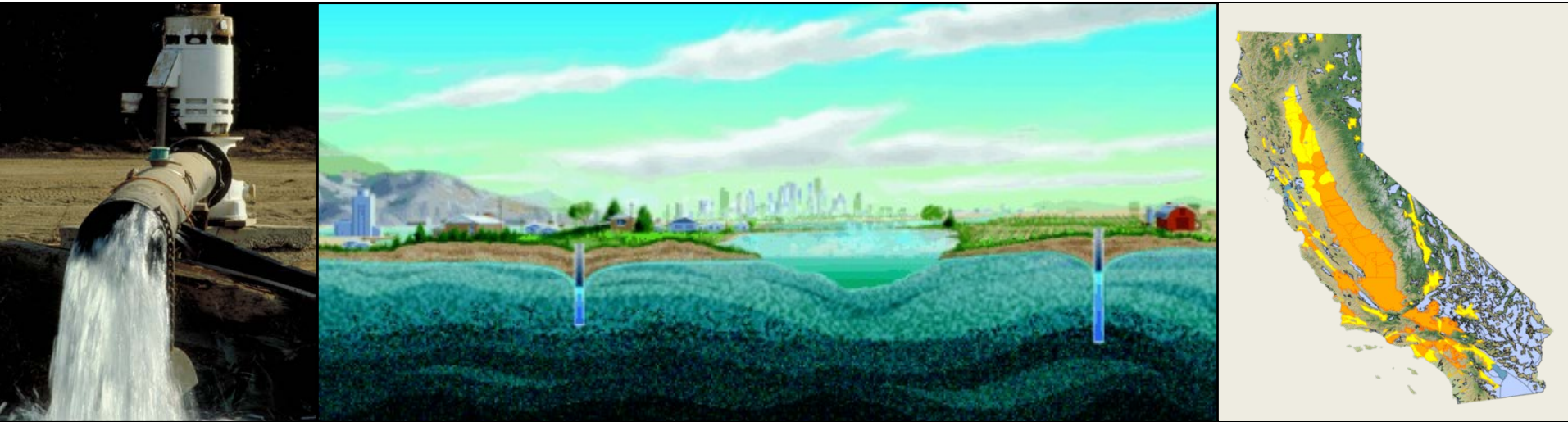


SGMA Technical Assistance

- *Climate Change Datasets for Use in GSP Development* -



GRA Annual Meeting, October 3rd , 2017

SGMA Modeling and Tools

Tyler Hatch, PhD, PE

DWR Sustainable Groundwater Management Branch

Presentation Overview

1. Background – SGMA and Climate Change
2. Climate Change in CA
3. Approach to SGMA Climate Change Data and Analysis for GSPs
4. Data, Tools and Guidance to be provided by DWR

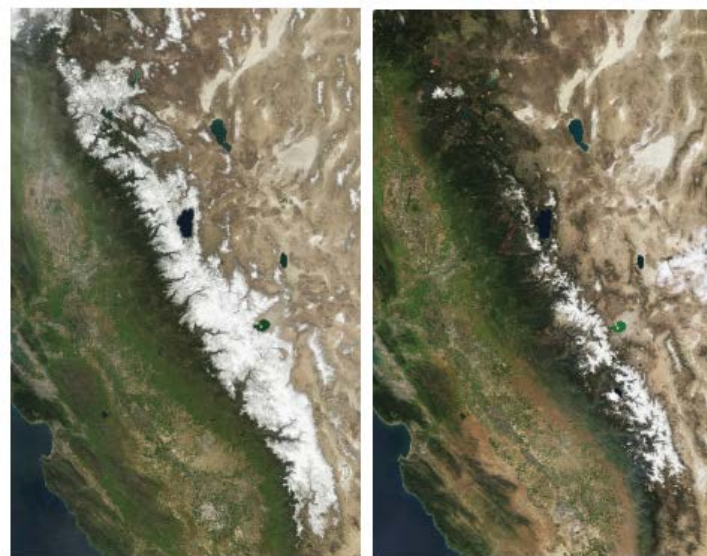


Image: NASAMODIS

SGMA and Climate Change

Sustainable Groundwater Management – management and use of groundwater in a manner that can be maintained during the planning and implementation horizon without causing undesirable results.

Planning and implementation

Horizon: a 50-year period over which a GSA determines that plans and measures will be implemented in a basin to ensure that the basin is operated within its sustainable yield



Lowering
GW Levels



Reduction
of Storage



Seawater
Intrusion



Degraded
Quality



Land
Subsidence



Surface Water
Depletion

Undesirable Results: *[Significant and Unreasonable]*

1. Chronic lower of Groundwater Levels indicating [] depletion of supply...
2. [] Reduction in Groundwater Storage.
3. [] Seawater Intrusion.
4. [] Degraded water quality, including the migration of contaminant plumes that impair water supplies.
5. [] Land subsidence that substantially interferes with surface land uses.
6. Depletions of interconnected surface water that have [] impacts on beneficial uses of the surface water.

SGMA requirements related to Climate Change

Uncodified Findings:

(a) The legislature finds and declares:

*(a)(4) When properly managed, groundwater resources will help protect communities, farms, and the environment against prolonged dry periods and **climate change**, preserving water supplies for existing and potential beneficial use*

§10727.2 Required Plan Elements

A groundwater sustainability plan shall include all of the following:

(a) A description of the physical setting and characteristics of the aquifer system underlying the basin that includes the following:

*(a)(3) A general discussion of historical and **projected water demands and supplies**.*

GSP Regulations on Climate Change Analysis Requirements

§354.18 Water Budget

(c) (3) Projected water budgets shall be used to estimate future baseline conditions of supply, demand, and aquifer response to Plan implementation, and to identify the uncertainties of these projected water budget components.

