The 4th National Climate Assessment

Translating Data to Inform Decisions

Dan Barrie
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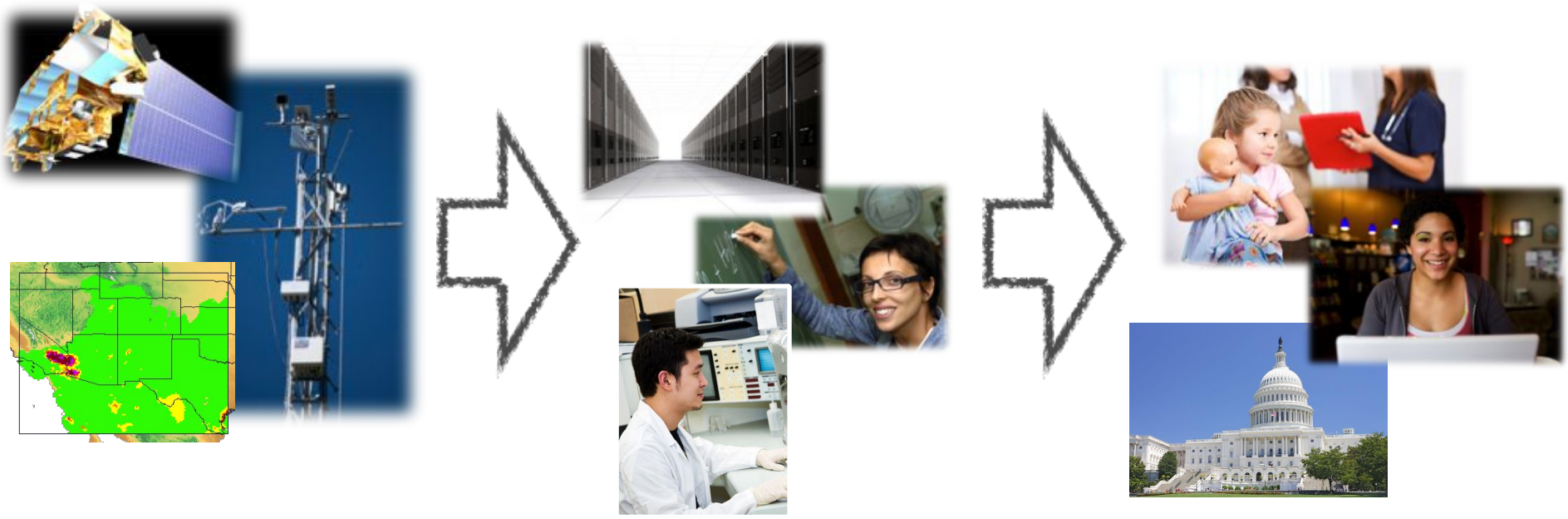
Data to Action Webinar: Increasing the Use and Value of Earth Science Data and Information

May 17th, 2019 | Webinar #3

ESIP Vision

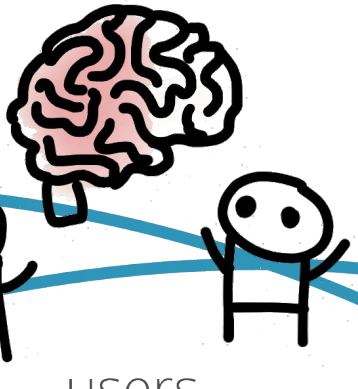
To be a leader in promoting
*the **collection, stewardship and (re)use***
Of Earth science data, information and knowledge
that is responsive to societal needs.



ESIP COMMUNITY

Brain trust of Earth & environmental science data people

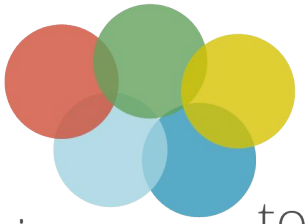
Multiple Science Domains



users

Corporate

data providers



application developers

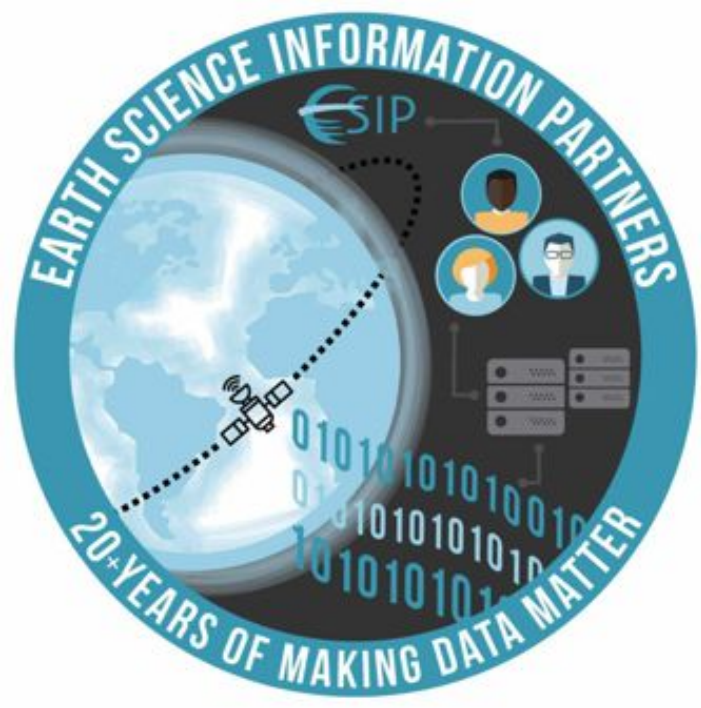
data archives

tool & system developers

Academia

Cross-Agency

Introduction



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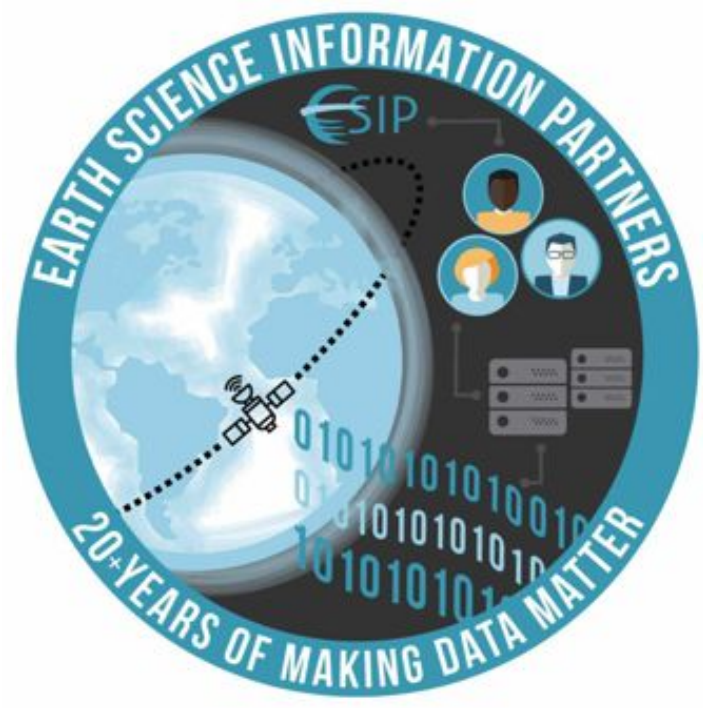
Presentations



Data to Action: Increasing the Use and Value of Earth Science Data and Information

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Data and Information Provenance in NCA4

Reid Sherman | GCIS Lead, National Coordination Office | Straughan Environmental, Inc.

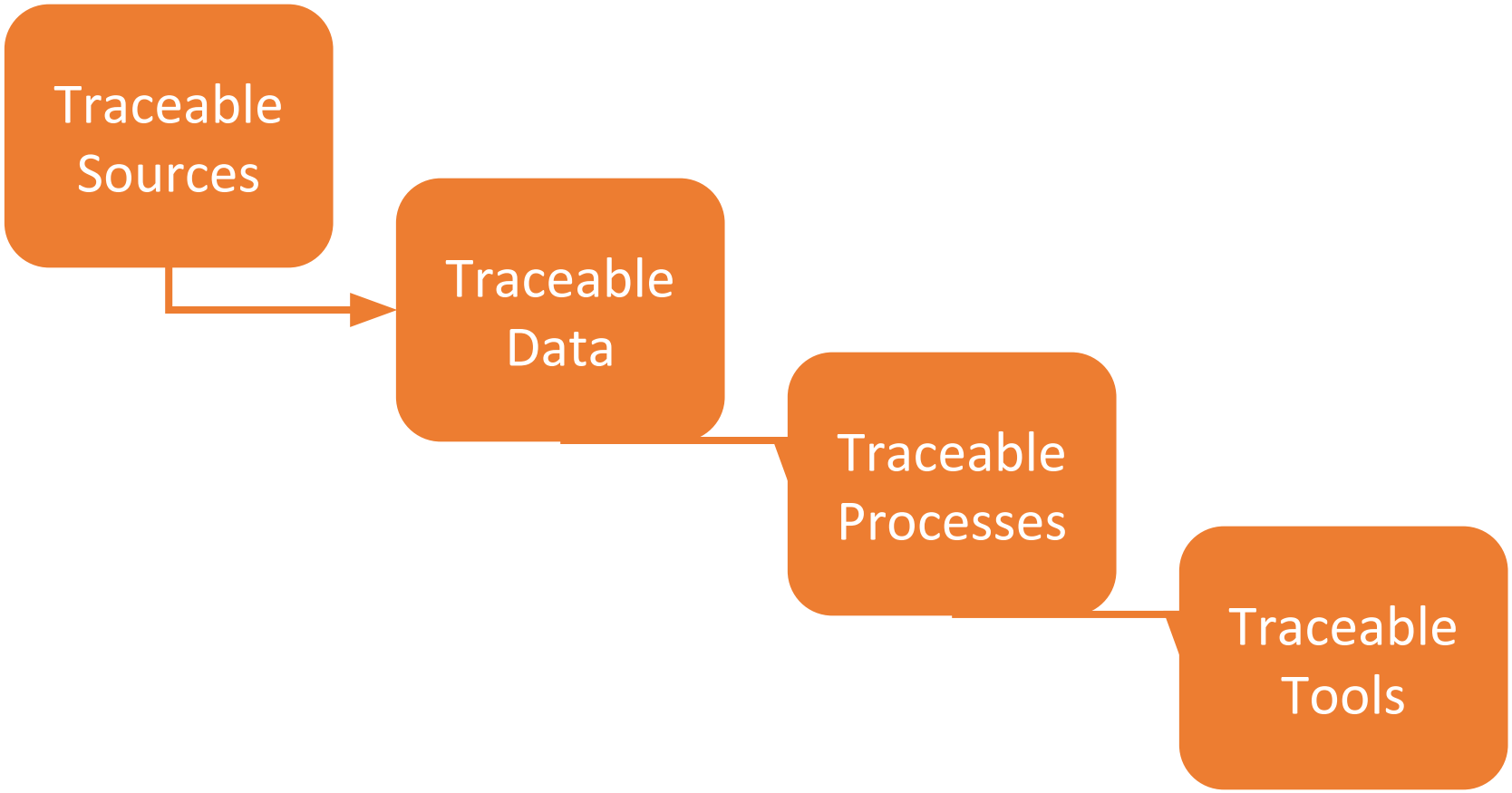
May 17, 2019

U.S. Global Change Research Program

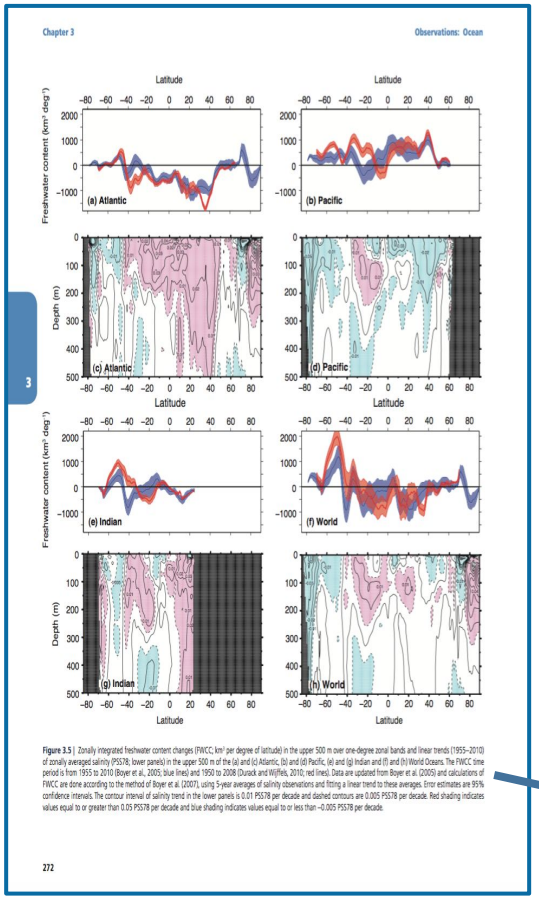
Why we need Traceable Provenance

1. Increase credibility
   - Demonstrate integrity
   - Conform to modern scientific standards
2. Enable reproducibility
   - Reproducible research
   - Government transparency
3. Inform decisions
   - Locate customizable data and information

The ideal for traceable provenance



Standard practice



Boyer, T. P., S. Levitus, J. I. Antonov, R. A. Locarnini, and H. E. Garcia, 2005: Linear trends in salinity for the World Ocean, 1955–1998. *Geophys. Res. Lett.*, **32**, L01604.

