Predicting Water Discharge Rates on the Russian River

Recent History and Future Climate Change Scenarios

Investigators

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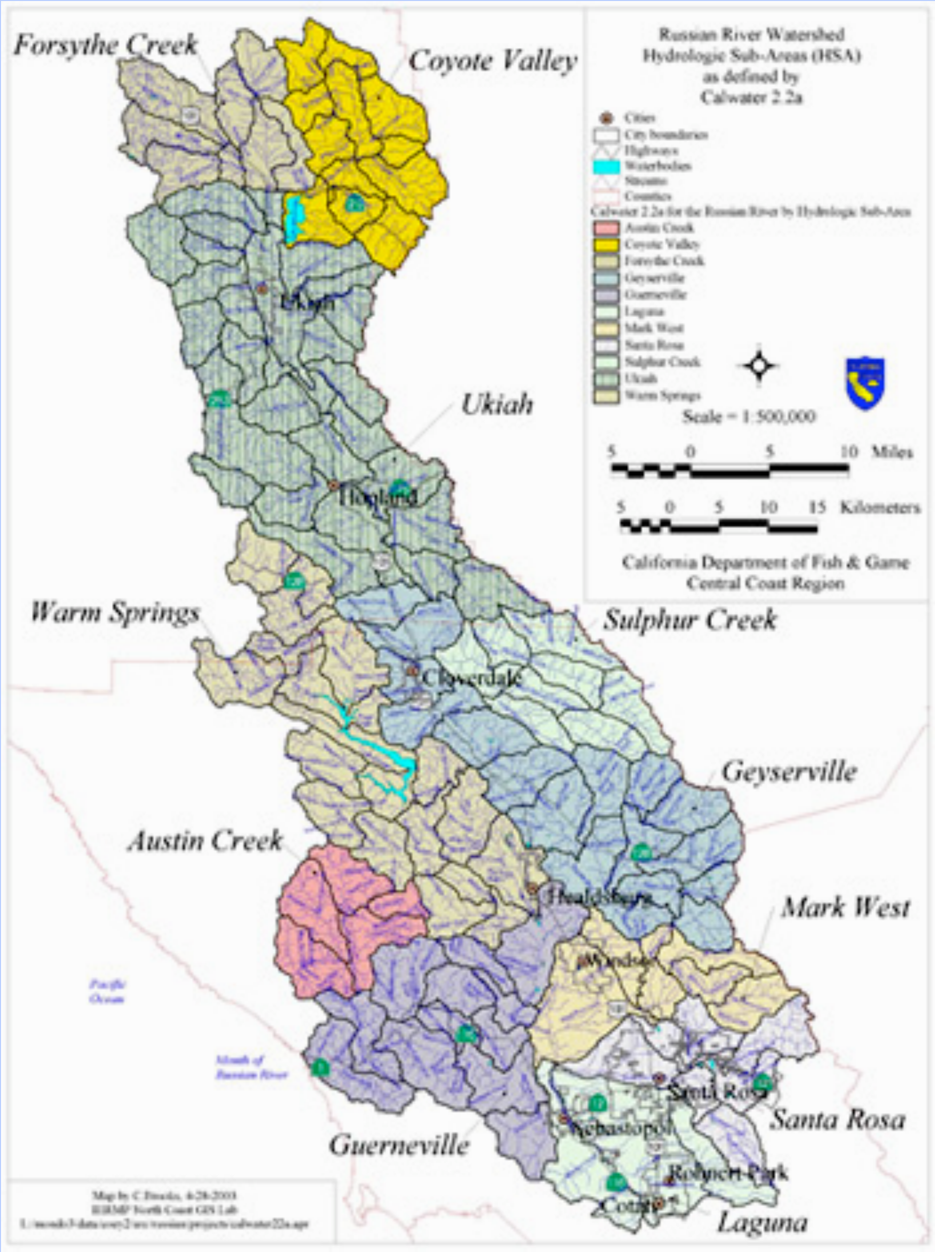
Russian River Profile

• Lake Mendocino and Lake Sonoma provide water for agriculture, municipal and industrial uses, in addition to maintaining the minimum stream flows required by Agency water rights permits.

• Minimum stream flows provide recreation and fish passage for salmon and steelhead.

• Most of the stream flow during the summer is provided by water imported from the Eel River drainage.

• Stream flows are augmented by releases from Lake Mendocino and Lake Sonoma.

