Status and plans on AROME-France configuration (model part)

Y. Seity, S. Riette, C. Lac, F. Couvreux, E. Bazile

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Outline

-> Modifications in current e-suite (37t1-op1)

- Cloud scheme and shallow convection
- New orography
- New clay and sand climatologies
- Modification of hydrometeors coupling

-> On going work on

- Cloud scheme and shallow-convection
- Fog
- Turbulence

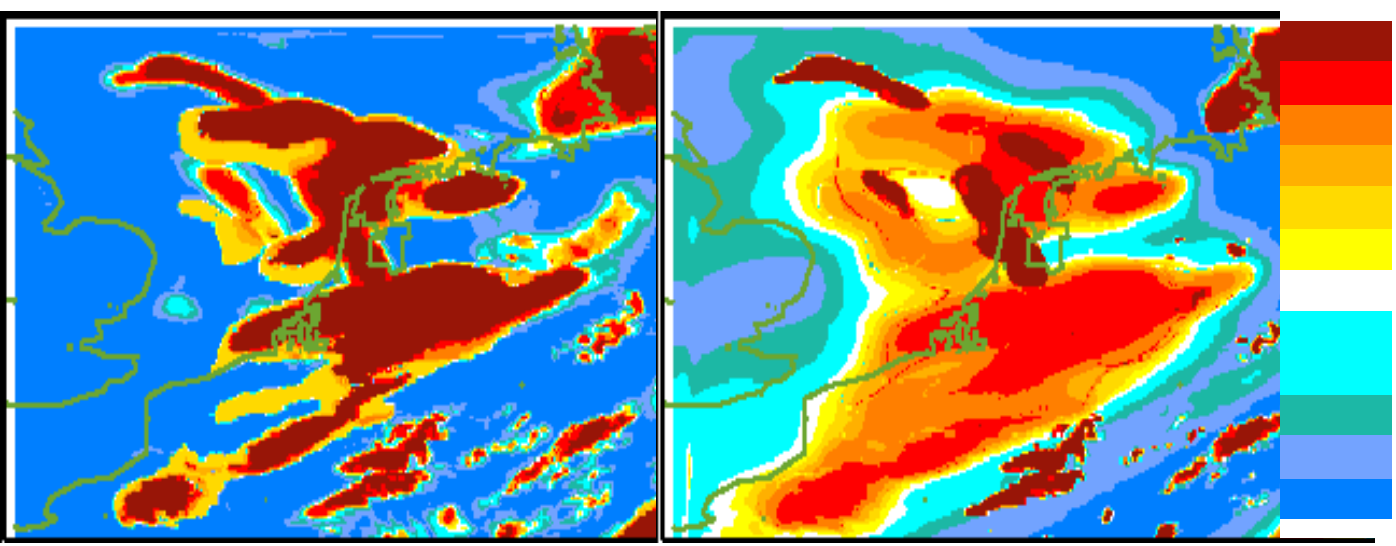
-> Preparation of AROME-1.3 km

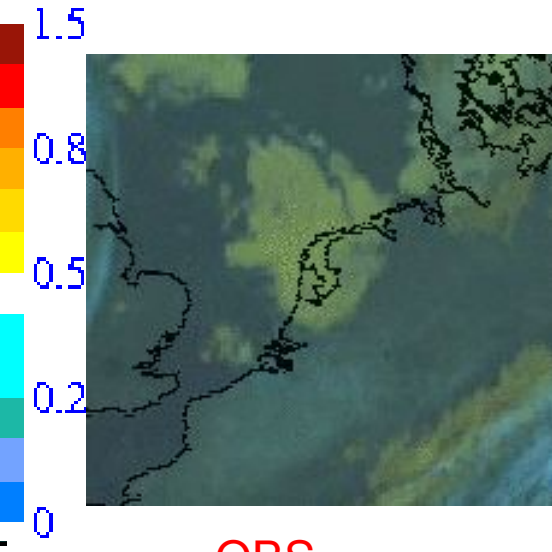
- Increased vertical resolution

Microphysics : adjustment to saturation

- Change threshold in microphysics adjustment

Total cloudiness : 20100409 +1 TU



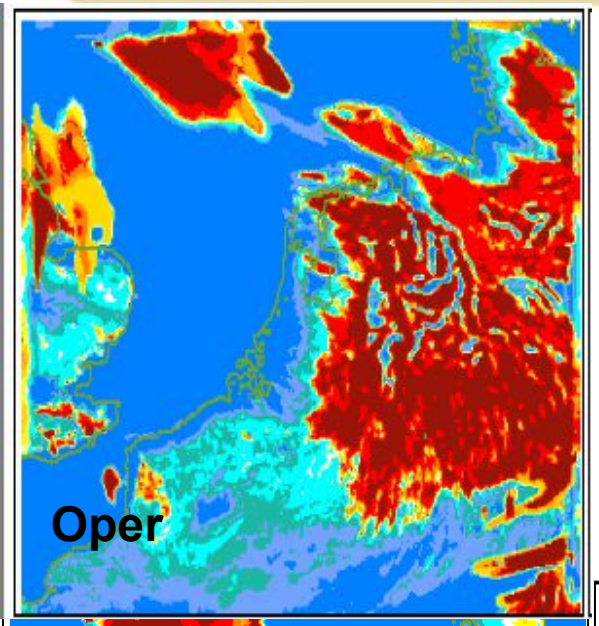


OBS

OPER : (if qc+qi < 10^{-6}, then q_c =0, q_i=0 and CF=0)

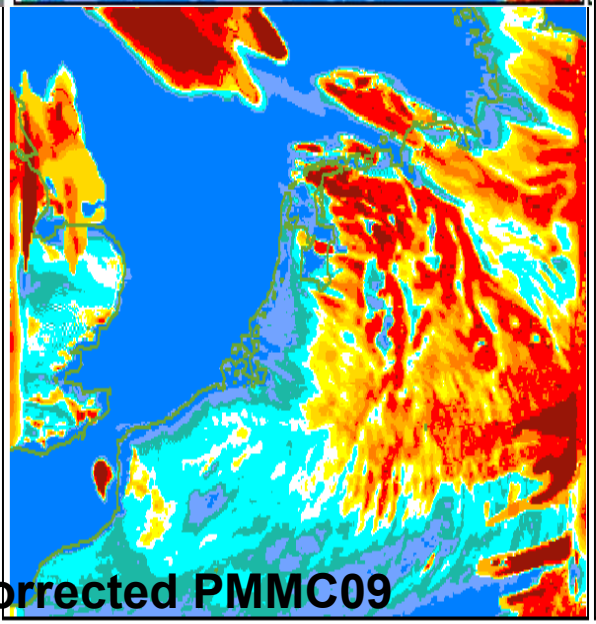
EXP : (if qc+qi < 10^{-12}, then q_c =0, q_i=0 and CF=0)

