

Calendar No. 556

116TH CONGRESS }
2d Session }

SENATE

{ REPORT
{ 116-269

FLOOD LEVEL OBSERVATION, OPERATIONS,
AND DECISION SUPPORT ACT

R E P O R T

OF THE

COMMITTEE ON COMMERCE, SCIENCE, AND
TRANSPORTATION

ON

S. 4462



SEPTEMBER 24, 2020.—Ordered to be printed

U.S. GOVERNMENT PUBLISHING OFFICE

99-010

WASHINGTON : 2020

SENATE COMMITTEE ON COMMERCE, SCIENCE, AND TRANSPORTATION

ONE HUNDRED SIXTEENTH CONGRESS

SECOND SESSION

ROGER F. WICKER, Mississippi, *Chairman*

JOHN THUNE, South Dakota	MARIA CANTWELL, Washington
ROY BLUNT, Missouri	AMY KLOBUCHAR, Minnesota
TED CRUZ, Texas	RICHARD BLUMENTHAL, Connecticut
DEB FISCHER, Nebraska	BRIAN SCHATZ, Hawaii
JERRY MORAN, Kansas	EDWARD J. MARKEY, Massachusetts
DAN SULLIVAN, Alaska	TOM UDALL, New Mexico
CORY GARDNER, Colorado	GARY C. PETERS, Michigan
MARSHA BLACKBURN, Tennessee	TAMMY BALDWIN, Wisconsin
SHELLEY MOORE CAPITO, West Virginia	TAMMY DUCKWORTH, Illinois
MIKE LEE, Utah	JON TESTER, Montana
RON JOHNSON, Wisconsin	KYRSTEN SINEMA, Arizona
TODD C. YOUNG, Indiana	JACKY ROSEN, Nevada
RICK SCOTT, Florida	

JOHN KEAST, *Staff Director*

DAVID STRICKLAND, *Minority Staff Director*

Calendar No. 556

116TH CONGRESS }
2d Session }

SENATE

{ REPORT
{ 116-269

FLOOD LEVEL OBSERVATION, OPERATIONS, AND DECISION SUPPORT ACT

SEPTEMBER 24, 2020.—Ordered to be printed

Mr. WICKER, from the Committee on Commerce, Science, and
Transportation, submitted the following

R E P O R T

[To accompany S. 4462]

The Committee on Commerce, Science, and Transportation, to which was referred the bill (S. 4462) to establish a national integrated flood information system within the National Oceanic and Atmospheric Administration, and for other purposes, having considered the same, reports favorably thereon with an amendment (in the nature of a substitute) and recommends that the bill (as amended) do pass.

PURPOSE OF THE BILL

The bill would authorize the National Oceanic and Atmospheric Administration (NOAA) to establish a national integrated flood information system and improve the coordination and communication of flood events by the National Weather Service (NWS) through site-specific designation of warning coordination hydrologists and an assessment of NOAA's system for issuing flash flood watches and warnings. This bill would also improve tornado warning and hurricane forecasting programs in order to reduce loss of life, injury, and damage to the economy.

BACKGROUND AND NEEDS
RECENT FLOODING IMPACTS

Flooding is the most common and widespread of all weather-related natural disasters in the United States.¹ Flooding can occur during heavy rains, coastal storm surges, fast snow melt, and when dams or levees break, making it a coast-to-coast issue. Over the last 25 years, 99 percent of U.S. counties have been impacted by a flooding event.² It is currently ranked as the fourth most costly weather disaster event in the United States, resulting in expected annual economic losses of over \$25 billion.³ If the recent trends of increasing frequency and severity of severe weather events and sea level rise continue, flood events will also become more likely.⁴

In 2019, there were three billion-dollar weather disasters from flooding.⁵ These three flooding events spanned over 7 months along the Mississippi, Missouri, and Arkansas rivers, impacting approximately 14 million people and more than 17 States.⁶ The Midwest States and some Southern States—Mississippi and Louisiana—were the most affected by the 2019 flooding events, with over 11 States seeking Federal disaster funds for more than 400 counties.⁷ The flooding started in March when an extratropical cyclonic low-pressure area underwent rapid intensification (commonly referred to as a “bomb cyclone”⁸) and dropped large amounts of snow and rain in a short period across the middle section of the United States.⁹ This resulted in the inundation of millions of acres of agriculture and widespread damage to roads, bridges, levees, and dams across South Dakota, Nebraska, and Iowa, becoming one of the costliest U.S. inland flooding events on record (\$10.8 billion).^{10 11} The second flood event occurred from mid-May through June along the Arkansas River, causing an estimated \$3 billion in damages to homes, agriculture, transportation infrastructure, and levees in eastern Oklahoma and western Arkansas.¹² The third flooding event was along the Mississippi River and spanned from mid-

¹ Department of Homeland Security, “Floods”, updated Sep. 9, 2020 (<https://www.ready.gov/floods>) (accessed Sep. 21, 2020).

