

Roundtable on Macroeconomics and Climate-related Risks and Opportunities

Panel on User Capabilities
and Needs

Session 1: Panel on User Capabilities and Needs

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CBO's Role in Assessing Climate Change

January 23, 2023

Presentation to the National Academies of Sciences, Engineering, and Medicine
Roundtable on Macroeconomic and Climate-Related Risks and Opportunities

Joseph Kile

Microeconomic Studies Division

Budgetary Effects of Climate Change and Efforts to Address It



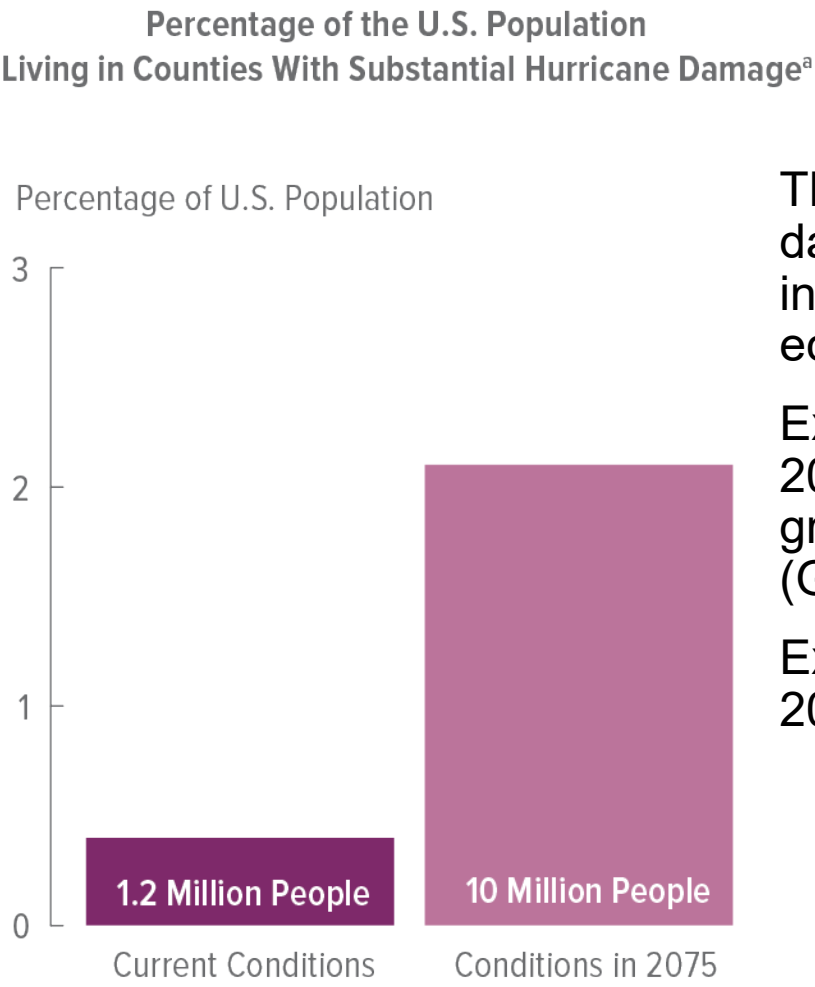
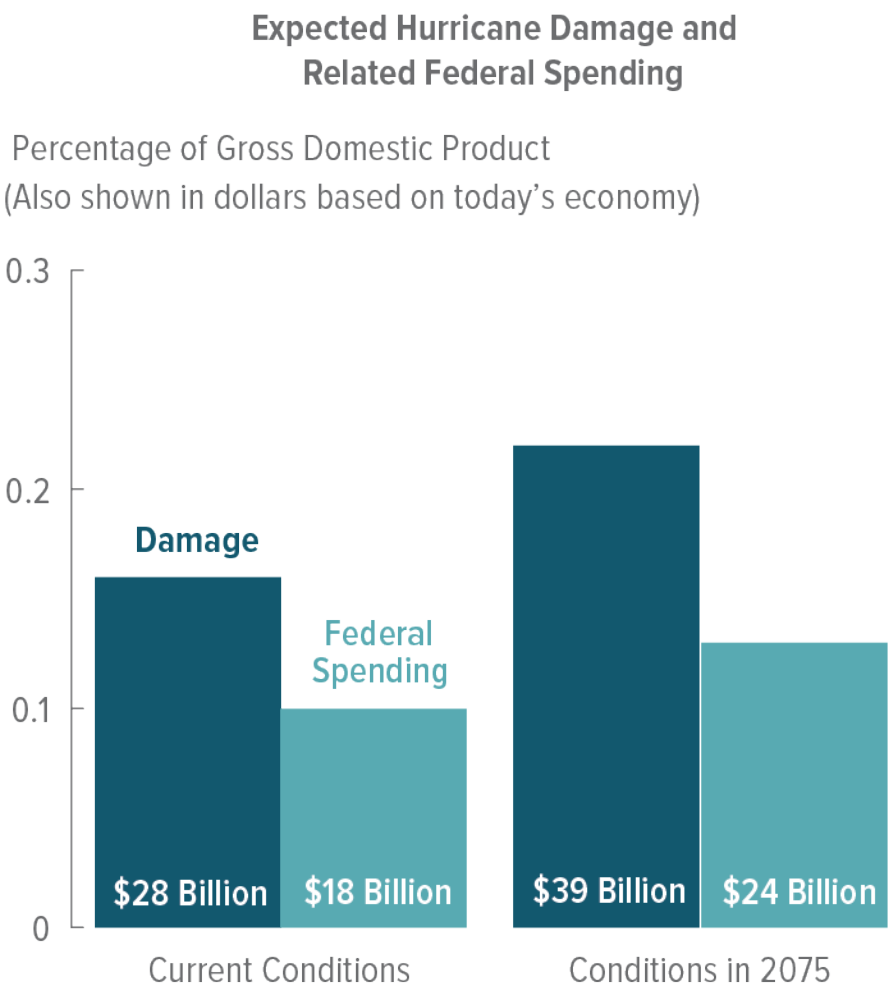
Climate change results in physical effects that reduce economic output.

