

Calendar No. 258118TH CONGRESS
1ST SESSION**S. 1284**

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

IN THE SENATE OF THE UNITED STATES

APRIL 25, 2023

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

DECEMBER 4, 2023

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 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,*

1 **SECTION 1. SHORT TITLE.**

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

5 **SEC. 2. DEFINITIONS.**

6 In this Act:

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

11 (A) severe storms, such as hurricanes and
12 short-fused, small-scale hazardous weather or
13 hydrologic events produced by thunderstorms,
14 including large hail, damaging winds, torna-
15 does, and flash floods;

16 (B) winter storms, such as freezing or fro-
17 zen precipitation (including freezing rain, sleet,
18 and snow), or combined effects of freezing or
19 frozen precipitation and strong winds; and

20 (C) other weather hazards, such as ex-
21 treme heat or cold, wildfire, drought, dense fog,
22 high winds, river flooding and lakeshore flood-
23 ing.

24 (2) **HISTORICALLY BLACK COLLEGE OR UNI-**
25 **VERSITY.**—The term “historically Black college or
26 university” has the meaning given the term “part B

1 institution” in section 322 of the Higher Education
2 Act of 1965 (20 U.S.C. 1061).

3 (3) INSTITUTION OF HIGHER EDUCATION.—The
4 term “institution of higher education” has the
5 meaning given the term in section 101(a) of the
6 Higher Education Act of 1965 (20 U.S.C. 1001(a)).

7 (4) NATIONAL LABORATORY.—The term “Na-
8 tional Laboratory” has the meaning given the term
9 in section 2 of the Energy Policy Act of 2005 (42
10 U.S.C. 15801).

11 (5) TRIBAL GOVERNMENT.—The term “Tribal
12 government” means the recognized governing body
13 of any Indian or Alaska Native tribe, band, nation,
14 pueblo, village, community, component band, or com-
15 ponent reservation, individually identified (including
16 parenthetically) in the list published most recently as
17 of the date of enactment of this Act pursuant to sec-
18 tion 104 of the Federally Recognized Indian Tribe
19 List Act of 1994 (25 U.S.C. 5131).

20 (6) UNDER SECRETARY.—The term “Under
21 Secretary” means the Under Secretary of Commerce
22 for Oceans and Atmosphere.

1 **SEC. 3. HAZARDOUS WEATHER AND WATER EVENT RISK**
2 **COMMUNICATION.**

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

9 (b) **HAZARD RISK COMMUNICATION IMPROVEMENT**
10 **AND SIMPLIFICATION.**—

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

16 (2) **TERMINOLOGY.**—The Office shall identify,
17 eliminate, or modify unnecessary, redundant, or con-
18 fusing terms for hazardous weather and water event
19 communications and add new terminology, as appro-
20 priate.

21 (3) **COMMUNICATIONS IMPROVEMENT.**—The Of-
22 fice shall improve the form, content, and methods of
23 hazardous weather and water event communications
24 to more clearly inform action and increase the likeli-
25 hood that the public takes such action to prevent the
26 loss of life or property.

1 (4) ~~EVALUATIONS.~~—The Office shall, in coordi-
2 nation with the performance branch of the National
3 Weather Service, develop metrics for that branch to
4 track and evaluate the degree to which hazardous
5 weather and water event communications result in
6 action and response.

7 (5) ~~SUPPORT PLAN.~~—The Office shall develop a
8 plan for the purpose of supporting the activities de-
9 scribed in paragraph (3). The plan shall be periodi-
10 cally updated and informed by internal and extra-
11 mural research and the results of the evaluation of
12 hazardous weather and water event communications
13 conducted under paragraph (4).

14 (6) ~~METHODS.~~—In carrying out this subsection,
15 the Office shall develop and implement recommenda-
16 tions that—

17 (A) are based on the best and most recent
18 understanding from social, behavioral, risk, and
19 communication science research;

20 (B) are validated by social, behavioral,
21 risk, and communication science, taking into ac-
22 count the importance of methods that support
23 reproduction and replication of scientific stud-
24 ies, use of rigorous statistical analyses, and, as

1 applicable; data analysis supported by artificial
2 intelligence and machine learning technologies;

3 ~~(C)~~ account for the needs of various demo-
4 graphics, vulnerable populations, and geo-
5 graphic regions;

6 ~~(D)~~ account for the differences between
7 various types of weather and water hazards;

8 ~~(E)~~ respond to the needs of Federal, State,
9 and local government partners and media part-
10 ners; and

11 ~~(F)~~ account for necessary changes in the
12 infrastructure, technology, and protocols for
13 creating and disseminating federally operated
14 watches and warnings.

15 ~~(7) COORDINATION.~~—In implementing this Act,
16 the Office shall coordinate with—

17 ~~(A)~~ Federal partners, including National
18 Laboratories, Cooperative Institutes, and re-
19 gional integrated sciences and assessments pro-
20 grams;

21 ~~(B)~~ State and local government partners;

22 ~~(C)~~ Tribal governments;

23 ~~(D)~~ institutions of higher education; and

24 ~~(E)~~ media partners.

1 (8) ~~TIMELINESS AND CONSISTENCY.~~—The Of-
2 fice shall develop best practices and guidance for en-
3 suring timely and consistent communication across
4 public facing platforms that disseminate hazardous
5 weather and water event information.

6 (c) ~~HAZARD COMMUNICATION RESEARCH AND EN-~~
7 ~~GAGEMENT.~~—

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

10 (A) to modernize the creation and commu-
11 nication of risk-based, statistically reliable,
12 probabilistic hazard information to inform effec-
13 tive actions and responses to hazardous weather
14 and water events; and

15 (B) to improve the fundamental social, be-
16 havioral, risk, and communication science re-
17 garding hazardous weather and water event
18 communication.

19 (2) ~~COORDINATION.~~—In carrying out the re-
20 search program required by paragraph (1), the
21 Under Secretary shall coordinate and communicate
22 with States, Tribal governments, localities, and
23 emergency managers on research priorities and re-
24 sults.

1 (3) PILOT PROGRAM FOR TORNADO HAZARD
2 COMMUNICATION REQUIRED.—

3 (A) IN GENERAL.—To further research
4 into hazard communication, the Under Sec-
5 retary, in collaboration with one or more eligible
6 institutions, shall establish a pilot program for
7 tornado hazard communication to test the effec-
8 tiveness of implementing the research conducted
9 under this subsection with respect to tornadoes.

10 (B) ELIGIBLE INSTITUTION DEFINED.—In
11 this paragraph, the term “eligible institution”
12 means any of the following:

13 (i) A historically Black college or uni-
14 versity located in an area of persistent pov-
15 erty that is subjected to frequent severe
16 weather, such as tornadoes, hurricanes,
17 and floods.

18 (ii) An institution of higher education
19 in close proximity to a National Weather
20 Service Weather Forecast Office of the Na-
21 tional Weather Service.

22 (d) DATA MANAGEMENT.—The Under Secretary
23 shall establish, maintain, and improve a central repository
24 system for the National Oceanic and Atmospheric Admin-
25 istration for social, behavioral, risk, and economic data re-

1 lated to the communication of hazardous weather and
2 water events, including data developed or received pursu-
3 ant to paragraphs (3), (4), and (5) of subsection (b).

4 (c) **DIGITAL WATERMARKING.**—The Under Secretary
5 shall develop methods to reduce the likelihood of unauthor-
6 ized tampering with online hazardous weather and water
7 event risk communication, such as developing digital wa-
8 termarks.

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

10 (a) **IN GENERAL.**—Not later than one year after the
11 date of the enactment of this Act, the Under Secretary
12 shall prepare and submit to Congress a strategic plan for
13 developing and prioritizing the implementation of high-
14 resolution probabilistic forecast guidance for hazardous
15 weather and water events using a next-generation weather
16 forecast and warning framework.

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

19 (1) A discussion of—

20 (A) the priorities and needs of vulnerable
21 populations and National Weather Service part-
22 ners; and

23 (B) high-performance computing, visualiza-
24 tion, and dissemination needs.

1 (2) A timeline and guidance for implementation
2 of—

3 (A) high-resolution numerical weather pre-
4 diction models;

5 (B) methods for meeting the high-perform-
6 ance computing, visualization, and dissemina-
7 tion needs discussed under paragraph (1)(B);

8 (C) real-time high-resolution probabilistic
9 forecasts;

10 (D) improved observations, including
11 through radars, satellites, and uncrewed aerial
12 systems;

13 (E) a flexible framework to communicate
14 clear and simple hazardous weather and water
15 event information to the public; and

16 (F) social, behavioral, risk, and commu-
17 nication research to improve the forecaster
18 operational environment and societal informa-
19 tion reception and response.

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

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

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

4 (2) determine whether updates to that system
5 are required to ensure that the ratings accurately re-
6 flect the severity of tornadoes.

7 (b) **UPDATE REQUIRED.**—If the Under Secretary de-
8 termines under subsection (a) that updates to the tornado
9 rating system are necessary, the Under Secretary shall up-
10 date the system.

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

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

17 (b) **COORDINATION.**—The Under Secretary shall co-
18 ordinate with Federal, State, and local governments, Trib-
19 al governments, private entities, and relevant institutions
20 of higher education when conducting post-storm surveys
21 and assessments under subsection (a) in order to optimize
22 data collection, sharing, and integration.

23 (c) **DATA AVAILABILITY.**—The Under Secretary shall
24 make the data obtained from each post-storm survey and
25 assessment conducted under subsection (a) available to the

1 public as soon as practicable after conducting the survey
2 and assessment.

3 ~~(d) IMPROVEMENT.—The Under Secretary shall—~~

4 ~~(1) investigate the role of uncrewed aerial sys-~~
5 ~~tems in data collection during post-storm surveys~~
6 ~~and assessments conducted under subsection (a);~~

7 ~~(2) identify gaps in and update tactics and pro-~~
8 ~~cedures to enhance the efficiency and reliability of~~
9 ~~data obtained from post-storm surveys and assess-~~
10 ~~ments; and~~

11 ~~(3) increase the number of post-storm commu-~~
12 ~~nity impact studies, including—~~

13 ~~(A) surveying individual responses;~~

14 ~~(B) conducting review of the accuracy of~~
15 ~~prior risk evaluations;~~

16 ~~(C) evaluating the efficacy of prior mitiga-~~
17 ~~tion activity; and~~

18 ~~(D) gathering survivability statistics.~~

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

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

2 (a) ~~IN GENERAL.~~—Section 103 of the Weather Re-
 3 search and Forecasting Innovation Act of 2017 (15 U.S.C.
 4 8513) is amended—

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

8 (2) in subsection (a), by striking “establish a
 9 tornado warning improvement and extension pro-
 10 gram” and inserting “maintain a program for rap-
 11 idly improving tornado forecast and warnings”;

12 (3) by redesignating subsections (d) and (e) as
 13 subsections (f) and (g), respectively;

14 (4) by inserting after subsection (e) the fol-
 15 lowing:

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

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

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

23 “(e) **RESEARCH.**—

24 “(1) **IN GENERAL.**—The Under Secretary shall,
 25 through the program required by subsection (a),

1 award grants for research that focuses on improv-
 2 ing—

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

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

13 “(2) PRIORITY INSTITUTIONS.—

14 “(A) IN GENERAL.—In awarding grants
 15 under paragraph (1), the Under Secretary shall
 16 prioritize awarding grants to minority-serving
 17 institutions.

18 “(B) DEFINITION OF MINORITY-SERVING
 19 INSTITUTION.—In this paragraph, the term ‘mi-
 20 nority-serving institution’ means—

21 “(i) a part B institution (as defined in
 22 section 322 of the Higher Education Act
 23 of 1965 (20 U.S.C. 1061));

1 “(ii) a Hispanic-serving institution (as
2 defined in section 502(a) of that Act (20
3 U.S.C. 1101a(a)));

4 “(iii) a Tribal College or University
5 (as defined in section 316(b) of that Act
6 (20 U.S.C. 1059e(b)));

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

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

13 “(vi) a Predominantly Black Institu-
14 tion (as defined in section 318(b) of that
15 Act (20 U.S.C. 1059e(b)));

16 “(vii) an Asian American and Native
17 American Pacific Islander-serving institu-
18 tion (as defined in section 320(b) of that
19 Act (20 U.S.C. 1059g(b))); or

20 “(viii) a Native American-serving,
21 nontribal institution (as defined in section
22 319(b) of that Act (20 U.S.C.
23 1059f(b))).”;

24 (5) by adding at the end the following:

1 “(h) AUTHORIZATION OF APPROPRIATIONS.—There
 2 is authorized to be appropriated to the Under Secretary
 3 to carry out this section \$11,000,000 for each of fiscal
 4 years 2023 through 2030, of which not less than
 5 \$2,000,000 each fiscal year shall be used for grants
 6 awarded under subsection (e).”.

7 (b) CLERICAL AMENDMENT.—The table of contents
 8 in section 1(b) of the Weather Research and Forecasting
 9 Innovation Act of 2017 (Public Law 115–25; 131 Stat.
 10 91) is amended by striking the item relating to section
 11 103 and inserting the following:

“Sec. 103. VORTEX-USA program.”.

12 **SEC. 8. REPORTS.**

13 (a) WEATHER RESEARCH AND FORECASTING INNO-
 14 VATION ACT OF 2017.—

15 (1) IN GENERAL.—Section 403 of the Weather
 16 Research and Forecasting Innovation Act of 2017
 17 (15 U.S.C. 8543) is amended by striking subsection
 18 (d).

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

22 (b) NATIONAL OCEANIC AND ATMOSPHERIC ADMIN-
 23 STRATION AUTHORIZATION ACT OF 1992.—Section 106
 24 of the National Oceanic and Atmospheric Administration
 25 Authorization Act of 1992 (Public Law 102–567; 106

1 Stat. 4274) is amended by striking subsection (c) (15
2 U.S.C. 1537).

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

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

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

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

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

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

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

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

16 **SECTION 1. SHORT TITLE.**

17 *This Act may be cited as the “Tornado Observations*
18 *Research and Notification Assessment for Development of*
19 *Operations Act” or the “TORNADO Act”.*

20 **SEC. 2. DEFINITIONS.**

21 *In this Act:*

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

1 (A) *severe storms, such as hurricanes and*
2 *short-fused, small-scale hazardous weather or hy-*
3 *drologic events produced by thunderstorms, in-*
4 *cluding large hail, damaging winds, tornadoes,*
5 *and flash floods;*

6 (B) *winter storms, such as freezing or frozen*
7 *precipitation (including freezing rain, sleet, and*
8 *snow), or combined effects of freezing or frozen*
9 *precipitation and strong winds; and*

10 (C) *other weather hazards, such as extreme*
11 *heat or cold, wildfire, drought, dense fog, high*
12 *winds, river flooding, and lakeshore flooding.*

13 (2) *HISTORICALLY BLACK COLLEGE OR UNIVER-*
14 *SITY.—The term “historically Black college or univer-*
15 *sity” has the meaning given the term “part B institu-*
16 *tion” in section 322 of the Higher Education Act of*
17 *1965 (20 U.S.C. 1061).*

18 (3) *INDIAN TRIBE.—The term “Indian Tribe”*
19 *has the meaning given the term in section 4 of the In-*
20 *Indian Self-Determination and Education Assistance*
21 *Act (25 U.S.C. 5304).*

22 (4) *INSTITUTION OF HIGHER EDUCATION.—The*
23 *term “institution of higher education” has the mean-*
24 *ing given the term in section 101(a) of the Higher*
25 *Education Act of 1965 (20 U.S.C. 1001(a)).*

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

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

8 **SEC. 3. HAZARDOUS WEATHER AND WATER EVENT RISK**
9 **COMMUNICATION.**

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

16 (b) *HAZARD RISK COMMUNICATION IMPROVEMENT*
17 *AND SIMPLIFICATION.*—

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

23 (2) *TERMINOLOGY.*—*The Office shall identify,*
24 *eliminate, or modify unnecessary, redundant, or con-*
25 *fusing terms for hazardous weather and water event*

1 *communications and add new terminology, as appro-*
2 *priate.*

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

9 (4) *EVALUATIONS.*—*The Office shall, in coordi-*
10 *nation with the performance branch of the National*
11 *Weather Service, develop metrics for that branch to*
12 *track and evaluate the degree to which hazardous*
13 *weather and water event communications inform ac-*
14 *tion and encourage response.*

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

22 (6) *METHODS.*—*In carrying out this subsection,*
23 *the Office shall develop and implement recommenda-*
24 *tions that—*

1 (A) are based on the best and most recent
2 understanding from social, behavioral, risk, and
3 communication science research;

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

11 (C) account for the needs of various demo-
12 graphics, vulnerable populations, and geographic
13 regions;

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15 ious types of weather and water hazards;

16 (E) respond to the needs of Federal, State,
17 and local government partners and media part-
18 ners; and

19 (F) account for necessary changes in the in-
20 frastructure, technology, and protocols for cre-
21 ating and disseminating federally operated
22 watches and warnings.

23 (7) COORDINATION.—In implementing this Act,
24 the Office shall coordinate with—

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

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

6 (C) *Indian Tribes;*

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

8 (E) *media partners.*

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

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

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 17 *tablish or maintain a research program—*

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 20 *abilistic hazard information, with the goal of in-*
 21 *forming effective actions and encouraging re-*
 22 *sponses to hazardous weather and water events;*
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3 (2) *COORDINATION.*—*In carrying out the re-*
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5 *Secretary shall coordinate and communicate with*
6 *States, Indian Tribes, localities, and emergency man-*
7 *agers on research priorities and results.*

8 (3) *PILOT PROGRAM FOR TORNADO HAZARD COM-*
9 *MUNICATION REQUIRED.*—

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

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

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

1 (ii) *An institution of higher education*
2 *in close proximity to a Weather Forecast*
3 *Office of the National Weather Service.*

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

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

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

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

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

1 (1) *A discussion of—*

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

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

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

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

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

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

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

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

22 (F) *social, behavioral, risk, and commu-*
23 *nication research to improve the forecaster oper-*
24 *ational environment and societal information re-*
25 *ception 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 the*
6 *enactment of this Act to rate the severity of tornadoes;*
7 *and*

8 (2) *determine whether updates to that system are*
9 *required to ensure that the ratings accurately reflect*
10 *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 perform*
17 *one or more post-storm surveys and assessments following*
18 *each hazardous weather or water event determined by the*
19 *Under Secretary to be of sufficient societal importance to*
20 *warrant a post-event survey and assessment.*

21 (b) *COORDINATION.*—*The Under Secretary shall co-*
22 *ordinate with Federal, State, and local governments, Indian*
23 *Tribes, private entities, and relevant institutions of higher*
24 *education when conducting post-storm surveys and assess-*
25 *ments under subsection (a) in order to optimize data collec-*
26 *tion, 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 and*
9 *assessments conducted under subsection (a);*

10 (2) *identify gaps in and update tactics and pro-*
11 *cedures to enhance the efficiency and reliability of*
12 *data obtained from post-storm surveys and assess-*
13 *ments; and*

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

16 (A) *surveying individual responses;*

17 (B) *conducting review of the accuracy of*
18 *prior risk evaluations;*

19 (C) *evaluating the efficacy of prior mitiga-*
20 *tion activity; and*

21 (D) *gathering survivability statistics.*

22 (e) *SUPPORT FOR EMPLOYEES.*—*The Under Secretary*
23 *shall provide training, resources, and access to professional*
24 *counseling to support the emotional and mental health and*

1 *well-being of employees conducting post-storm surveys and*
 2 *assessments under subsection (a).*

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

4 *(a) IN GENERAL.—Section 103 of the Weather Re-*
 5 *search and Forecasting Innovation Act of 2017 (15 U.S.C.*
 6 *8513) is amended—*

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

10 *(2) in subsection (a), by striking “establish a*
 11 *tornado warning improvement and extension pro-*
 12 *gram” and inserting “maintain a program for rap-*
 13 *idly improving tornado forecast and warnings”;*

14 *(3) by redesignating subsections (d) and (e) as*
 15 *subsections (f) and (g), respectively;*

16 *(4) by inserting after subsection (c) the fol-*
 17 *lowing:*

18 *“(d) WARNINGS.—The program required by subsection*
 19 *(a) shall—*

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

23 *“(2) incorporate, as appropriate, hazard commu-*
 24 *nication research.*

25 *“(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, and*
11 *technology related to tornado formation, the*
12 *interactions of tornadoes with the built and nat-*
13 *ural environment, and the interaction of torna-*
14 *does and hurricanes.*

15 “(2) *PRIORITY INSTITUTIONS.*—

16 “(A) *IN GENERAL.*—*In awarding grants*
17 *under paragraph (1), the Under Secretary shall*
18 *prioritize awarding grants to minority-serving*
19 *institutions.*

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

23 “(i) *a part B institution (as defined in*
24 *section 322 of the Higher Education Act of*
25 *1965 (20 U.S.C. 1061));*

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

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

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

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

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

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

20 “(viii) a *Native American-serving,*
21 *nontribal institution (as defined in section*
22 *319(b) of that Act (20 U.S.C. 1059f(b))*).”;

23 and

24 (5) by adding at the end the following:

1 “(h) *AUTHORIZATION OF APPROPRIATIONS.*—*There is*
 2 *authorized to be appropriated to the Under Secretary to*
 3 *carry out this section \$11,000,000 for each of fiscal years*
 4 *2023 through 2030, of which not less than \$2,000,000 each*
 5 *fiscal year shall be used for grants awarded under sub-*
 6 *section (e).”.*

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

“*Sec. 103. VORTEX-USA program.*”.

12 **SEC. 8. REPORTS.**

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

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

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

21 (b) *NATIONAL OCEANIC AND ATMOSPHERIC ADMINIS-*
 22 *TRATION AUTHORIZATION ACT OF 1992.*—*Section 106 of*
 23 *the National Oceanic and Atmospheric Administration Au-*
 24 *thorization Act of 1992 (Public Law 102–567; 106 Stat.*

1 4274) is amended by striking subsection (c) (15 U.S.C.
2 1537).

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

6 (a) *IN GENERAL.*—Not later than 540 days after the
7 date of the enactment of this Act, the Comptroller General
8 of the United States shall submit to the Committee on Com-
9 merce, Science, and Transportation of the Senate and the
10 Committee on Science, Space, and Technology of the House
11 of Representatives a report that examines the information
12 technology infrastructure of the National Weather Service
13 of the National Oceanic and Atmospheric Administration,
14 specifically regarding the system for timely public notifica-
15 tion of hazardous weather and water event alerts and up-
16 dates.

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

19 (1) *An analysis of the information technology in-*
20 *frastructure of the National Weather Service, includ-*
21 *ing software and hardware capabilities and limita-*
22 *tions, including an examination of server and data*
23 *storage methods, broadband, data management, and*
24 *data sharing.*

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

4 (3) *A determination of the extent to which public*
5 *notifications are delayed and an identification of cor-*
6 *rective measures that do not add additional notifica-*
7 *tion time.*

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

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

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A BILL

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

DECEMBER 4, 2023

Reported with an amendment