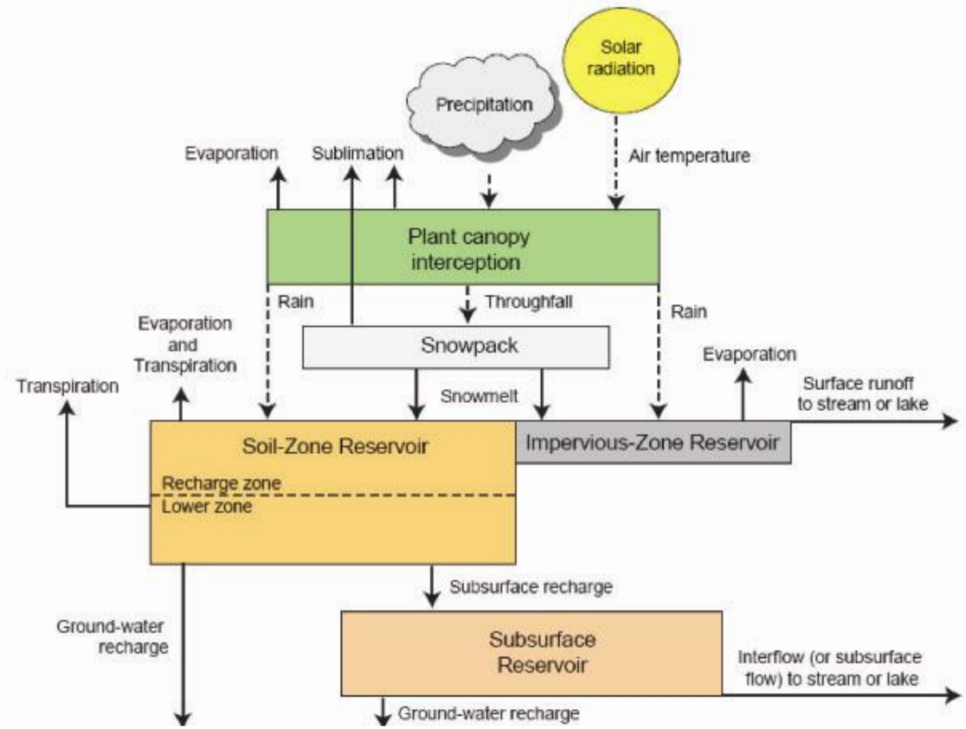
Surface-Water Groundwater Link

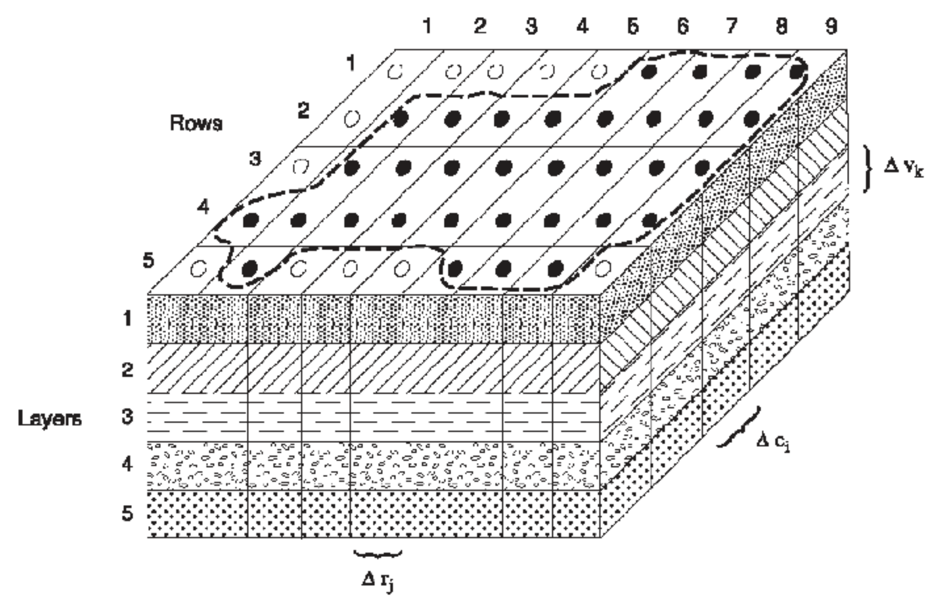
- Model Coupling

  - Develop PRMS simulation

  - Output "Recharge" from PRMS

  - Use PRMS simulated recharge as input for MODFLOW



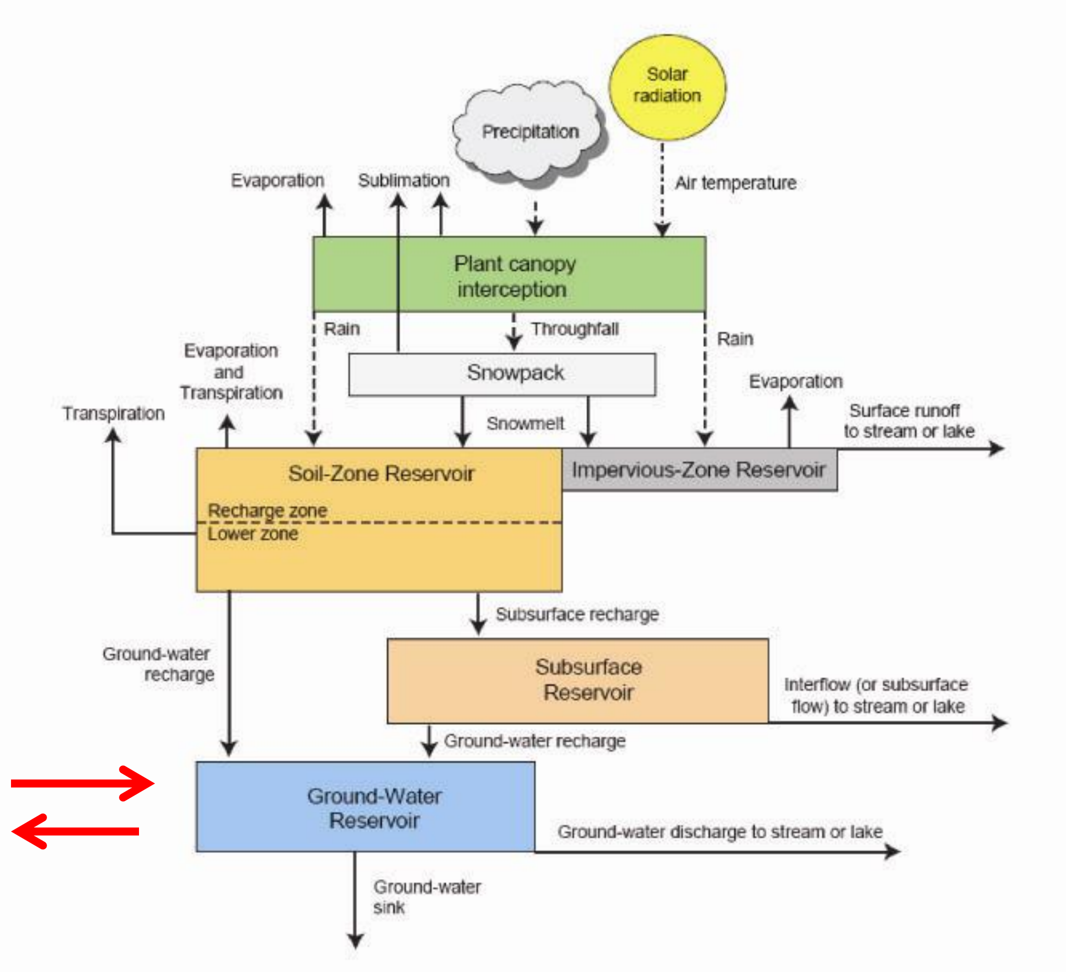


Surface-Water Modeling New capability

- Additional module for simulating gains and losses in groundwater reservoir

  - Regional groundwater flow interactions with adjacent basins.

  - Groundwater flow between adjacent modeling units in the study basin.



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Surface-water / Groundwater modeling

- Once models are calibrated and linked:
  - Investigate scenarios of potential changes in:
    - Climate
    - Land cover
    - Water use

Surface-water / Groundwater modeling

- Provide water budget information to meet WaterSMART objectives
- Incorporate water use to simulate hydrology
- Provide flow information to ecological modeling team
- Provide products to help inform stakeholders and decision makers in the basin