Ingredients of last Météo-France e-suite

16th ALADIN workshop

Sofia 16-19 May 2006

Schedule of the presentation

- Last Météo-France e-suites (end of 2005 ➔ 2006)
- Physics modifications
- Other modifications
- The new « V2 » (since end of April)
- Coupling strategy for ALADIN
- Some test with grid point q_v

Chronology …

- 22-11-2005 Stop of the 46 levels « Lopez » test (Just 29t2 + obs modifications (technical) + new climatological files)
- 23-01-2006 This suite became operationnal
- 19-02-2006 Start of a new 46 levels « Lopez » test + obs modifications, based on cy30t1
- 20-04-2006 « V2 » of this test (files + obs + dfi)

The reasons of the stop

- Good results in ALADIN (better structure of the precipitation fields, better cloudiness)
- Good synoptique scores for all the parameters and all the verification domains …
- … exept Europe (the most important !)
- Bad results on the 11/11 precipitations event

Modifications of the microphysics scheme

- Tuning of collection and autoconversion (increasment)
- Split of q_p into q_r and q_s
- Improvment of the physics/dynamic interface (a step toward unified interface)
- Addition of a microphysics adjustment after vertical diffusion (following JFG proposition)

Impact and quality of the scheme

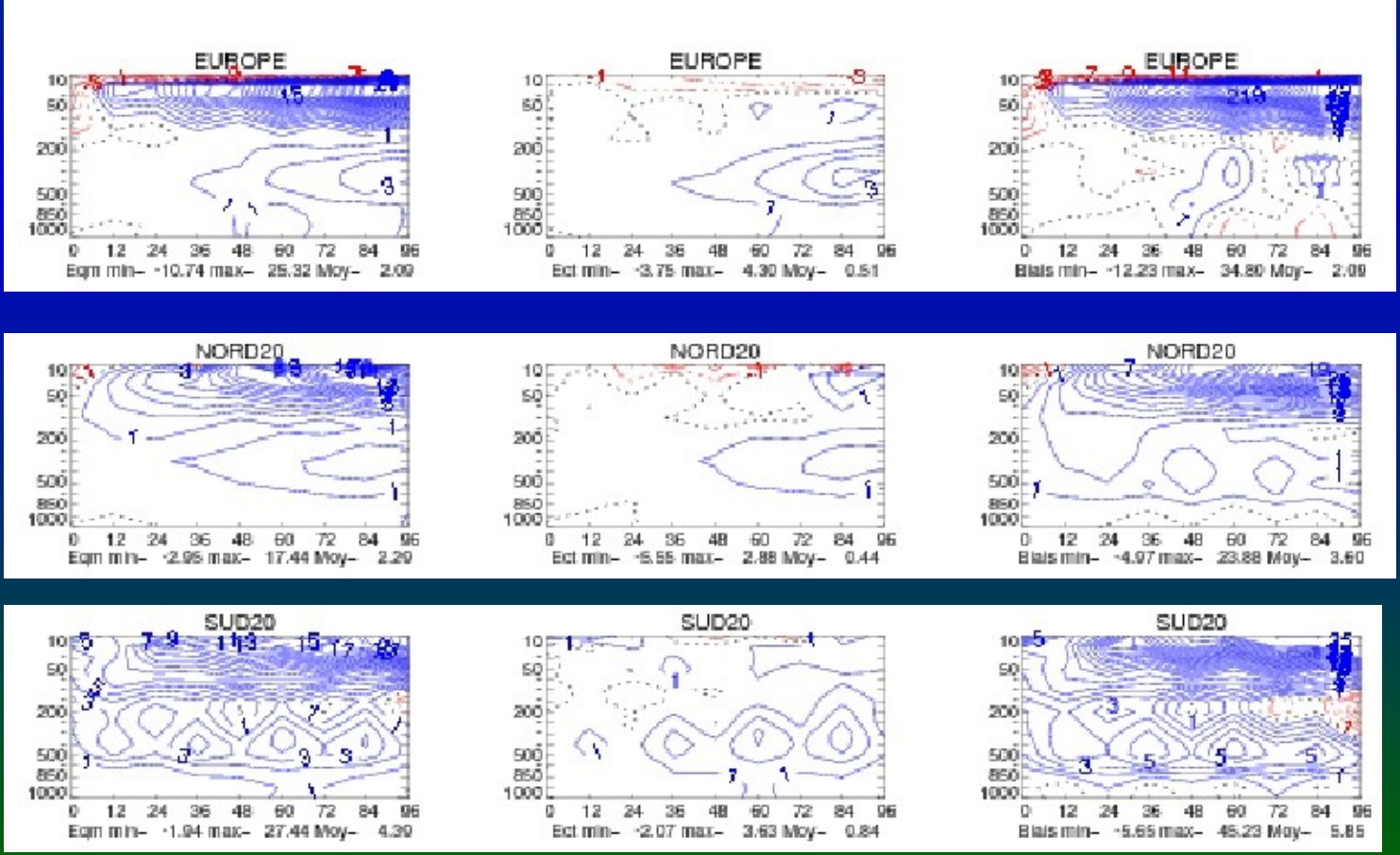
- Improvment of the scheme
- The scheme is very good in forecast mode, but this quality is not completly retrieve in 4DVAR (➔ why ?)
- May be there is some problems in the simplified/linear physics. Some tests (made by Cécile Loo) have shown that the use of the old simplified microphysics deteriorate the quality of the linear model
- It was decided to disconnect the simplified microphysics in the new suite (➔ improvment of the 4DVAR but a gap with forecast mode persists)
- It seems necessary in the future to work on simplified/linear physics

