GENERALIZING CATCHMENT-SCALE EVAPOTRANSPIRATION ACROSS CALIFORNIA THROUGH AUTOMATED DATA INTEGRATION

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Quantifying the partitioning of precipitation into surface runoff, evapotranspiration, and subsurface components is a long-standing goal of the hydrologic sciences given its importance to ecosystem dynamics and functions. The fate of any individual raindrop is determined by the full complexity of the atmospheric, land surface, and subsurface conditions and processes within a catchment. When the scale of observation is extended to an entire catchment on an annual basis, the generalizations that emerge offer insights that are valuable to both science and practice. The aggregated effect of the many physical and ecological interactions within a catchment can yield surprisingly consistent and straightforward behavior, with applications including the hydrology of ungauged basins, definition of habitat restoration goals, and anticipating the impacts of future climate scenarios.

We used a w ater balance method to estimate annual water partitioning for ov er one thousand catchments across California, observing characteristic values for annual evapotranspiration that were largely insensitive to interannual climate variations at the catchment and basin scales. Specifically, for water years when evapotranspiration was energy-limited, the annual partitioning was often described by the relationship

R = P – ETo, where R is runoff depth, P is precipitation depth, and ETo is the characteristic evapotranspiration depth for the catchment. This relationship was observed across the diversity of California climate regions, from the wet coastal mountains in the north to arid southern basins, and for catchment areas ranging in magnitude from 1 to 10,000 km2. Typical values for ETo ranged from 400 to 600 mm, with correlations to latitude and prevailing climate. When annual evapotranspiration is water-limited, that is, when P