



Climate in a Box

Current Status and Project Plans
Briefing to Climate in a Box Workshop



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Goddard Space Flight Center

March, 2010

Overview



Develop & improve our models through a more efficient open development environment

Get the models into the hands of the investigators much faster than we do today

Go beyond the traditional domain scientists for model development and validation

Models remain difficult to use – Valuable time is wasted helping new users spin up

Computing is not managed in a way that is friendly for the end user



Investments to Date



Global Forecast System (GFS)

Gridpoint Statistical Interpolation (GSI)

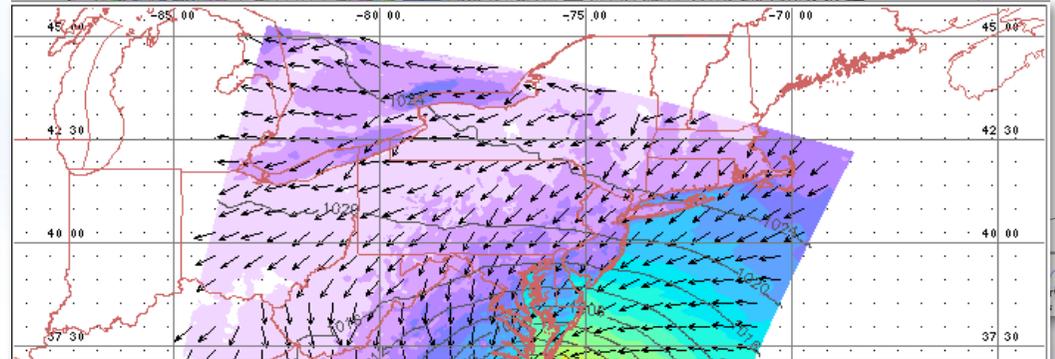
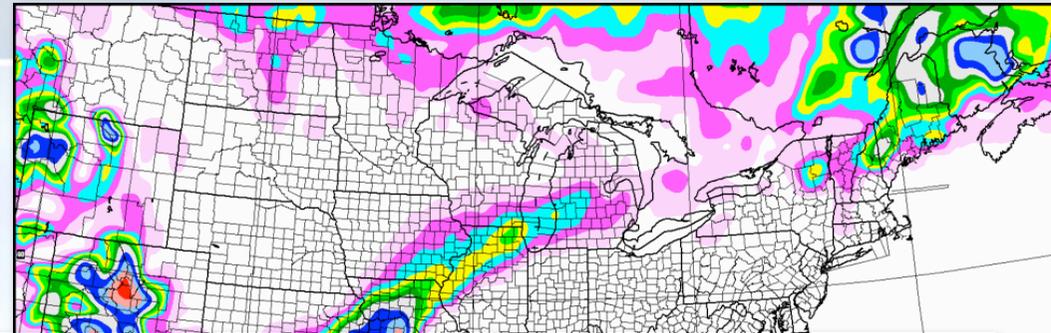
Goddard Earth Observing System - 5th Generation Model (GEOS5)

Weather Research & Forecasting (WRF) Model

Visualization Tools

Workflow Tool

Modeling Guru (social networking tool)



NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

Modeling Guru Beta

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[NASA Modeling Guru](#) > [Atmospheric Chemistry Models](#) > [G-Trajectories](#) > Documents

[Up to Documents in G-Trajectories](#)

Building and installing GTRAJ VERSION 12

Created on: Feb 23, 2010 6:45 PM by Carlos Cruz - Last Modified: Mar 10, 2010 8:32 AM by Carlos Cruz

NOTE: for a quick install - on DISCOVER - see helper script at the bottom of this page.