Other modifications

- Radiance bias correction (computed using previous version of new microphysics e-suite)
- LREGETA = .FALSE. (Modification in the SL vertical interpolations ➔ Impact on bias of temperature in the hight atmosphere)
- Use of 2 spectral intervals (instead of 6) in the SW (➔ reduction of a bias of temperature around 200 hpa ➔ improvment of the 4DVAR)
- Use of MODIS wind

This gives very good scores …

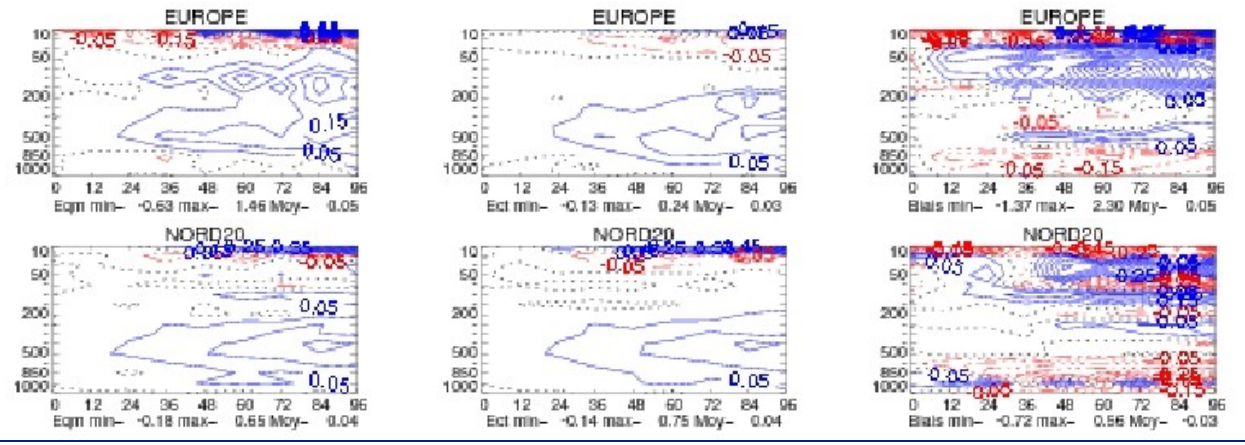
Score of geopotentiel (53 cases)

