Simulating International Drought Experiment Field Observations Using The Community Land Model

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SANTA CRUZ

Question: How will ecosystems respond to more frequent and intense drought?

photo: Cal. Dept. of Water Resources, Castaic Lake, Los Angeles County, 13 April 2016

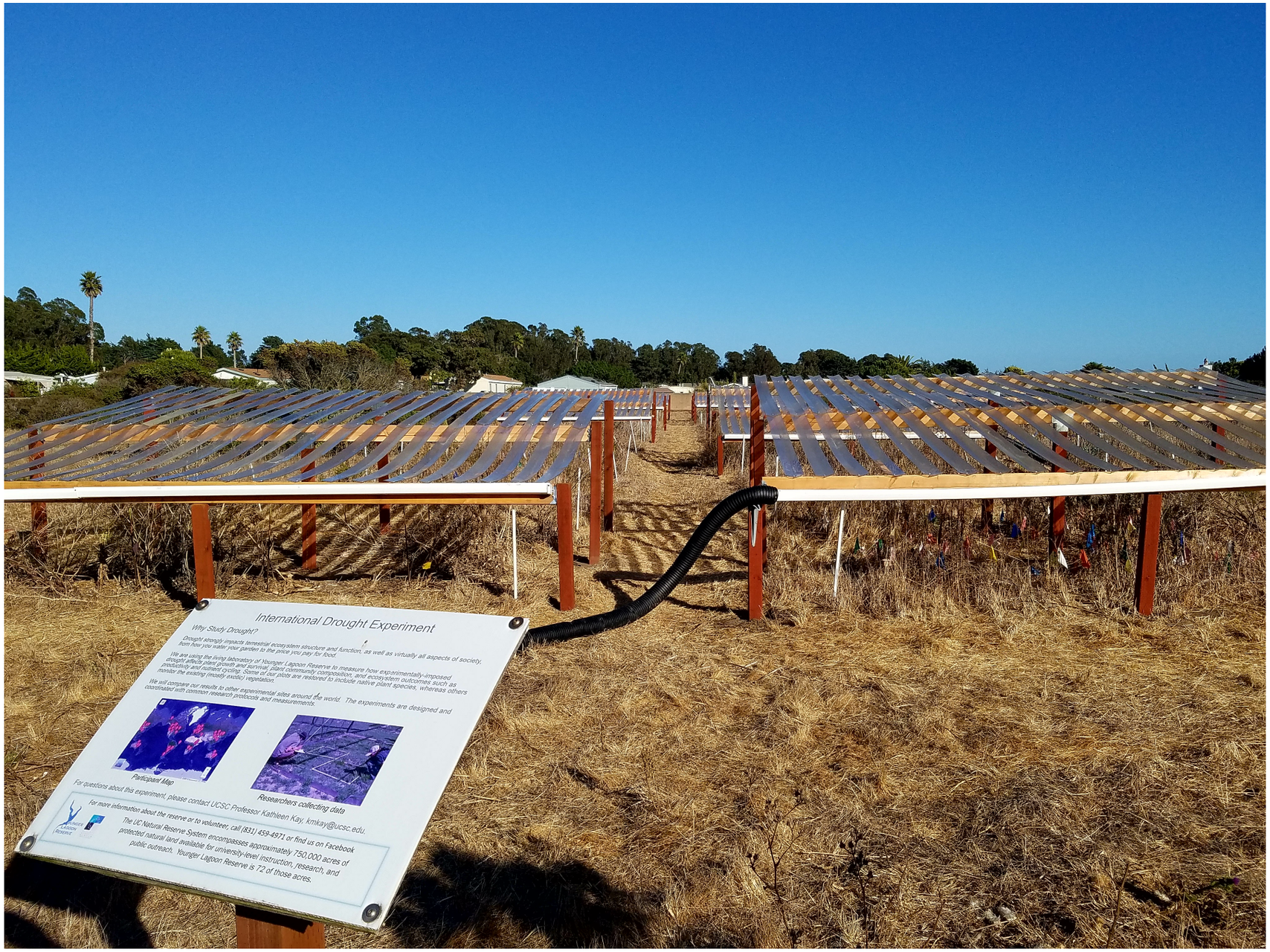
International Drought Experiment (IDE)

