

THE FEDERAL WEATHER ENTERPRISE

*Fiscal Year 2021
Budget and
Coordination
Report*

Interdepartmental Committee for Meteorological Services and Supporting Research

Working Group for the Budget and Coordination Report

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NOAA Budget Office
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The Federal Weather Enterprise:

Fiscal Year 2021 Budget and Coordination Report

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Preface

This year's Budget and Coordination Report (BCR) continues a streamlined format for reporting the Federal Weather Enterprise's (FWE) coordination efforts and by-agency budget information related to meteorological services and supporting research.

Section 1 highlights the efforts of the interagency committees and working groups in addressing ongoing concerns and their progress in meeting the goals and objectives of the Strategic Plan for Weather Enterprise Coordination published in 2019. You can find the Strategic Plan, along with information on the individual proceedings of the Federal Committee for Meteorological Services and Supporting Research (FCMSSR), committees, and working groups, on OFCM's website.

Section 2 of this report provides brief summaries of agency enacted funding and budget requests. These summaries satisfy the requirements of Public Law 87-843, Section 304, which calls for an annual cross-agency look at resources applied to meteorological services and supporting research. Where applicable, these summaries include amplifying information describing priority needs related to the forecast process, as called for in the recently enacted Weather Research and Forecasting Innovation Act of 2017. Table 1 reflects the agencies' "top line" meteorological services and supporting research budget numbers: FY21 requests along with enacted funding for two previous fiscal years. Table 2 shows significant interagency transfers of funds for meteorological services.

This report has been compiled through the efforts of many agency budget experts and meteorology-related functional experts. These contributors were formally established as an OFCM working group last year: the Working Group for the Budget and Coordination Report. The agency/entity leads are listed in the inside cover of this year's report. We at OFCM will continue our efforts to release this report in the spring to enhance the report's utility. My sincere thanks to our agency partners for their efforts in helping us achieve this goal, for their participation in our coordination activities, and for their meticulous efforts in preparing this report.

Michael F. Bonadonna
Federal Coordinator for Meteorological Services and Supporting Research

Purpose

This annual report is prepared for delivery to the Office of Management and Budget and the Congress to satisfy the requirements of PL 87-843 section 304, in which Congress directed that OMB prepare an annual horizontal budget for meteorological programs conducted by the Federal agencies. This report also satisfies Public Law 115-25, Title IV, Section 402(a)(2) - the Weather Research and Forecasting Innovation Act of 2017- by identifying and prioritizing top forecast needs for coordination against budget requests and program initiatives across federal offices and agencies.

The budgetary information in this report provides a ‘horizontal’ look at the meteorological funding requested in the current President’s Budget Request and the funding enacted over the previous two fiscal years. The specifics of the budgetary narrative and tabular information requested from the agencies are outlined in an OMB-OFCM coordinated, input guidance document that is provided to the agencies as part of the annual data call.

This report consists of two main sections. Section 1 is a description of the Federal weather coordination structure and the ongoing collaborative efforts supporting the goals and objectives of the Strategic Plan for Federal Weather Enterprise (FWE) Coordination. Section 2 consists of meteorological services and/or supporting research funding requested by and assigned to the Federal Weather Enterprise and, where applicable, reflects the agencies’ priorities related to the forecast process.

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Federal Coordination and Planning for Meteorological Services and Supporting Research

1

The mission of the Office of the Federal Coordinator for Meteorological Services and Supporting Research (OFCM) is to foster the effective use of federal meteorological resources by encouraging and facilitating the systematic coordination of weather services and supporting research across the Federal Weather Enterprise.

The OFCM operates with policy guidance from the Federal Committee for Meteorological Services and Supporting Research (FCMSSR). The principal work in coordinating meteorological activities and in the preparation and maintenance of OFCM reports, plans, and other documents is accomplished by the OFCM staff with the advice and assistance of the Interdepartmental Committee for Meteorological Services and Supporting Research (ICMSSR) and 25 program councils, committees, working groups, and joint action groups. The individuals who serve on these coordination entities are federal agency representatives.

Statutory Basis for the Federal Coordination Process

In Section 304 of Public Law 87-843 (the Appropriations Act for State, Justice, Commerce, and Related Agencies) Congress directed that the Bureau of the Budget prepare an annual horizontal budget for all meteorological programs in the federal agencies. The Bureau of the Budget (now the Office of Management and Budget, OMB) issued a set of ground rules to be followed in the coordination process. The Bureau tasked the Department of Commerce (DOC) to establish the coordinating mechanism in concert with the other Federal agencies. It also reaffirmed the concept of having a central agency—the DOC—to be responsible for providing common meteorological

facilities and services and clarified the responsibilities of other agencies for providing meteorological services specific to their mandated missions.

The implementation of these directives by DOC led to the creation of the OFCM and the appointment of the first Federal Coordinator for Meteorological Services and Supporting Research (the Federal Coordinator). The FCMSSR was established in 1964 to provide policy-level agency representation and guidance to the Federal Coordinator in addressing agency priorities, requirements, and issues related to meteorological services, operations, and supporting research.

The FCMSSR is comprised of representatives from the 15 federal agencies that engage in meteorological activities or supporting research, have a major need for meteorological services, or set policy and direction for such services and research. These 15 agencies are the Departments of Agriculture (USDA), Commerce (DOC), Defense (DOD), Energy (DOE), Homeland Security (DHS), Interior (DOI), State (DOS), and Transportation (DOT); the Environmental Protection Agency (EPA), National Aeronautics and Space Administration (NASA), National Science Foundation (NSF), National Transportation Safety Board (NTSB), Nuclear Regulatory Commission (NRC); OMB and the Office of Science and Technology Policy (OSTP). The Under Secretary of Commerce for Oceans and Atmosphere, who is also the Administrator of the National Oceanic and Atmospheric Administration (NOAA), serves as the FCMSSR Chairperson.

In addition to the original public law and directives which established the OFCM, the Weather Research and Forecasting Innovation Act of 2017 called for a new coordination structure under the President's Office of Science and Technology Policy and new coordination processes encompassing federal weather enterprise offices and agencies. As of the writing

Top image of a brush fire is courtesy of [Bureau of Land Management, California](#). Bottom image of the Garden Wall Weather Station in Montana is courtesy [United States Geological Survey](#).

of this report, this new structure is projected to be implemented in 2020.

OFCM Coordinating Infrastructure

The Federal Meteorological Coordinating infrastructure diagram (Figure 1) shows the current committees, working groups (WGs), and joint action groups (JAGs) through which OFCM carries out its mission. The FCMSSR is shown at the top of the diagram as the policy guidance advisor to its subordinate elements and the Federal Coordinator.

Program councils are executive bodies that coordinate the acquisition and management of cross-agency systems or important, broad initiatives. Working groups are intended to serve enduring coordination functions. Joint action groups are temporary elements established to address specific, short-term objectives.

The program councils, committees, working groups, and joint action groups operate at the executive, management, and subject matter expert levels to provide:

- A forum for reporting activities, challenges, and achievements;

- A mechanism for coordinating change and solving problems;
- A method for collecting, documenting, and consolidating agency requirements and inventories;
- A body for coordinating cross-agency system development;
- A vehicle for collaborating with other groups internal and external to the coordinating infrastructure; and
- A mechanism for preparing studies, agreements, standards, protocols, reports, and national plans.

Using these multiagency groups, OFCM pursues the following objectives as the means to achieve its mission:

- Coordinating the exchange of information, plans, and concerns among the FWE agencies to help the Nation achieve the most effective use of the \$4.7 billion (FY20 enacted) collectively spent annually by the partner agencies.
- Coordinating federal agency efforts toward achieving strategic coordination goals and objectives, as outlined in the Strategic Plan for Federal Weather Enterprise Coordination
- Producing and maintaining foundational meteorological documents including National

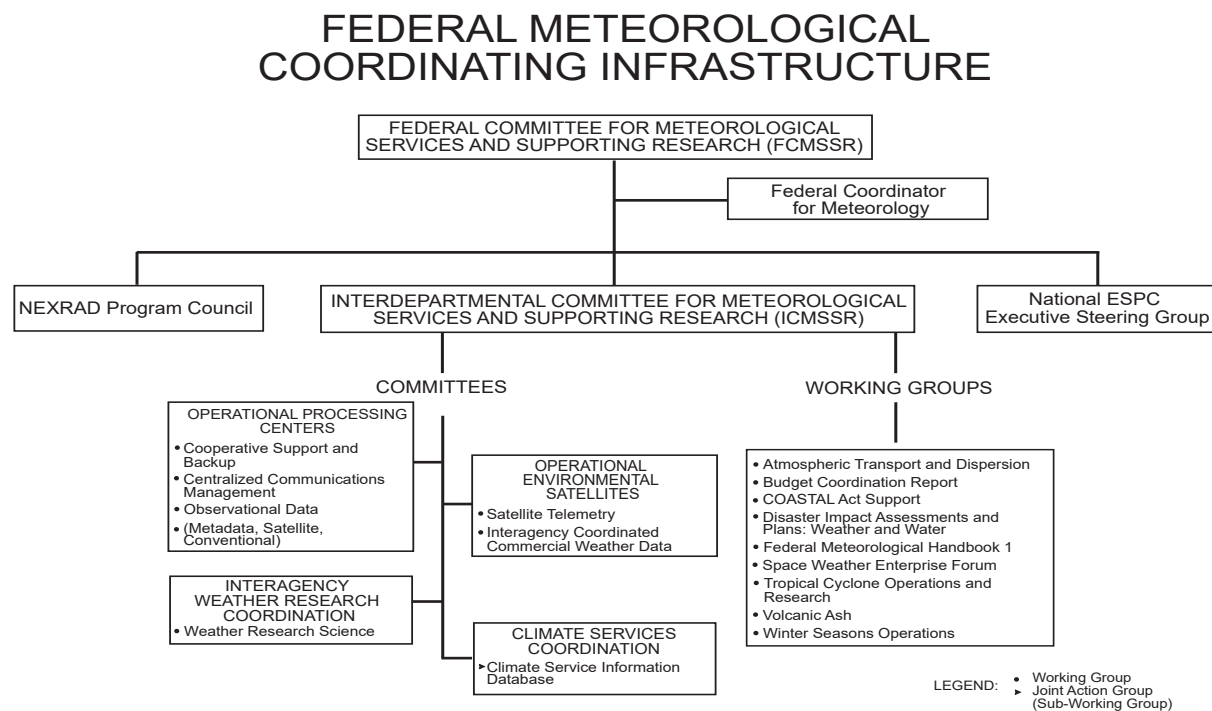


Figure 1: The Federal Coordinating Infrastructure.

Plans, Federal Meteorological Handbooks, and Standards.

Goals and Objectives of the Strategic Plan for Federal Enterprise Weather Coordination (FY2018-2022)

The [Strategic Plan for Federal Weather Enterprise Coordination](#) describes six coordination goal areas, each with several objectives that were determined by the FCMSSR to be areas readily benefited by inter-agency coordination. The goals and objectives are as follows:

1. Observing Capabilities

- 1.1: Enable interagency discussions of observation system acquisition at the capability planning stage.
- 1.2 Provide forums to discuss and promote development, deployment, and sustainment of common-use systems through formalized interagency processes.
- 1.3 Coordinate data formatting, processing, communication, management, and stewardship standards to optimize the exchange, timeliness, usability, and value of earth observations.
- 1.4 Coordinate the development of new observing technology and technology to extract information from observations.

2. Forecasting Processes

- 2.1 Strengthen interoperability among interagency forecasting centers in producing accurate, timely, and precise weather products, information, and services.
- 2.2 Ensure interagency utility (data types, precision, web services, etc.) of short-term to long-term forecasts.
- 2.3 Support agency efforts to plan and develop the cooperative use of processing resources to increase the Nation's computing power for enhancing data assimilation and modeling systems.

3. Decision support products, information, services

- 3.1 Coordinate interagency outreach efforts to identify weather and water-related information needs for decision making and risk management.

- 3.2 Improve the consistency of decision support and risk management products, information, and services across the FWE.

- 3.3 Cross feed processes and lessons learned between agencies to improve decision support tools.

4. Research

- 4.1 Exercise leadership in coordinating U.S. efforts in international weather research priorities including the current World Meteorological Organization Grand Challenges.
- 4.2 Foster interagency collaboration of research initiatives starting at the planning stage.
- 4.3 Support efforts among FWE participants to coordinate task definition and sponsorship of National Academies research initiatives.
- 4.4 Expand interagency use of data and information for research.
- 4.5 Develop coordination processes that facilitate operational feedback to the research community, and that accelerate the integration of promising research from federal, commercial and academic partners into operational improvements in observing, forecasting, warning and threat communication. (added in 2019)

5. Workforce management

- 5.1 Coordinate Office of Personnel Management definitions and requirements for meteorology-related positions to ensure appropriate education and experience of the FWE workforce.
- 5.2 Coordinate opportunities to leverage outreach, including education efforts, recruiting, and diversity and inclusion initiatives.
- 5.3 Cross feed information on career path planning, training opportunities, diversity and inclusion, professional development, and retention programs.

6. Messaging priorities and needs

- 6.1 Coordinate input about FWE priorities to the Executive and Legislative branches, including communicating these priorities to federal agencies that are not FWE participants.
- 6.2 Coordinate messaging about FWE priorities to academia, professional and industry associations, non-federal governmental entities, and the general public.

Coordination Goal and Objective Activities

This section describes the Enterprise's CY 2019 activities in support of these goals. Groups that have taken actions applicable to the goals and objectives are listed, followed by bulleted descriptions of their actions. Since the strategic plan was published, re-directing focus on the objectives has been evolving. Therefore, not every area has been addressed, several groups have been omitted, and some goal activities are not represented. We expect these gaps will be filled over the life of the strategic plan. Additionally, we will leverage this infrastructure to meet the coordination goals of the Weather Research and Forecasting Innovation Act of 2017.

Detailed descriptions of the committees, working groups, and joint action groups, including records of their meetings, are available at the [OFCM Groups web page](#).