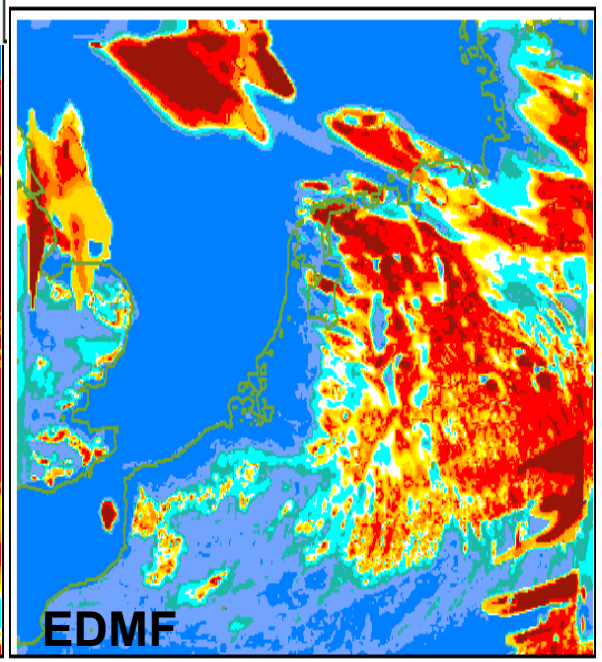
Modifications in shallow convection scheme



Corrections in PMMC09 shallow convection scheme (ice, guess used, convergence)
-> results closer to EDMF, used at KNMI

(Total cloud fractions, 9 April 2010 12TU)

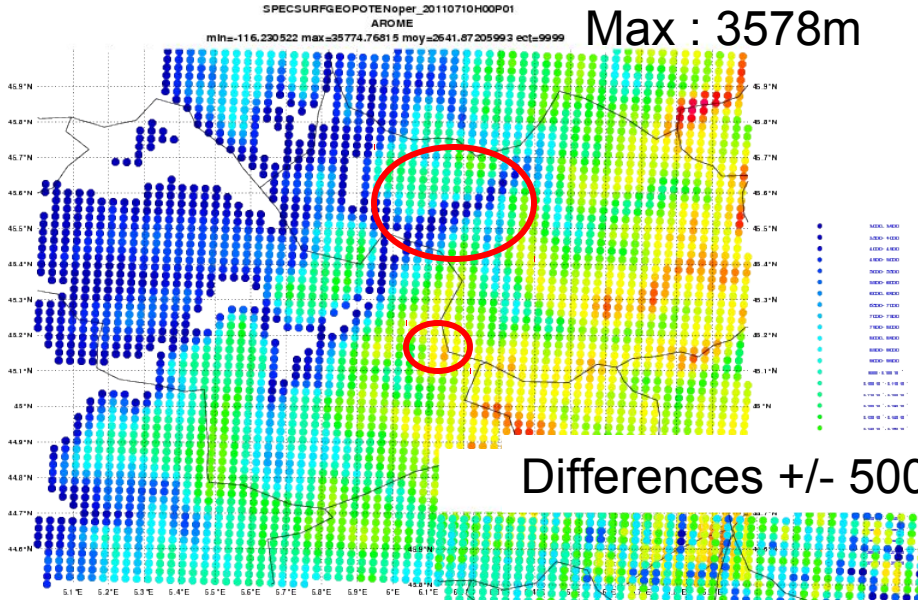




New orography

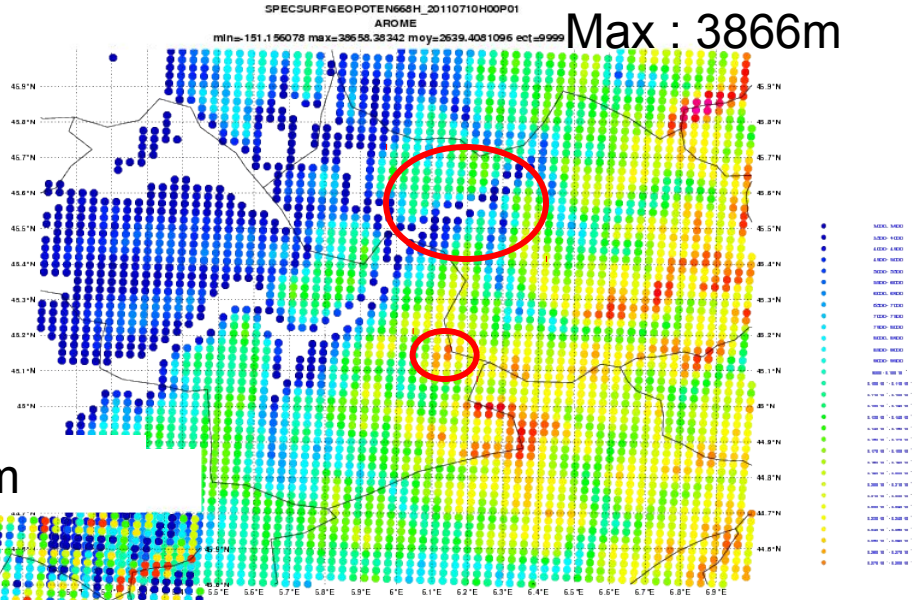
Zoom over the Alps :

Oper (base GTOPO30 – 5 km)



