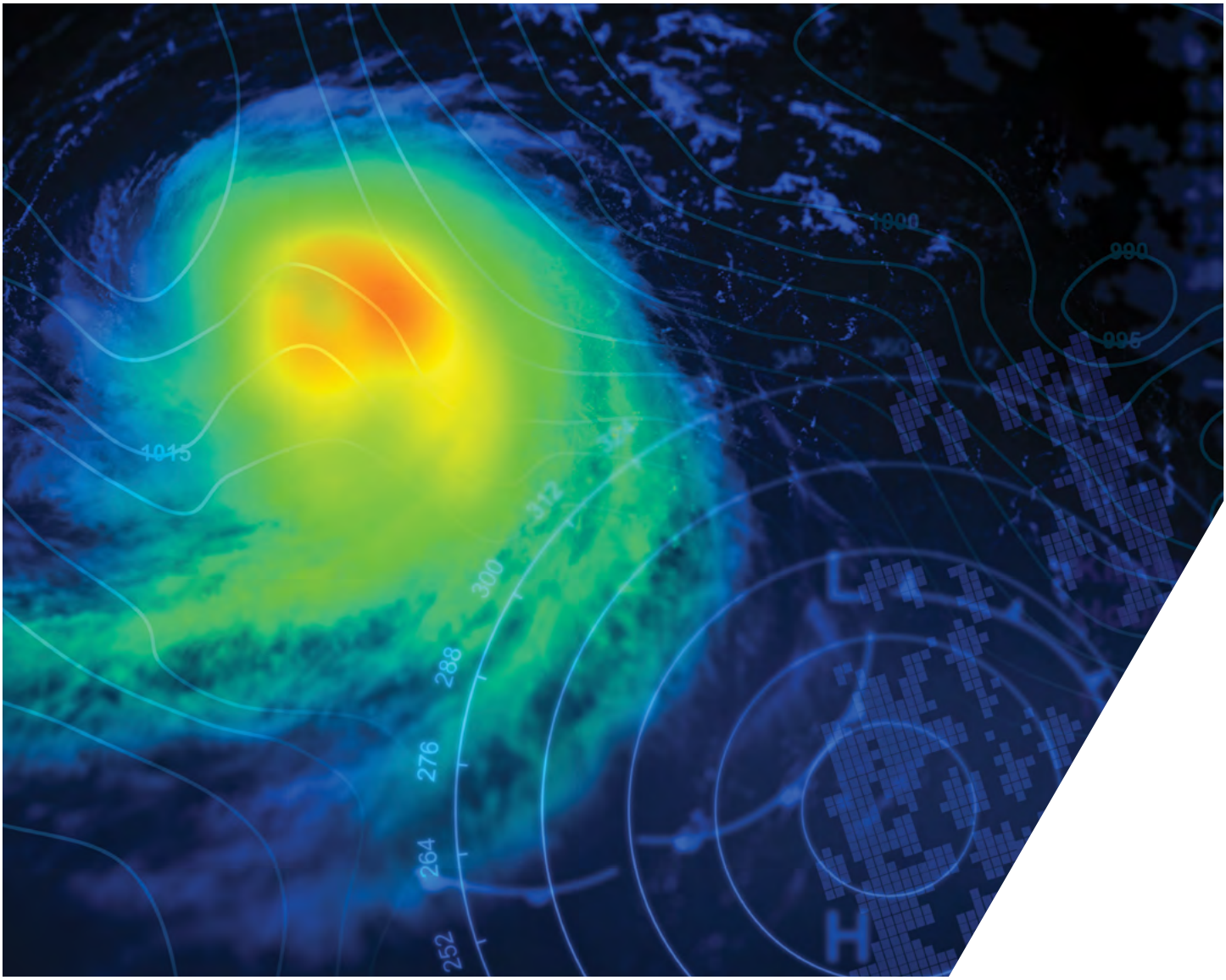


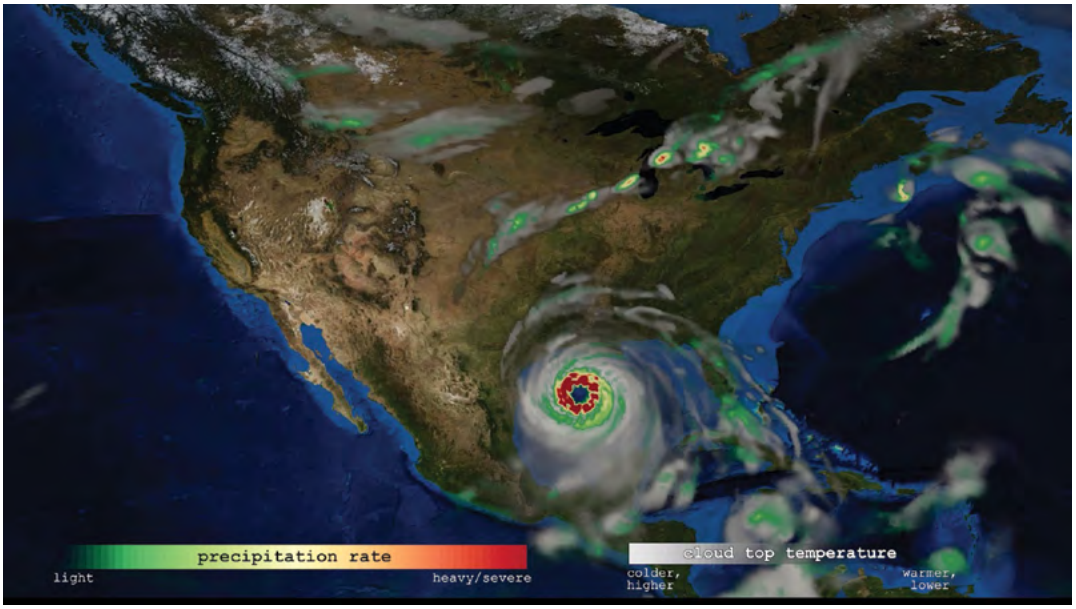
PREDICTING GLOBAL WEATHER & CLIMATE

NEW NCAR HPC SYSTEM EXPECTED TO ACHIEVE OVER 3X FASTER PERFORMANCE

About the Customer

High-performance computing (HPC) systems at the National Center for Atmospheric Research (NCAR) power the science behind global weather and climate prediction and research. In early 2021, NCAR announced that their Cheyenne supercomputer, located at the NCAR-Wyoming Supercomputing Center (NWSC), will be replaced by a new HPE Cray EX system with 3.5x more processing power, up to 19.87 petaflops with a combination of CPU and GPU nodes. The new system will be funded by the National Science Foundation (NSF) and will include efficient workload management and scheduling by Altair® PBS Professional® and Altair Accelerator™ Plus.

> “This new system is a major step forward in supercomputing power, providing the scientific community with the most cutting-edge technology to better understand the Earth system.
>
> Anke Kamrath, Director, NCAR’s Computational and Information Systems Laboratory



HPC at NCAR is critical for studying phenomena from terrestrial weather patterns to solar storms.

Left: Image ©University Corporation for Atmospheric Research
Right: Image by Matthias Rempel, ©University Corporation for Atmospheric Research

Their Challenge

The global challenge of understanding, simulating, and predicting the behavior of weather systems, climate patterns, and other atmospheric phenomena is critical for Earth and for everyone on it. **Keeping up with climate change** and the understanding the actions we must take to preserve our planet and its diversity of life requires powerful, sophisticated computing resources. To predict what happens next NCAR needs the latest, most powerful and fully featured HPC solutions to enable weather and climate research.

Our Solution