² Federal Emergency Management Agency, “Data Visualization: Historical Flood Risk and Costs”, updated Jul. 24, 2020 (<https://www.fema.gov/data-visualization-floods-data-visualization>) (accessed Sep. 21, 2020).

³ U.S. Congressional Budget Office, *Expected Costs of Damage from Hurricane Winds and Storm-Related Flooding*, April 2019, pp. 1–4. Available at CBO website (<https://www.cbo.gov/system/files/2019-04/55019-ExpectedCostsFromWindStorm.pdf>) (accessed Sep. 21, 2020).

⁴ Indiana University Environmental Resilience Institute, “Climate Implications—Storms and Flooding” (<https://eri.iu.edu/erit/implications/storms-flooding.html>) (accessed Sep. 21, 2020).

⁵ National Oceanic and Atmospheric Administration, National Centers for Environmental Information, “Billion-Dollar Weather and Climate Disasters: Events” (<https://www.ncdc.noaa.gov/billions/events/US/2019>) (accessed Sep. 21, 2020).

⁶ *Ibid.*

⁷ Sarah Almkhatar et al., “The Great Flood of 2019: A Complete Picture of a Slow-Motion Disaster”, *The New York Times*, Sep. 11, 2019 (<https://www.nytimes.com/interactive/2019/09/11/us/midwest-flooding.html?auth=link-dismiss-google1tap>) (accessed Sep. 21, 2020).

⁸ National Public Radio, “‘Bomb Cyclone’ Paralyzes Central U.S., Bringing Snow, Floods and Dangerous Winds,” Mar. 14, 2019 (<https://www.npr.org/2019/03/14/703352564/bomb-cyclone-paralyzes-central-u-s-bringing-snow-floods-and-dangerous-winds>) (accessed Sep. 23, 2020).

⁹ Center for Disaster Philanthropy, “2019 Catastrophic River Flooding”, Mar. 14, 2019 (<https://disasterphilanthropy.org/disaster/2019-u-s-spring-floods/>) (accessed Sep. 21, 2020).

¹⁰ National Oceanic and Atmospheric Administration, “Billion-Dollar Weather and Climate Disasters: Events” (<https://www.ncdc.noaa.gov/billions/events/US/2019>) (accessed Sep. 21, 2020).

¹¹ Sarah Almkhatar et al., “The Great Flood of 2019: A Complete Picture of a Slow-Motion Disaster”, *The New York Times*, Sep. 11, 2019 (<https://www.nytimes.com/interactive/2019/09/11/us/midwest-flooding.html?auth=link-dismiss-google1tap>) (accessed Sep. 21, 2020).

¹² National Oceanic and Atmospheric Administration, National Centers for Environmental Information, “Billion-Dollar Weather and Climate Disasters: Events” (<https://www.ncdc.noaa.gov/billions/events/US/2019>) (accessed Sep. 21, 2020).

March to late-September, significantly impacting Midwest and Southern States' agriculture, transportation infrastructure, levees, and dams and costing an estimated \$6.2 billion.¹³

Agriculture was one of the industries most affected by the 2019 flood events. In August 2019, the U.S. Department of Agriculture (USDA) Farm Service Agency reported that farmers were unable to plant 19.3 million acres in crops that year, with six States unable to plant on over 1 million acres,¹⁴ making 2019 the year with the most unplanted acres since the USDA began reporting those figures in 2007. As of November 2019, the USDA has paid out a record \$4.24 billion to farmers for acres they were unable to plant.¹⁵

Transportation infrastructure was another area significantly impacted by the floodwaters, which submerged roads and washed pavement away. For example, Nebraska went days without passable routes, with over 27 bridges damaged and over 3,300 miles of road closures, costing more than \$200 million in damages.¹⁶ These impacts to transportation infrastructure were also felt across Midwest and Southern States, crippling relief efforts and stopping the flow of other goods and services.

The historic high flooding also led the Army Corps of Engineers to open spillways to prevent damage to dams and to protect life and property, which resulted in unintended consequences to the Gulf Coast States' marine fisheries. Floodwaters from the Mississippi River Basin flowed downstream, where the Army Corps of Engineers opened the gates of the Bonnet Carré spillway twice in the same year for the first time since the spillway was constructed in 1928.¹⁷ The freshwater influx into the Mississippi Sound resulted in the deaths of almost all oysters in several areas.¹⁸ Additionally, the influx of water carried excess nutrient runoff and bacteria, promoting the formation of harmful algal blooms (HABs). HABs release biotoxins that can harm people, fish, shellfish, marine mammals, and birds.¹⁹ After algal blooms, such as HABs, die and decompose, the decomposition process uses up the available oxygen in the water, leading to the formation of a hypoxic dead zone.²⁰ The influx of freshwater and formation of HABs and dead

¹³ *Ibid.*

¹⁴ U.S. Department of Agriculture, Farm Service Agency, "Report: Farmers Prevented From Planting Crops on More Than 19 Million Acres", press release, Aug. 12, 2019 (<https://www.fsa.usda.gov/news-room/news-releases/2019/report-farmers-prevented-from-planting-crops-on-more-than-19-million-acres>) (accessed Sep. 21, 2020). The six States with more than 1 million acres unplanted were: South Dakota, Illinois, Ohio, Missouri, Arkansas, and Minnesota.