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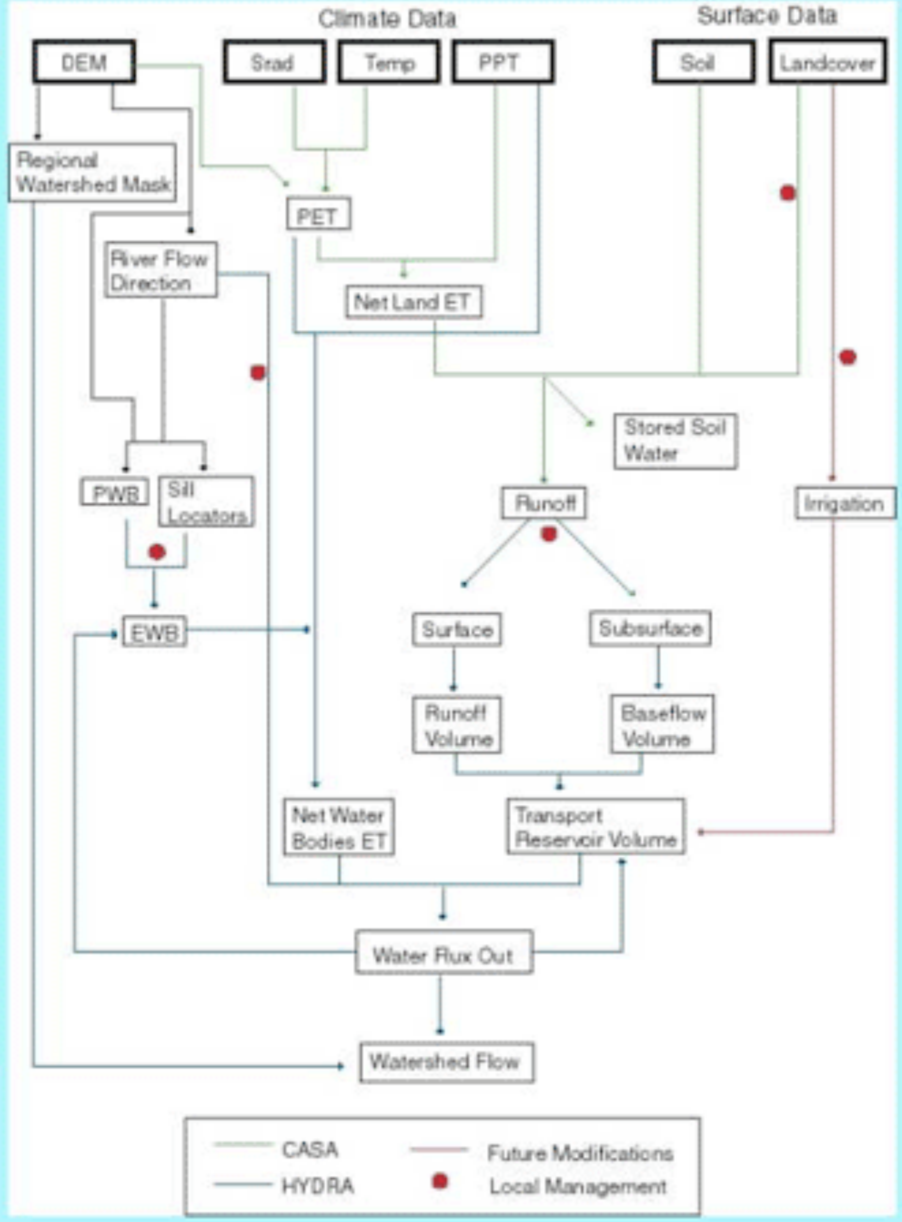
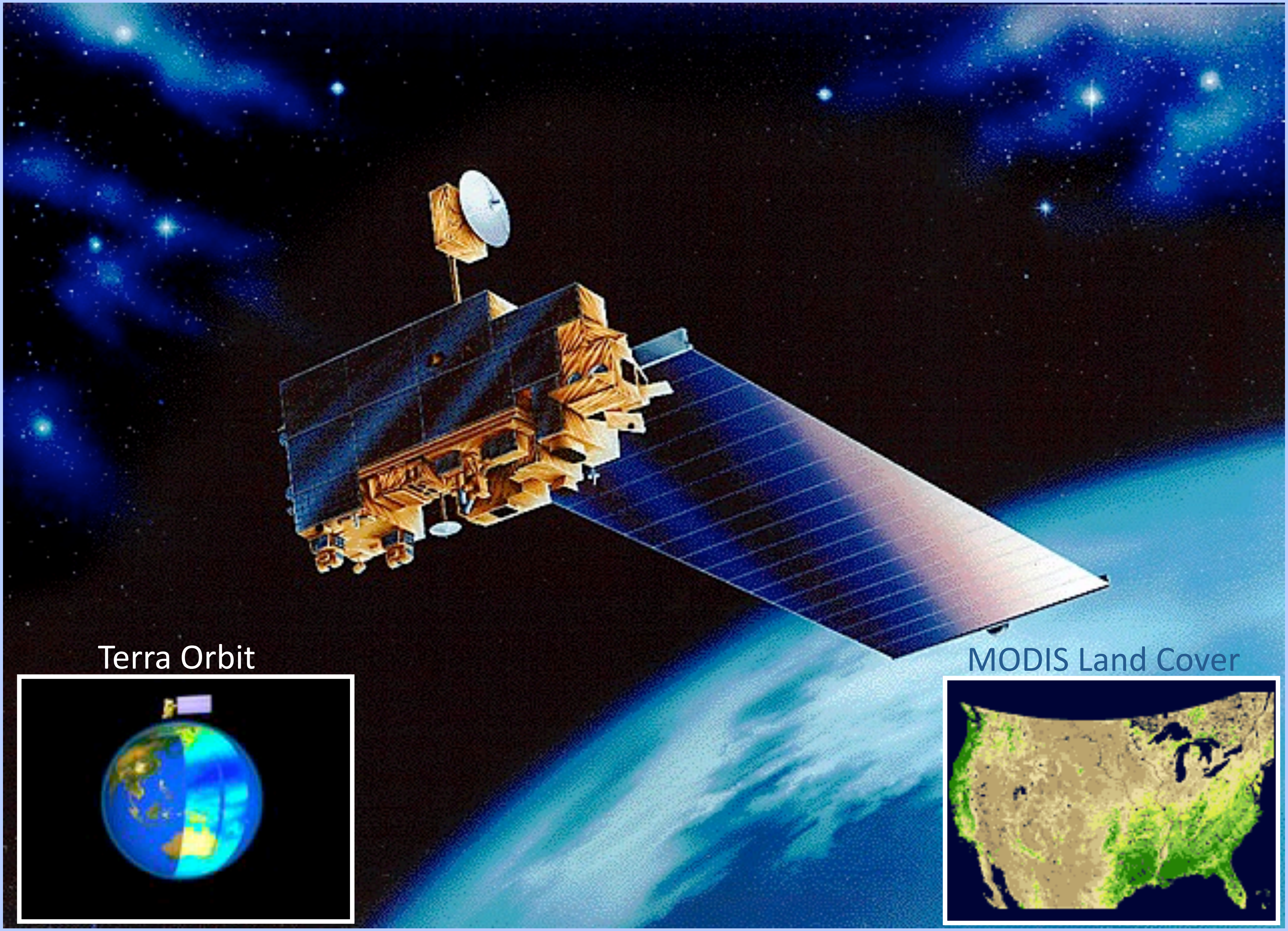
CASA-HYDRA Land Surface Hydrology Modeling

