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117TH CONGRESS
2D SESSION

S. 3817

To improve the forecasting and understanding of tornadoes and other hazardous weather, and for other purposes.

IN THE SENATE OF THE UNITED STATES

MARCH 10 (legislative day, MARCH 7), 2022

Mr. WICKER (for himself, Mr. GRASSLEY, Mrs. HYDE-SMITH, Mr. THUNE, Ms. ERNST, Ms. DUCKWORTH, Mr. CRUZ, and Mr. PETERS) introduced the following bill; which was read twice and referred to the Committee on Commerce, Science, and Transportation

DECEMBER 12, 2022

Reported by Ms. CANTWELL, with an amendment

[Strike out all after the enacting clause and insert the part printed in italic]

A BILL

To improve the forecasting and understanding of tornadoes and other hazardous weather, and for other purposes.

1 *Be it enacted by the Senate and House of Representa-*
2 *tives of the United States of America in Congress assembled,*

3 **SECTION 1. SHORT TITLE.**

4 This Act may be cited as the “Tornado Observations
5 Research and Notification Assessment for Development of
6 Operations Act” or the “TORNADO Act”.

1 **SEC. 2. DEFINITIONS.**

2 In this Act:

3 (1) **HISTORICALLY BLACK COLLEGE OR UNI-**
 4 **VERSITY.**—The term “historically Black college or
 5 university” has the meaning given the term “part B
 6 institution” in section 322 of the Higher Education
 7 Act of 1965 (20 U.S.C. 1061).

8 (2) **INSTITUTION OF HIGHER EDUCATION.**—The
 9 term “institution of higher education” has the
 10 meaning given the term in section 101(a) of the
 11 Higher Education Act of 1965 (20 U.S.C. 1001(a)).

12 (3) **UNDER SECRETARY.**—The term “Under
 13 Secretary” means the Under Secretary of Commerce
 14 for Oceans and Atmosphere.

15 **SEC. 3. HAZARDOUS WEATHER AND WATER EVENT RISK**
 16 **COMMUNICATION.**

17 (a) **IN GENERAL.**—The Under Secretary shall main-
 18 tain and improve the system of the National Oceanic and
 19 Atmospheric Administration by which the risks of haz-
 20 ardous weather and water events are communicated to the
 21 general public, with the goal of informing action and en-
 22 couraging response to prevent loss of life and property.

23 (b) **HAZARD RISK COMMUNICATION IMPROVEMENT**
 24 **AND SIMPLIFICATION.**—

25 (1) **IN GENERAL.**—The Under Secretary shall
 26 establish, or designate an existing office to serve as,

1 a hazard risk communication office (in this sub-
2 section referred to as the “Office”), for the purposes
3 of simplifying and improving the communication of
4 hazardous weather and water event risks.

5 (2) TERMINOLOGY.—The Office shall identify,
6 eliminate, or modify unnecessary, redundant, or con-
7 fusing terms for hazardous weather and water event
8 communications and add new terminology, as appro-
9 priate.

10 (3) COMMUNICATIONS IMPROVEMENT.—The Of-
11 fice shall improve the form, content, and methods of
12 hazardous weather and water event communications
13 to more clearly inform action and increase the likeli-
14 hood that the public takes such action to prevent the
15 loss of life or property.

16 (4) EVALUATIONS.—The Office shall, in coordi-
17 nation with the performance branch of the National
18 Weather Service, develop metrics for that branch to
19 track and evaluate the degree to which hazardous
20 weather and water event communications result in
21 action and response.

22 (5) SUPPORT PLAN.—The Office shall develop a
23 plan for the purpose of supporting the activities de-
24 scribed in paragraph (3). The plan shall be periodi-
25 cally updated and informed by internal and extra-

1 mural research and the results of the evaluation of
2 hazardous weather and water event communications
3 conducted under paragraph (4).

4 (6) METHODS.—In carrying out this subsection,
5 the Office shall develop and implement recommenda-
6 tions that—

7 (A) are based on the best and most recent
8 understanding from authoritative social, behav-
9 ioral, risk, and communication science research;

10 (B) are validated by social, behavioral,
11 risk, and communication science sound survey
12 designs, taking into account the importance of
13 reproducibility and replicability of results, using
14 rigorous statistical analyses;

15 (C) account for the needs of various demo-
16 graphics, vulnerable populations, and geo-
17 graphic regions;

18 (D) account for the differences between
19 various types of weather and water hazards;

20 (E) respond to the needs of Federal, State,
21 and local government partners and media part-
22 ners; and

23 (F) account for necessary changes in the
24 infrastructure, technology, and protocols for

1 creating and disseminating federally operated
2 watches and warnings.

