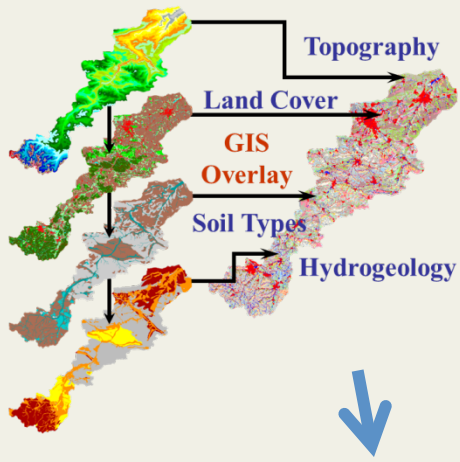
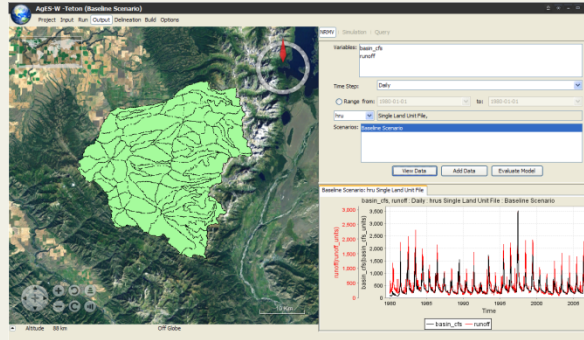


NWCC Forecast Modeling Toolbox

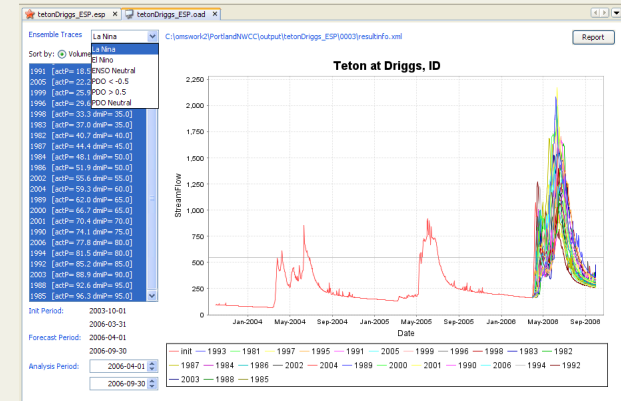
BAGIS H&P



Model Calibration & Analysis



ESP Raw Forecasts



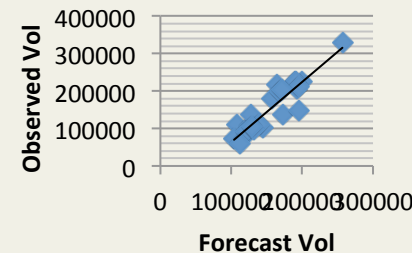
Create & Update Data/Parameter Files



- +
- Climate Data
 - ACIS
 - SNOTEL
 - Streamflow Data
 - USGS
 - NWCC adjusted

Debiased ESP Forecasts

Median Fcst vs Obs 1981 - 2010



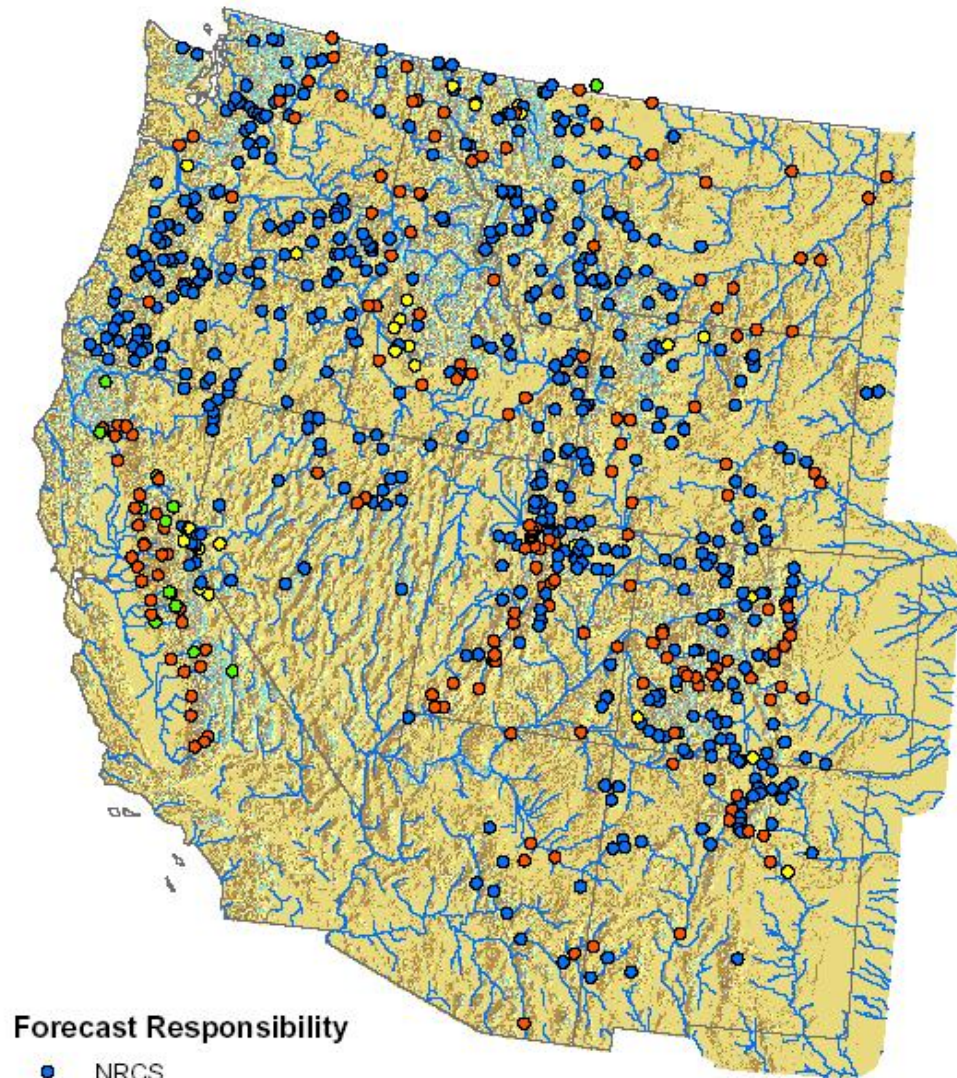
$$y = 1.6068x - 97108$$

$$R^2 = 0.84089$$

◆ Series1

— Linear (Series1)

Working with the Natural Resources Conservation Service (NRCS) to develop a streamflow forecasting toolbox using OMS and PRMS