*(A) Projected hydrology shall utilize 50 years of historical precipitation, evapotranspiration, and streamflow information as the baseline condition for estimating future hydrology. The projected hydrology information shall also be applied as the baseline condition used to evaluate future scenarios of hydrologic uncertainty associated with **projections of climate change and sea level rise.***

§354.18 (e) Modeling

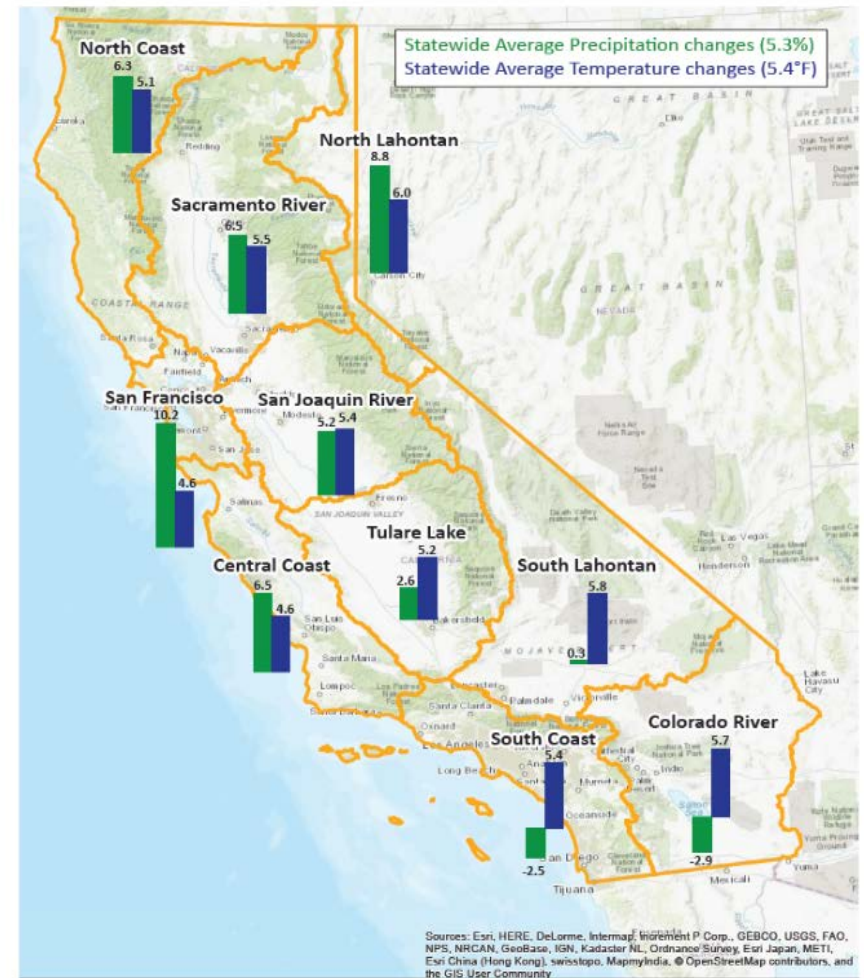
Each Plan shall rely on the best available information and best available science to quantify the water budget for the basin in order to provide an understanding of historical and projected hydrology, water demand, water supply, land use, population, climate change, sea level rise, groundwater and surface water interaction, and subsurface groundwater flow. If a numerical groundwater and surface water model is not used to quantify and evaluate the projected water budget conditions and the potential impacts to beneficial uses and users of groundwater, the Plan shall identify and describe an equally effective method, tool, or analytical model to evaluate projected water budget conditions.

CA Projected Climate [Change]