Potential consequences exist for revenues, mandatory spending, and discretionary spending.

Adaptation and mitigation could reduce physical and budgetary effects.

Effects of Climate Change

Estimates of Hurricane Damage



The cost of hurricane damage is expected to increase more than the economy will grow.

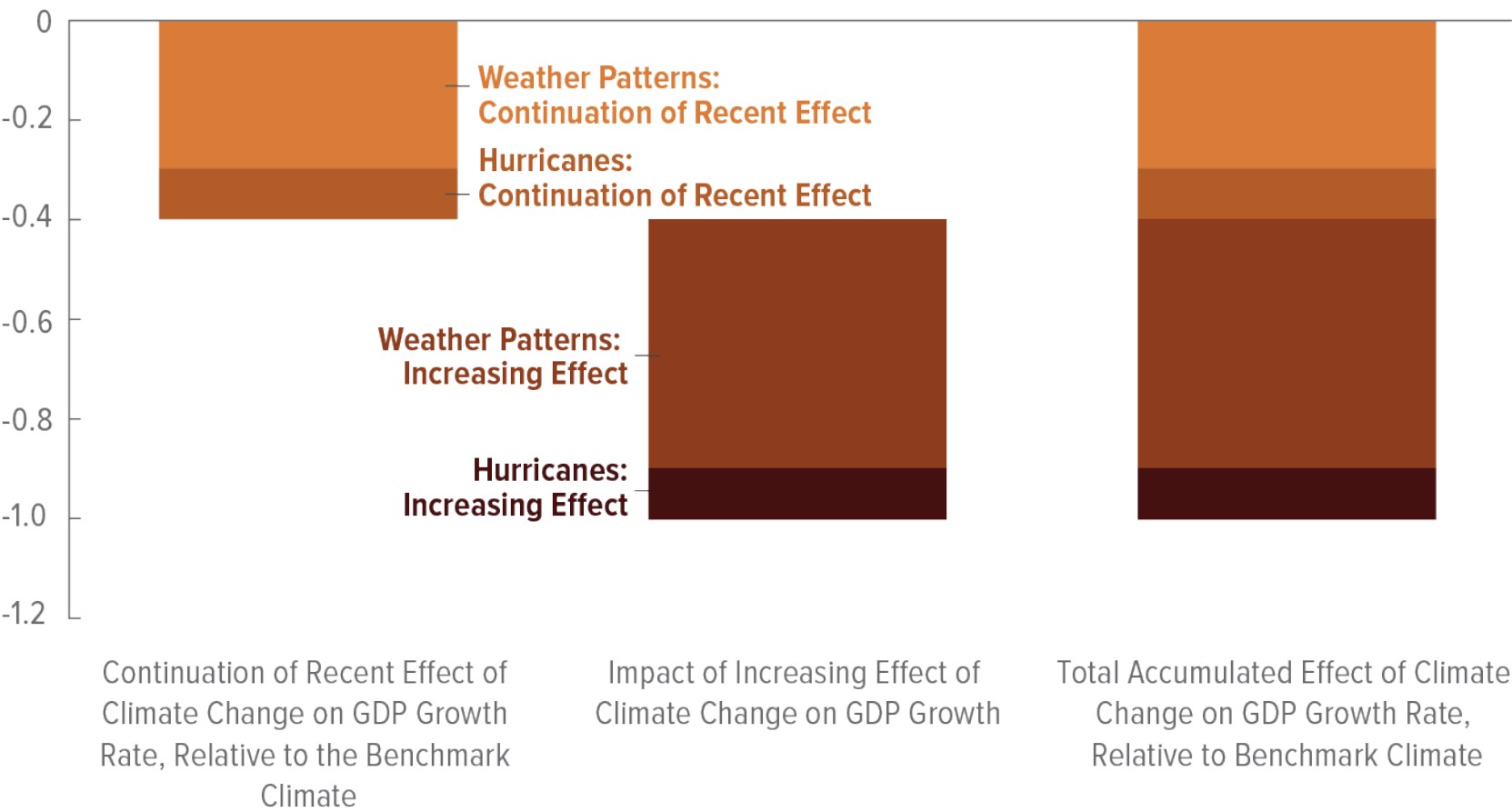
Expected annual damage in 2016 was 0.16 percent of gross domestic product (GDP).

Expected annual damage in 2075 is 0.22 percent of GDP.

See Congressional Budget Office, *Potential Increases in Hurricane Damage in the United States: Implications for the Federal Budget* (June 2016), www.cbo.gov/publication/51518.

How Climate Change Is Expected to Change the Level of Real Gross Domestic Product in 2050

Percentage of Real GDP



Climate change will reduce the growth rate of real (inflation-adjusted) GDP from 2020 to 2050 by an average of 0.03 percentage points.

That difference in annual growth accumulates to a 1.0 percent reduction in the projected level of real GDP in 2050.

Climate change will have effects on people's well-being that are not measured in GDP.

Effects of Policies That Would Address Climate Change

How a Tax on Greenhouse Gas Emissions Would Affect the Federal Budget

Billions of Dollars	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	Total	
											2023– 2027	2023– 2032
Decrease (-) in the Deficit												
Apply a \$25 tax per metric ton of emissions and increase tax annually by 5 percent, adjusted for inflation	-55.2	-86.2	-83.5	-82.4	-81.8	-81.3	-87.3	-95.4	-102.9	-109.5	-389.0	-865.4
Apply a \$25 tax per metric ton of emissions and increase tax annually by 2 percent, adjusted for inflation	-55.2	-84.7	-80.4	-77.3	-74.9	-72.2	-75.0	-79.6	-83.4	-86.2	-372.5	-768.9
Apply a \$25 tax per metric ton of emissions (excluding gasoline) and increase tax annually by 2 percent, adjusted for inflation	-43.3	-65.9	-61.0	-57.4	-54.6	-51.6	-54.0	-58.1	-61.5	-63.7	-282.1	-570.9

