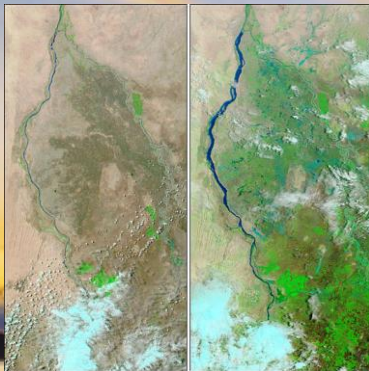
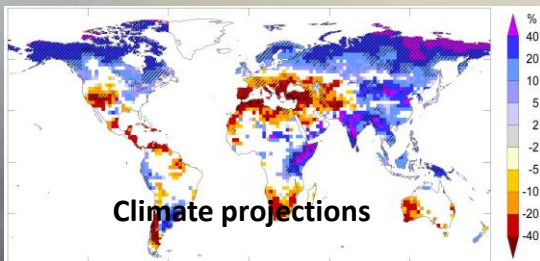
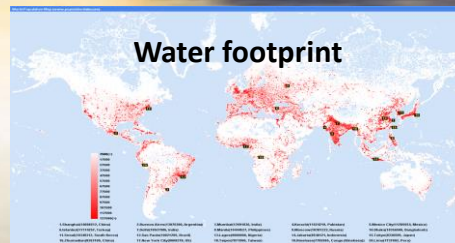


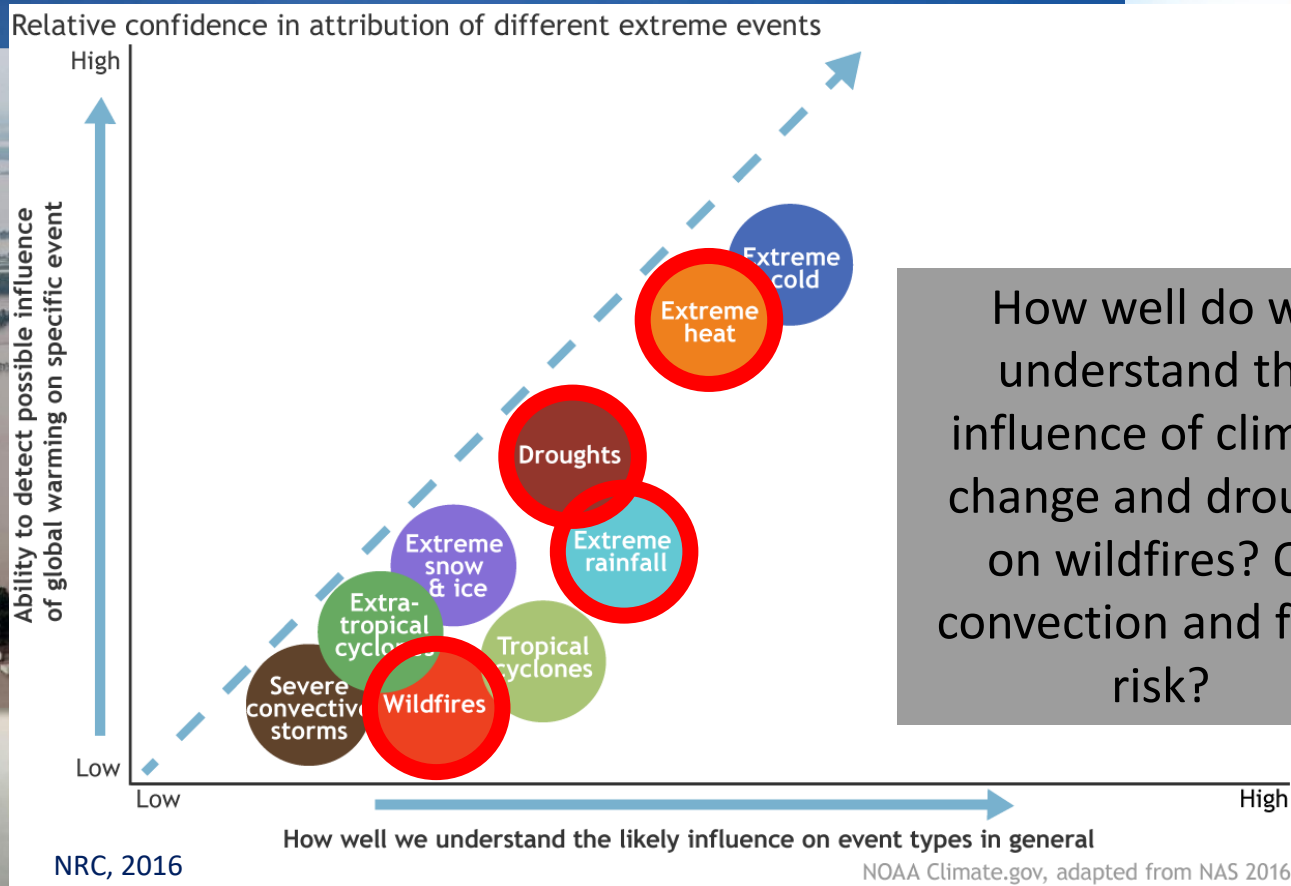
Climate: Risk, Resilience, and Services



Roger S. Pulwarty
**National Oceanic and
Atmospheric Administration**

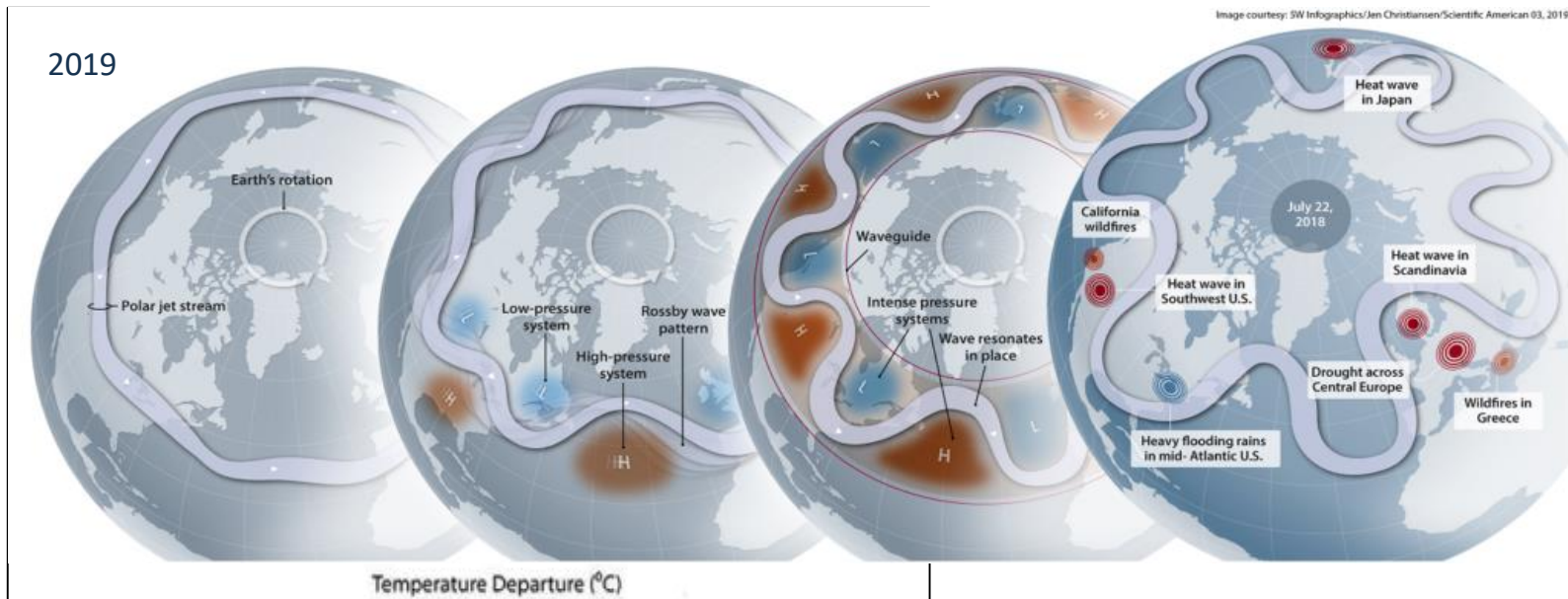


Changes in extreme weather and climate events



How well do we understand the influence of climate change and drought on wildfires? On convection and flood risk?