Federal Committee for Meteorological Services and Supporting Research (FCMSSR)

- Section 402 of the Weather Act (signed by the President on 19 April 2017) directs the Office of Science and Technology Policy (OSTP) to establish the Interagency Committee to Advance Weather Services (ICAWS). The Interdepartmental Committee for Meteorological Services and Supporting Research (ICMSSR) is coordinating with OSTP to respond to the legislation and recommend adjustments to the interagency coordination bodies. Implementation is expected in 2020. (Objectives 6.1, 6.2)
- Following direction from the ICMSSR, OFCM organized and conducted a one-day, exploratory meeting to examine the need for improved coordination across the Federal government for arctic environmental services and research. Over 60 participants from DOC, DOD, DOE, DHS, DOI EOP, NASA, and NSF gave presentations on the importance of the region and why there is a need for cooperation/collaboration to meet agency missions and associated requirements. The group reviewed policy coordination, operational collaboration, and research activities and interests. They also reviewed of satellite capabilities, sensors, observations and applications used to provide services to the Arctic Region and discussed research activities including ways to

coordinate R2O possibilities. (Objectives: 1.1, 1.2, 2.1, 2.2, 3.1, 4.4, 6.1)

NEXRAD Program Council

- Presented status of the WSR-88D program and management structure to the ICMSSR and will meet in 2020 to discuss outstanding interagency coordination issues. (Objective 1.2)

National Earth System Prediction Capability (ESPC), Executive Steering Group

- Integrated additional agencies into the development of 63 member multi-model (from multiple agencies) ensemble, forecasting out to 16 days; and is planning to extend to a 32 day forecast in the coming year. (Objective 2.3)
- Updating a joint roadmap describing an overarching investment strategy of earth system developmental and operational activities. (Objective 2.3)
- Working toward Common Model Architecture policies and standards, and towards producing a multi-model (from multiple agencies) ensemble for sub-seasonal to seasonal prediction. (Objective 2.3)
- Hosted Interagency High Performance Computing session to examine cloud computing and cloud applications to enhance Earth System Modeling objectives (Objective 4.2)
- Sponsoring interagency program managers summit and to determine areas of common interest and need and where the agencies can collaborate. (Objective 4.2)
- Drafted communications graphics materials for use in National ESPC agency materials. (Objective 6.2)
- Drafted suite of strategy documents to assist in National ESPC priority messaging across agencies. (Objective 6.2)

Interdepartmental Committee for Meteorological Services and Supporting Research (ICMSSR)

- The following groups gave presentations and provided vital updates to the ICMSSR leadership: FAA, NESDIS, NWS, USAF, USN. They covered subjects like satellite sharing information, Life expectancy of satellites, Coastal Act, Arctic, Aviation, Radar Modeling, Space Weather Centers. All of these presentations covered all the objectives listed above.

- The ICMSSR continues its work on updating the job qualifications for 1340 Meteorologist with OMB. (Objective 5.1)
- Developed a new objective for the Federal Weather Enterprise Strategic Plan to improve the Research-to-Operations / Operations-to-Research collaboration loop. (Objective 4.5)
- ICMSSR members reviewed and provided comments on the WIGOS Station ID guidance drafted in Part 1 of the Federal Meteorological Data Management Practices guide. (Objective 3.1)
- USAF A3W coordinate with 53rd WRS on bandwidth requirements on WC-130 aircraft to support real-time, high resolution, dropsonde data downlink capability. (Objective 4.4)

Committee for Climate Services Coordination (C/CS)

- Developed the Joint Action Group for Climate Services and Information Database (JAG – CSID) to address the need for a central location of climate data and services to support federal decision makers. (Objective 2.2)
- Presented information on the JAG-CSID at the American Meteorological Society Annual Meeting in Boston, MA to provide an overview of the group and how it will serve the Federal Weather Enterprise. (Objective 2.2)

Interagency Weather Research Coordination Committee (IWRCC)

- Coordinated to increase visibility of agencies priorities and projects, with specific focus on the WMO focus areas of High-Impact Weather, Polar Prediction, and Seasonal to Sub-seasonal forecasting. Members looked to National Academies' research as cross reference research requirements for the future. (Objective 4.1)
- Coordinated with U.S. Permanent Representative to the WMO to formulate positions on issues of interest to the U.S. agencies for WMO Executive Council meetings. (Objective 4.2)
- Coordinating with National ESPC group members to help refine Sub-seasonal to Seasonal forecast focus goals and act as working group for those topics (Objective 4.2)

Weather Research Science Working Group (SWG)

- IWRCC's SWG is composed of academic and other scientific community experts in focus areas such as High Impact Weather, Polar Prediction, and Seasonal forecasting. SWG conducted

a survey of research topics across federal government and academia, looking for places of intersection. (Objective 4.2)

Committee for Operational Environmental Satellites (COES)

- Coordinating NOAA, USAF, and NASA efforts to obtain and evaluate commercial weather satellite data sources. (Objective 1.2)
- Developed the Working Group for Interagency Coordination for Commercial Weather Data buys to address the coordination needs for data requirements, sharing, and evaluation. (Objective 1.2)
- Provided coordination for U.S. input to working groups under the international Coordination Groups for Meteorological Satellites Annual Meeting (Objective 1.2)

Satellite Telemetry Interagency Working Group (STIWG)

- Submitted collective STIWG response to FCC NPRM 19-116
 - Protection of 1675 – 1695 MHz spectrum from mobile radio interference
 - Detailed operational, economic and life-safety benefits of GOES DCS (Objective 1.3)
- Approved formation of a group to develop Random Channel User Guidelines
 - Revise DCS documentation for current conditions (Objective 6.2)

Committee for Operational Processing Centers (COPC)

Working Group for Cooperative Support and Backup (WG/CSAB)

- Coordinated each Operational Processing Center's (OPC) GOES-17 and GOES-15 data transition strategy. (Objective 1.2)
 - Coordinated assessing and monitoring mission impacts from the GOES-17 ABI loop heat pipe anomaly mitigation efforts which involved augmented coverage with Himawari-8, focal plane temp flags, predictive calibration, and ABI L2 enterprise algorithms. (Objective 1.3)
- Monitored and implemented Air Force and Navy efforts to move off the legacy Data Acquisition, Processing, and Exchange (DAPE) server to the enterprise Product Distribution and Access (PDA) system for the exchange of environmental satellite data. (Objective 1.3)

- Coordinated the OPC's awareness and implementation of the Meteosat decontamination exercise. (Objective 1.3)
- Implemented outage notification procedures among OPCs to ensure optimal situational awareness and allocation of recovery resources during operationally sensitive system down time events. (Objective 2.1)
- Monitored for awareness and potential coordination the individual OPC cloud migration efforts for the potential to exploit cloud data storage and cloud computing to optimize operations, backup arrangements, and data share among OPCs. (Objective 2.1, 2.3)
- Coordinated messaging of COPC's purpose, scope, responsibilities, procedures, and capabilities to achieve actionable interagency coordination between member meteorological and oceanographic operational processing centers regarding cooperative data exchange and increased effectiveness of products and services during the AMS session on Interagency Coordination by the Federal Weather Enterprise. (Objective 6.2)
- Monitored and coordinated the OPC's implementation of a new capability [using GOES 13 – GOES I/O – EWS-G] for Indian Ocean data imagery coverage. (Objective 1.4)

Working Group for Centralized Communications Management (WG/CCM)

- Coordinated the effort of assisting the JSH team (Joint Polar Satellite System [JPSS] Stored Mission Data Hub) in determining a data latency issue. (Objective 2.1)
- Coordinated the implementation of the ensemble exchange process with the development of an EMC webserver, potentially alleviating the latency mission impact for the Navy. (Objective 2.1)
- Supporting and monitoring the DOD's Joint Information Environment-Joint Regional Security Stack (JIE-JRSS) implementation for potential latency impacts. (Objective 2.1)

Working Group for Observational Data (WG/OD)

Conventional Data Subgroup

- Continued weekly interagency coordination meetings to address ongoing meteorological data management issues. (Objective 1.3)
 - Addressed data quality and data accessibility issues, and implemented an OPC-collaborative observational data quality control process for

metadata error discovery, reporting, tracking, and correction.

- Coordinated U.S. planned proposals to the WMO Inter-Programme Expert Team on Codes Maintenance (IPET-CM) for table-driven code forms, the Manual on Codes, and interoperability of metadata and data between WMO standards and formats. (Objective 1.4)
- Continued development of U.S. procedures for implementing the WMO Integrated Global Observing System (WIGOS) and the Observing Systems Capability Analysis and Review tool (OSCAR/Surface), the future observing framework in support of weather, climate, water and relevant environment services - a WMO priority. (Objective 1.2, 1.3)
- Continued collaborative development of the U.S. Federal Meteorological Data Management Practices guide, focusing on U.S. procedures for creating and assigning WIGOS station identifiers (WSI). (Objective 1.2, 1.3)
 - Alerted U.S. operational processing center directors of the transition to the new IDs, and informed the public, private, and academia sectors by presenting this information at the 2019 American Meteorological Society Meeting. (Objective 1.2, 1.3)
- Strengthened U.S. representation to the WMO by maintaining WG/OD members on WMO Task Teams for WIGOS station ID implementation, Upper Air Data management, and WIGOS Data Quality Management. (Objective 1.2, 1.3)
- Facilitated the National Science Foundation initiative to disseminate Antarctic Observations on the Global Telecommunications System. (Objective 1.2, 1.3)
- Facilitated the U.C. San Diego, Center for Western Weather and Water Extremes initiative to format radiosonde research data collected during Atmospheric River events and disseminate on the Global Telecommunications System. (Objective 1.2, 1.3)
- Coordinated interagency review and inputs to WIGOS-related U.S. position papers for the 2019 WMO Congress and assisted in planning the U.S. hosted International 2020 GODEX meeting. (Objective 1.2, 1.3)

Satellite Data Subgroup

- Coordinated testing of the Critical Infrastructure Protection satellite data services system that functions as a transparent backup for the most

critical Earth System Prediction Capability data services. (Objective 1.3)

- Monitored potential data access and preparation for Level 1 future satellite products to align with core mission objectives. [Jason-CS, Sentinel-3A, Metop-C, and Meteosat-TG satellites.] (Objective 1.3)
- Tracked and routinely satisfied Operational Processing Center requests for satellite data. (Objective 1.3)

Working Group for the Federal Weather Enterprise Budget and Coordination Report (WG/BCR)

- Coordinated and published the FY2020 Federal Weather Enterprise Budget and Coordination Report for reporting the Federal Weather Enterprise's (FWE) coordination efforts and by-agency budget information related to meteorological services and supporting research. (Objective 6.1, 6.2)
- Convened the annual meeting of the Working Group/BCR to initiate the FY2021 BCR development process. (Objective 6.1, 6.2)

Working Group/Tropical Cyclone Operations and Research (WG/TCOR)

- Conducted the 2019 Tropical Cyclone Operations and Research Forum (TCORF) / Interdepartmental Hurricane Conference. Participants of the annual TCORF review the National Hurricane Operations Plan and the hurricane forecasting and warning program. (Objective 1.1, 1.2, 1.3, 2.1, 4.2)
- Reached agreement to modify NHC products leading to improvements in forecasts. (Objective 1.3)
- Exchanged information regarding satellite data available due to new satellite launches. (Objective 1.2)

Working Group for Federal Meteorological Handbook Number 1 (WG/FMH-1)

- Examined and discussed weather observation guidelines for reporting changes in intensities for snow. The group met in 2019 and will continue to resolve this matter into 2020. (Objective 1.1, 1.2, 1.3, 1.4, 3.1, 3.2, 3.3)

Working Group for the Space Weather Enterprise Forum (WG/SWEF)

- Planned and conducted the 2019 SWEF as a public meeting at the Department of Interior Main Building in Washington DC Interior to

focus attention on the threat of Geomagnetic Disturbance and their potentially devastating impacts to the national power grid. (Objective 3.1, 3.2)

- Initiated planning for the 2020 SWEF to be conducted on Capitol Hill in November 2020 to provide congressional members and the public insights on the need for space weather services and supporting research to mitigate the impacts of space weather on vulnerable, essential technological infrastructure. (Objective 6.1, 6.2)

Working Group for Disaster Impact Assessments and Plans: Weather and Water Data (WG/DIAP)

- Coordinated interagency wind, water, and radar data collection and damage assessments for Hurricanes Barry and Dorian for use in federal, private sector, and academic model development, post-storm investigations and research. (Objective 1.3, 3.2, 4.4)
- Coordinated a change to the National Plan, Civil Air Patrol support request procedures, transferring some interagency coordination responsibilities to the NWS. (Objective 1.2)
- Coordinated Civil Air Patrol support for four season sorties in response to the Alaska-Pacific River Forecast Center request for aerial support for an assessment of the glacier dammed lakes located on the Kenai Peninsula, Alaska. (Objective 1.3, 3.2, 4.4)
- Reviewed and updated all sections of the National Plan for Disaster Impact Assessments with a special focus on the COASTAL Act Data Collection Protocol (Annex 2 of the National Plan), particularly the Digital Hurricane Consortium aspects of this protocol. (Objective 1.2, 1.3, 1.4, 3.1, 3.2, 3.3)

Working Group for COASTAL Act Support (WG/CAS)

- Facilitated open dialog between the federal agencies and academic partners in developing decision support tools required by the COASTAL Act. (Objective 3.3)
- Coordinating weather and hydrological products, information and services needed to meet the requirement of the COASTAL Act. (Objective 2.1)
- Finalized the Coastal Wind and Water Event Database (CWWED v1.0). (Objective 2.1)
- Collaborated with the WG/DIAP implementation team and sent a request to WG/DIAP responders to 2018 Hurricane Florence to

collect observations for the first exercise of the COASTAL Act Named Storm Event model. (Objective 2.1, 4.1, 4.4, 4.5)

Working Group/Winter Season Operations (WG/WSO)

