

Subject: Benchmarks for CPUs and Compilers for the CMAQ 4.2.2 release.

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Listed below are benchmarks for Athlon and Xeon CPUs for the demo case distributed with the most recent CMAQ v4.2.2 release.

Xeon = dual CPU 2.4 GHz Xeon machine

Athlon = dual CPU 1.67 GHz Athlon machine (MP 2000)

For both machines we used executables compiled with the Intel Fortran Compiler vrsion 7.1 (IFC) and the Portland Group Compiler version 4.0-2 (PGF). Each machine had 1 GB of RAM, and we used 2 CPUs for the benchmarks. Times are in minutes:sec.

Table 1. CMAQ 4.2.2 CPU and Compiler Benchmarks.

CPU	Intel Fortran Compiler (min:sec)	Portland Group Compiler (min:sec)
Athlon 1.67 GHz	6:33	6:51
Xeon 2.4 GHz	6:52	7:22

For the case of IFC with the Xeon we used the IFC optimizations for the Xeon. When we did not use the IFC optimizations the Xeon IFC case slowed from 6.52 to 7.33 min.

We compared model predicted concentrations for each case to the reference case included in the CMAQ distribution. For our Xeon IFC case our CMAQ output for ozone, aerosol nitrate and aerosol sulfate were identical to the benchmark file included in the distribution. For the other three cases ozone differences were always less than +/- 10^{-6} ppm (there were random differences between +/- 10^{-6} to 10^{-8}). Differences in aerosol nitrate and sulfate were less than +/- 10^{-2} ug/m³ (there were random difference between +/- 10^{-2} to $10e^{-4}$ ug/m³).

The errors appear to be caused by numerical noise with randomly changing grid cells of small increases or decreases. The errors are stable, that is, they do not grow during the 24 hour simulation, and based on our previous CMAQ evaluations, we expect the errors to remain small and stable for longer simulation.

Based on these results, either the Xeon or Athlon CPUs can be used for model simulations, and either the IFC or PGC compilers can be used for compiling the CMAQ executable programs. Based on current prices (6/9/2003) the Athlon CPU with the IFC compiler provides the best price to performance ratio for CMAQ simulations.