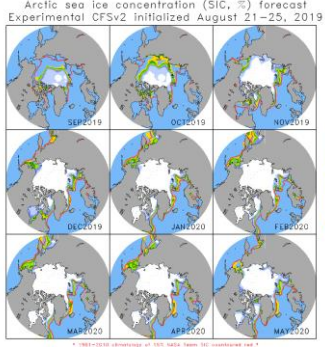
The Making of an Extreme Event: Putting the Pieces Together (Dole et al 2014 Bulletin American Meteorological Society)



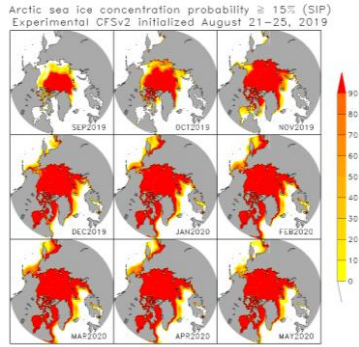
- Climatological
- Climatological + Trend
- Climatological + Trend + Boundary conditions
- Climatological + Trend + Boundary + Initial conditions

The changing nature of physical risks: Examples

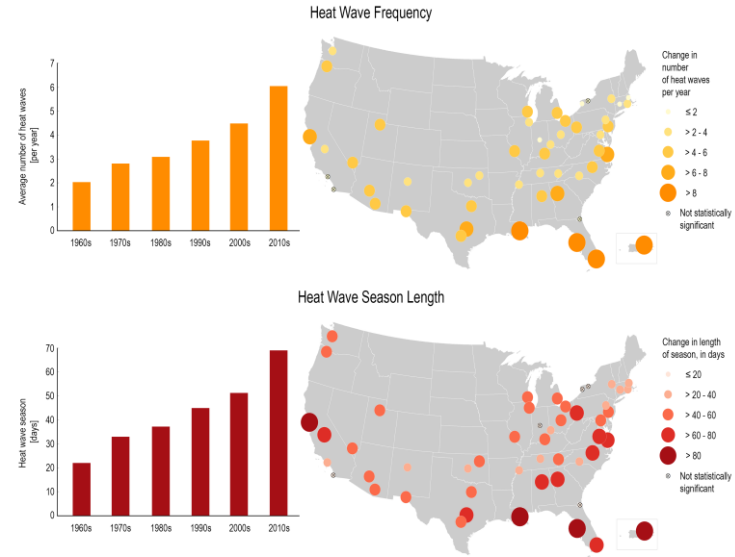
Monthly mean sea ice concentration



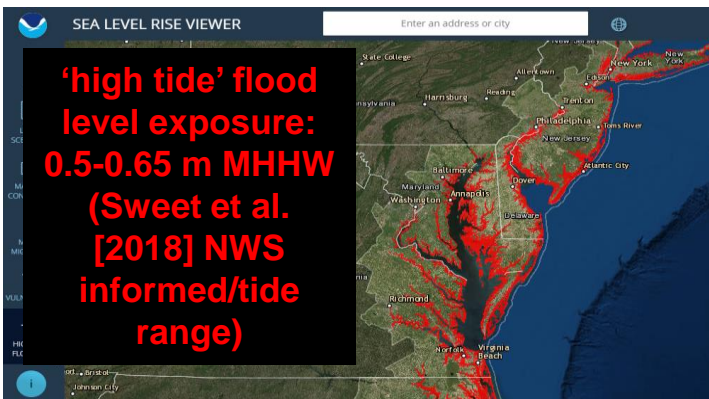
Monthly probability of sea ice existence



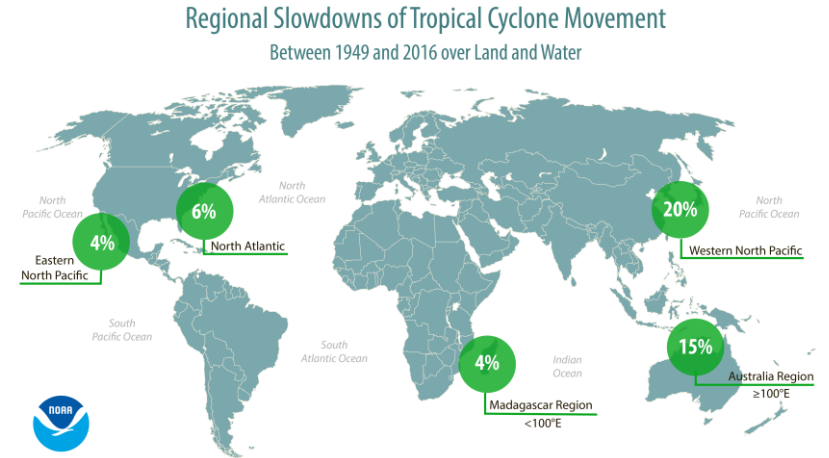
Heat Wave Characteristics in 50 Large U.S. Cities, 1961-2018



High Tide Flood Frequencies changing in 'leaps and bounds' <https://coast.noaa.gov/slr>




Extreme Rain Multiplier




Global Framework for Climate Services

Climate services provide climate information to help individuals and organizations make climate smart decisions.

The **Climate Services Information System (CSIS)** component of the **GFCS** is the principal mechanism through which information about climate – past, present and future – is being routinely archived, modelled, analyzed, processed, and communicated


National and international databases provide data, maps, risk and vulnerability analyses, assessments, and long-term projections and scenarios.




Socio-economic variables and non-meteorological data may be combined, depending on user needs.

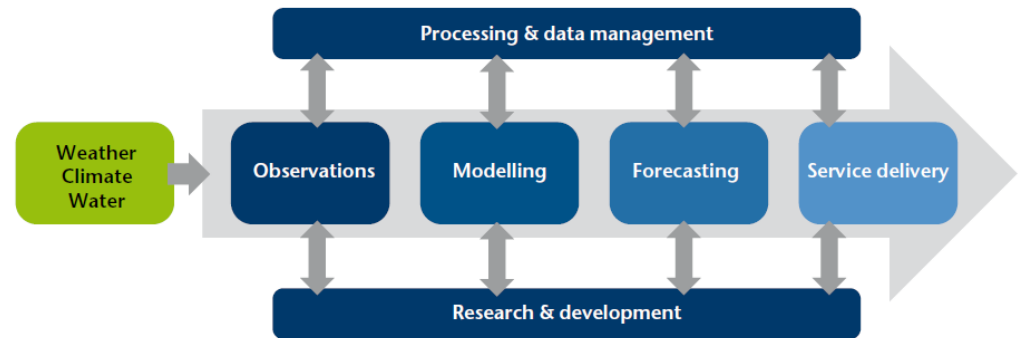
Customized products for different user communities.



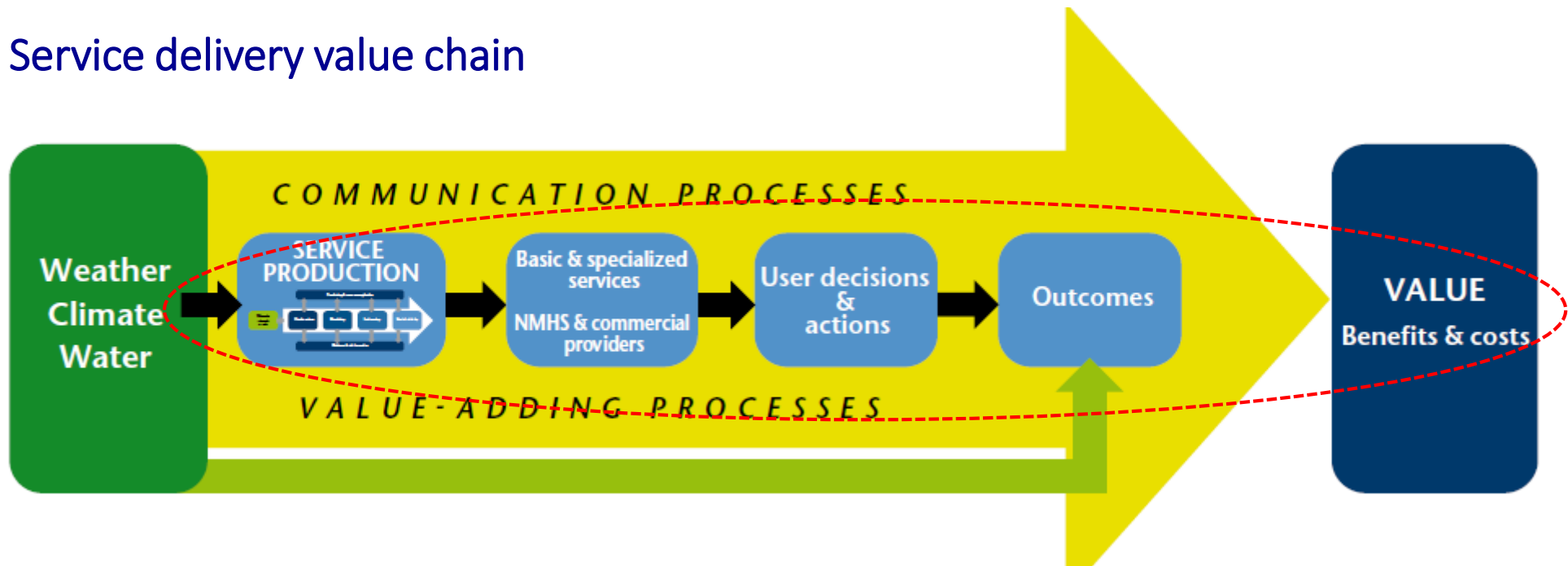
What is the Climate Services Information System?

