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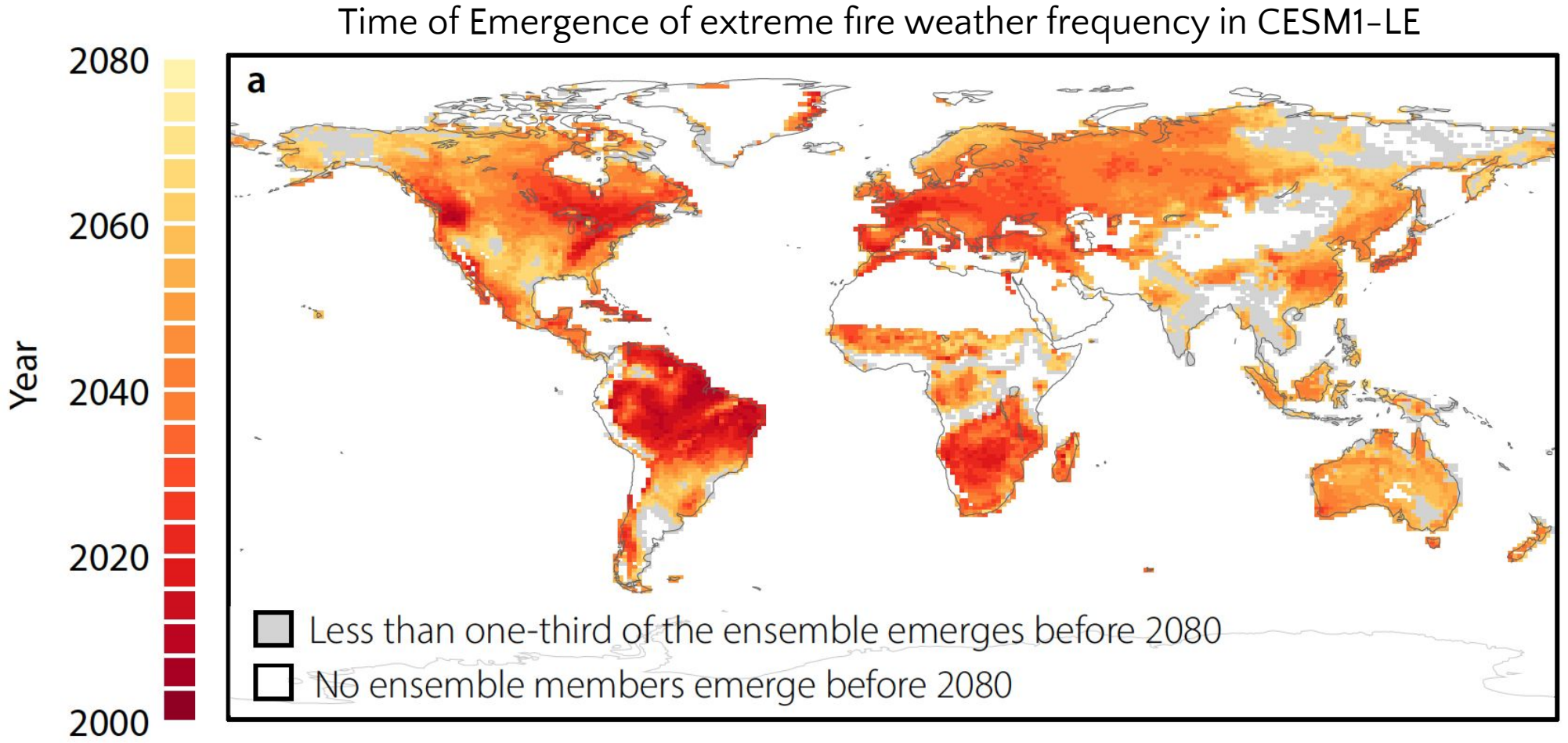
Extreme fire weather under climate variability and change

