

San Simon Wash Groundwater Basin Profile



Basin Summary Statistics

Size¹: 2,284 square miles

Elevation²: Range: 1,675-7,721 ft; Median: 2,192 ft

Top 3 land cover types by area³: Shrub/Scrub (96%), Woody Wetlands (2.2%), Grassland Herbaceous (0.86%)

Major surface watershed(s)⁴: San Simon Wash, Rio Sonoyta

Groundwater subbasins¹: None

Groundwater-derived streamflow fraction⁵:

0.42 (Moderate)



Mean Annual Hydrologic Cycle Components (1980-2020) SAN SIMON WASH

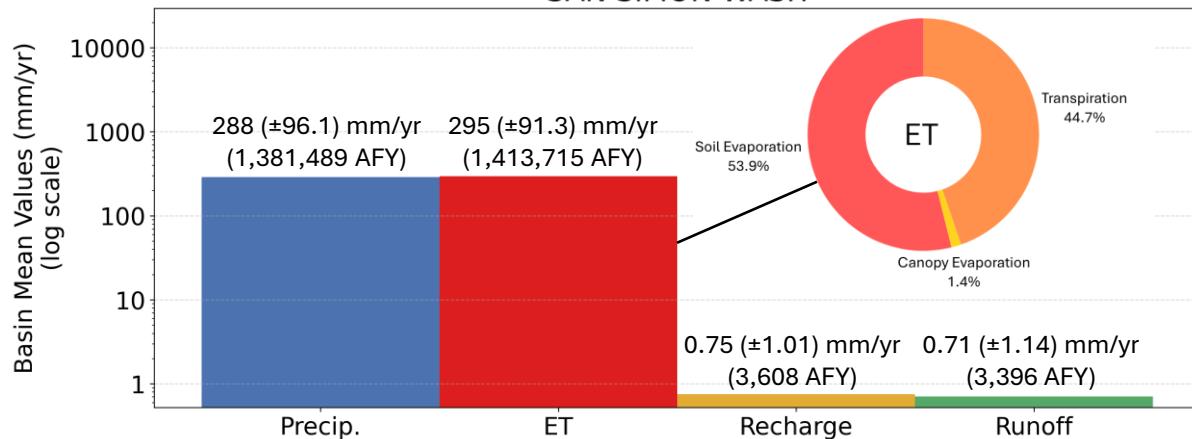


Figure 1 (above). Bar chart showing Noah-MP modeling results of the historical mean annual hydrologic cycle components (precipitation [P], evapotranspiration [ET], natural recharge, and runoff) in the basin from 1980-2020.⁶ ET is partitioned into soil evaporation, canopy evaporation, and transpiration.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

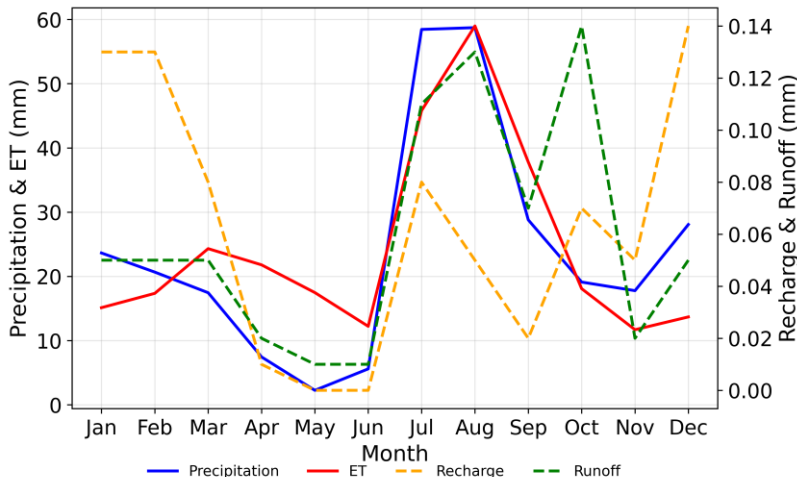


Figure 2. Graph showing monthly mean precipitation, ET, recharge, and runoff for the groundwater basin (1980-2020) from Noah-MP modeling results.⁶

On annual timescales, evapotranspiration (ET) exceeds precipitation (P) on average across the San Simon Wash basin, yielding near zero annual averages for natural recharge (0.75 mm) and runoff (0.71 mm). Seasonally, P in the San Simon Wash basin is affected by the North American Monsoon during the summer months. ET is greater P from mid-February to June and tracks with P from June to October. Soil evaporation makes up 53.9% of total ET in the basin, while transpiration comprises 44.7% and canopy evaporation accounts for the remainder (1.4%).

San Simon Wash



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.