simulates the 1-in-100-years drought in the field

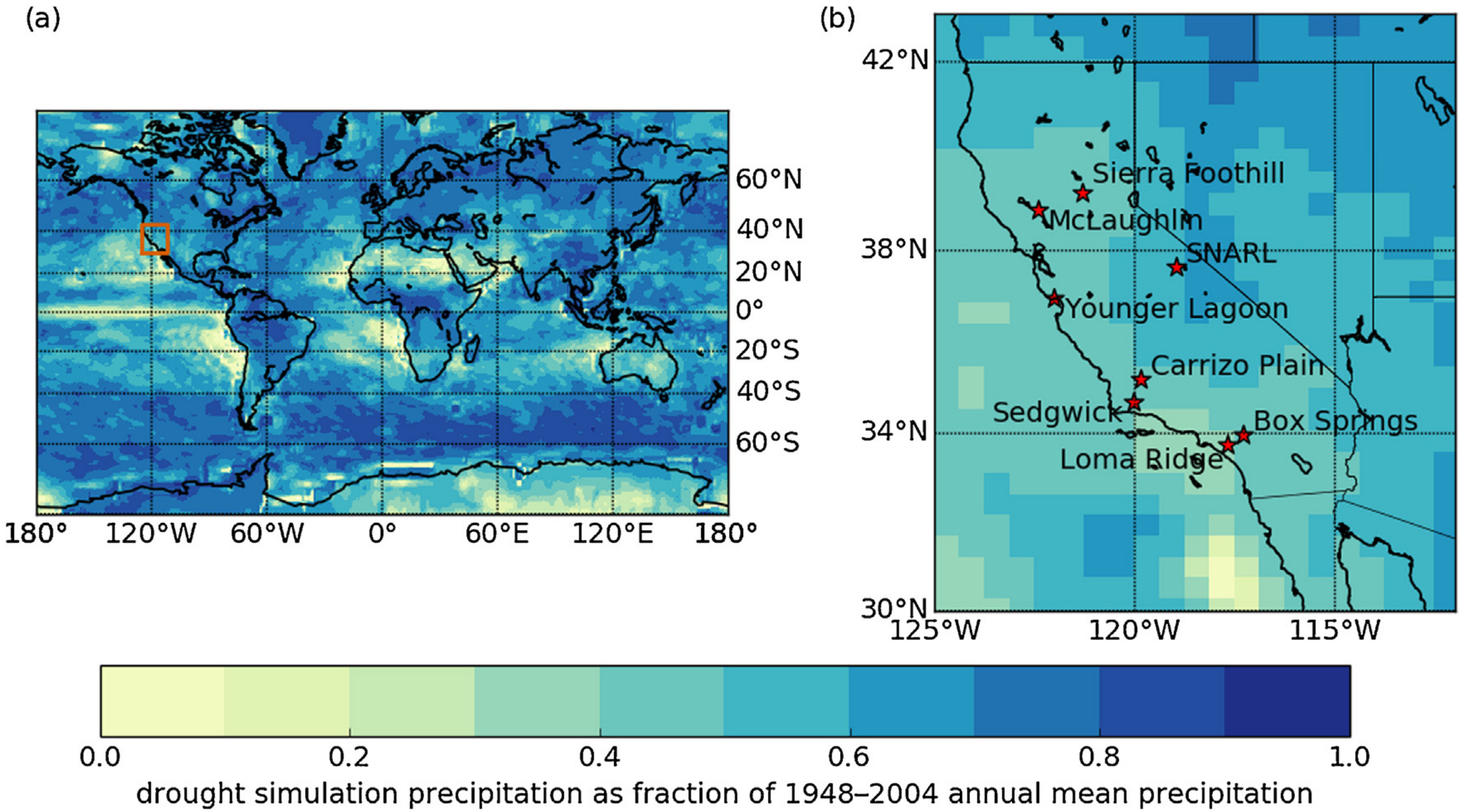
https://drought-net.colostate.edu/international-drought-experiment

International Drought Experiment (IDE)

IDE precipitation diversion structure
Younger Lagoon (Santa Cruz, California)

