The physics in HAAA galaxy and 1D model MUSC

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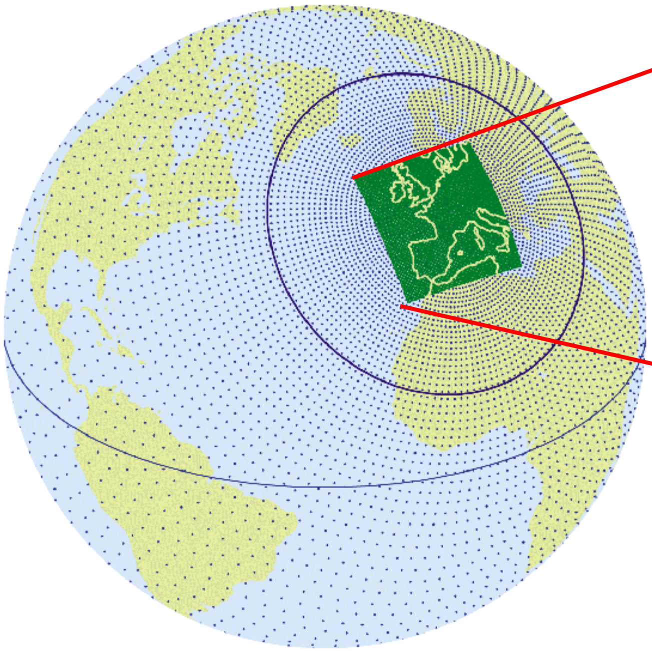
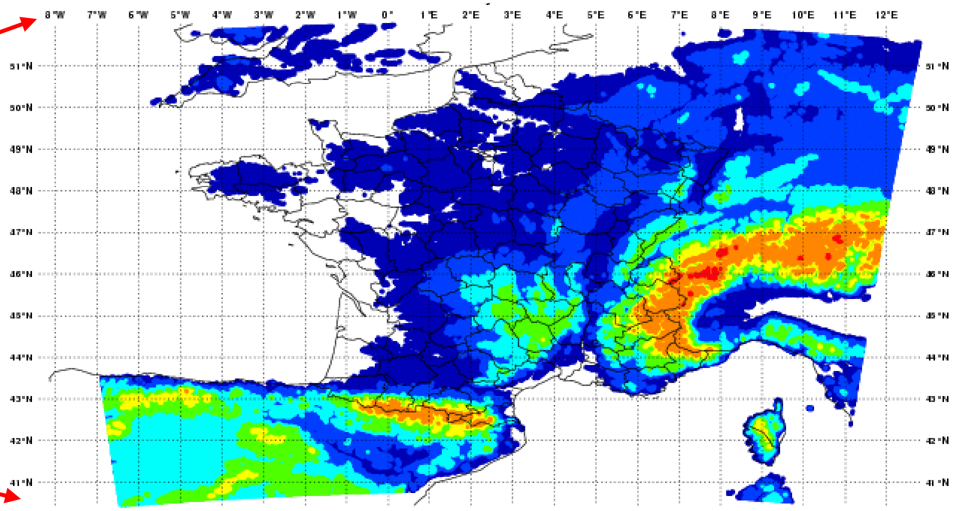
EFB working days
18-22 March 2012 Toulouse, France

Outline

1. Physics packages
2. Turbulence scheme and shallow convection
3. Problems …
4. MUSC and GABLS1

Operational Weather forecasting at Météo-France:
ARPEGE/ALADIN and AROME



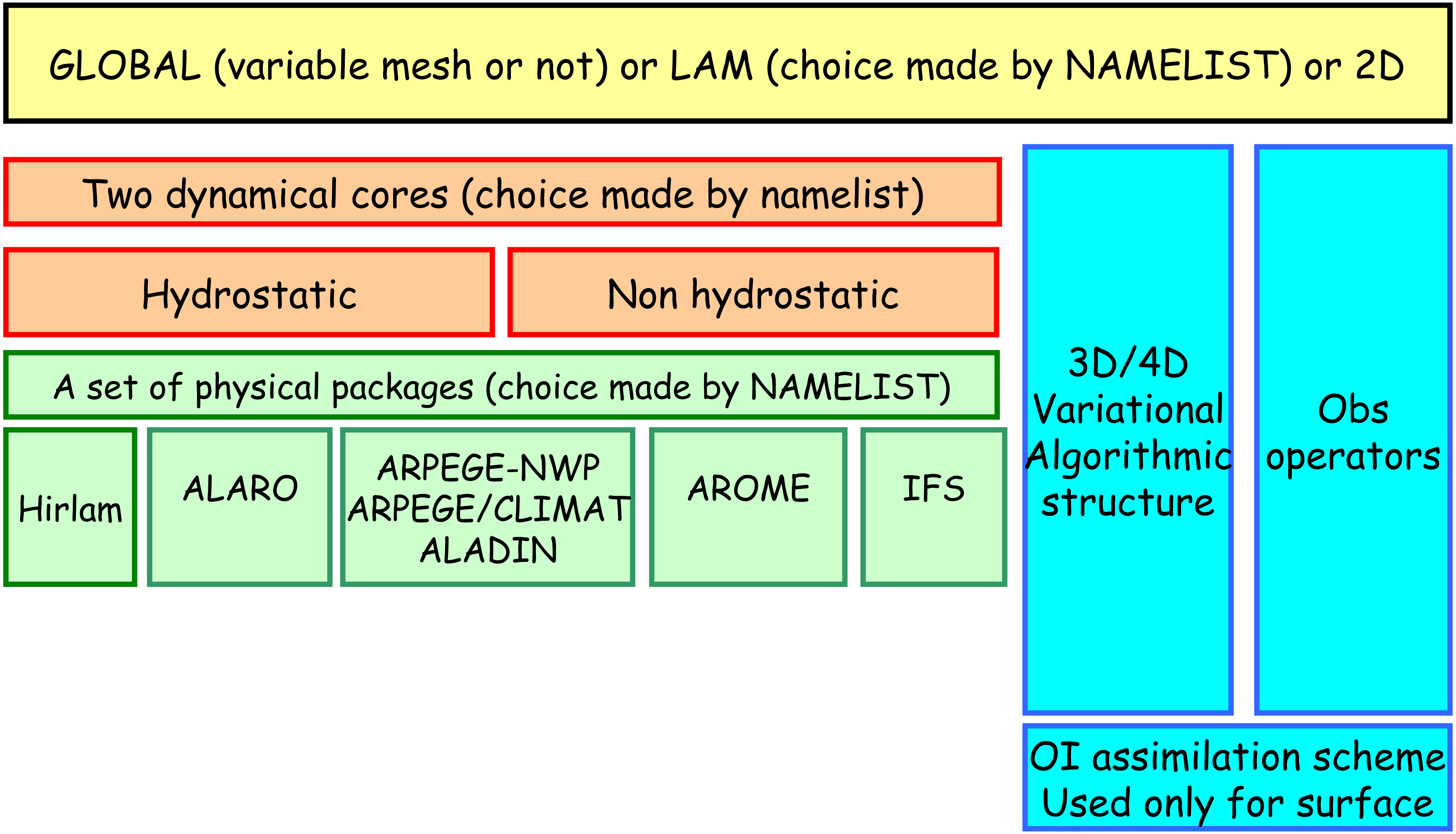


Cloud Resolving Model AROME
30 h forecasts every 6h
dx=2.5 km, 60 Levels, time-step=1mn (SL)
3DVar Data Assimilation system (RUC3h)