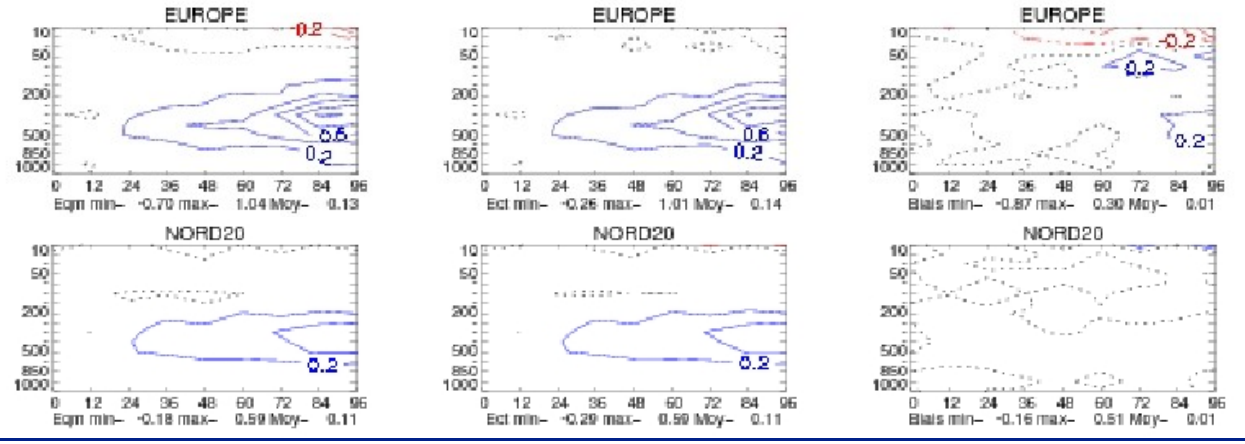


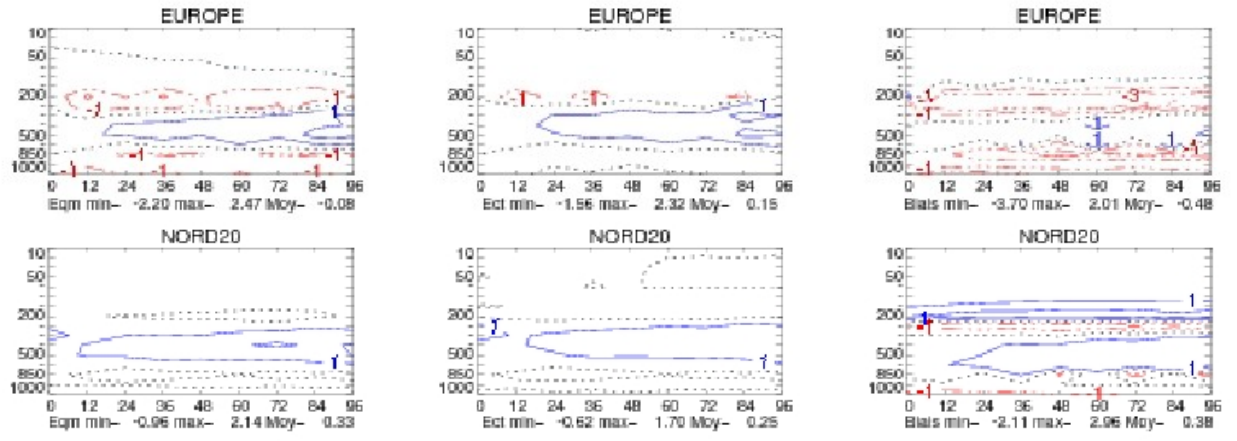
Temperature

Wind

Moisture







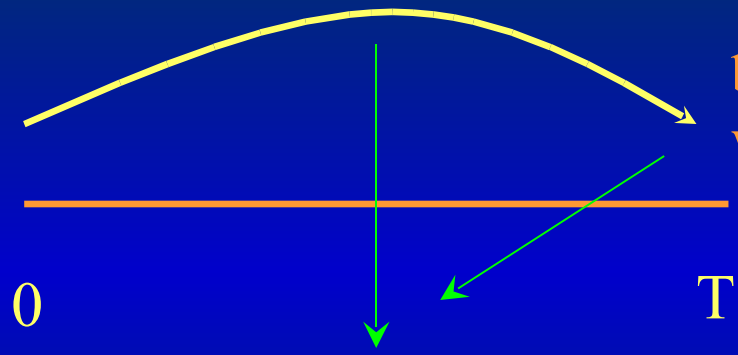
The « V2 » of this double suite

(20th of April)

- Microphysics fields are not writen in the historical files (operational consideration) ➔ no impact on scores
- Use of the geowind of meteosat 8 (instead of meteosat 7) ➔ small (negative !) impact
- Correction of a weakness in the DFI ➔ small positive impact in 4DVAR, not completly evaluated in ALADIN

Problem in the DFI with grid point GFL

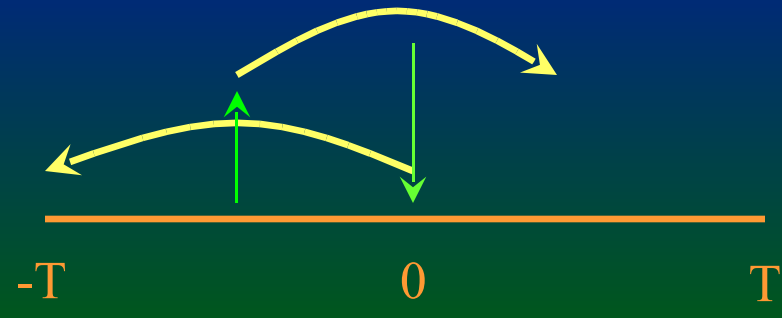
Forward integration (screening, second traj of the 4DVAR) :



but 3D grid point GFL (not filtred) were taken at the end of the window

Filtred Sp at T/2

In ALADIN it's a bit more complex with a backward integration followed by a forward integration

