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THE SUITABILITY OF DROUGHT METRICS HISTORICALLY AND UNDER CLIMATE CHANGE SCENARIOS

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ABSTRACT: Drought is an increasingly complex phenomenon in the western United States due to intersecting meteorological, physiographic and societal facets. Climate impacts involving water supplies are typically assessed using metrics developed for contemporary climate conditions. The physical manifestation of projected warming on hydrology are likely to change mountain snowpack storage efficiency and evapotranspiration thereby questioning the utility of contemporary metrics for managing water resources, particularly during droughts. To better understand how changes in climate affect the intensity and duration of drought two simple water balance models and four different drought indices, Standardized Precipitation Index (SPI), Standardized Precipitation-Evapotranspiration Index (SPEI), Palmer Drought Severity Index (PDSI), and a novel PDSI that includes a winter snowpack storage component (sPDSI), were examined for the western United States in both the observational record and using downscaled climate scenarios. Results suggest widespread increases in potential evapotranspiration and snowpack storage efficiency that translate into subsequent changes in the timing and magnitude of runoff and potential groundwater recharge. Projected changes in drought duration-magnitude vary markedly through the lens of various drought indices with metrics solely reliant on precipitation exhibiting a meridional dipole pattern with stronger and protracted drought conditions across the Southwestern US and reduced drought frequency for the Northwestern US. Drought metrics that incorporate temperature exhibit an overall increase in drought magnitude-duration under future climate scenarios and emphasize both the complexity of hydrologic resources in the West to warming and the need to better understand individual facets of the hydrologic cycle to climate change.

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