The background of the slide is a photograph of a calm lake. In the foreground, a rope with several blue and white buoys stretches across the water from the bottom right towards the center. On the right side, a wooden dock with a railing is visible. The far bank of the lake is lined with a dense forest of trees under a clear, bright sky.

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

Hal Davis and Jacob LaFontaine

U.S. GEOLOGICAL SURVEY

Apalachicola, Florida, 2012

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

Surface Water Flow Modeling Component

- Modeling Structure

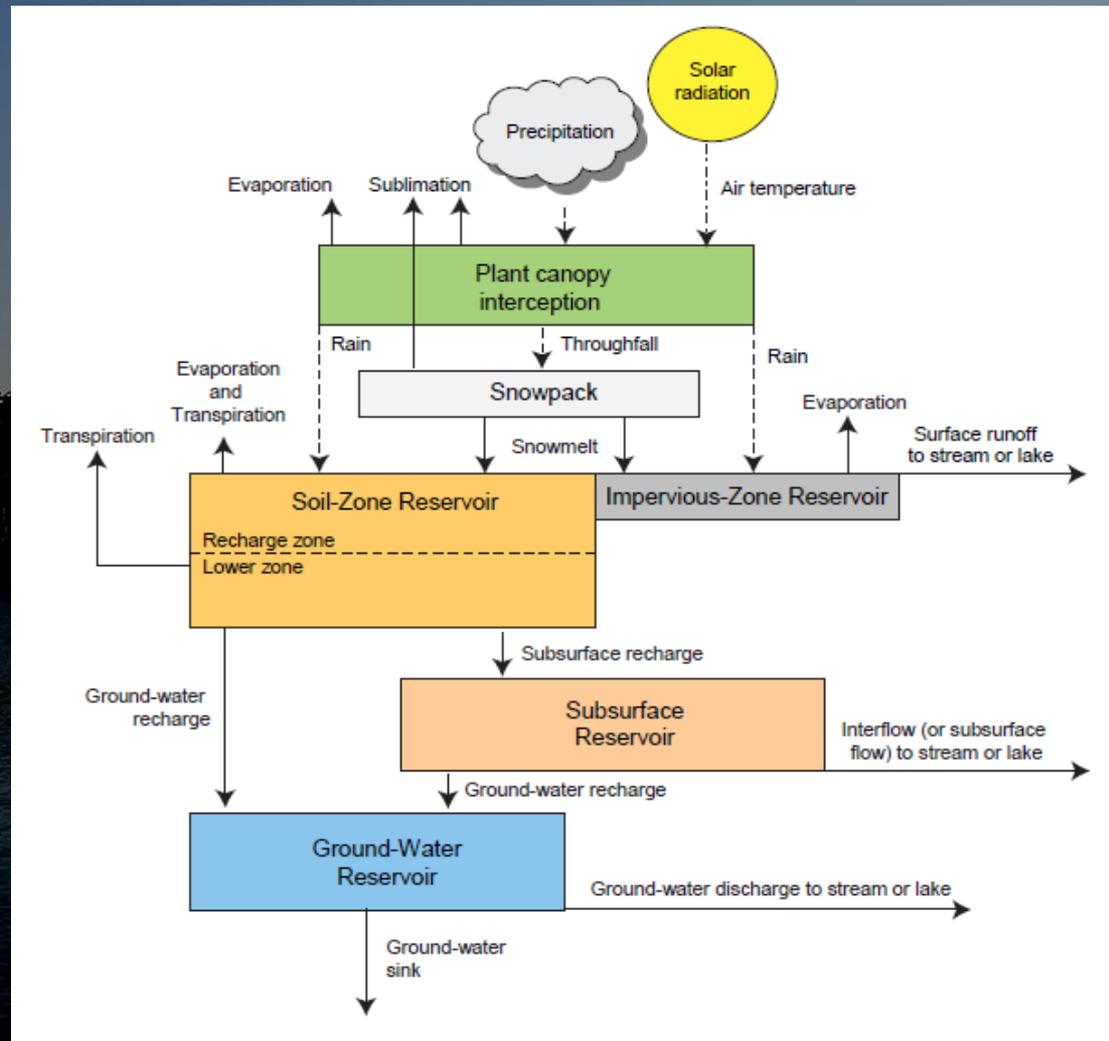
- USGS Precipitation-Runoff Modeling System (PRMS)

