

Calendar No. 199

119TH CONGRESS }
1st Session

SENATE

{ REPORT
119-88

TRANSFORMATIONAL ARTIFICIAL INTEL-
LIGENCE TO MODERNIZE THE ECONOMY
AGAINST EXTREME WEATHER AND
WILDFIRES ACT

R E P O R T

OF THE

COMMITTEE ON COMMERCE, SCIENCE, AND
TRANSPORTATION

ON

S. 1378



OCTOBER 21, 2025.—Ordered to be printed

U.S. GOVERNMENT PUBLISHING OFFICE

69-010

WASHINGTON : 2025

SENATE COMMITTEE ON COMMERCE, SCIENCE, AND TRANSPORTATION

ONE HUNDRED NINETEENTH CONGRESS

FIRST SESSION

TED CRUZ, Texas, *Chairman*

JOHN THUNE, South Dakota	MARIA CANTWELL, Washington
ROGER F. WICKER, Mississippi	AMY KLOBUCHAR, Minnesota
DEB FISCHER, Nebraska	BRIAN SCHATZ, Hawaii
JERRY MORAN, Kansas	EDWARD J. MARKEY, Massachusetts
DAN SULLIVAN, Alaska	GARY C. PETERS, Michigan
MARSHA BLACKBURN, Tennessee	TAMMY BALDWIN, Wisconsin
TODD YOUNG, Indiana	TAMMY DUCKWORTH, Illinois
TED BUDD, North Carolina	JACKY ROSEN, Nevada
ERIC SCHMITT, Missouri	BEN RAY LUJAN, New Mexico
JOHN CURTIS, Utah	JOHN W. HICKENLOOPER, Colorado
BERNIE MORENO, Ohio	JOHN FETTERMAN, Pennsylvania
TIM SHEEHY, Montana	ANDY KIM, New Jersey
SHELLEY MOORE CAPITO, West Virginia	LISA BLUNT ROCHESTER, Delaware
CYNTHIA M. LUMMIS, Wyoming	

BRAD GRANTZ, *Majority Staff Director*

LILA HARPER HELMS, *Democratic Staff Director*

Calendar No. 199

119TH CONGRESS }
1st Session }

SENATE

{ REPORT
119–88

TRANSFORMATIONAL ARTIFICIAL INTELLIGENCE TO MODERNIZE THE ECONOMY AGAINST EXTREME WEATHER AND WILDFIRES ACT

OCTOBER 21, 2025.—Ordered to be printed

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

R E P O R T

[To accompany S. 1378]

[Including cost of estimate of the Congressional Budget Office]

The Committee on Commerce, Science, and Transportation, to which was referred the bill (S. 1378) to enhance the use by the National Oceanic and Atmospheric Administration of artificial intelligence for weather forecasting, and for other purposes, having considered the same, reports favorably thereon with an amendment in the nature of a substitute and recommends that the bill, as amended, do pass.

PURPOSE OF THE BILL

The purpose of S. 1378 is to direct the National Oceanic and Atmospheric Administration (NOAA) to develop and implement forecasting models powered by artificial intelligence for weather and wildfires.

BACKGROUND AND NEEDS

NOAA estimates that since 2022, extreme weather events, such as tornadoes, hurricanes, and wildfires, have resulted in 1,534 fatalities and caused \$461.6 billion in damages.¹ As the primary agency responsible for weather prediction, NOAA has developed

¹“U.S. Billion-Dollar Weather and Climate Disasters Summary Stats,” NOAA National Centers for Environmental Information, 2025, <https://www.ncei.noaa.gov/access/billions/summary-stats#temporal-comparison-stats>.

and maintained numerical weather prediction (NWP) forecasting systems, which are the foundation of modern weather forecasting, through the National Weather Service (NWS) and Office of Oceanic and Atmospheric Research (OAR). NWP systems are still the primary forecasting tool used by the United States and rely on sophisticated mathematical models processed by supercomputers, using data from satellites, radar, and other observational sources to simulate and predict future weather patterns.²

