

Sacramento Valley Groundwater Basin Profile



Basin Summary Statistics

Size¹: 1,587 square miles

Elevation²: Range: 453-8,356 ft; Median: 2,620 ft

Top 3 land cover types by area³: Shrub/Scrub (95%), Evergreen Forest (3.0%), Developed – Low Intensity (0.63%)

Major surface watershed(s)⁴: Sacramento Wash

Groundwater subbasins¹: None

Groundwater-derived streamflow fraction⁵:

0.50 (Moderate)



Mean Annual Hydrologic Cycle Components (1980-2020) SACRAMENTO VALLEY

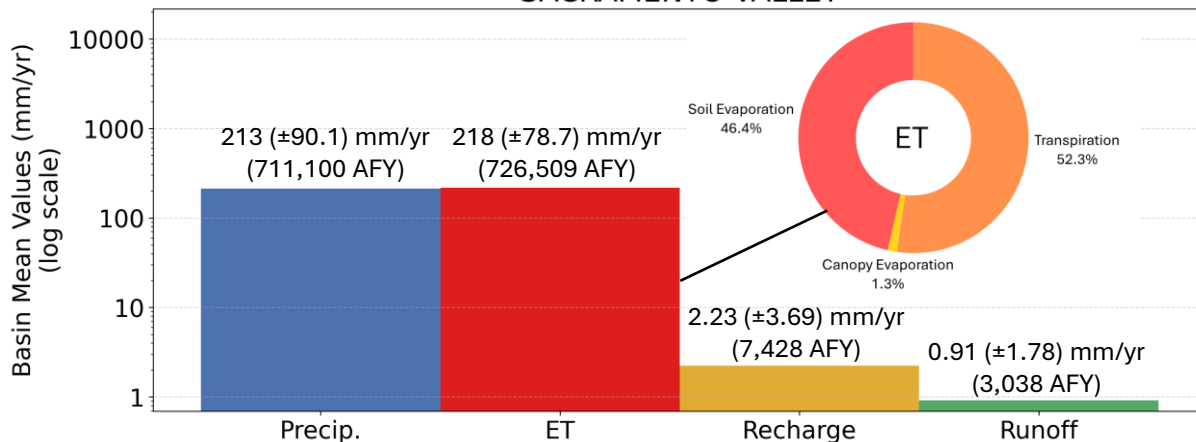


Figure 1 (above). Bar chart showing Noah-MP modeling results of the historical mean annual hydrologic cycle components (precipitation [P], evapotranspiration [ET], natural recharge, and runoff) in the basin from 1980-2020.⁶ ET is partitioned into soil evaporation, canopy evaporation, and transpiration. It is possible for ET to be greater than P when there are other sources such as groundwater, surface water, or water in storage.

Mean Monthly Hydrologic Cycle Components (1980-2020) SACRAMENTO VALLEY

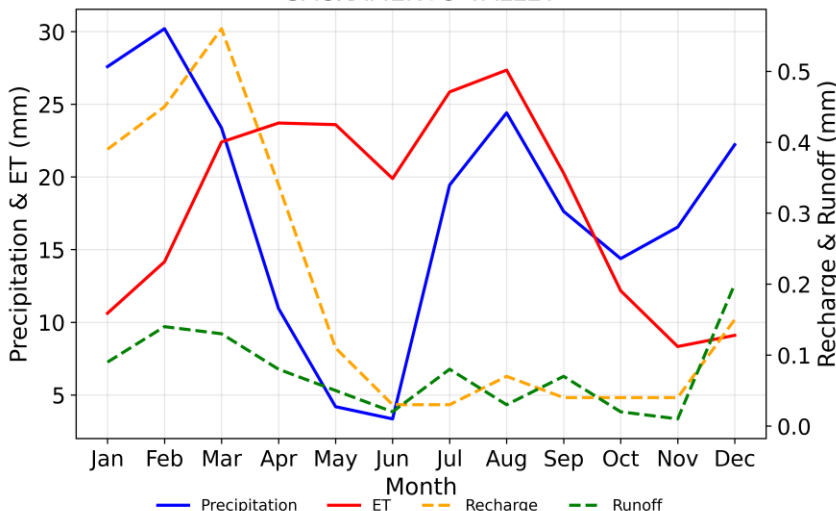


Figure 2. Graph showing monthly mean precipitation, ET, recharge, and runoff for the groundwater basin (1980-2020) from Noah-MP modeling results.⁶

