CalSimHydro Updates

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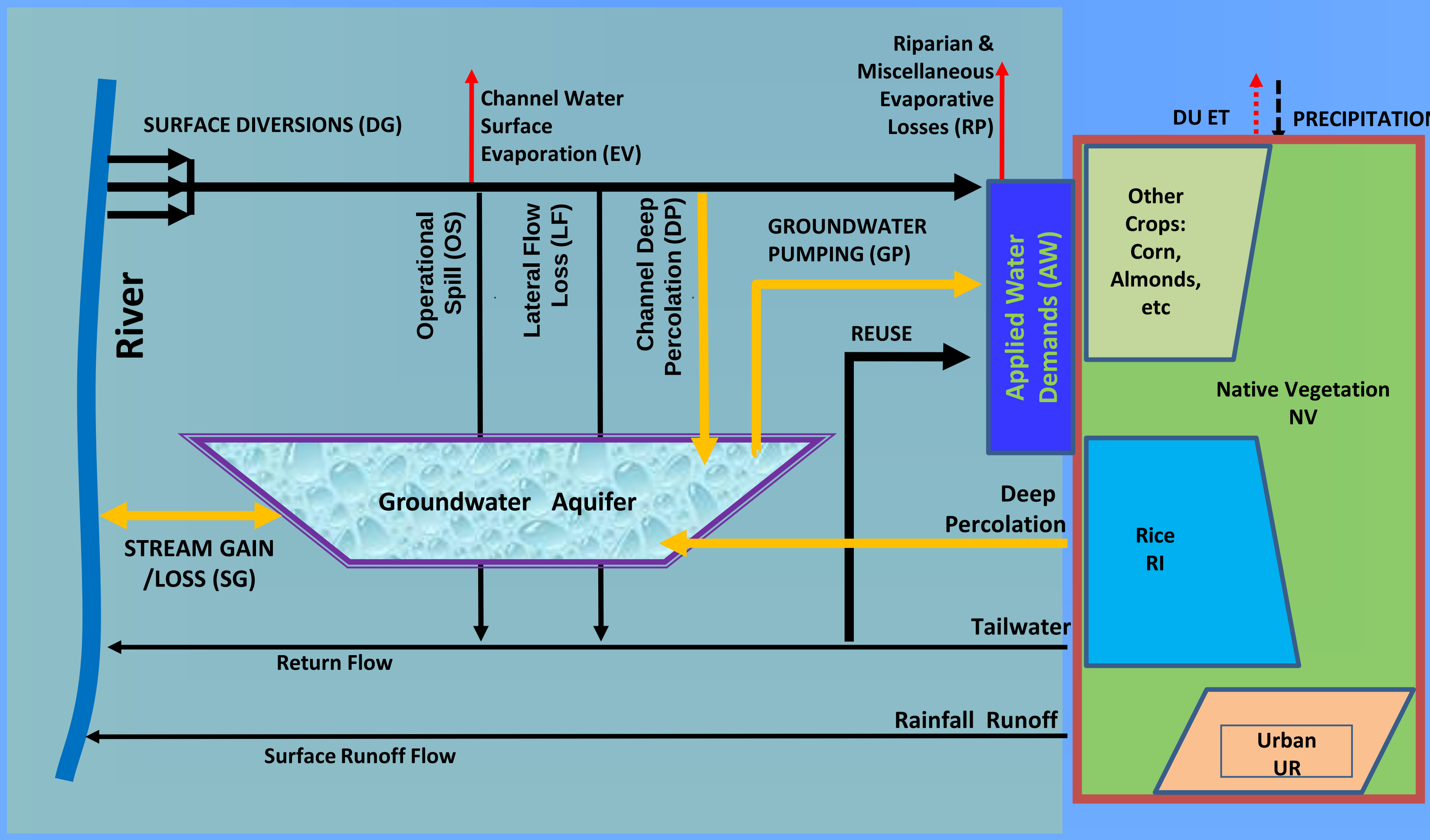
Introduction to CalSimHydro



CalSim 3.0

CalSimHydro

Major Updates

- Extended the data to 2013 (from 1922 to 2013)
- Addition of a spin-up period for initial soil moisture
- Irrigation Efficiencies based on irrigation technology
- Daily precipitation from PRISM (Parameter-Elevation Regressions on Independent Slopes Model)

Irrigation Efficiencies

What is this for? How would this affect the model?

