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1ST SESSION

S. 1378

To enhance the use by the National Oceanic and Atmospheric Administration of artificial intelligence for weather forecasting, and for other purposes.

IN THE SENATE OF THE UNITED STATES

APRIL 9, 2025

Mr. SCHATZ (for himself, Mr. SHEEHY, Mr. LUJÁN, and Mr. WELCH) introduced the following bill; which was read twice and referred to the Committee on Commerce, Science, and Transportation

A BILL

To enhance the use by the National Oceanic and Atmospheric Administration of artificial intelligence for weather forecasting, 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 “Transformational Arti-
5 ficial intelligence to Modernize the Economy against Ex-
6 treme Weather and Wildfires Act” or the “TAME Ex-
7 treme Weather and Wildfires Act”.

1 **SEC. 2. ARTIFICIAL INTELLIGENCE FOR WEATHER FORE-**
2 **CASTING.**

3 (a) DEFINITIONS.—In this section:

4 (1) ARTIFICIAL INTELLIGENCE.—The term “ar-
5 tificial intelligence”—

6 (A) has the meaning given that term in
7 section 5002 of the National Artificial Intel-
8 ligence Initiative Act of 2020 (15 U.S.C. 9401);
9 and

10 (B) includes machine learning, neural net-
11 works, and natural language processing.

12 (2) ARTIFICIAL INTELLIGENCE WEATHER
13 MODEL.—The term “artificial intelligence weather
14 model” means a weather model based primarily on
15 artificial intelligence technology to project future
16 Earth system conditions based on machine learning
17 using weather forecasting training datasets.

18 (3) CURATE.—The term “curate”, with respect
19 to a dataset, means—

20 (A) to collect and maintain the dataset—

21 (i) to ensure and document its quality;

22 and

23 (ii) to provide metadata on its prove-
24 nance; and

25 (B) to update the dataset periodically, as
26 appropriate and practicable.

1 (4) NUMERICAL WEATHER MODEL.—The term
2 “numerical weather model” means a weather model
3 based primarily on coupled Earth System processes
4 that uses numerical computation to forecast future
5 Earth system conditions.

6 (5) OBSERVATIONAL DATA.—The term “obser-
7 vational data” means data and metadata from ac-
8 tual observations of environmental conditions, in-
9 cluding remote sensing and in situ platforms.

10 (6) SEASONAL, SUBSEASONAL, UNDER SEC-
11 RETARY, WEATHER ENTERPRISE.—the terms “sea-
12 sonal”, “subseasonal”, “Under Secretary”, and
13 “weather enterprise” have the meanings given those
14 terms in section 2 of the Weather Research and
15 Forecasting Innovation Act of 2017 (15 U.S.C.
16 8501).

17 (7) SYNTHETIC DATA.—The term “synthetic
18 data” means data produced from a model or statis-
19 tical method in order to fill gaps in observational
20 data.

21 (8) WEATHER DATA.—The term “weather
22 data” means information used to track and predict
23 weather conditions and patterns, including forecasts,
24 observations, and derivative products from such in-
25 formation.

1 (b) PURPOSE.—The purpose of this section is—

2 (1) to improve accuracy and timeliness of
3 weather, water, and space weather forecasts and ef-
4 fective dissemination of critical information;

5 (2) to strengthen analytic capacity to inform re-
6 source deployments in response to and to mitigate
7 harm from weather, water, wildfires, and space
8 weather hazards through the mandated exploration
9 and use of artificial intelligence by Federal agencies;

10 (3) to strengthen public-private partnerships to
11 accelerate adoption and outcomes of the use of arti-
12 ficial intelligence in response to and to mitigate such
13 harm; and

14 (4) to strengthen public-private partnerships in
15 highly technical, high-risk, and high-reward fields re-
16 lated to weather, water, wildfires, and space weather
17 forecasts.