A climate information system coherently organizes different types of climate information and facilitates technical assistance to help decision makers understand how to integrate climate information into their planning processes (GAO, 2017: Bulletin of the WMO 2019: Bulletin of the American Meteorological Society 2020)

Information development chain

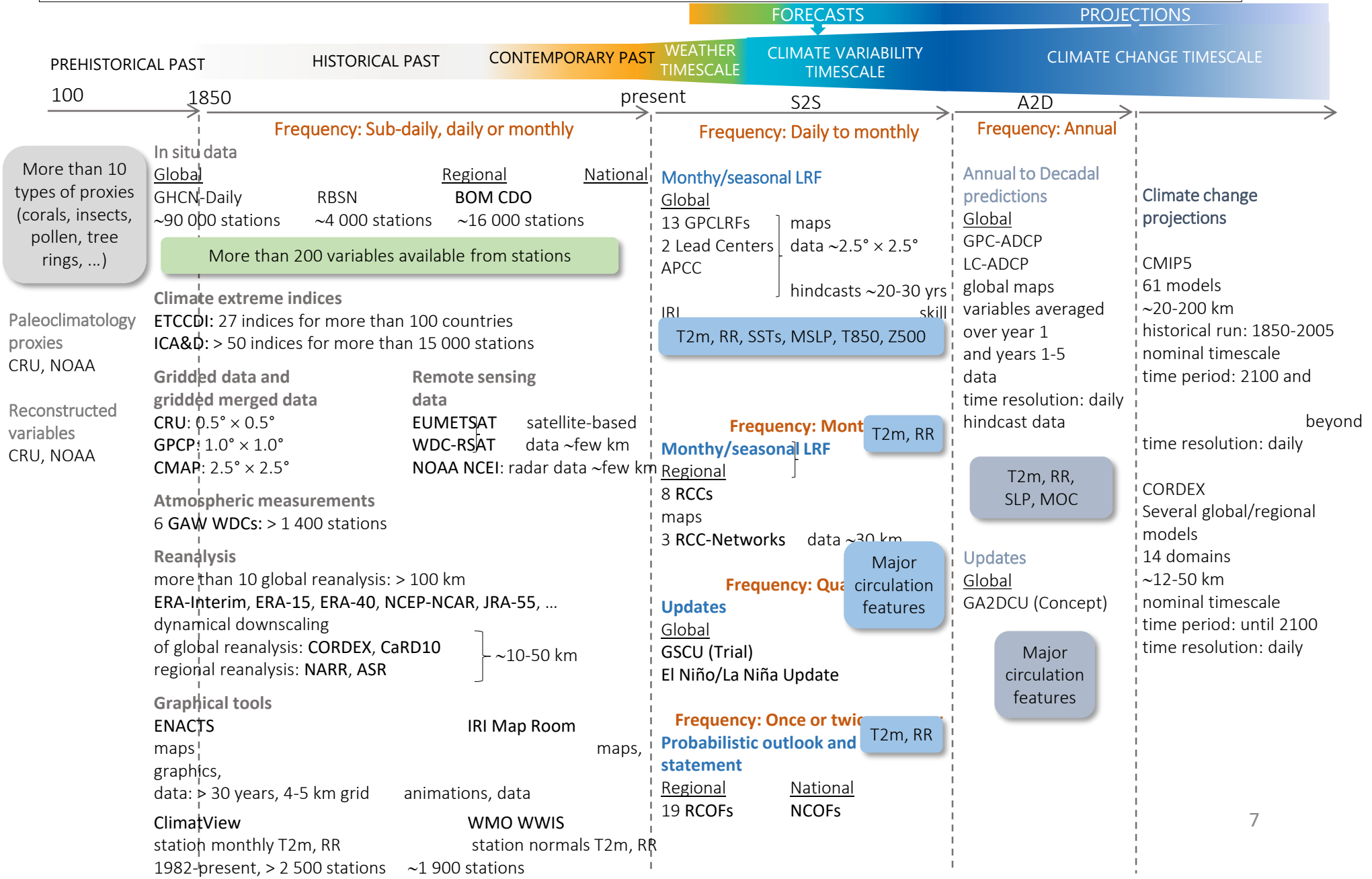


Service delivery value chain



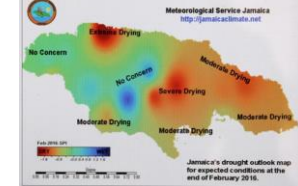
Current status, availability and access to data and products from CSIS entities for applications and planning

Availability of data and products (Non-exhaustive list)

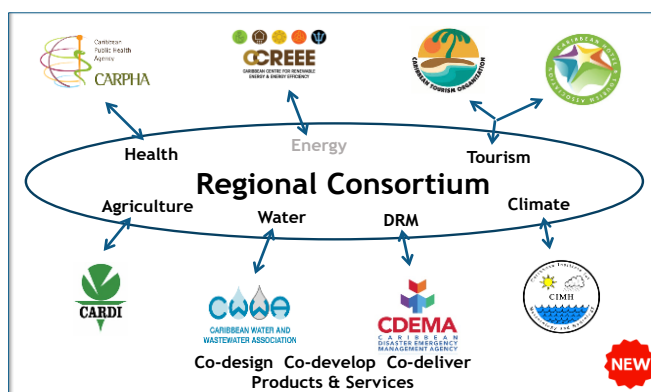
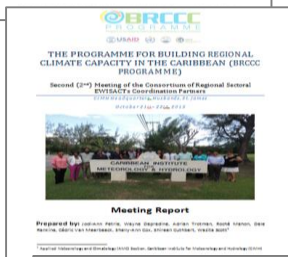
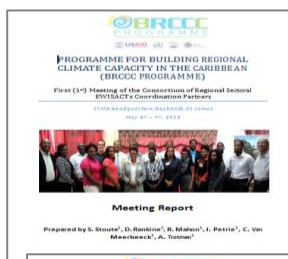




Caribbean Regional Climate Centre Early Warning Information Systems Across Climate Timescales



The Consortium is a key regional mechanism that champions the design, development and delivery of tailored climate products and services in the agriculture and food security, disaster risk management, energy, health, tourism and water sectors.



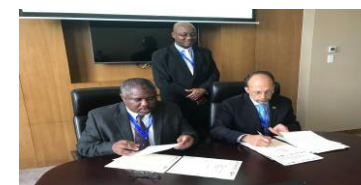
CTO and CHTA sign the LoA, September 16th, 2016



CWWA signs the LoA, October 26th, 2016



CARDI and CDEMA sign the LoA, December 6th, 2016



CARPHA and CIMH sign the LoA, April 26th, 2017

Sector-specific climate indices

- Facilitates broader dialogue and sustained engagement with regional and national stakeholders;
- Facilitates the identification and sharing of textual and georeferenced sectoral datasets;
- Facilitates the identification and sharing climate-related impact data;
- Supports research that examines associations between climate and relevant sectoral productivity outcomes; and
- Promotes the dissemination of climate information.

EWISACTs

The Climate Services Challenge: NOAA's Role

NOAA's climate capabilities

Observations, modeling and research

- Monitoring
- Modeling, predictions and projections
- Understanding the causes and impacts of climate extremes
- **Knowledge, applications and services to inform risk management and adaptation decisions**

NOAA's Timescales

NOAA provides a suite of weather and climate products from near-term forecasts to long-term projections, tailored to stakeholders' needs, to help create jobs, boost economies, and build resilience to extreme events.



