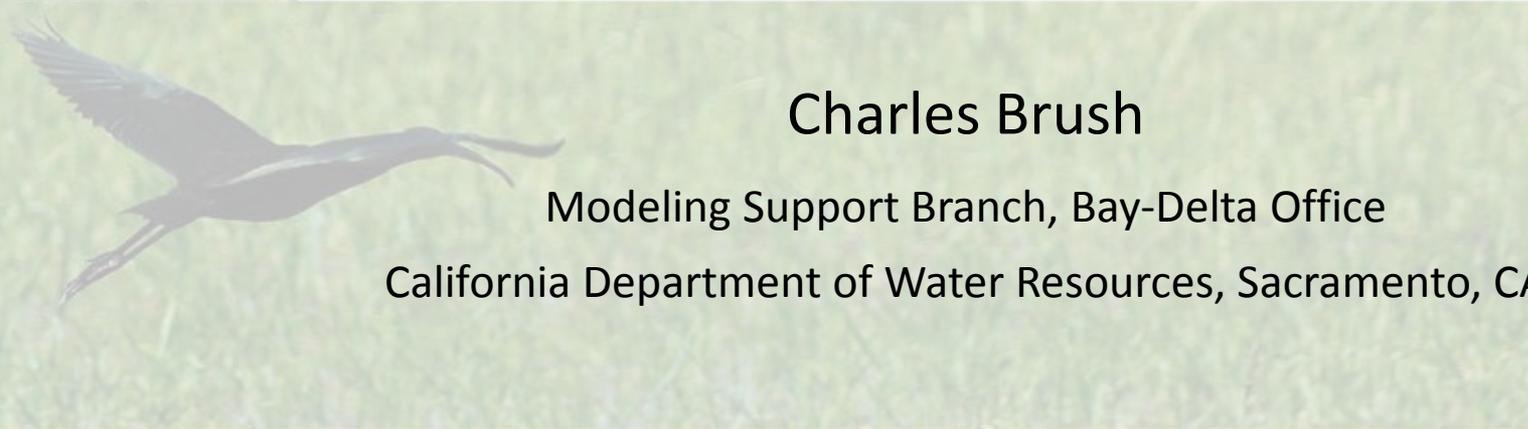
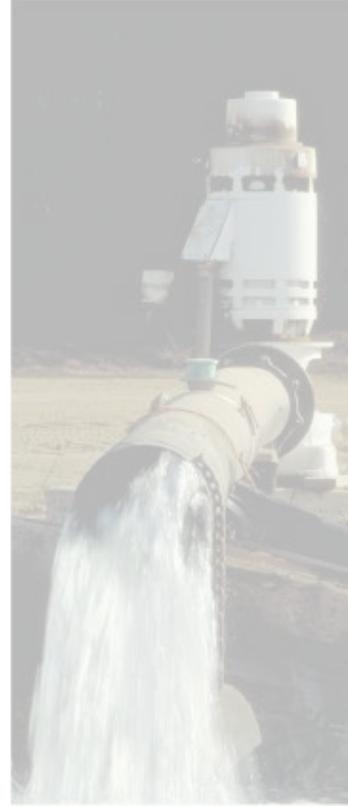




Current Status of C2VSim and Related Tools

IWFM Users' Group
December 18, 2012

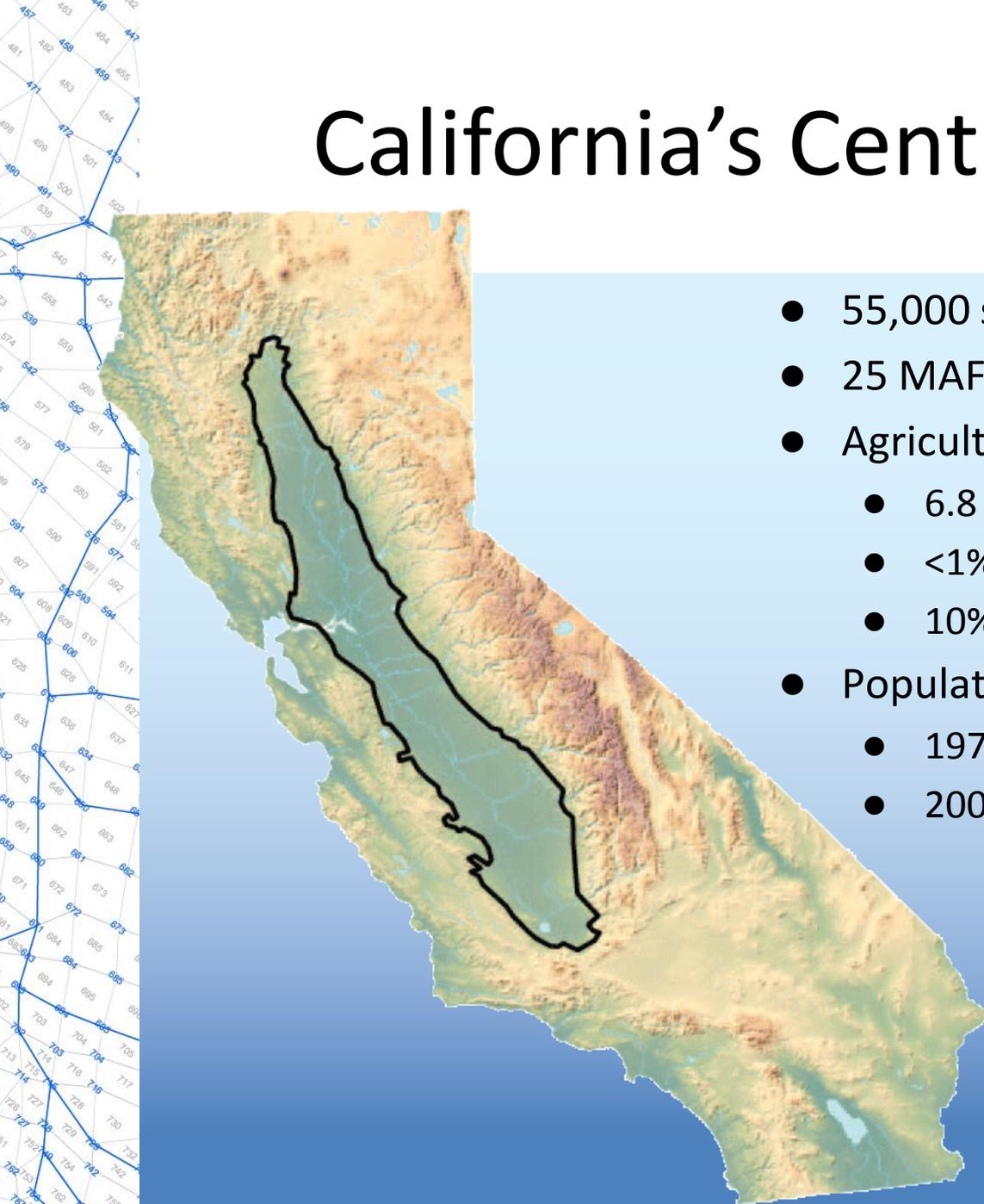


Charles Brush

Modeling Support Branch, Bay-Delta Office
California Department of Water Resources, Sacramento, CA



California's Central Valley



- 55,000 sq. km. (20,000 sq. mi.)
- 25 MAF/yr Surface Water Discharge
- Agricultural Production
 - 6.8 million acres (27,500 sq. km)
 - <1% of US farm land
 - 10% of US crops value in 2002
- Population Growth
 - 1970: 2.9 million
 - 2005: 6.4 million
- Groundwater Pumping
 - ~9 MAF in 2002
 - 10-18% of US pumping
 - Not measured or regulated



C2VSim Development

Derived from the CVGSM model

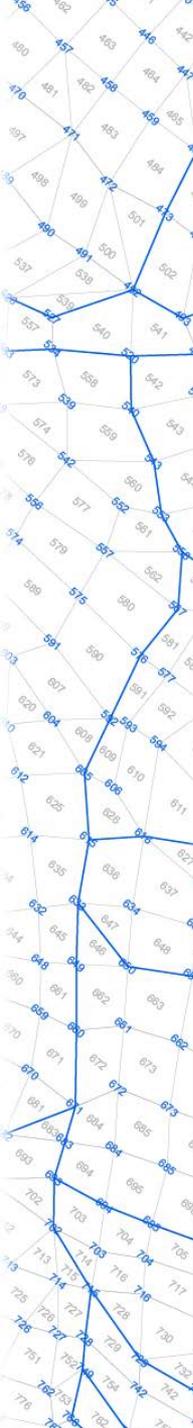
- WY 1922-1980 Boyle & JM Montgomery (1990)
- WY 1981-1998 CH₂M Hill

Steady modification

- DWR IWFM/C2VSim development began in 2000
- IWFM process and solver improvements
- C2VSim data sets reviewed and refined
- C2VSim input data extended through WY 2009

Calibration

- PEST parameter estimation program
- Three phases: Regional, Local, Nodal
- Calibration Period: WY 1973-2003 in phases 1 & 2, 1922-2004 in phase 3



C2VSim Versions

C2VSim CG 3.02 (R367): Pre-Release Version

- Water Years 1922-2009, monthly time step
- IWFIM version 3.02
- Expected release in January 2013

C2VSim FG 3.02 (R356): Draft Version

- Based on C2VSim 3.02 CG of Jan 2012
- Refine rivers, inflows, land use
- Next: Update to R367
- Expected release in Spring 2013

Planned Improvements

- C2VSim 3.02 CG/FG: Extend to WY 2011 or 2012
- C2VSim 4.0 FG: Element-level land use, crop and diversion data

C2VSim Coarse-Grid

“C2VSim CG-3.02”

Finite Element Grid

- 3 Layers or 9 Layers
- 1393 Nodes & 1392 Elements

Surface Water System

- 75 River Reaches, 2 Lakes
- 243 Surface Water Diversions
- 38 Inflows, 11 Bypasses
- 210 Small-Stream Watersheds