18 (c) EARTH SYSTEM FORECASTING AND INFORMA-
19 TION DELIVERY.—

20 (1) TRAINING DATASETS.—Not later than 4
21 years after the date of the enactment of this Act, the
22 Under Secretary, in consultation with the Secretary
23 of Energy, the Administrator of the National Aero-
24 nautics and Space Administration, the Director of
25 the National Science Foundation, the Director of the

1 National Center for Atmospheric Research, the
2 Interagency Council on Advancing Meteorological
3 Services, other appropriate Federal advisory commit-
4 tees as determined by the Under Secretary, and such
5 other technical experts as the Under Secretary con-
6 siders appropriate, shall develop and curate com-
7 prehensive weather forecasting training datasets
8 with relevant Earth system data, quality informa-
9 tion, and metadata necessary for weather fore-
10 casting.

11 (2) USE OF EXISTING DATASETS.—In order to
12 speed the development of the weather forecasting
13 training datasets required under paragraph (1), the
14 Under Secretary shall assess, and to the greatest ex-
15 tent practicable build on, existing Earth system rea-
16 nalysis datasets of the Federal Government.

17 (3) ARTIFICIAL INTELLIGENCE WEATHER
18 MODEL.—

19 (A) GLOBAL MODEL.—In carrying out this
20 subsection, the Under Secretary, in consultation
21 with appropriate Federal advisory committees
22 as determined by the Under Secretary, may de-
23 velop and test a global weather model based on
24 artificial intelligence technologies utilizing data

1 of the National Oceanic and Atmospheric Ad-
2 ministration to the extent possible.

3 (B) REGIONAL AND LOCAL MODELS.—In
4 addition to a global weather model under sub-
5 paragraph (A), the Under Secretary may exper-
6 iment with regional and local weather models
7 based on artificial intelligence technologies.

8 (4) USE OF ARTIFICIAL INTELLIGENCE TO DIS-
9 SEMINATE INFORMATION.—In coordination with an
10 artificial intelligence weather model or models devel-
11 oped under paragraph (3), the Under Secretary may
12 explore the use of artificial intelligence to enhance
13 the dissemination of information with respect to
14 weather and wildfire risks and evaluate the effective-
15 ness of communication for improved public under-
16 standing and preparedness.

17 (5) CONTINUED SUPPORT FOR OBSERVATIONS,
18 BASIC RESEARCH, AND NUMERICAL WEATHER MOD-
19 ELS.—Notwithstanding the requirements of this sub-
20 section, the Under Secretary shall continue to sup-
21 port and advance the activities of the National Oce-
22 anic and Atmospheric Administration—

23 (A) to collect and acquire traditional and
24 novel observational data relevant for artificial

intelligence and numerical weather, water, and
space weather forecasting;

(B) to advance research on the Earth system and numerical weather model forecasting;

(C) to develop and advance numerical Earth system modeling for predictions;

(D) to develop weather model data post-processing techniques; and

(E) to improve data assimilation techniques.

(6) OBSERVING SYSTEM COVERAGE.—In carrying out this subsection, the Under Secretary may evaluate the use of cost functions in data-driven machine learning model training to balance inequities in observing system coverage and data poor areas.

(7) UNCERTAINTY QUANTIFICATION RESEARCH.—In carrying out this subsection, the Under Secretary may develop uncertainty quantification research for the purpose of accurate environmental risk and hazard communications of probabilistic predictions and forecasts.

(8) REPORT.—Not later than 2 years after the date of the enactment of this Act, and not less frequently than every 2 years thereafter through 2035, the Under Secretary shall submit to the Committee

1 on Commerce, Science, and Transportation of the
 2 Senate and the Committee on Science, Space, and
 3 Technology of the House of Representatives a report
 4 on the activities conducted under this subsection.

5 (d) ADVANCED ARTIFICIAL INTELLIGENCE APPLICA-
 6 TIONS FOR WEATHER FORECASTS AND INFORMATION DE-
 7 LIVERY.—The Under Secretary shall explore advanced ap-
 8 plications of artificial intelligence to improve weather fore-
 9 casts and information delivery, such as by—

10 (1) improving data assimilation;

11 (2) accounting for coupled Earth system proc-
 12 esses;

13 (3) improving readiness and preparedness to
 14 combat wildfires, mitigation of the risk from
 15 wildfires, and improving safety for firefighters and
 16 communities at risk from wildfires;

17 (4) using artificial intelligence weather models
 18 to generate ensemble forecasts to more accurately
 19 assess flow-dependent forecast uncertainties; and

20 (5) improving impact-based decision support to
 21 diverse users and communities for greater societal
 22 benefits based on those forecasts.