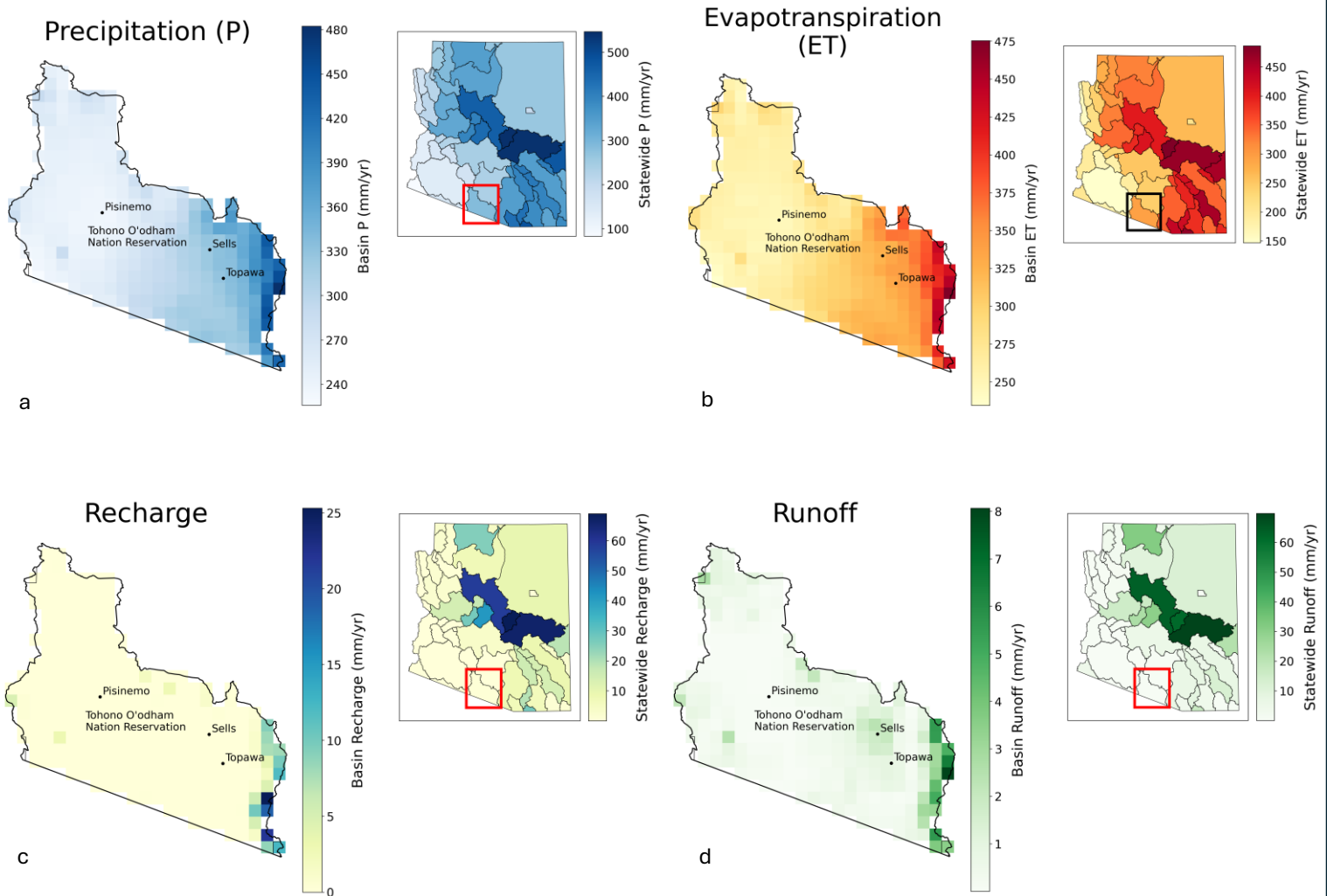
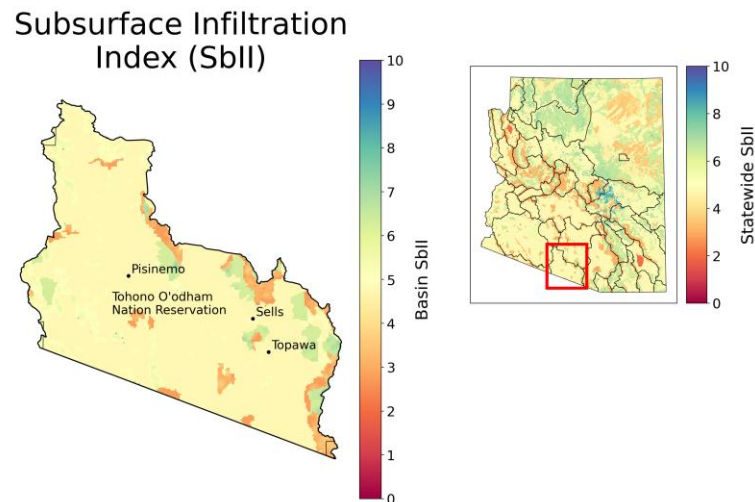


