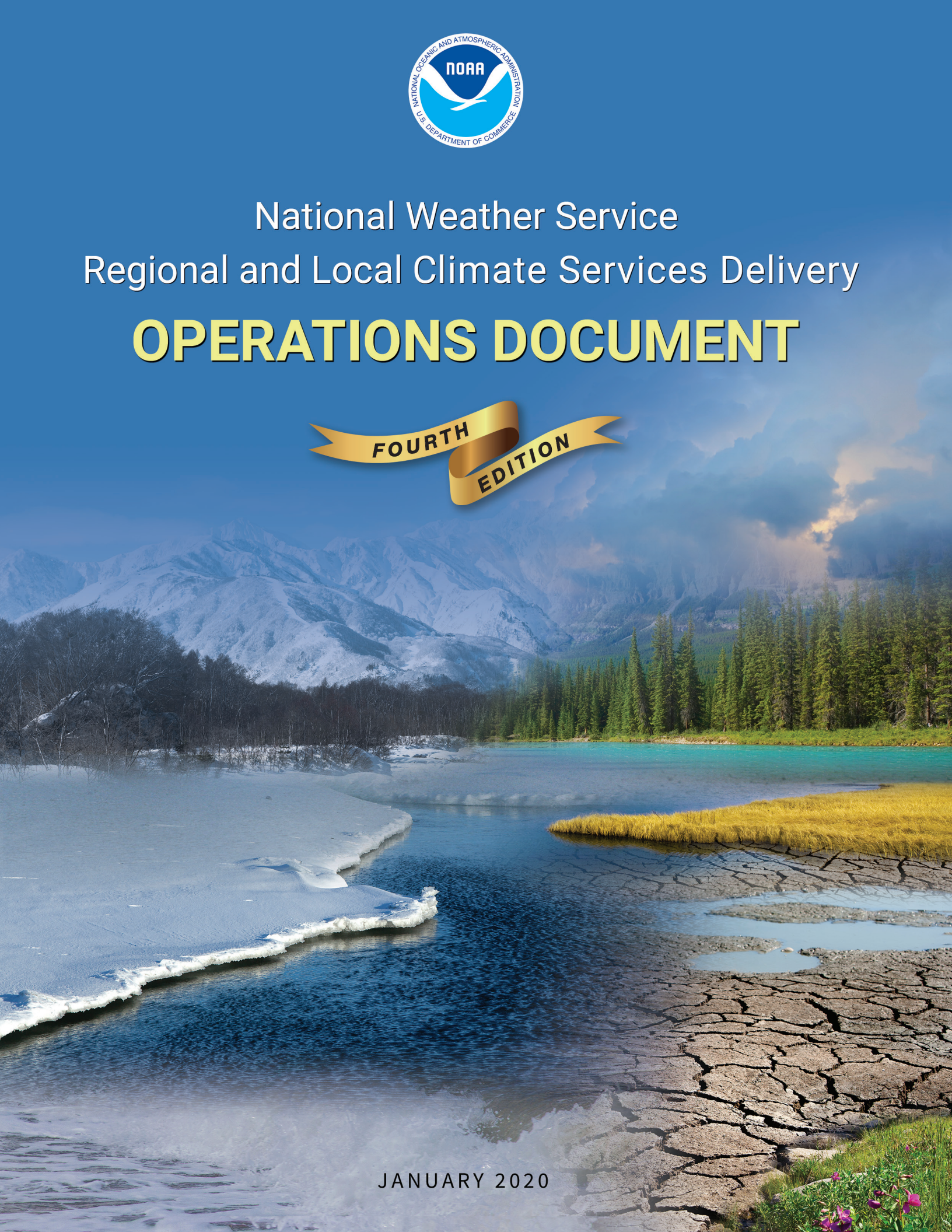
National Weather Service

Regional and Local Climate Services Delivery

OPERATIONS DOCUMENT

FOURTH EDITION



JANUARY 2020

From the Director

Delivering climate services to the nation is part of our mission. Provision of services on subseasonal to seasonal timescales enables Americans to prepare for and respond to hazardous weather and water events for the protection of life and property and the enhancement of the nation's economy. As with all our services, we meet the everyday needs for climate information of our Core Partners through "impact-based decision support services," or IDSS, at local, state, federal, and tribal nation levels. It is this climate information that allows our nation to be "climate-smart," and thus better prepared for and able to respond to disruptive weather and water events.

Your roles in delivery of our climate services are key to our success. This 4th edition of the National Weather Service Regional and Local Climate Service Delivery Operations Document provides detailed guidelines on how best to accomplish these climate services. It provides an overview of the NWS Climate Services Program, roles and responsibilities of NWS climate services staff, and examples of impact-based decision support services by local offices.

I urge you to follow the guidelines in this document to maximize our efficiency for required regional and local climate services. Your role in this endeavor is critical to maintain NWS' position at the forefront of climate services delivery to this nation and to achieve NOAA's mission goals.

Louis W. Uccellini

Director of the National Weather Service, NOAA

Table of Contents

SECTION 1: Introduction 2

SECTION 2: Climate Services Program 8

SECTION 3: Local Offices 11

SECTION 4: Regional Headquarters 28

SECTION 5: Climate Prediction Center 32

SECTION 6: Training 34

SECTION 7: Key Partners 35

SECTION 8: Tools and Resources 38

APPENDICES: 41

SECTION 1: Introduction

Purpose

The purpose of this document is to describe the National Oceanic and Atmospheric Administration (NOAA) National Weather Service (NWS) Climate Services Program and implementation actions as well as to clarify roles, duties, and responsibilities of NWS staff, who are in a position to deliver climate information and services at the national, regional, and local offices.

NWS Vision

A Weather-Ready Nation:
Society is prepared for and responds to weather, water, and climate-dependent events.

The Vision for Climate Services

A timely, accurate, and reliable NWS suite of subseasonal to seasonal monitoring and prediction products using trusted data, state-of-the-art models, and advances in physical and social sciences to provide impact-based decision support services in easy-to-understand formats from highly-trained, professional staff for preparedness, response, and climate-related risk reduction.

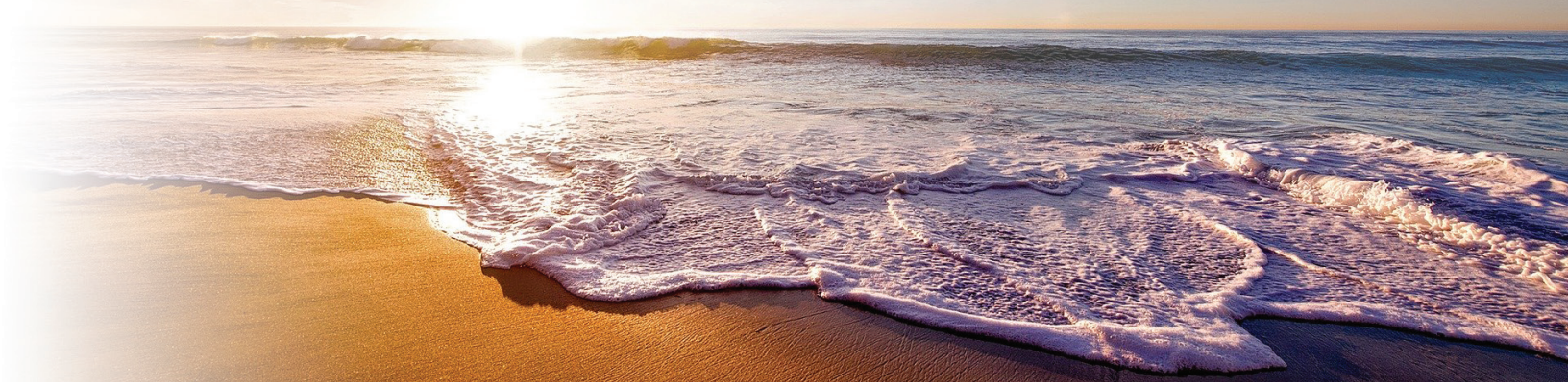
NWS Mission

Provide weather, water, and climate data, forecasts, and warnings for the protection of life and property and enhancement of the national economy.

GOAL 1:
Reduce the impacts of weather, water, and climate events by transforming the way people receive, understand, and act on information.

GOAL 2:
Harness cutting-edge science, technology, and engineering to provide the best observations, forecasts, and warnings.

GOAL 3:
Evolve the NWS to excel in the face of change through investment in our people, partnerships, and organizational performance.



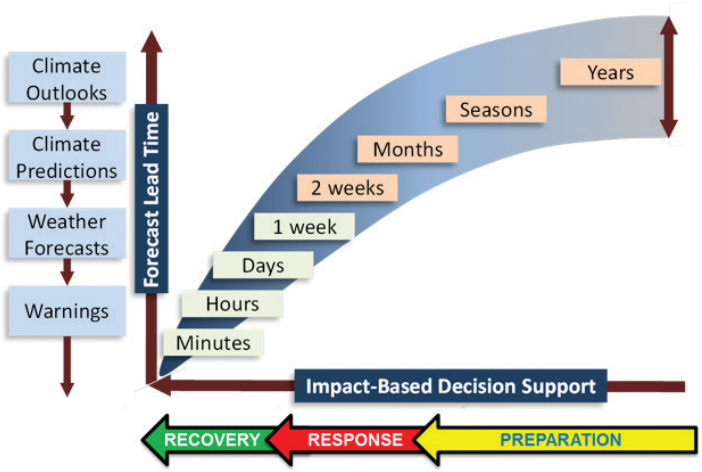
NWS Climate Services

Over recent decades, climate-related phenomena and their impacts have captured national attention. From the disruptive El Niño events of 1982-83 and 1997-98 to the recent heightened discourse concerning long-term global change, climate remains a high-visibility topic in the public consciousness. Recognizing this growing importance and the national engagement on this issue, NOAA has enhanced its efforts to deliver a broad array of climate services. A vital component of this enhancement is the extensive suite of climate services offered by the NWS, including observing systems, monitoring, predictions, analyses and assessments of the state of the climate, and the delivery system to reach users. NWS has already established trust and credibility in providing scientific information to local users, and its continued engagement with the public is a touchstone for continued success from the local to the national level for climate services.

Support for Decision Making on Subseasonal to Seasonal Timescales

NWS provides Impact-based Decision Support Services (IDSS) on subseasonal to seasonal (S2S[1]) timescales at more than 150 offices nationwide from National Centers to regional and local offices. S2S services help NWS Core Partners[2] better understand expected hazardous conditions and manage their risks by providing them with S2S information and interpretative services.

NWS currently provides S2S information in the form of historical data and analyses, the current state of the atmosphere and ocean system, and precipitation and temperature outlooks out to one year. This includes information on current and predicted drought conditions, expert interpretations and assessments of the state of several climate teleconnections, and tools that provide information on the impacts of S2S weather at regional and local levels.



Seamless suite of forecast products spanning weather and climate

Weather Act

https://www.congress.gov/bill/115th-congress/house-bill/353
https://www.congress.gov/bill/115th-congress/senate-bill/2200

U.S. Public Law 115–25 of April 18, 2017, reauthorized on January 7, 2019 through the NIDIS Reauthorization Act of 2018 (PL 115423), the "Weather Research and Forecasting Innovation Act of 2017," directs NWS to "(1) collect and utilize information in order to make usable, reliable, and timely foundational forecasts of subseasonal to seasonal temperature and precipitation; (2) leverage existing research and models from the weather enterprise to improve the forecasts...; and (3) determine and provide information on how the forecasted conditions may impact…...the number and severity of droughts, fires, tornadoes, hurricanes, floods, heat waves, coastal inundation, winter storms, high impact weather, or other relevant natural disasters, snowpack, and sea ice conditions..."

NWS collaborates with other relevant NOAA programs to identify high priority needs for research and development (R&D) and transition that R&D into operations to improve skill and usability of products and services. NWS developers and forecasters integrate scientific advances to evolve the operational product suite to meet the needs of those with the responsibility for decisions on S2S timescales.

[1] Subseasonal is defined as two weeks to three months and seasonal from three months to two years
[2] Core Partners are defined in more detail on page 6

Impact-based Decision Support Services

NWS defines IDSS as the provision of relevant information and interpretative services to enable Core Partners' decisions when weather, water, or climate has a direct impact on the protection of lives and livelihoods. IDSS may be characterized as either episodic or recurring.

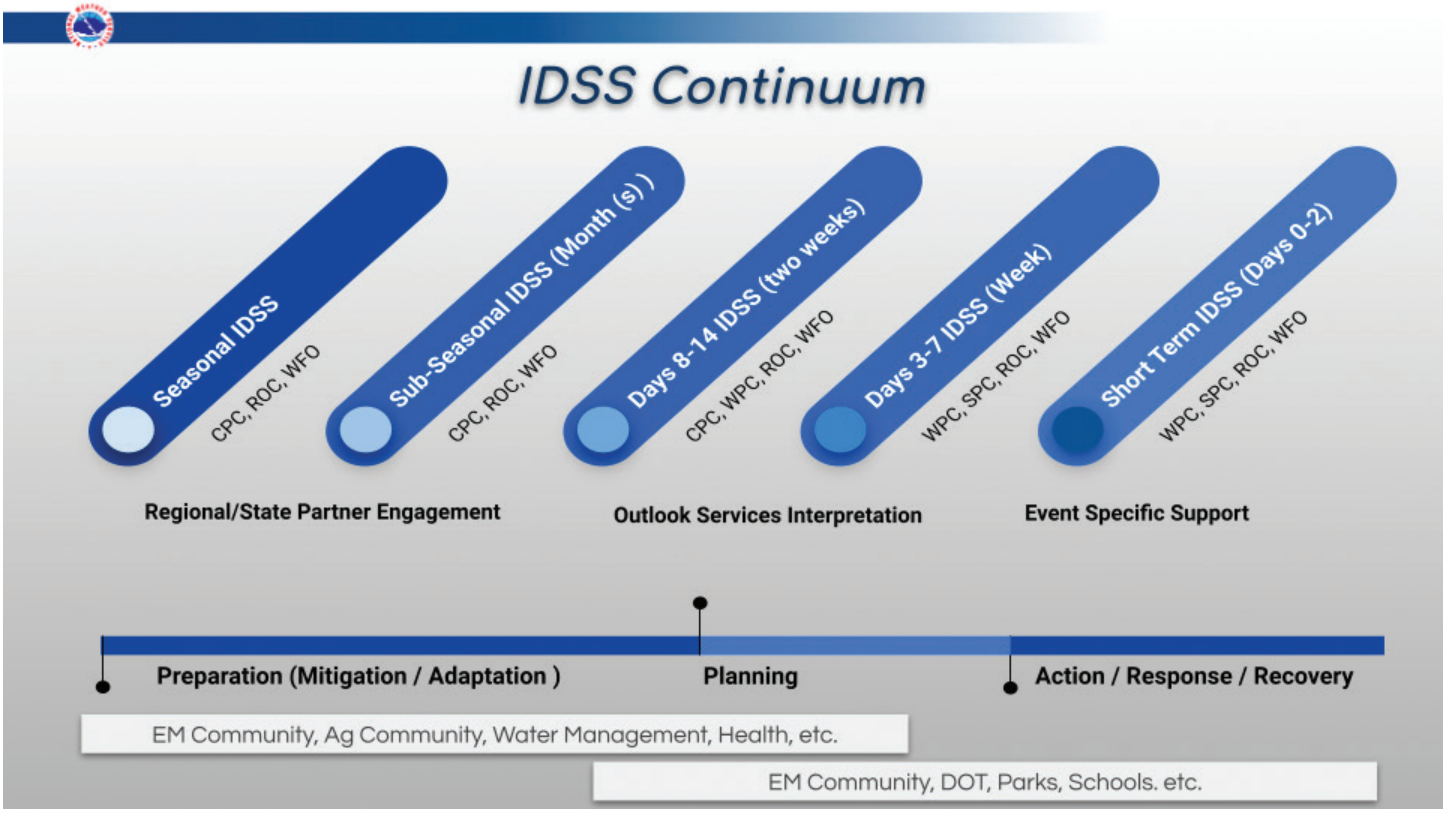
Episodic IDSS: Provision of information and interpretative services to directly support an event or incident where weather, water, or climate has a direct impact on the protection of lives/livelihoods. Examples include event-related webinars, NWSChat, iNWS, and on-site or remote interaction.

