

Committee to Advise the USGCRP

Spring 2024 Meeting: Public Briefing Book

Committee to Advise the U.S. Global Change Research Program Spring 2024 Meeting—Open Sessions

LOCATION

National Academy of Sciences, 2101 Constitution Ave NW, Washington DC

PURPOSE

- Leverage the range of perspectives and disciplines of the Advisory Committee to inform USGCRP's:
 - Coordination and development of federal climate services digital tools and platforms for climate decision support.
 - Selection and use of global change and climate scenarios in the 6th National Climate Assessment (NCA6) and other USGCRP products and activities—including perspectives and considerations related to development of national scenarios.
- Enhance coordination, support, and awareness of current global change activities through mutual program and activity updates from USGCRP and the National Academies.

Note: All times Eastern

WEDNESDAY, APRIL 17, 2024

OPEN SESSION 1: Climate Services Tools and Platforms for Decision Making

Moderator: Julie Vano, USGCRP AC vice-chair

10:00–10:30	Climate Services Updates: USGCRP and OSTP	USGCRP
10:30–11:45	Climate Services Tools and Platforms for Decision Making: Framing <ul style="list-style-type: none"> ▪ Julie Vano, Aspen Global Change Institute / Advisory Committee member ▪ Rob Lempert, RAND Corporation ▪ Gabrielle Wong-Parodi, Stanford University / Advisory Committee member ▪ Lesley-Ann Dupigny-Giroux, University of Vermont / Advisory Committee member Moderator: Jerry Melillo, Woods Hole Marine Biological Laboratory / Advisory Committee member	
11:45–12:45	LUNCH	

12:45–2:00 Federal Climate Services Platforms

Panel discussion with case studies of selected federal climate services platforms: USGCRP Climate Mapping for Resilience and Adaptation ([CMRA](#)), FEMA Climate Risk & Resilience Portal ([ClimRR](#)), US Climate Resilience Toolkit: [Climate Explorer](#)

Panelists

- David Herring, NOAA
- Quentin Cummings, DHS/FEMA
- Jeff Lukas, Lukas Climate
- Panel Discussion and Q&A

Moderator: Julie Vano

2:00–2:15 BREAK

2:15–3:00 Climate Services Platforms: Considerations and Coordination

Opportunities, gaps, and challenges for tools to support multiple benefits and objectives, with specific attention to coordination needs and opportunities, and to informing decisions and actions to advance climate adaptation and climate mitigation.

OPEN SESSION 2: Global Change Scenarios for NCA6 / USGCRP products and activities

Moderator: Phil Mote, USGCRP AC vice-chair

3:00–4:00 Scenarios: National Scenarios – International Perspectives and Alternate Approaches

This session will include presentations and discussions on the benefits and challenges of developing and using national scenarios, including international perspectives (UK and Australia) and alternate approaches (Global Warming Levels).

- Suraje Dessai, University of Leeds (*confirmation pending*)
- Marcus Sarofim, US EPA
- Mark Howden, Australian National University

4:00–5:00 Scenarios: Breakout Group Discussions

This session will include multiple breakout groups to discuss scenario-related considerations and decisions for USGCRP products and activities, including the 6th National Climate Assessment.

END OF DAY 1

THURSDAY, APRIL 18, 2024

9:00–10:30 Program Updates

- USGCRP Program Updates
- NASEM Updates

10:30–12:00 Scenarios: Breakout Group Discussions (continued)

This plenary session will include reports from the previous day's scenarios breakout group discussions, followed by continued group discussion in plenary.

12:00–1:00 LUNCH

OPEN SESSION 3: Intersections and Closing

1:00–2:20 Intersections: Climate Services Tools/Platforms and Global Change Scenarios

Observations and discussions of overlaps and synergies between the Spring 2024 meeting topical discussions—climate services and scenarios.

2:20–2:30 Closing Observations and Remarks

- USGCRP
- Jerry Melillo, Chair, USGCRP Advisory Committee. *This meeting is Jerry's final meeting as member and chair of the USGCRP Advisory Committee.*

ADJOURN OPEN SESSIONS

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National Academies Volunteer Resources

- [Volunteer | National Academies](#)
- [Conflict of Interest Policies and Procedures | National Academies](#)

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Updated December 2, 2021

Advisory Committee Statement of Task

The Committee to Advise the U.S. Global Change Research Program (USGCRP or Program) provides ongoing and focused advice to the USGCRP by convening key thought leaders and decision makers at semiannual meetings, providing strategic advice, reviewing draft plans for the Program, and serving as a portal to relevant activities from across the National Academies. The Committee is broadly constituted to bring expertise in all the areas addressed by the USGCRP. The Committee will, over time, organize ongoing discussions, take on specific tasks, and possibly issue reports on a variety of issues of importance to the USGCRP and its major program elements.