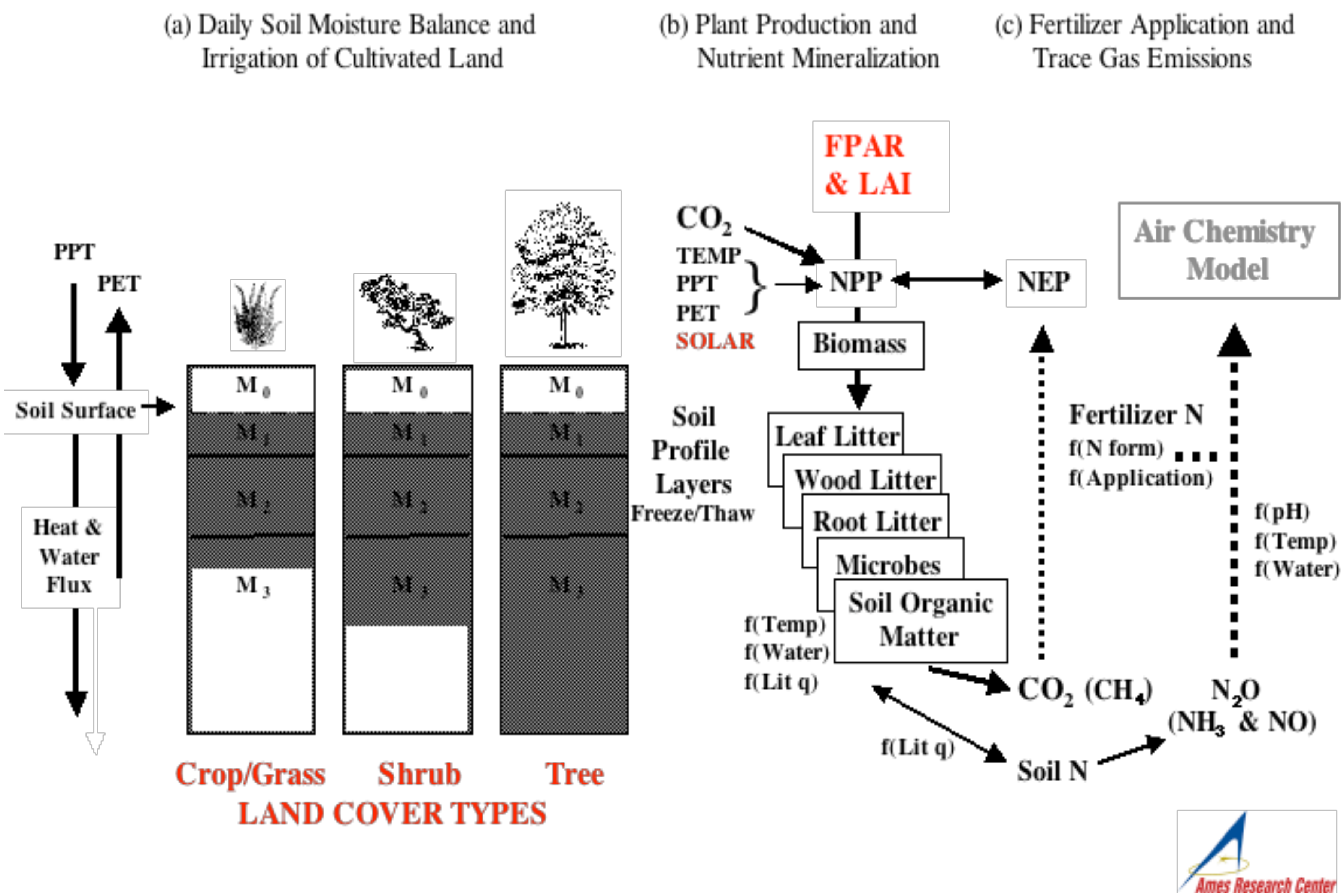


NASA *Terra* Satellite with MODIS



NASA-CASA Simulation Model

Satellite Product Inputs



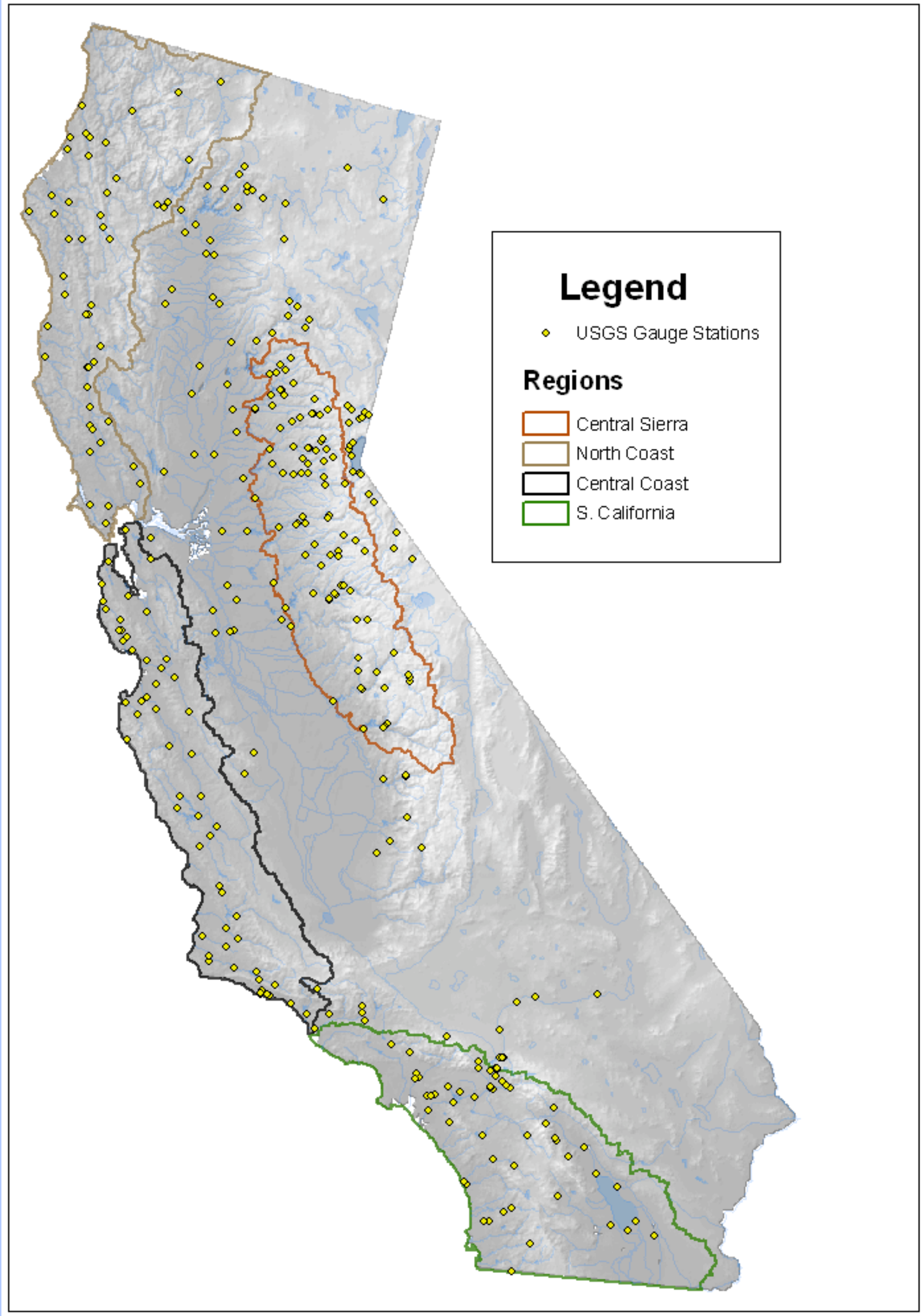
CASA-HYDRA for CA

- River channel delineation and water routing directions for HYDRA rely on high