3 ~~(7) COORDINATION.—~~The Office shall periodi-
4 cally provide updates on best practices for commu-
5 nicating hazardous weather and water events to
6 Federal, State, and local government partners, insti-
7 tutions of higher education, private entities, and
8 media partners.

9 ~~(8) TIMELINESS AND CONSISTENCY.—~~The Of-
10 fice shall develop best practices and guidance for en-
11 suring timely and consistent communication across
12 public facing platforms that disseminate hazardous
13 weather and water event information.

14 ~~(c) HAZARD COMMUNICATION RESEARCH AND EN-~~
15 ~~GAGEMENT.—~~

16 ~~(1) IN GENERAL.—~~The Under Secretary shall
17 establish or maintain a research program—

18 ~~(A) to modernize the creation and commu-~~
19 ~~nication of risk-based, statistically reliable,~~
20 ~~probabilistic hazard information to inform effec-~~
21 ~~tive responses to hazardous weather and water~~
22 ~~events; and~~

23 ~~(B) to improve the fundamental social, be-~~
24 ~~havioral, risk, and communication science re-~~

1 garding hazardous weather and water event
2 communication.

3 ~~(2) COORDINATION.—~~In carrying out the re-
4 search program required by paragraph (1), the
5 Under Secretary shall coordinate and communicate
6 with States, Tribes, localities, and emergency man-
7 agers on research priorities and results.

8 ~~(3) PILOT PROGRAM REQUIRED.—~~

9 ~~(A) IN GENERAL.—~~To further research
10 into hazard communication, the Under Sec-
11 retary, in collaboration with one or more eligible
12 institutions, shall establish a pilot program to
13 test the effectiveness of implementing the re-
14 search conducted under this subsection.

15 ~~(B) ELIGIBLE INSTITUTION DEFINED.—~~In
16 this paragraph, the term “eligible institution”
17 means any of the following:

18 (i) A historically Black college or uni-
19 versity located in an area of persistent pov-
20 erty that is subjected to frequent severe
21 weather, such as tornadoes, hurricanes,
22 and floods.

23 (ii) An institution of higher education
24 in close proximity to a National Weather

1 Service Weather Forecast Office of the Na-
2 tional Weather Service.

3 (d) **DATA MANAGEMENT.**—The Under Secretary
4 shall establish, maintain, and improve a central repository
5 system for the National Oceanic and Atmospheric Admin-
6 istration for social, behavioral, risk, and economic data re-
7 lated to the communication of hazardous weather and
8 water events, including data developed or received pursu-
9 ant to paragraphs (3), (4), and (5) of subsection (b).

10 (e) **DIGITAL WATERMARKING.**—The Under Secretary
11 shall develop methods to reduce the likelihood of unauthor-
12 ized tampering with online hazardous weather and water
13 event risk communication, such as developing digital wa-
14 termarks.

15 **SEC. 4. WARN-ON-FORECAST STRATEGIC PLAN.**

16 (a) **IN GENERAL.**—Not later than one year after the
17 date of the enactment of this Act, the Under Secretary
18 shall prepare and submit to Congress a strategic plan for
19 developing and prioritizing the implementation of high-
20 resolution probabilistic forecast guidance for tornadic con-
21 ditions using a next-generation weather forecast and
22 warning framework.

23 (b) **PLAN ELEMENTS.**—The strategic plan required
24 by subsection (a) shall include the following:

25 (1) A discussion of—

1 (A) the priorities and needs of vulnerable
2 populations and National Weather Service part-
3 ners; and

4 (B) high-performance computing, visualiza-
5 tion, and dissemination needs.

6 (2) A timeline and guidance for implementation
7 of—

8 (A) high-resolution numerical weather pre-
9 diction models;

10 (B) methods for meeting the high-perform-
11 ance computing, visualization, and dissemina-
12 tion needs discussed under paragraph (1)(B);

13 (C) real-time high-resolution probabilistic
14 forecasts;

15 (D) improved observations, including
16 through radars, satellites, and uncrewed aerial
17 systems;

18 (E) a flexible framework to communicate
19 clear and simple hazardous weather and water
20 event information to the public; and

21 (F) social, behavioral, risk, and commu-
22 nication research to improve the forecaster
23 operational environment and societal informa-
24 tion reception and response.

1 **SEC. 5. TORNADO RATING SYSTEM.**

2 (a) IN GENERAL.—The Under Secretary shall, in col-
3 laboration with such stakeholders as the Under Secretary
4 considers appropriate—

5 (1) evaluate the system used as of the date of
6 the enactment of this Act to rate the severity of tor-
7 nadoes; and

8 (2) determine whether updates to that system
9 are required to ensure that the ratings accurately re-
10 flect the severity of tornadoes.

