Parallelization of an accidental release code using P-GRADE environment

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Modelling the accidental release of radioactive or chemically toxic substances requires the study of long-range transport from a single concentrated emission source. The path of the resulting plume and the deposition of the pollutants should be predicted, along with its time of arrival to populated locations. To carry out successful and cost effective strategies requires a very accurate prediction of the location of the contaminant plume and concentrations. The simulations must be achieved faster than real time to be of use in decision support. One useful solution is the parallelization of the source codes and the application of the supercomputers, clusters, and Grid systems to solve these tasks. Computational Grid systems are becoming more and more popular in natural science. In such systems, large number of heterogeneous computer resources is interconnected to solve complex problems. Computer and Automation Research Institute of the Hungarian Academy of Sciences (MTA SZTAKI) has elaborated a product line; a Grid monitoring tool, called Mercury, and two integrated application development environments, called P-GRADE parallel programming environment, and P-GRADE Grid portal. These tools enable the parallelisation of sequential applications in an efficient and transparent way by means of their high level graphical approach and special performance debugging and analyzer tools. A multi-layered, parallelized Eulerian passive tracer transport model has been developed for the statistical investigation of the spatial distribution of the concentration and deposited tracer over Hungary. The concept is illustrated by the simulation of hypothetical nuclear accidents at the Paks NPP, in Central Hungary. The model domain covers Central-Europe including Hungary. This model has been coupled to the ALADIN meso-scale limited area numerical weather prediction model used by the Hungarian Meteorological Service.