Global ARPEGE-IFS
4-day forecasts every 6 hours dx=10 km on France, 55km on Australia dt=10mn
Stretching factor c=2.4 and turning of the pole over the zone of interest
Stretched vertical grid with 70 levels
4DVar Inc Data Assimilation system
(T107 25iter and T323 30iter dx=60km)

METEO FRANCE
Toujours un temps d'avance

ARPEGE/ALADIN/AROME/IFS/HARMONIE/MUSC
A NWP unified sofware



GLOBAL (variable mesh or not) or LAM (choice made by NAMELIST) or 2D

Two dynamical cores (choice made by namelist)

Hydrostatic

Non hydrostatic

A set of physical packages (choice made by NAMELIST)

Hirlam

ALARO

ARPEGE-NWP
ARPEGE/CLIMAT
ALADIN

AROME

IFS

3D/4D
Variational
Algorithmic
structure

Obs
operators

OI assimilation scheme
Used only for surface

Physics package in MUSC

	ARPEGE/ALADIN	AROME	ALARO0
Surface	ISBA (Noilhan, Planton (89), Giard Bazile (2000)) or SURFEX	SURFEX with ISBA, ECUME, TEB	ISBA (Noilhan, Planton (89),Giard Bazile (2000)) or SURFEX
Coeff K diffusion	TKE – CBR2000 (HL) modified for Km	TKE –CBR2000 (FL) modified for Km	TOUCANS (I. Bastak, JF. Geleyn)
L Mixing length	BL89 with possible modifications from the shallow and deep convection	BL 89	Int. HCLA Ayotte Several options
Shallow convection	KFB Bechtold et al 2000 or EDKF from AROME	EDKF (Pergaud et al 2009)	Geleyn 87 modified Ri
Clouds	Smith(90) or f0, f1, f2 Bougeault (82)	f0, f1, f2 Bougeault (82)	Xu & Randall
Micro-Physics	Ql,Qi,Qr,Qs Lopez(2002) Bouteloup et al (2005)	Ql,Qi,Qr,Qs,Qg Pinty and Jabouille 1998	Ql,Qi,Qr,Qs
Convection	Bougeault 85 with modifications	No	3MT-deep
Radiation	RRTM for LW (Mlawer et al. 1997) and Morcrette et al. 2001 for SW (6b)		New-Geleyn

cnrs INSU
Observer & comprendre

METEO FRANCE
Toujours un temps d'avance

PBL parametrization (before Feb. 2009) used in ARPEGE/ALADIN

How to compute the subgrid flux ? $\overline{w'\psi'}$

- with a diffusion scheme: $\overline{w'\psi'} = -K\dfrac{\partial \psi}{\partial z}$

-with a mass flux scheme : $\overline{w'\psi'} = -M\left(\psi - \psi_{updraft}\right)$
(used only for deep convection in the 90's)

Louis (79) propose to compute K as follows: $K_\psi = l_m \cdot l_\psi \left|\dfrac{\partial U}{\partial z}\right| F_\psi(R_i)$

And to "simulate" the mixing done by the shallow convection, a enhanced Ri is used following Geleyn 87 :

$$R_i = \frac{g}{c_p T}\,\frac{\partial s/\partial z + L\min\left(0, \partial\left(q - q_s\right)/\partial z\right)}{\left|\partial u/\partial z\right|^2}$$

But the PBL was too dry partly due to an excess of mixing with an underestimation of the stratocumulus and low cloud

Turbulence and shallow convection (used since Feb 2009 in ARPEGE/AROME)

EDMF concept : Siebesma and Teixeira, (2000) and Hourdin et al., (2002) and Soares et al., 2004

$$\overline{w'\psi'} = -K\frac{\partial \psi}{\partial z} - M\left(\psi - \psi_{updraft}\right)$$

TKE Scheme CBR(2000), BL(89)

- Shallow convection from Bechtold et al (2001) for ARPEGE/ALADIN (KFB) or Pergaud et al 2009 (EDKF) for AROME

$$K_u = \alpha_u \cdot l \cdot \sqrt{\overline{e_T}} \qquad K_{\theta/q} = \alpha_\theta \cdot K_M \cdot \phi_3$$

$$\frac{\partial e_T}{\partial t} = advec + P_d + P_\theta - \frac{1}{\rho}\cdot\frac{\partial \overline{\rho w' e_T'}}{\partial z} - c_\varepsilon \cdot \frac{\overline{e}_T^{3/2}}{l}$$

TKE scheme in ARPEGE/ALADIN

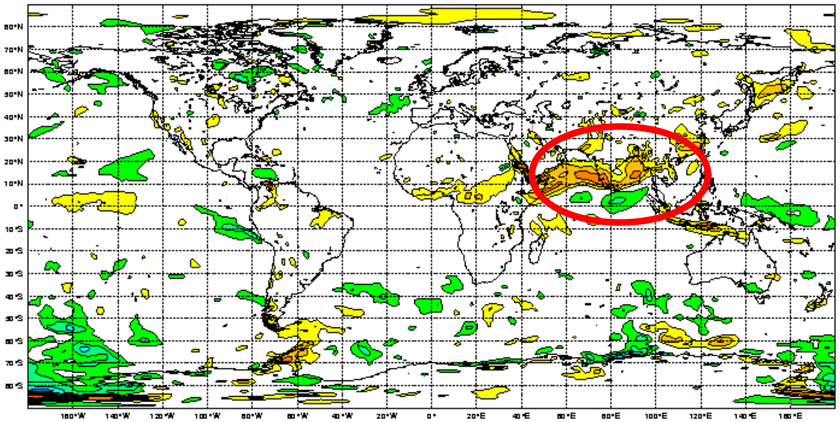
- The TKE is computed on the « half-level » , the levels of the exchange coefficients for momentum (Km) and temperature (Kt)
- The moist fluxes are computed with θ_{vl} and the Betts variables θ_l q_T

- The sub-grid variance of cloud water is computed with a "mixture"of a symmetric (Gaussian) and asymmetric (Exponential) for the Cumulus and the strato-cumulus respectively (Bougeault 82 and Bechtold 95)
- TKE is advected with the semi-lagrangian scheme. TKE is interpolated on the full-level after the physic for the advection and then go back to the half-level for the physic → small impact and only positive for the wind gust diagnostic