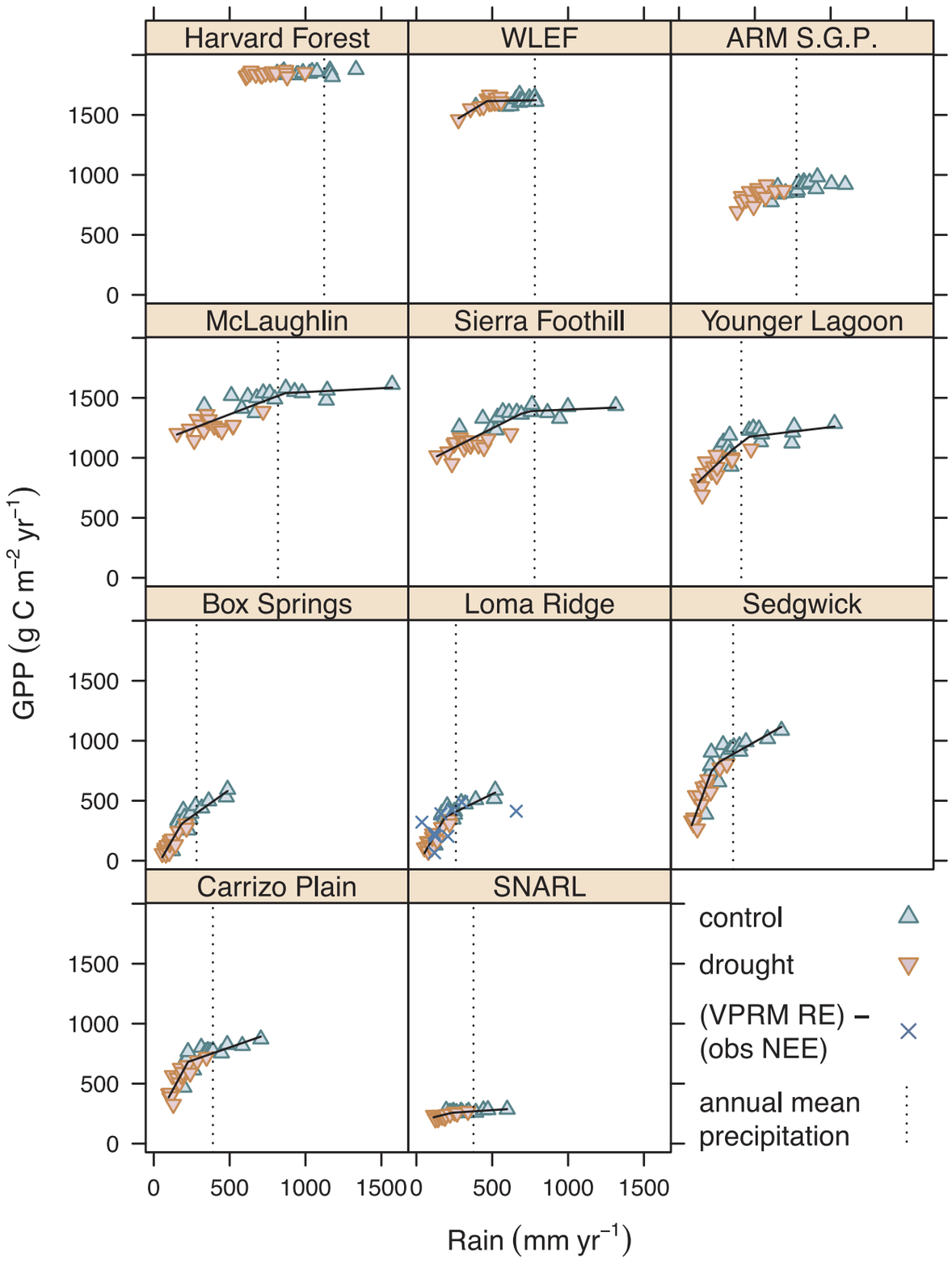


Simulated drought - CLM



Hilton et al., Agricultural and Forest Meteorology, 2019

Simulated drought - CLM



Eastern USA sites (for context)