¹⁵ High Plains Public Radio, "Farmers Receive Record Payments for the Crops They Couldn't Plant", Nov. 27, 2019 (<https://www.hppr.org/post/farmers-receive-record-payments-crops-they-couldnt-plant>) (accessed Sep. 21, 2020).

¹⁶ Nebraska Department of Transportation, "Nebraska DOT Flood Recovery Updates" (<https://dot.nebraska.gov/news-media/nebraska-flood-2019/>) (accessed Sep. 21, 2020).

¹⁷ U.S. Army Corps of Engineers, "Bonnet Carré Spillway Overview" (<https://www.mvn.usace.army.mil/Missions/Mississippi-River-Flood-Control/Bonnet-Carre-Spillway-Overview/Spillway-Operation-Information/>) (accessed Sep. 21, 2020).

¹⁸ University of Southern Mississippi, "2019 Bonnet Carré Spillway Monitoring Update", Jun. 21, 2019 (<https://gcr1.usm.edu/bonny.carre.spillway/2019%20Bonnet%20Carre%20Spillway%20Overview%20-%20June%2021%202019%20-%20Final%20Version%20v2.pdf>) (accessed Sep. 21, 2020).

¹⁹ National Oceanic and Atmospheric Administration, "Joining Forces to Understand the Impacts of Harmful Algal Blooms on Aquaculture", press release, Sep. 29, 2017 (<https://www.nefsc.noaa.gov/press--release/pr2017/features/harmful-algal-blooms-aquaculture/>) (accessed Sep. 21, 2020).

²⁰ Centers for Disease Control and Prevention, "Harmful Algal Bloom (HAB)-Associated Illness", last reviewed Dec. 14, 2017 (<https://www.cdc.gov/habs/illness-symptoms-freshwater.html>) (accessed Sep. 21, 2020).

zones resulted in over \$500 million in damages for marine fisheries for three Gulf Coast States: Alabama, Louisiana, and Mississippi.²¹

This year, significant flooding has continued to impact Midwest and Southern States. In February, heavy rain resulted in flooding across Southern States and near-record flooding in Mississippi and Tennessee, impacting hundreds of people's homes.²² In April, numerous severe storms and flooding swept through 10 Midwest and Southern States, killing at least 30 people and knocking out electricity for approximately 750,000 people.²³ In May, historic flooding in Michigan destroyed two dams, damaging homes and property and forcing more than 10,000 people to evacuate.²⁴ While flooding has not been as severe or prolonged this year as flooding in 2019, the effects have been exacerbated by the coronavirus pandemic, creating significant social and economic hardships.

Flood events have also impacted other regions. For example, in Washington, the costs of flooding are the greatest as compared to all other natural disasters.²⁵ The sources of flooding differ regionally: in western Washington, it's generally significant rain events, while in eastern Washington and the Cascades, spring snowmelt is the primary cause.²⁶ For this reason, the FLOODS Act contains provisions for a broad national integrated system that also accounts for regional variation in the kinds of flood events that are most prevalent.

IMPORTANCE OF MONITORING AND FORECASTING FLOODING

In 2015, NOAA established the National Water Center to better understand and predict flooding events and inform water management decisions. Central to the National Water Center's tools is the National Water Model (NWM). The NWM simulates and forecasts how water moves throughout the Nation's rivers and streams. The model generates hourly forecasts for the entire river network, including high-resolution forecasts of soil moisture, surface runoff, snow water equivalent, and other parameters. The NWM is a cornerstone of the new NOAA Water Initiative and the National Water Center, providing more closely integrated water predictive capabilities to promote resilience to water risks.²⁷

Products like these, hosted at the National Water Center, help communities and industries make better-informed decisions about water management and how to prepare and respond to extreme

²¹ Jessica Hathaway, "Long Road to Relief: Mississippi Oystermen Slated for \$1 Million in Disaster Checks", *National Fishermen*, Feb. 20, 2020 (<https://www.nationalfisherman.com/gulf-south-atlantic/long-road-to-relief-mississippi-oystermen-slated-for-1-million-in-disaster-checks/>) (accessed Sep. 21, 2020).

²² Doyle Rice et al., "'Historic, Unprecedented' Flooding Swamps Southern USA; Mississippi and Tennessee Hardest Hit", *USA Today*, Feb. 17, 2020 (<https://www.usatoday.com/story/news/nation/2020/02/17/mississippi-flooding-swamps-southern-us/4784911002/>) (accessed Sep. 21, 2020).

²³ Associated Press, "Storms Tear Through US South, Leaving At Least 30 People Dead", *The Guardian*, Apr. 13, 2020 (<https://www.theguardian.com/us-news/2020/apr/13/us-storms-latest-flooding-deaths-south-states>) (accessed Sep. 21, 2020).

