

Appendix B: Running the UEMS Benchmark Simulation

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B.1 A bit of an introduction is in order

The UEMS package includes a preconfigured WRF ARW core domain for the purpose of testing the installation and evaluating the performance of your system when running a simulation. All the initialization data are provided and the configuration has been well tested, so running the benchmark test should be a priority for new users or anyone else with the desire to taste the sweet nectar of success. Running the benchmark is straightforward provided you follow the simple guidance provided below.

The benchmark case consists of a primary (outermost) domain with two nested sub-domains. The purpose for this configuration is to provide an adequate measure of performance across a wide range of computer systems. If you are using a stand-alone workstation with a modest amount of physical memory (8Gb minimum) you should start by running only over the primary domain. This is simply because increasing the number of computational domains, and thus the number of grid points, will increase your system memory requirements.

BTW - If you don't know how much memory you have on your system, then just run the UEMS provided "sysinfo" utility:

```
% sysinfo
```

After you have familiarized yourself with the benchmark results, feel free to expand your numerical weather prediction horizons by testing the sensitivity of the simulation to changes in the model physics or dynamics. The configuration files are located within the `conf/ems_run` directory. However, keep in mind that this exercise is intended to be a learning experience, so failure is always an option.

B.2 Benchmark case background information

Note: Some of the information below has been "liberated" from various sources such as Wikipedia, NOAA/NWS Storm Prediction Center, and the Weather Channel. All spelling and grammatical errors are my own however.

The benchmark case is a 30-hour simulation of a major tornado outbreak that occurred from April 26-28 2011, across the southeast US. The simulation covers the period of 0600 UTC 27 through 12 UTC 28 April, during which time more than 300 tornadoes were reported.

A summary of the domain and run configuration is provided below.

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```
Active Domains          Domain 01          Domain 02          Domain 03
*****
Domain & Run Information

Domain Type             : Limited Area          Limited Area          Limited Area
Primary Time Step       : 90 Seconds           30 Seconds           10 Seconds
Grid dimensions (NX x NY) : 211 x 201           238 x 196           334 x 232
Vertical Layers (NZ)    : 45                   45                   45
Grid Spacing            : 18.00km             6.00 km              2.00 km
Top of Model Atmosphere : 50mb                 50mb                 50mb
Parent Domain           : NA                   Domain 01             Domain 02