- Finalized agenda for the 2019 working group meeting, in Lakeland, FL, to draft the National Winter Season Operation Plan for publication in the summer of 2020. (Objective 1.1, 1.2, 2.1, 3.1, 4.1, 4.2)

Working Group/Atmospheric Transport and Dispersion (WG/ATD)

- The WG/ATD held its annual interagency meeting at George Mason University. The conference included presentations from a number of agencies including NOAA/NWS, DOD, DOE, and NOAA/NESDIS. (Objective 1.2, 2.1, 2.3, 3.2, 3.3, 4.2, 4.5, 6.2)

Wildland Fire Weather Initiative

- In July 2019, the NWS brought to the attention of OFCM that there are new technologies available to find and evaluate fire hot spots. (Objective 1.2, 4.2)
- A meeting was planned between the NWS and OFCM with the Initiative to arrange and conduct an exploratory meeting with National Wildland Fire Weather program stakeholders. The purpose of meeting was to discuss that in light of new fire detection capabilities offered by GOES-17 and GOES-16, a review was needed to validate agency wildland fire weather roles and responsibilities, particularly as they relate to wildland fire: detection, data analysis, product development, and dissemination. The preliminary constituents included (but were not limited to NOAA/ National Weather Service, Bureaus of Land Management and Indian Affairs, Fish and Wildlife Service, National Park Service, Forest Service, National Emergency Management Agency). (Objective 1.2, 4.2)
- As requested by the Federal Coordinator, drafted proposed next steps to address this issue for presentation to the ICMSSR for approval and OFCM briefed this to the ICMSSR, the NWS Director asked that OFCM delay an interagency meeting until NWS could hold internal discussions/meeting. (Objective 6.1)
- On October 28: OFCM hosted fire weather meeting. In light of new fire detection capabilities offered by GOES-16/17 and NOAA-20, reviewed and validated agency wildland fire weather roles

and responsibilities, particularly as they relate to wildland fire: detection, data analysis, product development, dissemination, and watch/warning/ advisory responsibility. (Objective 1.2, 2.1)

Arctic Environmental Services Initiative

In response to ICMSSR direction, a one-day meeting was held on April 15, 2019 to review current and future operational meteorological, oceanographic, and space environmental services and supporting research for national interests in the arctic region with the purpose of determining whether collective inter-agency coordination is needed. The meeting included over 60 enthusiastic participants from DOC, DOD, DOE, DHS, DOI EOP, NASA, and NSF. Although the meeting attendees agreed that a new interagency group was not needed, they noted four Action Items for improving current efforts:

- With assistance from the meeting participants, develop a summary of organizations and responsibilities for Arctic region environmental services and research.
- Ensure issues regarding Arctic environmental services are addressed in existing elements of the FWE coordinating infrastructure.
- Assist interested FWE organizations to engage in the Interagency Arctic Research Policy Committee (IARPC).
- Reconvene an Arctic Environmental Services Interagency Exploratory meeting in April 2020.

OFCM completed these actions and continued to expand its engagement in interagency arctic environmental issues and activities. (Objective 1.1, 1.2, 3.1, 3.2, 3.3, 4.2, 4.4, 4.5)

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Agency Funding for Meteorological Services and Supporting Research: Resource Information and Agency Program Updates

2

The narratives and tables in this section summarize selected budgetary information for the Federal government for fiscal years (FY) 2019 through 2021. The funds shown are used to provide meteorological services and associated supporting research, which includes research and development with service improvements as their direct objectives. Fiscal data are current as of the end of March 2020 and are subject to later changes. The data for FY 2021 are derived from the President's Budget Request for FY 2021. The data for FY 2019 and FY 2020 represent enacted (congressionally approved) funding amounts. The budget data are submitted by each agency or entity and prepared by the Office of the Federal Coordinator for Meteorological Services and Supporting Research (OFCM) in compliance with Section 304 of Public Law 87-843, in which Congress directed that an annual horizontal budget, across Federal departments and agencies, be prepared for meteorological programs conducted by the Federal agencies. Where applicable, budget summaries identify and prioritize the agencies' top forecast needs for coordination across federal offices and agencies, as called for in Public Law 115-25, Title IV, Section 402(a)(2) - the Weather Research and Forecasting Innovation Act of 2017.

Department of Agriculture

The Department of Agriculture's (USDA) budget request for meteorological operations and supporting research for FY 2021 is \$174.8 million, up 13% from the FY 2020 funding level. The increase is largely due to a 19.1% decrease in the request for funding by the National Institute for Food and Agriculture (NIFA).

- USDA has requested \$154.1 million for research and development programs, about \$20.2 million more than in 2020. This funding is supported through USDA's two major research agencies. The National Institute for Food and Agriculture

(NIFA) provides grants that support weather and climate research initiatives, including drought and water quality issues facing our Nation's producers. ARS, USDA's principal in-house scientific research agency, conducts research on how to cope with annual variations of weather on crop and animal production, ecosystem services, and the environmental and economic sustainability of agricultural enterprises.

- The FY 2021 amount requested by USDA for meteorological operations is approximately \$20.7 million, equal to the FY 2020 funding level. Operational activities include specialized weather observing networks such as the SNOTEL (SNOW pack TELelemetry) network operated by the Natural Resources Conservation Service (NRCS) Snow Survey and Water Supply Forecasting program (SSWSF) and the Remote Automated Weather Stations (RAWS) network managed by the Forest Service. The SNOTEL and RAWS networks provide cooperative data for NOAA's river forecast activities, irrigation water supply estimates, and Bureau of Land Management operations. The SSWSF program, managed by the NRCS National Water and Climate Center, provides western states and Alaska with information on future water supplies. The Forest Service uses meteorological data to inform wildfire management decision-making regarding preemptive resource deployment and suppression strategy. The meteorological staff of the Office of the Chief Economist's World Agricultural Outlook Board (OCE/WAOB) routinely collects global weather data and agricultural information to assess the impact of growing season weather conditions on crops and livestock production prospects, keeping USDA commodity analysts, the Chief Economist, and the Secretary of Agriculture and top staff well informed of weather impacts on crops and livestock

A textbook weather front over the eastern two-thirds of the United States, courtesy [NASA](#).

worldwide. The Risk Management Agency (RMA) provides administration and oversight of programs authorized under the Federal Crop Insurance Act. RMA's Strategic Data Acquisition and Analyses (SDAA) unit works with Oregon State University's Parameter-Elevation Regressions on Independent Slopes Model (PRISM) Climate Group to develop and utilize spatial climate data sets to detect potential waste, fraud and abuse in the Federal crop insurance program and to assist underwriting in developing crop suitability mapping.

In FY2021, USDA agencies will continue to work with the National Oceanic and Atmospheric Administration's National Weather Service (NOAA/NWS) to coordinate their need for forecasts and outlooks, while also continuing to provide data to the NOAA/NWS data stream. The Forest Service, as a partner in the National Interagency Fire Center (NIFC) with NOAA and numerous other Federal agencies, leverages data from its RAWs network in support of fire prediction activities critical to effective fire management. Forest Service relies on NOAA/NWS forecasts and outlooks for activities including decision making for prepositioning of supplies and ensuring the safety of firefighting crews. Similarly, NRCS coordinates release of its Water Supply Forecasts with the NOAA/NWS spring seasonal outlook, in addition to year-round sharing of data from its SNOTEL and RAWs networks with the River Forecast Centers, local Forecast Offices, and other NOAA agencies. Beginning in FY2019, USDA's Regional Climate Hubs, under the leadership of the Forest Service, OCE, and ARS, have been working with the NOAA/NWS Climate Prediction Service to help tailor sub-seasonal and seasonal outlooks to the agricultural community. The Hubs have effected methods of gleaning information relevant to agriculture from outlooks in anticipation of weather events potentially harmful to crops and livestock (freezes, heatwaves, flooding, etc.), and have been working closely with agencies within NOAA, including offices within the National Weather Service and their regional counterparts the NOAA-led National Integrated Drought Information System.

Reference: [2021 Budget Summary for the U.S. Department of Agriculture \(USDA\)](#)

Department Of Commerce/ National Oceanic and Atmospheric Administration

National Weather Service

The National Weather Service (NWS) funding request for the FY 2021 President's Budget totals \$1.1 billion. This is a 4.1% decrease from the FY 2020 enacted budget. NWS provides weather, water, and climate forecasts and warnings for the United States, its territories, adjacent waters, and ocean areas for the protection of life and property and the enhancement of the national economy, 24 hours every day. NWS is the sole, official and authoritative U.S. voice for issuing warnings during life-threatening weather situations. With this request, NOAA proposes to focus on the core weather mission with more efficient processes to provide forecasts and warnings. NWS will also continue to pursue the NWS Weather-Ready Nation goals including activities to sustain forecast accuracy and consistency, as well as provide Impact-based Decision Support Services to core partners.

In FY 2021, NWS will continue its Next Generation Weather Radar (NEXRAD) Service Life Extension Program (SLEP), continuing transmitter, pedestal, and shelter refurbishments to extend overall service life, and reduce the average time between failures. NWS will also continue the Automated Surface Observing System (ASOS) SLEP with production and installation of the upgraded Acquisition Control Unit (ACU) and Data Collection Package (DCP), in partnership with and including reimbursable funding from tri-agency partners, the Federal Aviation Administration (FAA) and the Department of Defense (DoD).

Significant requested increases in funding from the FY 2020 enacted level included below were derived based on complex decisions and may affect more than one program.

Increase Data Sharing for Integrated Global Observing System and Global Basic Observing Network. NOAA requests an increase of \$4.0 million to increase observational data sharing with international partners. This request will provide funding for the World Meteorological Organization (WMO) Integrated Global Observing System (WIGOS) which is a framework for all WMO observing systems guiding planning, management, operations, and maintenance of these systems. Global Basic Observing Network (GBON), is a subset of the surface-based systems of WIGOS. The requested funds will provide hardware and software support for systems that collect observational data, improving the frequency and reliability of observational data used to generate weather and water forecasts, watches, and warnings.

Enhancing the World Meteorological Organization Information System. NOAA requests an increase of \$1.0 million for the World Meteorological Organization Information System. This request will bring the U.S. Global Information System Center (GISC) up to the WMO's new standards for information sharing. Funding will provide for the acquisition of new hardware and software to support the WMO systems, located in College Park, MD and Boulder, CO. This request will support NWS' ability to create and maintain the metadata associated with the GISC, as well as to provide the additional contractor support to standardize the data.

Establish National Weather Service Pilots.

NOAA requests an increase of \$2.0 million to accelerate efforts in NWS model technology that is foundational to the Collaborative Forecast Process (CFP); specifically, the National Blend of Models (NBM). NWS will focus on the NBM as a primary science and technology tool that will enable the CFP by allowing forecasters the ability to have a scientifically valid common starting point for forecasts. A common starting point will improve national forecast consistency, and improve NWS customers' confidence in the forecast. Early testing of the NBM as a common starting point suggests that there may be efficiencies in the forecast process that could be used to improve IDSS to core partners.

References: [NOAA FY2021 Congressional Justification](#)

NWS Overview: page NWS-1

Increase Data Sharing for Integrated Global Observing System and Global Basic Observing Network: page NWS-16

Enhancing the World Meteorological Organization Information System: page NWS-79

Establish National Weather Service Pilots: page NWS-101

National Environmental Satellite, Data, and Information Services

The National Environmental Satellite, Data, and Information Services (NESDIS) funding request for the FY 2021 President's Budget totals \$1.5 billion. This is a 0.6% decrease from the FY 2020 Enacted. The FY 2021 budget will support key initiatives committed to providing real-time operations and data services as well as continuing production of NOAA's flagship satellites to continue meeting NESDIS' primary mission essential functions without incurring gaps in coverage.

NESDIS is conducting a series of industry studies and performing critical analyses to develop a new generation of satellites to ensure that essential functions of weather forecasting are met. NOAA will

continue building robust Geostationary Operational Environmental Satellites – R (GOES-R) and the Polar Weather Satellites (PWS) satellite series, which will improve lead times for watches and warnings and will meet DOC's strategic goal to reduce impacts of extreme weather events. NESDIS will leverage its partnership with European Organisation for the Exploitation of Meteorological Satellites (EUMETSAT) to develop the infrastructure to ingest, process and distribute Meteorological Operational Satellite – Second Generation (Metop-SG), a satellite that will orbit in a mid-morning orbit, to increase the accuracy of numerical weather prediction. NOAA is also developing Space Weather Follow-On (SWFO)-L1, a satellite to monitor and issue geomagnetic storm warnings. NESDIS is responsible for managing all aspects of remotely gathered environmental data, providing uninterrupted global coverage, critical for generating short-and long-term weather forecasts to deliver observations for weather forecasting.

NESDIS encourages entrepreneurial and public service use of NESDIS data products, and searches for innovative approaches for exploiting environmental data from satellites. NOAA's Commercial Weather Data Pilot (CWDP) facilitates such demonstration projects to expand its observational datasets. CWDP allows NOAA to purchase and evaluate environmental data to meet NOAA's mission. NESDIS seeks environmental data and data products to be exploited by NOAA meteorological models to add value and benefit to weather forecasts.

Significant requested increases and decreases in funding over the FY 2020 Enacted Budget include:

GOES-R. NESDIS requests an increase of \$30.4 million for a total of \$334.5 million in the GOES-R Series program. This increase is for the near term sustainment funds in the GOES-R Series program. These funds will continue sustainment of the GOES-R Series Ground System, including replacement of the IBM servers, in compliance with requirements under the Consolidated Appropriations Act of 2014 and the Committee on Foreign Investment in the United States to discontinue use of Chinese data systems by FY 2022. NOAA will continue satellite engineering development, production, and integration for the GOES-T and -U satellites. The GOES program, which has provided essential observational data since 1975, supports the National Weather Service (NWS) in forecasting, tracking, and monitoring severe storms.

