How to Develop Ultra High-Resolution GFDL Climate-Weather Models for an Exascale System at ANL

Presented by

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November 30, 2009

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Outline:

- Introduction
- Software Infrastructure Projects:
  - Completed
  - Current
  - Proposed
- Initial Climate-Weather Experiments
- Computational Requirements for Experiments
- Summary

Introduction:

- Develop GFDL's climate-weather models for Exaflop platform at ANL
- Create ANL-GFDL partnerships in climate-weather and computational science
- Create model *consortium* for climate-weather community

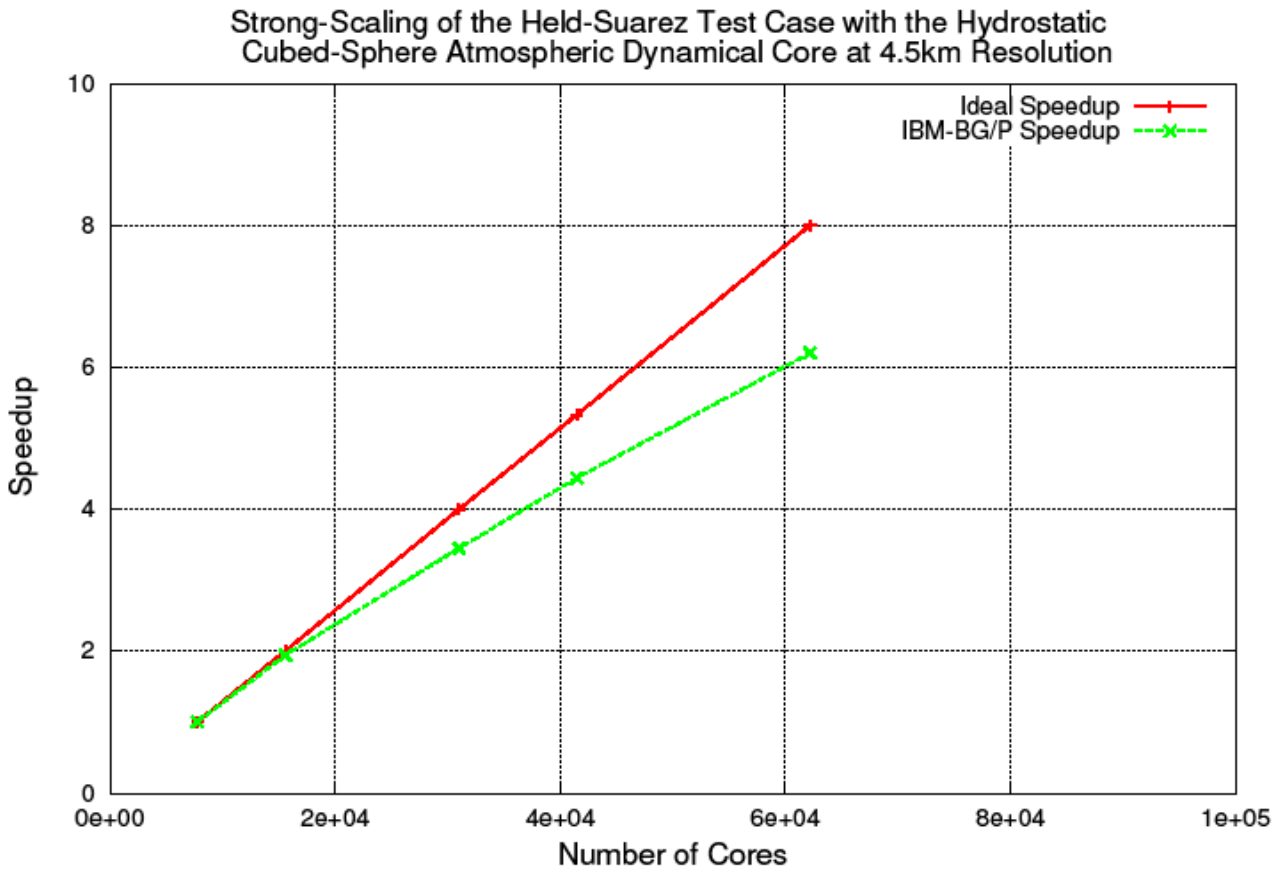
Software Infrastructure Projects – Completed:

- Flexible Modeling System (FMS)
- FMS Model:
  - Hybrid programming model
  - Memory footprint
  - I/O scheme
- FMS Support:
  - Pre- and post-processing scripts
  - Data transfer between ANL and GFDL

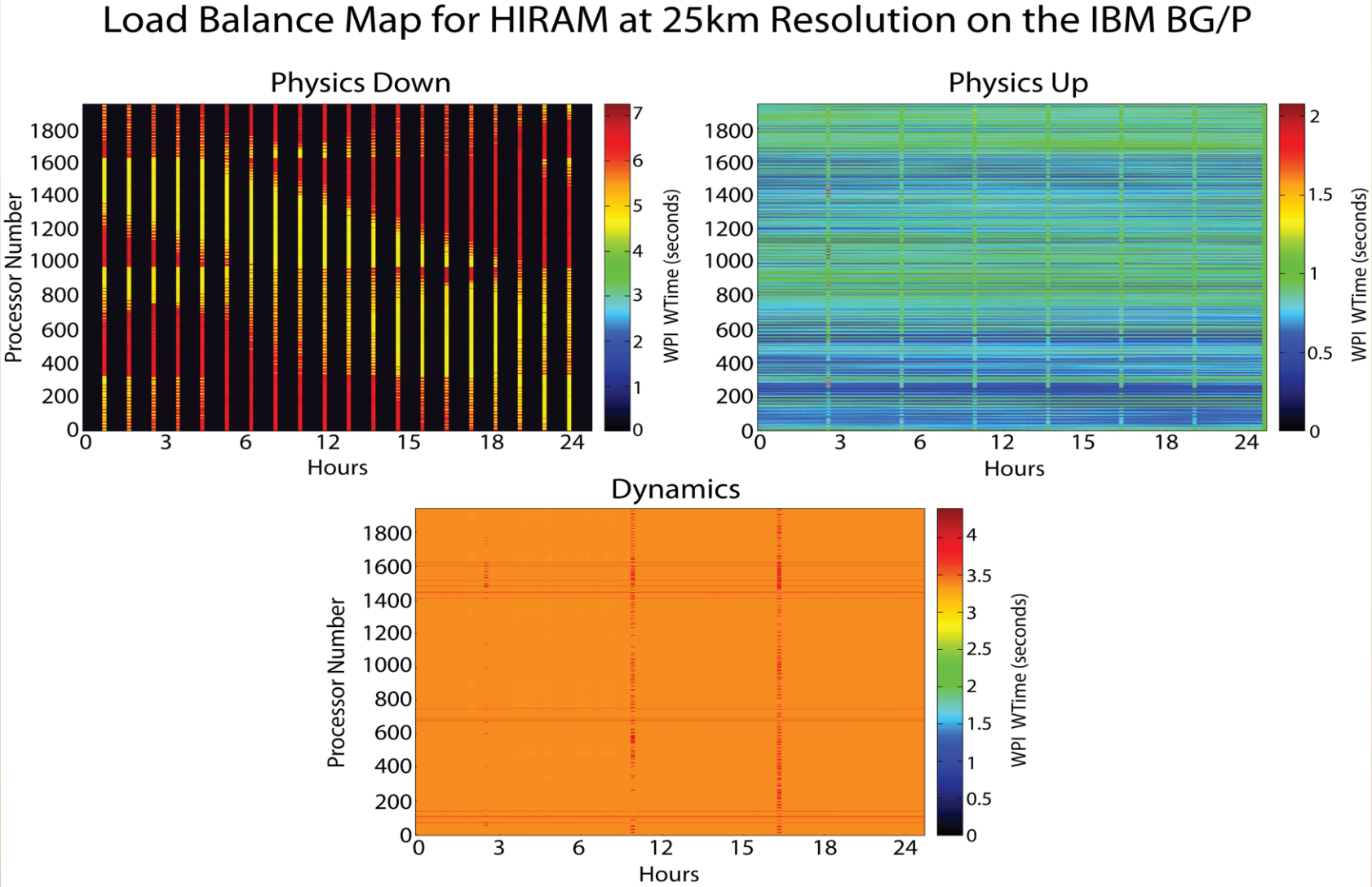
Software Infrastructure Projects – Current:

- Enable latest models to run at ANL
- Produce scalable pre- and post-processing
- Performance studies of models

Performance of Held-Suarez Test Case at 4.5km



Load Balance of HIRAM at 25km Resolution



Software Infrastructure Projects – Proposed:

- Performance improvements on: IBM-BG/P and projections on: IBM-BG/Q
- I/O model infrastructure
- Enable support infrastructure to run at ANL

Software Infrastructure Projects – Proposed:

- Data transfers between ANL and GFDL
- Gateway for community consortium
- Animations for communications

Initial Climate-Weather Experiments:

- Validate dynamical core with Held-Suarez test case. (12km and 4.5km)
- Perform short-term experiments for 2008 hurricane season. (12km and 4.5km)
- Perform multiple realizations for entire 2008. (12km)

Results for Held-Suarez Test Case at 4.5km

Held-Suarez Test Case with the Non-Hydrostatic Cubed-Sphere Dynamical Core at 4.5km Resolution

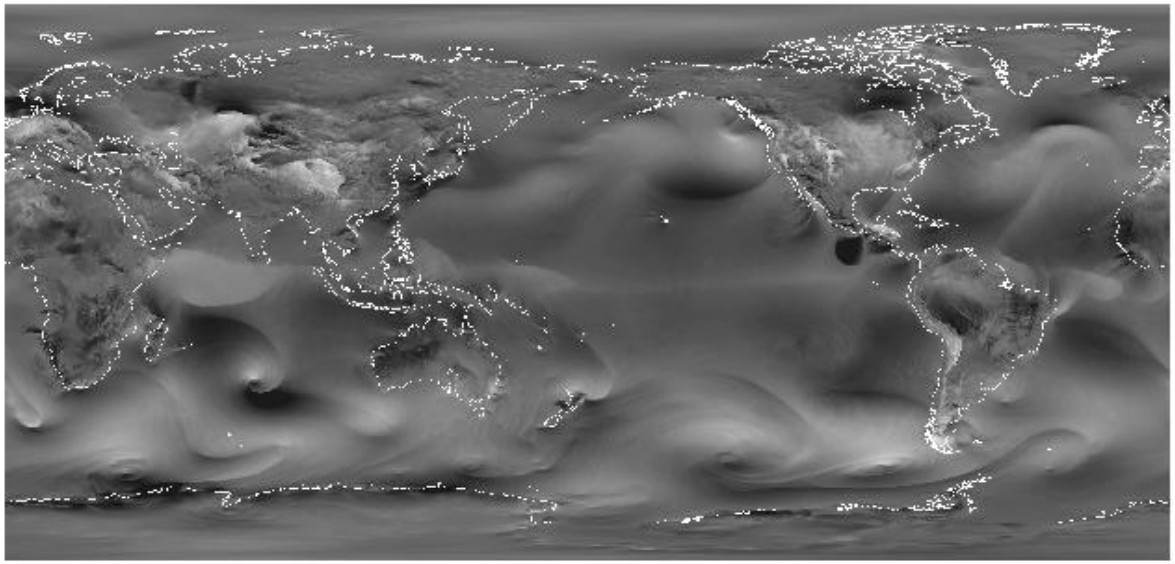


Figure 1 *Day 5: Zonal Wind (m/sec)*

Computational and Storage Requirements:

Model Resolution	Computational Performance	Number of Cores	Storage Requirement
12 km	0.33 hours/ model day	7,776	25GB/day
4.5km	0.40 hours/ model day	77,760	200GB/day

Computational and Storage Requirements:

- 25-30M CPU hours on IBM-BG/P
- Generate 43TB of data
- Data initially post-processed at GFDL
- Data post-processed at ANL

Summary:

- Develop GFDL's climate-weather model for Exaflop platform at ANL
- Create GFDL-ANL partnership for climate-weather and computational science
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Questions:

Presentation will be made available at:

www.gfdl.noaa.gov/chris-kerr-homepage