Forecast Responsibility

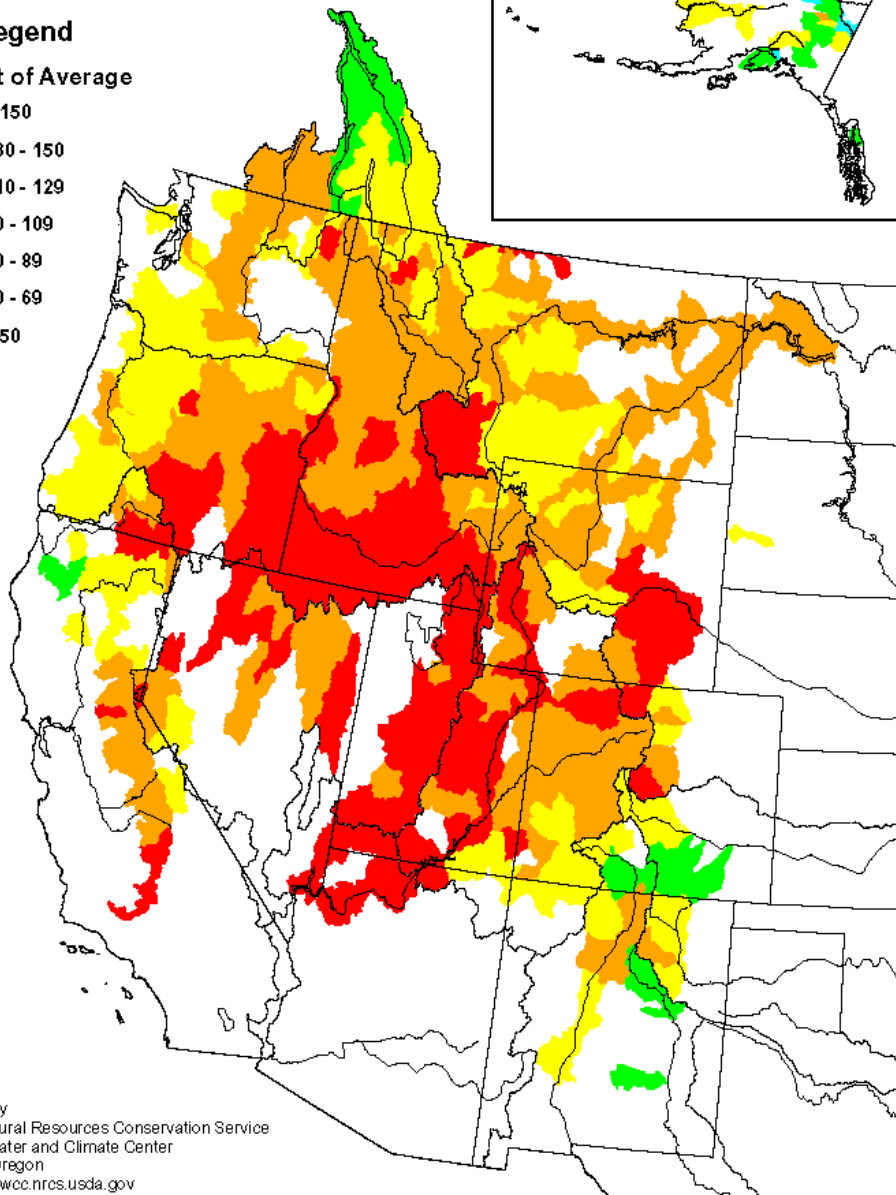
- NRCS
- NWS
- JOINT
- OTHER

All Alaska forecasts are produced by the NRCS

Spring and Summer Streamflow Forecasts as of May 1, 2004

Legend

Percent of Average



Prepared by
USDA, Natural Resources Conservation Service
National Water and Climate Center
Portland, Oregon
<http://www.wcc.nrcs.usda.gov>

Water Supply Forecasts

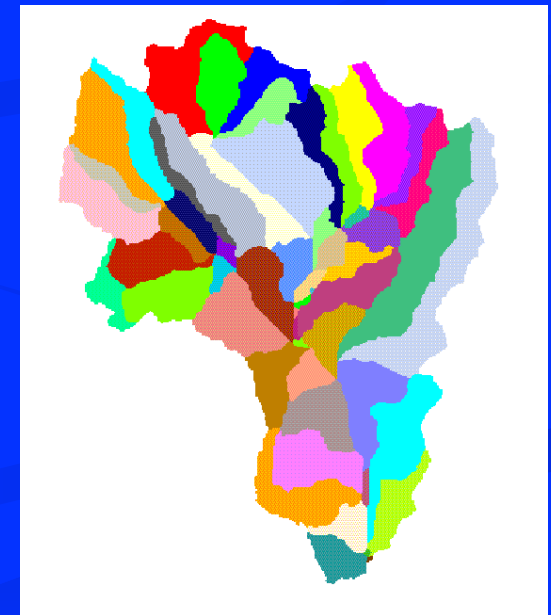
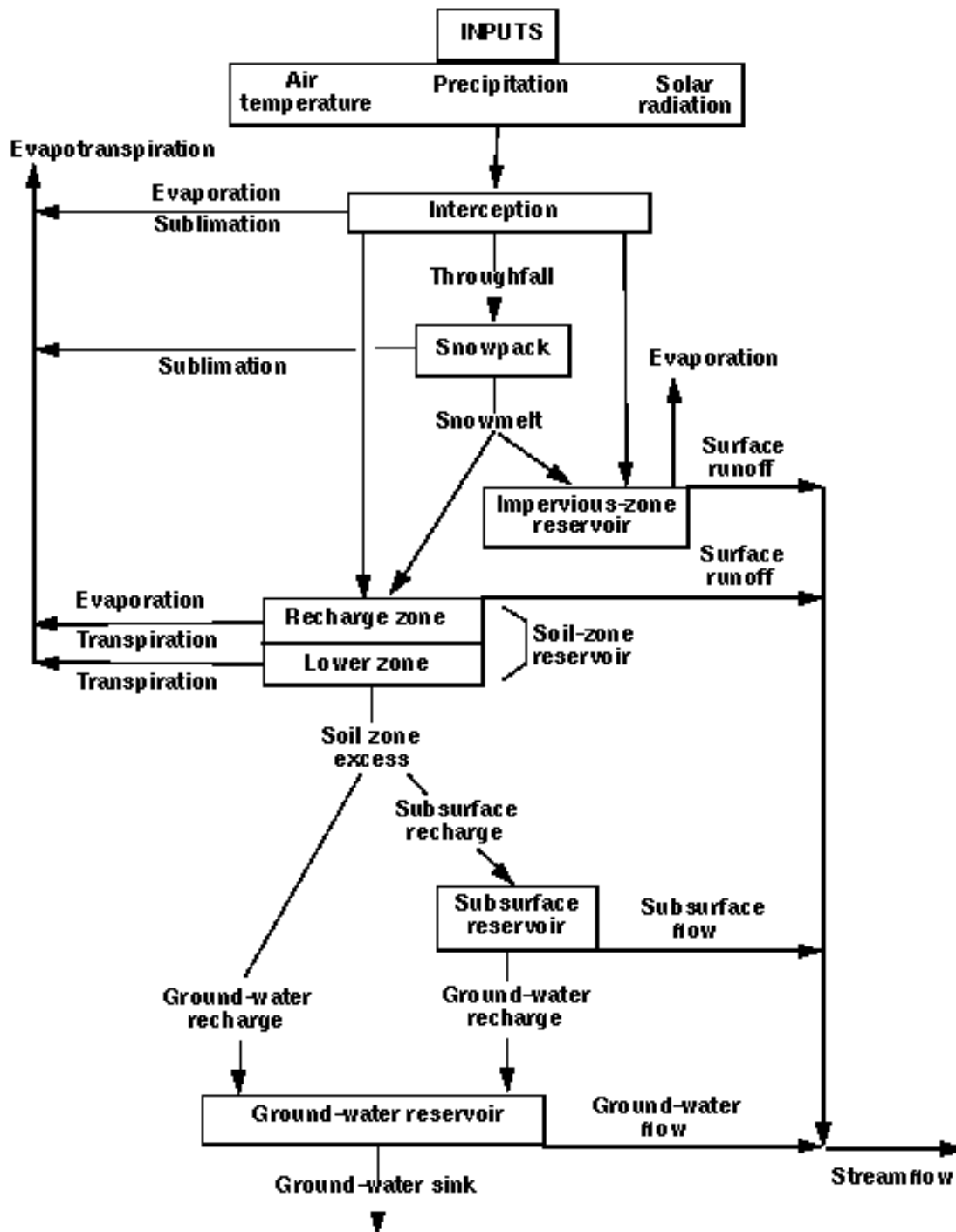
Distributed by the
Natural Resources
Conservation Service
(NRCS)

