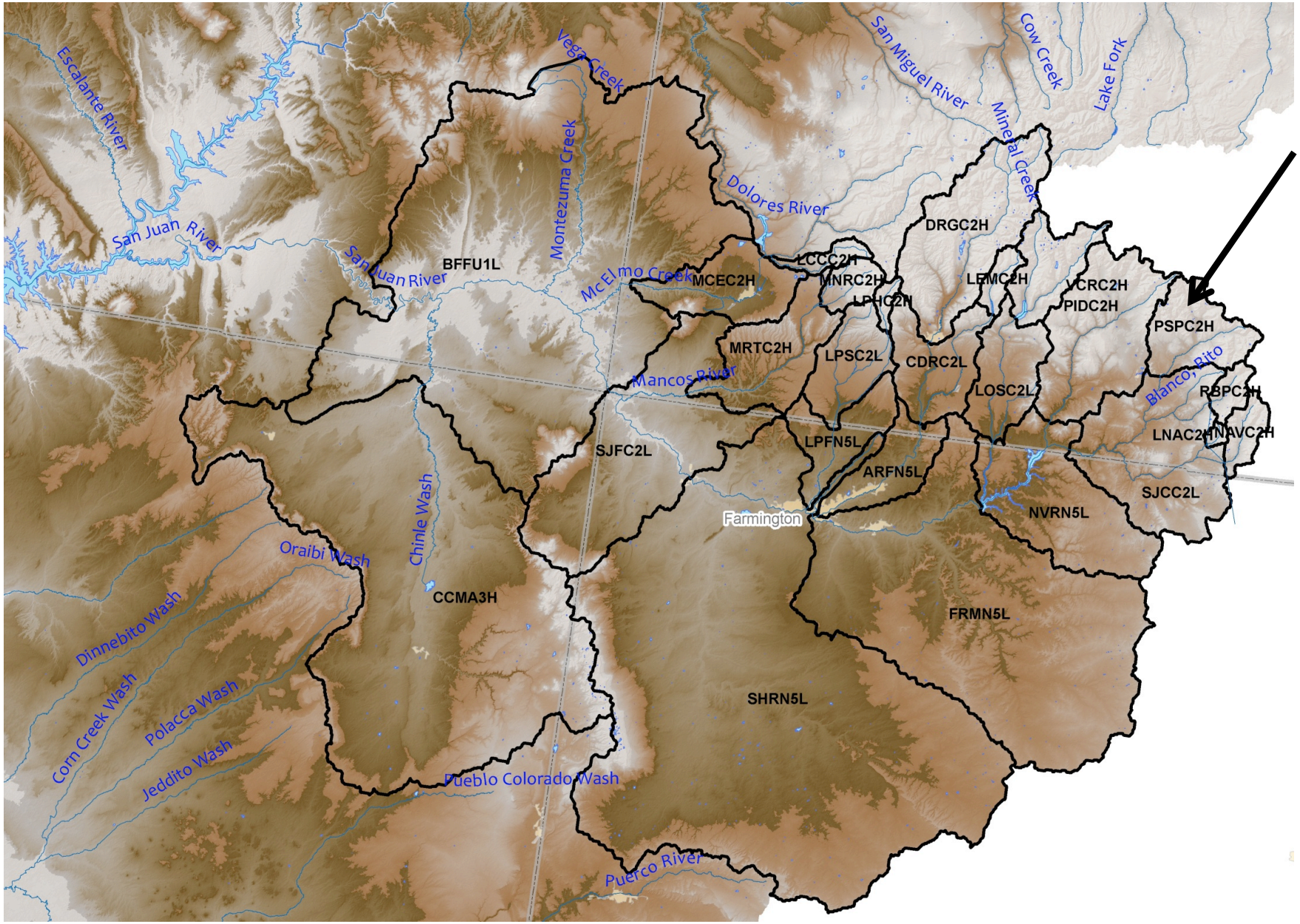
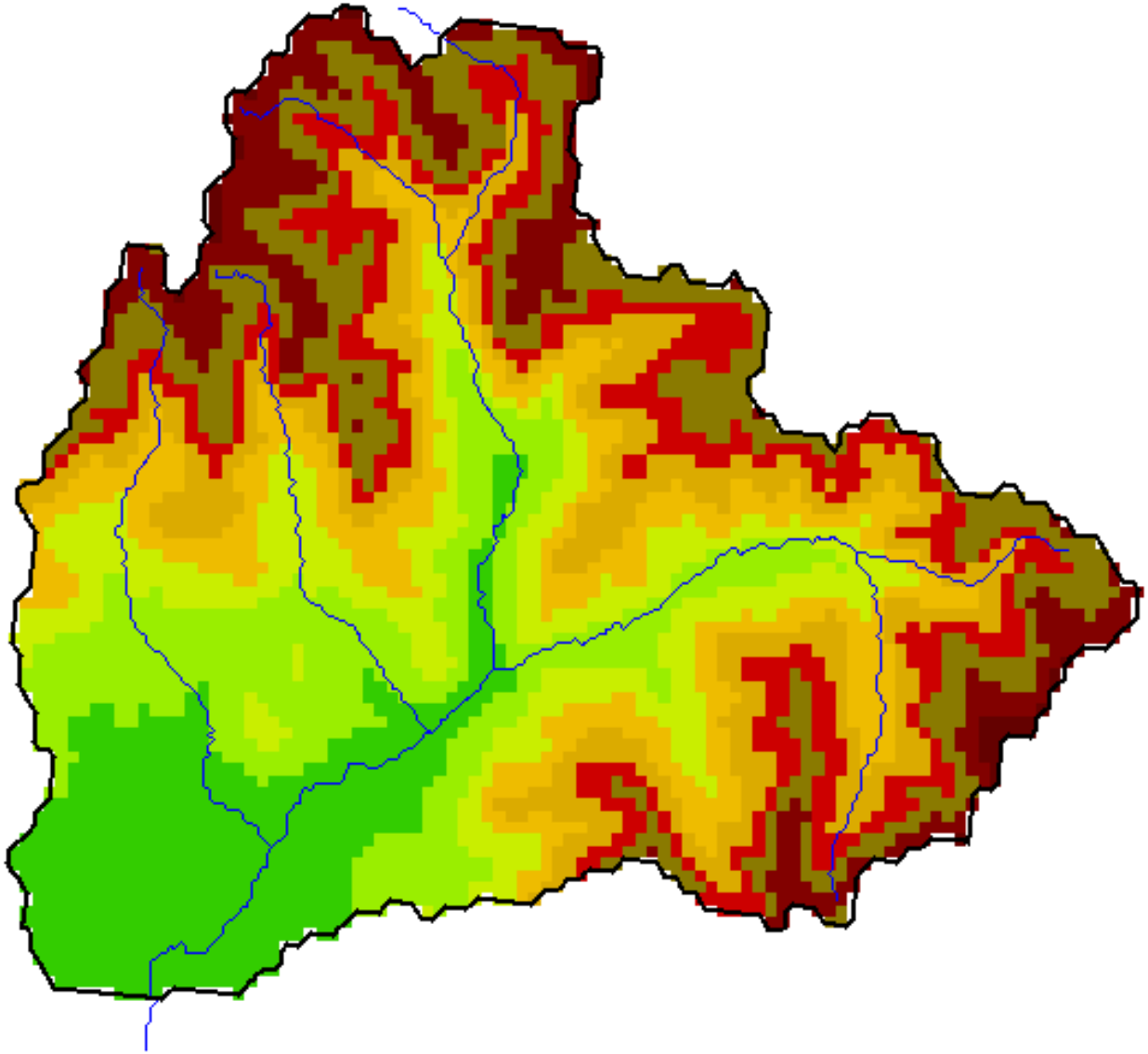
