Economic Risks of Climate Change

An American Prospectus

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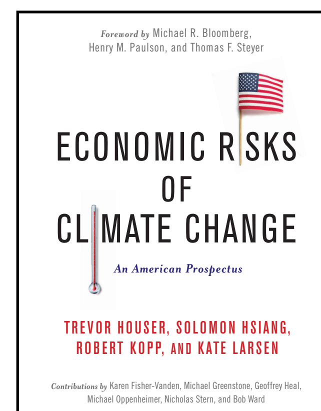
Maryland Climate Change Commission
August 5, 2015



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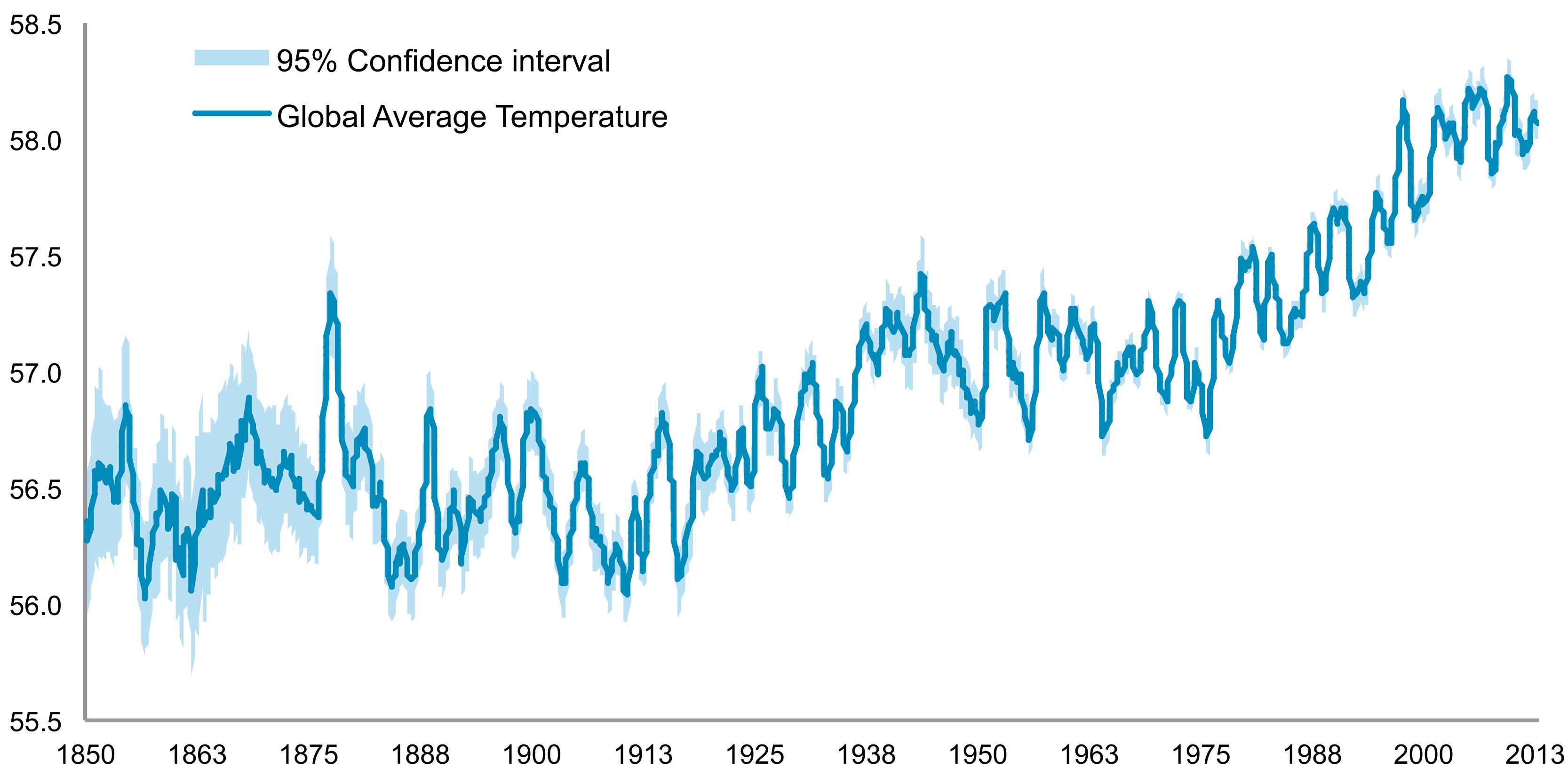
Overview

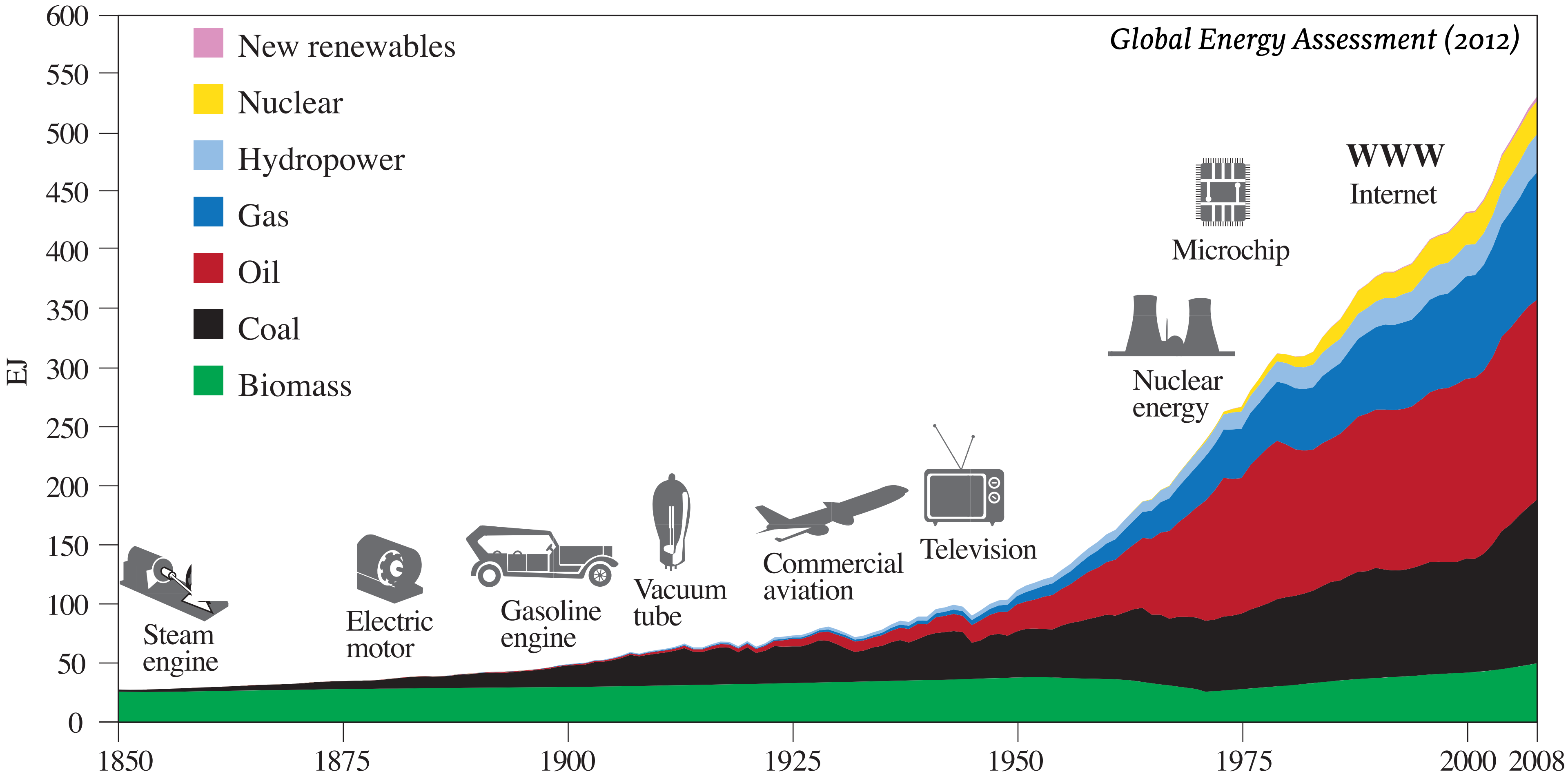
Global temperatures are rising…

Degrees Fahrenheit

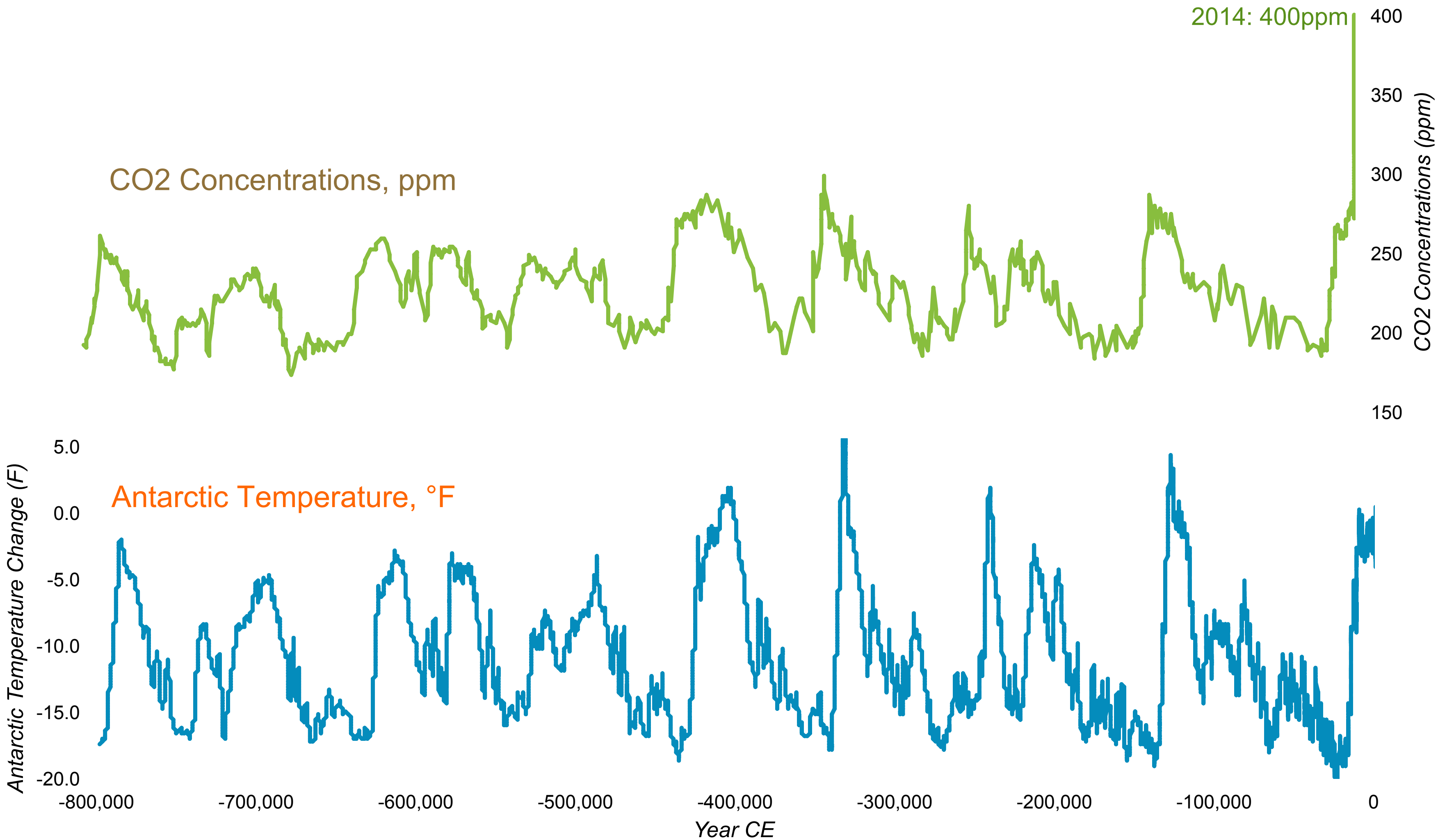


...and we know the main reason why.

World primary energy use, 1850-2008



We've changed the atmosphere in a way unprecedented in our species' history.



An Independent Assessment for a Climate Risk Committee

Analytical Support for the Risky Business Project (riskybusiness.org)









Next Generation

Bloomberg Philanthropies

THE PAULSON INSTITUTE

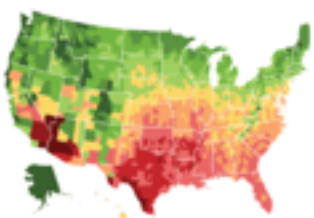
Research approach

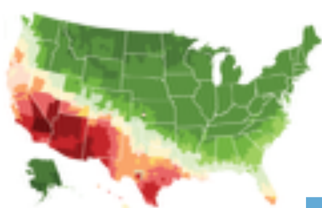
Spatial Empirical Adaptive Global-to-Local Assessment System (SEAGLAS)

Downscaled, probabilistic physical climate projections

Temperature

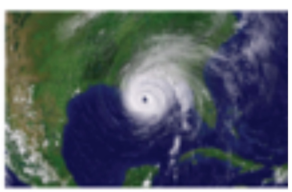
Precipitation



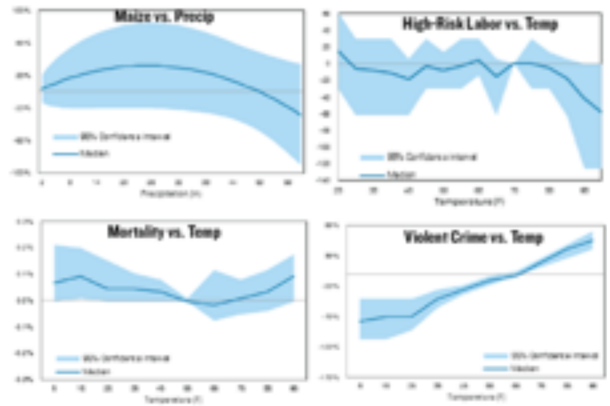


Tropical Cyclone Activity

Sea-Level Rise

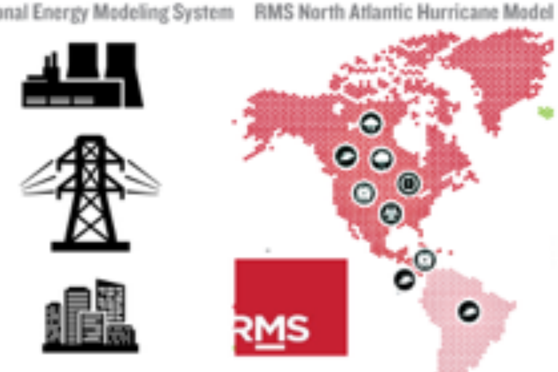


Impact estimates based on meta-analysis of econometric research



National Energy Modeling System

RMS North Atlantic Hurricane Model

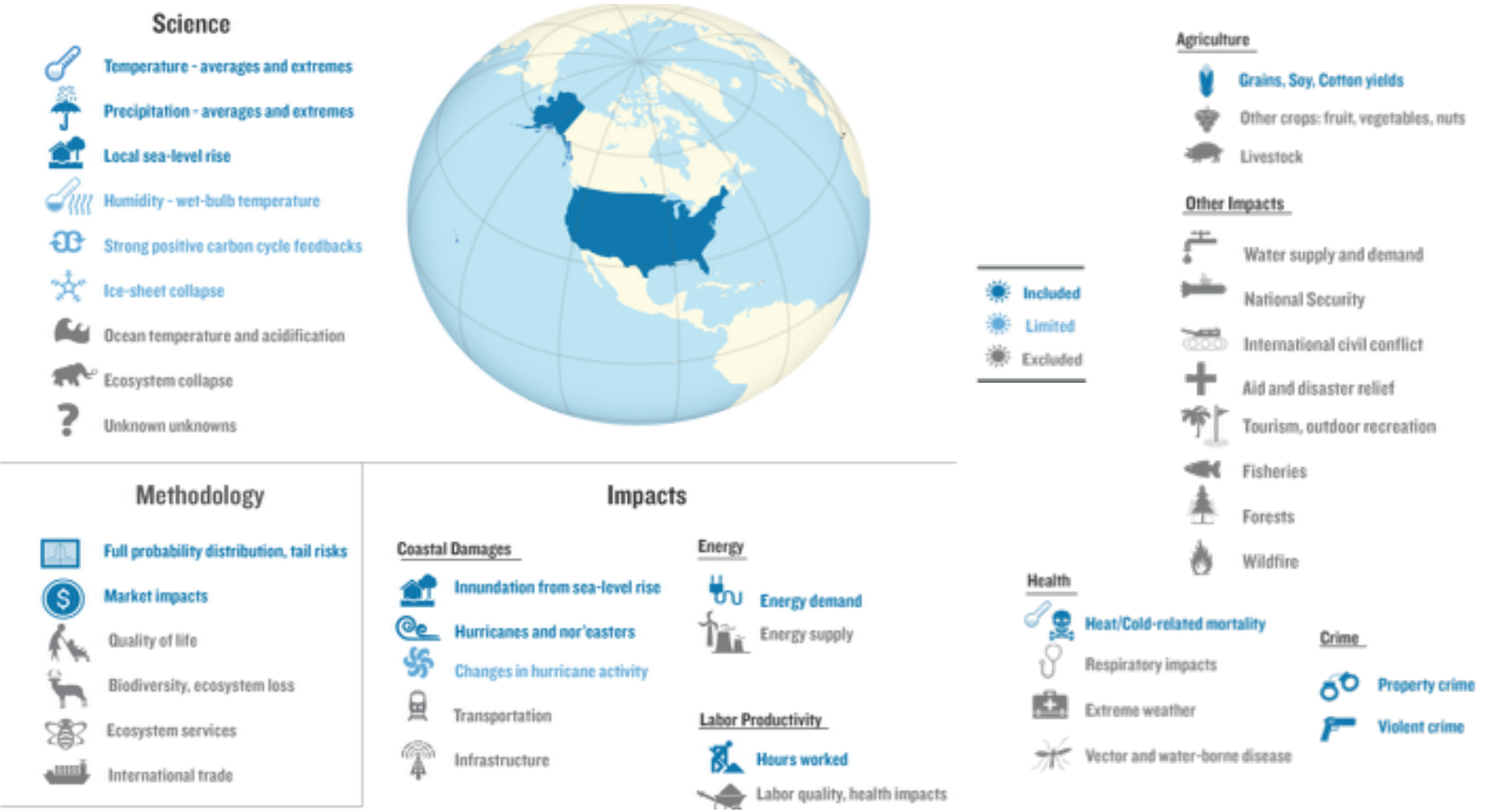


Complementary detailed sectoral models

Integrated economic analysis with CGE model, consideration of potential adaptations