- Daily time step

- Deterministic

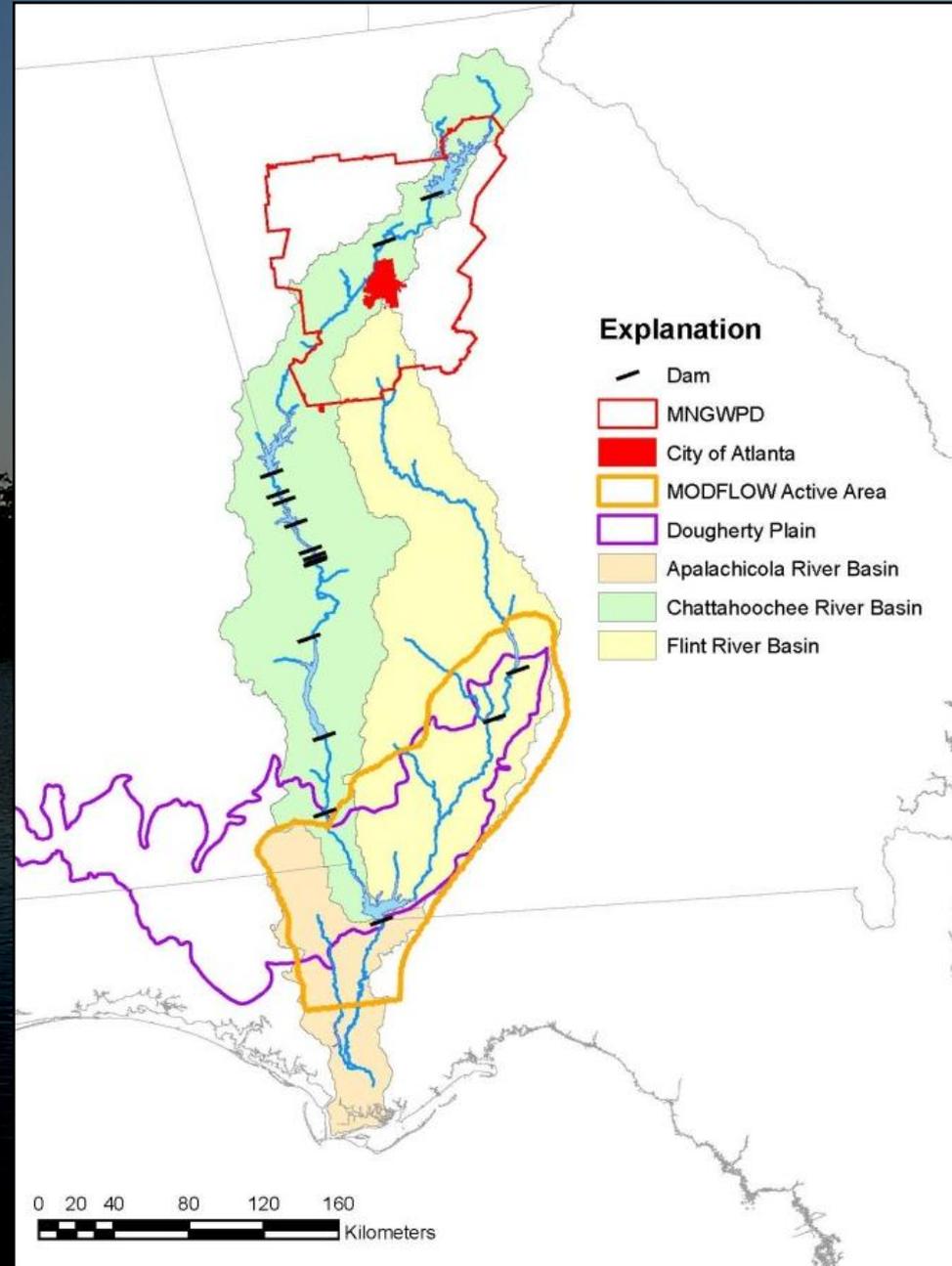
- Distributed parameters

- Physical process based



Surface Water Flow Modeling Component

- Entire ACF Basin with outlet located at most downstream USGS streamgage
- Apalachicola River at Sumatra, FL