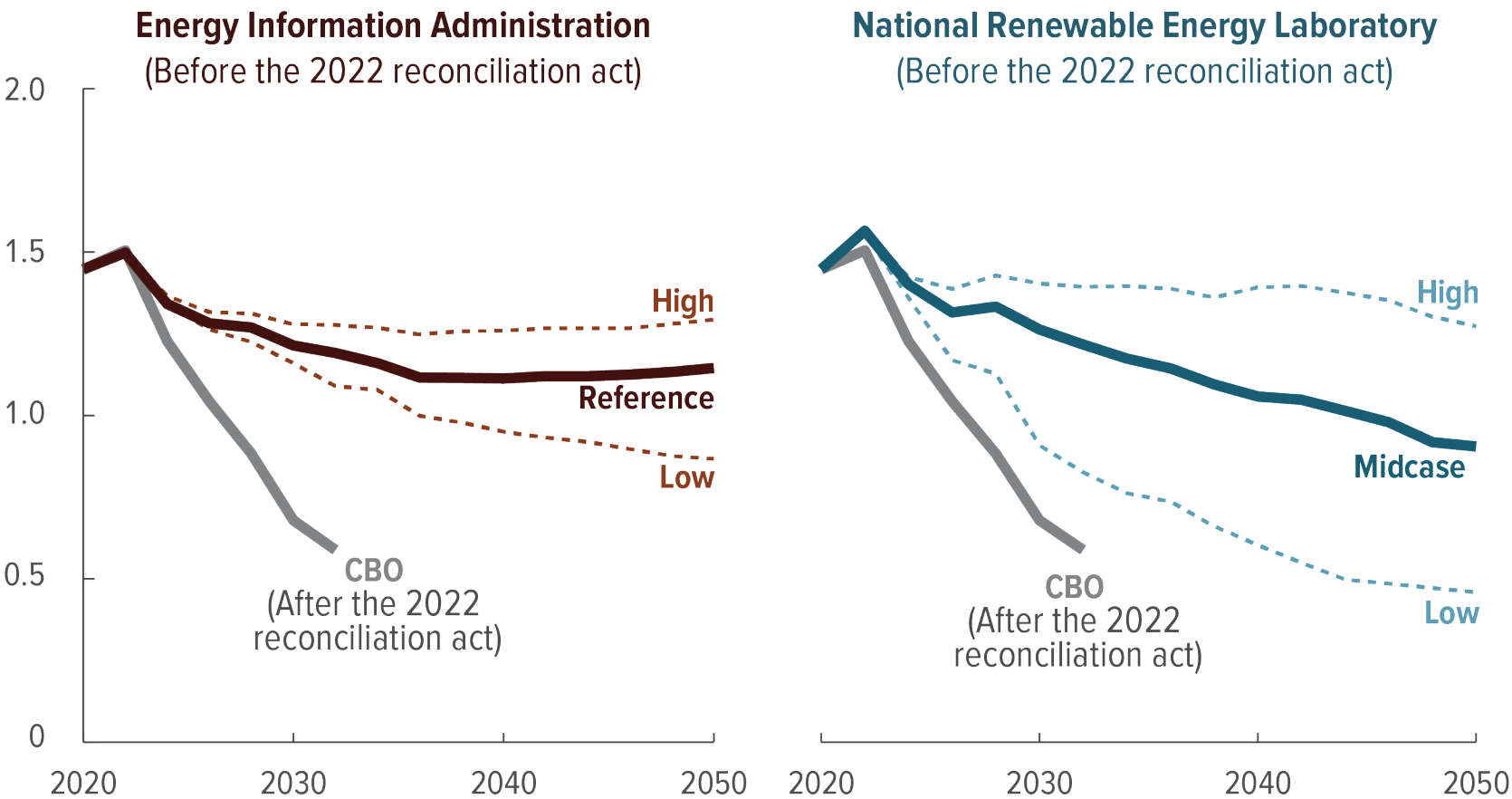
Data sources: Staff of the Joint Committee on Taxation; Congressional Budget Office.

This option would take effect in January 2023.

An offset to reflect reduced income and payroll taxes has been applied to the estimates in this table.

Projected Carbon Dioxide Emissions From the Electric Power Sector Before and After the 2022 Reconciliation Act

