

Salt River Groundwater Basin Profile



Basin Summary Statistics

Size¹: 5,230 square miles

Elevation²: Range: 1,485-11,417 ft; Median: 5,773 ft

Top 3 land cover types by area³: Evergreen Forest (51%), Shrub/Scrub (43%), Grassland Herbaceous (2.5%)

Major surface watershed(s)⁴: Salt River, Black River, White River, Carrizo Creek

Groundwater subbasins¹: Salt River Canyon, Black River, White River, Salt River Lakes

Groundwater-derived streamflow fraction⁵:

0.46 (Moderate)



Mean Annual Hydrologic Cycle Components (1980-2020)
SALT RIVER

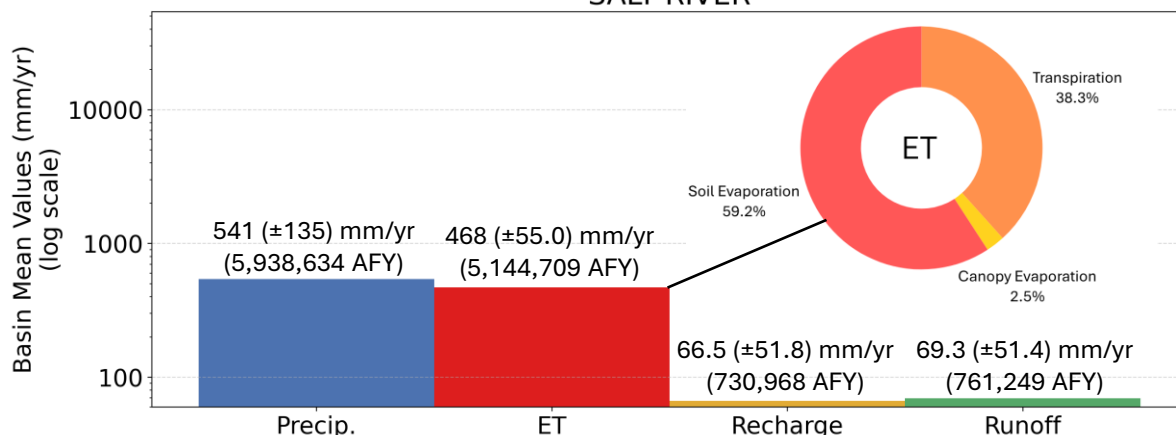


Figure 1 (above). Bar chart showing Noah-MP modeling results of the historical mean annual hydrologic cycle components (precipitation [P], evapotranspiration [ET], natural recharge, and runoff) in the basin from 1980-2020.⁶ ET is partitioned into soil evaporation, canopy evaporation, and transpiration. 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)
SALT RIVER

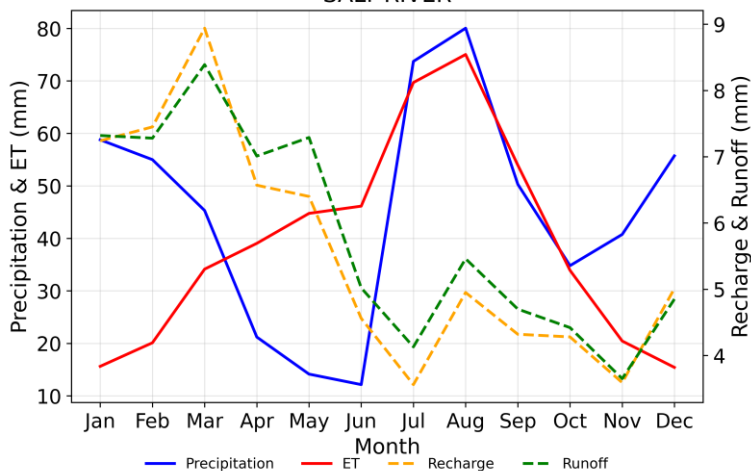


Figure 2. Graph showing monthly mean precipitation, ET, recharge, and runoff for the groundwater basin (1980-2020) from Noah-MP modeling results.⁶