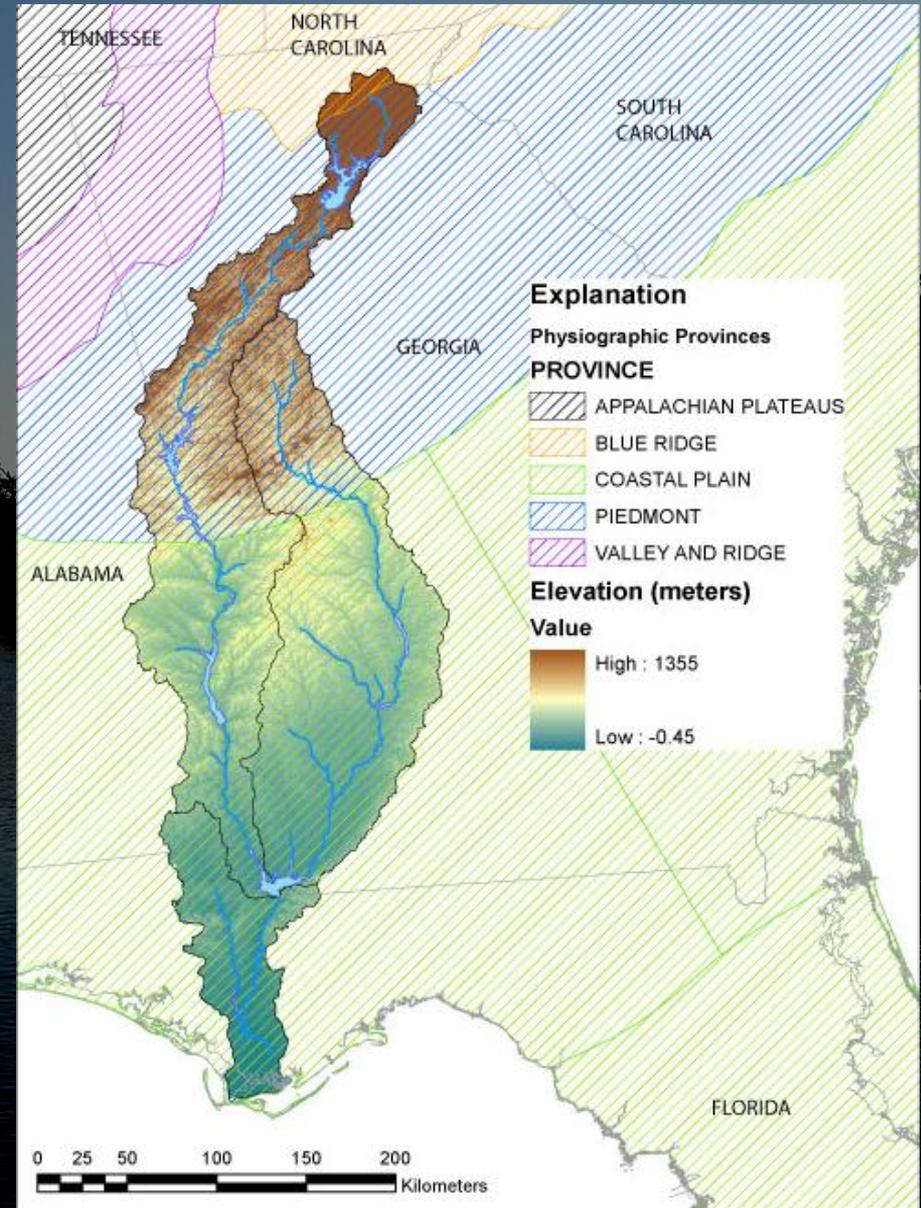


Surface Water Flow Modeling Component

- Basin Delineation

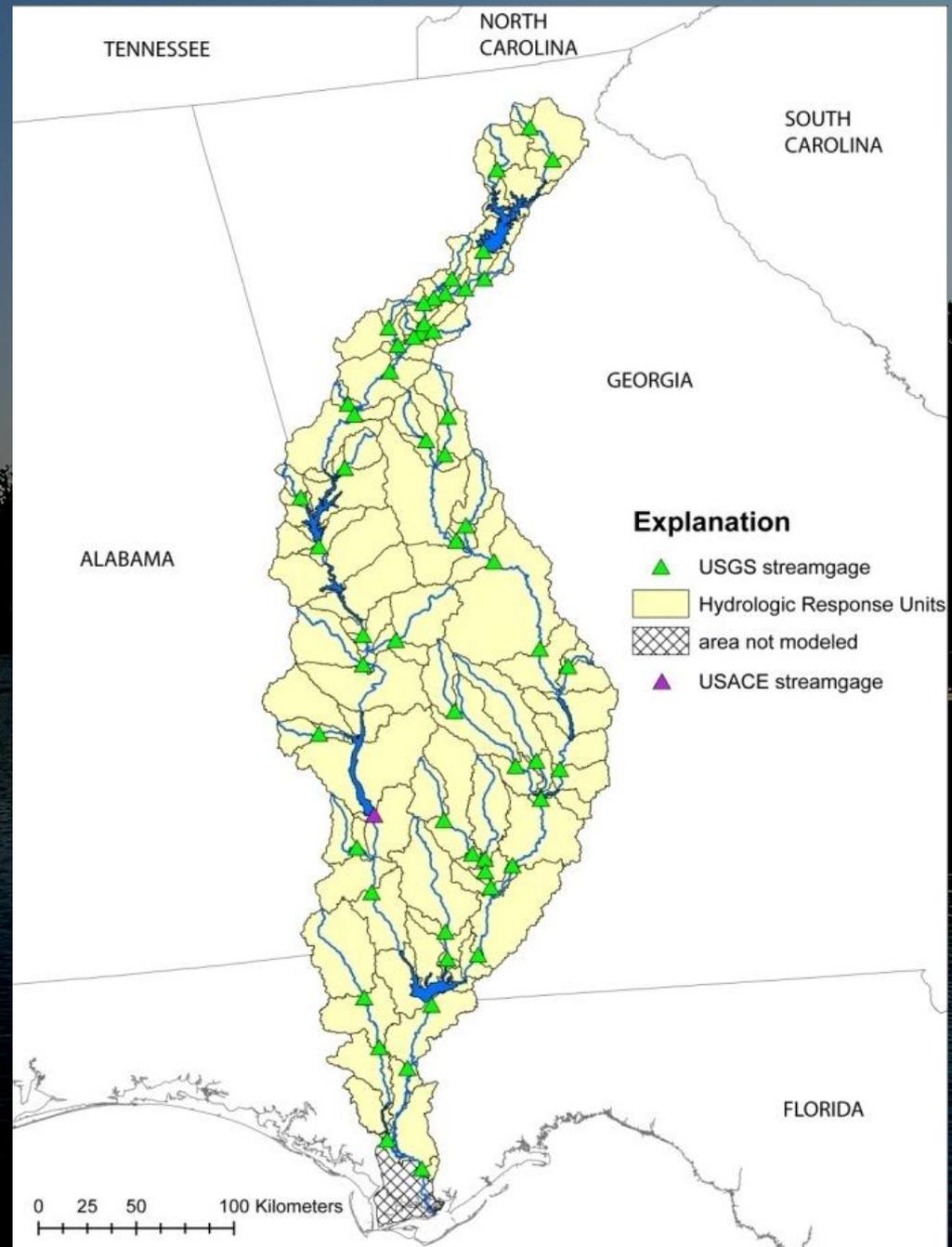
- In past applications, used raw Digital Elevation Model (DEM) to delineate and subdivide basin into modeling units.