Polar Weather Satellites. NESDIS requests a decrease of \$87 million for a total of \$658 million for the PWS. NOAA will continue the build of the JPSS-2 instruments and spacecraft, as well as the JPSS-2 satellite level integration and testing, in order to maintain the JPSS-2 launch schedule. NOAA will continue the development of the spacecraft and the Advanced Technology Microwave Sounder, Cross-track Infrared Sounder, Visible Infrared Imaging Radiometer Suite, and Ozone Mapping and Profiler Suite instruments for JPSS-3 and JPSS-4 in order to maintain synergies with JPSS-2 and efficiencies of the block buy approach for these elements of the PWS. NOAA will continue the maintenance and sustainment of the ground system supporting the Suomi National Polar-orbiting Partnership and NOAA 20 satellites, and continue development and testing of the ground system to support JPSS-2. NOAA will continue to work to refine its constellation strategy for PWS continuity.

Space Weather Follow On. NESDIS requests an increase of \$44 million for a total of \$108 million, to support a SWFO-L1 mission with Space Weather Instrument Suite for solar wind observations and a compact coronagraph (CCOR) for coronal mass ejection imagery at Lagrange point 1. The NOAA SWFO-L1 mission will ensure continuity of space weather data beyond NOAA's Deep Space Climate Observatory (DSCOVR) and NASA-European Space Agency research Solar and Heliophysics Observatory (SOHO), which are well past their design life.

Data-source Agnostic Common Services. NESDIS requests \$5 million to utilize essential data and observations from an increasingly capable and diverse array of partner and commercial systems to meet mission requirements in a cost-effective manner. NESDIS will transition new and legacy products and services to a cloud architecture to increase end-to-end efficiencies through a more flexible and scalable infrastructure and to enable advanced processing capabilities. The transition in FY 2021 will leverage pilots completed in FY 2020 and will focus on taking the current hardware and software functions to a cloud-enabled framework that will run updated software, generating products and services from any applicable data source (i.e., data-source agnostic). The increased infrastructure capacity will include the ability to securely and efficiently ingest, process, distribute, and archive an increasing volume and complexity of data.

Commercial Weather Data Pilot. NESDIS requests an increase of \$5 million for a total of \$8 million to continue executing pilots for the next available commercial capabilities. These pilots are critical to NOAA's future satellite architecture as they assess operational viability of possible future commercial capabilities. With the additional pilot project work, NOAA will continue to assess new capabilities that are available in the commercial market, and test commercially available capabilities based on market research, in accordance with the NOAA Commercial Space Policy.

Commercial Data Purchase. NESDIS requests an increase of \$10 million for a total of \$15 million to purchase commercial Global Navigation Satellite System (GNSS) Radio Occultation (RO) data for operational use. It will also support continued development and sustainment of the infrastructure and capability to securely import, transfer, process, and store external data from commercial partners for operational use. GNSS RO has the potential to be a cost-effective means of increasing the volume of quality global atmospheric soundings. It provides temperature, water vapor, and pressure profiles, necessary for accurate weather forecasts.

References: [NOAA FY 2021 Congressional Justification](#)

Overview: page NESDIS-1

GOES-R Series: page NESDIS-78

PWS: page NESDIS-56

SWFO: page NESDIS-88

Data-source Agnostic Common Services: page NESDIS-93

Commercial Data Weather Pilot: page NESDIS-101

Commercial Data Purchase: page NESDIS-104

Office of Oceanic and Atmospheric Research

The Office of Oceanic and Atmospheric Research (OAR) request for funding related to meteorological supporting research in the FY 2021 President's Budget totals \$185.0 million. This is a 7.5% decrease from the FY 2020 Enacted budget. OAR will continue to provide the nation with critical environmental information to support informed decision-making and promote healthy, productive, and resilient ecosystems, communities, and economies. OAR will continue research focused on improving our understanding and forecasting capabilities for atmospheric events that endanger lives and property and research focused on establishing a greater understanding of, and ability to predict, climate variability and change, and to enhance society's ability to plan and respond. OAR also will conduct innovative research for the

development of the next generation of products and services.

Climate Research. NOAA requests a decrease of \$85.8 million from a FY 2020 enacted level of \$169.5 million for the sub-activity dedicated to climate research, including eliminating Climate Competitive Research funding and arctic research. NOAA will reduce competitive research grants to Cooperative Institutes, universities, NOAA research laboratories, and other partners. With the remaining climate funding, OAR will preserve priority activities including 1) Earth System Research within the OAR laboratories; 2) Long-term observations and climate records; 3) Research and development associated with Seasonal to Sub-seasonal (S2S) atmospheric research; and 4) legislatively mandated work on the National Climate Assessment. NOAA requests an increase of \$3.8 million for a total of \$70.3 million for the Climate Labs and Cooperative Institutes program to support research activities that will help to gain a comprehensive understanding of the physical, chemical, and dynamical processes that shape our climate. NOAA will continue to support the world-class climate science that takes place at NOAA.

Weather and Air Chemistry Research (W&ACR). This sub-activity includes Laboratories and Cooperative Institutes (CIs) and Weather and Air Chemistry Research Programs. NOAA requests a decrease of \$18.8 million for a total of \$114.8 million. Within this level of funding NOAA would increase priority weather research contained within the US Weather Research Program by \$8.5 million, which leads to near-term, affordable, and attainable advances in weather forecasting and computer and modeling capabilities to deliver substantial improvements in weather forecasting. Within this amount, NOAA proposes to bolster the Earth Prediction Innovation Center (EPIC) to accelerate community-developed scientific and technological enhancements into operational applications for numerical weather prediction (NWP). This virtual center will serve as the core research-to-operations-to-research (R2O2R) center for building and maintaining a community modeling framework to link world class scientists and software engineers in academia, the private sector and partner agencies with the research, development, and operational activities inside the agency. Additionally within this amount, NOAA will establish a Tornado Warning Improvement and Extension Program (TWIEP) to improve the accuracy and timeliness of tornado forecasts, predictions, and warnings. With this increase, the TWIEP will carry out research and

leverage existing resources to advance NOAA's tornado observing systems, thunderstorm-scale computer models, and risk communication approaches. The following labs, programs and activities are proposed for reduction or termination:

- Air Resources Laboratory
- Vortex SE
- Infrasonic Research

References: [NOAA FY 2021 Congressional Justification](#)

OAR Overview: page OAR-1

Climate Research: page OAR-13

Weather Research: page OAR-44

National Ocean Service

The National Ocean Service (NOS) request for funding related to meteorological services in the FY 2021 President's Budget totals 34.6 million all within the Navigation, Observations, and Positioning PPA. This is a 1.6% decrease from FY 2020 enacted amount. These funds allow for continued operation of the National Water Level Observation Network (NWLON), the Physical Oceanographic Real-Time System (PORTS®) program, the data quality control program known as the Continuous Operational Real-time Monitoring System (CORMS), and the Ocean Systems Test and Evaluation Program (OSTEP), which is a development program for bringing new sensor technology into operations.

Both the NWLON and PORTS® programs include subsets of operational water level stations with meteorological sensors installed for various partners and users, including the National Weather Service (NWS). NOS will continue to provide meteorological observations that are critical to navigation activities and the safety of life and property. Though traditionally oceanographic observing systems, NWLON and PORTS® technology allows multiple other sensors to be added, including meteorological sensors measuring wind, air temperature, relative humidity, visibility and barometric pressure. These meteorological observations provide important data for improving and verifying marine weather forecasts and warnings. NOS has upgraded and enhanced the majority of its NWLON stations with new meteorological sensors. This increase in meteorological observations has led to a 10% increase in the probability of detection of marine weather events and a ten-minute increase in lead times for marine warnings, according to actual verification data for special marine warnings.

Navigation data users require a complete picture of their operating environment, which includes local

meteorological data, to make safe and cost-effective decisions. Leveraging existing observing infrastructure is a cost-effective alternative to establishing new platforms to collect these data. Additional meteorological data improves the accuracy of NWS forecasts for storm surge, marine winds, marine wave heights, and visibility used by both marine navigation and coastal communities when extreme weather events occur. NOS has fourteen PORTS® stations with operational visibility sensors located in Mobile Bay, AL, San Francisco Bay, CA, Narragansett Bay, RI, Northern Chesapeake Bay, MD, Tampa Bay FL and St. Johns River, Jacksonville, FL. There continues to be growing interest in real-time visibility observations and the importance of visibility monitoring and forecasting grows. Real time meteorological data is often used by emergency responders to make sound decisions based upon the most up to date and accurate information. For example, when coastal areas are flooding, emergency responders must know which evacuation routes are still viable and other related information that most accurately reflects the current state of the physical environment.

References: [NOAA FY2021 Congressional Justification](#)

NOS Overview: page NOS – 1

Navigation Services: page NOS – 10

PORTS® and Precision Navigation: page NOS-12

NOS Tides and Currents Activities: (NWLON, Modeling, PORTS): pages NOS – 13-14

Office of Marine and Aviation Operations

The FY 2021 President's Budget requests \$34.5 million for the Office of Marine and Aviation Operations (OMAO) in funding to support meteorological operations and research activities (\$26.5M for Aviation Operations and Aircraft Services, \$8.0M for NOAA Corps, Aviation). This is a 3.1% reduction from the FY 2020 enacted. OMAO supports meteorological operations and research activities through collection of related data from the aircraft fleet. The fleet supports NOAA's science, service, and stewardship mission. The fleet operates throughout the United States and around the world; over open oceans, mountains, coastal wetlands, and the Arctic. NOAA's fleet fulfills multiple missions in support of NOAA's programs providing capable, mission-ready platforms and professional crews that survey snow-pack levels for flood prediction, improve hurricane prediction models, assess air quality, survey coastal erosion, investigate oil spills and conduct oceanographic research and weather forecasts. In FY 2021, OMAO will continue to support meteorological

observations through its Aircraft Operations PPA and NOAA Corps PPA. OMAO's airplane and ships help local decision makers respond to real-time meteorological events, including hurricane reconnaissance and research.

References: [NOAA FY2021 Congressional Justification](#)

OMAO Overview: page OMAO-1

Aviation Operations and Aircraft Services: page OMAO-19

NOAA Corps: page OMAO-35

Department of Defense

U.S. Air Force

The U.S. Air Force request for meteorological program support FY 2021 is \$196.2 million. Air Force resources for meteorological support fall into three categories: general operations and maintenance, procurement, and research, development, test & evaluation. This is a 27.3% increase from FY20 enacted funding. The majority of this increase was in O&S (3400 WSS CAM) to help fund our cloud migration efforts for the Air Force Weather Virtual Private Cloud. This does not include all meteorological activities conducted within the Air Force.

Operations

Operational resources are dedicated to providing timely, accurate, resilient, and relevant environmental information, to include space and terrestrial weather for global battlespace situational awareness for U.S. Air Force/U.S. Army forces and platforms supporting the 2018 National Defense Strategy objectives. The majority of the 27.3% increase in the FY21 PBR was a result of an Air Force decision during the FY21 Zero-Based Review to accelerate Air Force Weather's transition to the Amazon Air Force Weather Virtual Private Cloud environment. This action supports federally-mandated data center reductions and 'Cloud Smart' migration strategies to help enable data discovery for Joint All Domain C2/Advanced Battle Management System/Sensing Grid integration priorities.

Research and Development

In order to align with the 2018 National Defense Strategy lines of effort, the U.S. Air Force continues investing in modernized environmental data collection, analysis, prediction, dissemination, and tailoring capabilities to include commercial technologies that enhance system efficiency, ensure cybersecurity, and promote interoperability. The USAF plans to invest in the following capability areas:

Weather Data Analysis and Dissemination.

Weather Data Analysis and Dissemination provides command and control and mission planning integration; centralized, cybersecure weather web service capability; large-scale data ingest, processing, and warfighter product generation and visualization; agile software development and deployment; global, regional, and mission execution forecasts; specific, mission-tailored weather data on demand; and weapon system interoperability through machine to machine interfaces. Research, development, test and evaluation activities will enhance the capability to ingest, process, store, access, and disseminate meteorological data via upgrades to the web services architecture to expand the Open Geospatial Consortium services, implementation of modular open system architecture, upgrades to large-scale data processing, migration to continuous delivery/continuous integration methods for software development and deployment, and transition to a cloud computing environment.

Weather Forecasting. Weather Forecasting provides advanced scientific numerical weather prediction capabilities for automated, high resolution forecast products for mission planning, rehearsal, and execution with an emphasis on clouds, theater scale weather, aerosol/chemical constituents, and space environment characterization. Weather Forecasting includes programs for Numerical Weather Modeling, Weather Services - Live, Virtual, Constructive, and Space Weather Analysis and Forecast System. Research, development, test and evaluation activities will develop software for exploitation of dynamic aerosols, new meteorological satellite data sources, explicit numerical weather prediction cloud forecasting, and exploitation of space weather data. Additional research, development, test and evaluation activities include optimization of software for cloud migration and transition of the machine-learning Global Synthetic Weather Radar capability to operations.

References: [U.S. Air Force FY2021. Congressional Justification](#)
OPERATION AND MAINTENANCE, AIR FORCE VOLUME II
Multiple Pages (Weather Systems), Depot maintenance
Other Procurement, Air Force - Vol 1
Line # 20, Pg 141, (Weather Observation Forecast)
Research, Development, Test & Evaluation, Air Force Vol-III
Part 2, Vol 3b
Line # 255 Pg 189 (Weather Service)
Research, Development, Test & Evaluation, Air Force Vol-II
Line # 43 Pg 85 (Air Force Weather Services Research)

U.S. Army

The U.S. Army (USA) submitted a \$24.0 million request for FY 2021 for meteorological operations,

acquisition, research, and development, an overall increase of 8.1% compared to FY 2020 enacted funding. The increase covers added funds to the Army Test and Evaluation Command (ATEC) meteorological support while the Army Research Lab saw a mild increase of .2% for acquisitions. The US Army Intelligence Center of Excellence (USAICOE) received a 1.4% increase in educational funding.

