Tying California's Water System Together

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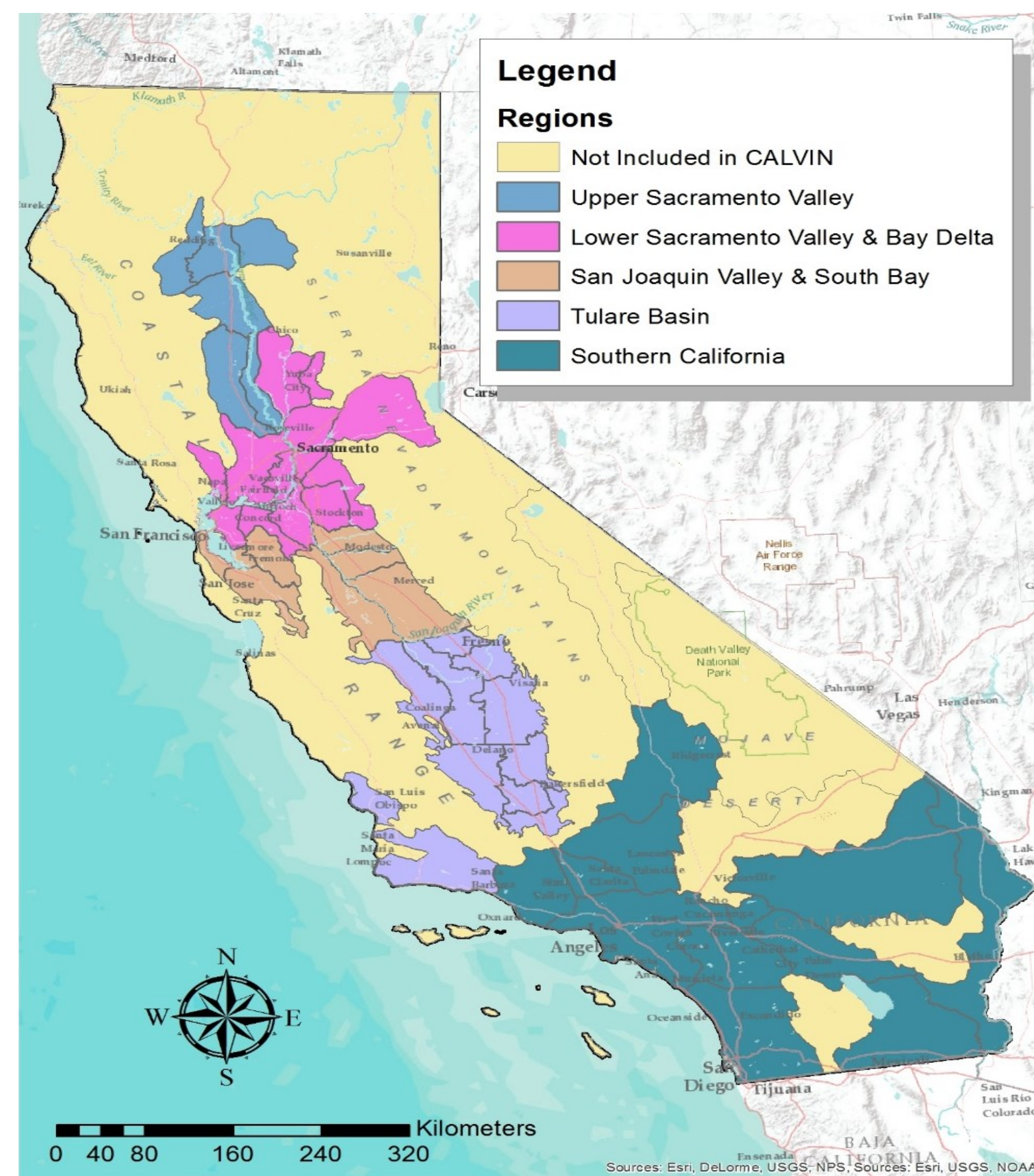