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



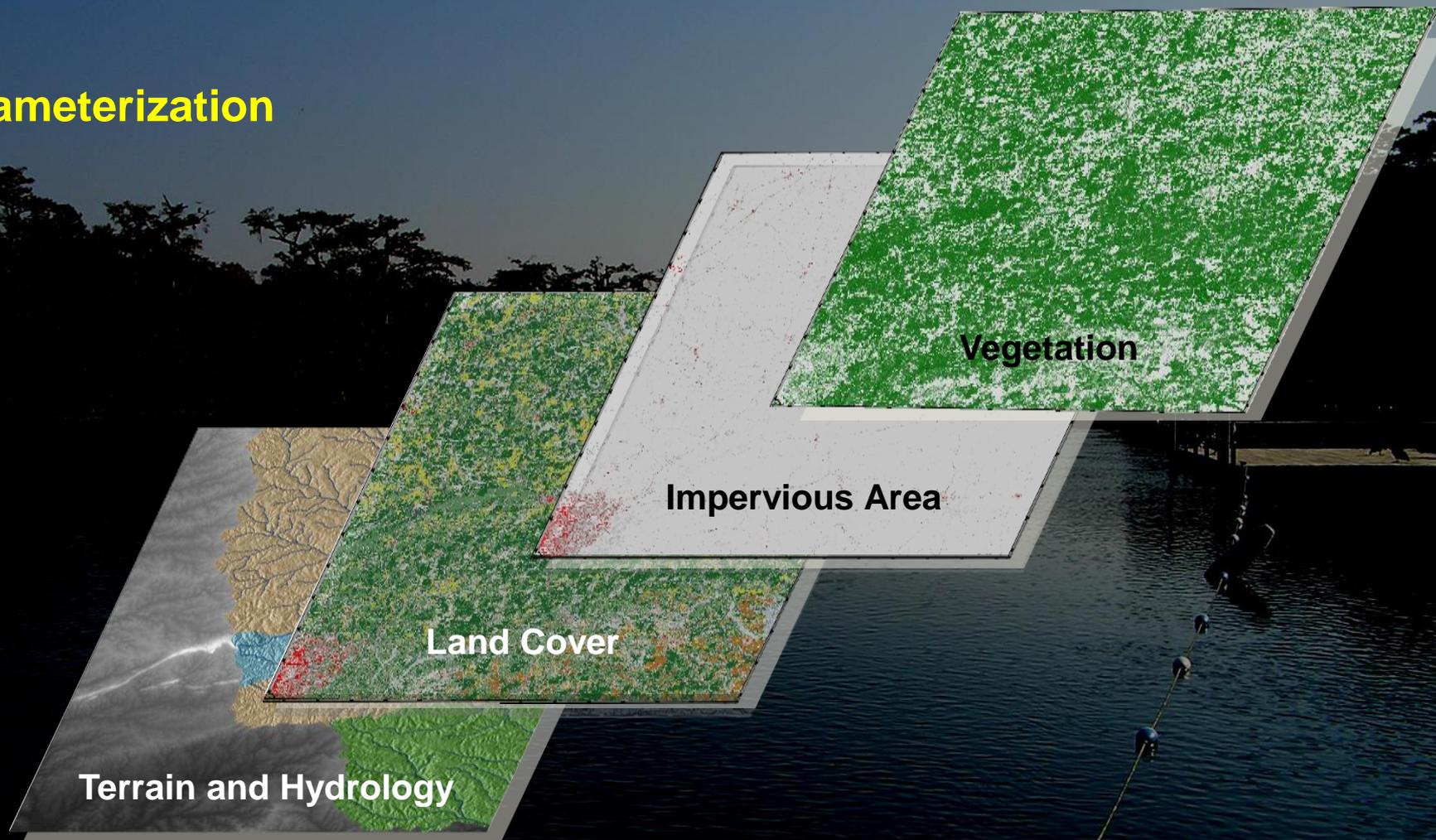
Surface Water Flow Modeling Component

- 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



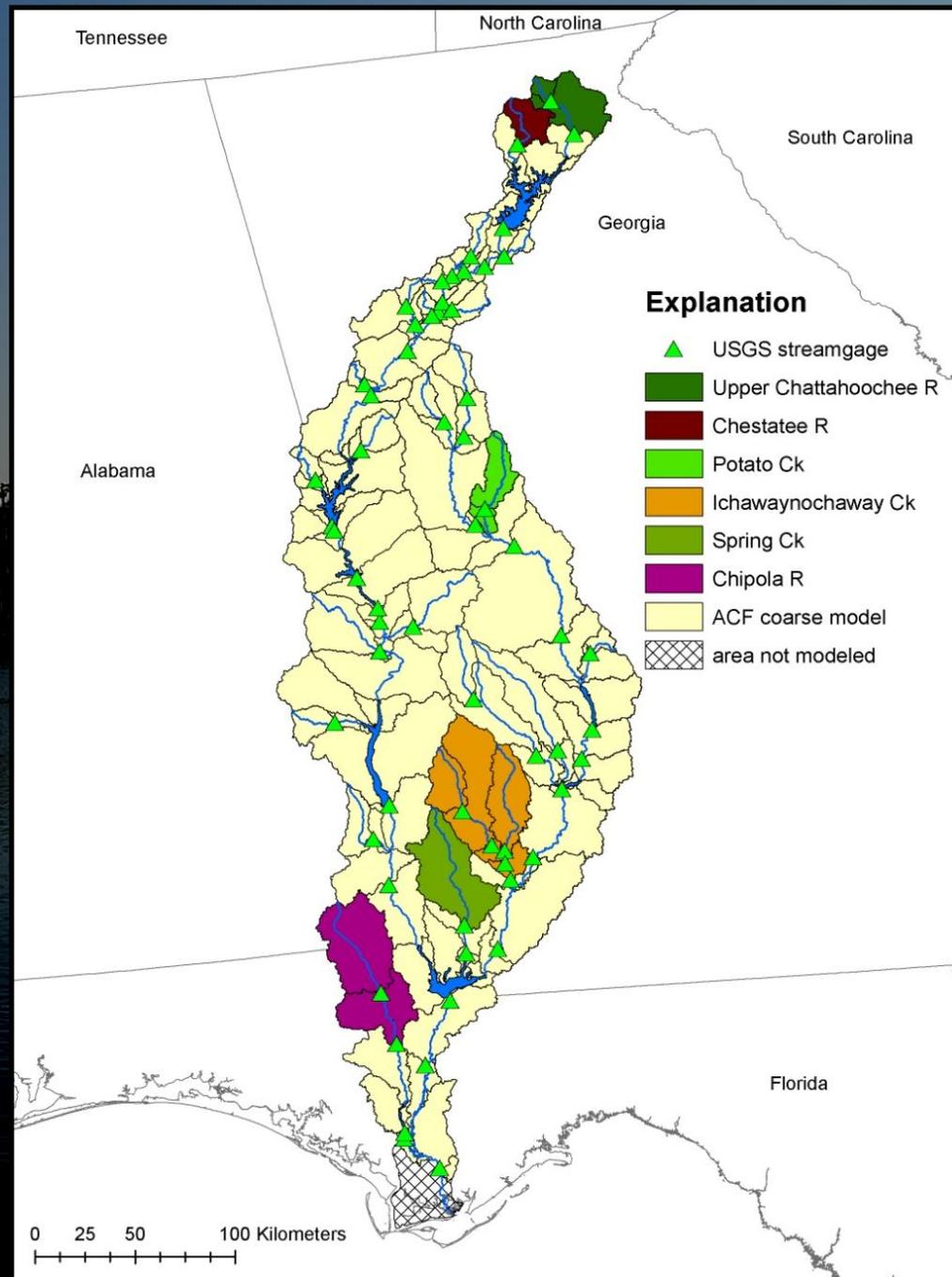
Surface Water Flow Modeling Component

- Parameterization

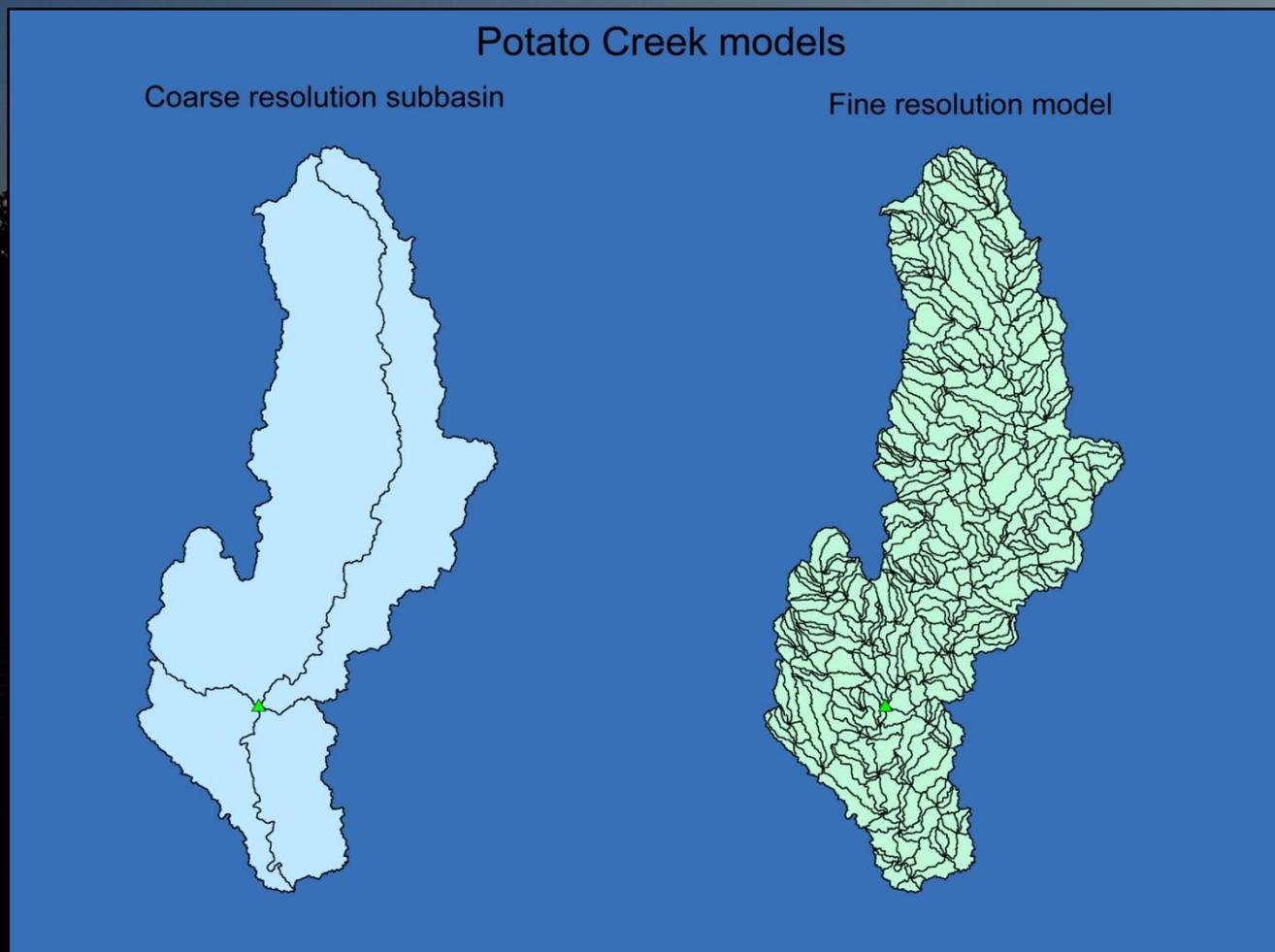