²⁴ N'dea Yancey-Bragg and Frank Wisil, "Mid-Michigan Flooding Crests at 35 Feet, Whitmer Requests FEMA Help: What We Know", *USA Today*, May 21, 2020 (<https://www.usatoday.com/story/news/nation/2020/05/21/michigan-flooding-floodwater-crests-whitmer-requests-fema-help/5234695002/>) (accessed Sep. 21, 2020).

²⁵ State of Washington, Department of Ecology, "Floods & Floodplain Planning" (<https://ecology.wa.gov/Water-Shorelines/Shoreline-coastal-management/Hazards/Floods-floodplain-planning>) (accessed Sep. 21, 2020).

²⁶ Id.

²⁷ National Oceanic and Atmospheric Administration, "National Water Center" (<https://water.noaa.gov/about/nwc>) (accessed Sep. 21, 2020).

water events.²⁸ The NWM is providing impact-based decision support services nationwide by providing “street level” water information and guidance, as well as serving as the foundation for additional private sector water services. The NWM also improves NOAA’s ability to meet the needs of its stakeholders (e.g., emergency managers, reservoir operators, floodplain managers, farmers, etc.) with more accurate, detailed, frequent and expanded water information.²⁹

Additionally, NOAA produces precipitation frequency estimates that are used by Federal, State, and local agencies to produce flood maps and develop regulations related to infrastructure design and planning activities to minimize flood risks.³⁰ These values are reported in a Precipitation-Frequency Atlas, commonly referred to as Atlas 14, and help define point-based rainfall amounts for 1-, 5-, 10-, and 100-year rainfall events. The Atlas is made up of 12 volumes, representing different geographic regions across the United States and affiliated territories.³¹ In NOAA’s most recent volume update (volume 11), it showed that values previously classified as 100-year events in Houston were now 25-year events.³² Currently, funding for NOAA Atlas 14 work comes entirely from external sources, requiring NOAA to solicit funding from partner and customer Federal and State agencies for each volume.³³ This has resulted in irregular volume updates, and caused a lapse of over 50 years in updates for five Northwestern States (Idaho, Montana, Oregon, Washington, and Wyoming).³⁴ In 2018, the Subcommittee on Hydrology listed Atlas 14 as one of three extreme storm products needed to help the United States prepare for extreme weather events, recommending that the program receive a secure funding source, improve methodology to evaluate precipitation frequency, and be updated every 10 years.³⁵

NEED TO IMPROVE TORNADO WARNING AND HURRICANE COMMUNICATION

Windstorms are the largest loss-producing natural hazards in the United States, causing over \$1 trillion in economic losses and over 8,000 fatalities from 1980 to 2018.³⁶ The majority of losses related to life and property by windstorms can be attributed to tornadoes and hurricanes. Between 2017 and 2019, there were 23 billion-dol-

²⁸ National Oceanic and Atmospheric Administration, “2019 National Hydrologic Assessment”, Mar. 21, 2019 (<https://www.nws.noaa.gov/oh/2019NHA.html>) (accessed Sep. 21, 2020).

²⁹ *Ibid.*

³⁰ National Oceanic and Atmospheric Administration, “Precipitation Frequency Data Server” (<https://hdsc.nws.noaa.gov/hdsc/pfds/index.html>) (accessed Sep. 21, 2020).

³¹ *Ibid.*

³² National Oceanic and Atmospheric Administration, “NOAA Updates Texas Rainfall Frequency Values”, press release (<https://www.noaa.gov/media-release/noaa-updates-texas-rainfall-frequency-values>) (accessed Sep. 21, 2020).

³³ Subcommittee on Hydrology, Extreme Rainfall Product Needs, Oct. 10, 2018 (https://acwi.gov/hydrology/extreme-storm/product_needs_proposal_20181010.pdf) (accessed Sep. 21, 2020).

³⁴ National Oceanic and Atmospheric Administration, “Precipitation Frequency Data Server” (<https://hdsc.nws.noaa.gov/hdsc/pfds/index.html>) (accessed Sep. 21, 2020).

³⁵ Subcommittee on Hydrology, Extreme Rainfall Product Needs, Oct. 10, 2018 (https://acwi.gov/hydrology/extreme-storm/product_needs_proposal_20181010.pdf) (accessed Sep. 21, 2020).