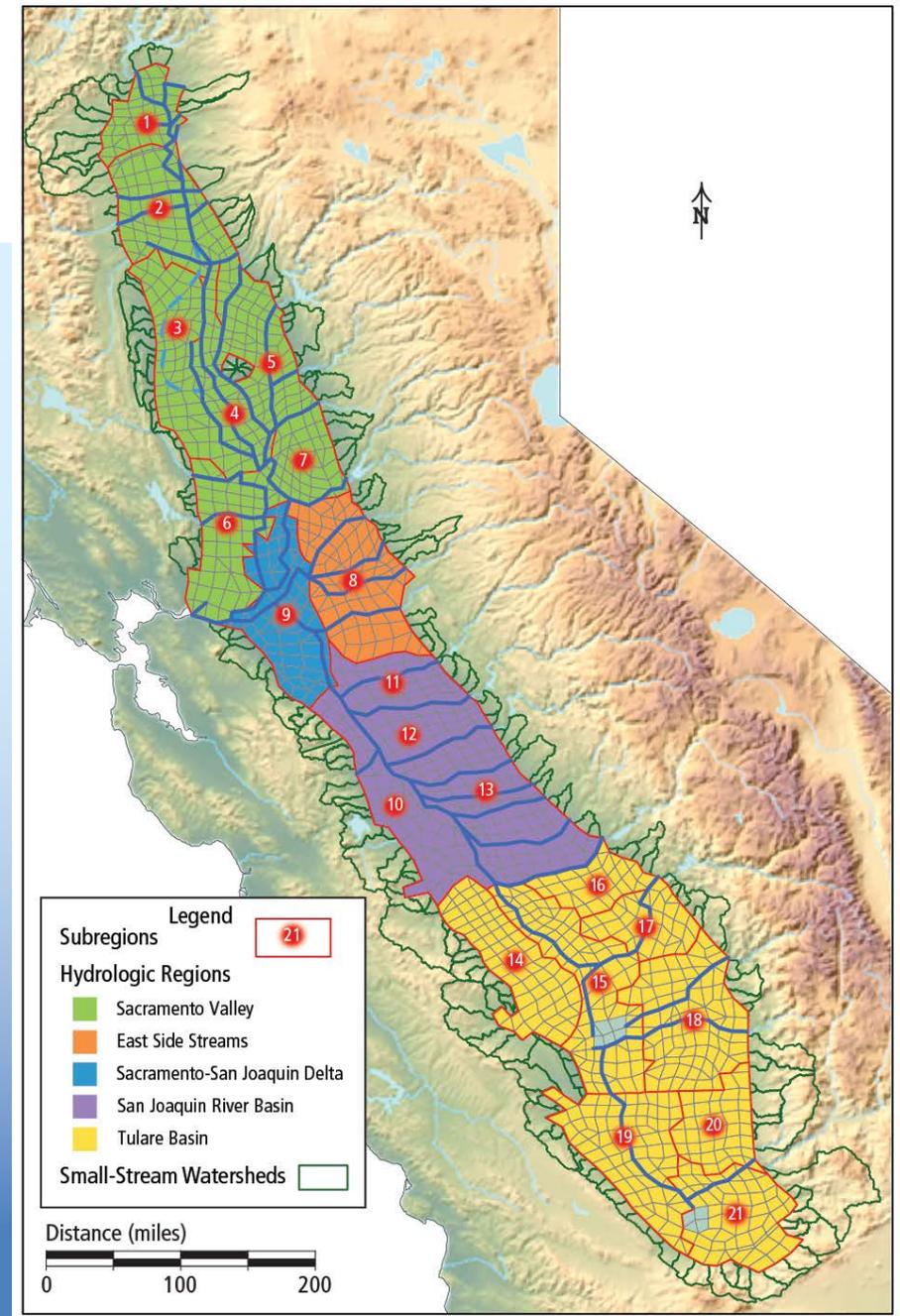
Land Use Process

- 21 Subregions (DSAs)
- 4 Land Use Types

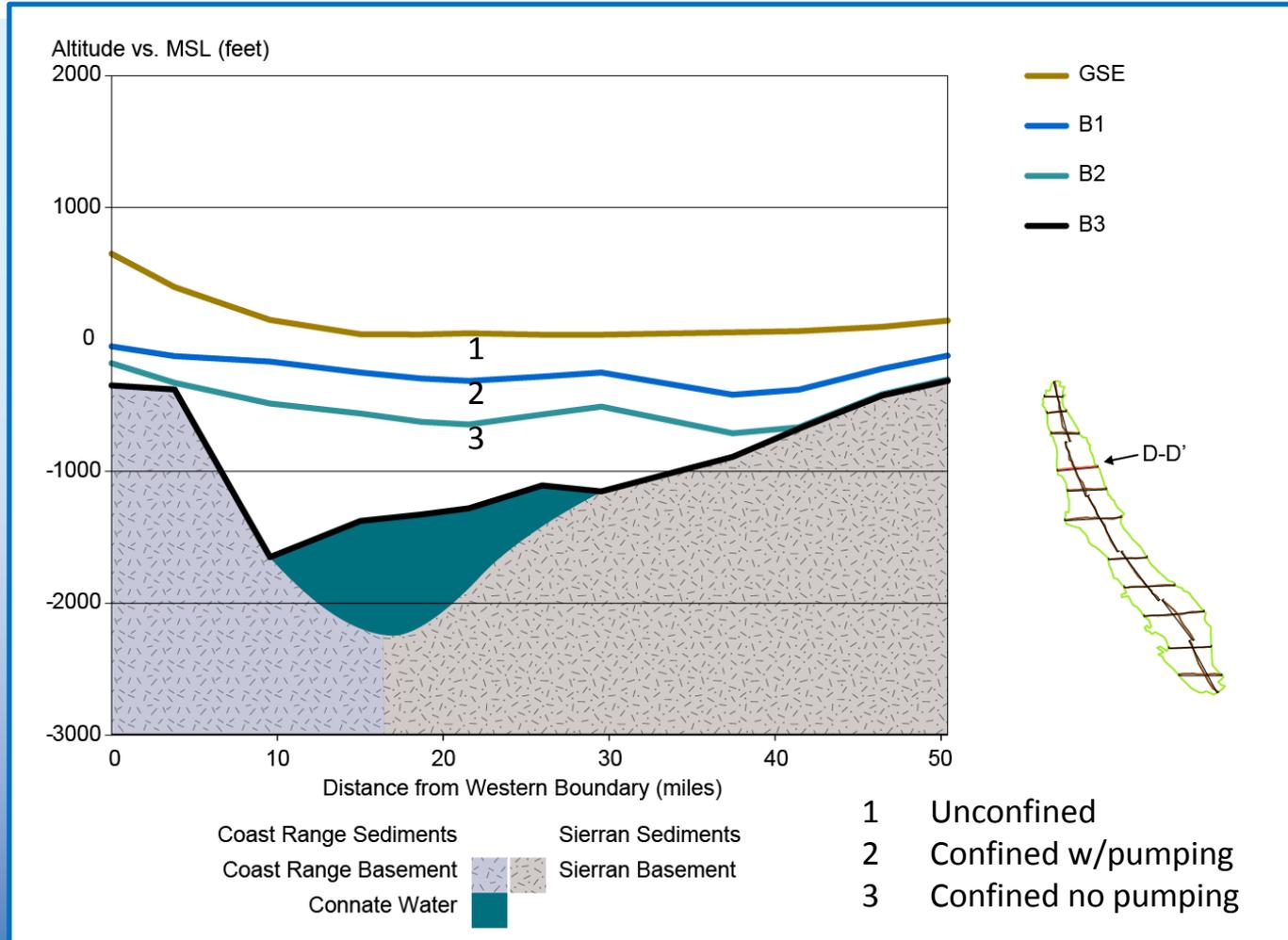
Simulation periods

- 10/1921-9/2009 (88 yrs)
- runs in 3-6 min

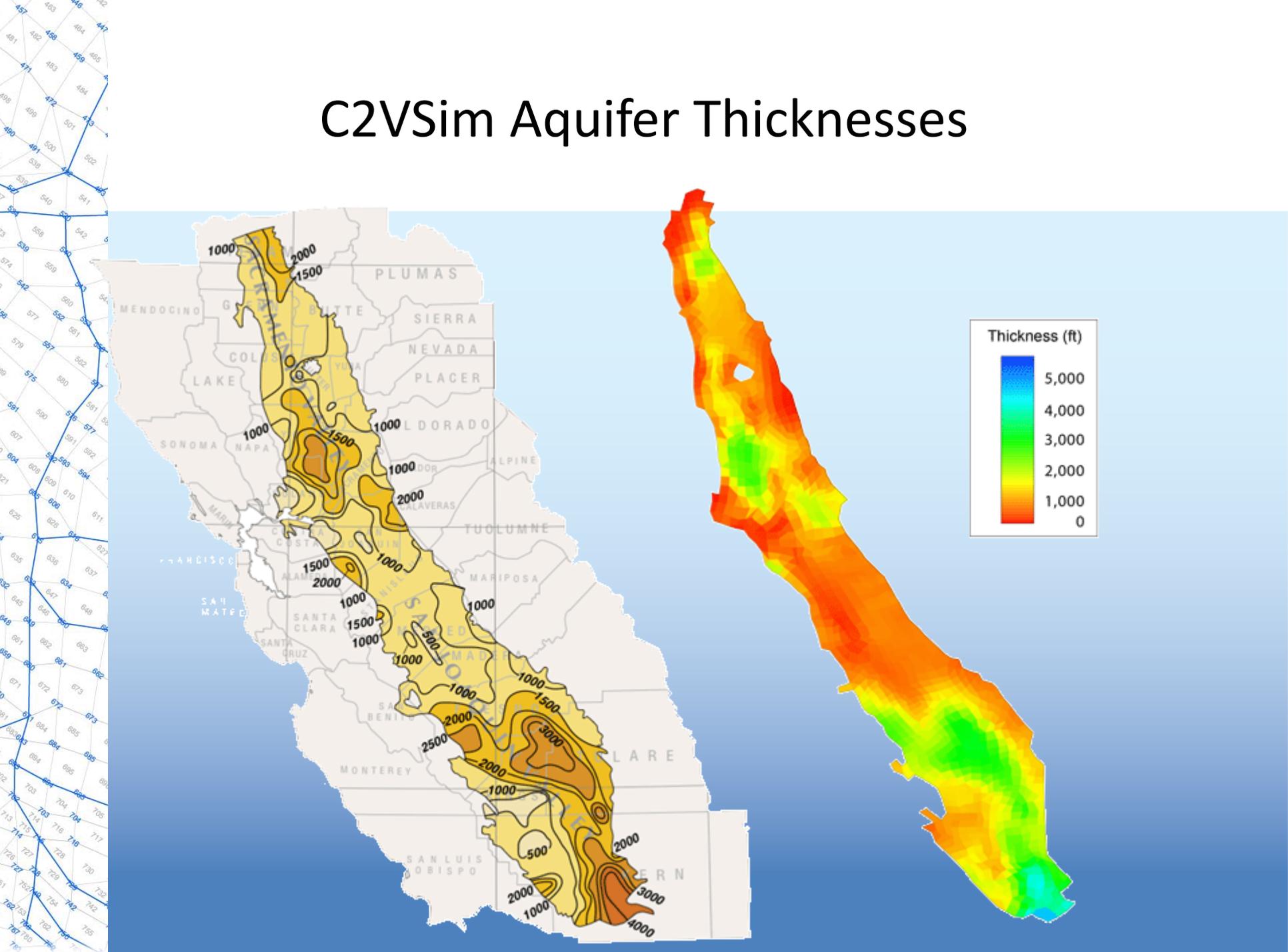
IWFM version 3.02



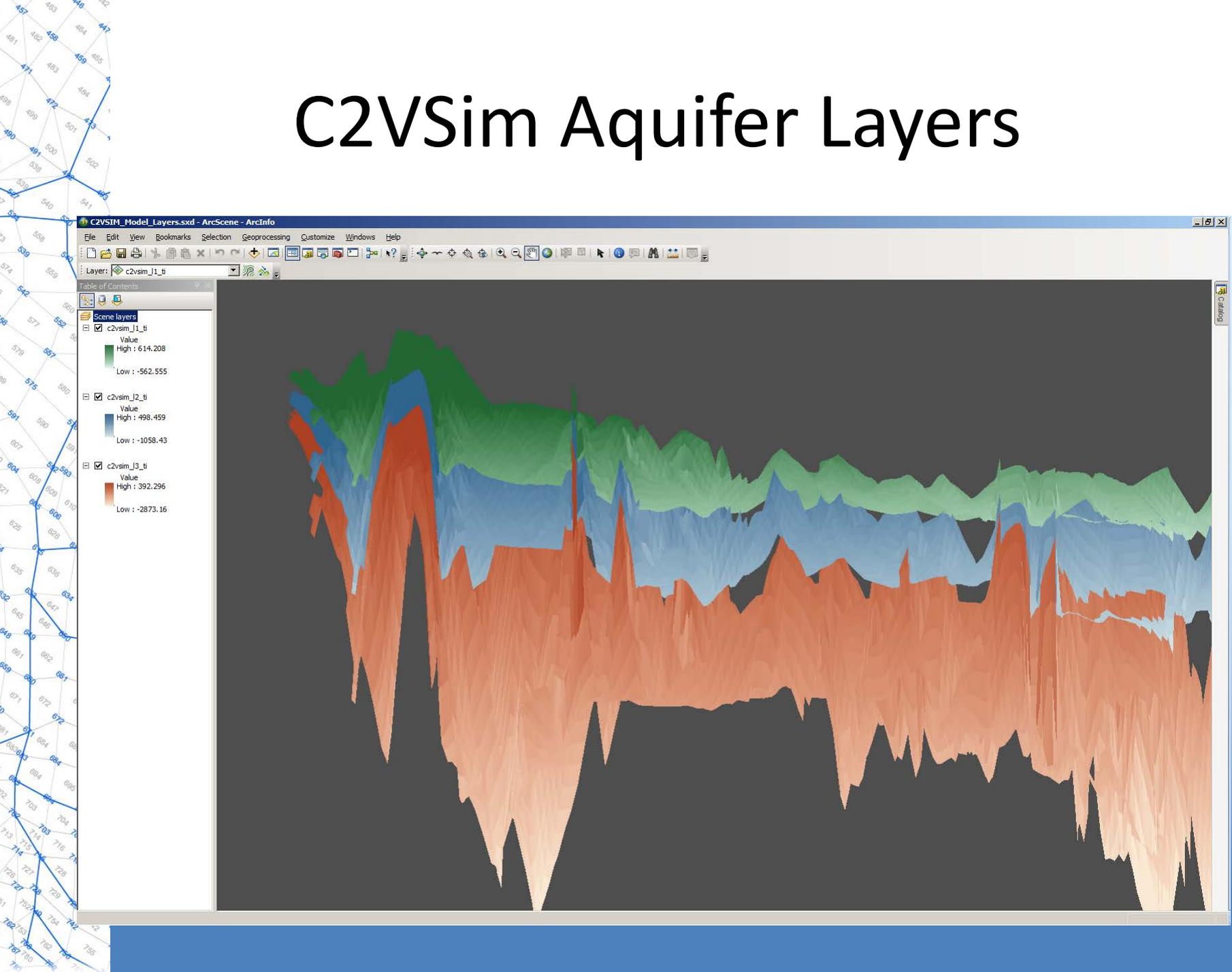
C2VSim Aquifer Layers



C2VSim Aquifer Thicknesses



C2VSim Aquifer Layers



Base of Fresh Groundwater in the Sacramento Valley, California

California Department of Water Resources Report name/#

Steven Springhorn, Nick Hightower, and Tad Bedegrew
October, 2012



Abstract

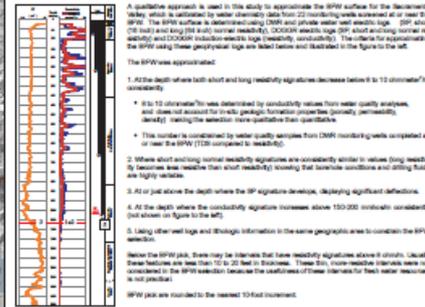
A base of fresh groundwater (BFG) contour map was created to identify the approximate lower limit and the thickness of the fresh water aquifer system in the Sacramento Valley. The BFG map is useful for groundwater resource and storage analysis, groundwater modeling, and delineating structural geologic features in the Sacramento Valley.

Two BFG maps covering the Sacramento Valley were previously created by the USGS in 1981 (Cronsted and Clark) and 1973 (Berntsen). The BFG map in this study relies on a substantial amount of new subsurface geophysical and water quality data that has been collected since the earlier BFG maps.

Fresh groundwater is defined in this study as water containing less than 1,000 mg/L total dissolved solids (TDS) (approximately 1,500 µmhos conductivity), instead of 2,000 mg/L TDS used in the earlier studies. The BFG is estimated based on a comparison analysis of geophysical logs and geologic data from 2,736 geophysical logs from groundwater resource wells and collection of US, state, and California Resources (CORGAR) well records. The BFG elevation criteria were established using water chemistry data and constrained by comparing multiple well logs and geologic information in the same geographic area.

The BFG boundary occurs primarily in late Tertiary to Quaternary unconsolidated sediments at depths near and surface to more than 3,000 feet below ground surface. The BFG is an unwell boundary that in some places reflects the major geologic structures underlying the Sacramento Valley and in other areas, intragrade underlying geologic structures. In some areas, the BFG boundary is well below the base of post-orogenic mafic rocks. This is most likely caused by high stream pressures and spatial vertical gradients in deep aquifers in the Sacramento Valley, which have been documented in Department of Water Resources (DWR) monitoring wells. This suggests that migration of poor quality water into continental sediments that previously contained freshwater has occurred over geologic time. This finding has implications for brackish and saline water appearing beneath areas of prolonged groundwater pumping in the Sacramento Valley.

Criteria for Approximating Base of Fresh Groundwater



- A qualitative approach is used in this study to approximate the BFG surface for the Sacramento Valley which is supported by water chemistry data from 22 monitoring wells collected at or near the BFG. The BFG surface is determined using DWR and private water well electric logs (EP) about 100 feet and using EPs with resistivity, induction, and sonic logs (RIS) about an additional 100 feet in depth and CORGAR induction electric logs (resistivity, induction). The criteria for approximating the BFG using these geophysical logs are listed below and illustrated in the figure to the left.
- The BFG was approximated:
1. At the depth where both short and long resistivity signatures decrease below 6 to 10 chorameters/in consistency.
 - 6 to 10 chorameters/in was determined by resistivity values from water quality analysis, and does not account for multi-grain formation processes (primarily, primary, secondary, tertiary, and diagenetic) which can cause resistivity data to be unreliable.
 - This number is constrained by water quality samples from DWR monitoring wells collected at or near the BFG (TDS compared to resistivity).
 2. Where short and long resistivity signatures are consistently similar in value (resistivity induction logs measure true resistivity) indicating that formation conditions and drilling fluids are highly variable.
 3. At or just above the depth where the EP signatures deviate, displaying significant deflections.
 4. At the depth where the conductivity signatures increase above 150-200 mhos/cm consistently and above in figure to the left.
 5. Using other well logs and geologic information in the same geographic area to constrain the BFG selection.
- Below the BFG pick, there may be intervals that have resistivity signatures above 6 chorams. Ideally these features are less than 10 feet in thickness. These logs were reviewed but were not included in the BFG selection because the thickness of these intervals for fresh water resource is not predicted.
- BFG picks are rounded to the nearest 10-foot interval.

Definition of Fresh Groundwater

Fresh water is defined in this study as water containing less than 1,000 mg/L TDS (approximately 1,500 µmhos conductivity) as defined by French and Chery (1976). This concentration is used instead of 2,000 mg/L TDS used in Berntsen (1973), because the focus of this study is on the composition of the fresh water aquifer in the Sacramento Valley and groundwater exceeding 1,000 mg/L TDS is generally considered unsuitable for drinking water and irrigation water. Other measurements of TDS or conductivity in water collected at or near the BFG in this project are from 110 wells in the study area.

Category	Total Dissolved Solids (mg/L)
Fresh water	0 - 1,000
Brackish water	1,000 - 10,000
Saline water	10,000 - 100,000
Sea water	>100,000

Data Sources

The BFG was determined based on 2,736 geophysical logs and water chemistry data from 110 monitoring wells collected near the BFG or in areas of brackish water near and surface. Subsurface geophysical logs were obtained from the following sources:

- 68 groundwater resource geophysical logs
- 2,668 California Division of Oil and Gas well logs

Resistivity Geophysics

The primary data used to approximate the BFG are electric logs from DWR monitoring wells or private water wells, and electric and induction electric logs of wells drilled for natural gas obtained from CORGAR. Because of the small volume of the study and the variability of the subsurface geology, the geophysical logs were interpreted by inspection, and no attempt was made to calculate the bulk formation resistivity or compute the sodium-chloride content.

Stratigraphic Information

It is important to have stratigraphic data to compare to the resistivity geophysics when evaluating BFG. Because the stratigraphic correlation is independent of the interpretation, in some cases very low resistivity signatures can be produced by low permeability coarse sand, silt, and clay, which are where most of the water is found (brackish) and would contribute little to the water content of a well. Thin logs permeability zones sand and gravel with very low resistivity signatures and a developed SP signature can be interpreted as containing brackish to saline water. Lithologic information also provides insights on the depositional environment in which each subsurface formation was deposited, which helps to determine if the unit was formed in a marine (propensity to contain saline or carbonate water) or continental setting (propensity to contain freshwater).

Water Chemistry Data

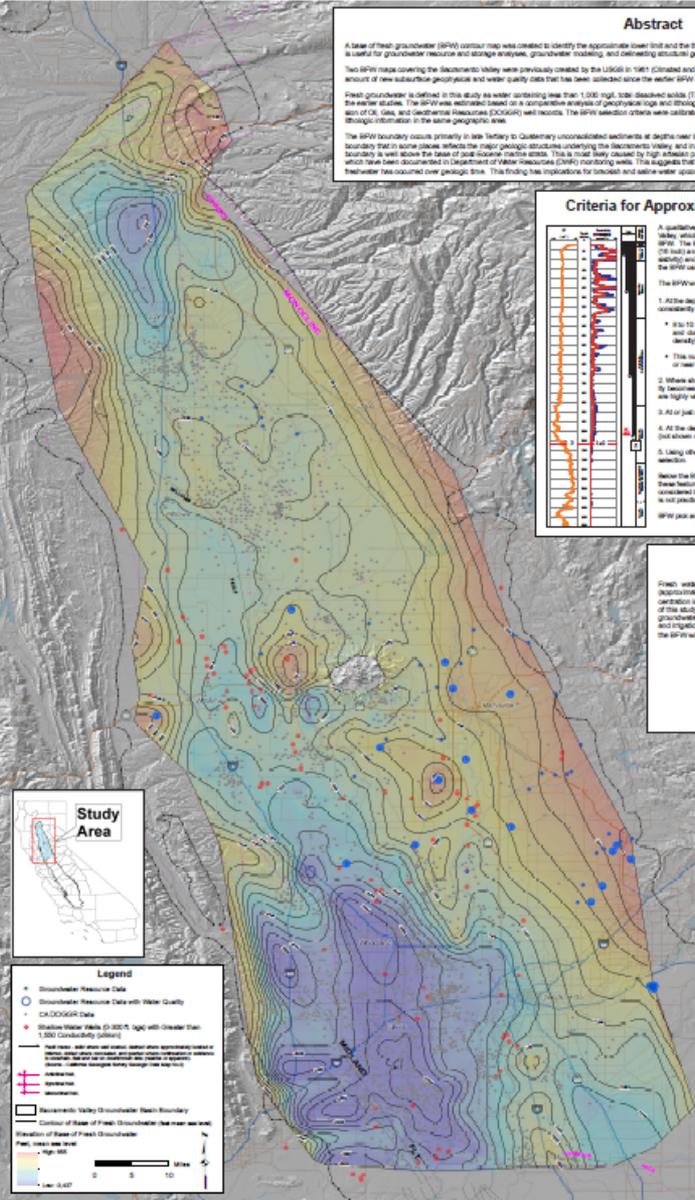
The BFG boundary was defined by comparing the resistivity geophysics with water chemistry results from 22 water wells adjacent near the BFG and 50 water wells within the brackish water system (1,000 mg/L TDS). Water chemistry results provide an independent check on the BFG criteria used in this study.

References

Bedegrew, T.A., 1973. Base of Fresh Groundwater, approximately 1,000 micromhos/cm, in the Sacramento Valley and Surroundings. San Joaquin Valley, California. U.S. Geological Survey Water Resources Investigations Report 73-10.

French, R. A. and Chery, J. A., 1976. Groundwater, Freshwater, Inc., Redwood City, CA.

Cronsted, P.H., and Clark, S.H., 1981. Geologic features and ground water storage capacity of the Sacramento Valley, California. U.S. Geological Survey Water Supply Paper 1487, 341 p.



Legend

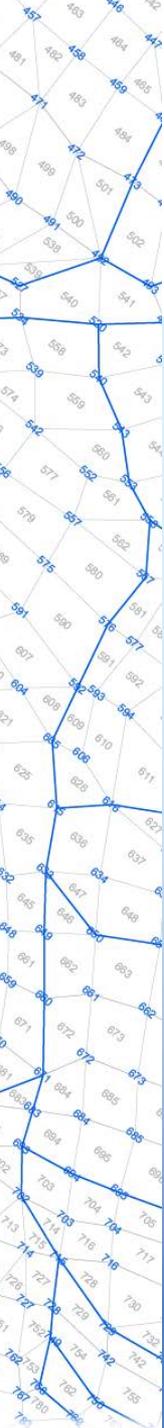
- Groundwater Resource Data
- Groundwater Resource Data with Water Quality
- CORGAR Data
- Shallow Water Wells (0-200 ft logs) with Conductivity less than 1,500 Conductivity (µmhos)
- Salt water, and show water-saturated sedimentary rocks in the Sacramento Valley and surrounding areas. (Color indicates average temperature in degrees Celsius)
- Sacramento Valley Groundwater Basin Boundary
- Contour of Base of Fresh Groundwater (the lower and wetter)
- Elevation of Base of Fresh Groundwater
- Fresh water sea level
- High tide

Scale: 0 5 10 Miles

Faults

- Battle Creek Fault
- **Red Bluff Arch**
- Plainfield Ridge Anticline
- Pittsburgh – Kirby Hills – Vaca Fault
- Vernalis Fault
- Graveley Ford Faults
- Visalia Fault
- Pond-Poso Creek Fault
- Edison Fault
- **White Wolf Fault**