11 (b) UPDATE REQUIRED.—If the Under Secretary de-
12 termines under subsection (a) that updates to the tornado
13 rating system are necessary, the Under Secretary shall up-
14 date the system.

15 **SEC. 6. POST-STORM SURVEYS AND ASSESSMENTS.**

16 (a) IN GENERAL.—The Under Secretary shall per-
17 form one or more post-storm surveys and assessments fol-
18 lowing each hazardous weather or water event determined
19 by the Under Secretary to be of sufficient societal impor-
20 tance to warrant a post-event survey and assessment.

21 (b) COORDINATION.—The Under Secretary shall co-
22 ordinate with Federal, State, and local governments, pri-
23 vate entities, and relevant institutions of higher education
24 when conducting post-storm surveys and assessments
25 under subsection (a) in order to optimize data collection,
26 sharing, and integration.

1 (c) DATA AVAILABILITY.—The Under Secretary shall
 2 make the data obtained from each post-storm survey and
 3 assessment conducted under subsection (a) available to the
 4 public as soon as practicable after conducting the survey
 5 and assessment.

6 (d) IMPROVEMENT.—The Under Secretary shall—

7 (1) investigate the role of uncrewed aerial sys-
 8 tems in data collection during post-storm surveys
 9 and assessments conducted under subsection (a);

10 (2) update tactics and procedures to enhance
 11 the efficiency and reliability of data obtained from
 12 post-storm surveys and assessments; and

13 (3) increase the number of post-storm commu-
 14 nity impact studies, including surveying individual
 15 responses and gathering survivability statistics.

16 (e) SUPPORT FOR EMPLOYEES.—The Under Sec-
 17 retary shall provide training, resources, and access to pro-
 18 fessional counseling to support the emotional and mental
 19 health and well-being of employees conducting post-storm
 20 surveys and assessments under subsection (a).

21 **SEC. 7. VORTEX-USA PROGRAM.**

22 (a) IN GENERAL.—Section 103 of the Weather Re-
 23 search and Forecasting Innovation Act of 2017 (15 U.S.C.
 24 8513) is amended—

1 (1) in the section heading, by striking “**TOR-**
 2 **NADO WARNING IMPROVEMENT AND EXTEN-**
 3 **SION**” and inserting “**VORTEX-USA**”;

4 (2) in subsection (a), by striking “establish a
 5 tornado warning improvement and extension pro-
 6 gram” and inserting “maintain a program for rap-
 7 idly improving tornado forecast and warnings”;

8 (3) by striking subsections (c) and (d); and

9 (4) by adding at the end the following:

10 “(c) **INNOVATIVE OBSERVATIONS.**—The Under Sec-
 11 retary shall ensure that the program required by sub-
 12 section (a) periodically examines the value of incorporating
 13 innovative observations with respect to the improvement
 14 of tornado forecasts, predictions, and warnings, such as
 15 acoustic or infrasonic measurements, observations from
 16 phased array radars, and observations from mesonets.

17 “(d) **WARNINGS.**—The program required by sub-
 18 section (a) shall—

19 “(1) continue the research necessary to develop
 20 and deploy probabilistic weather forecast guidance
 21 technology for tornadoes; and

22 “(2) incorporate, as appropriate, hazard com-
 23 munication research.

24 “(e) **RESEARCH.**—

1 “(1) IN GENERAL.—The Under Secretary shall,
 2 through the program required by subsection (a),
 3 award grants for research that focuses on improv-
 4 ing—

5 “(A) the social, behavioral, risk, commu-
 6 nication, and economic sciences related to
 7 vulnerabilities, risk communication, and delivery
 8 of information critical for saving lives and prop-
 9 erty related to tornadoes; and

10 “(B) the physical sciences, engineering,
 11 and technology related to tornado formation,
 12 the interactions of tornadoes with the built and
 13 natural environment, and the interaction of tor-
 14 nadoes and hurricanes.

15 “(2) PRIORITY INSTITUTIONS.—In awarding
 16 grants under paragraph (1), the Under Secretary
 17 shall prioritize awarding grants to historically Black
 18 colleges and universities.

19 “(f) AUTHORIZATION OF APPROPRIATIONS.—There
 20 is authorized to be appropriated to the Under Secretary
 21 to carry out this section \$7,500,000 for each of fiscal
 22 years 2022 through 2030, of which not less than
 23 \$2,000,000 each fiscal year shall be used for grants
 24 awarded under subsection (e).”.

1 (b) ~~CLERICAL AMENDMENT.~~—The table of contents
 2 in section 1(b) of the Weather Research and Forecasting
 3 Innovation Act of 2017 (Public Law 115–25; 131 Stat.
 4 91) is amended by striking the item relating to section
 5 103 and inserting the following:

“Sec. 103. VORTEX-USA program.”.