Figure 3.5 | Zonally integrated freshwater content changes (FWCC; km³ per degree of latitude) in the upper 500 m over one-degree zonal bands and linear trends (1955–2010) of zonally averaged salinity (PSS78; lower panels) in the upper 500 m of the (a) and (c) Atlantic, (b) and (d) Pacific, (e) and (g) Indian and (f) and (h) World Oceans. The FWCC time period is from 1955 to 2010 (Boyer et al., 2005; blue lines) and 1950 to 2008 (Durack and Wijffels, 2010; red lines). Data are updated from Boyer et al. (2005) and calculations of FWCC are done according to the method of Boyer et al. (2007), using 5-year averages of salinity observations and fitting a linear trend to these averages. Error estimates are 95% confidence intervals. The contour interval of salinity trend in the lower panels is 0.01 PSS78 per decade and dashed contours are 0.005 PSS78 per decade. Red shading indicates values equal to or greater than 0.05 PSS78 per decade and blue shading indicates values equal to or less than –0.005 PSS78 per decade.

NCA4 Provenance

Surfacing information sources

- Traceable Accounts
- Sources linked with publication metadata
- Figures have data and processes documented

Traceable Accounts

- Process Description
- For each Key Message:
  - Description of Evidence Base
  - Major Uncertainties
  - Description of Confidence and Likelihood

Citations

Rapid Forest Change—Insects and Pathogens

Climate change is expected to increase the effects of some insect species in U.S. forests[23, 61, 62] but reduce the effects of others.[63] For example, drought increases populations of some defoliating insect species[64] defoliators.[65] In some cases, fire exclusion in fir effects of insects by increasing forest density, th tree to resist stress) and resistance to insect att on trees with reduced vigor is expected to be on climate. Altered thermal conditions, including va some insect life cycles, causing seasonal mismatches between insect species and tree hosts in some systems.[66]

Kolb, T. E., C. J. Fettig, M. P. Ayres, B. J. Bentz, J. A. Hicke, R. Mathiasen, J. E. Stewart, and A. S. Weed, 2016: Observed and anticipated impacts of drought on forest insects and diseases in the United States. *Forest Ecology and Management*, **380**, 321–334. doi:10.1016/j.foreco.2016.04.051.

Citations in GCIS

Individual feedback contributions to the seasonality of surface warming

2014

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Journal of Climate volume 27 pages 5653-5669
DOI : 10.1175/JCLI-D-13-00658.1

This work is referenced by:

- Climate Science Special Report: The Fourth National Climate Assessment: Volume I (reference)
  - chapter 2 (reference)

Figure Metadata

Figure 6.4: Wildfires—Changes in Area Burned and Cost

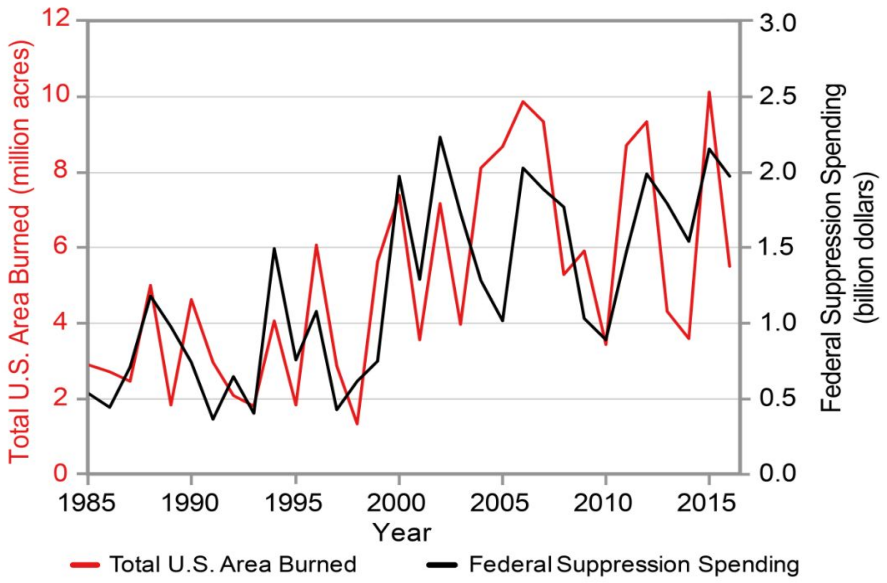
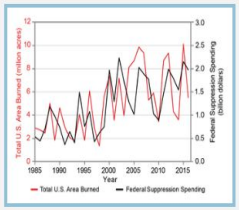


Figure Metadata

Wildfires—Changes in Area Burned and Cost

Overview | Panel Details | Full Record | Figure Downloads



Zoom

Caption: This figure shows the annual wildfire area burned in the United States (red) and the annual federal wildfire suppression expenditures (black), scaled to constant 2016 U.S. dollars (Consumer Price Index deflated). Trends for both area burned and wildfire suppression costs indicate about a fourfold increase over a 30-year period. Source: U.S. Forest Service.

This figure, ***"Wildfires—Changes in Area Burned and Cost"***, provided by Jeffrey P. Prestemon . Please contact Jeffrey P. Prestemon for any questions or additional information regarding this figure.

Figure Metadata

- Point of contact
- Panel information
- Datasets Used
- Analysis Methods and Tools

Planning for NCA5

GCIS planned improvements

1. Establishing metrics to measure our metadata quality
2. Improving ingestion from report authors
3. Implementing navigation through topical keywords
4. Improving our data model and technology

Acknowledgments

- USGCRP Global Change Information System Team
  - Amrutha Elamparuthy – Data Manager
  - Reuben Aniekwu – Research Coordinator
  - [Kathryn Tipton] – Software Engineer
- NOAA Technical Support Unit – North Carolina Institute for Climate Studies

data.globalchange.gov

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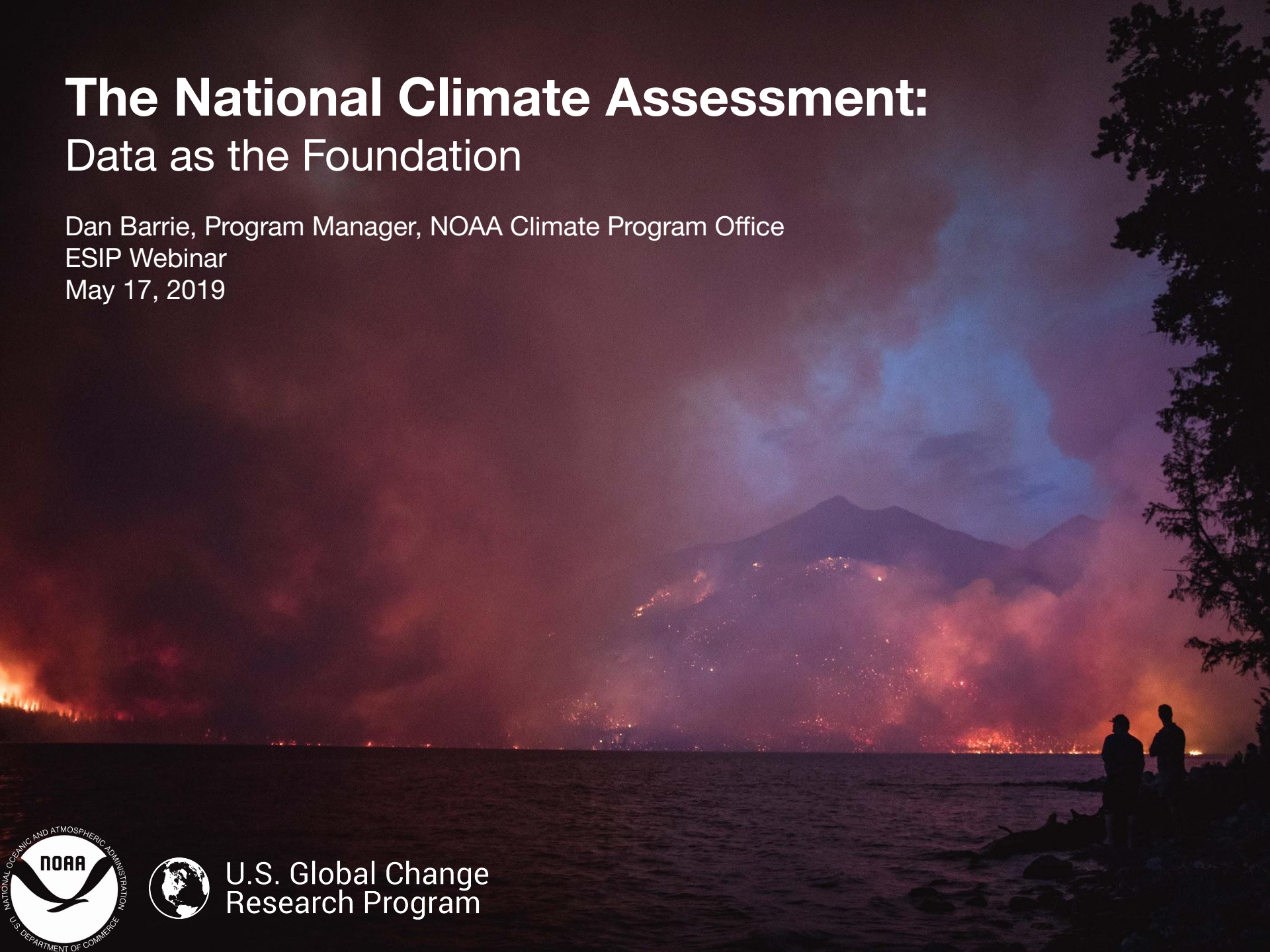
GlobalChange.gov

The National Climate Assessment:
Data as the Foundation

Dan Barrie, Program Manager, NOAA Climate Program Office
ESIP Webinar
May 17, 2019



U.S. Global Change Research Program

U.S. Global Change Research Program

- USGCRP began as a Presidential initiative in 1989
- Mandated by Congress in the U.S. Global Change Research Act of 1990 “to assist the Nation and the world to **understand, assess, predict,** and **respond** to human-induced and natural processes of global change”
- Overseen by Principals representing the 13 member agencies of the National Science & Technology Committee’s Subcommittee on Global Change Research (SGCR)

National Climate Assessment (NCA)

GCRA (1990), Section 106:

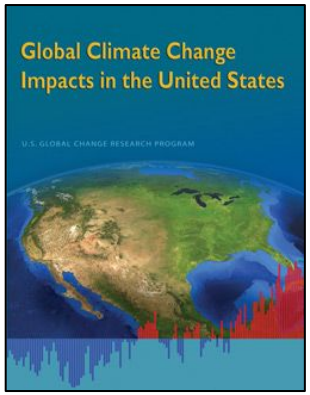
- Not less frequently than **every 4 years** … [USGCRP] shall prepare and submit to the President and Congress an assessment which:
- Integrates, evaluates, and interprets the findings ….and discusses the scientific uncertainties associated with such findings
- Analyzes the effects of global change on the **natural environment, agriculture, energy production and use, land and water resources, transportation, human health and welfare, human social systems, and biological diversity**
- Analyzes **current trends** in global change, both human- induced and natural, and projects major trends for the **subsequent 25 to 100 years**.