Tornadoes



Wildfires



Floods



Droughts



Heat waves



Snowstorms/
Blizzards



Geophysical



Hurricanes &
Tropical Storms

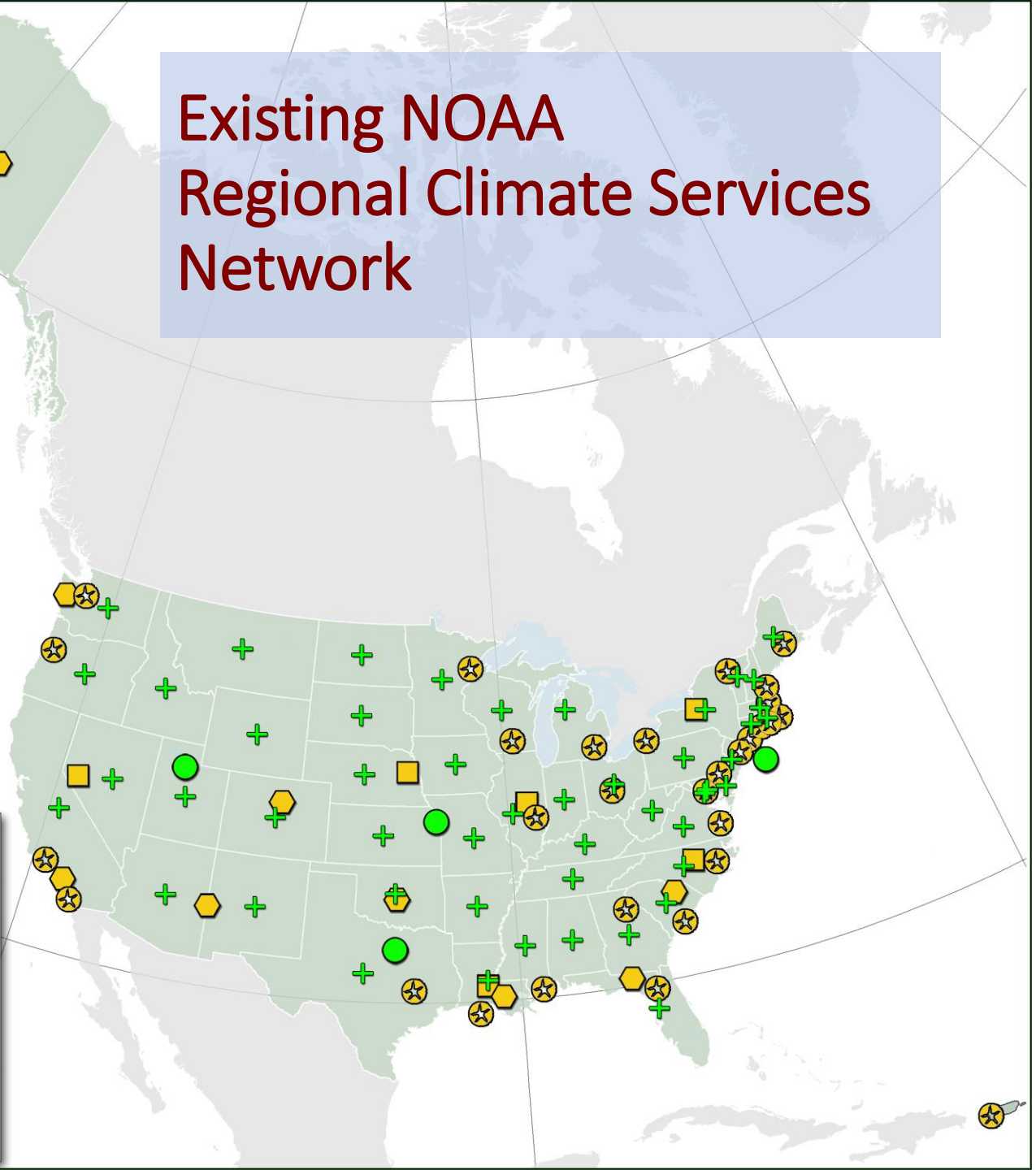
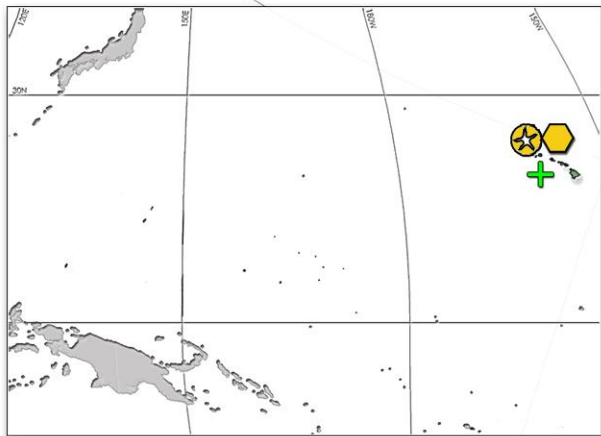
Existing NOAA Regional Climate Services Network