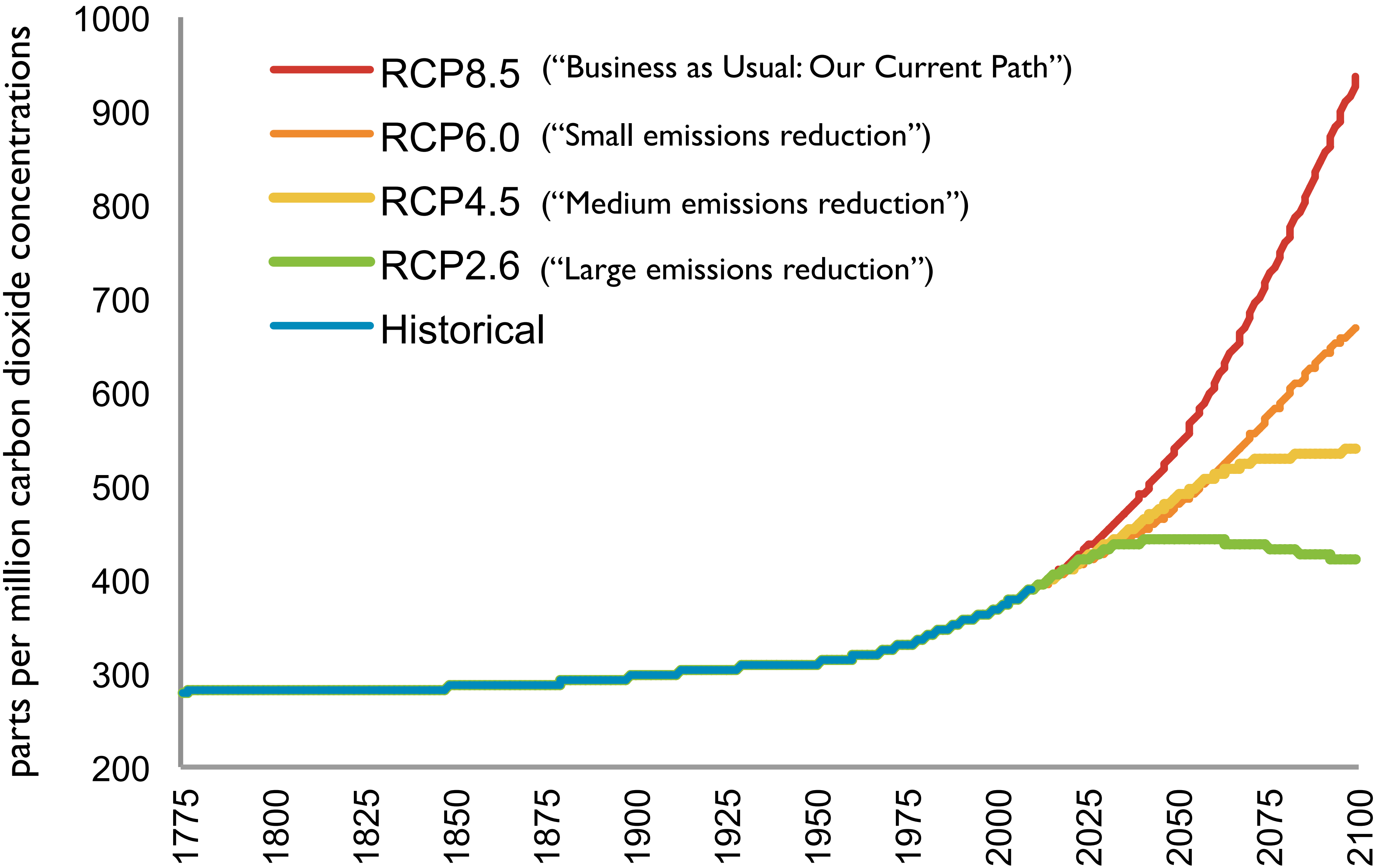
Scope of coverage

Far from comprehensive – focus on impacts quantifiable in a 1-year analysis



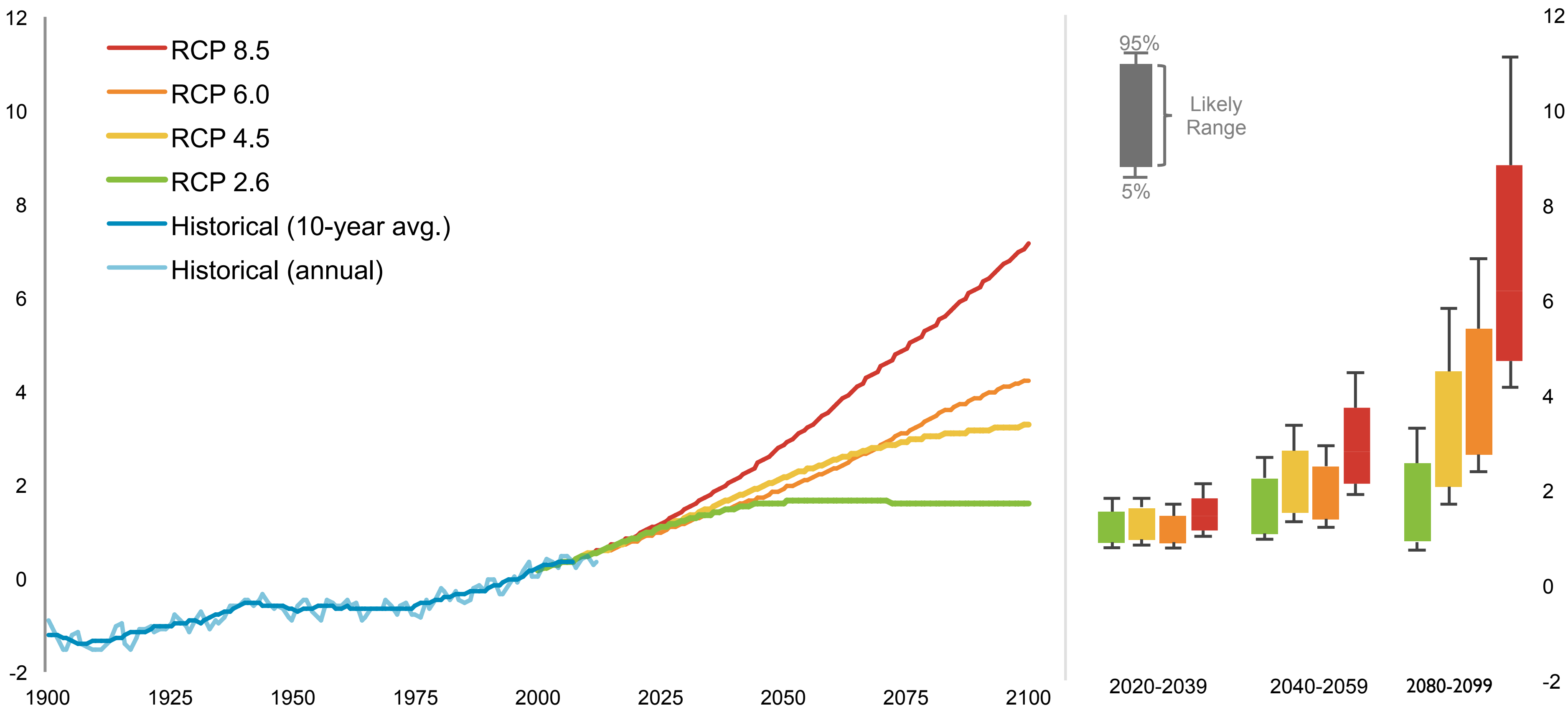
Physical Climate Projections

We can shape the path of future greenhouse gas emissions.



Those choices affect the future temperature trajectory of the planet.

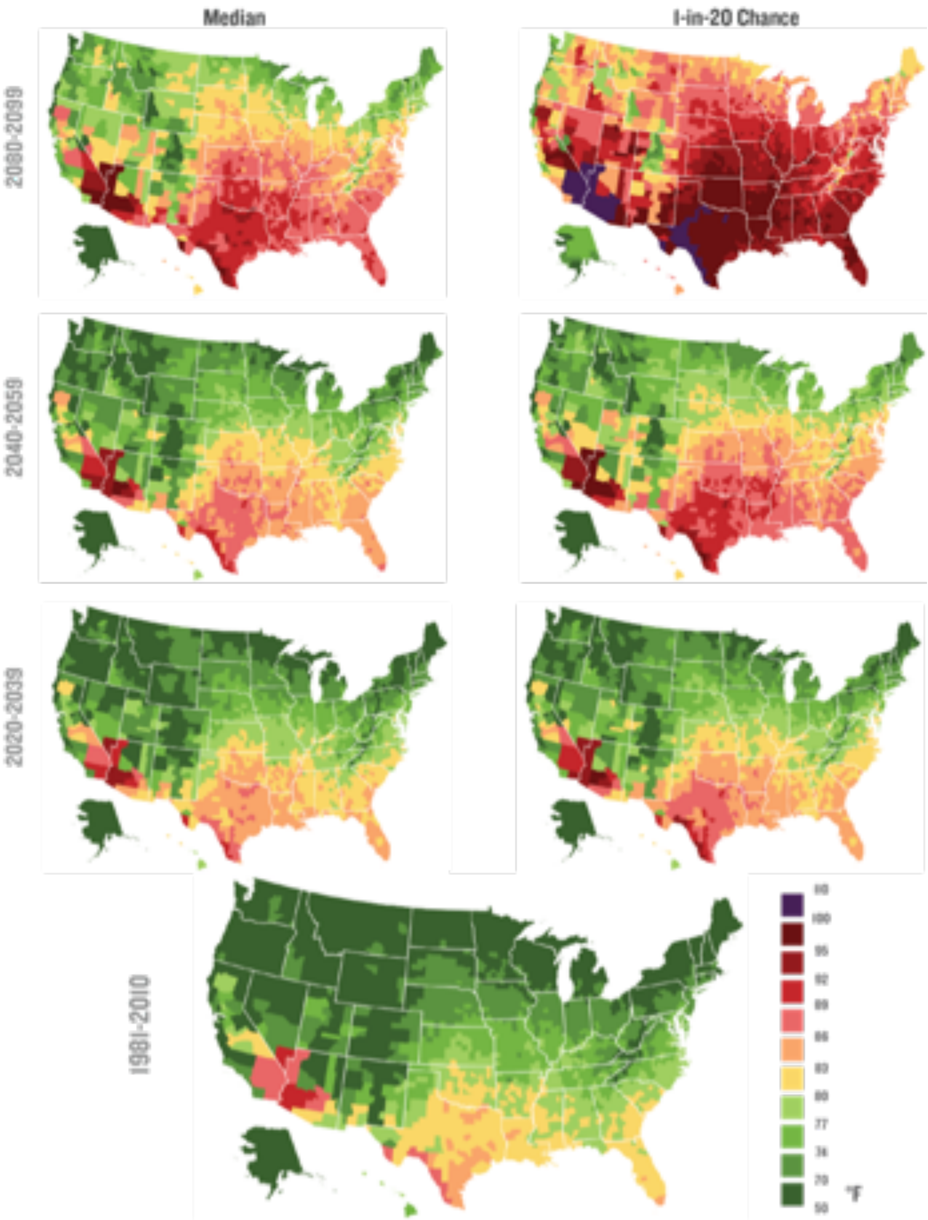
Temperature projections (°F) from the MAGICC simple climate model, courtesy Malte Meinshausen

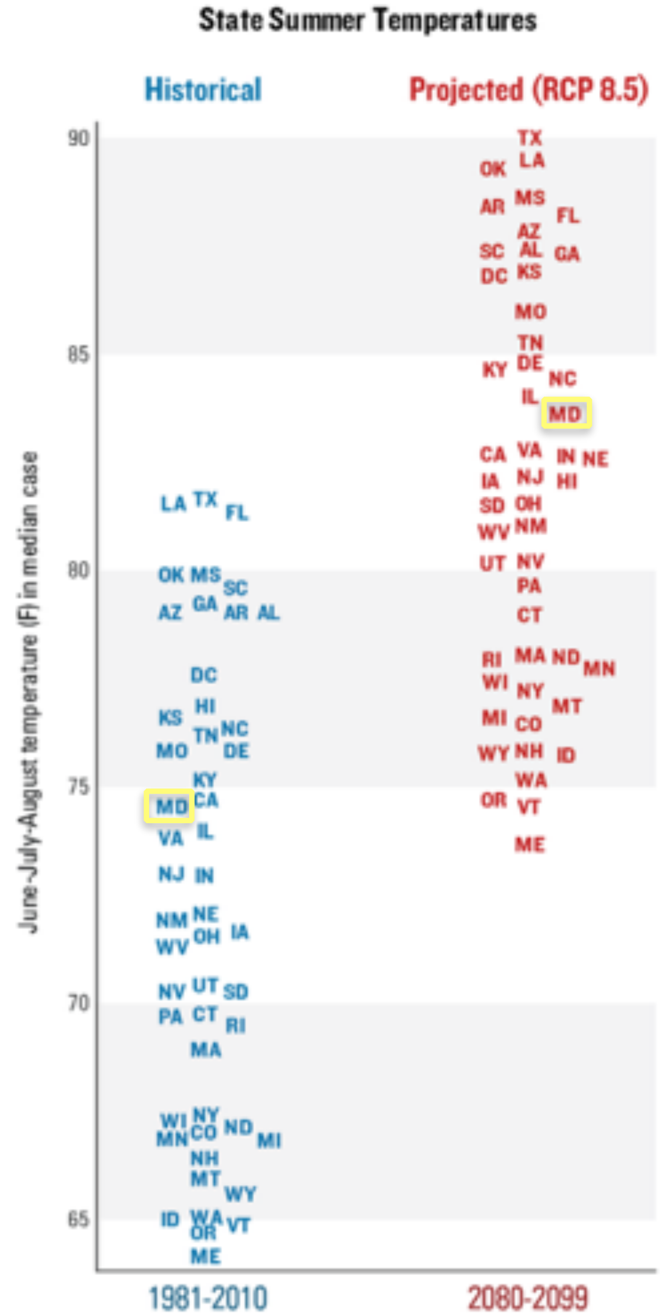


And of the United States.

Median and 1-in-20 chance summer temperature projections (°F)

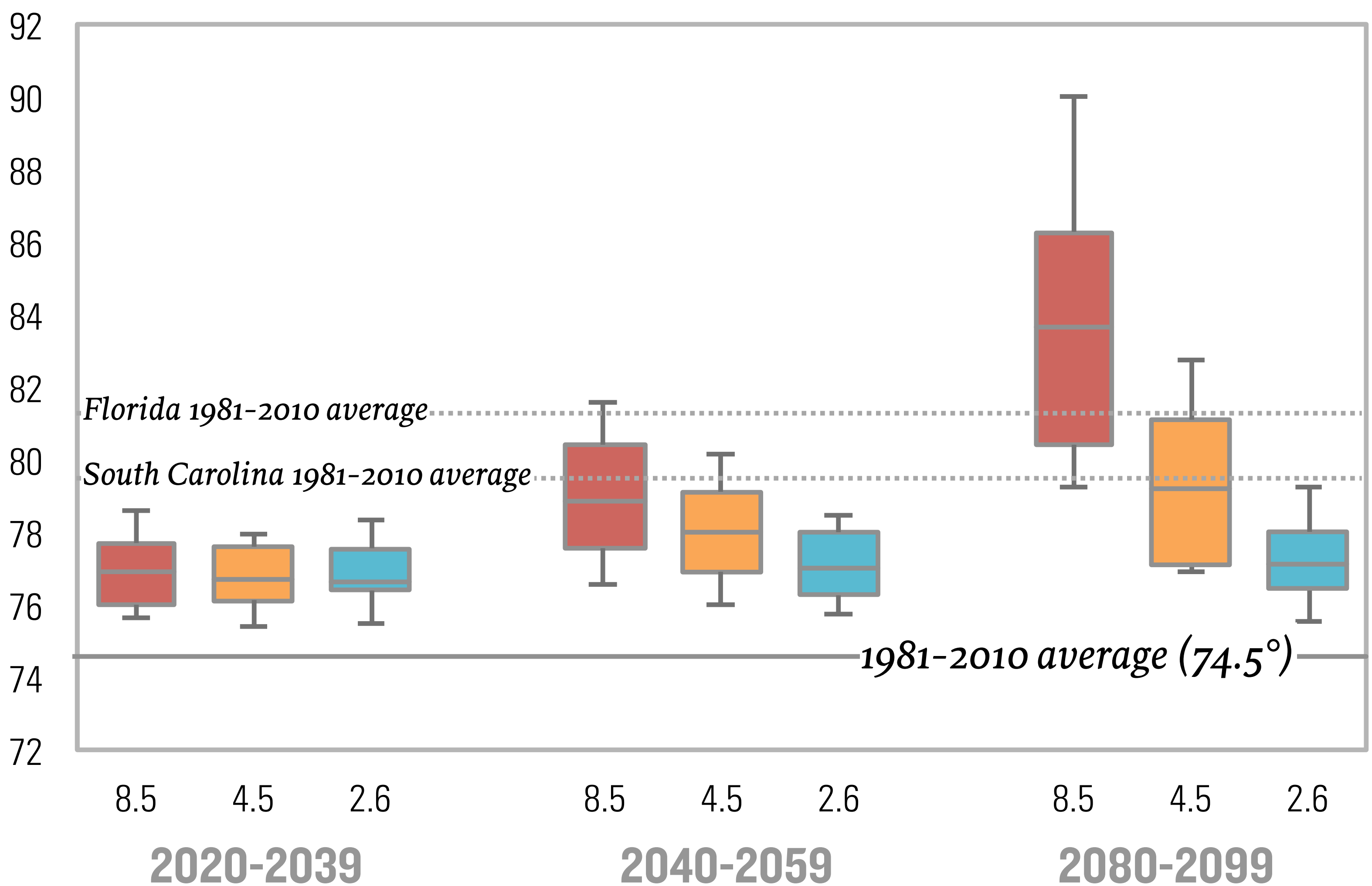
RCP 8.5 (high emissions)