resolution (e.g., 30-meter resolution SRTM) digital elevation models (DEMs).

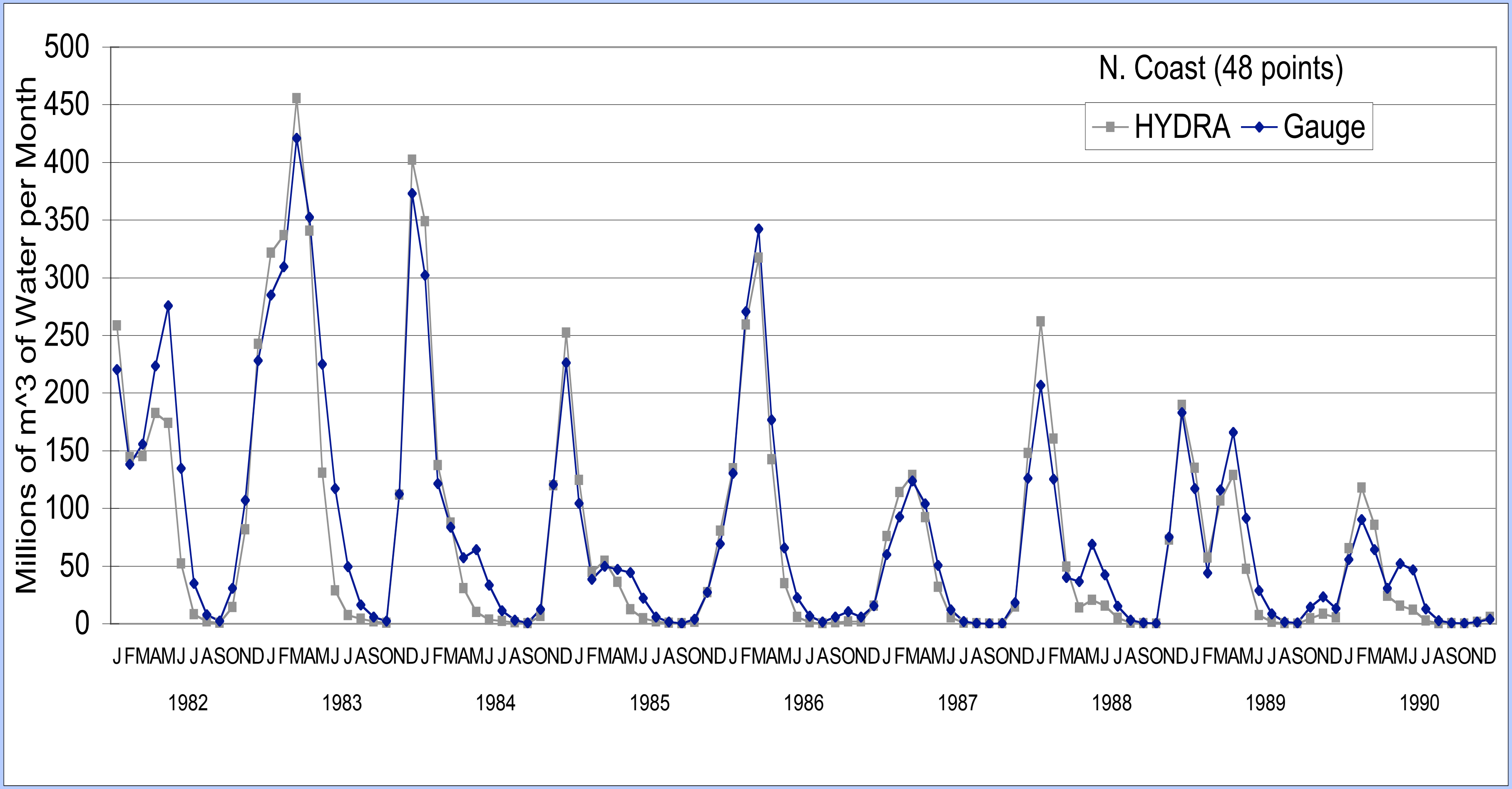
- Satellite imagery of land cover and land use patterns at 30-meter resolution (Landsat) are model inputs used to refine soil water predictions in CASA.