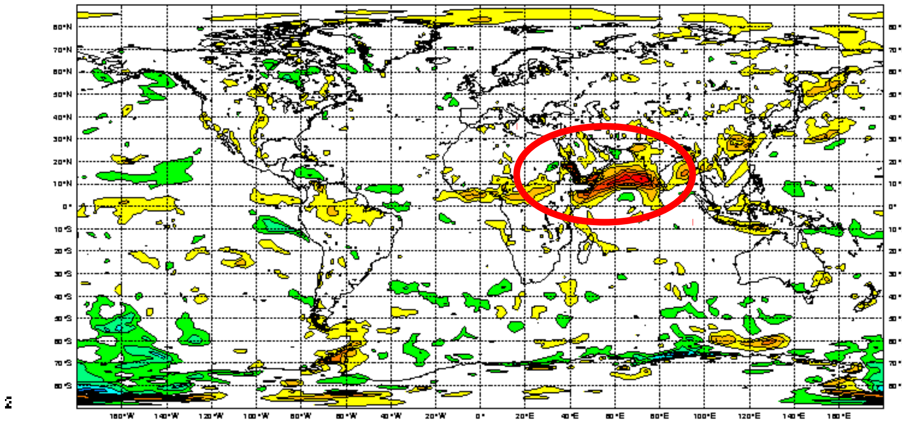
In the tropics ….

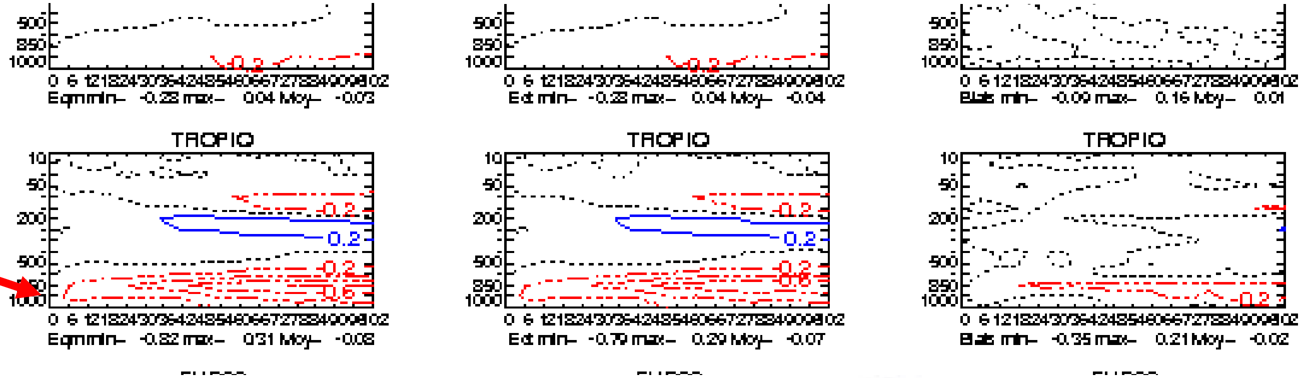
Wind anomaly 850hPa vs ECMWF analysis

ARPEGE (with Louis)



ARPEGE withTKE+KFB





Wind
Pb in the
tropics

For the wind problem …

1. Increase the wind mixing with new values for the TKE scheme
2. Modify the mixing length with the shallow convection scheme and additional term for the thermal production

$$K_u = \alpha_u \cdot l \cdot \sqrt{\overline{e_T}} \qquad K_\theta = \alpha_\theta \cdot l \cdot \sqrt{\overline{e_T}} \cdot \phi_\theta$$

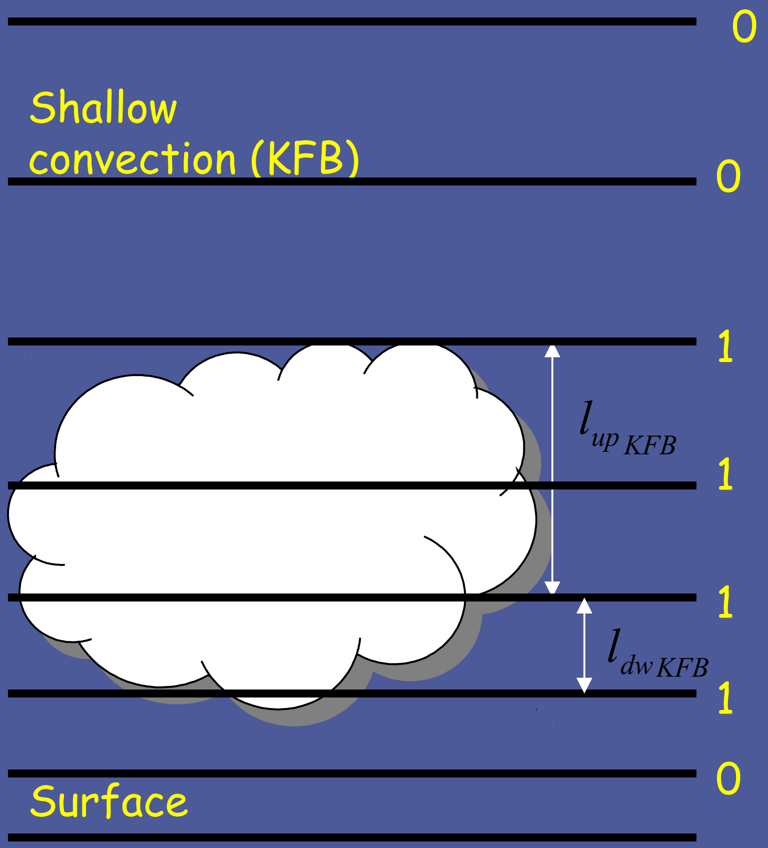
$$\alpha_u = 0.0667 \rightarrow 0.126 \qquad \alpha_\theta = 0.16675 \rightarrow 0.142$$

$$\frac{\partial \overline{e}_T}{\partial t} = P_d + P_\theta - \frac{\partial \overline{w' e_T}}{\partial z} - c_\varepsilon \frac{\overline{e}_T^{3/2}}{l_\varepsilon} \qquad C_\varepsilon = 0.7 \rightarrow 0.85$$

$$\frac{1}{\rho} \frac{\partial}{\partial z}\left(\rho \cdot C_e \cdot l \cdot \sqrt{\overline{e_T}} \cdot \frac{\partial e_T}{\partial z} \right)$$

$$C_E = 0.4 \rightarrow 0.34$$

Link between shallow convection and TKE



Shallow convection (KFB)

Surface

$$l_{up\_cvpp} = Max(l_{up\,bl89}, l_{up\,KFB})$$

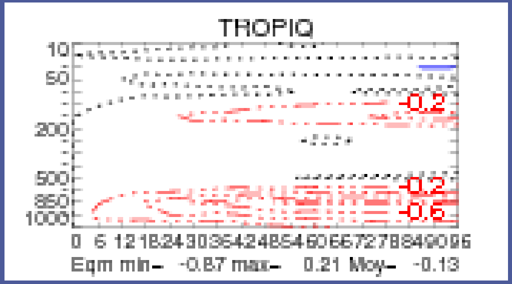
$$l_{dw\_cvpp} = Max(l_{dw\,bl89}, l_{dw\,KFB})$$