Billions of Metric Tons

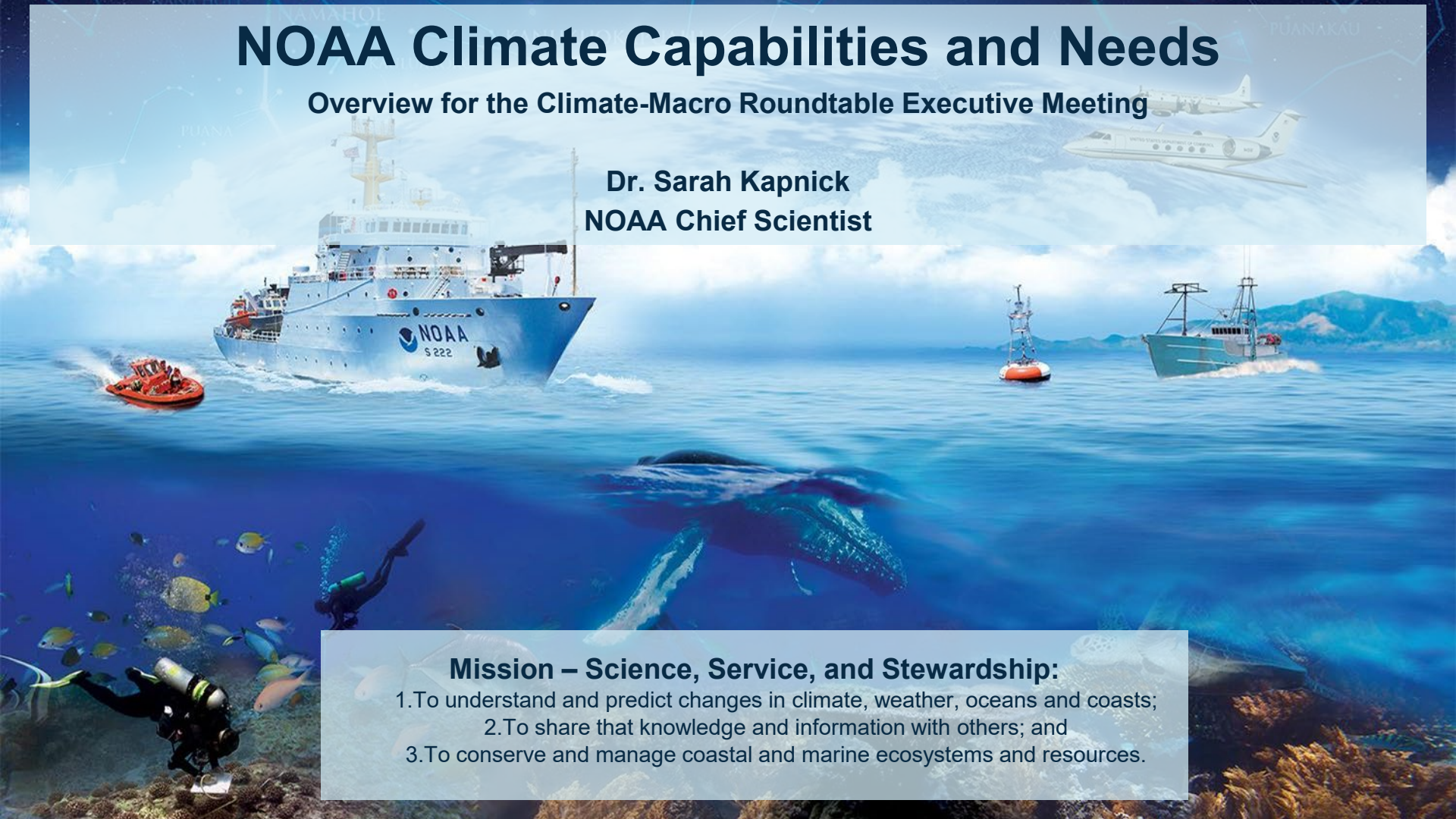


Thank You

NOAA Climate Capabilities and Needs

Overview for the Climate-Macro Roundtable Executive Meeting

Dr. Sarah Kapnick
NOAA Chief Scientist



Mission – Science, Service, and Stewardship:

1. To understand and predict changes in climate, weather, oceans and coasts;
2. To share that knowledge and information with others; and
3. To conserve and manage coastal and marine ecosystems and resources.



NOAA Data: What We Have



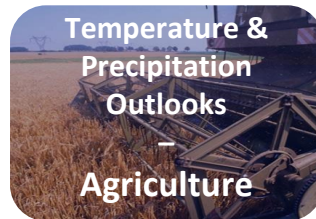
Daily/Weekly

Monthly

Seasonal – Annual

Annual to
Decadal

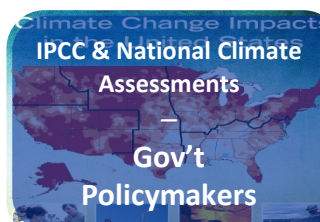
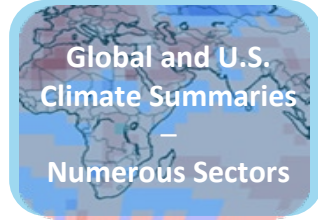
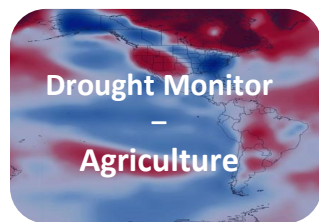
Local