- Inclusion of irrigation losses and related diversions of river drainage water (canals and aqueducts) within valley cropland areas are required to refine mean annual flow predictions in HYDRA.

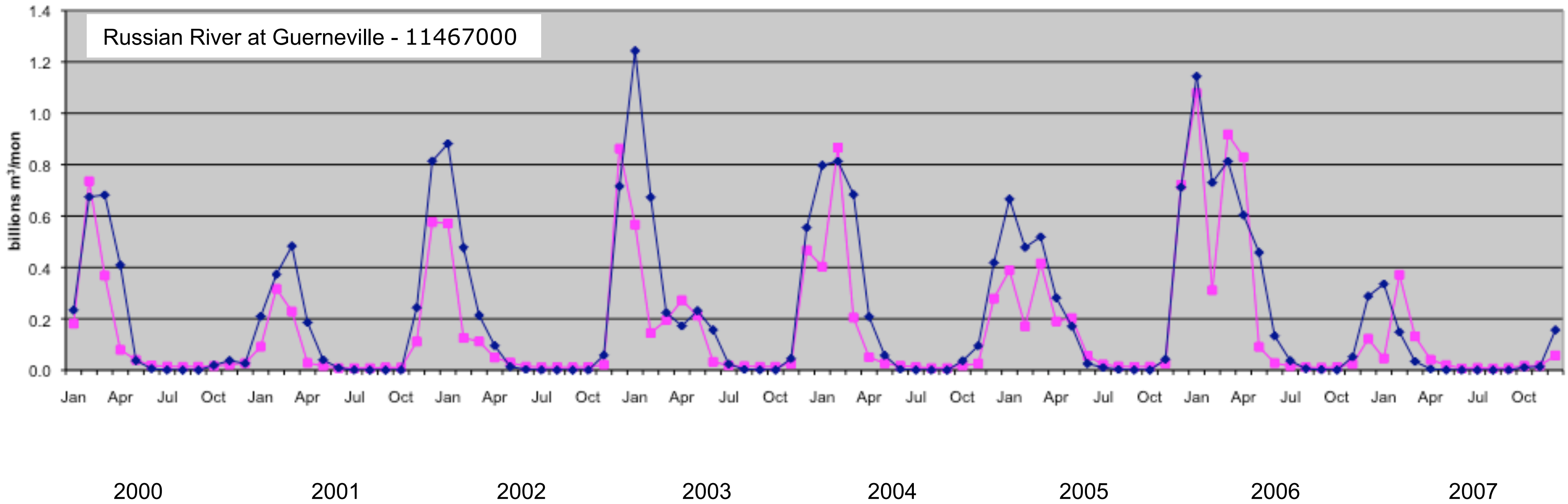
- Inclusion of dam and power house effects and related release schedules of drainage water in upland areas are required to refine mean seasonal and annual flow predictions in HYDRA.

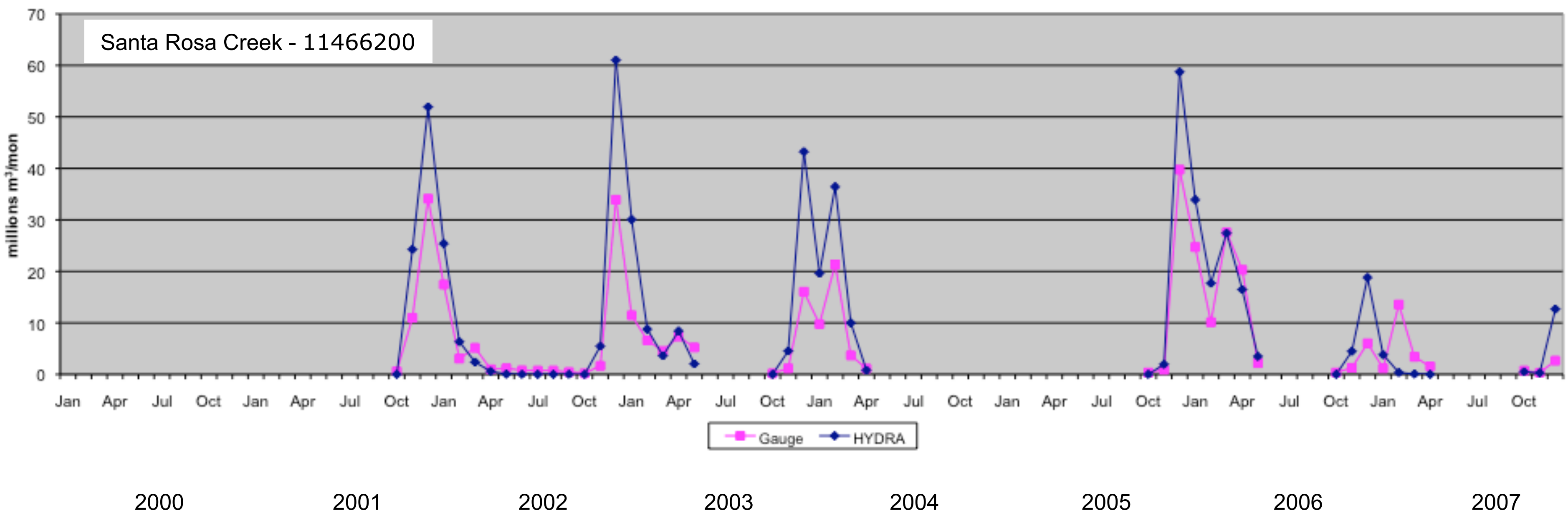


Potter, C., J. Shupe , P. Gross, V. Genovese, S. Klooster, 2009, **Modeling River Discharge Rates in California Watersheds**, (*under journal review*).

