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COMMENTARY

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Key Points:
- California has experienced the worst drought in its historical record during 2012–2015
- Effects of this event have been relatively mild in some sectors but very severe others
- El Niño presents the simultaneous prospect of drought relief but also an increased risk of flooding

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A tale of two California droughts: Lessons amidst record warmth and dryness in a region of complex physical and human geography

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Abstract The state of California has experienced the worst drought in its historical record during 2012–2015. Adverse effects of this multiyear event have been far from uniformly distributed across the region, ranging from remarkably mild in most of California's densely populated coastal cities to very severe in more rural, agricultural, and wildfire-prone regions. This duality of impacts has created a tale of two very different California droughts—highlighting enhanced susceptibility to climate stresses at the environmental and socioeconomic margins of California. From a geophysical perspective, the persistence of related atmospheric anomalies has raised a number of questions regarding the drought's origins—including the role of anthropogenic climate change. Recent investigations underscore the importance of understanding the underlying physical causes of extremes in the climate system, and the present California drought represents an excellent case study for such endeavors. Meanwhile, a powerful El Niño event in the Pacific Ocean offers the simultaneous prospect of partial drought relief but also an increased risk of flooding during the 2015–2016 winter—a situation illustrative of the complex hydroclimatic risks California and other regions are likely to face in a warming world.

California's extraordinary and ongoing drought of 2012–2015 provides a fascinating example of complex interactions between the atmosphere, ocean, and land surface playing out in region of great geographic and socioeconomic diversity. From a meteorological perspective, the present California drought is unparalleled in the more than century-long instrumental record [*Griffin and Anchukaitis*, 2014; *Robeson*, 2015] (Figure 1a); the paleoclimate record suggests that the event is remarkable even in a millennial context [*Griffin and Anchukaitis*, 2014; *Robeson*, 2015]. At the same time, natural and human systems across California have experienced a wide range of drought impacts—ranging from the barely perceptible to the profound. The ongoing situation in California holds the potential to become an important case study both for scientists interested in understanding the causes of underlying temperature and precipitation anomalies and also for decision makers responsible for long-range planning and on-the-ground response to extreme climate events.

The California drought has garnered considerable attention in the scientific community: its complex evolution has highlighted gaps in the collective knowledge regarding processes governing extreme, persistent, and recurring atmospheric circulation patterns in the midlatitudes. The proximal cause of California's enormous multiyear precipitation deficit—a recurring northward shift in the Pacific storm track during California's rainy season associated with a prominent region of high pressure known as the "Ridiculously Resilient Ridge" (Figure 2)—has already been characterized extensively [*Swain et al.*, 2014; *Wang et al.*, 2014; *Seager et al.*, 2015]. Yet partitioning the relative contributions to this highly anomalous atmospheric feature by potential geographically remote influences—including tropical and midlatitude ocean warming [*Wang et al.*, 2014, 2015; *Hartmann*, 2015; *Seager et al.*, 2015; *Lee et al.*, 2015], declining Arctic sea ice [*Lee et al.*, 2015], internal atmospheric variability [*Seager et al.*, 2015], and anthropogenic radiative forcing [*Swain et al.*, 2014; *Wang et al.*, 2014, 2015; *Lee et al.*, 2015]—remains a considerable challenge. The hypothesized importance of complex interactions between various Earth systems across a wide range of spatial and temporal scales reinforces the notion that understanding the physical causes of extreme events like the current drought will require an integrated, cross-disciplinary approach. Given California's location near the climatological winter mean position of the Pacific storm track and its large interannual precipitation variability, such investigations are likely to yield substantial insights into the broader mechanisms underlying regional climate variability and change in the midlatitudes.