Recurring IDSS: Provision of ongoing support to a subset of Core Partners throughout the year to improve partner mitigation, preparation, response, and recovery related to events/incidents where weather, water, or climate has a direct impact on the protection of lives/livelihoods; or to support routine-high value decisions. Examples include joint training, Integrated Warning Team interactions, pre-event/scenario planning, water use/contingency forecasts and planning, table-top exercises used to plan actions and procedures addressing these events or incidents, after-action reviews, and daily coordination regarding routine high-value decisions such as aviation operations or reservoir releases.

S2S IDSS includes engagement, collaboration, and provision of interpretative services of S2S information to NWS Core Partners, which enables them to prepare for and respond to hazardous weather, water, and climate events. S2S information includes foundational data, potential risks, and predictions to enable stakeholders to conduct vulnerability analyses and assessments and take actions that are "climate-smart" and weather-ready.

IDSS extends along a time continuum from the near term (minutes) to seasonal. Climate-focused IDSS requirements are based on partner needs within a given time frame and address: 1) hazardous weather, water, and climate impacts; 2) mitigation and adaptation efforts on the seasonal scale; 3) preparedness efforts on the subseasonal scale; and 4) planning activities in response and recovery efforts in the short term. The expertise and focus of NWS National Centers and local offices play vital roles in providing IDSS along this continuum.

S2S Services in the IDSS time continuum (Andy Foster, NWS Headquarters)



Working with the Global Climate Community

The NWS Climate Services Program leverages the work done within the global climate community of researchers, developers, and providers, including the World Meteorological Organization (WMO), to identify partners and users, and their needs for climate information. NWS' foundational data and standard products are available to support priority areas of the Global Framework for Climate Services (GFCS), which fall under the auspices of the WMO, as well as others including academia, state climatologists, other state and local providers, and the private sector.

GFCS priority areas for application of climate services:

- Agriculture and food security
- Disaster risk reduction
- Energy
- Health
- Water

GFCS components and priority areas (https://gfcs.wmo.int/about-gfcs)

NWS Core Partners Definition

IDSS Directive 10-24 - April 9, 2019

NWS Core Partners are defined as government and non-government entities which are directly involved in the preparation, dissemination, and discussions involving weather, water, or climate related National Weather Service information that supports decision making for routine or episodic *high impact* events. These entities have a unique need for increased interaction with NWS personnel for provision of IDSS, or to facilitate their role in supporting the NWS mission.

NWS General Criteria for Core Partners:

- Directly involved in the preparation, dissemination, or discussion involving hazardous weather, water, climate, or other emergency information
- Possess a unique need for increased interaction with the NWS for IDSS
- Have an operational nexus necessitating mutual exchange of data/information to support each other's operations

For full definition of NWS Core Partners, please visit: https://www.nws.noaa.gov/directives/sym/pd01024curr.pdf

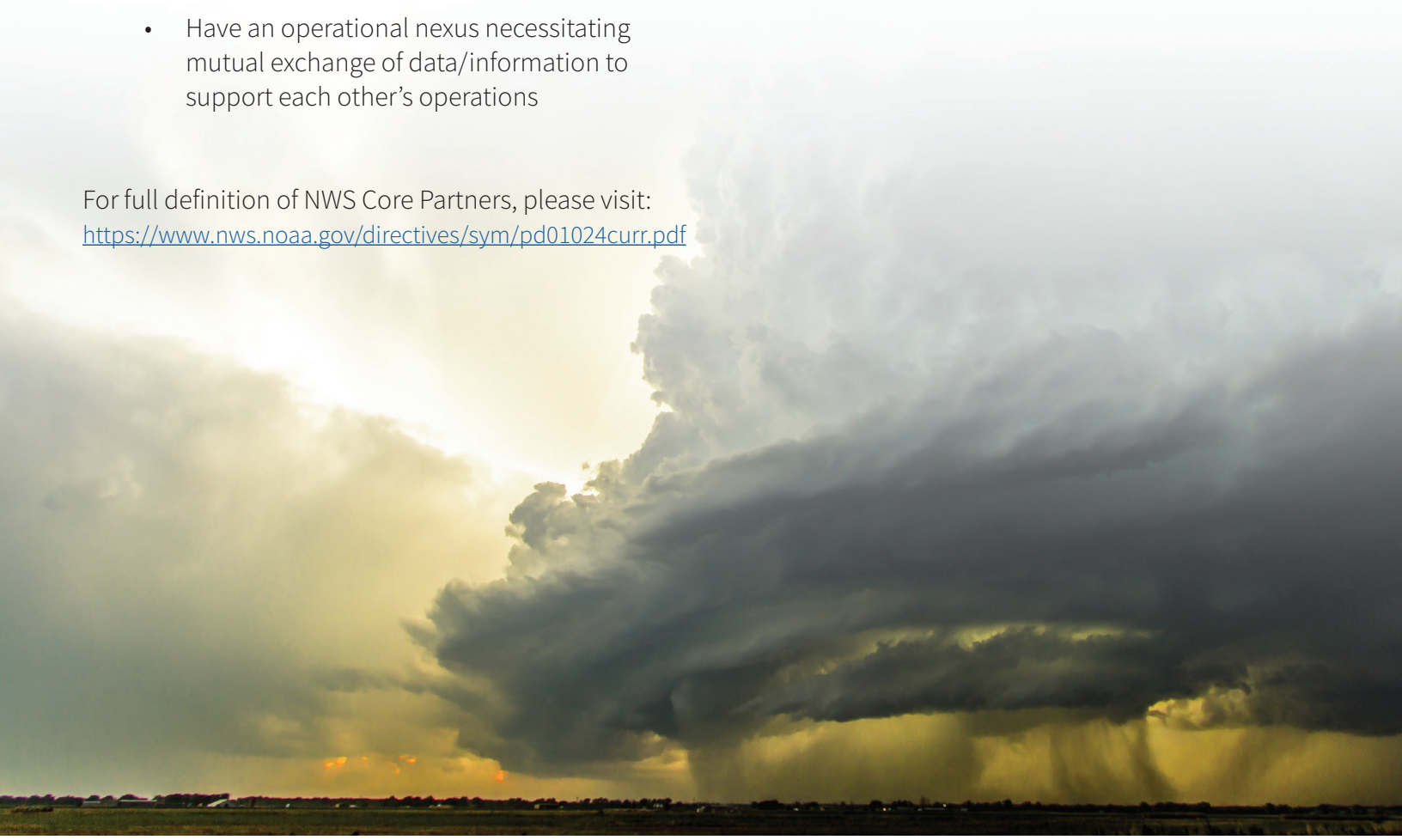
Climate Coordination Partnerships

NWS Climate Services partnerships may further be characterized as follows:

Upstream Partners: those who conduct applied climate research, develop and provide sector-specific and value-added data products, tools, and services.

Downstream Partners: those who coordinate with NWS on the use of climate science, data, products, tools, and services to support climate-sensitive decision making.

High impact - Any weather-dependent event that significantly impacts safety, health, the environment, economic productivity, or homeland security. No standard, nationwide criteria define a high impact event. It may impact millions of people or one sector, and it may vary in timing or location.



Historical Perspective

NWS has been providing the nation with climate services since the late 1800s. At that time, the Weather Bureau (the predecessor to NWS) was still expanding the Cooperative Observer Program network as mandated by the Organic Act of 1890. The nation continues to rely on NOAA/NWS as the neutral brokers of observations as we assess long-term temperature trends.

The Dust Bowl years of the 1930s led to the first concerted effort in long-range prediction. The first experimental monthly prediction was issued by the Weather Bureau in 1947, followed by seasonal predictions 35 years later. The passage of the National Climate Program Act in the mid-1970s led to the formation of the Climate Analysis Center in NWS in 1979, presently called the Climate Prediction Center, which provides national and global operational climate prediction, monitoring, and assessment products for timescales from weeks to years.

Further advances in extended and long-range prediction occurred over the ensuing decades as the prediction process gradually evolved from a largely subjective procedure to one that employs a more objective use of specific tools. The first results from operational modeling that coupled the atmosphere and the ocean became available in 1995.

Historical U.S. Weather Bureau Cooperative Observer Program Station (NOAA Library)

To enhance and improve NWS climate services capabilities at the regional and local offices, the Climate Services Division (presently called the Climate Services Branch) was established at NWS headquarters in 2000. In 2003, each NWS regional headquarters appointed a Climate Services Program Manager, and each local office appointed a Climate Services Leader. Together with the Climate Prediction Center, the national, regional, and local offices deliver climate services to users.

Dust Bowl of 1930s (NOAA Library)

SECTION 2: Climate Services Program

NWS Climate Services are distributed across the organization: national headquarters, national centers, regional offices, and local offices. While the majority of service delivery exists at the local office level and at the Climate Prediction Center, program management resides within the regional headquarters offices and the Analyze, Forecast, and Support Office (AFSO) at national headquarters.

Climate Services Program Core

Climate Services Branch

The Climate Services Branch (CSB) provides support and oversight of the NWS Climate Services Program and develops climate prediction operations plans, policies, and procedures. Its mission is to ensure NWS has the capacity to develop and deliver reliable climate services integrated with weather and water information through user engagement, policy development, data stewardship, facilitating the incorporation of research into operations, training, education, and outreach in collaboration with partners. CSB works with field offices and users to identify and validate climate services needs and establish operational requirements for climate observations.

Climate Prediction Center

The Climate Prediction Center (CPC) develops and delivers operational predictions of climate variability, provides real-time monitoring of climate and the required databases, and produces assessments of the origins of major climate anomalies. The products cover timescales from a week to seasons, extending into the future as far as technically feasible, and cover the land, the ocean, and the atmosphere, extending into the stratosphere.

Climate Services Program Managers

The Regional Climate Services Program Managers (CSPMs) support NWS local offices as the liaisons to NWS national headquarters and national centers, ensuring local compliance to NWS climate services policies and providing applied science, technologies, tools, communication, and training to local offices. CSPMs also initiate, coordinate, and foster regional partnerships and climate services activities.

Climate Services Leaders

The local NWS offices are the most common points of entry for users requesting information. Climate-related requests would most often be referred to the Climate Services Leader (CSL) within the local NWS office. However, the provision of climate services is a team effort, often requiring participation from several members in the office. The CSL leads the local office climate team, which delivers climate outlooks, analyses, and observations, and provides local interpretation of CPC products. The CSL works with the entire local office climate team ensuring the integrity of observations; serving as an expert for local, state, and tribal decision makers; and acting as a local liaison between NWS and NOAA partners.

Service Program Team

The Forecast Services Division, within NWS AFSO, is home to the eleven National Service Programs (NSP). Each NSP has a corresponding Service Program Team (SPT) responsible for capturing, vetting, and becoming a champion of proposed field requirements, providing programmatic input into the Annual Operating Plan process, reviewing and making approval decisions for Experimental Products and Services (supporting the Products and Services Change Management Process: NWSI 10-102), and providing the service delivery portfolios with subject matter expertise regarding innovation context and research transition.

Members of the Climate SPT include representatives from:

- Climate Services Branch (lead)
- Climate Services Program Managers
- Climate Prediction Center
- Water Resources Services Branch
- Office of Science and Technology Integration
- NWS International Affairs Office

AFS National Service Programs

- Aviation
- Climate
- Fire Weather
- Marine
- Public
- Severe Weather
- Space Weather
- Tropical
- Tsunami
- Water Resources
- Winter Weather

Additional Supporting Offices

National Centers for Environmental Prediction

The National Centers for Environmental Prediction (NCEP) Centers analyze and project short-term climate fluctuations on a regional and worldwide basis, identify significant climate anomalies, and provide current climate information to users. NCEP Centers also develop and produce oceanographic products and guidance; provide weather support for special aerospace and satellite operations; perform research and development to improve its climatic, hydrologic, meteorological, space weather, and oceanographic products; develop plans and provide direction for improving products; and advise leadership of new capabilities resulting from new techniques or procedures.

In addition to CPC, two other NCEP Centers provide direct support to the NWS Climate Services Program:

Environmental Modeling Center

The Environmental Modeling Center (EMC) improves numerical weather, marine, and climate predictions through a broad program of research in data assimilation and modeling. In support of the NCEP operational forecasting mission, EMC develops, improves, and monitors data assimilation systems and models of the atmosphere, ocean, land surface, sea ice, and coupled system, using advanced methods developed internally as well as cooperatively with scientists from universities, NOAA laboratories and other government agencies, and the international scientific community.

NCEP Central Operations

The NCEP Central Operations (NCO) sets the standard for information technology excellence for the NWS. NCO serves as a valued technical asset for NWS and NOAA in defining and accomplishing mission goals. NCO executes the NWS operational model suite, creating climate, weather, ocean, space, and environmental hazard products. It manages improvements to the NWS/NCEP model suite including supporting research, development, and transition of new or enhanced models to operations. It develops meteorological software used by the NCEP Centers to create forecaster generated products. NCO manages the flow of data and products to and from the NWS including NCEP Centers, partners, and customers.

Office of Water Prediction

The Office of Water Prediction (OWP) collaboratively researches, develops, and delivers state-of-the-science national hydrologic analyses, forecast information, data, decision support services, and guidance to support and inform essential emergency services and water management decisions. In partnership with NWS national, regional, and local offices, OWP coordinates, integrates, and supports consistent water prediction activities from global to local levels.

OWP's operational unit is the National Water Center (NWC), which is located in Tuscaloosa, Alabama. Within the NWC, the Water Prediction Operations Division (WPOD), in collaboration with NOAA field offices and other federal water agencies, is responsible for the delivery of forecast guidance and analyses, as well as inundation information for hydrologic events in the United States. This information is leveraged by NCEP, as well as the River Forecast Centers (RFCs) and Weather Forecast Offices (WFOs) for their official outlooks, forecasts, watches, and warnings, information on flash and riverine flooding, water resources outlooks, and providing IDSS to inform emergency and water resources management decisions.

