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Reformulation of the physics-dynamics interface for the non-hydrostatic model

Any atmospheric model is composed of two parts: a dynamics part for the solution of the mechanical equations and physical parameterisation package which represents the smaller scale phenomena. There is a number of techniques that can be used for combining the dynamics and physics tendencies in the environment of semi-implicit model. For example, the time-splitting method is used in some models because of its simplicity and stability properties. It consists in solving the dynamics part of the model and then adding the physical contributions. The more traditional method which is used in Arpege/Aladin is to add the physical tendencies together with non-linear explicit tendencies in the semi-implicit scheme. We made an attempt to test the splitting method applied to the simplified 1d model from Gospodinov et al. (2001) which simulates quite well the properties of the 3d model Arpege/Aladin and to compare the performance to the classical method used in the 3d model. The resu!
lt we obtained was in general favorable to the current solution. The choice of diabatic forcing for the 1d 'shallow water' model is not obvious because it should be applied like external forcing. This should be studied further in order to find forcing which conforms better to more realistic atmospheric phenomena.

There was a plan to study also the application in Aladin the so called quasi-hydrostatic and quasi-anelastic approximations to the treatment of the diabatic heating. They have been empirically derived by Thurre (1998). They were named quasi-hydrostatic and quasi-anelastic because they produce results analogous to those obtained with the corresponding approximations of the dynamics model when using short time steps. The model was relatively indifferent to the application of these two approximations of the diabatic heating. Further research should be carried out.

For the occasion of some personal communication with D. Durran from the University of Washington , Seattle, USA (see Durran and Alaxander Reinecke 2003) who was interested in our work on two-time-level semi-Lagrangian schemes I reviewed some of our work on schemes applied for the non-linear residual from the forcing terms in the system of discretized semi-implicit equations (see Gospodinov et al. 2001). It has been shown that there is a parameter alpha which determines a large class of schemes for the non-linear residual with 2nd order accuracy. However it turned out that stability considerations play also important role when one should choose the most appropriate scheme. The scheme which allows stable integration within the largest interval is the SETTLS scheme first used by Hortal (2002). Although the model is relatively indifferent to the choice of scheme for the non-linear residual we believe that the one which is theoretically the most accurate should always be pr!
eferred. In the ARPEGE/ALADIN system the SETTLS scheme for the non-linear residual has already been operational for a couple of years. This choice has now also been justified. Of course the model remains much more sensitive to the choice of scheme for the semi-Lagrangian trajectory and especially its vertical part. That is why one should not expect any practical value and improvement of the performance of the model due to the implementation of the SETTLS scheme for the non-linear residual. The instability problems described in Gospodinov et al. (2001) has been largely studied last years and it turned out that the right solution would be the fully-implicit method of time integration. This has been studied within ALADIN and ALATNET too.

Other activities

I was supposed to participate the 3rd Alatnet summer school in Kranjska Gora Slovenia, 27-31 May 2002, as well as the 12th Aladin Workshop in Medulin Croatia, 3-6 June 2002. I could not attend those events due to expired ID card.

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