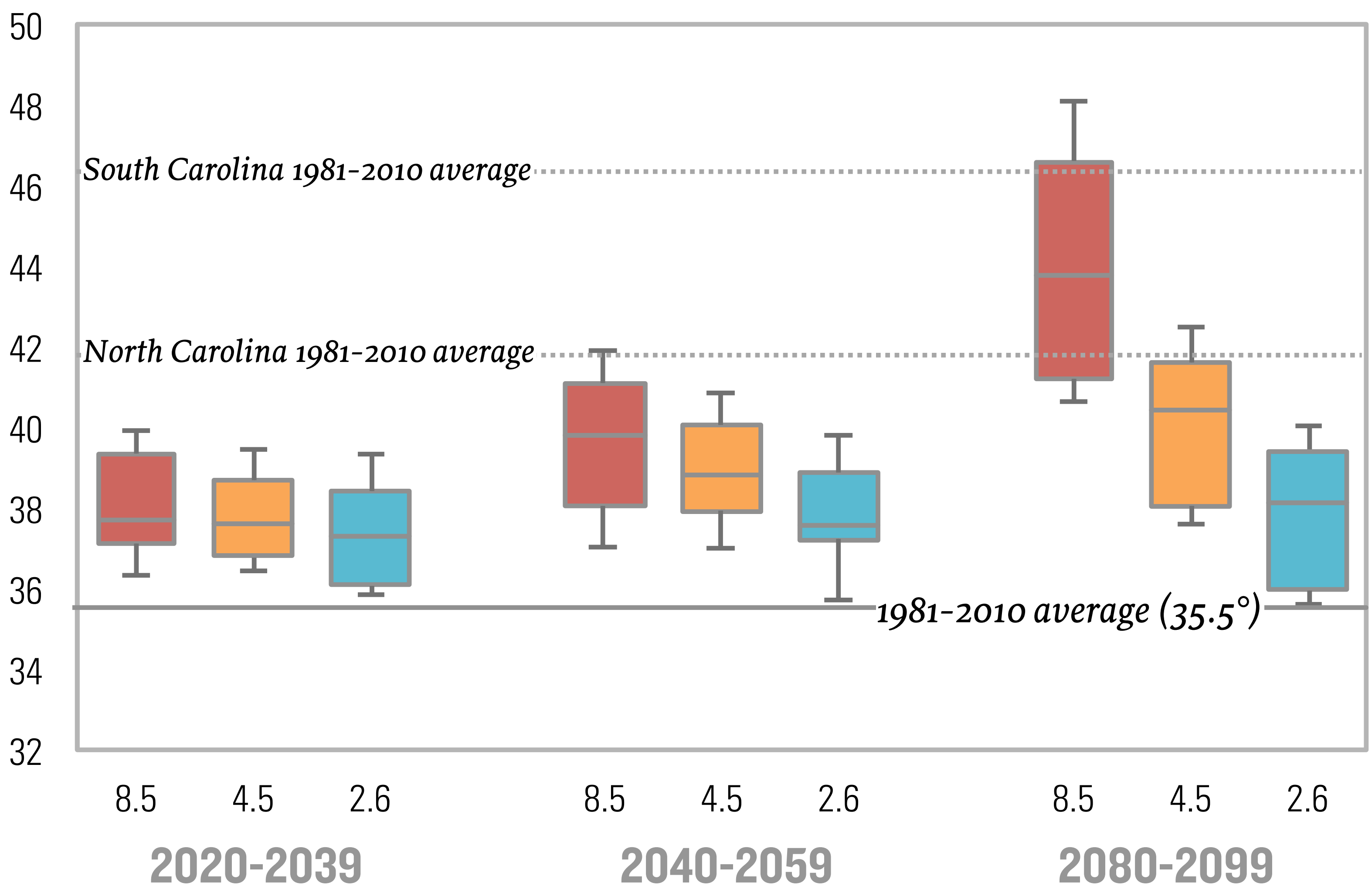
Average summer temperature in Maryland

Degrees Fahrenheit



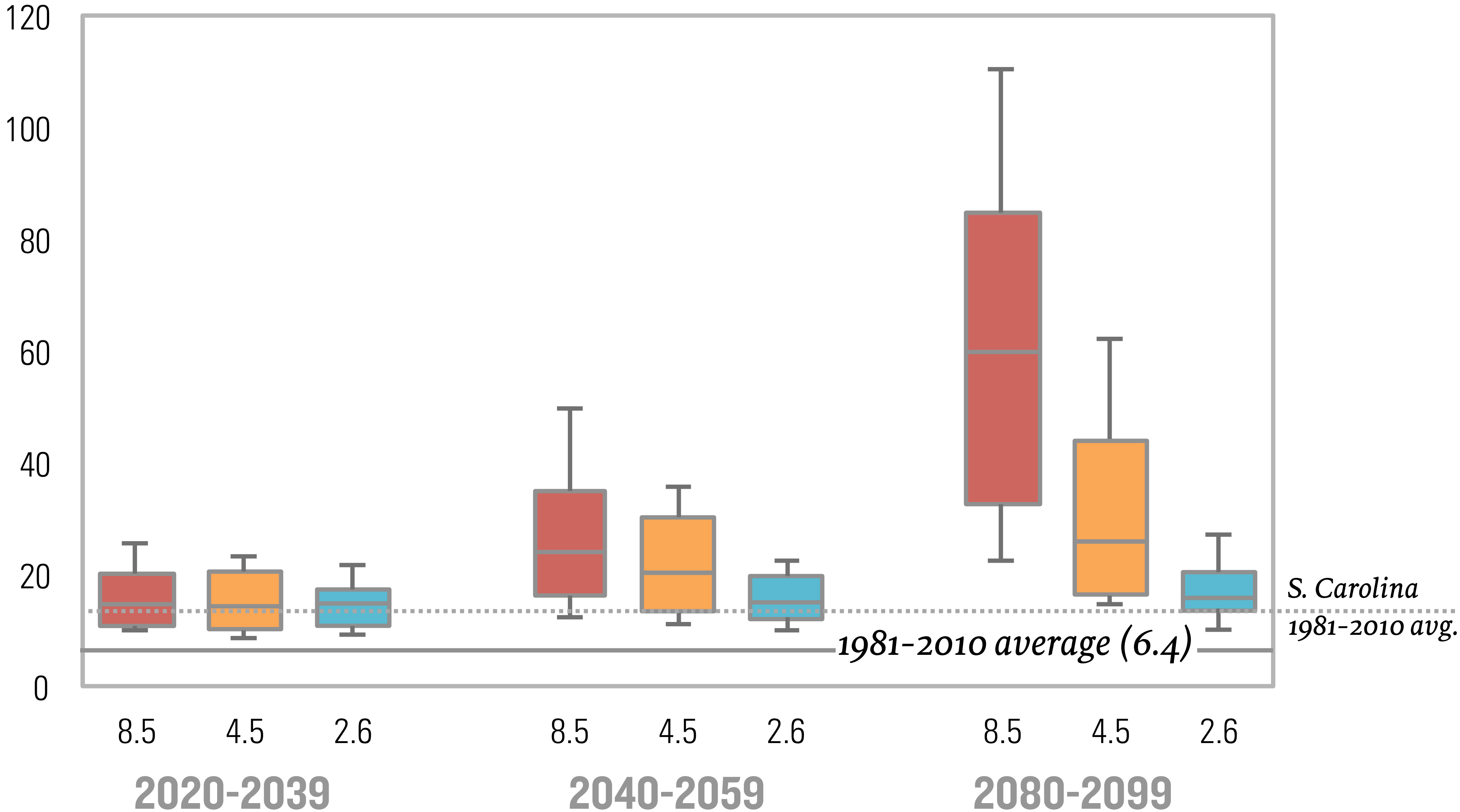
Average winter temperature in Maryland

Degrees Fahrenheit



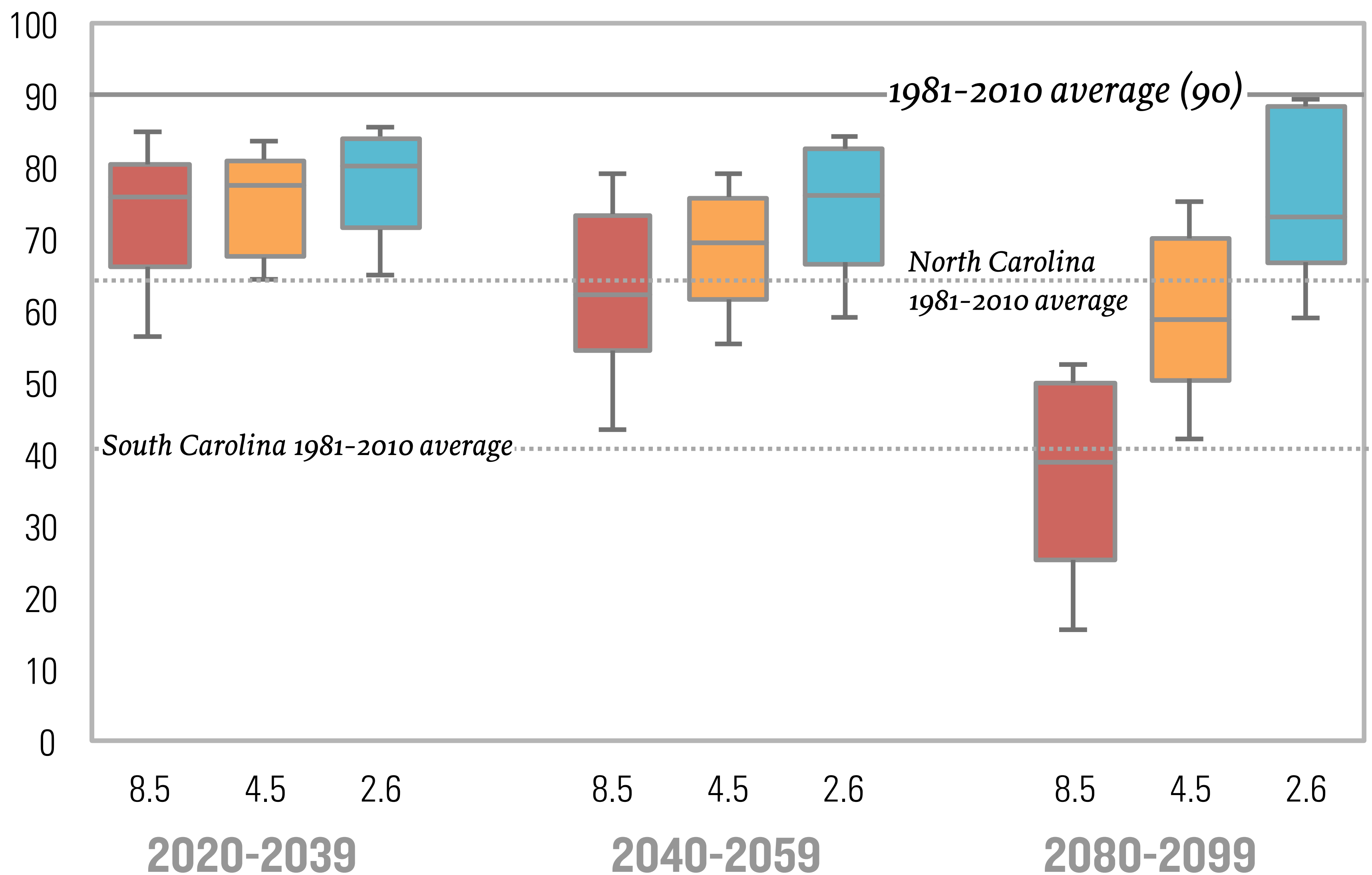
Number of days above 95°F in Maryland

Average days/year, population-weighted



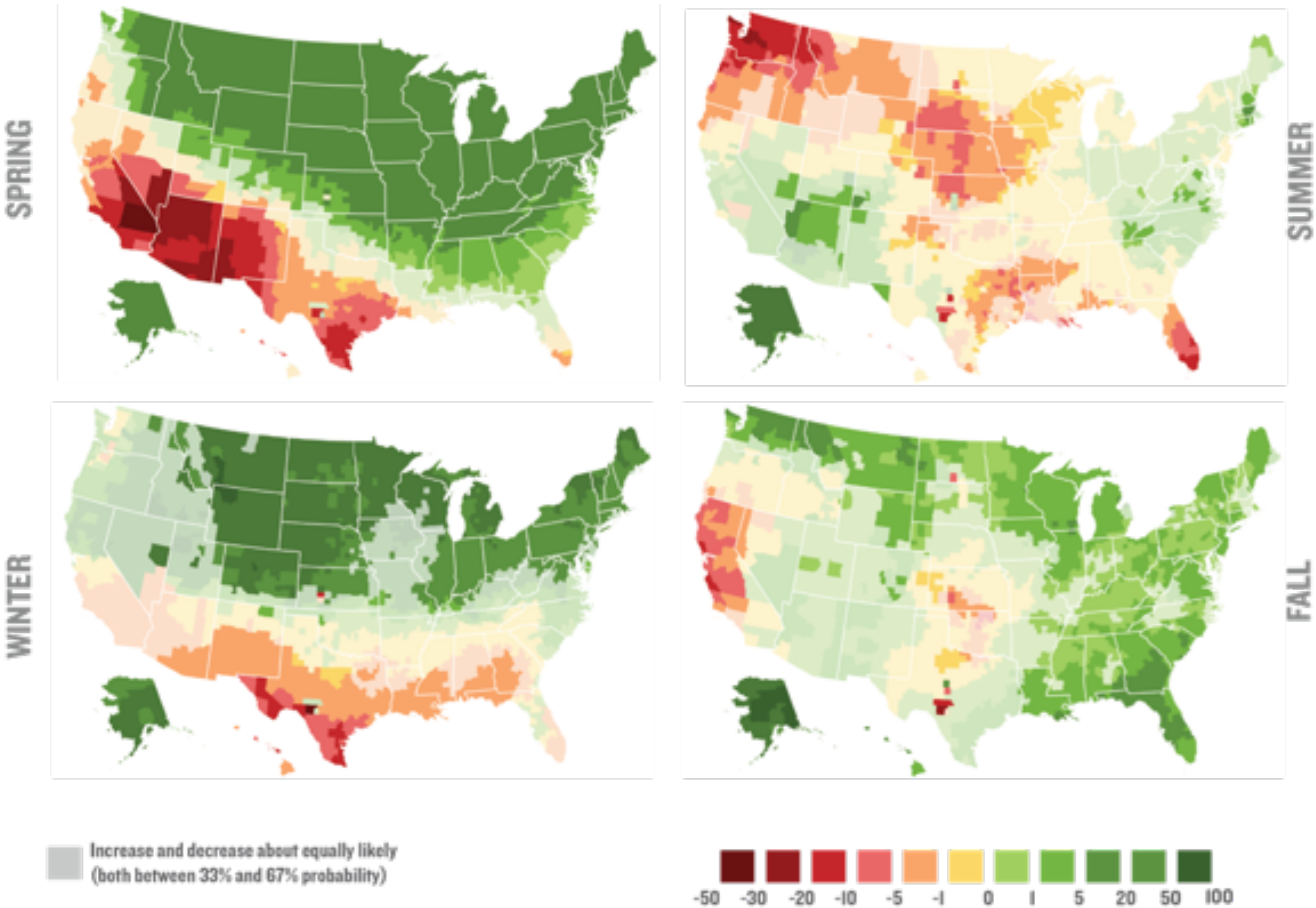
Number of freezing days in Maryland

Average days/year, population-weighted



They will also affect precipitation.

Median projected % precipitation change, RCP 8.5 (high emissions) in 2080-2099.
In the faded regions, an increase and an decrease are both about equally likely.