³⁶ Interagency Coordinating Committee, National windstorm Impact Reduction Program: Biennial Progress Report to Congress for Fiscal Years 2017 and 2018 (<https://www.nist.gov/system/files/documents/2020/03/04/NWIRP%20FY17-18%20Progress%20Report%2024-2020.pdf>) (accessed Sep. 21, 2020).

lar tornado and hurricane disaster events reported by the NWS, resulting in 3,338 deaths and over \$360 billion in damages.³⁷

Tornadoes remain one of the most challenging extreme-weather events to predict and warn against, with first-person observations being the primary tool for confirming tornado presence.³⁸ On March 2, 2020, Nashville, Tennessee, had a tornado touch down in the middle of the night without warning, killing 24 people. Residents of downtown Nashville had about 6 minutes of warning before the tornado was directly overhead, while the Nashville International Airport and locations to the west were hit without warning.³⁹ This event further demonstrates the need to improve tornado forecasting. Since the 1970s, scientists have known that tornadoes emit acoustic radiation at audio and infrasonic (sound inaudible to humans) frequencies.⁴⁰ Scientists at the University of Mississippi's National Center for Physical Acoustics have begun using infrasound produced by tornadoes to detect, locate, and characterize tornadoes in real time.⁴¹ Recent work has shown that detection of infrasound through low-frequency audio acoustic sensors can help identify directional movement, bearing, and the intensity of tornadoes as well as expand the distance of detection to over 50 miles. Additional work is needed to determine if tornado signals are distinctive from other sources of infrasound, ensuring that forecasts can accurately predict tornado presence from other storm systems.⁴²

Hurricane forecasting has improved substantially in the last century, largely due to weather satellites and computer models. Less than 100 years ago, hurricane landfall was often a surprise—leaving no time for preparedness or evacuation. Today, the National Hurricane Center (NHC) is improving forecasting between 24 hours and 5 days before landfall, which can save lives, property, and billions of dollars.

Understanding how people interpret forecasts and how that interpretation can influence behavior and motivation is valuable in advancing the impact the weather enterprise can have on saving lives. Weather forecasting is inherently uncertain. Therefore, it is particularly important to address the communication of uncertainty to users, as well as the need to discuss not only predictions of weather variables, but also predictions of weather impacts.⁴³ Be-

³⁷National Oceanic and Atmospheric Administration, “Billion-Dollar Weather and Climate Disasters: Events” (<https://www.ncdc.noaa.gov/billions/events/US/2019>) (accessed Sep. 21, 2020).

³⁸Maddie Stone, “Scientists are Using Nuclear Weapons Surveillance Tech to ‘Hear’ Tornadoes”, *The Washington Post*, Feb. 23, 2020, at <https://www.washingtonpost.com/weather/2020/02/23/scientists-are-using-nuclear-weapons-surveillance-tech-hear-tornadoes/> (accessed Sep. 21, 2020).

³⁹Matthew Cappucci, “Tennessee Tornadoes’ Death Toll Was Tied to a Lack of Warning, Awareness and Readiness”, *The Washington Post*, Mar. 6, 2020 (<https://www.washingtonpost.com/weather/2020/03/06/tennessee-tornado-tragedy-was-tied-lack-warning-awareness-readiness/>) (accessed Sep. 21, 2020).

⁴⁰T.M. Georges, “Infrasound From Convective Storms: Examining the Evidence”, *Reviews of Geophysics*, vol. 11 (August 1973), p. 571–594 (doi:10.1029/RG011i003p00571) (accessed Sep. 21, 2020).

⁴¹William Garth Frazier et al., “Acoustic Detection, Tracking, and Characterization of Three Tornadoes”, *The Journal of the Acoustical Society of America*, vol. 135, no. 4 (April 2014), p. 1742–1751 (<http://dx.doi.org/10.1121/1.4867365>) (accessed Sep. 21, 2020).

⁴²Maddie Stone, “Scientists Are Using Nuclear Weapons Surveillance Tech to ‘Hear’ Tornadoes”, *The Washington Post*, Feb. 23, 2020 (<https://www.washingtonpost.com/weather/2020/02/23/scientists-are-using-nuclear-weapons-surveillance-tech-hear-tornadoes/>) (accessed Sep. 21, 2020).

⁴³Jack Williams, “When Storms Were a Surprise: A History Of Hurricane Warnings”, *The Washington Post*, Aug. 16, 2013 (<https://www.washingtonpost.com/news/capital-weather-gang/wp/2013/08/16/when-storms-were-a-surprise-a-history-of-hurricane-warnings/>) (accessed Sep. 21, 2020).

cause of these gaps, many experts believe that social science should be incorporated as a primary element of the solution and not just considered in hindsight.

SUMMARY OF PROVISIONS

If enacted, S. 4462, the Flood Level Observation, Operations, and Decision Support Act, would do the following:

- Establish a national integrated flood information system to reduce flood-related effects and costs.
- Establish partnerships with institutions of higher education and Federal agencies to improve total water predictions.
- Designate a service coordination hydrologist at each NWS River Forecast Center to increase impact-based decision support services at the State and local level.
- Evaluate and improve flood watches and warnings and communication of information to support coordinated flood management.
- Authorize the NOAA Precipitation Frequency Atlas of the United States program to estimate and communicate precipitation frequency in the United States.
- Establish a committee to ensure coordination of Federal departments with joint or overlapping responsibilities in water management.
- Establish a hydrologic research fellowship program.
- Identify, and support research that enables a consistent, Federal set of forward-looking, long-term meteorological information.
- Assess gaps in the availability of snow-related data to assess and predict floods and flood impacts.
- Make flood-related data more readily available to the public.