6 **SEC. 8. REPORTS.**

7 (a) ~~WEATHER RESEARCH AND FORECASTING INNO-~~
 8 ~~VATION ACT OF 2017.~~—

9 (1) ~~IN GENERAL.~~—Section 403 of the Weather
 10 Research and Forecasting Innovation Act of 2017
 11 (15 U.S.C. 8543) is amended by striking subsection
 12 (d).

13 (2) ~~TECHNICAL AMENDMENT.~~—Section 403(a)
 14 of such Act (15 U.S.C. 8543(a)) is amended by in-
 15 serting “the” after “Director of”.

16 (b) ~~NATIONAL OCEANIC AND ATMOSPHERIC ADMIN-~~
 17 ~~ISTRATION AUTHORIZATION ACT OF 1992.~~—Section 106
 18 of the National Oceanic and Atmospheric Administration
 19 Authorization Act of 1992 (Public Law 102–567; 106
 20 Stat. 4274) is amended by striking subsection (c) (15
 21 U.S.C. 1537).

1 **SEC. 9. GOVERNMENT ACCOUNTABILITY OFFICE REPORT**
2 **ON HAZARDOUS WEATHER AND WATER**
3 **ALERT DISSEMINATION.**

4 (a) IN GENERAL.—Not later than 540 days after the
5 date of the enactment of this Act, the Comptroller General
6 of the United States shall submit to the Committee on
7 Commerce, Science, and Transportation of the Senate and
8 the Committee on Science, Space, and Technology of the
9 House of Representatives a report that examines the infor-
10 mation technology infrastructure of the National Weather
11 Service of the National Oceanic and Atmospheric Adminis-
12 tration, specifically regarding the system for timely public
13 notification of hazardous weather and water alerts and up-
14 dates.

15 (b) ELEMENTS.—The report required by subsection
16 (a) shall include the following:

17 (1) An analysis of the information technology
18 infrastructure of the National Weather Service, in-
19 cluding software and hardware capabilities and limi-
20 tations, including an examination of server and data
21 storage methods, broadband, data management, and
22 data sharing.

23 (2) An identification of secondary and tertiary
24 fail-safes for the timely distribution of hazardous
25 weather event alerts to the public.

1 (3) A determination of the extent to which pub-
 2 lie notifications are delayed and an identification of
 3 corrective measures that do not add additional noti-
 4 fication time.

5 (4) An assessment of whether collaboration with
 6 other Federal offices, States, or private entities
 7 could reduce delays in notifications to the public.

8 (5) A description of actions being undertaken to
 9 better identify critical steps in the hazards notifica-
 10 tion process that may be vulnerable to disruption or
 11 failure in the event of communication, technologic,
 12 or computational failure.

13 **SECTION 1. SHORT TITLE.**

14 *This Act may be cited as the “Tornado Observations*
 15 *Research and Notification Assessment for Development of*
 16 *Operations Act” or the “TORNADO Act”.*

17 **SEC. 2. DEFINITIONS.**

18 *In this Act:*

19 (1) *HAZARDOUS WEATHER AND WATER*
 20 *EVENTS.*—*The term “hazardous weather and water*
 21 *events” means weather and water events that have a*
 22 *high risk of loss of life or property, including—*

23 (A) *severe storms, such as hurricanes and*
 24 *short-fused, small-scale hazardous weather or hy-*
 25 *drologic events produced by thunderstorms, in-*

1 cluding large hail, damaging winds, tornadoes,
2 and flash floods;

3 (B) winter storms, such as freezing or frozen
4 precipitation (including freezing rain, sleet, and
5 snow), or combined effects of freezing or frozen
6 precipitation and strong winds; and

7 (C) other weather hazards, such as extreme
8 heat or cold, wildfire, drought, dense fog, high
9 winds, river flooding and lakeshore flooding.

10 (2) *HISTORICALLY BLACK COLLEGE OR UNIVER-*
11 *SITY.*—The term “historically Black college or univer-
12 sity” has the meaning given the term “part B institu-
13 tion” in section 322 of the Higher Education Act of
14 1965 (20 U.S.C. 1061).

15 (3) *INSTITUTION OF HIGHER EDUCATION.*—The
16 term “institution of higher education” has the mean-
17 ing given the term in section 101(a) of the Higher
18 Education Act of 1965 (20 U.S.C. 1001(a)).

19 (4) *NATIONAL LABORATORY.*—The term “Na-
20 tional Laboratory” has the meaning given the term in
21 section 2 of the Energy Policy Act of 2005 (42 U.S.C.
22 15801).