The National Climate Assessment

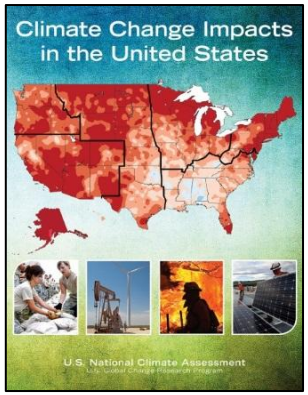
NCA1 through NCA4: 2000 to 2018

- USGCRP has produced four National Climate Assessments (NCAs)
- Each covers climate change science and impacts to sectors and regions in the United States
- Each NCA had a unique production process

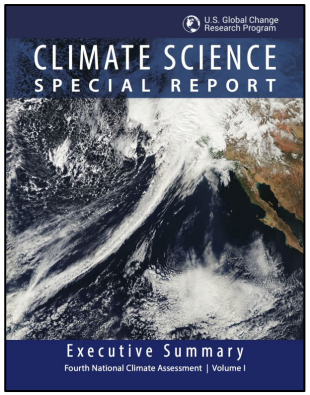
NCA1

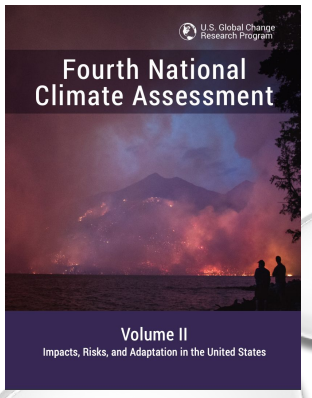


NCA2

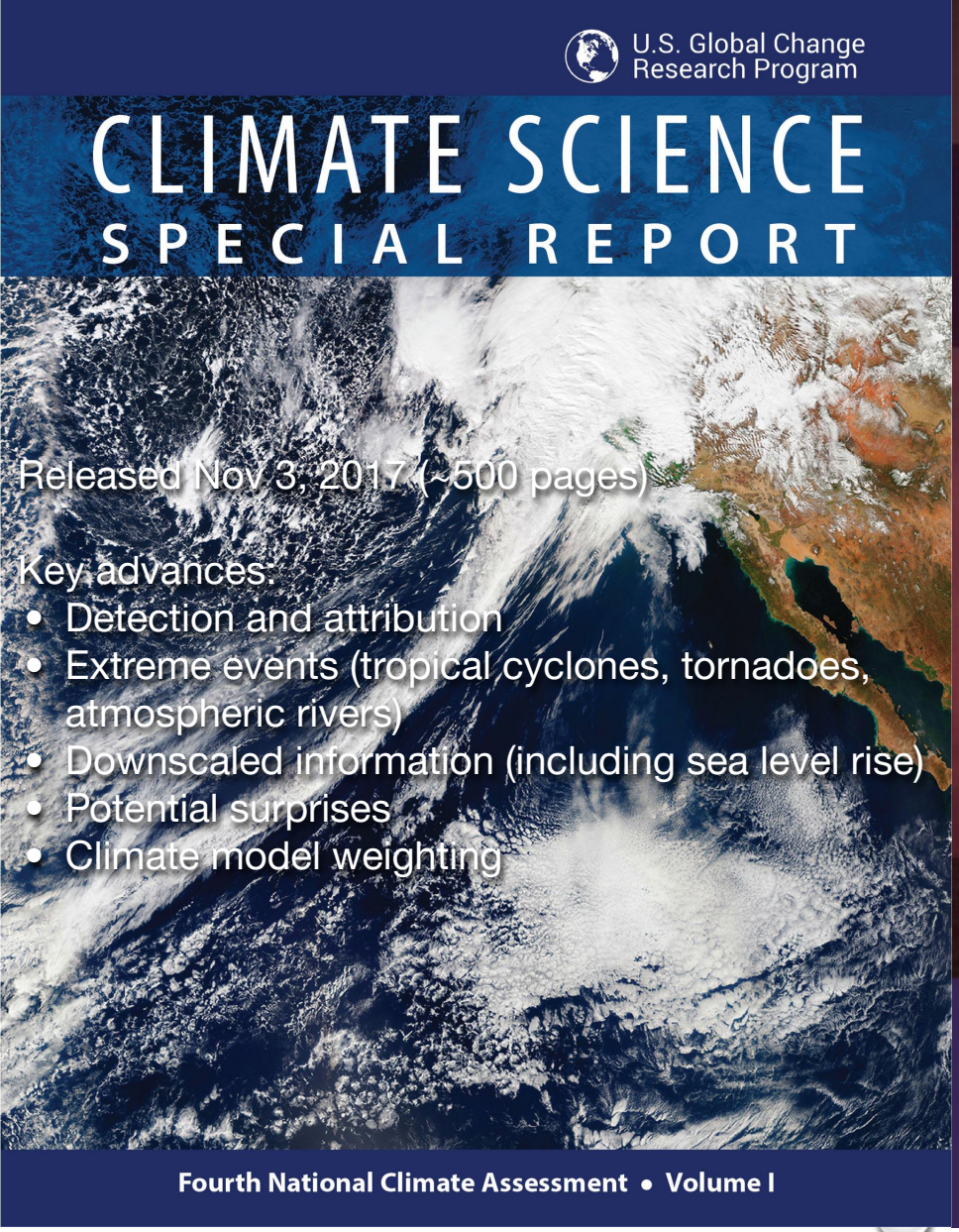


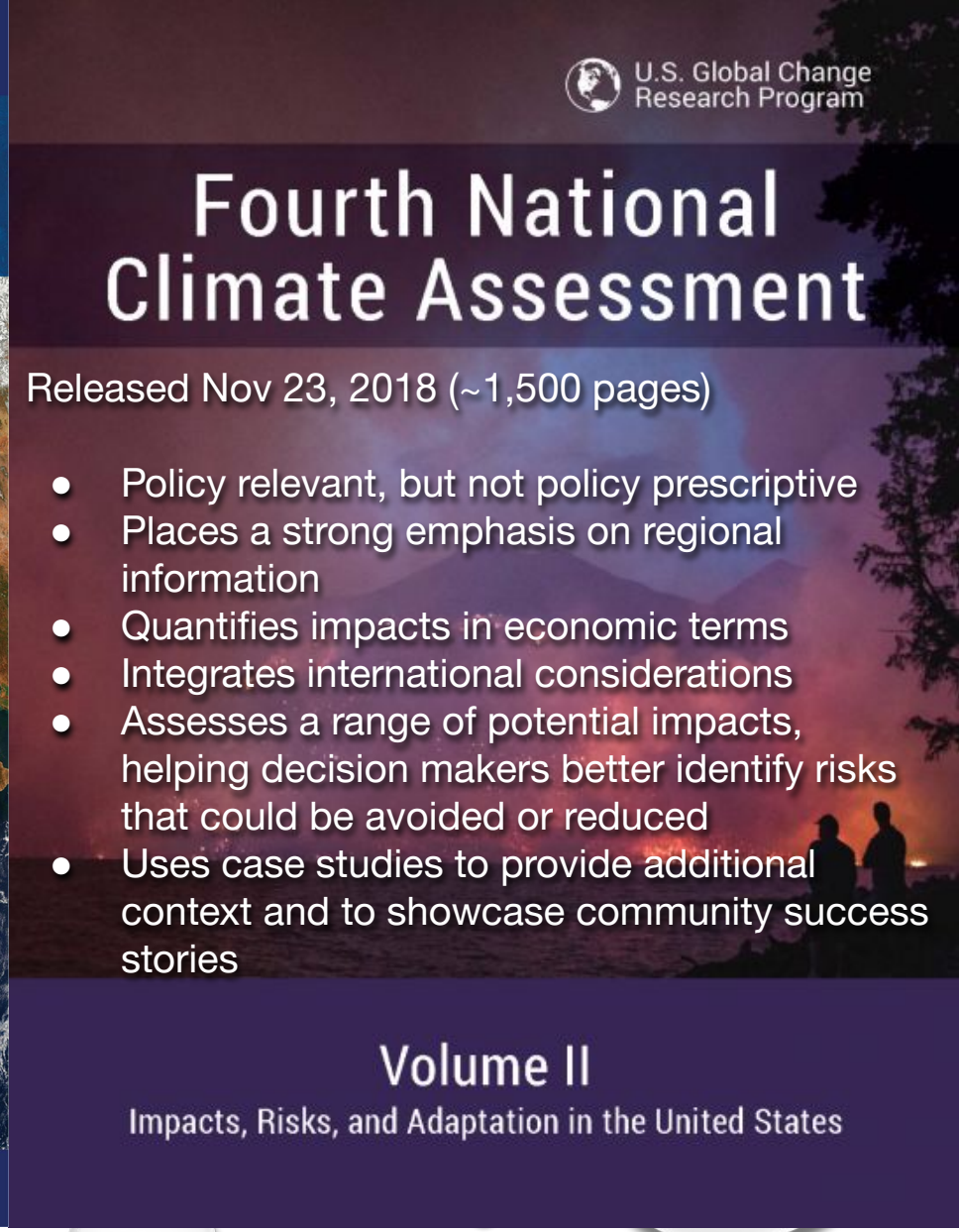
NCA3





NCA4


U.S. Global Change Research Program
CLIMATE SCIENCE
SPECIAL REPORT
Released Nov 3, 2017 (~500 pages)
Key advances:
• Detection and attribution
• Extreme events (tropical cyclones, tornadoes, atmospheric rivers)
• Downscaled information (including sea level rise)
• Potential surprises
• Climate model weighting
Fourth National Climate Assessment • Volume I