Regional



National
& Global

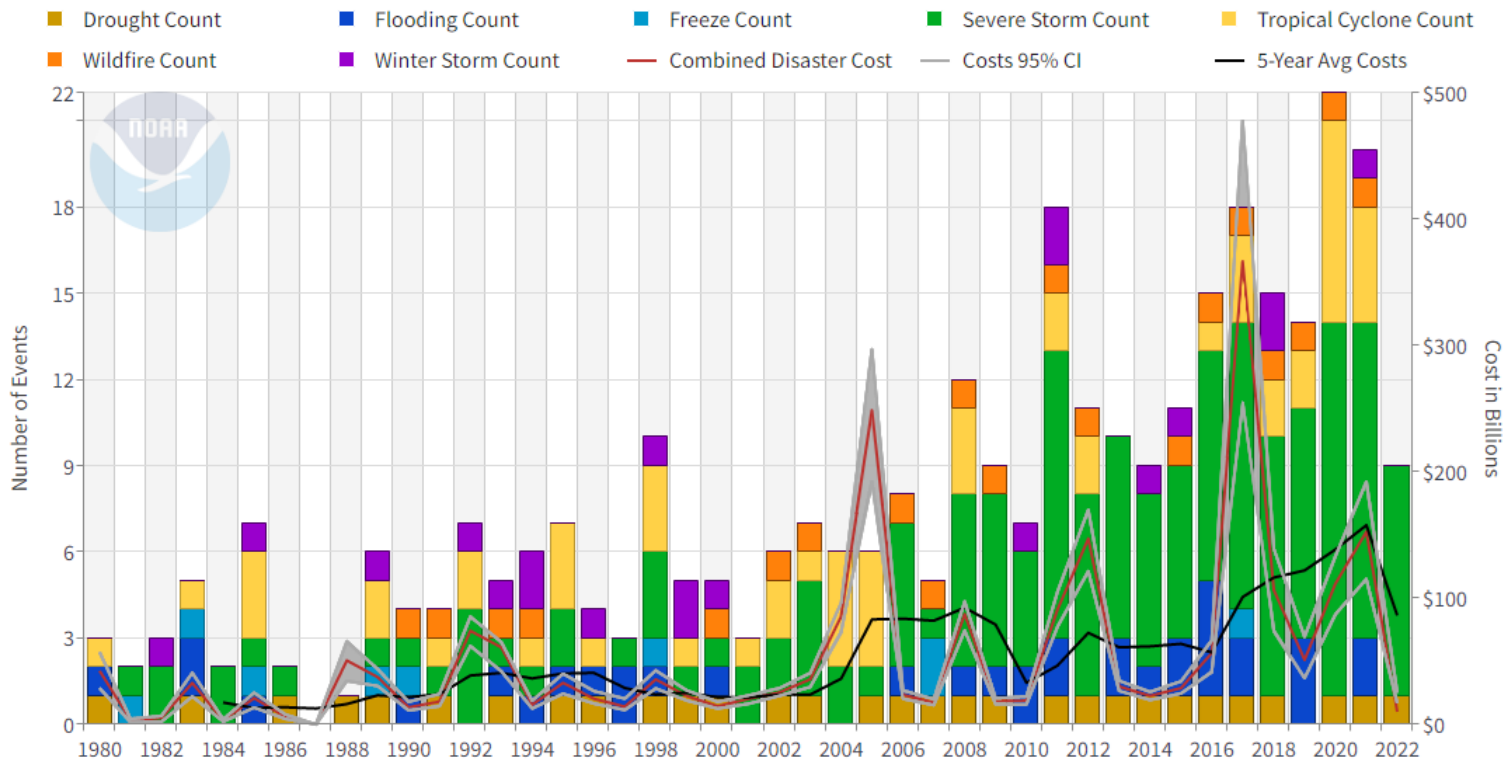




Example: Billion Dollar Disasters



United States Billion-Dollar Disaster Events 1980-2022 (CPI-Adjusted)



Updated: July 11, 2022

Powered by ZingChart



NOAA Chief Economist Team



Executive Decision Support

What We Do
Executive decision support by integrating social, behavioral, and economic science in NOAA's missions and priorities.



Guidance and reviews for the development of robust economic analysis



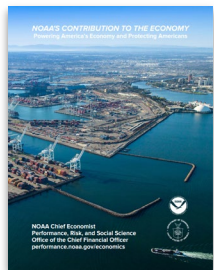
Evidence and statistics for the NOAA budget proposals and justification



International and Interagency coordination



Economic Valuation, Societal Benefits, Market Research & Development





Example: Understand Exposure and Vulnerability



Future Heat Events and Social Vulnerability 2018

NOAA Future Heat Events

CDC's Social Vulnerability Index 2018



Heat Events

Year **2020**

Total days with temperatures over 95°

14 - Two Weeks

Display

Total Days

Days Increase

Estimates (2018)

Population: 151,339,330

Daytime Population: 137,207,596

Housing Units: 62,300,934

Households: 54,713,443

Overall Score

Socioeconomic Status

Household Composition & Disability

Minority Status & Language

Housing & Transportation

Brooks County, Texas

In 2020 a projected maximum of
114 total days with temperatures over 95°

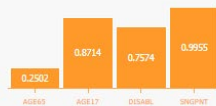
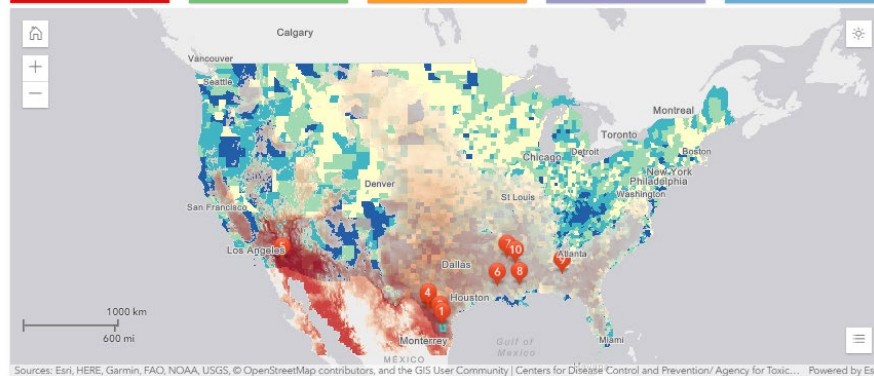
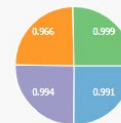
Population