NWS National Headquarters Portfolio Offices

The Office of Science and Technology Integration (STI) supports the Climate Services Program by analyzing requirements for service improvements from NWS field offices and CPC through close coordination with AFSO; develops potential scientific and technological solutions through coordination with partners within NOAA and with the external research community; and sponsors applied research and development of programs and projects to address these requirements. This includes providing project management for the development of the Local Climate Analysis Tool (LCAT). STI plays a key role in the adjudication and, in most cases, the development of projects submitted through the NWS/Oceanic and Atmospheric Research (OAR) Service Level Agreement for Climate.

The Office of Observations (OBS), Office of Dissemination (DIS), and Office of Central Processing (CP) also have linkages to the Climate Services Program. OBS supports the many observing programs, including the Cooperative Observer Program (COOP), by deploying and maintaining various sensors and ensuring that new sensors meet requirements for climate continuity. DIS provides web and dissemination services for public access to climate data, products, and tools.

CP runs various climate models, such as the Climate Forecast System (CFS), and maintains and upgrades climate programs within the Advanced Weather Interactive Processing System (AWIPS) for data integration and product development.

NWS Operations Center

The NWS Operations Center's (NWSOC) primary responsibilities are to organize and maintain two-way communications between senior leadership and the field, provide NWS Continuity of Operations planning, and support NWS liaisons that are embedded at the agencies of Federal Core Partners. The NWSOC supports climate services by serving as a dissemination mechanism for climate information to both the local offices and senior leadership. The NWSOC coordinates with NWS Regional Operations Centers (ROCs) and the NWS National Centers, including CPC by reporting out on S2S outlooks and related major climate anomalies.

SECTION 3: Local Offices

The core of the NWS Climate Services Program resides at the local offices. Although the WFOs are the primary public interface for NOAA, RFCs and Center Weather Service Units (CWSUs) provide focused climate services for Core Partners, specializing in hydrology and aviation respectively. While much of this document deals with the interface and structure of WFOs in climate services, RFCs and CWSUs may have similar operational functions and demands. The local offices have five primary climate services functions to which all activities can be tied.

- Deliver climate information and services to users as the primary local interface for NOAA
- Serve as the steward and conscience for the integrity of the historical climate record
- Participate in NWS climate analysis, monitoring, and prediction activities
- Support the NOAA mission of having a ready, responsive, and resilient nation to extreme weather, water, and climate events
- Provide climate-focused IDSS to NWS Core Partners

Local Office Climate Team

Local NWS offices are the most common points of entry for customers and partners needing climate-related information. This requires a team effort from the entire local office in order to provide the best climate information and decision support services. The CSL is the team member who would most often respond to climate-related requests; however, all members of the local office play an important role in fulfilling the NWS mission as it relates to climate and achieving a Weather-Ready Nation. The whole-office team concept should be employed where all members of the office are adept in responding to climate requests and are cognizant of other NWS and NOAA climate resources available in their area.

Although all members of the local office should be able to provide basic climate services, significant contributions are provided by members of the local office climate team.

- Meteorologist-in-Charge (MIC)/ Hydrologist-in-Charge (HIC)
- Science and Operations Officer (SOO)/ Development and Operations Hydrologist (DOH)
- Warning Coordination Meteorologist (WCM)/ Service Coordination Hydrologist (SCH)
- Service Hydrologist (SH)/ Hydrology Focal Point (HFP)
- Observing Program Leader (OPL)/ Data Acquisition Program Manager (DAPM)
- Climate Services Leader (CSL)

MIC/HIC

The role of the MIC/HIC is to ensure local office personnel support NWS' and NOAA's mission to deliver climate services.

- Identify and support the CSL function
- Include climate program development in local office goals
- Promote education and training for CSL and local staff in climate services

- Ensure resources are allocated for climate services at the local level, including travel and outreach intended for participation in climate-related conferences and workshops
- Support local office participation in developing and using climate analysis tools
- Support staff to ensure proper siting, relocation, installation, maintenance, and use of equipment at climate observing sites
- Support local office data stewardship practices
- Support local office participation in CSB and regional climate services activities
- Support local office initiatives to help inform communities, businesses, and governments of important climate information and support Core Partners in making climate-related decisions

SOO/DOH

The role of the SOO/DOH, in coordination with the CSL, is to provide guidance in technical areas (e.g., the use of technologies and tools in local climate studies), ensure scientific rigor is maintained, and safeguard data integrity in the conduct of office activities.

- Provide applied science, tools, and training to support local office climate products and services
- Offer guidance and assistance to the CSL on local climate studies
- Support development of techniques for the local office to use in generating local climatologies and assist in testing and evaluation of new climate products and services
- Maintain professional competency through NWS training in climate services for staff in field offices

WCM/SCH

The role of the WCM/SCH is to contribute to the climate services mission through extensive familiarity with the local community they serve in their day-to-day operational weather responsibility. Their experience in local outreach can be applied as they collaborate with the CSL in reaching climate users, particularly Core Partners in need of climate-focused IDSS.

- Conduct climate-related outreach activities including public awareness of local climate impacts
- Participate in NOAA climate communication activities
- Support the CSL in coordinating, integrating, and delivering NWS climate products and climate-focused IDSS
- Work closely with the CSL to educate local customers and partners on the science of climate variability and change and support Core Partners in making climate-related decisions in their community

SH/HFP

The SH/HFP is responsible for understanding the hydrologic conditions of the local WFO area and maintains relationships with water resources managers. The SH/HFP can aid the CSL in ways similar to the WCM and SOO, with a primary focus on the hydrologic aspects of climate services.

- Advise the CSL on how climate-scale rainfall/snowfall surplus or deficit impacts local water resources
- Work with the CSL on climate studies focused on precipitation and associated impacts to the water resources community
- In times of drought, assist the CSL with local Drought Information Statements (DGT), outreach efforts, weekly input for the U.S. Drought Monitor, and local studies
- Support local water resources Core Partner needs in making climate-related decisions

OPL/DAPM

The role of the OPL/DAPM is to oversee the operations and maintenance of data collection for the climate record in WFOs and Weather Service Offices (WSOs). The CSL and the OPL/DAPM maintain a close working relationship and coordinate on all issues related to climate data.

- Ensure climate observations and related metadata, data continuity, and data quality control activities are fully coordinated with partners and conform to NWS policy
- Ensure proper siting, relocation, installation, maintenance, and use of equipment at climate observing sites
- Routinely communicate with users, Core Partners, and the regional CSPM on issues related to ensuring the integrity of the climate record and user requirements
- Serve as data stewards in the collection, quality control, and dissemination of climate data
- Remain up-to-date on new NOAA climate products and services and relay pertinent news and tools to local staff
- Promote NOAA climate products, services, and education and outreach activities at the local level
- Conduct local climate studies using nationally provided analysis tools (See Section 8)
- Understand content, use, and location of CPC products (see Appendix B) and educate local office personnel and community partners on proper interpretation
- Educate and provide outreach to local customers on the science of climate variability and change
- Enhance climate-focused IDSS activities by integrating climate information for assessment of long-term risks of severe weather events and attribution of climate variability and change
- Respond to climate inquiries from local users

CSL

The role of the CSL is to lead the local office climate team, which includes the delivery of climate outlooks, analyses, and observations, and providing local interpretation of CPC products. The CSL works with the entire local office climate team ensuring the integrity of observations; serving as an expert for local, state, and tribal decision makers; and acting as a local liaison between NWS and NOAA partners.

- Develop and maintain relationships with Core Partners and provide climate-focused IDSS as needed

Climate Services Program at the Local Offices

Local offices are the primary interface for users of NWS climate information and services. They work hand-in-hand with Core Partners to support decision making when climate impacts life and property.

- Provide climate data and product interpretation to Core Partners to better inform their decisions affected by climate variability and change
- Build strong and trusted relationships with Core Partners primarily impacted by climate variability and change
- Provide climate variability and change insights with respect to impacts on weather and water conditions in the local area of responsibility
- Provide climate context for current weather events through comparisons with historical records, normals, and other statistics
- Work with Core Partners in emergency response exercises, drills, and simulations related to adaptation and mitigation due to a changing climate

Local offices will respond to partner and customer requests for IDSS and coordinate those requests with the regional CSPM and CSB.

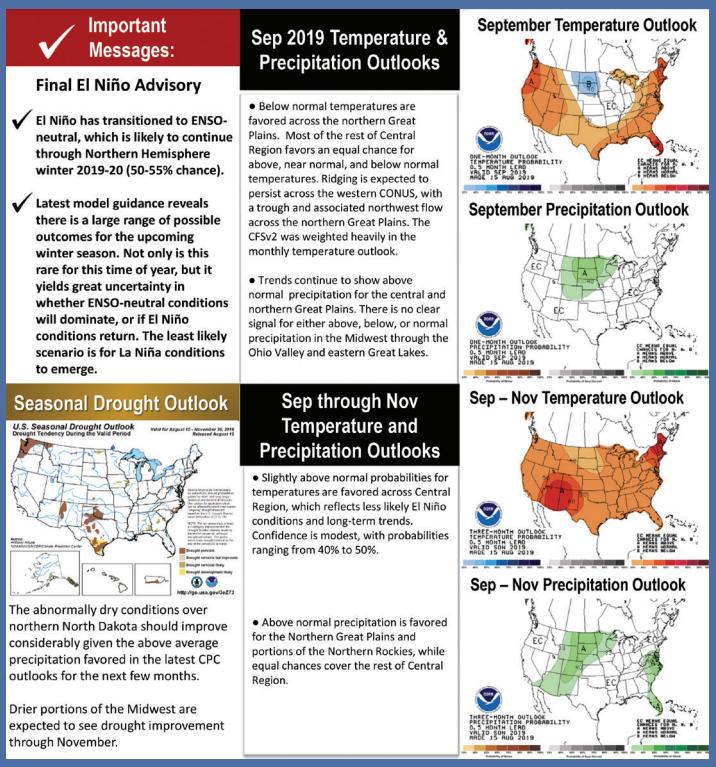
Many climate-related events that require the application of IDSS often transcend the established boundaries of a single WFO. In such cases, where several WFOs are affected, a response at the state or regional level may be more appropriate. Enlisting coordination through the CSPM, the affected Regional Operations Center (ROC), and CSB would ensure a team-led consistent response.

Examples of Climate Services at S2S Timescales

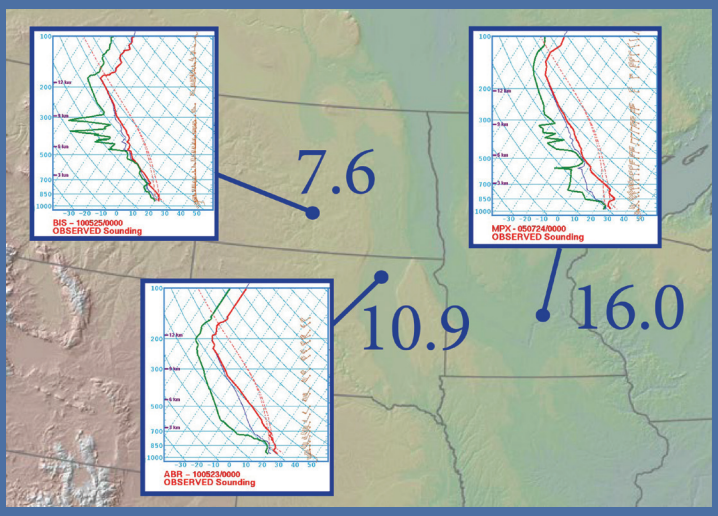
Sectoral Communities

Core Partner systems that wisely use climate information can make better informed decisions at policy, institutional, and community levels. This helps to improve efficiency of resources and serves to increase production in areas such as agriculture. In order to assist meeting these goals, Central Region publishes a monthly climate summary for a broad ranges of users, including the agricultural community. The summary contains interpretative services for pertinent CPC forecasts, including monthly and seasonal temperature and precipitation outlooks, El Niño/Southern Oscillation (ENSO) predictions, and the U.S. Seasonal Drought Outlook.

– Shawn Rossi, NWS Hastings, and Ray Wolf, NWS Quad Cities



Example of Central Region Climate Outlook



The numbers indicate the highest observed Significant Tornado Parameter values for the associated soundings during the period of study

Disaster Risk Management

On average, nearly 125 tornadoes occur per year in the Northern Plains region of the United States. Understanding these frequently occurring disasters is essential in order to prepare for them. To assess the probability of a tornado occurring given certain environmental conditions, WFO Bismarck performed a study on the climatology of tornadoes in the Northern Plains states of North Dakota, South Dakota, and Minnesota. Using an environment analog-based approach, they examined multiple parameters of atmospheric soundings to correlate how specific conditions relate to tornado occurrence. Assessing risk of significant tornadoes provides for opportunities of training, simulation, and community preparedness for such events.

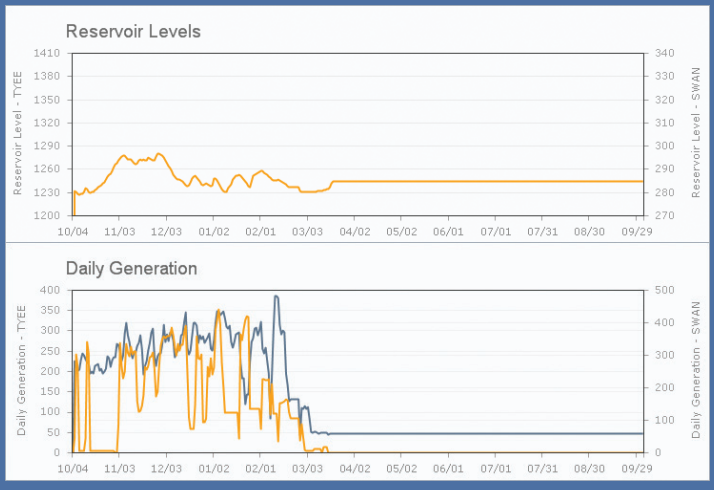
– Chauncy Schultz, NWS Bismarck

Community Outreach

Native communities in Western Alaska face many challenges related to the local climate. The harsh environment generates many threats, such as coastal storm flooding, high wind events, erosion, icing, and permafrost thawing. In order to bring native communities into a more modern era of understanding and predicting climatic variations, a partnership between the NWS Alaska Region Office, the Alaska Institute for Justice, and the Alaska Division of Geological and Geophysical Surveys was formed. The goals of this partnership consist of informing communities of environmental trends, preparing them for threats, and advocating for their rights. Each organization provides a different aspect of assistance. NWS Alaska Region Office delivers climate information that is helping native communities adapt to rapidly changing environmental conditions, such as coastal flooding, coastal erosion, and sea ice extent.

