WRF Software and Tools Update

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WRF Problemos …
Est Omnis Divisa in Partes Tres

- Independence from your Sys Admin

- Output in Itty-Bitty Pieces
- Szip or Extended-Rice Algorithm
- Whacking that which be Deemed Unnecessary

- Using “WTF” in polite company
- The Secret Handshake

Building WRF and WPS and Libs

- Kelly Keene has posted and supports a scripting system that builds the required libraries for WPS and WRF, and then builds WPS and WRF
- The libs:
  - NETCDF and MPICH (for WRF and WPS)
  - JPEG, JASPER, PNG, ZLIB (WPS Grib2 support)

Building WRF and WPS and Libs

- The builds are designed for desk-top systems that tend to not have structured system administrator support
- Users must have the standard Unix development environment available, such as make
- Several compilers are available: GNU, INTEL, PGI, as well as the vendor XLF compiler

Building WRF and WPS and Libs

- The user selects from available compilers found by the script and then the package takes 15 – 30 minutes to build the libraries
- The WPS configure.wps file is modified to use the new Grib2 support libraries
- Files with recommended “env” settings are constructed

Building WRF and WPS and Libs

- This is the TOP line in the WRF FAQs
- Available for 3.4.1 and 3.5
- A short README is included in the tar file
- http://www.mmm.ucar.edu/wrf/users/FAQ.html

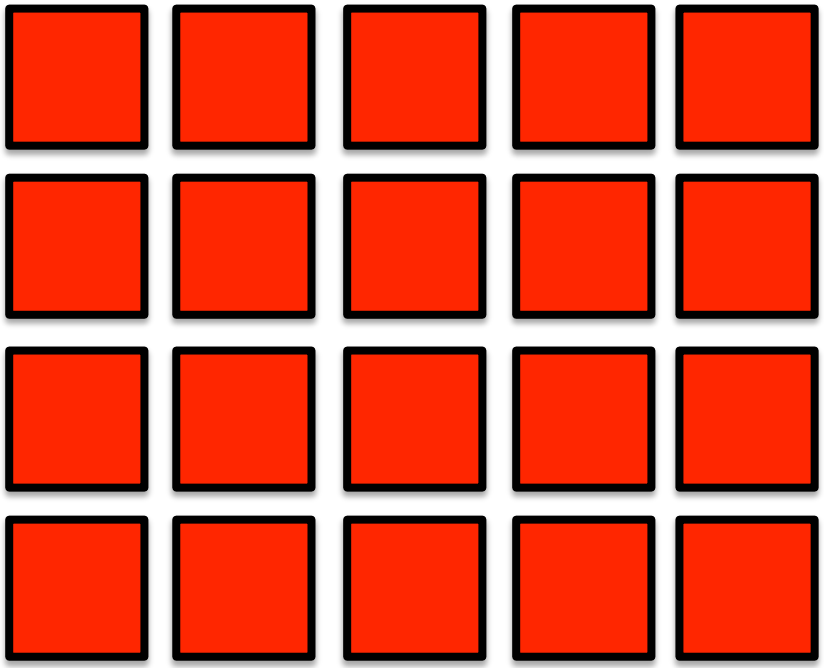
Stitching Model Output Together

- Yunheung Wang (CAPS) developed and Kevin Manning improved a scheme that joins “split data” back together

```
&time_control
history_interval_s = 150,   60,    60,
io_form_history    = 102
/
```

Stitching Model Output Together

- Running on 20 cores could produce the following WRF model decomposition and output:



Stitching Model Output Together

- With large domains, model output can dominate the total wall clock time
- When running on 800 cores, there are 800 files per output time written
- Files get constructed with names such as

wrfout_d01_2010-06-23_15:00:00_0000

Stitching Model Output Together

- The only purpose is timing performance
- Works well with multiple domains and when restarts overlap with model output times
- The joining program is DM parallel
- For a 2000x2000x100 WSM6 domain, 2 minutes per time period with 8 cores manufactured the single file
- Scripts exist to run the joining program concurrently with WRF

Stitching Model Output Together

- Single file input:

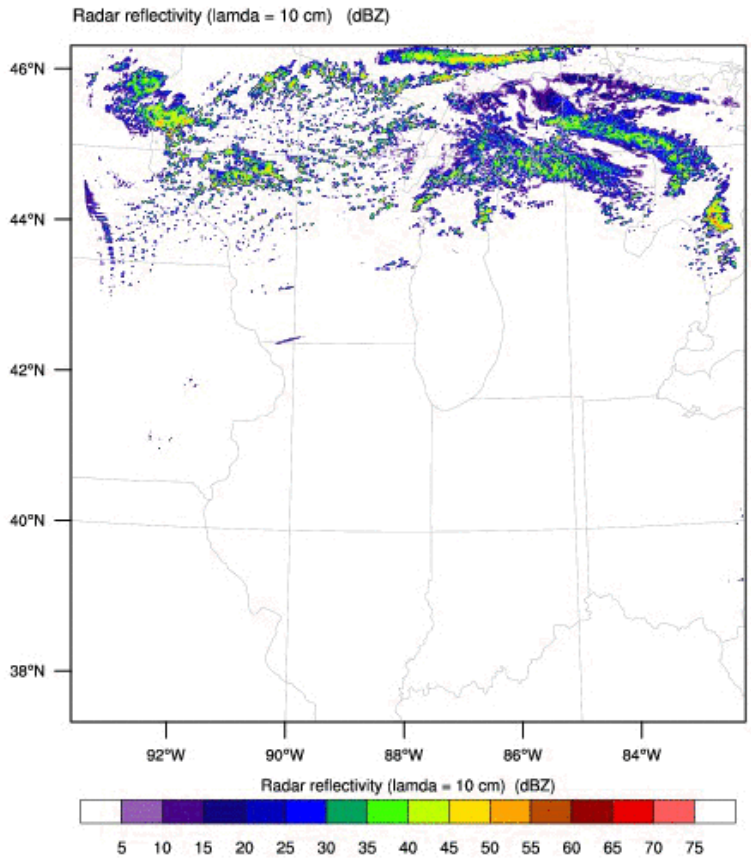
```
Timing for processing wrfinput file
(stream 0) for domain        1:
320.15085 elapsed seconds
```

- Multiple file output:

```
Timing for Writing
wrfout_d01_2010-06-23_12:00:00 for
domain        1:    0.90883 elapsed
seconds
```

WRF: OHARE

Init: 2010-06-23_12:00:00
Valid: 2010-06-23_18:00:00



OUTPUT FROM WRF V3.5 MODEL
WE = 2001 ; SN = 2001 ; Levels = 105 ; Dis = 0.5km ; Phys Opt = 6 ; PBL Opt = 1 ; Cu Opt = 1

NETCDF4 Compression

- Huang Wei and Jianyu Liu have put in a simple way to get impressive NETCDF4 compression with WRF model output

- If the user has NETCDF4 libraries that have HDF5 compression included, then a single “env” variable is all that is required

NETCDF4 Compression

- Prior to running **`./configure`** …

```
setenv NETCDF4 1
export NETCDF4=1
```

NETCDF4 Compression

- This is fully supported in WRF 3.5
- File sizes tend to be about half of the original size
- The compression works well with fields which contain similar values (such as near-zero quantities for many of the hydrometeor fields)
- NOTE: All of the NETCDF tools need to support the compression: ncview, ncBrowse, ncl, nco

(De)Selecting Model Output Fields

- Several years ago John Michalakes provided a simple run-time option to add and remove fields from WRF streams

```
&time_control
iofields_filename = "myoutfields.txt"
/

-:h:0:W,PB,P
```

(De)Selecting Model Output Fields

- Particularly helpful when ncview shows:

(De)Selecting Model Output Fields

- Removing half of the unwanted or never used 3d arrays cuts your file sizes in half
- Default values for “history” that are in the Registry do not obligate users

WRF Testing Framework: WTF

- Brian Bonnlander has put together a testing framework for the WRF model
- Runs on yellowstone and janus (large Linux systems with queues)
- Ported to Darwin desktops
- Simple README documentation

WRF Testing Framework: WTF

- Lots of “different core count” tests conducted:

em_b_wave - 10 (serial, SM, DM)

em_quarter_ss – 16 (serial, SM, DM)

em_chem – 6 (serial, DM)

em_real – 25 (serial, SM, DM) + 27 (serial, DM)

nmm_real – 9 (serial, DM)

- With GNU + PGI + Intel, over 600 tests and 400 bit-wise comparisons conducted weekly

WRF Testing Framework: WTF

- The WTF script system is available for download
- Idea is to eventually test all physics and dynamics options in WRF
- For version 3.6, code contributors will be required to run WTF and other tests
- http://www.mmm.ucar.edu/wrf/users/testing.html

Helpful Policy Documents

- Several existing documents have been updated to reflect the latest policies for getting software into WRF
- These include lists of tests, recommendations, best practices, schedules, and the mechanics of proxy interaction with the WRF repository

Helpful Policy Documents

- Testing policies

http://www.mmm.ucar.edu/wrf/users/testing.html

Helpful Policy Documents

- WRF Software Administration

http://www.mmm.ucar.edu/wrf/users/code_admin.html

Helpful Policy Documents

- Coding standards for contribution

http://www.mmm.ucar.edu/wrf/users/contrib_info.html

Helpful Policy Documents

- The WRF team is intending to offload much of the preliminary testing of delivered software back onto the original contributors
- Automated testing and simple case studies are provided on the testing web pages
- Some minimal coding standards are going to be (more strictly) enforced
- Purpose: reduce the amount of time it takes to get code into the WRF repository

The Big Three Issues

- Building WRF
- Reducing some WRF bulkiness
- Getting code into WRF