The model code is available from the CVS repository at <http://progress.gsfc.nasa.gov> in which an account is required. Before downloading the program, it is useful to start by setting the following environment variables in order to specify the remote login program and to point to the location of the root directory of the source code. (Note that this requires some additional settings for version control over SSH. Please see <https://progress.nccs.nasa.gov/trac/admin/wiki/QuickStart>.) For example, if you are using csh:

```
setenv CVS_RSH ssh
setenv CVSROOT progressdirect:/cvsroot/gtraj
```

Or, if using bourne shell:

Actions

- [View as PDF](#)
- [View print preview](#)

More Like This

- [Nightly regression tests](#)
- [vcdat on discover](#)
- [CDAT Related Tools](#)
- [pFUnit unit testing framework for Fortran](#)
- [How to build GEOS-5 \(AGCM\)](#)

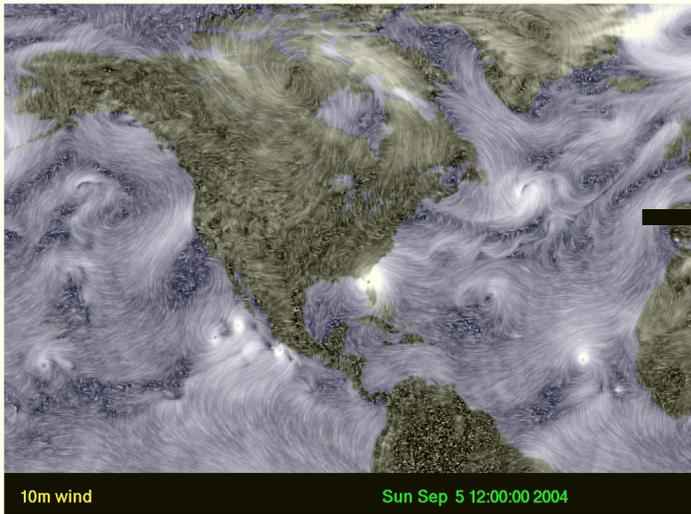




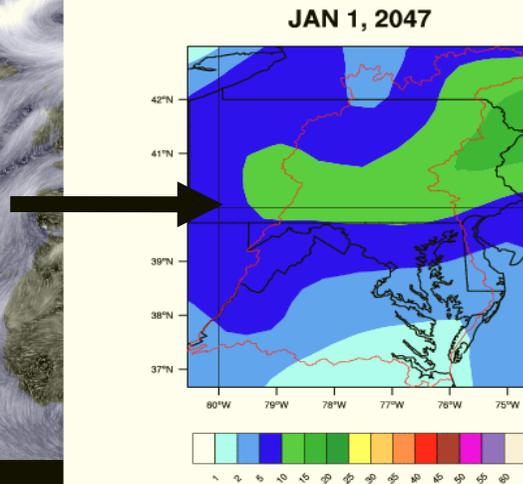
Downscaling Example

Dynamic Downscaling: Scales That Matter to Decisions

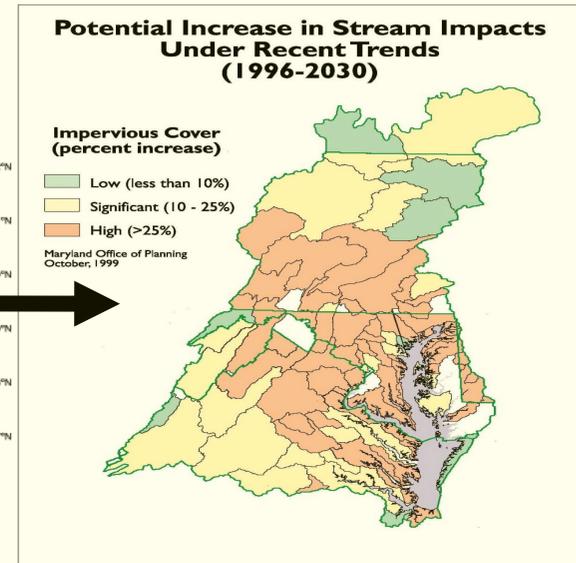
GLOBAL MODEL



REGIONAL MODEL



REGIONAL DECISIONS



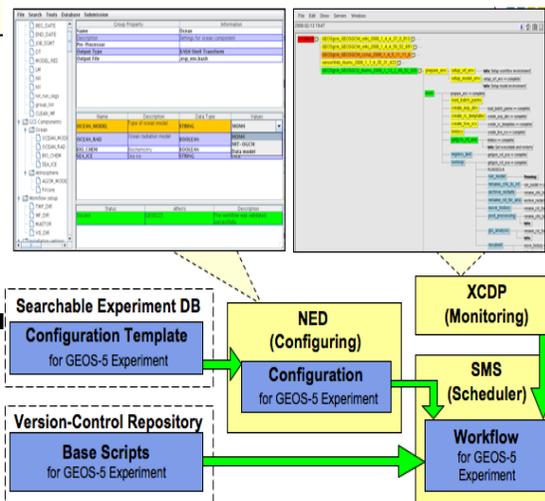
MULTI-MODEL ENSEMBLES OR IPCC SCENARIOS

Figure 5-8. Great stretches of the Chesapeake Bay watershed will likely see more areas covered by impervious surfaces—roads, highways, driveways, rooftops, and parking lots. The areas most acutely affected (see map) will experience increases of 25 percent or more in impervious cover, if recent trends persist.