– Rick Thoman, Alaska Center for Climate Assessment and Policy

Example of coastal erosion in Alaska



Reservoir levels compared to daily generation of hydropower

Hydro Power Generation

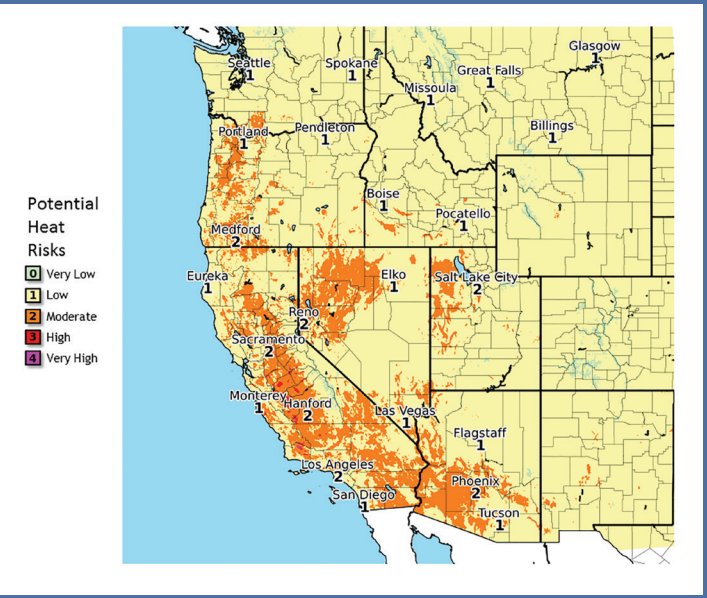
The NWS Forecast Office in Juneau, Alaska is providing weekly drought situational reports to Core Partners in the Metlakatla Indian Community to help manage their fragile water supply and prepare the community for their energy needs. In the southern half of Southeast Alaska, rainfall and multi-year snowpack deficits have left communities with less water to generate power from hydro-power generators. The drought conditions have led to the shutdown of many hydro-power generators that are being replaced with expensive diesel generators, increasing the costs to customers. The community of Metlakatla, the only Native reservation in Alaska, has seen the worst of the drought conditions and has requested increased decision support from the NWS in order to better handle their energy challenges.

– Aaron Jacobs, NWS Juneau

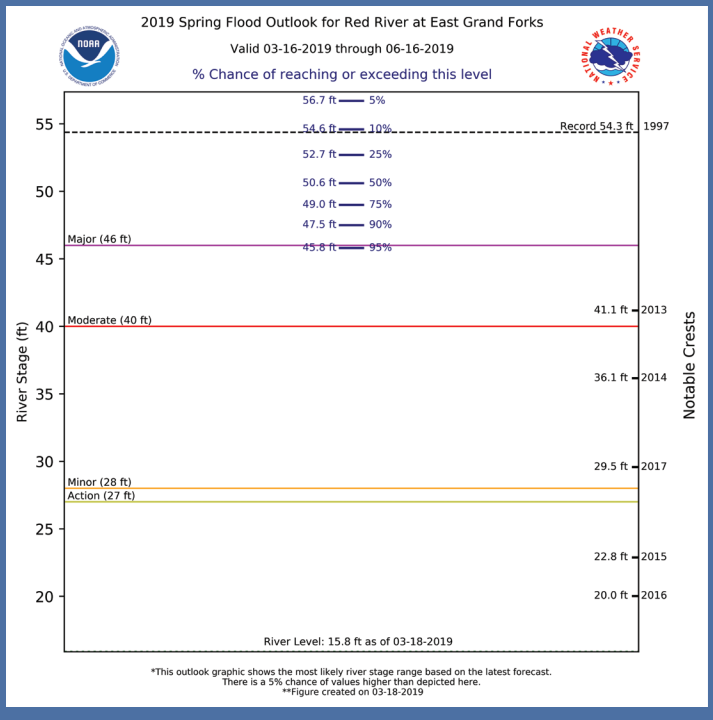
Health

Heat has been the leading cause of weather-related fatalities in the United States since recording began in 1986. The NWS Western Region produces HeatRisk, a forecast that provides numerical potential heat risk thresholds and colors for specific locations in the United States. Four different thresholds are delineated within the HeatRisk product to exhibit progressive levels of risk (low, medium, high, very high). Many factors go into determining the levels of risk, including temperature difference from the average, time of year, expected duration of abnormal heat, and risk of health-heat complications. The HeatRisk page also informs visitors of the groups most at risk, such as the elderly, the very young, and those working outdoors. It is used by partners in many sectors, such as the media, hospitals, and schools.
[https://www.wrh.noaa.gov/wrh/heatrisk/]

– Paul Iniguez, NWS Phoenix



Western Region's HeatRisk product



Outlook graphic showing most likely river stage range based on the latest forecast

Water Resources

The Red River of the North experiences flooding regularly, with major flooding occurring along its main stem in 45% of all years in the record. Core Partners in this region had a desire for a new style of flood outlook forecasts, focused on the spring snowmelt season. WFO Grand Forks developed a new product, with the goal to better communicate probabilities for understanding of flood risk. After multiple collaboration sessions with partners for feedback on the current Advanced Hydrologic Prediction System (AHPS) flood outlook products, they created the Probabilistic Flood Outlook Summary, which displays the probabilities of 95%, 90%, 75%, 50%, 25%, 10%, and 5% of reaching certain river stages in a brand new graphical format. The product was met with a great response from partners, and there are plans to make a new online interface and expand the program to more locations along the Red River in coming years.
[https://www.weather.gov/fgf/PFOS]

– Ryan Knutsvig, NWS Grand Forks

Partnerships

Local office staff members are encouraged to develop close working relationships with their local internal and external climate partners and familiarize themselves with existing and new climate services at NOAA centers and laboratories.

- Engage local Core Partners and other stakeholders in the development and delivery of climate services and identify opportunities for joint activities
- Promote NWS climate products, services, and outreach activities to the local climate community
- Support partner needs for climate-related decision making toward protection of life and property

Communication

CSLs should ensure clear communication with both internal and external partners and stakeholders.

- Communicate regularly with the CSPM to remain current on emerging NWS climate services initiatives and promote local-level climate priorities and needs
- Identify and request resources required to respond to local user needs from local office management or regional CSPMs
- Inform NOAA and Core Partners on emerging climate projects, products, and initiatives
- Follow the existing policy for communicating requirements and feedback as per NWSI 10-102, "Products and Services Change Management" process
- Subscribe to the NWS climate services and local Regional Integrated Sciences and Assessments (RISA) listservs
- Join the U.S. Drought Monitor and NIDIS listservs
- Participate in CPC's NWSChat room as a means to interact with CPC forecasters

NWS Climate Services Listserv

The NWS Climate Services e-mail listserv provides an internal forum to coordinate and communicate climate-related information, questions, and announcements. Individuals can sign up easily, send messages, receive posts automatically, and begin searching through previous archived conversation threads. Examples of posts include meeting announcements, training opportunities, new research and papers on climate, and general questions (and answers) about climate. Join the nws_climate listserv at: [https://infolist.nws.noaa.gov]

Social Media as an avenue for delivery of climate-related information

Social media has proven to be a powerful tool for local offices to convey climate-related information to customers and partners. One of the most effective ways to elicit actionable responses from users is to provide climate context to events by making comparisons to extreme or historical conditions. CSLs should work closely with the local office climate team and social media focal points to ensure climate-related information is properly communicated. This may encompass providing recurrent local climate information graphics or interpretations of National Center outlooks. Any local interpretation of S2S outlooks provided for public consumption must remain consistent with the National Center forecast through open communication with the official producers.

Outreach & Education

- Provide information to users on new climate products and services, and know where to refer customers for additional information on complex climate questions
- At the request of CSB or the CSPM, participate on regional and national external climate teams as an expert from a local perspective
- Support climate literacy with local educators through the NWS Education Program and NOAA Office of Education
- Conduct activities at the request of educators in the local area of responsibility in coordination with the WCM
- Educate local users on science of climate variability and change

Conduct outreach and education in the local area of responsibility on climate products, data, and information

For the local office outreach program, the WCM and the CSL should ensure climate information is included in any outreach and educational materials and activities. Packaging climate information with the meteorological and hydrological outreach programs is a natural fit and should be encouraged. Activities such as school talks and meetings with local constituent groups are excellent entry-level outreach and education efforts.

Ensure local webpages are routinely updated

The CSL, information technology staff, and webmaster should ensure the local climate web pages, including the Local Data/Records section, are updated on a regular basis.

Organize climate awareness events in support of local communities

Climate events, such as El Niño and La Niña, may significantly impact local climate. To ensure local, state, and tribal governments and businesses are informed about such events and equipped to mitigate the impacts, CSLs should conduct climate awareness outreach activities.

Participate in other outreach activities

Additional outreach activities include supplying climate factsheets to the public and discussing local applications with Core Partners and stakeholders. Such discussions may include how drought impacts the area, the current seasonal hurricane/typhoon outlooks, and the effect of ENSO and other teleconnections on local weather patterns. Offices should include climate topics when conducting workshops targeted to local audiences (media, agriculture sector, energy, emergency managers, water resources managers, etc.) to inform users on the potential uses of climate resources and to gather feedback on products and services.

Requirements

Evaluate user needs and make recommendations for products and services

CSLs should establish trust with local users and Core Partners through frequent interaction and identify local needs for climate information. They have access to national and local climate data and established methods for climate analysis, and can conduct initial investigations to establish the science-based capacity for responding to specific user needs. CSLs should report findings and make recommendations on local user needs to the regional CSPMs and CSB for further review and action.

- Monitor customer feedback when making product and service enhancements
- Integrate Core Partner information on local user needs
- Solicit feedback from customers on improving existing (and design for new) climate services and products
- If a specific need or product enhancement is necessary, coordinate through the CSPM and follow the NWS Capability and Requirements Decision Support (CaRDS) process

Maintain office procedures to support local climate services

To maintain local office climate services continuity and ease the transition for newly appointed CSLs, each CSL should maintain a local office guide containing useful documents.

- Latest version of the NWS Regional and Local Climate Services Delivery Operations Document
- Information on local climate services tools (e.g., Datzilla, xmACIS, LCAT, and others)
- List of climate contact points and partners
- Directory of useful web links, including climate services directives
- Reference to useful presentations and publications
- Climate services training and education resources
- Job sheets for various tasks using the AWIPS climate program (such as the process for correcting data) or other programs
- Factsheets and brochures [weather.gov/climateservices/print]

Maintain local office climate program requirements within the office Station Duty Manual (SDM)

To maintain a reference on national directives pertaining to the local office climate policy, the CSL should author (or provide information to the author of) chapters related to climate services in the local office SDM.

- References to applicable NWS Directives
- Local office-specific climate services requirements and best practices
- Examples of routinely-issued climate products

Data Services

Local offices are the stewards for the data that serve as the nation's climate record. The MIC or HIC has overall responsibility for the successful collection of accurate climate data and takes action when necessary to ensure the integrity of the climate record.

However, on a day-to-day basis, this critical climate function should be shared by the CSL and the OPL/DAPM. The OPL/DAPM oversees the operations and maintenance of data collection for the climate record. The CSL and the OPL/DAPM, with the support of the local office climate team, must maintain a close working relationship and coordinate on all issues related to climate data. The team ensures climate observations and related metadata, data continuity, and data quality control activities are fully coordinated with partners and conform to NWS policy and needs. The team routinely communicates with customers, climate services partners, and the regional CSPM on issues related to ensuring the integrity of the climate record and customer requirements.

Local Climate Data Experts

- Serve as data stewards in the gathering and quality control of climate data that meet national standards for dissemination
- Respond to customer inquiries regarding the collection and interpretation of climate data and products
- Act as the local expert on complementary data, such as local mesonet data, and understand details on mesonet data accuracy (instrumentation, exposure, and maintenance)
- Provide local expertise (when needed) to the National Centers for Environmental Information (NCEI)/State Climate Extremes Committee if a potential state meteorological value record has been observed; coordinate with the state's State Climatologist and adjacent WFOs
- Provide data summaries in response to local user inquiries utilizing data records available through NOWData, xmACIS, and other data tools

- Work closely with NCEI to ensure that the Global Historical Climate Network (GHCN) data are correct for all locations within a County Warning Area (CWA) or Hydrologic Service Area; when needed, corrections are made using the Datzilla system

Climate Observing Requirements and Policy

The CSL coordinates with the OPL/DAPM to ensure data quality from the point of observation through the point of delivery. This includes site support for COOP stations and training for observers, as well as the collection, quality control, archiving, and dissemination of secure and accurate observations.

- Understand NWS Climate Data Services policy and Climate Records policy (NDS 10-1003 and NDS 10-1004)

- Ensure compliance with NWS web policy with respect to climate information (NDS 10-1003), including the labeling of NWS data as "preliminary" and not freely distributing value-added data products for which NCEI charges a fee for cost recovery

- Provide weather observers and their staff with proper tools and training required to ensure the collection of accurate and consistent climate data at all sites in compliance with NWS observation policies and customer needs

Climate Data Quality

- Ensure integrity of the data record by following quality control policies; ensure that daily, monthly, seasonal, and annual climate summaries for key locations are disseminated

- In coordination with the CSPM, serve as the liaison between local office-specific quality control activities and NCEI, the Regional Climate Centers (RCC), and State Climatologists (SC), and ensure problems are identified and solutions implemented

- Leverage Quality Assurance/Quality Control (QA/QC) tools provided by partners such as the ACIS Climate Data Comparison Tool [http://acis-compare.rcc-acis.org/] and data correction tracking system Datzilla [http://datzilla.srcc.lsu.edu/datzilla/] to report erroneous records

- Coordinate with the regional CSPM, CSB, and NCEI on updating and expanding ThreadEx to provide a longer period of record for data extremes (see page 35 for more on ThreadEx)

Climate Data Continuity

The CSL and local office climate team may be requested to participate in plans for conducting overlapping observations with other climate services partners. The team also ensures that customers are advised of pending changes at long-standing climatological data stations that can introduce data discontinuities (e.g., station moves, instrument changes, etc.).

The team ensures:

- Impacts of proposed changes are understood and options considered before implementation

- Requirements for overlapping observations are addressed

- Any changes (planned, accidental, or natural) are adequately and appropriately documented in metadata

- Customers are advised in a timely fashion of pending and completed changes

The team may also be requested to:

- Serve as the focal point for data continuity issues

- Monitor and oversee changes to observing systems supporting the climate record, including coordinating changes with climate partners

Climate Analysis, Monitoring, and Prediction Activities

Monitor, assess, and communicate the state of the climate, including variability and change, and potential local impacts

CSLs should monitor global-scale weather and climate events with support from the regional CSPM and CSB. Information gained through this analysis, along with National Center forecasts, can be used in the delivery of IDSS on S2S timescales.