LEGISLATIVE HISTORY

S. 4462, the Flood Level Observation, Operations, and Decision Support (FLOODS) Act, was introduced on August 6, 2020, by Senator Wicker (for himself and Senator Peters) and was referred to the Committee on Commerce, Science, and Transportation of the Senate. On September 16, 2020, the Committee met in open Executive Session and, by voice vote, ordered S. 4462 reported favorably with an amendment (in the nature of a substitute).

A related bill, S. 914, was introduced on March 27, 2019, as the Coordinated Ocean Observations and Research Act of 2019, by Senator Wicker (for himself and Senator Cantwell) and was referred to the Committee on Commerce, Science, and Transportation of the Senate. S. 914 would establish the National Water Center, within the NWS, as the primary facility for hydrologic decision support services. On July 30, 2020, S. 914, the Coordinated Ocean Observations and Research Act of 2020, passed the Senate with an amendment (in the nature of a substitute) by unanimous consent.

In the 115th Congress, H.R. 353, the Weather Research and Forecasting Innovation Act of 2017,⁴⁴ became law on April 18, 2017, prioritizing weather research through improved weather

⁴⁴Public Law 115–25.

data, modeling, computing forecasts, and warnings for the protection of life and property.

H.R. 244, the Consolidated Appropriations Act, 2017,⁴⁵ became law on May 5, 2017, appropriating funds for the National Water Center.

ESTIMATED COSTS

In compliance with subsection (a)(3) of paragraph 11 of rule XXVI of the Standing Rules of the Senate, the Committee states that, in its opinion, it is necessary to dispense with the requirements of paragraphs (1) and (2) of that subsection in order to expedite the business of the Senate.

A formal cost estimate was not timely submitted to the Committee before the filing of this report, but the Committee notes that the Congressional Budget Office (CBO) provided an informal cost estimate by email as follows:

From: Robert Reese <Robert.Reese@cbo.gov>
Sent: Tuesday, September 22, 2020 10:09 AM
To: [REDACTED] <[\[REDACTED\]@commerce.senate.gov](mailto:[REDACTED]@commerce.senate.gov)>
Cc: Susan Willie <Susan.Willie@cbo.gov>
Subject: Re: S. 4462 Cost Estimate

[REDACTED] I've read through S4462 (attached). I can tell you now that the bill would not affect direct spending or revenues.

It would require higher appropriation levels and I'm working with NOAA to determine how much that would be. However, because of how widespread the bill's effects would be (across many NOAA programs) that may take a few weeks.

If you all are looking to move the bill before October and the budget committee asks for our estimate you can forward this email to them as my informal estimate.

Thanks,
 Robert

Robert Reese
 Principal Analyst
 Congressional Budget Office
Robert.Reese@cbo.gov

REGULATORY IMPACT STATEMENT

In accordance with paragraph 11(b) of rule XXVI of the Standing Rules of the Senate, the Committee provides the following evaluation of the regulatory impact of the legislation, as reported:

NUMBER OF PERSONS COVERED

S. 4462, as reported, would not impose any new significant regulatory requirements, and, therefore, would not subject any individuals or businesses to new significant regulations.

⁴⁵Public Law 115-31.

ECONOMIC IMPACT

Enactment of S. 4462 is not expected to have any significant adverse impacts on the Nation's economy. It will likely have a positive impact by increasing the efficiency of Federal flood coordination and prediction and protecting human lives and property.

PRIVACY

S. 4462, as reported, would not have any adverse impact on the privacy of individuals.

PAPERWORK

S. 4462, as reported, would not impose substantial paperwork burden on individuals or businesses.

CONGRESSIONALLY DIRECTED SPENDING

In compliance with paragraph 4(b) of rule XLIV of the Standing Rules of the Senate, the Committee provides that no provisions contained in the bill, as reported, meet the definition of congressionally directed spending items under the rule.

SECTION-BY-SECTION ANALYSIS

Section. 1. Short title; table of contents.

This section would provide that the bill may be cited as the "Flood Level Observation, Operations, and Decision Support Act" or the "FLOODS Act" and would provide a table of contents.

Section 2. Definitions.

This section would define the terms "State" and "Under Secretary".

Section 3. National Integrated Flood Information System.

This section would authorize the Under Secretary to establish a system, referred to as the "National Integrated Flood Information System" (NIFIS), to reduce flood-related effects and costs by leveraging existing work within NOAA and partnerships to better support more timely decision making. NIFIS would provide a flood early warning system that collects information necessary to predict floods and flooding impacts, coordinating and integrating inter-agency Federal research and monitoring. NIFIS would translate and communicate predictions into flood forecasts and watches and warnings to public and private entities engaged in flood planning and preparedness, at the national, regional, and local levels. This section would also allow NIFIS to continue ongoing research and monitoring activities and collaborations relating to floods, develop private partnerships and academic cooperative partnerships, utilize citizen scientists to collect and integrate monitoring data, and engage with and leverage existing resources within the Administration.

Section 4. Observations and modeling for total water prediction.

