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Separating warming-induced drought from drought-induced warming

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A very widely held public perception is that increasing temperature is a cause of “drying” and drought. The atmospheric-focused meteorologic community has often assumed that the warmer temperatures increase evaporation and that this contributes to worsening drought via atmospheric demand. On the other hand, the agricultural and hydrologic scientific communities have a very different interpretation linked to water supply, with the lack of available water leading to reduced evaporation and enhanced surface warming. This is a classic chicken-or-the-egg problem that has resisted definitive explanation probably due to the lack of radiative observations at suitable spatial and temporal scales. Here we use recently released NASA CERES satellite radiation data to study the 2013-2014 Californian drought. We evaluate whether the observed increase in near-surface air temperature should be considered a forcing (as per standard meteorological approaches) or a feedback (as per standard agricultural and hydrologic approaches). We find that the radiative perturbation associated with the drought has a distinct radiative signature for more incoming shortwave- and less incoming longwave-radiation. That result, coupled with estimates of decreased evapotranspiration show that around two-third of the warming has a radiative origin and the remaining one-third is the result of a surface feedback from reduced evaporative cooling. Hence, the radiative perturbation during the recent Californian drought was distinctly different from the projected radiative perturbation of the enhanced greenhouse effect. We conclude that the warming experienced during meteorological drought is very different from the warming projected as a consequence of the enhanced greenhouse effect.