2023 CESM Climate Variability and Change Working Group Meeting

Collaborators: Clara Deser, David Lawrence, Jackie Shuman

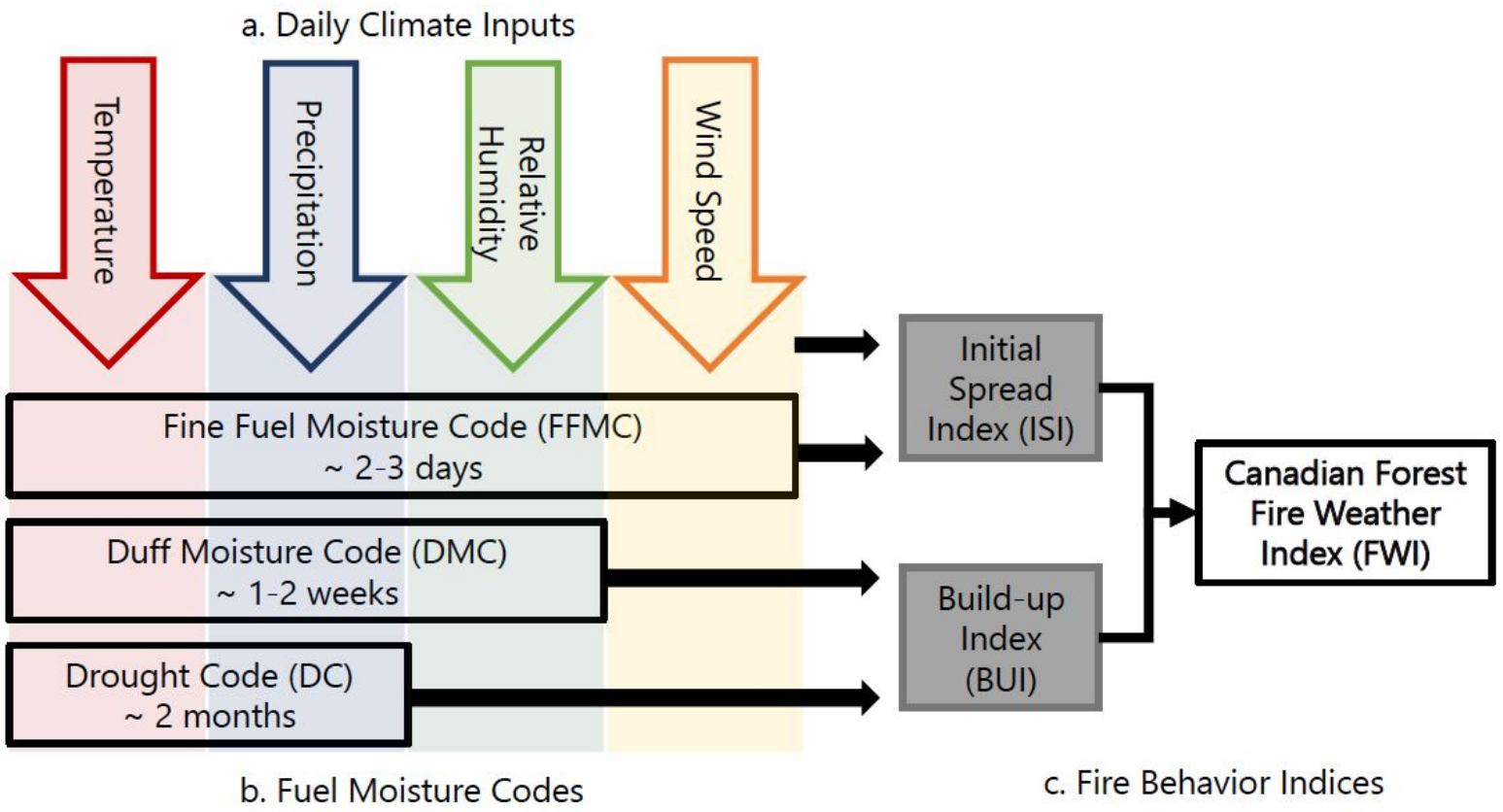
What is driving increases in future extreme fire weather frequency?



Touma et al. (2021)

Quantifying extreme fire weather under climate variability and change

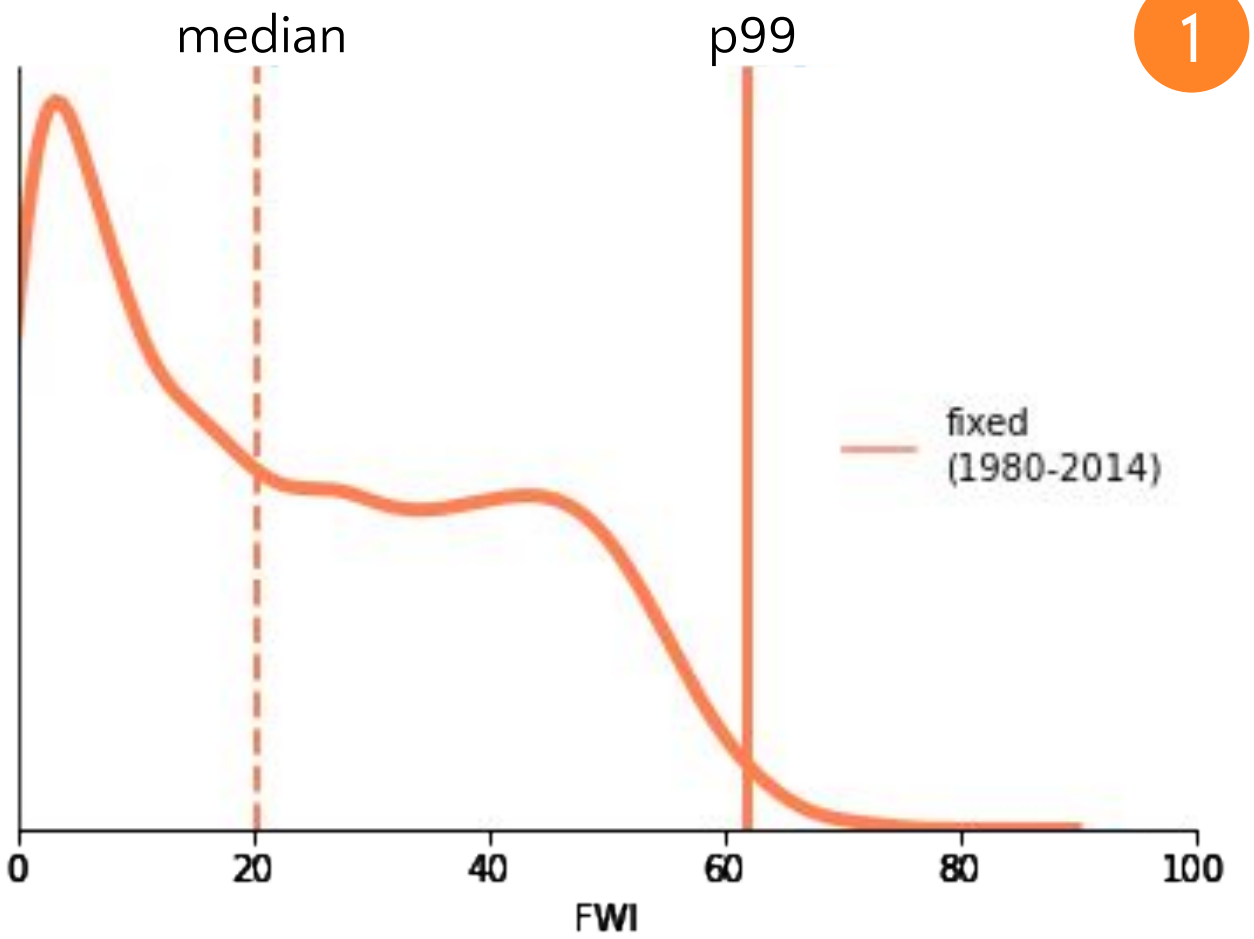
CESM2-LE
~100 members
1980-2100
Historic and SSP3-7.0