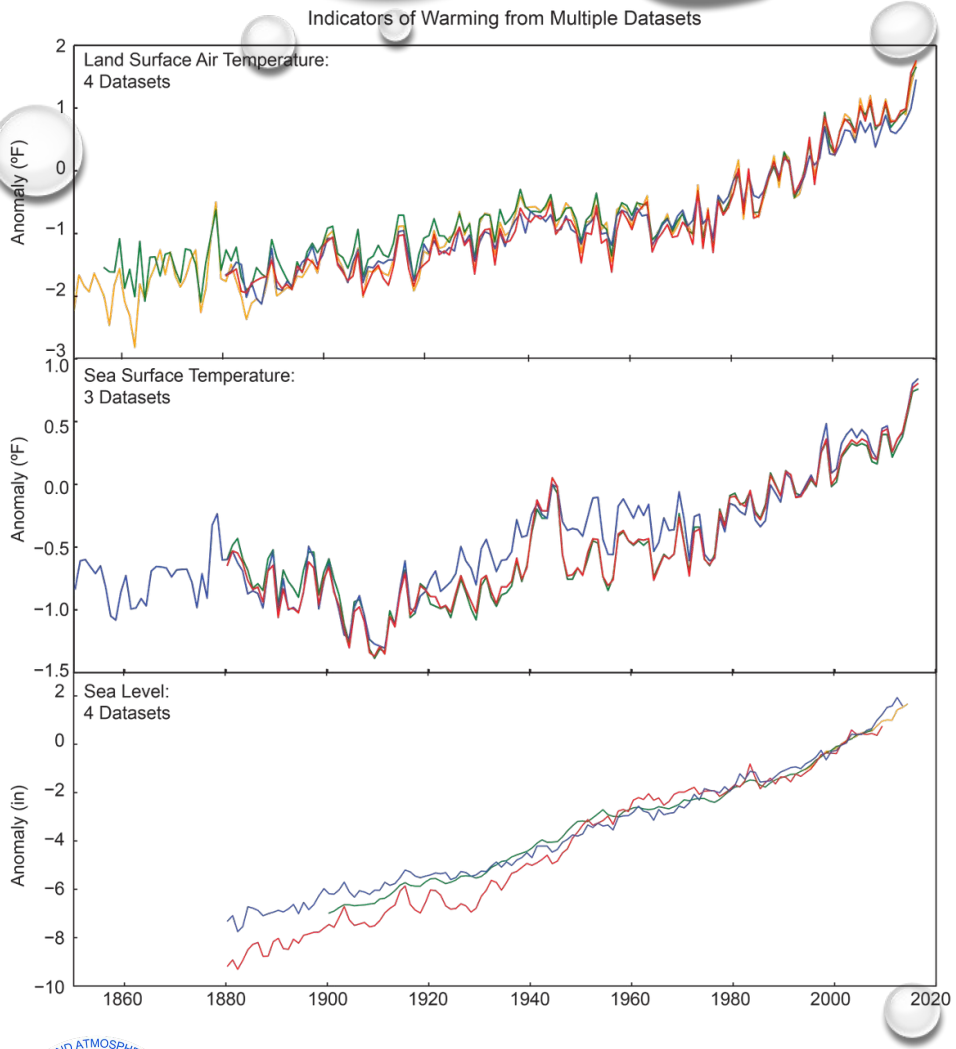

U.S. Global Change Research Program
Fourth National Climate Assessment
Released Nov 23, 2018 (~1,500 pages)
• Policy relevant, but not policy prescriptive
• Places a strong emphasis on regional information
• Quantifies impacts in economic terms
• Integrates international considerations
• Assesses a range of potential impacts, helping decision makers better identify risks that could be avoided or reduced
• Uses case studies to provide additional context and to showcase community success stories
Volume II
Impacts, Risks, and Adaptation in the United States

Types of Data in the Assessment

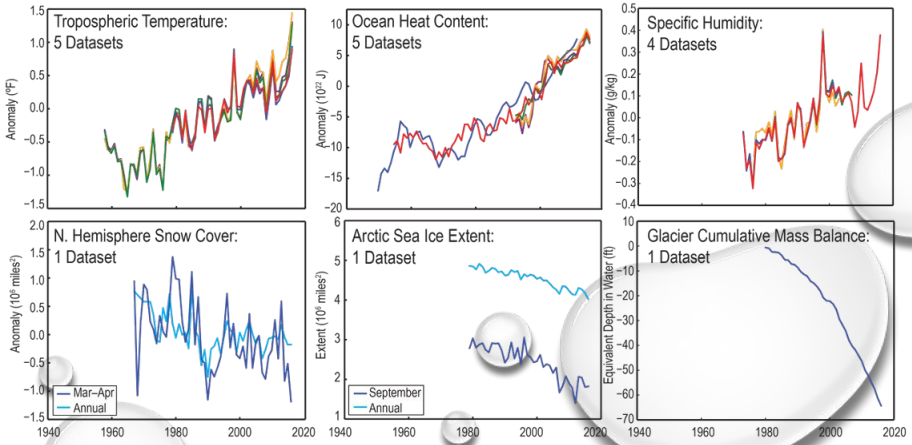
- **Observational** data -- in situ measurements, satellite retrievals, proxy/paleoclimate records
- **Model** data -- historical simulations, projections
- **Other** records -- case studies, data rescue, socioeconomic data, economic studies
- **Fusion** -- scenarios, model validation/bias correction, risk exposure

Climate Science Special Report (NCA Volume I), page 436: "Observations, including those from satellites, mobile platforms, field campaigns, and ground-based networks, **provide the basis of knowledge** on many temporal and spatial scales for understanding the changes occurring in Earth's climate system. These observations also **inform the development, calibration, and evaluation of numerical models** of the physics, chemistry, and biology being used in analyzing past changes in climate and for making future projections."

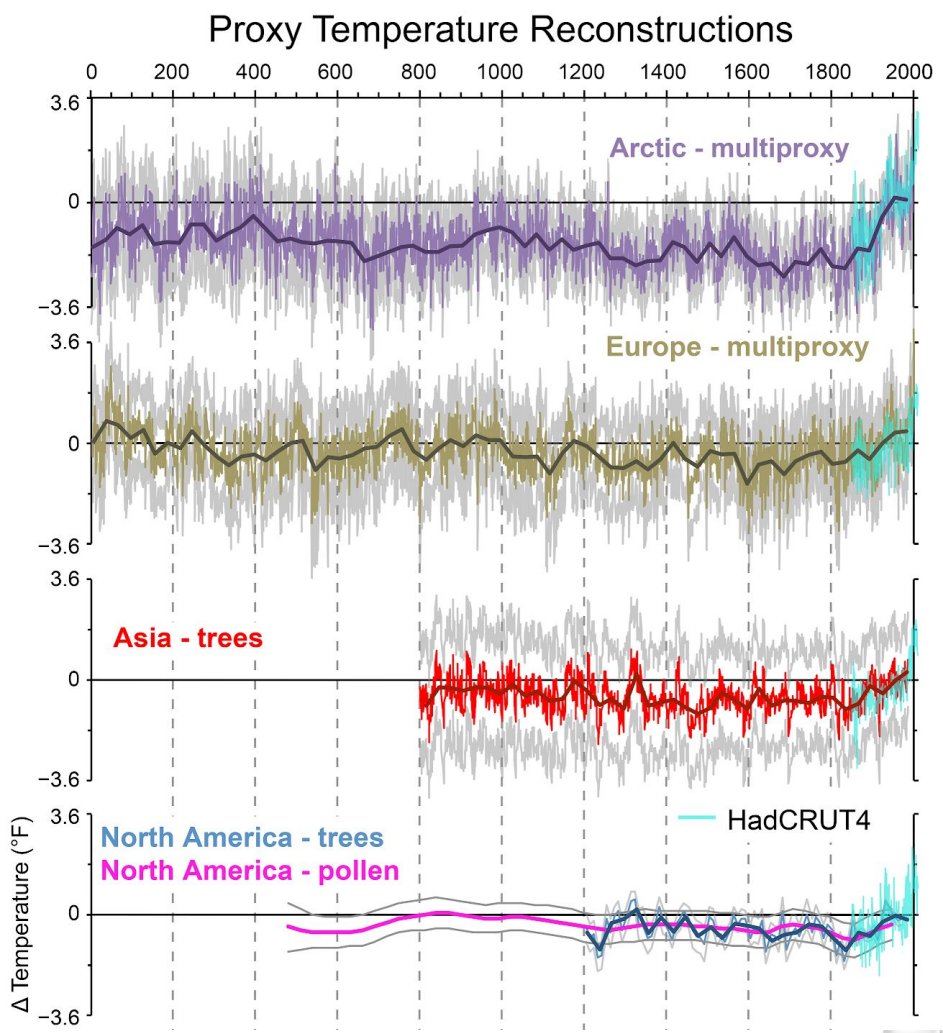
In Situ/Remotely-Sensed Observations

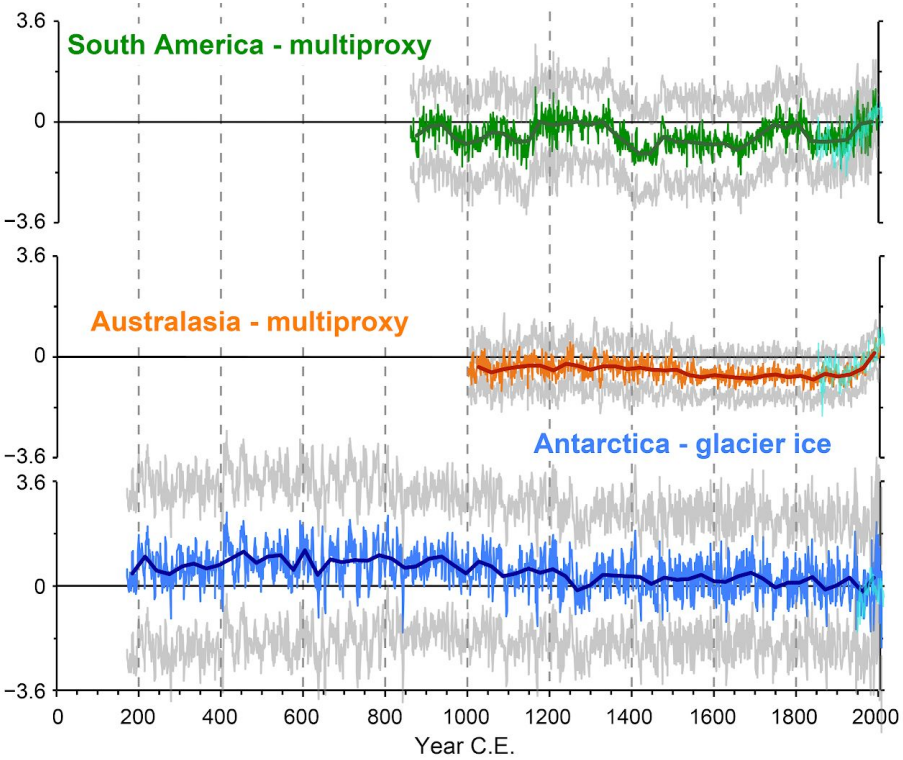


- A variety of indicators provide records of change in a number of physical systems, as shown in Figure 1.1 of Volume I.
- These indicators use a number of overlapping and complementary data records, when possible, to increase confidence and uncertainty estimation.
  - For example, there are 4+ datasets each for T, SL, $T_{troposphere}$, OHC, SH.