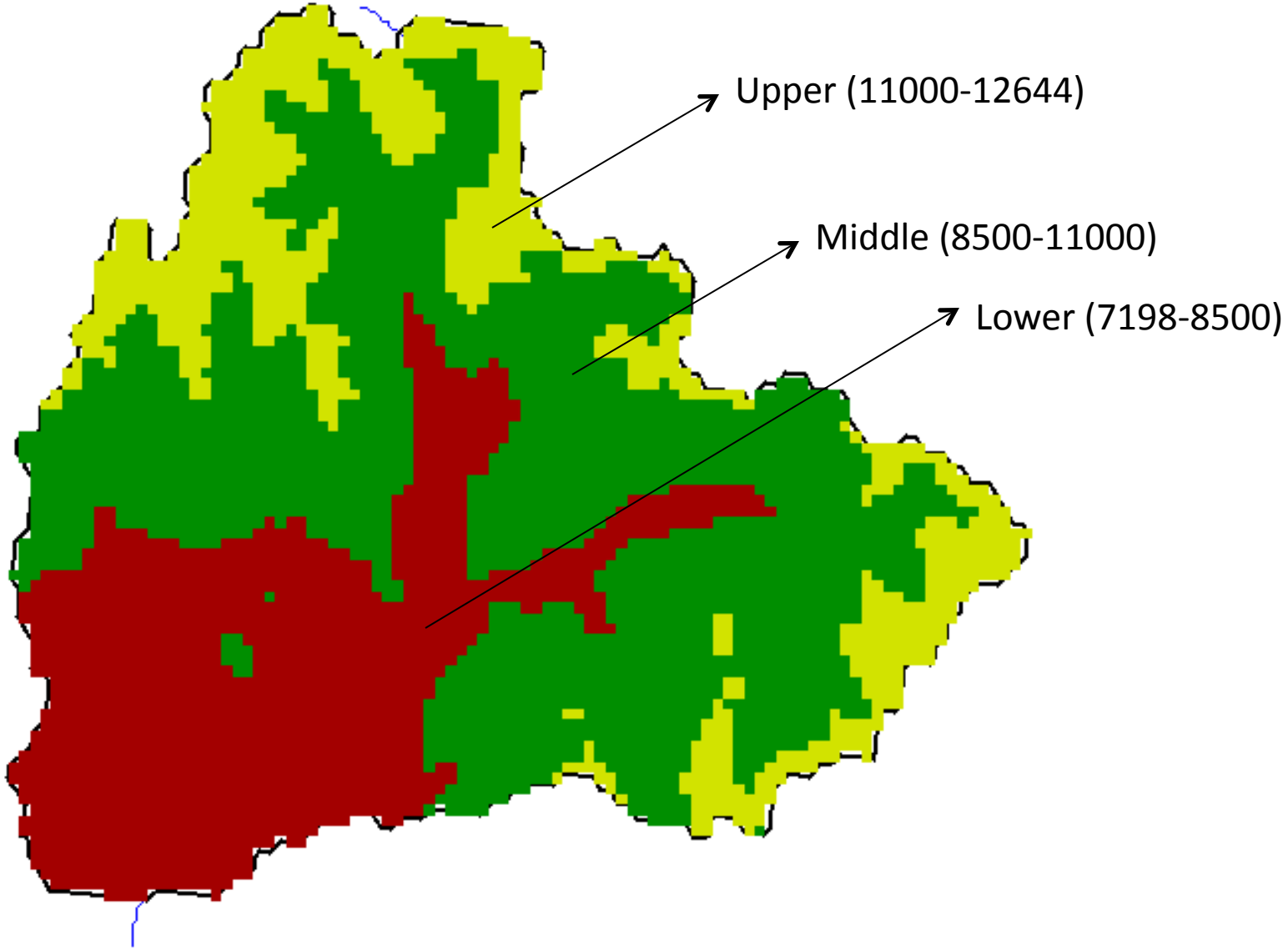
San Juan Basin