PRE-CONFIGURED FOR REGIONAL SECTOR



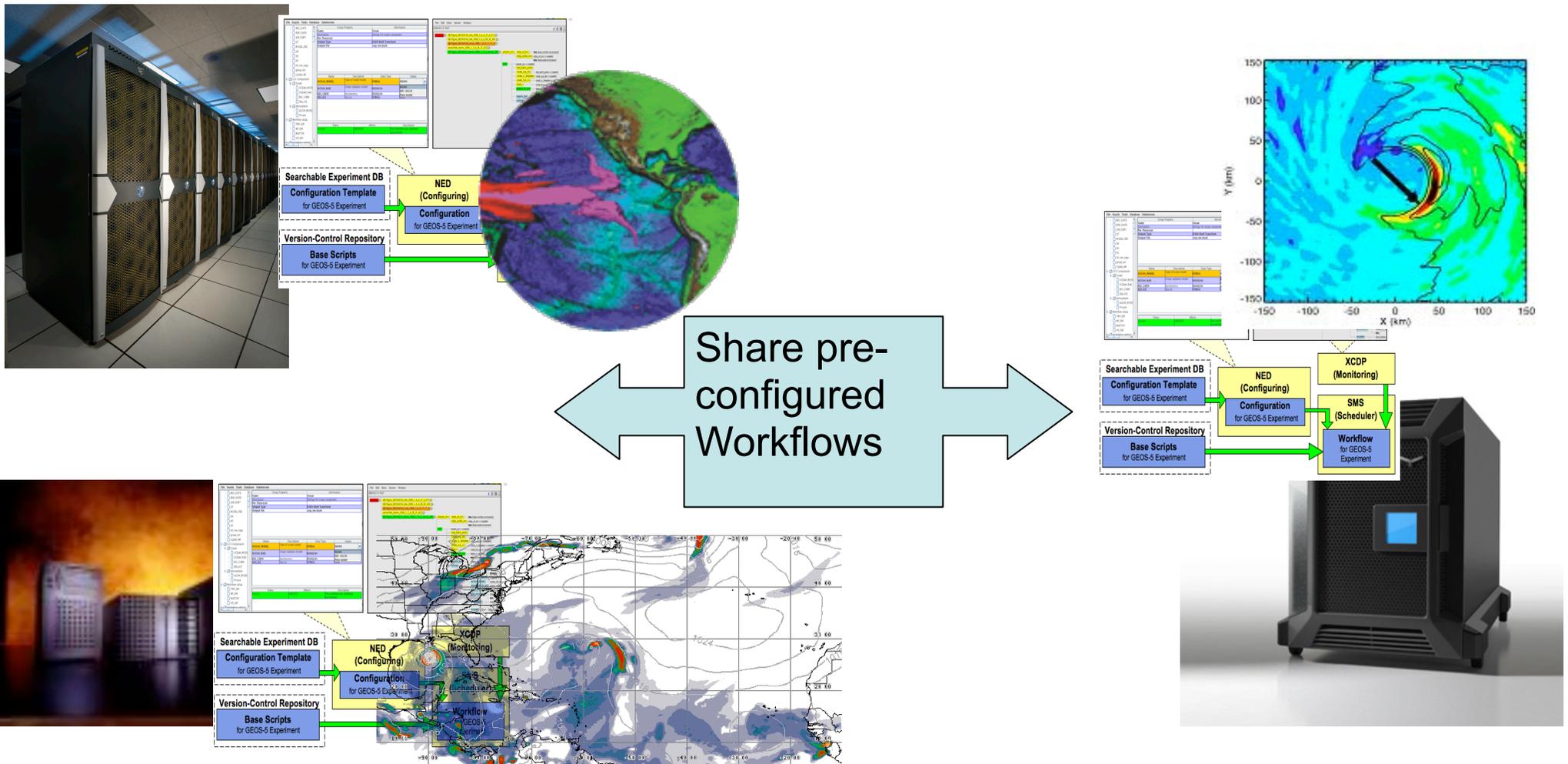
Courtesy: G. McConaughy





“Shared Workflow”

- Shift from Local Model Runs to Larger Facility to Obtain Greater Numbers of CPUs, or
- Collaborate among Ensemble, or
- Use Global Model Output to Drive Regional Models
- Using Pre-Configured “Workflow Sharing” Support Global and Regional Modeling
- Access to common data system & tools (PCMDI/ESG portal, NOAA Global Interoperability Program)