Rodgers et al. (2021); Touma et al. (in prep)

Calculating the extreme threshold

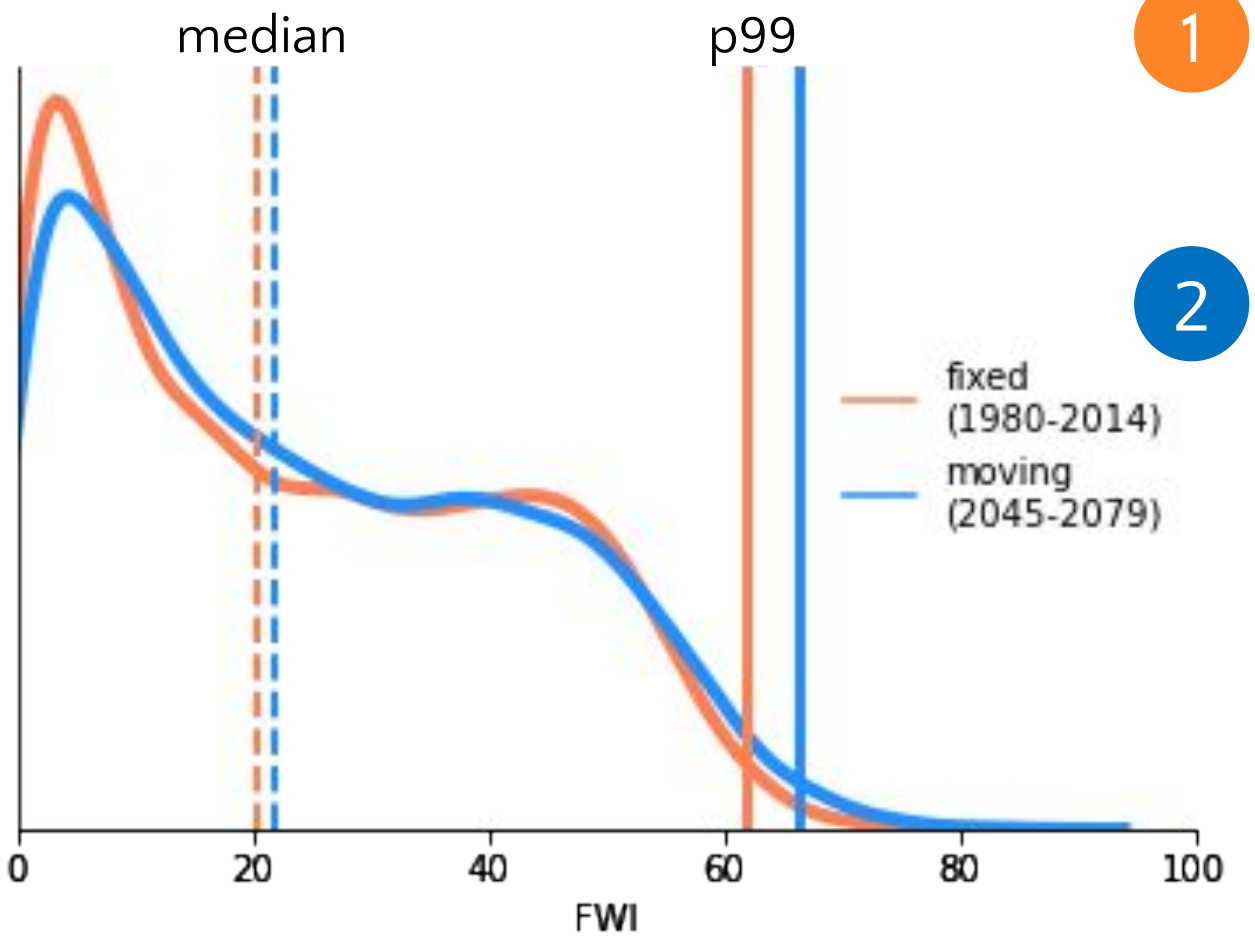
Distribution of FWI across all 100 ensembles