Non-Federal Partners

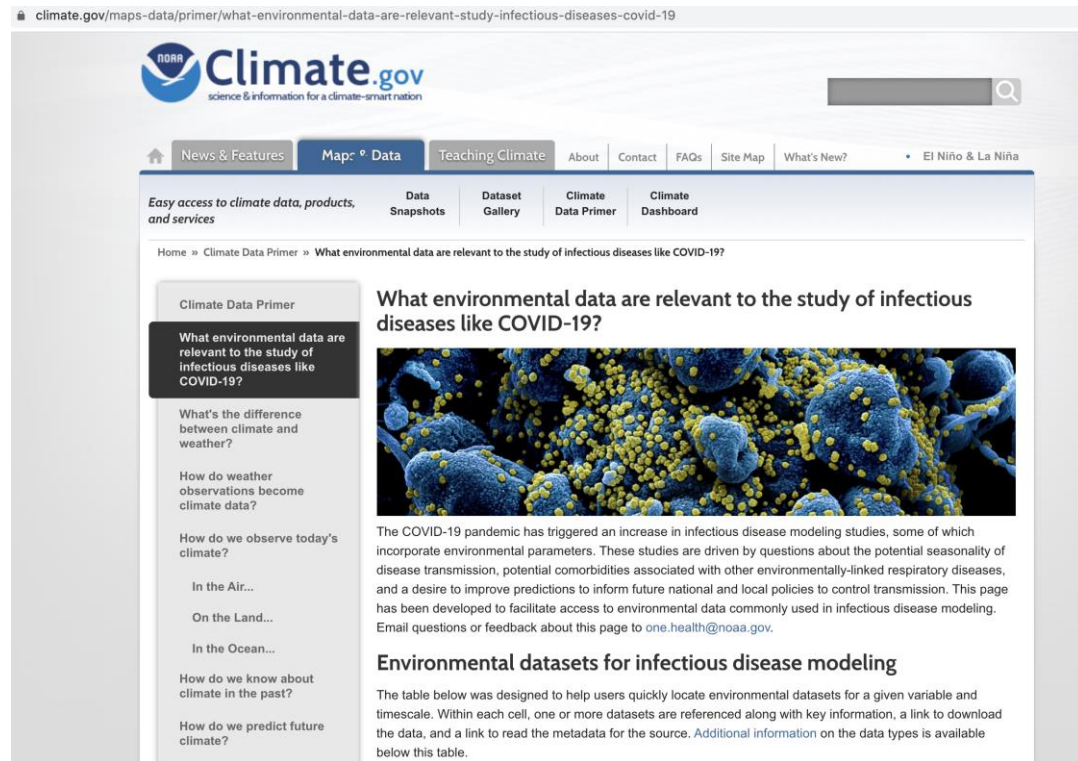
- ⬡ RISA (9)
- ⬢ RCC (6)
- ⊛ Sea Grant

NOAA Offices

- NCS Focal Points (6)
- + State Climatologists



Climate.gov and the Climate Resilience Toolkit

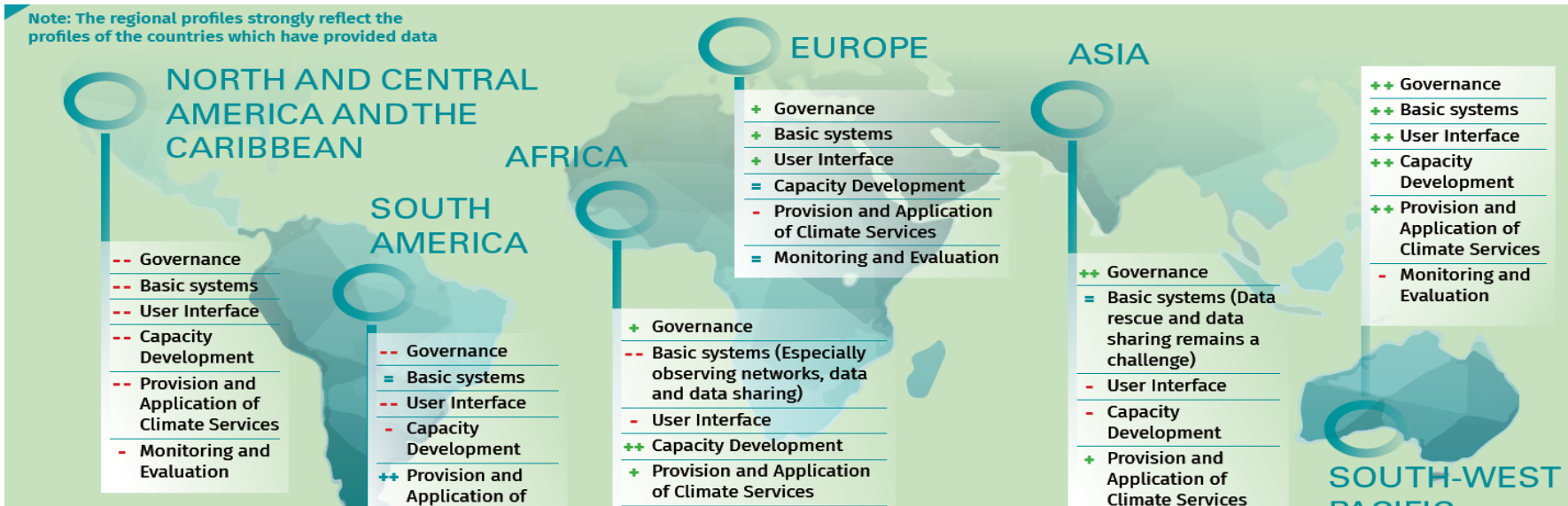


Goal: Enhance and simplify access to climate science data & information, including projections

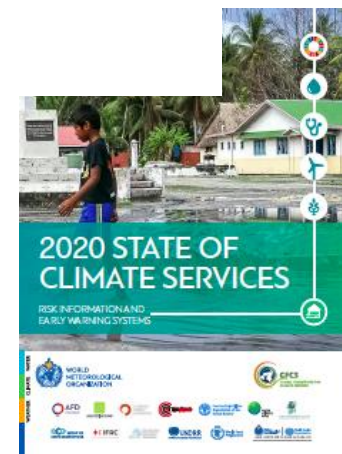
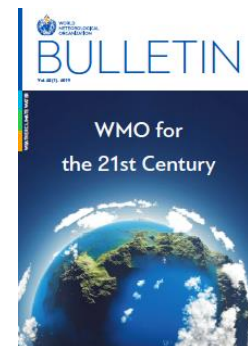
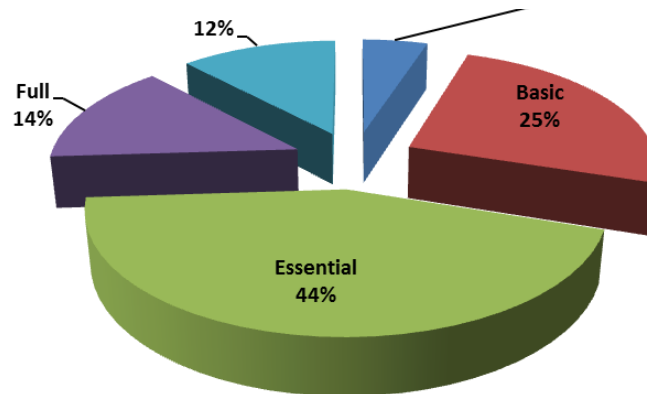
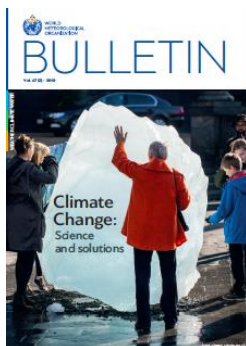
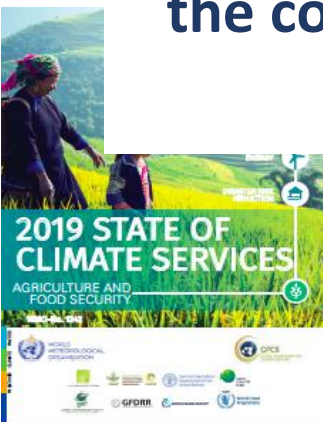
(1) Provide easy and robust access to climate projections for "designers" to provide adaptation/resilience decision services to their end users/consumers

(2) Conceive and articulate an overall plan for how USGCRP agencies may make their climate-related web presence more cohesive, coherent, and user friendly

The "Status" of Climate Services

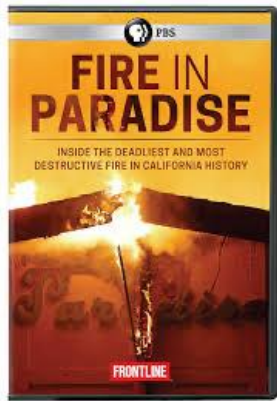


The benefits of investment in climate services greatly outweigh the cost, and yet the capacity to deliver and access these services is uneven and inadequate in different regions



Emerging Challenge:

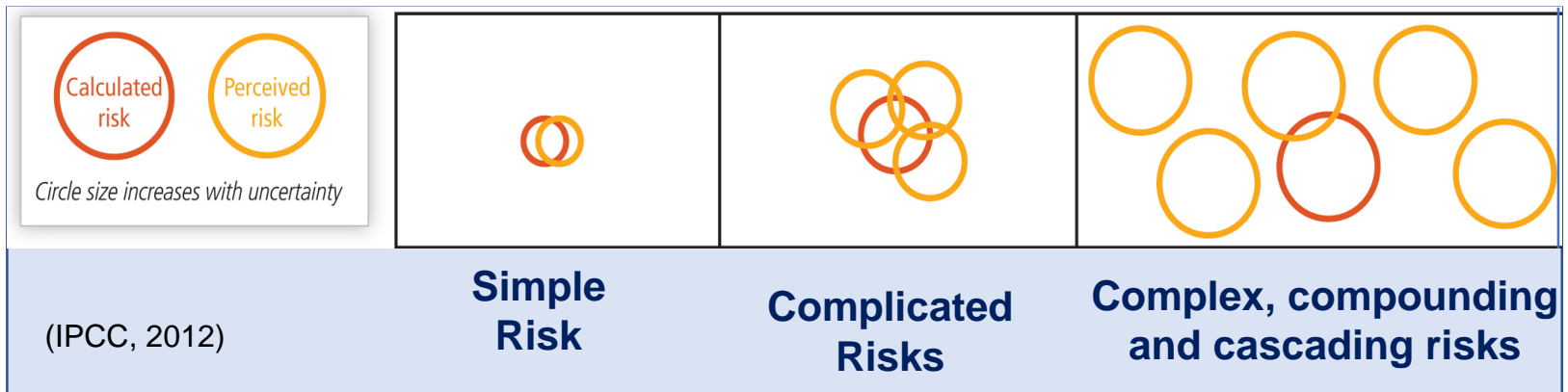
Traditional risk assessment and management strategies are increasingly challenged by **systemic and evolving** impacts of compound extremes, biodiversity loss, economic and other instabilities