[http://
www.wcc.nrcs.usda.g
ov/wsf](http://www.wcc.nrcs.usda.gov/wsf)

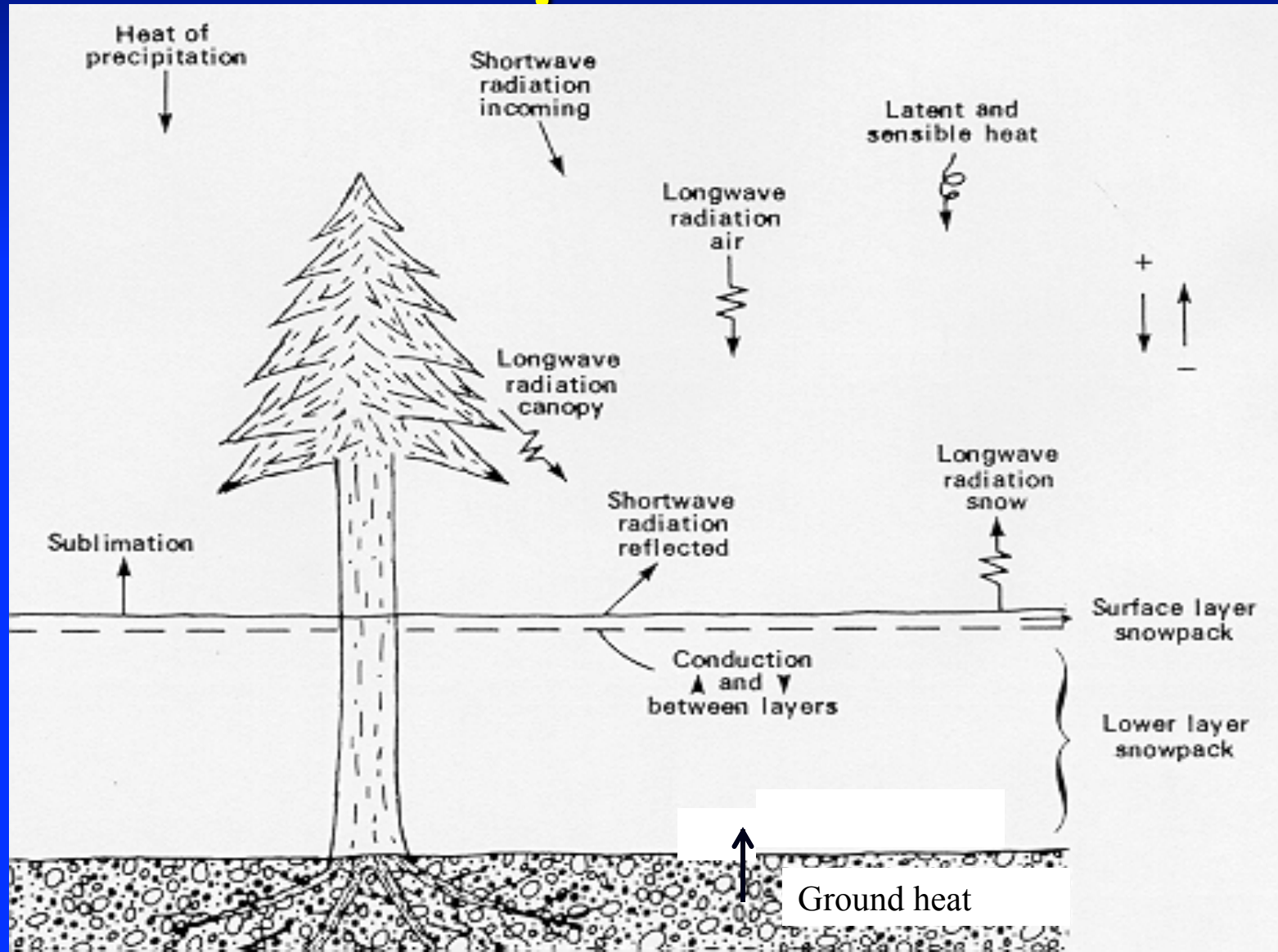
Combined product
of NRCS and
National Weather
Service Forecasts

Selected Watershed Model

PRMS



Snowpack Energy Balance Components



PRMS SNOW MODEL

Energy Balance Formulation

$$H_m = H_{sn} + H_{ln} + H_c + H_e + H_g + H_p + H_q$$

Model Formulation (on each HRU)

$$H_{sn} = \text{swrad} * (1. - \text{albedo}) * \text{rad_trncf}$$

$$H_{ln} = \text{emis} * \text{sb_const} * \text{tavg}^4 \quad (\epsilon \sigma T^4)$$