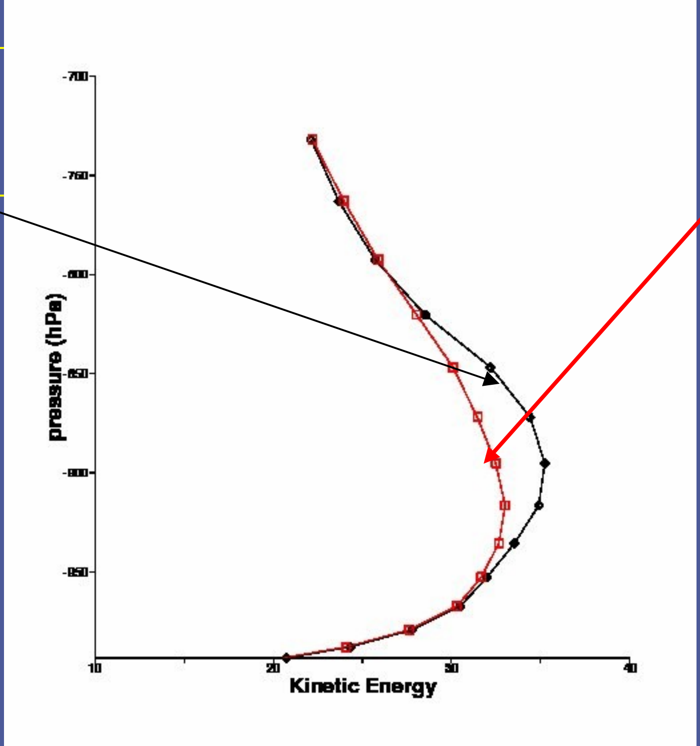
$$\left(-\frac{g}{\theta_v}\overline{w'\theta_v'}\right)_{shallow} \longrightarrow \frac{\partial \bar{e}_T}{\partial t}$$

Enhance the mixing

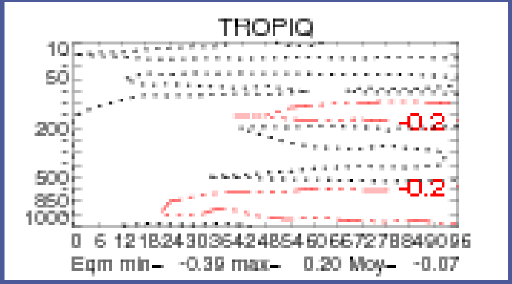
Impact of the thermal production from KFB for the TKE and the modified mixing length.
Diff of RMS error for wind

without thermal prod.. from shallow





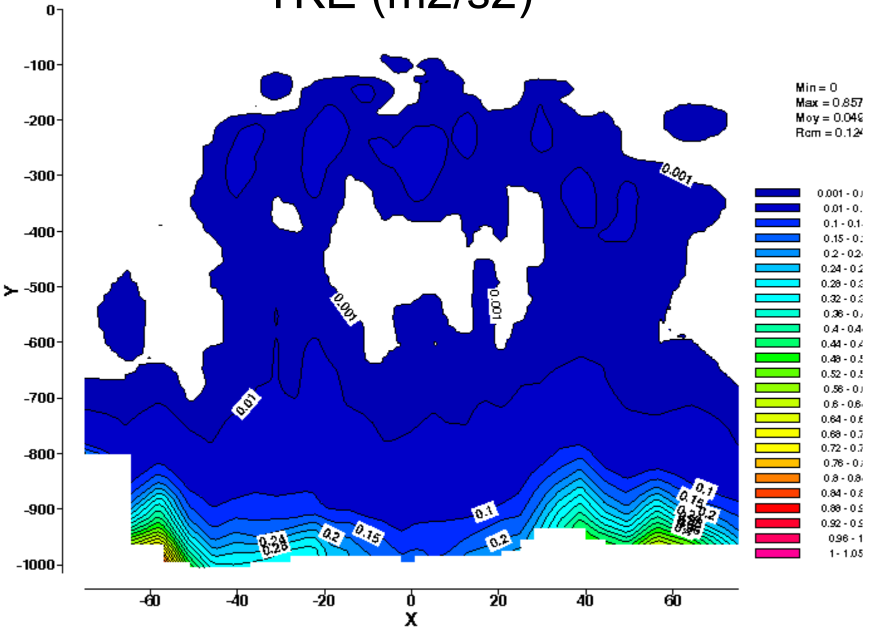
With thermal prod. from shallow + modified L

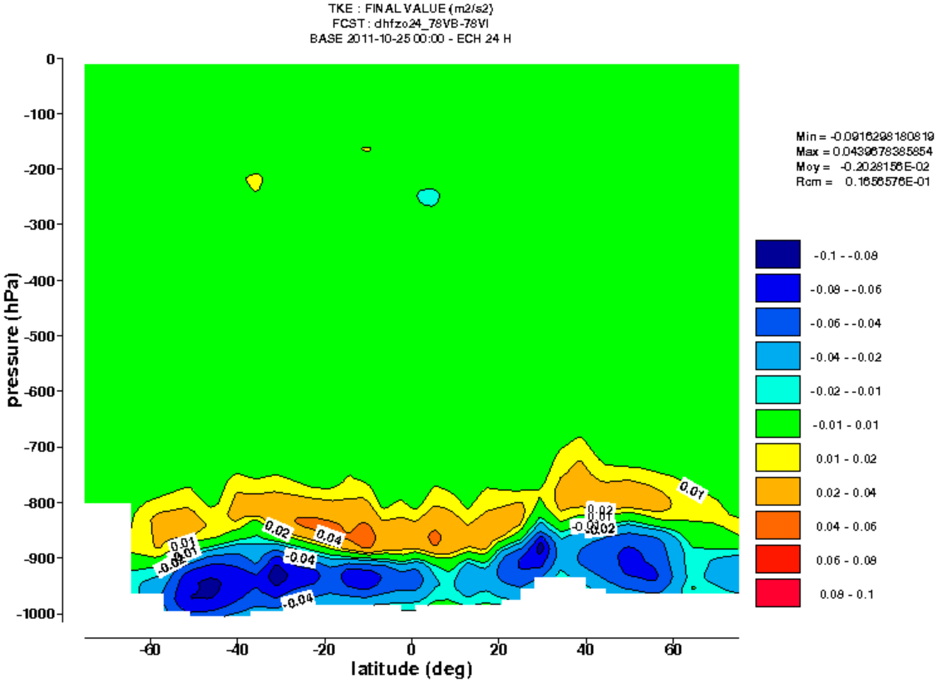


Zonal mean over the tropical area of the Kinetic energy (J/kg)

Impact of the thermal production from KFB for the TKE and the modified mixing length.

