EMS7/ECAM8 Abstracts,
Vol. 4, EMS2007-A-00151, 2007
7th EMS Annual Meeting / 8th ECAM

1-D Single Level Primitive Equation Model with Pure Lagrangian (L4E) Advection Scheme

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The interpretation of advection in equations of dynamics meteorology is highly important for different numerical models, particularly numerical weather prediction, air quality and chemical ones. Because of that importance, there are a number of numerical schemes that offer a solution of this problem. Generally, all of these schemes can be classified into two broad groups: Eulerian and Semi-Lagrangian schemes. However, advection schemes that use one of the above approaches suffer from several disadvantages, such as numerical dispersion, implicit diffusion and/or violation mass conservation. Recently, we have proposed the application of a pure Lagrangian approach in numerical modeling of the advection term. The new advection scheme, called L4E scheme, consists of two parts. The first one is pure Lagrangian advection, while the second one is a kind of interpolation procedure of obtained Lagrangian values to the Eulerian grid. Numerical tests, where we performed a comparison of the L4E scheme against piecewise parabolic (representing the Eulerian schemes) and two time level Semi-Lagrangian schemes, show that the L4E scheme has persuasive advantages concerning accuracy and saving computational time. Presented in this paper is an application of the L4E advection scheme in numerical integration of atmospheric primitive equatons. In addition to that, we performed comparisons of the accuracy and numerical time consuming efficiency of the L4E, piecewise parabolic and two time level Semi-Lagrangian schemes.