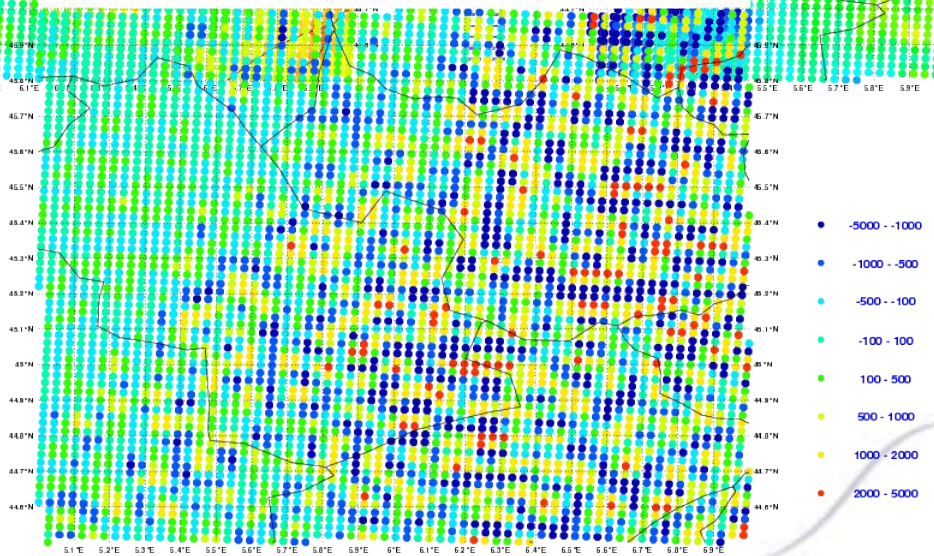
Max : 3578m

New (base GTOPO30 – 1 km)



Max : 3866m

Differences +/- 500m



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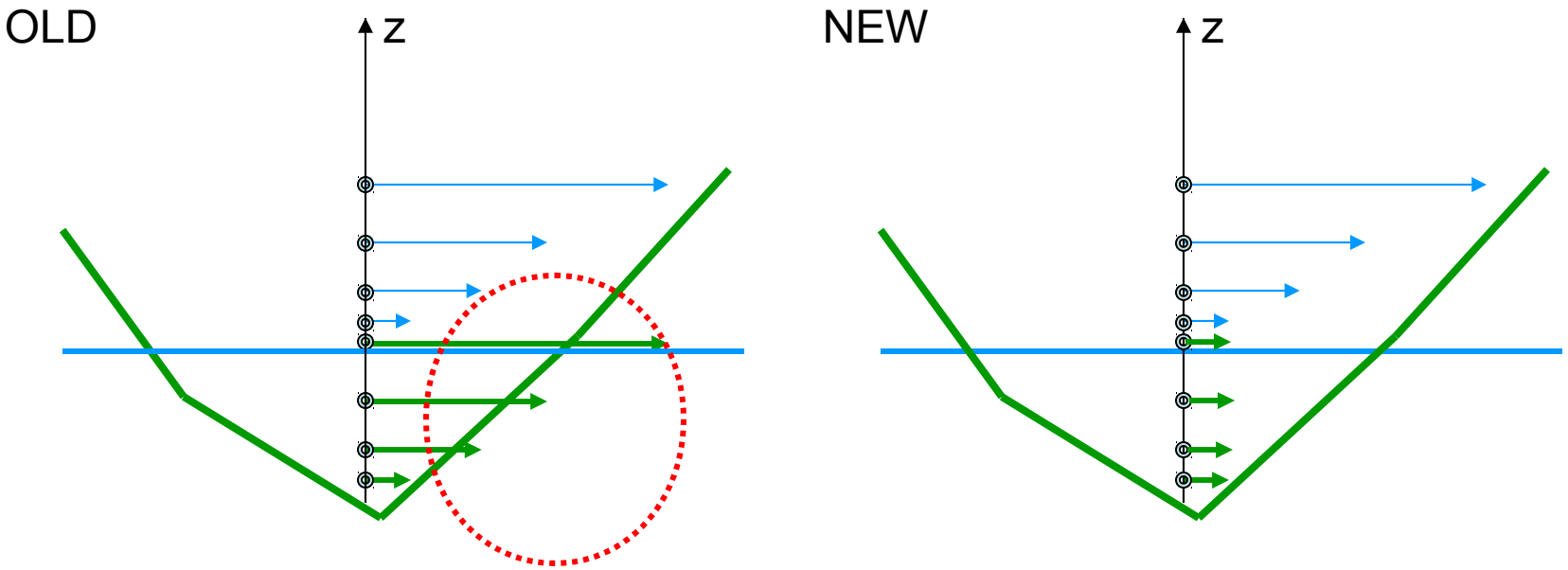
Problem without data assimilation (dynamical adaptation)



Forecast blows up after a few time steps (Lot of SMILAG TRAJECTORY UNDERGROUND)

Wind is not correctly adjusted to the orography.

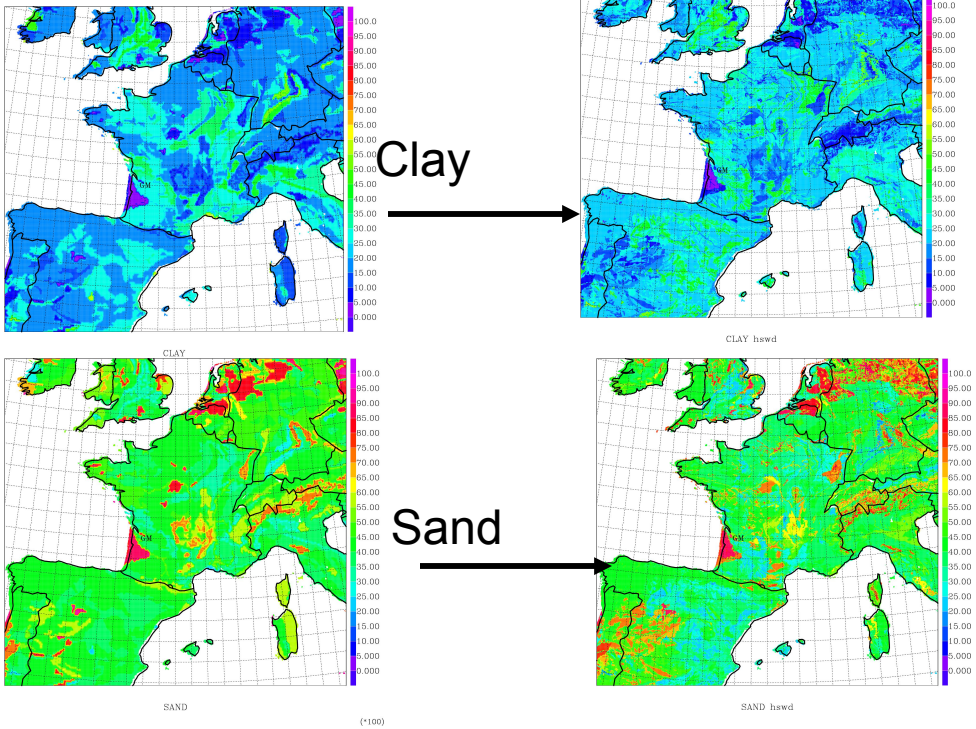
-> modification of wind interpolation during preparation of initial file (apache.F90 in E927)