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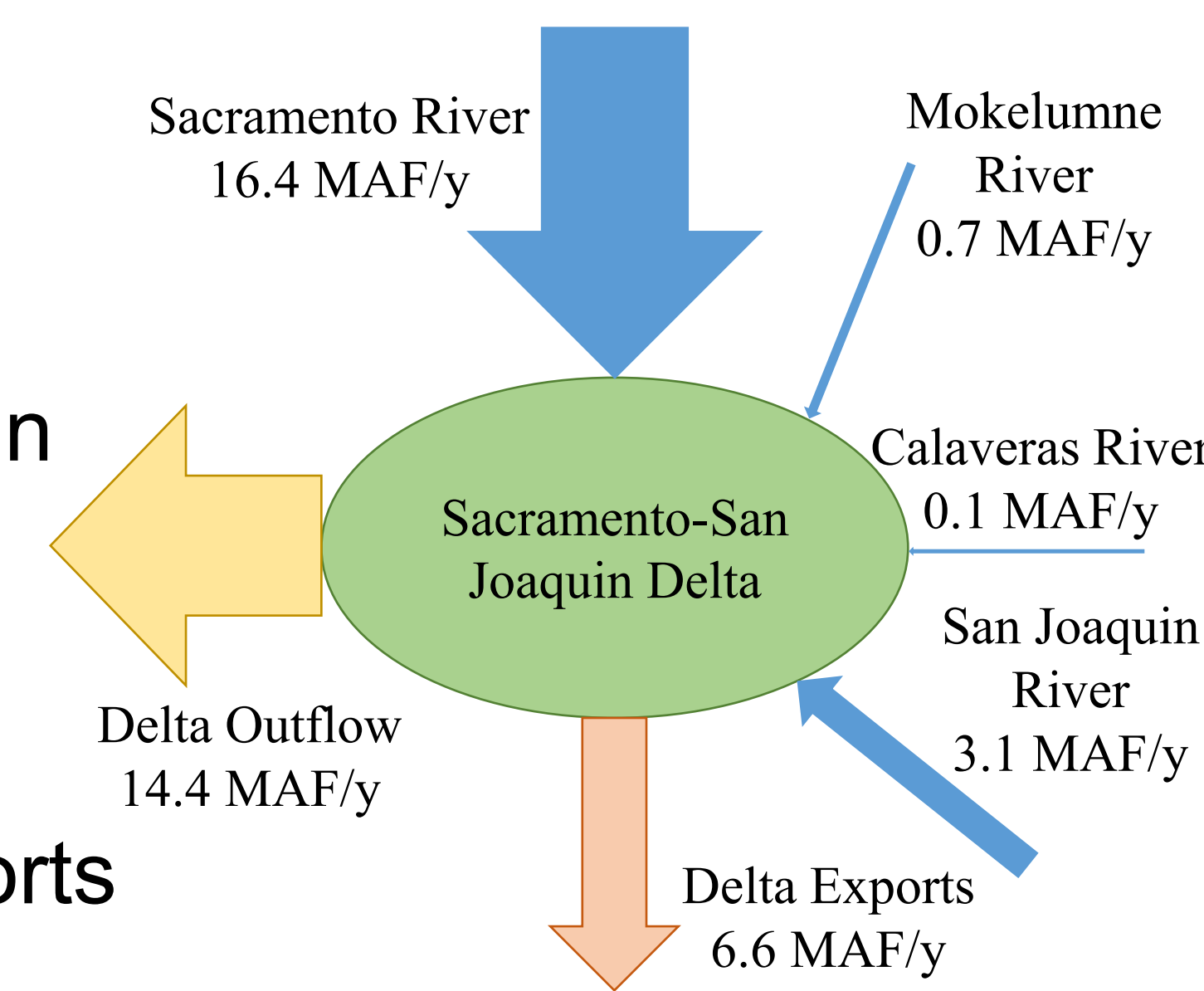
CALVIN Model