Projected Precipitation and Temperature Changes



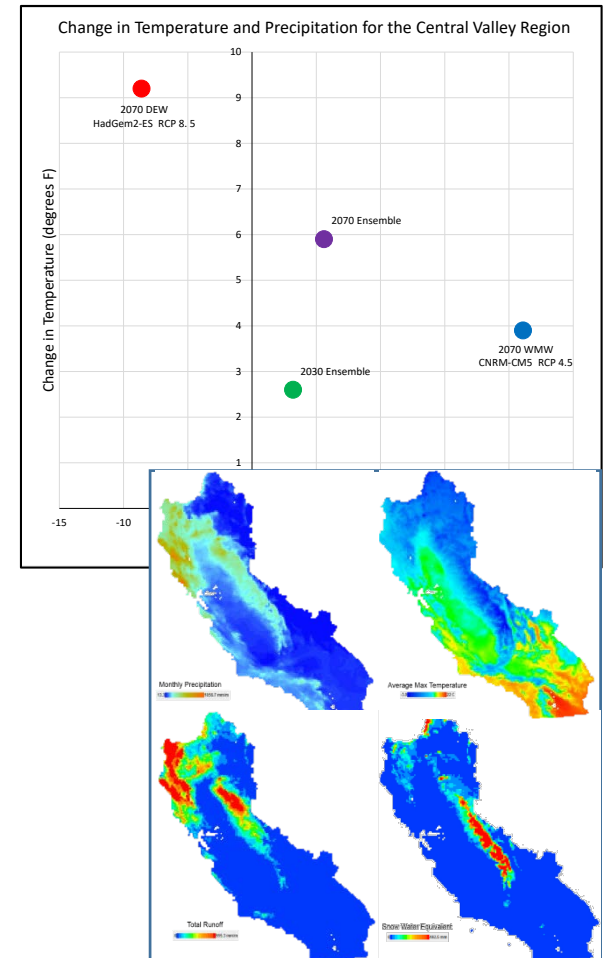
Around 2030



Around 2070

DWR Climate Change Adaptation

- Actions DWR has taken related to Climate Change:
 - Climate Action Plan – Phase 2 complete
 - Water Plan – Update 2013. Being updated for 2018.
 - CCTAG – 2012 to 2015 resulted in selection of climate models appropriate for California water resources planning
 - Prop 1 Water Storage Investment Program (WSIP) – Developed data using guidance provided by the CCTAG. Released as part of the application resources in spring 2017.



Approach to SGMA Climate Change Data and Analysis for GSPs

- The climate data source and methodology is consistent with other State programs.
- It leverages WSIP-developed products.
 - Data related to future projected climate conditions around 2030 and 2070 over an 82-year hydrologic period.
 - 2030 data will be useful to evaluate projects and actions in order to achieve sustainability.
 - 2070 data will be useful to show that sustainability will be maintained into the planning and implementation horizon.

Anticipated Application of Climate Datasets for GSP Development

- ✓ Development of climate change related inputs for Integrated hydrologic models, if used.
- ✓ Calculation of projected water budgets
- ✓ Establishment of sustainable management criteria
- ✓ Evaluation of projects and management actions

Use of the DWR provided Climate Data

- Recommended, but not required
- Other methods and data are available:
 - USGS Basin Characterization Model (BCM)
(https://ca.water.usgs.gov/projects/reg_hydro/projects/dataset.html)
 - Other Local Analyses
- Approach used should be performed consistently

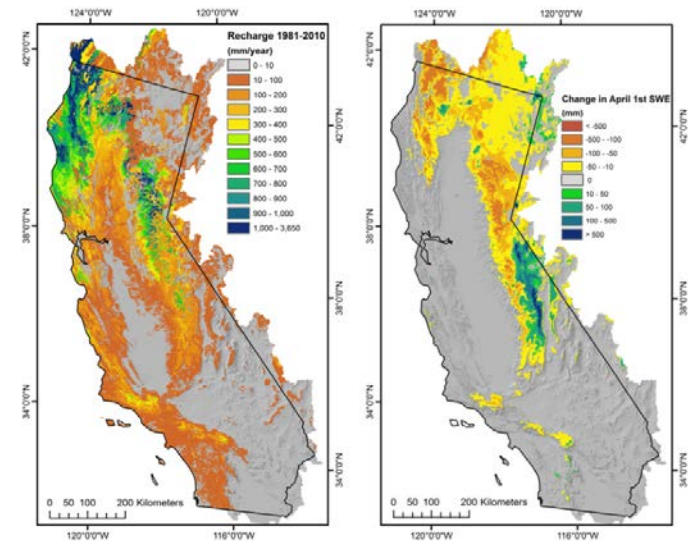
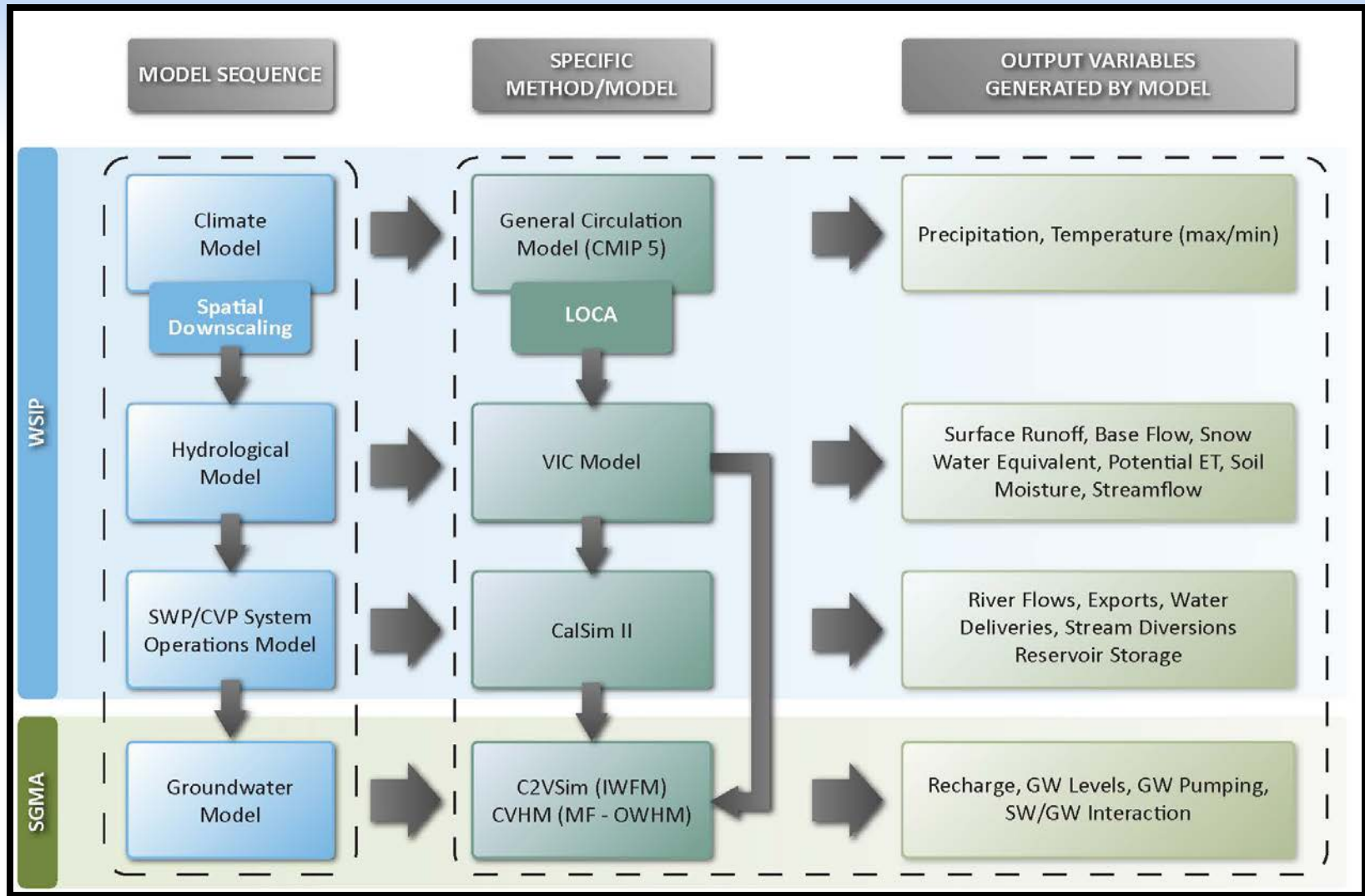