Northern California

Southern California

Hilton et al., Agricultural and Forest Meteorology, 2019

Simulated drought - CLM

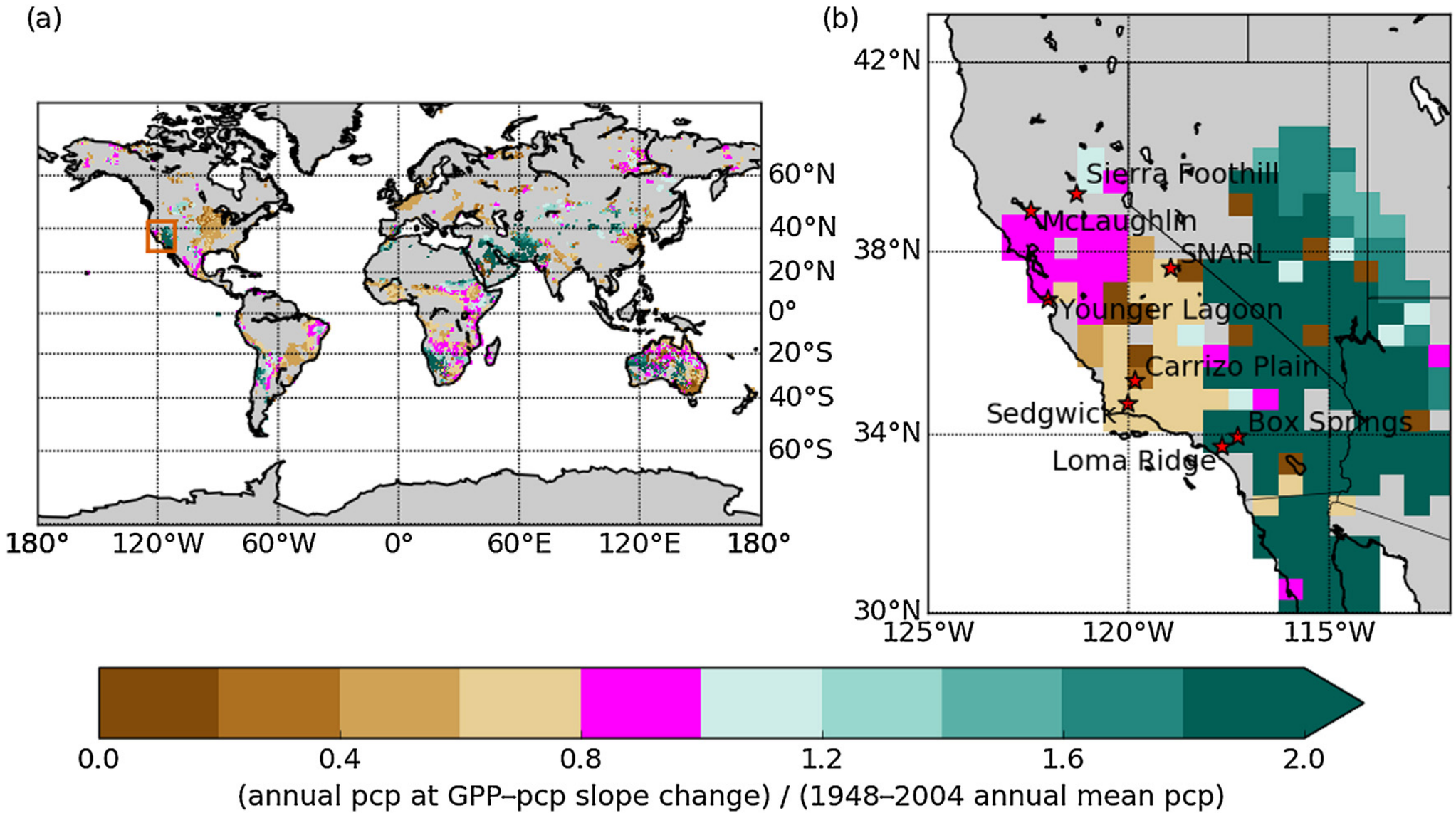


Fig. 3. Long-term mean annual precipitation (pcp) (Qian et al., 2006) versus the empirically fit transition point in the modeled GPP–pcp relationship. At colored points AIC (Akaike, 1976) preferred the two-regime straight-line fit (black lines) over a linear fit. At uncolored points GPP–pcp did not show a significant slope transition. Points in magenta show a ratio between 0.8 and 1.0, indicating that the long-term mean pcp is slightly wetter than the GPP-pcp inflection point. This suggests that a small decrease in pcp at these locations could produce a larger decline in GPP than previous behavior might indicate. (For interpretation of the references to color in this figure legend, the reader is referred to the web version of this article.)