Precipitation (P) in the Sacramento Valley basin is affected by the North American Monsoon during the summer months and large frontal systems during the winter. On annual timescales, evapotranspiration (ET) is approximately equal to P, resulting in low basin-wide averages of natural recharge (2.23 mm/yr) and runoff (0.91 mm/yr). Soil evaporation makes up 46.4% of total ET in the basin, while transpiration comprises 52.3% and canopy evaporation accounts for the remainder (1.3%). Natural recharge is slightly higher in the cooler months when P exceeds ET.

Sacramento Valley



Figure 3 (below). Gridded depiction of mean annual water fluxes across the groundwater basin from Noah-MP modeling (1980-2020): (a) precipitation, (b) evapotranspiration, (c) recharge, (d) runoff.⁶ Major cities/towns⁷ and Native American Reservation boundaries⁸ are shown (as applicable) to help orient the reader.

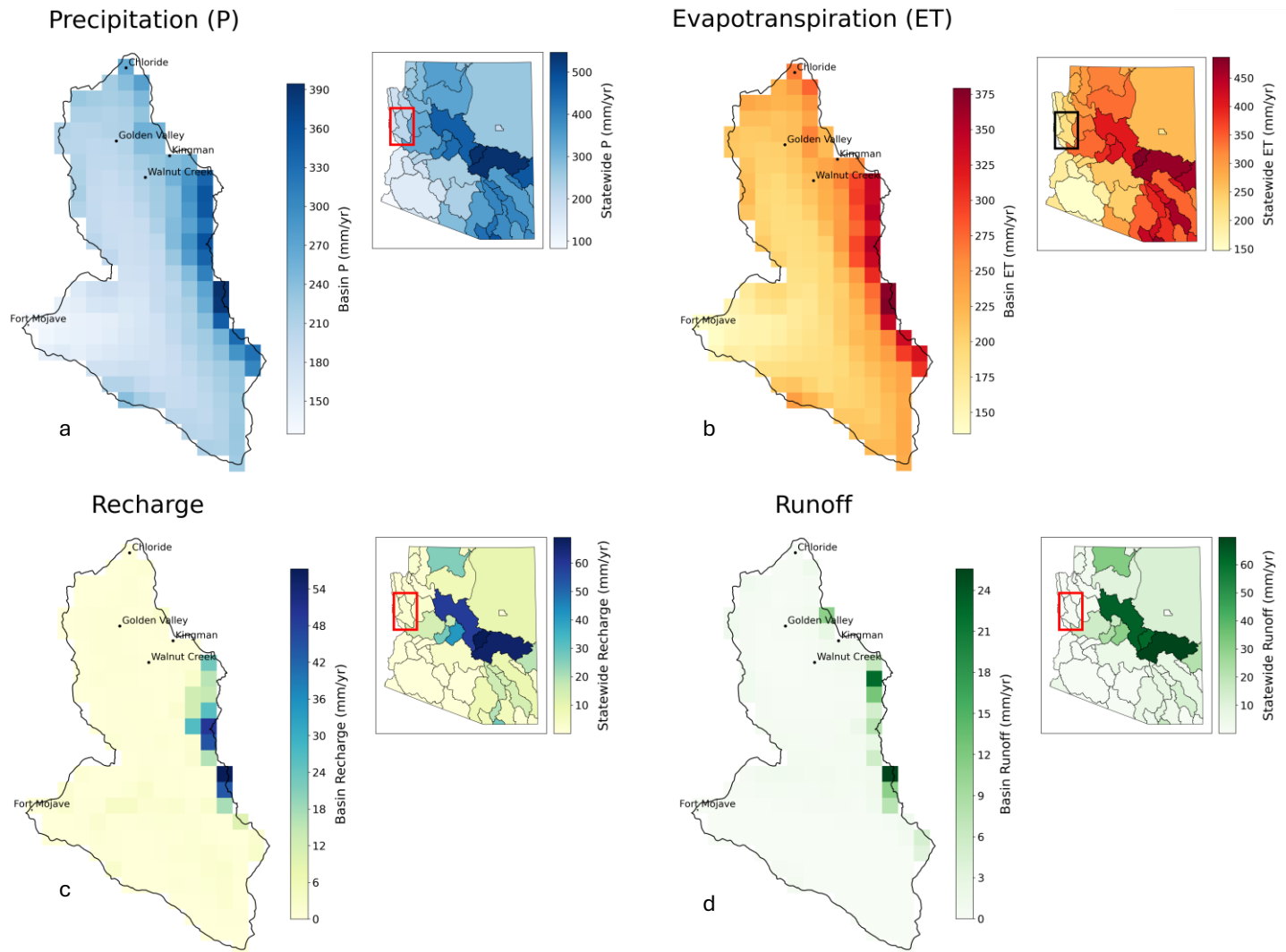
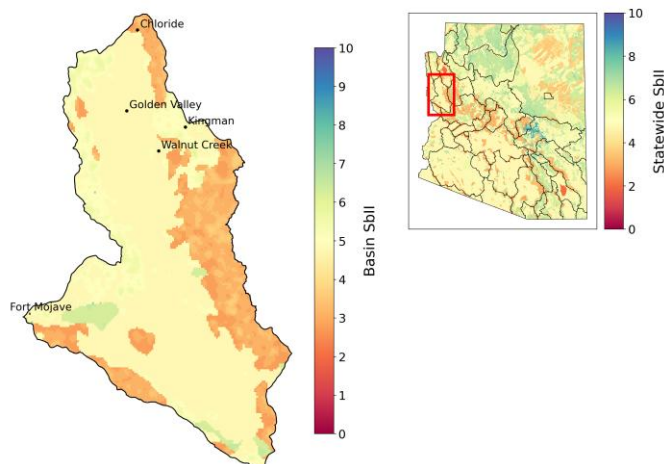