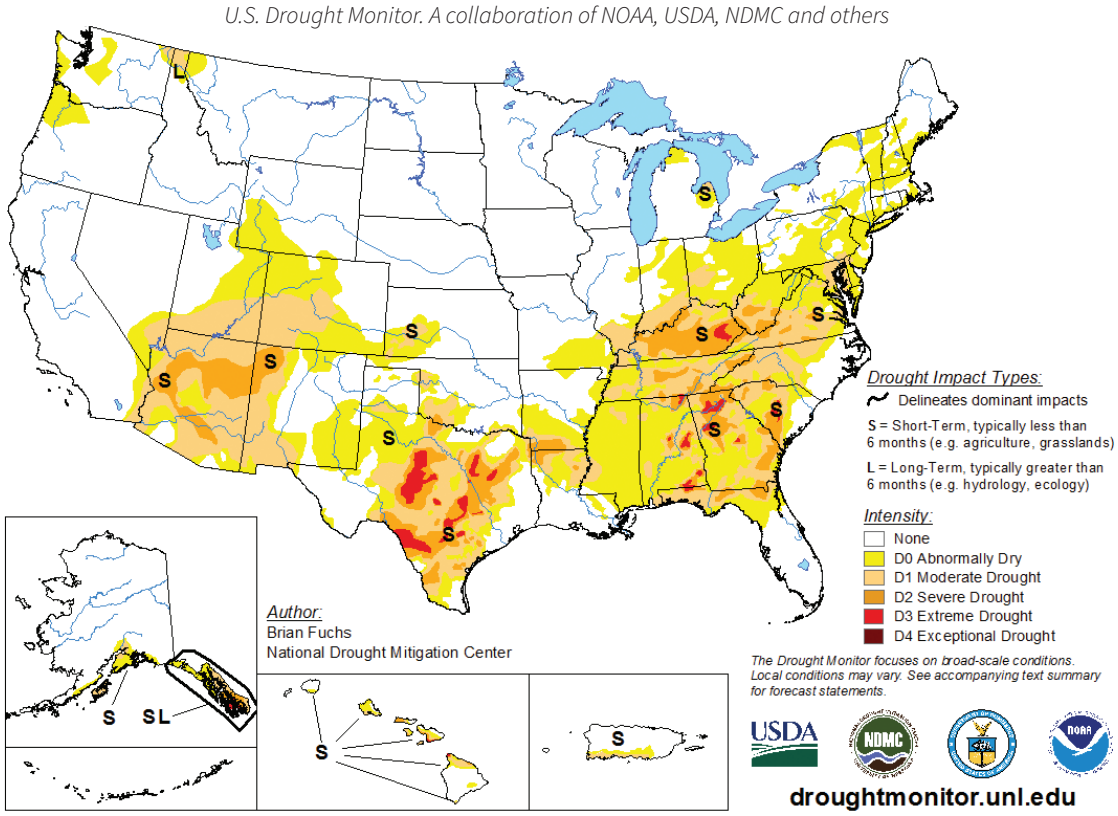
- Assess global domain satellite imagery
- Monitor the global-scale circulation and other teleconnections
- Review other source material from National Centers, including forecasts and outlooks, discussions, bulletins, and updates

Monitor the status of drought or excessive rainfall, temperature anomalies, and other parameters (e.g., evapo-transpiration)

During periods of insufficient or excessive precipitation, extreme temperature anomalies, or other unusual climate situations, the local office climate team maintains up-to-date information regarding the status of specific events and provides local insights to the CSPMs and National Centers. This information may be used in national products (such as the U.S. Drought Monitor) or in local information releases such as a Public Information Statement (PNS). For drought periods, the DGT is used to convey relevant information on local impacts and current water resources.

Products

- Remain current with changes in NWS climate products and services
- Participate in NWS climate analysis, monitoring, and prediction activities (e.g., CPC seasonal outlooks and hazards assessment, U.S. Drought Monitor, and others)



Local Climate Studies

- Identify sensitivity of local weather and water conditions to climate variability and change
- Provide guidance and expertise for climate data continuity studies
- Translate climate analysis and prediction into relevant context for actionable decisions by Core Partners for protection of life and property

Identification of sensitivities often requires additional background studies by the CSL. Climate studies at scales important to NWS local users reveal important relationships and information unavailable through CPC national products. Such information could include long-term statistics of local climate variables (averages, variability, rate of long-term trends, etc.), probabilities for future weather and/or climate events, or the historical climate context of weather events for mitigation and adaptation practices.

Climate studies should be conducted using methodologies consistent with CPC practices, which are available in LCAT. LCAT is an online statistical tool that can be used by local offices to access data and perform local climate analysis studies responding to user requests and inquiries. The LCAT dialog interface allows users to specify data and analysis methods for studying the local rate of climate change, local climate variability impacts, and local drought severity and water resources applications.

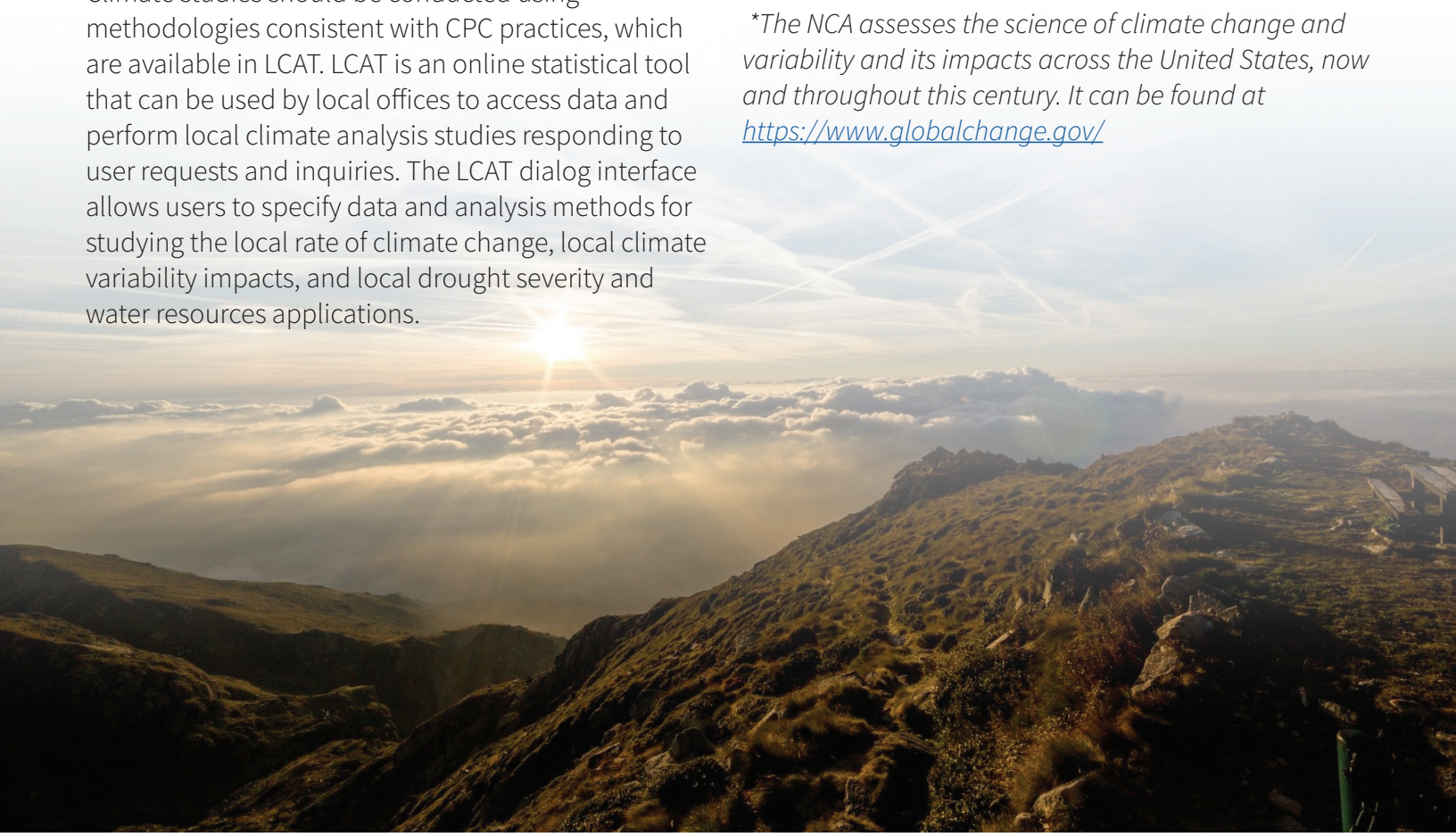
The CSL is encouraged to share the results of local studies through peer-reviewed papers, regional and national conferences, as regional technical attachments, or as online posts for the general public. See Section 8 for more information about LCAT.

Develop expertise in local climate variability and change

CSLs can use the extensive NWS formal training available from CSB and the NWS Training Center (see Section 6 for more information) and review literature on regional and local climates. Routine participation in climate-related conferences and workshops will allow CSLs to network, learn, develop ideas, and explore new techniques for communicating climate issues to users more effectively.

CSLs should be the local office climate team expert concerning the National Climate Assessment (NCA)* and in particular chapters pertaining to their respective regions and climate regimes. Where applicable, CSLs should convey this information and educate decision makers within their communities towards building a climate-resilient nation.

**The NCA assesses the science of climate change and variability and its impacts across the United States, now and throughout this century. It can be found at https://www.globalchange.gov/*

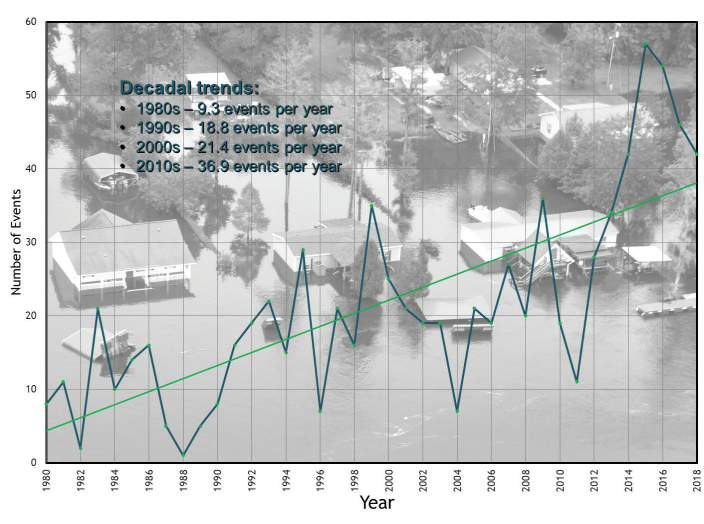


Examples of local climate variability and change studies by the local offices

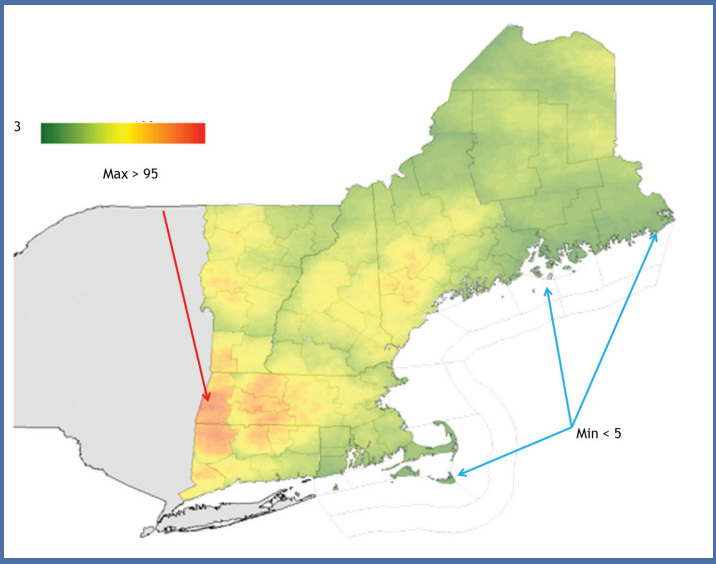
Trends in Coastal Flooding

In recent years, coastal flooding has caused significant, negative economic impacts and damage to infrastructure along the East Coast of the United States. The City of Charleston, SC is located on a peninsula, making it especially prone to flooding. Using National Ocean Service records, WFO Charleston documented a climatology of flood events that surpassed a level of 7.0 feet on the MLLW (Mean Lower Low Water) scale, and found an increasing trend in the number of such floods per year.

– Emily McGraw, NWS Charleston



Charleston, SC coastal flood events by year (7.00 ft MLLW or higher)



Severe Thunderstorm Warnings, New England, 2008 to 2014

A Climatology of Severe Thunderstorm Warnings

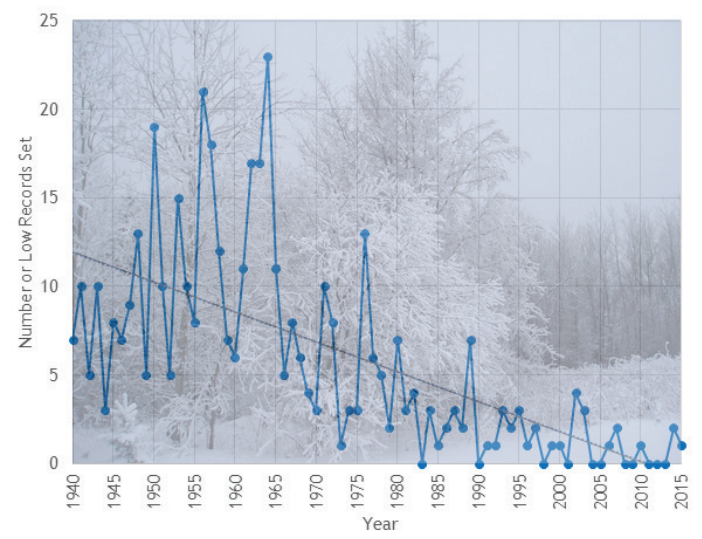
Studying the climatology of severe weather helps promote preparedness and the safety of residents in a County Warning Area. A study of the New England area identified severe weather hot spots and trends in the frequency of severe thunderstorm warnings using GIS polygons of severe thunderstorms events. The study revealed areas of improvement for issuing warnings in a CWA, such as better understanding artificial warning minima along CWA boundaries.

– Chris Kimble, NWS Portland/Gray

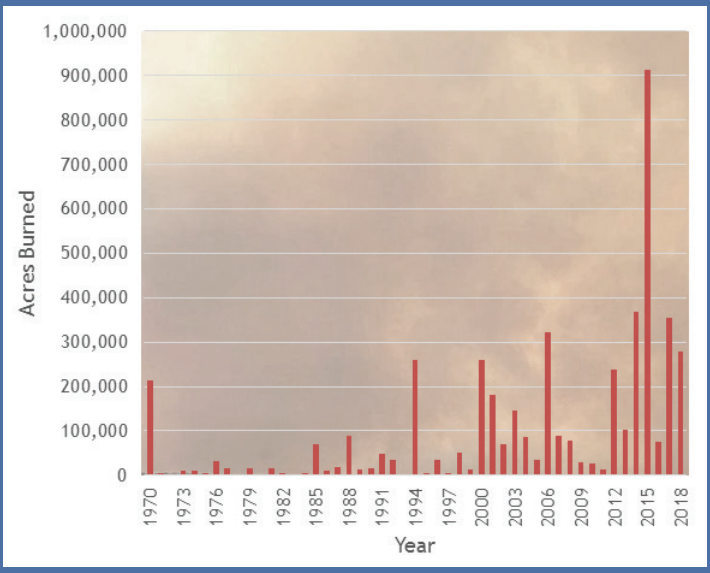
Assessing Temperature Trends

Motivated by social media reports of extreme temperatures in Portland, ME, NWS Gray performed a statistical study to analyze whether any observable temperature trends were occurring. Although there is no clear trend in the number of record highs being set, a downward trend and strong correlation in the number of record lows was discovered. One of the most important aspects of NWS climate observing is the reporting of daily record highs and lows. Daily climate records help to place extremes within a historical context.