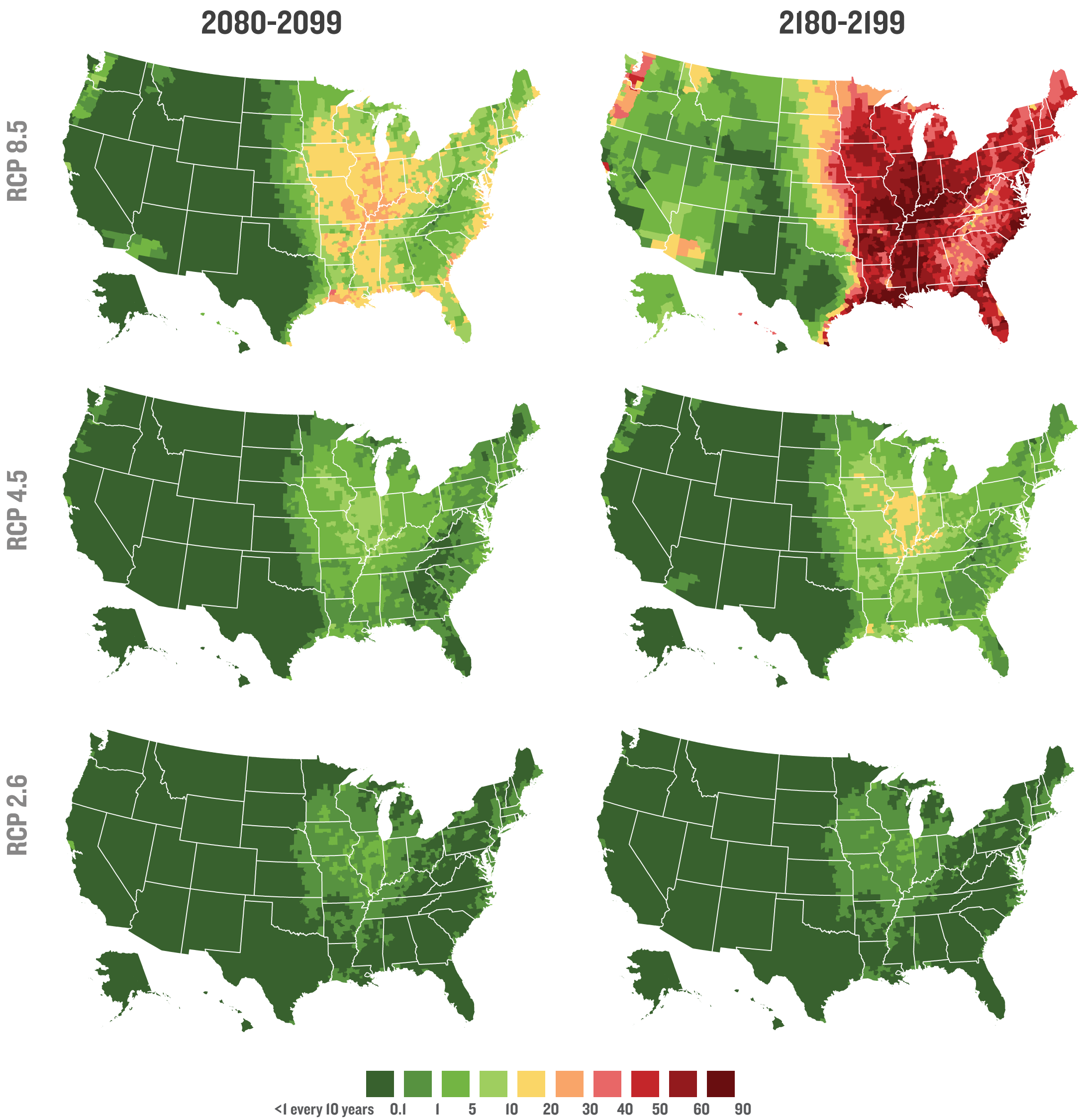
ACP Humid Heat Stroke Index

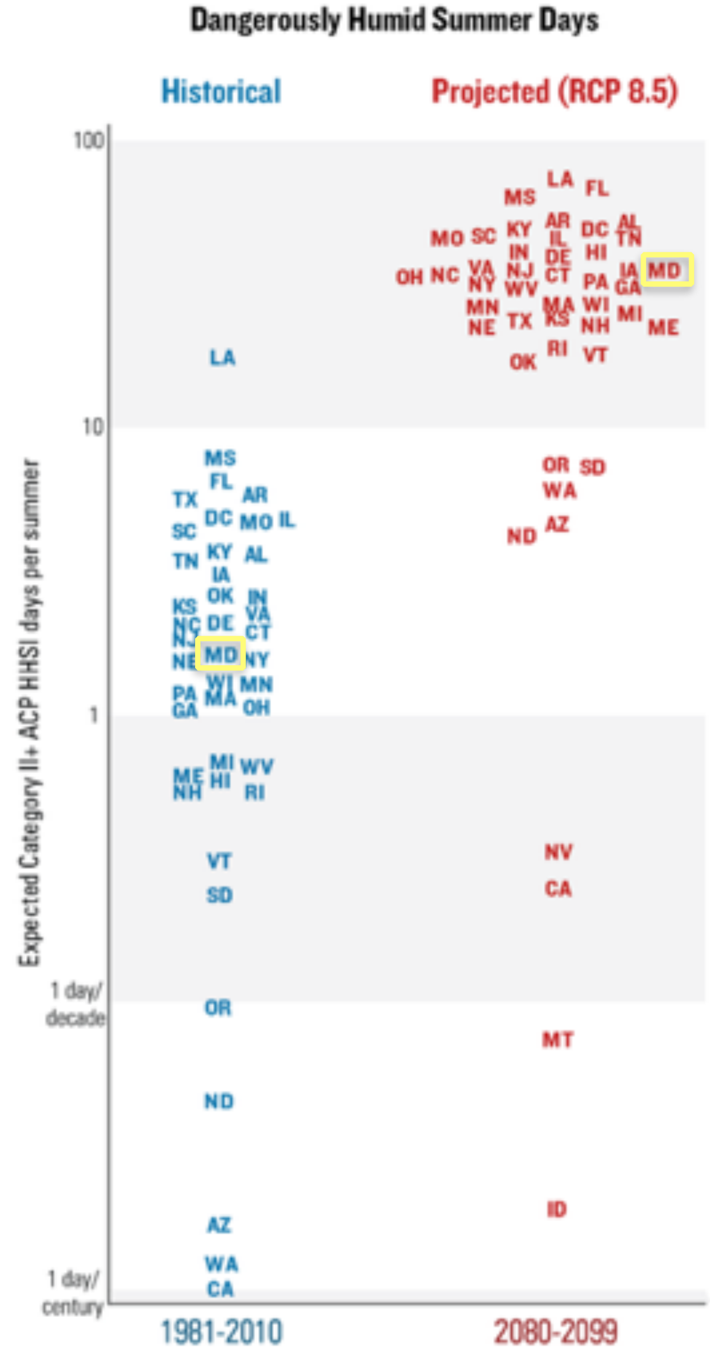
"It's not just the heat; it's the humidity."

ACP HHSI	Peak Wet Bulb Temperature	Description (hottest part of day)
I	74°F-80°F	Uncomfortable. Typical of much of summer in the Southeast.
II	80°F-86°F	Dangerous. Typical of most humid parts of Texas and Louisiana in hottest summer month, and most humid summer days in Washington and Chicago.
III	86°F-92°F	Extremely dangerous. Comparable to Midwest during peak days of 1995 heat wave.
IV	>92°F	Extraordinarily dangerous. Exceeds all U.S. historical records. Heat stroke likely for fit individuals after less than one hour of moderate activity in the shade.

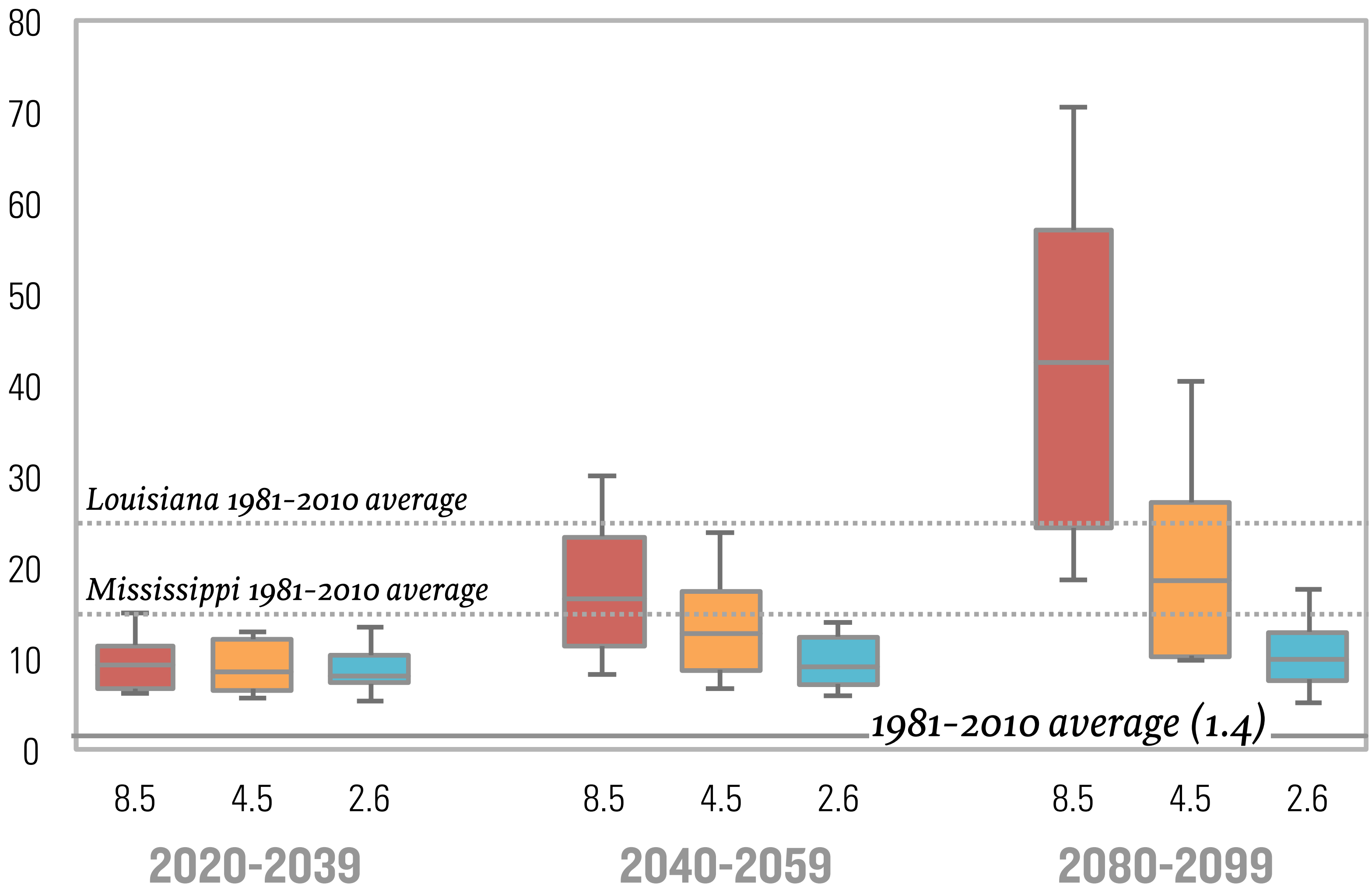
They will also affect humidity extremes.

Expected number of Category 3+ (extremely dangerous) in a typical year



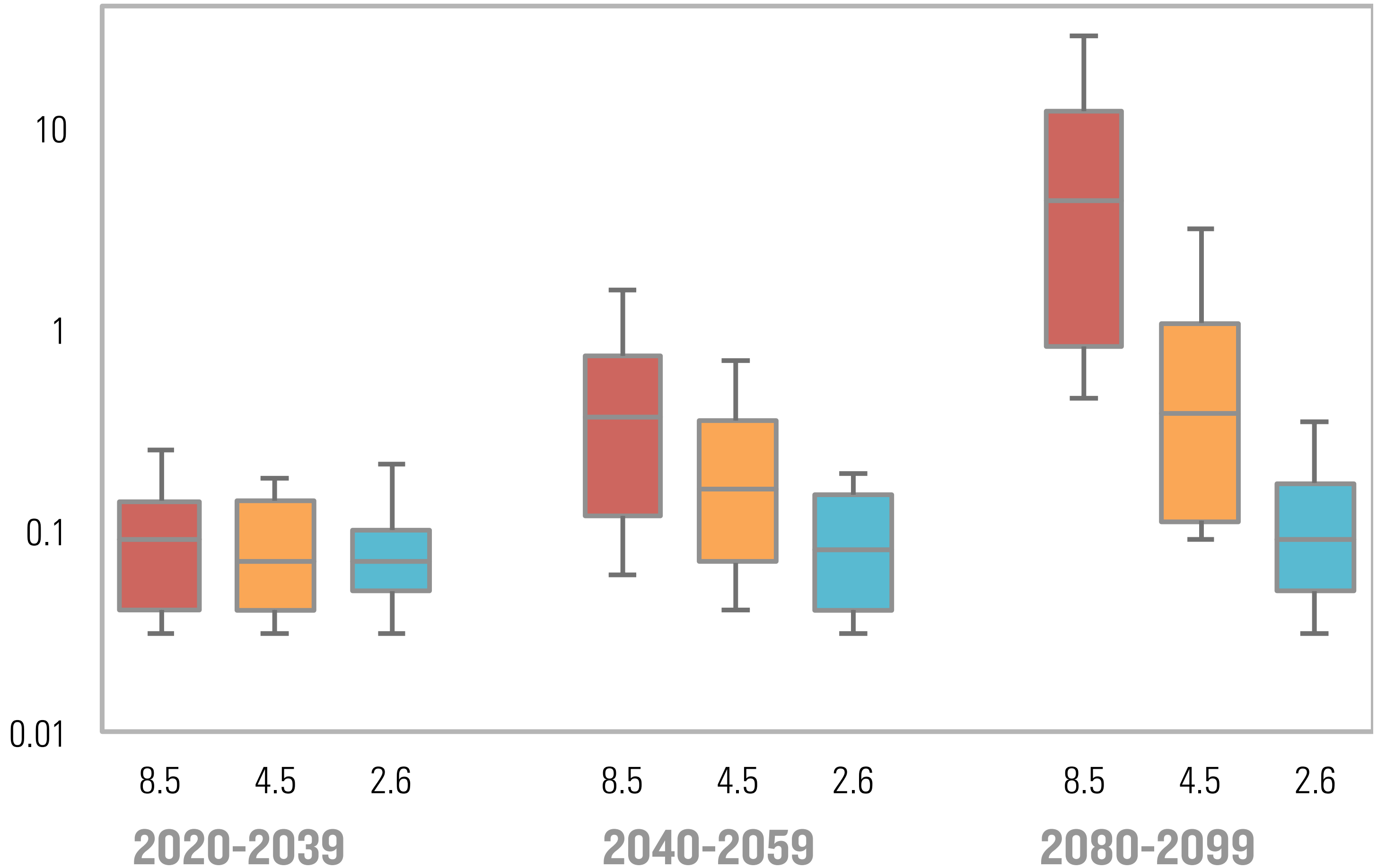


Number of dangerously humid (Category II+) days in average Maryland summer



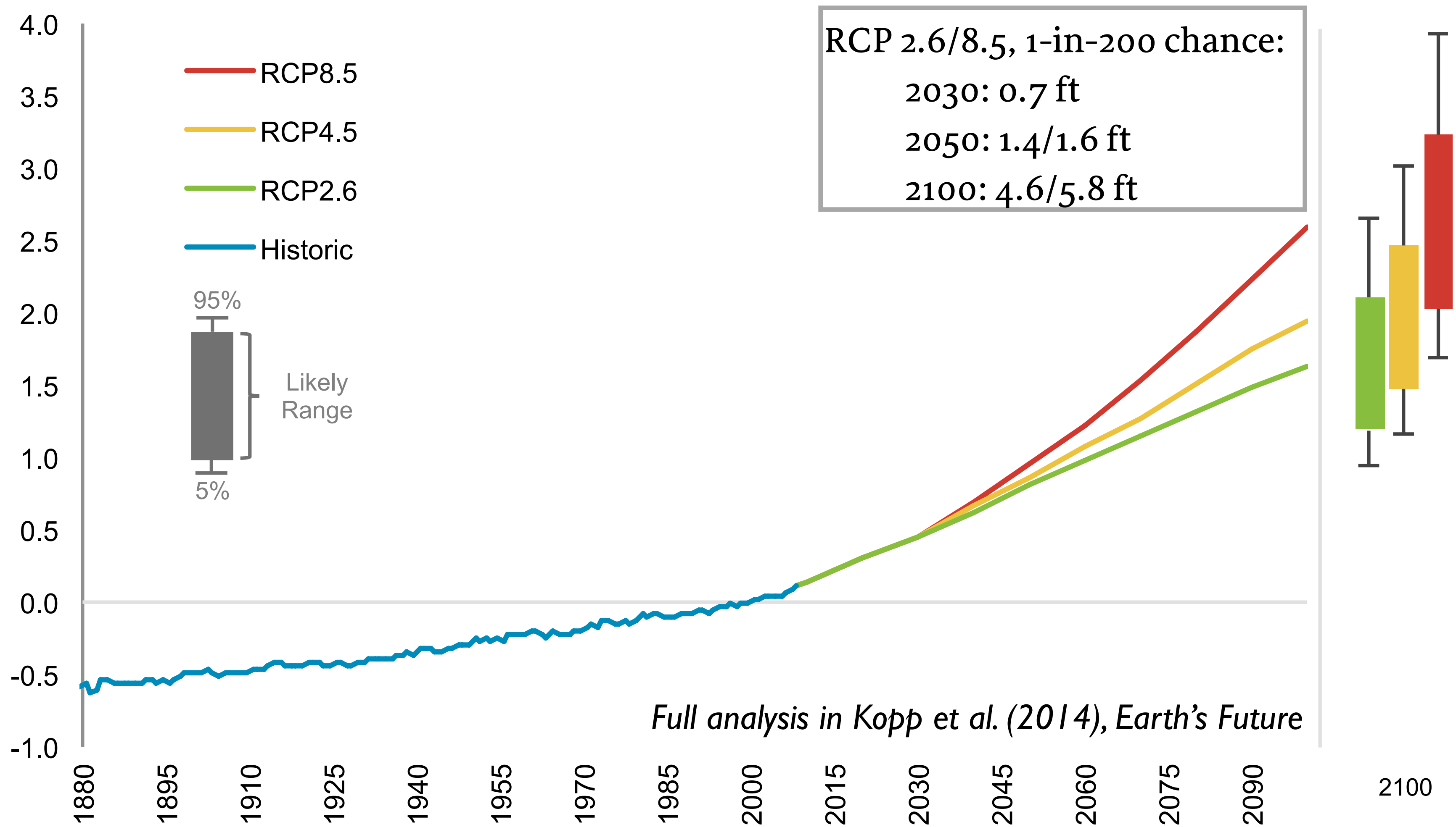
Number of extremely dangerously humid (Category III+) days in average Maryland summer

(Note logarithmic scale!)