$$H_c + H_e = \text{cecn_coef}(\text{mo}) * \text{tavg} \text{ (ppt days)}$$

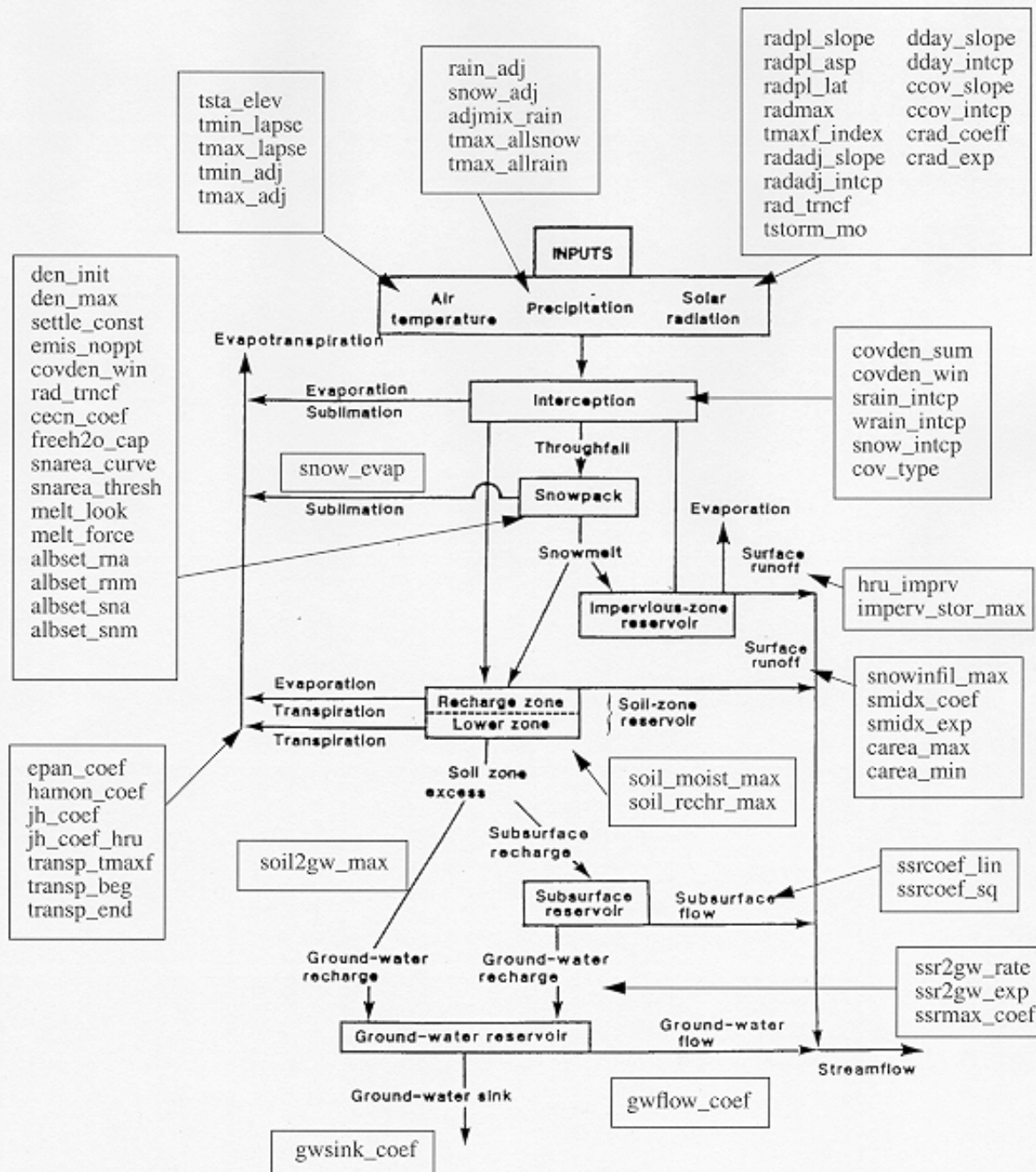
$$= 0 \quad \text{(dry days)}$$

$$H_p = \text{tavg} * \text{net_precip}$$

$$H_g = \text{groundmelt}$$

H_q is computed

PRMS/MMS PARAMETERS



PRMS Parameters

MMS Version

BAGIS-H Functions



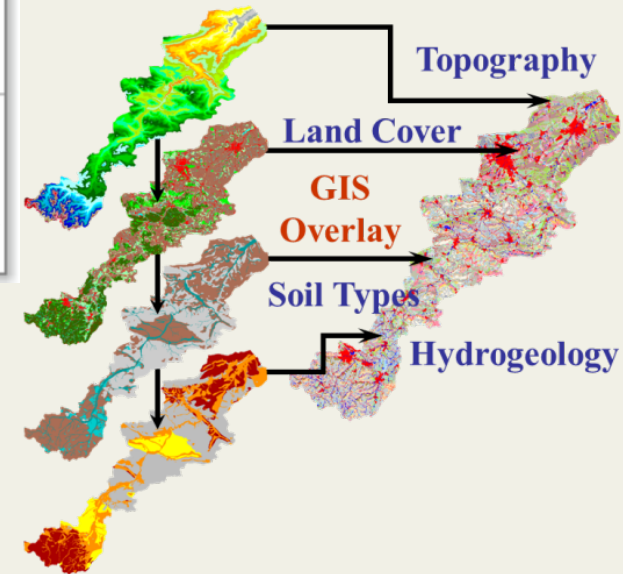
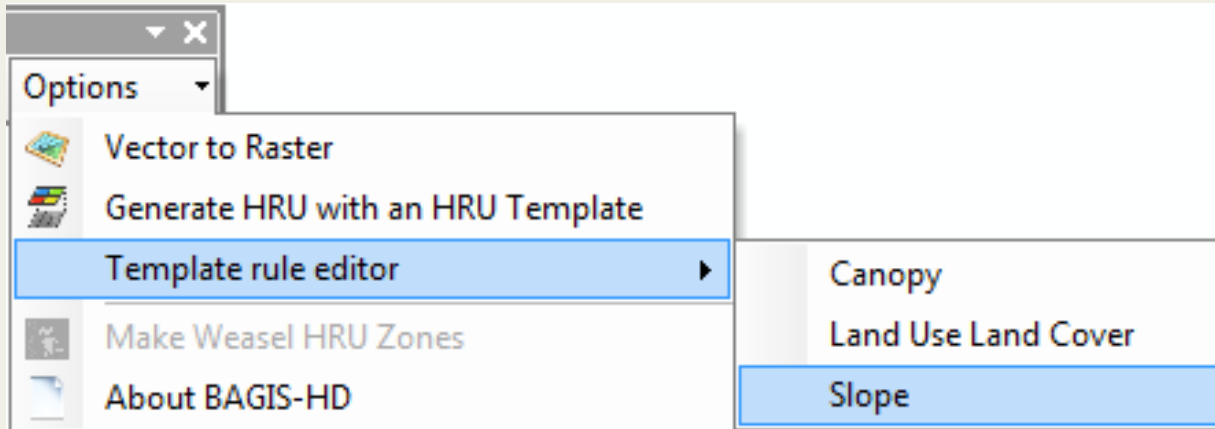
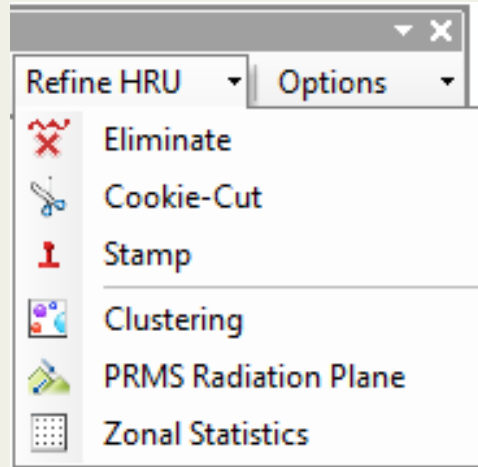
Set AOI Tool / AOI Layers Viewer



Define HRU Zones Tool

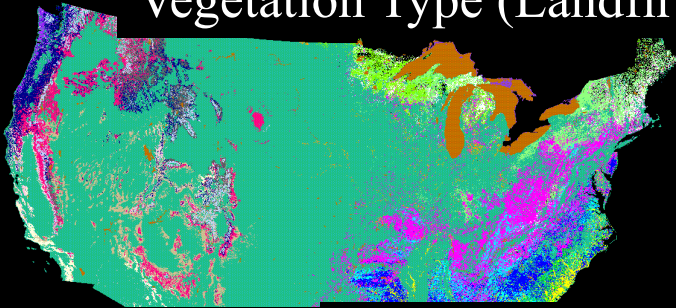
Refine HRU Toolset

Options / Utilities



DIGITAL DATABASES

Vegetation Type (Landfire)



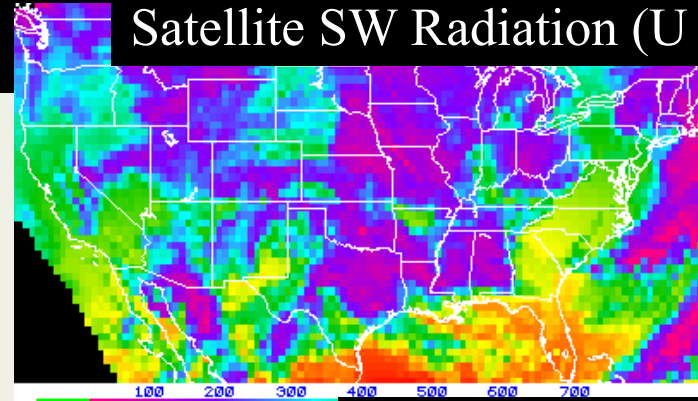
STATSGO Soils (USDA)



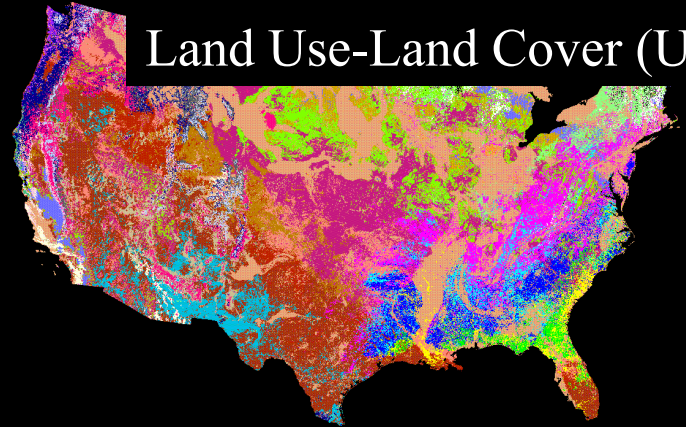
Vegetation Density
(Landfire + NLCD)