**Software
Integration
and
Visualization
Office
(SIVO)**

Climate-in-a-Box: Status Update

Rahman Syed, AMTI

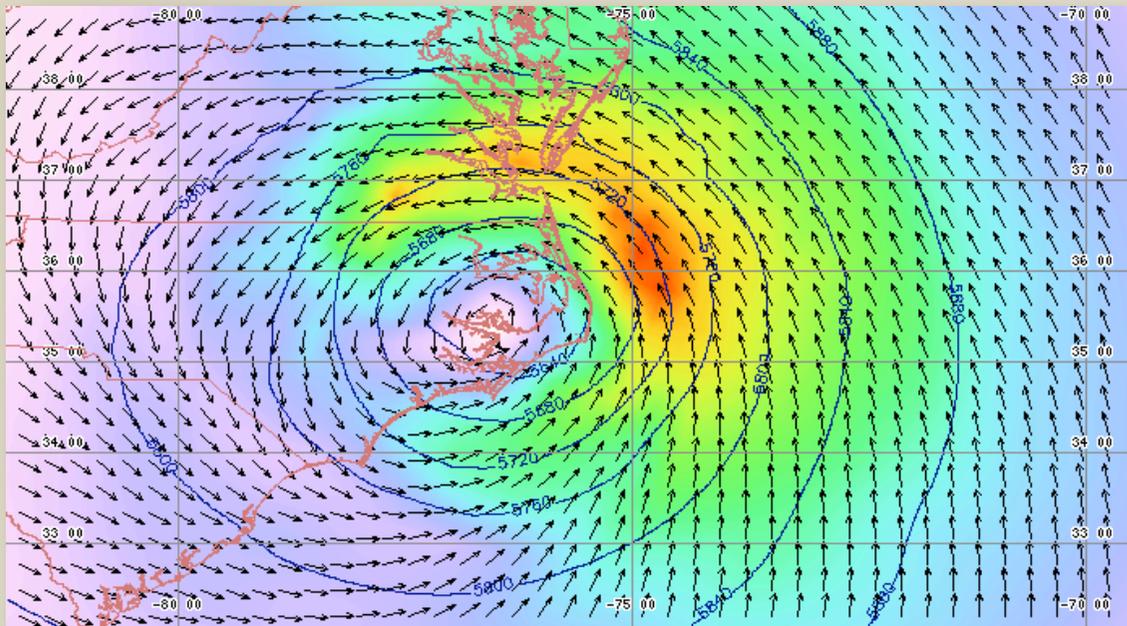
Mar 22, 2010: Climate-in-a-Box Workshop

Sunday, March 21, 2010

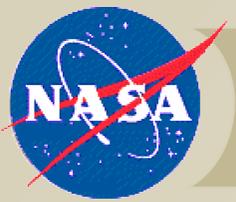


Model Porting Status

- Linux CX1
 - WRF, ModelE, GEOS-5 GCM have been run successfully and validated



- GFS and LIS have run successfully and will be validated

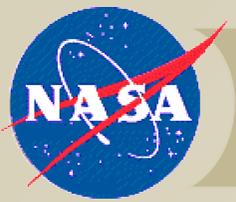


Model Porting Status

- Windows HPC CX1
 - ModelE built serially in Visual Studio
 - Incorporated PGI's port of WRF to Visual Studio 2008 into our Windows environments