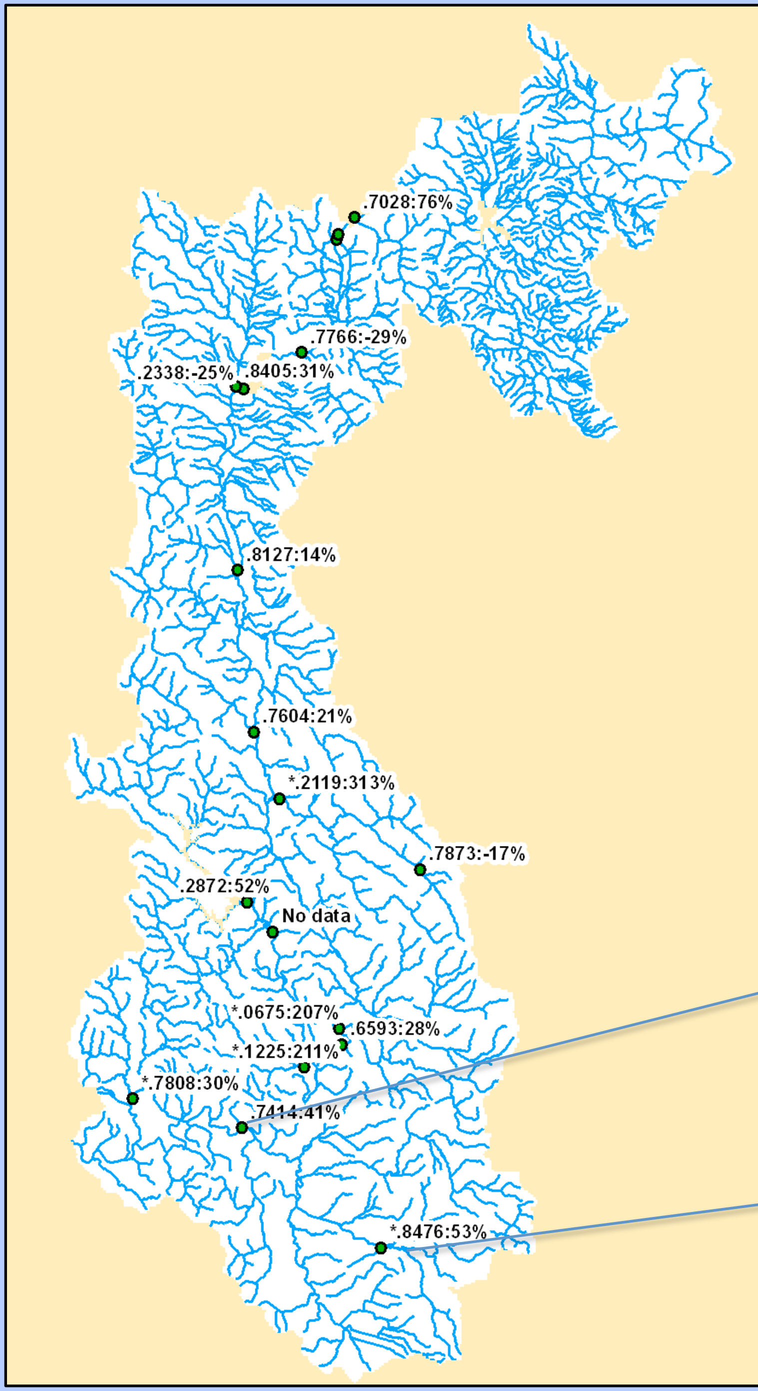


CASA-HYDRA Discharge Rates on the Russian River 2000-2007



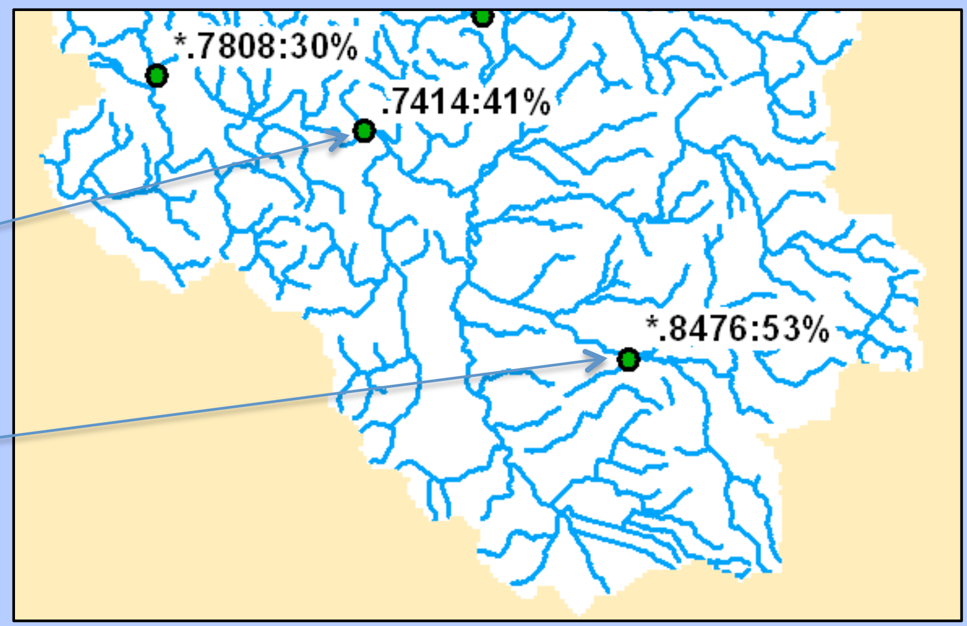


Basin-wide Model Evaluation



• Initial model-gauge correlation results show R^2 values 0.75 and 0.85 for most monthly gauge flow records over the period 2000-2007.