Daytime Population

Housing Units

Households

Overall Vulnerability Score: 1.000



Most Vulnerable

Overall Score

Most Vulnerable by Theme

Socioeconomic Status

Household Composition & Disability

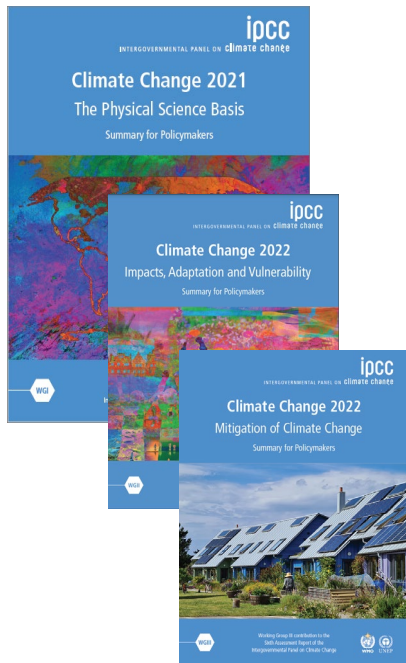
Minority Status & Language

Housing & Transportation

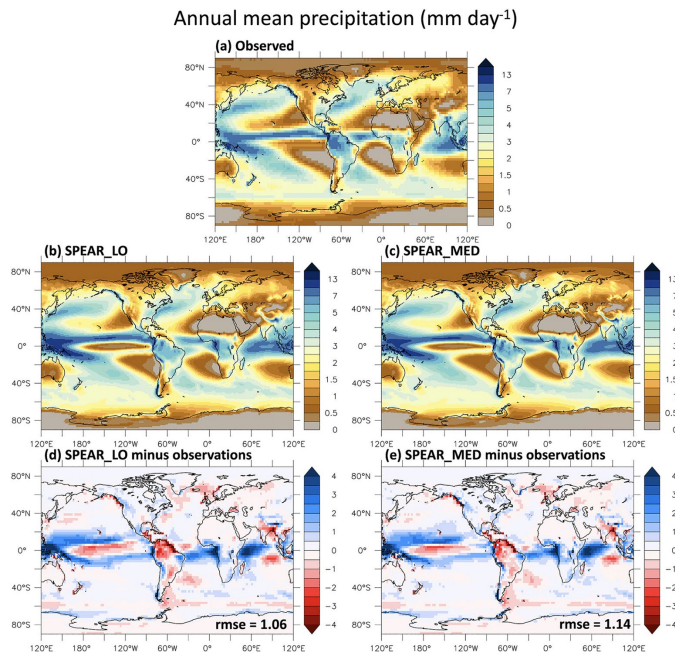




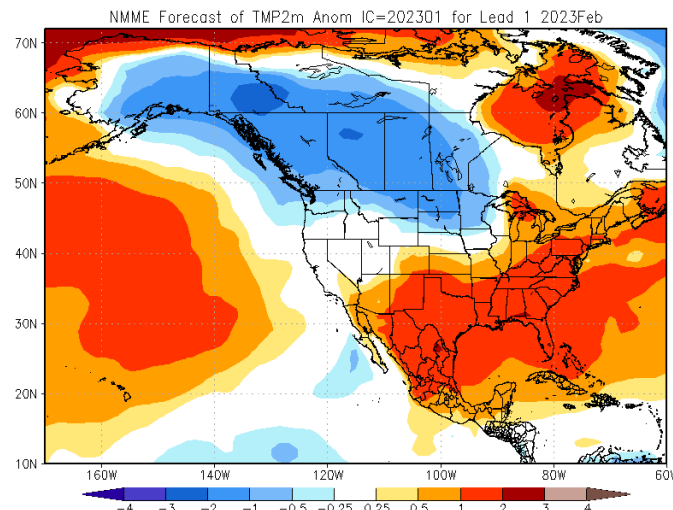
NOAA Data: Where Are We Going



IPCC:
Uses Coupled Model
Intercomparison Project



SPEAR:
NOAA Next Generation Seasonal
Modelling System



**North American Multi Model
Ensemble (NMME):**
Multiple coupled models in
seasonal forecast





How Can the Climate Macro RT Help?



- NOAA continues to look for opportunities to make our environmental information more accessible and useful- help us identify those opportunities!
 - What types of information are needed?
 - How can we make them more/most accessible?
 - As we consider the future of climate modeling for understanding physical risk, what should be top of mind?
 - What types of scenarios are needed?
 - What types of partnerships would help us to strengthen macroeconomic modelling?
 - What type of support is needed/how to build expertise to interpret and communicate model outputs?





Additional Resource Examples



NCEI: <https://www.ncei.noaa.gov/>

Sea Level Rise Viewer: <https://coast.noaa.gov/slr/>

NOAA Climate.gov: <https://www.climate.gov/>



U.S. Climate Resilience Toolkit: <https://toolkit.climate.gov/>

Climate Mapping for Resilience and Adaptation: <https://resilience.climate.gov/>

National Integrated Heat Health Information System: <https://www.heat.gov/>



National Integrated Drought Information System: <https://www.drought.gov/>

Famine Early Warning System Network: <https://fews.net/>

Billion Dollar Weather and Climate Disasters: <https://www.ncei.noaa.gov/access/billions/>

[An Evidence-based Collaborative Framework for Improving Predictive Capabilities](#)

[2022 Sea Level Rise Technical Report](#)





THE WHITE HOUSE
WASHINGTON

An Intro to the Federal Budget, Or One Way This Work Could Impact the Real World

Zach Liscow, Chief Economist, Office of Management and Budget

National Academy of Sciences

January 23, 2023

The President's Budget



- Each year, the President puts out a budget. It includes an economic forecast used to project the budgetary impacts of:
 - Proposed spending for each agency
 - Government revenues
 - New policies
- This budget gives guidance to agencies and helps set the agenda for Congress
- Climate impacts on the macroeconomy matter for the budget in multiple ways:
 - Impact analysis of proposed policies (which are based on economic assumptions)
 - We care about the trajectory of GDP (and climate harms → lower GDP)



Standard presentation of economic assumptions

Table S-9. Economic Assumptions¹

(Calendar years)

	Actual 2020	Projections											
	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	
Gross Domestic Product (GDP):													
Nominal level, billions of dollars	20,894	22,899	24,631	25,853	26,966	28,064	29,200	30,380	31,626	32,957	34,382	35,877	37,437
Percent change, nominal GDP, year/year	-2.2	9.6	7.6	5.0	4.3	4.1	4.0	4.0	4.1	4.2	4.3	4.3	4.3
Real GDP, percent change, year/year	-3.4	5.5	4.2	2.8	2.2	2.0	2.0	2.0	2.1	2.2	2.3	2.3	2.3
Real GDP, percent change, Q4/Q4	-2.3	5.1	3.8	2.5	2.1	2.0	2.0	2.0	2.1	2.2	2.3	2.3	2.3
GDP chained price index, percent change, year/year	1.3	3.9	3.3	2.1	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Consumer Price Index,² percent change, year/year	1.2	4.6	4.7	2.3	2.3	2.3	2.3	2.3	2.3	2.3	2.3	2.3	2.3
Interest rates, percent:³													
91-day Treasury bills ⁴	0.4	*	0.2	0.9	1.6	1.9	2.1	2.2	2.3	2.3	2.3	2.3	2.3
10-year Treasury notes	0.9	1.5	2.1	2.5	2.7	2.8	3.0	3.1	3.1	3.2	3.2	3.2	3.3
Unemployment rate, civilian, percent³	8.1	5.4	3.9	3.6	3.7	3.8	3.8	3.8	3.8	3.8	3.8	3.8	3.8

* 0.05 percent or less

Note: A more detailed table of economic assumptions appears in Chapter 2, "Economic Assumptions and Overview," in the *Analytical Perspectives* volume of the Budget.