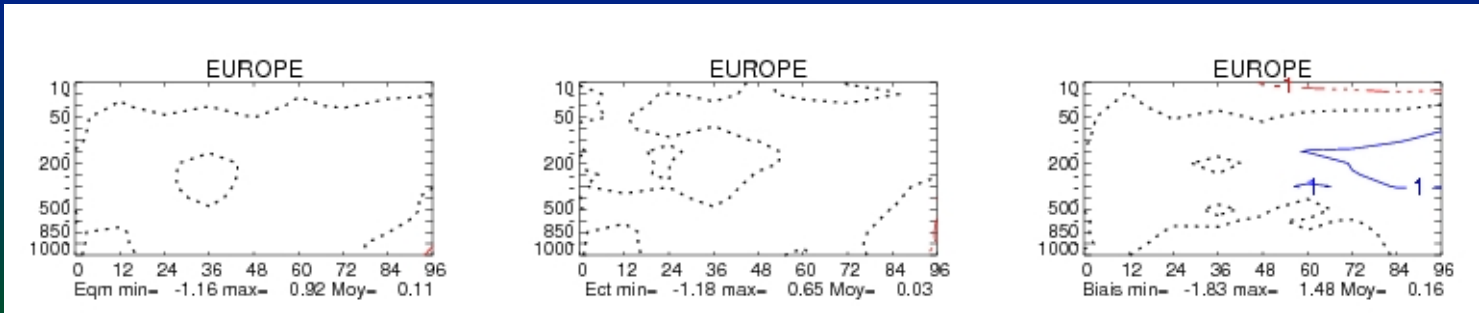


Problem in the DFI with grid point GFL

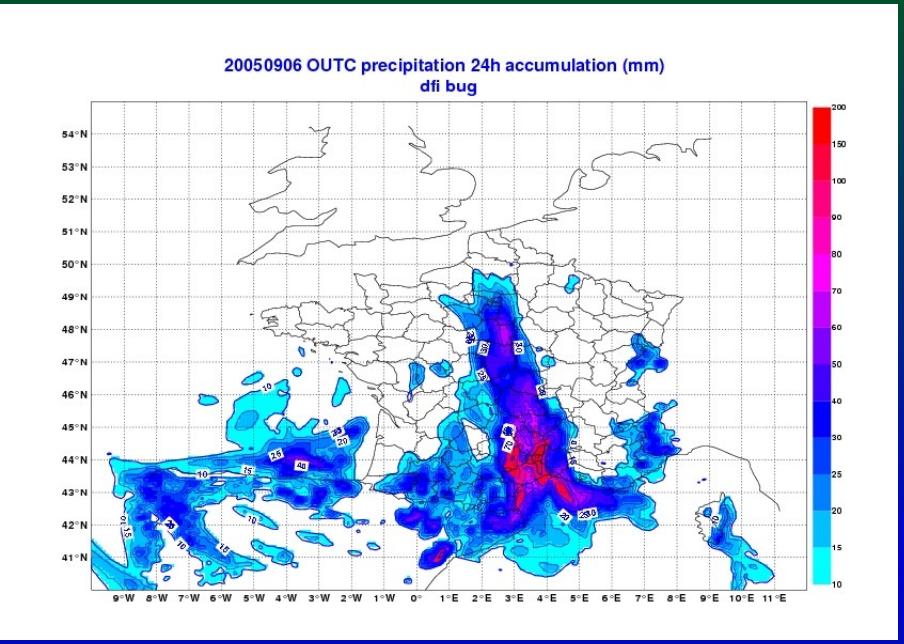
➔ The solution is to store in a buffer the values of the GFL at the midle of the integration (forward or backward) and then to restore them at the end.

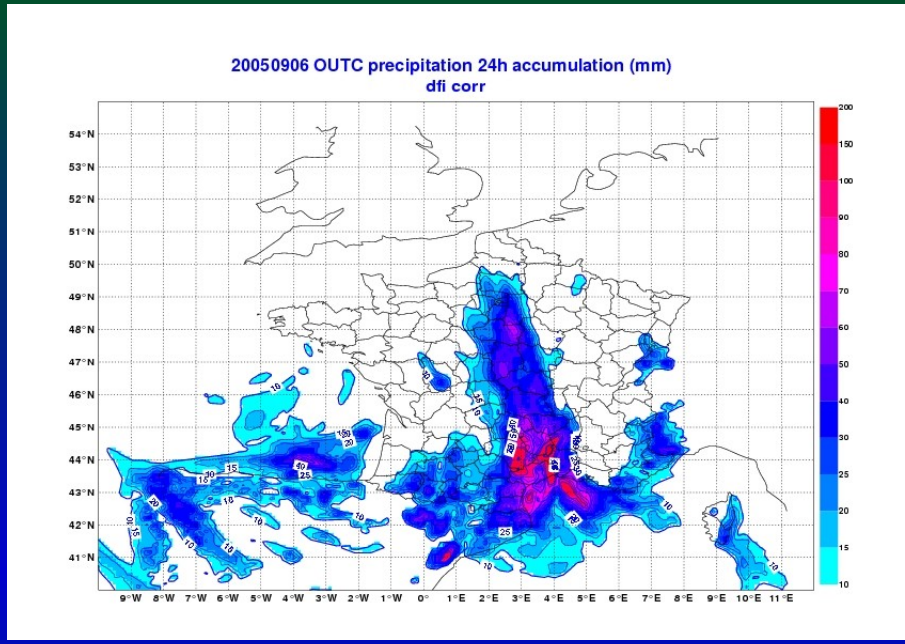
Impact of the correction in a 4DVAR (21 cases) :

