Empowering Cloud-Resolving Models Through GPU and Asynchronous I/O

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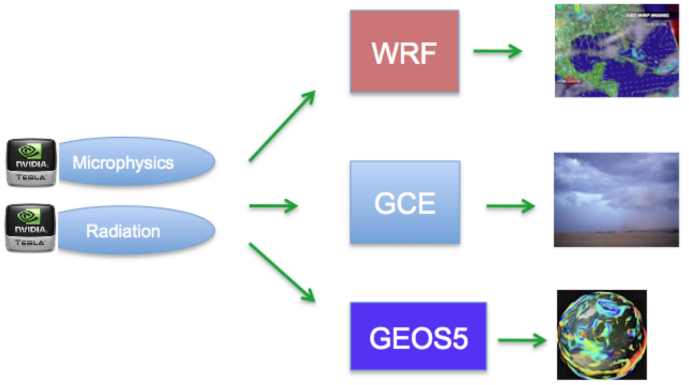
Objective

Facilitate use of Goddard Cumulus Ensemble (GCE), Weather Research and Forecasting Model (WRF), and Goddard Multi-scale Modeling Framework (MMF) with bin microphysics schemes that model aerosol-cloud-radiation interaction to:

- remove the largest source of uncertainty in climate modeling
- allow large-domain, long-term integrations to significantly improve the modeling capability of the aerosol effects for weather prediction and climate change studies



GPU-accelerated components on hurricane forecasting (upper), cloud formation (middle) and climate study (lower)

Accomplishments

- Port computationally intensive the microphysics and radiation components of Cloud-Resolving Models (CRMs) to Graphics Processing Units (GPUs) to run faster
- One-moment microphysics tests showed that the wall-clock time with the GPU was reduced at a ratio of 3.7 x
- Radiation microphysics tests showed that the wall-clock time with the GPU was reduced at a ratio of 2.54 x
- Developed an asynchronous input/output (AsyncIO) tool to improve model efficiency
- Developed a data compression mechanism to further increase the I/O data rate

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$TRL_{in} = 2$ $TRL_{out} = 4$