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Can the complementary relationship between actual and potential evaporation be used to quantify heatwaves?

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Extreme climate events such as heatwaves with prolonged periods of high air temperatures have large environmental, social, and economic impacts ranging from crop failure to health and desiccation damages. Periods of low precipitation with high temperatures decrease soil moisture storage and thus affect surface energy partitioning. The heuristic concepts in the basis of the Complementary Relationship (CR) suggest that a fraction of radiative energy not used for evaporation contributes to increased sensible heat flux thus heats near-surface atmosphere. We have recently generalized the CR framework for spatially heterogeneous landscapes thereby enable prediction of actual evapotranspiration (ET) from routine atmospheric measurements. Capitalizing on the coupling between moisture availability, actual ET and sensible heat flux we propose using the CR to predict conditions conducive to rapid increase in regional sensible heat flux associated with the onset of extreme heatwaves. The proposed framework is evaluated using satellite surface temperature and FLUXNET data with newly derived metrics for the onset of heatwaves. The concepts could be extended to obtain new insights into the dynamics of more persistent climate extremes such as regional droughts.