geopotentiel



Impact of DFI correction in ALADIN

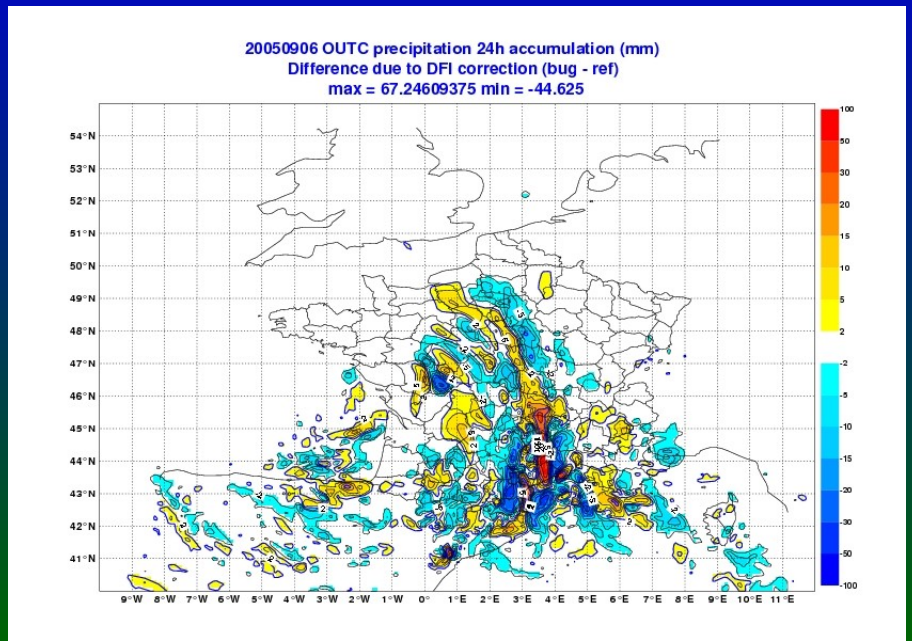




bug

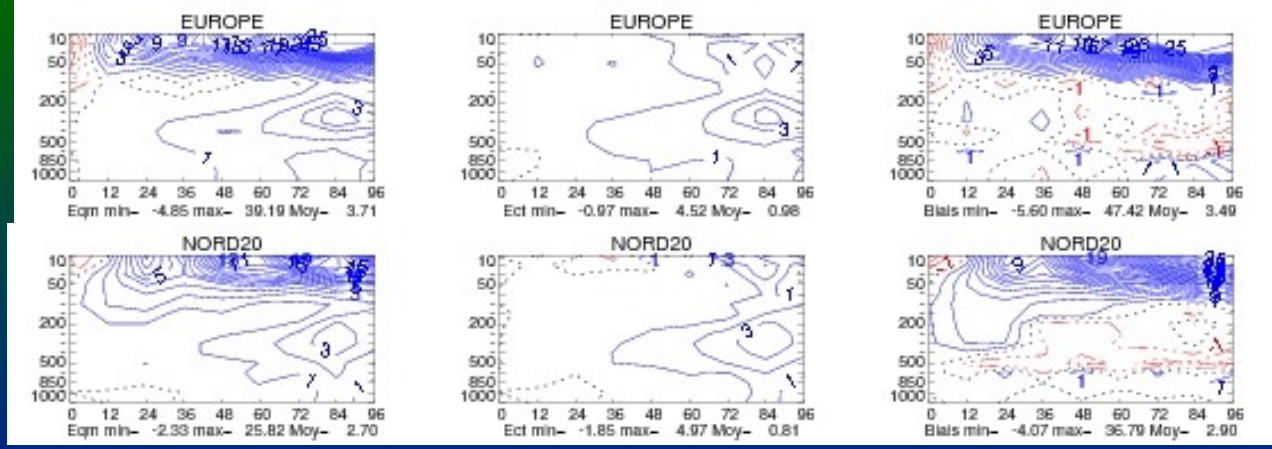
no bug

diff

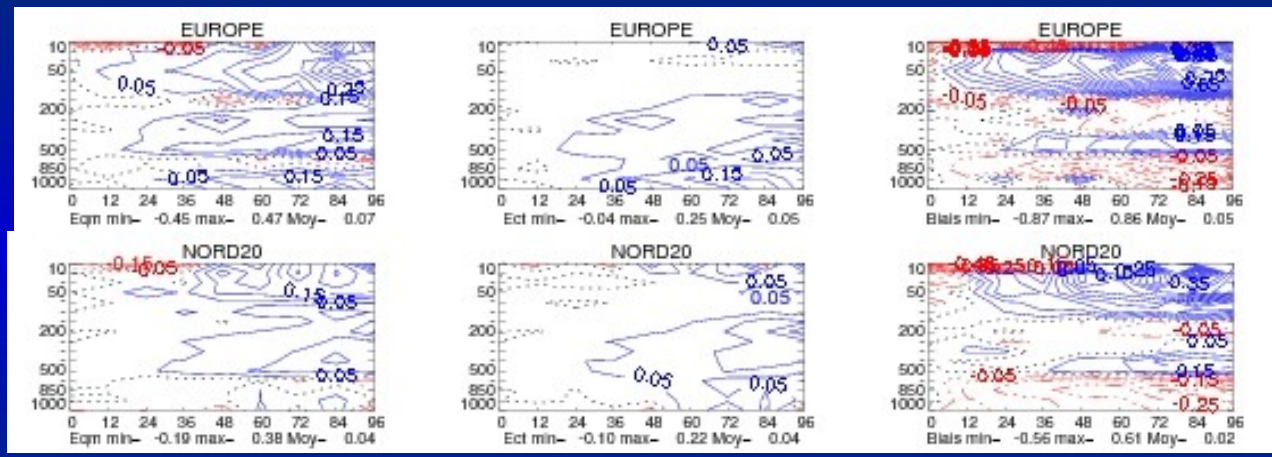


Scores of v2 (16 cases)