Operations

The U.S. Army funds meteorological support for developmental and operational tests and evaluations at ranges across CONUS, Alaska and Panama to provide essential information to acquisition decision makers and commanders. The Army also funds systems which provide highly accurate meteorological data for long range missile systems, ballistic missile defense systems, and government and commercial space mission tests as well as for operational employment of Field Artillery weapon systems. In its civil operational activities, the U.S. Army Corps of Engineers (COE) funds an extensive network of land-based gages collecting hydrologic and meteorological data used in support of COE major water projects, flood control, navigation, hydroelectric power, irrigation, water supply, and water quality. Within the Army's Training and Doctrine Command, funds are provided to conduct meteorological education and training at several Centers of Excellence. USAICOE received a \$1.4M increase due to an expansion in the number of students attending courses. The ATEC utilizes their funds for indirect meteorological support costs not billable to ATEC subordinate command research, development, engineering and test and evaluation customers and additionally to replace and upgrade meteorological instrumentation and support systems. The only decrease occurred within ATEC's 4-Dimensional Weather Model support at a loss of \$0.4M which is attributable to the conclusion of programs that occurred at the end of FY19.

Research and Development

The U.S. Army funds laboratories to conduct basic and applied research in atmospheric science and technology with a focus on atmospheric sensing, modeling, and dynamics. The Army also provides funding to conduct research, development, and engineering services to solve the challenging problems in military engineering, geospatial sciences, water resources, and environmental sciences.

References: [Army Justification Book of Other Procurement](#)
Army Communications and Electronics Equipment, Budget
Activity 2; p148, p332, p383.

Operation and Maintenance - Volume I, Operation and Maintenance, Army Justification Of Estimates, Operation and Maintenance, Army Budget Activity 01: Operating Forces Activity Group 13: Land Forces Readiness Support Detail by Subactivity Group 131: Base Operations Support, p198.

Army Justification Book of Research, Development, Test & Evaluation Army RDT&E – Volume I, Budget Activity 1; p72, p85, p150.

Army Justification Book of Research, Development, Test & Evaluation Army RDT&E – Volume I, Budget Activity 2; p229, p336, p363

Army Justification Book of Research, Development, Test & Evaluation Army RDT&E – Volume I, Budget Activity 3; p215, p435

U.S. Navy

The U.S. Navy FY21 budget request for meteorological programs is \$133.3 million, made up of \$100.1 million for operations and \$33.2 million to support enabling research. This represents a 7.9% increase from FY20 enacted funding. The Chief of Naval Operations, through the Oceanographer of the Navy, sponsors the Naval Oceanography Program consisting of operational Navy Meteorology and Oceanography (METOC) services and related research and development. Navy Headquarters, Navy Information Forces and the Commander, Naval Meteorology and Oceanography Command work together to field new capabilities for operations. Funding for significant systems and capabilities include the following:

Earth Systems Prediction Capability (ESPC)

The FY21 request of \$10.8 million reflects a \$0.1 million increase from the FY20 enacted funding. The Navy's ESPC program will provide a more accurate, longer prediction, global ocean, atmosphere, and sea ice forecast system of global coupled ensemble technologies for lead times of 1-10 days and longer as well as a new capability for accurate forecasts from the Tropics to the Poles at tactical, operational, and strategic lead times. It will develop a Navy interface to NOAA's products for seasonal to multi-annual lead times for deliberate planning through integrating atmosphere, ocean, ice, land and near-space forecast models into a seamless prediction system.

Naval Integrated Tactical Environmental System – Next (NITES-Next) The FY21 request of \$12.1 million reflects a \$0.1 million decrease from the FY20 enacted funding. NITES-Next is a set of software and hardware tools that provide METOC professionals with capabilities to process (analyze), exploit (forecast/performance prediction), and disseminate (customer delivery) METOC information afloat and ashore. NITES-Next is Open Geo-spatial Consortium compliant, maximizes use of Department of Navy IT afloat enterprise hardware/services (Consolidated Afloat Networks and Enterprise

Services/Agile Core Services and Assured Command and Control), enables Integrated Fires, and supports Electromagnetic Maneuver Warfare. NITES-Next includes sustainment of NITES IV, which provides mobile operational and tactical systems METOC support to the Navy and Marine Corps ashore and afloat. Changes in FY21 funding for NITES-Next continues the re-phasing of the program plan of FY20 to better align with the Program Manager's fielding schedule.

Surface-Based Sensing The FY21 request of \$11.2 million includes both shipboard and land-based weather radar. The Surface-Based Sensing request is a decrease of \$0.6 million from the FY20 enacted funding. The Automated Surface Observing Systems (ASOS) is an interagency program that provides the Navy and Marine Corps the capability for automatic and continuous collection, transmission, and display of surface weather conditions supporting flight planning, safety of flight, and data archiving for climatological purposes. The ASOS collects data from its suite of high-accuracy weather sensors and disseminates the information to both a local display and to authorized Naval, DOD, NOAA, and FAA networks and systems. The shipboard program pulls Doppler information from the air search radar and converts the data into weather information, providing Sailors and Marines the ability to organically obtain local area weather and environmental measurements and provide near real-time weather information without adversely affecting tactical operations. The land-based Doppler weather radar provides Navy and Marine Corps with advance warning of hazardous weather enabling safety of flight and resource protection.

References: [NAVY METOC FY 2021 Congressional Justification RDT&E:](#)

RDT&E Air/Ocean Equipment Engineering PE 0604218N and PE 0604231N project 2343 appear in DON2021 BA:05 Exhibit R-2A.

RDT&E Air/Ocean Tactical Applications PE 0603207N appears in DON2021 BA:04 Exhibit R-2A.

OPN Navy Meteorological and Ocean Sensors-Space PE 0305111N appears in DON2021 Exhibit P-40.

Department of Homeland Security

Federal Emergency Management Agency

The FY 2021 requested funding for FEMA's meteorological operations and supporting research programs is \$1.8 million, a slight increase from the FY 2020 Enacted Budget. The majority of this funding, approximately \$1 million, supports the National

Hurricane Program new web-based HURREVAC decision support platform relied on by state, local, tribal, and territorial (SLTT) emergency managers to inform life-saving evacuation decisions.

FEMA's Response Directorate administers the National Hurricane Program (NHP), which provides technical assistance focused on hurricane evacuation and response, spanning from steady-state deliberate planning to operational decision support and crisis planning when hurricanes threaten the United States and its territories. The NHP is an interagency partnership, administered by FEMA, in collaboration with the U.S. Army Corps of Engineers (USACE) and the National Oceanic and Atmospheric Administration's (NOAA) National Hurricane Center (NHC).

Under an Interagency Agreement between FEMA and the NOAA NHC, the NHC develops and applies its SLOSH (Sea, Lake, and Overland Surges from Hurricanes) storm surge model to provide planning and operational products to support storm surge risk analysis. Development of these products includes model runs and simulations, as well as inundation mapping. The operational products are used to support state and local evacuation decisions and are used at all levels of government to prepare for the potential impacts and required response.

Under an Interagency Agreement between FEMA and the USACE, the NHP provides technical assistance for States to conduct Hurricane Evacuation Studies (HES) that include multiple components that inform and enhance operational response planning for hurricanes: assess community risk for hurricane winds and storm surge; understand the risk perception of the population, the actions they may take, and effective communication methods; determine shelter need and availability; model transportation evacuation routes; and develop evacuation zones and clearance times based on hazard scenarios.

As part of the NHP, FEMA develops, operates, maintains and distributes the HURREVAC decision-support software tool. HURREVAC combines the real-time NHC forecast data and SLOSH storm surge modeling with evacuation clearance times from the HESs to guide state, local, tribal, and territorial (SLTT) emergency managers to inform life-saving evacuation decisions. The new web-based HURREVAC has more than 11,500 SLTT users across 22 States, who depend on HURREVAC to make timely, informed, and life-saving decisions for hurricane evacuations.

In order to disseminate these meteorological resources to the SLTT emergency managers, the NHP offers training courses that are a collaborative effort between FEMA, NOAA NHC, and USACE. The course material showcases all the meteorological services and research in the program: SLOSH storm surge modeling and risk products, hurricane forecast information, hurricane evacuation studies and the associated clearance times, and a table top exercise to simulate using HURREVAC and the associated data to support life-saving evacuation decisions during a hurricane response. In addition, the program facilitates an annual meeting of emergency managers to share new meteorological resources with state and local partners, arming them with the most effective tools with which to plan for hurricane response and to support operational decision making during the hurricane season.

FEMA's Recovery Directorate provides the necessary funding for NOAA's National Centers for Environmental Information (NCEI) to improve, maintain, and update its Snow Climatology Database (SCDB) and allows for more stations to participate in climatological and near-real time snowfall datasets and comparisons. These activities are necessary to support FEMA's emergency and major disaster declaration process and assistance to state, local, and tribal governments related to snow events.

References: [DHS Congressional Budget Justification FY 2021 FEMA Budget Overview](#)

U.S. Coast Guard

All of the U.S. Coast Guard's (USCG) funding for meteorological programs is for operations support. For FY 2021, the requested funding level is an estimated \$30.4 million, essentially no change from the FY 2020 enacted estimate. The Coast Guard does not have a specific program and budget for meteorology—all meteorological activities are accomplished as part of general operations. The USCG does not track meteorological costs at an organizational level, so the funding level is an estimate. The Coast Guard's activities include the collection and dissemination of meteorological and iceberg warning information for the benefit of the marine community. The Coast Guard also collects coastal and marine observations from its shore stations and cutters and transmits these observations daily to the Navy's Fleet Numerical Meteorology and Oceanography Center and NOAA's National Weather Service. These observations are used by both the Navy and NOAA in generating weather forecasts.

The Coast Guard also disseminates a variety of weather forecast products and warnings to the marine community via radio transmissions. Coast Guard shore stations often serve as sites for NWS automated coastal weather stations, and the National Data Buoy Center provides logistics support in deploying and maintaining NOAA offshore weather buoys from Coast Guard cutters. The International Ice Patrol conducts iceberg surveillance operations and provides warnings to mariners on the presence of icebergs in the North Atlantic shipping lanes. Coast Guard efforts in meteorological operations and services have not changed significantly during recent years.

References: [DHS Congressional Budget Justification FY 2021](#)
Attachment 9, U.S. Coast Guard

Department of the Interior

Bureau of Land Management

The Bureau of Land Management (BLM) requested funding for meteorological activities for FY 2021 is \$4.80 million, which is a 1.8% decrease from enacted funding in FY 2020. The BLM funds two principal programs related to meteorological services and supporting research —the fire weather activities of the Office of Fire and Aviation (OFA) and within the broader Natural Resource Program areas.

References: DOI Wildland Fire Management FY2021 Budget Justification

[Preparedness Program](#), predictive services: pages 19-31

References: [BLM FY21 Budget Justifications](#)

Bureau of Ocean Energy Management

The Bureau of Ocean Energy Management (BOEM) requests an estimated \$1.00 M to continue ongoing air quality studies and to initiate new pollutant emission modeling studies in FY 2021, a 20% decrease from FY 2020 funding levels. These are environmental studies to inform the safe management and development of U.S. Outer Continental Shelf energy and mineral resources in an environmentally and economically responsible way. Any funding that goes towards the federal weather enterprise is usually in the form of supporting research for marine air quality modeling and monitoring. In FY 2021 BOEM will establish three centers of expertise one being the Center for Marine Air Quality. Each center will drive consistent and sustainable assessment, policy and science solutions across BOEM regions and programs. In FY 2021, BOEM will begin implementation of the centers of expertise strategic plans.

References: [BOEM FY2021 Budget Justifications](#)

Pages: 31, 84, 94 - 96

National Park Service

The National Park Service (NPS) budget request for meteorological operations and research for FY 2021 is an approximate \$3.2 million, approximately a 3% increase in this area from FY 2020 enacted funding. The NPS expends about \$800 K on atmospheric research with a focus on measurements of all forms of atmospheric reactive nitrogen and on aerosol science. The goal of this research is to identify the sources of air pollution that are affecting park ecosystems and visibility and to quantify their impacts. The NPS also expends approximately \$2.4 million in routine air quality, visibility, and meteorological monitoring networks.

References: [DOI National Park Service FY2021 Budget Justification](#)

Note: The NPS budget request and enacted funding is not this granular - Natural Resource Management is the lowest level in the authorized budget. The allocations estimated here are based on internal assessment of needs and are not explicitly indicated by Congress.

U.S. Geological Survey

The U.S. Geological Survey (USGS) requested funding for FY 2021 is \$55.38 million, a 3% decrease from the FY 2020 enacted funding. This reflects funding requirements for the Water Resources Mission Area and the Natural Hazards Mission Area.

Hydrometeorological Data Collection and Distribution

Water Observing Systems: The FY2021 request is \$47.1 million. The USGS Water Resources Mission Area collects streamflow, precipitation, water quality, ground-water level, and other water resources and climatological data as part of a national network and for a number of projects concerning rainfall-runoff, water quality, and hydrologic processes. A number of federal, state, and local agencies contribute to the costs of collection and distribution of these data. This includes the Federal Priority Streamgauge Network, plus a prorated share of USGS Cooperative Matching Funds, used to support 4,300 streamgages used by the National Weather Service for various meteorological purposes.

Landslide Hazards

Post-wildfire debris flow warning operations:

The USGS FY2021 request for operations and research for landslides and debris flows totals \$3.6 million. The USGS Landslide Hazards Program (LHP)

conducts targeted studies to understand landslide initiation and mobility processes. This understanding is used to develop methods and models for landslide hazard assessment, develop and deploy systems to monitor threatening landslides, and to develop methods and tools for landslide early warning and situational awareness. Such data and understanding form the scientific underpinnings for early warning of conditions that may trigger landslides. The LHP delivers debris-flow hazard assessments and other rainfall guidance for recently burned areas that are used by the National Weather Service to deliver debris-flow alerts in California and other western states.