In its role as a single entry point of contact to the National Academies, source of strategic input, and convener of strategic discussions with appropriate experts, the Committee to Advise the US Global Change Research Program will:

1. Provide ongoing, integrated advice to the USGCRP on broad, program-wide issues and documents when requested, including reviewing draft strategic plans and updates thereof.
2. Provide a forum for informal interaction between the USGCRP and the relevant scientific communities and other interested parties.
3. Provide a forum for exchange of experience and insights for integrating across science communities and disciplines, and improving linkages between officials of the Program and the science communities.
4. Improve the internal coordination across existing and future entities of the Academies related to global change (including coordination across NAS, NAE, and NAM).
5. Help identify issues of importance for the global change research community. This implies a proactive role that goes beyond simply responding to requests from the USGCRP.
6. Interact with and provide advice to USGCRP relevant to its international activities, such as shaping the future of relevant international global environmental change programs.
7. In addition to producing Academies' reports as tasked, the committee may help develop other work requests and promote collaboration on such efforts with appropriate units within the Academies.

Open Session Agenda and Virtual Connection Details (next page)

Climate Resilience Information System

Source: USGCRP

Federal agencies and non-federal entities are responding to requests for tailored, actionable information about the impacts of climate change on potential decisions and actions. Federally supported research produces projections of future climate conditions (e.g., temperature, precipitation), as well as many risks (e.g., flooding, wildfire) that are influenced by climate conditions. This information is needed by a spectrum of users, each with different needs for planning and decision-making.

Planned for initial implementation in Fiscal Year 2024, the **Climate Resilience Information System** (CRIS) will facilitate access to federal decision-relevant information, enabling users to easily find and customize information for their needs.

For example, fruit growers want to know the timing and duration of frost days at critical times of the year, public health officials need projections for days exceeding critical temperature limits, and coastal planners want information on extreme events and flood risk. CRIS will support the development of tools and services for each of these constituencies from a single, authoritative source of information—integrating both past and future as well as climate and non-climate data.

CRIS will use an open, accessible, and interoperable architecture that is intended to support designers of decision-support tools and services. Pathfinding precursor projects include [Climate Mapping for Resilience and Adaptation \(CMRA\)](#) and the [NCA Interactive Atlas](#). Thus, the vision for CRIS is a foundational resource that supports multiple climate services and resilience priorities, including those outlined in the [NSTC Federal Framework and Action Plan for Climate Services](#) and [National Climate Resilience Framework](#).

Components

Ultimately, CRIS will contain six components:

1. A collection of federal decision-relevant data
2. Tools and utilities for browsing, mapping, graphing, interpreting, and analyzing
3. An open-source repository of the software underpinning all tools and utilities
4. An open tool-developers forum to foster synergies and community-building
5. Ready-to-use web templates that are compatible with CRIS and facilitate easy integration of federal agencies' maps and data with local, state, and Tribal maps and data
6. Free training and online tutorials about CRIS resources

The system will use a no-wrong-door design philosophy, enabling users to access the same underlying climate data from multiple federal storefronts or web applications.