Calibrated Parameters

Aquifer nodes

- Conductivity
- Storage
- Subsidence

River nodes

- Conductance

Unsaturated Zone

- Porosity
- Conductivity

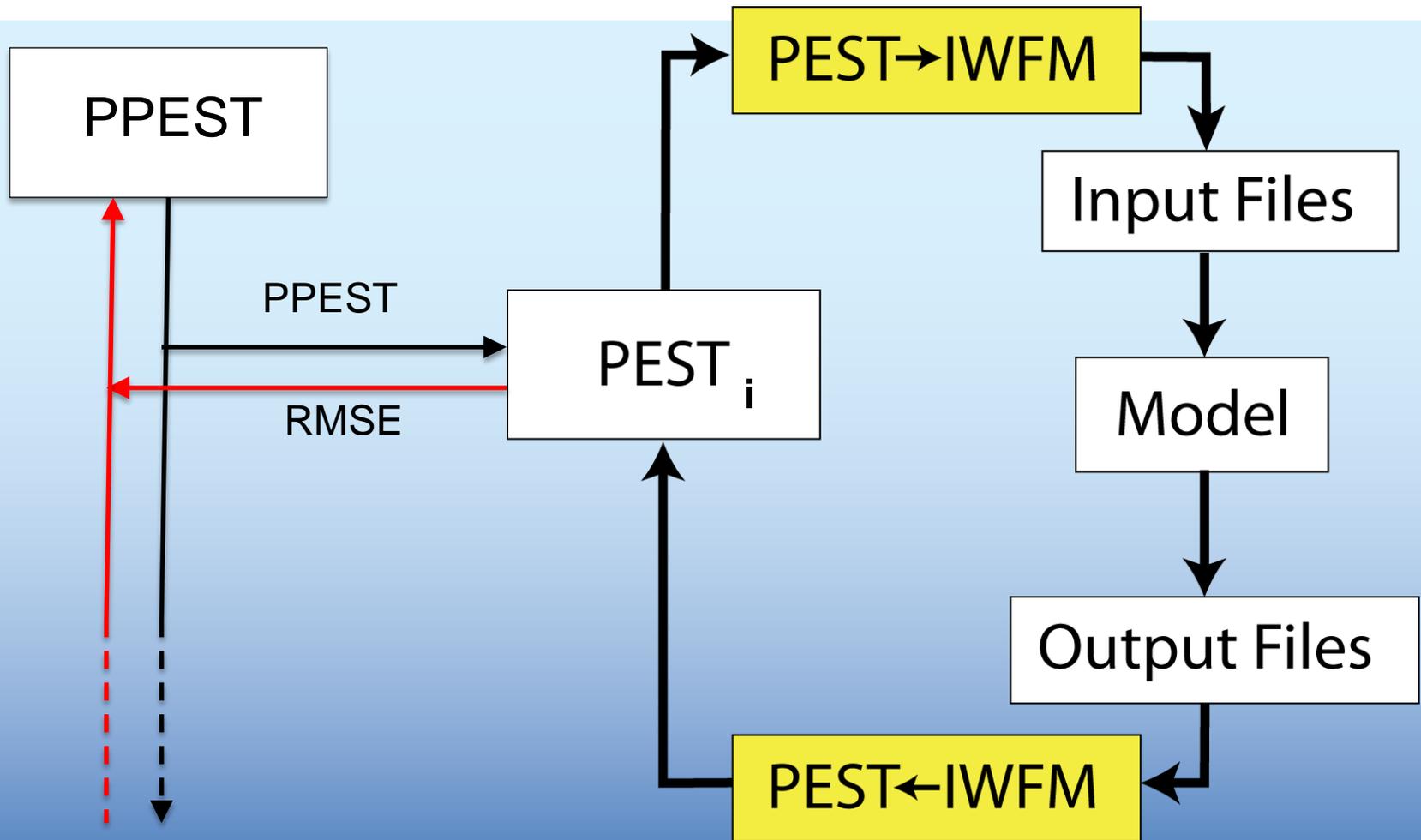
Soil properties

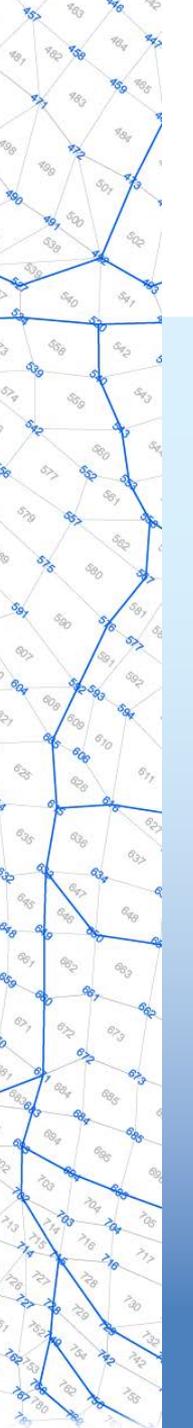
- Field capacity
- Porosity
- Recharge factor
- Curve Numbers

Small Watersheds

- Field capacity
- Porosity
- Conductivity
- Discharge threshold
- Recession coefficients

Calibration with PPEST





IWFM-PEST Tools

- **Translate parameters from pilot points to IWFM**
 - CVoverwrite.dat file
 - FAC2REALI program
- **Convert IWFM hydrographs to SMP format**
 - IWFM2OBS program
- **Calculate vertical head differences to SMP format**
 - IWFM2OBS program
- **Stream-groundwater flows to SMP format**
 - STACDEP2OBS program
- **Log-transform surface water hydrographs**
 - LOG_TRAN_SMP program

C2VSim Calibration

- Calibrate parameter values at each model node and layer
- Using computers at the USDOE National Energy Research Scientific Computing Center (NERSC)
 - Carver
 - IBM iDataPlex
 - 3,200 CPU cores, 34 Tflop/s
- Comparison:

	PPs	Compter	Run Time
R300	137	15 PCs	1 week
R326	394	15 PCs	3 weeks
R346	1393	15 PCs	16 weeks
R346	1393	NERSC	2 weeks



Model Performance

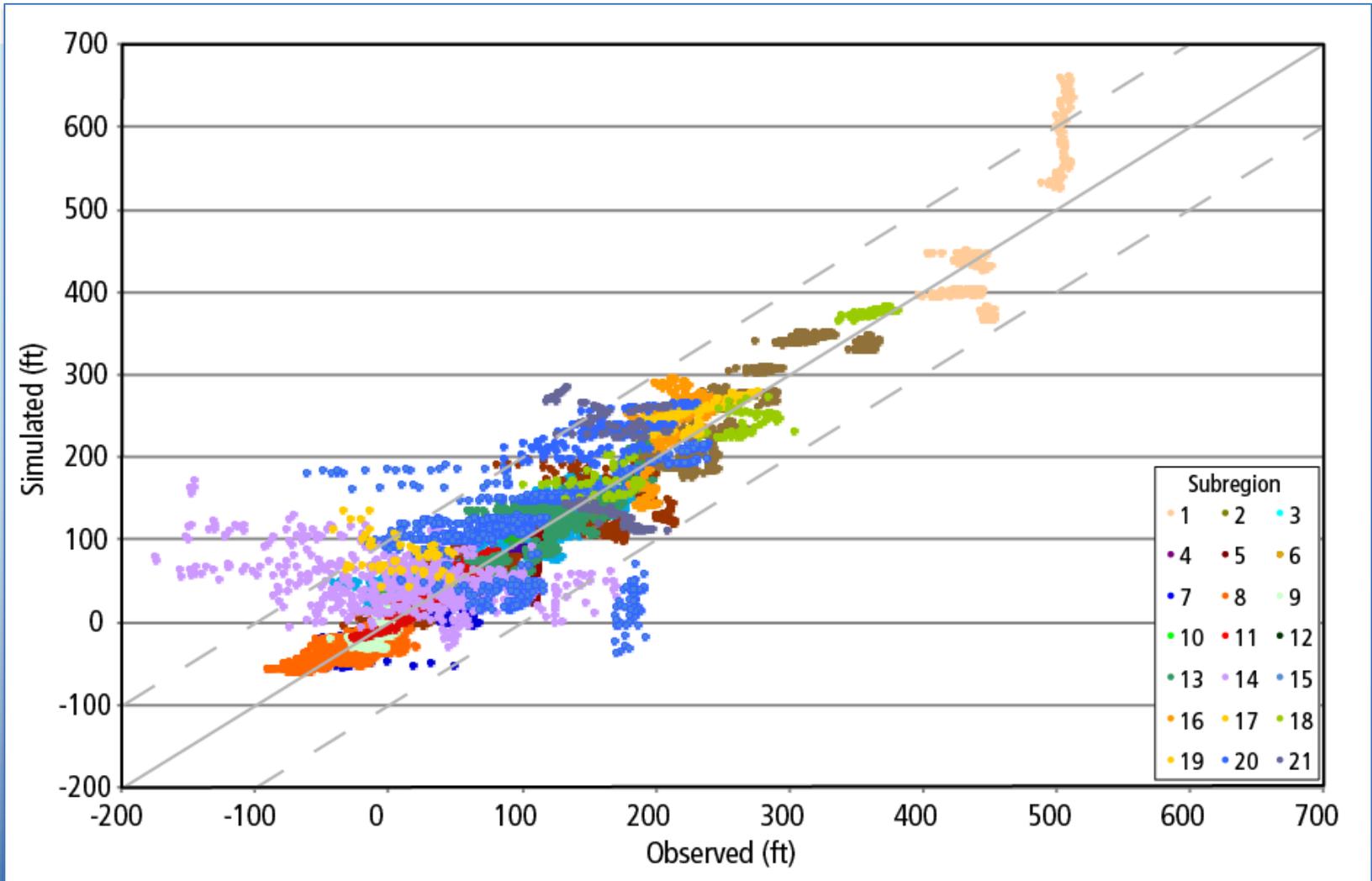
Observation Type	No. Observation Sites	No. Observations	Range
Groundwater heads	1,378	62,981	1,252
Vert. Groundwater Head Difference	163	3,017	698
River Flows	22	5,636	6,561,453
River-Groundwater Flows	33	33	38,117
Subsidence	24	3,700	6.2
TOTAL	1,620	75,367	

Observation Type	Root Mean Squared Error	Residual	<u>RMSE</u> Range	<u>Residual</u> Range
Groundwater heads	65.4	2.14	0.052	0.002
Vert. Groundwater Head Difference	96.2	-13.3	0.138	-0.019
River Flows	145,591	-13,720	0.022	-0.002
River-Groundwater Flows	8,875	3,620	0.233	0.095
Subsidence	17.4	-11.5	2.81	-1.86

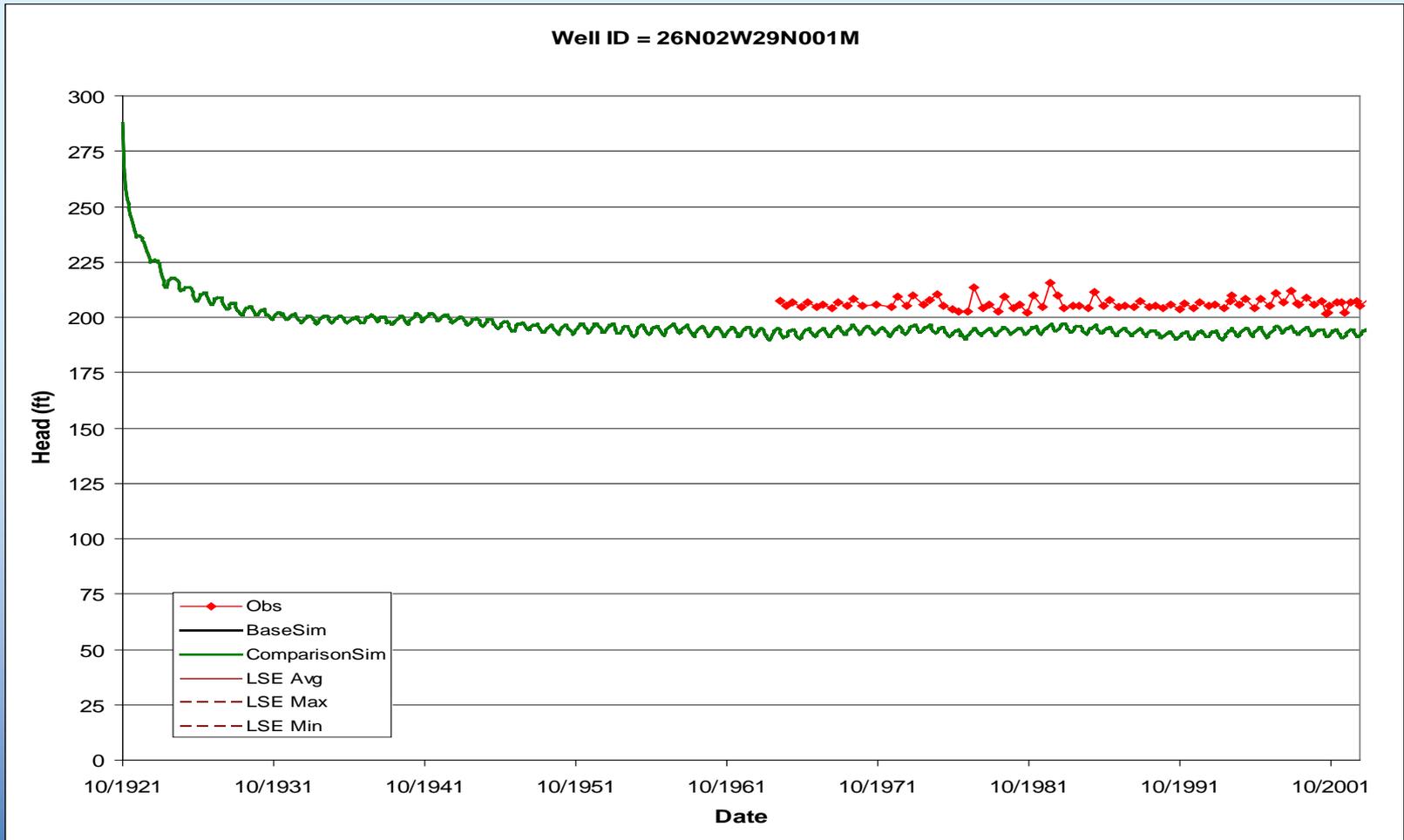
Units: Heads and subsidence in feet, flows in acre-feet

Head and flow observations from October 1975 to September 2003, Subsidence observations from September 1957 to May 2004

