Short list of activities and plans linked with ALARO-1 developments in 2009, 2010

15 July 2009 (based on the meeting in Norrkoping 17 June 2009)
version 1

1. Radiation

1.1. the new transmission functions are already available in cy35t1

1.2. validation and retuning with new transmission functions and climatology of aerosols together with TKE scheme (dry part of PBL) is needed (during summer in Prague)

2. Turbulence

The aim is to develop a common framework for prognostic TKE schemes

(i) extensions of the Louis formalism,

(ii) the RANS (Reynolds-average Navier-Stokes) aspect of the QNSE (Quasi-Normal Scale Elimination) theory

(iii) the class of 'No Ri(cr)' Reynolds-type schemes

2.1. revalidation of various mixing length computations (Filip)

2.2. stability tests for various scheme variants (stability functions, exchange coefficient computation)(Filip)

2.3. tuning (together with radiation) (see 1.2)

2.4. a posteriori correction of the TKE after the effective computations of ACDIFUS

2.5. study of the possibility to parameterize third order momentum terms (TOMs) on top of e-TKE (i.e. abandoning track '(i)' if '(ii) & (iii)' are proved better (Jean-Francois, Radmila)

2.6. research studies to include moist effects (Jean-Francois, Ivan, Daan)

- introduction of condensate after the reach of saturation by modifying the Ri number
- consequences on 2.4

3. Convection

3.1. correction of a bug in "acupu" (between updraft computation and microphysics):

- security to limit to 1 the cloud fraction

3.2. Luc Gerard's new developments:

- Reduction of buoyancy "Bjerknes Buoyancy Reduction" (BBR) - following Bjerknes (1938) (+ Asai & Kasahara (1967))
- Limitation of the top of the cloud to the level it can reach while mesh fraction increases - "Area Extension by Growing New Updraught and Merging" (AEGNUN)

Coding the new developments and testing (Radmila, Luc, Jean-Francois)

- co-existence with the actual 3MT is required
- modifications*: re-organization of GFL, new switches and set-up, routines (accvud)

3.3. prognostic entrainment

- re-tuning after implementation of Luc's new development:
  for the time being too much convective activity (Doina, Radmila)

4. Adjustment

4.1. to implement Rasch-Kristjansson large scale condensation in the 3MT framework (Lisa) **

4.2. to merge TLS solutions in the 3MT framework; there are three things interacting in ARPEGE:

- Cloudiness
  - computed after adjustment and convection
  - temporary solution: part of stratiform condensation ("accdev") put in "acneb" only for the Xu-Randall case
- Unique protection for condensation
- The co-existence of two competitive scheme (deep and shallow convection); the problem is how to decide what scheme is working at a certain moment.

4.3. the development of the graupel part such to be possible to use ICE3 (long term)

4.4. protection against negative values in sedimentation

4.5. phasing (even if in preliminary fashion) all aspects of this section, between themselves and with the rest; testing as many options as possible for non-stupidity (EVERYBODY !!!)

5. Shallow convection

The idea (see the 2.5 and 2.6 'bricks') is to extend RANS and/or QNSE for the emulation of EDMF (Eddy-Diffusivity/Mass-Flux);
based on Mironov's idea for an emulation of EDMF: the 2nd order momentum production and destruction terms in the TKE equation (not yet seen as implicit terms at that stage) are used to simulate part of mass transport ("counter gradient"). Open question is the turbulent transport of ql, qi.

For the next phasing a CY36T1 (deadline end of October)

- tasks in radiation, turbulence, convection are planed to be ready
- tasks in adjustment have longer perspective except 4.1, but the basic phasing should not be forgotten (see 4.5)

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Coding the Luc's developments – some details

1. GFL – re-organization

1.1. 3D GFL: YUNEBH.

- Advected (new organization): If YUNEBH%LADV = T then put the convective cloud fraction nc=sigma_u+sigma_D into it.
- Not advected (current organization): leave only the detrainment fraction sigma_D into it (as done currently).

To be adapted in APLPAR, ACUPU + beware what is passed to the other subroutines.

In this case YUAL should not be advected and most often not used (see 1.4 below).

1.2. new 2-D pseudo-historic field sigma_b="UD_BASE_FRAC" (not advected)

1.3. Use a 3-D pseudo-historic field "UD_PROFILE" (not advected)... containing information about
   a. active layers (KNACT= 0/1)
   b. active layers (ZNACT=0 to 1 - seems less relevant)
   c. normalized vertical profile of ud mesh fraction (0 to 1, case of a vertical variation)
   d. minus relative elevation of a cloud top above highest active layer below it (-0 to -1, in complement to c.)

1.4. ... instead of the current 3-D prognostic field YUAL (UD_MESH_FRAC).
This one becomes obsolete when working with UD_PROFILE.

Actually, the same GFL could be used with a different name for (1.3) and (1.4) and an ABORT if the name does not match in the input files.

1.5. Keep 3D GFL YUOM (UD_OMEGA) (updraught prognostic velocity), probably advected. YDOM (DD_OMEGA) as well. YDAL (DD_MESH_FRAC) would stay as now, probably advected together with YDOM.

2. New switches and set-up – proposal will be prepared by Luc
Switches are anticipated for the Limitation of the cloud top, Additional ascent above the level, Buoyancy reduction, Distinction between the production and transport terms, Closure.

3. Separation of the omega_u computation from the vertical profile one (first vertical loop in “accvud”)

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List of “issues” for the implementation of the Rasch-Kristjansson large scale condensation into the 3MT framework:

1. The fact that in the condensation-evaporation processes needs dynamic tendencies, although dynamics is called after physics in ALARO. For this perhaps 3 new GFL's will be needed.
2. Cloud fraction includes shallow convective clouds in RK before condensation is called. But if turbulence will be implemented after condensation in 3MT, then this needs to be addressed.
3. Adjustments need to be made in order to handle "Meteo-France" physics.