Climate Resilience Information System

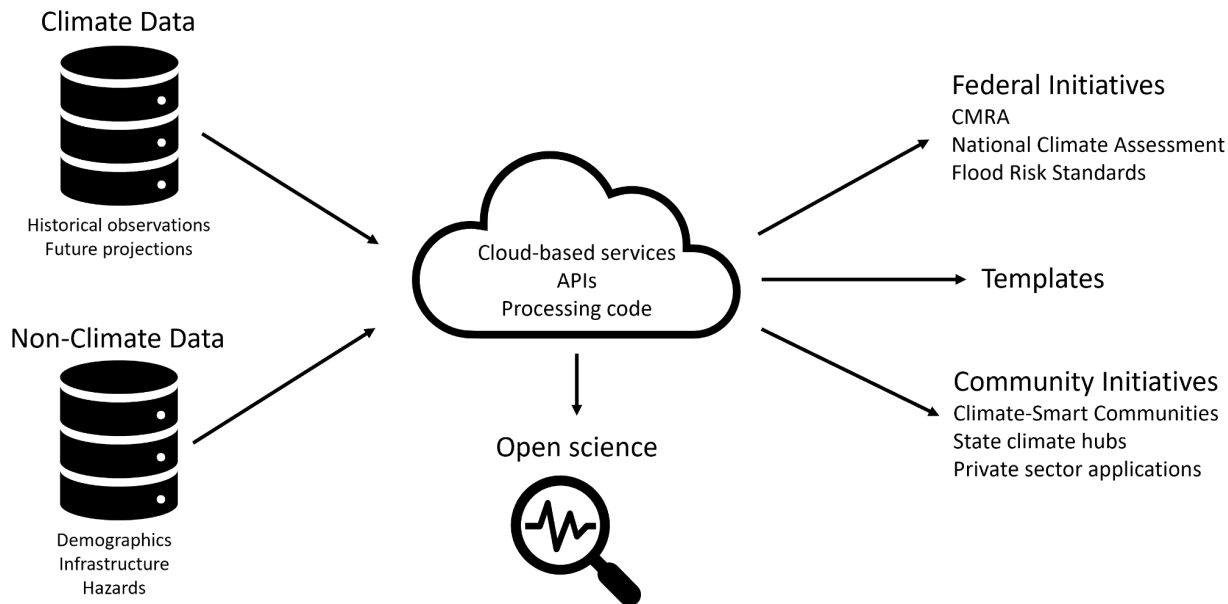


Figure 1: CRIS improves access to both climate and non-climate data via cloud services that support and adhere to open science standards. Multiple federal initiatives, such as CMRA, can access this authoritative source, which also supports community initiatives that seek to build resilience. Credit: Esri

Audience: CRIS broadly defines its audience as designers of services who then create websites (themed data portals or ‘storefronts’) for consumers of climate services or initiatives that supply climate services (Figure 1). As new information flows into CRIS and new applications become available, the updates will propagate to the storefronts that build on the common architecture.

Data sources: Decision-relevant data includes both climate and non-climate data that support assessments of exposure, vulnerability, and risk among valued assets, populations, and built and natural environments. The aim is to inclusively and equitably support communities and businesses building resilience to weather and climate hazards all across the nation. Over time, CRIS’ scope will expand to offer international and global data as well.

Architecture: The CRIS architecture will consist of three tiers: a data tier, a service tier, and a storefront tier (Figure 2).

- The **data tier** envisions both cloud data repositories such as the [NGDA](#) (National Geospatial Data Asset) Portfolio or commercial services (Amazon Web Services - AWS), as well as federal resources such as NOAA’s [NCEI](#) or [NASA DAACs](#).
- The **service tier** is designed to ensure open-source compliance with international OGC (Open Geospatial Consortium) standards but also to support commercial services (e.g. Esri’s ArcGIS) and provide analytical capabilities and links to other APIs.
- The **storefront** tier ensures open science standards for metadata and code are met, along with workflows, map services, and importantly, guides for the use of the data based on assessment of different downscaled dataset options. This tier would feed into both federal storefront portals, such as Climate Mapping for Resilience and Adaptation ([CMRA](#)), hazard-focused portals that tailor information for specific audiences (e.g., [Heat.gov](#)), and locally focused portals that integrate federal data with local, state, and Tribal data for knowledge-building and constituent engagement.