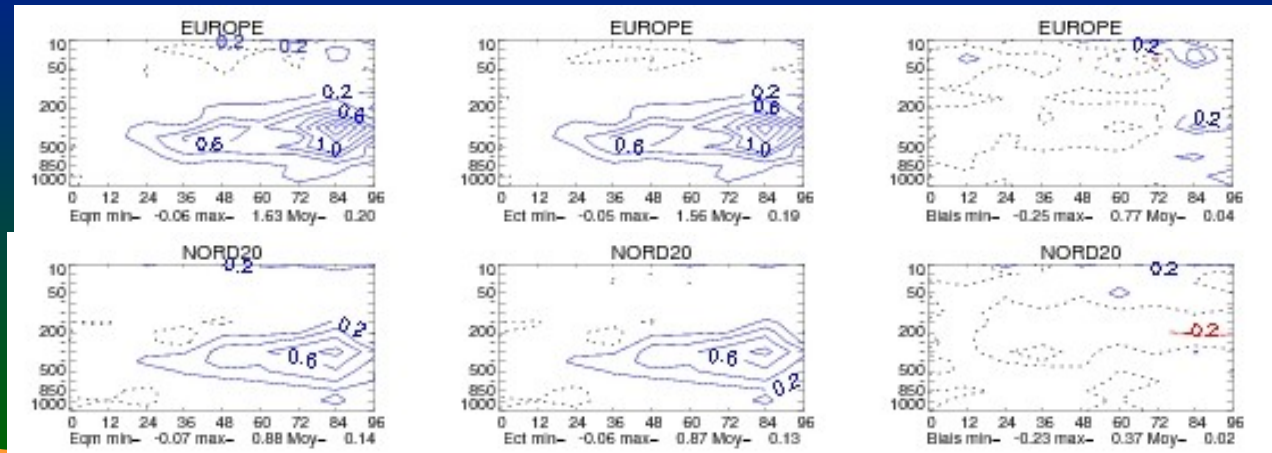
Geopoteniel



Temperature



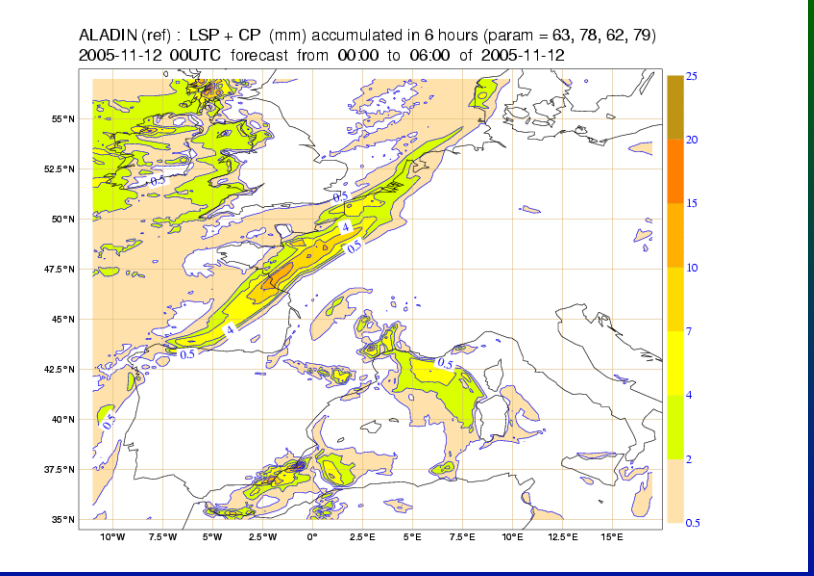
Wind



Coupling strategy in ALADIN

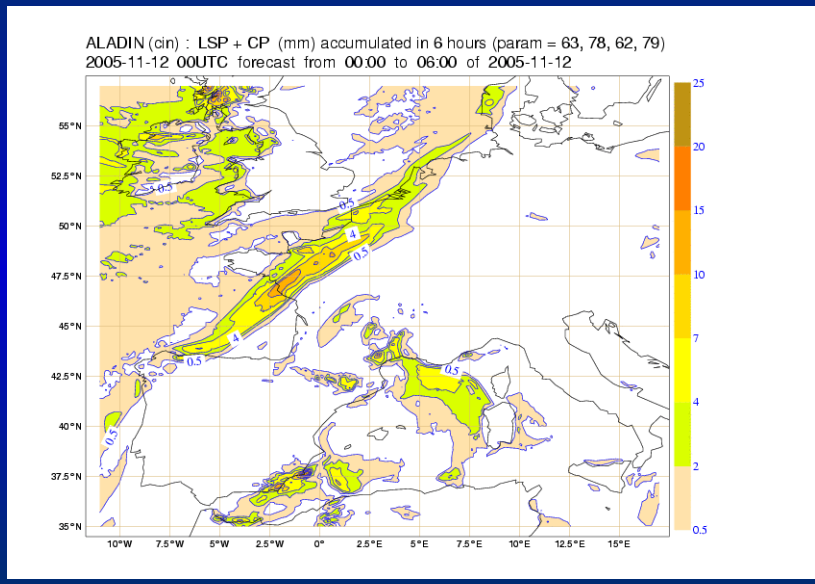
- Microphysics fields are not writen in ARPEGE historical files
- It is then impossible to produce them in coupling files
- In 3DVAR case the fields can be cycled via pseudotraj procedure in the initial conditions but they are not in coupling files
- In dynamical adaptation the fields are not in the initial conditions nor in the coupling files
- Impact of coupling/not coupling, initial conditions or not is weak (shown by the work of Manuel João Lopes part 2 : Evaluation of different strategies for coupling/initialization of the new prognostic variables in ALADIN)

