Adjusting for Climate Trends in Normal Peak Loads

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Summary So Far…

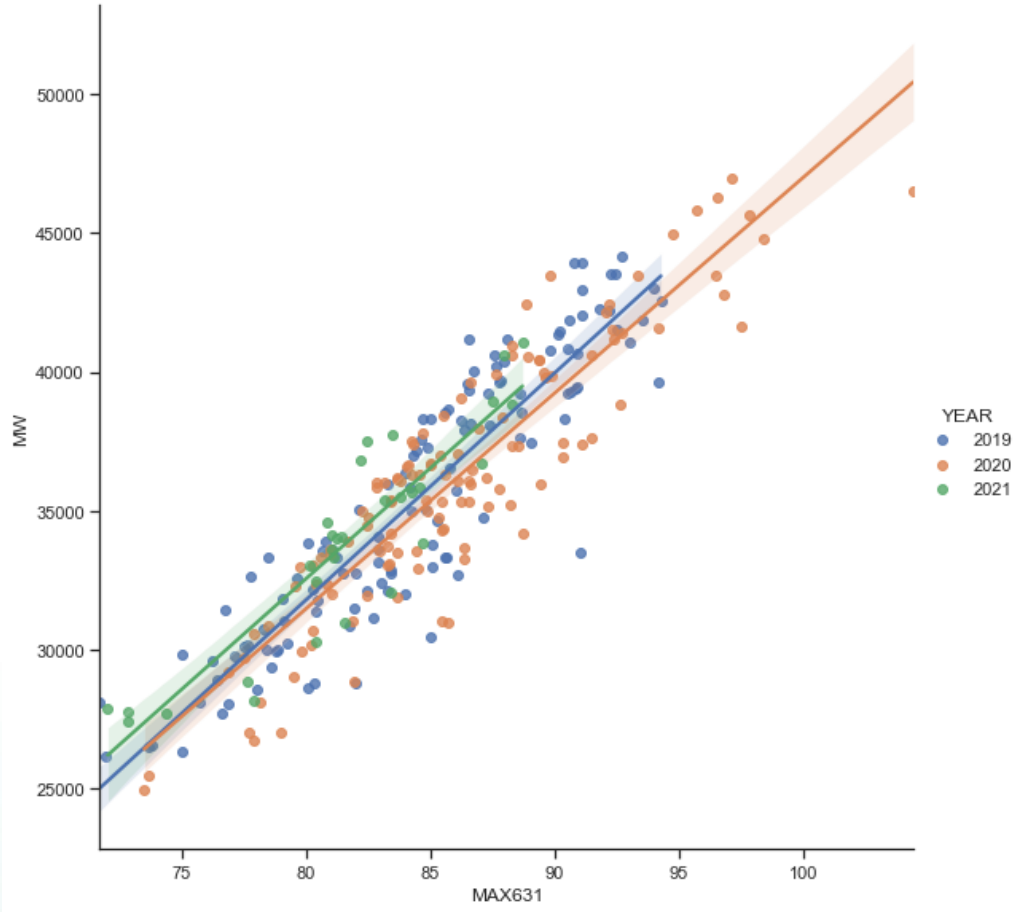
- CEC's demand forecast includes climate change load impacts based on GCM projected temperature trends
- Forecasted impacts are added to model results **incrementally over base year loads****
- Base year loads are normalized using historic weather data
- Historic record indicates a warming trend across key temperature statistics

**Implicit in this process is the assumption that normal base-year loads reflect climate change that has occurred to date

Current Normalization Process

Three-step process:

1. Estimate daily peak load-response to maximum and minimum temperatures (3 years of data)
2. Simulate daily peaks using 30 years of historic temperature data
3. Examine distribution of annual peak loads taken from simulated data to determine 1-in-x peak variants, including 1-in-2 “normal”



