ALADIN PhD studies

1. Radi AJJAJI : "Incrementality deficiency in ARPEGE 4d-var assimilation system"

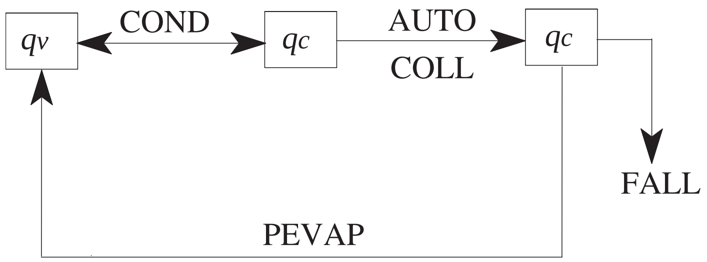
Nothing new (implementation of the new operational suite in Casablanca).

2. Karim BERGAOUI : "Investigation of the potential of a convection scheme using prognostic mass fluxes for NWP in the African-Mediterranean domain"

Introduction of a cloud geometry in the Lopez model

We have started to code a subroutine which introduces the cloud geometry in a simple microphysical calculus. The microphysics is limited to the computation of the large scale precipitation tendency in the clouds ($q_{r/s}$, with r for rain and s for snow; we will treat only q_r).

We used the Lopez model for microphysics (see figure hereafter)



$$d/dt\,(q_r) = \text{AUTO} + \text{COLL} - \text{PEVAP} + \text{FALL} \quad (1)$$

q_r = large-scale precipitation content
q_c = large-scale cloud condensate ($q_{l/i}$: l for liquid water and i for ice)
q_v = water vapour

The microphysics processes are parameterized in the right-hand terms of Equation (1) :
AUTO = auto-conversion rate
COND = condensation rate
FALL = precipitation falling rate
PEVAP= precipitation evaporation rate

In our work, we acted by two steps:

1. We tried to stationarize q_r which is a prognostic quantity in the Lopez model, but a diagnostic one in ALADIN. We have then expressed q_r as a function of the precipitation flux R : $q_r = R/xw$ where x is the air density and w the mean fall-velocity of rain drops. We used the Marshall-Palmer formulation to determine a relationship between q_r and R.

2. We have started to introduce a cloud geometry in the expressions of the different microphysical processes of the Lopez model. Each of them (evaporation, auto-conversion) will be treated differently if we are in a cloudy fraction or in a clear-sky one, within a fixed layer. Thus we defined cloud geometry coefficients:

b_1 = fraction of the precipitation flux in a clear-sky area falling in a clear area, 1-b_1 is then the fraction passing to a cloudy area.
b_3 = fraction of the precipitation flux in a cloudy area falling into a cloudy area, 1-b_3 is thus the fraction passing to a clear-sky area.

Coefficients b_1 and b_3 depend on the cloud geometry (considering that adjacent clouds have a maximum overlap and unconnected clouds have a random overlap). The improvement of this subroutine and its coding are in process in Tunis.

3. Jean-Marcel PIRIOU : "Correction of compensating errors in physical packages; validation with special emphasis on cloudiness representation"

PhD work from January to June 2002 :

- Better understand the role played by the "undilute plume approach" in the operational deep convection scheme, using the EUROCS "idealized humidity" case frame proposed by Steve Derbyshire (Met' Office). Presentation on this subject at the EUROCS Workshop in Utrecht.
- Presentation at the same workshop of a synthesis of the "good points" and "bad points" of the operational deep convection scheme with respect to cloud triggering and large-scale feedbacks, as coming out from 3d operations.
- Bibliography about turbulence, Large Eddy Simulations, and history of deep convection parameterizations.
- Following Ayotte BLM 1996, proposal of a new diagnosis of PBL depth.
- Contacts and coordination work with Pascal Marquet and Martin Gera about the steps to go towards a prognostic TKE scheme for ARPEGE / ALADIN.
- Bibliography about parameterizations of cloudiness. Build up of a new diagnostic cloud condensates scheme for shallow convection, to be used with a "Xu and Randall" cloudiness. Test in 1d and in 3d stable cases.

4. Wafaa SADIKI : "A posteriori verification of analysis and assimilation algorithms and study of the statistical properties of the adjoint solutions"

Nothing new (implementation of the new operational suite in Casablanca).

5. Filip VANA : "The dynamical and physical control of kinetic energy spectra in a NWP spectral semi-lagrangian model"

Nothing new (LACE duties), apart from good news : the work should restart next autumn.