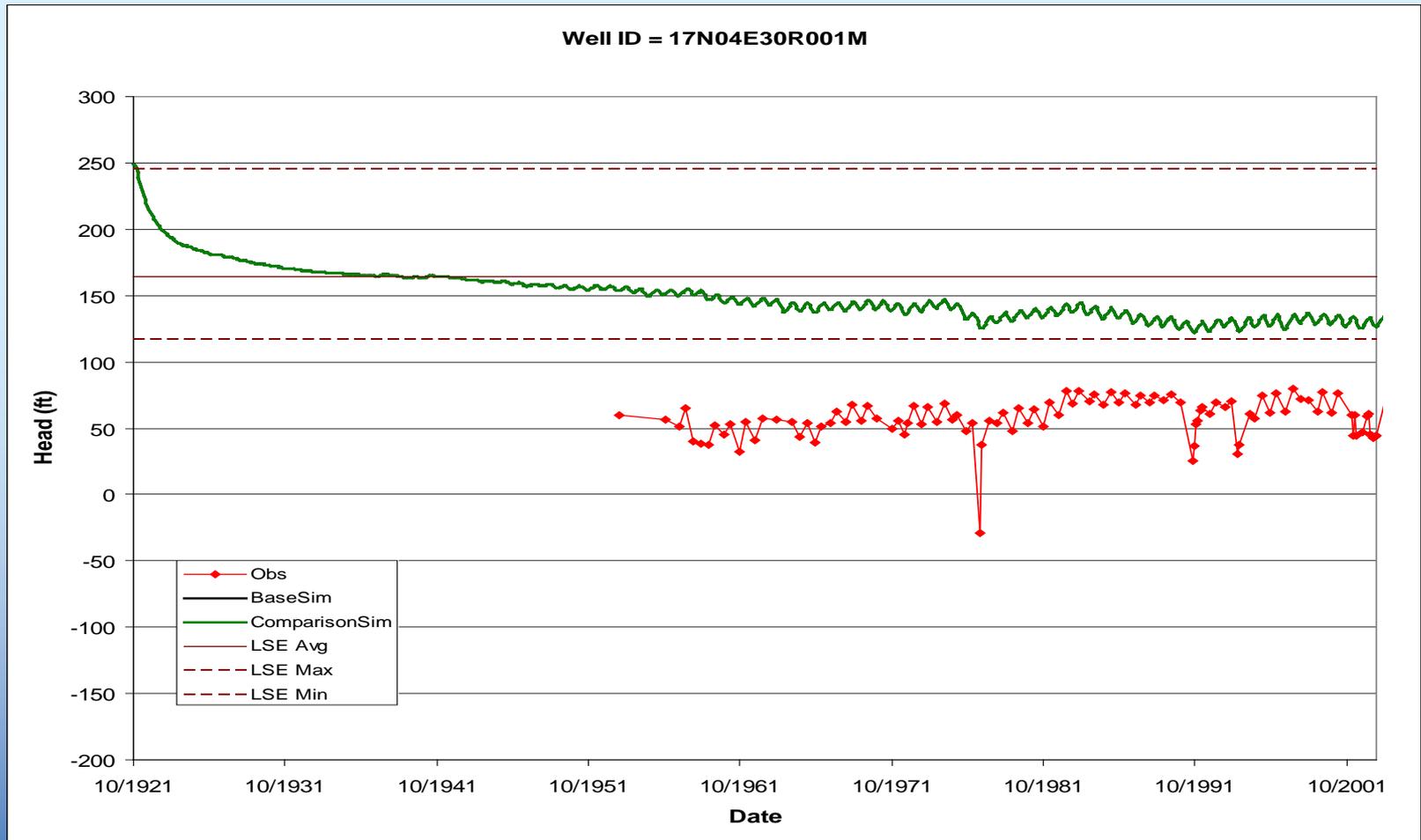
Groundwater Heads



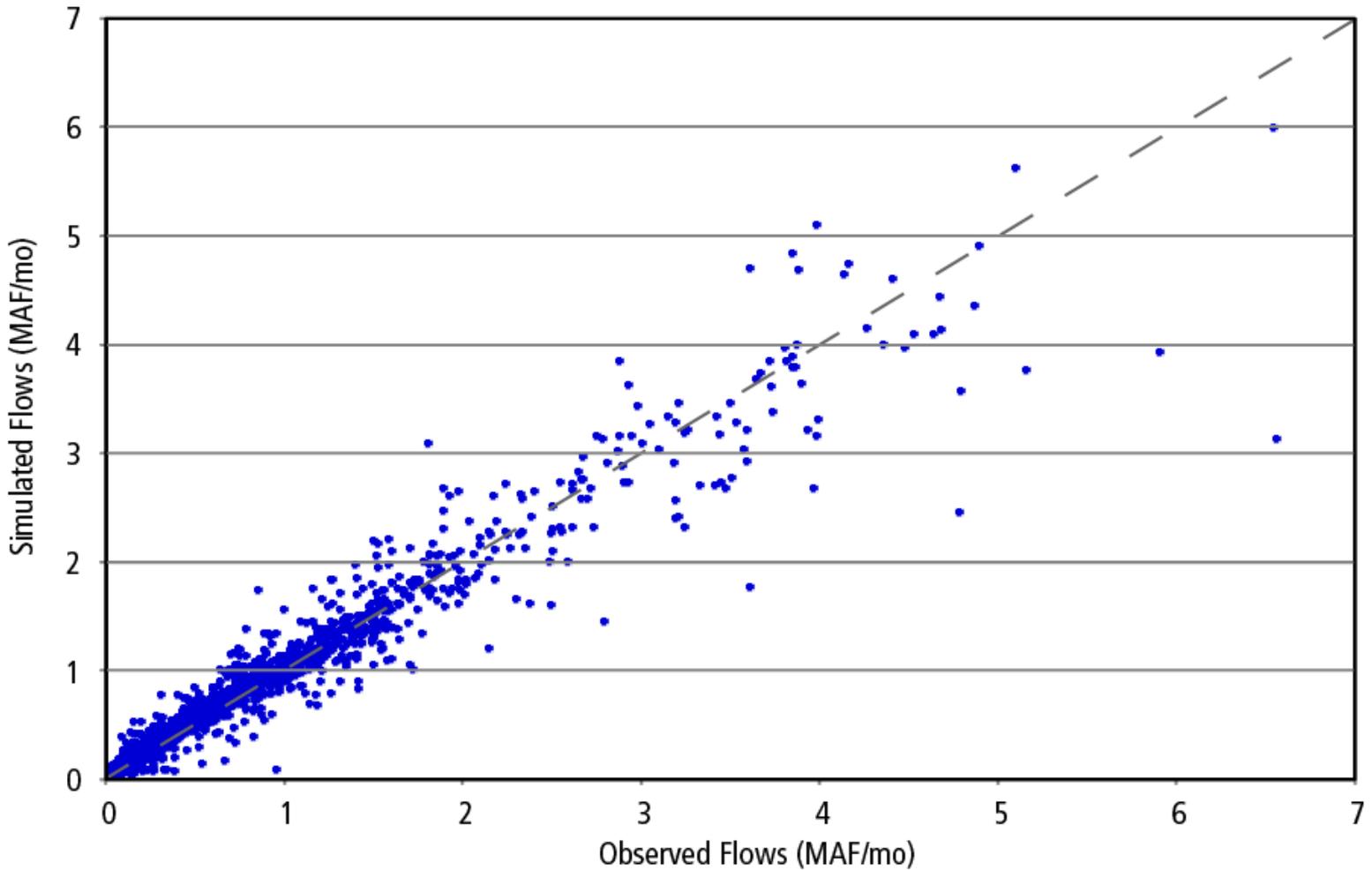
Groundwater Hydrographs



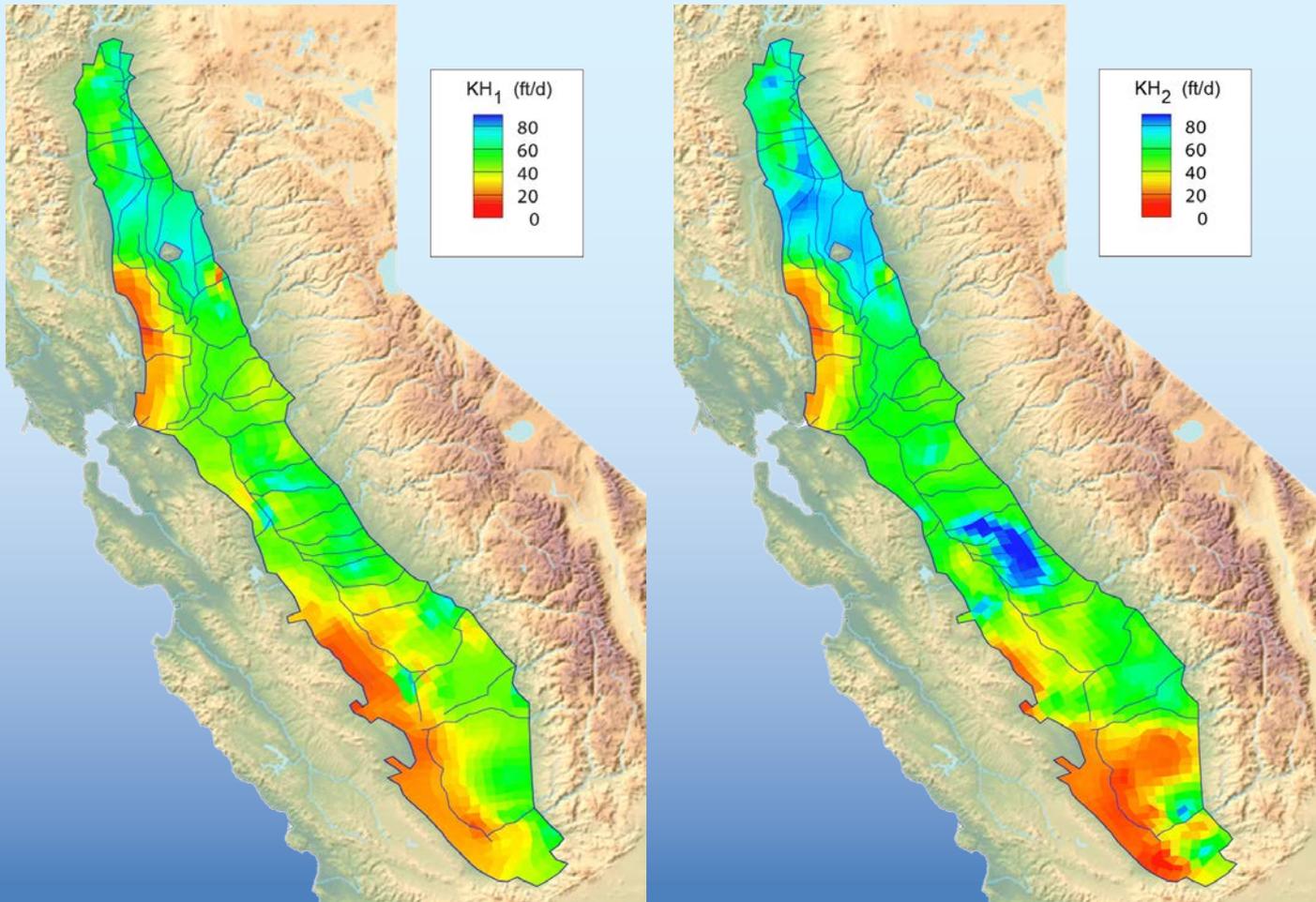
Groundwater Hydrographs



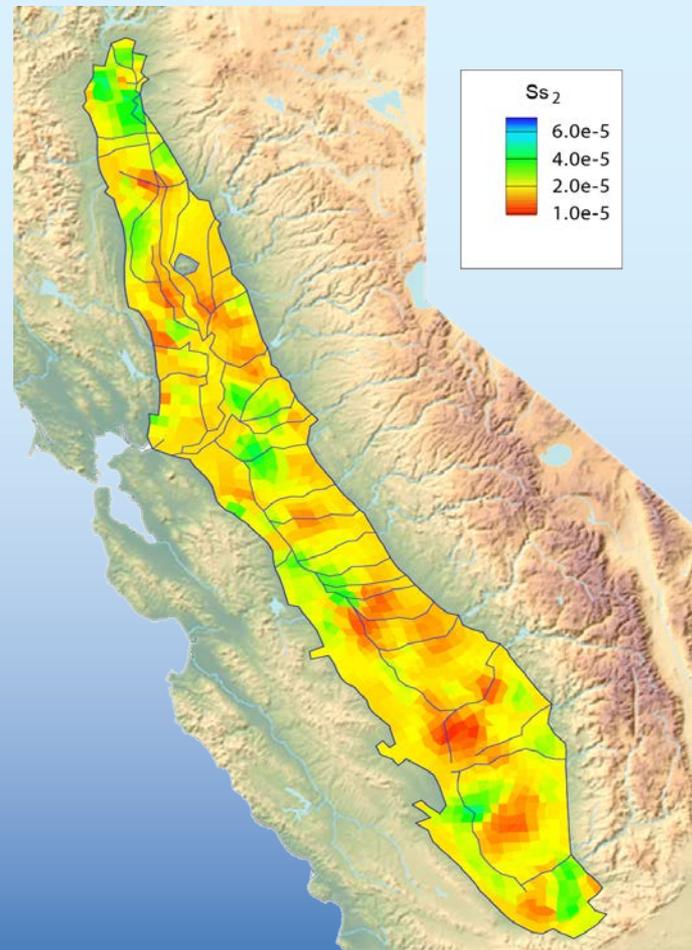
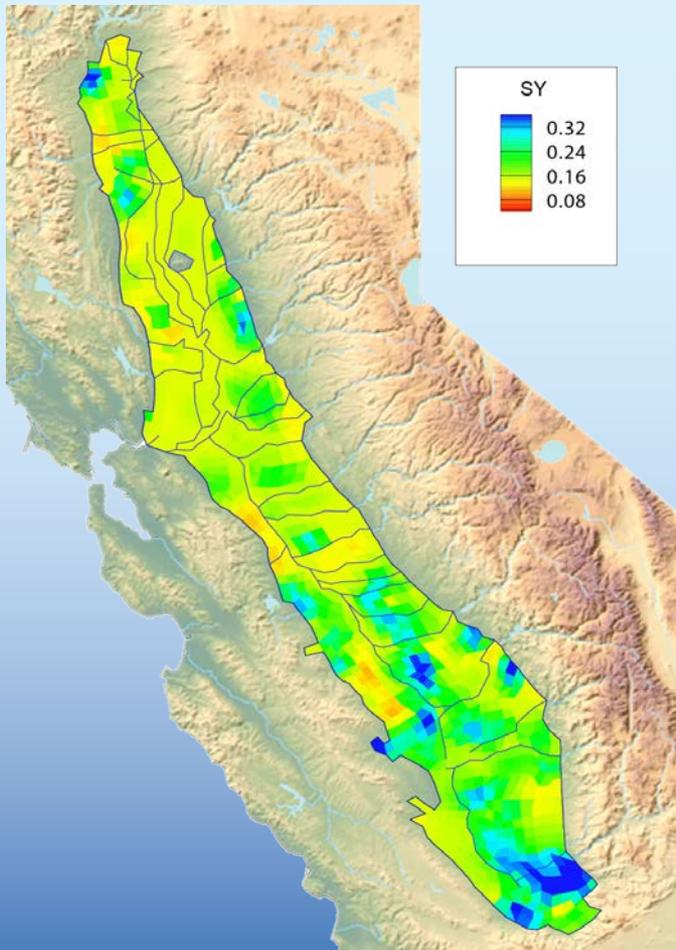
Surface Water Flows



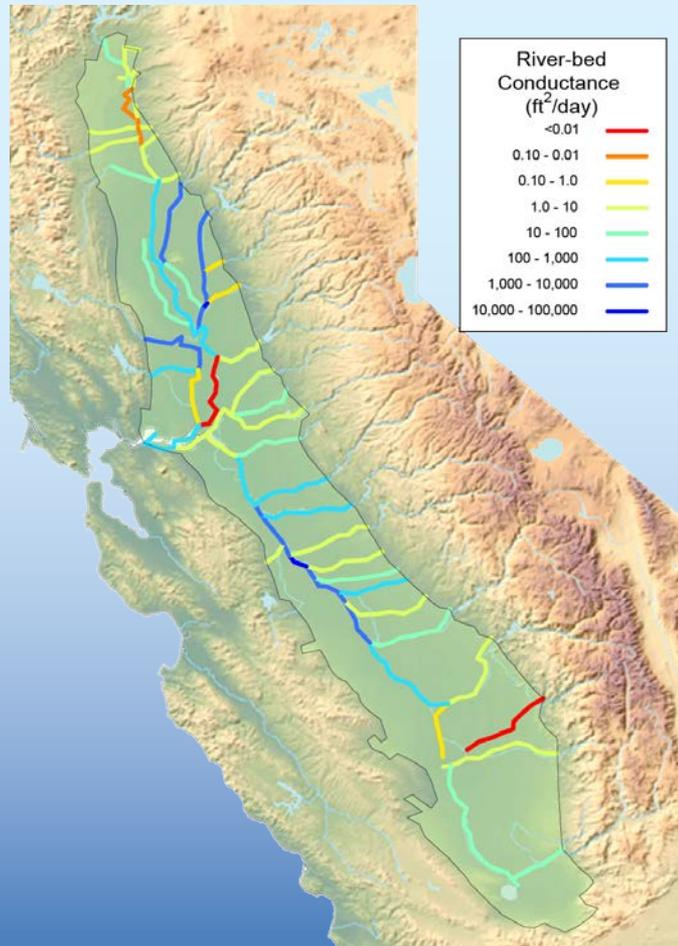
Hydraulic Conductivity



Storage Parameters

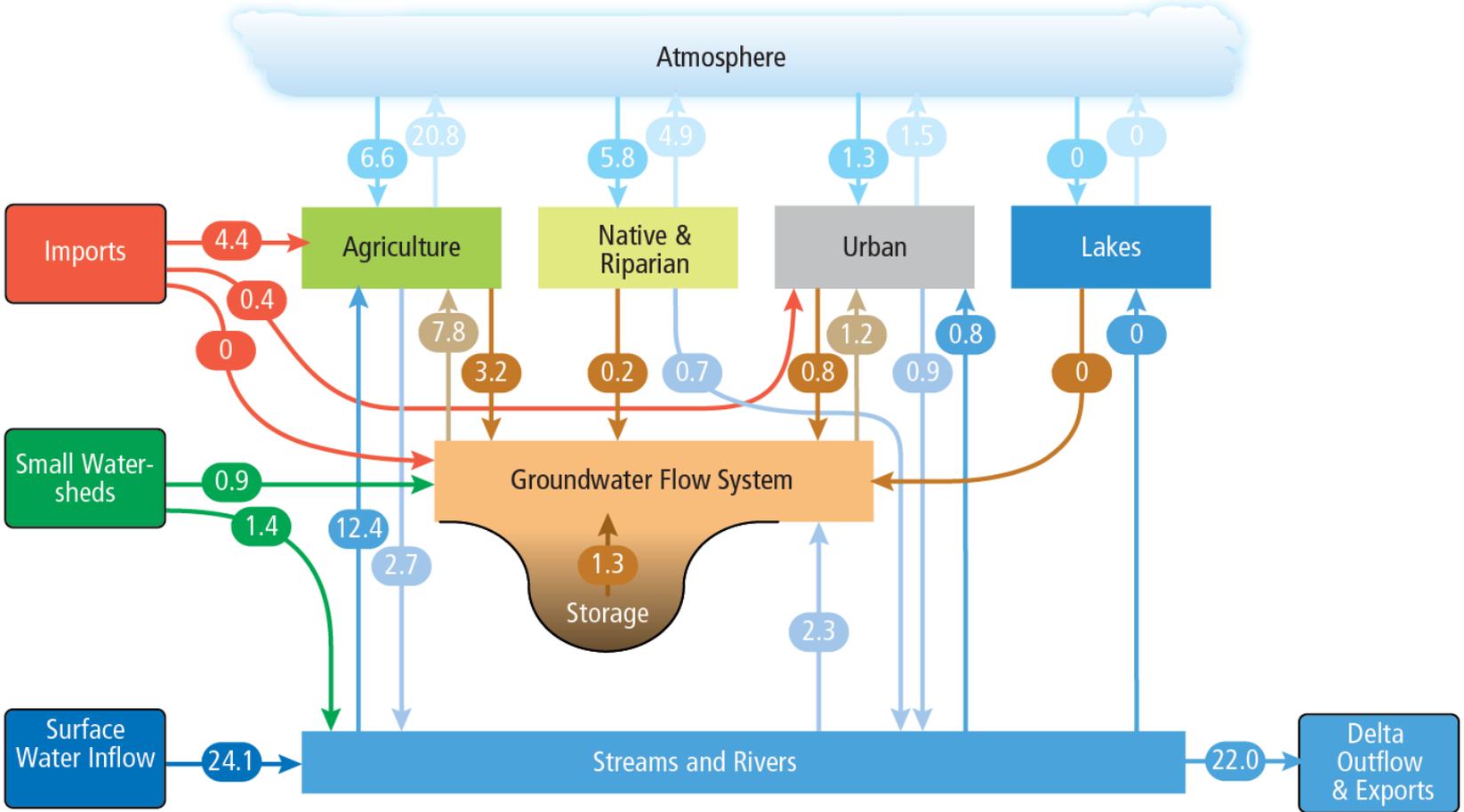


River-Bed Conductance

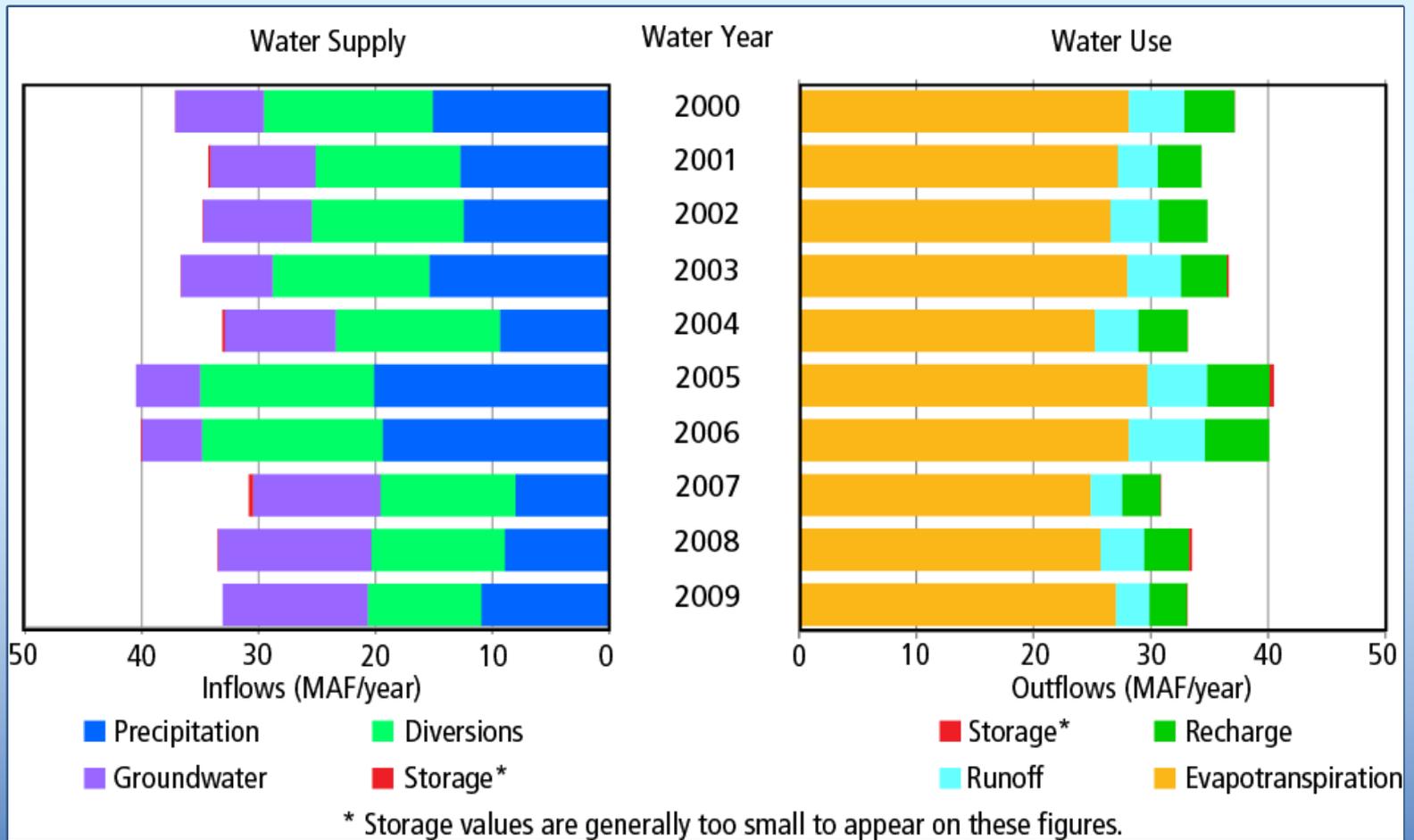


Simulated Annual Water Budget

Average Flows for water years 2000-2009
[Million Acre-Feet/Year]