1 Fixed
p99 of historic distribution

Calculating the extreme threshold

Distribution of FWI across all 100 ensembles

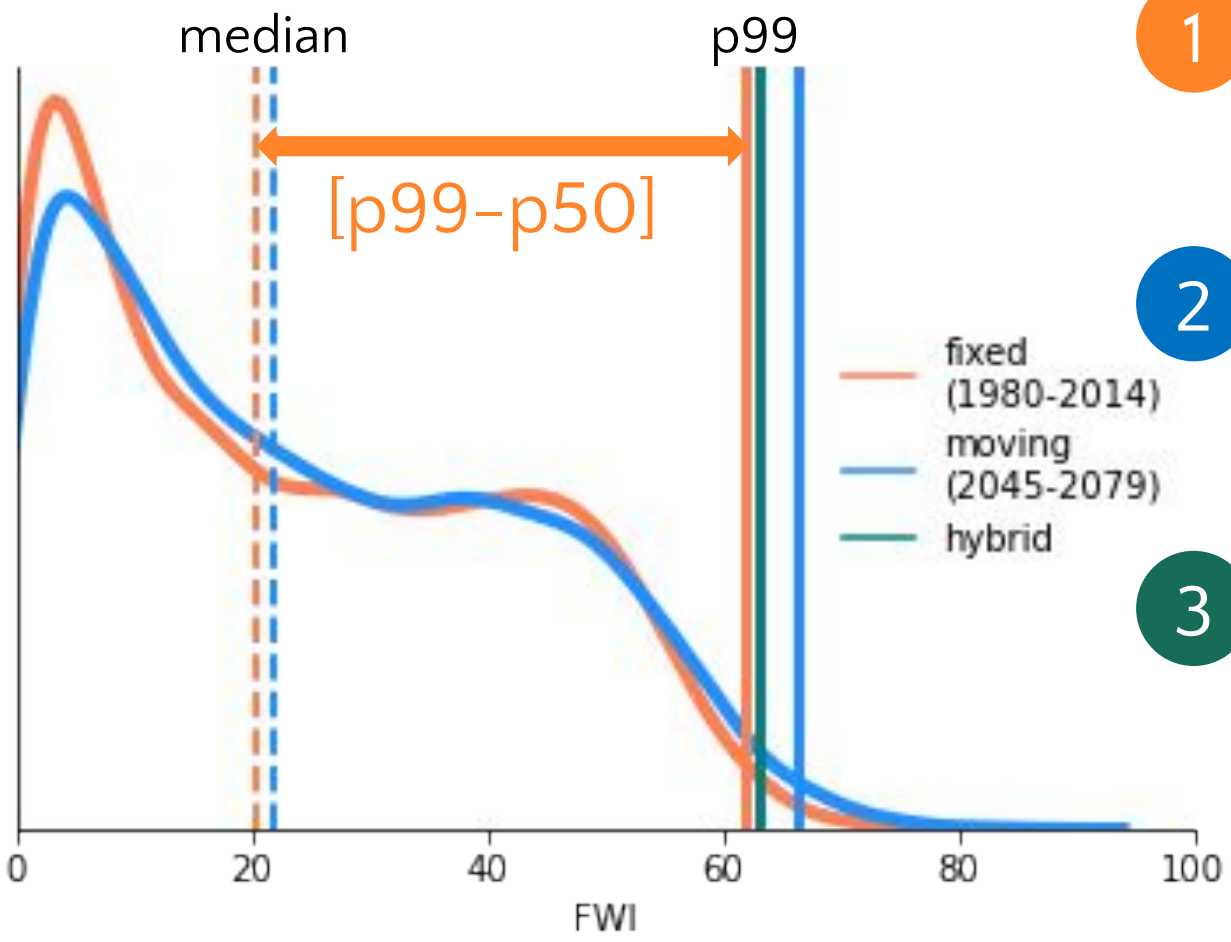


1. Fixed
   p99 of historic distribution

2. Moving
   p99 of moving-window distribution

Calculating the extreme threshold

Distribution of FWI across all 100 ensembles



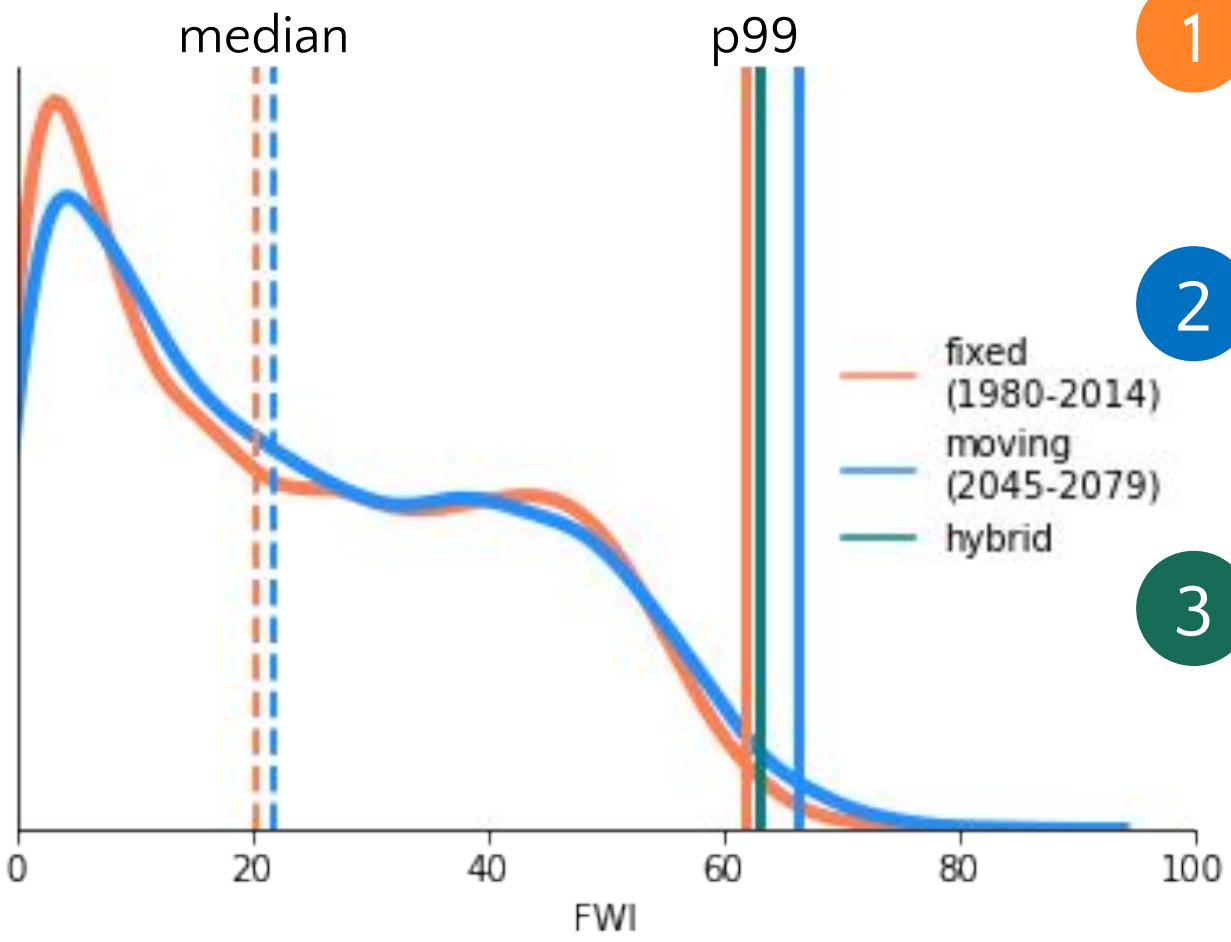
1. **Fixed**
   p99 of historic distribution