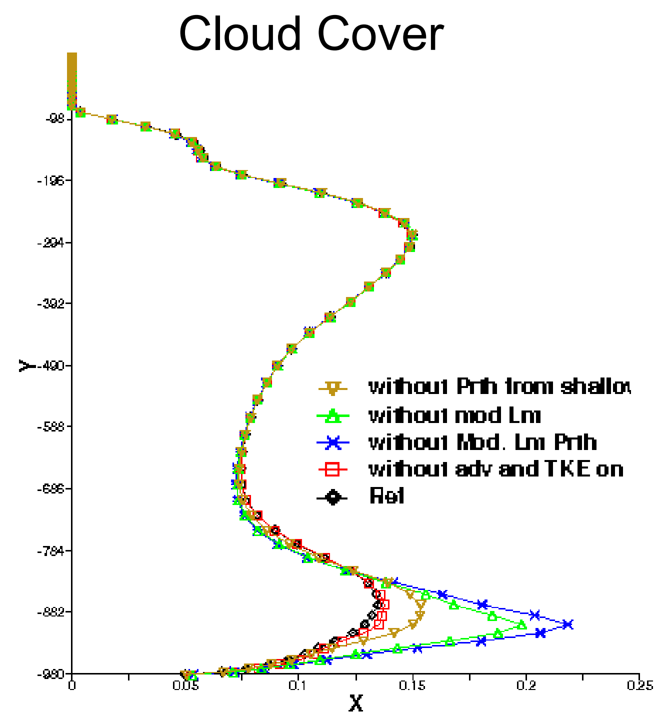
TKE (m2/s2)

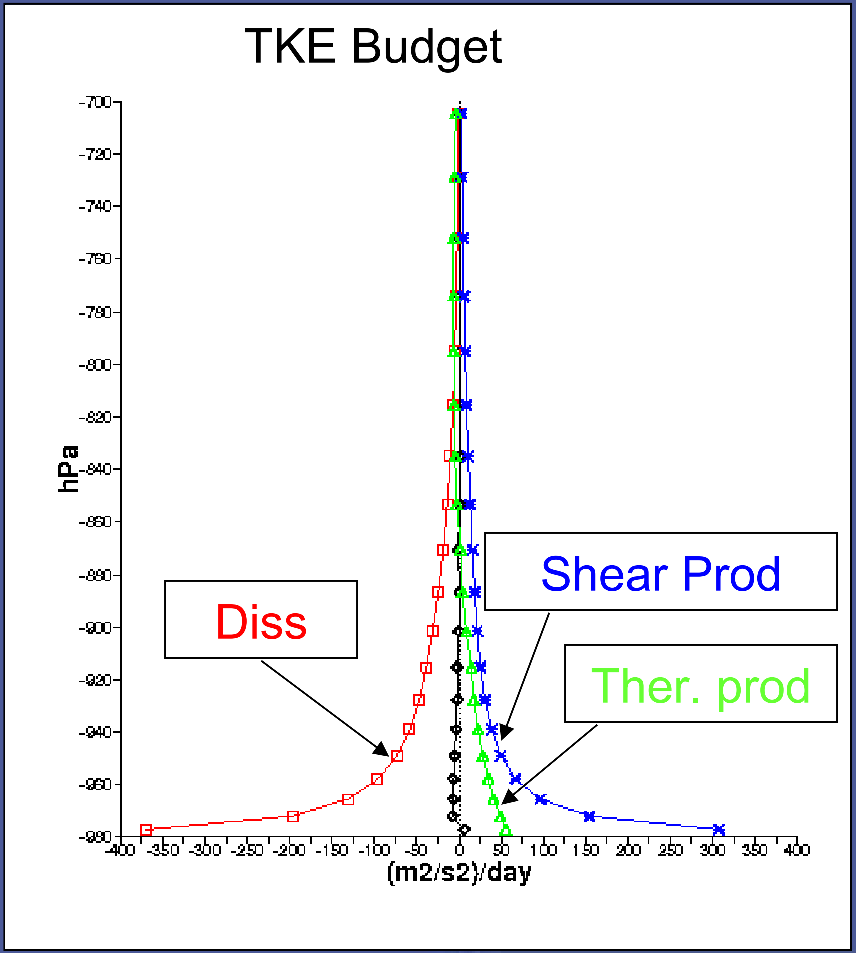




More TKE with Lm increased → more mixing

Impact of the thermal production from KFB for the TKE and the modified mixing length.


Cloud Cover


TKE Budget

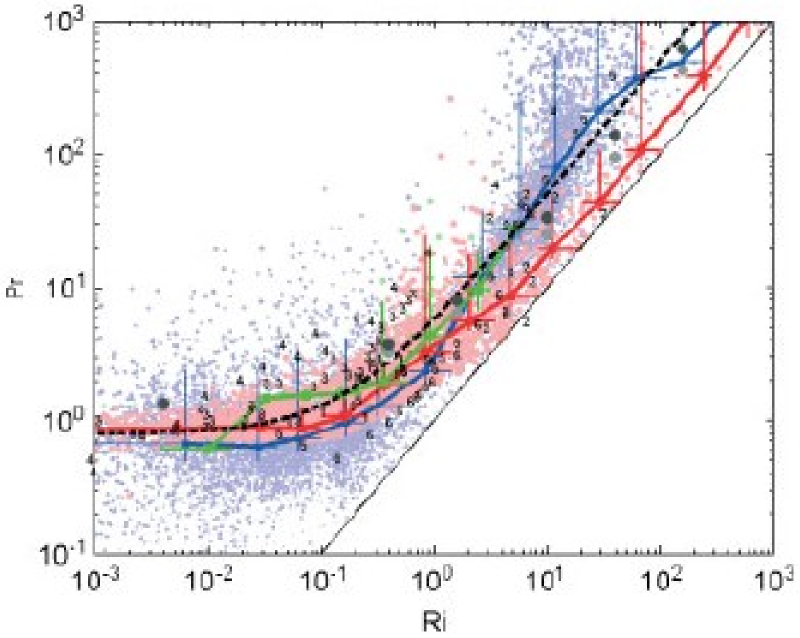
Diss

Shear Prod

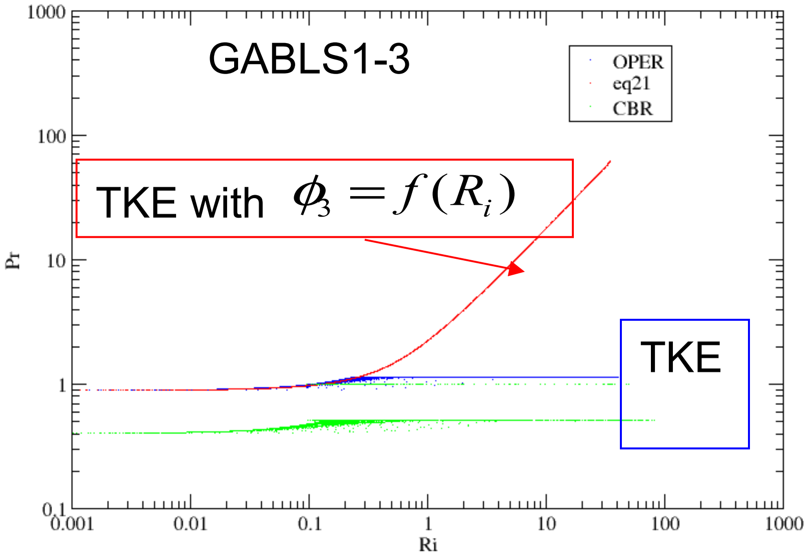
Ther. prod

Some weaknesses …

1. We still have warm bias → interaction with the surface and the snow scheme
2. Following Galperin et al 2007 and Zilitinkevich et al 2008 turbulence survives for Ri>>1. It is not the case with TKE …