23 (5) *TRIBAL GOVERNMENT.*—The term “Tribal
24 government” means the recognized governing body of
25 any Indian or Alaska Native tribe, band, nation,

1 *pueblo, village, community, component band, or com-*
 2 *ponent reservation, individually identified (including*
 3 *parenthetically) in the list published most recently as*
 4 *of the date of enactment of this Act pursuant to sec-*
 5 *tion 104 of the Federally Recognized Indian Tribe*
 6 *List Act of 1994 (25 U.S.C. 5131).*

7 (6) *UNDER SECRETARY.*—*The term “Under Sec-*
 8 *retary” means the Under Secretary of Commerce for*
 9 *Oceans and Atmosphere.*

10 **SEC. 3. HAZARDOUS WEATHER AND WATER EVENT RISK**
 11 **COMMUNICATION.**

12 (a) *IN GENERAL.*—*The Under Secretary shall main-*
 13 *tain and improve the system of the National Oceanic and*
 14 *Atmospheric Administration by which the risks of haz-*
 15 *ardous weather and water events are communicated to the*
 16 *general public, with the goal of informing action and en-*
 17 *couraging response to prevent loss of life and property.*

18 (b) *HAZARD RISK COMMUNICATION IMPROVEMENT*
 19 *AND SIMPLIFICATION.*—

20 (1) *IN GENERAL.*—*The Under Secretary shall*
 21 *maintain a hazard risk communication office (in this*
 22 *subsection referred to as the “Office”), for the pur-*
 23 *poses of simplifying and improving the communica-*
 24 *tion of hazardous weather and water event risks.*

1 (2) *TERMINOLOGY.*—*The Office shall identify,*
2 *eliminate, or modify unnecessary, redundant, or con-*
3 *fusing terms for hazardous weather and water event*
4 *communications and add new terminology, as appro-*
5 *priate.*

6 (3) *COMMUNICATIONS IMPROVEMENT.*—*The Of-*
7 *fice shall improve the form, content, and methods of*
8 *hazardous weather and water event communications*
9 *to more clearly inform action and increase the likeli-*
10 *hood that the public takes such action to prevent the*
11 *loss of life or property.*

12 (4) *EVALUATIONS.*—*The Office shall, in coordi-*
13 *nation with the performance branch of the National*
14 *Weather Service, develop metrics for that branch to*
15 *track and evaluate the degree to which hazardous*
16 *weather and water event communications result in*
17 *action and response.*

18 (5) *SUPPORT PLAN.*—*The Office shall develop a*
19 *plan for the purpose of supporting the activities de-*
20 *scribed in paragraph (3). The plan shall be periodi-*
21 *cally updated and informed by internal and extra-*
22 *mural research and the results of the evaluation of*
23 *hazardous weather and water event communications*
24 *conducted under paragraph (4).*

1 (6) *METHODS.*—*In carrying out this subsection,*
2 *the Office shall develop and implement recommenda-*
3 *tions that—*

4 (A) *are based on the best and most recent*
5 *understanding from social, behavioral, risk, and*
6 *communication science research;*

7 (B) *are validated by social, behavioral, risk,*
8 *and communication science, taking into account*
9 *the importance of methods that support repro-*
10 *duction and replication of scientific studies, use*
11 *of rigorous statistical analyses, and, as applica-*
12 *ble, data analysis supported by artificial intel-*
13 *ligence and machine learning technologies;*

14 (C) *account for the needs of various demo-*
15 *graphics, vulnerable populations, and geographic*
16 *regions;*

17 (D) *account for the differences between var-*
18 *ious types of weather and water hazards;*

19 (E) *respond to the needs of Federal, State,*
20 *and local government partners and media part-*
21 *ners; and*

22 (F) *account for necessary changes in the in-*
23 *frastructure, technology, and protocols for cre-*
24 *ating and disseminating federally operated*
25 *watches and warnings.*

1 (7) *COORDINATION.*—*In implementing this Act,*
 2 *the Office shall coordinate with—*

3 (A) *Federal partners, including National*
 4 *Laboratories, Cooperative Institutes, and re-*
 5 *gional integrated sciences and assessments pro-*
 6 *grams;*

7 (B) *State and local government partners;*

8 (C) *Tribal governments;*

9 (D) *institutions of higher education; and*

10 (E) *media partners.*

11 (8) *TIMELINESS AND CONSISTENCY.*—*The Office*
 12 *shall develop best practices and guidance for ensuring*
 13 *timely and consistent communication across public*
 14 *facing platforms that disseminate hazardous weather*
 15 *and water event information.*

16 (c) *HAZARD COMMUNICATION RESEARCH AND EN-*
 17 *GAGEMENT.*—

18 (1) *IN GENERAL.*—*The Under Secretary shall es-*
 19 *tablish or maintain a research program—*