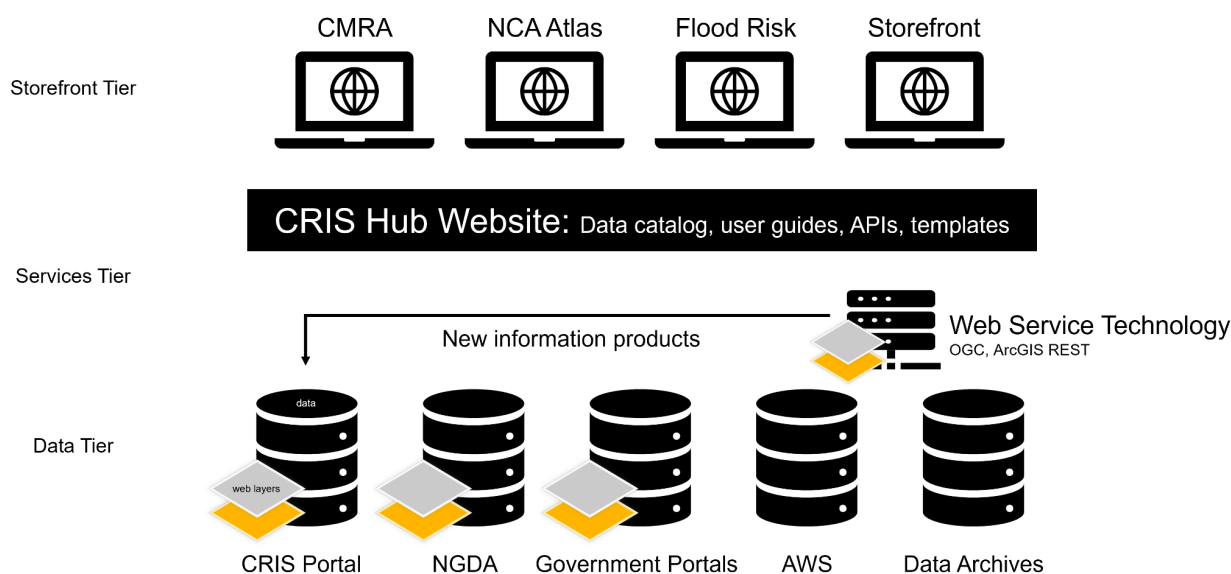


Figure 2: Another view of CRIS illustrates the CRIS Hub website, which will contain a data tier catalog, user guides for different levels of expertise, and tools such as templates or analytical services for designers of services (see Figure 1). Credit: Esri

Leadership and Development

CRIS is guided by an interagency leadership team hosted by USGCRP, with representatives from NOAA, DOI/USGS, NASA, NSF, USDA, FEMA, DOE, and OSTP.

The contract to develop CRIS is managed by NOAA's Geospatial Information Officer and the Climate Program Office and executed by Esri. Additional guidance and support is provided by the [Federal Geospatial Data Committee](#) and the [Open Geospatial Consortium](#).

Contact

For more information, contact flipschultz@usgcrp.gov or raniekwu@usgcrp.gov.

USGCRP Advisory Committee Spring 2024 Meeting: Climate Services discussion resources—USGCRP Reports and Resources

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USGCRP Decadal Strategic Plan: 2022-2031

[The U.S. Global Change Research Program 2022–2031 Strategic Plan | GlobalChange.gov](#)

Tools-related references and commitments

Executive Summary

USGCRP’s 2022-2031 Strategic Plan lays the foundation for meeting a new set of challenges and demands for useful, accessible, and inclusive data and information alongside advancements in understanding of a rapidly changing environment. As the Nation responds to these challenges, USGCRP seeks to provide the information and tools needed to inform actions to manage risks and strengthen resilience. This Plan sets a course to expand the impact of Federal global change science and better deliver this urgently needed information to the Nation and the world. [p 3]

Pillar 1: Advancing Science

[Biodiversity] “development and provision of tools and synthesis products that inform actions to conserve biodiversity and employ nature-based solutions to address multiple threats” [p 13]

[Organizations / Federal Agencies and Departments] “To increase Federal capacity for managing sectoral portfolios, USGCRP agencies will conduct scientific workforce development to better connect Federal leaders and employees with appropriate global change information and tools. A focal point of this effort will be training Federal employees on the available information and tools that are appropriate to agency sectors and stakeholders, including for application on Federal lands. [p 13]

[Organizations / Federal Regional Science Organizations] “... USGCRP will prioritize standardized, centralized, and built-to-purpose climate information, tools, and services as determined through its collaboration with the RSOs.” [p 13]

Pillar 3: Informing Decisions

[Data and tools] “**Enhance usability of and public capacity to use Federal data, information, and analysis tools for decision-making.** USGCRP will help coordinate agency activities to sustain and improve existing online tools and develop new tools that allow decision-makers to engage with and find, tailor, and use relevant Federal data, software, and information, consistent with the FAIRER (Findable, Accessible, Interoperable, Reusable, Equitable,

and Responsible) Principles, as a means of informing decisions and improving science literacy. USGCRP is undertaking a new initiative in 2022 that aims to make USGCRP and other relevant Federal data, tools, and information more findable, usable, and customizable, in combination with non-Federal and localized data, so that users can package and generate information at low cost for their specific decision contexts.” [p 26]

“USGCRP will also work with its member agencies to train and increase the capacity of a range of users to engage in the use of USGCRP-produced models and information. In turn, USGCRP will use experiences with these practitioners to inform future USGCRP research, as well as how USGCRP information can be tailored and communicated to a range of different decision-makers.” [p 26]

Pillar 4: Collaborating Internationally

[Capacity Strengthening] “Support more equitable access to the tools of climate science and assessment—namely datasets, models, and adequate computing—in lesser/least developed countries.” [p 31]