From Zilitinkevich et al 2008



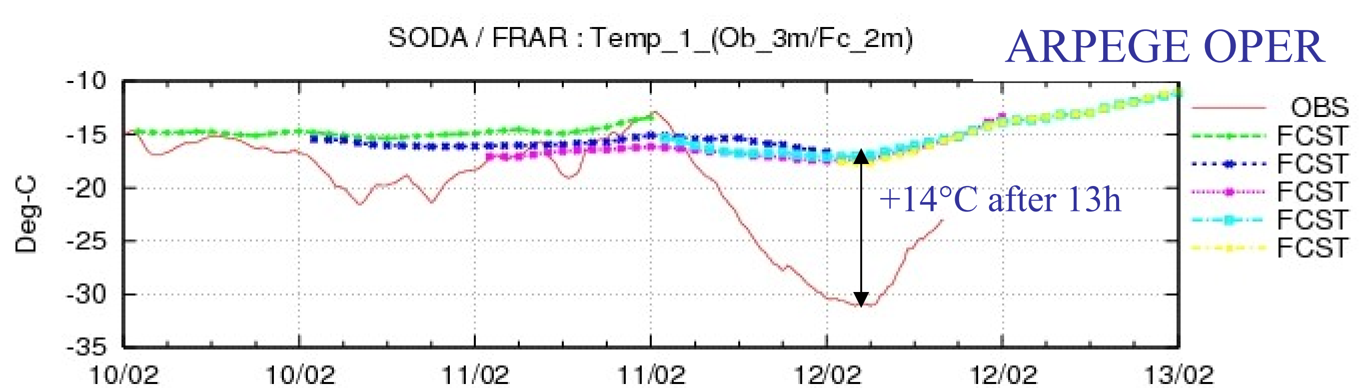
$$\mathrm{Pr} = \frac{K_m}{K_h} = \frac{1}{\alpha_\theta \phi_3}$$

with $\alpha_\theta = 1.13$

$0.78 < \phi_3 < 2.2$

Sodankyla T2m 20100211 starting at 12UTC

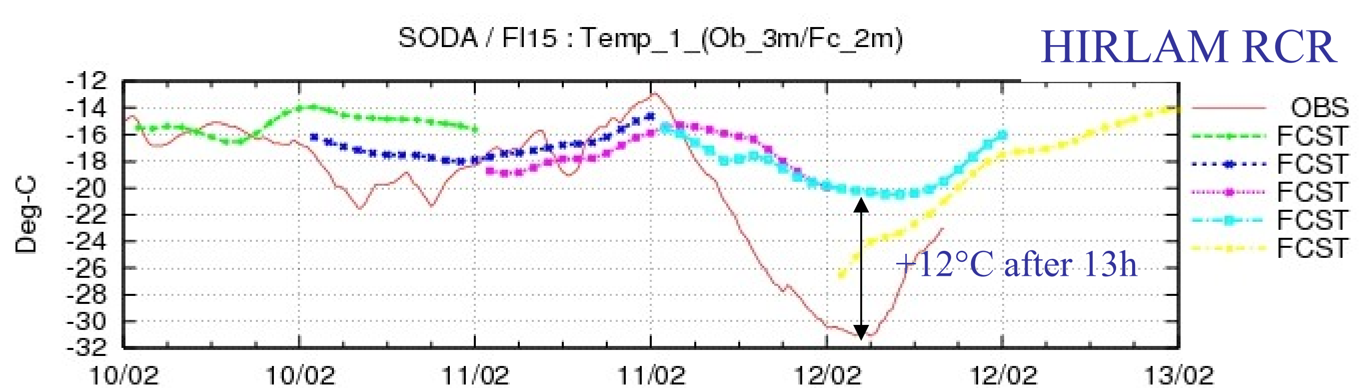
From http://fminwp.fmi.fi/mastverif/mastverif.html



ARPEGE OPER

+14°C after 13h

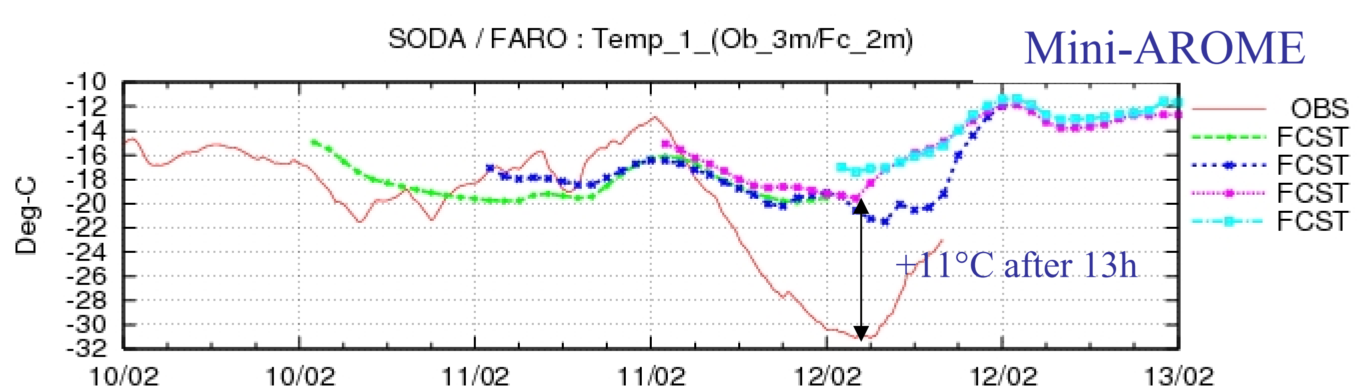
ARPEGE: too warm →surface analysis has rejected the T2m obs at 00UTC the 12th Feb. (yellow curve)



HIRLAM RCR

+12°C after 13h

HIRLAM RCR : also too warm but less than ARPEGE → the surface analysis is able to capture the cooling (yellow curve)



Mini-AROME

+11°C after 13h

Mini-AROME : 30x30 pts dynamical adaptation from ARPEGE with SURFEX (snow scheme D95) → no specific analysis.