Model Description

- Hydro-economic optimization model
- 82 years of monthly hydrologic data and operations
- Economic values for agricultural and urban uses
- Flow constraints for environmental and wildlife refuge uses
- Conjunctive use of groundwater and surface water
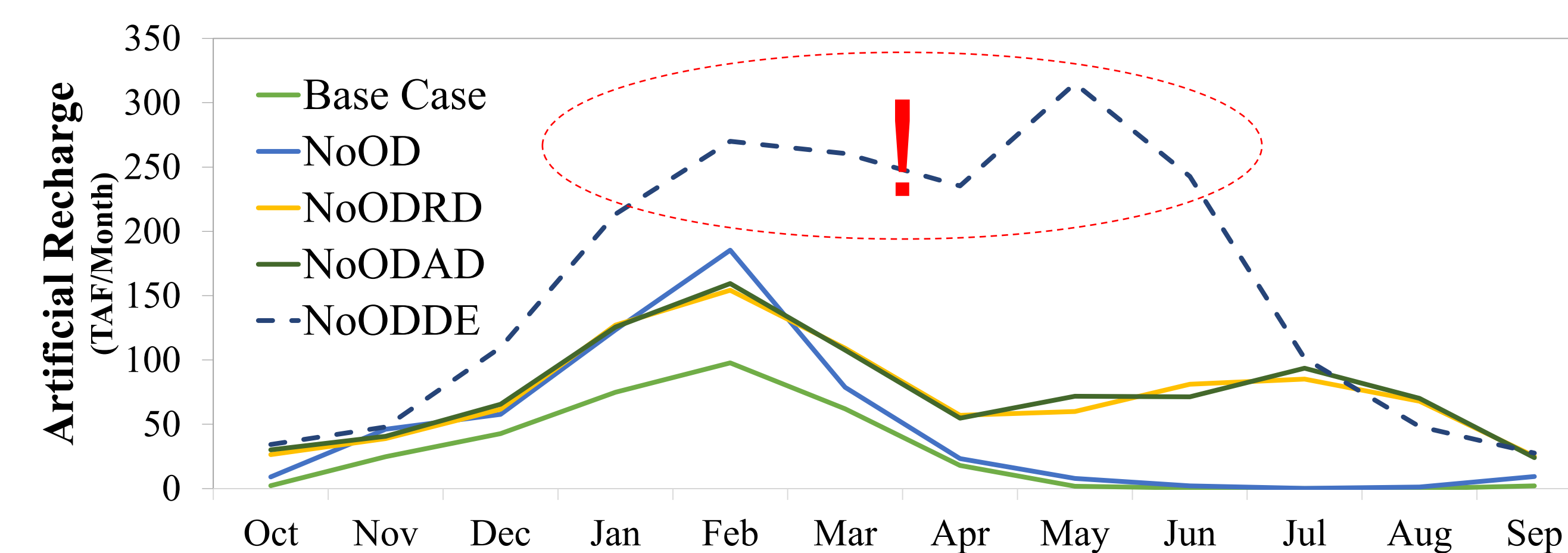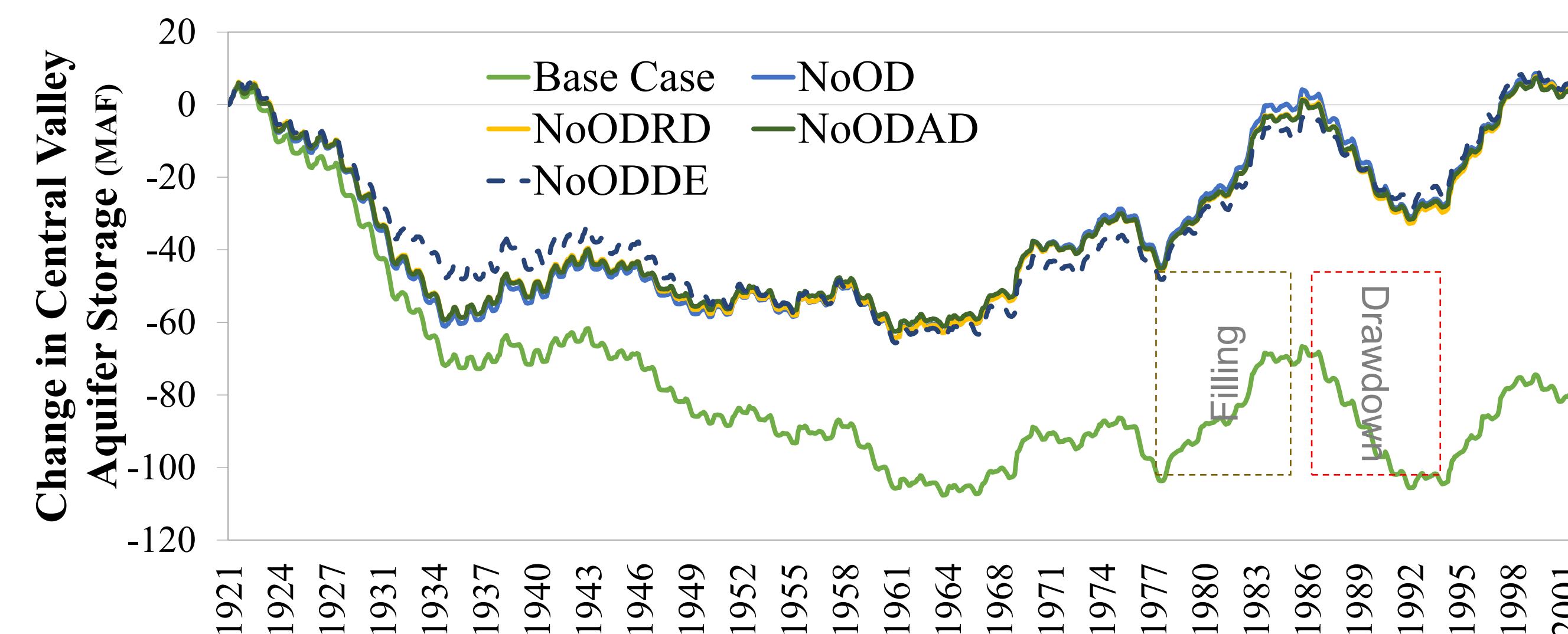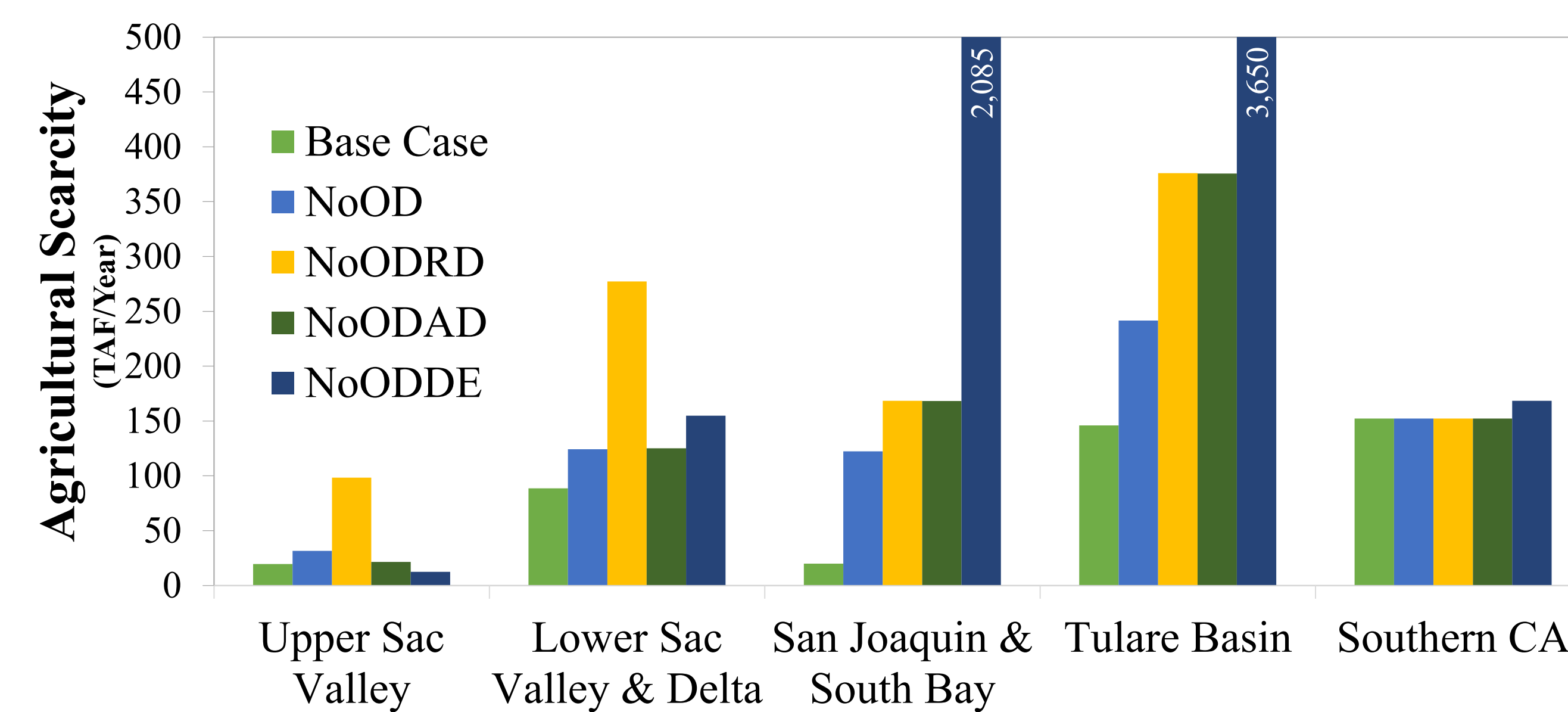- Minimize statewide operating and scarcity cost