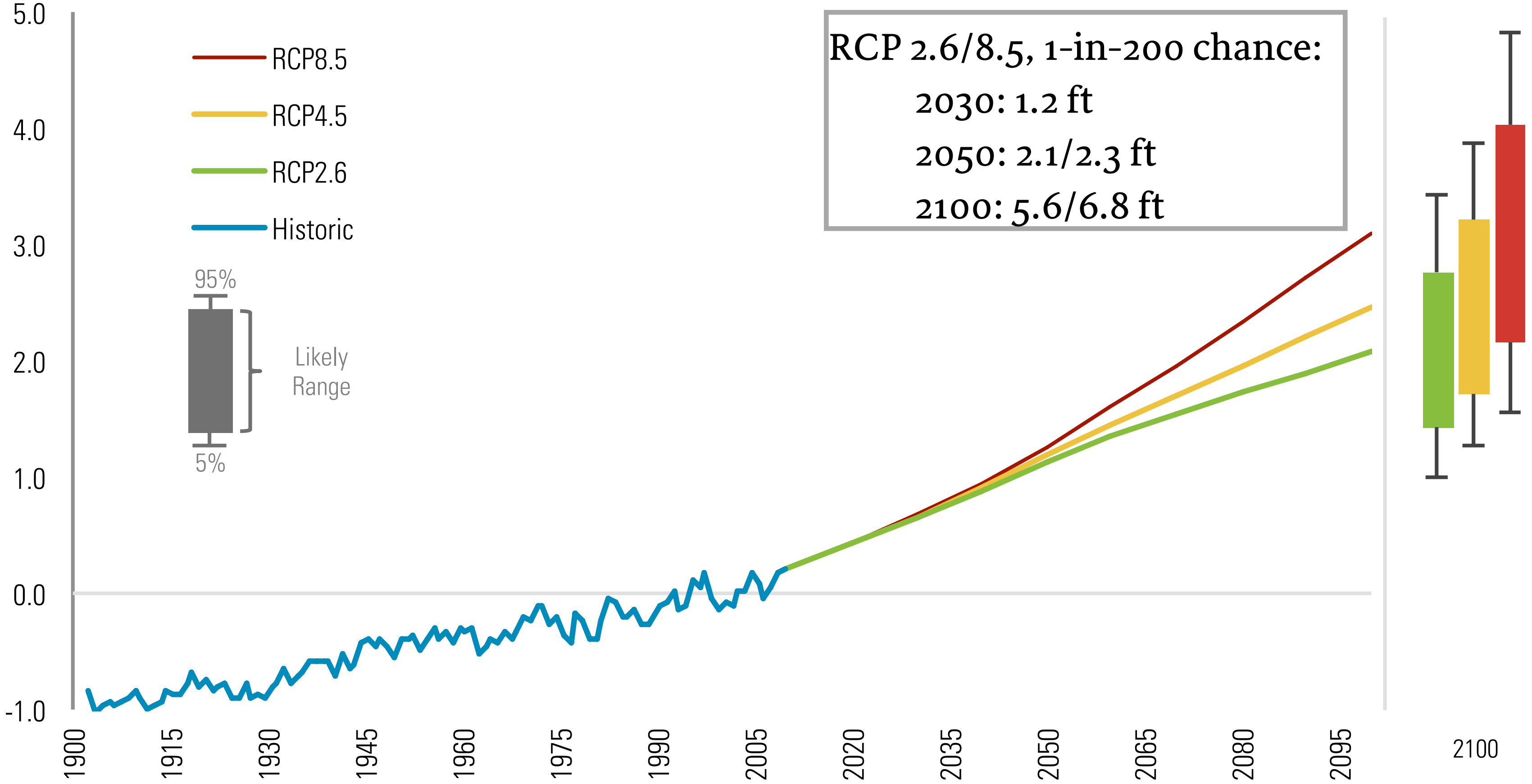
They also drive rising sea levels, both globally…

Feet global mean sea-level rise above year 2000 levels



...and here in Maryland.

Feet Baltimore sea-level rise above year 2000 levels



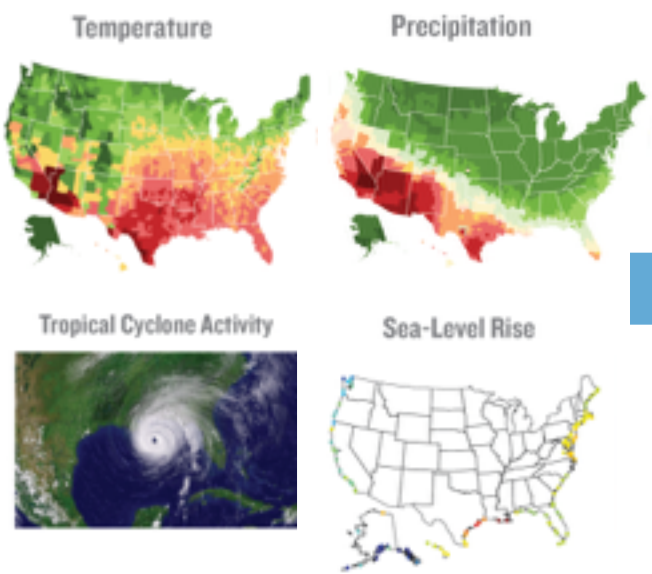
Sea-level rise in enhanced in Maryland due to the ongoing response to the end of the last ice age, changes in the Gulf Stream, and the gravitational and rotational effects of Antarctic mass loss.

Economic projections

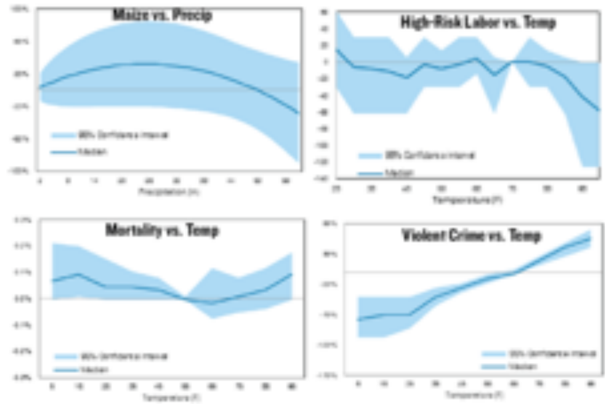
Research approach

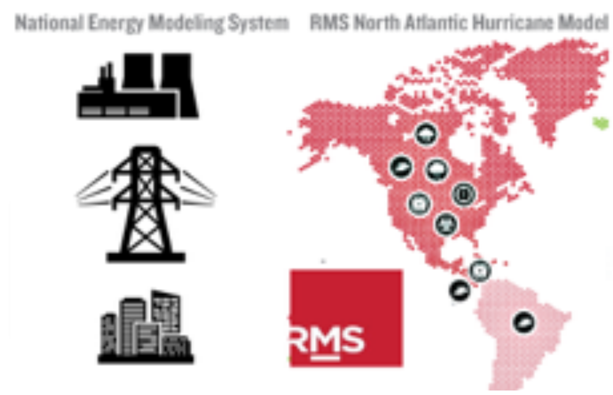
Spatial Empirical Adaptive Global-to-Local Assessment System (SEAGLAS)

Downscaled, probabilistic physical climate projections



Impact estimates based on meta-analysis of econometric research

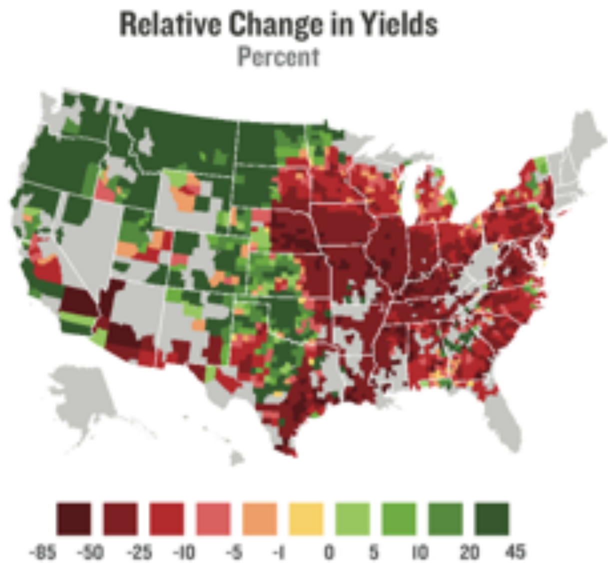


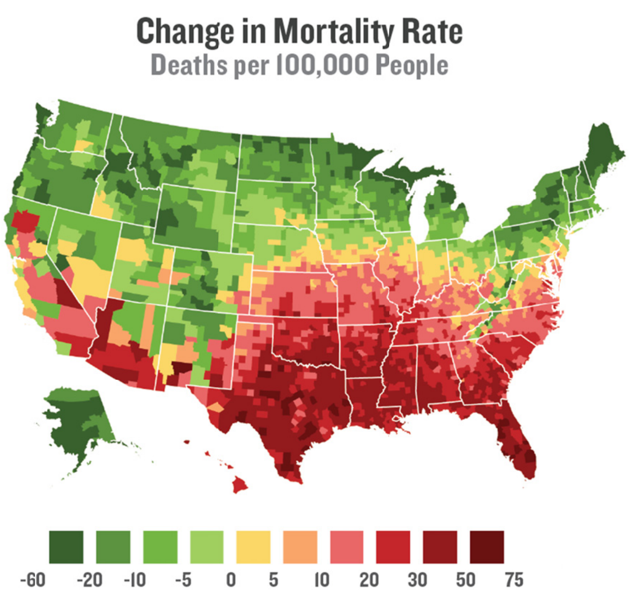


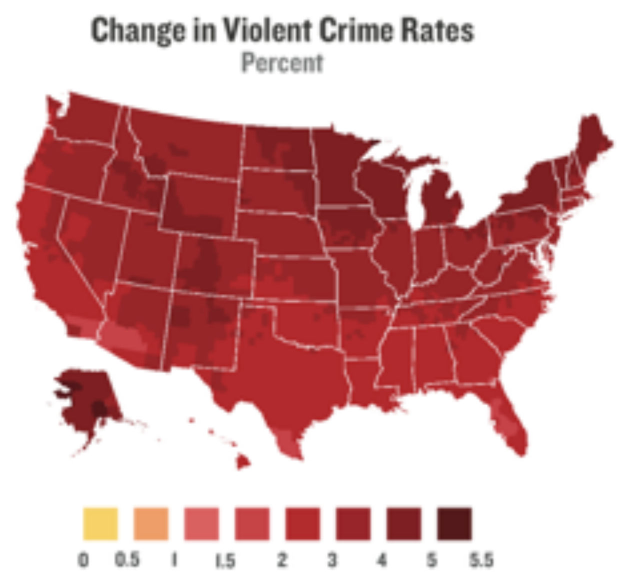
Complementary detailed sectoral models

Integrated economic analysis with CGE model, consideration of potential adaptations

Climate change will have unevenly distributed economic impacts.



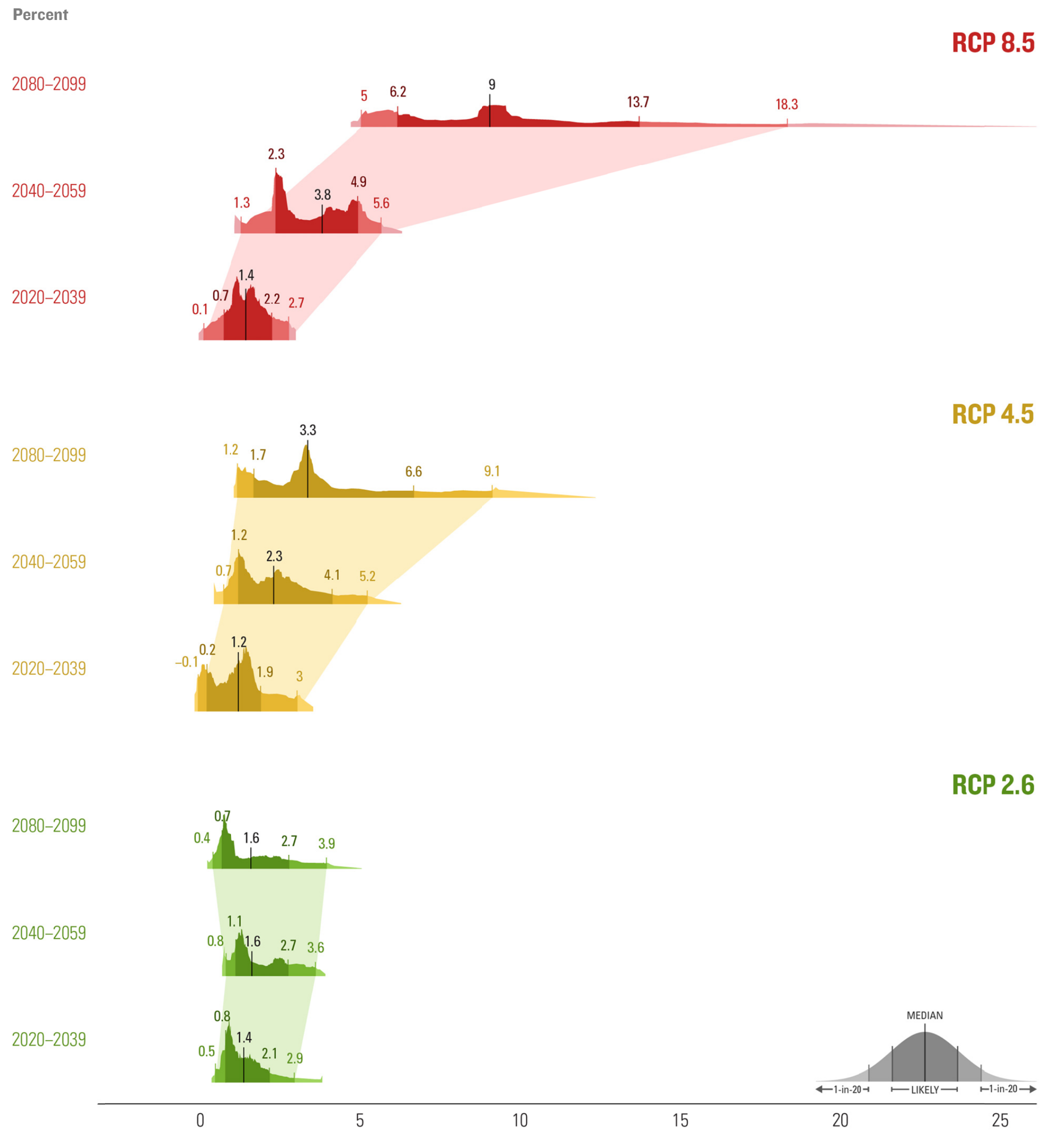




Energy demand

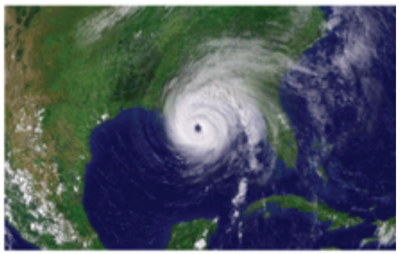
% increase in annual residential + commercial energy expenditures