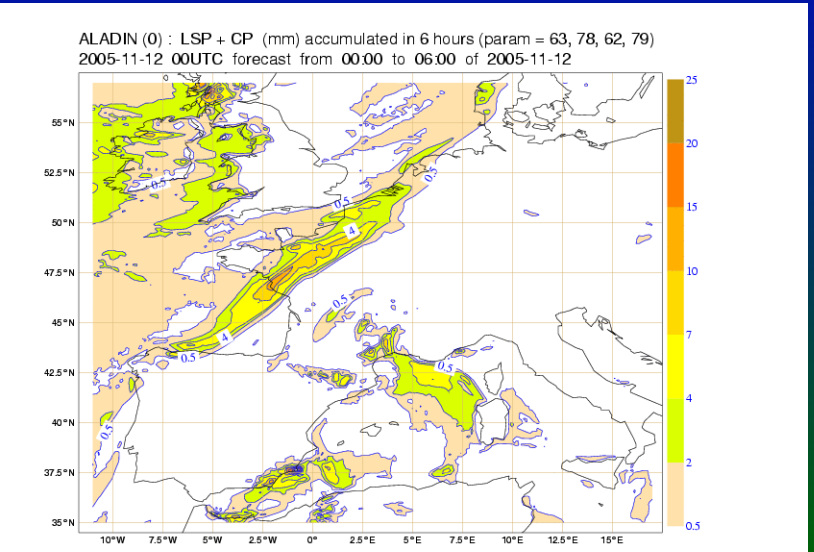
Accumulated precipitation (mm) from 00 to 06UTC of 12th November



Reference

No microphysics variables in coupling files



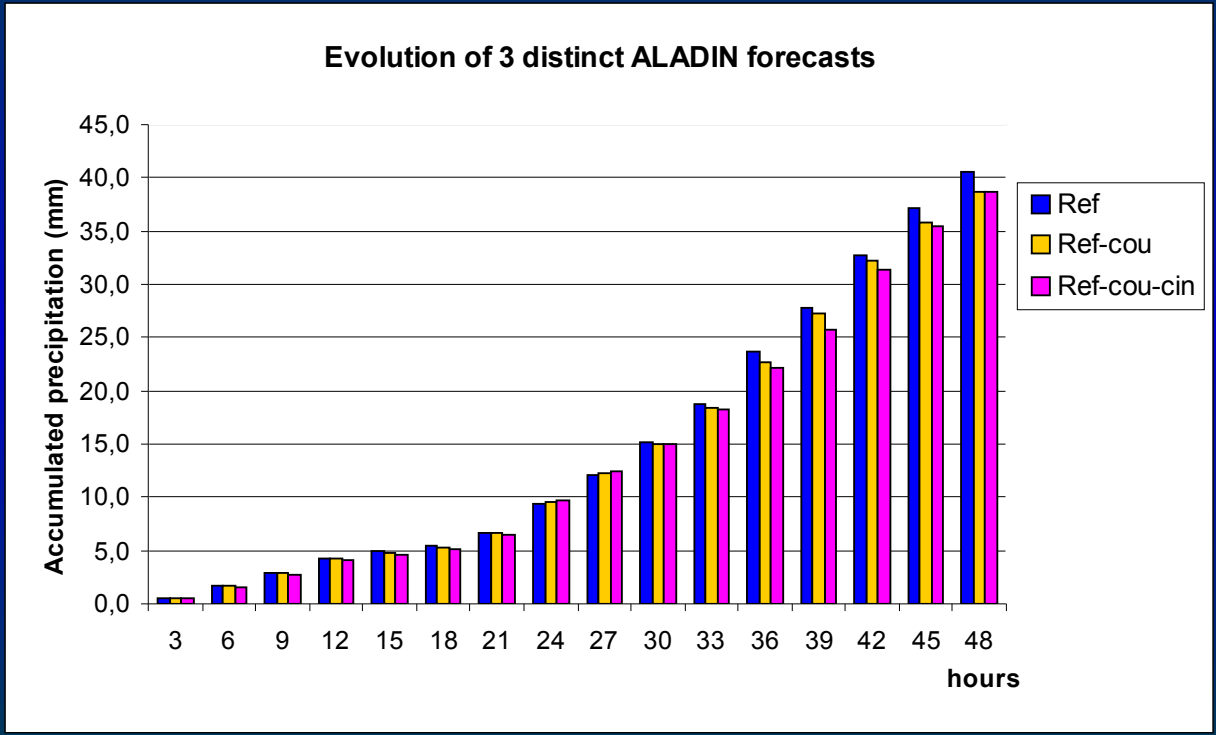


No microphysics variables in coupling files nor in initial conditions

Extract from the report of Manuel João Lopes

Comparison of the accumulated precipitation forecasts inside one « box » (45°N/2.5°E/42.5°N/5°E)

Evolution of the accumulated precipitation forecasts (mm) in 48h, from 00UTC of 12th November to 24UTC of 13th November.



Extract from the report of Manuel João Lopes

Use of grid point q_v

- With spectral q_v and prognostic microphysics variables there is an incoherence between the computation of geopotentiel and its gradient
- The solution is to use a grid point q_v and T_v as a spectral variable (LSPRT=.TRUE.)
- Presently the deep convection scheme need a computation of moisture convergence, which used the derivative of q_v
- Some modifications were made to compute moisture convergence with grid point q_v

Computation of moisture convergence

- Two techniques were coded, the first one use a new spectral variable the second one a new grid point variable.
- In the first case q_v is copied in a new spectral GFL, derivatives are computed and are used to compute moisture convergence.
- In the second case semi-lagrangian advection is used to estimate the moisture convergence. The moisture convergence computed with this last solution is different, too weak.