Coastal-Marine Hazards and Resources Program

Operational and event-based forecasts of shoreline waves, water levels, and coastal change:

The USGS requested \$540k in the FY2021 budget to support operational forecasts of shoreline waves, water levels, and coastal change, as well as real-time assessment of hurricane-induced impacts. USGS, in collaboration with NOAA NCEP and NHW, will continue to focus on developing, providing, and improving observational and modeling resources for local officials, resource managers, and emergency responders on the growing exposure and vulnerability of coastal resources and communities to erosion and inundation hazards due to both persistent forcing and extreme event. Over the next two years, USGS and NOAA will expand operational, six-day forecasts of waves and water levels along the shoreline, as well as the expected coastal impacts, to include sandy shorelines along the US Pacific coast, providing forecasters and the public with national, real-time guidance on potential beach erosion and flooding.

Geomagnetism Program. The FY 2021 budget request for the USGS Geomagnetism Program is \$4.14 million, a 3.5% increase from the Consolidated Appropriations Act, 2020 funding level. The 2021 budget request supports a continued focus on operating magnetic observatories and providing real-time geomagnetic data needed for issuing warnings and forecasts of geomagnetic storms. In 2021, the USGS will also continue the development of geoelectric hazard maps, development of existing data sets required to estimate Earth surface impedance, and development of computer-based tools needed for real-time mapping of geomagnetic and geoelectric field variation, all of which are needed to help mitigate hazards for the electric-power grid industry and other national critical infrastructure. This work is part of a National Science and Technology Council working group for coordinating Space Weather Operations

Research and Mitigation (SWORM) across multiple Federal agencies. These results will help power-grid companies improve the resilience of their systems to magnetic storms, as required by the Federal Energy Regulatory Commission. Power grid operators will use these results to design mitigation strategies for geomagnetic storms, and the space weather alerting agencies will use the resulting electric field model to issue improved forecasts and nowcasts for space weather alerts.

Furthermore, in 2021, the USGS will continue the magnetotelluric (MT) survey of the contiguous U.S. to improve U.S. electrical grid resilience, improve forecast models for geomagnetic storms, and aid in mineral resource assessments. Collection of MT data on a national scale is a basis for modeling the Earth's electric field, which can be used to assess the impact of electrical storms. This survey is mandated by Executive Order 13865 Coordinating National Resilience to Electromagnetic Pulse and is responsive to priorities established in the National Space Weather Strategy, as well as related international initiatives for pursuing induction hazard research. This broad collaboration includes scientists from NASA, NOAA, the Institute for Defense Analyses, the Federal Energy Regulatory Commission, the Federal Emergency Management Agency, and NSF.

References: [FY 2021 Department of Interior Budget Justifications – U.S. Geological Survey](#)

pages 49-67 Natural Hazards

pages 75-80 Water Observing Systems

[Executive Order 13865 – Coordinating National Resilience to Electromagnetic Pulses](#)

pages 12043-12044 Geomagnetism Program

Department of Transportation

Federal Aviation Administration (FAA)

For FY 2021, the FAA is requesting a total of \$274.4 million for Aviation Weather related Operations Support, Facilities and Equipment, and Research and Development costs, an approximate 2% decrease from FY 2020 actual funding appropriated. The changes are comprised of:

- Consistent requested funding for Operations Support (OPS): a requested \$237 million in FY 2021, the same as the actual funding appropriated in FY 2020, in line with Agency needs and priorities.
- An increase in requested funding for Facilities and Equipment (F&E): from \$28 million of funding appropriated in FY 2020 to a requested \$29

million in FY 2021, in line with Agency needs and priorities.

- A decrease in requested funding for Research and Development (RE&D): from \$16 million funding appropriated in FY 2020 to a requested \$8 million in FY 2021, in line with Agency needs and priorities.

The funding will support the Aviation Weather programs for the Next Generation (NextGen) National Air Transportation System. The funding will support enhancements, including the dissemination of weather products and decision-making information.

For FY 2021, we will continue to research and make progress in the aviation weather area to support NextGen weather requirements. Research projects may include integration of weather products into the air traffic decision-making tools, air traffic control decision-making processes, weather sensor improvement, weather needs in the flight deck, and refresh of the weather infrastructure.

United States (U.S.) Code Title 49 Section 44720 (49 U.S.C. 44720) designates the FAA as the Meteorological Authority for domestic and international aviation weather services of the U.S. In this capacity, the FAA provides requirements for the administration of aviation weather services to the National Weather Service (NWS). The FAA is responsible for ensuring compliance with these services and with maintaining International Civil Aviation Organization (ICAO) Standards and Recommended Practices as specified in Annex 3-Meteorological Service for International Air Navigation.

References: The weather Operations Support numbers source is the documentation from the Operations Review Board (ORB) process within ATO.

US DOT FAA FY-2021 President Budget Submission

Page 82(244) - Facilities and Equipment; Detailed Justification for 2A14 - NextGen Weather Processors (NWP)

Page 132(244) - Facilities and Equipment; Detailed Justification for 2C01 - Aviation Surface Observation System (ASOS/ASWON)

Page 45(86) - Research, Engineering & Development; Detailed Justification for A.j - Weather Program

Page 65(86) - Research, Engineering Development; Detailed Justification for A.p NextGen-Weather Technology in the Cockpit

Federal Highway Administration

The current transportation authorization, the Fixing America's Surface Transportation (FAST) Act, allocates funds for Research, Technology and Education. This authorization includes core Highway Research and Development as well as Intelligent Transportation Systems (ITS). Of this, for FY 2021, the

Road Weather Management Program (RWMP) was budgeted at \$1.1 million, which is lower than the FY 2020 budget by \$0.4 million. All of RWMP's funding is for applied research, with an increased emphasis on knowledge and technology transfer to assist operating agencies in the deployment of the research products. The RWMP research activities involve the development, testing and evaluation of analysis tools and decision support systems that integrate high-resolution road weather and connected vehicle data to enable transportation system owners and operators to make more effective and efficient management decisions. Such decisions save lives, time and money for both the operating agencies and the traveling public. Work will continue to evaluate the challenges and opportunities of automated vehicles operating under adverse weather conditions.

Reference: [FHWA FY 2021 Budget Estimates](#)

Section IV Research, Development and Education

- Highway Research and Development Program
- Intelligent Transportation Systems

Environmental Protection Agency

The anticipated funding level in FY 2021 for directed meteorological research is approximately \$2.7 million, a 65% decrease from FY 2020 funding. All of the Environmental Protection Agency's (EPA) funding of meteorological and air quality programs is for supporting basic and applied research.

Continued but reduced attention is being paid to the effects of airborne toxins, ozone, and fine particulate matter on human health, and the impact of air pollution on human health and sensitive ecosystems. To promote excellence in environmental science and engineering, the EPA historically has supported a national research grants program for investigator-initiated research. The funding for grants (with reliance on quality science and peer review) and for graduate fellowships (to support the education and careers of future scientists) has provided for a more balanced, long-term capital investment in improved environmental research and development. The funding for the extramural grants program is slated to be eliminated in FY2021.

The EPA continues its development and evaluation of air quality models for air pollutants on all temporal and spatial scales as mandated by the Clean Air Act as amended in 1990. Research at reduced levels compared to previous years will focus on urban-to-hemispheric scales, and multimedia models,

which will be used to guide development air pollution control policies, human and ecosystem exposure assessments, and air quality forecasts. Emphasis will be placed on meteorological research into global-to-regional-to-urban-local formation and intercontinental transport of air contaminants in support of the revisions to the National Ambient Air Quality Standards and ecosystem protection strategies. Some increased efficiency of computation and interpretation of model results are being made possible by means of supercomputing and scientific visualization techniques.

Reference: [United States Environmental Protection Agency Fiscal Year 2021 Justification of Appropriation Estimates for the Committee on Appropriations, EPA-190-S-20-001, February 2020, Tab 03: Science and Technology](#)

Pages 122-124: Research – Air and Energy

Note: Based on historical records (pre-FY17), a proportion of the Air and Energy (AE) research program budget is estimated to apply to meteorological services and supporting research. Year-to-year changes in these budget values reflect annual variations in the total AE budget.

National Aeronautics and Space Administration

The National Aeronautics and Space Administration FY21 proposed budget for activities supporting meteorological services and research is \$497 million, an increase of approximately 5.5% from enacted FY20 funding. The budget figures reported are based on relevant missions and programs in the Earth Science Division (ESD) and Heliophysics Division (HPD) within the Science Mission Directorate (SMD) as well as a smaller set of programs in the Human Exploration and Operations Mission Directorate (HEOMD). The \$26 million increase is the net of a decrease of \$9 million from the combined budget of Earth Science Research and Earth Science Flight Missions and an increase of \$35 million in the Heliophysics budget. Only missions and programs relevant to meteorological operations and research are included in these figures and in this report, with select missions and programs highlighted below.

Earth Science Division (ESD): The FY21 ESD budget includes \$212 million in terrestrial weather observations and research as well as other closely related program activities, a \$9 million decrease from the FY20 enacted amount. Research and satellite mission budgets are calculated based on their estimated overall contributions to weather-relevant activities.

- **Earth Science Research:** NASA's FY21 budget supports \$57 million for Earth Science Research relevant to meteorological services and research, a \$2 million increase from the FY20 enacted

amount of \$55 million. Earth Science Research addresses complex, interdisciplinary Earth science problems in pursuit of a comprehensive understanding of Earth's interconnected systems. The portfolio's strategy involves six interdisciplinary and interrelated science focus areas, one of which is specifically dedicated to weather research.

The projected FY21 budget will provide continued investments in weather-related Research and Analysis (R&A) projects, including competed atmospheric dynamics investigations and researches from operational geostationary satellite systems, as well as the Global Modeling and Assimilation Office (GMAO), Short-term Prediction Research and Transition (SPoRT), and the NASA-National Oceanic and Atmospheric Administration (NOAA)-Department of Defense (DOD) Joint Center for Satellite Data Assimilation (JCSDA) and its supporting data system for weather-related missions and projects. GMAO is responsible for building NASA's state-of-the-art Earth system modeling and data assimilation system for fundamental research in atmospheric science, study of disastrous weather phenomena including hurricanes and floods, as well as techniques to utilize satellite observations in models through data assimilation. SPoRT transitions NASA-developed satellite algorithms and data products into operational weather forecast environments to improve short-term forecasts on a local and regional scale, especially for NOAA's National Weather Service. JCSDA is a broader multi-agency effort that draws on the nation's existing satellite assets, including NASA's, to improve weather, ocean, and climate prediction.

- **Earth Science Flight Missions:** NASA's FY21 budget supports \$155 million for Earth Science Flight Missions relevant to meteorological services and research, an \$11 million decrease from the FY20 enacted level. Earth Science flight missions include those that are operational and those under development, covering a broad range of multi-disciplinary science investigations aimed at understanding the Earth system and its response to natural and human-induced forces and changes. Also in this budget, the portion designated for the Earth Science Data System (ESDS) that is relevant to meteorological services and research is increasing by \$2 million due to the expansion of ESDS's capabilities to support data from the in-development Surface Water and Ocean

AGENCY FUNDING

Topography (SWOT) and NOAA's Joint Polar Satellite System-2 (JPSS-2) missions.

Of the missions managed by ESD's Earth Systematic Missions program office, Global Precipitation Measurement (GPM), Suomi National Polar-orbiting Partnership (Suomi-NPP), Aqua, SWOT, the Deep Space Climate Observatory (DSCOVR), and the European Space Agency's (ESA) Sentinel-6 Michael Freilich are most relevant to the Federal Weather Enterprise. The portion of the FY21 budget that supports continuing operations of the four missions already in orbit – GPM, Aqua, Suomi-NPP, and DSCOVR – add up to a combined \$44.5 million. This amount supports the production of long-term data records for these missions as well as related weather services and research.

In continuing mission operations, the Global Precipitation Measurement (GPM) mission, a NASA-Japanese Aerospace Exploration Agency (JAXA) collaboration supporting a constellation of Earth orbiting spacecraft, continues to provide next-generation observations of rain and snow worldwide every three hours, advancing our understanding of Earth's water and energy cycles, improving the forecasting of extreme rain events that cause natural disasters, and extending current predictive capabilities that utilize satellite precipitation information. The Aqua spacecraft continues to carry six, state-of-the-art instruments that observe Earth's oceans, atmosphere, land, ice and snow cover, and vegetation, providing high measurement accuracy, spatial detail, and temporal frequency. Aqua and Suomi-NPP bridge the Earth Observing System's weather-relevant measurements to NOAA's JPSS series of operational weather satellites, of which one has successfully launched and three more are currently in development.

For missions currently in development, SWOT, one of two weather-relevant missions managed by Earth Systematic Missions (ESM) Program Office, will make the first global survey of Earth's surface water, observe the fine details of the ocean's surface topography, and measure how water bodies change over time. In FY21, SWOT is set to complete integration and testing of its KaRIn instrument, integration and testing of its nadir payload, and will begin integration and testing of its integrated payload module. The projected SWOT budget relevant to meteorological services and supporting research is

\$51 million in FY21, a decrease of \$14.6 million from the FY20 amount.

The ESA-NASA Sentinel-6 mission, another weather-relevant mission in development and managed by the ESM Program Office, will provide continuity of ocean topography measurements. In FY20, ESA renamed the Sentinel-6 mission, after recently retired ESD Director Michael Freilich. NASA has completed development and testing of its instrument payload and has shipped it to Airbus, the ESA spacecraft integrator. NASA's projected Sentinel-6 Michael Freilich budget relevant to weather research needs in FY21 is \$4 million, a decrease of \$7.8 million from FY20. During FY21, Sentinel-6 Michael Freilich will begin its launch campaign following completion of observatory-level integration and testing at Airbus and the IABG environmental test facility.

Consistent with the 2017 Earth science decadal survey, the FY21 budget supports the continuation of four designated observable (DO) studies for future Earth Science missions, with a \$7.6 million portion relevant to weather services and supporting research. The decadal survey recommended that ESD follow through with all currently planned Earth Science missions as well as plan for major new observational capabilities, including, the priority DOs: Aerosols; Clouds, Convection, and Precipitation; Mass Change; Surface Biology and Geology; and Surface Deformation and Change.