Impact function calibrated against RHG–National Energy Modeling System



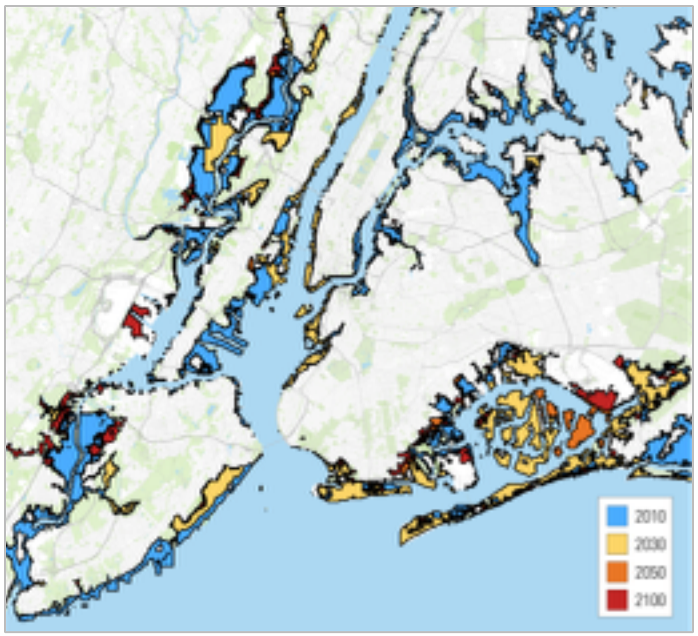
Coastal impacts

Tropical Cyclone Activity

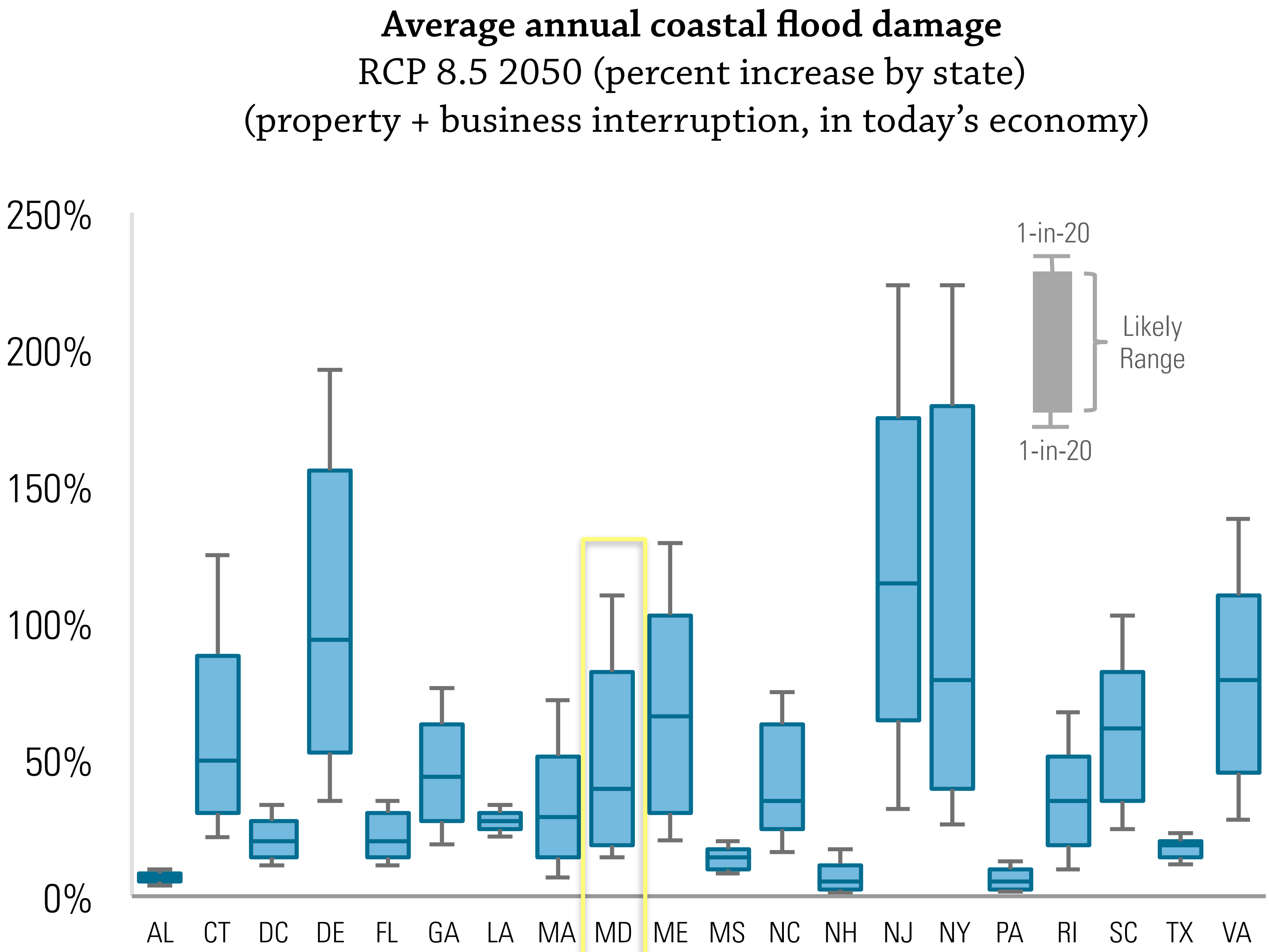


Sea-Level Rise

RMS North Atlantic Hurricane Model

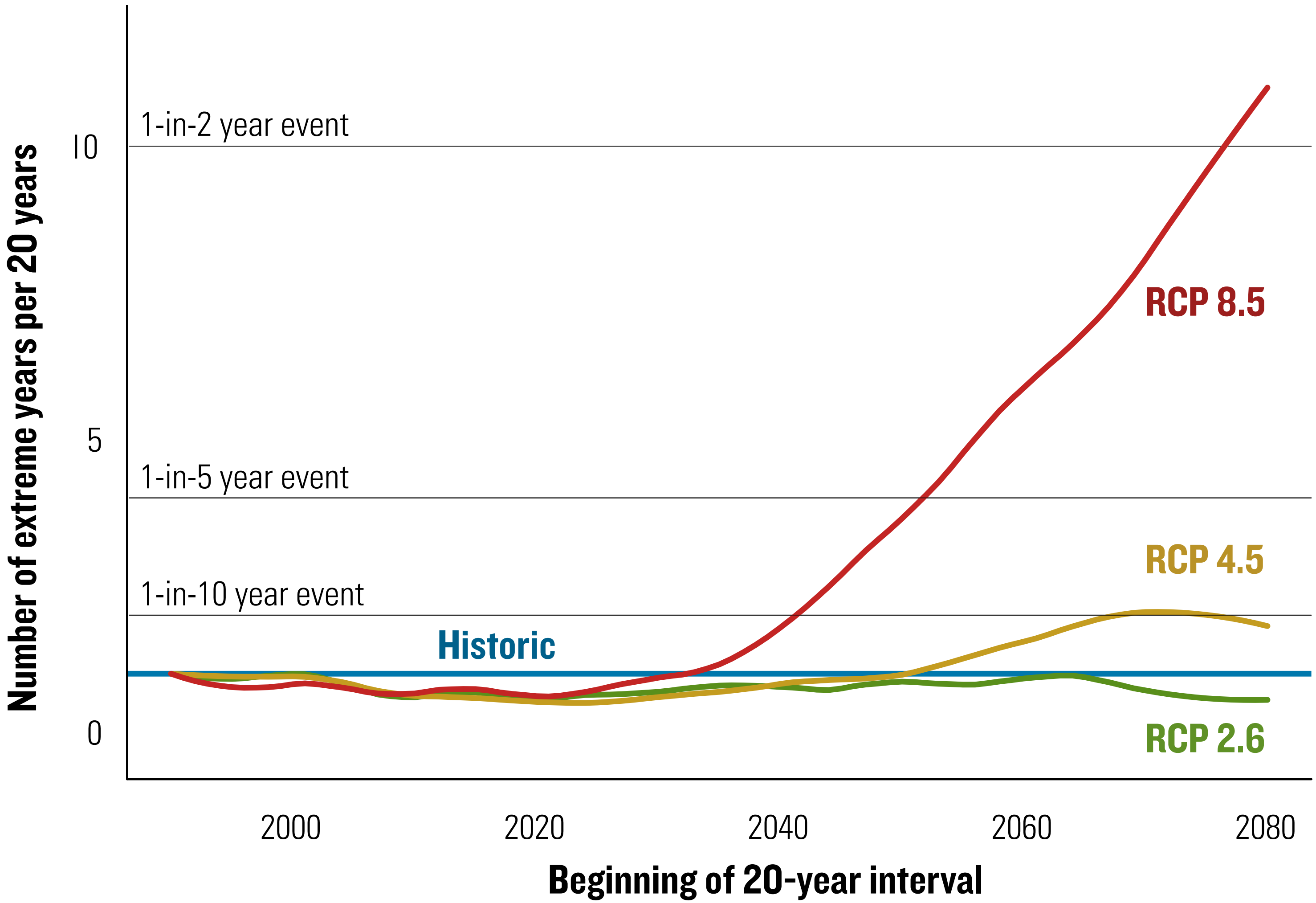


Increased average annual coastal storm damage due to sea-level rise



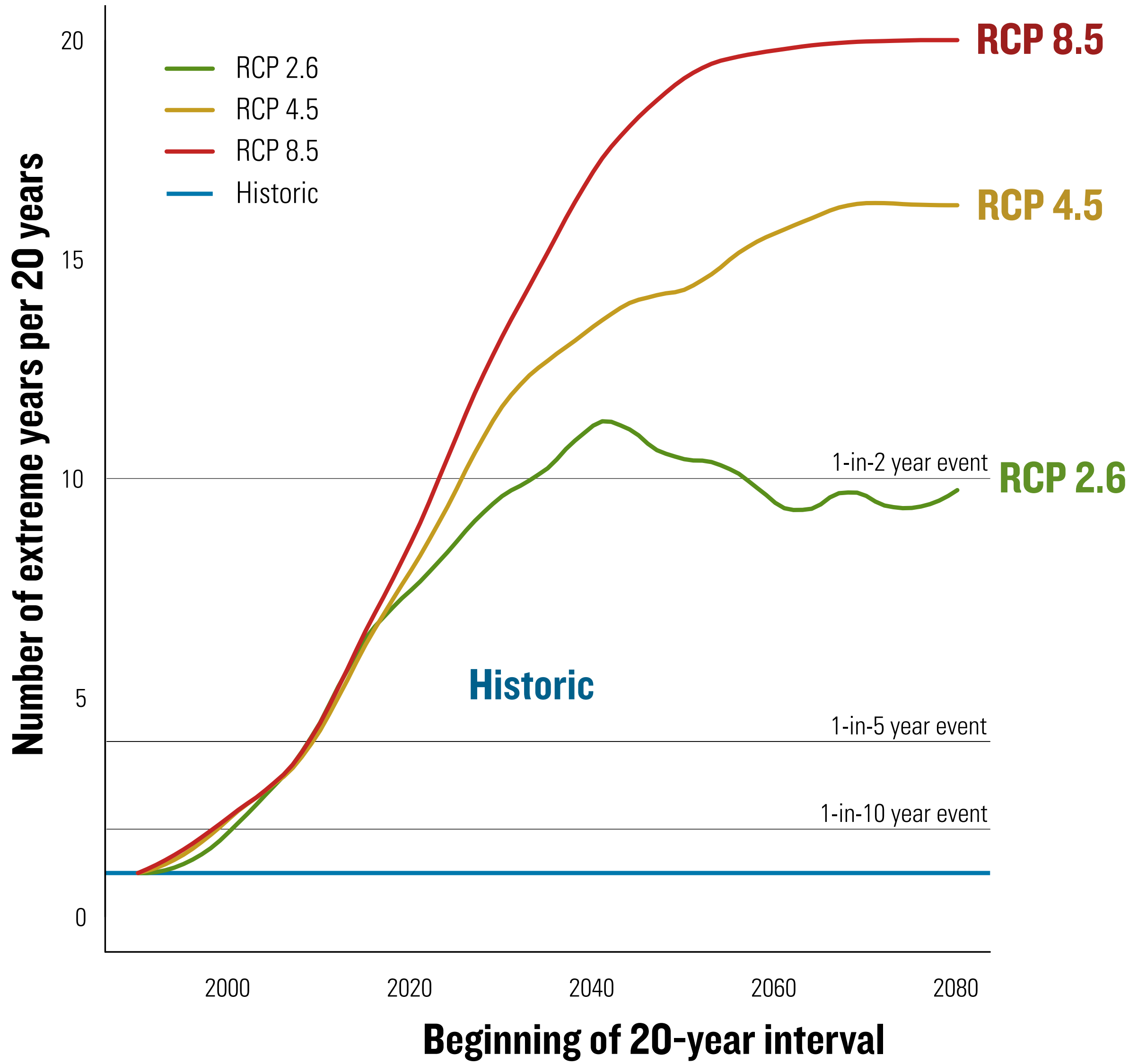
Climate change will make extremes more commonplace.

Expected number of extreme fatal heat waves nationally

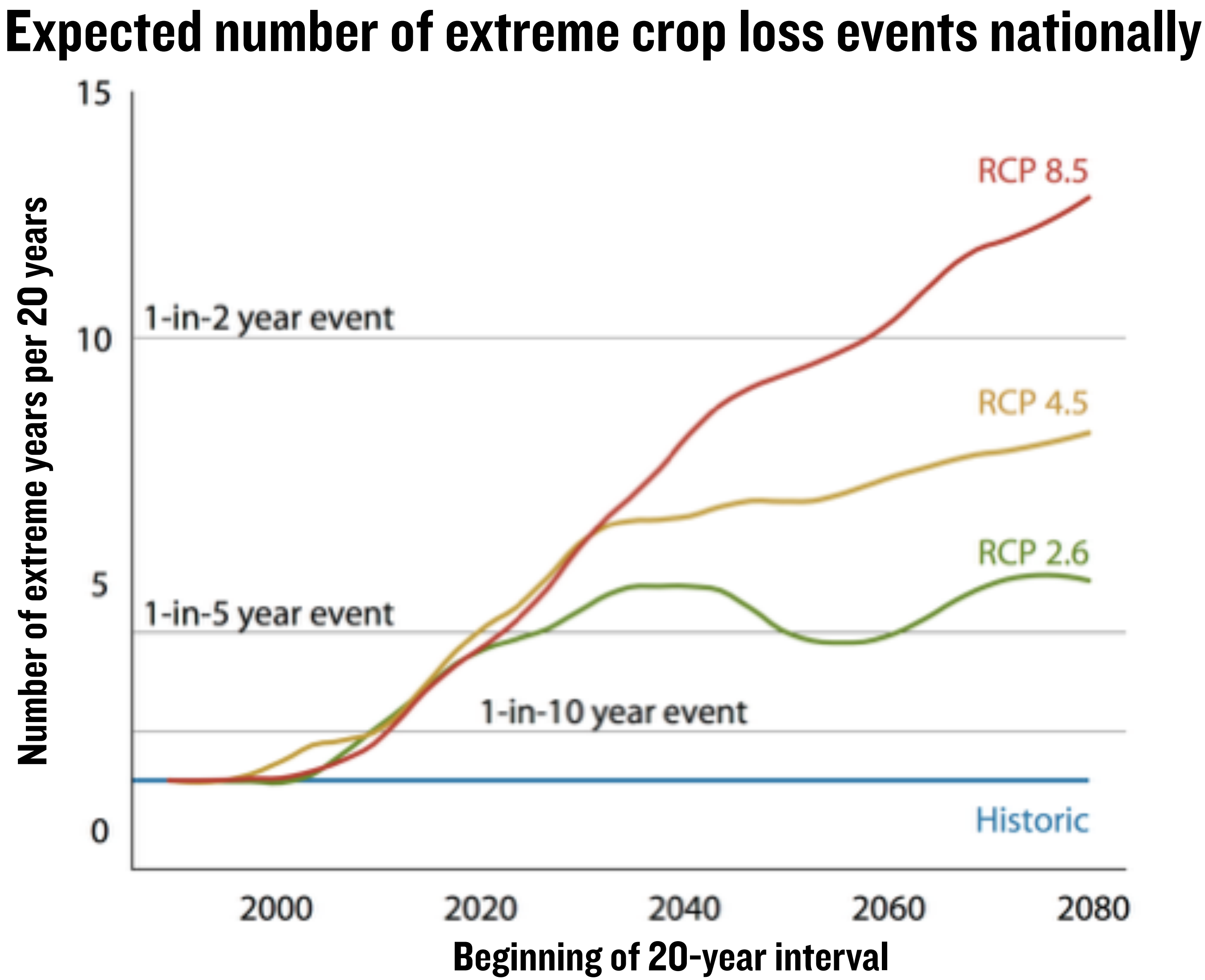


Climate change will make extremes more commonplace.

Expected number of extreme low-productivity heat waves nationally



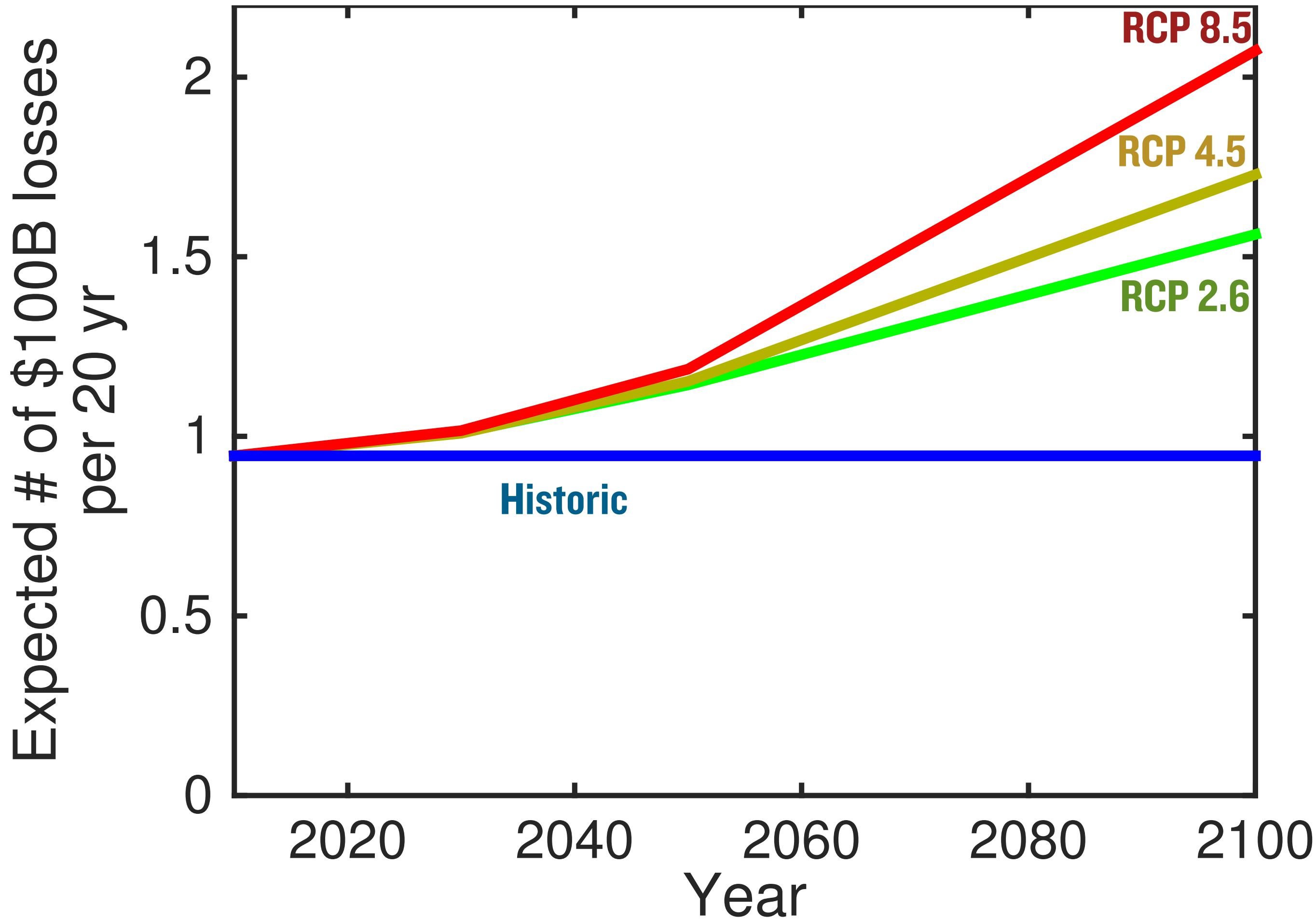
Climate change will make extremes more commonplace.