Surface Water Flow Modeling Component

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

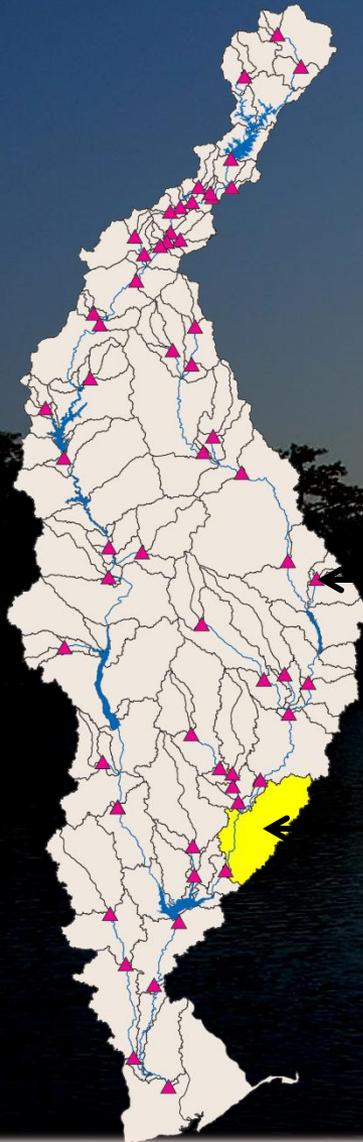


Surface-Water Modeling at multiple resolutions



Nested Hydrologic Models

Coarse
Resolution
Hydrologic
Model



Streamgage

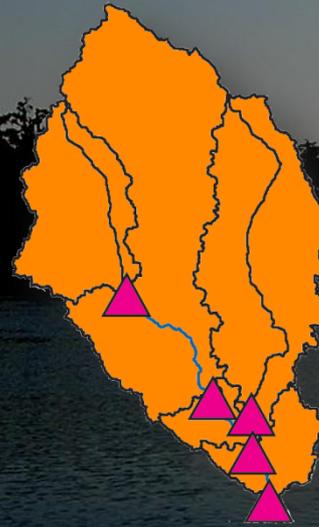
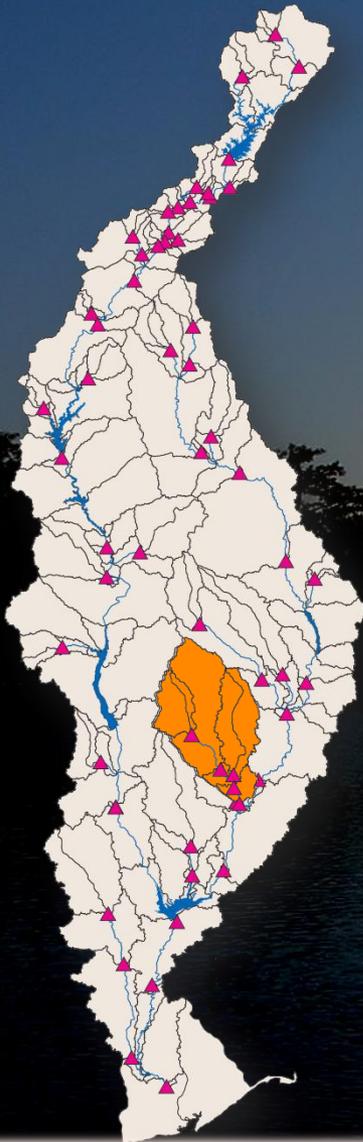
Hydrologic
Response
Unit
(HRU)