20 (A) *to modernize the creation and commu-*
 21 *nication of risk-based, statistically reliable, prob-*
 22 *abilistic hazard information to inform effective*
 23 *actions and responses to hazardous weather and*
 24 *water events; and*

1 (B) *to improve the fundamental social, be-*
 2 *havioral, risk, and communication science re-*
 3 *garding hazardous weather and water event com-*
 4 *munication.*

5 (2) *COORDINATION.—In carrying out the re-*
 6 *search program required by paragraph (1), the Under*
 7 *Secretary shall coordinate and communicate with*
 8 *States, Tribal governments, localities, and emergency*
 9 *managers on research priorities and results.*

10 (3) *PILOT PROGRAM FOR TORNADO HAZARD COM-*
 11 *MUNICATION REQUIRED.—*

12 (A) *IN GENERAL.—To further research into*
 13 *hazard communication, the Under Secretary, in*
 14 *collaboration with one or more eligible institu-*
 15 *tions, shall establish a pilot program for tornado*
 16 *hazard communication to test the effectiveness of*
 17 *implementing the research conducted under this*
 18 *subsection with respect to tornadoes.*

19 (B) *ELIGIBLE INSTITUTION DEFINED.—In*
 20 *this paragraph, the term “eligible institution”*
 21 *means any of the following:*

22 (i) *A historically Black college or uni-*
 23 *versity located in an area of persistent pov-*
 24 *erty that is subjected to frequent severe*

1 *weather, such as tornadoes, hurricanes, and*
 2 *floods.*

3 (ii) *An institution of higher education*
 4 *in close proximity to a National Weather*
 5 *Service Weather Forecast Office of the Na-*
 6 *tional Weather Service.*

7 (d) *DATA MANAGEMENT.*—*The Under Secretary shall*
 8 *establish, maintain, and improve a central repository sys-*
 9 *tem for the National Oceanic and Atmospheric Administra-*
 10 *tion for social, behavioral, risk, and economic data related*
 11 *to the communication of hazardous weather and water*
 12 *events, including data developed or received pursuant to*
 13 *paragraphs (3), (4), and (5) of subsection (b).*

14 (e) *DIGITAL WATERMARKING.*—*The Under Secretary*
 15 *shall develop methods to reduce the likelihood of unauthor-*
 16 *ized tampering with online hazardous weather and water*
 17 *event risk communication, such as developing digital water-*
 18 *marks.*

19 **SEC. 4. WARN-ON-FORECAST STRATEGIC PLAN.**

20 (a) *IN GENERAL.*—*Not later than one year after the*
 21 *date of the enactment of this Act, the Under Secretary shall*
 22 *prepare and submit to Congress a strategic plan for devel-*
 23 *oping and prioritizing the implementation of high-resolu-*
 24 *tion probabilistic forecast guidance for hazardous weather*

1 *and water events using a next-generation weather forecast*
 2 *and warning framework.*

3 (b) *PLAN ELEMENTS.*—*The strategic plan required by*
 4 *subsection (a) shall include the following:*

5 (1) *A discussion of—*

6 (A) *the priorities and needs of vulnerable*
 7 *populations and National Weather Service part-*
 8 *ners; and*

9 (B) *high-performance computing, visualiza-*
 10 *tion, and dissemination needs.*

11 (2) *A timeline and guidance for implementation*
 12 *of—*

13 (A) *high-resolution numerical weather pre-*
 14 *diction models;*

15 (B) *methods for meeting the high-perform-*
 16 *ance computing, visualization, and dissemina-*
 17 *tion needs discussed under paragraph (1)(B);*

18 (C) *real-time high-resolution probabilistic*
 19 *forecasts;*

20 (D) *improved observations, including*
 21 *through radars, satellites, and uncrewed aerial*
 22 *systems;*

23 (E) *a flexible framework to communicate*
 24 *clear and simple hazardous weather and water*
 25 *event information to the public; and*

1 (F) social, behavioral, risk, and commu-
2 nication research to improve the forecaster oper-
3 ational environment and societal information re-
4 ception and response.

5 **SEC. 5. TORNADO RATING SYSTEM.**

6 (a) *IN GENERAL.*—The Under Secretary shall, in col-
7 laboration with such stakeholders as the Under Secretary
8 considers appropriate—

9 (1) evaluate the system used as of the date of the
10 enactment of this Act to rate the severity of tornadoes;
11 and

12 (2) determine whether updates to that system are
13 required to ensure that the ratings accurately reflect
14 the severity of tornadoes.

15 (b) *UPDATE REQUIRED.*—If the Under Secretary de-
16 termines under subsection (a) that updates to the tornado
17 rating system are necessary, the Under Secretary shall up-
18 date the system.

19 **SEC. 6. POST-STORM SURVEYS AND ASSESSMENTS.**

20 (a) *IN GENERAL.*—The Under Secretary shall perform
21 one or more post-storm surveys and assessments following
22 each hazardous weather or water event determined by the
23 Under Secretary to be of sufficient societal importance to
24 warrant a post-event survey and assessment.

1 (b) *COORDINATION.*—*The Under Secretary shall co-*
2 *ordinate with Federal, State, and local governments, Tribal*
3 *governments, private entities, and relevant institutions of*
4 *higher education when conducting post-storm surveys and*
5 *assessments under subsection (a) in order to optimize data*
6 *collection, sharing, and integration.*

7 (c) *DATA AVAILABILITY.*—*The Under Secretary shall*
8 *make the data obtained from each post-storm survey and*
9 *assessment conducted under subsection (a) available to the*
10 *public as soon as practicable after conducting the survey*
11 *and assessment.*

12 (d) *IMPROVEMENT.*—*The Under Secretary shall—*

13 (1) *investigate the role of uncrewed aerial sys-*
14 *tems in data collection during post-storm surveys and*
15 *assessments conducted under subsection (a);*

16 (2) *identify gaps in and update tactics and pro-*
17 *cedures to enhance the efficiency and reliability of*
18 *data obtained from post-storm surveys and assess-*
19 *ments; and*

20 (3) *increase the number of post-storm commu-*
21 *nity impact studies, including—*

22 (A) *surveying individual responses;*

23 (B) *conducting review of the accuracy of*
24 *prior risk evaluations;*

1 (C) evaluating the efficacy of prior mitiga-
 2 tion activity; and

3 (D) gathering survivability statistics.

4 (e) *SUPPORT FOR EMPLOYEES.*—The Under Secretary
 5 shall provide training, resources, and access to professional
 6 counseling to support the emotional and mental health and
 7 well-being of employees conducting post-storm surveys and
 8 assessments under subsection (a).

9 **SEC. 7. VORTEX-USA PROGRAM.**

10 (a) *IN GENERAL.*—Section 103 of the Weather Re-
 11 search and Forecasting Innovation Act of 2017 (15 U.S.C.
 12 8513) is amended—

13 (1) in the section heading, by striking “**TOR-**
 14 **NADO WARNING IMPROVEMENT AND EXTEN-**
 15 **SION**” and inserting “**VORTEX-USA**”;

16 (2) in subsection (a), by striking “establish a
 17 tornado warning improvement and extension pro-
 18 gram” and inserting “maintain a program for rap-
 19 idly improving tornado forecast and warnings”;

20 (3) by striking subsections (c) and (d); and

21 (4) by adding at the end the following:

22 “(c) *INNOVATIVE OBSERVATIONS.*—The Under Sec-
 23 retary shall ensure that the program required by subsection
 24 (a) periodically examines the value of incorporating inno-
 25 vative observations with respect to the improvement of tor-

1 nado forecasts, predictions, and warnings, such as acoustic
 2 or infrasonic measurements, observations from phased
 3 array radars, and observations from mesonets.

4 “(d) WARNINGS.—The program required by subsection
 5 (a) shall—

6 “(1) continue the research necessary to develop
 7 and deploy probabilistic weather forecast guidance
 8 technology for tornadoes; and

9 “(2) incorporate, as appropriate, hazard commu-
 10 nication research.

11 “(e) RESEARCH.—

12 “(1) IN GENERAL.—The Under Secretary shall,
 13 through the program required by subsection (a),
 14 award grants for research that focuses on improv-
 15 ing—

16 “(A) the social, behavioral, risk, commu-
 17 nication, and economic sciences related to
 18 vulnerabilities, risk communication, and delivery
 19 of information critical for saving lives and prop-
 20 erty related to tornadoes; and

21 “(B) the physical sciences, engineering, and
 22 technology related to tornado formation, the
 23 interactions of tornadoes with the built and nat-
 24 ural environment, and the interaction of torna-
 25 does and hurricanes.

1 “(2) *PRIORITY INSTITUTIONS.*—

2 “(A) *IN GENERAL.*—*In awarding grants*
 3 *under paragraph (1), the Under Secretary shall*
 4 *prioritize awarding grants to minority-serving*
 5 *institutions.*

6 “(B) *DEFINITION OF MINORITY-SERVING IN-*
 7 *STITUTION.*—*In this paragraph, the term ‘mi-*
 8 *nority-serving institution’ means—*

9 “(i) *a part B institution (as defined in*
 10 *section 322 of the Higher Education Act of*
 11 *1965 (20 U.S.C. 1061));*

12 “(ii) *a Hispanic-serving institution*
 13 *(as defined in section 502(a) of that Act (20*
 14 *U.S.C. 1101a(a));*

15 “(iii) *a Tribal College or University*
 16 *(as defined in section 316(b) of that Act (20*
 17 *U.S.C. 1059c(b));*