2. **Moving**
   p99 of moving-window distribution

3. **Hybrid**
   p50 of moving-window distribution
   + [p99-p50] of historic distribution

Calculating the extreme threshold

Distribution of FWI across all 100 ensembles



1 **Fixed**

No forced changes in **mean** & **variability**

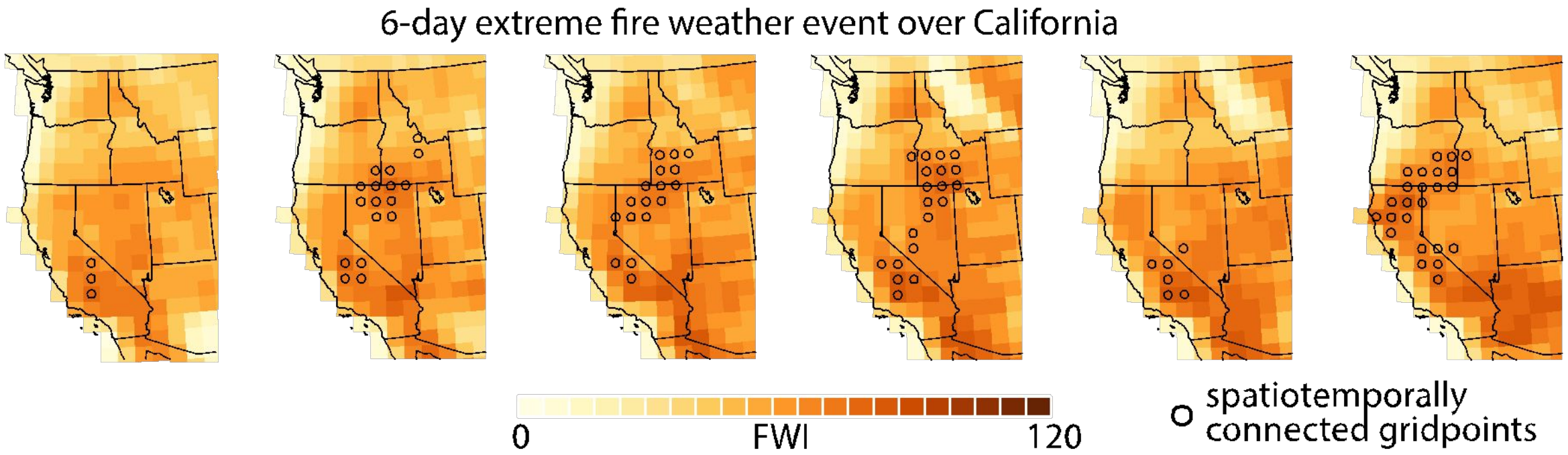
2 **Moving**

Forced changes in **mean** & **variability**

3 **Hybrid**