- Irrig_Eff = CUAW / AW
- Input to CalSimHydro IDC
  - crop-specific
  - different values for WBAs (but similar values)
- IDC:
  1. calculates CUAW first by root zone soil moisture routing under ideal conditions
     - no return flow, no deep percolation
  2. calculates AW = CUAW / Irrig_Eff
  3. calcualtes return flow and deep percolation
     - Assumed field return flow (tailwater) is 10% of AW
     - Lower Irrig_Eff, higher AW, higher DP

Irrigation Efficiencies

- Previously irrigation efficiencies from DSIWM
  - collects information and assesses irrigation efficiencies through Regional offices
  - Estimated efficiencies are reported by DAU and county
  - These values do no vary significantly between counties in the same DAU.

- It is unclear how often these estimates are reviewed and updated. Procedures between regional offices also may vary.

Irrigation Efficiencies

- Now: Estimate Irrigation efficiencies based on irrigation technology
- Different irrigation technology → distribution uniformity (DU)
- $DU = \frac{\text{Avg water depth of lowest quarter of distribution}}{\text{Avg water depth of avg quarter of distribution}}$
- Potential application efficiency (PAE):
  - PAE = DU * (100 – percentage of tailwater)

Irrigation Efficiencies

- Example of PAE for some irrigation methods:
  - Source: UC Davis Water Management Research Group.
  - 2013. Spatial Analysis of Application Efficiencies in Irrigation for CA

Irrigation Method	Potential Application Efficiency		
	Low	High	Mean
Surface Irrigation			
Wild Flood	0.50	0.86	0.68
Border	0.62	0.83	0.73
Basin	0.72	0.93	0.83
Furrow	0.60	0.85	0.73
Surface – Sprinkler Side-Roll	0.60	0.75	0.68
Surface – Sprinkler Hand-Move	0.60	0.75	0.68
Sprinkler Irrigation			
Permanent	0.70	0.85	0.78
Hand-Move	0.60	0.80	0.70
Linear-Move	0.73	0.90	0.82
Side-Roll	0.60	0.80	0.70
Micro-Mini	0.73	0.88	0.81
Hose-Pull	0.70	0.75	0.73
Center-Pivot	0.70	0.90	0.80
Trickle/Drip Irrigation			

Irrigation Efficiencies

- Potential Application Efficiencies by County: (developed by UC Davis)

2001 and 2010 Seasonal Irrigation Efficiency Estimates by Crop in California

2010 County - level Seasonal Irrigation Efficiency Estimates for 20 Crop Categories in Colusa

Crop Name	Low Irrigation Efficiency	High Irrigation Efficiency	Mean Irrigation Efficiency
Corn	0.60	0.84	0.72
Cotton	--	--	--
Beans (dry)	0.61	0.83	0.72
Grains	0.59	0.86	0.73
Safflower	--	--	--
Sugar beets	--	--	--
Other Field crops	0.60	0.85	0.73
Alfalfa	0.60	0.84	0.72
Pasture	0.58	0.83	0.71
Cucurbit	0.65	0.87	0.76
Onions & Garlic	--	--	--
Potatoes	--	--	--
Tomatoes (fresh)	--	--	--

- We mapped this County-Specific-PAE to WBAs.