Conclusions

... “In 10 years, USGCRP envisions a more robust and inclusive understanding of the changing Earth system and how it affects, and is affected by, people and human systems. Making the information and tools associated with this greater understanding more accessible to a broad suite of knowledge users will move us toward the goal of a more informed Nation better equipped to respond to and manage the critical risks of global change. The strategy described in this Plan provides broad guidance and flexibility to meet those demands and sets the foundation for the Nation’s global change research for the coming decade.” [p 35]

A Federal Framework and Action Plan for Climate Services

In March 2023, the NSTC Fast Track Action Committee on Climate Services released the report [*A Federal Framework and Action Plan for Climate Services*](#). This report included a key recommendation for USGCRP’s role in coordinating federal activities related to climate services and included recommendations and guidance on the development, dissemination, and use of climate-related tools.

Recommendation: USGCRP federal coordination role for climate services

“... the FTAC’s overarching recommendation is for the U.S. Global Change Research Program (USGCRP) to expand its research coordination role to provide national leadership in coordination and strategic planning of climate services. This recommendation is grounded in knowledge of 1) the USGCRP’s considerable experience in effectively coordinating global change research and assessment; 2) its mandate under the Global Change Research Act of 1990 to inform decisions; 3) its track record of producing useful climate services; and 4) USGCRP’s 2022-2031 Strategic Plan which includes an ambitious agenda to advance usable science and engage the public.⁶ Extending the USGCRP’s activities from the current focus on coordination of research to also include coordination of services will necessitate structural changes to USGCRP.” [p 2]

FTAC Report: Tools-related recommendations and descriptions

Selected Recommendations

- Recommendation 1.1: Launch a Climate Services Summit that brings together federal and non-federal producers and users of climate data and tools.
- Recommendation 1.3: Develop guidance for federal agencies on the effective use of co-production methods for the design and dissemination of climate services. [“This action would develop guidance on the use of co-production tools and methods that reflects the diversity of missions and expertise among federal agencies.”]

- Recommendation 2.5: Develop a federal data policy governing the design and development of climate services. [Including: “Federal processes for ensuring the discoverability of data, products, and tools including operationalization of a “no wrong door” approach across the Federal Government.”]
- Recommendation 3.2: Develop and maintain an inventory of climate service data, products, and tools.
- Recommendation 4.2: Launch a specific training program or capability that builds capacity among federal personnel to discover and use available climate services.

Tools-related excerpts

2.2 The Climate Services Knowledge Value Chain

“The development phase of climate service provision involves the synthesis and translation of information to distill key findings or enhance the accessibility of the information for different audiences. It also includes the design process of climate services, which necessitates appreciation of the needs of intended users and the extent to which knowledge co-production can add value in meeting those needs. Moreover, development of climate services involves processes for building user interfaces, data dashboards, and various types of products and tools.” ... “The delivery link is associated with processes for the dissemination and sharing of knowledge. A broad range of communication challenges are inherent in such delivery. For example, products and tools for mapping and visualizing climate information are increasingly common. But delivery often involves more than making data available.” [p 7]

2.3.3 Expanding the Scope of Climate Services

“Based on the vision and principles outlined above and the feedback from external stakeholders from the listening sessions, the FTAC identified several aspects regarding the scope of federal climate services that merit clarification in the development of a common federal understanding. These include the following: ...”

- “Sixth, maximizing the value of climate services may necessitate users having access to a broad range of non-climatic information, data, and tools. Understanding the risks of sea-level rise, for example, may require information on coastal elevation and the location of infrastructure assets and their vulnerability and economic value. Particularly at the local level, the Federal Government may be limited in the comprehensiveness and quality of its non-climatic information. Therefore, the co-production of services with local partners who can bring such data to the table may be necessary. Additionally, designing services so that users can integrate their own information with that of the Federal Government may be an effective strategy.” [pp 12-13]

3.1.3 Technology

“... Moreover, increasing interoperability among data and software platforms creates opportunities for leveraging common architectures that can be applied in the creation of diverse tools that cater to different users. This includes capabilities that allow users to access, visualize, and analyze federal information alongside of their own data via application programming interfaces (APIs) and geospatial data hubs. The federal GeoPlatform, for example, which was featured in the Section 211d *Geospatial* report provides applications and tools for accessing, integrating, synthesizing, analyzing, and visualizing geospatial data. Such shared resources can enhance interoperability and internal consistency among federal datasets and analytic tools, while reducing the costs of developing and delivering new services.” [p 17]