Hilton et al., Agricultural and Forest Meteorology, 2019

Simulated drought - CLM

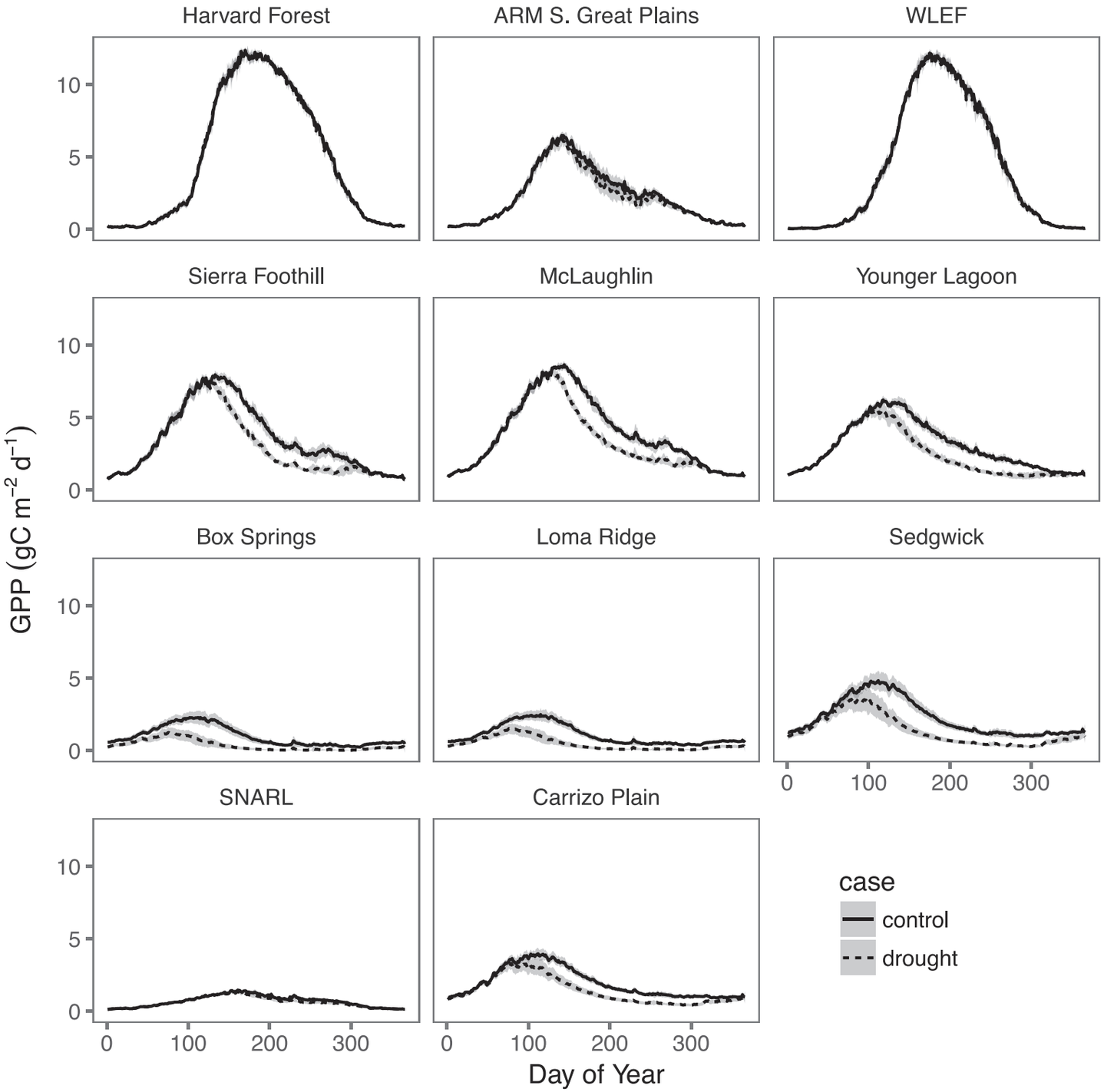


Fig. 4. Mean annual cycle (solid and dashed lines) and 95% confidence intervals (gray envelopes) in CLM GPP at selected U.S. analysis sites (site locations in Fig. 1b and Table 1). The means are calculated over the 15-year simulations (see Section 2).