Paleoclimate/Proxy Records

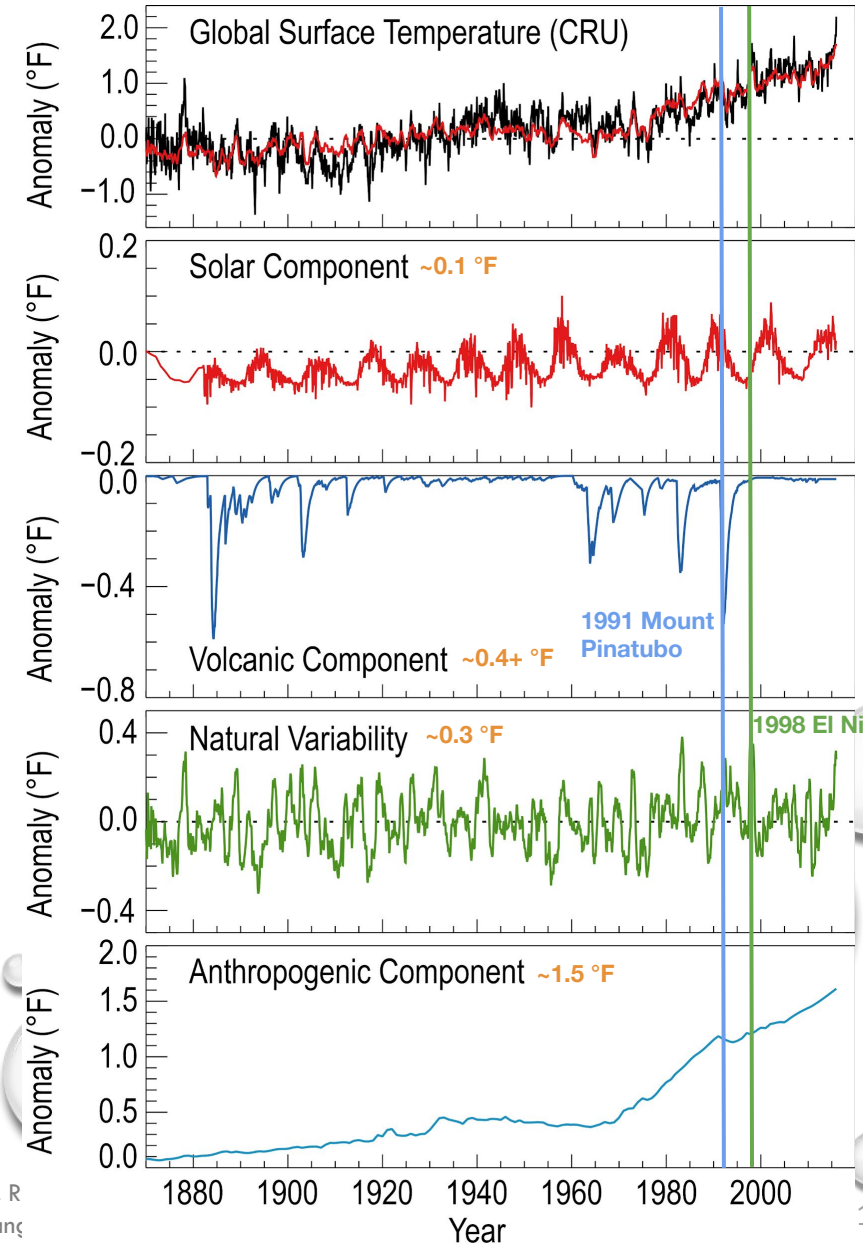




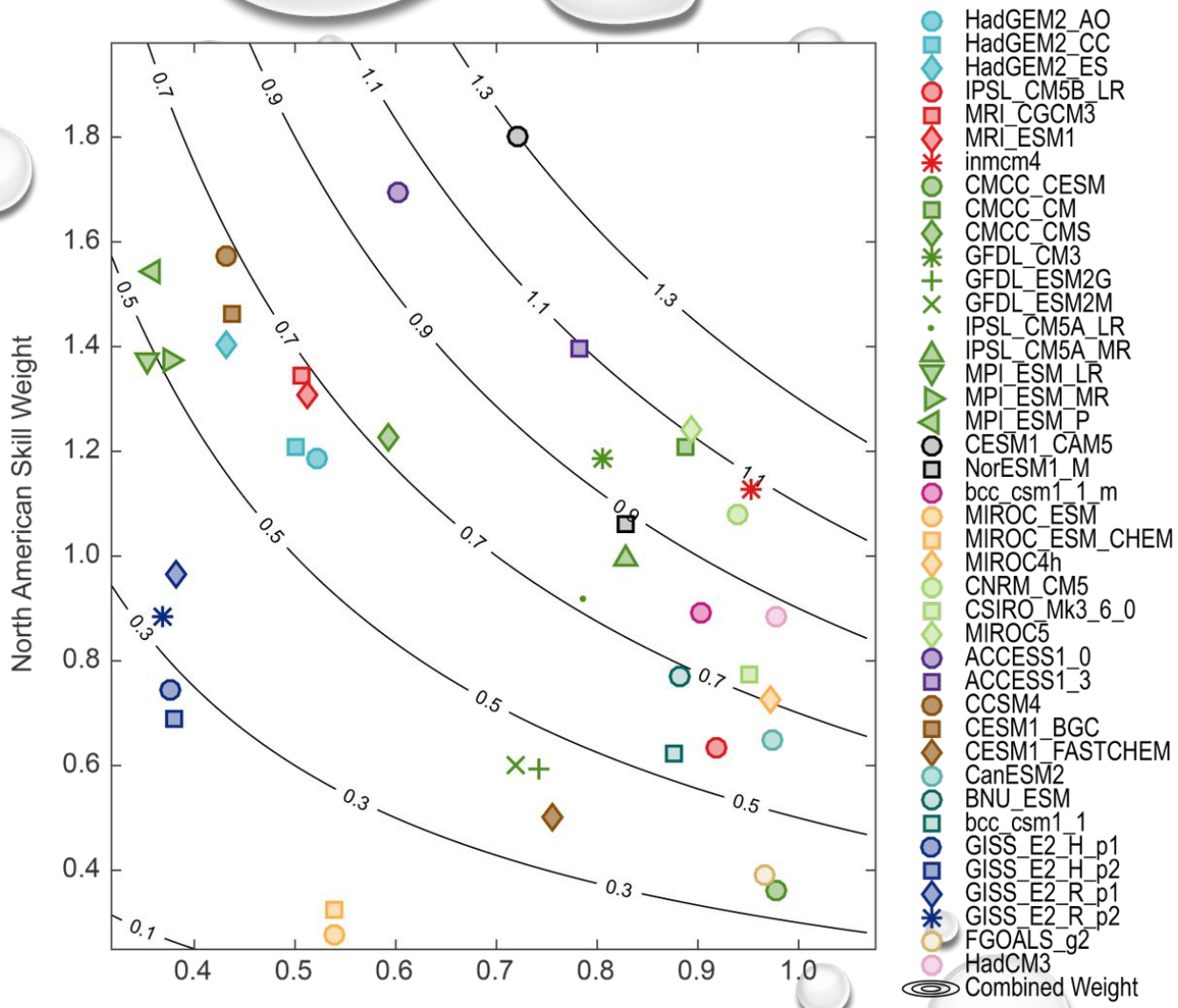
- Proxy/paleoclimate records are used to contextualize recent change (figure 1.9 from Volume I)
- A variety of records are split out regionally to depict long-term context and change, and provide robust uncertainty assessment.

Fingerprints -- Observations Plus Analysis

- Figure 3.3 in Volume I depicts the application of analysis methodology to decompose various contributions to observed change in temperature
- The observed global temperature record is decomposed into its various forcing components
- The impact of solar cycles and variability, volcanic eruptions, natural variability, and anthropogenic contributions can be isolated.

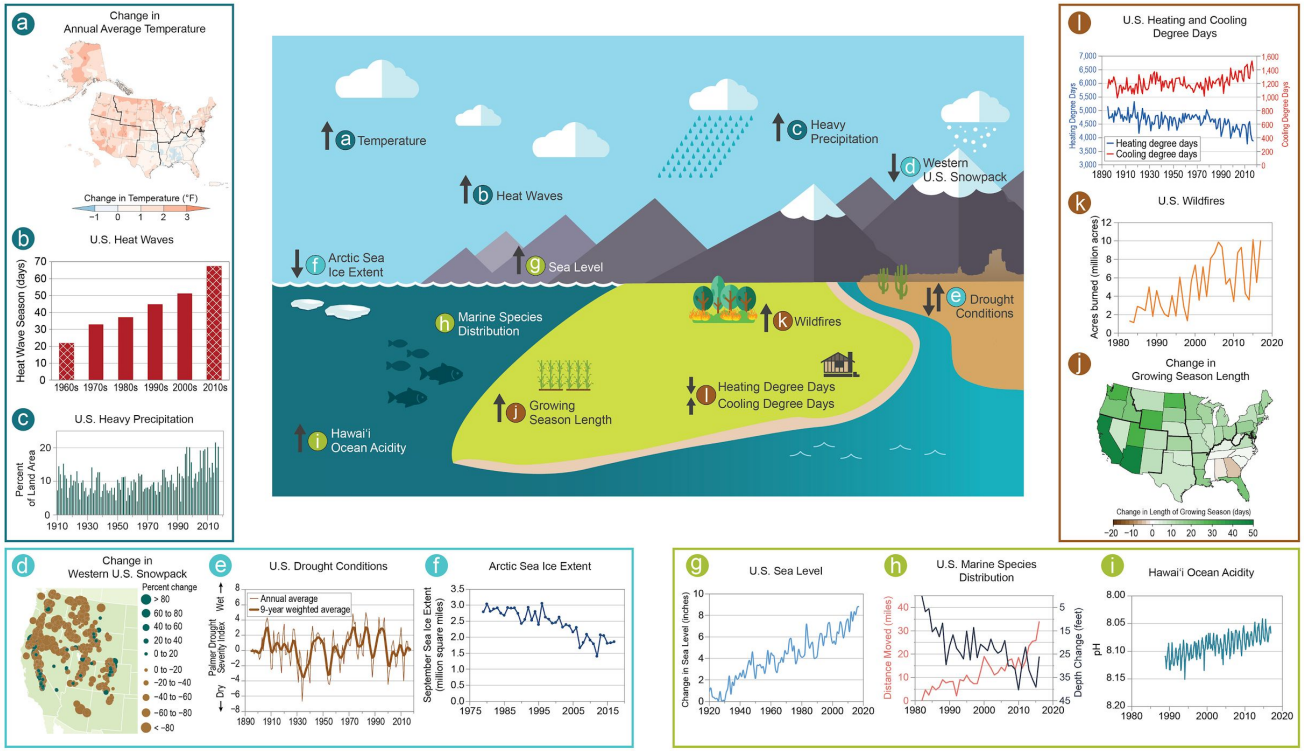


Model Data



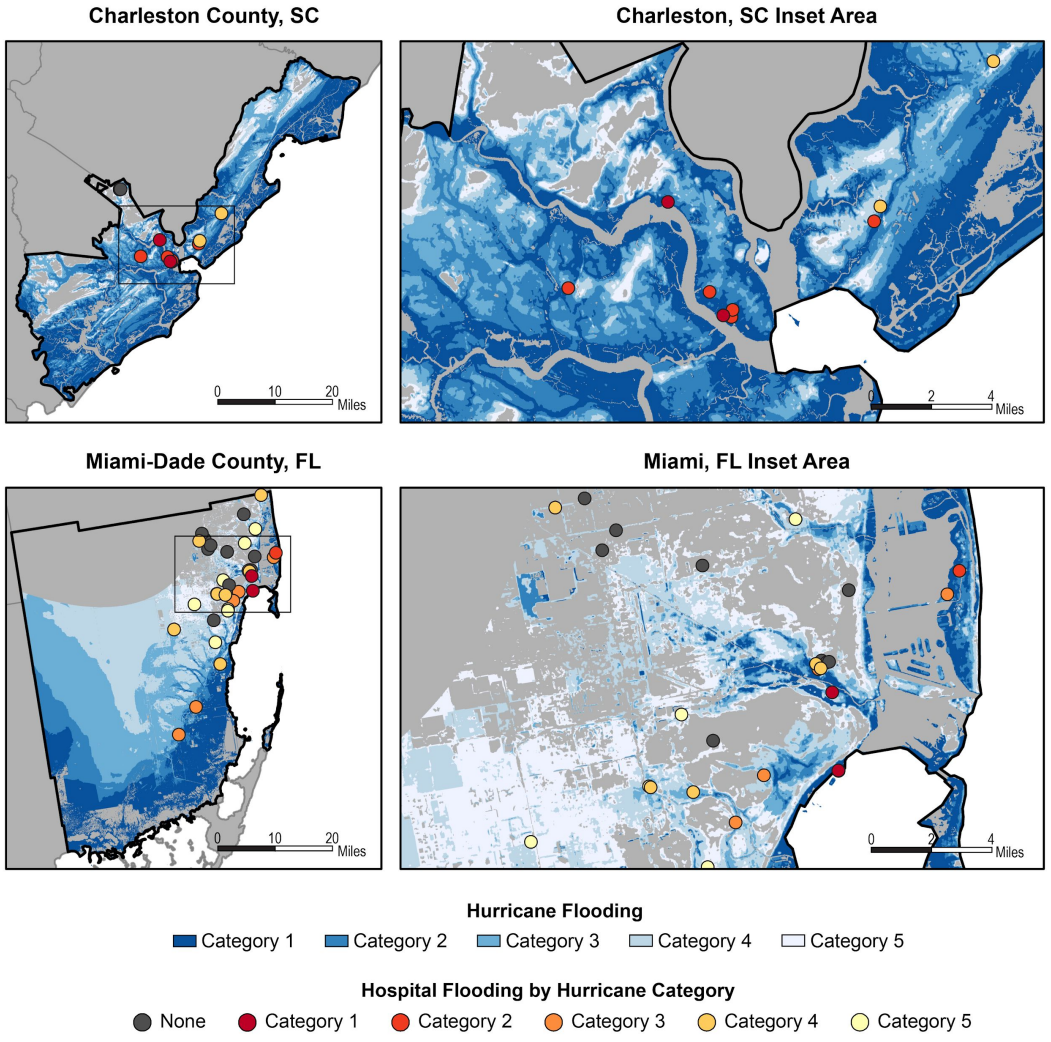
- The report took a novel approach to weight model projections according to performance (vertical axis) and uniqueness (horizontal axis).
- This analysis, showing in figure B.3 results in weights according to the contour values in the plot.
- This work is a fusion of model data and observations, used to benchmark performance.