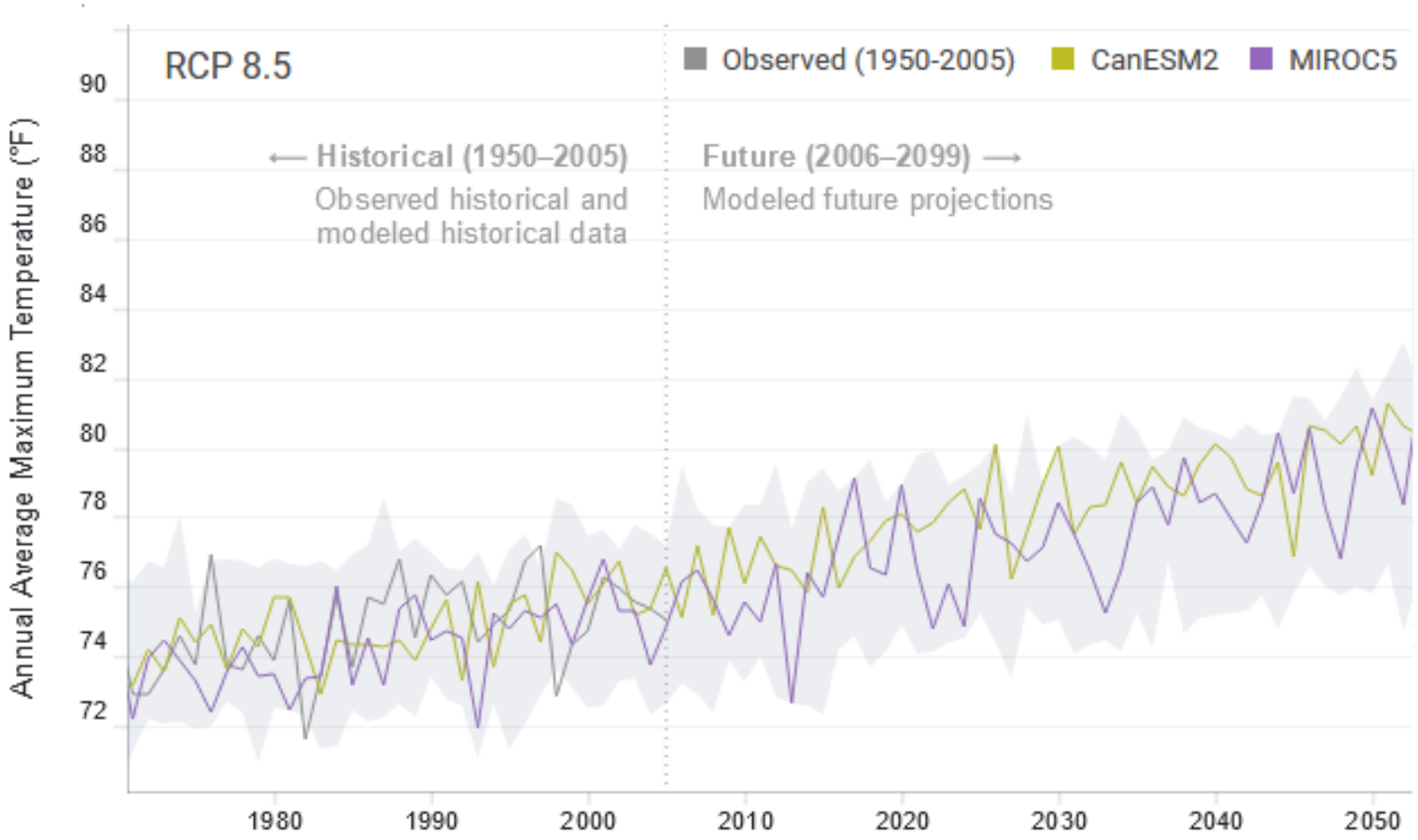
A Non-Stationary Series

Given an increasing linear trend over n years, the most recent year should carry the highest expected value

A typical 30-year normal would likely underestimate present-day expectations

Graphic:

https://cal-adapt.org/



Two Intuitive Approaches

Both are straightforward to implement within our existing normalization process

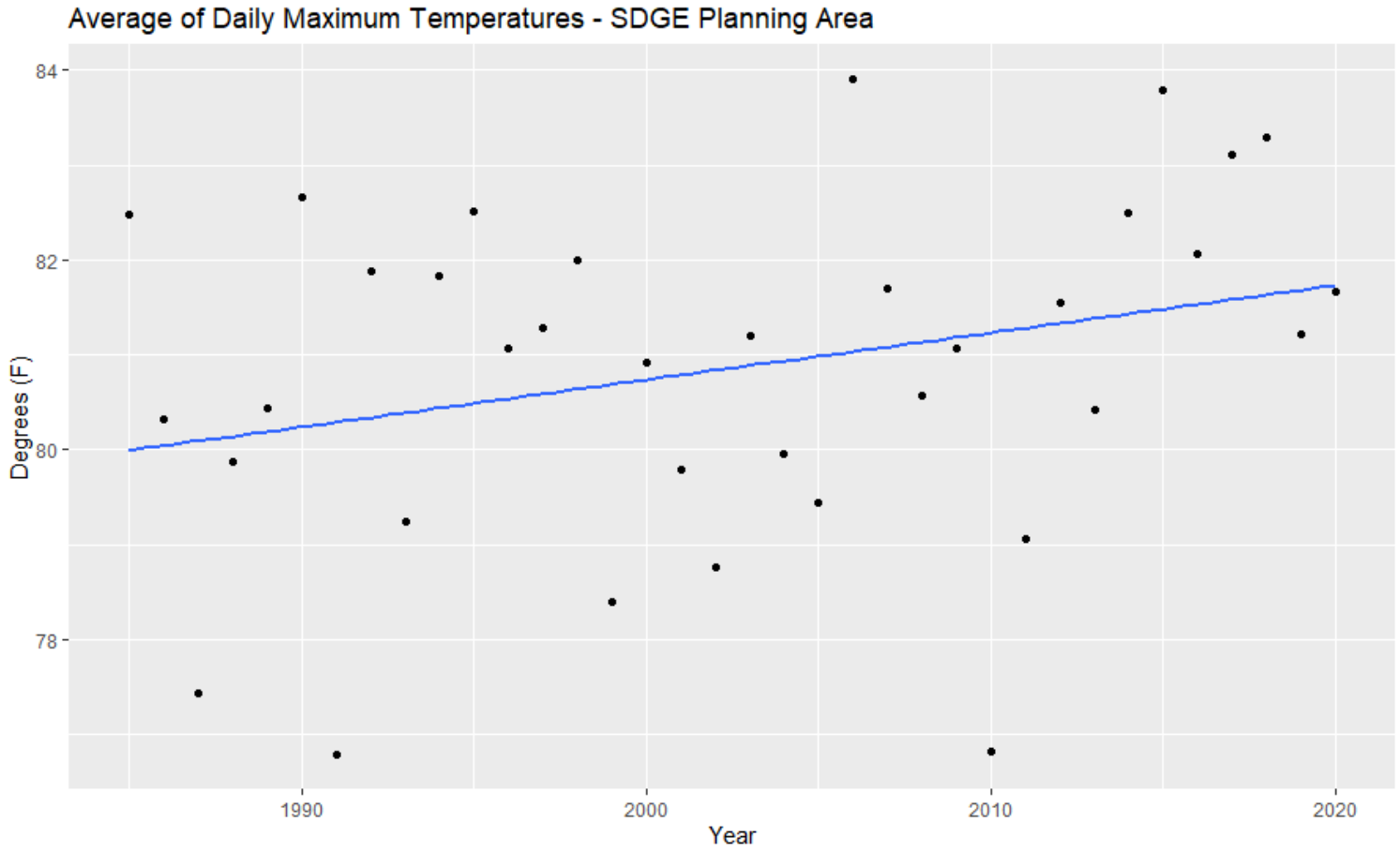
1) Apply heavier “weight” to recent years
   - Intuitive
   - Captures cyclical effects with long periods

2) Truncate the window over which historical temperatures are considered
   - Less confidence in 1-in-x events
   - Periodic effects can be mistaken for trends

Illustration - Periodic Effects

Daily max temperatures (SDG&E) show a slight warming trend from 1990-2020

1990-2000 was generally warm—dropping these years would lower the overall average, despite the increasing trend



Weighting Method

Additional Steps:

1) Assign weights to all 30 historical years
2) During simulation step, draw historical years such that each year's likelihood of selection is proportional to its weight

For this presentation, weights are consistent across decades:

- 1991-2000 … weight of 1
- 2001-2010 … weight of 2
- 2011-2020 … weight of 3

Other weighting schemes could easily be tested and considered

Truncation Method

Additional Steps:

1) Define a subset of the historical window representing the most recent n-years
2) During simulation step, randomly draw daily max and min temperatures from n-year window (enough to represent a full summer)
3) Randomly select a year from the historical window to use as a pattern, assigning temperatures from step (2) to particular days by rank

This presentation examines 10- and 20-year windows, but other selections of n could be considered

Summary of Results

Table shows percent increases to 1-in-x peak load relative to unadjusted results

Weighted	1-in-2	1-in-5	1-in-10
PGE	1.1%	1.0%	0.3%
SCE	1.5%	0.2%	0.6%
SDGE	2.0%	1.2%	1.6%
Truncated (20yr)			
PGE	1.2%	1.6%	0.6%
SCE	2.1%	0.0%	1.3%
SDGE	3.3%	-0.6%	-0.1%
Truncated (10yr)			
PGE	1.5%	2.2%	1.2%
SCE	3.7%	1.8%	3.8%
SDGE	5.5%	1.2%	1.7%

Weighted method:

- In the vicinity of forecasted climate load impacts (~1 percent over ten years)
- Greatest impact on 1-in-2 peak variant

Truncation method:

- Extreme relative to forecasted 1-in-2 climate change load impacts
- Imply downward adjustments, in some cases

Next Steps

Near term…

- Weather normalization analysis begins in October
- Preview and discussion at a November DAWG meeting ahead of December results workshop
- Climate adjusted results will be compared to unadjusted results

Longer term…

- EPIC-funded climate assessments to examine questions of normal and 1-in-x weather events
- Earliest study results could be considered in 2022 / 2023 IEPR cycles

Questions / Discussion