Hilton et al., Agricultural and Forest Meteorology, 2019

Simulated drought - CLM

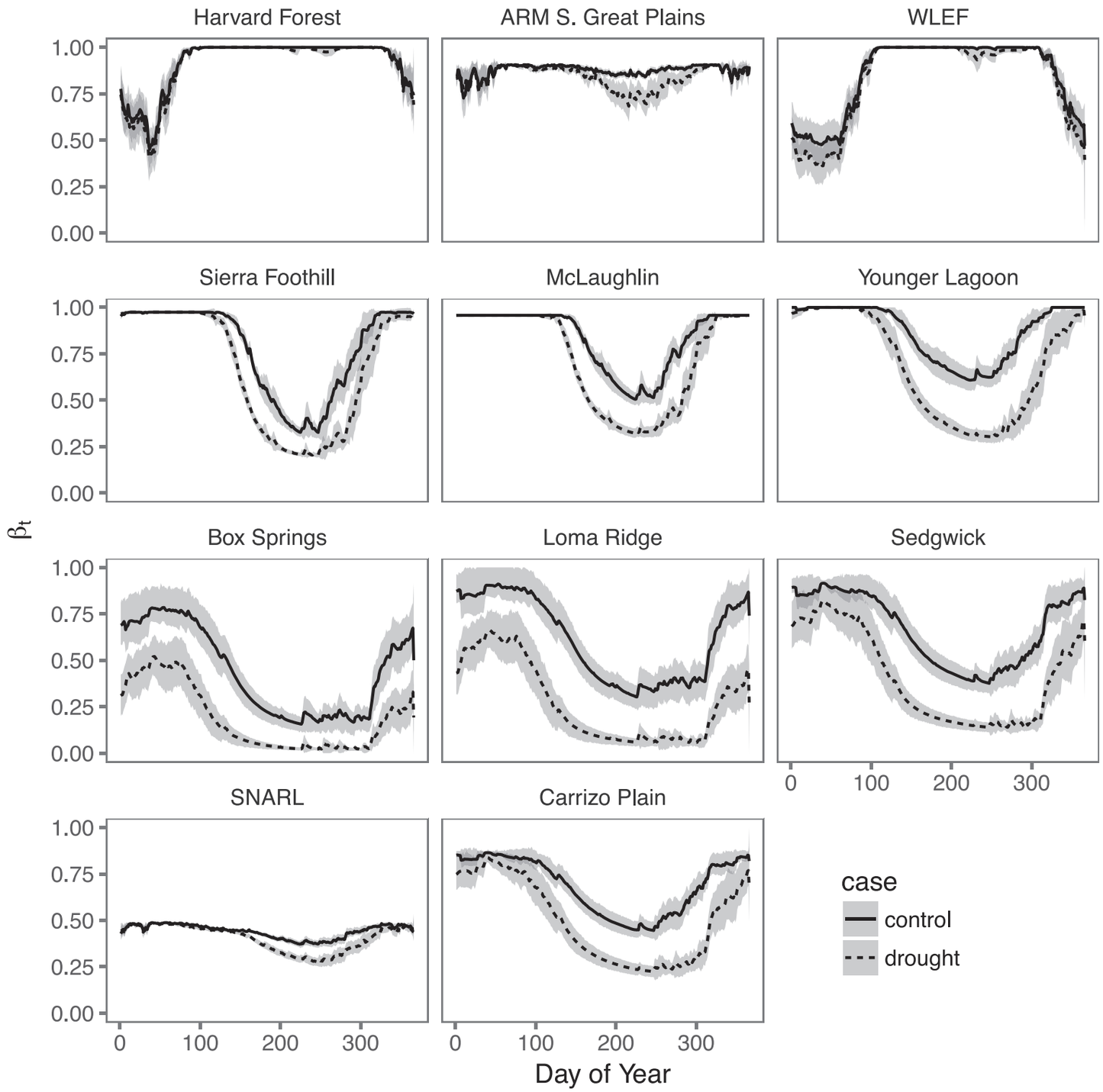


Fig. 5. Mean annual cycle (solid and dashed lines) and 95% confidence intervals (gray envelopes) in CLM transpiration beta factor (β_t) parameter at selected U.S. analysis sites (site locations in Fig. 1b and Table 1). Within CLM (β_t) varies between 0.0 and 1.0 to attenuate photosynthesis (Oleson et al., 2010) in response to soil water shortage.

Hilton et al., Agricultural and Forest Meteorology, 2019

Question: How will ecosystems respond to more frequent and intense drought?

Notable changes to magnitude (and seasonality) of photosynthesis. Notable differences from Northern California to Southern California.

photo: Cal. Dept. of Water Resources, Castaic Lake, Los Angeles County, 13 April 2016

Question: How will ecosystems respond to more frequent and intense drought?

https://drought-net.colostate.edu

Hilton, T. W., M. E. Loik, and J. E. Campbell (2019), Simulating International Drought Experiment field observations using the Community Land Model, Agricultural and Forest Meteorology, 266-267, 173–183, doi:https://doi.org/10.1016/j.agrformet.2018.12.016.

Thanks to:

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photo: Cal. Dept. of Water Resources, Castaic Lake, Los Angeles County, 13 April 2016