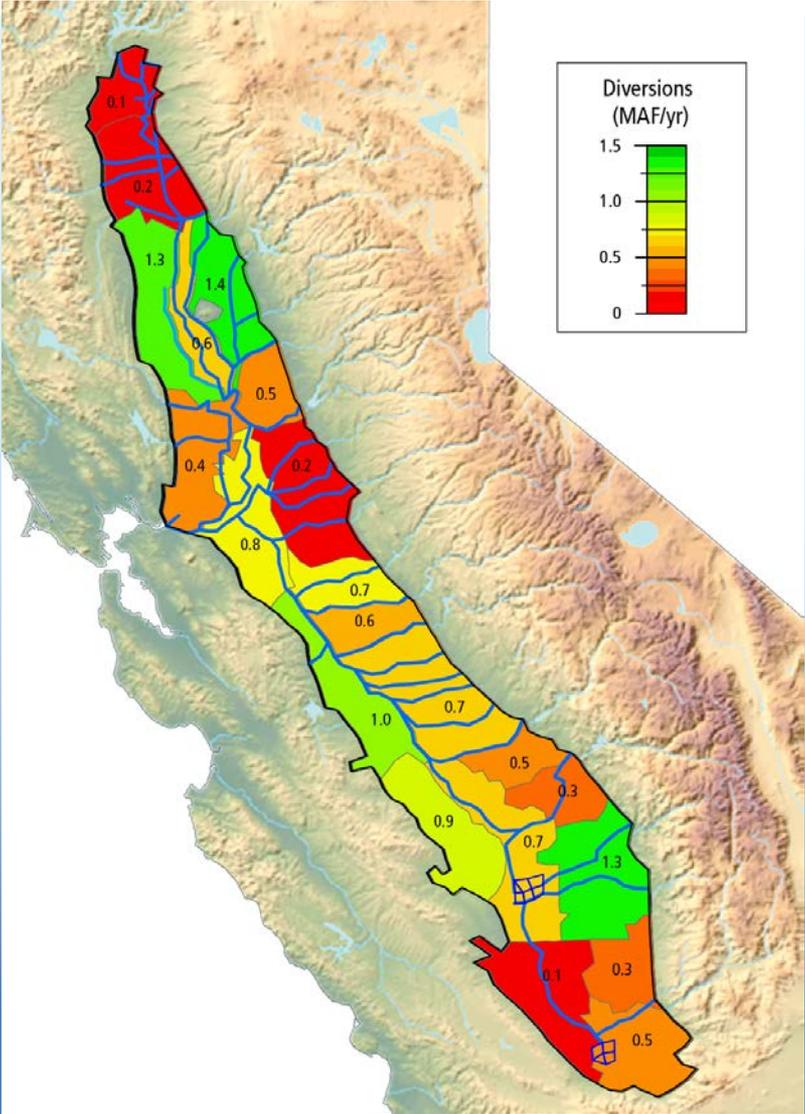


Land-Surface Water Balance



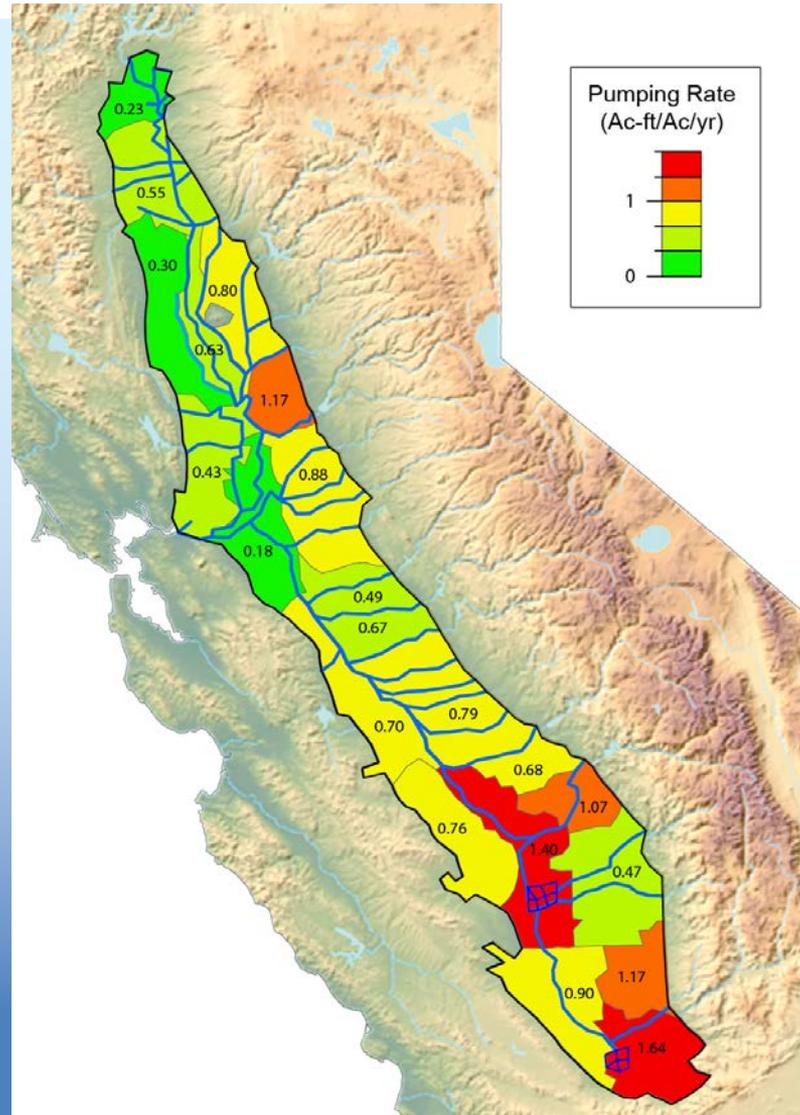
Surface Water Deliveries

2000-2009

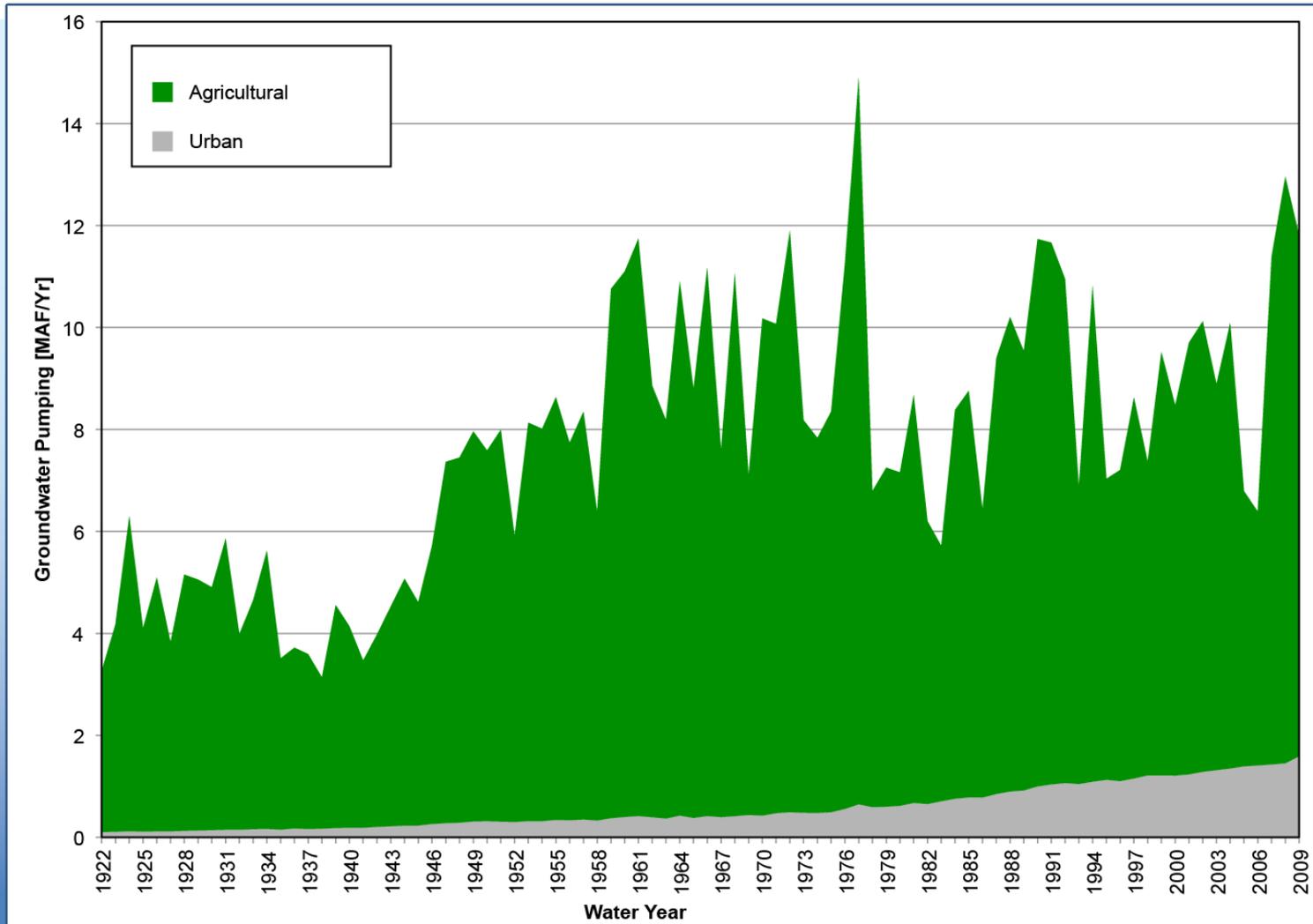


Groundwater Pumping

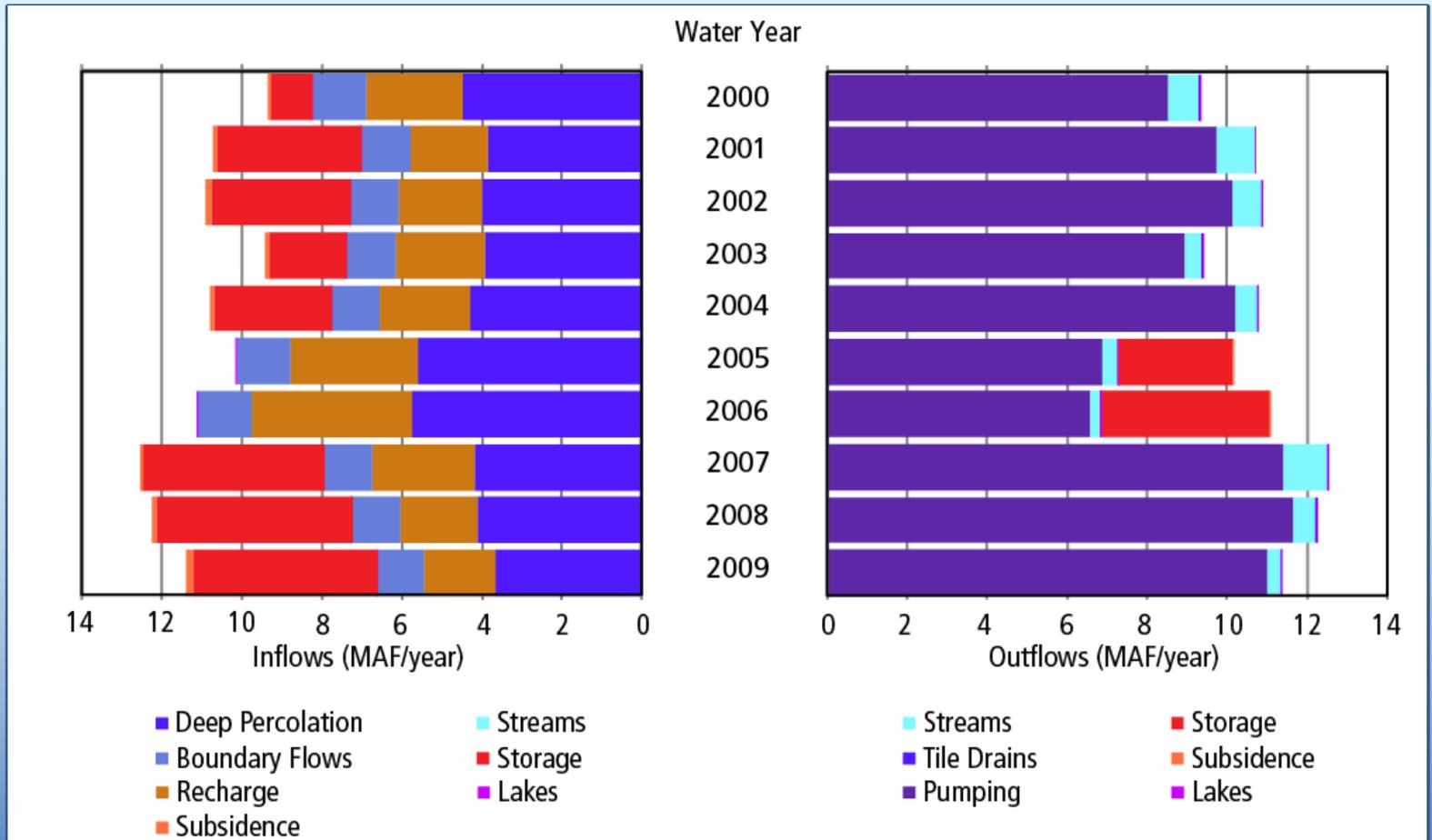
2000-2009



Groundwater Pumping

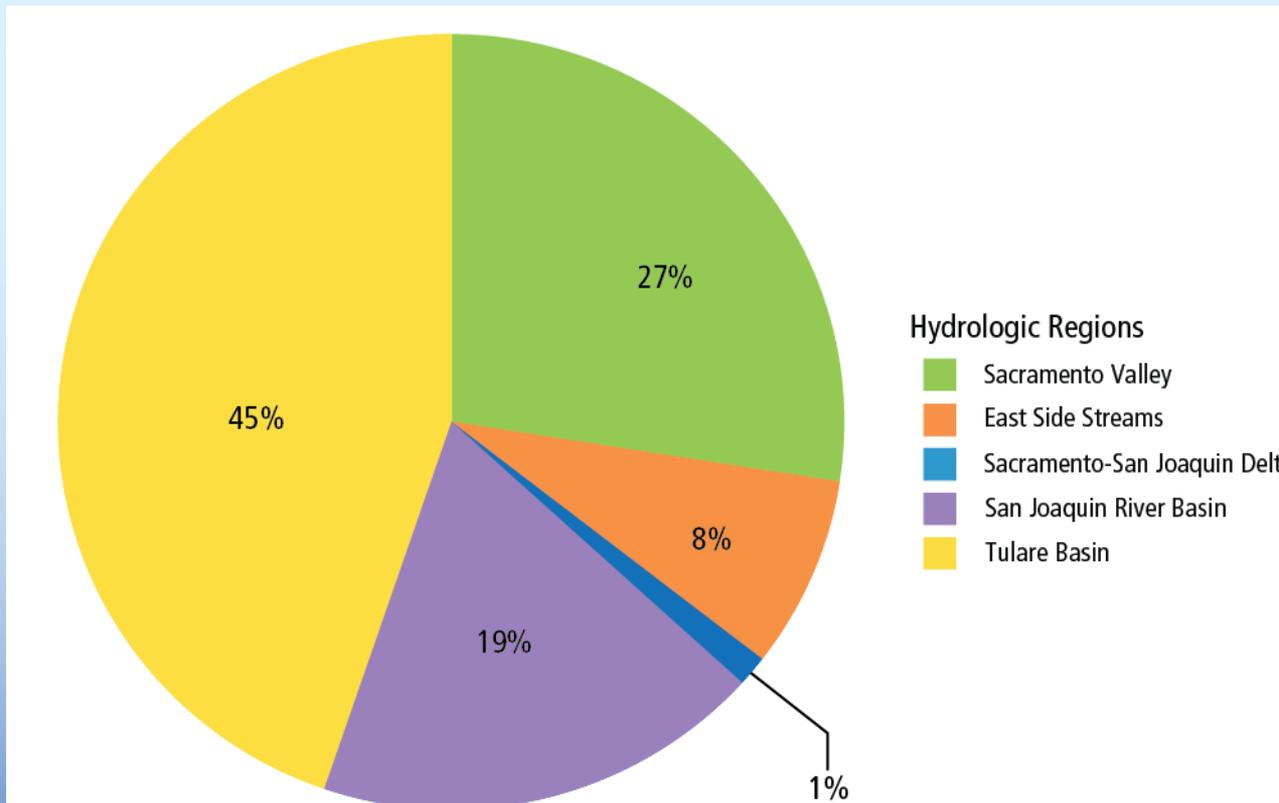


Aquifer Water Balance

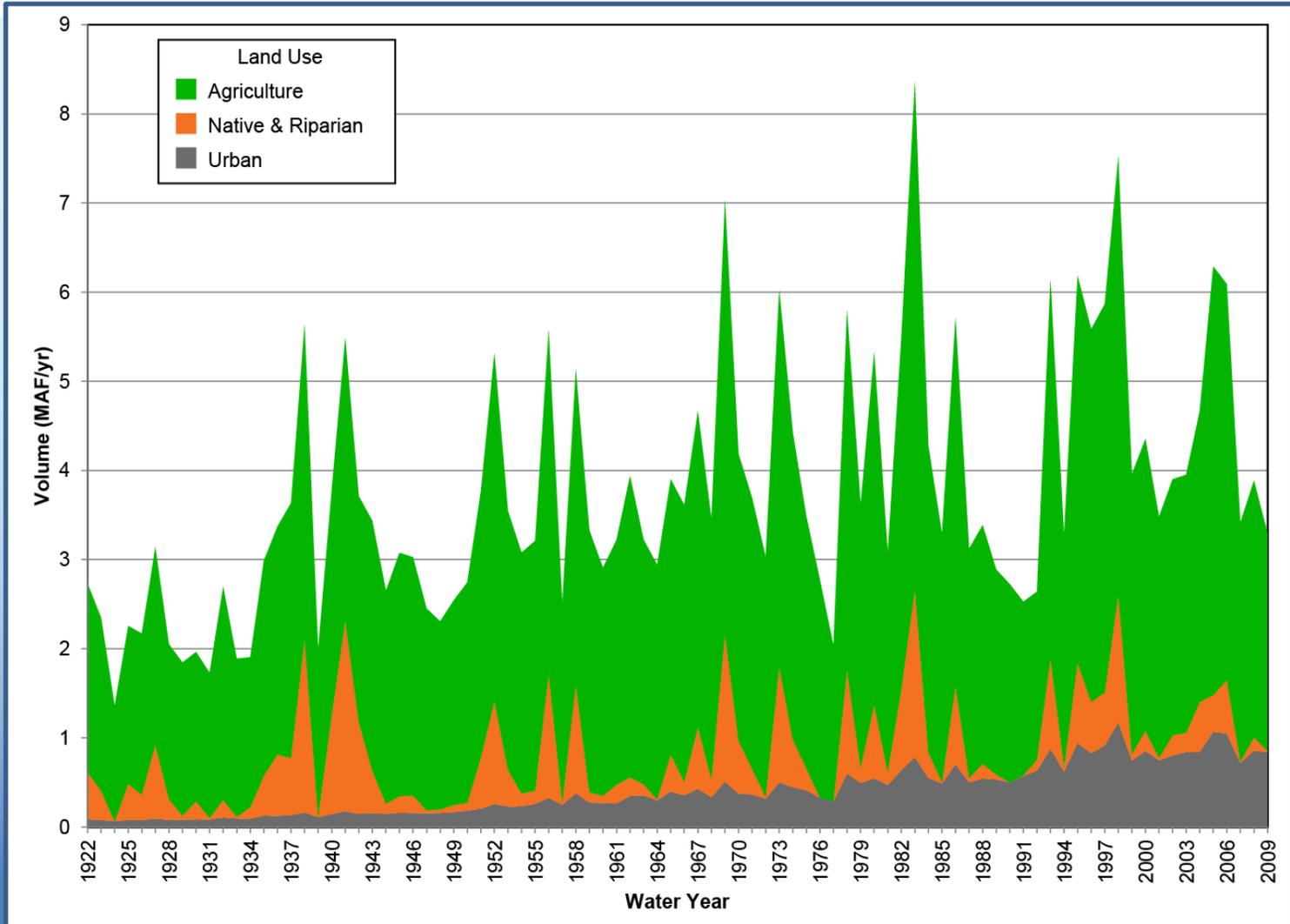


Groundwater Pumping

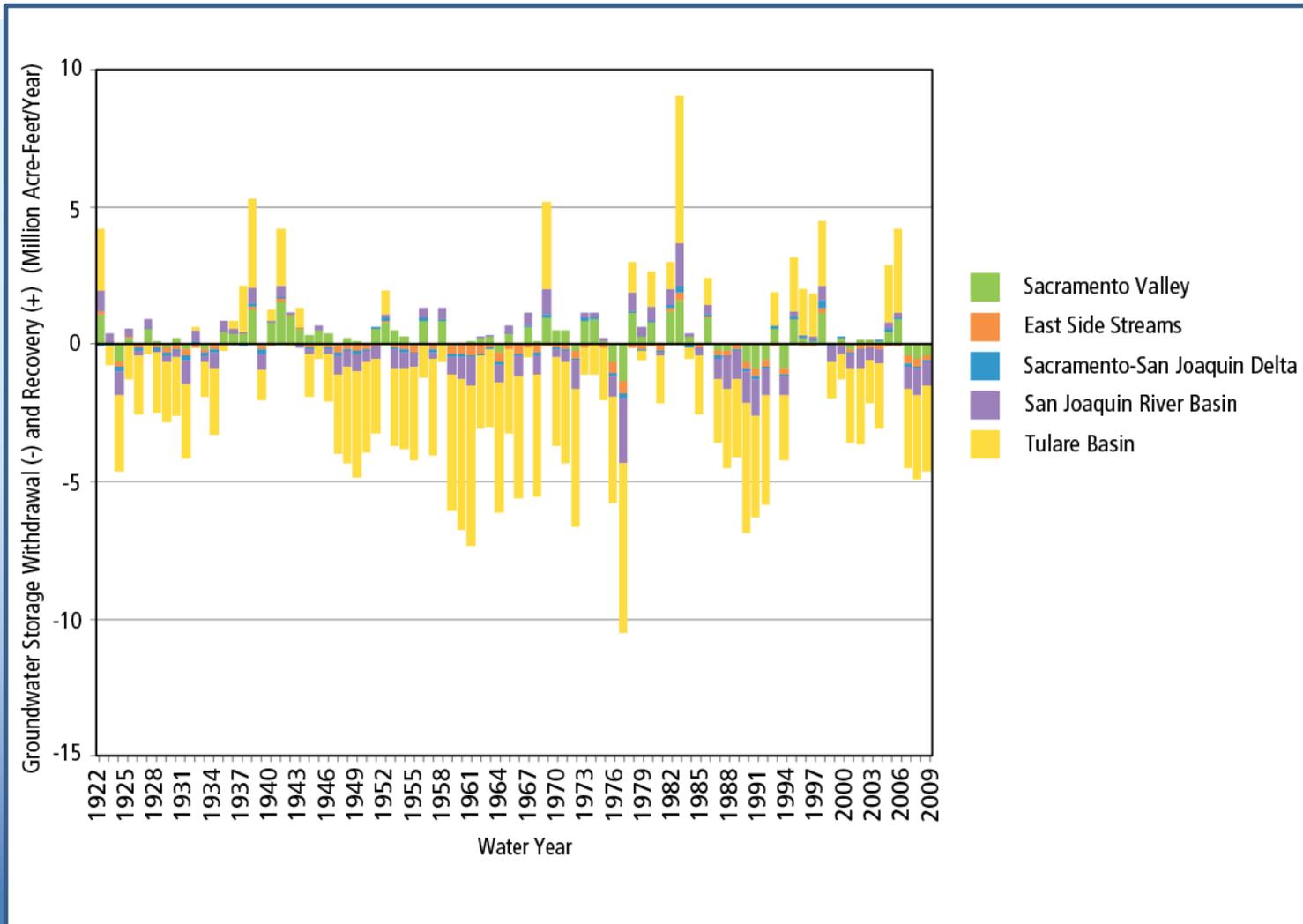
2000-2009



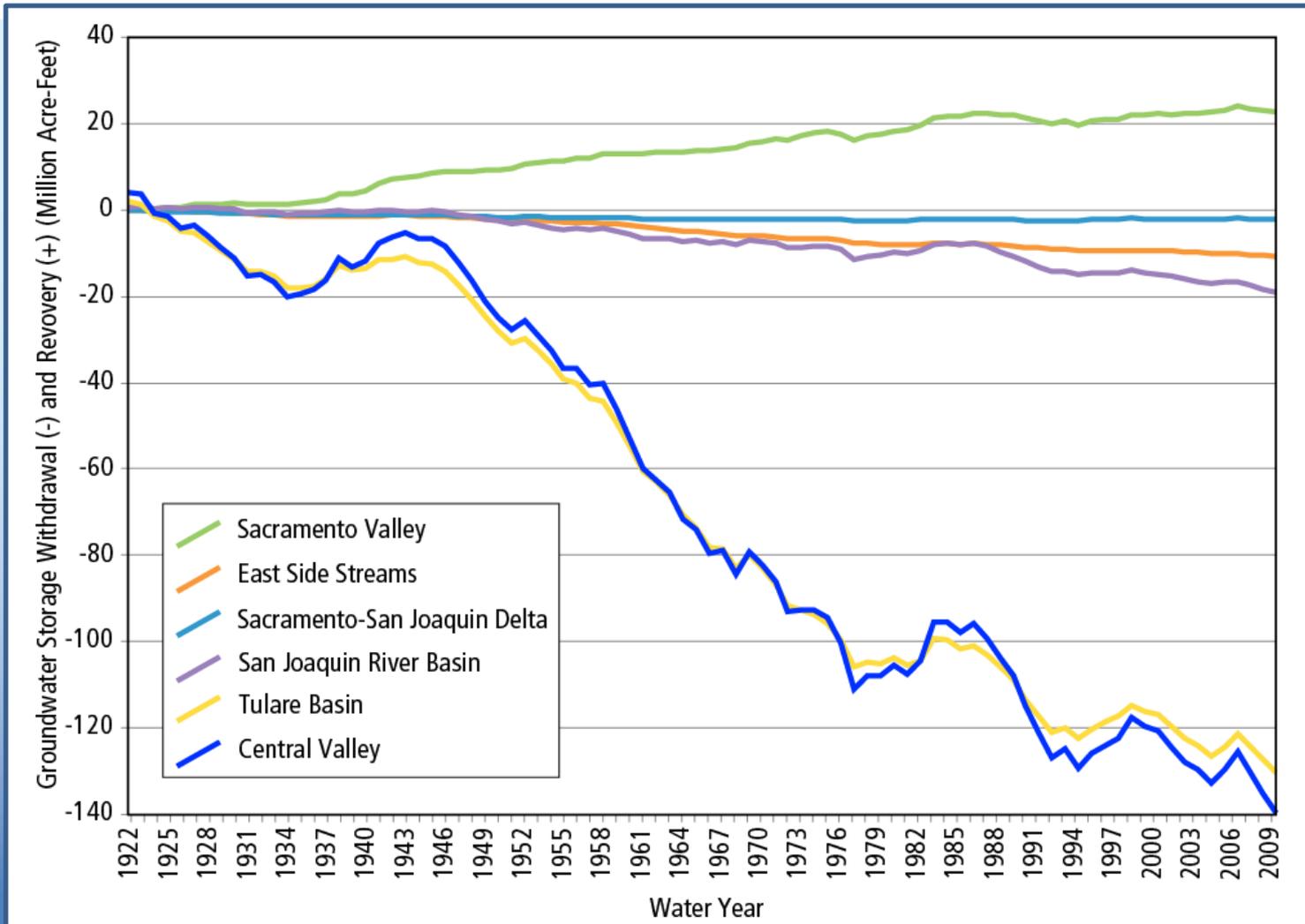
Deep Percolation



Groundwater Depletion

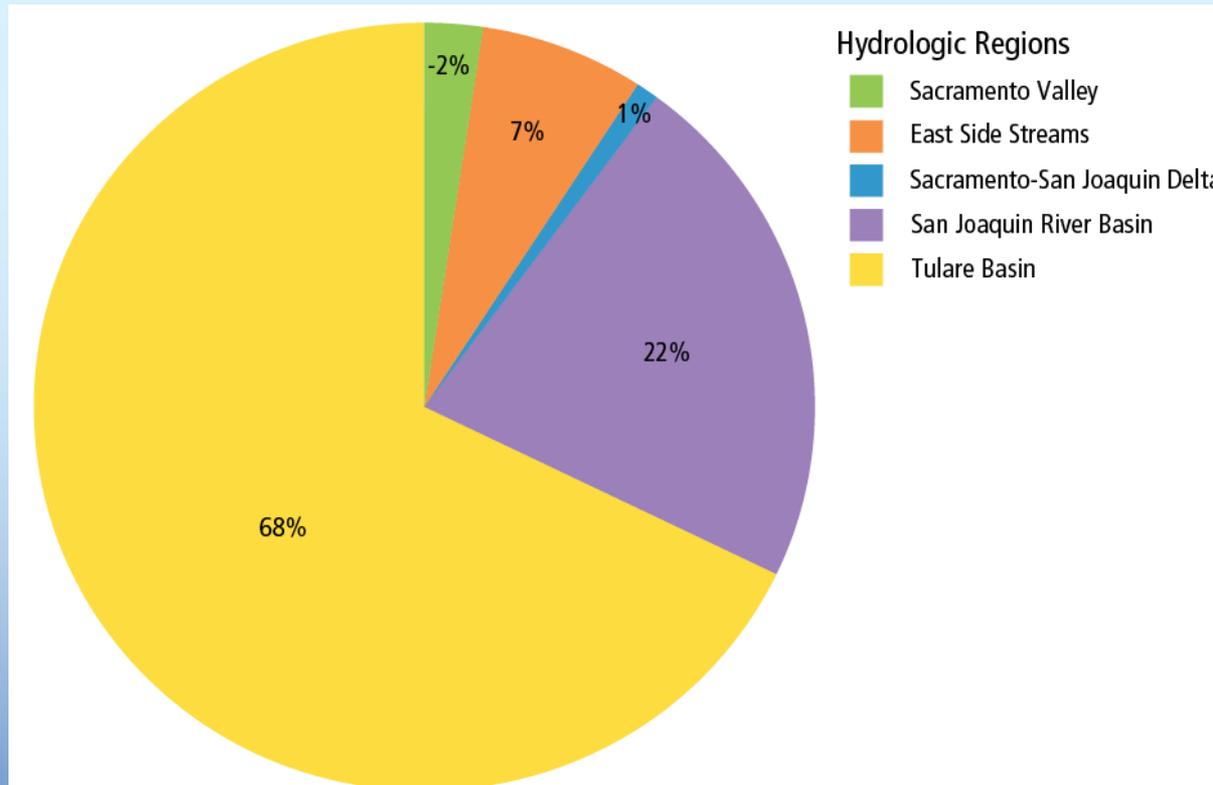


Groundwater Depletion

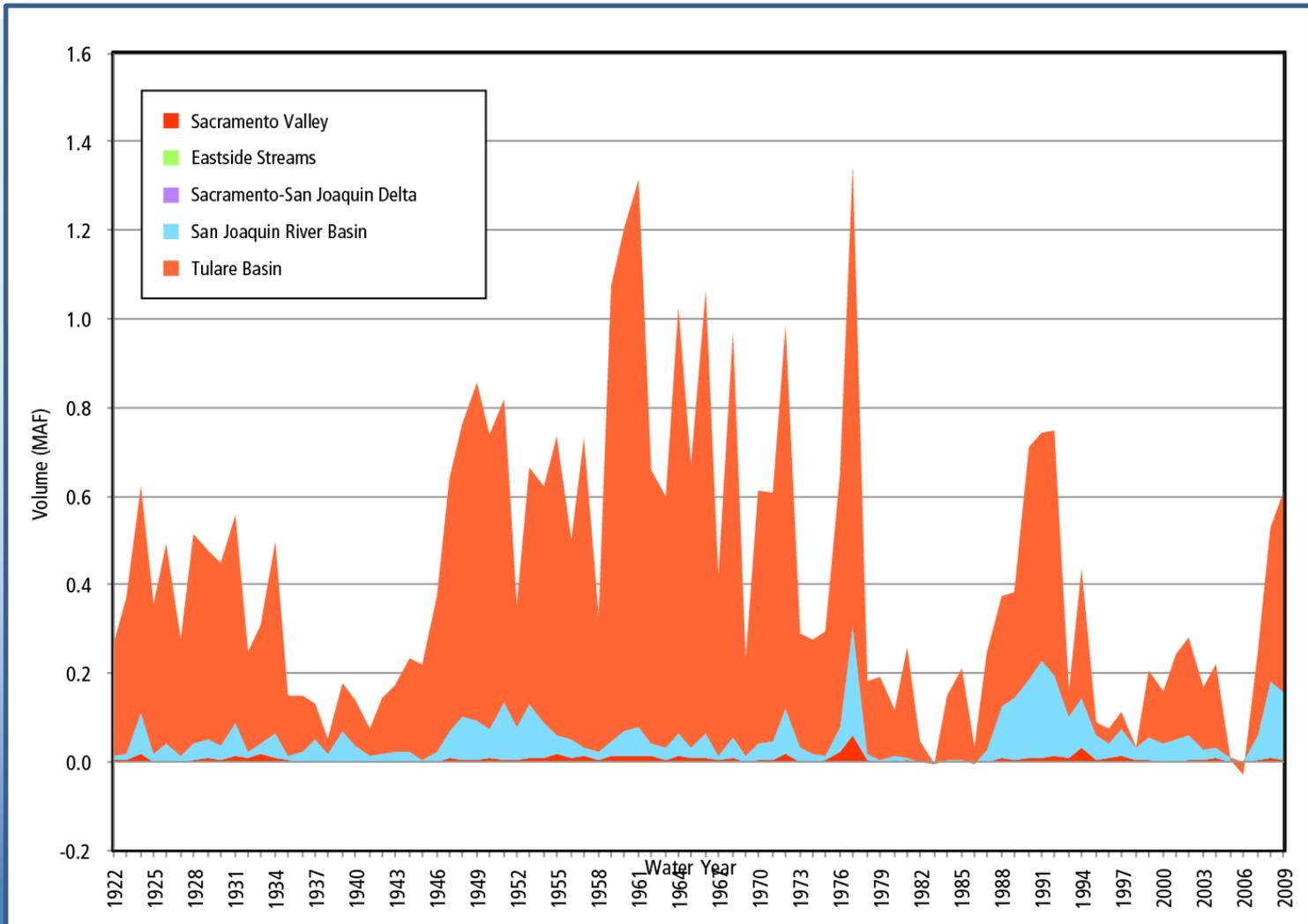


Groundwater Depletion

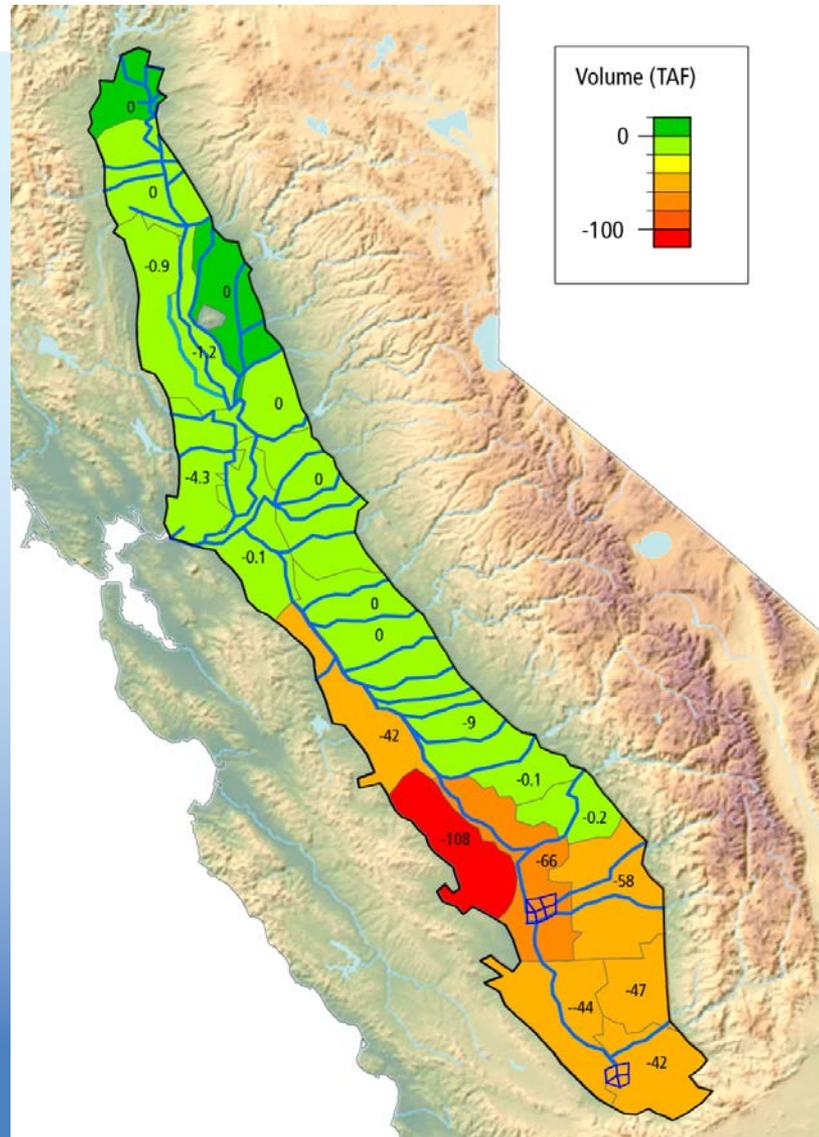
2000-2009



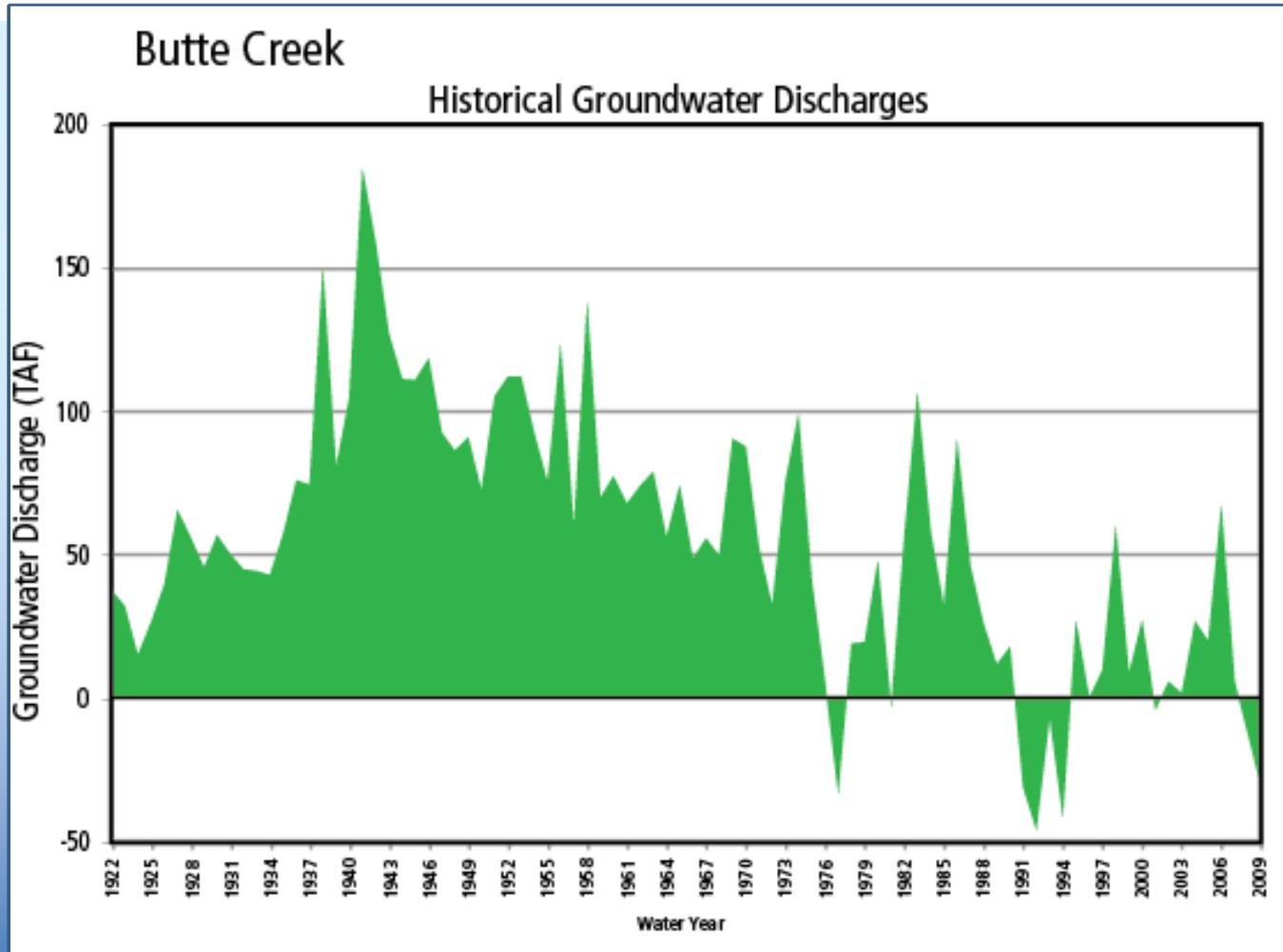
Groundwater Depletion



Subsidence, 2000-2009

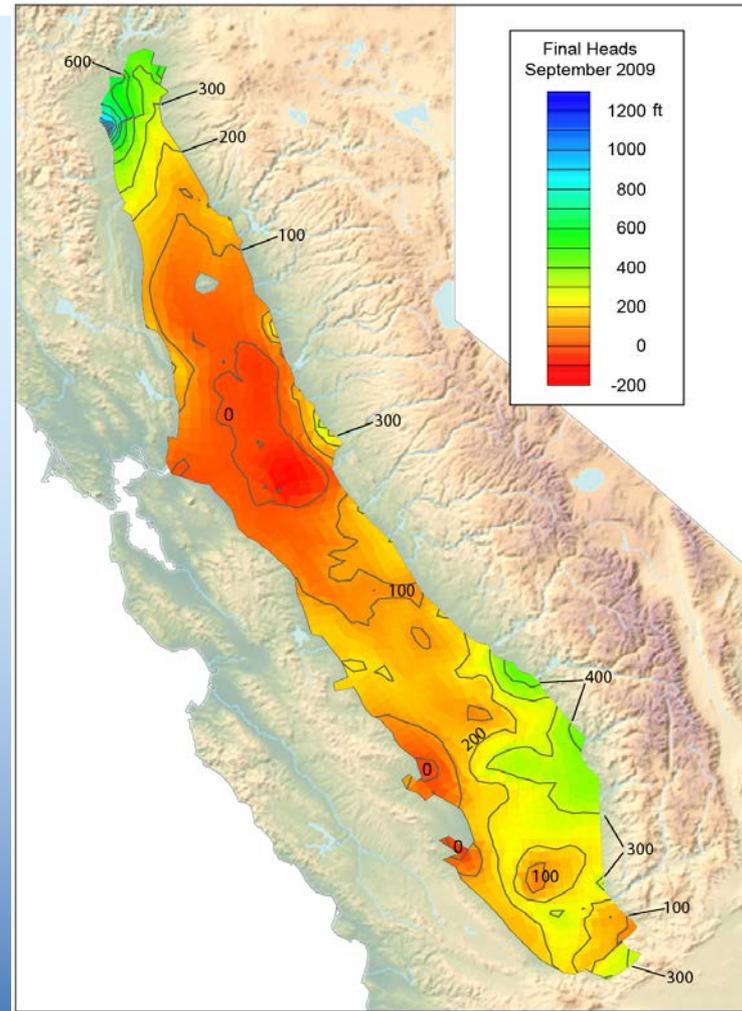
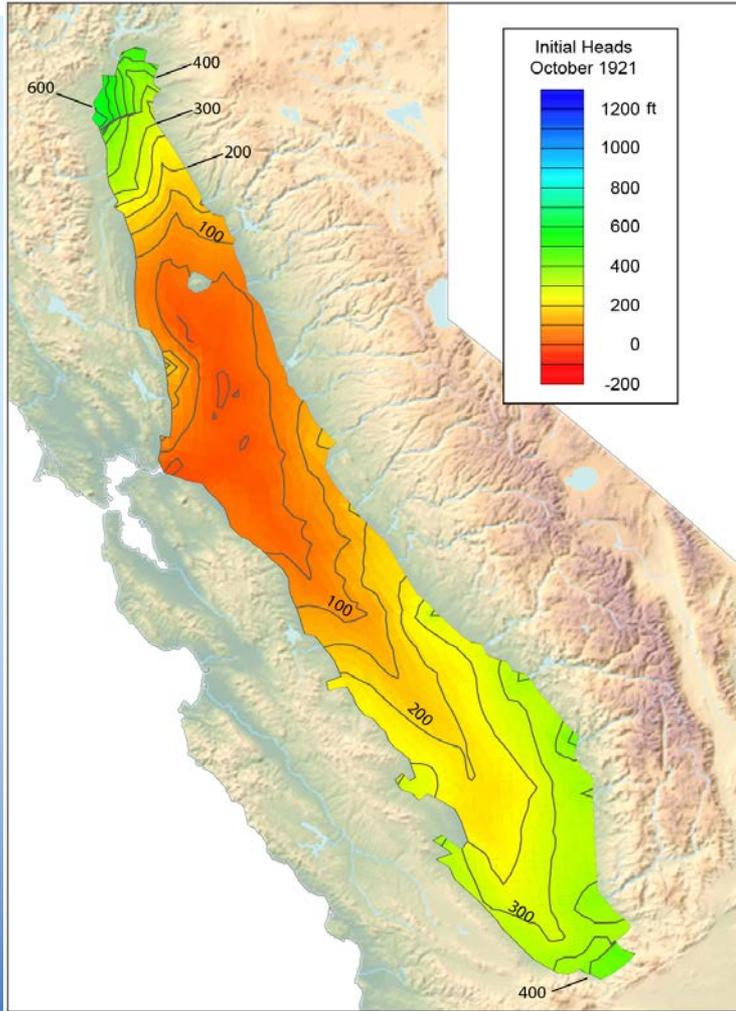


Stream-Groundwater Flows



Water Table Altitude

Produced from IWFM's TecPlot[®] output files



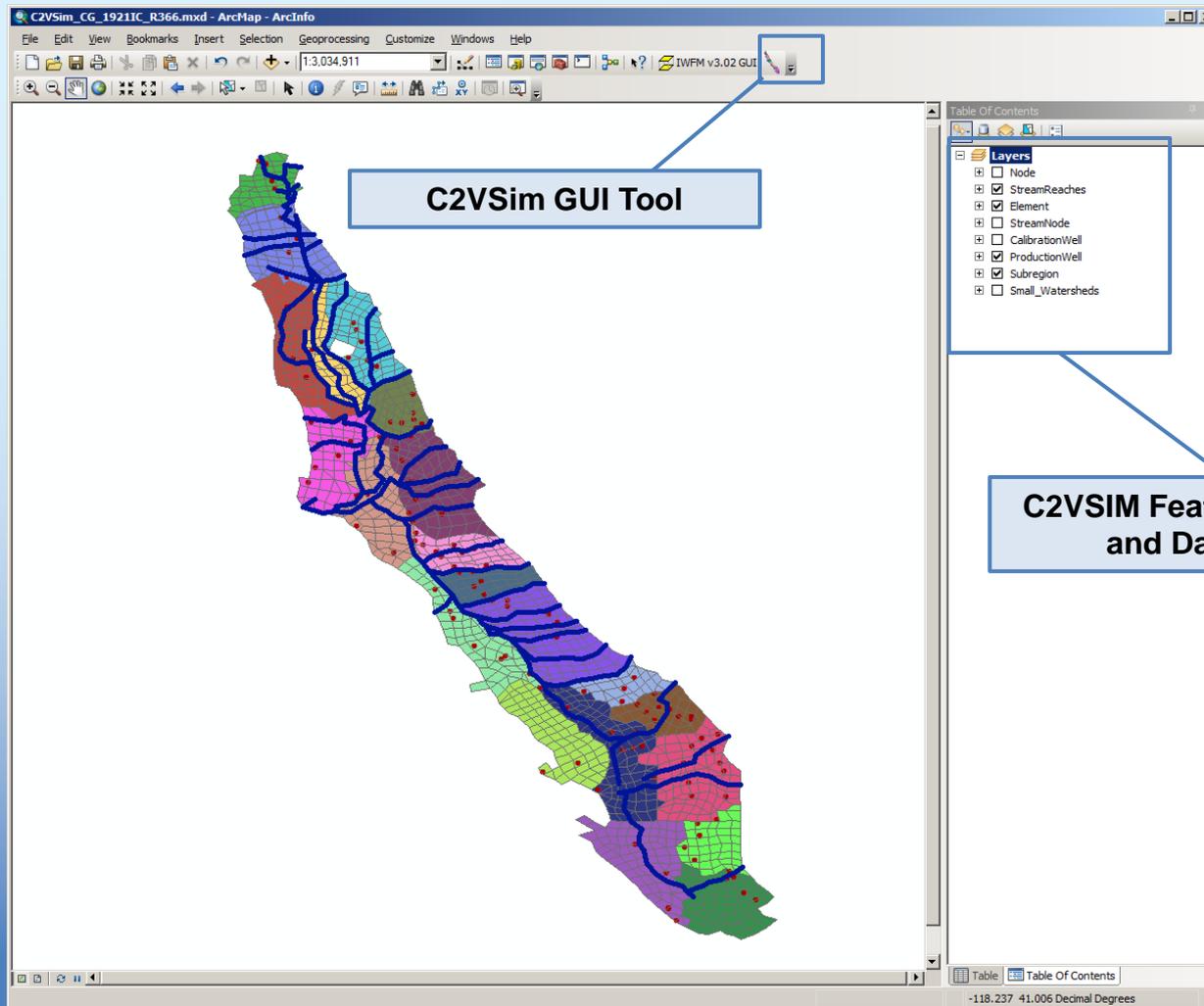


Key Limitations

- **Time step and stream routing:** Stream flow must travel from upstream to downstream within the length of time step for the zero-storage assumption to be valid
- **Time step and rainfall runoff:** Re-calibrate curve numbers for different time steps (for C2VSim, the input data time step is itself a limitation)
- **Spatial scale of demand and supply:** Demand and supply computations are performed at the subregion level
- **Vertical distribution of pumping:** Static distribution limits the ability to simulate changes in the pumping depth during simulation period
- **Aquifer and root zone thickness:** Aquifer thickness should be large compared to root zone thickness to minimize error in case groundwater table is close to ground surface; likely to occur in native and riparian vegetation areas

C2VSim ArcGIS Tool

ArcGIS tool to display model output (based on RMC-WRIME tool)



C2VSim GUI Tool

C2VSim Feature Shapefiles
and Data Tables

IWFM Excel Add-In