2018 California Fires

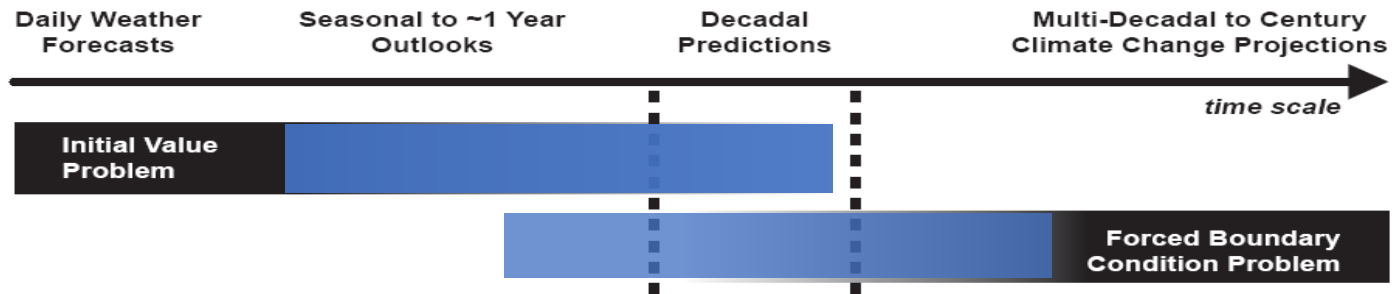


Storm sequences 2017
Tropical Atlantic hurricane season

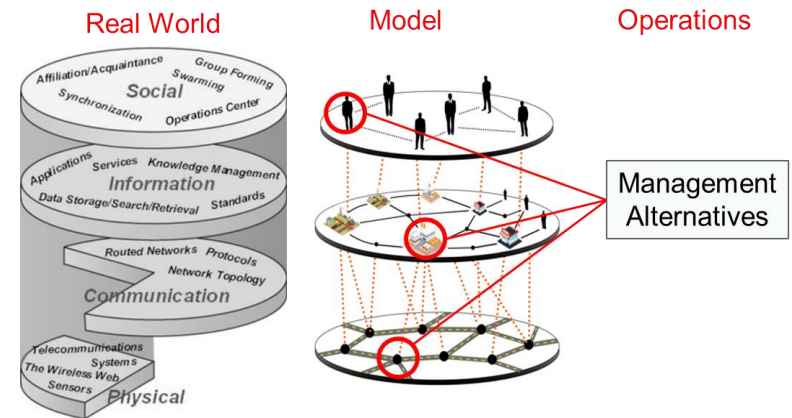


Challenge: Navigating through (not just “for”) a changing climate

1. Understand and characterize the cascading and compounding nature of structural and systemic climate risks

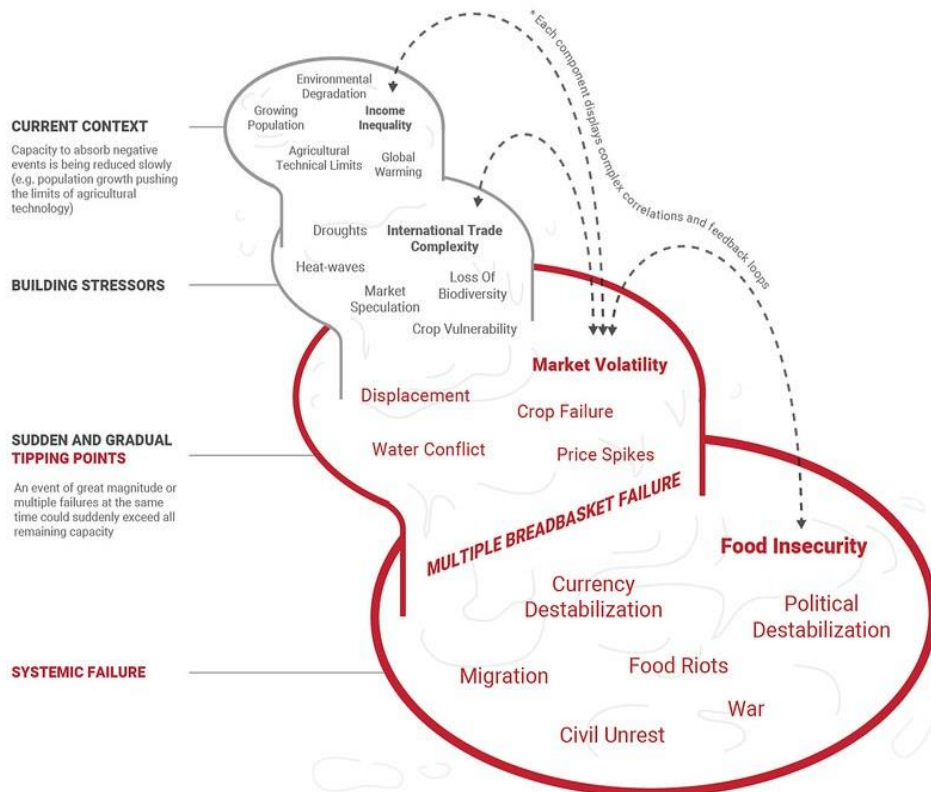


When and where can investments and financing be prioritized to reduce future across the continuum



Cascading and Systemic risks:

e.g. modern food systems highly dynamic, complex, formal and informal – fundamentally important to food security



Optimized for

- globalized trade regimes efficiency
- relatively stable environments

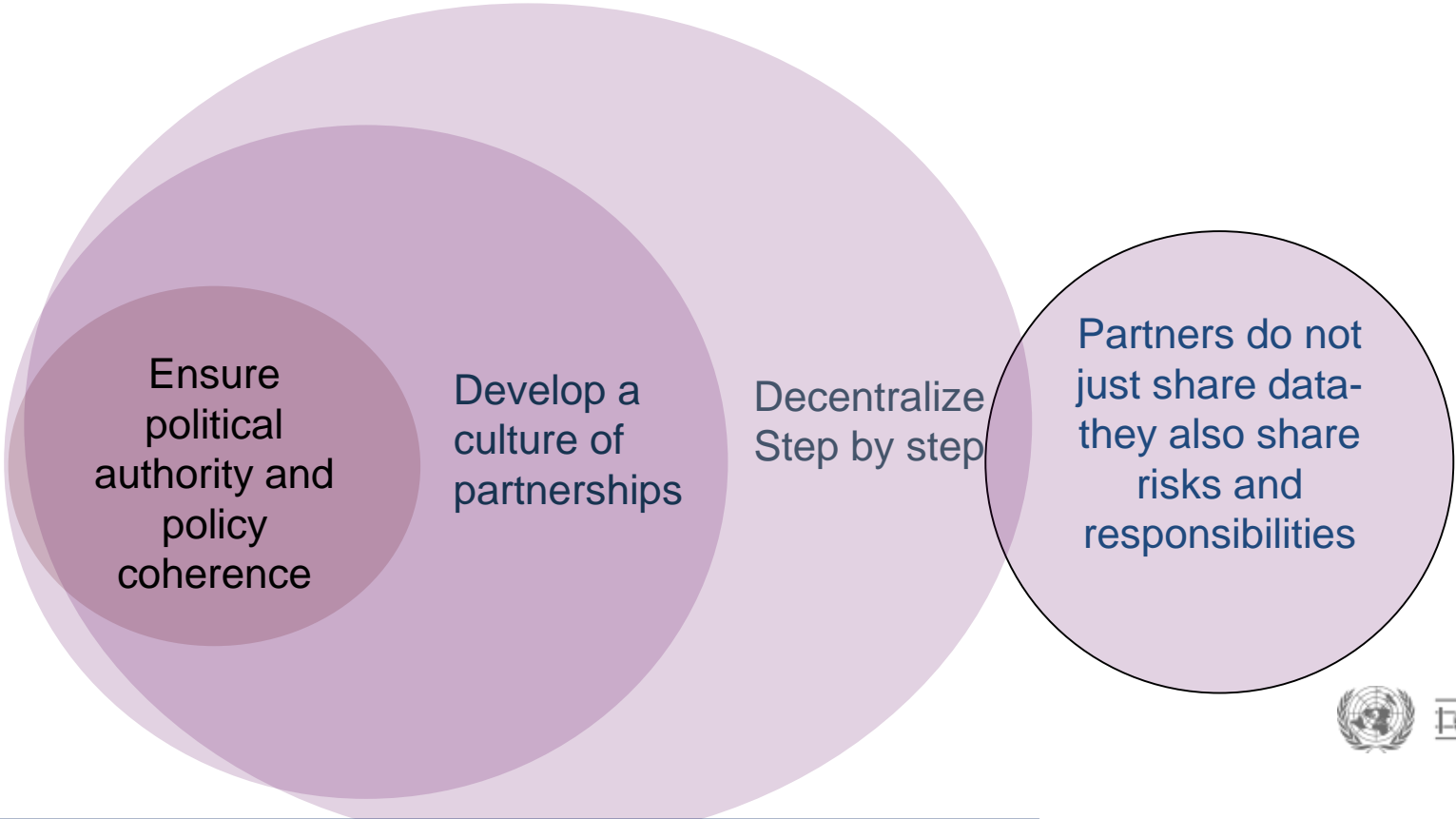
GAR
Global Assessment Report
on Disaster Risk Reduction

2019

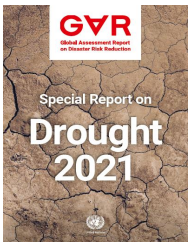


3. Improve knowledge governance: Broadening the actor network across the risk management to resilience continuum:

.....