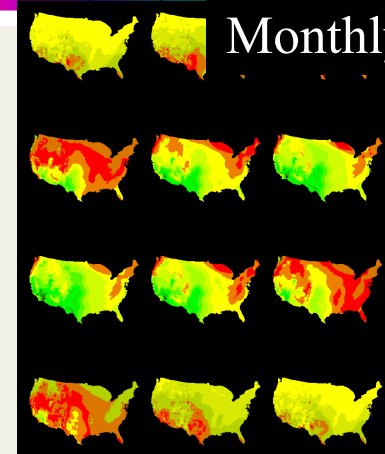
Satellite SW Radiation (U Md)



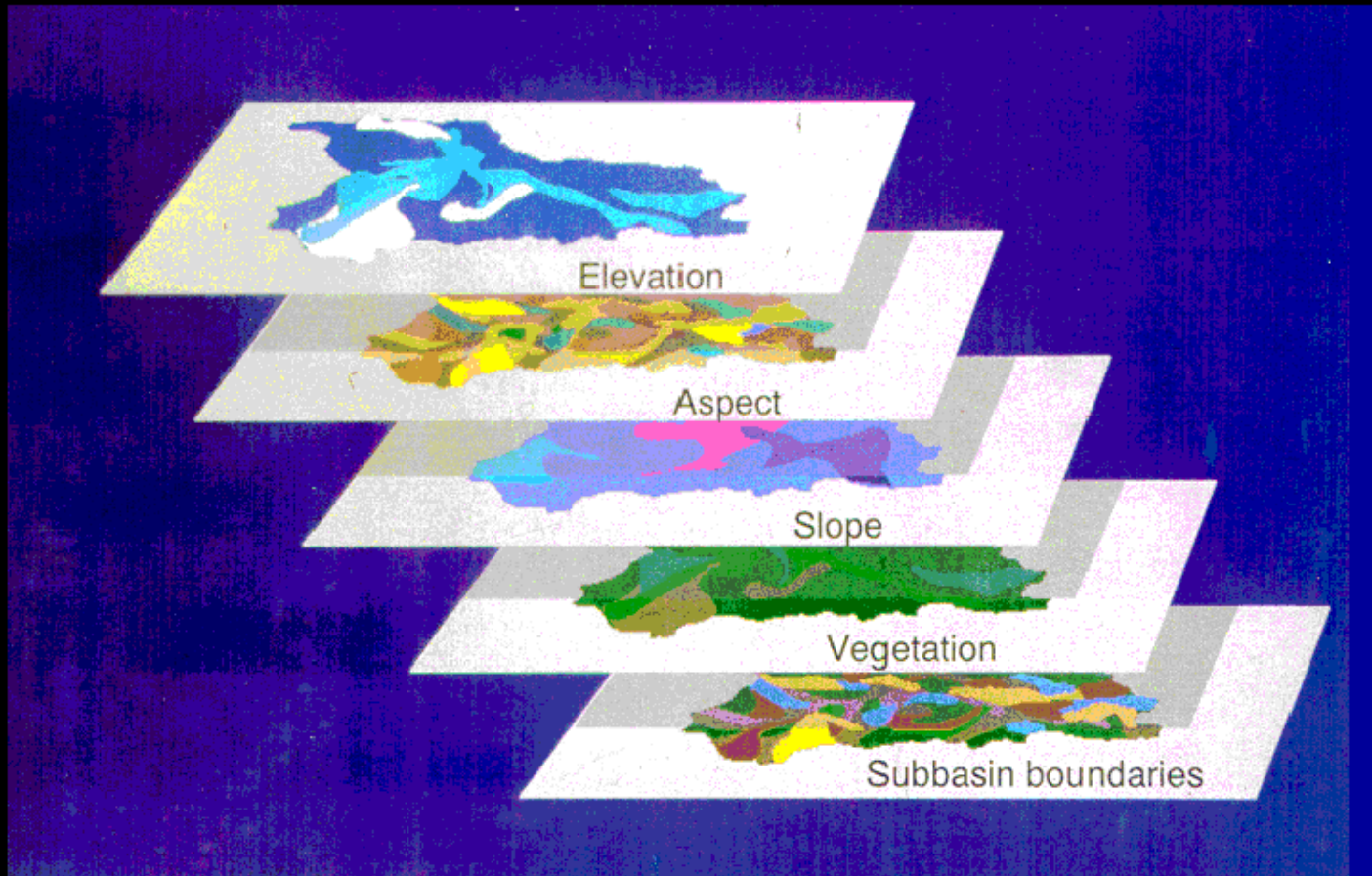
Land Use-Land Cover (USGS)



Monthly PET (NWS)



AUTOMATED PARAMETER ESTIMATION



BAGIS-P Parameter Database Manager

Set AOI

S:\GIS\basins\uco\test_aoi

Parameter Viewer

HRU Layers

HRU1
 HRU2
Final_HRU
 Other_HRUs

Methods

Methods	Status
Aspect.xml	Undefined
Area.xml	! Defined
Elevation.xml	Online
<u>VegCov_Density.xml</u>	Online
!	
SWE.xml	Online
Root-depth.xml	Online
Soilmoist.xml	Online

Current Profile: Make Public

Number of Methods:

Current Method:

Output Name:

Equation:

Veg-cover.value / 100

Edit Equation

(Re)Calculate Parameters

Profiles	Param
NWCC_Profile.xml	-
USGS_Profile.xml	-
<u>My_Profile.xml</u>	Present
Other_Profile.xml	Present