Legend — Regions:
- Not Included in CALVIN
- Upper Sacramento Valley
- Lower Sacramento Valley & Bay Delta
- San Joaquin Valley & South Bay
- Tulare Basin
- Southern California

Overdraft

Definition

- Overdraft is the case where groundwater extraction through pumping exceeds recharge over a long period

Consequences

- Higher pumping cost
- Water quality degradation
- Land subsidence
- Salt intrusion in coastal areas
- Flow reduction in streams, wetlands, and springs that are hydraulically connected to underlying aquifer

Source: CDWR

Overdraft Management

Management Cases

- Base historical operations with overdraft (Base Case)
- No long-term overdraft in the Central Valley (NoOD)
- No overdraft and no reduction in Delta outflow (NoODRD)
- No overdraft and no additional Delta exports (NoODAD)
- No overdraft and no Delta exports (NoODDE)

Sacramento River 16.4 MAF/y
Mokelumne River 0.7 MAF/y
Calaveras River 0.1 MAF/y
San Joaquin River 3.1 MAF/y
Sacramento–San Joaquin Delta
Delta Outflow 14.4 MAF/y
Delta Exports 6.6 MAF/y

Results

Annual Average Delta Exports and Average Marginal Values

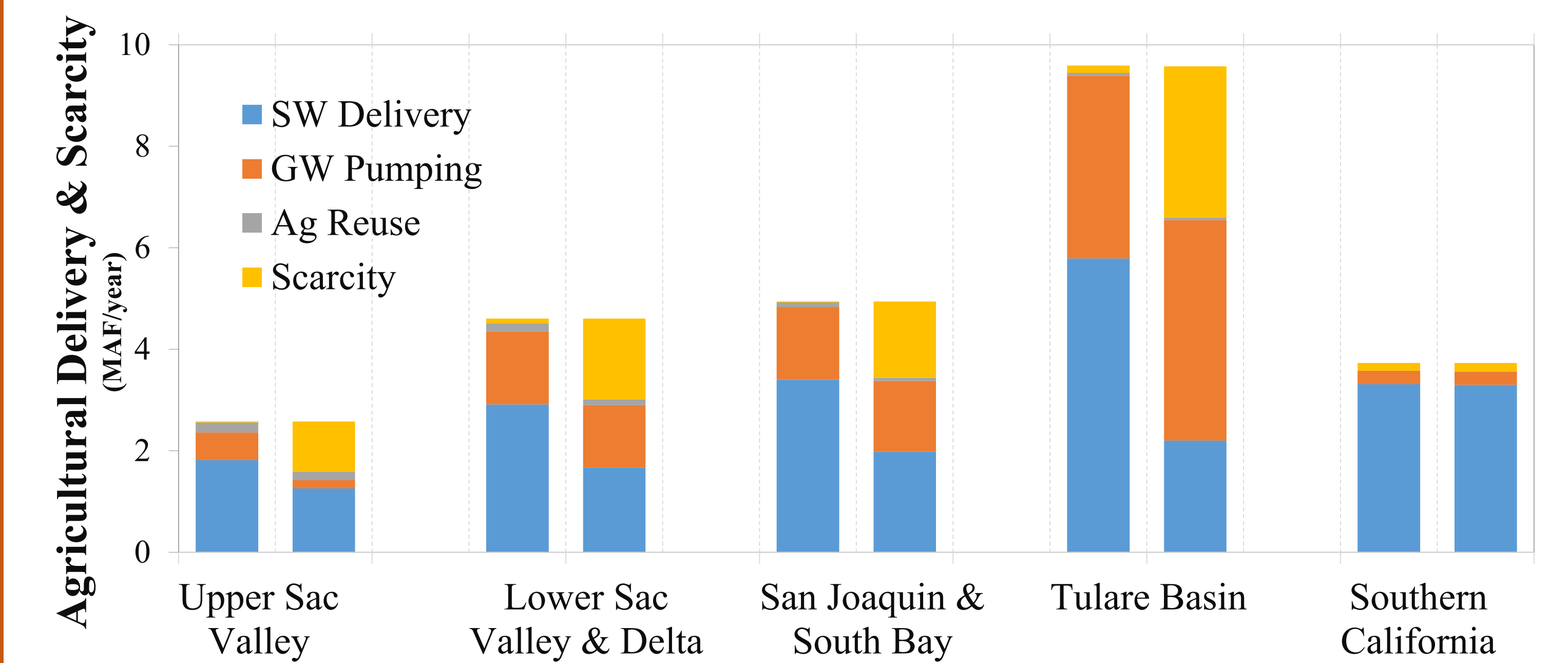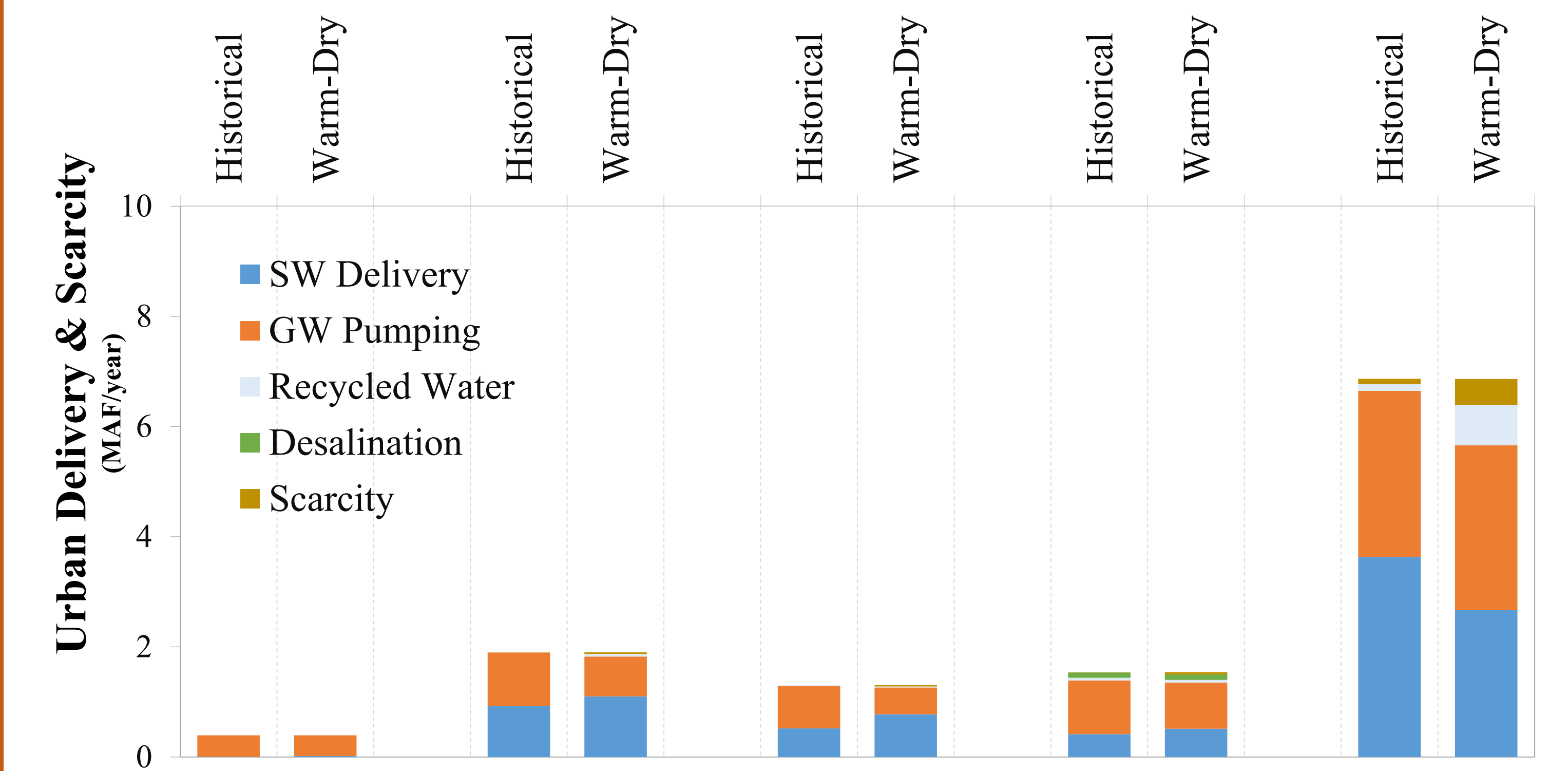| Case		Base Case	NoOD	NoODRD	NoODAD	NoODDE
Export (TAF/y)	Banks	4,108	4,657	4,158	4,108	251
	Tracy	2,478	2,597	2,475	2,478	167
	Total	6,587 → 7,254		6,634	6,587	418
Marginal Values on Upper Bound ($/AF)	Banks	14	16	13	65	1,761
	Tracy	8	14	8	58	1,756