Figure 1 Maps of hydrologic output variables for (a) average recharge (net infiltration below the root zone) for water years 1981-2010 and (b) change in average April 1st snow water equivalent (SWE) between 1981-1980 and 1981-2010 calculated by the Basin Characterization Model for the California hydrologic region.

(From Flint and Flint, 2014)

Example Use of WSIP Products for SGMA Application



Future Projected Climate Datasets

Gridded Datasets (California wide at 6km by 6km resolution)

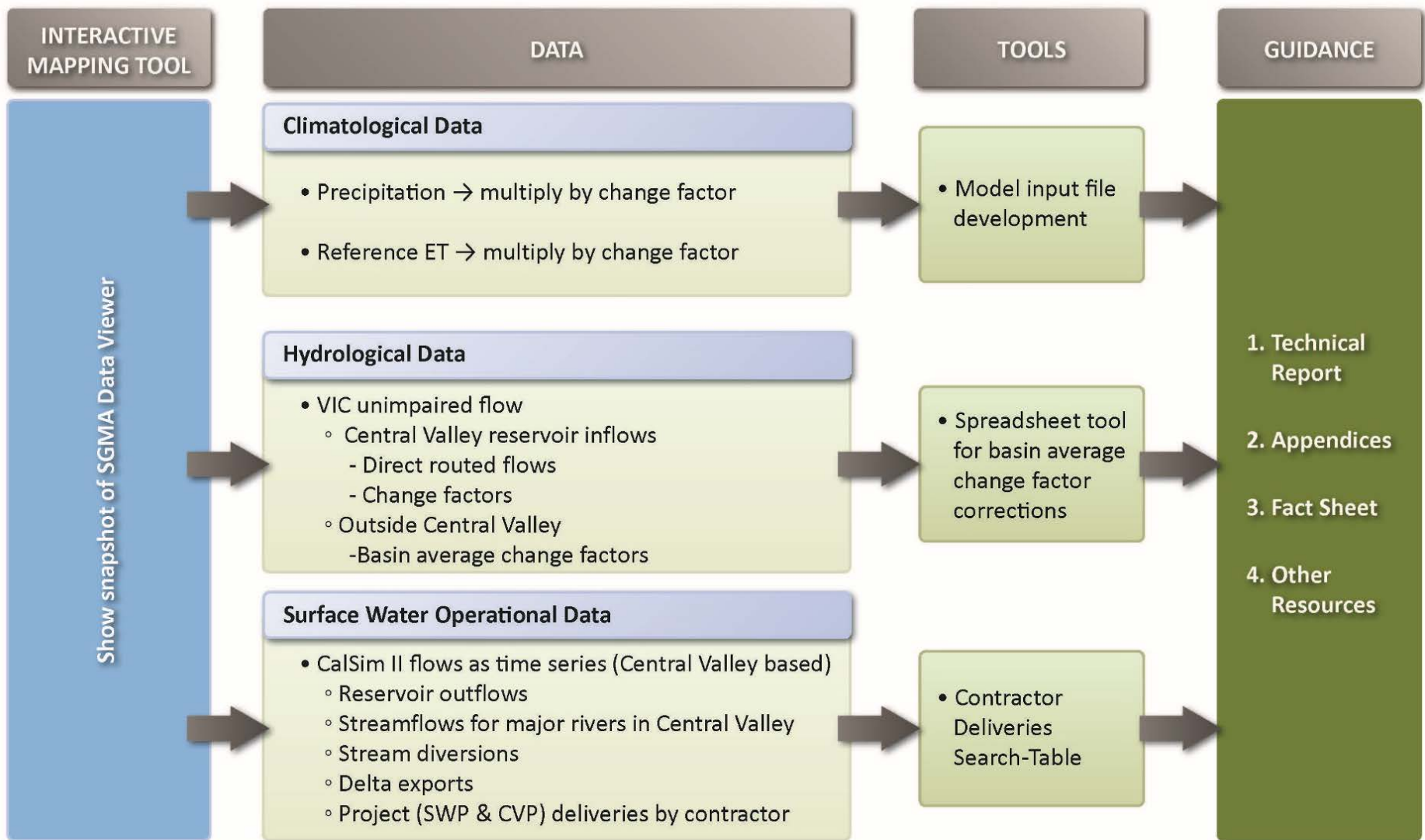
Change factors for:

- Precipitation
- Reference Evapotranspiration

Selected Flows and Deliveries (CALSIM II and VIC Analysis)

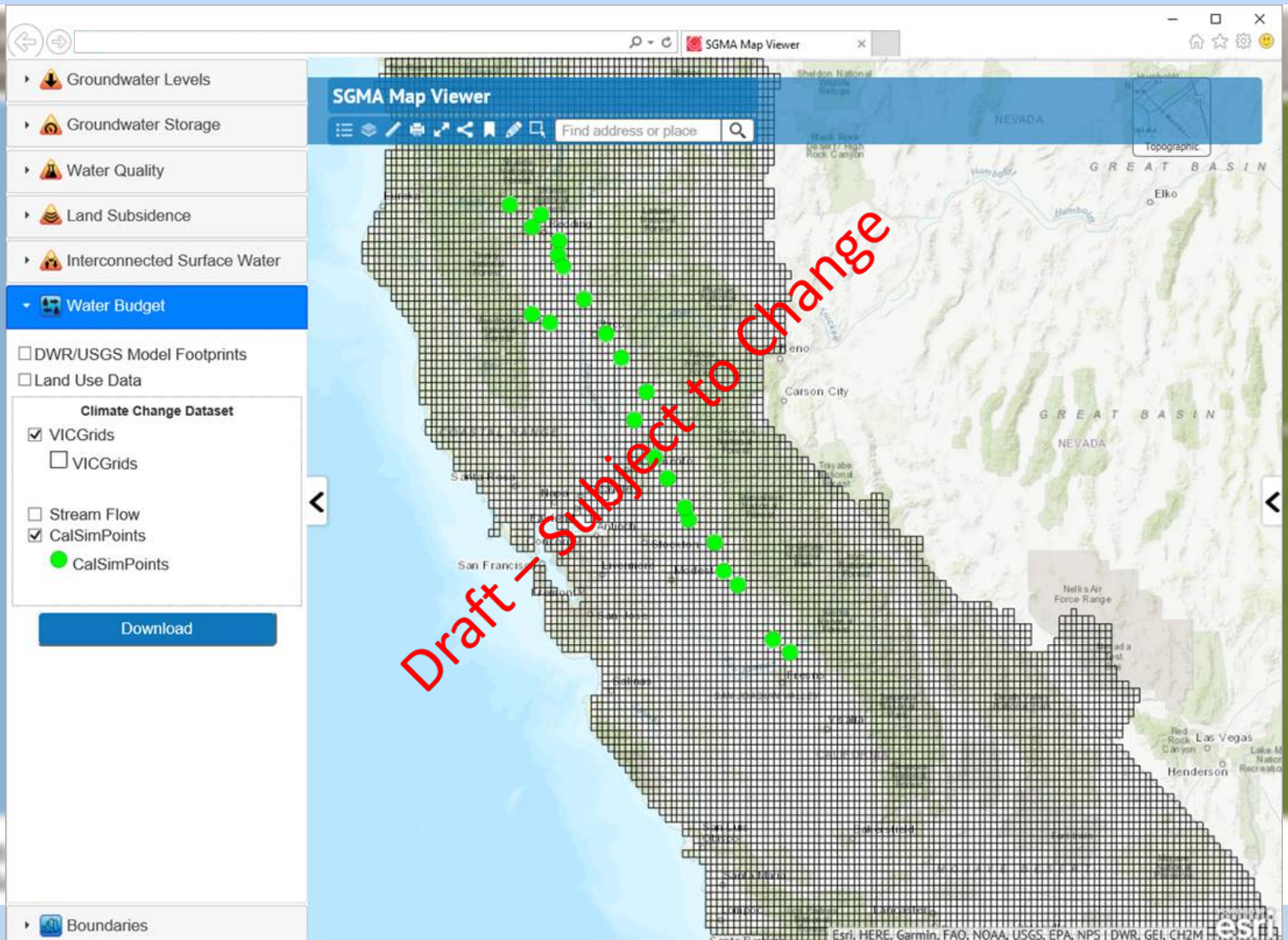
- SWP/CVP imports (Delta exports)
- SWP/CVP diversions
- SWP/CVP deliveries
- SWP/CVP reservoir releases
- Routed streamflow for select Central Valley watersheds
- Routed streamflow change factor for other watersheds
- Non-project reservoir outflows – change factors to modify existing historical flow data into reservoirs

