Studying an Eulerian Computer Model Performance on Different High-performance Computer Platforms

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The Danish Eulerian Model (DEM) is an Eulerian model for studying the transport of air pollutants on large scale. Originally, the model was developed at the National Environmental Research Institute of Denmark. The model computational domain covers Europe and some neighbour parts belong to the Atlantic Ocean, Asia and Africa. If DEM model is to be applied by using fine grids, then its discretization leads to a huge computational problem. This implies that such a model as DEM must be run only on high-performance computer architectures. The implementation and tuning of such a complex large-scale model on each different computer is a non trivial task.

Here, some comparison results of running of this model on different kind of vector (CRAY C92A, Fujitsu, etc.), parallel computers with distributed memory (IBM SP, CRAY T3E, Beowulf clusters, Macintosh G4 clusters, etc.), parallel computers with shared memory (SGI Origin, SUN, etc.) and parallel computers with two level of parallelism (IBM SMP, IBM BlueGene/P, clusters of multiprocessor nodes, etc.) will be presented. The main idea in the parallel version of DEM is domain decomposition approach. Discussions according to the effective use of the cache and hierarchical memories of the modern computers as well as the performance, speed-ups and efficiency achieved will be done. The parallel code of DEM, created by using MPI standard library, appears to be highly portable and shows good efficiency and scalability on different kind of vector and parallel computers.

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