Figure 4 (below). Subsurface infiltration index (SbII) showing infiltration potential of the subsurface across the groundwater basin on a scale of 1-10 based on geologic features.⁹

Subsurface Infiltration Index (SbII)



Precipitation (P) in the Sacramento Valley basin is greatest at the higher elevations, particularly in the Hualapai Mountains where P can exceed 360 mm/yr on average. ET (~350 mm/yr), natural recharge (~50 mm/yr), and runoff (~15 mm/yr) are also highest in this region. Infiltration potential varies across the basin. The area of highest infiltration potential results from higher permeability soils in the alluvial fans along the Sacramento Wash just south of the Warm Springs Wilderness in the eastern portion of the basin.

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Climate Change Projections: Changes in Temperature, Precipitation, ET, Recharge, and Runoff (2060-2099 vs. 1981-2020)

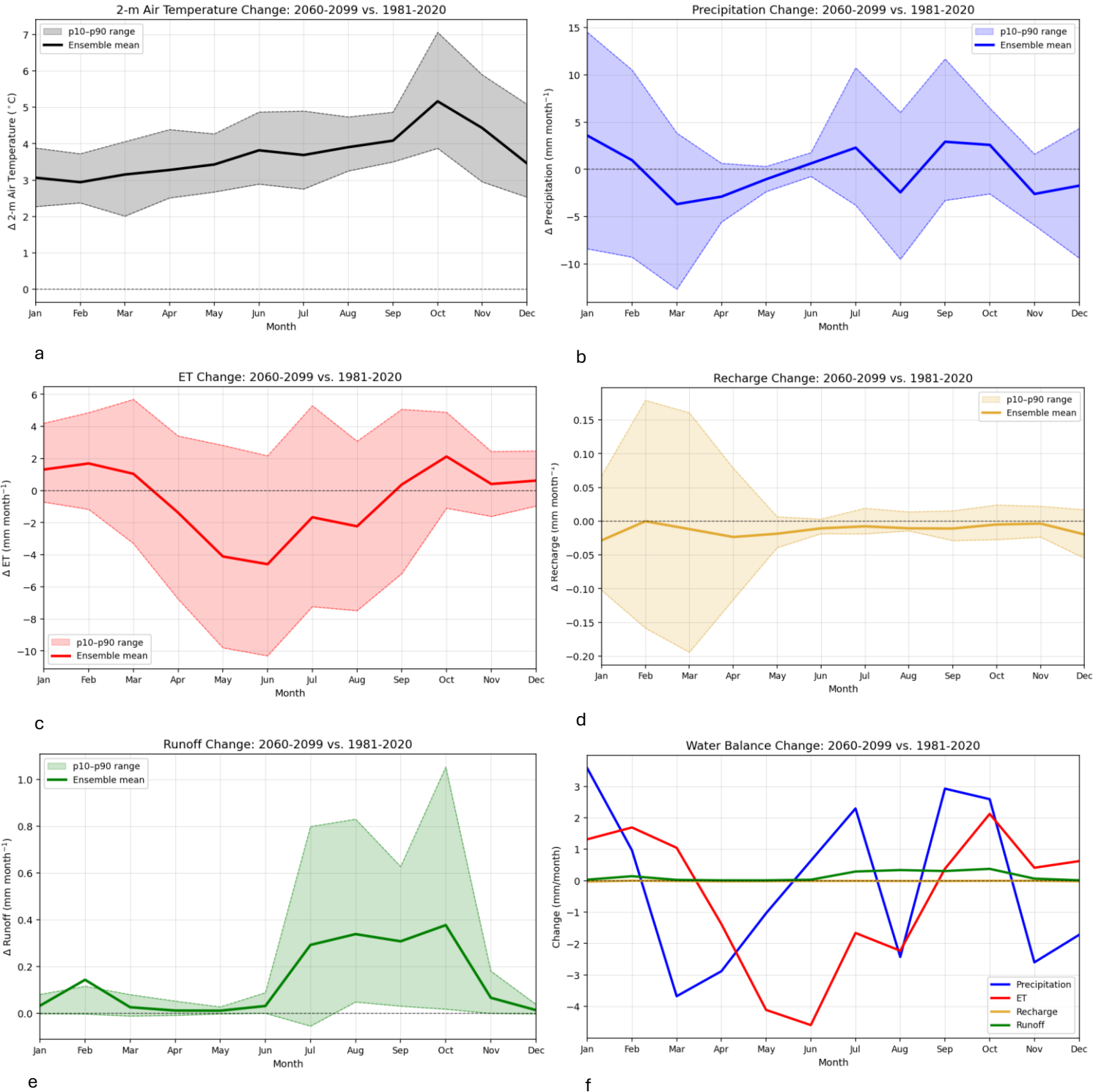


Figure 5. Plots (a)-(e) show projected changes in (a) temperature, (b) precipitation, (c) evapotranspiration (ET), (d) natural recharge, and (e) runoff statewide, comparing end of the 21st century to the historical record from 1981-2020 under the IPCC Scenario SSP3-7.0.¹⁰ Plot (f) shows the change in the water balance components (P, ET, recharge, and runoff) on a single graph for direct comparison. The analysis uses 14 dynamically downscaled global climate models (GCM) at 9-km resolution and the Noah-MP land surface model. The ensemble mean of the 14 GCMs is shown in bold for each component of the hydrologic cycle, with the 10-90th percentile shaded to show model projection uncertainty.



Climate change projections across the Sacramento Valley basin show drier springs (14-28% drier March through May), and a drier August (9%), November (17%), and December (7%). July, September, and October are projected to be 12-17% (2.4-2.9 mm/month) wetter on average by the end of the century, which is consistent with a projected increase in extreme events associated with hurricane and tropical cyclone activity. Natural recharge is projected to remain near zero throughout the year, and slightly negative from June through November (-0.01 to -0.02 mm/month).^{*} While runoff is projected to remain below 0.6 mm/month, minor increases of 0.3-0.4 mm/month are projected for July-October. Projected increases in temperature range from approximately 3.0 °C in February to 5.2 °C in October. Higher temperatures and greater water availability from precipitation lead to a projected 16% (2.1 mm) increase in evapotranspiration (ET) in October and 12% (1.3 mm) in January compared to the baseline period, while less water availability in August leads to a projected decline in ET (9% or -2.2 mm).

^{*}Projected negative recharge values are attributed to increased capillary rise from the aquifer through the vadose zone due to climate factors, resulting in water loss from the system. Because the Noah-MP model does not include groundwater pumping, this indicates that climate-driven factors play a significant role in groundwater storage decline in Arizona.

References

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