Precipitation (P) in the Salt River basin is affected by the North American Monsoon during the summer months and large frontal systems during the winter. The greatest atmospheric losses occur during the summer months, where evapotranspiration (ET) exceeds P from mid-March through July. Soil evaporation makes up 59.2% of total ET in the basin, while transpiration comprises 38.3% and canopy evaporation accounts for the remainder (2.5%). The Salt River basin has the second highest average annual natural recharge (66.5 mm/yr) and the highest runoff (69.3 mm/yr) in the state. Natural recharge and runoff peak in March due to springtime snowmelt.

Salt River



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.

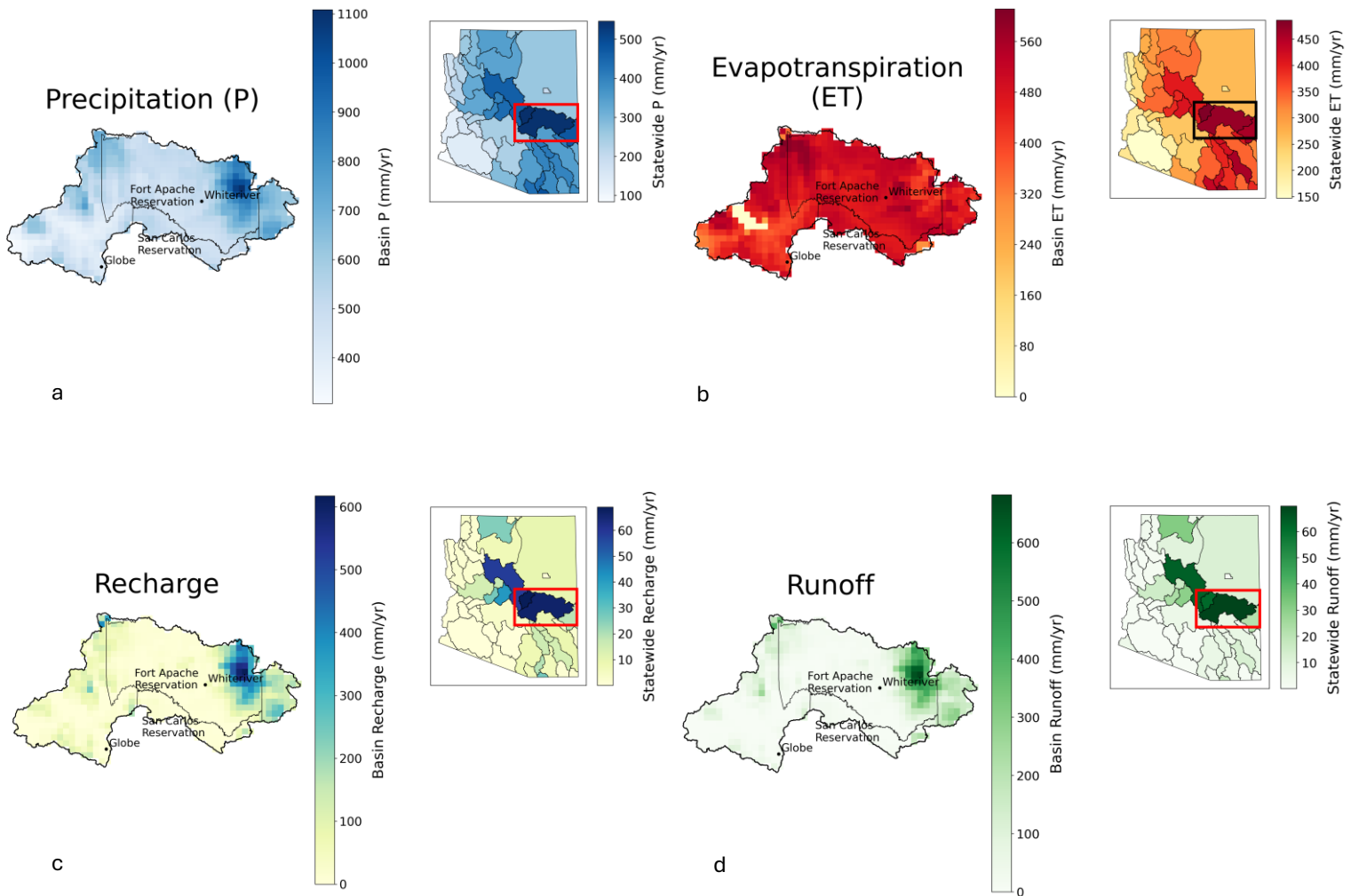
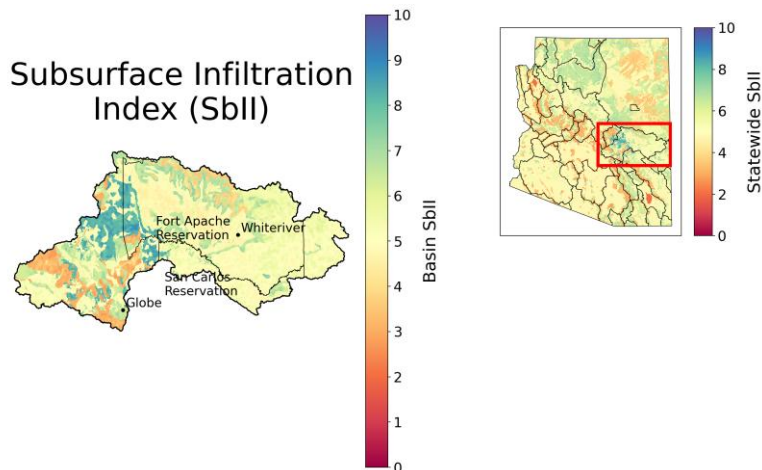