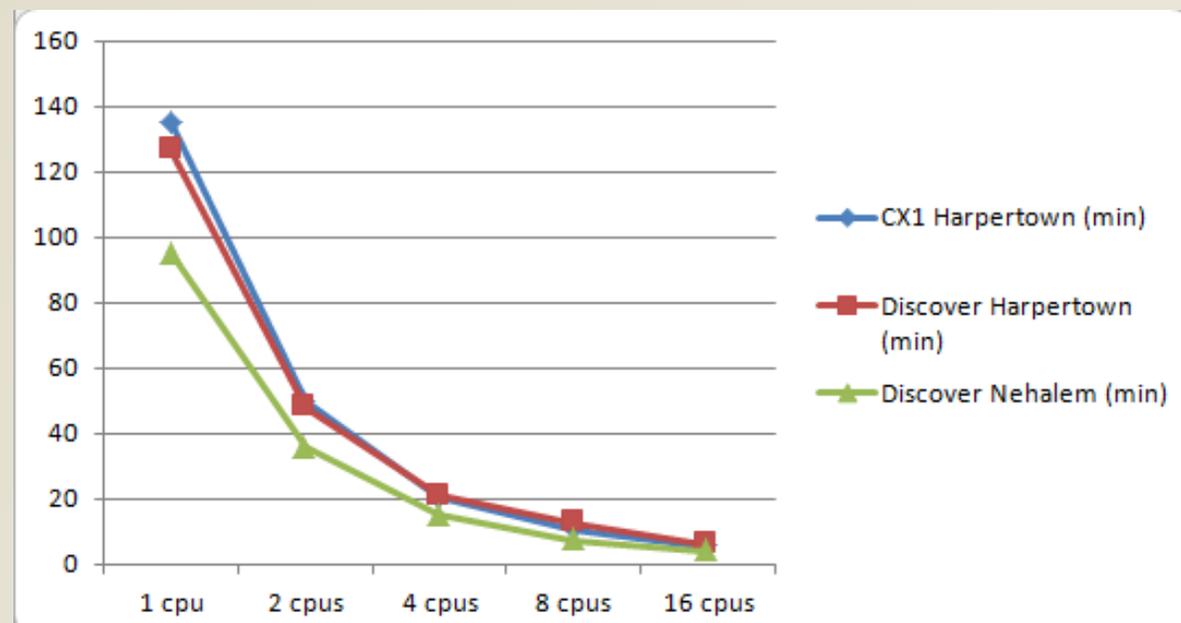
- Various models can be run from cygwin, command-line emulated Linux environment

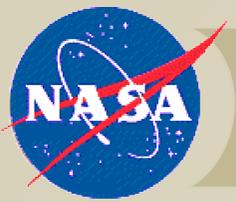


Timing and Accuracy Analysis

- No difference in model runs between Discover and CX1
- Linux CX1 shows comparable performance to Discover at low CPU counts

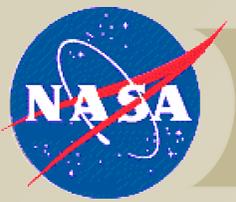
GEOS-5





Next Steps

- Port GMAO GEOS5-DAS
 - Transferring data for an experiment and editing scripts
- Port NOAA GDAS
 - Porting GSI from AIX to Linux
 - Reverse engineering NCEP Operational scripts
- Improve out-of-the-box user experience