Indicators



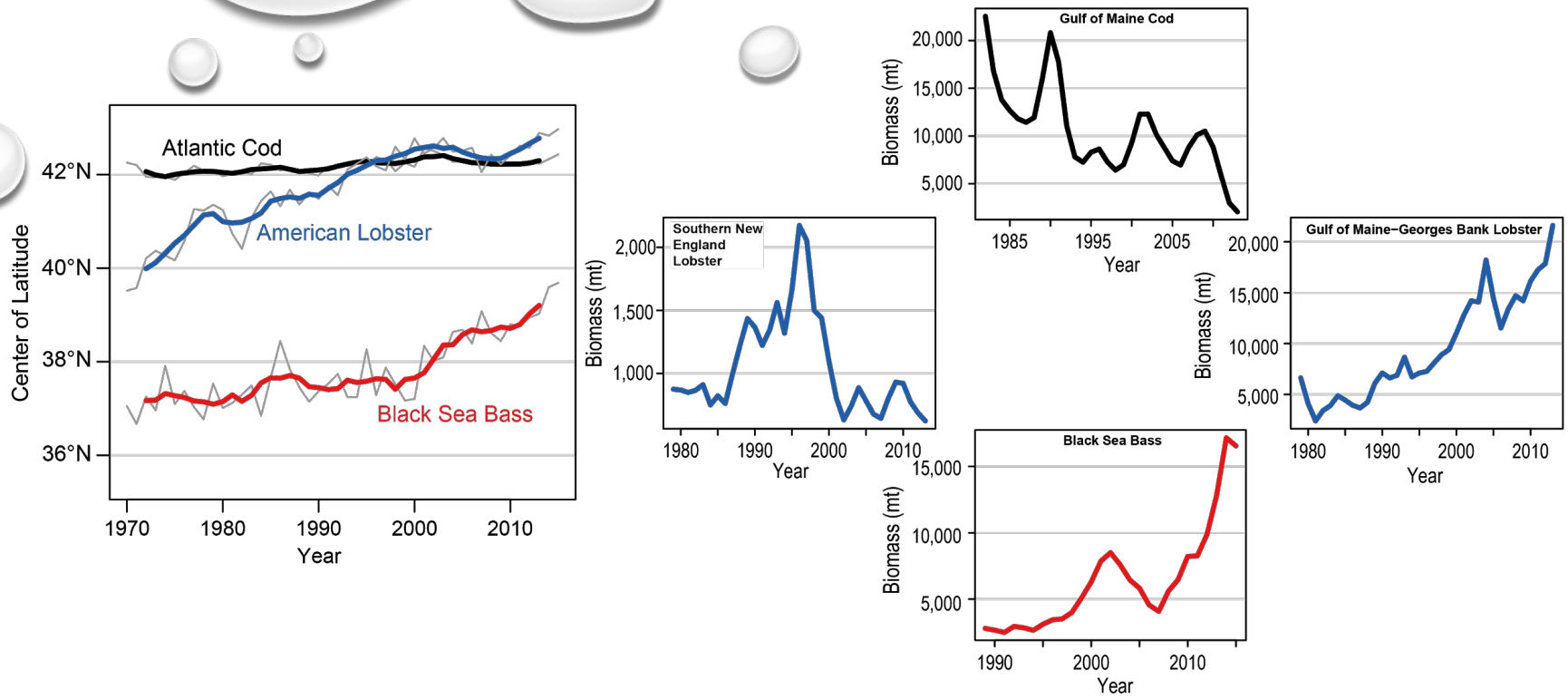
- A variety of indicator undergird discussion in Volume II (figure 1.2). These indicators bridge physical, integrative, and socially-relevant topics.
- The indicators are maintained as part of a USGCRP indicator platform.

Merging Physical Risk and Infrastructure Exposure



- Volume II uses a risk framing approach, which frequently merges physical hazards with levels of risk to stakeholder concerns.
- In figure 14.3, from the Human Health chapter, the risk of hurricane-induced flooding to hospital infrastructure is shown in Charleston and Miami.

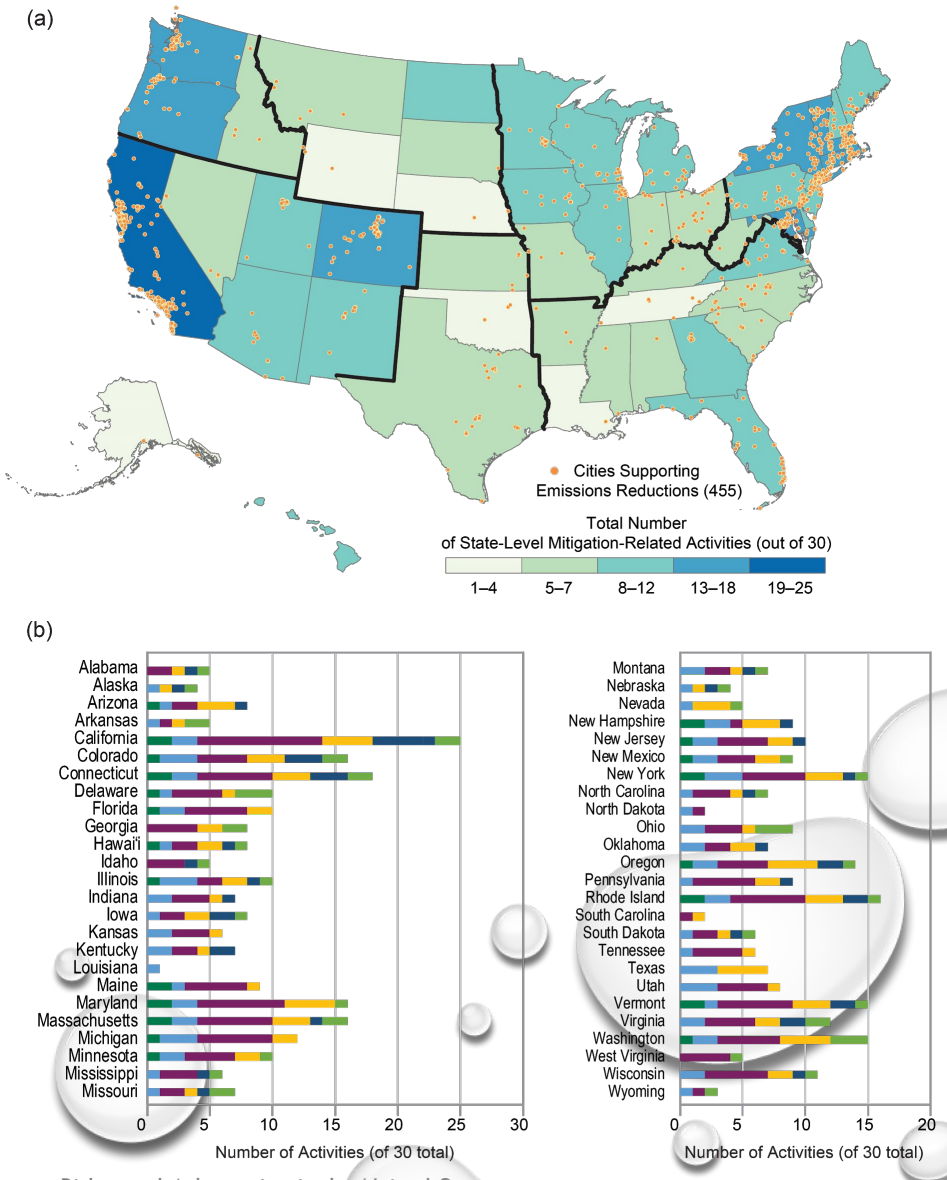
Distribution and Abundance of Marine Species



- Figure 18.6, from the Northeast chapter in Volume II, depicts the observed changes in marine fishery characteristics and catch over the late 20th and early 21st century.
- Data such as this documents the combined aspects of climate change and variability, management decisions, and economic outcomes.

Measuring Human Response to Climate Change

- The report also documents human responses to climate change in the Adaptation and Mitigation chapters
- Figure 29.1 from the Mitigation chapter in Volume II documents the distribution of local and state-level mitigation activities, broken across various categories of efforts.



Acknowledgements

Thanks to Dave Reidmiller (USGCRP) for contributing slide content.

NCA4 Volume I (Climate Science Special Report) is available at:

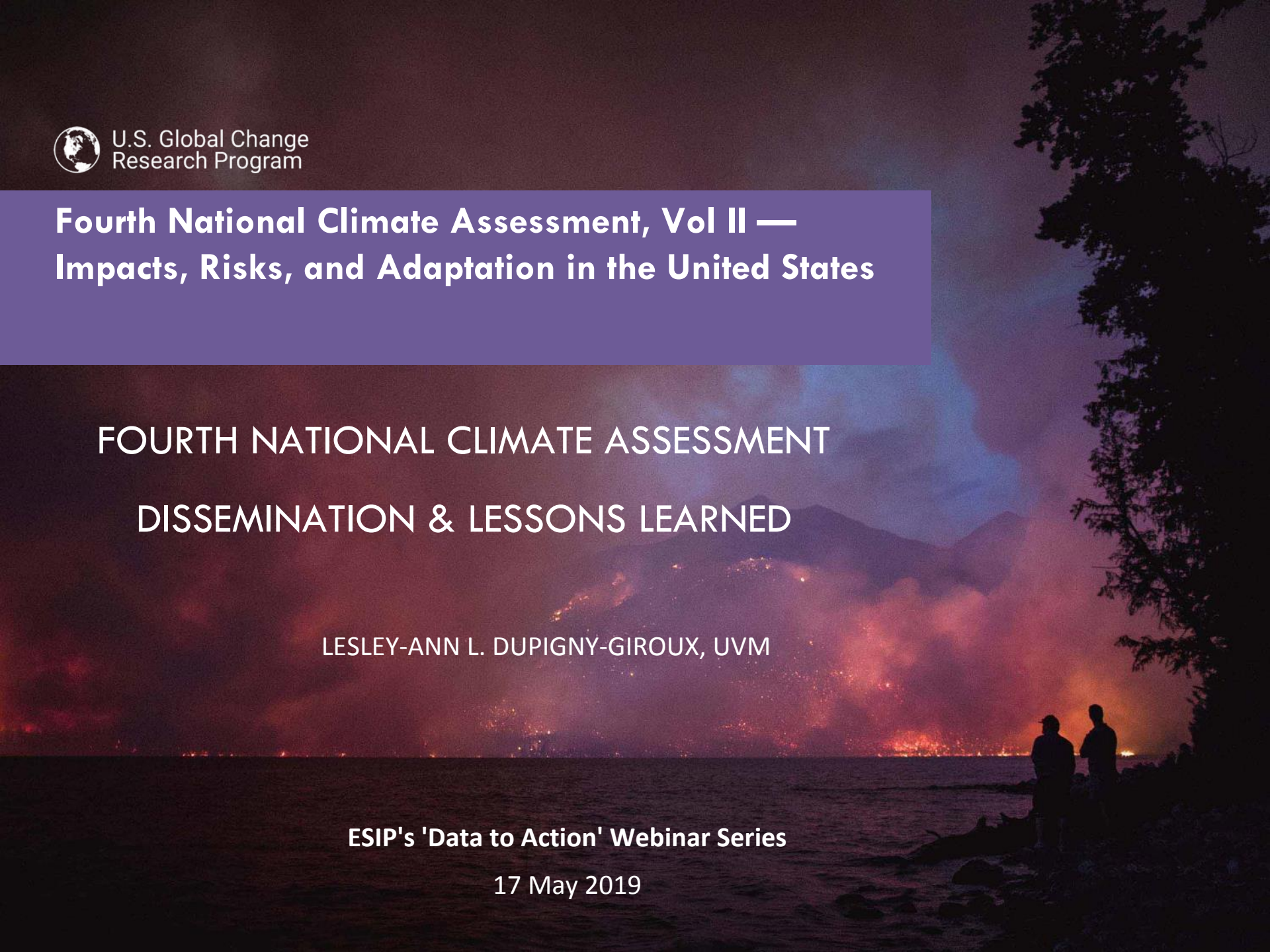
https://science2017.globalchange.gov/

NCA4 Volume II (Impacts, Risks, and Adaptation in the United States) is available at:

https://nca2018.globalchange.gov/

USGCRP Indicators are available at:

https://www.globalchange.gov/browse/indicators/catalog



U.S. Global Change Research Program

Fourth National Climate Assessment, Vol II — Impacts, Risks, and Adaptation in the United States

FOURTH NATIONAL CLIMATE ASSESSMENT

DISSEMINATION & LESSONS LEARNED

LESLEY-ANN L. DUPIGNY-GIROUX, UVM

ESIP's 'Data to Action' Webinar Series

17 May 2019

FIVE ADAPTATION STAGES AND PROGRESS

ADAPTATION ENTAILS A CONTINUING RISK MANAGEMENT PROCESS. WITH THIS APPROACH, INDIVIDUALS AND ORGANIZATIONS BECOME AWARE OF AND ASSESS RISKS AND VULNERABILITIES FROM CLIMATE AND OTHER DRIVERS OF CHANGE, TAKE ACTIONS TO REDUCE THOSE RISKS, AND LEARN OVER TIME. THE GRAY ARCED LINES COMPARE THE CURRENT STATUS OF IMPLEMENTING THIS PROCESS WITH THE STATUS REPORTED BY THE THIRD NATIONAL CLIMATE ASSESSMENT IN 2014; DARKER COLOR INDICATES MORE ACTIVITY.

From Figure 28.1, Ch. 28: Adaptation (Source: adapted from National Research Council, 2010. Used with permission from the National Academies Press, © 2010,National Academy of Sciences. Image credits, clockwise from top: National Weather Service; USGS; Armando Rodriguez, Miami-Dade County; Dr. Neil Berg, MARISA; Bill Ingalls, NASA).

OVERARCHING THEMES

- ECOSYSTEMS AND ECOSYSTEM SERVICES
- SEA LEVEL RISE
- MARINE & COASTAL RESOURCES
- HUMAN HEALTH
- INDIGENOUS PEOPLES
- RURAL COMMUNITIES & THEIR LIVELIHOODS
- ADAPTATION & ADAPTIVE CAPACITY
- AGRICULTURAL PRODUCTIVITY
- INFRASTRUCTURE & TRANSPORTATION

LESSONS LEARNED - **PROCESS**

- ROLE OF NETWORKING
  - CONTENT
  - INPUT TO REWS
  - HI MAYOR EXAMPLE
  - STATE CONNECTIONS
  - REGIONS WITH EXISTING NETWORKS OR TEAMS OF AUTHORS
- STARTS BEFORE NCA IS RELEASED - NEEDS TO BE ACTIVE
- INDIGENOUS PEOPLES

LESSONS LEARNED - **OUTCOMES**

- AUDIENCES - THEIR USE OF THE REPORT & MATERIALS
- POLICY-RELEVANT, NOT POLICY-PRESCRIPTIVE
- "TALK ABOUT FUTURE CLIMATE CHANGE"
- DRILLING DOWN TO THE STATE, COUNTY, CITY LEVEL
- RESPONDING TO RESEARCH/METHODOLOGICAL GAPS IDENTIFIED
- VISUALIZATIONS

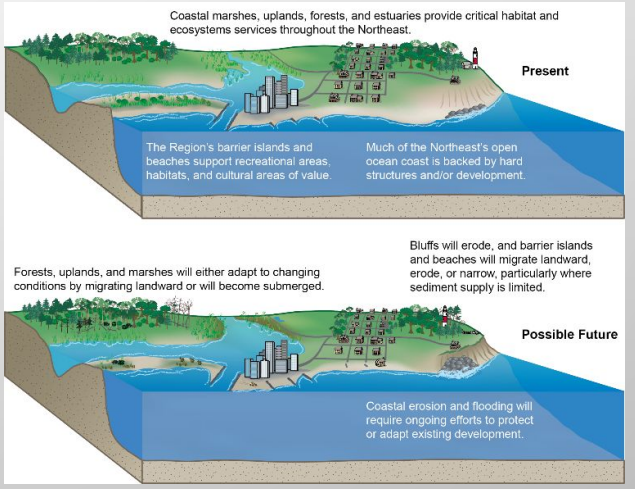


Fig. 18.7

VISUALIZATIONS

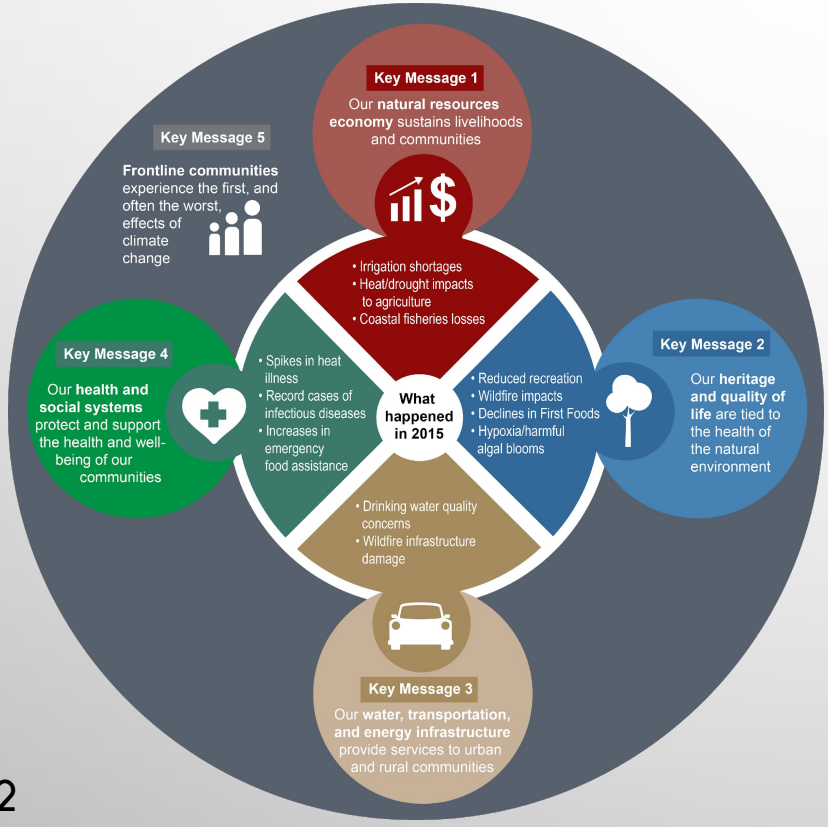


Fig. 24.2

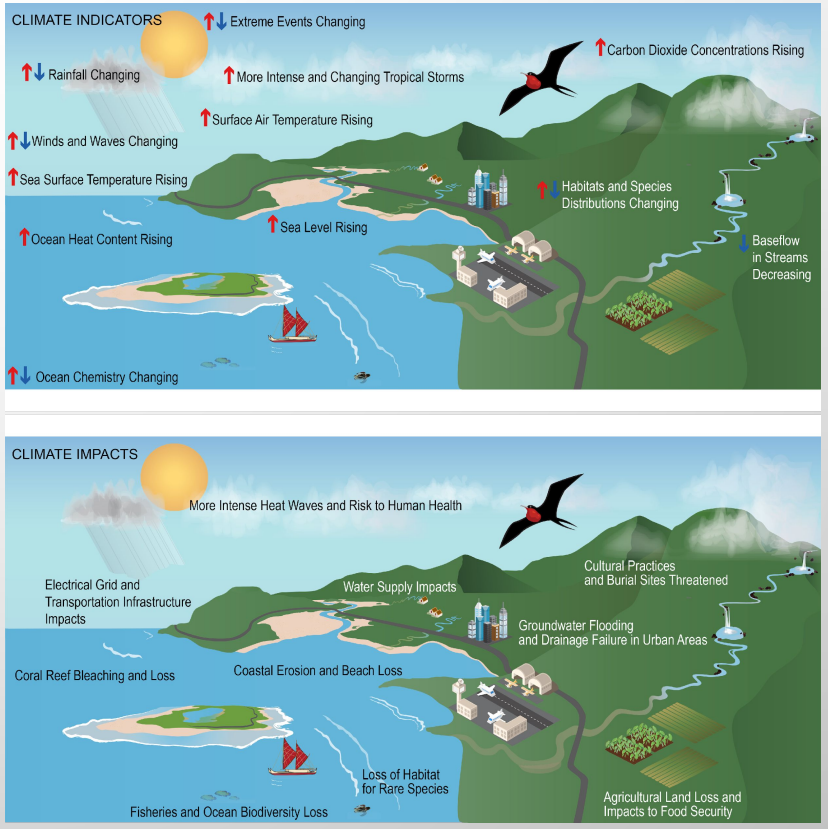
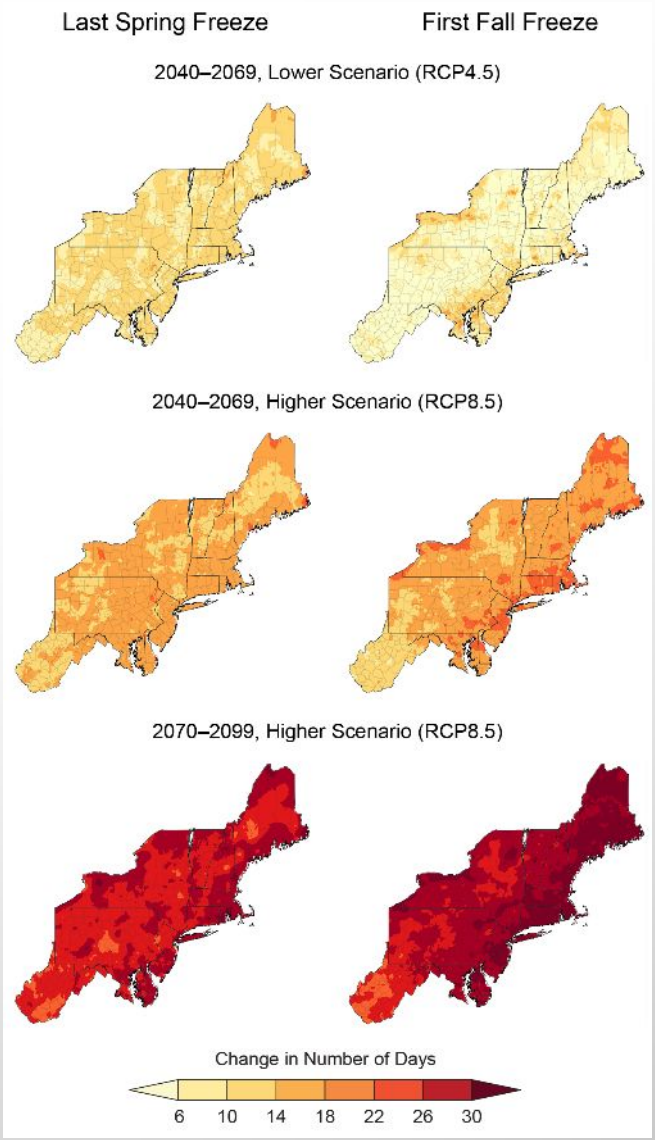