Run Information

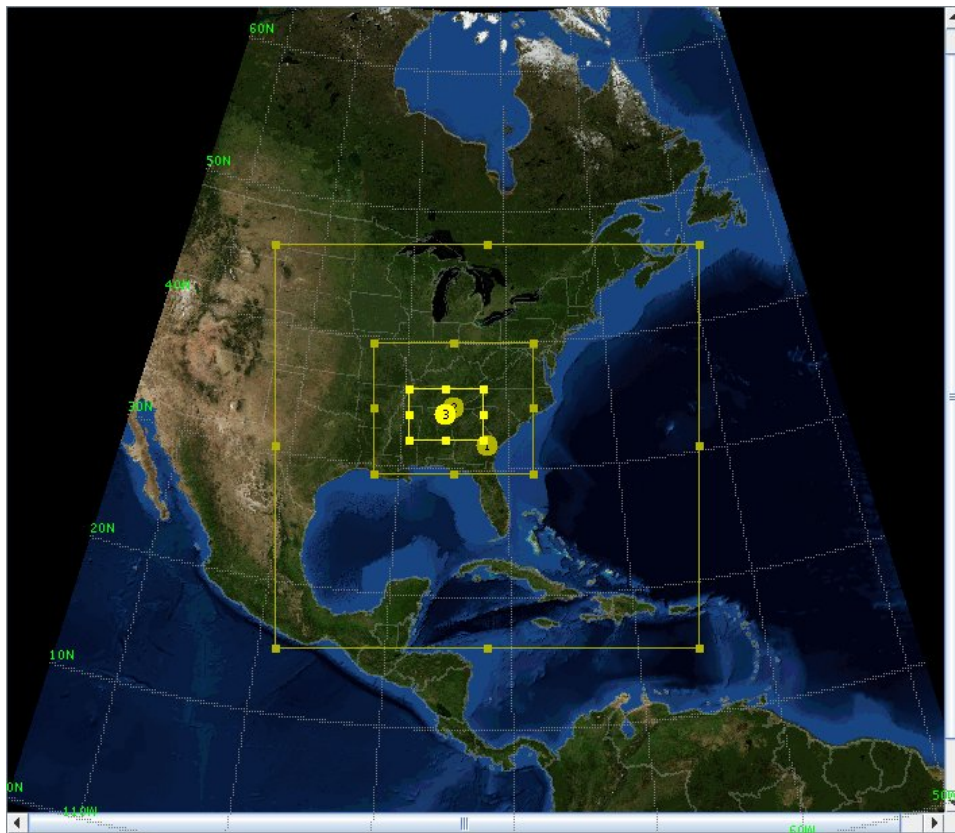
Start Date              : 2011 Apr 27 06:00 UTC      2011 Apr 27 06:00 UTC      2011 Apr 27 06:00 UTC
End Date                : 2011 Apr 28 12:00 UTC      2011 Apr 28 12:00 UTC      2011 Apr 28 12:00 UTC
Simulation Length       : 30 Hours                30 Hours                30 Hours
Boundary Update Freq    : 06 Hours
```

A complete listing of the configuration along with the physics and dynamics options can be found by using the “runinfo” utility - after you have run `ems_prep` (see below). To view this information for any simulation, run the following from the top of any run-time domain directory:

```
% runinfo [--domain 2[,3[,...]]]
```

Where the “--domain” flag is only necessary when requesting information about nested domains.

If you prefer looking at pictures, and who doesn't, a depiction of benchmark domain is provided by `27april2011/static/projection.jpg`, but to save you the time it is also presented here:



Finally, prior to running the benchmark simulation, be sure to check the number of CPUs to be used in the `conf/ems_run/run_ncpus.conf` file and edit the values to reflect your system. And no, you cannot use any “virtual” processors made available when hyper-threading is turned on.

B.3 How to run the benchmark case

Running the benchmark case for each WRF core with the UEMS is straightforward:

Step I. From the `util/benchmark/27april2011` directory, run the `ems_prep`

```
% ems_prep --benchmark
```

Or if you wish to include the first nested domain:

```
% ems_prep --benchmark --domain 2
```

Or if you are going for the “whole kielbasa”:

```
% ems_prep --benchmark --domain 2,3 (no spaces between 2,3)
```

Note: If you request domains 2 and 3 when running `ems_prep`, you do not have to include them when running the simulation; however, they must be included if you plan on using them.

Step II. Run `ems_run` to begin the simulation

```
% ems_run
```

Or if you wish to include the nested domain:

```
% ems_run --domain 2[,3]
```

Following completion of the simulation the output in netCDF format will be located in the `wrfprd` directory. You may use the “`ncview`” utility (provided with the EMS) to view the results:

```
% ncview <netCDF filename>
```

Or you can continue and post-process the files into a secondary format.

Step III. (Optional) Convert the output files and view the results

The netCDF simulation output files will be located in the `wrfprd` directory along with any files from the nested domains (if selected). You can convert the files to grib 2 format (and GrADS, GEMPAK) by running the `ems_post` routine.

```
% ems_post --grib (For GRIB2 files)
```

Or if you want to process the nested domain:

% `ems_post --grib --domain 2 (or 3)`

Note that you can currently process only one domain at a time. All processed data files will be located in the `emsprd` directory.

There are additional post-processing options available to you. Please see Chapter 9 of the UEMS user's guide or "`ems_post --help`" for the gory details.