NCAR already relies on PBS Professional for workload orchestration on Cheyenne. The team was running Slurm on their "Casper" data analysis and machine learning system, but they switched to PBS Professional to take advantage of **advanced scheduling features and Altair's expert support**. The Altair solution will keep jobs running smoothly on the new HPE Cray system and will introduce features such as **cloud bursting for near-infinite scalability** — a requirement when it's critical to quickly understand harsh weather conditions in places like Antarctica. With a limited window of opportunity to fly goods, equipment, and people onto and off of the frozen continent, knowing exactly what to expect is paramount to safety and efficiency. PBS Professional also enables the NCAR team to use live fairshare data in job sort formulas and allows HPC administrators to make maintenance reservations. PBS Professional reservations are robust and can replace down nodes during the life of a reservation. Additional features on the new NCAR system will include **high-throughput hierarchical scheduling** with Accelerator Plus for greater throughput, better license and resource utilization, and more flexible scheduler usage models. This will help NCAR develop and test the Weather Research and Forecasting (WRF) model for atmospheric research and operational forecasting applications.

Results

The new system, dubbed "Derecho" — a powerful type of storm — in a competition among Wyoming K-12 students, is slated for delivery in late 2021 and production in early 2022. It will replace NCAR's Cheyenne and Laramie systems and is **expected to rank among the top 25 supercomputers** on the Top500 list. "With its extra storage and a 3.5-fold capability improvement over the current NCAR supercomputer, Cheyenne, the new supercomputer will provide the necessary resources for our scientists to continue **expanding their research in the atmospheric and geospatial sciences**," said Irfan Elahi, project director for the new system and director of NCAR's High-Performance Computing Division. "To provide this capability, the new supercomputer is designed for highly energy-efficient operations and by exploiting the workload manager and job scheduler features like green provisioning and energy-aware scheduling."