3.2.2 Alignment to User Needs

“The Federal Government has generated a number of climate change datasets, products, and tools that have become indispensable to the management of climate change risk. Examples include the U.S. Climate Resilience Toolkit, the National Climate Assessment, the Sea Level Rise Portal, as well as a range of products that have been developed by SLTT governments, non-profit organizations, and the private sector. Nevertheless, a number

of factors often limit the ability of such data and tools to complete the “last mile” of decision-support. These include spatial or temporal scales that are limited by scientific factors and less useful to users, the need for derived variables not directly generated by climate models, or lack of capacity of users to understand and use information effectively. In particular, significant user knowledge is needed regarding the contemporary modeling paradigm that generates climate projections – from modeling centers, to scenarios, to downscaling – in order to effectively access and appropriately use many of the climate data and products available.”

“Insufficient attention has been given to the experiences of users in engaging with the wealth of data and tools that currently exist and their struggles in finding the right information for their needs.” ... [p 20]

3.2.4 Funding for Climate Services

“Users of Federal Climate Services have had multiple opportunities in recent years to identify gaps in climate services that undermine their ability to respond to climate change. For example, a 2016 report from NASA, NOAA, and OSTP on users of climate data reported that users perceived federal data to be inconsistently maintained, hard to use, and scattered and difficult to find. Furthermore, federal data and tools often lack the necessary science translation and connection to local context that users often need. Listening sessions conducted by the FTAC with non-federal participants echoed these challenges and also raised the importance of helping users with accessing federal funding to respond to climate change. Moreover, services that build capacity among users to understand the local implications of climate change and plan responses may be more beneficial than those that simply provide data and information about climate.” [pp 21-22]

4.2.2.1 Principles for Federal Coordination

“Effective coordination of climate services will be aided by the adoption of shared principles for how federal agencies work with one another to develop, deliver, and use climate services. These include the following:

- Recognizing the development, delivery, and use of climate services is a shared, whole-of government responsibility
- Aligning climate service investments to the existing authorities, expertise, technical capabilities, and stakeholder relationships within each agency (Box 4.1)
- Prioritizing the user experience in terms of discoverability, design, and usability of data, products, and tools
- Maintaining internal consistency across the Federal Government with respect to climate data, products, and tools, while maintaining flexibility to meet the diverse needs of agencies and their stakeholders” [p 28]

Box 4.2. Climate Services in the USGCRP Decadal Strategic Plan

“The most recent USGCRP Decadal Strategic Plan, published in 2022, outlines the program’s priorities in the years ahead. Those priorities are largely oriented toward the fundamental global change and Earth system sciences that address key uncertainties and shape our understanding of global and climate change processes. Nevertheless, the plan represents an unprecedented recognition that a diverse community is dependent on such scientific advances for policy development, planning, financial investment, and risk management. Accordingly, engaging with that community and translating science into useable and useful information and products tailored to different user contexts is consistent with USGCRP’s Congressional mandate and represent a mechanism for maximizing the return on investment in science.” [p 35]

Recommendation 3: Develop Common Infrastructure and Processes for the Development and Delivery of Climate Services Across the Federal Government

Recommendation 3.1: Identify and/or develop common platforms and system architectures for supporting the development and delivery of existing and new climate services. “This action would expand existing, or develop

new, common platforms that can be routinely used to support the hosting, design, and development of climate products and tools. For example, the GeoPlatform has been recommended as a common infrastructure that could be exploited by multiple federal agencies for the hosting, publishing, and discovery of geospatial data assets and tools. Data.gov/Climate provides metadata and access for a much broader array of climate-related data developed and maintained by the Federal Government. More importantly for users, however, is the development of flexible platforms for the construction of built-for-purpose portals and applications that integrate access to multiple, disparate federal (and potentially non-federal) data with tools for data synthesis, analysis, and interpretation. Platforms are also needed that provide gateways to the rich landscape of data, products, and tools that exist. Climate.gov, for example, is one existing gateway that provides an entry point to various federal resources including those within the U.S. Climate Resilience Toolkit. Continuing to leverage such existing assets across agencies to enhance discovery of, and access to, climate services will benefit federal and non-federal users. Platform-development efforts would be led by agencies with relevant expertise and infrastructure, and coordinated by the USGCRP in partnership with the Federal Geographic Data Committee (FGDC).” [p 43]