Fig. 27.2

FIG. 18.3: LENGTHENING OF THE FREEZE-FREE PERIOD

THESE MAPS SHOW PROJECTED SHIFTS IN THE DATE OF THE LAST SPRING FREEZE (LEFT COLUMN) AND THE DATE OF THE FIRST FALL FREEZE (RIGHT COLUMN) FOR THE MIDDLE OF THE CENTURY (AS COMPARED TO 1979–2008) UNDER THE LOWER SCENARIO (RCP4.5; TOP ROW) AND THE HIGHER SCENARIO (RCP8.5; MIDDLE ROW). THE BOTTOM ROW SHOWS THE SHIFT IN THESE DATES FOR THE END OF THE CENTURY UNDER THE HIGHER SCENARIO. BY THE MIDDLE OF THE CENTURY, THE FREEZE-FREE PERIOD ACROSS MUCH OF THE NORTHEAST IS EXPECTED TO LENGTHEN BY AS MUCH AS TWO WEEKS UNDER THE LOWER SCENARIO AND BY TWO TO THREE WEEKS UNDER THE HIGHER SCENARIO. BY THE END OF THE CENTURY, THE FREEZE-FREE PERIOD IS EXPECTED TO INCREASE BY AT LEAST THREE WEEKS OVER MOST OF THE REGION. *SOURCE: ADAPTED FROM WOLFE ET AL. 2018.*[35]



INTERACTIONS WITH USERS

- NEW ENGLAND FEDERAL PARTNERS - DROUGHT
- NATIONAL MEETINGS (AASC, AGU, AMS) - SIERRA CLUB
  - ANTHROPOCENE
- INTERNATIONAL JOINT COMMISSION - ADAPTATION
- REGIONAL PLANNING COMMISSION - STATE AGENCIES

- AN ASSESSMENT REPORT VS. A ROADMAP OF POLICIES, STRATEGIES
  - TRACEABLE ACCOUNTS

CROSS-BORDER CONNECTIONS

- CANADA'S CHANGING CLIMATE REPORT (APRIL 2019)
- HEALTH ASSESSMENT, THE NATIONAL ISSUES VOLUME AND THE REGIONAL PERSPECTIVES VOLUME
- QUEBEC REGION CHAPTER OF THE REGIONAL PERSPECTIVES VOLUME (LED BY OURANOS)
- INDIGENOUS RESILIENCE REPORT

Elizabeth Bush, Don Lemmen, Marjorie Shepherd (NRCAN)

Table A4.1: Summary of Assessment Models by Country

Nation(s)	Assessment Model	Number of Assessments to Date
Brazil	Not mandated by law, developed by a scientific panel established by ministerial ordinance, and modeled after IPCC assessment reports. http://www.pbmc.coppe.ufrj.br/en/	1 assessment (2013)
Canada	Not mandated by law, developed by federal government departments and modeled after the NCA4. http://www.nrcan.gc.ca/environment/impacts-adaptation/10029	6 assessments (1998, 2008 [2], 2014, 2016, 2017)

https://nca2018.globalchange.gov/downloads/NCA4_App4_International.pdf

U.S. Global Change Research Program

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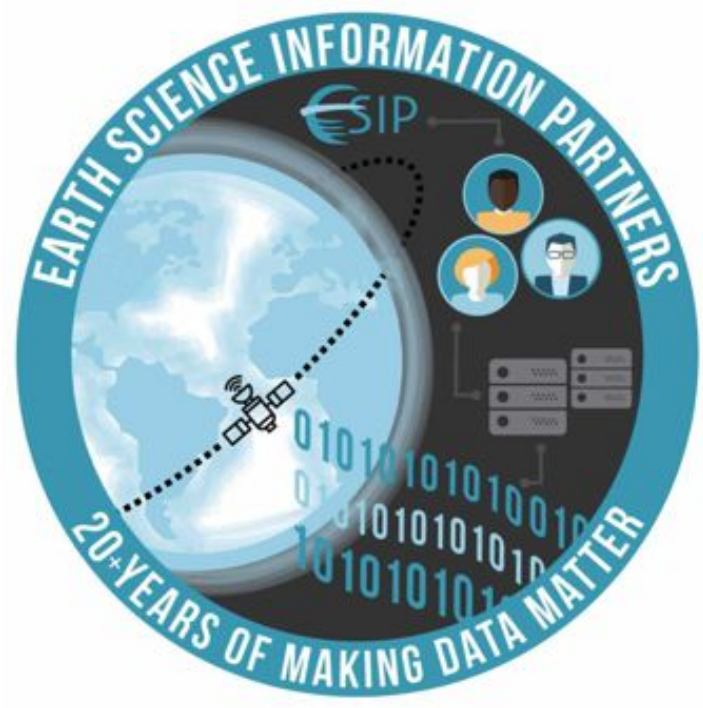
Questions?



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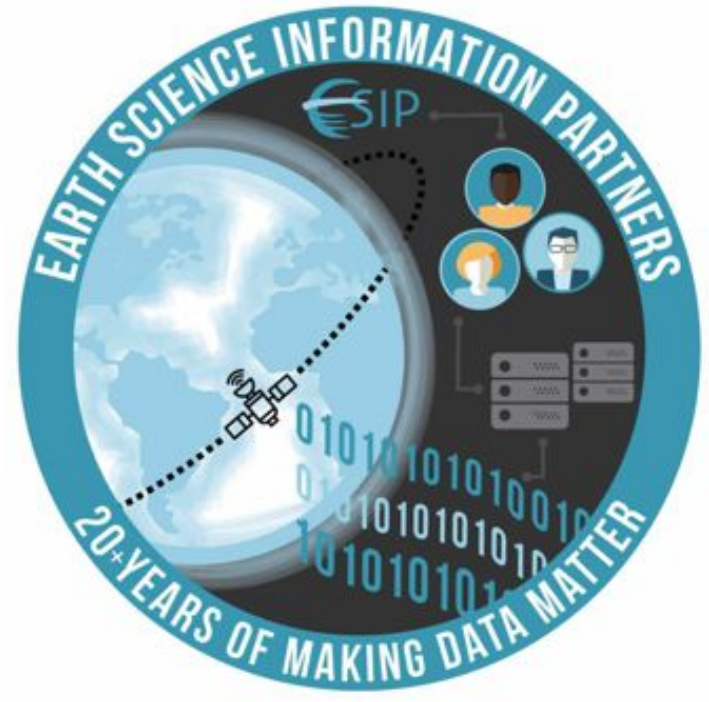

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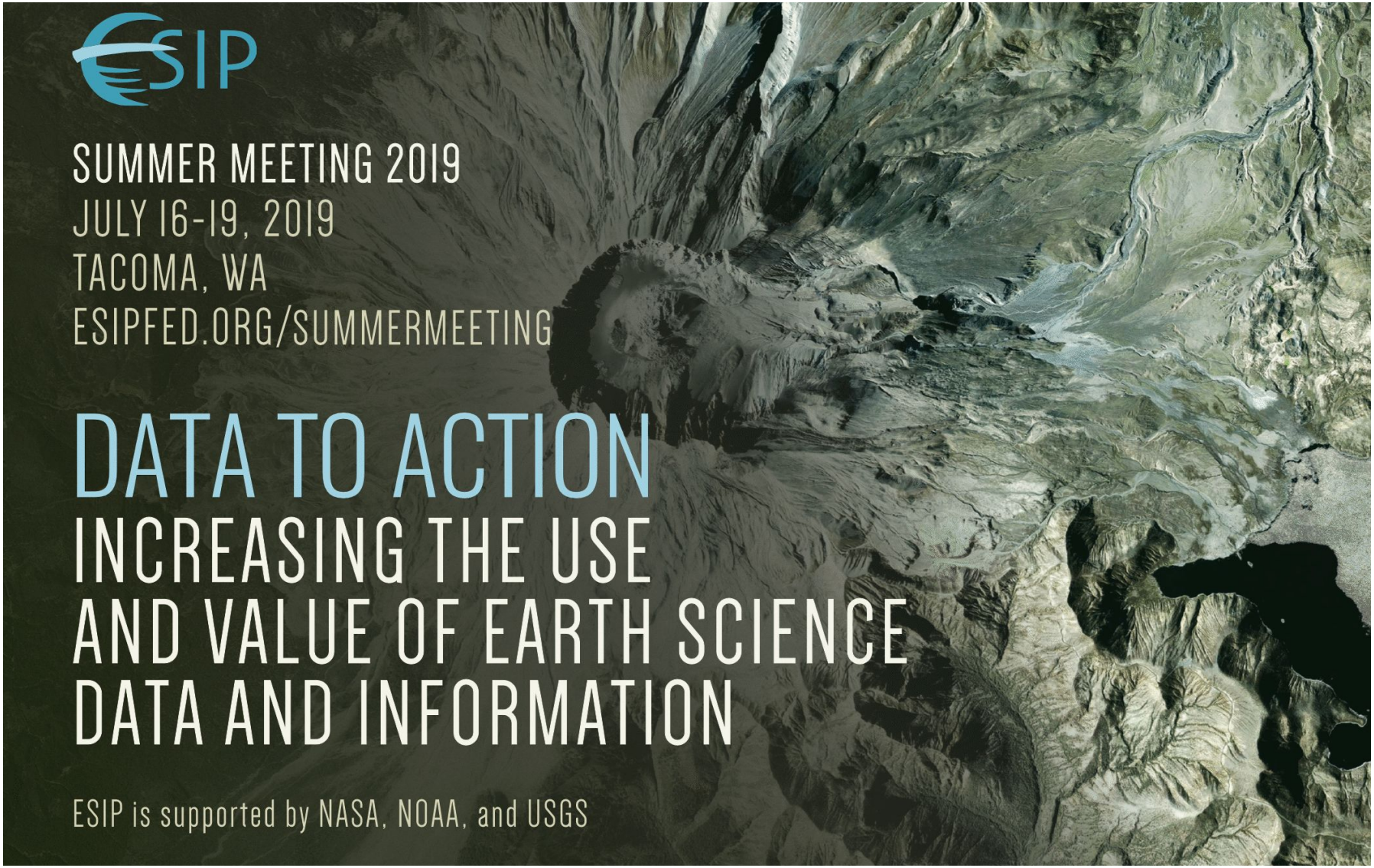
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