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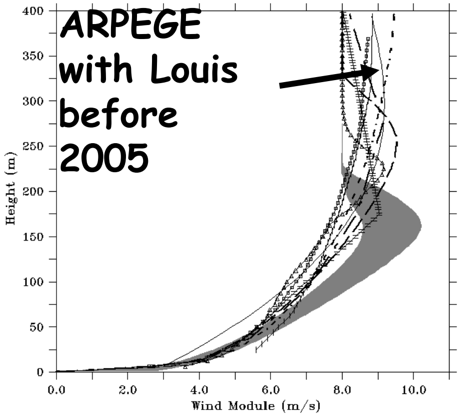
Toujours un temps d'avance

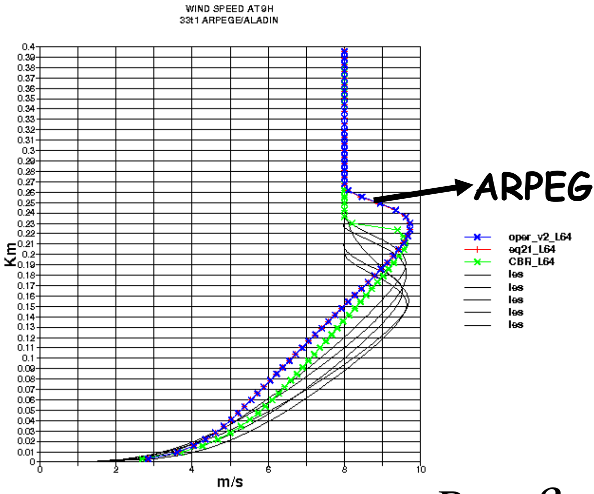
Impact of Phi3=f(Ri)



ARPEGE with Louis before 2005

Cuxart (2006)

GABLS1



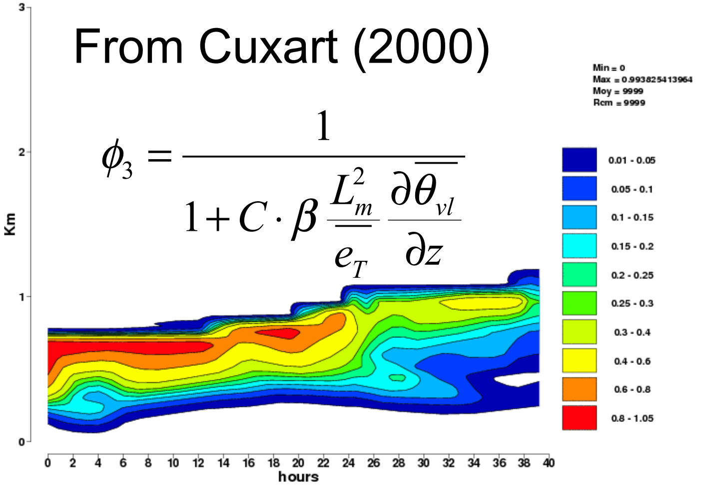
ARPEGE Oper

$$\overline{(w'\theta_l')} = -\alpha_\theta \alpha_u l \sqrt{\overline{e_T}} \cdot \frac{\partial \overline{\theta_l}}{\partial z} \cdot \phi_3$$

$$\overline{(w'q_t')} = -\alpha_\theta \alpha_u l \sqrt{\overline{e_T}} \cdot \frac{\partial \overline{q_t}}{\partial z} \cdot \phi_3$$

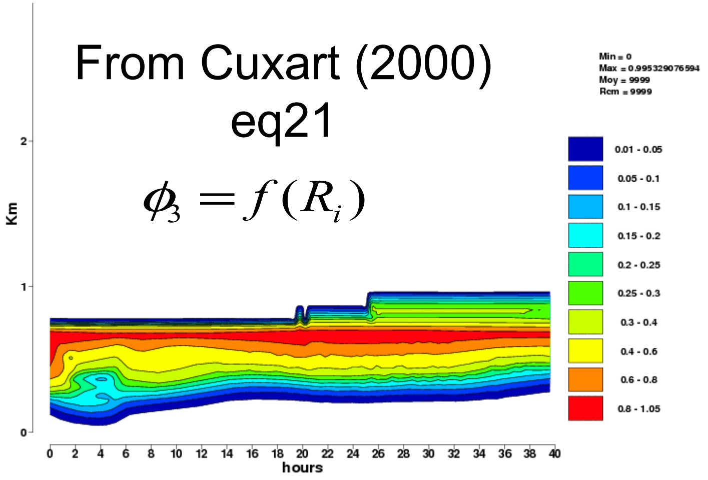
$$P_\theta = \beta \cdot \overline{(w'\theta_{vl}')} = \beta \cdot E_q \overline{(w'q_t')} + \beta \cdot E_\theta \overline{(w'\theta_l')}$$

Cloud Cover ASTEX Lagrangian (Euclipse)



From Cuxart (2000)

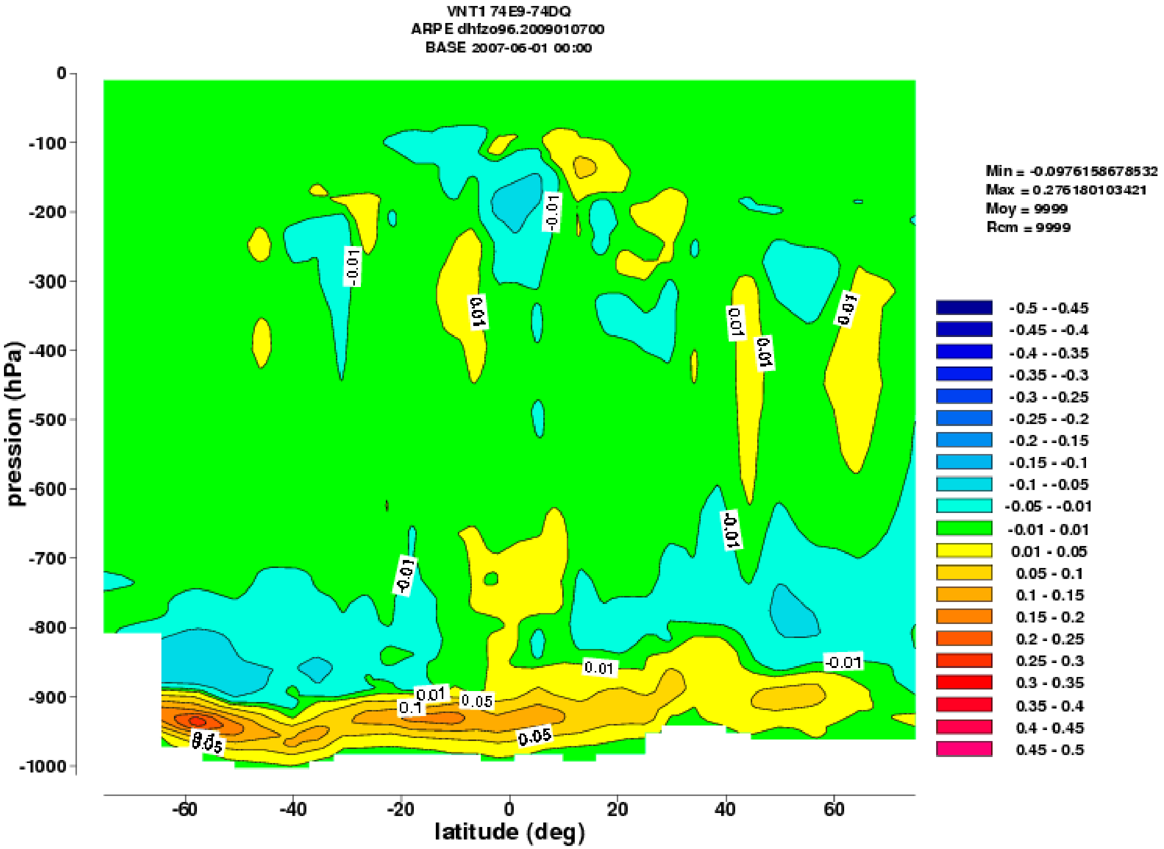
$$\phi_3 = \frac{1}{1 + C \cdot \beta \frac{L_m^2}{\overline{e_T}} \frac{\partial \overline{\theta_{vl}}}{\partial z}}$$