The projected FY21 budget for Earth Science flight missions also includes \$24.6 million for the weather-relevant portion of missions and instruments in development in the Earth System Science Pathfinder (ESSP) Program Office. ESSP provides frequent, competitively selected Earth science research opportunities, including space missions and remote sensing instruments for space-based missions of opportunity or extended duration airborne science missions. The two ESSP missions of most relevance to weather services and research are the Time-Resolved Observations of Precipitation structure and storm Intensity with a Constellation of Smallsats (TROPICS) and Cyclone Global Navigation Satellite System (CYGNSS) missions.

TROPICS will provide rapid-refresh microwave measurements over the tropics to observe the thermodynamics and precipitation structure of tropical cyclones over much of the system's lifecycle. CYGNSS, currently in operation, has the

mission objective to measure ocean surface winds throughout the lifecycle of tropical storms and hurricanes to facilitate better weather forecasting. \$8.4 million is budgeted in FY21 for TROPICS, while \$1.4 million is budgeted for ongoing CYGNSS operations.

In FY20, the amount of funding for the Earth Venture missions related to meteorological services and research was reduced in order to prioritize other Earth Venture missions: to fund the Geostationary Littoral Imaging and Monitoring Radiometer (GLIMR) and the Geostationary Carbon Observatory (GeoCarb). Funding has been restored for FY21 in anticipation of future selections. In particular, the Investigation of Microphysics and Precipitation for Atlantic Coast-Threatening Snowstorms (IMPACTS), an Earth Venture Suborbital airborne mission included in the FY21 budget, will conduct precipitation science research on the formation of snow bands in East Coast winter storms.

Heliophysics Division (HPD). This report also includes HPD research assets and satellite programs that contribute significantly to the advancement of space weather knowledge and to the transfer of that knowledge into space weather prediction systems.

- **Heliophysics Space Weather:** Projected FY21 funding for the share of Heliophysics Division (HPD) activities supporting meteorological services and research is \$281 million, an increase from \$246 million enacted in FY20. The FY21 projected budget reflects the initiation and planning of two missions in formulation: the Geospace Dynamics Constellation (GDC) and Polarimeter to Unify the Corona and Heliosphere (PUNCH). It also reflects the transition of the Solar Orbiter mission, a collaboration between the European Space Agency (ESA) and NASA, and the Ionospheric Connection Explorer (ICON) mission from development to operations, following their successful launches.

It also includes a steady budget of \$21 million for continued operations of the flagship Parker Solar Probe (PSP) mission in FY21. PSP is tracing the flow of energy from the Sun to help scientists better understand the dynamics of the solar corona, the Sun's outer atmosphere, and exploring what accelerates the solar wind by flying through the region of the corona where these processes happen. In FY20, the mission conducted its fourth and fifth perihelion (closest approaches to

the Sun) passes, began returning science data, and provided the first public release of findings.

In FY20, HPD supported the February 2020 launch of the Solar Orbiter mission by providing instruments and launch services. A projected budget of \$8 million in FY21 will support initial on-orbit operations and subsequent data collection. The mission will perform a close-up study of our Sun and inner heliosphere using a combination of in-situ and remote-sensing instruments.

The Van Allen Probes mission concluded operations in FY20 and was decommissioned, and therefore no budget is projected in FY21.

HPD's Space Weather Science and Applications (SWxSA) program expands the role of NASA in space weather science under a single budget element and supports the Administration's multi-agency Space Weather Strategy and Action Plan. The program is consistent with the recommendations of the 2013 Heliophysics decadal survey. It competes ideas and products, leverages existing agency capabilities, collaborates with other agencies, and partners with user communities to facilitate the effective transition of science knowledge to operational environments. A budget of \$15 million in FY21 is requested for the SWxSA program.

HPD is also working closely with the Artemis Program to support the human exploration of deep space and on potential approaches to measure the radiation environment on and around the Moon. These measurements will aid in the prediction and validation of the cislunar radiation environment in which astronauts will live and work. To this end, HPD is providing radiation and space weather instruments that will be installed on the Propulsion and Power Element of the Gateway, an early key component of the Artemis Program. HPD also includes investment in research that addresses science that impacts life and society. Other programs that support space weather services and research include the Community Coordinated Modeling Center, which supports space weather modeling efforts, and missions such as Solar Terrestrial Relations Observatory (STEREO), Advanced Composition Explorer (ACE), Solar and Heliospheric Observatory (SOHO), and Global-scale Observations of the Limb and Disk (GOLD).

Human Exploration and Operations. The HE-OMD reported budget included in this report covers

its terrestrial and space weather operations and research activities.

- **HEOMD Terrestrial and Space Weather:** The projected FY21 budget for HEOMD's Terrestrial and Space Weather is \$4 million. HEOMD measures and forecasts atmospheric and space weather events that impact all operational phases (e.g., design, test, ground operations, launch, landing and recovery) of NASA's human space flight and Expendable Launch Vehicle (ELV) programs, as well as crew radiation exposure at all phases of space flight (i.e., extra- and intra-vehicular activity). Additionally, HEOMD maintains the required weather infrastructure; develops and implements weather support requirements; develops and evaluates launch and landing constraints; and improves operational and launch availability through the development, evaluation, and transition of weather technology into operations.

References: [NASA FY2021 Full Budget Request \(Congressional Justification\)](#):

Earth Science Research: pages ES-2, 8

Earth Science Flight Missions: pages ES-14, 16, 35-36, 52-56, 62, 66, 67

Heliophysics Space Weather: pages HELIO-1, 13, 16, 22-25, 33-34, 45-46

Nuclear Regulatory Commission

The Nuclear Regulatory Commission's (NRC's) request for meteorological activities in the FY 2021 President's budget request totals \$765K. This is a 22% increase from the FY 2020 enacted funding. This funding supports NRC's total planned expenditures for meteorological operations and supporting research and included the following areas:

- **Research on Application of Point Precipitation Frequency Estimates to Watershed-Scale Flood Modeling.** The objective of this project is to develop guidance on the application of NOAA point precipitation estimates to watersheds (i.e. conversion of point estimates to areal estimates).
- **Radiation Protection Dispersion Computer Codes Analysis & Maintenance.** Resources are used to maintain and develop the NRC's radiation protection and dose assessment computer codes, including RASCAL, ARCON, PAVAN, NRCDOSE, and HABIT. These codes support the Agency's safety and environmental reviews for nuclear power plant siting, design, construction, and operation.

- **Accident Consequence Computer Code Analysis and Maintenance.** The MACCS probabilistic consequence analysis code uses a Gaussian plume segment model for atmospheric transport and dispersion modeling due to its flexibility, computational efficiency, and modest data needs. The MACCS code supports regulatory applications involving estimation of health and economic consequences arising from hypothetical severe accidents at nuclear power plants. In FY2020, NRC completed the integration of NOAA's HYSPLIT model into MACCS as an alternate atmospheric transport and dispersion model for consequence analysis and plans to complete an external peer review of the MACCS-HYSPLIT integration. NRC staff is also evaluating the applicability of the existing MACCS code capabilities for modeling atmospheric transport and dispersion at short (<500 m) downwind distances.

- **Meteorology, Availability of NOAA Databases for NRC Guidance.** NRC staff is undertaking a major effort to update and modernize the Standard Review Plan (SRP) to improve the agency's agility in reviewing future applications for new reactor technologies, streamline the reviews, and incorporate lessons learned from past reviews. For example, meteorology data resources currently cited in the NRC's Interim Staff Guidance document DC/COL-ISG-007 and in the SRP Sections 2.3.1, "Regional Climatology," and 2.3.2, "Local Meteorology", are typically used by applicants to identify or estimate meteorological parameters applicable to a specific nuclear power plant design or to characterize a specific site and/or region where a given design might be deployed. Collaborative work between NRC staff and NOAA staff will focus on updating and further developing climatology and meteorology datasets that will be used in NRC licensing actions. NRC staff expects to update references in other meteorology related sections of the SRP.

- **Meteorology, Advanced and Micro-Reactor Licensing Guidance.** NRC staff is developing Interim Staff Guidance and Regulatory Guides for meteorological considerations associated with micro-reactors. This guidance may also apply to advanced reactors depending on the proposed design. The primary focus of this new guidance for staff and industry is for areas of the applications and review where our existing

guidance may not apply to the much-smaller-in-scale micro-reactors.

- **Meteorology, New and Operating Nuclear Power Plant Licensing Applications.** NRC staff reviews meteorological portions of license applications for new nuclear power plants. This work relates to Regional Climatology, Local Meteorology, the On-site Meteorological Measurements Program, and Short and Long Term Atmospheric Dispersion calculations. This work is expected to continue through 2021 for both the siting of new reactors, and in determining design-basis conditions for new reactor designs. NRC staff also reviews applications for License Amendment Requests (LARs) from current NRC license holders. These applications aim to modify the current licensing basis for a specific plant, and may be related to issues such as the source term, the ultimate heat sink, wind speed, precipitation, or other meteorologically related topics. LAR reviews are expected to continue through FY2021.

References: [USNRC FY 2021 Congressional Budget Justification](#)

Operating Reactors/Major Activities: page 13

New Reactors/Major Activities: page 33

Department of Energy

The Department of Energy (DOE) requested funding for meteorological activities in FY 2021 is an estimated \$129.1 million a 53% decrease from enacted funding in FY 2020. DOE conducts meteorological services and supporting research and related activities within several DOE entities: the Office of Science/Biological and Environmental Research (BER), the National Nuclear Security Administration (NNSA) for emergency operations and in the Office of Energy Efficiency and Renewable Energy (EERE) for Wind Energy Technologies.

References: [DOE FY2021 Budget Justification](#)

Volume 1: National Nuclear Security Administration

Volume 3 Part 2: Energy Efficiency and Renewable Energy

Volume 4: Science

Office of Science/Biological and Environmental Research (BER)

The Office Science/BER/Earth and Environmental Systems Sciences Division (EESD) FY 2021 request for funding for basic research is \$127.80 million, a 50.6% decrease from the FY 2020 enacted funding. The Office of Science's EESD activity supports basic research involving atmospheric and ecological sciences as well as research on integrative Earth sys-

tem modeling. The goal of the activity is to enhance the predictive, systems-level understanding of the Earth system, including improved process-level understanding of the atmospheric, ecological, hydrological, cryospheric, and human components as well as interdependencies among the components. EESD does not provide climate services to federal, state, or local agencies nor does it conduct research for the purpose of improved weather forecast operations or climate services.

National Nuclear Security Administration (NNSA)

Office of Emergency Operations. The DOE/NNSA request for funding related to coordinating and supporting operational meteorological programs at Defense Nuclear Facilities (DNF) in the FY 2021 President's budget request is \$50 K, no change compared to FY 2020 enacted funding. Requested FY 2021 funds would allow NNSA to continue funding the DOE Meteorological Coordinating Council (DMCC) activities, provide meteorological expertise, and support Consequence Assessment Modeling tools in support of the NNSA Emergency Management and Response Enterprise.

Office of Energy Efficiency and Renewable Energy (EERE)

Wind Energy Technologies Office (WETO). The DOE/EERE request for funding related to meteorological supporting research for FY2021 is \$1.25 million, a 92% decrease from FY2020 enacted funding. Requested FY2021 funds would allow DOE-EERE to continue to fund the DOE National Laboratories' support of the Offshore Wind Resource Science funding opportunity awarded in FY2020 for conducting an offshore field observational study addressing the unique offshore environment including coastal and marine atmospheric boundary layer process data, wave-atmosphere interactions, and factors that control wind speeds within the marine boundary layer, including cloud cover, land-ocean coupling that drives coastal meteorology. Funding will also continue support for an initiative targeting wind energy specific forecasting. Using the Weather Research and Forecasting (WRF) model as a starting point, the Energy Research and Forecasting (ERF) simulation framework will provide high-fidelity weather and environment-dependent energy inflow and boundary condition information to the microscale wind plant simulator (Nalu), within DOE's advanced HPC environments. Additionally, in collaboration with BOEM, WETO is supporting the deployment and data

analysis from two DOE met-ocean LIDAR buoys deployed off the coast of California.

Department of State

In the FY 2021 President's budget request, the Department of State (DOS) requests \$6.4 million to fund U.S. contributions to the UN Framework Convention on Climate Change (UNFCCC) and the Intergovernmental Panel on Climate Change (IPCC), including for related research programs such as the Global Climate Observing System and the Group on Earth Observations, in which the United States protects U.S. interests and advances a level playing field. The United States supports a balanced approach to economic growth, energy security, and environmental protection and highlights private sector innovation and deployment of technologies that reduce emissions, strengthen resilience, and foster sustainable land use. As of this writing, FY 2020 enacted amount information is not available regarding potential contributions to UNFCCC, IPCC, GCOS, GEO and WMO.

References: FY2021 Congressional Budget Justification for Foreign Operations

(Appendix 2) State Bureau of Oceans and International Environmental and Scientific Affairs (OES)

Note: as of 04/02/2020 Appendix 2 had not yet been released.

Smithsonian Institution

Global Volcanism Program (GVP). The Smithsonian Institution requested funding for meteorology-related activities in FY 2021 is \$15 K to support the Natural History Museum, Global Volcanism Program. This funding level is comparable to FY2020 levels. The GVP collects, catalogs, and disseminates information on over 1,400 volcanoes active in the last 10,000 years, using a small staff working regular business hours Monday to Friday in the Natural History Museum in Washington, D.C.

National Science Foundation

The National Science Foundation (NSF) request for funding related to meteorological supporting research in the FY 2021 President's budget request is \$116 million, an 11.0% decrease from FY 2020 enacted funding levels. Requested FY 2021 funds will allow NSF to continue to fund research related to basic meteorology, climate, and space weather. NSF proposal requests are community-driven, which allows funding to move to emerging areas of interest. In addition, the funding will ensure that facilities, both observational and computational, are made

available for community use. NSF awards grants to single investigators or small collaborative groups working on specific topics, as well as larger interdisciplinary groups and the National Center for Atmospheric Research.