Figure 4 (below). Subsurface infiltration index (SbII) showing infiltration potential of the subsurface across the groundwater basin on a scale of 1-10 based on geologic features.⁹

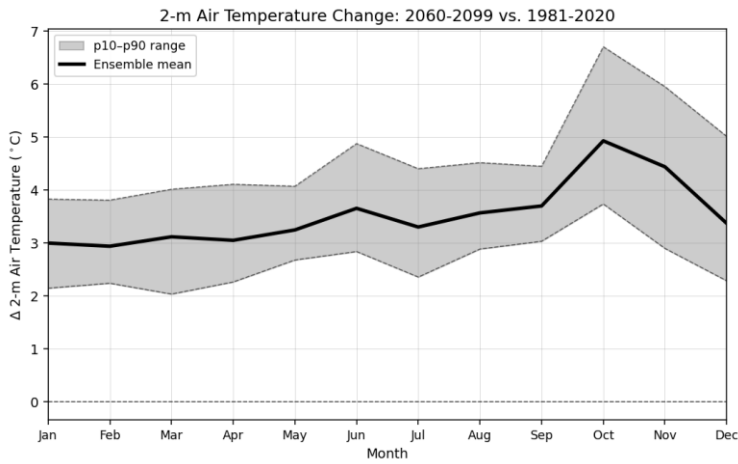


Precipitation in the San Simon Wash basin is highest in the Baboquivari Mountains to the southeast, which receive over 450 mm/yr on average. Evapotranspiration (ET, ~450 mm/yr) is also highest in this area. Natural recharge and runoff are generally minimal across the basin; however, in the Baboquivari Mountains, recharge can exceed 20 mm/yr and runoff exceeds 6 mm/yr. Subsurface infiltration potential is low to moderate across the basin; however, the presence of karst-type geology in the mountains creates pockets of higher infiltration potential.

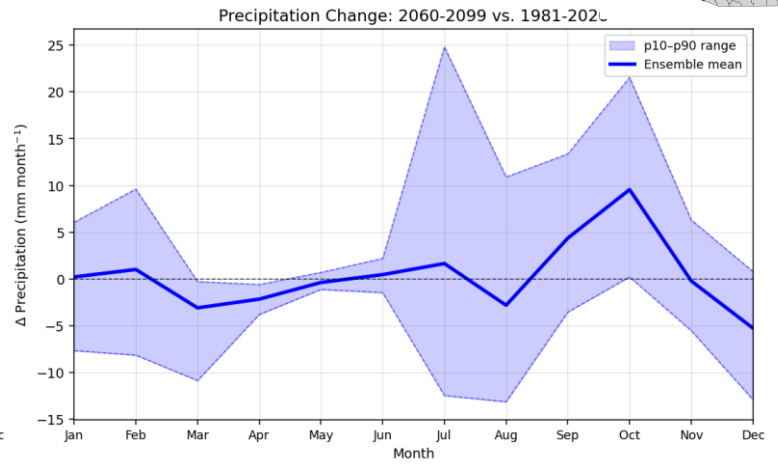
San Simon Wash



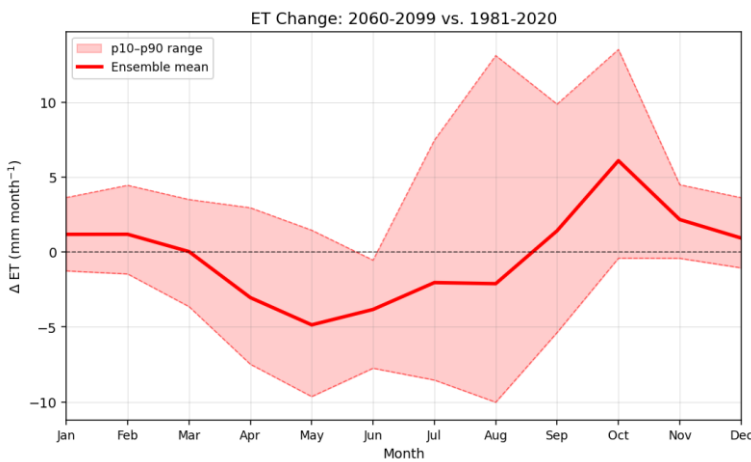
Climatic Change Projections: Changes in Temperature, Precipitation, ET, Recharge, and Runoff (2060-2099 vs. 1981-2020)