NWP systems in the United States may be falling behind their international counterparts due to their reliance on resource-heavy physics-based models, difficulty in accurately predicting rare weather events, and challenges in processing the increasing volume of observational data. These issues are compounded by limited computing resources and a slower pace of technological adoption compared to other major forecasting centers worldwide.³ Currently, the United States forecasting efforts depend heavily on datasets maintained by the European Centre for Medium-Range Weather Forecasts (ECMWF).⁴ The ECMWF weather forecast models have been shown to be more accurate than U.S.-based models because the ECMWF has invested more heavily in supercomputing, data processing, data assimilation, and the integration of research into operational forecasting.⁵

Artificial intelligence (AI) can help identify complex patterns in large datasets, enhance the use of weather data, produce faster and more accurate forecasts, and significantly improve predictions of extreme weather events.⁶ NOAA scientists have suggested AI could offer significant enhancements to crucial modeling efforts like tracking and monitoring hurricanes.⁷ The ECMWF has developed and implemented the first fully operational AI-powered weather forecasting model.⁸ Many other countries, including the United States, are using the dataset for this model to train and build their own AI-powered weather models.⁹

The TAME Extreme Weather and Wildfires Act seeks to modernize U.S. weather forecasting by directing NOAA to develop domestically curated datasets, support the development of AI-based global and regional weather models, and strengthen partnerships with private and academic institutions. It emphasizes the integration of AI with existing NWP models and enhances public access to forecasting data while safeguarding national security and intellectual property.

²“Weather Models,” NOAA, <https://www.noaa.gov/jetstream/upper-air-charts/weather-models>.

³Jerald Brotzge et. al, “Challenges and Opportunities in Numerical Weather Prediction,” *American Meteorological Society Journals*, March 28, 2023, <https://journals.ametsoc.org/view/journals/bams/104/3/BAMS-D-22-0172.1.xml>.

⁴Clifford Mass, “The Uncoordinated Giant II: Why U.S. Operational Numerical Weather Prediction Is Still Lagging and How to Fix It,” *Bulletin of the American Meteorological Society*, April 25, 2023, <https://journals.ametsoc.org/view/journals/bams/104/4/BAMS-D-22-0037.1.xml>.

⁵Muhammad Waqas et al., “Artificial Intelligence and Numerical Weather Prediction Models: A Technical Survey,” *Natural Hazards Research*, June 2025, <https://www.sciencedirect.com/science/article/pii/S266659212400091X>.

⁶Ibid.

⁷Madison Alder, “Bipartisan Bill Aimed at Enhancing NOAA’s AI Use Reintroduced in House, Senate,” *FedScoop*, April 10, 2025, <https://fedscoop.com/bipartisan-bill-noaa-ai-reintroduced-house-senate/>.

⁸Nicola Jones, “A.I. Is Quietly Powering a Revolution in Weather Prediction,” *Yale Environment* 360, April 15, 2025, <https://e360.yale.edu/features/artificial-intelligence-weather-forecasting>.

⁹Ibid.

SUMMARY OF PROVISIONS

S. 1378 would do the following:

- Direct NOAA to develop and curate comprehensive weather forecasting training datasets and experiment with regional and local artificial intelligence weather models.
- Authorize NOAA to explore the use of artificial intelligence to enhance the dissemination of information related to weather and wildfire risks.
- Direct NOAA to explore advanced applications of artificial intelligence to enhance weather forecasts and information delivery, as well as to provide technical assistance and support for the use of artificial intelligence in weather.
- Authorize NOAA to explore partnerships and consider novel co-investment strategies with private academic and international entities to support innovative research.
- Authorize \$105 million for fiscal year 2026 and \$25 million for each of fiscal years 2027–2030.

