

# Case Study



HPC in the Cloud  
2nd Generation Intel® Xeon® Scalable Processors

# Blue Skies Ahead: ClimaCell Delivers Innovative Weather Prediction Solutions

**2nd Generation Intel® Xeon® Scalable processors, powering Google Cloud C2 nodes, provide the performance, flexibility, and AI-readiness ClimaCell needs for complex weather modeling and micro-forecasting**

*"Accurate and real-time weather prediction can save lives. Google Cloud's Compute Engine C2 instances, powered by 2nd Gen Intel Xeon processors, provide us the exceptional speed (40% better performance on certain models) and scalability we need to provide our clients detailed and accurate micro-forecasts. Migrating our innovative solution to the cloud is a massive undertaking. Without the excellent support levels Intel and Google Cloud provide us, we'd be using outdated solutions."*

-Dan Slagen, chief marketing officer, ClimaCell



## Executive Summary

[ClimaCell](#) disrupts today's weather prediction industry with all-new tools and an Application Programming Interface (API) for high precision micro-forecasting. That information helps ClimaCell's clients make more informed operational decisions to increase efficiency, reduce costs, and minimize employee safety risks. The global API platform runs on Google Cloud Compute Optimized instances (C2) featuring 2nd Generation Intel Xeon Scalable processors to deliver a high performance computing (HPC) solution. The combination provides ClimaCell's unique business model a fast and scalable solution to accommodate massive datasets and artificial intelligence (AI) assisted modeling.

## Challenge

In the past, accurate weather prediction proved a daunting task. ClimaCell's government and enterprise clients needed better ways to understand current and future weather patterns. That actionable information helps clients mitigate business and safety consequences caused by severe weather conditions. ClimaCell's micro-forecasts gather weather data from government sources, Internet of Things (IoT) devices, connected cars, wireless signals, drones, and other proprietary data. Making sense of the enormous data volumes, and forming accurate predictive models using it, requires high-performance computing (HPC) systems that can accommodate heavy workloads.

## Solution

By incorporating AI into their detailed analysis process, ClimaCell can maximize its predictive services to produce a holistic and highly accurate model of impending weather conditions. After rigorous proof-of-concept testing, ClimaCell selected Google Cloud's Compute Engine C2 instances, powered by 2nd Generation Intel Xeon processors with AI acceleration built-in. The infrastructure solution offers the scalability, performance, and cost-effectiveness needed to process and interpret the broad mix of data.

Driven by 2nd Generation Intel Scalable Processors, CPU-only C2 machine types offer up to 3.8 GHz of sustained all-core turbo boost. The instances also provide transparency into the architecture of the underlying server platforms, letting users fine-tune the performance. Compared with N1 high-CPU machine types, C2 machine types offer much more computing power, run on a newer platform, and are generally more robust for compute-intensive workloads. The C2 instances also scale globally as needed.

Intel Xeon Scalable Processors are architected to deliver performance leadership across a broad range of demanding workloads. 2nd Generation Xeon Scalable processors are the only data center CPU with AI acceleration built in. The C2 instance with the 2nd Gen Intel Xeon Scalable processor scales up to 60 vCPUs with exceptional memory bandwidth per vCPU.

### Spotlight on ClimaCell

ClimaCell offers people and organizations the best weather insights through big data collection and exclusive analysis and modeling approaches. By providing its clients with highly accurate micro-forecasts, ClimaCell solutions offer invaluable business insights. ClimaCell's patented MicroWeather technology engine gathers Weather of Things data from wireless signals, connected cars, drones, and other devices. By combining that data with proprietary AI-driven models, insights from ClimaCell solutions improve safety, operational efficiency, and profitability.

### Spotlight on Google Cloud

Google Cloud solutions help customers solve their biggest business challenges through outstanding technology and a toolset engineered for ease of use. As a leader in cloud services, Google Cloud provides customers a holistic solution for data security, intelligent analytics, and hybrid or multicloud solutions. Today, customers in over 150 countries trust Google Cloud to modernize their computing environment to bring ideas, insights, and people together.

Customers can make reservations to ensure their applications have the capacity required for scale. Together, these features simplify integration and help users derive more value from their hosted environment.

In addition, ClimaCell used Intel® compilers and Intel® MPI with their code to help boost weather forecasting application performance on C2 instances. The Intel software helps maximize the code's performance by utilizing the latest hardware instructions (such as Intel® AVX-512), optimally use all the cores and memory footprint, and help the code scale without degradation among multiple C2 nodes.

### Results

To find the instance that would provide the best micro-forecast performance, ClimaCell performed internal benchmarking of the proof-of-concept solution, comparing a Google Cloud C2 instance with previous-generation N1 clusters. With the C2 instances, ClimaCell achieved 40% better price/performance<sup>1,2,3</sup> than the N1 instances. The Google Cloud Compute Engine C2 nodes also address ClimaCell's unique needs for elasticity. The cloud solution can spin up additional nodes whenever workloads require it.

