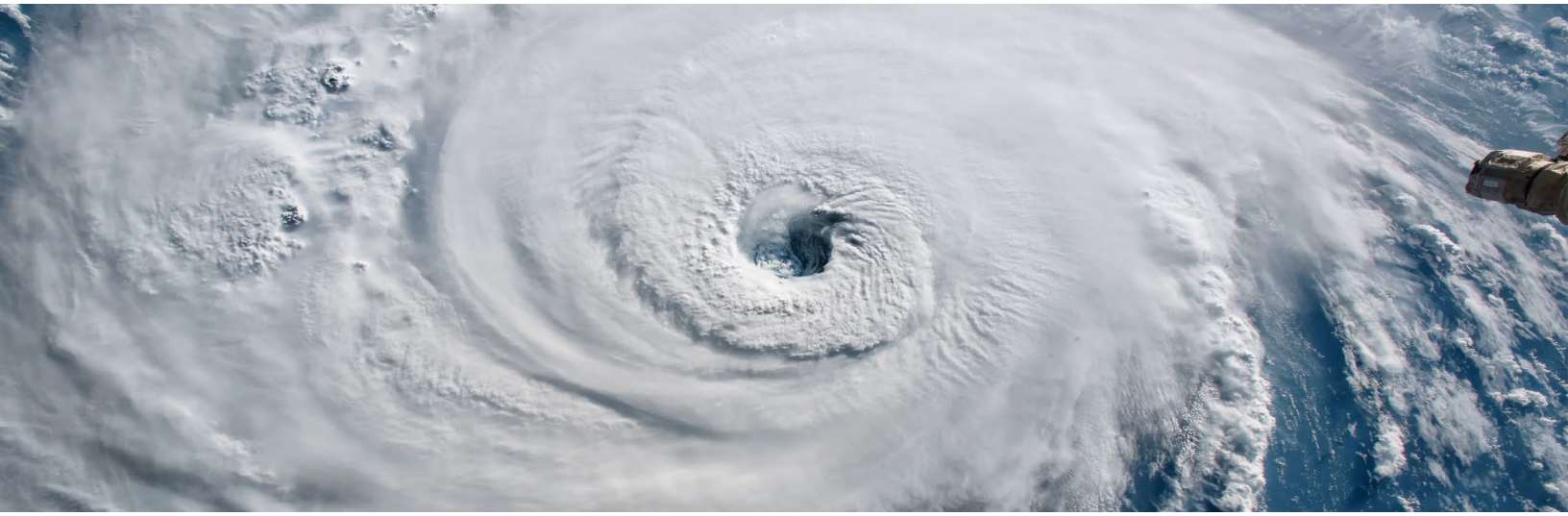
Numerical Weather Prediction

Shrinking **time-to-results** for weather research and forecasting at **extreme scale**



Airline traffic coordination, global shipping and logistics systems, national defense, and disaster preparedness to ensure public safety, all share a fundamental need – fast and accurate weather forecasting. By delivering the highest-resolution weather simulation capabilities and doing so with world-record speed, Microsoft and AMD are empowering stakeholders with critical insights and decision-making tools.

Incorporating simulations into the weather research process addresses several **business challenges:**

Time to Forecast

Rapidly deliver actionable weather predictions to those with compelling need.

Agility

Respond with full command of the right resources, to rapidly evolving situations as they unfold in real time.

High Fidelity

Simulate atmospheric conditions at high resolution in time and space through physics and data assimilation.

Weather events can significantly impact public and commercial organizations, as well as the general population. To deliver the most-accurate forecasts in a timely fashion, Numerical Weather Prediction (NWP) demands parallel computing at scale and Microsoft Azure supports this with:

HBv2 VM **80K** Scaling WRF v4 to 80,000 CPU cores

URL > https://bit.ly/35DlvOt

Azure HBv2 Virtual Machines

HBv2 VMs feature 120 AMD EPYC 7002 Series CPU cores, 340 GB/s of memory bandwidth, and Mellanox 200 Gigabit/sec HDR InfiniBand™.

AMD EPYC™ 7002 Virtual Machines

The EPYC 7002 offers 45% higher memory bandwidth than competitive alternatives and PCIe Gen 4.0 to support the most-advanced networking.

WRF v4

WRF v4 is a mesoscale NWP system that incorporates 2 dynamical cores and data assimilation while supporting parallelism at extreme scale.

Platform performance benchmarks & validation data

Hurricane Maria

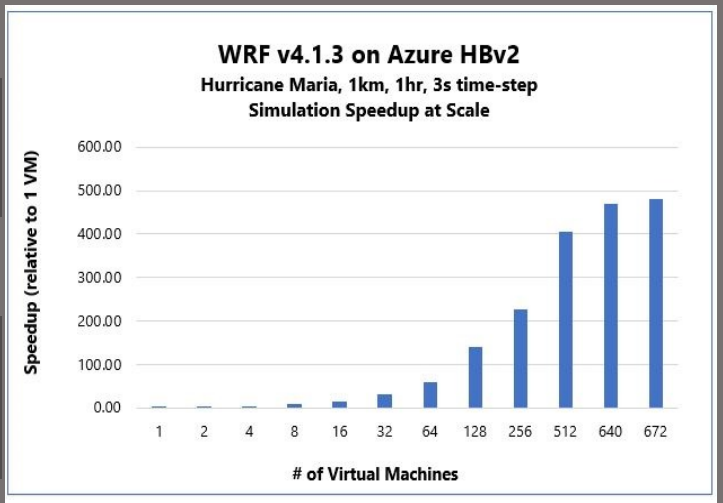
A Category 5 storm that struck the Caribbean in 2017.

The National Center for Atmospheric Research built a 1-kilometer resolution model of the storm with an astounding **371,000,000** grid points.

On Azure HBv2, WRF v4 scales with **90%** efficiency to over 20,000 parallel processes.

WRF ultimately scaled to over **80,000** processes, still achieving over **70%** efficiency, and 2.2X the performance of a supercomputer that debuted in the TOP20 globally.

The time required to complete a **24-hour simulation** of Hurricane Maria was *reduced* from 6 days to **18 minutes** on Azure HBv2.



Note: Even with 371M grid points, WRF model resolution constrains scaling - not Azure HBv2.

Microsoft Azure

HBv2

Virtual Machines

Azure HBv2 virtual machines feature 120 EPYC 7002 Series Processors from AMD. These VMs offer supercomputer-class performance, MPI scalability, and cost efficiency for a variety of real-world high-performance computing (HPC) workloads, such as CFD, explicit finite element analysis, seismic processing, reservoir modeling, rendering, and weather simulation. Specifications:

CPU cores	Memory	Memory per core
120	480 GB	4 GB

Local SSD: GiB	RDMA network	Azure network
1.6 TB	200 Gbps	40 Gbps

AMD

EPYC 7002

Series Processors

AMD EPYC 7002 Series Processors unlock performance and redefine economics for HPC in Azure. AMD works with the open source community to help ensure your applications work exceptionally well with EPYC. AMD's comprehensive coverage of software compatibility and certifications are why Microsoft Azure trusts AMD EPYC processors for its most demanding services. AMD EPYC enables Azure HBv2 customers to achieve ground-breaking HPC performance at a competitive price point.

45%

more memory bandwidth than competitive alternatives

PCIe 4.0

supporting advanced networking capabilities for tightly coupled workloads

Next Steps

[Simulate regional weather with WRF v4 on Azure via AMD EPYC CPUs](https://bit.ly/2Wm3Wzz)
(URL: https://bit.ly/2Wm3Wzz)

Microsoft Azure

AMD