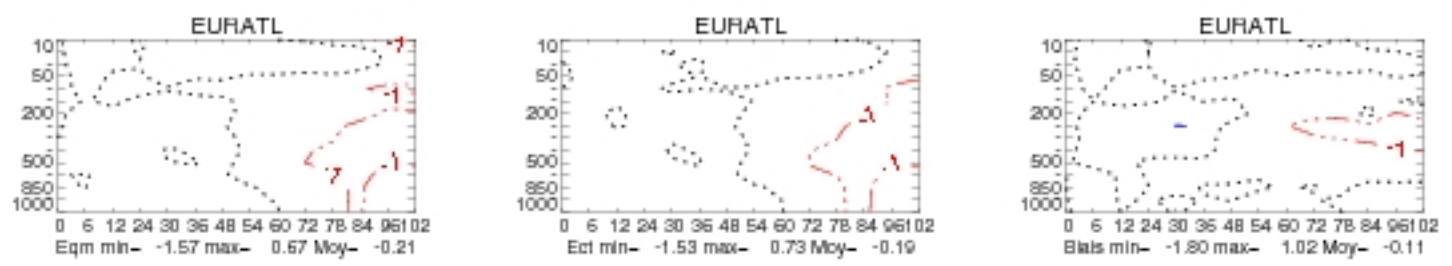
Lagrangian computation of moisture convergence

$$\frac{dq}{dt} = \frac{\partial q}{\partial t} + \left(U\frac{\partial q}{\partial x} + V\frac{\partial q}{\partial y} + W\frac{\partial q}{\partial z} \right) \Rightarrow Mc = \frac{dq}{dt} - \frac{\partial q}{\partial t}$$

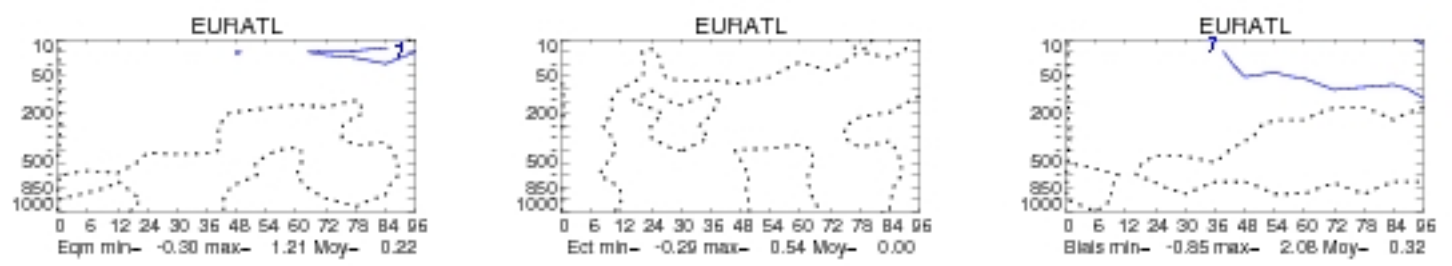
$$\begin{cases} \dfrac{dq}{dt} = q(F,t) - q(O,t-\Delta t) \\ \dfrac{\partial q}{\partial t} = q(F,t) - q(F,t-\Delta t) \end{cases}$$

$$\Rightarrow \quad Mc = q(F,t-\Delta t) - q(O,t-\Delta t)$$

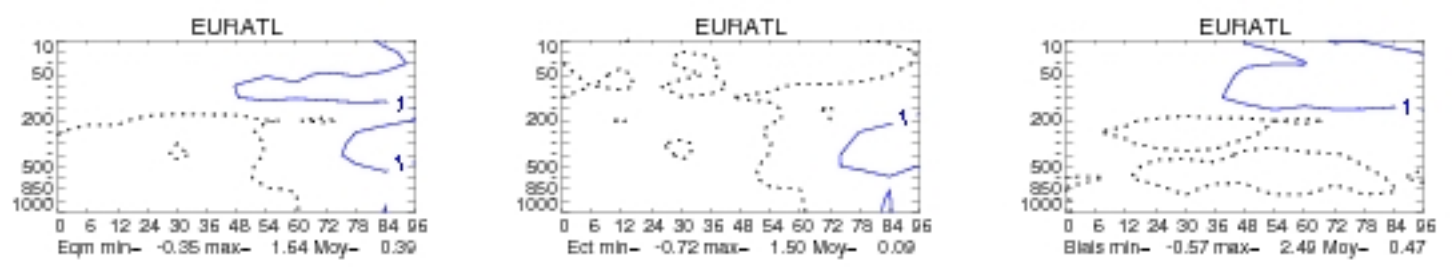
Grid point q_v 4DVAR against e-suite13 cases



Grid point q_v forecast mode against e-suite 13 cases



Grid point q_v forecast mode against grid point qv 4DVAR 13 cases



Conclusion

- Prognostic microphysics will become operationnal soon (June)
- Complementary works are necessary for grid point q_v (DFI on grid point GFL ?)
- Works are also necessary on linear physics
- On physics part the next step is TKE/CVPP/CVP