Irrigation Efficiencies

- Crop-specific Irrigation efficiencies = 0.9 * PAE
  - Assume 10% of tailwater
- crop-specific irrigation efficiencies do not vary significantly between WBAs.
  - constant over the irrigation season
  - Zero during non-irrigation season

Irrigation Efficiencies

WBA	Almond & Pistacio	Corn	Cotton	Cucurbit	Dry beans	Grains	Other Deciduous	Other Truck Crops	Pasture	Subtropical Trees
02	70%	66%	68%	68%	64%	65%	65%	67%	64%	71%
03	70%	65%	68%	68%	64%	65%	65%	67%	64%	71%
04	70%	65%	68%	68%	64%	65%	65%	67%	64%	72%
05	69%	65%	68%	68%	64%	66%	65%	66%	63%	70%
06	70%	71%	68%	68%	64%	65%	66%	67%	64%	67%
07N	70%	71%	68%	66%	65%	65%	66%	67%	64%	67%
07S	72%	65%	68%	68%	65%	65%	66%	67%	64%	71%
08N	70%	70%	68%	68%	65%	65%	66%	67%	64%	67%
08S	72%	65%	68%	68%	65%	65%	66%	67%	64%	70%
09	69%	71%	68%	66%	65%	65%	66%	67%	64%	70%
10	69%	65%	68%	68%	64%	66%	65%	67%	64%	70%
11	70%	70%	68%	68%	64%	65%	66%	67%	64%	70%
12	69%	65%	68%	68%	64%	66%	65%	67%	64%	70%
13	69%	66%	68%	68%	64%	66%	65%	67%	64%	70%
14	70%	66%	68%	68%	64%	66%	66%	67%	64%	70%
15N	70%	65%	68%	68%	64%	66%	66%	67%	64%	70%

Precipitation

Two Purpoes in CalSim 3.0 model:

1. average annual precipitation to estimate streamflows from rim watersheds which has no gages
2. Daily precipitation timeseries of WBAs for Rainfall Runoff model in CalSimHydro
   - To estimate surface runoff
   - To esitmate infiltration of precipitation for root zone soil moisture counting in IDC

Daily Precipitation

Data Sources:

- National Climate Data Center (NCDC)
  - Daily precipitation for 32 gages located with Central Valley
  - Constructed from gaged NCDC precipitation timeseries + statistical methods to fill data gaps

- PRIMS (Parameter-Elevation Regressions on Independent Slopes Model) Climate Group at Oregon State University
  - Distributed grids of daily, monthly, and average annual precipitation

PRIMS data

- Grids of monthly and daily precipitation data from PRIMS web site:
  - Resolution: 4km x 4km
  - Two data sets: AN81 d and AN81m are used
  - Can be easily mapped into precipitation by WBA using GIS

- AN81d
  - Daily precipitation
  - Predictor Grids for the parameter-elevation model: 1981-2010 monthly climatologies
  - Data available: January 1981 – most recent day

- AN81m
  - Monthly
  - Predictor Grids for the parameter-elevation model: 1981-2010 monthly climatologies
  - Data availiable: January 1895 – most recent month

Q & A

PRIMS data

Why PRIMS data

- High quality spatial climate data sets
- The 4kmx4km grids of monthly and daily precipitation are updated and extended as quick as the end of last month
- Easily download data sets for the whole California from its web site
- Easily to map the data into WBAs when using GIS

Daily Precipitation

First use GIS to intersect PRISM grids with CalSim 3.0 WBA boundaries and calculated the monthly and daily precipitation for each WBA.

Oct 1st, 1981 – Sep 30th, 2015

- Since the monthly sum of PRISM daily precipitation is slight different than the PRISM month precipitation, adjusted daily precipitation:

$$P_{WBA,adj}(d,m) = P_{WBA}(d) \times P_{WBA}(m) \div \sum_{d=1}^{D_m} P_{WBA}(d)$$

Oct 1st, 1921 – Sep 30th, 1981:

- Since the PRISM daily precipitation is not available before 1981
- Monthly precipitation by PRISM
- Used NCDC daily precipitation from Oct 1st 1921 to Sep 30th 1981 to disaggregate PRISM's monthly precipitation.