Conclusions of the working group on moist physics and convection

Medulin, 4 June 2002

1 Physical challenges

1. The time response in specific situations calls for the use of prognostic variables for convective mass fluxes and micro-physics.
2. A representation of cloud suspended water, with at least liquid and ice phases is urgently needed.
3. A new specific shallow convection scheme is required, probably using a mass flux approach.
4. The triggering of the convection has to be assessed more closely. We may distinguish two different regimes:
   - passive: large scale convergence induces convection (nearly the present closure);
   - active: deep convection induces large scale convergence.

   For the latter, we can consider
   - the links with other subgrid schemes (turbulent diffusion and the future shallow convection scheme); the coexistence of three or more schemes requires also some work to ensure a smooth transition between them.
   - Various predictants may or should intervene: CAPE, CIN, PBL moisture convergence, TKE...
5. Cloud top has been shown to be more correlated to saturation deficit than to the CAPE. The saturation deficit and the DCAPE are then relevant predictants for cloud decay. The idea is to combine Cloud Top Evaporative Instability representation with the downdraught and/or the mass flux shallow convection scheme.

2 Operational efficiency

The correct behaviour of the physical schemes has to be checked and certified in a more systematic way. For this, the following actions are planned:

1. Setting an alarm in the 3D operational model on the total physical tendency, reporting unlikely values and their location in the log file. This requires an adaptation of `cpg` for the next cycle of the model.
   Jean-Marcel Piriou and Eric Bazile will arrange this for the end of July.
2. A validation chart for physics will be issued. The test suite will include at least
   - Single column model validation with respect to experimental profiles extracted from the 3D model;
   - Aladin 3D model tests;
   - ARPEGE 3D tests using zonal DDH, in order to control zonal biases: these biases directly affect 4DVAR assimilation cycle stability

   J.M. Piriou and E. Bazile will prepare this chart.
3. A documented database of critical/dangerous/typical profiles extracted from the 3D model to force the single column model should be made available.
   Contributions should come from all centers, extracting the information as soon as they observe singular behaviours of the physical schemes.

4. The DDH do not presently work properly in Aladin.
   Yves Bouteloup will try to fix the problem.

5. Extraction of profiles to force the single column model (tendencies along the run) does not work properly in Aladin.
   Jean Marcel Piriou will do the debugging work.

3 Development work plan

Starting with the proposition from the working group in Toulouse, after further discussion, the following plan has been adopted:

1. Separation of

   - Updraught, large scale condensation, condensation-evaporation micro-physics;
   - downdraught and final budgets.

   For this, we must

   - harmonize the updraught and large scale precipitation parameterisations, use a diagnostic cloudiness variable consistent with micro-physics, consider non organized evaporation below the precipitating clouds.
   - Isolate the downdraught (using the total precipitation as input) and complete it with something like LCVLIS for global budgets consistency.

   This part will be developed by Thomas Haiden, in mail contact with Luc Gerard and Eric Bazile. Validation will also be coordinated by mail and performed at different centers.

2. Development of a new mass flux scheme for shallow convection.
   Thomas Haiden proposes to work on this subject, with 1 or 2 colleagues from the LACE group to join the work.
   Jean-Marcel Piriou, who focuses on the issue of transition between shallow and deep convection, may also develop a shallow convection scheme.

3. Adaptation of Lopez's prognostic micro-physics, to separate the ice and liquid phases of the condensate, and return provisionally to a diagnostic precipitation content.
   Luc Gerard works on it, in collaboration with Karim Bergaoui.

4. Further work on the functional boxes scheme, introducing the downdraught at the same level as micro-physics.
   Eric Bazile continues this work.

5. Further work on L. Gerard's prognostic mass flux scheme:

   - Further validation :
     Stefan Greilberger will analyse new cases during this summer, Karim Bergaoui will carry tests over Tunisia.
   - Towards a 3D updraught mesh fraction, and new developments for the updraught with prognostic condensates:
     L. Gerard continues his developments, and will have more contacts with K. Bergaoui
   - Handling precipitating water (as in Lopez's scheme):
     Luc Gerard will care for this part, in the frame of the development of a full forecasting scheme for the draughts (+ collaborations with K. Bergaoui).

Additional remarks:

- *Jean-François Geleyn, Doina Banciu and Martin Bellus – absent at this meeting – are also expected to participate to the development work around physics and micro-physics.*

- *Last minute news: two more persons are likely to join the team, Alexander Kann from ZAMG and a Hungarian newcomer, with interests in shallow convection and cloud micro-physics respectively.*