US National Hurricane Center and Google DeepMind cyclone model

IMPLEMENTED 2025 · GOVERNMENT AND PUBLIC SERVICES · US · BAND D · PARTLY PROVED
VERSION 1.0 · PUBLISHED 15 NOVEMBER 2026 · UPDATED 15 NOVEMBER 2026 · FACTS CHECKED 15 NOVEMBER 2026

The US National Hurricane Center's forecasters received live output from Google DeepMind's experimental AI cyclone model in the 2025 season, and the Center's own verification report rates it among the best guidance.

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NOTICE WORDING LAST UPDATED 16 NOVEMBER 2026

AT A GLANCE

Frontier case: AI used for a scientific, medical or engineering breakthrough. The transformation is potential and unproven; MarLuc grades what has changed in practice so far.

AI used: Machine-learning cyclone model (stochastic neural network) used as forecast guidance.

Implemented: 2025. Grade: band D, Task support, Partly proved.

Headline result, as reported: In the Center's 2025 verification report, the Google DeepMind ensemble mean slightly outperformed official track forecasts at 12 to 72 hours in the Atlantic; official forecasts remain human-issued

1 · The case

The facts, as reported by the 2 sources listed at the end. Where a source is silent, the field says "Not reported".

Organisation

National Hurricane Center. The National Hurricane Center issues official forecasts and warnings for tropical cyclones in the Atlantic and eastern North Pacific basins. Canvas block: 4. Operations and process. Also 2. Technology.

Business challenge

The challenge. A single physics-based model finds it hard to predict both a cyclone's track and its intensity, according to Google DeepMind, so forecasters use many models and regional high-resolution models.

How it was addressed. Google DeepMind launched Weather Lab in June 2025 with an experimental AI cyclone model that produces 50 scenarios up to 15 days ahead, and says NHC forecasters were seeing live predictions from it alongside physics-based models and observations. NHC evaluated the model, labelled GDMI, in its 2025 verification. [1] [2]

Who implemented it

Google DeepMind and Google Research (Model or cloud provider): Developed the experimental cyclone model and shares live output with NHC through Weather Lab.
In-house (In-house): National Hurricane Center: Evaluates the model against its own best-track data and issues official forecasts and warnings.
DeepMind also names the Cooperative Institute for Research in the Atmosphere at Colorado State University as a collaborator that evaluated the model.

Technology (SEAM pillar E)

SEAM types: T5 Custom / fine-tuned models, T8 Predictive / ML models. Deployment: Not reported. Vendors and products: Google DeepMind, Weather Lab, WeatherNext, Experimental cyclone model (GDMI in NHC's verification report).

Where it was built in: Live model output is shown to NHC forecasters alongside physics-based models and observations; it is guidance for forecasters, not an official product. The NHC report names the member as the Google DeepMind ensemble mean (GDMI) and does not give a model version.

What changed

Before: NHC forecasters worked from physics-based and statistical guidance. After: a Google DeepMind AI ensemble mean is part of the guidance. NHC's 2025 report says GDMI slightly outperformed official forecasts at short ranges in the Atlantic and excelled at 48 to 120 hours in the eastern Pacific. Official forecasts remain issued by NHC forecasters. [1] [2]

What it cost

Not reported

What it saved

Not reported [1] [2]

Governance and control

NHC publishes a homogeneous verification of all guidance against best-track data each year. DeepMind says its live predictions are not official warnings. Contract terms, forecaster procedures and decision rules for using the model: Not reported.

S2 · Accountable owner · Evidenced
NHC issues official forecasts and publishes the annual verification report under named NHC authors. [1]

A1 · Safe use · Claimed
DeepMind states that Weather Lab live predictions are generated by models still under development and are not official warnings. [2]

A2 · Human in the loop · Claimed
DeepMind says NHC forecasters see the predictions alongside physics-based models and observations; the sources do not describe how forecasters weigh it. [2]

A3 · Monitoring and assurance · Evidenced
NHC verified the model's track and intensity forecasts against best-track data in its annual verification report and compared them with its other guidance. [1]

A4 · Vendor AI · Claimed
The model is supplied by Google DeepMind; the sources do not describe an agreement or access terms. [2]

A5 · Agent controls · Not reported
Not reported.

A6 · Standards and regulation · Not reported
Not reported.

What worked, what did not, what is unproven

WORKED

– NHC's report says the Google DeepMind ensemble mean slightly outperformed NHC official track forecasts from 12 to 72 hours in the Atlantic.