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

Nested Hydrologic Models

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

Coarse
Resolution
Hydrologic
Model



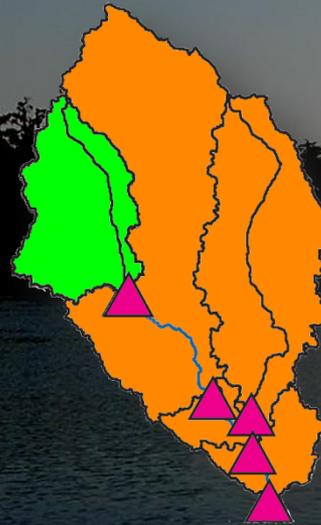
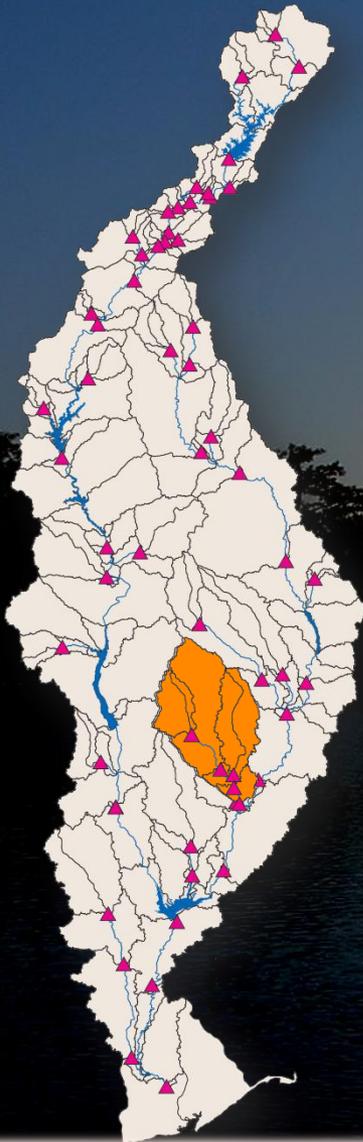
Coarse resolution HRUs based on
stream gages and real-world
geographic locations to ensure
consistency when nesting models

Nested Hydrologic Models

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

Nest a stand-alone fine resolution model

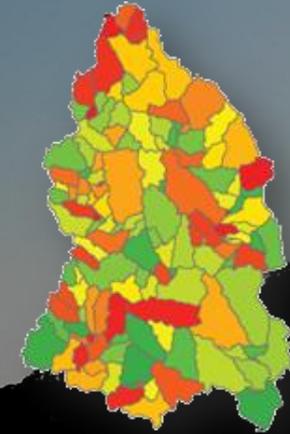
Coarse Resolution Hydrologic Model



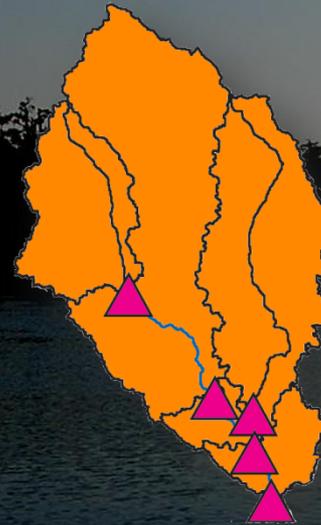
Coarse resolution HRUs based on stream gages and real-world geographic locations to ensure consistency when nesting models

Nested Hydrologic Models

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

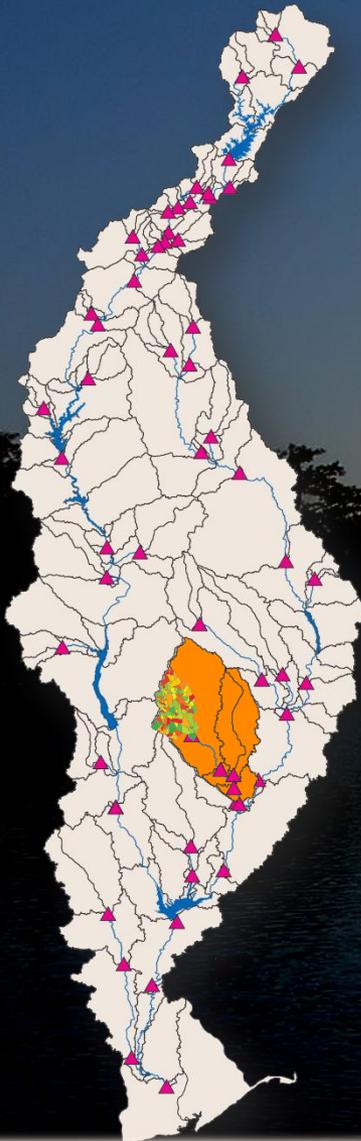


Nest a stand-alone fine resolution model



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

Coarse Resolution Hydrologic Model



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

Surface-Water Model calibration

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

Luca

Calibration Run (13 of 13)

Calibration Current State

Round 1
Step 3
Model Execution 29 / 10000
Objective Function Value 1.883711

Running...

Best Values & Status for each Step of each Round

Luca Result

- Round 1
 - Step 1
 - Step 2
 - Step 3
 - Step 4
- Round 2
 - Step 1
 - Step 2
 - Step 3
 - Step 4
- Round 3
 - Step 1
 - Step 2
 - Step 3
 - Step 4
- Round 4
 - Step 1
 - Step 2
 - Step 3
 - Step 4

Model Execution 29 / 10000
Objective Function Value 0.57893
Output Parameter File chefrq_grid64_round1_step3.par

Running ...

	carea_max	fastcoef_lin	fastcoef_sq	pref_flow_den	sat_threshold	smidx_coef	smidx_exp
Round 1	0.6	0.1	0.8	0	9.356	0.000131	0.328492
Round 2	0.6	0.1	0.8	0	11.4444	0.0001	0.279845
Round 3	0.6	0.1	0.8	0	11.3366	0.0001	0.279845
Round 4	0.6	0.1	0.8	0	9.8348	0.0001	0.279845
Round 5	0.6	0.1	0.8	0	10.0032	0.0001	0.279845
Round 6	0.6	0.1	0.8	0	9.8152	0.0001	0.279845
Round 7	0.6	0.1	0.8	0	9.058	0.0001	0.279845
Round 8	0.6	0.1	0.8	0	8.139	0.000101	0.281026
Round 9	0.6	0.1	0.8	0	8.4798	0.0001	0.279845
Round 10	0.6	0.1	0.8	0	8.4568	0.0001	0.279845
Round 11	0.6	0.1	0.8	0	9.3386	0.0001	0.279845

Calibration Trace File: will not be generated
Summary File:

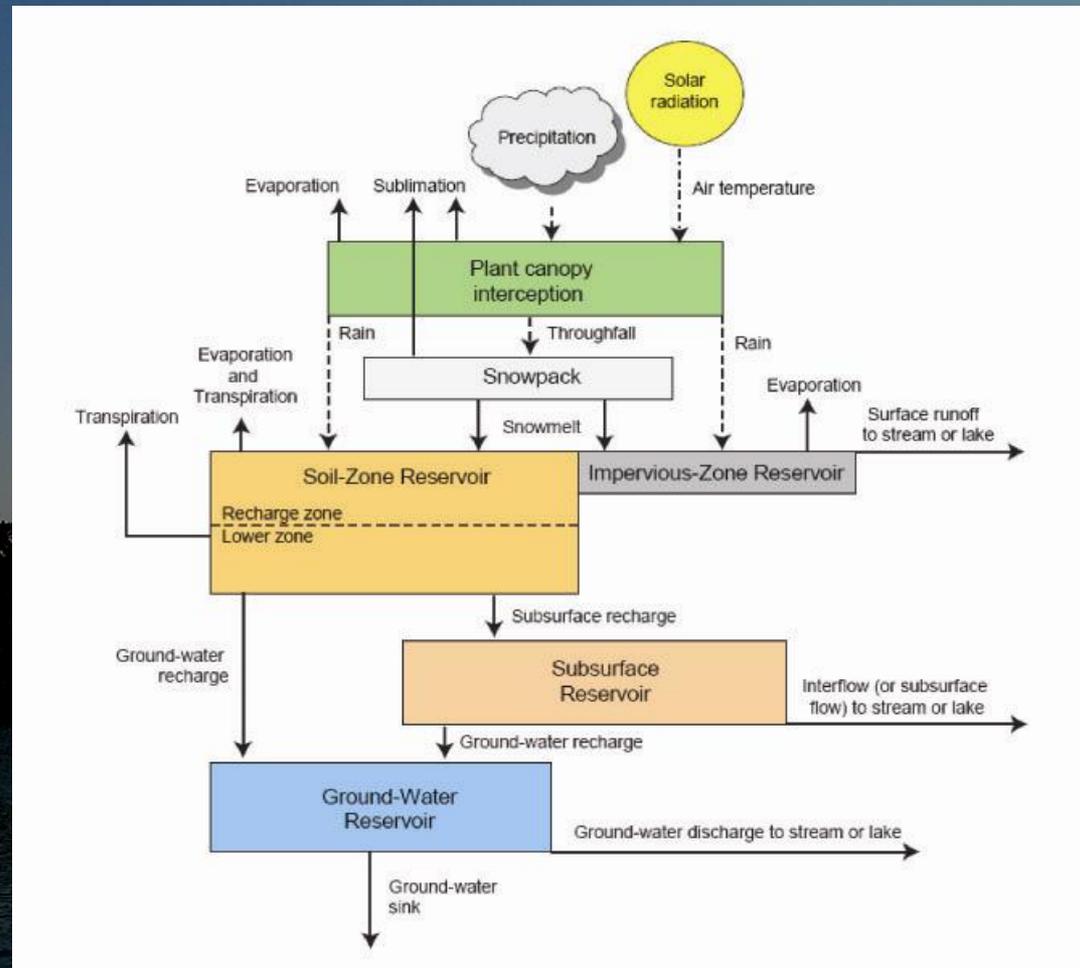
Run Calibration Stop

< Back Next > Finish Cancel

Surface-Water Groundwater Link

- Model Coupling

- Develop PRMS simulation

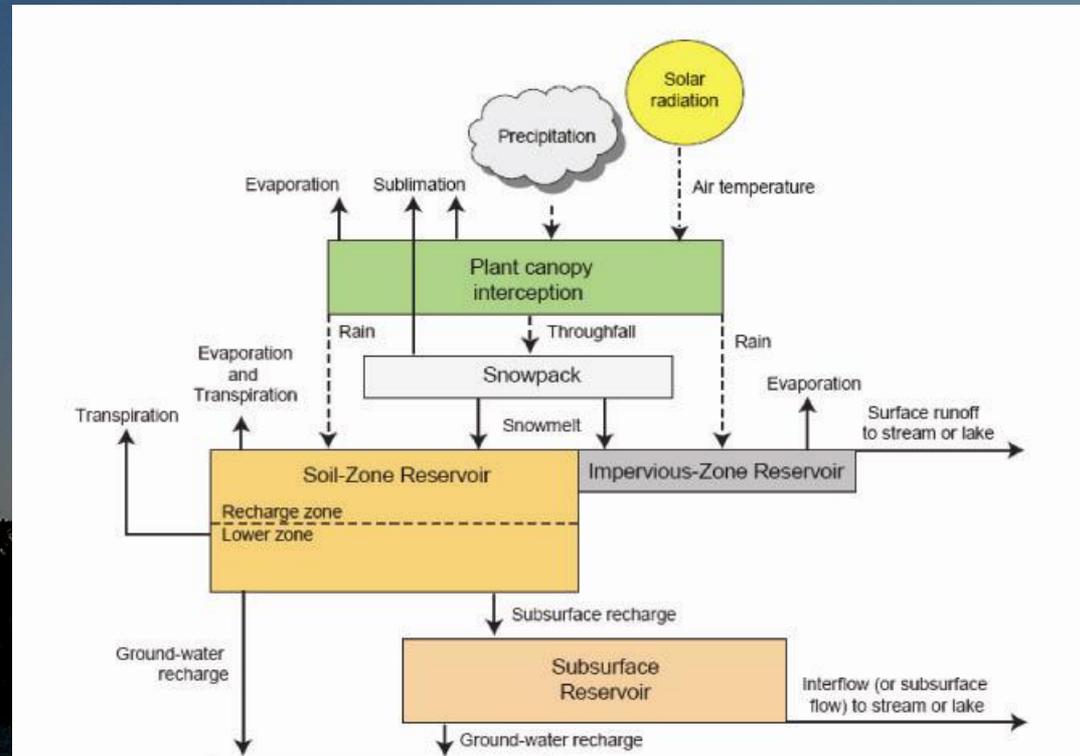


Surface-Water Groundwater Link

- Model Coupling

- Develop PRMS simulation

- Output "Recharge" from
PRMS