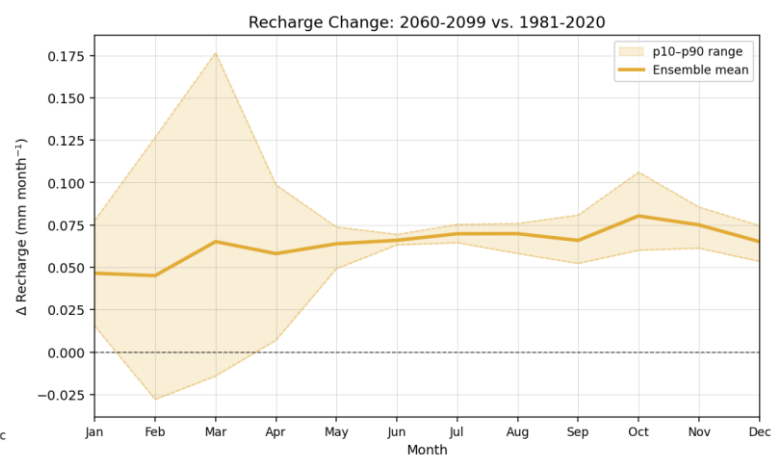
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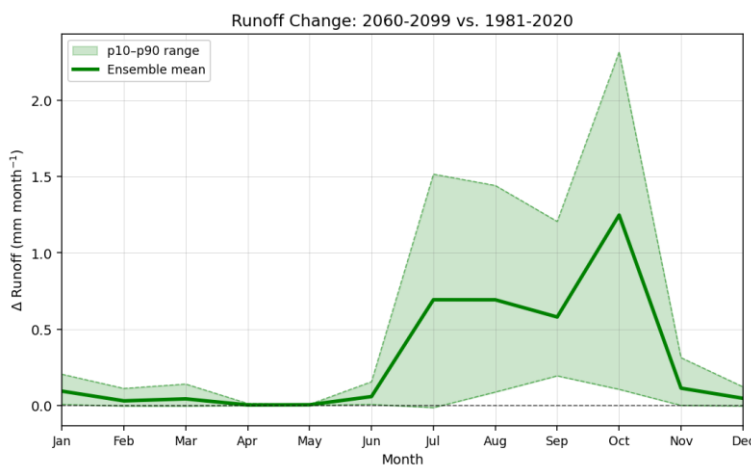
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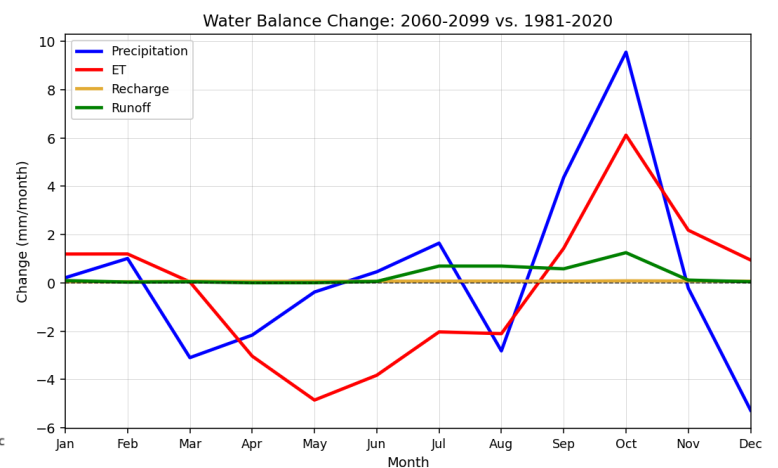
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e



f

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 San Simon Wash basin show drier springs (16-37% drier March through May) and a drier August (4%) and December (18%). July (3%), September (15%), and October (47%) are projected to be wetter on average by the end of the century. The increase in precipitation in September-October (4.4-9.8 mm/month) is consistent with a projected increase in extreme events associated with hurricane and tropical cyclone activity. Natural recharge is projected to remain near zero, with slightly negative projections (-0.01 to -0.05 mm/month) from April through January.* While runoff is projected to remain below 1.7 mm/month, minor increases of 0.59-1.3 mm/month are projected for July-October. Projected increases in temperature range from approximately 3.0 °C in February to 5.0 °C in October. Less water availability from March to May leads to projected declines (13-26% or -3.1 to -5.0 mm/month) in evapotranspiration (ET) during the warmer months, while higher temperatures and greater precipitation are consistent with a projected 30% (6.2 mm) increase in 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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