- NSF will fund research on processes related to physical and mesoscale meteorology at a projected level of \$53.6 million in FY 2021. This level of funding will allow NSF to support basic research on observational systems, analysis techniques and understanding of phenomena that will help to improve weather forecasts and public safety. Recent major investments include the study of the impact of small changes in temperature and humidity on the development of tornadoes and downslope windstorms in mountainous regions that can impact wildfire growth.
- NSF will fund basic climate research, modeling, and process studies at a projected level of \$44.7 million in FY 2021. NSF invests in the Community Earth System Model (CESM), a fully coupled global climate model that provides state-of-the-art simulations of the Earth's past, present, and future climate states. NSF also funds the supporting infrastructure for climate studies by making computing resources required to perform data-intensive simulations available for community use. As a basic science funding agency, NSF does not directly provide climate services to federal, state, and local agencies, but through its funding of basic science research, NSF contributes to the fundamental understanding of the climate system which is required for the provision of climate services.
- NSF will fund supporting research on Space Weather at a projected level of \$17.3 million in FY 2021. NSF supports the National Space Weather Strategy and National Space Weather Action Plan in pursuing the program's objective to perform the research and technology transfer needed to improve the specification and forecasts of space weather events that can cause disruption and failure of space-borne and ground-based technological systems and that can endanger human health. Space weather relevant research efforts include the development of large-scale space weather forecast models and the development and demonstration of innovative and creative small space weather satellites.
- Significant funding is dedicated for new priorities related to NSF's Big Ideas. It is anticipated that supporting research for meteorological processes

will have connections to the Navigating the New Arctic (NNA), Harnessing the Data Revolution (HDR), and Mid-scale Research Infrastructure Big Ideas. Across NSF, \$432 million is set aside for these activities in FY 2021. Funding from these sources is not guaranteed for meteorological research and will depend on the outcome of the peer review process.

References: [NSF FY 2021 Budget Request to Congress](#)

Budget Tables

Table 1. Meteorological Services and Supporting Research by agency–funding levels (not actual spending) for three consecutive fiscal years:

- Enacted Budget for Fiscal Years 2019 and 2020
- President’s Budget Request for Fiscal Year 2021

Table 2. Funds transferred (or planned) during FY2020 for meteorological services and supporting research activities:

- Only transfers near or exceeding a \$1 million dollar threshold are included

AGENCY FUNDING

Table 1: Meteorological Services and Supporting Research* (.00M)

Agency	FY19	FY20	FY21
USDA	112.68	154.53	174.82
DOC/NOAA (Subtotal)	3129.64	2952.40	2878.36
NWS	1162.60	1168.64	1120.26
NESDIS	1698.54	1512.88	1503.98
OAR	196.30	200.10	185.00
NOS	35.00	35.18	34.62
OMAO	37.20	35.60	34.50
DOD (Subtotal)	318.90	299.80	353.50
Air Force	169.10	154.10	196.20
Navy	128.30	123.50	133.30
Army	21.50	22.20	24.00
DHS (Subtotal)	32.24	32.20	32.20
FEMA	1.94	1.8	1.80
USCG	30.30	30.40	30.40
DOI (Subtotal)	62.88	66.53	64.38
BLM	4.56	4.89	4.80
BOEM	0.85	1.26	1.00
NPS	2.80	3.10	3.20
USGS	54.67	57.28	55.38
DOT (Subtotal)	285.90	282.74	275.50
FAA	284.40	281.24	274.40
FHWA	1.50	1.50	1.10
EPA	6.22	7.65	2.68
NASA	432.00	471.00	497.00
NRC	0.81	0.63	0.77
DOE (Subtotal)	261.31	274.15	129.10
Science/BER	258.50	258.80	127.80
NNSA	0.35	0.05	0.05
EERE	2.46	15.3	1.25
DOS	**	7.4	6.40
Smithsonian	0.02	0.02	0.02
NSF	129.61	129.61	115.61
Total	4772.21	4678.66	4530.34

*FY19 and FY20 amounts reflect Congressionally appropriated funds.

FY21 amounts reflect funding requested in the President's FY21 budget submission to Congress

** Unavailable

Table 2 - Interagency Fund Transfers for Meteorological Operations and Supporting Research for FY2020, Estimated or Planned

Transferred			
From:	To:	(.00 M)	Purpose
DOC/NOAA			
NESDIS	NASA	787.58	Build, integration and testing of JPSS-2, -3, and -4 instruments and spacecraft. Continue work on GOES-R series spacecraft, instruments, and launch vehicle, as well as NASA sustainment. Award instrument and spacecraft contracts to develop a Space Weather Follow On satellite mission to rideshare with the NASA Interstellar Mapping and Acceleration Probe to Lagrange Point 1. Continue integration activities for a compact coronagraph on the GOES-U satellite mission in support of the Space Weather Follow On program.
NESDIS	DOD/USAF	11.72	Continue hosted payload solution for CDARS/Argos. Continued support from Lincoln Labs.
NESDIS	DOD/NRL	16.86	Continue development of the compact coronagraph in support of the Space Weather Follow On program.
NESDIS	GSA	7.18	Satellite Ground Services assistance with acquisition of Engineering and Technical Support.
DOD			
Air Force	DOE/ORNL	8.41	Oak Ridge National Lab High Performance Computing and Partnership
Air Force	NOAA/NWS	2.25	NEXRAD Service Life Extension Program/Spares
Air Force	NOAA/NWS	5.25	NEXRAD (Precision Measurement Equip/Depot Purchased Equip Maintenance)
Air Force	NASA Goddard Space Ctr	2.67	Land Information System (3600)
Army	NCAR	2.40	4DWX Model Support
Army	DOI/USGS	22.50	Hydro-meteorological collection
Navy	NASA	2.30	Stennis Space Center operations
Navy	NOAA	1.00	Satellite Data and Analysis
DOT			
FAA Weather	DOC/NOAA/NWS	19.00	IAA-Center Weather Service Unit
FAA Weather	DOC/NOAA/NWS	14.00	IAA-ASOS/ALDARS

Federal Coordination and Planning Crosscut Matrix



Strategic Plan Objectives

	1.1	1.2	1.3	1.4	2.1	2.2	2.3	3.1	3.2	3.3	4.1	4.2	4.3	4.4	4.5	5.1	5.2	5.3	6.1	6.2
FCMSSR	x	x			x	x	x	x						x					x	x
NEXRAD PC		x														x				
ESPC ESG							x					x								x
ICMSSR								x						x	x	x				
C/CS						x														
IWRCC											x	x								
SWG												x								
COES		x																		
STIWG			x																	x
WG/CSAB		x	x		x		x													x
WG/CCM					x															
WG/OD		x	x	x																
WG/BCR																			x	x
WG/TCOR	x	x	x		x							x								
JAG/FMH1	x	x	x	x				x	x	x										
JAG/AWCT			x						x											
WG/SWEF								x	x										x	x
WG/DIAP		x	x	x	x			x	x	x	x			x	x					
WG/CAS					x					x	x			x	x					
WG/WSO	x	x			x			x			x	x								
WG/ATD		x			x		x		x	x		x			x					x
Fire Wx		x			x							x							x	
Arctic	x	x						x	x	x		x		x	x					

OFCM Activities

B

2019 Activities Review

February

Interdepartmental Committee for Meteorological Services and Supporting Research

March

Space Weather Operations, Research and Mitigation Committee

Tropical Cyclone Operations and Research Forum/73rd IHC

Committee for Operational Environmental Satellites

April

Space Weather Operations, Research and Mitigation Committee

Federal Committee for Meteorological Services and Supporting Research

*Space Weather Workshop

*AMS Washington Forum

Committee for Operational Processing Centers

May

Interdepartmental Committee for Meteorological Services and Supporting Research

*Arctic Incident of National Significance (IoNS) Workshop/Exercise

*Interagency Coordinating Committee for Airborne Geosciences Research and Applications

June

GMU Atmospheric Transport and Dispersion Conference Special Session on Federal Agency Activities

*Interagency Coordinating Committee for Airborne Geosciences Research and Applications (ICCAGRA)

Committee for Operational Environmental Satellites

*AMS Policy Colloquium

Space Weather Enterprise Forum

July

*Friends and Partners in Aviation Weather

Space Weather Operations, Research and Mitigation Committee

August

*Earth Prediction Innovation Center Workshop
Interagency Weather Research Coordination Committee

Interdepartmental Committee for Meteorological Services and Supporting Research

September

Committee for Operational Environmental Satellites

Interdepartmental Committee for Meteorological Services and Supporting Research

EUMETSAT Satellite Conference

October

Federal Committee for Meteorological Services and Supporting Research

Interagency Weather Research Coordination Committee

Committee for Operational Processing Centers

*Women of Color in STEM Conference

November

*Conference on Space Environment Applications, Systems, and Operations for National Security

*NOAA Hurricane Conference

Committee for Operational Processing Centers

December

Interdepartmental Committee for Meteorological Services and Supporting Research

Committee for Operational Environmental Satellites

*American Geophysical Union Annual Meeting

Interagency Weather Research Coordination Committee

Asterisks indicate meetings not sponsored by OFCM.

FY 2019 OFCM Publications

The publications listed in Table 3 were added to [OFCM's website](#) during FY 2019.

Table 3: FY19 OFCM Publications

OFCM Publication	Date	Number
The Federal Weather Enterprise: Fiscal Year 2019 Budget and Coordination Report	June 2019	FCM-R38-2019
National Hurricane Operations Plan	May 2019	FCM-P12-2019
2019 Build 18.X Dual Pol WSR-88D Tropical Cyclone Operations Plan	May 2019	n/a
18.X "QUICK CHECK" List	May 2019	FCM-P12-2019
National Winter Season Operations Plan	June 2019	FCM-P13-2019
Federal Meteorological Handbook No. 1 – Surface Weather Observations and Reports	July 2019	FCM-H1-2019
2019 Tropical Cyclone Operations and Research Forum/73rd Interdepartmental Hurricane Conference Summary Report	March 2019	n/a
Summary report of the Special Session, 23rd Annual George Mason University (GMU) Atmospheric Transport and Dispersion Modeling Conference	June 2019	n/a
Summary report of the Space Weather Enterprise Forum	June 2019	n/a

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OFCM External Involvement



American Meteorological Society (AMS)

In 2019, OFCM substantially increased its engagement with the AMS serving on several planning committees and participating in key AMS events. OFCM senior staff serve on the AMS Water Resources Committee; the Climate Services Committee; the Committee on satellite Meteorology, Oceanography & Climatology, Committee on Environmental Information Processing Technologies; and the Environmental Security Committee.

OFCM staff members provided several presentations at the AMS annual meeting in Boston, MA on a wide variety of topics. Additionally, OFCM organized, and the Federal Coordinator moderated, a session on interagency coordination of the Federal Weather Enterprise during the 36th Conference on Environmental Information Processing Technologies (EIPT).

Finally, OFCM staff members participated on the AMS Summer Policy Colloquium and Washington DC Forum.

These activities support all Goals of the Strategic Plan for FWE Coordination.

Interagency Coordinating Committee for Airborne Geosciences Research and Applications (ICCAGRA)

The ICCAGRA was formed in the late 1990s to improve cooperation, foster awareness, and facilitate communication among the partner agencies within the U.S. government. Membership consists of most of the Federal agencies participating in the FWE. These agencies oversee numerous and varied manned and unmanned aircraft dedicated to geosciences research. ICCAGRA recently has been involved in

overseeing standardization of instrument interfaces and data formats within the United States to improve access across the different agencies. OFCM participates as a member of ICCAGRA and has raised its profile by facilitating an overview presentation to ICMSSR.

Acting on a recommendation from the OFCM-Tropical Cyclone Operations and Research Forum, the working group Air Recon Equipment (WG-ARE) was initiated to focus on equipment needs for tropical reconnaissance aircraft. The group consists of both operational forecasters and researchers. The group met for the first time in November 2018 and developed a ten-year plan for tropical and winter season reconnaissance equipment needs. The ICCAGRA was briefed of the group's findings in May 2019. The WG-ARE met for a second time in January 2020, and brief the ICCAGRA in the spring of 2020 with the updates to the 10 year plan.

Friends and Partners of Aviation Weather

OFCM support the Friends and Partners in Aviation Weather (FPAW) spring 2020 meeting in Washington, DC on 15-16 April 2020 by organizing and conducting a one-day session of the federal aviation weather efforts. This session provided an overview of operational and research aviation weather activities across federal agencies. In particular, it highlighted research and development efforts in support of providing weather guidance to manned and unmanned aviation. Air Force, Navy, NWS, FAA, and other agencies gave presentations. These agency briefings were followed by a panel discussion with audience participation. The session created a shared situational awareness of the range of activities and identified opportunities to enhance collaboration with and between federal agencies.

National Academies of Sciences, Engineering, and Medicine (NAS)

The OFCM continues its mutually beneficial interactions with the National Academies of Sciences Engineering, and Medicine (the National Academies). The Federal Coordinator participates in the National Academies' Board on Atmospheric Sciences and Climate (BASC) strategic planning workshops and attends regularly scheduled BASC meetings.

In addition, the OFCM provided program updates to the National Academies' Space Science Board (SSB) and its Committee on Space and Solar Physics (CSSP).

The NAS and its members address all Goals of the Strategic Plan for FWE Coordination.

Office of Science and Technology Policy (OSTP)

OFCM provides Executive Secretary support for the Space Weather Operations, Readiness, and Mitigation (SWORM) Interagency Working Group and all three of its Sub Working Groups. OFCM was a primary author of the National Space Weather Strategy and Action Plan (NSW-SAP) published by the White House in 2019. The Federal Coordinator also serves as a Principal Member of the Space Weather, Security, and Hazards (SWSH) Subcommittee. By pursuing interagency activity through the SWORM and SWSH activities, OFCM supports the NSW-SAP Objectives and those of the Strategic Plan for FWE Coordination.

OFCM also participated in the US Group for Earth Observations (USGEO) managed through OSTP. USGEO activities support the National Plan for Civil Earth Observations and Goals 1, 3, 4, and 6 of the Strategic Plan FWE Coordination.