– Chris Kimble, NWS Portland/Gray



Record low temperatures in Portland, ME



Wildfire acres burned in Spokane, WA area

Fire Season Climatology

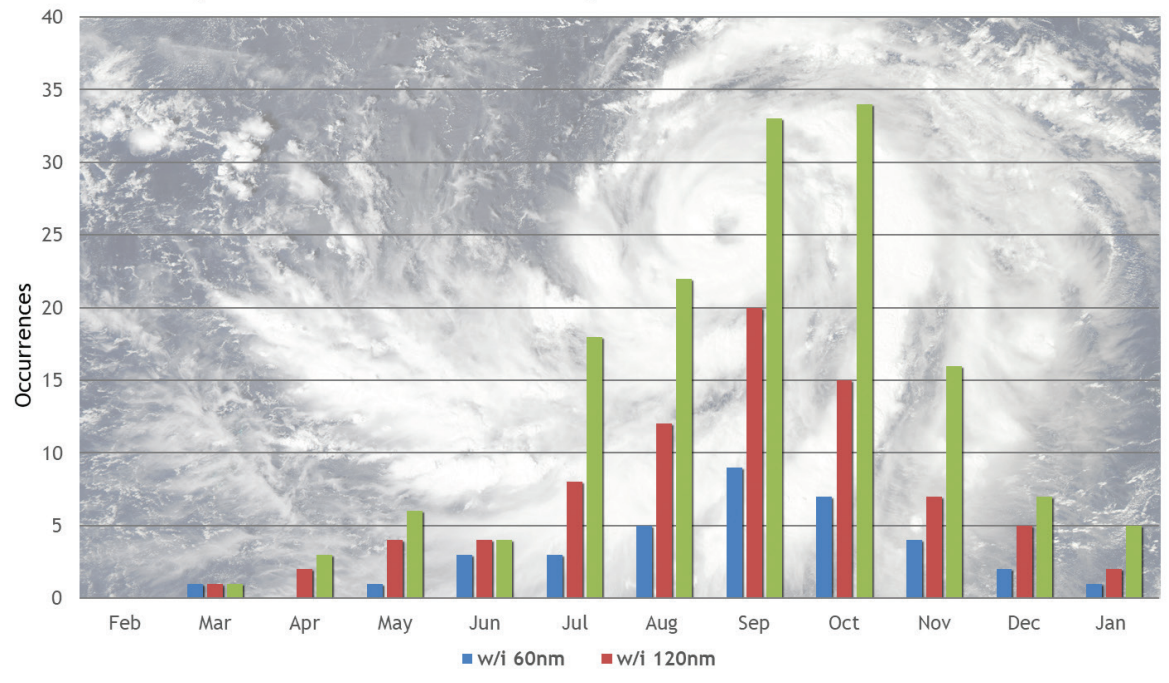
The study of fire weather climatology is important, especially in the Spokane area, where the amount of land affected by wildfires has risen substantially over the past few decades. WFO Spokane examined links between wildfires, seasonal temperatures, and precipitation using LCAT. Since 1950, seasonal spring total precipitation and average temperatures in the Spokane area have increased, while seasonal summer total precipitation has decreased and the average temperature has increased. These changes affect wildfire risk: wetter springs lead to taller grasses which, when combined with hotter and drier summers, provide more fuel for wildfires.

– Jeremy Wolf, NWS Spokane

Tropical Cyclone Climatology

Guam's isolated location in the middle of the western Pacific Ocean leaves it susceptible to the damaging effects of tropical cyclones. WFO Guam analyzed the seasonality of tropical cyclone frequency and proximity. While most tropical cyclones around the contiguous United States occur in September, around Guam they occur in October. This finding will help WFO Guam to better prepare for future cyclones.

– Brandon Bukunt, NWS Guam

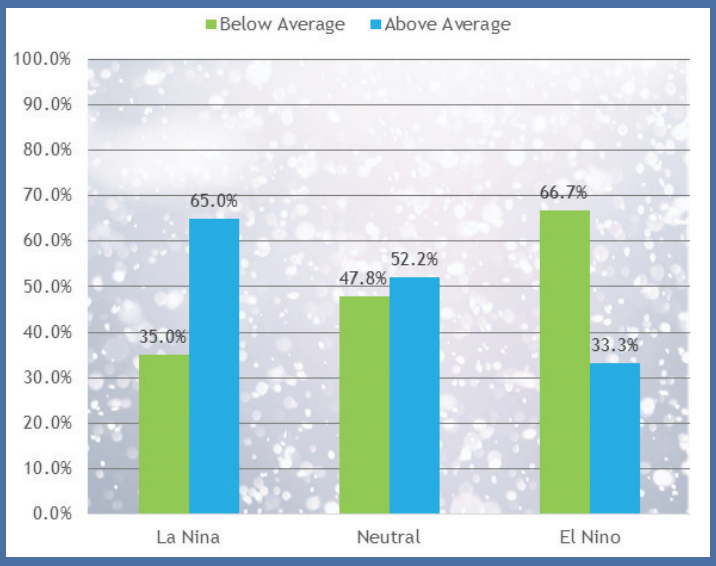


Tropical storms affecting Guam from 1945-2018

ENSO Linkages to Snowfall

Using LCAT, WFO Grand Junction analyzed the relationship between ENSO and three different yearly variables: average temperature, total precipitation, and total snowfall. Many linkages with ENSO were discovered across several locations. In this example, La Niña years correlated significantly to above-average total snowfall in the months of December, January, and February, and vice-versa with El Niño.

– Megan Stackhouse, NWS Grand Junction



Total snowfall in Hayden, CO (Dec-Jan-Feb)

Evaluate routine climate analysis information to explore linkages between climate phenomena and local weather events

The CSL should routinely review climate analysis and monitoring information, including NOAA websites of CPC, NCEI, NOAA's Earth Systems Research Laboratory, and RCCs. Information such as the ENSO Diagnostic Discussion, sea surface temperatures, and knowing the characteristics of different teleconnection patterns or oscillations such as the Arctic Oscillation (AO), Pacific-North American pattern (PNA), the Madden-Julian Oscillation (MJO), and the North Atlantic Oscillation (NAO) can help provide larger-scale context for local conditions.

Local Office Workload

An extensive array of relevant climate services activities is presented in this document. Some of them are basic and common to all local offices, particularly those related to routine monitoring and data dissemination, prediction and assessment products, and training. Other issues and challenges are not uniform across the country. For example, some areas experience greater impacts from particular climate signals with subsequent socio-economic consequences, whereas others may have very limited climate-related impacts. Some locales have greater populations that require more outreach activities.

The provision of climate services is a team effort, requiring participation of the entire local office. Effective IDSS delivery should extend beyond just the CSL and the WCM/SCH, incorporating a whole-office effort, or drawing participation from multiple local offices. The distribution of duties among the team is the ultimate responsibility of the MIC/HIC, who assigns the CSL to perform the activities required to support the NWS climate mission.

SECTION 4: Regional Headquarters

Regional headquarters offices serve as the liaisons to national offices, ensuring local compliance to NWS policies, and providing applied science, tools, and training to support local climate programs. Additionally, they initiate, coordinate, and foster regional partnerships and climate services activities.

Regional Director

The NWS Regional Director supports the Climate Services Program Manager.

- Allocates resources to local offices for climate-. related capabilities
- Allocates regional resources (i.e. funding, personnel, training, etc) to support climate services
- Promotes the NWS strategic goals for building a Weather-Ready Nation, which includes climate services
- Ensures climate services are part of the Evolve initiatives in the region
- Promotes the NOAA climate goal at the regional level and coordinates with NOAA climate stakeholders
- Ensures CSPM and CSL professional development in climate science and services
- Ensures the development, implementation, . and revision of a regional climate services plan that is consistent with national objectives
- Includes climate-related milestones in the annual regional operating plan
- Ensures that national policies and directives . are regionally supplemented
- Ensures that regional NWS observing systems are managed in accordance with the data continuity plans

Climate Services Program Manager

The Climate Services Program Manager (CSPM) supports the local offices as the liaison to national offices, ensuring local compliance to NWS climate services policies, and promoting applied science, technologies, tools, communications, and training. The CSPM also initiates, coordinates, and fosters regional partnerships and climate services activities. The CSPM ensures field offices have adequate resources (within fiscal constraints) to fulfill their mission.

Overall Program Management

- Allocate resources to field offices
- Conduct local office assessments and program reviews
- Understand NOAA and NWS vision and goals for climate services, and know the local requirements and abilities needed to achieve them
- Develop a regional climate services plan in coordination with CSB
- Implement national climate services program policies and directives
- Set annual goals for regional and local offices for planned activities (face-to-face interactions)
- Coordinate with the other services programs (i.e. Water Resources, Marine, etc.) on climate services requirements, and pass those to CSB

Communication

- Support exchange of information among local offices, NWS headquarters, and regional users
- Communicate with NOAA climate services partners on initiatives and identify opportunities for joint activities
- Promote partnerships to identify local level priorities and develop regional products

Communication Activities

- Distributing relevant information to the local offices from CPC or CSB such as upcoming local meetings, press releases, and notification that feedback is being sought on products
- Use the climate listserv to communicate routine and relevant climate news, announcements, training opportunities, and inquiries
- Solicit local office and regional user input for monthly teleconferences with the Climate SPT
- Partner with RCCs, in coordination with NCEI, on the need for new products as well as ensure that existing products are pertinent and up-to-date with current data
- Collaborate with NIDIS Drought Early Warning System Coordinators on the provision of drought updates and webinars to users on a multi-state and regional spatial scale when appropriate
- Partner with NOAA-funded RISAs to ensure that new research and focused applications and services are topical and pertinent for the appropriate geographical area

Impact-based Decision Support Services

- Enhance and promote climate-focused IDSS through integration of climate information into other NWS decision support activities
- Provide climate product and data interpretation services to regional Core Partners
- Collaborate with the ROCs to include climate information in their regional IDSS

Local Studies

- Investigate opportunities for regional and local studies by establishing working relationships with local academic communities
- Provide guidance, expertise, and tools to local offices for conducting studies
- Support development of techniques for local offices to generate local conditional climatologies
- Review scientific findings of local climate studies
- Coordinate local field office participation as beta-test sites for transition of new climate products and services from research to operations

Climate Data

- Coordinate with regional Observing Services Program Manager on data-related activities
- Ensure local offices serve as data stewards in the gathering, quality control, and dissemination of data and data continuity plans

Outreach & Education

- Provide materials and tools for regional and local climate services
- Know where to refer customers for additional information to answer complex climate questions

Partnerships

- Engage regional government partners in the development and delivery of climate services
- Provide regional coordination with other NOAA line offices and key external partners and users such as RCCs, RISAs, and SCs
- Refer questions in areas beyond NWS expertise to our partners in America's Weather and Climate Industry [weather.gov/enterprise]

Products

- Collect, synthesize, and convey input from partners and local offices to CSB on national products such as the Drought Monitor, Drought Outlook, Hazards Assessment, etc.
- Collaborate with National Centers on testing new methods at the regional level and recommending improvements for regional and local products and services
- Ensure regional and local observations and forecast products meet national standards for dissemination

Requirements

- Follow the existing policy for communicating requirements and seeking feedback on proposals for new/enhanced products/services as per NWSI 10-102, "Products and Services Change Management"
- Solicit feedback from local offices and regional customers for monthly teleconferences with the Climate SPT to improve existing products and identify requirements for new products

Drought

- Maintain situational awareness of current drought conditions in the region
- Coordinate drought-related activities, policy needs, and regional partnerships with the regional Water Resources Program
- Maintain international contacts for understanding drought in border regions

Training

- Monitor, coordinate, and manage CSL professional development in the area of climate science and services
- Assess field training needs in collaboration with CSB
- Oversee capacity building of local staff

Regional Operations Centers

Regional Operations Centers (ROCs) provide regional partners with IDSS. ROCs also provide a centralized message coordination point for local NWS offices (WFOs, RFCs, CWSUs) and NWS National Centers. ROCs maintain situational awareness of S2S outlooks and use appropriate climate information to provide regional IDSS. The ROCs should communicate regional partner requirements and feedback on climate services to the CSPM, who will coordinate with CSB. The ROCs also serve as a central dissemination point and can distribute relevant climate information to the region's field offices. The CSPM will also work with the ROCs to provide the climatological context and historical anomalies of extreme weather events to Federal Emergency Management Agency (FEMA) to support Presidential Disaster Declarations under the Stafford Act. This could involve drought, heavy rains/floods, or snowfall.

The NWS Alaska Region Headquarters provides climate services information to the Alaska River Forecast Center (APRFC), which helps to improve APRFC's spring breakup outlooks and fuel the highly successful River Watch program. The River Watch program is a partnership between the State of Alaska, Division of Homeland Security and Emergency Management, and APRFC. During the annual spring ice jam breakup, these organizations partner to do aerial reconnaissance, ground observations, and remote sensing of river and ice observations. This serves to identify flood threats and navigational hazards. [weather.gov/aprfc/riverWatchProgram]

– Eric Holloway, Alaska Region Headquarters

Water Resources

Regional Hydrology Program Managers (HPM) maintain situational awareness of S2S outlooks and work with WFOs, RFCs, and OWP/WPOD to provide climate-focused IDSS to local and regional hydrology Core Partners. They coordinate with the CSPM to provide regional drought-focused IDSS and to support local water resource planning. Regional HPMs share feedback and requirements from the WFOs, RFCs, OCP/WPOD, and regional hydrology partners to the regional CSPMs, who will coordinate with CSB.

SECTION 5: Climate Prediction Center

The Climate Prediction Center (CPC) serves the national need for timely, accurate, and actionable climate information as an integral part of the NWS seamless product suite to respond to the needs of users who experience climate impacts on their activities or are interested in climate issues. CPC develops and delivers climate prediction, monitoring, and assessment products on S2S timescales to the NWS field offices, the nation, and the global community.

CPC interacts closely with EMC, OAR Climate Program Office, and other NOAA-funded partners towards development of climate models, data assimilation systems, and climate monitoring and prediction products.

CPC coordinates with NWS field operations and CSB to (1) identify and develop user requirements; (2) improve operational climate outlooks and monitoring and assessment products; (3) improve delivery of climate products and services and measure success through a variety of web-interactive and direct outreach mechanisms (meetings, teleconferences, and webinars); (4) accelerate the transition of science and technology advances to improve operational climate models and forecasts; (5) take advantage of opportunities to develop collaborative products and services, both within NWS and with users and partners; and (6) enhance climate training and ensure consistency with NOAA and NWS training plans.

Operational Monitoring Branch

The Operational Monitoring Branch (OMB) has a broad mission and performs the following functions:

- Prediction, monitoring, and assessment of short-term climate anomalies
- Climate research for improved understanding of climate variability in order to improve operational products
- Development and transition to operations of techniques and tools for improved climate prediction, monitoring, and assessment of short-term (S2S) climate variability
- Training support at the national and international levels in order to build capacity to use short-term climate information

OMB performs these functions in close coordination and collaboration with the CPC Operational Prediction Branch (OPB) in order to meet stakeholder needs and to provide decision support services for Core Partners.