LEGISLATIVE HISTORY

S. 1378 was introduced on April 9, 2025, by Senator Schatz (for himself and Senators Sheehy, Luján, and Welch) and was referred to the Committee on Commerce, Science, and Transportation of the Senate. On April 30, 2025, the Committee met in open Executive Session and, by voice vote, ordered S. 1378 reported favorably with an amendment (in the nature of a substitute).

H.R. 2770, a House companion bill to S. 1378, was introduced on April 9, 2025, by Representative Franklin and was referred to the Committee on Science, Space, and Technology of the House of Representatives.

118th Congress

S. 3888, the TAME Extreme Weather Act, was introduced on March 6, 2024, by Senator Schatz (for himself and Senators Luján, Butler, and Welch) and was referred to the Committee on Commerce, Science, and Transportation of the Senate.

H.R. 9498, a House companion bill to S. 3888, was introduced on September 9, 2024, by Representative Franklin (for himself and Representative Mullin) and was referred to the Committee on Science, Space, and Technology of the House of Representatives.

ESTIMATED COSTS

In accordance with paragraph 11(a) of rule XXVI of the Standing Rules of the Senate and section 403 of the Congressional Budget Act of 1974, the Committee provides the following cost estimate, prepared by the Congressional Budget Office:

S. 1378, TAME Extreme Weather and Wildfires Act			
As ordered reported by the Senate Committee on Commerce, Science, and Transportation on April 30, 2025			
By Fiscal Year, Millions of Dollars	2025	2025-2030	2025-2035
Direct Spending (Outlays)	0	0	0
Revenues	0	0	0
Increase or Decrease (-) in the Deficit	0	0	0
Spending Subject to Appropriation (Outlays)	0	188	203
Increases <i>net direct spending</i> in any of the four consecutive 10-year periods beginning in 2036?	No	Statutory pay-as-you-go procedures apply? No	
		Mandate Effects	
Increases <i>on-budget deficits</i> in any of the four consecutive 10-year periods beginning in 2036?	No	Contains intergovernmental mandate?	No
		Contains private-sector mandate?	No

S. 1378 would authorize the appropriation of \$105 million for fiscal year 2026 and \$25 million annually from 2027 through 2030 for the National Oceanic and Atmospheric Administration (NOAA) to develop comprehensive datasets for training weather forecasting models, in coordination with other federal entities and technical experts.

The bill also would allow NOAA to:

- Use artificial intelligence (AI) to disseminate weather and wildfire risk information,
- Partner with nonfederal entities to study and recommend best practices for AI-based weather forecasting, and
- Recruit expert personnel to support AI weather forecasting.

In addition, S. 1378 would require NOAA to report to the Congress on AI-based weather forecasting and potential security risks related to foreign access to weather data.

The costs of the legislation, detailed in Table 1, fall within budget function 300 (natural resources and environment).

TABLE 1.—ESTIMATED INCREASES IN SPENDING IN SUBJECT TO APPROPRIATION UNDER S. 1378

	By fiscal year, millions of dollars—						
	2025	2026	2027	2028	2029	2030	2025–2030
Authorization	0	105	25	25	25	25	205
Estimated Outlays	0	63	38	36	26	25	188

Using historical spending patterns for similar activities, CBO estimates that implementing S. 1378 would cost \$188 million over the 2025–2030 period and \$15 million after 2030, assuming appropriation of the authorized amounts.

The CBO staff contact for this estimate is Kelly Durand. The estimate was reviewed by H. Samuel Papenfuss, Deputy Director of Budget Analysis.

PHILLIP L. SWAGEL,
Director, Congressional Budget Office.

REGULATORY IMPACT STATEMENT

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

Number of Persons Covered

S. 1378, as reported, would not subject individuals to new regulations.

Economic Impact

S. 1378, as reported, is not expected to have any significant adverse impacts on the Nation's economy. The bill may have a positive economic impact by reducing the loss of lives and property.