New
Delete

New

Delete

Import/Copy

Update Data

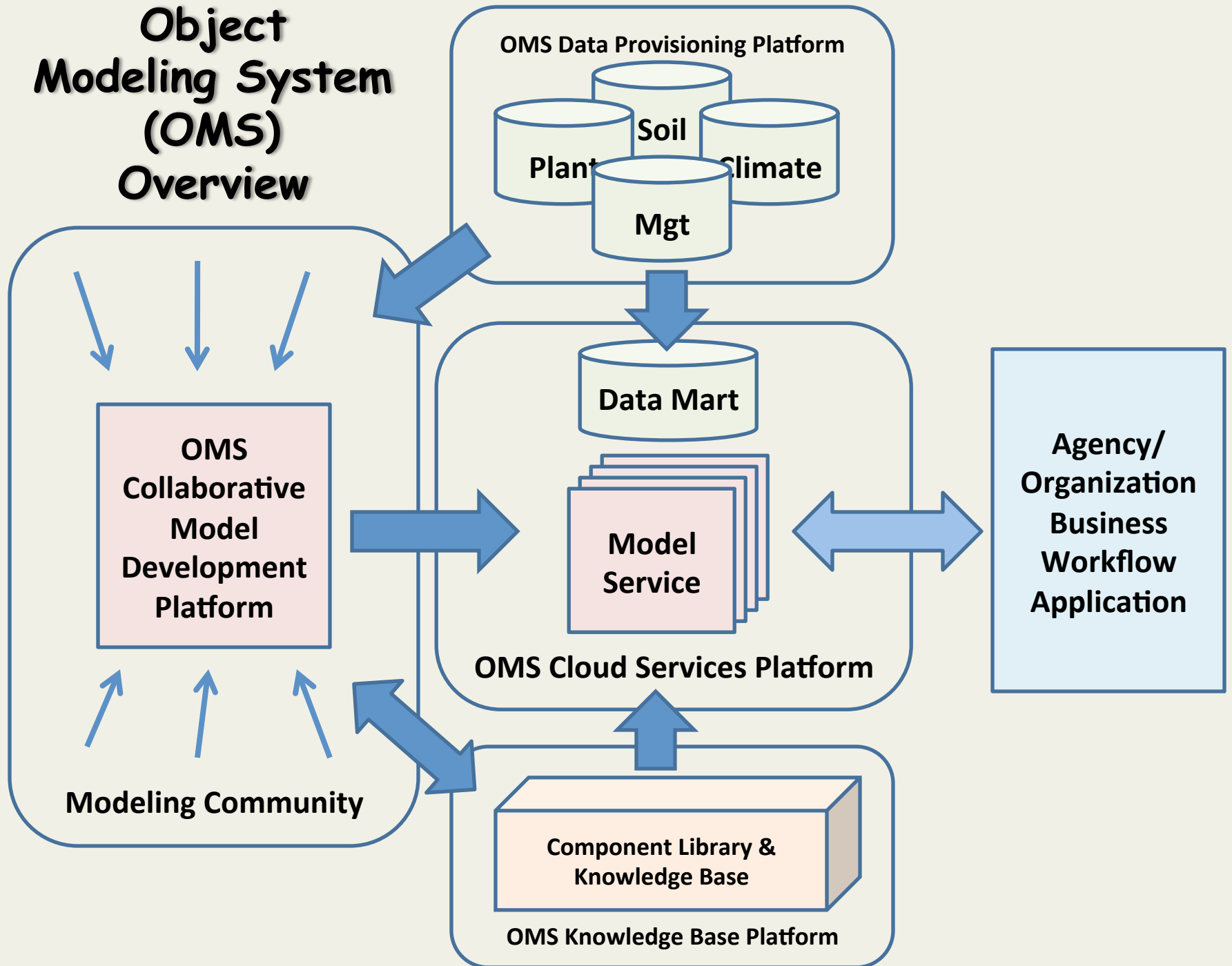


Model Component Framework

Object Modeling System (OMS)