ARPEGE AROME

New clay and sand climatologies :

OPER (FAO : 10km)

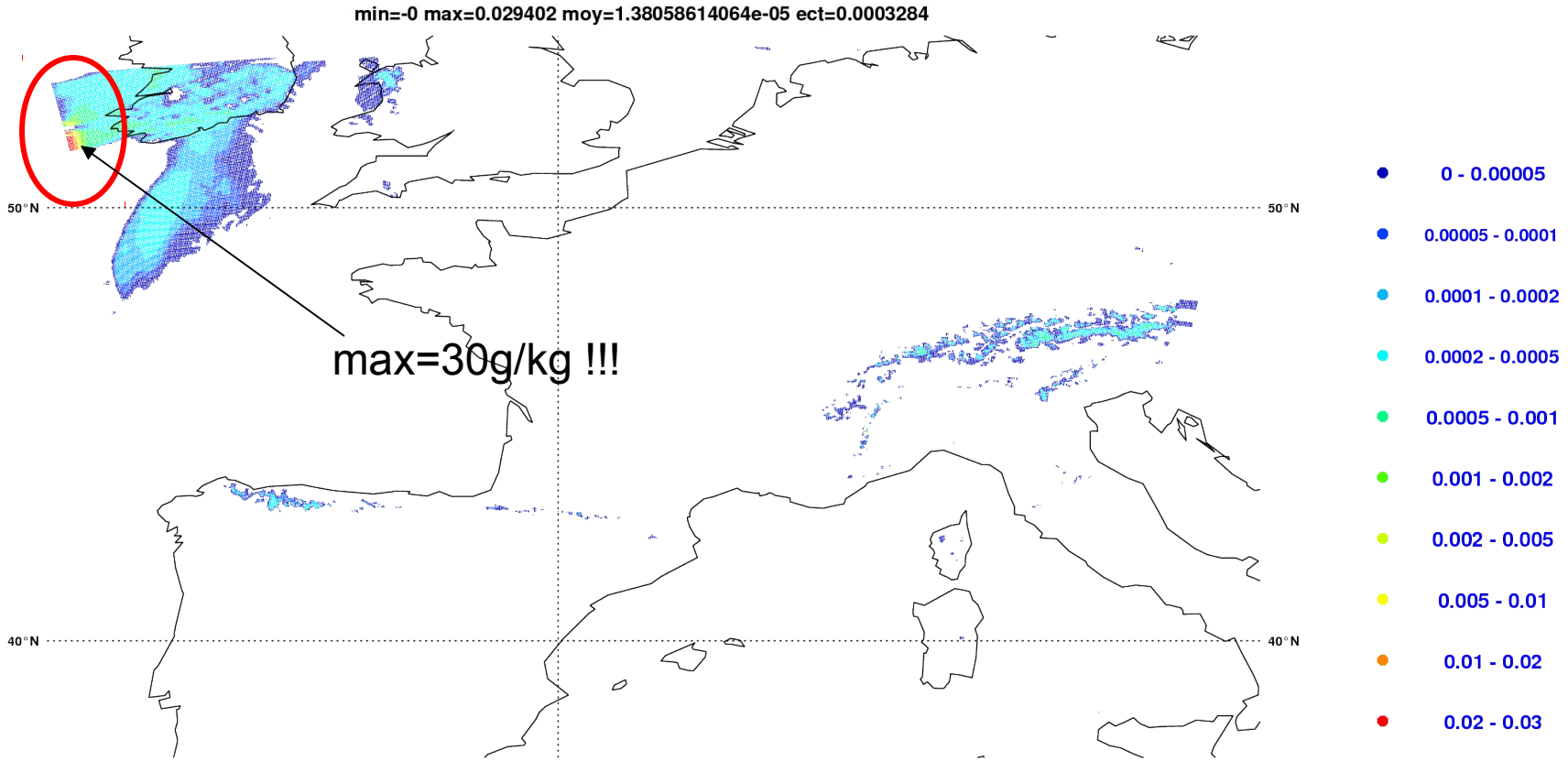
Test(1km HWSD)



- Neutral impact with and without data assimilation

Modification of hydrometeors coupling (in oper, only q_v is coupled)

Example of q_c horizontal cross section (level 50) AROME 6 July 2010 :



Inconsistancies between Arpege fields imposed on the domain's border and AROME physics which cannot modify q_v (infinite source of water) !! -> they persist until ARPEGE profiles allow physics to evaporate them, or until being removed by rainfalls. They can be advected inside the domain.

->coupling with 0 to remove them. Neutral impact on scores.

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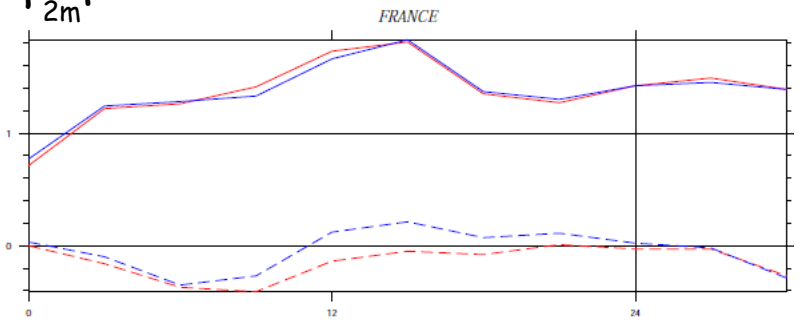
Scores (12 April to 1 May 2012)

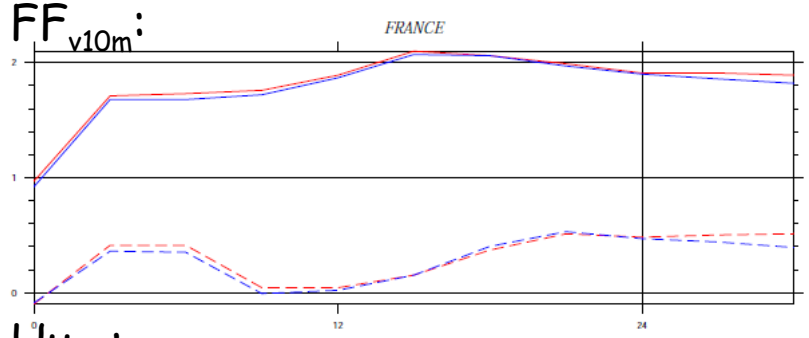
T_{2m}:



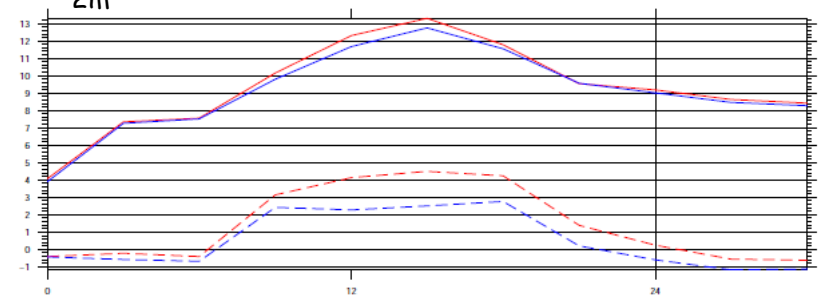
OPER

TEST

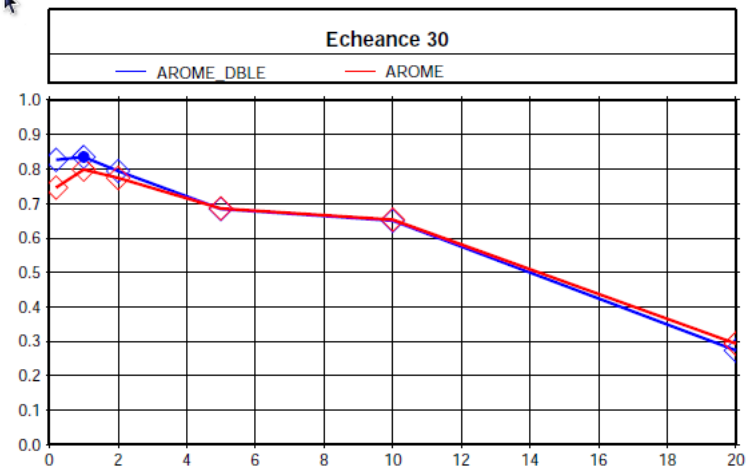
FF_{v10m}:



Hu_{2m}:



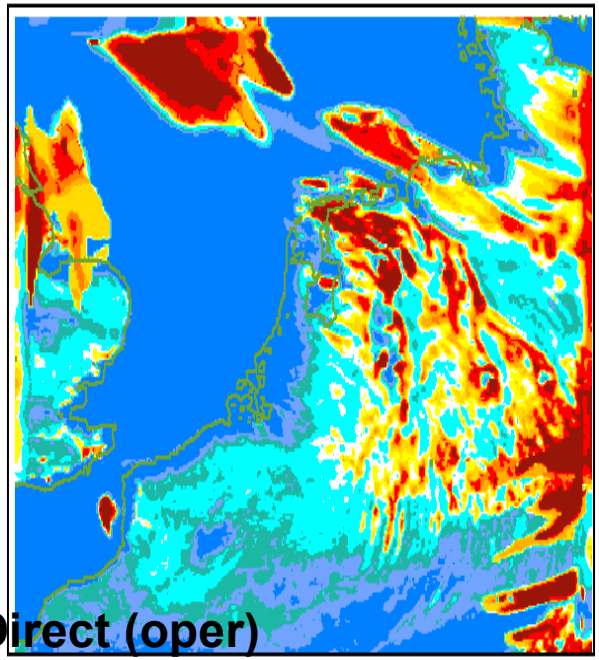
RR24h (P30-P6):

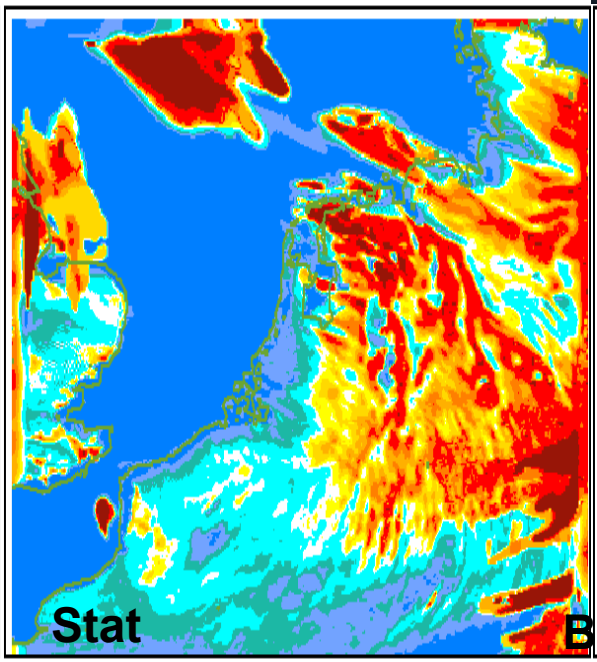


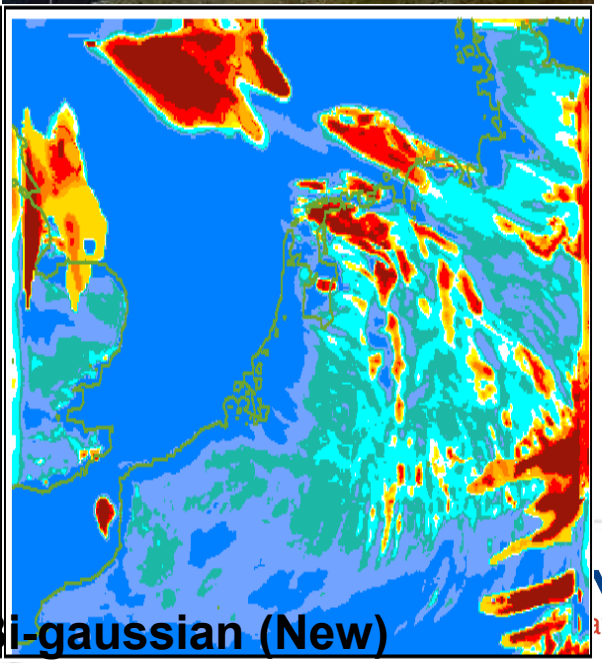
Positive impact on surface parameters (T2m, Hu2m, V10m) and light rains.