SGMA Climate Change Information to be Provided

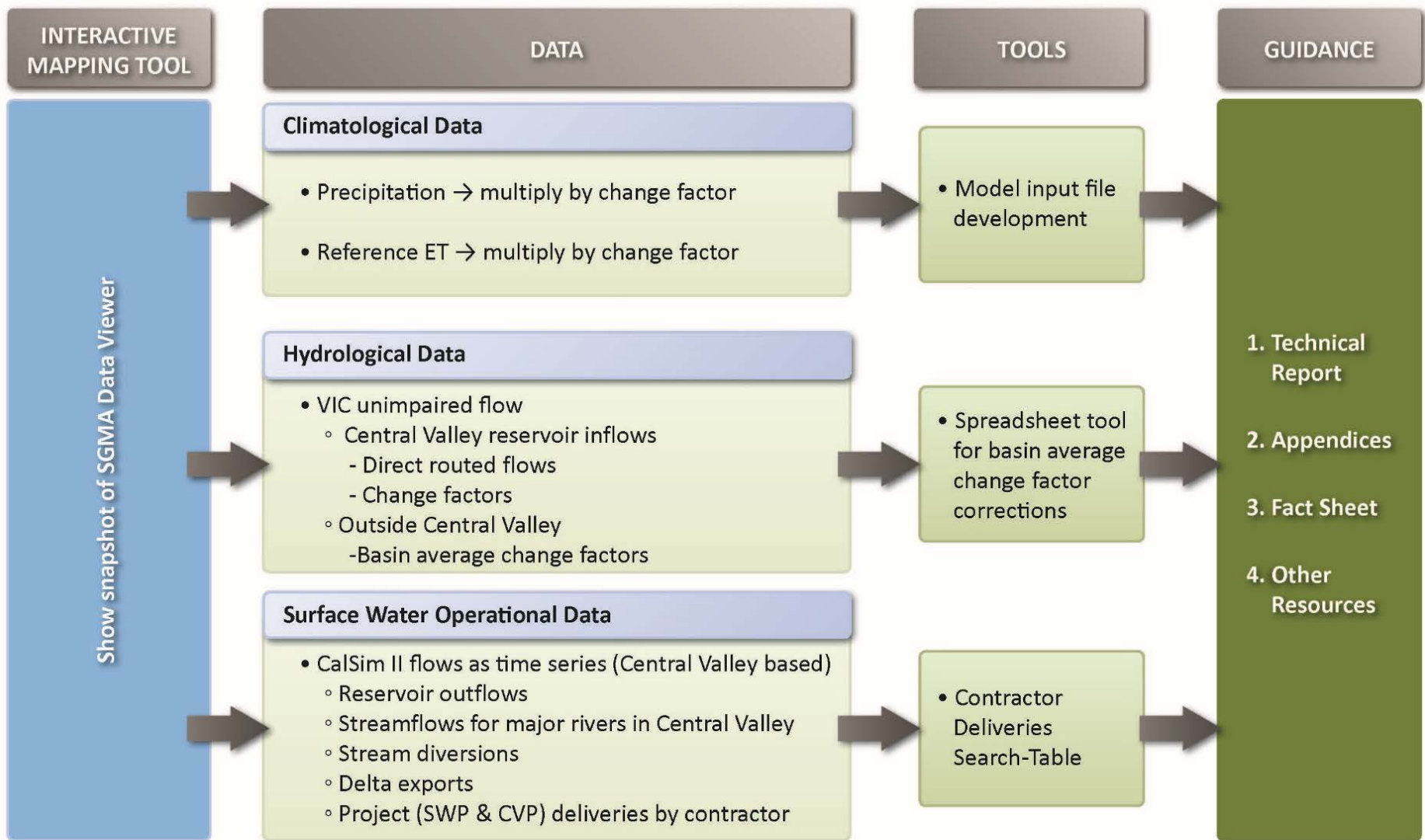


ET: Evapotranspiration; VIC: Variable Infiltration Capacity; SWP: State Water Project; CVP: Central Valley Project; CalSim: SWP and CVP Operations Model System