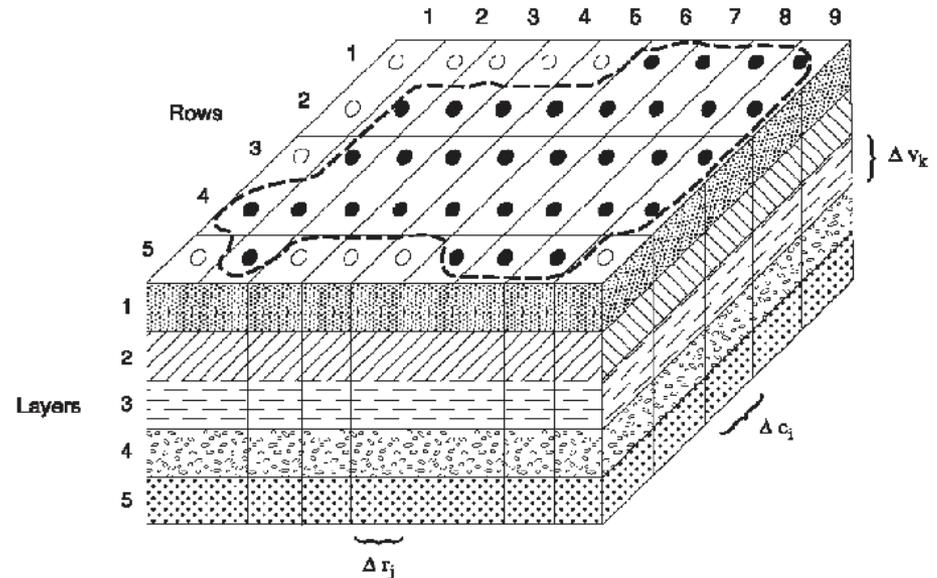
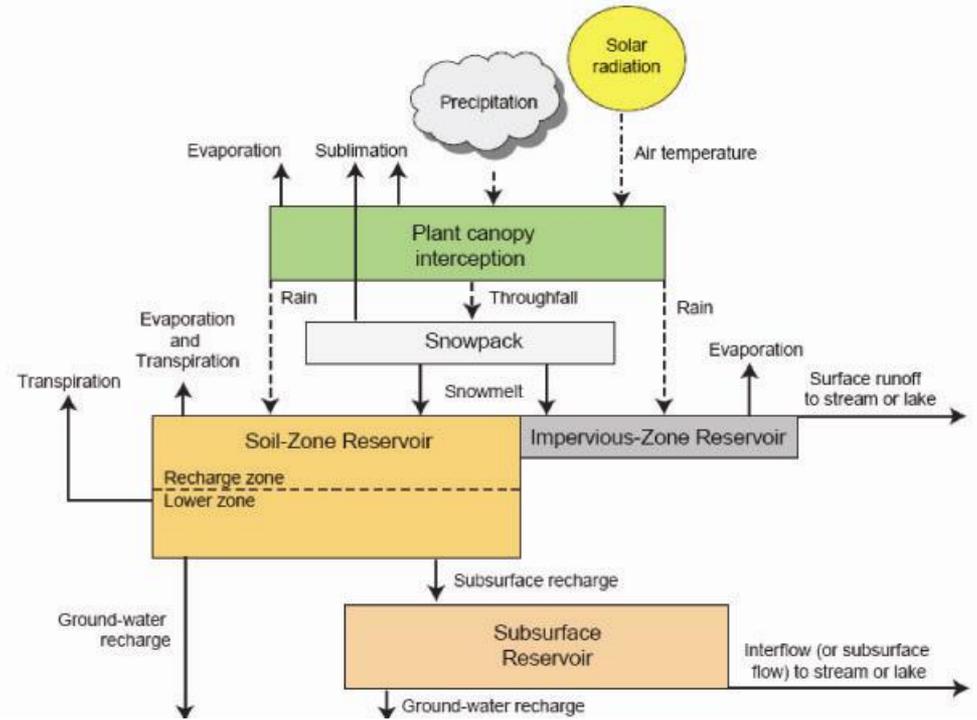
Surface-Water Groundwater Link

- Model Coupling

- Develop PRMS simulation

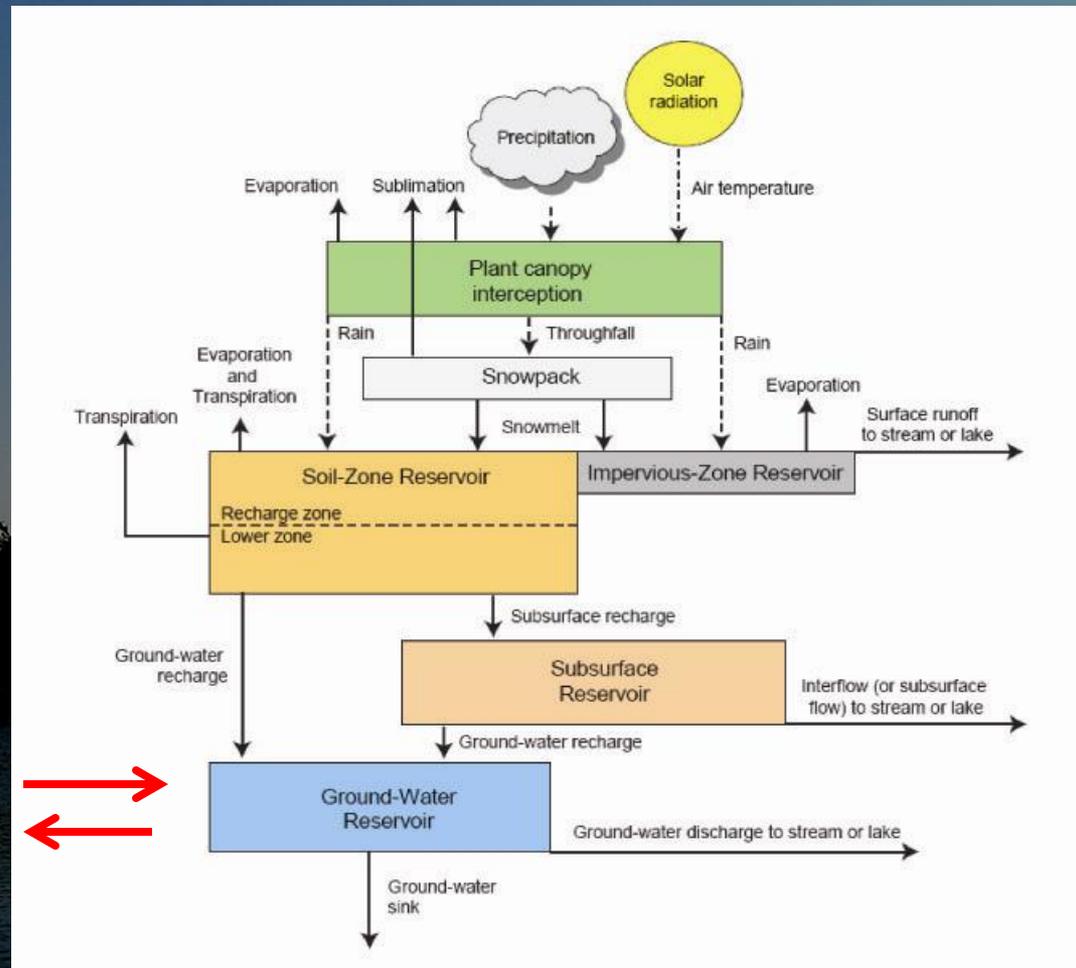
- Output "Recharge" from PRMS

- 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.



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