18 “(iv) *an Alaska Native-serving institu-*
 19 *tion (as defined in section 317(b) of that*
 20 *Act (20 U.S.C. 1059d(b));*

21 “(v) *a Native Hawaiian-serving insti-*
 22 *tution (as defined in section 317(b) of that*
 23 *Act (20 U.S.C. 1059d(b));*

1 “(vi) a *Predominantly Black Institu-*
 2 *tion (as defined in section 318(b) of that*
 3 *Act (20 U.S.C. 1059e(b))*);

4 “(vii) an *Asian American and Native*
 5 *American Pacific Islander-serving institu-*
 6 *tion (as defined in section 320(b) of that*
 7 *Act (20 U.S.C. 1059g(b))*); or

8 “(viii) a *Native American-serving,*
 9 *nontribal institution (as defined in section*
 10 *319(b) of that Act (20 U.S.C. 1059f(b))*).

11 “(f) *AUTHORIZATION OF APPROPRIATIONS.—There is*
 12 *authorized to be appropriated to the Under Secretary to*
 13 *carry out this section \$7,500,000 for each of fiscal years*
 14 *2023 through 2030, of which not less than \$2,000,000 each*
 15 *fiscal year shall be used for grants awarded under sub-*
 16 *section (e).*”.

17 (b) *CLERICAL AMENDMENT.—The table of contents in*
 18 *section 1(b) of the Weather Research and Forecasting Inno-*
 19 *vation Act of 2017 (Public Law 115–25; 131 Stat. 91) is*
 20 *amended by striking the item relating to section 103 and*
 21 *inserting the following:*

 “Sec. 103. *VORTEX-USA program.*”.

22 **SEC. 8. REPORTS.**

23 (a) *WEATHER RESEARCH AND FORECASTING INNOVA-*
 24 *TION ACT OF 2017.—*

1 (1) *IN GENERAL.*—Section 403 of the Weather
 2 *Research and Forecasting Innovation Act of 2017* (15
 3 U.S.C. 8543) is amended by striking subsection (d).

4 (2) *TECHNICAL AMENDMENT.*—Section 403(a) of
 5 *such Act* (15 U.S.C. 8543(a)) is amended by inserting
 6 “the” after “Director of”.

7 (b) *NATIONAL OCEANIC AND ATMOSPHERIC ADMINIS-*
 8 *TRATION AUTHORIZATION ACT OF 1992.*—Section 106 of
 9 *the National Oceanic and Atmospheric Administration Au-*
 10 *thorization Act of 1992* (Public Law 102–567; 106 Stat.
 11 4274) is amended by striking subsection (c) (15 U.S.C.
 12 1537).

13 **SEC. 9. GOVERNMENT ACCOUNTABILITY OFFICE REPORT**
 14 **ON HAZARDOUS WEATHER AND WATER ALERT**
 15 **DISSEMINATION.**

16 (a) *IN GENERAL.*—Not later than 540 days after the
 17 date of the enactment of this Act, the Comptroller General
 18 of the United States shall submit to the Committee on Com-
 19 merce, Science, and Transportation of the Senate and the
 20 Committee on Science, Space, and Technology of the House
 21 of Representatives a report that examines the information
 22 technology infrastructure of the National Weather Service
 23 of the National Oceanic and Atmospheric Administration,
 24 specifically regarding the system for timely public notifica-

1 *tion of hazardous weather and water event alerts and up-*
 2 *dates.*

3 (b) *ELEMENTS.*—*The report required by subsection (a)*
 4 *shall include the following:*

5 (1) *An analysis of the information technology in-*
 6 *frastructure of the National Weather Service, includ-*
 7 *ing software and hardware capabilities and limita-*
 8 *tions, including an examination of server and data*
 9 *storage methods, broadband, data management, and*
 10 *data sharing.*

11 (2) *An identification of secondary and tertiary*
 12 *fail-safes for the timely distribution of hazardous*
 13 *weather and water event alerts to the public.*

14 (3) *A determination of the extent to which public*
 15 *notifications are delayed and an identification of cor-*
 16 *rective measures that do not add additional notifica-*
 17 *tion time.*

18 (4) *An assessment of whether collaboration with*
 19 *other Federal offices, States, or private entities could*
 20 *reduce delays in notifications to the public.*

21 (5) *A description of actions being undertaken to*
 22 *better identify critical steps in the hazards notifica-*
 23 *tion process that may be vulnerable to disruption or*
 24 *failure in the event of communication, technologic, or*
 25 *computational failure.*

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A BILL

To improve the forecasting and understanding of
tornadoes and other hazardous weather, and for
other purposes.

DECEMBER 12, 2022

Reported with an amendment