Operational Prediction Branch

The Operational Prediction Branch (OPB) prepares and disseminates NWS climate outlooks to a wide array of users that include NWS field offices, government agencies, regional and local governments, and the general public. OPB produces:

- Outlooks for temperature and precipitation for the 6-10 and 8-14 day periods, week 3-4, monthly, and seasonal out to one year
- Hazard outlooks for the U.S. and global tropics
- Contributions to the multi-agency Drought Monitor
- Monthly and seasonal drought outlooks

OPB also maintains, develops, and applies empirical, statistical, and dynamical techniques to support, improve, and extend CPC's official operational climate outlooks. Climate database management (assembling, quality control, and interpretation of global data), real-time outlook verification, and application of new and improved web-related technology and applications are an important component of the work in OPB. OPB closely coordinates and collaborates with OMB in order to meet stakeholder needs and provide decision support services for Core Partners.

Climate Test Bed

CPC manages the NOAA Climate Test Bed (CTB), whose mission is to accelerate research-to-operations (R2O) to improve NCEP operational climate models, monitoring, and predictions. CTB also provides operations-to-research (O2R) support to the climate research community with access to operational models, forecast tools, and datasets. CTB closely coordinates with OMB and OPB, and EMC under the supervision of the CPC and EMC Directors.

International Activities

CPC engages in a broad set of international activities that serve to strengthen partnerships and build capacity for international collaboration. CPC provides international expert assessment products, as well as weather and climate information, that are used to assess past, present, and future conditions around the globe. Specific expert assessment products include seasonal rainfall outlooks using the NCEP CFS, extended range and long-range weather and climate guidance, and global and regional hazards outlooks prepared in coordination with national and international partners, including United States Agency for International Development Famine Early Warning System and Office of Foreign Disaster Assistance teams.

CPC is heavily engaged in professional development training through the African Desk and Monsoon Desk training programs. These desks provide opportunities for professional meteorologists and university scientists in Africa, Asia, and elsewhere to train and collaborate at NCEP. Tailored curricula have been developed to meet the needs of participants, improve climate services, and enhance capacity building.

SECTION 6: Training

The NWS Climate Services training program consists of both online and residence courses for NWS personnel to:

- Ensure professional competency in the provision of climate services including S2S IDSS
- Support capacity building of local and regional staff

Online Professional Development Series

NWS operational personnel have access to online training through the Climate Services Professional Development Series (PDS) [https://training.weather.gov/pds/climate/]. Knowledge of climate phenomena and services acquired through this training should be conveyed to other staff members through local office training by the CSL working with the SOO/DOH and their regional CSPM.

The Climate Services PDS comprises six Professional Competency Units (PCU) that provide targeted training for each of the three primary functions (customer interface, data stewardship, and participation in analysis, monitoring, and prediction) of the local offices.

- PCU 1: Know the Infrastructure for Climate Data and Services
- PCU 2: Understand Climate Variability and Change and Apply to Local Services
- PCU 3: Understand the Basis and Methodologies of CPC Products
- PCU 4: Use NOAA Climate Products and Tools in Local Climate Services
- PCU 5: Apply Climate Information to Decision Support, Partnership, and Communication
- PCU 6: Understand Principles for Conducting Timely, Accurate, and Consistent Climate Data Observations and the Broad Range of Their Applications

Instructor-led coursework

In addition to the online training modules, NWS CSB offers instructor-led courses. All courses are available for registration at U.S. Department of Commerce Learning Center Management System [https://doc.csod.com]. Not all courses are offered annually, and these courses may be offered as residence or virtual depending on availability of funding. Although the target audience for the residence courses are the CSLs, they are also offered to other NOAA employees and key external partners when space is available.

- *Subseasonal to Seasonal Impact-based Decision Support Services (S2S IDSS) Course* provides knowledge and skills on S2S timescales for planning and response to disruptive weather, water, and climate events and the use of tools for interpretive services of NWS climate products for Core Partners
- *Operational Climate Services Course* provides an introduction to NWS local office climate services, familiarity with climate tools and products, and best methods for delivery of climate services
- *Climate Variability and Change Course* provides scientific knowledge on physical mechanisms, impacts, and predictability of climate variability and change events and their use in NWS climate products
- *Advanced Climate Variability and Change Course* provides advanced scientific knowledge used in modeling of climate variability and change, climate attribution of severe meteorological and hydrological events, and hands-on knowledge for conducting local climate studies

SECTION 7: Key Partners

National Centers for Environmental Information

NOAA's National Centers for Environmental Information (NCEI) is responsible for preserving, monitoring, assessing, and providing public access to the nation's treasure of climate and historical weather data and information. From the depths of the ocean to the surface of the sun, and from million-year-old ice core records to near real-time satellite images, NCEI is the nation's leading authority for environmental information. NCEI puts a priority on interpreting and applying scientific understanding to an extensive array of climate datasets through two Centers: the Center for Weather and Climate (CWC) and the Center for Coasts, Oceans, and Geophysics (CCOG).

NCEI's Regional Climate Service Directors (RCSDs)

The RCSDs support the development and delivery of a wide range of place-based climate science and information products and services to help people make informed decisions. RCSDs regularly communicate with stakeholders across a breadth of economic sectors, about climate information needs, and help build and strengthen active partner networks with public and private constituents. They play a primary role in integrating the work within NOAA and among its partners engaged in developing and delivering climate services at the regional level, including the NWS field offices, the Regional Integrated Sciences and Assessment programs, Regional Climate Centers, state climatologists, the National Integrated Drought Information System as well as other agencies, institutions, and organizations.

Regional Climate Centers

The Regional Climate Centers (RCC) program, managed by NCEI, provides climate services to six regions encompassing the United States. Services provided by the RCCs have evolved through time to become an efficient, user-driven program that exemplifies many of the components that have been cited for effective regional climate services.

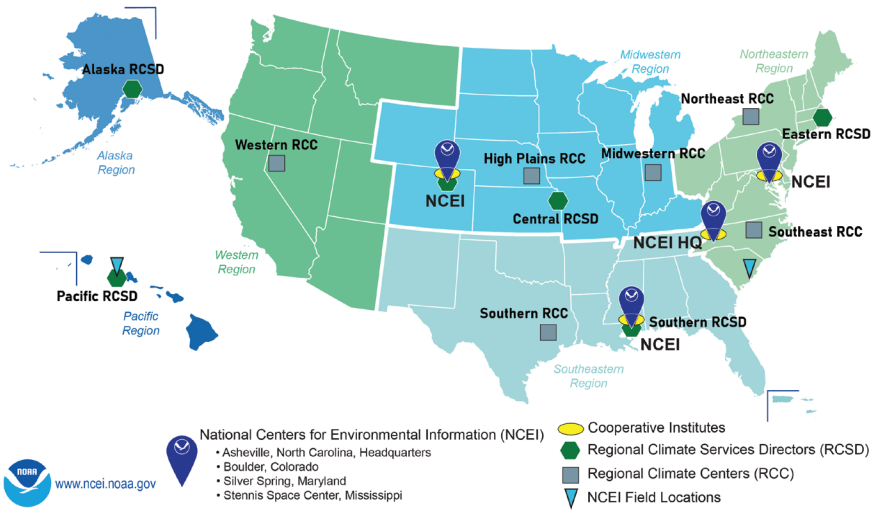
- The RCCs maintain and provide a subscription to the xmACIS and NOWData systems, and they develop the ThreadEx stations at the request of CSB (see Section 8 for more information).

Many local offices work collaboratively on climate services with their local RCC, which provide scientific expertise and the provision of and interpretation of NWS data, forecasts, and products. CSLs are encouraged to reach out to their respective RCC.

As operational climate service providers, the RCCs fill three main niches:

- Provision and development of sector-specific and value-added data products and services
- Establishment of robust and efficient computer-based infrastructure for providing climate information
- Seamless integration and storage of non-NOAA climate data with traditional NOAA data sources

National Centers for Environmental Information (NCEI)



Regional Integrated Sciences and Assessments Program

NOAA's Regional Integrated Sciences and Assessments (RISA) program supports research teams that help expand and build the nation's capacity to prepare for and adapt to climate variability and change. Central to the RISA approach are commitments to process, partnership, and trust building. RISA teams work with public and private user communities to:

- Advance understanding of context and risk
- Support knowledge to action networks
- Innovate services, products, and tools to enhance the use of science in decision making
- Advance science policy

The RISAs also extensively partner with NWS local offices. They offer scientific expertise and frequently collaborate with local offices as part of their research agendas. NWS may support RISA efforts through the provision of and interpretation of NWS climate data, forecasts, and products. CSLs are encouraged to reach out to RISAs in their area to coordinate on climate services-related activities.

State Climatologists

NOAA collaborates with the American Association of State Climatologists (AASC) to help provide improved climate services to the nation. Founded in 1976, the AASC is a professional scientific organization composed of one state climatologist per state as well as the directors of the six RCCs and other associate members. Together, all of AASC's members work to advance the development and delivery of science-based climate services on the local and state levels. State Climatologists are excellent resources for their expertise in climate science and services. Coordination with respective State Climatologists is very important so that consistent messages are conveyed to stakeholders. CSLs are encouraged to seek out their respective State Climatologists to coordinate on delivery of climate services.

Tribal Partners

NWS is working closely with tribal communities across the nation to provide products and services that enable the residents to make informed decisions about their subsistence way of life and to take the necessary steps to protect their lives and properties when threatened by weather, water, and climate events. Across the country, both within and outside the Contiguous United States (CONUS), there are 573 federally recognized Tribal Nations spread across 36 states. Many field office CWAs cover numerous tribes spanning different cultures, languages, and environmental and geographic challenges.

Tribes often survive by their closeness to nature, and climate change has become one of their biggest threats, upsetting the lives and livelihoods of these native communities. In many instances, traditional knowledge no longer applies or serves their needs as hazardous and extreme events are becoming more and more unprecedented. The communities are reaching out for help, and as NWS Core Partners, local offices have the opportunity to form close, trusted relationships with tribal community residents in order to deliver effective and beneficial IDSS. Engagement for building trust and forming long-standing ties is crucial when working with these Sovereign Nations. Actively listening to community members and spending time face-to-face learning about their traditions and significance of natural elements helps to link science and culture, which is critical for building these tight-knit, connected relationships.

Outside Contiguous United States (OCONUS) regions face additional challenges with Tribal Nations as many are in remote locations where transportation is difficult and communication options are limited. For example, in Alaska, Indigenous Peoples comprise roughly 24 percent of the state's population. Many live in one of 229 federally recognized Alaska Native villages, some with as few as 60 members, while others have close to several thousand. Most villages are located along rivers or on the western and northern coasts, facing the Bering, Chukchi, and Beaufort Seas. For those who live along those Alaskan coasts, the retreat of sea ice no longer protects these communities from storm surge, erosion, and flooding due to hurricane-force storms that batter the villages.

For all communities that rely on subsistence hunting, the loss of sea ice threatens the ability to safely hunt for whales and other marine mammals. Communities along the river are often threatened by flooding from spring ice jams. In the southeast, drought conditions can impact hydroelectric production.

As waters continue to warm across Alaska, marine ecosystems are impacted in a profound way: 1) seabirds and mammals are starving as their food sources move further north; 2) walruses are coming ashore because they cannot find suitable sea ice on which to rest and forage for food; and 3) there are increased concerns about harmful algal blooms and toxic shellfish poisoning.

In the Pacific Islands, NWS offices serve thousands of people covering multiple time zones across several islands, and they often must have products and services translated into native languages. El Niño has a very strong signal in this region, and the native island communities rely on dependable ENSO outlooks and value local interpretation of impacts, including drought, low or high sea levels, flash floods, typhoons, mudslides, and wildland fires.

Other Key Partners

- Oceanic and Atmospheric Research (OAR) | Climate Program Office (CPO)
- Oceanic and Atmospheric Research (OAR) | Earth System Research Lab (ESRL)
- National Ocean Service (NOS)
- National Marine Fisheries Service (NMFS)
- National Drought Mitigation Center (NDMC)
- National Integrated Drought Information System (NIDIS)
- National Integrated Heat Health Information System (NIHHIS)
- United States Global Change Research Program (USGCRP)
- United States Geological Survey (USGS) | Climate Science Centers
- United States Department of Agriculture (USDA) | Climate Hubs
- International Research Institute for Climate and Society (IRI)
- World Meteorological Organization (WMO)

SECTION 8: Tools and Resources

CSLs have a number of tools available to facilitate climate services to the various partners and customers of NWS. These tools are designed to aid in providing decision support services to build a weather, water, and climate ready nation. CSLs should have working knowledge of these tools in order to use them effectively to deliver climate services. Within their office, they should work with their WCM/SCH to promote these tools to partners and customers and work with their SOO/DOH to ensure the staff is trained to use the tools and properly interpret results.

NOWData

[https://www.weather.gov/climateservices/nowdatafaq]

NOWData is a public-facing tool that provides on-demand queries of the Applied Climate Information System (ACIS) climate database for preselected stations from a drop down menu on the local office climate website. This tool can be used by the CSL or anyone in the local office for media inquiries or general public questions. As it is public-facing, it is a more "user friendly" self-service tool that the public can use to easily locate a station and get basic data and information on their local climate.

xmACIS

[https://xmacis.rcc-acis.org/]

xmACIS is a tailored version for the ACIS database for use by NWS staff. This tool can be used to query any station with a valid site ID from the NWS or Federal Aviation Agency. It gives the ability to search for individual stations and/or multiple stations within a specific area such as a county, Climate Division, CWA, or state. This tool is for more advanced climate data users, including those conducting studies at universities, weather forecasting operations, climate centers, and other government agencies. It provides an easier way to search the official NCEI GHCN database for climatological values, and checking values for state climate extremes.

Location	Freeze Chances		
	50% Chance	25% Chance	Latest Freeze
Pocatello	May 17	May 20	June 22
Idaho Falls	May 25	June 8	June 26
Burley	May 9	May 17	June 25

Table: When is it safe to plant my garden?

xmACIS is a nationally maintained climate data toolset, created through a partnership between NWS, NCEI, and RCCs. There are many useful datasets available through xmACIS, such as the records and extremes data from thousands of sites across the nation, including those from Local Climatological Data (LCD) sites and COOP stations. WFO Pocatello uses xmACIS regularly to publish reports on climate data sets (including freeze chances, as seen in the graphic above) to help serve their local Core Partners, especially those with interests in agriculture and gardening.

– Alex DeSmet, NWS Pocatello

ThreadEx

[http://threadex.rcc-acis.org/]

ThreadEx is designed to address the fragmentation of station information over time due to station relocation for the express purpose of calculating daily extremes of temperature and precipitation. As observation locations change, especially in large metropolitan areas (most commonly due to urban sprawl), the quality of an observation can degrade if left in the same location. This is due to the addition of buildings, roads, and other structures that ultimately affect temperature and precipitation observations. ThreadEx is a means to find the greatest or least value of an element over the lifespan of the station.