23 (e) TECHNICAL ASSISTANCE ON USE OF ARTIFICIAL
 24 INTELLIGENCE WEATHER, WATER, AND SPACE WEATH-
 25 ER MODELS.—

1 (1) IN GENERAL.—The Under Secretary shall
2 provide—

3 (A) technical assistance, data access, and
4 support for forecasters, scientists, social sci-
5 entists, and engineers to test and evaluate the
6 use and effectiveness of the artificial intel-
7 ligence models of the National Oceanic and At-
8 mospheric Administration, including within the
9 testbeds of the Administration;

10 (B) best practices on providing forecasts
11 based on outputs from artificial intelligence
12 weather models and numerical weather models,
13 or a combination thereof; and

14 (C) support for emergency managers to
15 make operational decisions based on outputs
16 from artificial intelligence weather models and
17 numerical weather models, or a combination
18 thereof.

19 (2) ASSESSMENT OF WEATHER MODELS.—

20 (A) IN GENERAL.—The Under Secretary
21 shall support the development of a common
22 framework for the assessment of numerical
23 weather models and artificial intelligence weath-
24 er models by comparing model output and ob-
25 servational data over a period of time in the

1 past through the use of such methodologies as
2 the Under Secretary considers appropriate.

3 (B) BEST PRACTICES.—In carrying out
4 this paragraph, the Under Secretary may de-
5 velop and disseminate best practices in collabo-
6 ration with—

7 (i) the National Institute of Standards
8 and Technology, the National Aeronautics
9 and Space Administration, the National
10 Science Foundation, and the Department
11 of Energy;

12 (ii) academic and research institu-
13 tions; and

14 (iii) the private sector.

15 (3) TECHNICAL ASSISTANCE.—In carrying out
16 this subsection, the Under Secretary may provide
17 technical assistance, best practices, and support re-
18 quired under paragraph (1) through the National
19 Weather Service.

20 (4) INDEPENDENT STUDY ON THE IMPACTS OF
21 ARTIFICIAL INTELLIGENCE WEATHER, WATER, AND
22 SPACE WEATHER MODELS.—The Under Secretary
23 may enter into an agreement with the National
24 Academy of Sciences or another entity as determined
25 appropriate by the Under Secretary to assess the

1 impacts of artificial intelligence weather models on
 2 the weather enterprise and make recommendations
 3 to improve the integration of such models in oper-
 4 ational forecasting.

5 (f) PARTNERSHIPS FOR TRANSFORMATIONAL INNO-
 6 VATION.—

7 (1) IN GENERAL.—The Under Secretary may
 8 explore novel structures for partnerships with pri-
 9 vate, academic, and international entities for re-
 10 search and development of transformative innovation
 11 in weather forecasting and other environmental fore-
 12 casts—

13 (A) to further the understanding of weath-
 14 er, water, wildfires, and space weather, and
 15 their societal impact;

16 (B) to advance the science of weather and
 17 water forecasting, including seasonal and sub-
 18 seasonal forecasting; and

19 (C) to develop, evaluate, and transition ar-
 20 tificial intelligence weather, water, and hazard
 21 forecasting applications to operations.

22 (2) CO-INVESTMENT.—Subject to applicable
 23 law, the Under Secretary may consider and adopt
 24 novel co-investment strategies with the private aca-

1 demic and international sectors to carry out para-
 2 graph (1), including—

3 (A) non-Federal Government contributions
 4 to resource and support high-risk, high-return
 5 research and development in environmental
 6 forecasting, data science, artificial intelligence,
 7 and related fields;

8 (B) shared rights to intellectual property
 9 from research and development activities under
 10 this subsection; and

11 (C) other approaches to sharing resources
 12 and results under this subsection.