Framework for
developing and
deploying science
models

Object Modeling System (OMS) Overview

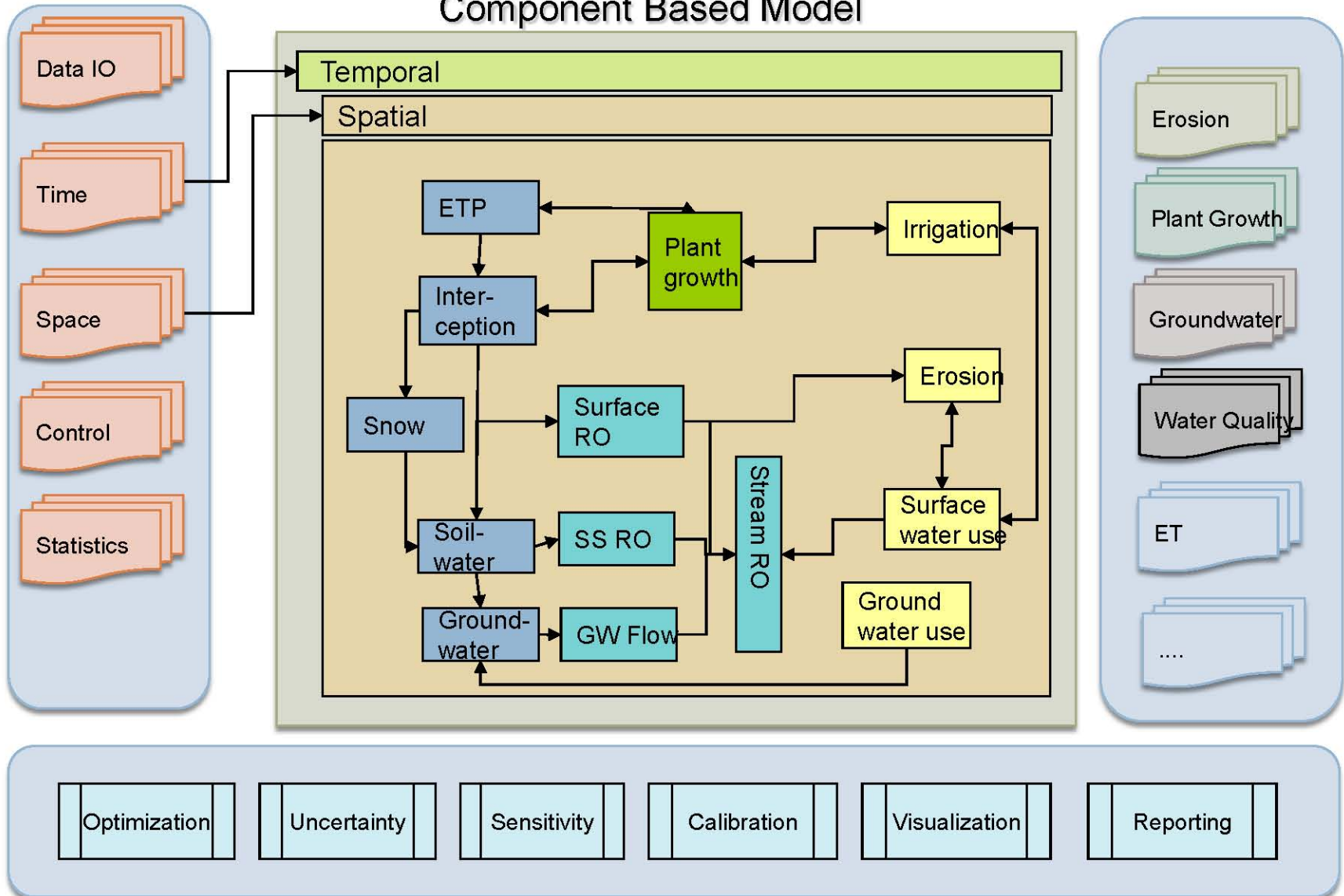


OMS Model Development Architecture

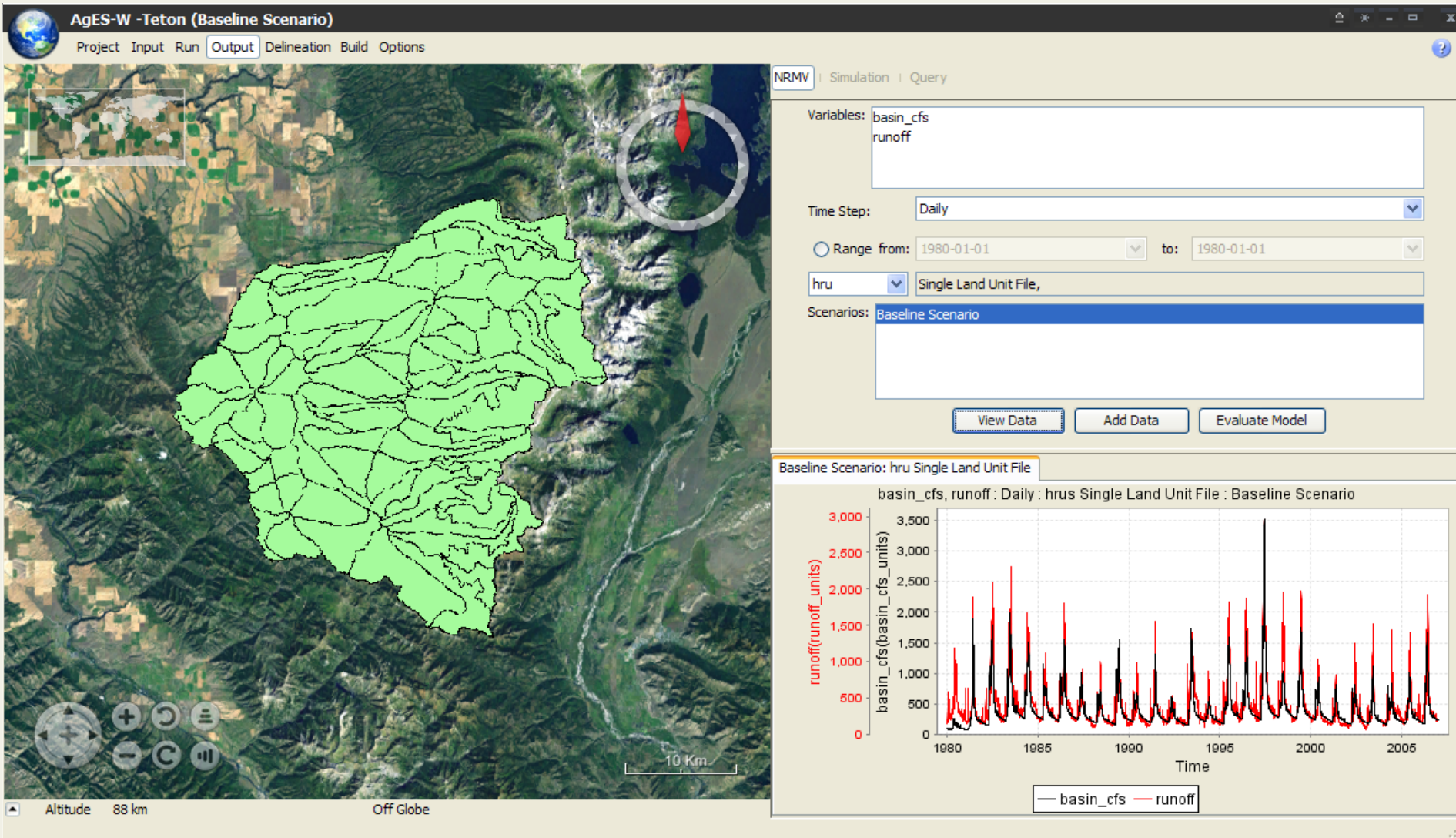
Component Based Model

System Components

Science Components

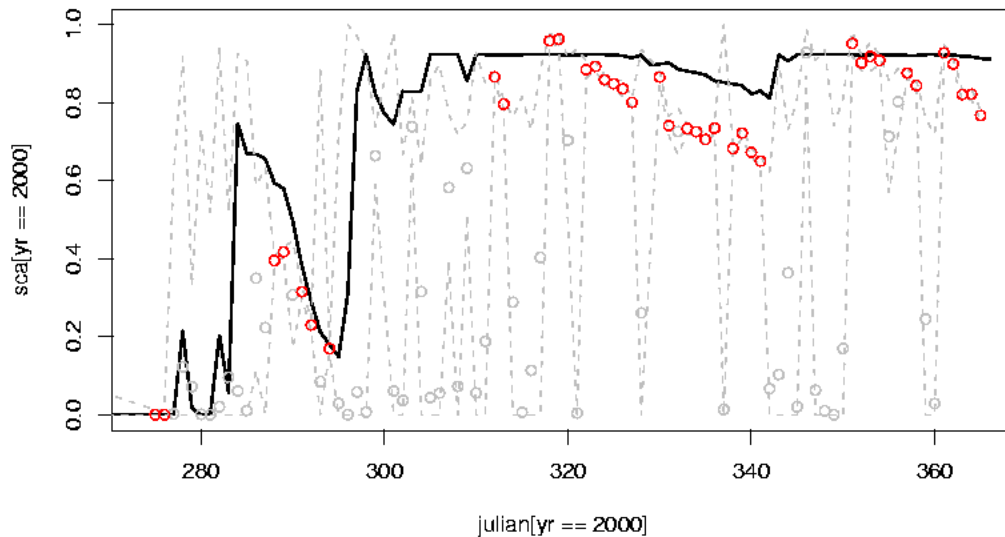
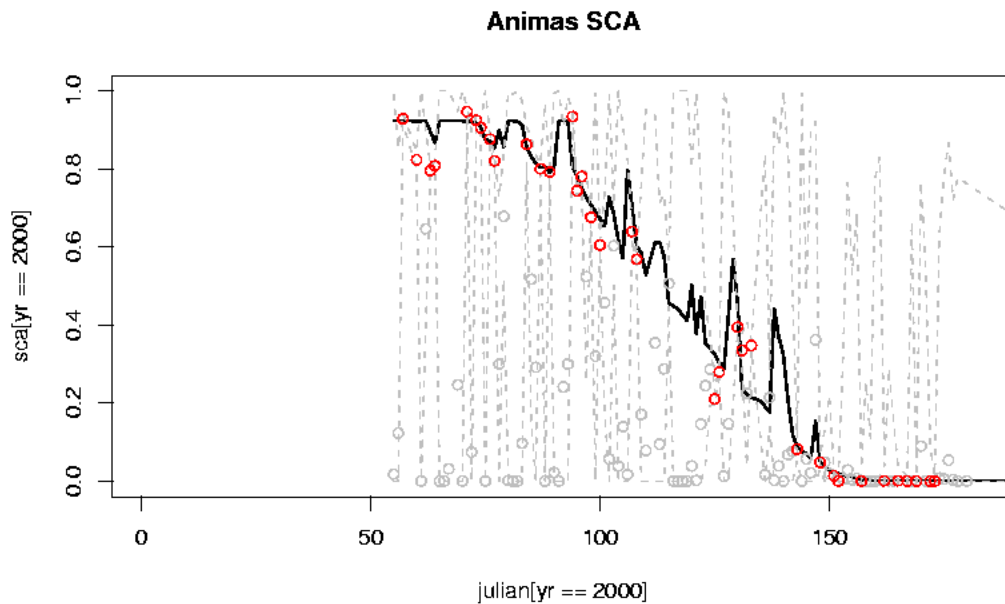