San Juan-Pagosa Springs(PSPC2)



San Juan-Pagosa Springs(PSPC2)



Calibrations/Simulations - inputs

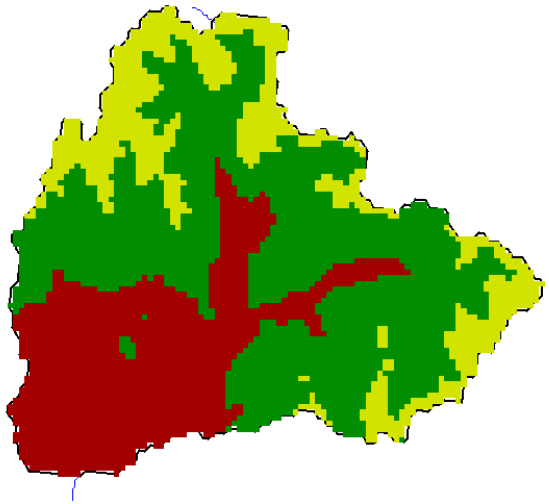
- In reality the 3 areas (upper, middle and lower) are represented (simulated) by only 3 points
- The inputs our model needs for calibrations and operations (at these 3 points) are:
  - precipitation
  - temperature
  - freezing level

For San Juan River at Pagosa Springs (PSPC2)