– In the Atlantic track comparison the GDMI 120-hour error was 173.1 n mi, against 362.3 n mi for GFSI and 168.5 n mi for the official forecast.

– For intensity, NHC says the official forecasts had comparable skill with the best model, GDMI, at most forecast times in the Atlantic.

– In the eastern North Pacific, NHC says GDMI excelled at 48 to 120 hours for track.

DID NOT

– The model was not available at the start of the season, so the comparison excludes the first two Atlantic storms.

– NHC says official forecasts generally outperformed most dynamical and consensus models, and the Atlantic official 120-hour track error (168.5 n mi) was lower than GDMI (173.1 n mi).

UNPROVEN

– Whether using the AI model improved NHC's official forecast accuracy; the report does not separate its effect for the Atlantic.

– Whether the result holds over more seasons; the 2025 sample is 193 forecasts at 12 hours and 59 at 120 hours.

– DeepMind's launch claim of a 1.5-day gain in 5-day track accuracy over ECMWF's ensemble rests on its internal tests on 2023 and 2024 data.

Timeline

Jun 2025 Google DeepMind launches Weather Lab and says NHC forecasters are seeing live predictions from its experimental models [2]

2025 Google DeepMind ensemble mean (GDMI) available to NHC during the season, though not at the start [1]

Mar 2026 NHC publishes its 2025 verification report, which includes GDMI [1]

2 · Grade and SEAM assessment

MarLuc's opinion, made on the evidence above. How cases are graded: marluc.co.uk/case-studies/how-we-rate

Level of change and impact

Claimed: A. Grade: D, Task support. Proof: Partly proved. Level of change: Task support.

Task support (Level 1, band D). Forecasters have a top-performing AI model as extra guidance, documented in the Center's own verification; official forecast accuracy is not shown to have changed because of it. Transformation of hurricane forecasting is claimed as potential and not proved.

Graded D, claimed A. The transformation is potential and unproven. NHC forecasters now see a top-performing AI model beside physics-based guidance, and the Center's own verification report documents its skill. Official forecasts are still made by forecasters, and the report says official forecasts outperformed most models. The report does not show that the AI model changed NHC's official forecast accuracy, and DeepMind's launch claims of a 1.5-day gain come from its own internal tests.

The SEAM view and lessons learnt

The useful idea is that the forecast user, not the supplier, ran the evaluation, using its own homogeneous verification protocol against ground truth. A model shared as guidance with a human issuing the forecast kept responsibility with the Center while letting it test a new tool in live conditions. The report does not say how forecasters used the output.

1. Evaluate a vendor's model on your own data and protocol before relying on it.
2. Keep a named human forecaster accountable for the official output.
3. Report the periods where the model was missing or lagged, as well as where it led.

Evidence

Score 3 of 4. Independent evaluation by the forecast user: NHC's published verification report against best-track data; the vendor's own claims are separate.

Evaluation method. Official evaluation by the user: NHC's annual verification report, with DeepMind's own announcement as the source for how the model was shared; no peer-reviewed paper opened.

Sources disagree. DeepMind's June 2025 launch says its model's 5-day track prediction was on average 140 km closer to the true location than ECMWF's ensemble in 2023 and 2024 tests. NHC's 2025 Atlantic table shows GDMI close to the official forecast at 120 hours (173.1 against 168.5 n mi), a different test on a single season.

Status. Ongoing: model available to NHC through the 2025 season; evaluation published in March 2026.

3 · Original sources

Read these in full. To challenge a fact or a grade, use the contact form at marluc.co.uk or the link on https://marluc.co.uk/case-studies/nhc-google-deepmind-cyclone-model

[1] National Hurricane Center: Forecast Verification Report, 2025 Hurricane Season (30 March 2026)
https://www.nhc.noaa.gov/verification/pdfs/Verification_2025.pdf

[2] Google DeepMind: How we're supporting better tropical cyclone prediction with AI
https://deepmind.google/discover/blog/weather-lab-cyclone-predictions-with-ai/

National Hurricane Center website: https://www.nhc.noaa.gov

Version 1.0 · Published 15 November 2026 · Updated 15 November 2026 · Facts checked against sources 15 November 2026 · Downloaded 26 November 2026. This PDF may be out of date: the latest version, and a way to report an error or a better source, is at https://marluc.co.uk/case-studies/nhc-google-deepmind-cyclone-model

VERSION HISTORY

v1.0 15 November 2026 First published