Climate Change

Climate Scenario

- Warm and dry climate
- Hydrologic changes
  - Δ Stream flow: -28%
  - Δ Gw. inflow: -6%
  - Δ Local runoff: -68%
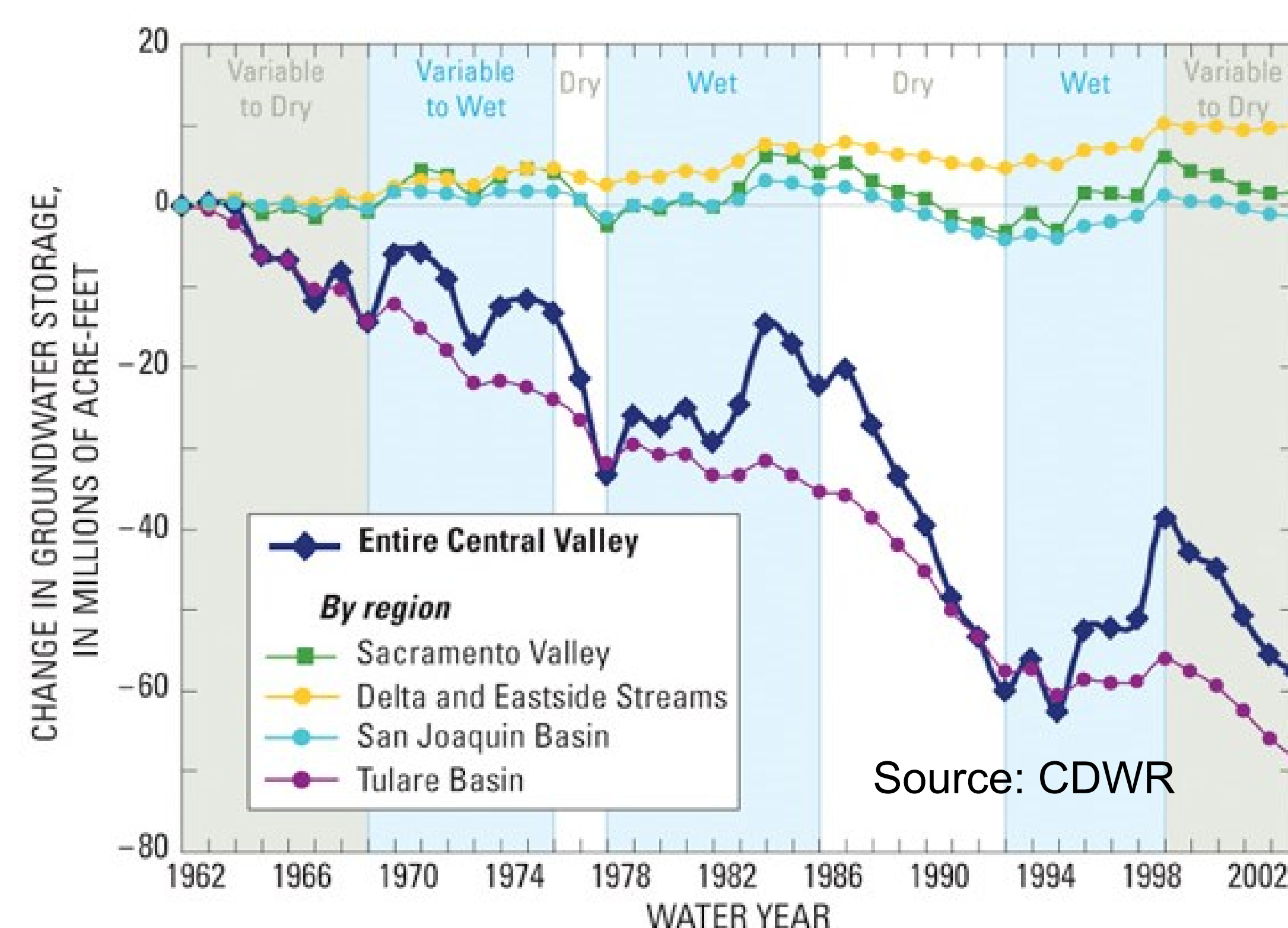 - Δ Overall: -26%
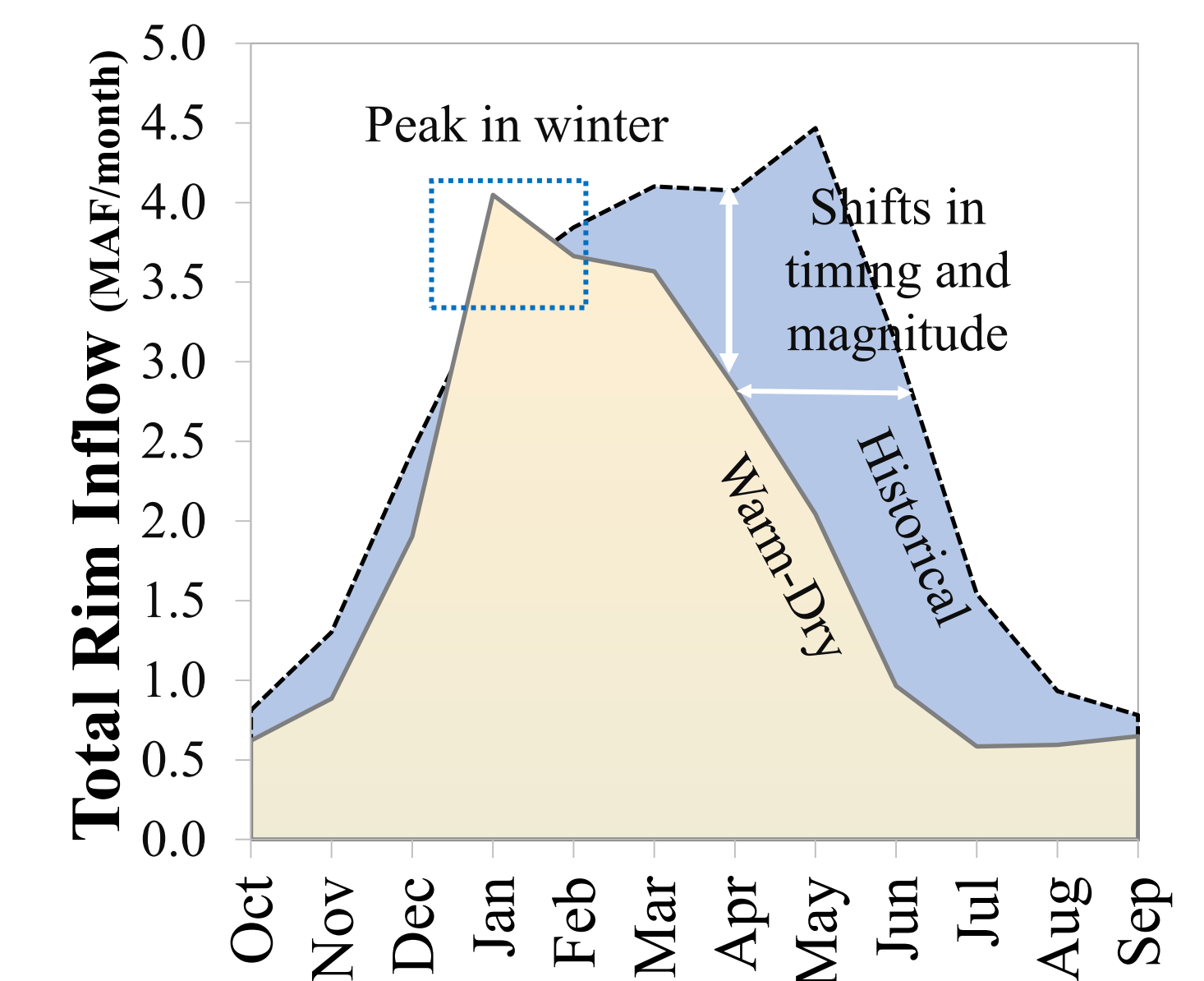
Temperature   Precipitation

Conclusions

- No overdraft policy and climate change effects on California's water supply system are evaluated
- Delta exports, water trading, and gw. banking are useful adaptations in overdraft and climate change management
- Conjunctive use of surface and ground water is essential to meet water demand and reduce scarcities
- New supply sources, such as wastewater recycling, have some potential in the southern California

For more results:
https://watershed.ucdavis.edu/shed/lund/CALVIN/
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