PSPC2 upper area
Elevation = 11437
Area=60nm

PSPC2 middle area
Elevation = 9774
Area=152nm

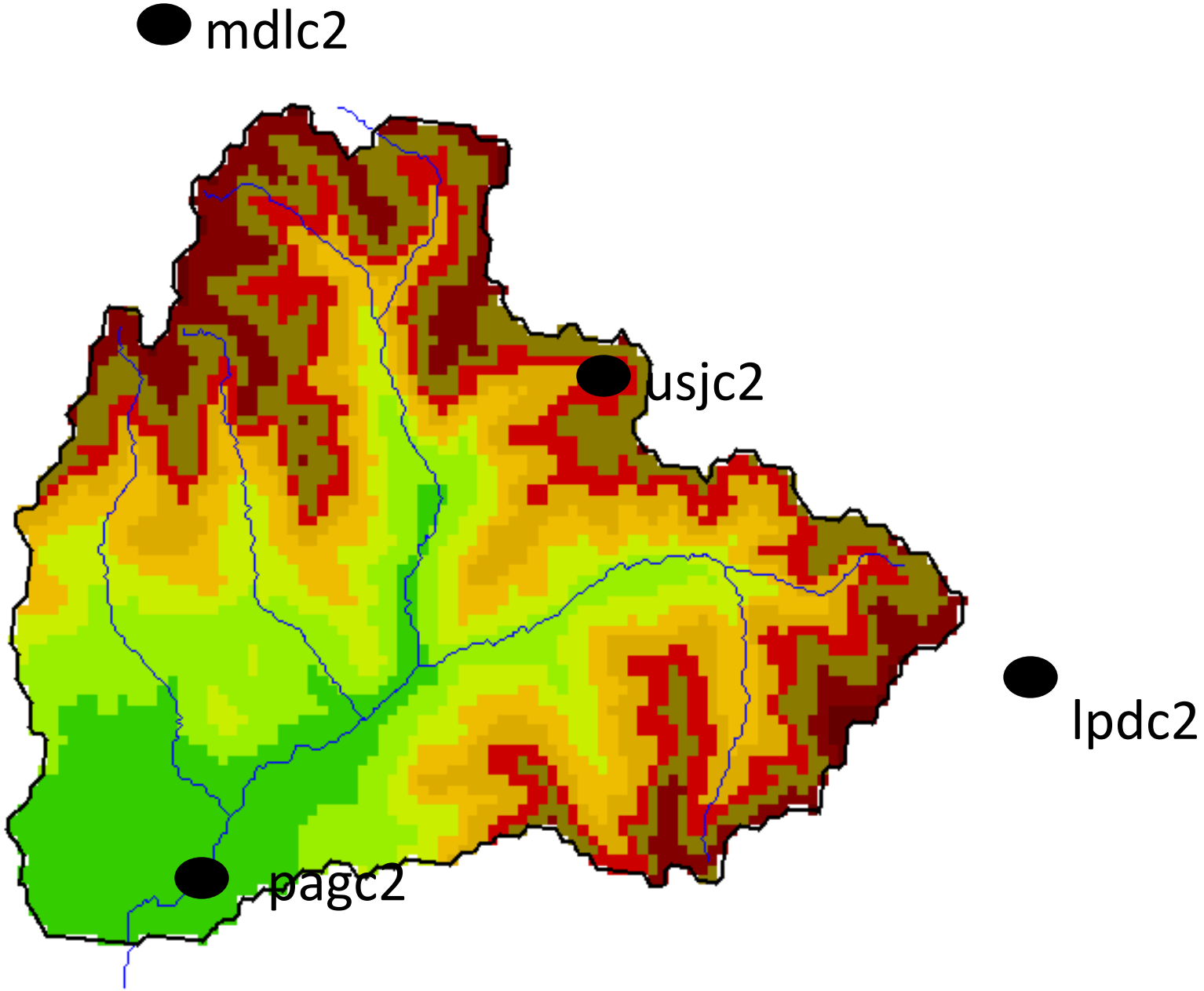
PSPC2 lower area
Elevation = 7844
Area=88nm



Calibrations/Simulations - Precipitation

- Each area (upper, middle and lower) MAP is built using precipitation stations that (hopefully) have similar characteristics to that area
- For the PSPC2
  - Upper area – Upper San Juan.4, Lily Pond. 35, Middle Creek.36
  - Middle area - Upper San Juan.31, Lily Pond. 31, Middle Creek.32
  - Lower area - Pagosa Springs 1.06
- These weights were chosen to guarantee water balance in each area. The water balance in each area was calculated using the PRISM sets

San Juan-Pagosa Springs(PSPC2)



Calibrations/Simulations - Temperature

- Nearby stations (whose climatology is known) area used to calculate the temperature at the mid-point elevation of the area (whose climatologies are calculated using the climatology of the nearby stations)
- Temperature is calculated by using the difference in station and area climatology

