



NOAA Artificial Intelligence Strategy

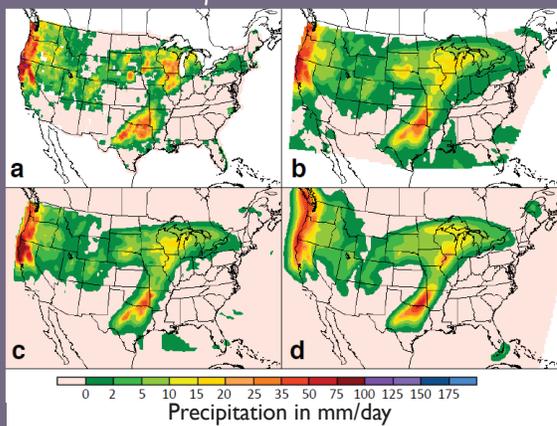
The NOAA AI Strategy will dramatically expand the application of artificial intelligence (AI) in every NOAA mission area by improving the efficiency, effectiveness, and coordination of AI development and usage across the agency. As data exploitation capabilities continue to increase exponentially with improved data from a scalable consolidated satellite architecture, unmanned systems, and commercial data sources, AI methods will provide transformative techniques to enhance the quality and timeliness of NOAA science, products, and services.

Demonstrated Leadership in Artificial Intelligence

Artificial Intelligence involves techniques in machine learning and deep learning including neural networks, evolutionary computation, probabilistic and statistical methods. NOAA's robust experience with AI applications across a range of mission areas is already demonstrating improvements in performance and skill at greatly reduced costs and compute time as the examples in this handout illustrate. Additional cost savings are shown in arenas as diverse as deep-sea exploration, habitat characterization, and processing of earth observations. By strengthening AI coordination, operational capabilities, workforce proficiency, and multisector partnerships, NOAA's national and global leadership in AI will support science, public safety, and security. Example applications include:

- Aerial and underwater surveys from ships and autonomous platforms to assess the abundance of marine mammal and fish populations;
- Robotics for deep-sea exploration;
- Quality control of weather observations;
- Improving physical parameterization for weather, ocean, and ice modeling, and the computational performance of numerical models;
- Automating weather-warning generation;
- Operation of unmanned systems for bathymetric mapping, habitat characterization, hydrologic, oceanographic, atmospheric, fishery, ecosystem, and geographic surveys;
- Using machine learning to analyze satellite imagery for severe weather detection and prediction, oil spill and hazardous material trajectory, wildfire detection and movement, ecosystem health, and detection of potentially illegal fishing activity; and
- Using machine learning for reliable and efficient processing, interpretation, and utilization of earth observations.

Example of AI (NN)-based Ensemble: Nonlinear Multimodel Ensemble Mean Precipitations over ConUS



NOAA National Weather Service demonstrates the use of AI to improve ensemble modeling accuracy. (a) Climate Prediction Center (CPC) analysis (ground truth); (b) Ensemble mean of eight models: NCEP (global and regional) and six international models. Reduced maximum and diffused sharpness of fronts due to slightly shifted maps from ensemble members, produced many false alarms; (c) AI-based Ensemble composite. Closer to CPC with maintained sharpness and minimal alarm rates; (d) the forecast produced by human analyst at the Weather Prediction Center (WPC).

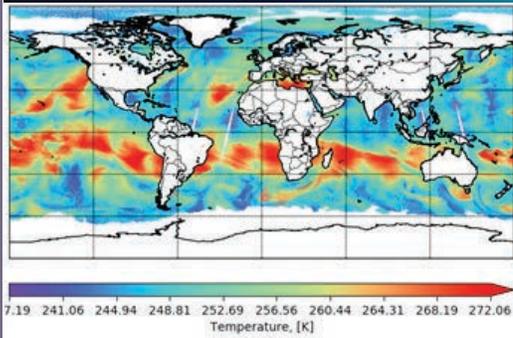


NOAA National Ocean Service and National Weather Service are partnering with researchers at UC Santa Cruz to use AI to detect rip currents from coastal imagery. The rip current observations are supporting implementation and improvement of the NOAA rip current forecast model.

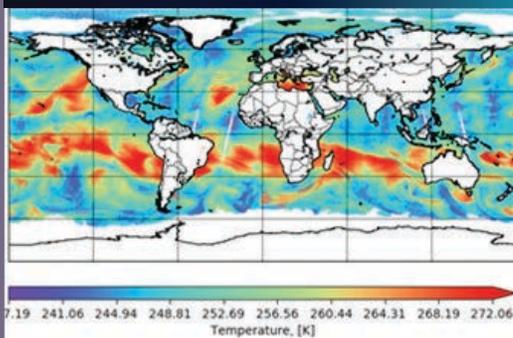
Artificial Intelligence Strategy Goals

1. Establish an efficient organizational structure and processes to advance AI across NOAA.
2. Advance AI research and innovation in support of NOAA's mission.
3. Accelerate the transition of AI research to operational capabilities.
4. Strengthen and expand AI partnerships.
5. Promote AI proficiency in the workforce.

AI-CRTM (ATMS Channel 21)



CRTM (ATMS Channel 21)



Processing time for 1 day of ATMS: AI-CRTM, 1 s; CRTM, 1.3 h

Simulated JPSS-1 ATMS channel 21 (183 GHz mid-upper tropospheric water vapor channel) from AI-based radiative transfer model (AI-CRTM) trained using CRTM (top), and operational CRTM (bottom). CPU time required to simulate 1 day of JPSS-1 ATMS (all channels) is reduced from 1.3 hrs using CRTM, to 1 second using AI-CRTM.

Bold New Era in Harnessing AI

To ensure the NOAA AI Strategy realizes transformational advances in performance, skill, and efficiency, NOAA is developing an AI Strategic Implementation Plan or "Roadmap" that defines detailed action items, deadlines, and responsibilities. In the meantime, the NOAA AI Strategy is already improving performance in our lifesaving and economically impactful missions—and setting the course to strengthen our renowned environmental science and technology leadership for the coming decades. Through this, NOAA will achieve our top agency priorities to regain and maintain global leadership in numerical weather prediction and sustainably expand the American Blue Economy.

NOAA's Artificial Intelligence Strategy aligns with:

- The Executive Order on *Maintaining American Leadership in Artificial Intelligence*.
- The National Science and Technology Council's *The National Artificial Intelligence Research and Development Strategic Plan: 2019 Update* and its *Science and Technology for America's Oceans: A Decadal Vision*.
- The Executive Office of the President's August 30, 2019, Memorandum "Fiscal Year 2021 Administration Research and Development Budget Priorities."



NOAA Southwest Fisheries Science Center uses machine learning to deliver higher quality and more timely science for policy decision on protected and endangered species. In this example, machine learning has provided automated detection and identification of seals during aerial surveys.