Figure 4 (below). Subsurface infiltration index (SbII) showing infiltration potential of the subsurface across the groundwater basin on a scale of 1-10 based on geologic features.⁹



Natural recharge is greatest in the far eastern portion of the basin, exceeding 500 mm/year near the White Mountains. Most of the basin's runoff is generated in the White Mountains, with additional runoff generated in the Sierra Anchas and Mogollon Rim to the west and northwest. Infiltration potential is greatest in the Sierra Anchas in northwestern portion of the Upper Salt watershed due to presence of karst-type geology and faulting in that region, as well as alluvial deposits along the Salt River.



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

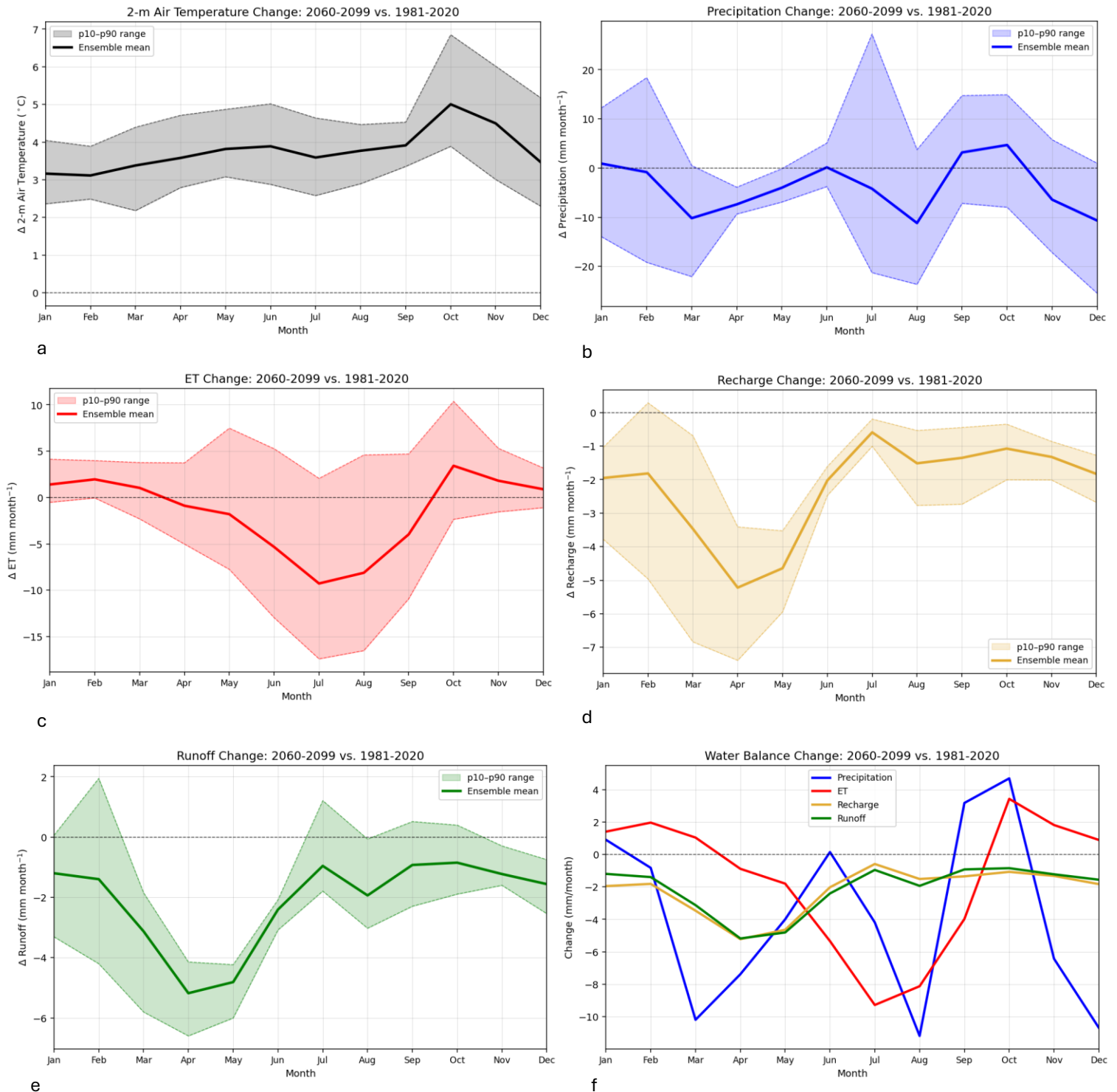


Figure 5. Plots (a)-(e) show projected changes in (a) temperature, (b) precipitation, (c) evapotranspiration (ET), (d) natural recharge, and (e) runoff statewide, comparing end of the 21st century to the historical record from 1981-2020 under the IPCC Scenario SSP3-7.0.¹⁰ Plot (f) shows the change in 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 Salt River basin show drier springs (21-38% drier March through May), a drier July-August (6-13%), and a drier November-December (17-19%). September and October are projected to be 6-13% (2.9-4.9 mm/month) wetter on average, which is consistent with a projected increase in extreme events associated with hurricane and tropical cyclone activity by the end of the century. Declines in natural recharge are projected for all months of the year, with projections in the highest recharge months (February-May) showing declines of 30-71% (-1.9 to -5.3 mm/month). Recharge projections are slightly negative (-0.25 mm) in July.* Runoff is projected to decrease in all months of the year, with 27-71% (-1.5 to -5.2 mm/month) declines in the highest runoff months (February-May). Projected increases in temperature range from approximately 3.1 °C in February to 5.0 °C in October. Higher temperatures and greater water availability from precipitation lead to a projected 10% (3.4 mm) increase in evapotranspiration (ET) in October compared to the baseline period.

*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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