¹The Administration's forecast was finalized on November 10, 2021.

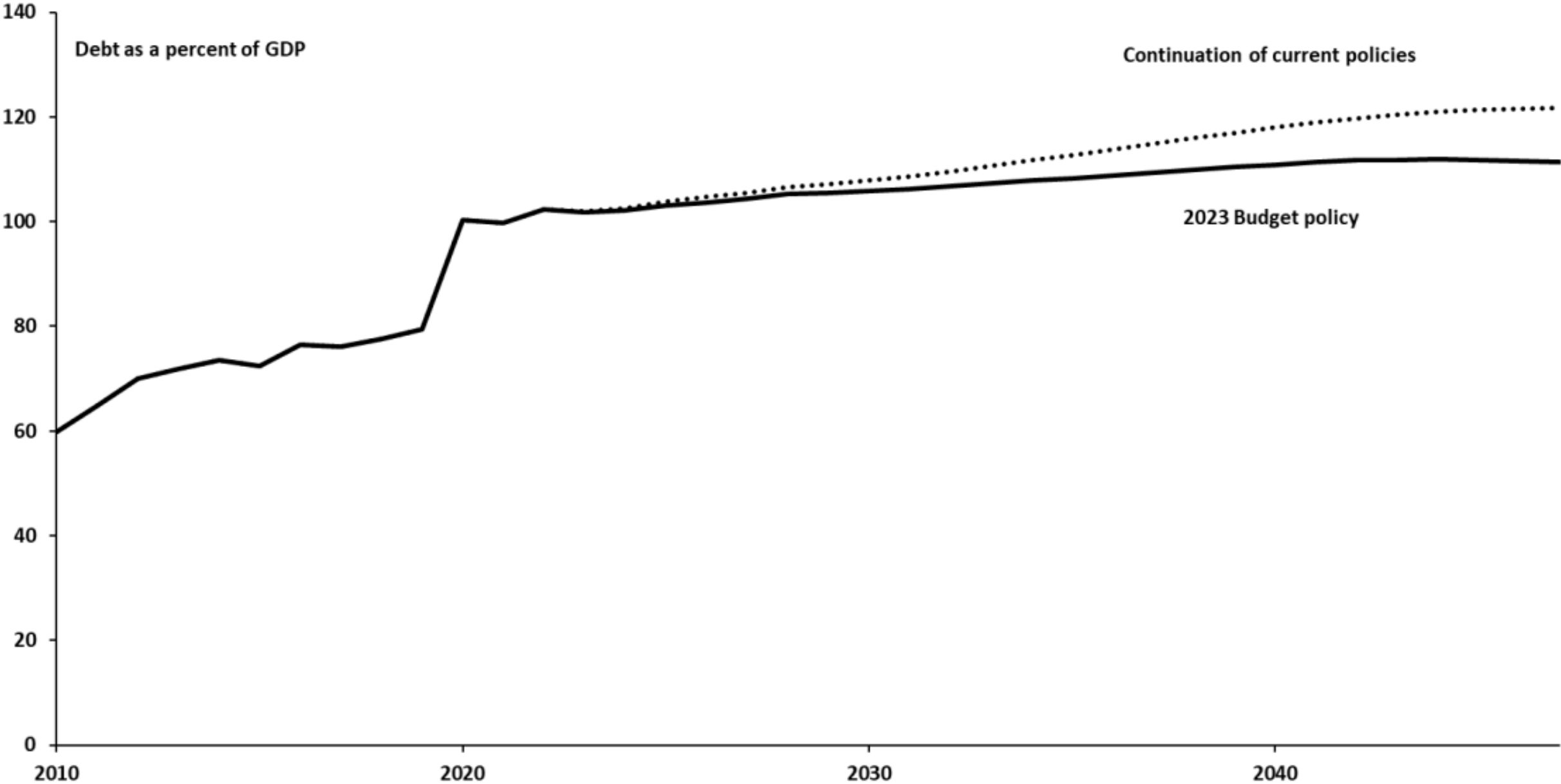
²Seasonally adjusted CPI for all urban consumers.

³Annual average.

⁴Average rate, secondary market (bank discount basis).