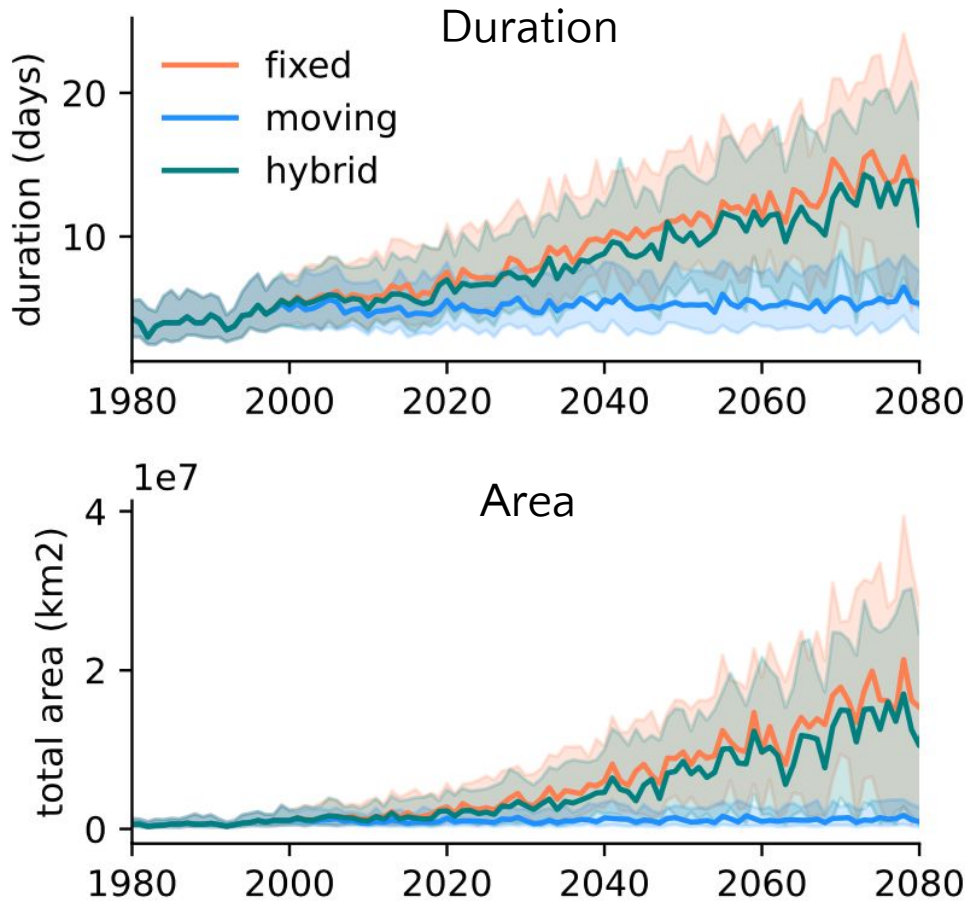
Forced changes in **only mean**

Identifying spatiotemporally connected extreme fire weather events



>13,000 extreme fire weather events over California
with area, duration, location, maximum FWI and average FWI

How are the characteristics of extreme fire weather events changing?



Moving thresholds:

No change

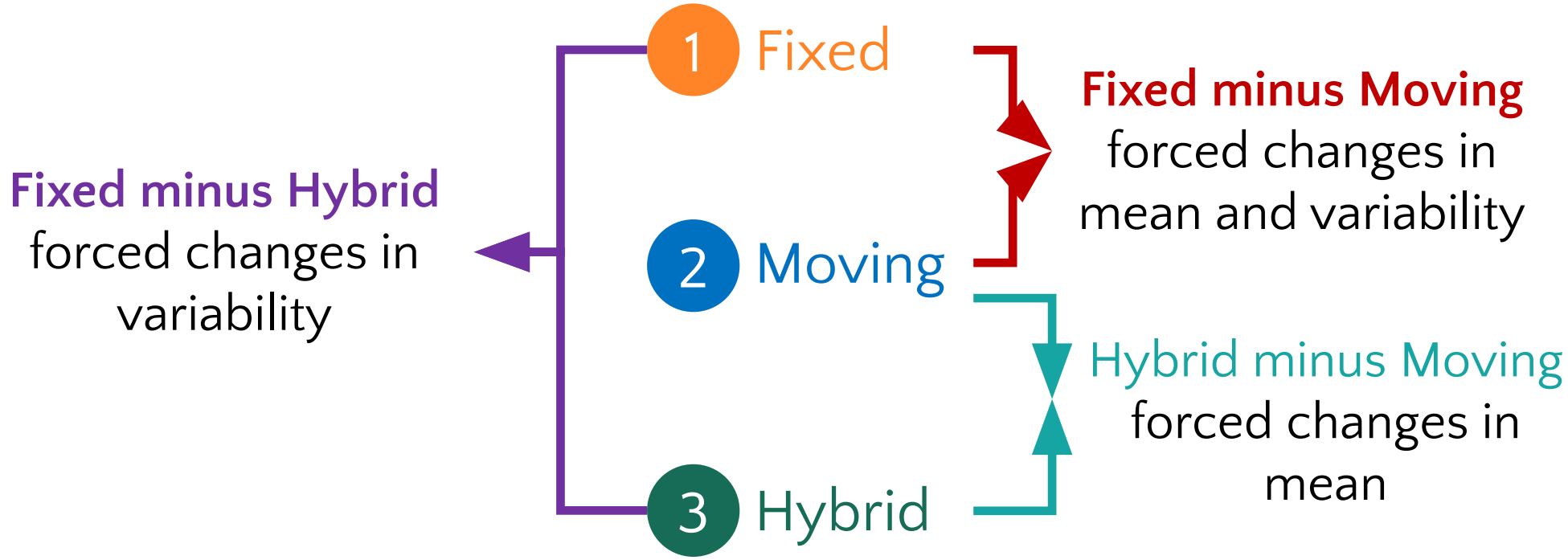
No change

Fixed and **hybrid** thresholds:

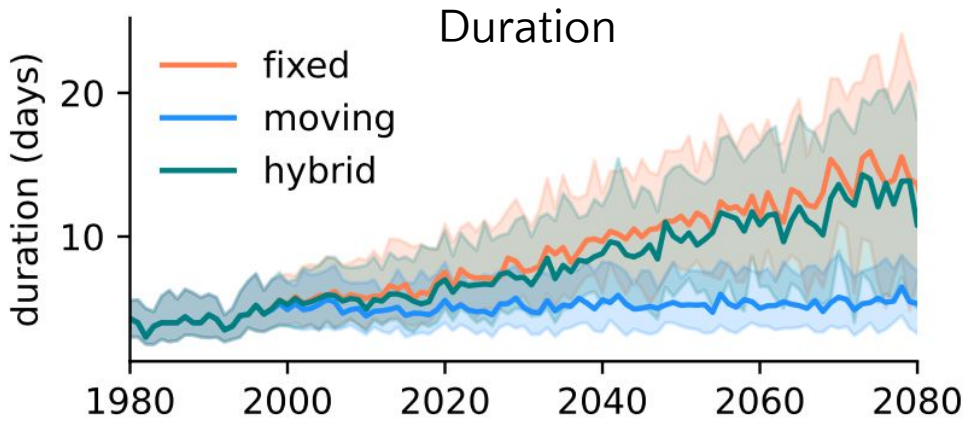
~10 days longer

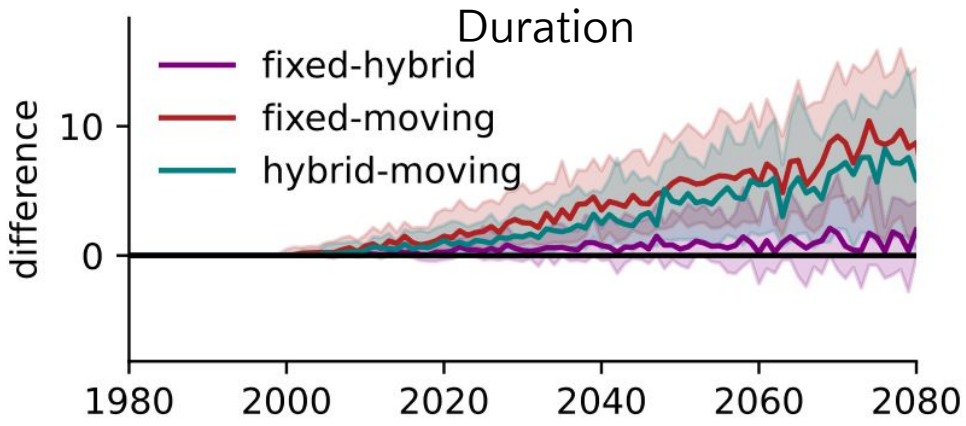
~20x area coverage

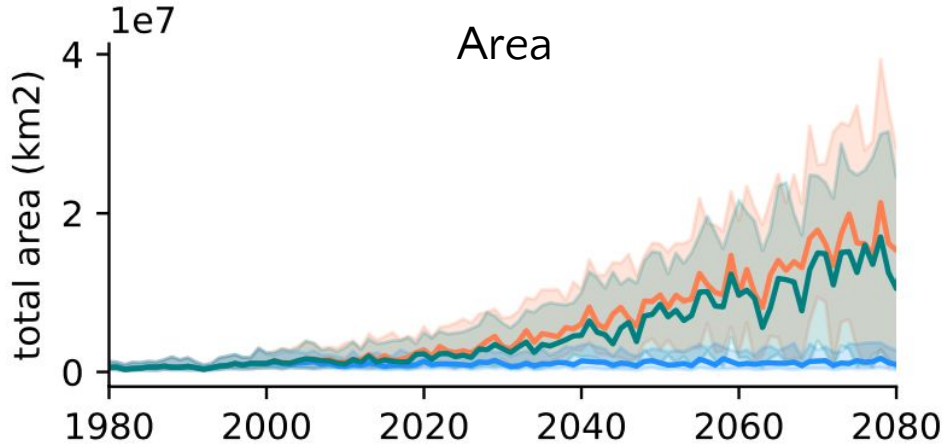
Quantifying effects of forced changes in mean and variability