• Overestimation of annual flows must be corrected for multiple diversions and demands for irrigation water supply.



Predicting Future River Flows on the Russian River

Top Floods (documented)

1. 48.8 - 2/18/1986
2. 48.0 - 1/10/1995
3. 47.6 - 12/23/1955
4. 47.4 - 12/23/1964
5. 46.9 - 2/28/1940
6. 45.0 - 1/1/1997
7. 42.5 - 1/5/1966
8. **41.8 - 1/1/2006**
9. 41.5 - 3/10/1995
10. 41.3 - 1/24/1970
11. 41.1 - 2/1/1963
12. 40.7 - 1/17/1974
13. 40.4 - 1/27/1983
14. 40.2 - 2/25/1958
15. 39.5 - 1/22/1943
15. 39.5 - 1/14/1969
15. 39.5 - 1/17/1978

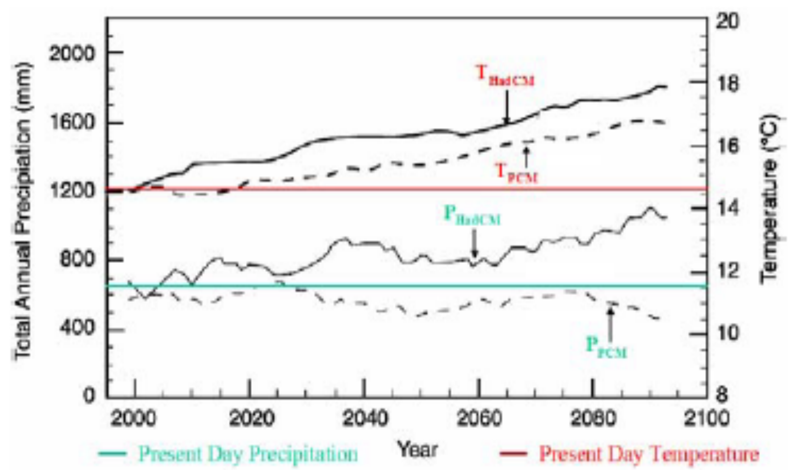
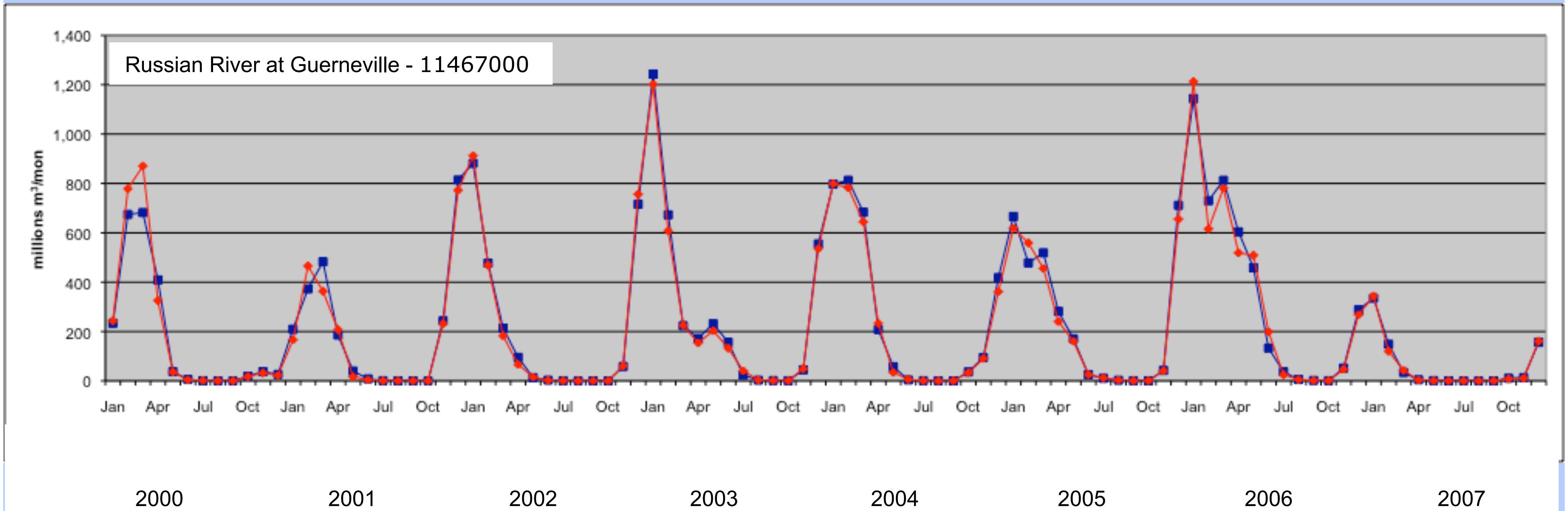
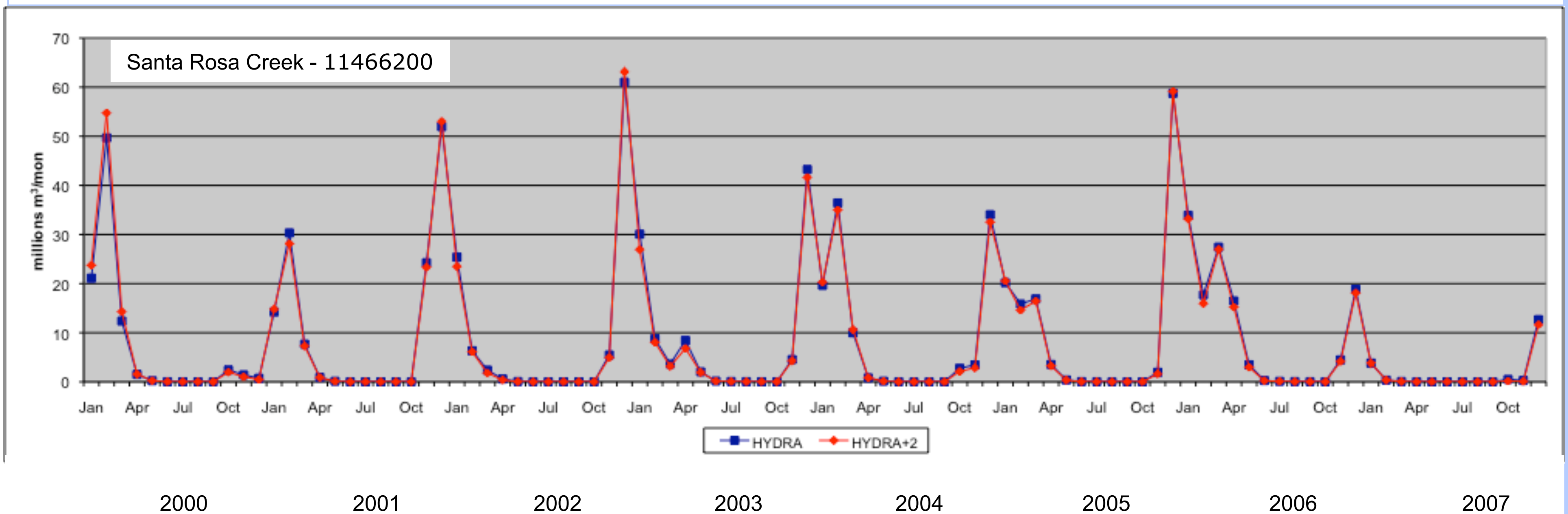