Extra slides

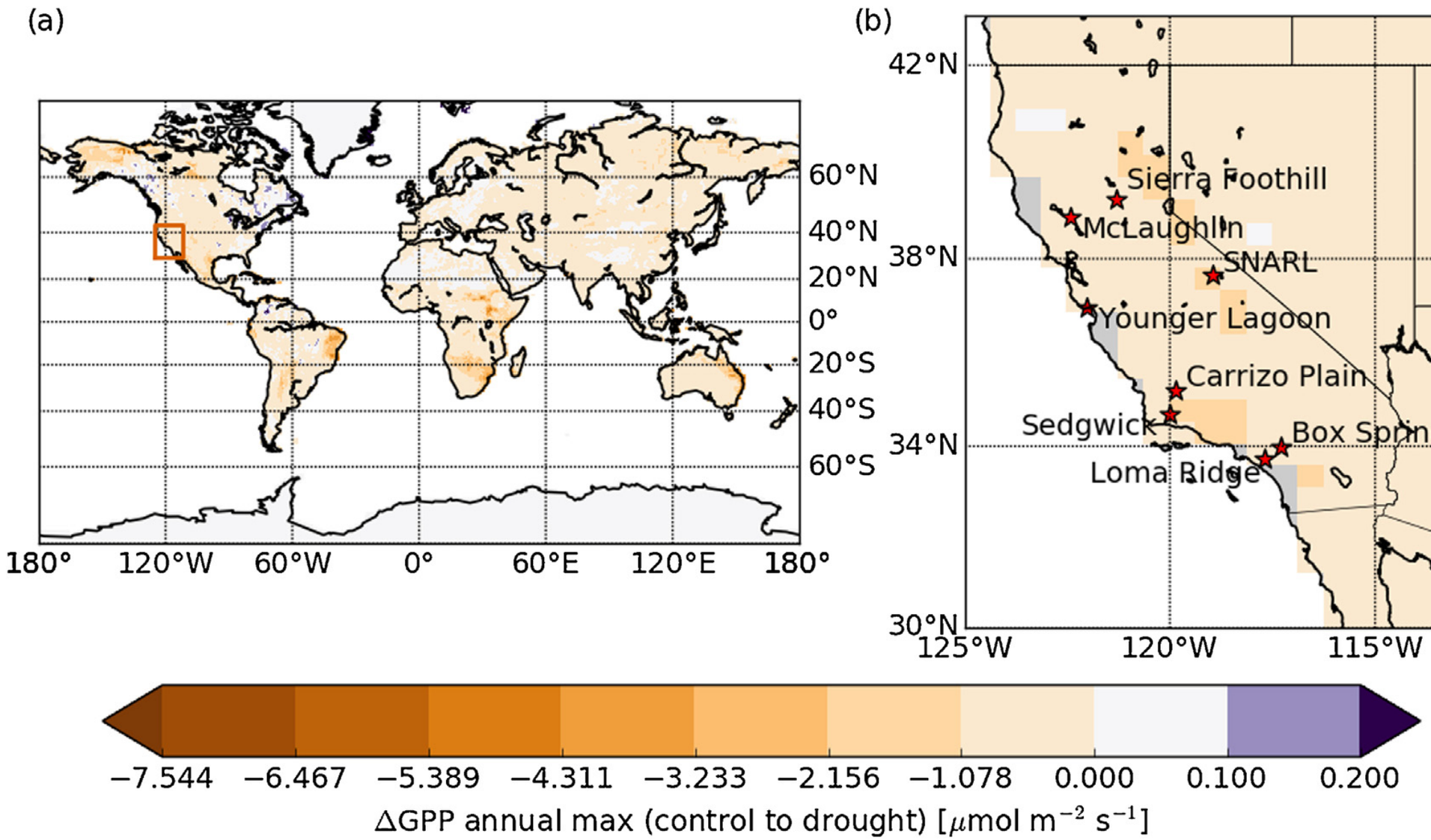

Fig. 6. Absolute decline in mean annual maximum CLM GPP, CLM control runs to CLM drought runs (drought minus control). Grey land areas denote areas masked to water on the CLM 0.47 by 0.63 degree grid. (For interpretation of colors in this figure legend, the reader is referred to the web version of this article.)

Hilton et al., Agricultural and Forest Meteorology, 2019

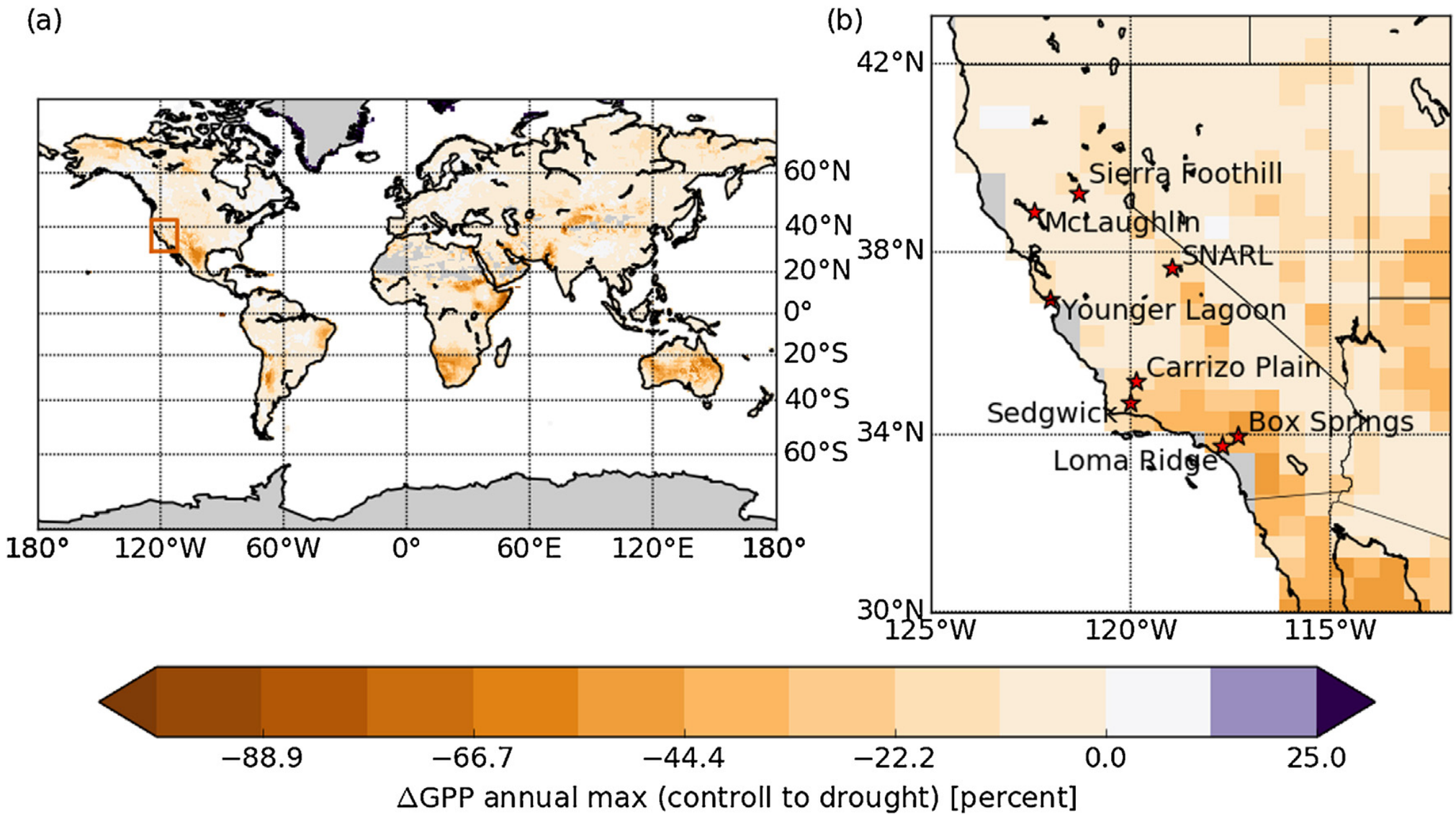

Fig. 7. Percent decline in mean annual maximum CLM GPP, CLM control runs to CLM drought runs. Grey land areas denote areas masked to water on the CLM 0.47 by 0.63 degree grid. (For interpretation of colors in this figure legend, the reader is referred to the web version of this article.)