Visualization and Analysis Tools



Remotely-Sensed Data Integration

Animas Basin, CO Snow-covered Area Year 2000



Simulated —

Measured (MODIS Satellite) ○

Error Range ≤ 0.1

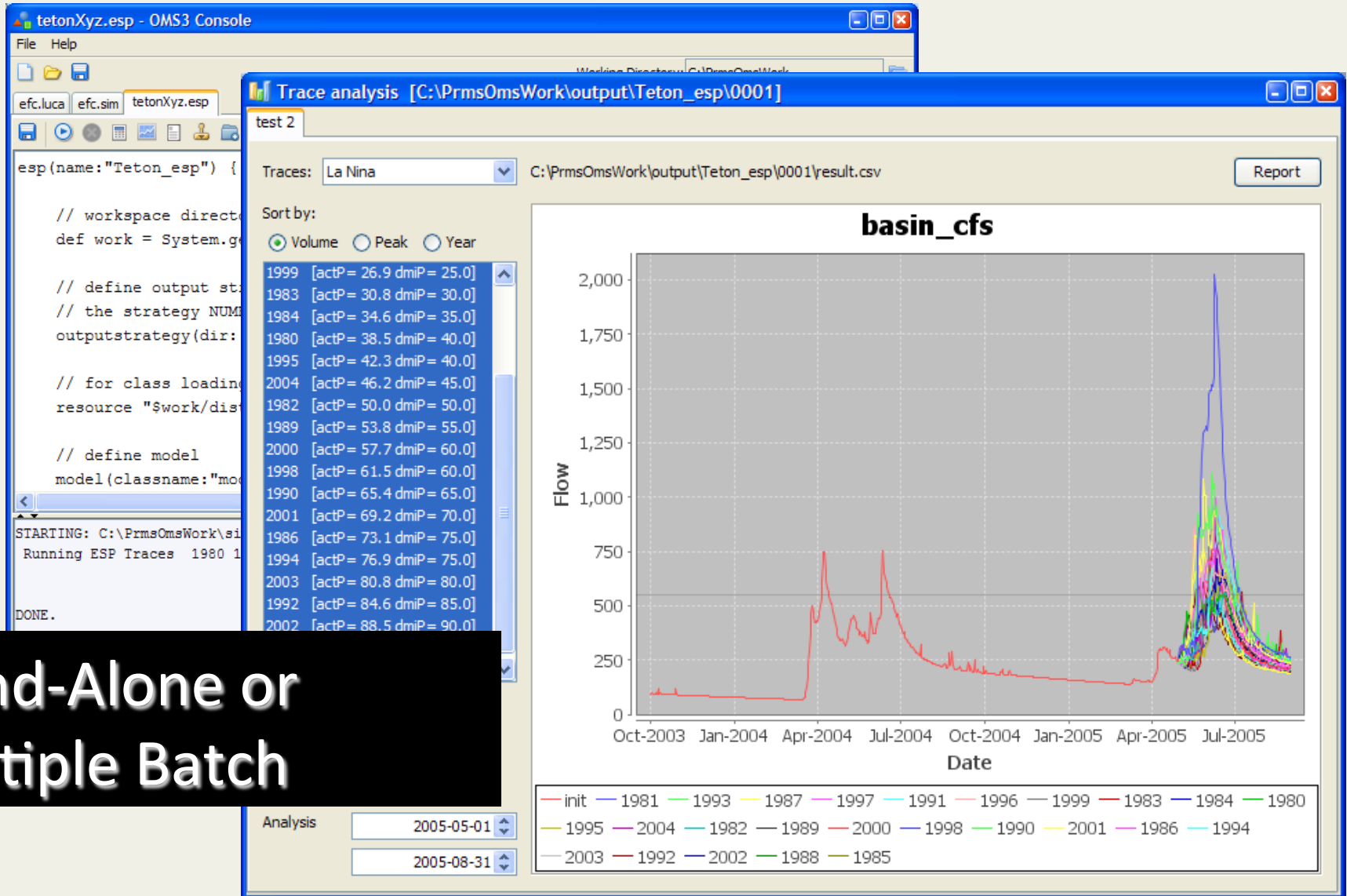
OMS3 Console

The image displays three overlapping windows from the OMS3 software interface:

- efc.sim - OMS3 Console:** Shows the simulation configuration script. The script includes comments for workspace directory, output strategy, class loading, and model definition. The simulation has completed, showing "STARTING: C:\PrmsOmsWork\simulations" and "DONE." at the bottom. The loaded file is "C:\PrmsOmsWork\simulations\teton\tetonXyz.esp".
- Parameter Efcarson:** A console window with a filter set to "nhru" and a file path "C:\PrmsOmsWork\data\efcarson\efc_params.csv". It contains the text: "> Parameter Console, type 'help' for commands." and ">".
- Simulation Output [C:\PrmsOmsWork\output\Efcarson\0004]:** A graph titled "Components of Flow" showing flow components over time from 1981 to 1986. The Y-axis represents flow rate (0 to 4,000). The X-axis represents Date (1981 to 1986). The legend indicates three components: basin_sroff_cfs (red), basin_ssflow_cfs (blue), and basin_gwflow_cfs (green). The blue line shows the highest flow, with a major peak in 1984. The red line shows a sharp peak in 1986. The green line shows a smoother, lower flow component.

Index	Value
0	0.20000
1	0.20000
2	0.20000
3	0.20000
4	0.20000
5	0.20000
6	0.20000
7	0.20000
8	0.0
9	0.0
10	0.20000
11	0.20000
12	0.20000

ESP Trace Analysis



Stand-Alone or Multiple Batch

ESP Forecasting

(Raw and Debiased)

Run once a year

- Debias_ESP:
 - Develops linear regression coefficients to adjust raw ESP forecasts

Run for each forecast

- Batch ESP:
 - Runs ESP on multiple basins
 - Creates raw forecasts for selected probability of exceedance values
 - Uses regression coefficients from Debias_ESP to adjust raw forecast values

Debias ESP

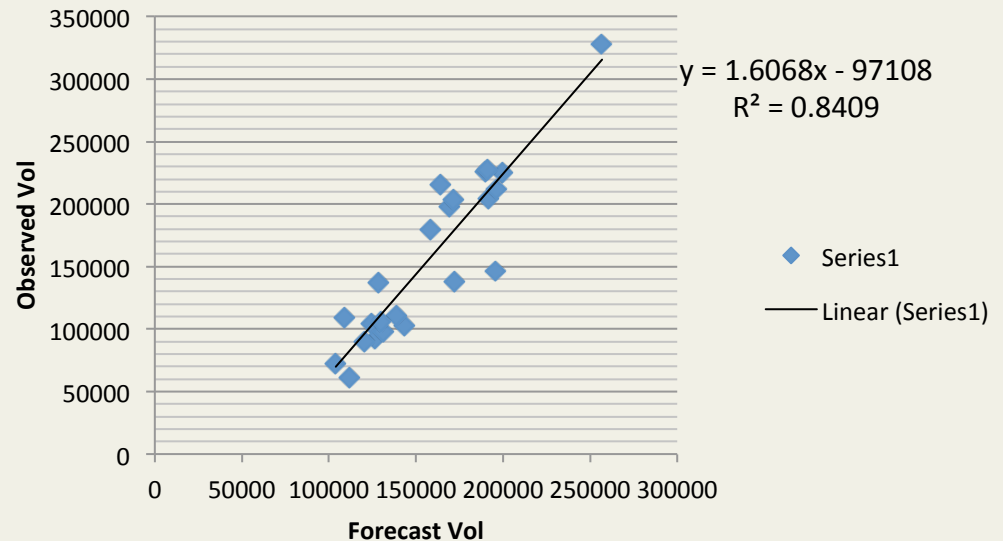
Run ESP for each year in the historic data file (eg. 1981 -2010)

Sort traces for each forecast ensemble, excluding forecast year

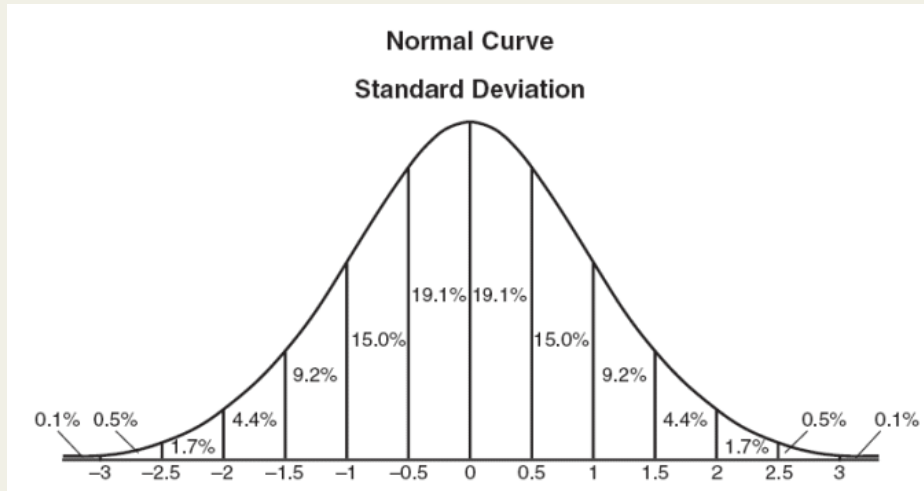
Plot median ensemble forecast volume against observed volume

Run linear regression to get debias coefficients: slope, intercept, std error

Median Fcst vs Obs 1981 - 2010



Forecast Probabilities of Exceedance



5% - median vol + (1.64 * stderr)

10% - median vol + (1.28 * stderr)

30% - median vol + (.52 * stderr)

50% - median trace volume

70% - median vol - (.52 * stderr)

90% - median vol - (1.28 * stderr)

95% - median vol - (1.64 * stderr)

Forecast Types

Currently Available

- Volumes for multiple forecast periods

Future

- Peak flow
- Date flow goes below selected threshold