The screenshot displays the Microsoft Excel interface with the 'IWFM Tools' ribbon active. A dialog box titled 'Budget To Excel (v3.02)' is open, allowing the user to select a budget input file and a budget table. The spreadsheet below shows a table with the following columns:

	Time	Deep Percolation	Beginning Storage (+)	Ending Storage (-)	Net Deep Percolation (+)	Gain from Stream (+)	Recharge (+)	Gain from Lake (+)	Boundary Inflow (+)	Subsidence (+)	Subsur Irrigat (+)
1	IWFM (v3.02.0063)										
2	GROUND WATER BUDGET IN AC.FT. FOR SUBREGION 22 (ENTIRE MOD										
3	AREA= 12793138.59 AC										
4											
5											
6	10/31/1921 12:00 AM	107,891.70	3,102,558,944.94	3,101,455,762.76	1,545,662.55	-1,380,216.55	1,027,128.06	-1,807,079.49	31,090.13	90,405.00	
7	11/30/1921 12:00 AM	10,499.60	3,101,455,762.76	3,101,687,810.88	922,094.97	-853,966.91	254,904.92	-78,310.97	36,201.50	56,617.07	
8	12/31/1921 12:00 AM	388,957.48	3,101,687,810.88	3,102,682,423.77	741,696.22	-216,993.75	346,284.30	17,852.75	72,838.18	39,597.99	
9	01/31/1922 12:00 AM	288,004.05	3,102,682,423.77	3,103,133,215.27	599,366.24	-560,369.70	313,857.01	18,954.57	59,790.60	34,261.40	
10	02/28/1922 12:00 AM	459,924.77	3,103,133,215.27	3,104,249,438.91	598,605.79	15,574.91	396,432.61	12,344.91	77,750.28	27,915.73	
11	03/31/1922 12:00 AM	79,849.93	3,104,249,438.91	3,104,396,762.34	433,088.52	-505,423.51	272,187.24	1,602.94	67,726.33	36,638.00	
12	04/30/1922 12:00 AM	111,986.03	3,104,396,762.34	3,104,289,059.02	386,101.08	-297,765.27	240,572.35	-5,210.40	41,927.63	37,081.13	
13	05/31/1922 12:00 AM	300,406.95	3,104,289,059.02	3,105,144,811.92	398,053.82	94,041.18	609,448.05	-14,825.96	44,015.81	29,131.90	
14	06/30/1922 12:00 AM	295,835.03	3,105,144,811.92	3,105,311,640.26	398,037.38	-465,298.77	618,372.60	-16,319.23	38,869.57	48,762.12	
15	07/31/1922 12:00 AM	117,767.33	3,105,311,640.26	3,104,218,749.41	320,944.80	-998,822.49	287,627.18	-12,155.49	37,650.36	77,713.66	
16	08/31/1922 12:00 AM	83,349.87	3,104,218,749.41	3,103,179,917.61	287,975.70	-764,044.06	201,662.00	-9,568.70	37,245.50	80,870.22	