Recommendation 3.2: Develop and maintain an inventory of climate service data, products, and tools. This action could generate a whole-of-government approach to the identification and reporting of federally-recognized climate services spanning those associated with climate resilience, climate adaptation, and greenhouse gas mitigation. “It could leverage existing efforts to develop inventories in support of various agency and White House initiatives and be constructed around a common typology of services that is consistently applied across agencies and regularly updated to support real-time situational awareness of available services. Each federal agency would be responsible for identifying its own climate services and reporting on sponsored services in response to a standard template or data call. USGCRP and the USGCRP NCO could be responsible for routine collection and consolidation of information across agencies and maintaining a comprehensive inventory.” [p 43]

Recommendation 4.2: Launch a specific training program or capability that builds capacity among federal personnel to discover and use available climate services. If the evaluation in Recommendation 4.1 identifies gaps in training and professional development, this action would build capacity in the effective use of climate services to enable federal users to more effectively support their own climate inquiries and analyses. This includes specific training in use cases that integrate an array of relevant climate data, products, and tools applied to different sectoral and geographic contexts. It also includes training in fundamental building blocks that support climate services such as mapping techniques, scenario analysis, and the assessment of vulnerability and risk. Training for specific services would be provided by the agency sponsoring that service, although opportunities may exist for interagency coordination in the provision of cross-cutting general trainings needed to support the effective use of a given service in support of a federal policy initiative, such as the development of federal adaptation plans.” [p 44]

Global Change Scenarios Topical Discussion

Scenarios Selection and Use for NCA6 and Other USGCRP Products and Activities

All of the following literature has been pulled from the [Fourth National Climate Assessment](#) and the [Fifth National Climate Assessment](#).

Chapter 4 section 4.2 Future Scenarios of the Fourth National Climate Assessment has an in-depth discussion of emission scenarios, RCPs, and SSPs in section 4.2.1 and a discussion on alternative scenarios in section 4.2.2. Link to [Section 4.2: Future Scenarios](#)

Appendix 3 of the Fifth National Climate Assessment discusses the scenarios used in the report as well as a discussion of some of the limitations that the authors faced with using CMIP6 data. Link to the full [Appendix 3: Scenarios and Datasets](#)

NCA5 Front Matter: [Table 3. Descriptive Terms for Common Climate Scenarios Used in NCA5](#)

NCA5 Chapter 3: [Figure 3.4 SSP-Based Scenarios and Their Use in Climate Model Projections](#) (PDF on following page)

Selection Process for Downscaled Climate Projection Data in the Fifth National Climate Assessment

This document describes the general process that informed the selection and use of downscaled data in the Fifth National Climate Assessment (NCA5). Downscaled climate data provide more localized and higher resolution climate information than global models to support assessments of impacts for decision-making. In 2020, USGCRP convened a group of federal climate experts (NASA, NOAA, USGS, DOD, DOE) to identify and recommend to NCA5 leadership appropriate downscaled products for use in NCA5 that derived from the latest international global modeling experiments. As part of the NCA5 development process, this set of downscaled climate data products were made available to authors to inform their chapter analyses and were publically available after release of the report.

Background

The Global Change Research Act of 1990 requires that the USGCRP produce and submit a quadrennial assessment (i.e., the National Climate Assessment) to the President and to Congress that broadly interprets the state of climate science, analyzes the effects of global change on the Nation's resources, and analyzes projected trends in global change. The development of a National Climate Assessment is a multi-year process involving participation of all 14 of USGCRP's member agencies along with multiple opportunities for stakeholder and public engagement.

In developing NCA5, USGCRP encouraged the integration of model projections from the Coupled Model Intercomparison Project Phase 6 (CMIP6). The CMIP6 model data started becoming publicly available in 2019 to support the Sixth Assessment Report from the Intergovernmental Panel on Climate Change (IPCC AR6; working group reports were published in 2021 and 2022) and reflected scientific advances and knowledge gained over the last decade. The full release of CMIP6 global data was delayed, which hindered the production of proposed downscaled datasets. Despite the delays in CMIP6 global data and downscaled products, the NCA5 development timeline remained unchanged, which limited the availability, selection, and evaluation of downscaled products to support the analysis in NCA5.

NCA5 development also aligned with laws and policies that impact federal data provision, including:

- The [Information Quality Act](#), which includes data standards related to utility, transparency, objectivity, integrity, and reasonable reproducibility.
- The [Foundations for Evidence-Based Policymaking Act \(Evidence Act\)](#), which expands on prior Open Government policy initiatives and public access to agency data assets.