SGMA Climate Change Information to be Provided

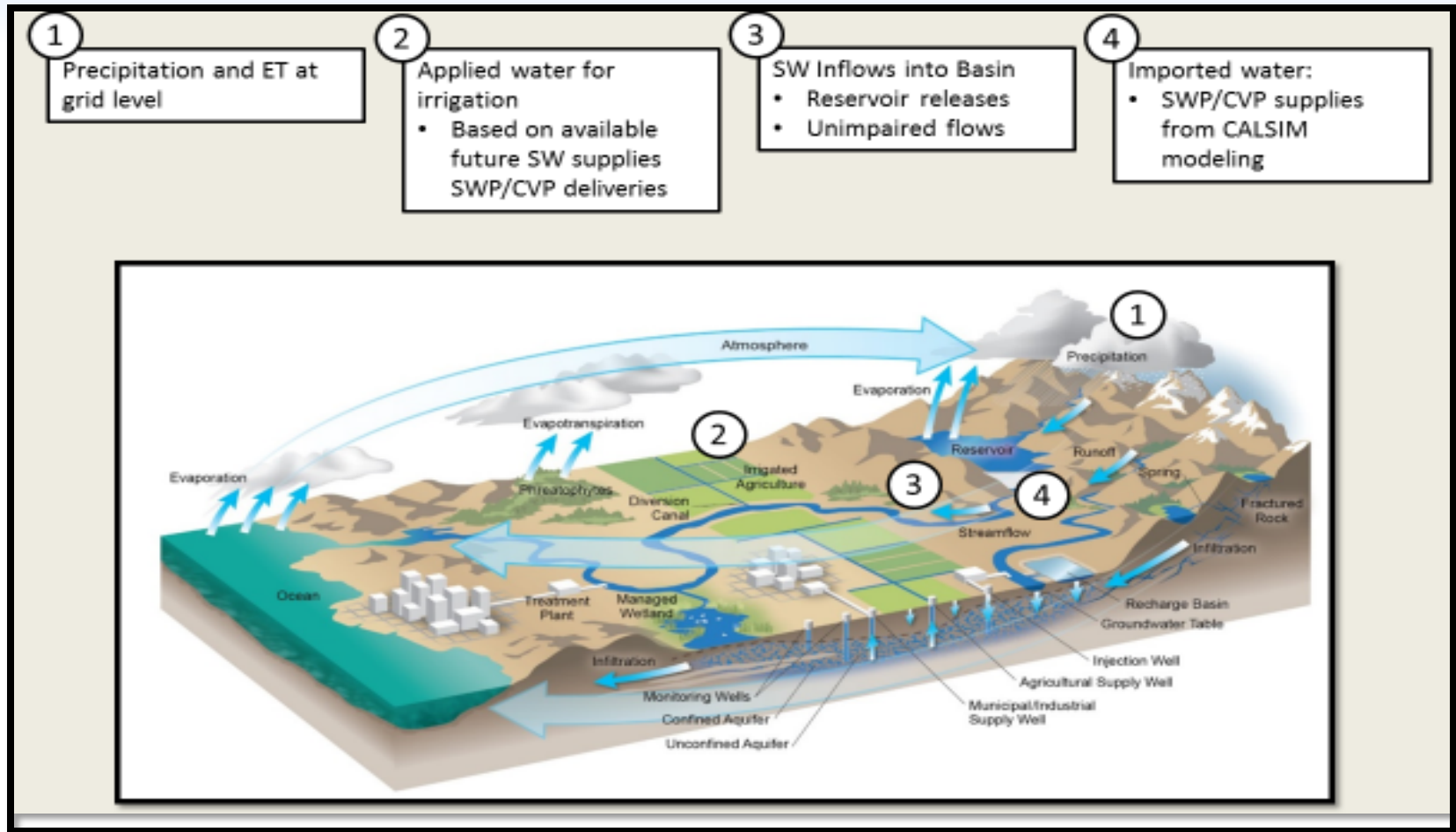


SGMA Climate Change Information to be Provided

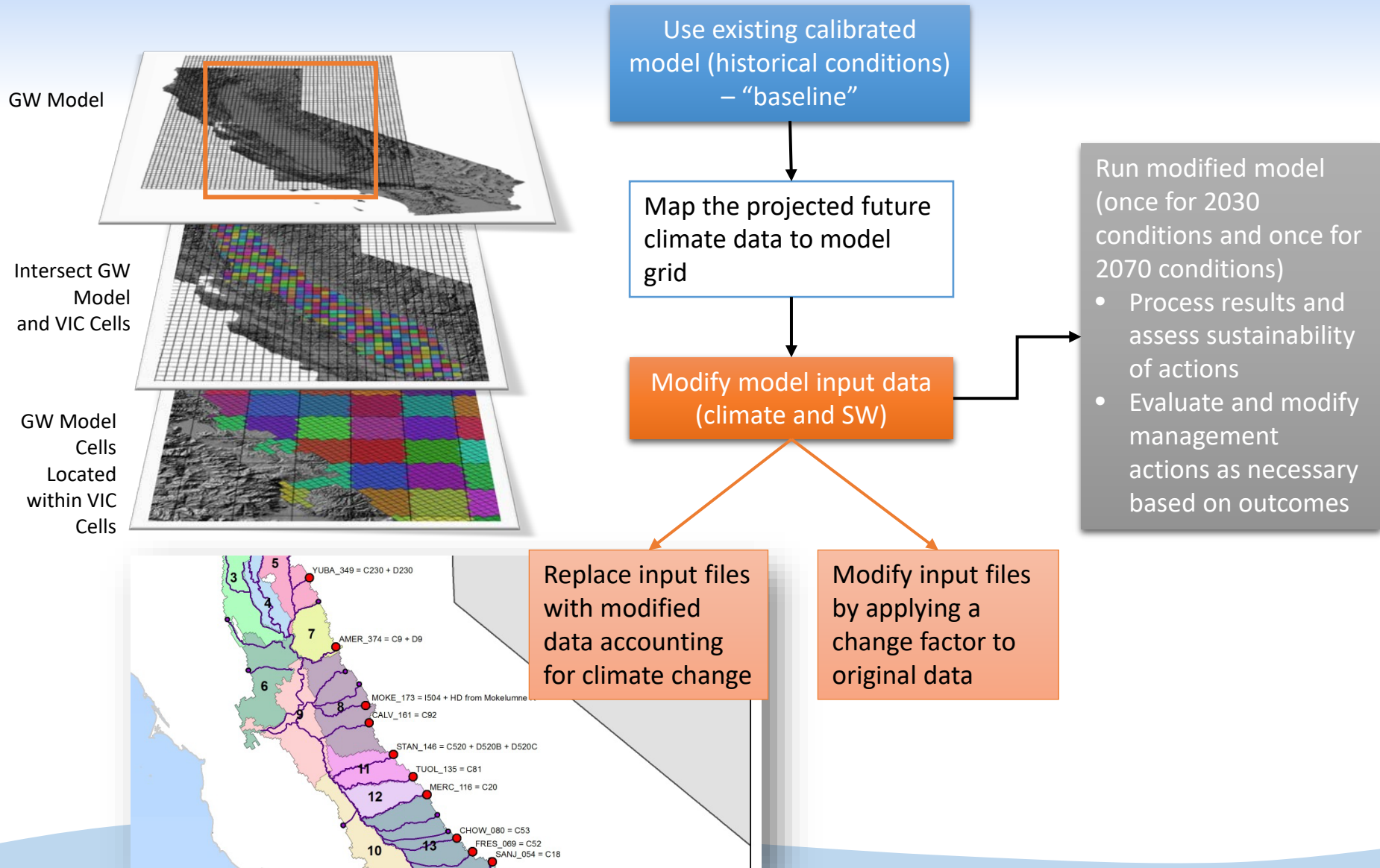


ET: Evapotranspiration; VIC: Variable Infiltration Capacity; SWP: State Water Project; CVP: Central Valley Project; CalSim: SWP and CVP Operations Model System