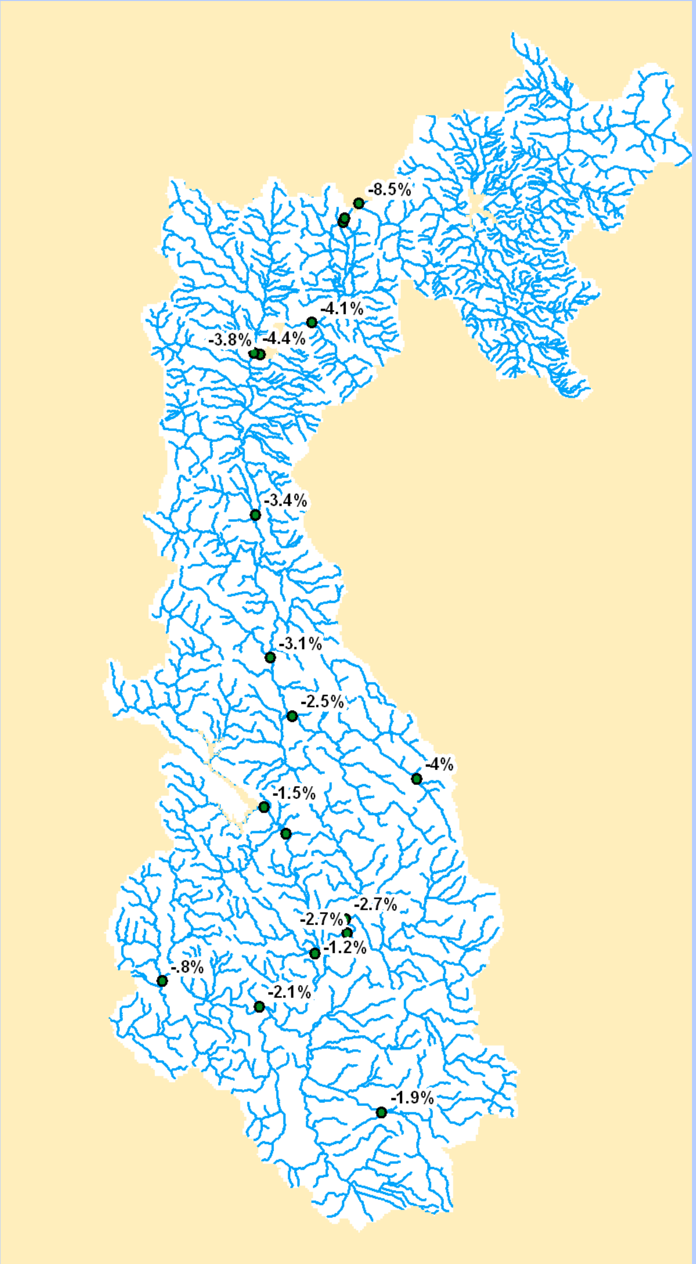
Fig. 6. The California area-averaged temperature for HadCM2 and PCM show an increase from present day (red) of approximately 4.5°C and 2.1°C, respectively, by 2100. While the HadCM2 shows a precipitation increase of approximately 1.9% and the PCM decreases by 0.85% from the present day precipitation (green).

CASA-HYDRA Discharge Rates on the Russian River +2º C





CASA-HYDRA Discharge Rates on the Russian River +2° C



Basin-wide Model Evaluation

- Based on the average of the 15 gauge locations in the watershed, there is 3% less water discharge with a 2° C rise in temperature.

- There is a greater loss of water in the northern sections of the watershed than in the southern sections with a 2° C rise in temperature.

- Flood stage (from 2006 prediction results) are not affected by 2° C rise in temperature, indicating that the majority of water loss would come in the recession and low-flow months of the year.