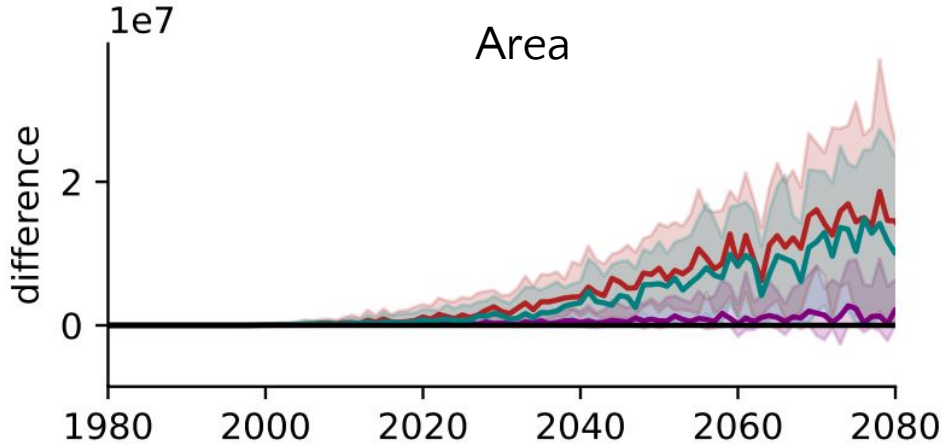


Quantifying effects of forced changes in mean and variability

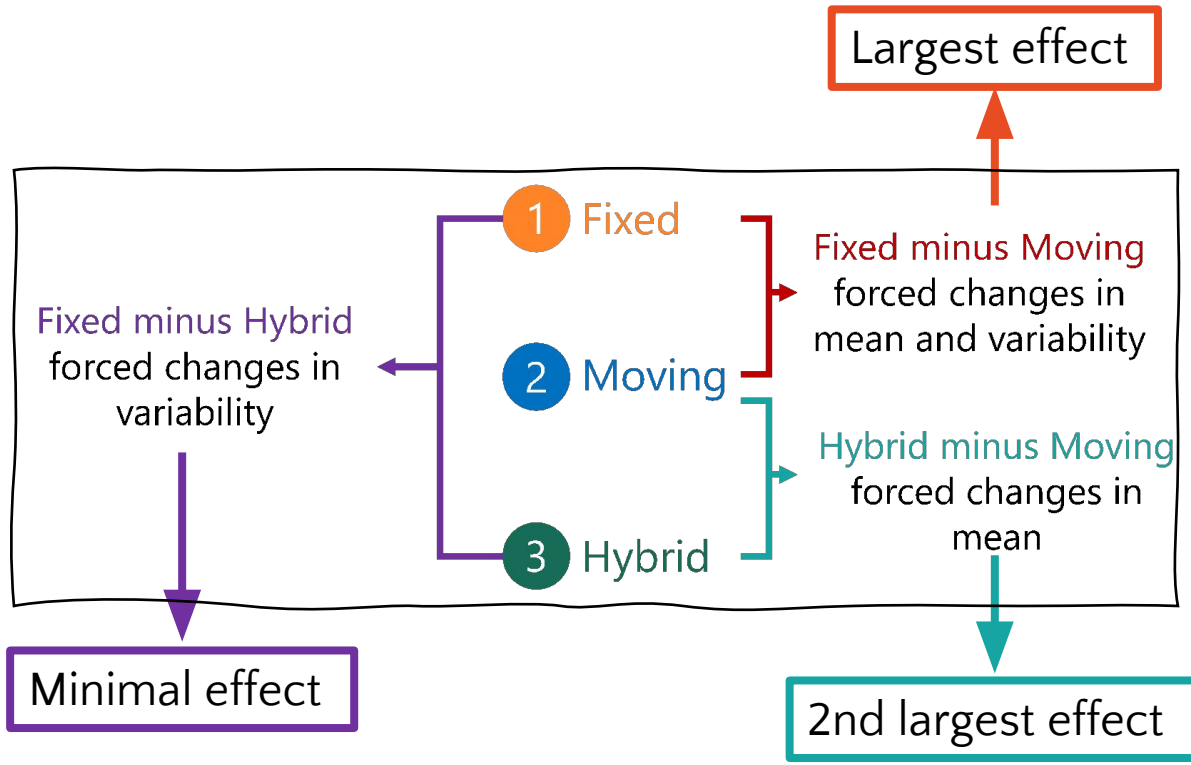


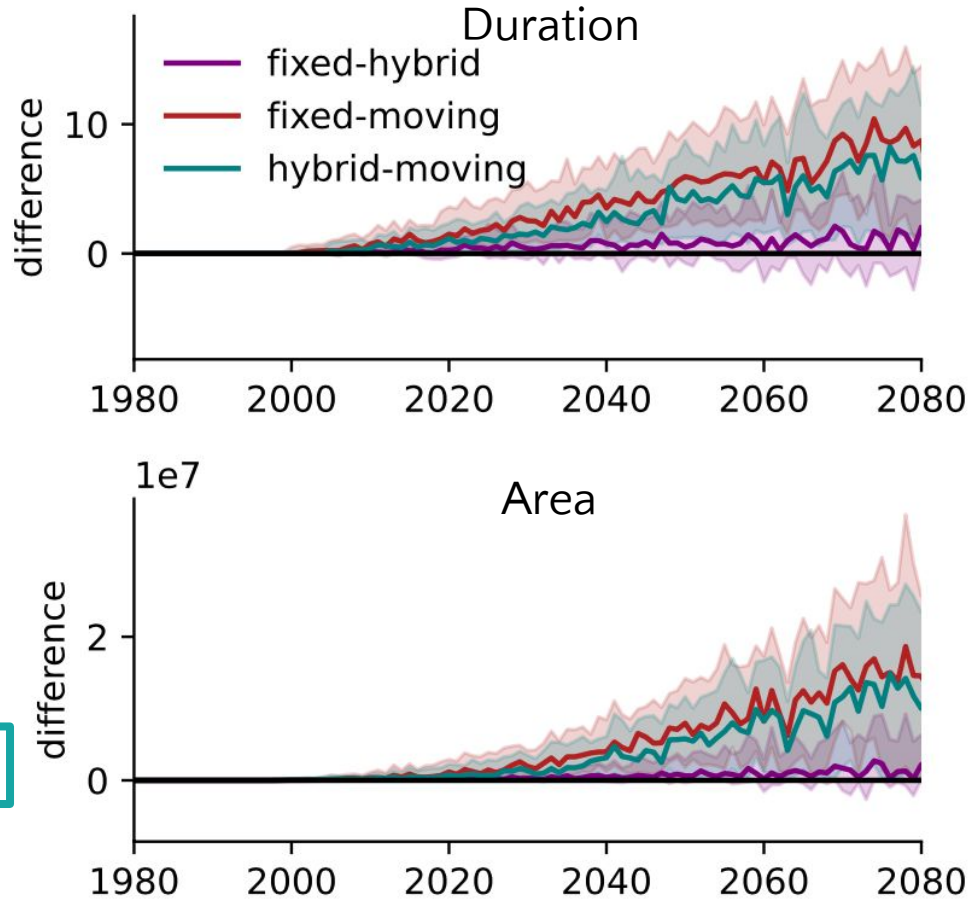






Quantifying effects of forced changes in mean and variability





Take aways

- Extreme fire weather events are becoming larger, more intense, and longer in duration compared to the current climate
- These changes are largely driven by changes in the mean climate
- Effects of forced changes in climate variability are small
- What about changes in the individual variables and large-scale conditions?