Shallow convection cloud schemes

- 3 methods are available :
  - « Direct » : direct use of q_c calculated in the updraft (Pergaud et al, 2009)
  - « Stat » : provide a σ_{shal} (which will be added to the one of turbulence scheme) given to adjustment process.
  - « Bi-gaussian » : bi-gaussian PDF used (Perraud et al.,2010) (2nd peak modelled using shallow convection updraft specifications)



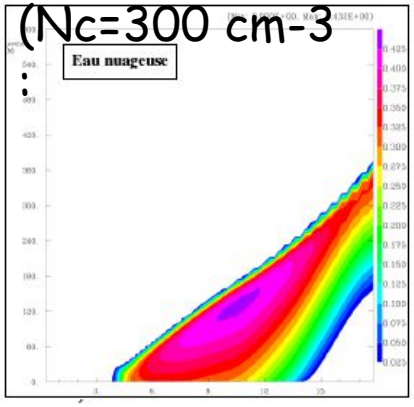




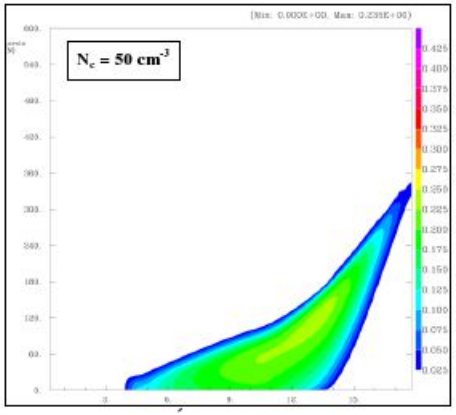
Simulation of polluted/non polluted areas with ICE3 :
Fog case studies of variation of Nc in microphysics and radiation

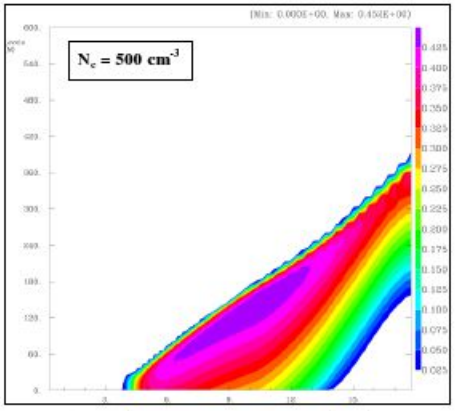
q_c :

ICE3 Ref (Nc=300 cm-3 :



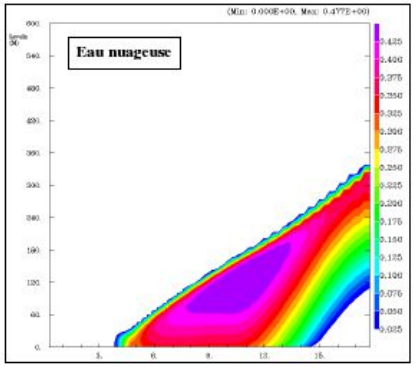
z





time

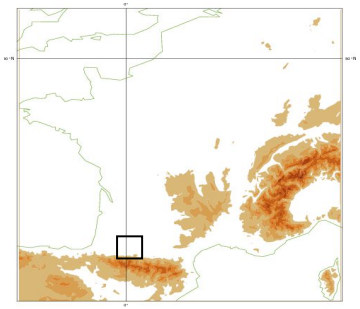
KHKO (2 moments microphysics scheme):



-The variation on Nc has a significant impact on fog structure (q_c content and vertical extent of the fog). The impact is smaller on formation and dissipation times.
-Impact of a more sophisticated 2-moments microphysics scheme is reduced.
-> Perspective : use an aerosol analysis to initialise Nc ?

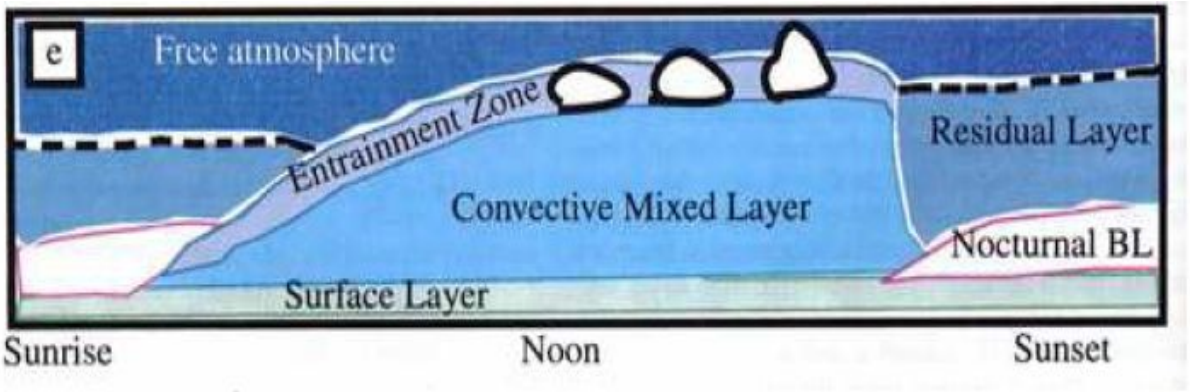
participation to the BLLAST experiment

- Boundary Layer Late Afternoon and Sunset Turbulence



15 June- 8 July around Lannemezan (SW of France) (http://www.aero.obs-mip.fr)

To study the transition from the mixed layer convective boundary layer to a residual layer overlying a stably-stratified surface layer in late afternoon



- For the model point of view, data to evaluate quality in terms of :
  - Vertical structure of the atmosphere
  - turbulence scales
  - Entrainment, wind shear quantification
  - Surface heterogeneity (Q and T soil, VEG, surface budgets…)

(http://bllast.sedoo.fr/campaigns/2011/)

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BLLAST observations

14 June-8 July 2011
11 IOPs

Instrumented towers (6 at 10 m, 1 at 60 m)
tethered baloons, radiosoundings
Instrumented aircrafts and Unmanned aerial vehicules,
UHF radars, sodars, lidars
Scintillometers