Hilton et al., Agricultural and Forest Meteorology, 2019

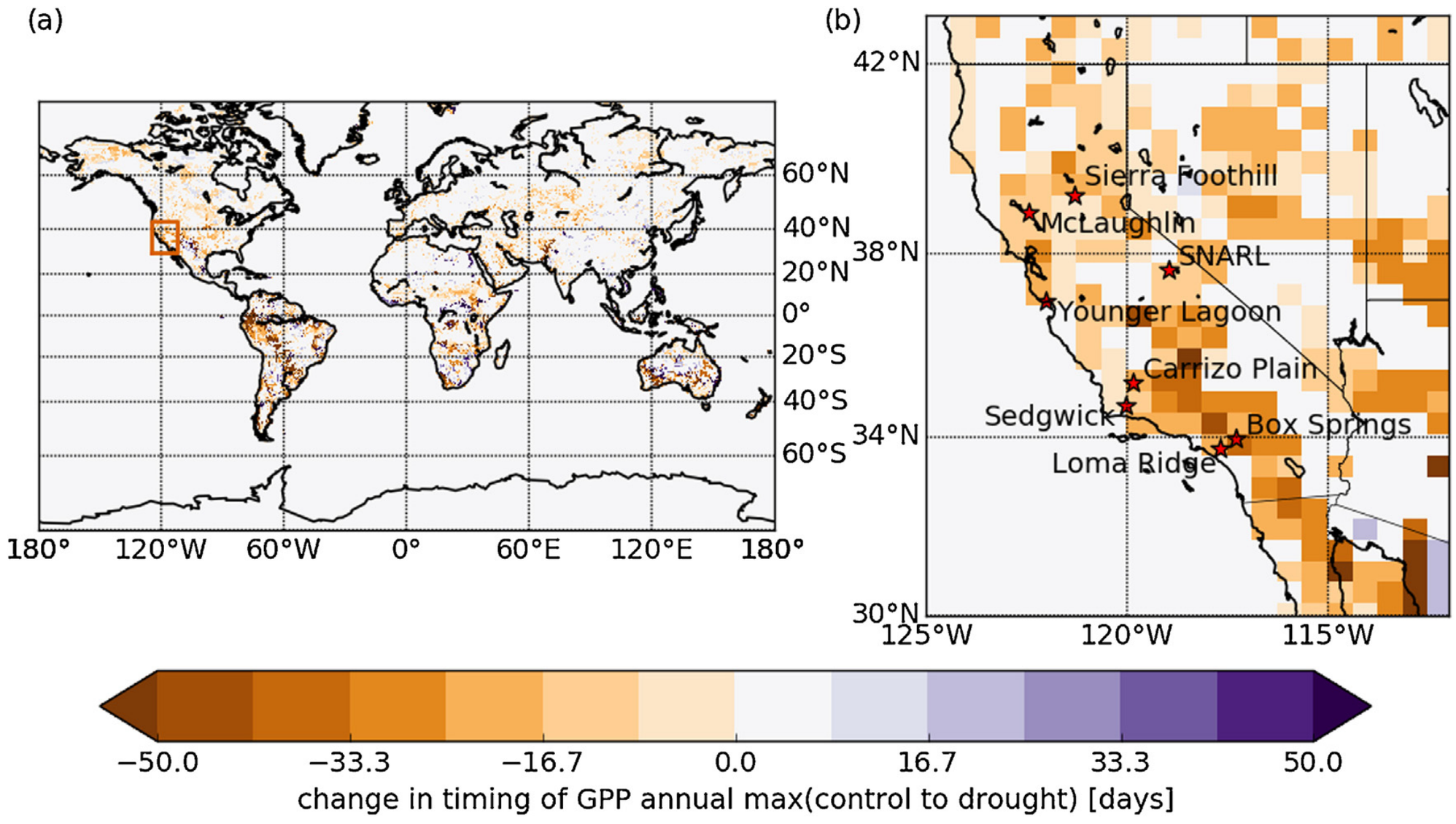

Fig. 8. Shift in day of year of mean annual maximum CLM GPP, CLM control runs to CLM drought runs. (For interpretation of colors in this figure legend, the reader is referred to the web version of this article.)

Hilton et al., Agricultural and Forest Meteorology, 2019