RECENT DEVELOPMENTS FOR PARALLEL CMAQ

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This presentation discusses recent work in optimizing the CMAQ chemistry-transport model for faster execution time. The main emphasis was to optimize the code for parallel operation. An initiative to use CMAQ for air quality forecasting at NOAA's National Centers for Environmental Prediction (NCEP) was recently launched, and work was undertaken to develop CMAQ to run on their IBM p690 (Power4) parallel servers. The NCEP forecast meteorology model used is Eta and requires postprocessing to get data into CMAQ. Since the time window after Eta has run to do the postprocessing and then run CMAQ is tight, the air quality forecasting version (AQF) of CMAQ has to run fast. The focus for modifying CMAQ was on the model I/O, and particularly on the writing to disk of the modeled concentration data, since this was known to consume a large proportion of the total execution time in parallel and is not scalable. A scheme was developed that uses asynchronous writes, which overlaps computation in the science solvers. The resulting time for the modified CMAQ to run a 48 hour forecast for a northeast domain is about 26 minutes using 33 processors, a considerable improvement over the standard CMAQ. The AQF CMAQ currently is not simulating aerosols and uses the CB4 chemical mechanism. It also uses an advection scheme modified as in some recent work by Yamartino to reduce errors incurred through interpolation from the Eta configuration (Arakawa E-Grid) to the CMAQ's C-Grid and to maintain mass consistency.

The presentation compares timing results between the May 2003 public release of CMAQ and the AQF version on various platforms. The results show much improved scalability for the AQF version. Timing comparisons between the model physical processes are analyzed, especially with regard to scalability. Issues concerning the message passing interprocessor communication are also highlighted.