This section would require the Under Secretary to establish partnerships with one or more institutions of higher education and Fed-

eral agencies to evaluate observations that would improve total water prediction, prioritizing partnerships that evaluate enhancing in-situ observations through manned and unmanned aerial systems. This section would also direct improvements in coastal oceanographic modeling and the incorporation of observations that improve total water prediction.

Section 5. Service coordination hydrologists at River Forecast Centers of the National Weather Service.

This section would codify the existing position of service coordination hydrologist at NWS River Forecast Centers. Service coordination hydrologists would increase impact-based decision support services.

Section 6. Improving National Oceanic and Atmospheric Administration communication of future flood risks and hazardous flash flood events.

This section would authorize the Under Secretary, within two years of enactment of this Act, to conduct and submit an assessment to Congress on the NWS's flash flood watches and warnings and communication of information to support coordinated flood management. The assessment would specifically focus on: (1) ways to communicate hazardous flash flood events to the public; (2) ways to provide actionable geographic information to watch and warning recipients; and (3) an evaluation of information delivery to support coordinated Federal and non-Federal flood preparation and response. The assessment would be done in consultation with weather and flood management related governmental, academic, not-for-profit and private entities, and reviewed by the National Academy of Sciences for scientific and technical soundness. Based on the evaluation, the Under Secretary shall submit recommendations to improve watches and warnings, including improvement of the communication of the risks posed by hazardous flood events and providing actionable geographic information to the recipient of a watch or warning for a flash flood. This section would also define the terms watch and warning as products issued by the NOAA to alert the general public to the potential for or presence of an event and to inform the action to prevent loss of life and property, excluding technical or specialized meteorological and hydrological forecast products.

Section 7. Freshwater monitoring along the coast.

This section would require the Under Secretary to assess the availability of data for freshwater flooding into oceans, bays, and estuaries and the need for additional data to assess and predict the effect of flooding or freshwater discharge. The Under Secretary would create an inventory of those data needs and use the inventory when planning for collection of additional data.

Section 8. Tornado warning improvement.

This section would amend the Weather Research and Forecasting Innovation Act of 2017,⁴⁶ requiring the Under Secretary to examine

⁴⁶Public Law 115-25.

the value of incorporating innovation observations to improve tornado forecasts, predictions, and warnings.

Section 9. Hurricane forecast improvement program.

This section would amend the Hurricane Forecast Improvement Program in the Weather Research and Forecasting Innovation Act of 2017,⁴⁷ requiring the Under Secretary to examine the value of incorporating innovation observations to improve hurricane forecasts.

Section 10. Weather and water research and development planning.

This section would amend NOAA's weather research and development plan, specifying the consideration of flood-events when identifying and specifying research and development activities to meet the operational weather mission of the NWS.

Section 11. Forecast communication coordinators.

This section would require the Under Secretary to provide assistance to States for forecast communication coordinators to enable local interpretation and planning based on the information.

Section 12. Estimates of precipitation frequency in the United States.

This section would direct the NOAA Administrator to establish a program, referred to as the "NOAA Precipitation Frequency Atlas of the United States", to estimate and communicate precipitation frequency in the United States. The program would serve as the official source of the Federal Government for estimates on precipitation frequency and would better inform the public and provide information on temporal and spatial distribution of heavy precipitation, analyses of seasonality in precipitation, and trends in annual maximum series data. The program would conduct estimates for the United States at least once every 10 years, publish those estimates, and make them available on a publicly accessible NOAA website. The Administrator may partner, consult, and/or coordinate with Federal, State, local, Tribal, territorial government agencies, academic, private, and nonprofit organization. The program would be authorized appropriations of \$3.5 million for each fiscal year from 2021 through 2030.

Section 13. Interagency Coordinating Committee on Water Management.

This section would establish a committee, referred to as the "Interagency Coordinating Committee on Water Management", to ensure that Federal departments and agencies that engage in water-related matters work together where they have joint or overlapping responsibilities to do the following:

- Improve interagency coordination on water resource and data management.
- Coordinate and consolidate existing water-related Federal task forces and groups.
- Designate and consolidate repositories responsible for archiving and managing water-related infrastructure.

⁴⁷Id.

- Conduct integrated planning for Federal investments in water-related infrastructure.
- Support water infrastructure workforce development.

The Interagency Coordinating Committee on Water Management would be co-chaired by the Secretary of Interior and the Environmental Protection Agency Administrator and would submit a report to Congress listing research and cross-agency research and coordination needs.

Section 14. National Weather Service hydrologic research fellowship program.

This section would direct the Director of the NWS to establish a hydrologic research fellowship program for individuals who are U.S. citizens and enrolled in a research-based graduate program that advances hydrologic research priorities. Selection preference would be given to applicants from historically Black colleges and universities and minority-serving institutions. Successful applicants would be placed in positions within the Executive branch for up to 2 years and would do research on priorities deemed appropriate by the Under Secretary and in consultation with the United States Geological Survey, Federal Emergency Management Agency, and the Army Corps of Engineers. Individuals that successfully complete the program requirements shall be eligible for direct hire for up to 2 years.