### Advanced Cloud-based Weather Modeling Enables Breakthroughs for Multiple Industries

With real-time insights, ClimaCell's enterprise customers derive value from the service in multiple ways:

- A major airline taps ClimaCell data to increase passenger safety and minimize operational costs. With ClimaCell solutions, the airline can determine in advance when extreme weather conditions pose a safety risk or impact flight times. In the winter, micro-predictions can also inform staff if their planes require de-icing before takeoff. By providing insights like these, the airline claims that ClimaCell's weather prediction technology saves the company \$50,000 per month per airport hub.
- A large investment trust owns power transmission infrastructure across India. In 2020, a cyclone posed an unprecedented safety threat to the region. With the assistance of ClimaCell technology, the company found it was able to predict the path of the cyclone and determine which of its hundreds of locations were at risk. ClimaCell solutions identified the two vulnerable sites, allowing their client to prioritize their attention on the safety and service at those specific locations.
- A professional football team in the United States depends on ClimaCell to mitigate operational challenges. With insights about the approaching weather, managers can determine the best times to water or paint the football field. They can also plan for snow, or halt operations when lightning storms approach. The team asserts that the combination of benefits reduces the cost of stadium upkeep and reduces risk to staff.
- ClimaCell.org solutions offer weather prediction capability to the 5 billion people living in regions where traditional weather forecasting technologies do not reach. In parts of Africa, for example, ClimaCell solutions help farmers determine the ideal time to plant crops. With foreknowledge of coming weather, farmers can lessen the cost of field maintenance and maximize crop yields.
- A class-A railroad uses ClimaCell technology to predict weather patterns that could impact train travel. In one case, the railroad found the weather model predicted 90 mile-per-hour winds along their route of travel. By delaying the trip, the train avoided the possibility of a dangerous and costly derailment.

### Key Takeaways

- ClimaCell's micro-forecasts derive from a mix of proprietary and publicly available weather data that is combined and processed using HPC-driven AI, simulation, and modeling workloads.
- With the underlying support of 2nd Generation Intel Xeon Scalable Processors and Intel software, Google Cloud C2 nodes provide a fast, highly elastic, scalable, and AI-ready solution.
- Google Cloud's Intel-based HPC solution provides ideal price-performance for ClimaCell's unique business service.

## Google Cloud's Compute Optimized (C2) HPC Instances<sup>3</sup>

Machine Name	vCPUs <sup>4</sup>	Memory (GB)	Max number of persistent disks (PDs) <sup>5</sup>	Max total PD size (PD)	Local SSD	Network egress bandwidth (Gbps) <sup>6</sup>
c2-standard-4	4	16	128	257	Yes	10
c2-standard-8	8	32	128	257	Yes	16
c2-standard-16	16	64	128	257	Yes	32
c2-standard-30	30	120	128	257	Yes	32
c2-standard-60	60	240	128	257	Yes	32

C2 machine types have the following restrictions:

- You cannot use regional persistent disks with compute-optimized machine types.
- C2 machine types are subject to different disk limits than general-purpose and memory-optimized machine types.
- C2 machine types are only available in select zones and regions.

· C2 machine types are only available on select CPU platforms.

- Caution: C2 machine types do not support GPUs.

### Learn More

Find out more about [Intel Xeon Scalable Processors](#)

Find out more about HPC Best practices in [Google Cloud on C2 instances](#)

Learn more about [ClimaCell](#)

Read additional information about [Google Cloud](#)

Find the HPC solution that is right for your organization.

Contact your Intel representative or visit [www.intel.com](http://www.intel.com)

### Footnotes

- <sup>1</sup> "The new Compute-Optimized VMs offer a greater than 40% performance improvement compared to current GCP VMs." Bart Sano, VP of Platforms, Google Cloud. Learn more [here](#).
- <sup>2</sup> From Google Cloud's CPU platforms page: Learn more here. C2 instance all-core turbo CPU frequency is 3.8 GHz, with the lowest first-generation N1 machine type base frequency being 2.0 GHz. Note, all-core turbo not available for first generation N1 instances. Improvement from 2.0GHz to 3.8GHz=40%. Also see <https://cloud.google.com/blog/products/compute/expanding-virtual-machine-types-to-drive-performance-and-efficiency>
- <sup>3</sup> Information provided by Google. See <https://cloud.google.com/blog/products/compute/introducing-compute-and-memory-optimized-vm-for-google-compute-engine>
- <sup>4</sup> A vCPU is implemented as a single hardware Hyper-thread on one of the available [CPU platforms](#).
- <sup>5</sup> Persistent disk usage is charged separately from [machine type pricing](#).
- <sup>6</sup> Network egress bandwidth is up to the specified limit. Actual performance depends on [factors](#) such as network congestion or protocol overhead.



Software and workloads used in performance tests may have been optimized for performance only on Intel microprocessors.

Performance tests, such as SYSmark and MobileMark, are measured using specific computer systems, components, software, operations and functions. Any change to any of those factors may cause the results to vary. You should consult other information and performance tests to assist you in fully evaluating your contemplated purchases, including the performance of that product when combined with other products. For more complete information visit [www.intel.com/benchmarks](http://www.intel.com/benchmarks).

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