Water Budget Components to Modify for Future climate change based Projections



GW Model Components to Modify for Future climate change based Projections



Other SGMA – Tools Currently Available

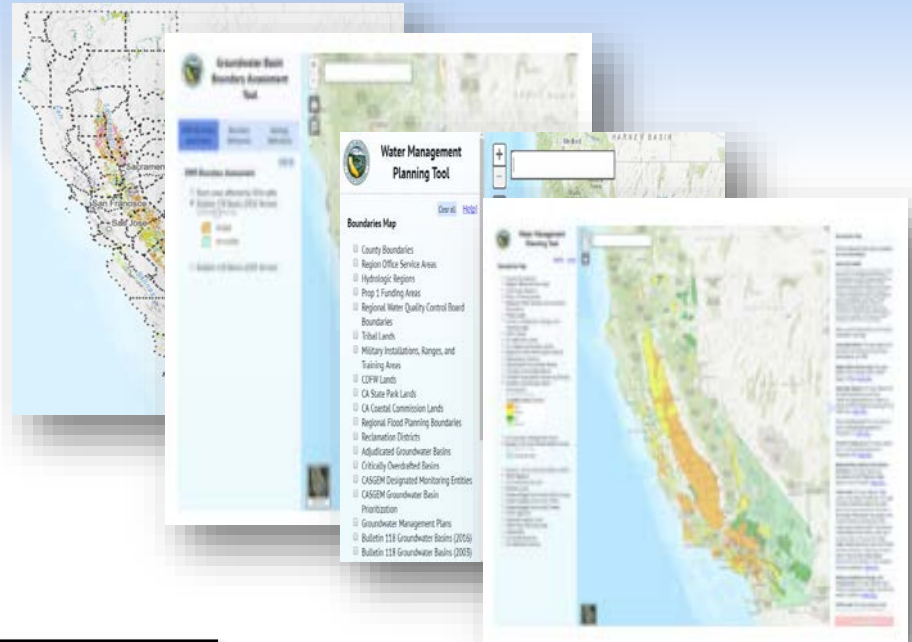
Online Map Viewers

Land Use Viewer

GW Basin Boundary
Assessment Tool

GW Information Tool

Water Management Planning
Tool

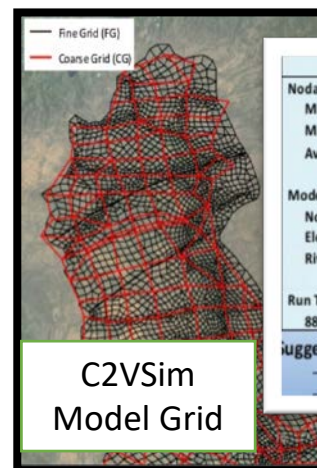


MODELS

C2VSim (Fine Grid – Q1 2018)

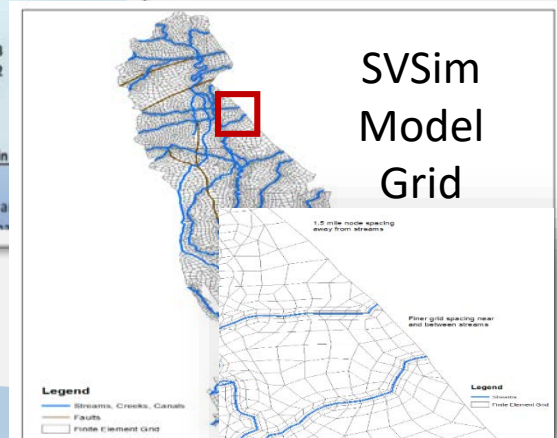
SVSim (Q1 2018)

IWFM – Currently available)



C2VSim
Model Grid

| | Coarse Grid | Fine Grid |
|-----------------|---------------------------------------------------------|---------------------|
| Nodal Spacing | | |
| Minimum | 0.6 mi | 0.4 mi on rivers |
| Maximum | 9.4 mi | 1.5 mi on edge |
| Average | 14.4 mi ² | 0.6 mi ² |
| Model Grid | | |
| Nodes | 1,393 | |
| Elements | 1,392 | |
| River nodes | 449 | |
| Run Time | | |
| 88 years | 3-6 min | |
| Suggested uses: | - CG region-scale analysis - FG local-scale analysis | |



SVSim
Model
Grid

DWR Contacts & SGMA Resources

DWR Sacramento:

- **Steven Springhorn**
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- **Tyler Hatch**
Tyler.Hatch@water.ca.gov

SGMA Resources

- **DWR SGMP Webpage**
www.water.ca.gov/groundwater/sgm/index.cfm
- **Subscribe to DWR SGMP Email List**
www.water.ca.gov/groundwater/sgm/subscribe.cfm
- **DWR Data, Tools, and Reports Webpage**
http://www.water.ca.gov/groundwater/sgm/data_tools_reports.cfm

DWR Regional Offices:

