

118TH CONGRESS  
1ST SESSION

**S.** \_\_\_\_\_

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

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IN THE SENATE OF THE UNITED STATES

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

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**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,*

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”.

7 **SEC. 2. DEFINITIONS.**

8 In this Act:

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

5                   (A) severe storms, such as hurricanes and  
6                   short-fused, small-scale hazardous weather or  
7                   hydrologic events produced by thunderstorms,  
8                   including large hail, damaging winds, torna-  
9                   does, and flash floods;

10                   (B) winter storms, such as freezing or fro-  
11                   zen precipitation (including freezing rain, sleet,  
12                   and snow), or combined effects of freezing or  
13                   frozen precipitation and strong winds; and

14                   (C) other weather hazards, such as ex-  
15                   treme heat or cold, wildfire, drought, dense fog,  
16                   high winds, river flooding and lakeshore flood-  
17                   ing.

18           (2) HISTORICALLY BLACK COLLEGE OR UNI-  
19           VERSITY.—The term “historically Black college or  
20           university” has the meaning given the term “part B  
21           institution” in section 322 of the Higher Education  
22           Act of 1965 (20 U.S.C. 1061).

23           (3) INSTITUTION OF HIGHER EDUCATION.—The  
24           term “institution of higher education” has the

1 meaning given the term in section 101(a) of the  
2 Higher Education Act of 1965 (20 U.S.C. 1001(a)).

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

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

16 (6) UNDER SECRETARY.—The term “Under  
17 Secretary” means the Under Secretary of Commerce  
18 for Oceans and Atmosphere.

19 **SEC. 3. HAZARDOUS WEATHER AND WATER EVENT RISK**  
20 **COMMUNICATION.**

21 (a) IN GENERAL.—The Under Secretary shall main-  
22 tain and improve the system of the National Oceanic and  
23 Atmospheric Administration by which the risks of haz-  
24 ardous weather and water events are communicated to the

1 general public, with the goal of informing action and en-  
2 couraging response to prevent loss of life and property.

3 (b) HAZARD RISK COMMUNICATION IMPROVEMENT  
4 AND SIMPLIFICATION.—

5 (1) IN GENERAL.—The Under Secretary shall  
6 maintain a hazard risk communication office (in this  
7 subsection referred to as the “Office”), for the pur-  
8 poses of simplifying and improving the communica-  
9 tion of hazardous weather and water event risks.

10 (2) TERMINOLOGY.—The Office shall identify,  
11 eliminate, or modify unnecessary, redundant, or con-  
12 fusing terms for hazardous weather and water event  
13 communications and add new terminology, as appro-  
14 priate.

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

21 (4) EVALUATIONS.—The Office shall, in coordi-  
22 nation with the performance branch of the National  
23 Weather Service, develop metrics for that branch to  
24 track and evaluate the degree to which hazardous

1 weather and water event communications result in  
2 action and response.

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

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

13 (A) are based on the best and most recent  
14 understanding from social, behavioral, risk, and  
15 communication science research;

16 (B) are validated by social, behavioral,  
17 risk, and communication science, taking into ac-  
18 count the importance of methods that support  
19 reproduction and replication of scientific stud-  
20 ies, use of rigorous statistical analyses, and, as  
21 applicable, data analysis supported by artificial  
22 intelligence and machine learning technologies;

23 (C) account for the needs of various demo-  
24 graphics, vulnerable populations, and geo-  
25 graphic regions;

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

3 (E) respond to the needs of Federal, State,  
4 and local government partners and media part-  
5 ners; and

6 (F) account for necessary changes in the  
7 infrastructure, technology, and protocols for  
8 creating and disseminating federally operated  
9 watches and warnings.

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

12 (A) Federal partners, including National  
13 Laboratories, Cooperative Institutes, and re-  
14 gional integrated sciences and assessments pro-  
15 grams;

16 (B) State and local government partners;

17 (C) Tribal governments;

18 (D) institutions of higher education; and

19 (E) media partners.

20 (8) TIMELINESS AND CONSISTENCY.—The Of-  
21 fice shall develop best practices and guidance for en-  
22 suring timely and consistent communication across  
23 public facing platforms that disseminate hazardous  
24 weather and water event information.

1 (c) HAZARD COMMUNICATION RESEARCH AND EN-  
2 GAGEMENT.—

3 (1) IN GENERAL.—The Under Secretary shall  
4 establish or maintain a research program—

5 (A) to modernize the creation and commu-  
6 nication of risk-based, statistically reliable,  
7 probabilistic hazard information to inform effec-  
8 tive actions and responses to hazardous weather  
9 and water events; and

10 (B) to improve the fundamental social, be-  
11 havioral, risk, and communication science re-  
12 garding hazardous weather and water event  
13 communication.

14 (2) COORDINATION.—In carrying out the re-  
15 search program required by paragraph (1), the  
16 Under Secretary shall coordinate and communicate  
17 with States, Tribal governments, localities, and  
18 emergency managers on research priorities and re-  
19 sults.

20 (3) PILOT PROGRAM FOR TORNADO HAZARD  
21 COMMUNICATION REQUIRED.—

22 (A) IN GENERAL.—To further research  
23 into hazard communication, the Under Sec-  
24 retary, in collaboration with one or more eligible  
25 institutions, shall establish a pilot program for

1           tornado hazard communication to test the effec-  
2           tiveness of implementing the research conducted  
3           under this subsection with respect to tornadoes.

4           (B) ELIGIBLE INSTITUTION DEFINED.—In  
5           this paragraph, the term “eligible institution”  
6           means any of the following:

7                   (i) A historically Black college or uni-  
8                   versity located in an area of persistent pov-  
9                   erty that is subjected to frequent severe  
10                  weather, such as tornadoes, hurricanes,  
11                  and floods.

12                  (ii) An institution of higher education  
13                  in close proximity to a National Weather  
14                  Service Weather Forecast Office of the Na-  
15                  tional Weather Service.

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

23          (e) DIGITAL WATERMARKING.—The Under Secretary  
24          shall develop methods to reduce the likelihood of unauthor-  
25          ized tampering with online hazardous weather and water



1 event risk communication, such as developing digital wa-  
2 termarks.

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

4 (a) IN GENERAL.—Not later than one year after the  
5 date of the enactment of this Act, the Under Secretary  
6 shall prepare and submit to Congress a strategic plan for  
7 developing and prioritizing the implementation of high-  
8 resolution probabilistic forecast guidance for hazardous  
9 weather and water events using a next-generation weather  
10 forecast and warning framework.

11 (b) PLAN ELEMENTS.—The strategic plan required  
12 by subsection (a) shall include the following:

13 (1) A discussion of—

14 (A) the priorities and needs of vulnerable  
15 populations and National Weather Service part-  
16 ners; and

17 (B) high-performance computing, visualiza-  
18 tion, and dissemination needs.

19 (2) A timeline and guidance for implementation  
20 of—

21 (A) high-resolution numerical weather pre-  
22 diction models;

23 (B) methods for meeting the high-perform-  
24 ance computing, visualization, and dissemina-  
25 tion needs discussed under paragraph (1)(B);

1 (C) real-time high-resolution probabilistic  
2 forecasts;

3 (D) improved observations, including  
4 through radars, satellites, and uncrewed aerial  
5 systems;

6 (E) a flexible framework to communicate  
7 clear and simple hazardous weather and water  
8 event information to the public; and

9 (F) social, behavioral, risk, and commu-  
10 nication research to improve the forecaster  
11 operational environment and societal informa-  
12 tion reception and response.

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

14 (a) IN GENERAL.—The Under Secretary shall, in col-  
15 laboration with such stakeholders as the Under Secretary  
16 considers appropriate—

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

20 (2) determine whether updates to that system  
21 are required to ensure that the ratings accurately re-  
22 flect the severity of tornadoes.

23 (b) UPDATE REQUIRED.—If the Under Secretary de-  
24 termines under subsection (a) that updates to the tornado

1 rating system are necessary, the Under Secretary shall up-  
2 date the system.

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

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

9 (b) COORDINATION.—The Under Secretary shall co-  
10 ordinate with Federal, State, and local governments, Trib-  
11 al governments, private entities, and relevant institutions  
12 of higher education when conducting post-storm surveys  
13 and assessments under subsection (a) in order to optimize  
14 data collection, sharing, and integration.

15 (c) DATA AVAILABILITY.—The Under Secretary shall  
16 make the data obtained from each post-storm survey and  
17 assessment conducted under subsection (a) available to the  
18 public as soon as practicable after conducting the survey  
19 and assessment.

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

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

24 (2) identify gaps in and update tactics and pro-  
25 cedures to enhance the efficiency and reliability of

1 data obtained from post-storm surveys and assess-  
2 ments; and

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

5 (A) surveying individual responses;

6 (B) conducting review of the accuracy of  
7 prior risk evaluations;

8 (C) evaluating the efficacy of prior mitiga-  
9 tion activity; and

10 (D) gathering survivability statistics.

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

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

17 (a) IN GENERAL.—Section 103 of the Weather Re-  
18 search and Forecasting Innovation Act of 2017 (15 U.S.C.  
19 8513) is amended—

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

23 (2) in subsection (a), by striking “establish a  
24 tornado warning improvement and extension pro-

1       gram” and inserting “maintain a program for rap-  
2       idly improving tornado forecast and warnings”;

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

5               (4) by inserting after subsection (c) the fol-  
6       lowing:

7       “(d) WARNINGS.—The program required by sub-  
8       section (a) shall—

9               “(1) continue the research necessary to develop  
10       and deploy probabilistic weather forecast guidance  
11       technology for tornadoes; and

12               “(2) incorporate, as appropriate, hazard com-  
13       munication research.

14       “(e) RESEARCH.—

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

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

24               “(B) the physical sciences, engineering,  
25       and technology related to tornado formation,

1 the interactions of tornadoes with the built and  
2 natural environment, and the interaction of tor-  
3 nadoes and hurricanes.

4 “(2) PRIORITY INSTITUTIONS.—

5 “(A) IN GENERAL.—In awarding grants  
6 under paragraph (1), the Under Secretary shall  
7 prioritize awarding grants to minority-serving  
8 institutions.

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

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

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

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

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

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

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

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

11 “(viii) a Native American-serving,  
12 nontribal institution (as defined in section  
13 319(b) of that Act (20 U.S.C.  
14 1059f(b))).”; and

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

16 “(h) AUTHORIZATION OF APPROPRIATIONS.—There  
17 is authorized to be appropriated to the Under Secretary  
18 to carry out this section \$11,000,000 for each of fiscal  
19 years 2023 through 2030, of which not less than  
20 \$2,000,000 each fiscal year shall be used for grants  
21 awarded under subsection (e).”.

22 (b) CLERICAL AMENDMENT.—The table of contents  
23 in section 1(b) of the Weather Research and Forecasting  
24 Innovation Act of 2017 (Public Law 115–25; 131 Stat.

1 91) is amended by striking the item relating to section  
2 103 and inserting the following:

“Sec. 103. VORTEX-USA program.”.

3 **SEC. 8. REPORTS.**

4 (a) WEATHER RESEARCH AND FORECASTING INNO-  
5 VATION ACT OF 2017.—

6 (1) IN GENERAL.—Section 403 of the Weather  
7 Research and Forecasting Innovation Act of 2017  
8 (15 U.S.C. 8543) is amended by striking subsection  
9 (d).

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

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

19 **SEC. 9. GOVERNMENT ACCOUNTABILITY OFFICE REPORT**  
20 **ON HAZARDOUS WEATHER AND WATER**  
21 **ALERT DISSEMINATION.**

22 (a) IN GENERAL.—Not later than 540 days after the  
23 date of the enactment of this Act, the Comptroller General  
24 of the United States shall submit to the Committee on  
25 Commerce, Science, and Transportation of the Senate and



1 the Committee on Science, Space, and Technology of the  
2 House of Representatives a report that examines the infor-  
3 mation technology infrastructure of the National Weather  
4 Service of the National Oceanic and Atmospheric Adminis-  
5 tration, specifically regarding the system for timely public  
6 notification of hazardous weather and water event alerts  
7 and updates.

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

10 (1) An analysis of the information technology  
11 infrastructure of the National Weather Service, in-  
12 cluding software and hardware capabilities and limi-  
13 tations, including an examination of server and data  
14 storage methods, broadband, data management, and  
15 data sharing.

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

19 (3) A determination of the extent to which pub-  
20 lic notifications are delayed and an identification of  
21 corrective measures that do not add additional noti-  
22 fication time.

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

- 1           (5) A description of actions being undertaken to
- 2           better identify critical steps in the hazards notifica-
- 3           tion process that may be vulnerable to disruption or
- 4           failure in the event of communication, technologic,
- 5           or computational failure.