Privacy

S. 1378, as reported, would not have any adverse impact on the personal privacy of individuals.

Paperwork

S. 1378, as reported, would not increase paperwork requirements for private individuals or businesses. It would increase NOAA's paperwork burden by requiring the agency to submit reports to Congress regarding the use of datasets for AI weather forecasting, use of AI for dissemination of information on weather models, support by NOAA of existing observations, research, and weather models, observation system coverage, and use of uncertainty quantification research. It would also require NOAA to develop and implement a plan to make AI weather models and information and documentation of AI models available to the public.

CONGRESSIONALLY DIRECTED SPENDING

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

SECTION-BY-SECTION ANALYSIS

Section 1. Short title.

This section would provide that the bill may be cited as the "Transformational Artificial intelligence to Modernize the Economy against Extreme Weather and Wildfires Act" or the "TAME Extreme Weather and Wildfires Act".

Section 2. Artificial intelligence for weather forecasting.

This section would define the terms "artificial intelligence", "artificial intelligence weather model", "curate", "numerical weather model", "observational data", "seasonal", "subseasonal", "Under Secretary", "weather enterprise", "synthetic data", and "weather data".

This section would direct NOAA to develop and curate comprehensive weather forecasting training datasets within 4 years. Additionally, this section would authorize NOAA to develop and test a global weather model based on AI technologies. Additionally,

this section would authorize NOAA to experiment with regional and local AI weather models.

This section would authorize NOAA to explore the use of AI to enhance the dissemination of information related to weather and wildfire risks. Additionally, this section would require NOAA to continue supporting its current activities regardless of the new initiatives under this subsection. These current activities include collecting and acquiring traditional and novel observational data relevant to AI and numerical forecasting for weather, water, and space weather; advancing research on the Earth system and numerical weather model forecasting; developing and advancing numerical Earth system modeling for predictions; developing weather model data post-processing techniques; and improving data assimilation techniques.

This section would authorize NOAA to evaluate advanced machine learning model techniques to improve observing system coverage in regions with limited data collection to help improve the accuracy of forecasts in these regions. Additionally, it would authorize NOAA to conduct research to better assess uncertainty in weather forecasting to enable more accurate risk communication.

This section would require NOAA to submit a report of the details of the activities carried out under the “Earth System Forecasting and Information Delivery” subsection to Congress every 2 years until 2035.

This section would direct NOAA to explore advanced applications of AI to enhance weather forecasts and information delivery. This section would direct NOAA to provide technical assistance, data access, and support to forecasters, scientists, social scientists, and engineers to evaluate AI models. It would require NOAA to provide both best practices for developing forecasts and support to emergency managers for making operational decisions based on AI, numerical, and combined weather model outputs.

This section would require NOAA, in partnership with other Federal agencies, academics, and the private sector, to develop a common assessment framework for numerical and AI weather models. This section would authorize NOAA to partner with the National Academy of Sciences or another appropriate entity to assess the impact of AI weather models on the weather enterprise and make recommendations for integrating AI models into weather forecasting.

This section would authorize NOAA to explore partnerships with private, academic, and international entities to support transformative research and development in weather and environmental forecasting; these partnerships could include the consideration and adoption of co-investment strategies with private academic and international sectors.

This section would require NOAA to develop and implement a plan to make certain AI weather model resources and data publicly available at no cost, subject to applicable law, national security considerations, intellectual property rights, and policy. It would require NOAA to submit a classified and unclassified report to Congress on security risks related to foreign countries of concern having access to U.S. weather data within 1 year of enactment of this section.

This section would allow NOAA to explore novel methods for recruiting, retraining, and retaining expert personnel to support the activities outlined in this section. This section would allow NOAA, in consultation with the Secretary of Defense, to withhold models or data if necessary to protect the national security interests of the United States. This section would clarify that nothing written in this Act supersedes existing laws related to national security protections.

Lastly, this section would authorize appropriations of \$105 million for fiscal year 2026 and \$25 million annually for fiscal years 2027 through 2030.

CHANGES IN EXISTING LAW

In compliance with paragraph 12 of rule XXVI of the Standing Rules of the Senate, the Committee states that the bill as reported would make no change to existing law.