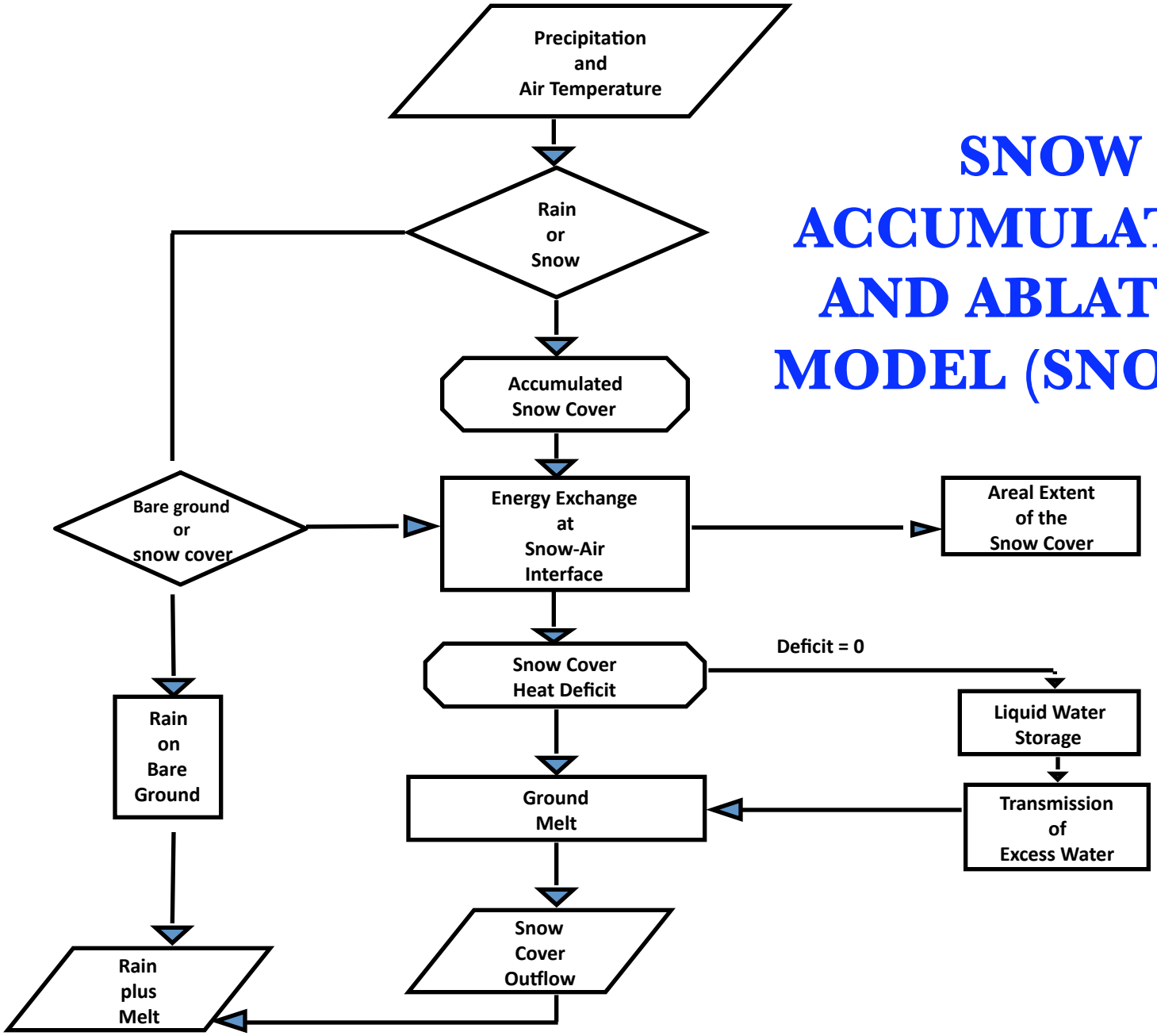
Calibrations/Simulations
- Inputs

- Precipitation and temperature are calculated every six hours at each area within the basin
  - 30 years
  - Used to calibrate hydrologic models
- Operationally done in a similar way
  - Ensures our forecasts will have similar quality/characteristics to 30 years of calibration
- For the San Juan at Pagosa Springs this is done for the upper, middle and lower areas