17	09/30/1922 12:00 AM	28,923.90	3,103,179,917.61	3,102,820,892.90	253,924.33	-596,841.42	149,685.52	-7,595.87	36,845.29	23,265.59	
18	10/31/1922 12:00 AM	10,428.49	3,102,820,892.90	3,102,582,016.85	225,377.20	-452,920.73	127,476.29	-4,115.57	43,394.52	24,244.99	
19	11/30/1922 12:00 AM	70,374.76	3,102,582,016.85	3,102,721,899.87	222,037.87	-270,795.03	140,477.99	-1,732.60	50,286.94	12,802.53	
20	12/31/1922 12:00 AM	533,756.17	3,102,721,899.87	3,103,584,673.76	345,057.00	170,966.55	267,785.60	1,642.19	74,722.35	9,683.82	
21	01/31/1923 12:00 AM	261,607.92	3,103,584,673.76	3,103,741,171.42	315,762.47	-394,511.54	202,499.85	-744.76	59,740.68	11,617.37	
22	02/28/1923 12:00 AM	9,367.59	3,103,741,171.42	3,103,658,892.63	223,091.59	-505,579.67	181,794.97	-1,683.15	47,251.54	11,187.23	
23	03/31/1923 12:00 AM	44,164.47	3,103,658,892.63	3,103,171,074.82	201,887.75	-412,750.01	165,605.02	-3,402.00	41,247.75	44,107.47	
24	04/30/1923 12:00 AM	233,033.44	3,103,171,074.82	3,103,587,456.36	232,389.77	80,022.76	291,067.94	-6,032.68	70,155.39	13,045.71	
25	05/31/1923 12:00 AM	335,245.96	3,103,587,456.36	3,103,564,048.83	281,657.76	-223,711.69	355,450.74	-16,428.24	40,600.98	33,112.55	
26	06/30/1923 12:00 AM	233,136.62	3,103,564,048.83	3,102,891,317.94	270,147.56	-527,062.02	281,956.57	-15,056.77	40,224.26	63,912.58	
27	07/31/1923 12:00 AM	105,872.22	3,102,891,317.94	3,101,996,265.57	221,507.44	-571,914.33	237,613.53	-13,251.18	39,472.15	85,038.94	
28	08/31/1923 12:00 AM	89,867.15	3,101,996,265.57	3,101,039,103.09	205,997.89	-566,873.80	168,454.90	-11,201.68	39,056.09	84,120.98	
29	09/30/1923 12:00 AM	40,347.40	3,101,039,103.09	3,100,856,488.57	186,652.19	-421,756.99	126,753.62	-8,781.12	45,086.41	11,231.73	
30	10/31/1923 12:00 AM	10,213.68	3,100,856,488.57	3,100,591,491.95	165,245.16	-337,797.06	104,846.44	-5,843.04	40,668.26	20,628.35	
31	11/30/1923 12:00 AM	8,320.47	3,100,591,491.95	3,100,474,310.43	151,010.16	-372,397.35	92,894.94	-3,338.63	38,773.25	7,927.13	
32	12/31/1923 12:00 AM	10,612.22	3,100,474,310.43	3,100,424,642.41	130,024.82	-247,749.27	82,512.29	-1,706.60	44,524.62	6,059.16	