Section 15. Identification and support of consistent, Federal set of forward looking, long-term meteorological information.

This section would direct the Under Secretary to identify, and support research that enables, a consistent, Federal set of forward-looking, long-term meteorological information that models future extreme weather events, other environmental trends, projections, and up-to-date observations, including mesoscale information deemed appropriate by the Under Secretary.

Section 16. Gap analysis on availability of snow-related data to assess and predict flood and flood impacts.

This section would direct the Under Secretary to conduct a gap analysis of the availability of snow-related data to assess and predict floods and flood impacts. Findings from the gap analysis and opportunities for additional collaboration among Federal agencies to collect snow-related data to better assess and predict floods and flood impacts would be submitted in a report to Congress within 180 days of enactment of this Act.

Section 17. Availability to the public of flood-related data.

This section would direct the Under Secretary to make flood-related data freely accessible, or available at a cost that does not exceed the cost of preparing the data, to the public on a NOAA website.

CHANGES IN EXISTING LAW

In compliance with paragraph 12 of rule XXVI of the Standing Rules of the Senate, changes in existing law made by the bill, as reported, are shown as follows (existing law proposed to be omitted

is enclosed in black brackets, new material is printed in italic, existing law in which no change is proposed is shown in roman):

WEATHER RESEARCH AND FORECASTING INNOVATION ACT OF 2017

* * * * *

[15 U.S.C. 8513]

SEC. 103. TORNADO WARNING IMPROVEMENT AND EXTENSION PROGRAM.

(a) **IN GENERAL.**—The Under Secretary, in collaboration with the United States weather industry and academic partners, shall establish a tornado warning improvement and extension program.

(b) **GOAL.**—The goal of such program shall be to reduce the loss of life and economic losses from tornadoes through the development and extension of accurate, effective, and timely tornado forecasts, predictions, and warnings, including the prediction of tornadoes beyond 1 hour in advance.

(c) **INNOVATIVE OBSERVATIONS.**—*The Under Secretary shall ensure that the program periodically examines the value of incorporating innovative observations, such as acoustic or infrasonic measurements, observations from phased array radars, and observations from mesonets, with respect to the improvement of tornado forecasts, predictions, and warnings.*

[(c)] (d) PROGRAM PLAN.—Not later than 180 days after the date of the enactment of this Act, the Assistant Administrator for Oceanic and Atmospheric Research, in coordination with the Director of the National Weather Service, shall develop a program plan that details the specific research, development, and technology transfer activities, as well as corresponding resources and timelines, necessary to achieve the program goal.

[(d)] (e) ANNUAL BUDGET FOR PLAN SUBMITTAL.—Following completion of the plan, the Under Secretary, acting through the Assistant Administrator for Oceanic and Atmospheric Research and in coordination with the Director of the National Weather Service, shall, not less frequently than once each year, submit to Congress a proposed budget corresponding with the activities identified in the plan.

[15 U.S.C. 8514(b)]

SEC. 104. HURRICANE FORECAST IMPROVEMENT PROGRAM.

(a) * * *

(b) **GOAL.**—The goal of the project maintained under subsection (a) shall be to develop and extend accurate hurricane forecasts and warnings in order to reduce loss of life, injury, and damage to the economy, with a focus on—

(1) improving the prediction of rapid intensification and track of hurricanes;

(2) improving the forecast and communication of storm surges from hurricanes[; and];

(3) incorporating risk communication research to create more effective watch and warning products[.]; and

(4) *evaluating and incorporating, as appropriate, innovative observations, including acoustic or infrasonic measurements.*

(c) * * *

[15 U.S.C. 8515(2)]

SEC. 105. WEATHER RESEARCH AND DEVELOPMENT PLANNING.

Not later than 1 year after the date of the enactment of this Act, and not less frequently than once each year thereafter, the Under Secretary, acting through the Assistant Administrator for Oceanic and Atmospheric Research and in coordination with the Director of the National Weather Service and the Assistant Administrator for Satellite and Information Services, shall issue a research and development and research to operations plan to restore and maintain United States leadership in numerical weather prediction and forecasting that—

(1) * * *

(2) identifies and prioritizes specific research and development activities, and performance metrics, weighted to meet the operational weather *and flood-event* mission of the National Weather Service to achieve a weather-ready Nation;

(3) * * *

(4) * * *

* * * * *

FOOD SECURITY ACT OF 1985

* * * * *

[15 U.S.C. 8521(f)(1)]

SEC. 1762. WEATHER AND CLIMATE INFORMATION IN AGRICULTURE.

(a) * * *

* * * * *

(f) FORECAST COMMUNICATION COORDINATORS.—

(1) IN GENERAL.—The Under Secretary shall foster effective communication, understanding, and use of the forecasts by the intended users of the information described in subsection (d). This [may] *shall* include assistance to States for forecast communication coordinators to enable local interpretation and planning based on the information.

(2) * * *

(3) * * *

* * * * *