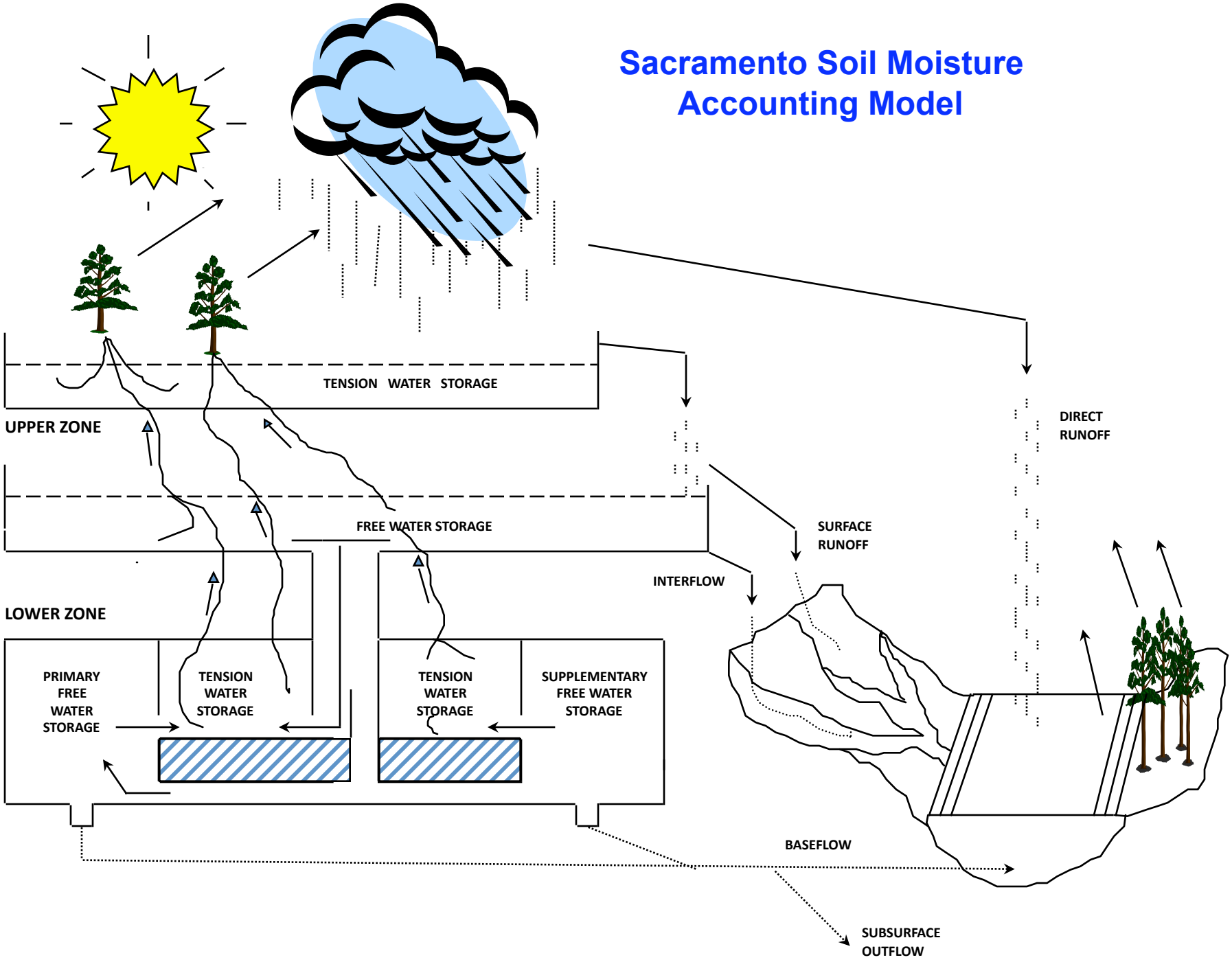
Calibrations/Simulations - Models

- A snow model (accumulates/ablates snow) is run for each area in the basin
- A soil moisture model (controls amount of water from the snow model which is retained in the soil/evaporates or ends up in the stream) is run for each area
    - Evaporation is a calibrated amount :
        - E=P-Q

