NOAA

Earth System Research Laboratory (ESRL)
Global Systems Division (GSD)
Putting tools in the hands of users
Gaming Technology Speeding up Science

The GPU Tesla gaming card by NVIDIA; innovative technology to power our science. Development is underway in NOAA's Earth System Research Laboratory to explore these powerful processors for research.

Example of a high-resolution weather model-called the FIM that runs faster and uses less power on a GPU. Graphic by Evan Polster.

NOAA supercomputer. It takes up more space and power than the proposed GPUs, and is more expensive and less reliable. Photo by Will von Dauster.

Next Generation of High-Performance Computing

New regional and global models are being developed that will require over 200,000 computer-processing units (CPUs) in order to improve prediction of hurricanes, and other severe weather events. NOAA researchers are exploring cutting-edge, high-performance computer architectures to handle these enormous computational demands. The key to solving this dilemma lies in affordable, powerful processors called graphics-processing units or GPUs, designed for life-like video games.

Why Explore GPUs?

- Reliability: Accurate weather forecasting depends on reliability. By their sheer size, large CPU systems are more complex and sensitive to individual component failure than GPUs with equivalent processing power.

- Economics: GPUs are 10 – 20 times cheaper than CPUs for equivalent performance. They also consume less power and space.

- Efficiency: GPU microprocessors execute work in small batches using memory more effectively so computations are never waiting in line.

- Speed: ESRL/GSD has demonstrated that weather models can run 5 to 10 times faster on GPUs than on traditional multi-core CPUs.

- Limitations: NOAA's current supercomputer architecture will be unable to operate next generation environmental models under development.

Revolutionary Advancement Requires Relentless Research

ESRL/GSD has made exciting progress since beginning to use GPUs for their advanced computing, and now NOAA looks at ESRL/GSD to continue this revolutionary research. Many uncertainties still remain and a lot of work lies ahead. GSD perseveres with creative solutions.

Our goal is to provide technology that meets the needs of NOAA environmental modeling programs such as the Hurricane Forecast Improvement Program (HFIP), Warn-on-Forecast, and the National Weather Service's Next Generation Aviation Weather Program.

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