HEC-DSS

C2VSim_R365.DSS - HEC-DSSVue

File Edit View Display Utilities Help

CDEC Excel Precision USGS

File Name: Z:\temp\r365\1921-2009-DSS\Results\C2VSim_R365.DSS

Pathnames Shown: 4204 Pathnames Selected: 0 Pathnames in File: 37836 File Size: 33987 KB

Search A: [] C: [] E: []

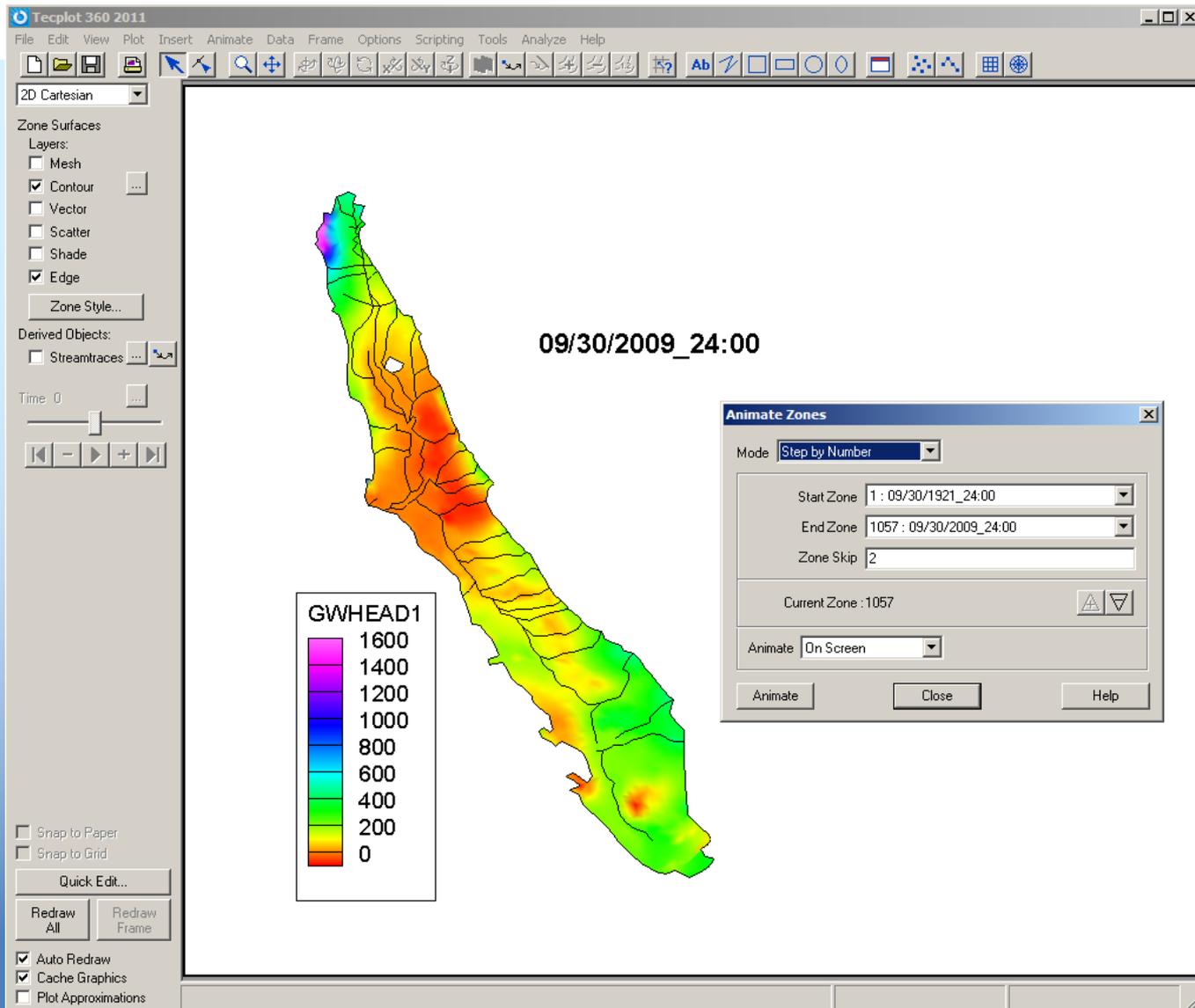
By Parts: B: IWVFM_DIVERDTL_BUD C: [] D: [] F: []
 IWVFM_GW_BUD
 IWVFM_L&W_USE_BUD

Number			C part	D part / range	E part	F part
1	IWVFM_LAKE_BUD		VOLUME	01 JAN 1920 - 01 JAN 2000	1MON	DELI
2	IWVFM_ROOTZN_BUD		VOLUME	01 JAN 1920 - 01 JAN 2000	1MON	DELI_SHORT
3	IWVFM_STREAM_BUD		VOLUME	01 JAN 1920 - 01 JAN 2000	1MON	DIVER
4	IWVFM_STRMRCH_BUD		VOLUME	01 JAN 1920 - 01 JAN 2000	1MON	DIVER_SHORT
5	IWVFM_SWSHED_BUD		VOLUME	01 JAN 1920 - 01 JAN 2000	1MON	DIVER
6	IWVFM_SWSHED_BUD		VOLUME	01 JAN 1920 - 01 JAN 2000	1MON	DIVER_SHORT
7	IWVFM_DIVERDTL_BUD	SR10:DV130:R134	VOLUME	01 JAN 1920 - 01 JAN 2000	1MON	DIVER
8	IWVFM_DIVERDTL_BUD	SR10:DV130:R134	VOLUME	01 JAN 1920 - 01 JAN 2000	1MON	DIVER_SHORT
9	IWVFM_DIVERDTL_BUD	SR10:DV131:R115	VOLUME	01 JAN 1920 - 01 JAN 2000	1MON	DIVER
10	IWVFM_DIVERDTL_BUD	SR10:DV131:R115	VOLUME	01 JAN 1920 - 01 JAN 2000	1MON	DIVER_SHORT
11	IWVFM_DIVERDTL_BUD	SR10:DV172:R0	VOLUME	01 JAN 1920 - 01 JAN 2000	1MON	DELI
12	IWVFM_DIVERDTL_BUD	SR10:DV172:R0	VOLUME	01 JAN 1920 - 01 JAN 2000	1MON	DELI_SHORT
13	IWVFM_DIVERDTL_BUD	SR10:DV173:R0	VOLUME	01 JAN 1920 - 01 JAN 2000	1MON	DELI
14	IWVFM_DIVERDTL_BUD	SR10:DV173:R0	VOLUME	01 JAN 1920 - 01 JAN 2000	1MON	DELI_SHORT
15	IWVFM_DIVERDTL_BUD	SR10:DV174:R0	VOLUME	01 JAN 1920 - 01 JAN 2000	1MON	DELI
16	IWVFM_DIVERDTL_BUD	SR10:DV174:R0	VOLUME	01 JAN 1920 - 01 JAN 2000	1MON	DELI_SHORT
17	IWVFM_DIVERDTL_BUD	SR10:DV176:R0	VOLUME	01 JAN 1920 - 01 JAN 2000	1MON	DELI
18	IWVFM_DIVERDTL_BUD	SR10:DV176:R0	VOLUME	01 JAN 1920 - 01 JAN 2000	1MON	DELI_SHORT
19	IWVFM_DIVERDTL_BUD	SR10:DV177:R0	VOLUME	01 JAN 1920 - 01 JAN 2000	1MON	DELI
20	IWVFM_DIVERDTL_BUD	SR10:DV177:R0	VOLUME	01 JAN 1920 - 01 JAN 2000	1MON	DELI_SHORT
21	IWVFM_DIVERDTL_BUD	SR10:DV178:R0	VOLUME	01 JAN 1920 - 01 JAN 2000	1MON	DELI

Select De-Select Clear Selections Restore Selections Set Time Window

No time window set.

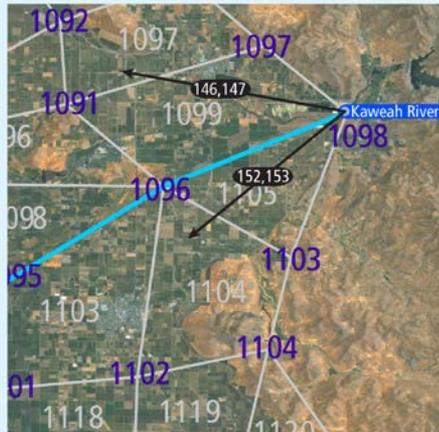
TecPlot-Ready Output



C2VSim Reports

Department of Water Resources Division Report

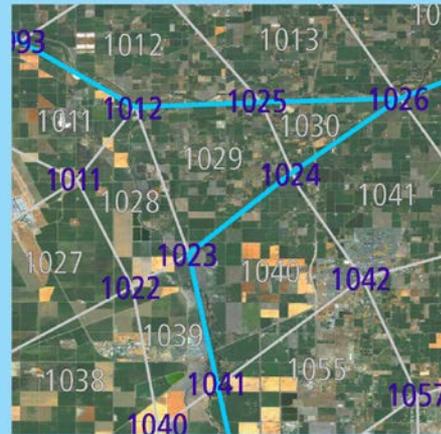
Historical Rim Inflows, Surface Water Diversions and Bypass Flows
for the
California Central Valley Groundwater-Surface Water Simulation Model
(C2VSim), Version 3.0
Charles F. Brush



Bay-Delta Office, California Department of Water Resources, 1416 Ninth Street, Sacramento, CA 95814

Department of Water Resources Division Report

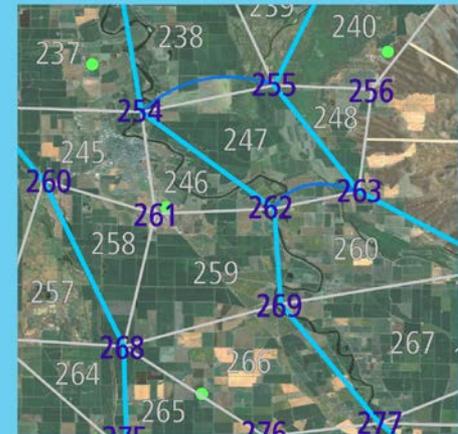
User Manual
for the
California Central Valley Groundwater-Surface Water Simulation Model
(C2VSim), Version 3.02-CG
Charles F. Brush, Emin C. Dogrul



Bay-Delta Office, California Department of Water Resources, 1416 Ninth Street, Sacramento, CA 95814

Department of Water Resources Division Report

Development and Calibration of the
California Central Valley Groundwater-Surface Water Simulation Model
(C2VSim), Version 3.02-CG
Charles F. Brush, Emin C. Dogrul and Tariq N. Kadir



Bay-Delta Office, California Department of Water Resources, 1416 Ninth Street, Sacramento, CA 95814

C2VSim Coarse Grid

“C2VSim CG-3.02”

DWR Web Site

- Model files
- User Manual
- ArcGIS shapefiles
- C2VSim Tools
- IWFM Application
- IWFM Tools

Support

- **Training:** IWFM and C2VSim workshops will be offered through CWEMF
- **Technical support:** Email and telephone

A Google search for “C2VSim” brings up this page
Links will go ‘live’ with C2VSim public release



The screenshot shows the C2VSim website interface. At the top, there is a navigation bar with links for California Home, Governor Home, and Amber Alert, along with the date Friday, September 21, 2012. Below this is a banner for "Welcome to California" featuring various scenic images. The main content area is divided into several sections:

- Navigation:** Links for DWR Home, BDO Home, Organization, Administration & Program Control, Delta Conveyance, Modeling Support, South Delta, DWR Computers Only, BDO Currents, DWR Forms, Organization Charts, SAP ESS, BDO Computer Support Request, and Training.
- Department of Water Resources:** A central banner for the Department of Water Resources, BAY-DELTA, featuring a logo and a scenic image of a river valley.
- C2VSim: California Central Valley Groundwater-Surface Water Simulation Model:** A section with a description of the model, its history, and its use. It includes a "Description" paragraph, a "Training" image, and contact information for the Bay-Delta Office.
- Section Pages:** A list of links for Central Valley Water Resources System, Modeling, Delta Modeling, and Computer Assistance.
- Quick Hits:** A list of links for WRIMS/CalSim, CalLite, DSM2, IWFM, and IDC.
- C2VSim Model:** A list of links for Model Files, ArcGIS GUI, User's Manual, and Surface Water Data Report.

C2VSim Fine Grid

“C2VSim FG-3.02”

Nodal Spacing:

- 0.5 mi on rivers
- 1.5 mi on edge
- Average 0.6 mi²

Model grid:

- 32,537 elements
- 30,179 nodes
- 4,529 river nodes

Run times:

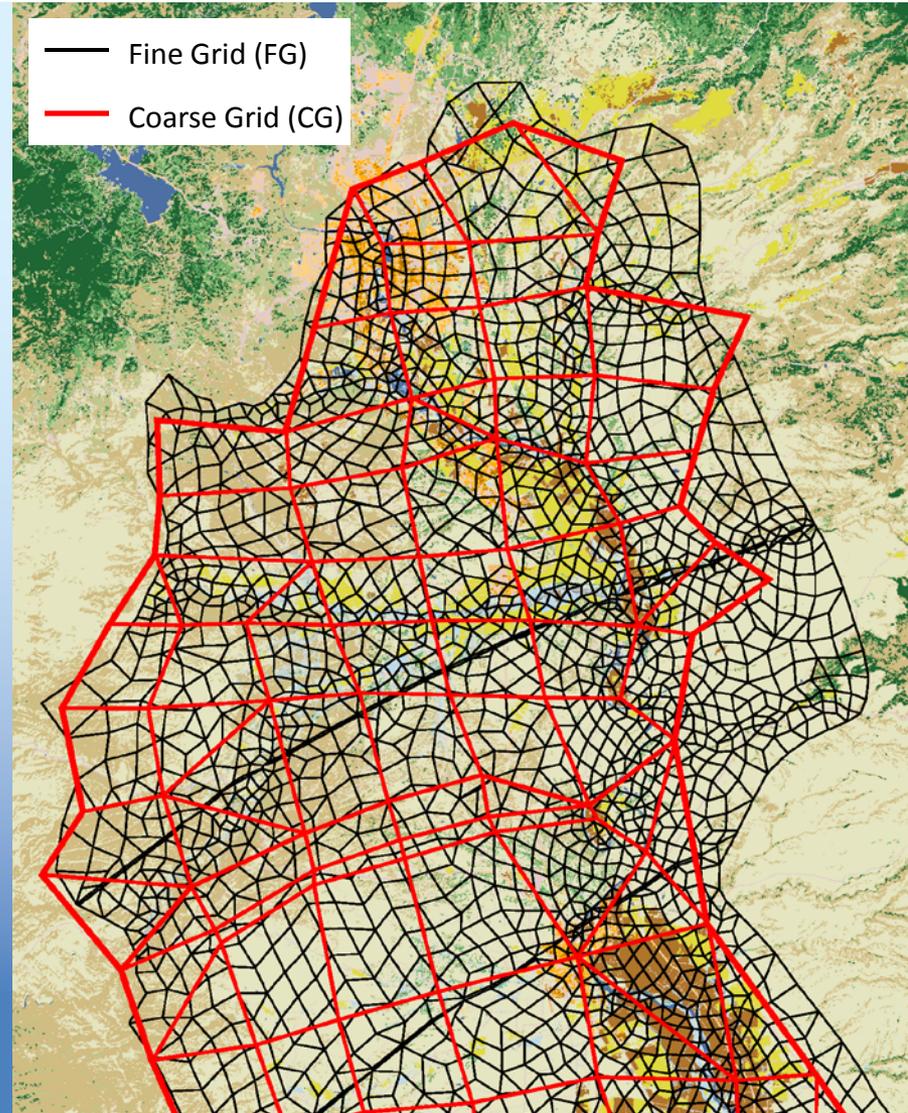
- CG 88 yrs in 3-6 min
- FG 88 yrs in appx 6 hrs

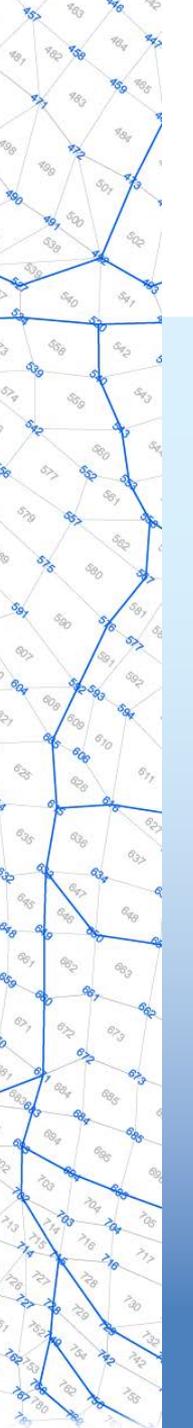
Suggested uses:

- CG region-scale analyses
- FG local-scale analyses

Beta release after staff review

- Integrated with C2VSim ArcGIS tool





C2VSim Applications

- CalSim 3 groundwater component
- Integrated Regional Water Management Plans
- Stream-groundwater flows
- Climate change assessments
- Groundwater storage investigations
- Planning studies
- Ecosystem enhancement scenarios
- Infrastructure improvements
- Impacts of operations on Delta flows

Acknowledgements

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Charles Burt and staff, ITRC; Claudia Faunt, USGS

currently with: (1) MBK Engineers, (2) Groundwater Dynamics, (3) U. of San Francisco, (4) U. of Edinburgh