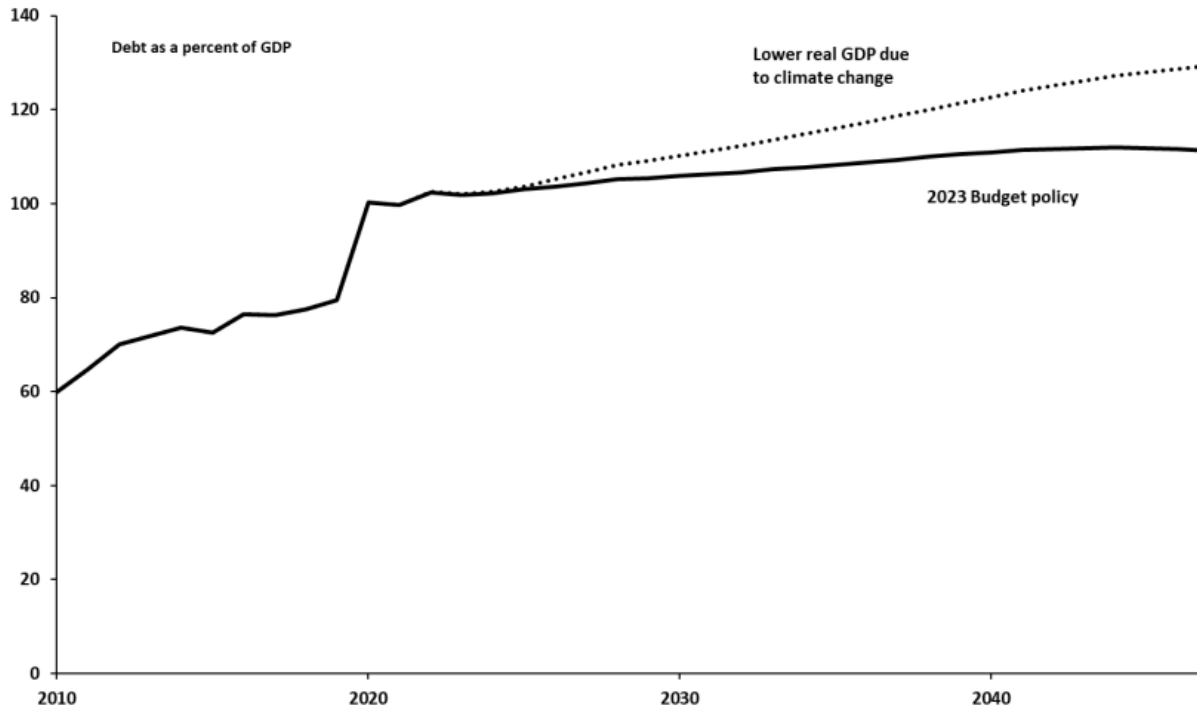


Standard presentation of long-term budget outlook (last year)



Budget outlook with potential climate impacts (last year)

Chart 3-4. Climate Risk Alternative



Presented as “climate-risk alternative” in long-term budget outlook.

- Single emissions scenario with 95th percentile damages from Kalkuhl and Wenz (2020)

High-level results:

- Physical climate risks are fiscally significant
 - Increases mid-century debt/GDP by 18pp
 - Decreases late-century revenues by 7% (roughly \$2T/year)



How incorporating climate into the forecast matters



- We want higher GDP and lower debt/GDP
- Incorporating climate impacts into the forecast:
 - Helps make appropriate economic planning overall
 - Helps make accurate tradeoffs when considering climate policy
 - These policies cost money
 - But also reduce climate harms, and thus increase GDP (and tax revenue) alongside off-budget benefits

Climate-macro can be useful in shaping proposed policy and determining the economic and budgetary impacts of that policy

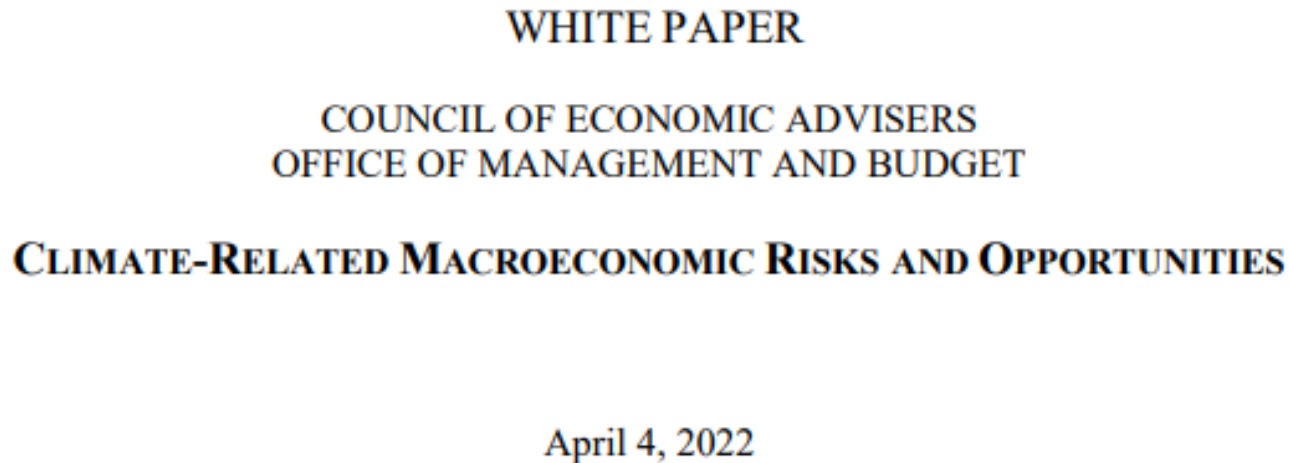


What we've done so far

- We have convened an Interagency Technical Working Group to develop a framework for incorporating climate risks into macro-economic forecasting.
- They have:
 1. Informed an initial risk analysis in the long-term outlook (FY 2023 Budget) – this is what you saw
 2. Written a white paper (Spring 2022) highlighting USG resources
 3. Produced an initial assessment of resources required for this effort (Summer 2022)
 4. Begun to evaluate candidate resources for this effort (Fall/Winter 2022)



Step 2: Review of the literature and USG capabilities



High-level conclusions:

- Physical and transition effects are highly macro-significant
- The limited policy-relevance of the current literature
- US government has strong (perhaps unparalleled) capabilities in energy, land system, and economic modeling



Steps 3 and 4: working towards a framework

- The working group convened through Spring 2022 and developed an outline of required resources to develop a USG climate-macro forecasting capability
 - Part of this outline was a direct set of requests for funding and man-hours
 - It also mapped out a rough timeline for meeting certain objectives
 - This outline has been refined through Fall 2022 as certain resources were evaluated for use within the current economic assumptions framework
- This is recognized as a multi-year, iterative effort
 - Incremental progress will be made each year until a complete framework can be integrated into the President's Budget economic assumptions
 - As progress is made, a more complete risk analysis will be presented in the long-term budget outlook each year



Key data and analytic needs of the climate-macro framework

- The ability to analyze a range of scenarios and policy tools
- Realistic technology pathways – learning curves; performance improvements; comprehensive set of lower-carbon alternatives
- Challenges modeling a dynamic system – induced innovation; changing preferences; climate tipping points and nonlinear damage functions
- Hard macro questions for integration into existing budget framework
 - Ex: existing budget framework is focused on central tendencies rather than scenarios
- How do physical and transition effects interact with each other and macro outcomes?