Required and Recommended Attributes for NCA5-relevant Downscaled Datasets

The expert group developed a set of ideal attributes to apply to downscaled datasets for use in NCA5. These attributes were created in part to fulfill federal requirements as well as to support more advanced climate impact analysis for the United States. However, the group recognized that the substantial overlap in the timelines of NCA5 and the production of CMIP6 data carried some risk that the availability and processing of downscaled datasets would not fully satisfy these ideal attributes.

Required Attributes for downscaled climate data in NCA5:

- Publicly-available algorithms and source code for the downscaling models
- Methodology and technical documentation, including the final datasets, are available in peer-reviewed scientific publications

- Downscaled datasets are derived from CMIP6 global projections
- Downscaled datasets were available to the NCA5 author teams during the NCA5 writing window
- The dataset producers granted permission to the NCA5 Technical Support Unit from NOAA (TSU) to analyze the downscaled data prior to publication
- Derived data from the downscaled models used in NCA5 are available without restrictions on a free and public platform by NCA5 publication

Recommended Attributes for NCA5 downscaled data:

- All four “Tier 1” CMIP6 scenarios are downscaled to sub-global grid spacing
- The size of the downscaled model ensemble is sufficiently large to capture differences in output that stem from differences in how each global model was constructed
- Downscaled variables are relevant to climate impacts at multiple spatial/temporal scales
- The spatial and temporal resolutions of the data are appropriate to create derived variables relevant to climate impacts (e.g., days with temperature > 95°F, days with precipitation > 1 inch)
- Data coverage for nationally affiliated geographies outside of the contiguous U.S.

The expert group recommended two statistically-downscaled datasets for use in NCA5:

1. Localized Constructed Analogs Version 2 ([LOCA2](#))
2. Seasonal Trends and Analysis of Residuals, Empirical-Statistical Downscaling Model ([STAR-ESDM](#))

Downscaled data are not readily available for U.S. regions outside of the contiguous United States. Where applicable for Alaska, Hawai’i, the U.S.-Affiliated Pacific Islands, and the U.S. Caribbean, the expert group recommended use of the STAR-ESDM downscaled weather station data (separate from the gridded dataset). Dynamically-downscaled [North American CORDEX data](#), based on CMIP5, was also suggested for select precipitation variables where available.

Lessons Learned

There was a substantial overlap in the timelines of NCA5 and the production of CMIP6 data and derivative downscaled products. The concurrent development of the CMIP6-based downscaled datasets and NCA5 therefore created notable challenges for satisfying all of the ideal attributes for the downscaled climate data, such as for data availability, ensemble size, and scenarios. Notably, no CMIP6 downscaled products were available to the NCA5 author teams for all U.S. regions outside of the contiguous United States, which reflects persistent gaps in data coverage. This data gap leaves portions of the U.S. population without access to downscaled information for decision-making. It was a major challenge and limitation to ensure that downscaled datasets align with the requisite attributes, timelines, and spatial coverage that were appropriate for NCA5. This challenge carried over to the calculation of derived variables and model-weighting strategies.

Ideally, the selection criteria should also include metrics that promote confidence in data quality, including the strengths and limitations of the two selected datasets using metrics for average climate conditions, climate extremes, temporal and spatial patterns (e.g., trends and gradients) for both datasets, as well as a comparison of the different historical products used for the downscaling.

Global Warming Levels Resources in NCA5

All the following literature has been taken for the [Fifth National Climate Assessment](#)

[Box 1. Global Warming Levels Measure How Much the Planets Have Warmed](#)

[Box 1.4. Global Warming Levels](#)

Global Warming Levels Information: OSTP 2023 Resource

"Another potential approach that uses a different viewpoint from the timelines inherent in RCPs and SSP-based approaches is to use global warming levels (GWLs). Rather than looking at when a certain temperature or amount of rainfall occurs in the future, one can consider which GWL would trigger a decision (e.g., 2°C). This approach may remove some of the complexity of navigating the RCP or SSP-RCP scenario framework by exploring the impact of a few key thresholds (i.e., 2°C, 3°C, or 4°C). This approach is becoming more common, such as in IPCC reports, and is comparable to how one explores the impact of sea level rise by focusing on a specific level of rise (e.g., 0.6 m or 2 ft) rather than focusing on a specific time period and RCP scenario (e.g., RCP6 in 2050). Ultimately, of course, the GWL approach relies on the same underpinning global climate model scenarios, so the time period when a certain GWL might be reached can still be considered." [pp 12-13 in [*Selecting Climate Information to Use in Climate Risk and Impact Assessments: Guide for Federal Agency Climate Adaptation Planners*](#)]