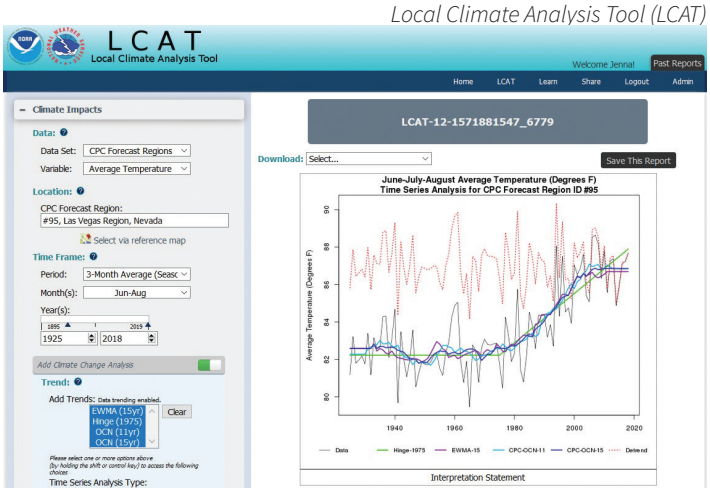
For instance, the most recent location of any given station may only have the extreme values for the last 20 to 30 years; however, by threading all the historical station locations together from a particular area, the extremes data may be available for well over 100 years.

ThreadEx was largely designed to support media inquiries for records that appear in almanacs, newspapers, or electronic/broadcast media. ThreadEx locations can also be used to provide climate statistics in legacy NWS text products, including the climate section in the Area Forecast Discussion as well as for social media content. ThreadEx stations also enable State Climatologists and regional and national climate centers to refer to the same period of record as local WFOs for a particular location.

LCAT
[https://nws.weather.gov/lcat/]

The Local Climate Analysis Tool (LCAT) is a web-based interactive statistical tool providing NWS local offices with easy access to information for delivery of timely responses to climate-related questions from their customers. LCAT uses trusted data and scientifically-sound analysis techniques to provide reliable data and analysis on the impacts of climate variability and change at the local level. The tool links local weather and water events to signals in the climate system, providing information about how climate variability and change contribute to local climate trends. LCAT enables users to conduct in-depth local studies, download the data used, and generate statistics and graphics to aid in delivery of IDSS.

Local Climate Analysis Tool (LCAT)



LCAT also has embedded training modules and is continuously being upgraded with new datasets and capabilities. Local office climate teams are encouraged to make use of the tool in their provision of climate-focused IDSS.

LCAT: Five Areas of Analysis

- **Climate Change Impacts**
  Trend analysis, rate of change
- **Climate Variability Impacts**
  Compositing, box plots
- **Drought Analysis & Impacts**
  Drought index analysis
- **Sectoral Applications**
  Water resources (snow, precipitation), energy (degree days)
- **Arctic Capabilities**
  Sea ice thickness, salinity, water potential temperature

NWS AHPS Precipitation Analysis
[https://water.weather.gov/precip/]

AHPS serves as a visualization tool to aid in the analysis of hydroclimatology, such as assessing water deficits and surpluses. AHPS provides information on historic events and can be used as a tool to assist in quality control of climate records.

NCEI State of the Climate
[https://www.ncdc.noaa.gov/sotc/]

State of the Climate reports are a collection of monthly summaries documenting climate-related occurrences on both a global and national scale. They provide an in-depth look at various weather and climate phenomena and can be used as a reference for research or articles. The maps can be used in social media or web content in summary reports.

RCC Tools and Data

Several tools developed and maintained by the RCCs are provided below.

- HPRCC ACIS Climate Maps [https://hprcc.unl.edu/maps.php?map=ACISClimateMaps]
- MRCC cli-MATE [https://mrcc.illinois.edu/CLIMATE]
- MRCC Vegetation Impact Program [https://mrcc.illinois.edu/VIP/]
- MesoWest [https://mesowest.utah.edu/]
- Climate Data Online [https://www.ncdc.noaa.gov/cdo-web/]
- U.S. Climate Atlas [https://www.ncdc.noaa.gov/climateatlas/]
- WRCC Westwide Drought Tracker [https://wrcc.dri.edu/wwdt/]

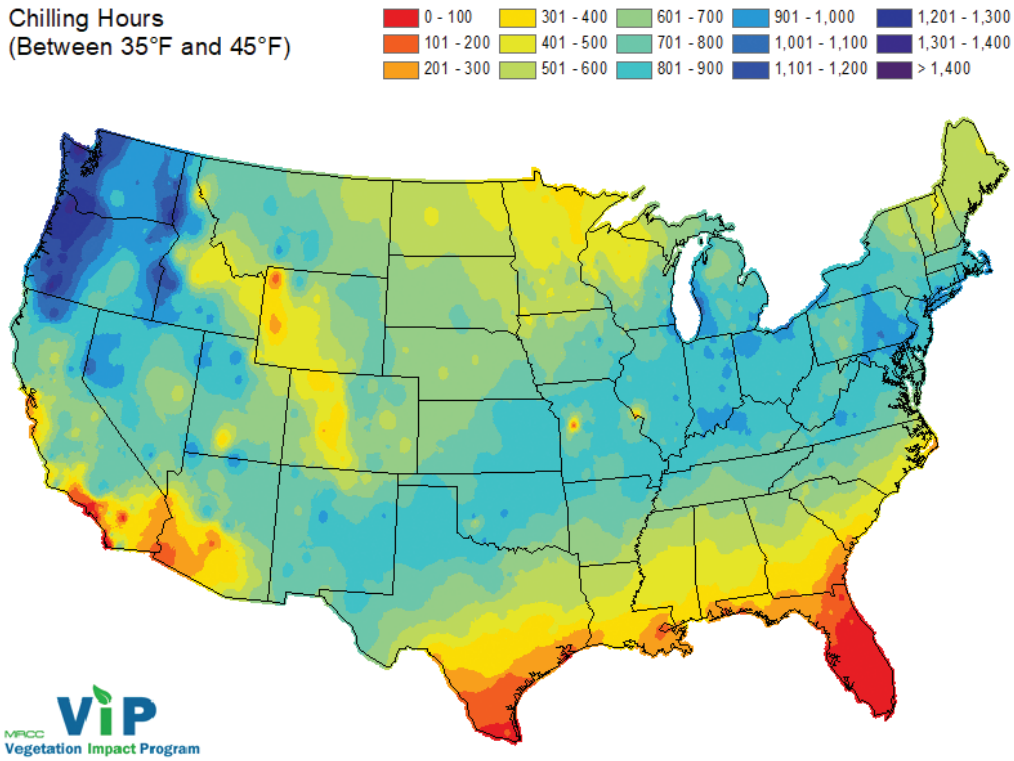
RISA Tools and Data

[https://cpo.noaa.gov/Meet-the-Divisions/Climate-and-Societal-Interactions/RISA]

RISAs are NOAA-supported research teams that help expand and build the nation's capacity to prepare for and adapt to climate variability and change. Individual RISA teams develop various decision support tools that NWS local office climate teams can leverage to facilitate their IDSS. CSLs are encouraged to identify a RISA team within their region and understand the tools available for their use.

IDSS Delivery Methods

CSLs are encouraged to work with their RCC to develop templates for social media and more formal briefings, including one-pagers that communicate local impacts of national and regional outlooks. Internal talking points should be developed for common climate questions and make them available for quick reference via the local office guide or SDM. Local climate webpages should be monitored and updated as needed. Any new or enhanced products and services for IDSS must be addressed through the NWSI 10-102 process.



MRCC Vegetation Impact Program

APPENDICES

Appendix A: Ten Principles of Climate Monitoring

Effective monitoring systems for climate should adhere to the following principles:

1. The impact of new systems or changes to existing systems should be assessed prior to implementation

2. A suitable period of overlap for new and old observing systems is required

3. The details and history of local conditions, instruments, operating procedures, data processing algorithms, and other factors pertinent to interpreting data (i.e., metadata) should be documented and treated with the same care as the data themselves

4. The quality and homogeneity of data should be regularly assessed as a part of routine operations

5. Consideration of the needs for environmental and climate-monitoring products and assessments, such as IPCC assessments, should be integrated into national, regional, and global observing priorities

6. Operation of historically-uninterrupted stations and observing systems should be maintained

7. High priority for additional observations should be focused on data-poor regions, poorly observed parameters, regions sensitive to change, and key measurements with inadequate temporal resolution

8. Long-term requirements, including appropriate sampling frequencies, should be specified to network designers, operators, and instrument engineers at the outset of system design and implementation

9. The conversion of research observing systems to long-term operations in a carefully-planned manner should be promoted

10. Data management systems that facilitate access, use, and interpretation of data and products should be included as essential elements of climate monitoring systems

Source:
atdd.noaa.gov/wp-content/uploads/2019/01/GCW_GCOS_principles.pdf

Appendix B: Climate Operational Product List

Climate Outlooks
10-1001 Climate Outlooks Directive

- Three-Month Outlooks (Contiguous U.S. and Alaska)
- Three-Month Outlooks Discussion (Contiguous U.S. and Alaska)
- Three-Month Probability of Exceedance Out looks (Selected U.S. cities and divisions)
- Three-month 50 Percent Probability of Exceedance Outlook Charts (Contiguous U.S.)
- One-Month Outlook (Contiguous U.S. and Alaska)
- One-Month Outlook Discussion (Contiguous U.S. and Alaska)
- Hawaiian One-Month and Three-Month Outlooks and Discussion
- 6- to 10-Day and 8- to 14-Day Outlooks (Contiguous U.S. and Alaska)

- 6- to 10-Day and 8- to 14-Day Outlook Discussion (Contiguous U.S. and Alaska)
- 6- to 10-Day and 8- to 14-Day Mean North American 500 millibar Outlook
- 6- to 10-Day and 8- to 14-Day Excessive Heat Outlooks (Contiguous U.S.)
- 6- to 10-Day and 8- to 14-Day Maximum Heat Index Prediction (Contiguous U.S.)
- 6- to 10-Day and 8- to 14-Day Minimum Wind Chill Prediction (Contiguous U.S. and Alaska)
- 4- to 14-Day Hazards Outlook (Contiguous U.S. and Alaska)
- 4- to 14-day Hazards Outlook Discussion (Contiguous U.S. and Alaska)
- Tropical Pacific Mean Sea Surface Temperature Outlook (Niño 3.4 area)
- Atlantic Hurricane Season Outlook
- Eastern North Pacific Hurricane Season Outlook
- Global Tropics Hazards/Benefits Outlook
- Week 3-4 Temperature Outlook (Contiguous U.S., Alaska, and Hawaii)
- Week 3-4 Temperature Outlook Discussion (Contiguous U.S., Alaska, and Hawaii)

Climate Monitoring
10-1002 Climate Monitoring Directive

- Crop Moisture Index
- Weekly Weather and Crop Bulletin (WWCB)
- Climate Diagnostics Bulletin
- CLIMAT Messages
- El Niño/Southern Oscillation (ENSO) Diagnostic Discussion

National Drought Products
10-1202 Drought Services

- Palmer Drought Severity Index (Contiguous U.S.)
- U.S. Drought Monitor (Contiguous U.S., Alaska, Hawaii, Puerto Rico, the US Virgin Islands, and US-affiliated Pacific Islands)
- National Drought Summary (Contiguous U.S., Alaska, Hawaii, and Puerto Rico)
- U.S. Drought Outlooks (Contiguous U.S., Alaska, Hawaii, and Puerto Rico)
- U.S. Drought Outlooks Discussion (Cont. U.S., Alaska, Hawaii, and Puerto Rico)

Appendix C: Directives

10-1001 Climate Outlooks
[nws.noaa.gov/directives/sym/pd01010001curr.pdf]

10-1002 Climate Monitoring
[nws.noaa.gov/directives/sym/pd01010002curr.pdf]

10-1003 Climate Data Services
[nws.noaa.gov/directives/sym/pd01010003curr.pdf]

10-1004 Climate Records
[nws.noaa.gov/directives/sym/pd01010004curr.pdf]

10-1005 Local Climate Outlooks
[nws.noaa.gov/directives/sym/pd01010005curr.pdf]

12-1202 Drought Services
[nws.noaa.gov/directives/sym/pd01012002curr.pdf]

Appendix D: Acronyms

AASC	American Association of State Climatologists
AFSO	Analyze, Forecast, and Support Office
AHPS	Advanced Hydrologic Prediction Service
AO	Arctic Oscillation
AWIPS	Advanced Weather Interactive Processing System
CaRDS	Capability and Requirements Decision Support
CCOG	Center for Coasts, Oceans, and Geophysics
CFS	Climate Forecast System
CONUS	Contiguous United States
COOP	Cooperative Observer Program
CP	Office of Central Processing
CPC	Climate Prediction Center
CSB	Climate Services Branch
CSL	Climate Services Leader
CSPM	Climate Services Program Manager
CTB	Climate Test Bed
CWA	County Warning Area
CWC	Center for Weather and Climate
CWSU	Central Weather Service Unit
DAPM	Data Acquisition Program Manager
DGT	Drought Information Statement
DIS	Office of Dissemination
DOH	Development and Operations Hydrologist
EMC	Environmental Modeling Center
ENSO	El Niño-Southern Oscillation
ESRL	Earth System Research Lab
FEMA	Federal Emergency Management Agency
GFCS	Global Framework for Climate Services
GHCN	Global Historical Climatology Network
HFP	Hydrology Focal Point
HIC	Hydrologist-in-Charge
HPM	Hydrology Program Manager
IDSS	Impact Based Decision Support Services
IRI	International Research Institute for Climate and Society
LCAT	Local Climate Analysis Tool
LCD	Local Climatological Data
MIC	Meteorologist-in-Charge
MJO	Madden-Julian Oscillation
NAO	North Atlantic Oscillation
NCA	National Climate Assessment
NCEI	National Centers for Environmental Information
NCEP	National Centers for Environmental Prediction
NCO	NCEP Central Operations
NDMC	National Drought Mitigation Center
NIDIS	National Integrated Drought Information System
NIHHIS	National Integrated Heat Health Information System
NMFS	National Marine Fisheries Service
NOAA	National Oceanic and Atmospheric Administration
NOS	National Ocean Service
NOWData	NOAA Online Weather Data
NWC	National Water Center
NWS	National Weather Service
NWSOC	NWS Operations Center
NSP	National Service Program
O2R	Operations-to-Research
OAR	Oceanic and Atmospheric Research
OBS	Office of Observation
OCONUS	Outside Contiguous United States
OMB	Operational Monitoring Branch
OPB	Operational Prediction Branch
OPL	Observations Program Leader
OWP	Office of Water Prediction
PCU	Professional Competency Unit
PDS	Professional Development Series
PNA	Pacific/North American Pattern
PNS	Public Information Statement
QA/QC	Quality Assurance/Quality Control
R&D	Research and Development
RCC	Regional Climate Center
ROCs	Regional Operations Centers
RFC	River Forecast Center
RISA	Regional Integrated Sciences and Assessments
S2S	Subseasonal to Seasonal
SC	State Climatologist
SDM	Station Duty Manual
SCH	Service Coordination Hydrologist
SH	Service Hydrologist
SOO	Science and Operations Officer
SPT	Service Program Team
STI	Office of Science and Technology Integration
USDA	United States Department of Agriculture

RCSD	Regional Climate Services Director
USGCRP	United States Global Climate Research Program
USGS	United States Geological Survey
WCM	Warning Coordination Meteorologist
WFO	Weather Forecast Office
WMO	World Meteorological Organization
WPOD	Water Prediction Operations Division
WSO	Weather Service Office
xmACIS	Applied Climate Information System

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Acknowledgments

The NWS Climate Services Branch would like to thank all NOAA and NWS staff who reviewed and provided substantial comments to improve this publication.

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