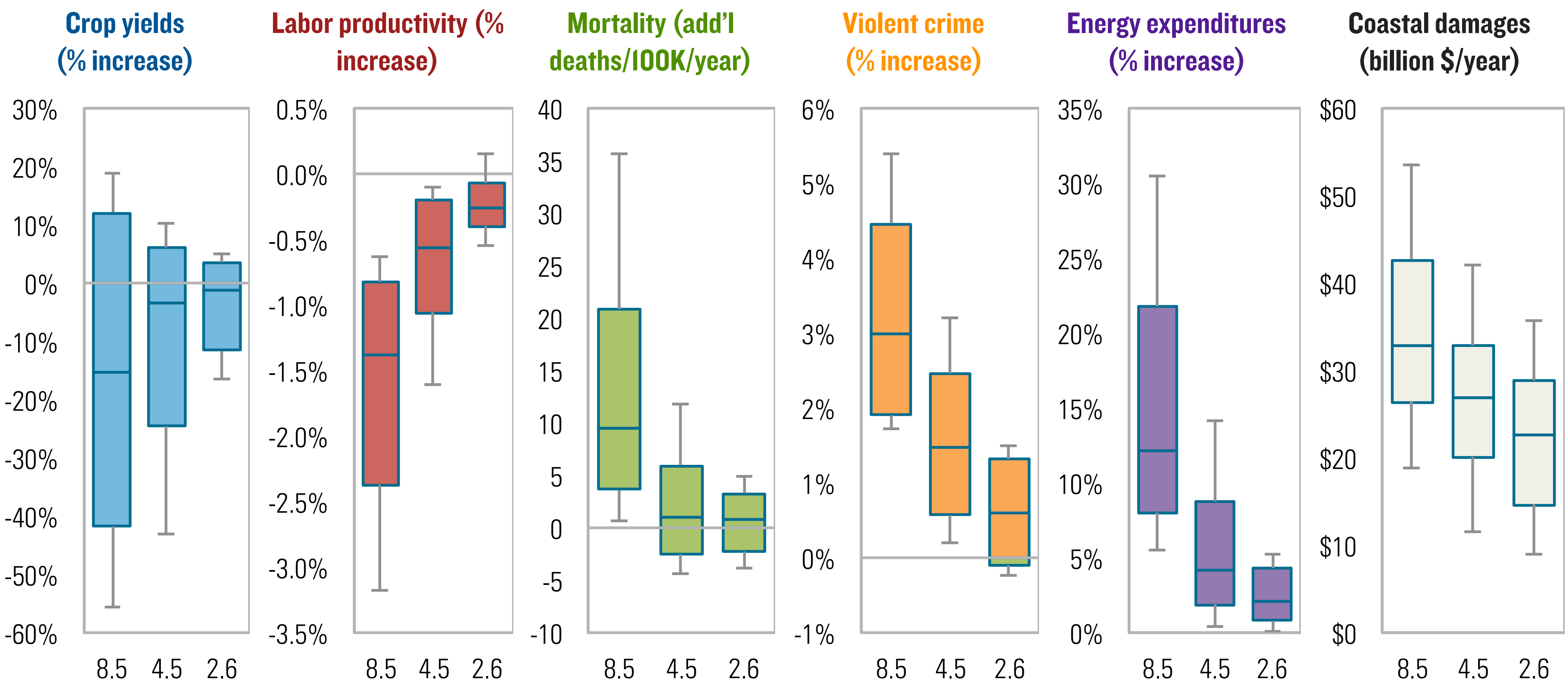
Climate change will make extremes more commonplace.

Expected number of extremely damaging ($100B) hurricanes nationally

(accounting only for sea-level rise, not storm changes)

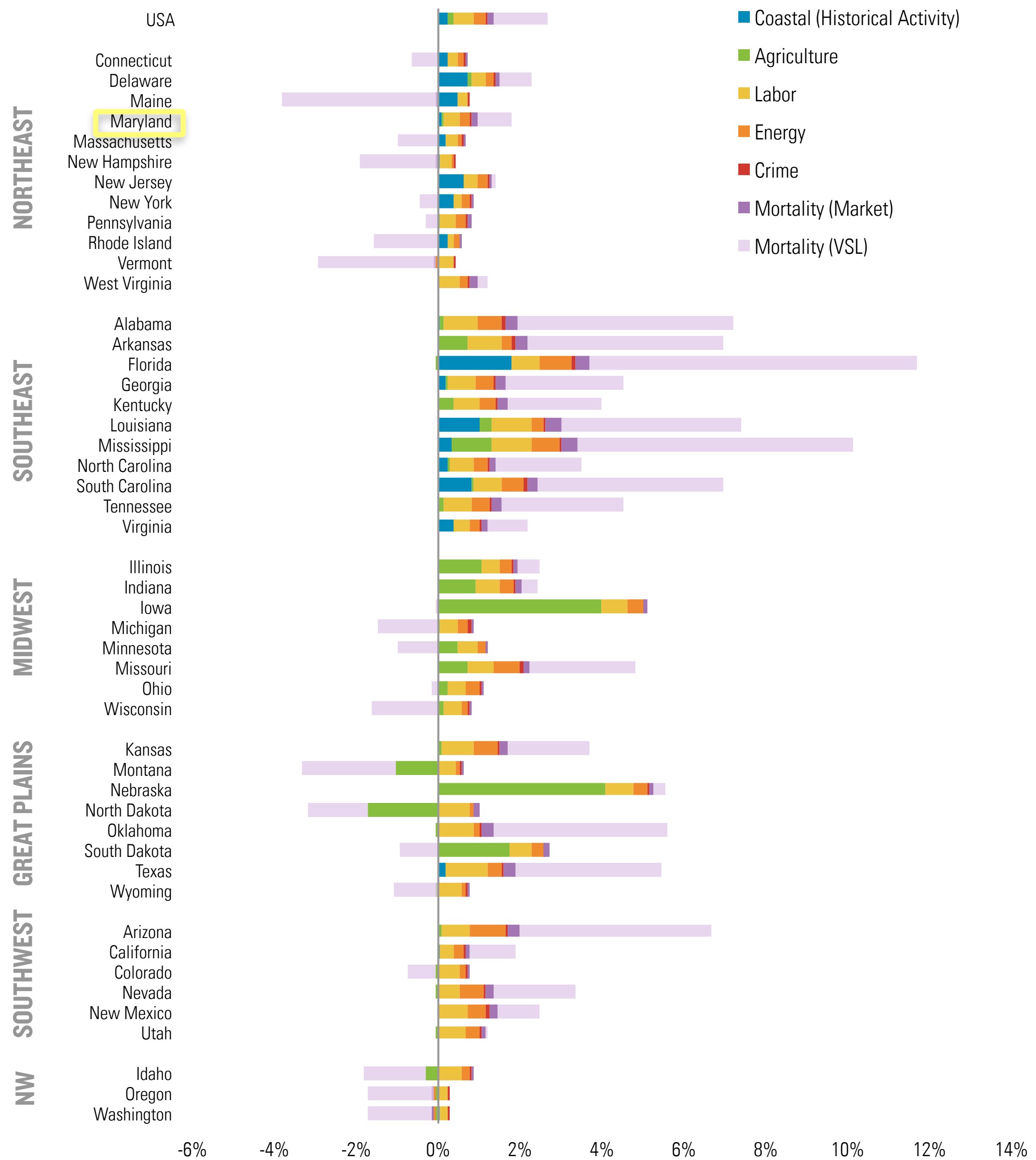


Our mitigation choices make a real difference – but we will have to prepare for some impacts even under low emissions.



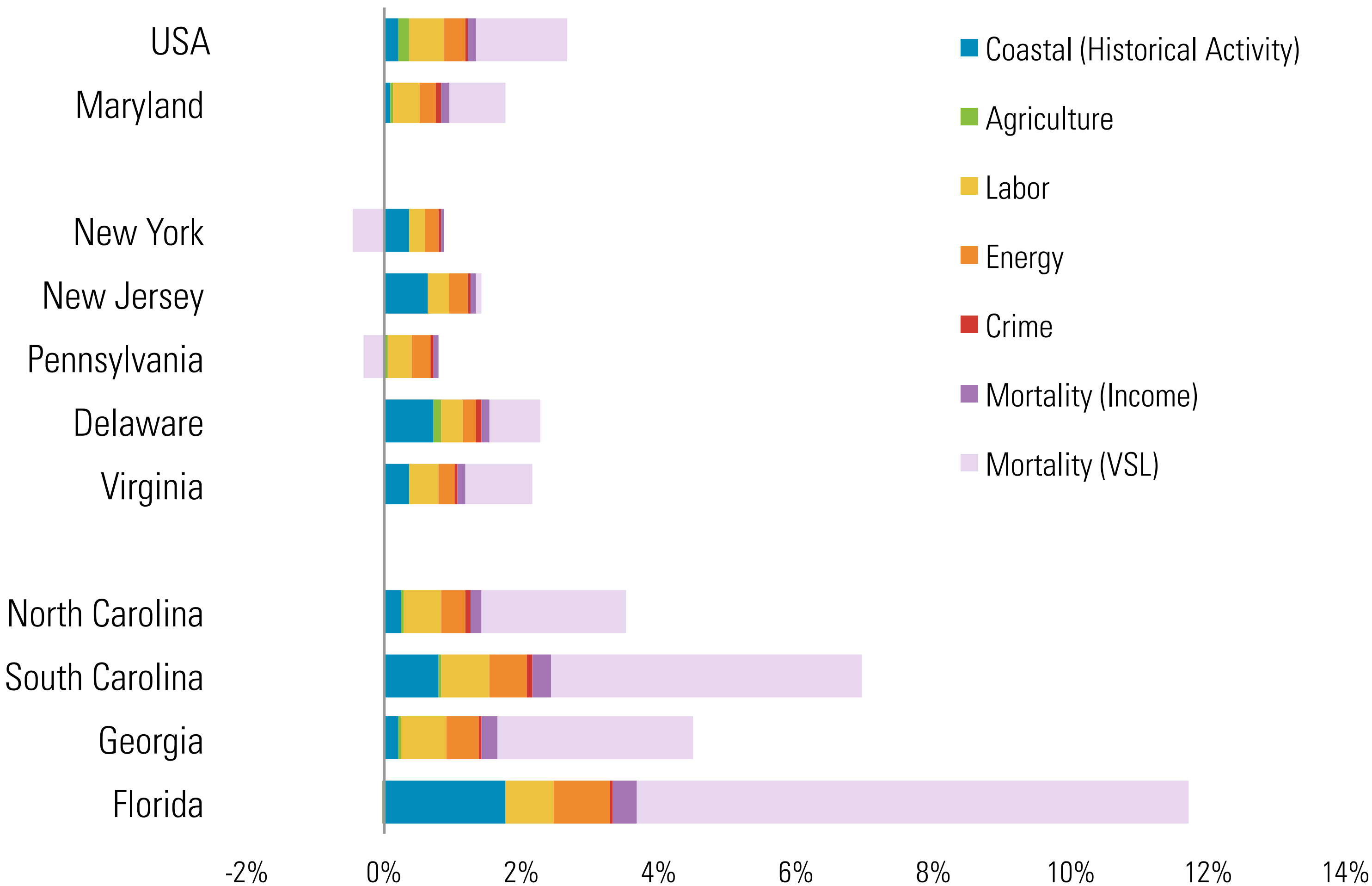
Total cost and sectoral breakdown differ by region

RCP 8.5, median case, 2080-2099, % of GSP



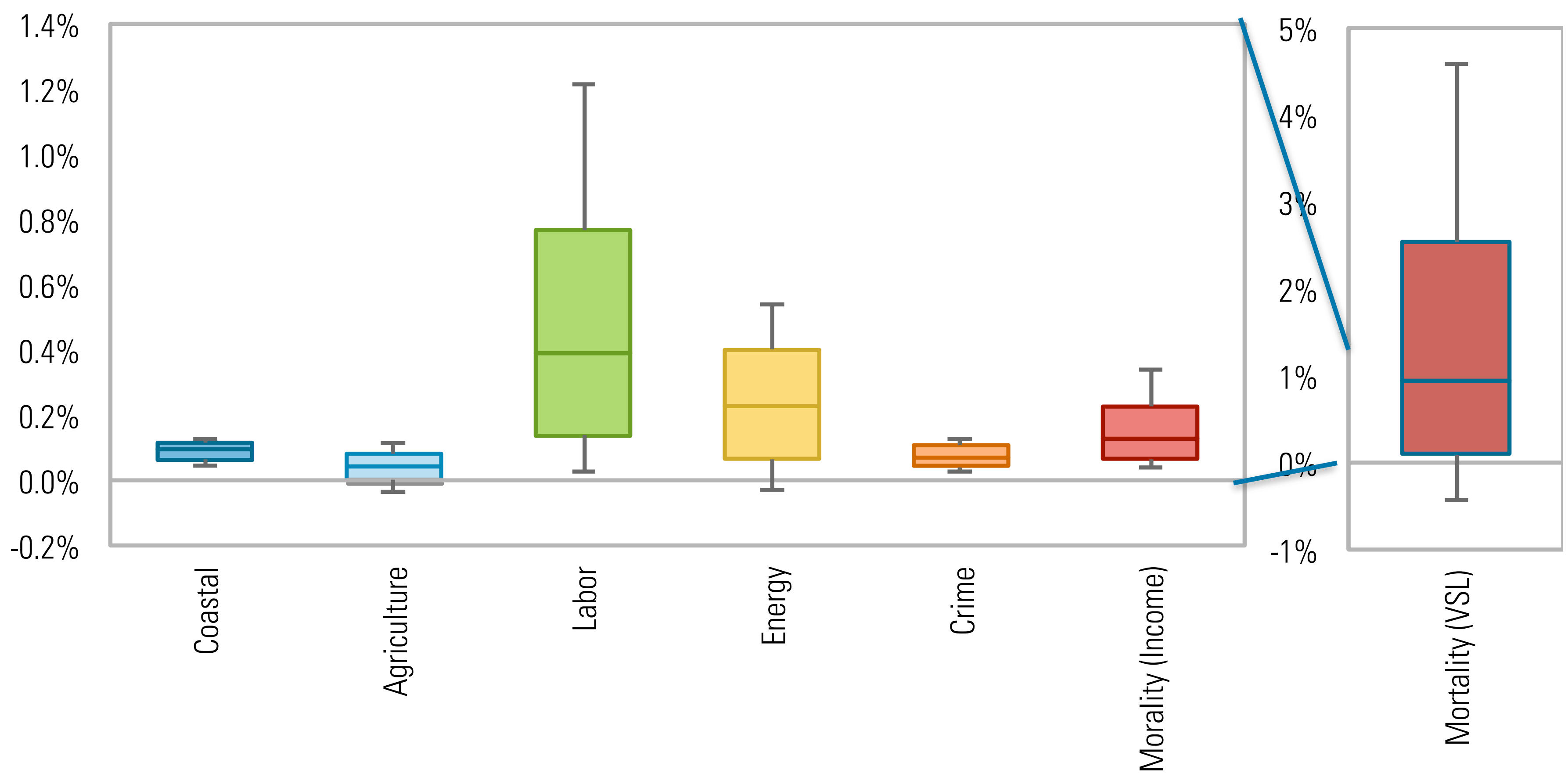
Maryland is slightly less exposed than national average.