Arrangements for linking emergency management responsibilities and decisionmaking for climate-related resilience



...for complex problems .communication is critical but not sufficient

- The “push” supply of new information by providers of information/technology and the “pull” or demand for new information is never linear-and is more than 2- way
- More challenging is an understanding the framing and socialization of lessons learned by particular individuals and organizations through direct trial and error experiences



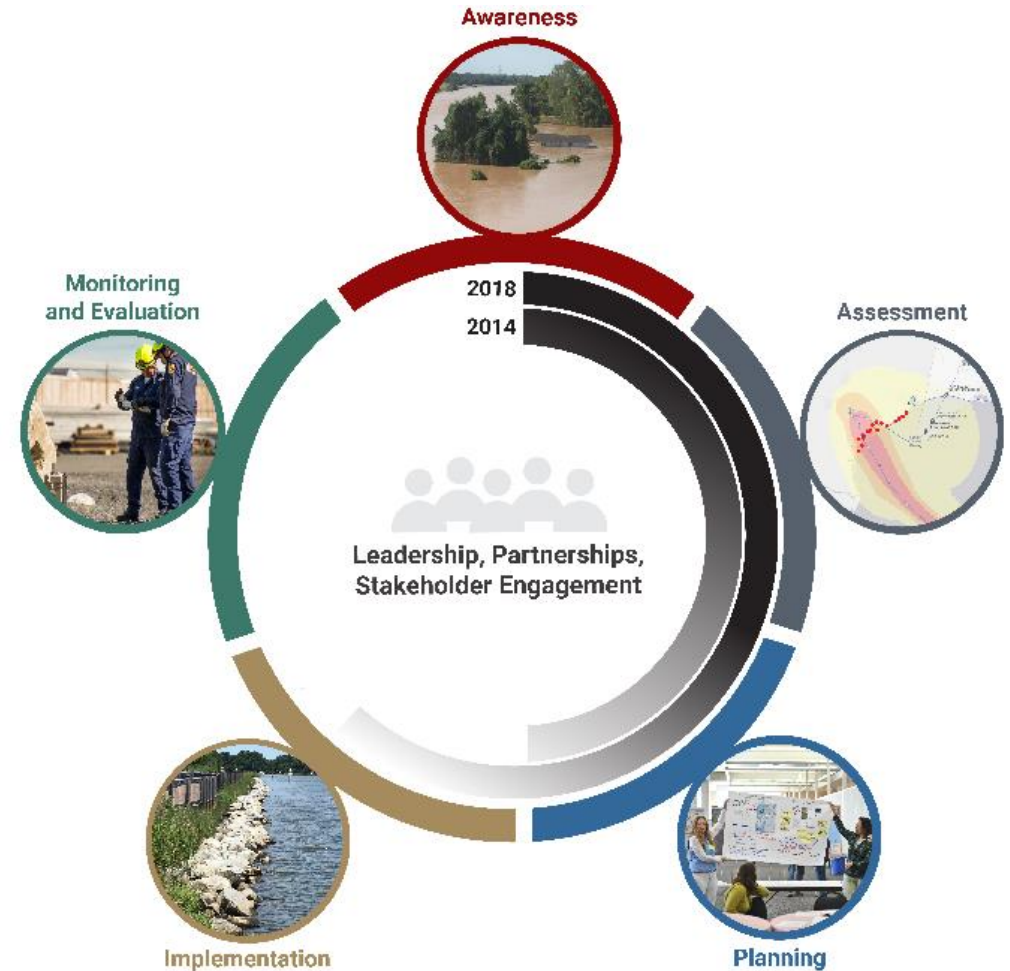
Framing Factor	<u>Water Managers Perspective</u>	<u>Researchers Perspective</u>
Identifying critical issue		
Time frame		
Spatial resolution		
Goals		
Basis for Decisions		
Expectation		
Product Characteristics		
Frame		
Nature of Use		

4. Recognize resilience...as an iterative learning process

Improving Alignment, Agility and Adaptability

Beyond co-production: the varieties of trust
Joint visioning, policy development, and implementation of paths to sustainable futures

Sustaining regional, national and local capabilities and collaborative learning networks



Presidential Documents

Executive Order 14008 of January 27, 2021

Tackling the Climate Crisis at Home and Abroad

The United States and the world face a profound climate crisis. We have a narrow moment to pursue action at home and abroad in order to avoid the most catastrophic impacts of that crisis and to seize the opportunity that tackling climate change presents. Domestic action must go hand in hand with United States international leadership, aimed at significantly enhancing global action. Together, we must listen to science and meet the moment.

By the authority vested in me as President by the Constitution and the laws of the United States of America, it is hereby ordered as follows:

PART I—PUTTING THE CLIMATE CRISIS AT THE CENTER OF UNITED STATES FOREIGN POLICY AND NATIONAL SECURITY

The American Jobs Plan Gets Serious about Infrastructure and Climate Change

[csis.org/analysis/american-jobs-plan-gets-serious-about-infrastructure-and-climate-change](https://www.csis.org/analysis/american-jobs-plan-gets-serious-about-infrastructure-and-climate-change)

March 2021

BRIEFING ROOM

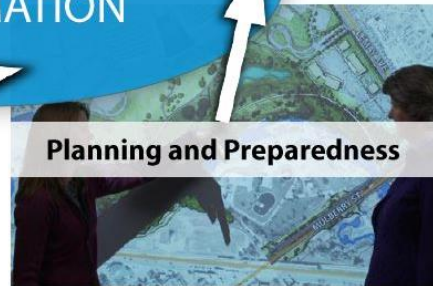
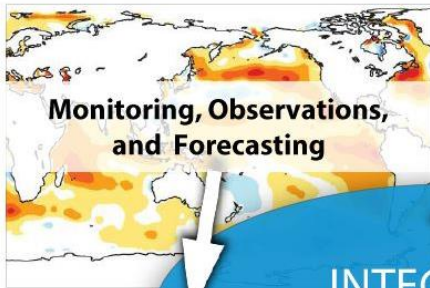
FACT SHEET: The American Jobs Plan

MARCH 31, 2021 • STATEMENTS AND RELEASES

While the American Rescue Plan is changing the course of the pandemic and delivering relief for working families, this is no time to build back to the way things were. This is the moment to reimagine and rebuild a new economy. The American Jobs Plan is an investment in America