13 (g) AVAILABILITY OF DATASET.—

14 (1) IN GENERAL.—The Under Secretary shall
 15 develop and implement a plan to make available to
 16 the public, at no cost and subject to applicable law
 17 and policy, the following:

18 (A) Operational artificial intelligence
 19 weather models developed by the National Oce-
 20 anic and Atmospheric Administration.

21 (B) Artificial intelligence weather models
 22 that are not operational models, including ex-
 23 perimental and developmental models, as the
 24 Under Secretary determines appropriate.

1 (C) Applicable information and documenta-
2 tion for artificial intelligence weather models
3 described in subparagraphs (A) and (B), includ-
4 ing a description of intended model outputs.

5 (D) Subject to subsection (i), all data
6 owned by the Federal Government and data
7 that the Under Secretary has the legal right to
8 redistribute that are associated with artificial
9 intelligence weather models made available to
10 the public pursuant to the plan and used in
11 operational forecasting by the Administration,
12 including—

13 (i) relevant metadata; and

14 (ii) data used for operational artificial
15 intelligence weather models used by the
16 Administration.

17 (2) ACCOMMODATIONS.—In developing and im-
18 plementing the plan under paragraph (1), the Under
19 Secretary may make such accommodations as the
20 Under Secretary considers appropriate to ensure
21 that the public release of any artificial intelligence
22 weather model, information, documentation, or data
23 pursuant to the plan does not jeopardize—

24 (A) national security;

1 (B) intellectual property or redistribution
2 rights, including under titles 17 and 35, United
3 States Code;

4 (C) any trade secret or commercial or fi-
5 nancial information subject to section 552(b)(4)
6 of title 5, United States Code;

7 (D) any models or data that are otherwise
8 restricted by contract or other written agree-
9 ment; or

10 (E) the mission of the Administration to
11 protect lives and property.

12 (3) REPORT.—

13 (A) IN GENERAL.—Not later than one year
14 after the date of the enactment of this Act, the
15 Under Secretary shall submit to Congress a re-
16 port, in both unclassified and classified form,
17 regarding the risks to the economic and intellec-
18 tual security of the United States from foreign
19 countries of concern through access by those
20 countries to weather data in the United States.

21 (B) ELEMENTS.—The report required
22 under subparagraph (A) shall include—

23 (i) a full analysis of the national, in-
24 tellectual, and economic security implica-
25 tions for the United States with respect to

1 intellectual property theft or cyber or
2 human espionage through access to weath-
3 er data; and

4 (ii) conclusions of the Under Sec-
5 retary and recommendations for legislative
6 and administrative action, if any.

7 (C) FOREIGN COUNTRY OF CONCERN DE-
8 FINED.—In this paragraph, the term “foreign
9 country of concern” has the meaning given that
10 term in section 9901 of the William M. (Mac)
11 Thornberry National Defense Authorization Act
12 for Fiscal Year 2021 (15 U.S.C. 4651).

13 (h) RETENTION OF FEDERAL GOVERNMENT EXPER-
14 TISE.—Subject to applicable law, the Under Secretary
15 may consider novel methods to recruit, retrain, and retain
16 expert personnel to support activities under this section,
17 including by—

18 (1) using methods to be competitive with sala-
19 ries outside the Federal Government;

20 (2) developing staff exchange programs and
21 training programs; and

22 (3) leveraging diverse hiring strategies.

23 (i) PROTECTION OF NATIONAL SECURITY INTER-
24 ESTS.—

1 (1) IN GENERAL.—Notwithstanding any other
2 provision of this section, the Under Secretary, in
3 consultation with the Secretary of Defense, as ap-
4 propriate, may withhold models or data used under
5 this section if the Under Secretary determines doing
6 so to be necessary to protect the national security
7 interests of the United States.

8 (2) RULE OF CONSTRUCTION.—Nothing in this
9 section shall be construed to supersede any other
10 provision of law governing the protection of the na-
11 tional security interests of the United States.

12 (j) AUTHORIZATION OF APPROPRIATIONS.—There is
13 authorized to be appropriated to the Under Secretary to
14 carry out this section—

15 (1) for fiscal year 2026, \$311,000,000; and

16 (2) for each of fiscal years 2027 through 2030,
17 \$76,000,000.

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