RCP 8.5, median case, 2080-2099, % of GSP



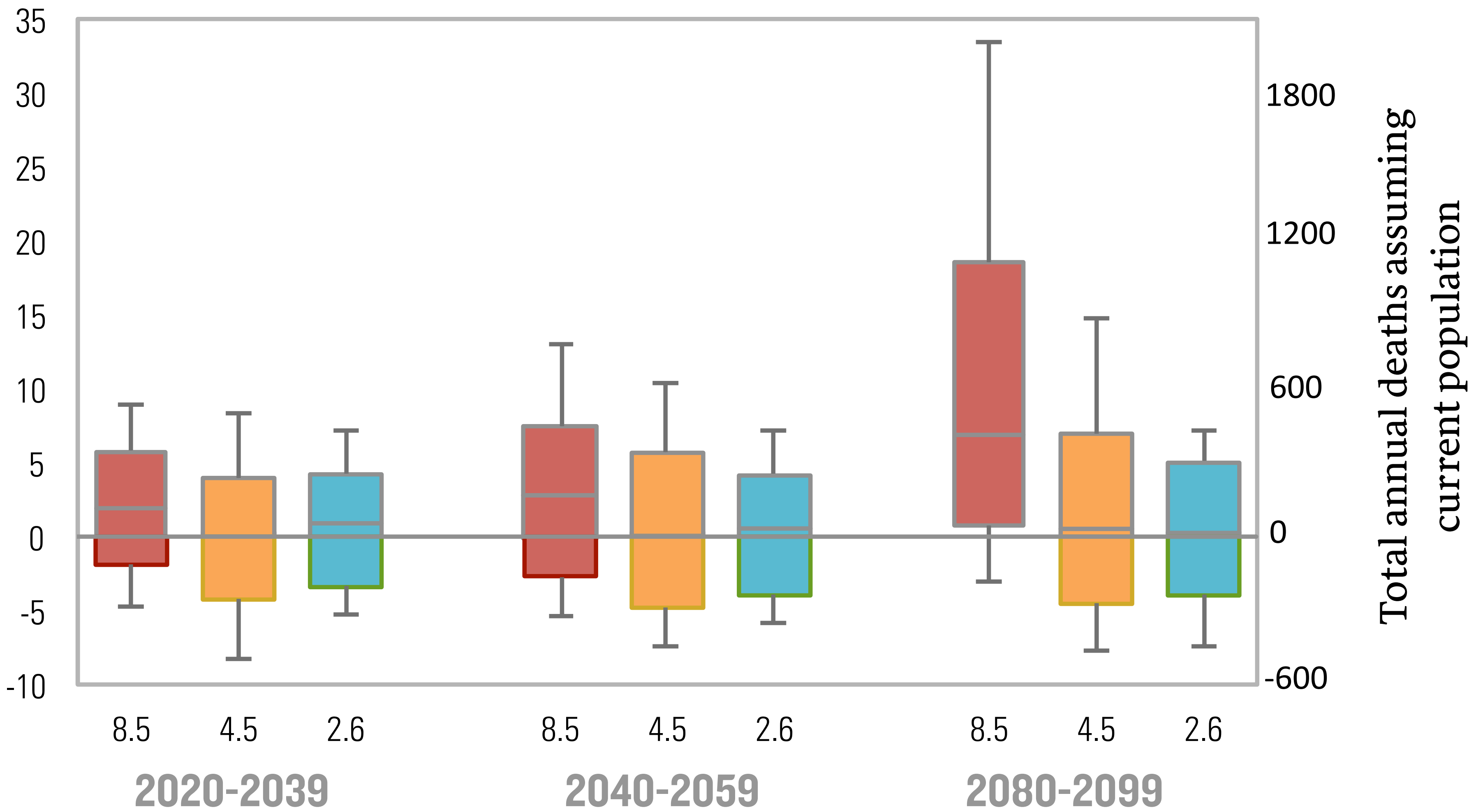
Direct damages in Maryland as % of GSP

RCP 8.5, 2080-2099

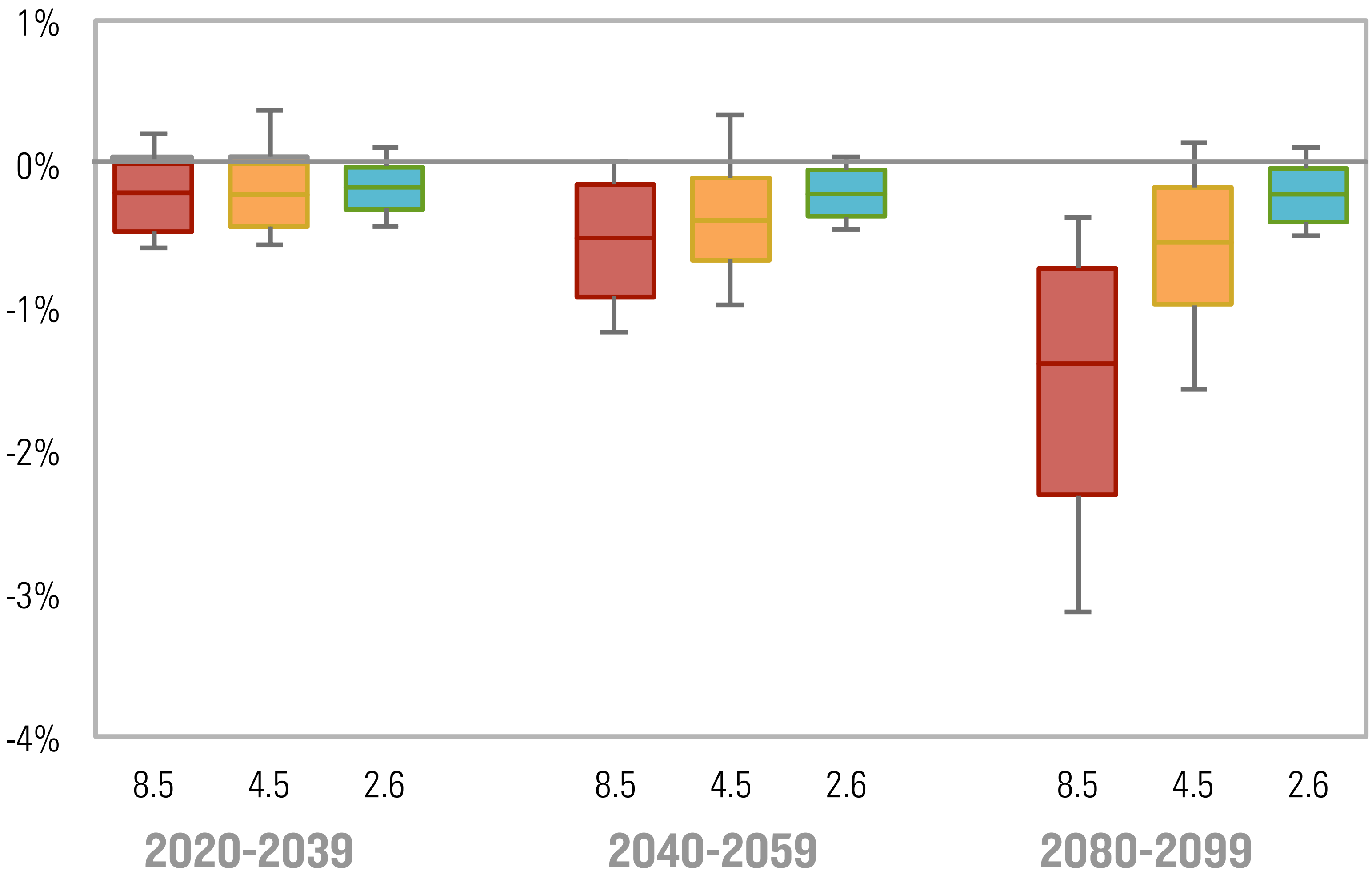


Increased mortality in Maryland

Additional annual deaths per 100,000

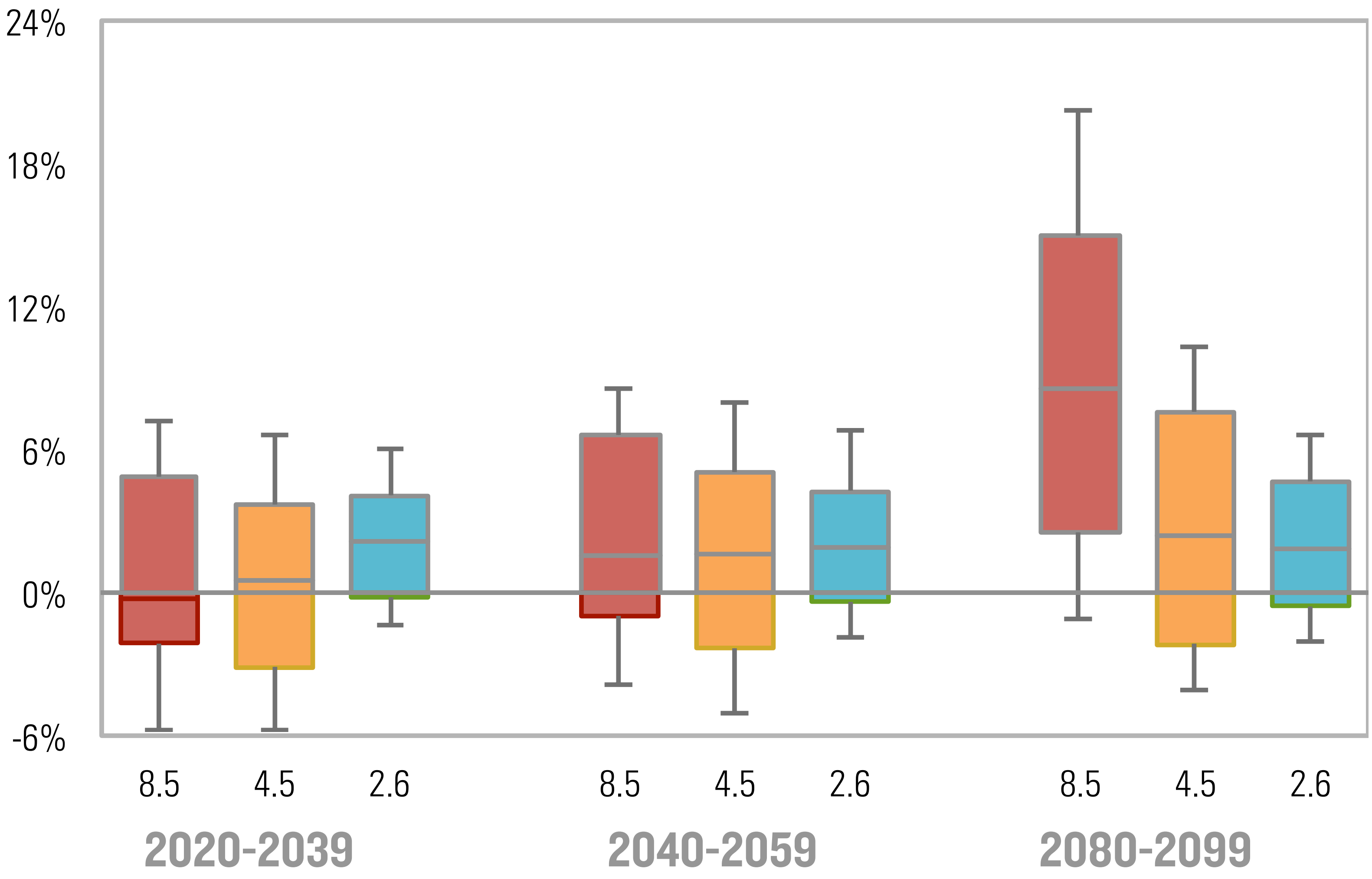


Decreased labor productivity in high-risk sectors (~20% of workers) in Maryland



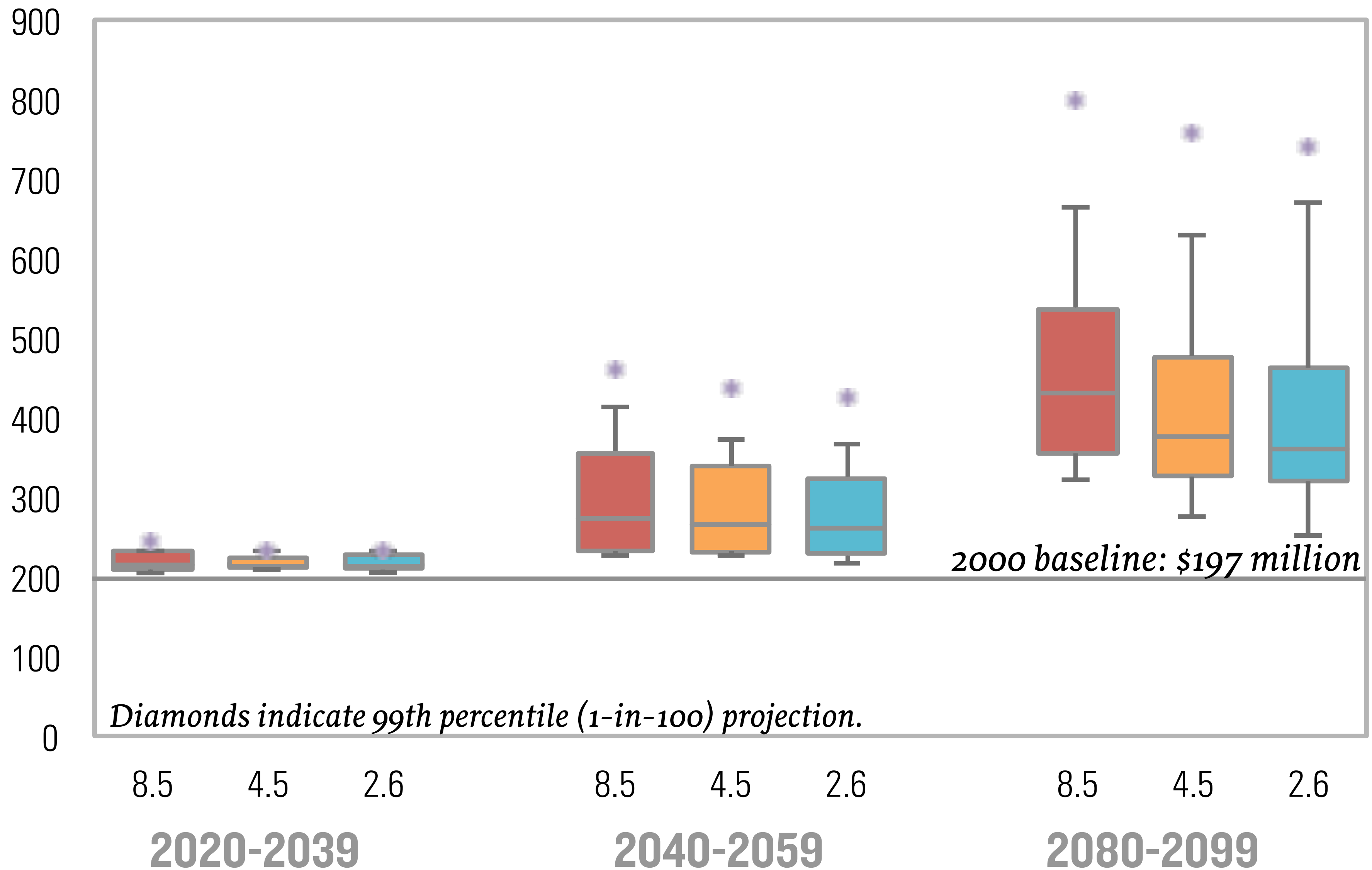
Increased residential & commercial energy expenditures in Maryland

% above year 2012 base ($9.0 billion)



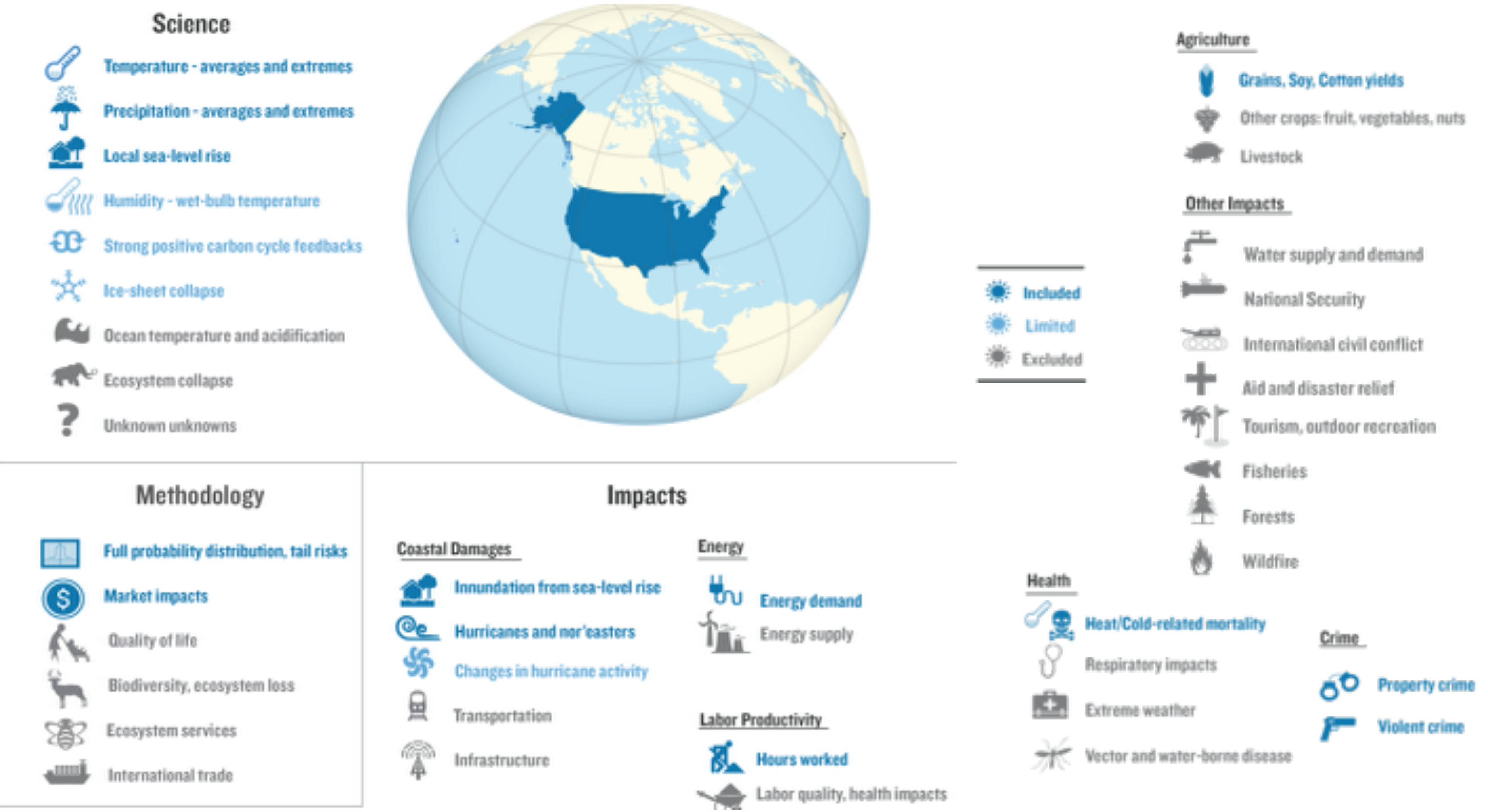
Increased average annual coastal storm damage

Million dollars per year (assuming current property distribution)



Reminder: Scope of coverage

Far from comprehensive – focus on impacts quantifiable in a 1-year analysis



Take-aways

- By 2040-2059 under RCP 8.5, median projected summer temperature in Maryland will be comparable to that in Georgia today; the expected number of dangerously humid days will exceed those of Mississippi today.
- Economic impacts are unevenly distributed across the country, with Maryland losses close to but slightly below national average.
- Of impacts examined, in Maryland, labor productivity, mortality, and energy demand are the largest by late century.
- Median projected increase in Maryland deaths under RCP 8.5, 2080-2099, is about 7 per 100,000 (about 400 additional people in current Maryland population), similar to current homicide rate.
- Mitigation benefits largest and most certain for labor, mortality, energy, and crime. Agriculture benefits less clear because of carbon fertilization; coastal because of slow response of the system.

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James Rising
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Paul Wilson
RMS

Presented by Robert Kopp (robert.kopp@rutgers.edu)

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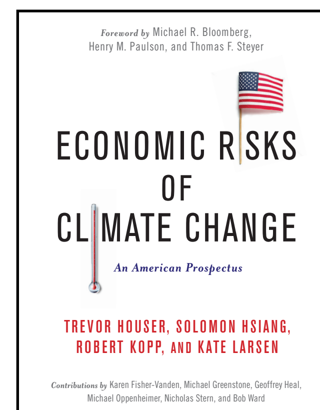

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