Desktop System Experience

- Systems do not yet work well “deskside”
 - Noise and power issue



- Hardware and supply processes may not yet be mature
 - Hardware failures, delays from companies



Climate in a Box

Group Discussion - Future Direction of Computing
Briefing to Climate in a Box Workshop



Michael Seablom
Head, Software Integration & Visualization Office - GSFC

March, 2010

Near-Term



End of Moore's "Law"? (Probably not)

Intel, others, have viable roadmaps for the remainder of the decade

Technology forecasting not accurate beyond 10 years

Overall computing trends are driven by consumer demands

Market for desktop supercomputing workstations driven mostly by science needs

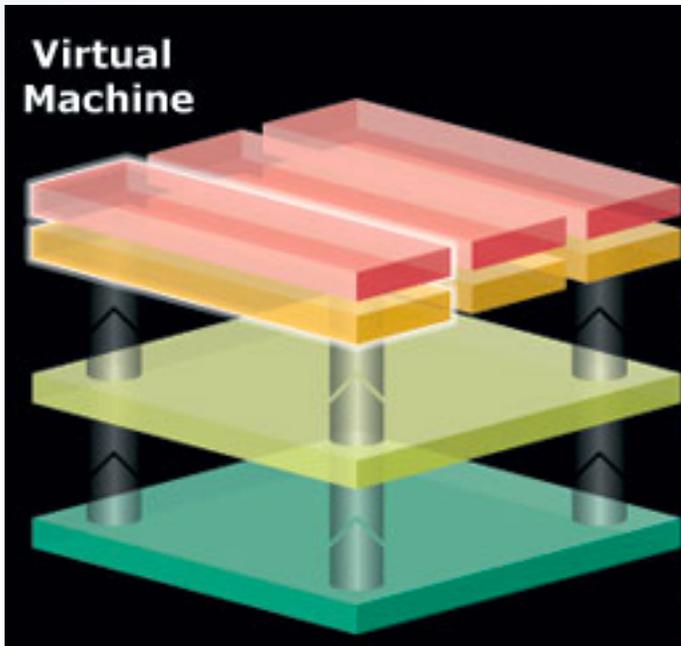
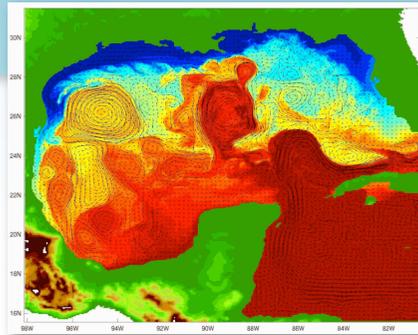
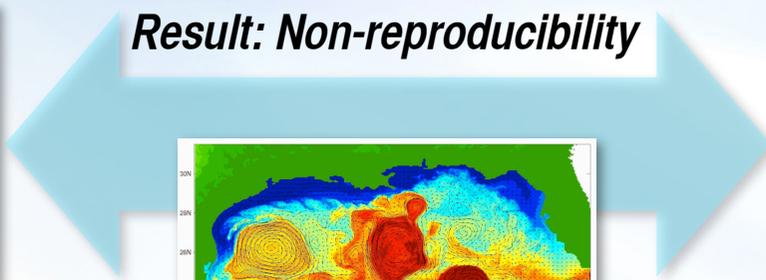
Virtualization



Problem: “Seamless” interaction between desktop & mainframe prevented by subtle differences in operating systems, software/ middleware stacks



Result: Non-reproducibility



Application Layer
Operating System

Virtualization Layer

Hardware Architecture

Solution: Virtualization effectively “wraps” an application in its native operating system

Result: Complete reproducibility of a climate model simulation between desktop & mainframe

“Cloud Computing”



Possible HPC delivery mechanism in the next
5–10 years

Compute cycles provided by utilities (similar
to the electric grid) where power is cheap

Advantage: Complete user control of virtual
machine, user completely removed from
hardware environment

Example: Amazon Cloud, Microsoft Azure

Technical challenges posed by MPI/
Infiniband interconnect

SIVO/SBIR investments directed at solving
those problems