Challenge: Navigating through a changing climate

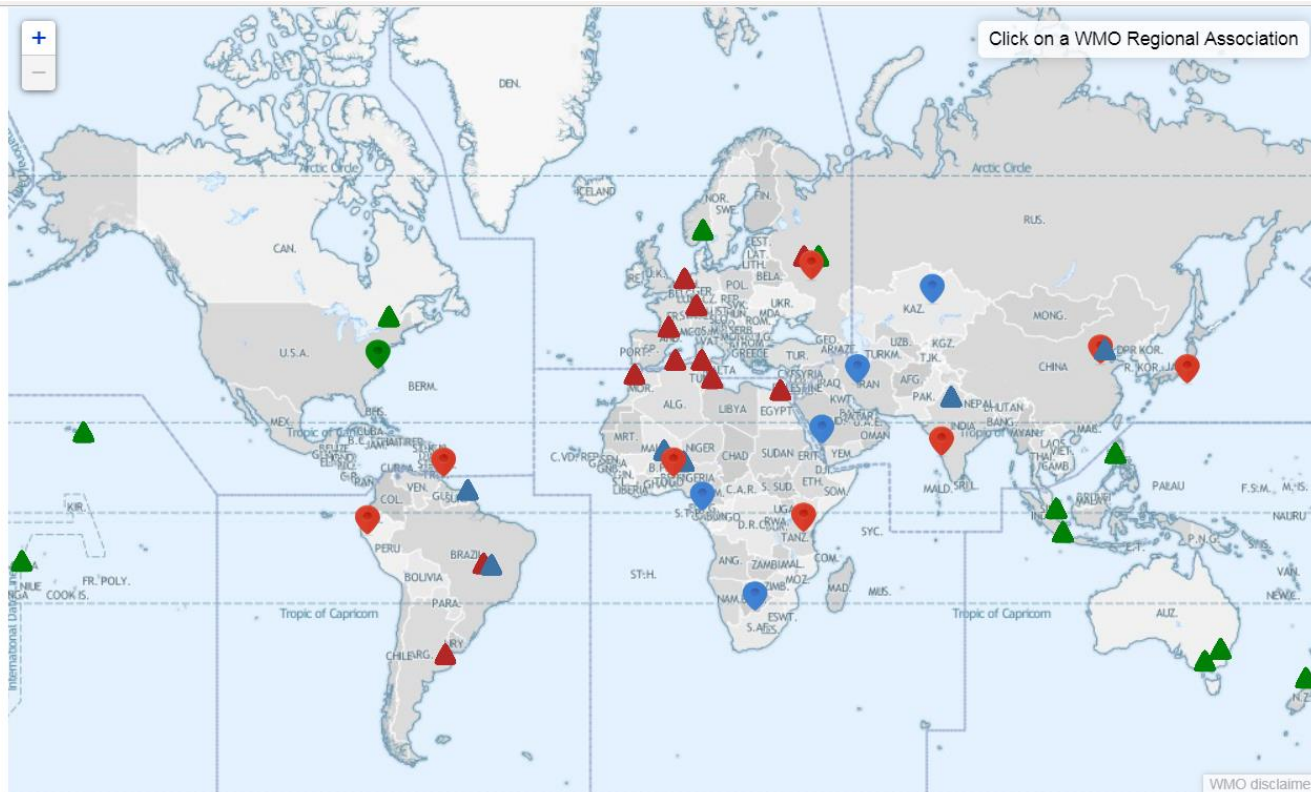


Thank you!
roger.pulwarty@noaa.gov



**Backup
slides**

WMO Regional climate centres



Legend

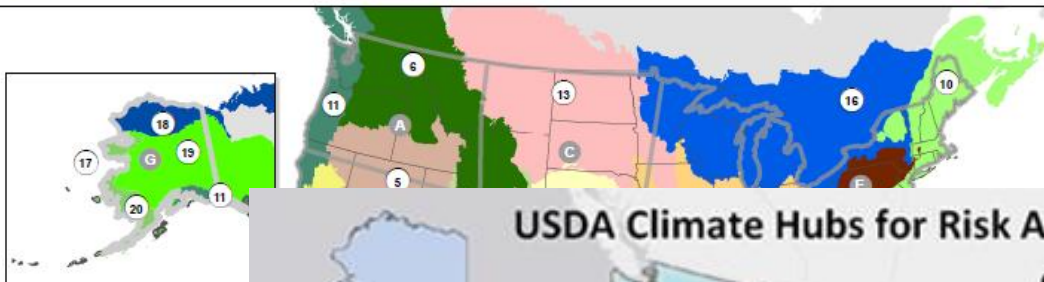
- designated RCC
- RCC in demonstration phase
- RCC proposed
- ▲ designated RCC-Network
- ▲ RCC-Network in demonstration phase
- ▲ RCC-Network proposed

Key Federal Partnerships



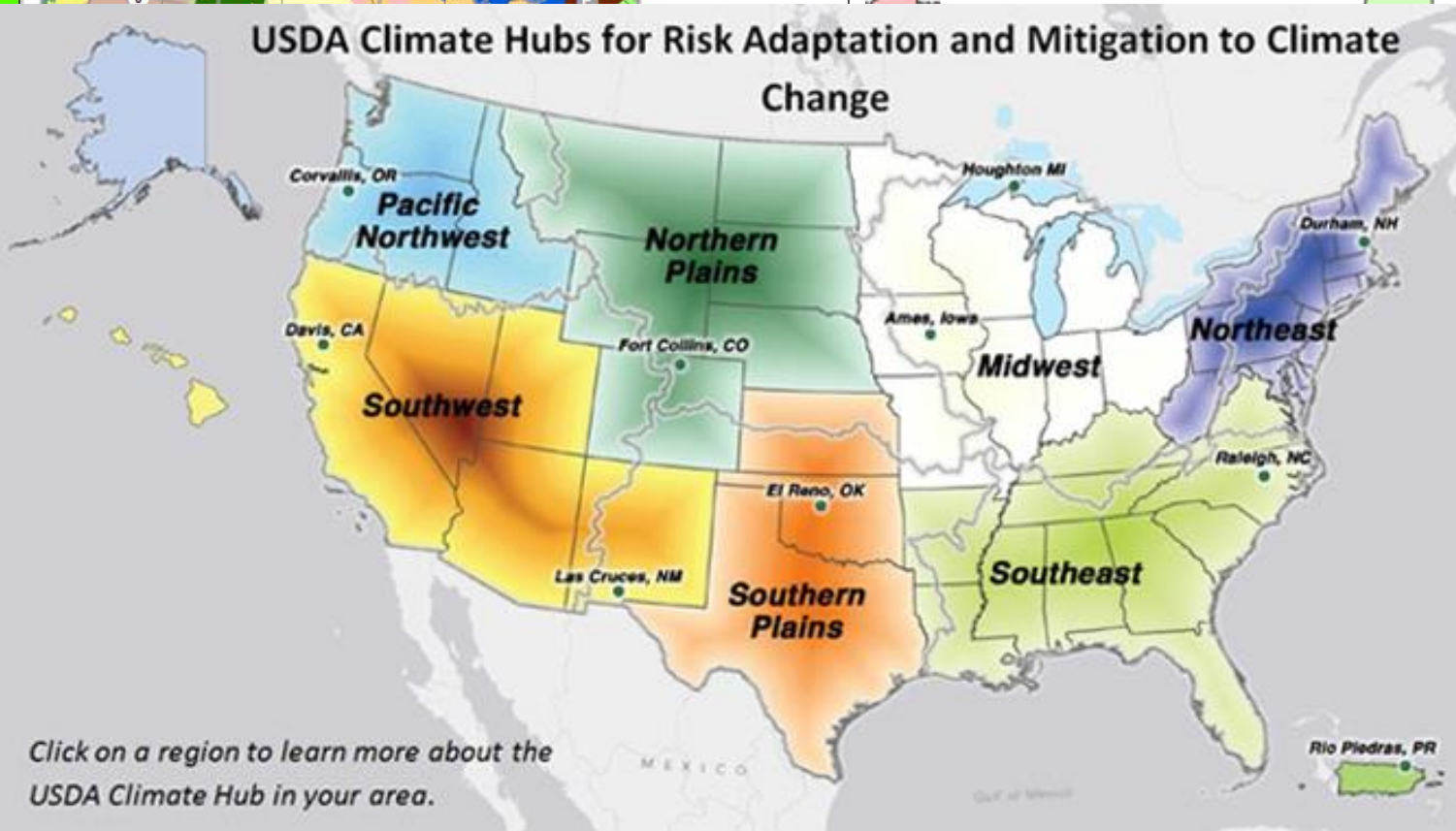
U.S. Department of the Interior

Landscape Conservation Cooperatives - Climate Science Centers



DOI Climate Science Centers	Lands
Northwest	1
Southwest	2
North Central	3
South Central	4
Northeast	5
Southeast	6
Alaska	7
Pacific Islands	8

USDA Climate Hubs for Risk Adaptation and Mitigation to Climate Change



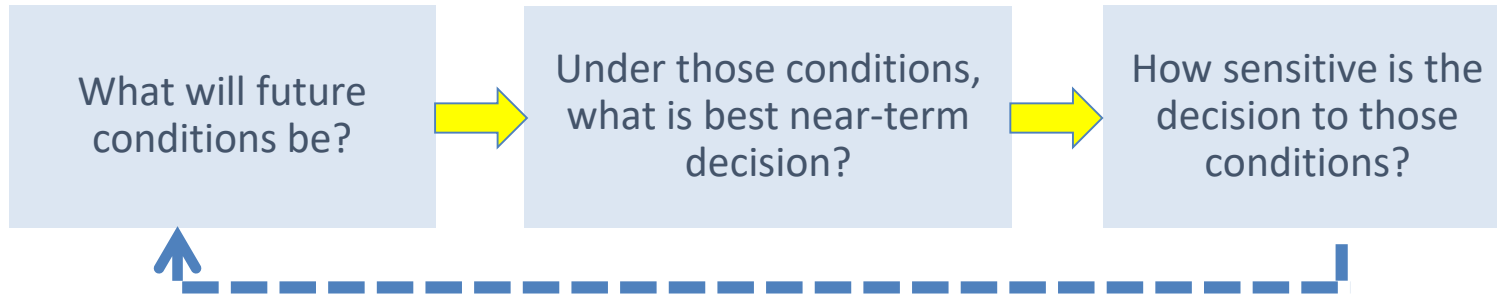
Click on a region to learn more about the USDA Climate Hub in your area.

Expanding the ranges of choice:

- (1) Understand and characterize the relationship between extremes and slow onset physical and social changes: rapid transitions, thresholds and tipping points.**
- (2) Make the link between capacity-building and community-based implementation explicit: Monitor and evaluate.**
- (3) Collaborate with multiple actors on the design and equitable diffusion of smart technologies, decision support tools and best practices.**
- (4) Resource the process and the people (as well products e.g. assessments and tools): Finance and sustain partnerships and a new cadre of entrepreneurs and leadership at each level.**



“Predict-then-Act” methods can backfire in deeply uncertain conditions



- **Uncertainties are underestimated**
- Competing analyses can contribute to gridlock
- Misplaced concreteness can mask surprises

Result:

- **It can be easy to underestimate the complexities of adaptation including tradeoffs between near-term efficiency and the need for long-term resilience**