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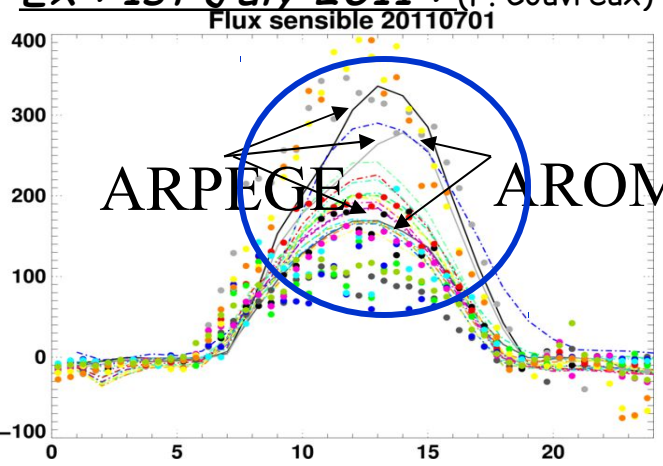
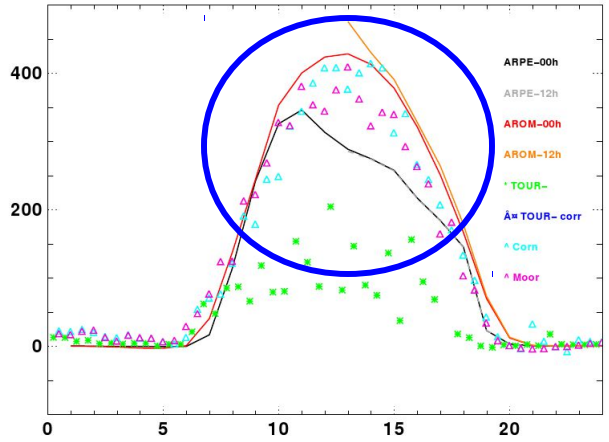
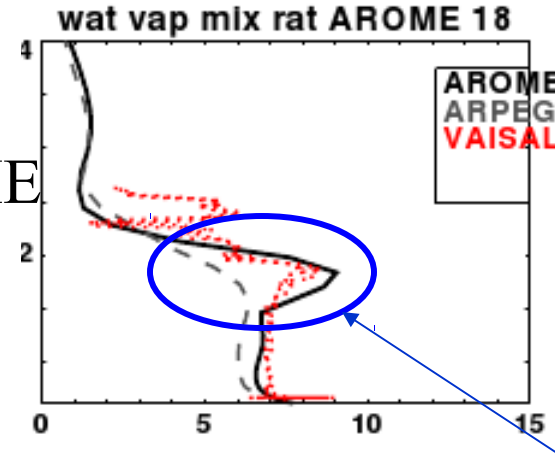
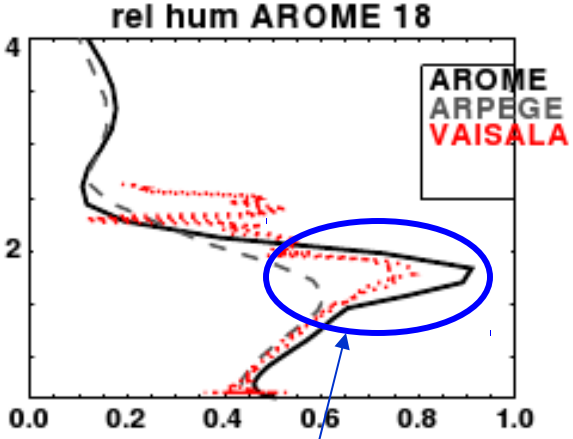
First results from the BLLAST campain

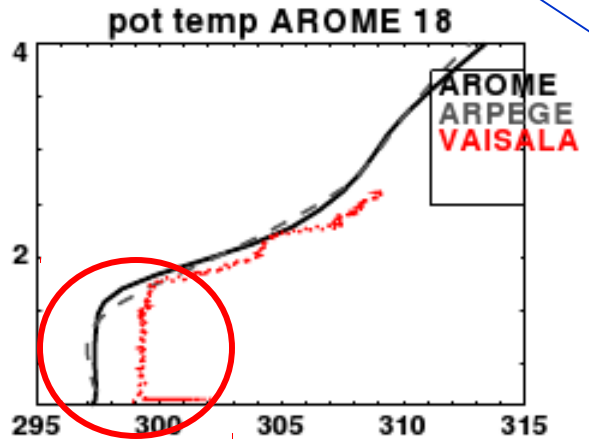
Ex : 1st July 2011 : (F. Couvreux)











Linked with dry thermals mixing in PMMC09 (AROME with KFB is closer to ARPEGE)

AROME performs better than ARPEGE in terms of humidity profiles

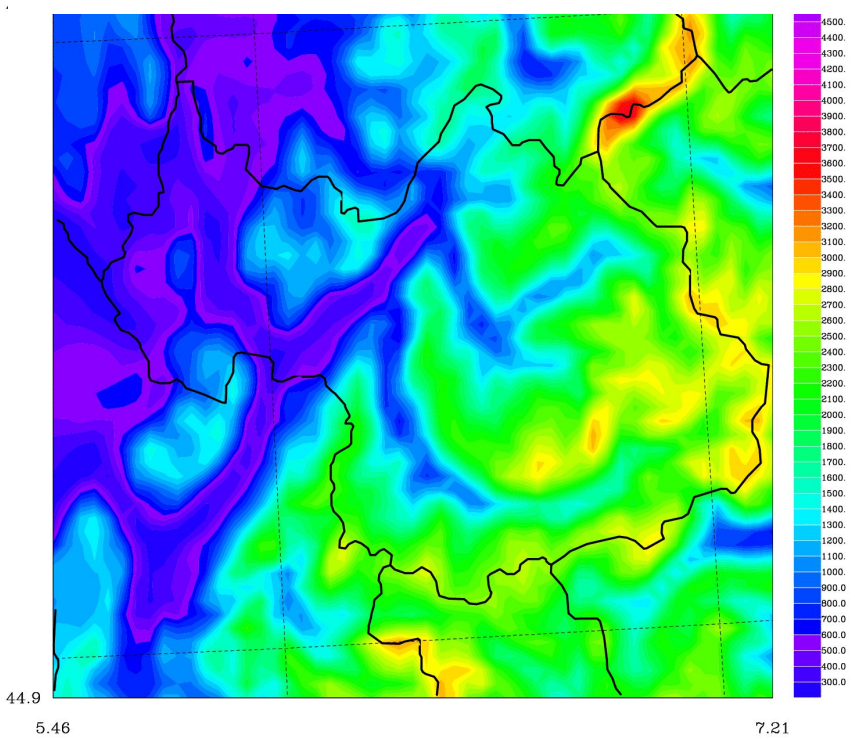
Be carreful in model single points comparison (cf ARPEGE/AROME/Obs variability between nearest points)

