Specialized Sparse Matrices Solver in the Chemical Part of an Environmental Model

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A two-dimensional advection-diffusion-chemistry module of a large-scale environmental model (Danish Eulerian Model for studying the transport of air pollutants on large scale - UNI-DEM) is taken. The module is described mathematically by system of partial differential equations. Sequential splitting is used in the numerical treatment. The non-linear chemistry is most the time-consuming part during the computer runs and it is handled by six implicit algorithms for solving ordinary differential equations. This leads to the solution of very long sequences of systems of linear algebraic equations. It is crucial to solve these systems efficiently. This is achieved by applying four different algorithms which are developed, tested and discussed.