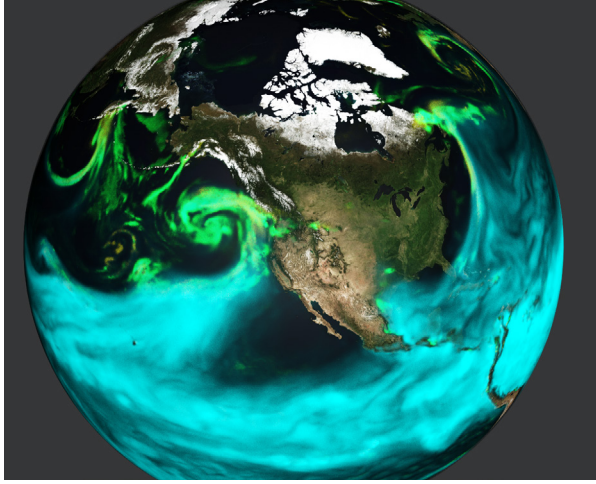
Solution Brief

Predicting Weather With AI

Transform weather and climate prediction with massive AI-generated ensembles.



Extreme weather simulation with FourCastNet.

Introduction

Extreme weather disasters, amplified by climate change, are expected to result in the loss of a million lives and USD$1.7 trillion per year by 2050 (Munich RE). Today's weather forecasts are generated using numerical weather prediction models by over 180 weather modeling centers across the globe. The European Center for Medium-Range Weather Forecasts (ECMWF) high-performance computing facility uses 983,040 CPU cores and the UK Met Office supercomputer has over 1.5 million CPU cores, consuming 2.7 megawatts (MW) of power. Generating an ensemble of many forecasts is essential to estimating probabilities of low-likelihood but high-impact extreme weather events.

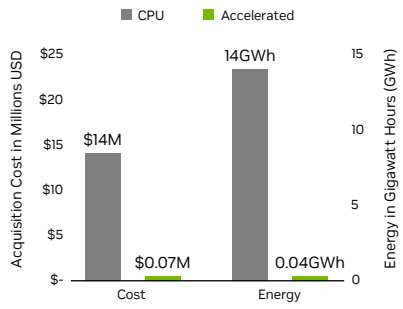
Key Points

- Thousands of applications and industries
- 17 billion CPU hours consumed annually
- 2,000X performance speedup
- $14 million and 14 gigawatt hours (GWh) saved annually

Applications

NVIDIA FourCastNet is a data-driven, generative AI-based weather prediction model that matches the accuracy of the gold standard in numerical weather prediction–ECMWF's Integrated Forecasting System–orders-of-magnitude faster and more energy-efficiently. FourCastNet combines the latest advances in transformers and neural operators, bringing together the best of AI and physics. It's the first of a wave of data-driven, AI-based weather prediction models poised to revolutionize the enterprise of weather and climate prediction. FourCastNet and other AI-based weather and climate prediction models are available open-source through NVIDIA PhysicsNeMo™, a physics-informed machine learning (physics-ML) framework for scientific computing.

200X Lower Cost and 300X Less Energy



ECMWF IFS 51-member ensembles on Intel Broadwell CPUs, FourCastNet 1,000-member ensembles on 4x NVIDIA A100 Tensor Core GPUs. Assumed 10 modeling centers running the same forecast workload.

Use Cases

FourCastNet's speed and accuracy enable unprecedented high-confidence predictions of low-likelihood, high-impact extreme weather events by generating massive 10,000-member ensembles. This could help mitigate extreme weather disasters and better prepare society for the harsh impacts of climate change.

Accelerate, Reclaim, and Save

As the demand for reduced carbon footprint in the compute-intensive enterprise of weather and climate prediction increases, AI-driven weather prediction will be crucial to minimizing environmental impact. It will also provide actionable life-saving weather information. FourCastNet is pioneering the AI revolution in weather and climate prediction.

> "NVIDIA FourCastNet opens the door to the use of AI for a wide variety of applications that will change the shape of the numerical weather prediction enterprise."
>
> **Prof. Dr. Bjorn Stevens**, Director, Max Planck Institute for Meteorology

To learn more, visit: nvidia.com/sustainable-computing

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