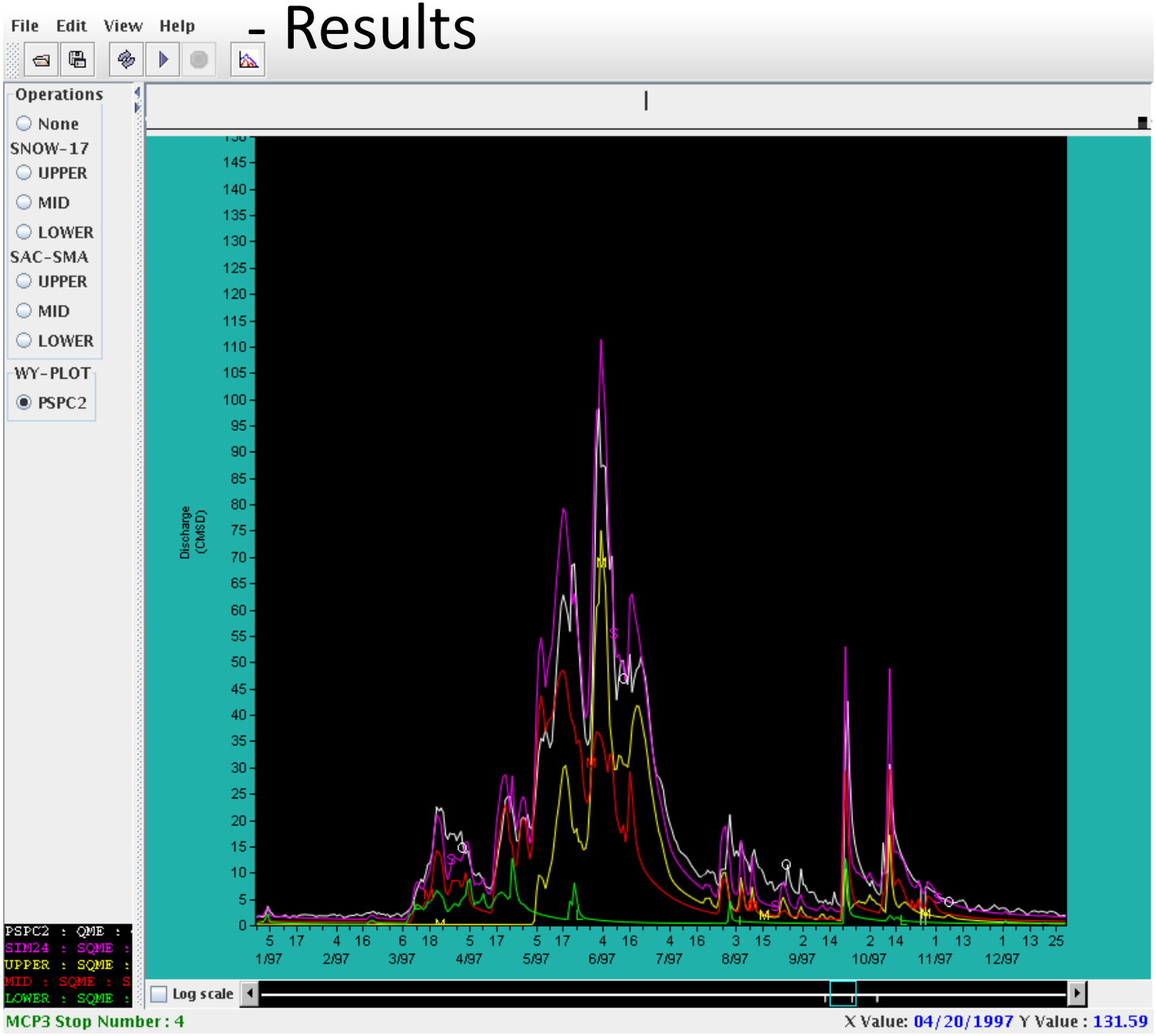
SNOW ACCUMULATION AND ABLATION MODEL (SNOW-17)