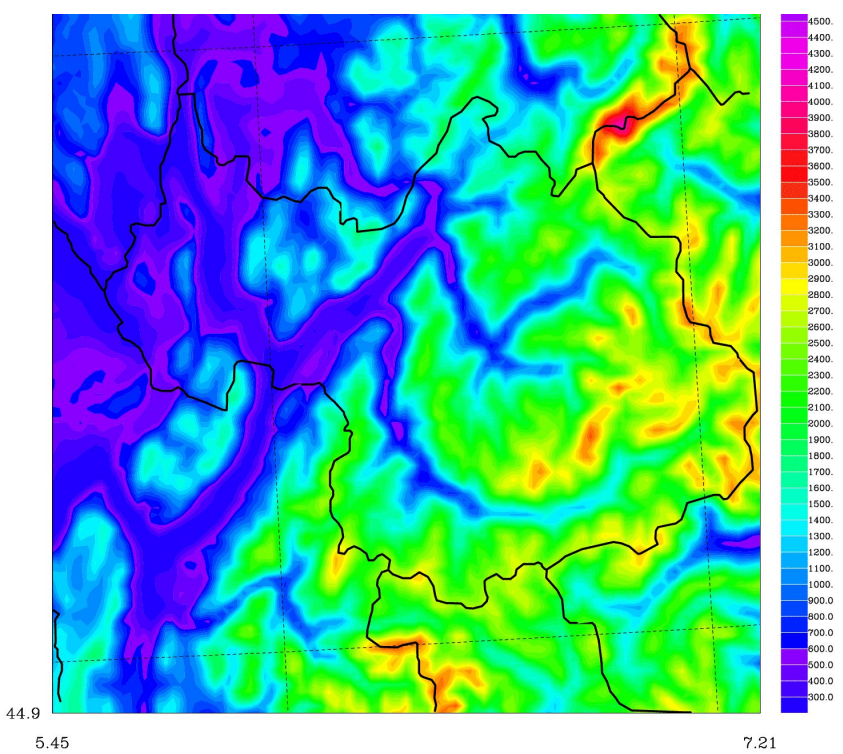
Models are too cold in the boundary layer, deeper evaluation ongoing…

Preparation of AROME-France 1.3km

- Increase horizontal and vertical resolution in 2014 (1.3 kmxL90?)

  « deeper valleys, higher peaks » -> max slope = 39° (versus 23° in oper 2.5km)

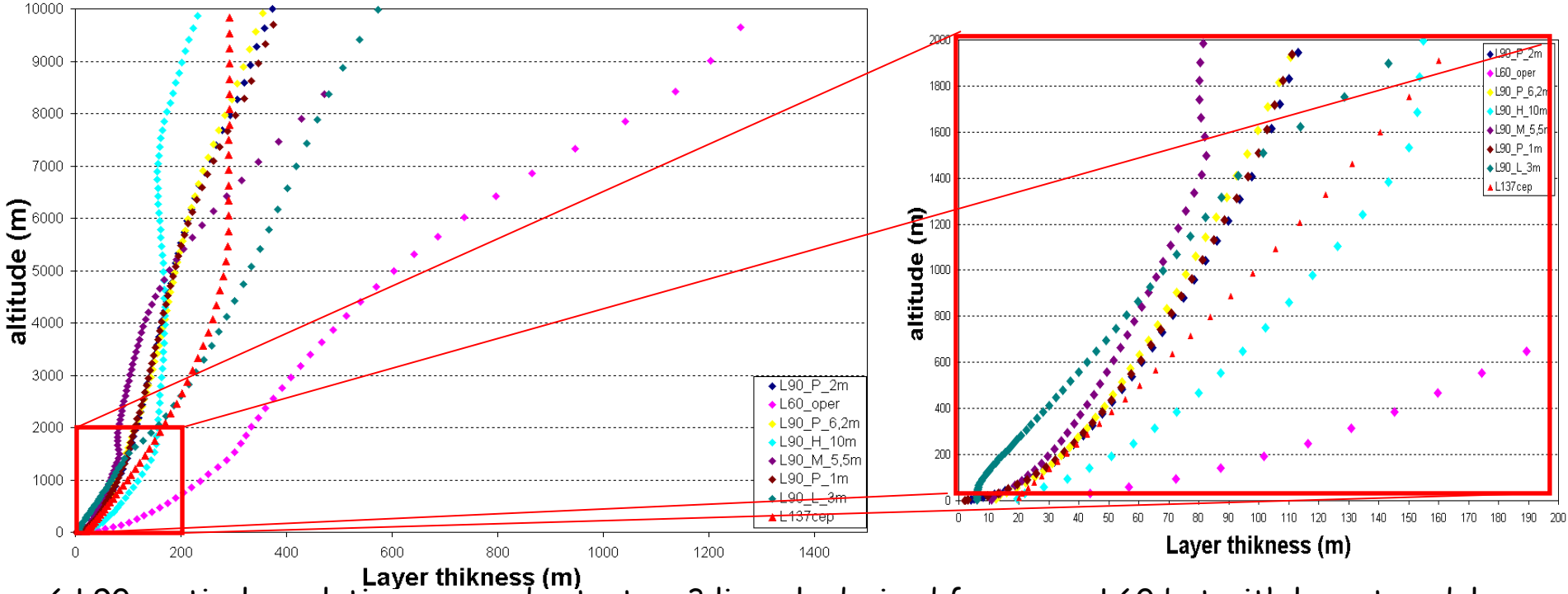




Preparation of AROME_1.3km (vertical resolution)

- Lowering model's roof to prevent instabilities in stratosphere (cf P.Bénard's talk)

- Compromise between numerical efficiency (time step), lowest model level height, meteorological scores



- 6 L90 vertical resolutions are under tests : 3 linearly derived from oper L60 but with lowest model level at 1, 2 or 6 meters), 3 with increased vertical resolution in low, medium, high troposphere.

-First tests on Xynthia storm case -> lowest model levels below 4m requires too small dt (<30s)

-> other L90s are stable with PC scheme at dt=45s

Conclusion / Perspectives

- Current e-suite : Modifications of cloud and shallow convection, new clims (orography and soil), hydrometeors coupling -> positive scores

- New shallow convection cloud schemes available.

- Impact of Nc variation in microphysics.

- Good behaviour of AROME during BLLAST campain

- Preliminary tests to prepare 2014 configuration (1.3km L90?)

Perspectives :

-Meteorological behaviour of 2014 configuration (trainings on fog and convection) and tunings (orographic drag, wind gusts …)

- Improve radiation/surface interaction over orography

- Test Rio et al. Entrainment/Detrainment formulation in PMMC09.

- Use of lakes surface temperature climatologies

- ECOCLIMAP 2

- Reorganisation of apl_arome (optimisations, microphysics adjustment at the end …)

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