Sacramento Soil Moisture Accounting Model



Calibrations/Simulations - Results



Calibrations/Simulations

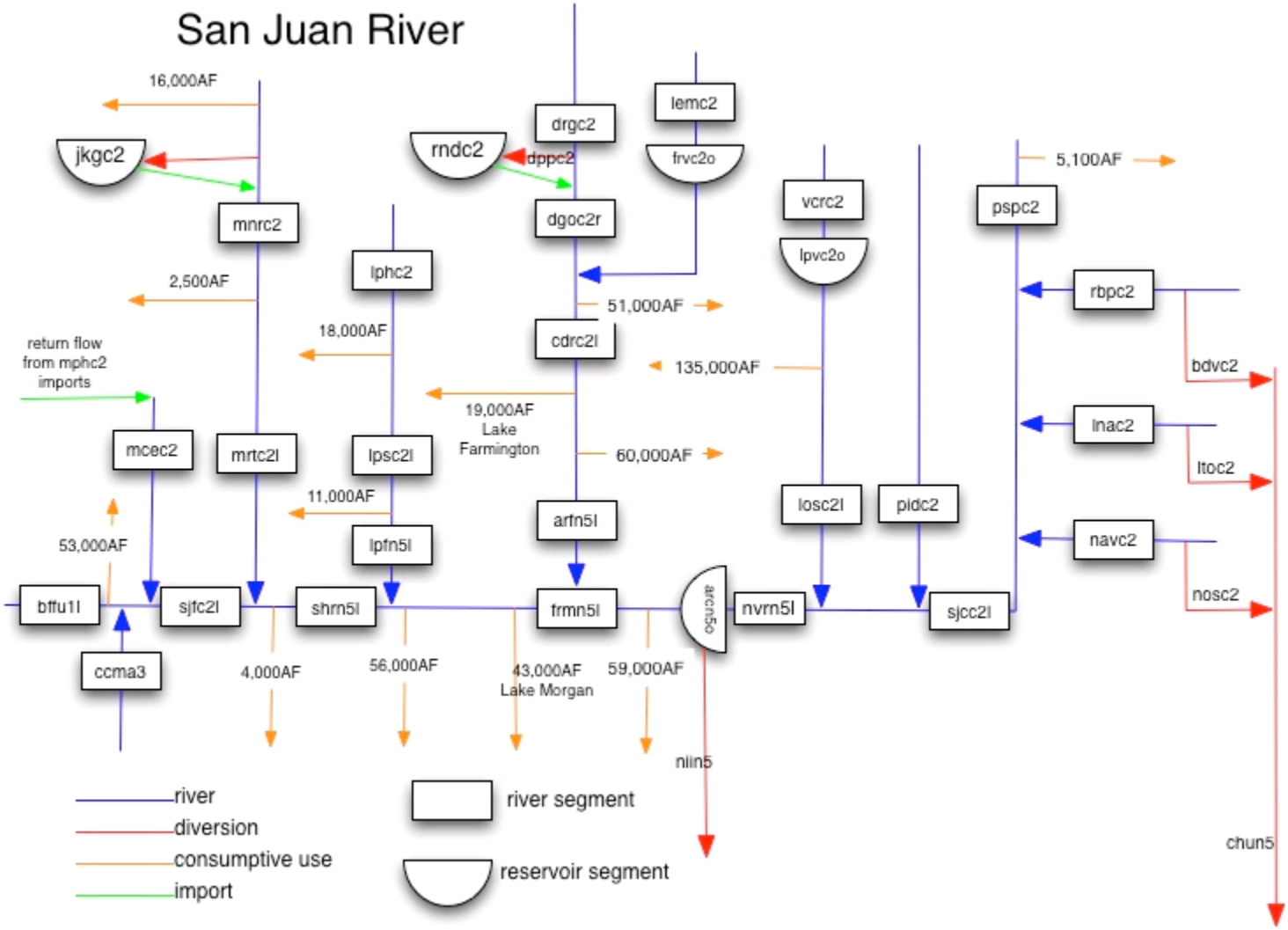
- 456 basins
- 1130 areas (2-3 per basin)
- 85 reservoirs

Calibrations/Simulations - Reservoirs

- Reservoir modeling is difficult as they are not physically based. However, we calibrate the reservoir models assuming two different modes:
  - Irrigation (use average releases)
  - Spillway/passflow
- Operationally we do the following:
  - Assume the current release
  - Input a schedule
  - Allow the spill/passflow rules

Adjustments to Flow

- Unregulated flow=
  Observed flow + Diversions (measured) + Storage
- Natural flow=
  Unregulated flow + Consumptive Use
- Consumptive use (in basin irrigation) can only be estimated
- In our simulations we simulate natural flow but subtract out the consumptive use so the output is always unregulated flow
- So:
  - We simulate “natural flow”
  - We remove the in-basin irrigation (consumptive use)
  - This is the simulated unregulated flow. It simulates the actual flow plus the measured diversions (adjusted flow)
- Operational considerations
  - Observed flow=Unregulated flow-Diversions-Storage


San Juan River
16,000AF
jkgc2
mnrc2
2,500AF
return flow
from mphc2
imports
mcec2
53,000AF
bffu1l
ccma3
sjfc2l
4,000AF
mrtc2l
shrn5l
56,000AF
lphc2
18,000AF
lpsc2l
11,000AF
lpfn5l
rndc2
drgc2
dppc2
dgoc2r
51,000AF
cdrc2l
19,000AF
Lake
Farmington
60,000AF
arfn5l
frmn5l
43,000AF
Lake Morgan
lemc2
frvc2o
59,000AF
arcn5o
nlin5
vcrc2
lpvc2o
135,000AF
losc2l
pidc2
nvrn5l
sjcc2l
5,100AF
pspc2
rbpc2
bdvc2
lnac2
ltoc2
navc2
nosc2
chun5
river
diversion
consumptive use
import
river segment
reservoir segment