From Cuxart (2000)
eq21

$$\phi_3 = f(R_i)$$

Impact of Phi3=f(Ri) in ARPEGE 3D



Phi3=f(Ri) increases the humidity in the PBL → more low cloud

MUSC

- MUSC for “Modèle Unifié Simple Colonne” in French Unified Single Column Model
- MUSC exists since the cy32 (S. Malardel initiative) but since her departure the maintenance and the development have been postponed or done for specific 1D intercomparison GABLS3 or physics validation (TKE+KFB)
- The main advantage of MUSC is to be **“to be fully integrated“** in the 3D model since the Cy38t1 but unfortunately for several reasons (time, manpower, surfex version, forcing options etc ..), all the 1D case potentially available are not validated !

1D Cases potentially available in MUSC

- Convective Boundary Layer: IHOP (2002), Wangara, Ayotte, AMMA 5/06/2006
- Cumulus: **ARM (21/06/1997)**, **BOMEX**, RICO-composite
- Stratocumulus : **FIRE-I (juillet 1987)**
- Oceanic Deep Convection : Idealized Case (Derbyshire et al 2004), TOGA-COARE
- Continental Deep Convection :ARM (27-28/06/1997), AMMA 10/07/2006 (project FP7/EMBRACE; ANR/DECAF)
- Stratocumulus transition → cumulus :**Astex + COMPOSITE case**
- Stable Boundary Layer : GABLS cases (**GABLS 1, 2 et 3**)

•Available at least in one MUSC version

•Will be done soon

•Not available in MUSC but used in the old 1D model or in Meso-NH 1D

LFA files with LMUSCLFA (NAMLSFORC)

- In mf_phys.F90 (file created at each time step)=Out.0hh.xxxx.lfa with xxxx= seconds /3600 and hh forecast length in hour

```
#include "open_output_lfa.intfb.h"
!     ------------------------------------------------------------------
IF (LHOOK) CALL DR_HOOK('CPG',0,ZHOOK_HANDLE)
IF (LMUSCLFA) CALL OPEN_OUTPUT_LFA)
..
..
IF(LGSCM.OR.LMUSCLFA)
        CALL WRITEPHYSIO ( (KEND,   KST, KGL1, KGL2, KSTGLO,
NSTEP   , NTSSG   , & &YSP_SBD%NLEVS   ,PGELAM, PGEMU, PGM, ZMU0,
POROG, POROGL, …… )
..


..
IF (LMUSCLFA) CALL LFAFER(86)
!     ------------------------------------------------------------------
```

If LMUSCLFA

CALL WRITEMUSC (…..)
write common diagnostic for AROME and ARPEGE fluxes, variables etc …

LFA files with LMUSCLFA (NAMLSFORC)

```
WRITEMUSC (KIDIA   , KFDIA   , KLON    ,&
 &KTDIA   , KLEV    , KGL1    , KGL2    , &
 &KSTEP   , KSGST   , KCSS    , &
 &PAPHI   , PAPRS   , PAPHIF , PAPRSF , PALPH   , PARG    , PD2     ,&
 &PDELP   , PIVEG   , PLAI    , PLNPR   , PRDELP , PRSMIN , PSAB    ,&
 + several   FLUXES ....
 & PFPFPSL, PFPFPSN, PFPFPCL, PFPFPCN,
&PFPEVPSL,PFPEVPSN,PFPEVPCL,&
 & PFPEVPCN,PFTKE   , PGZ0    , PGZ0H   , PNEIJ   , PVEG    , PQS     ,&
 & PQSATS , PRUISL , PRUISP , PRUISS , PUCLS   , PVCLS   , PTCLS   ,&
 & PQCLS   , PRHCLS , PCLCT   , PCLCH   , PCLCM   , PCLCL   , &
 & PCLCC   , PCAPE   , KCLPH   , PCLPH   , PUGST   , PVGST   ,&
 & CDLOCK )
```

- Minimum common output for AROME,ARPEGE,ALADIN,ALARO physics

WRITEMUSC.F90

```
CALL WRSCMR(IUSCM,'PU',PU,KLON,KLEV)
CALL WRSCMR(IUSCM,'PV',PV,KLON,KLEV)
ZVENT(:,:)=SQRT(PU(:,:)**2+PV(:,:)**2)
CALL WRSCMR(IUSCM,'PVENT',ZVENT,KLON,KLEV)
DO JLON=1,KLON
DO JLEV=1,KLEV
CALL RECPOL(PU(JLON,JLEV),PV(JLON,JLEV),ZVENT(JLON,JLEV),ZDIRVENT(JLON,JLEV))
ZDIRVENT(JLON,JLEV)=ZDIRVENT(JLON,JLEV)/RPI*180._JPRB
ZDIRVENT(JLON,JLEV)=270._JPRB-ZDIRVENT(JLON,JLEV)
IF (ZDIRVENT(JLON,JLEV) < 0.0_JPRB) THEN
  ZDIRVENT(JLON,JLEV)=360._JPRB+ZDIRVENT(JLON,JLEV)
ELSEIF (ZDIRVENT(JLON,JLEV) > 360.0_JPRB) THEN
  ZDIRVENT(JLON,JLEV)=ZDIRVENT(JLON,JLEV)-360._JPRB
ENDIF
ENDDO
ENDDO
CALL WRSCMR(IUSCM,'PDIRVENT',ZDIRVENT,KLON,KLEV)
CALL WRSCMR(IUSCM,'PT',PT,KLON,KLEV)
```

write the wind speed in
the lfa file named
PVENT

write the wind direction
in the lfa file named
PDIRVENT

LFA files with LMUSCLFA (NAMLSFORC)

- and after for "specific outputs" for 1D case : example with Kh the exchange coefficient for T and Q

For ARPEGE/ALARO:
WRSCMR (for 2d) and ECR1D in APLPAR

```
! MUSC Specific outpout should
!be put under LMUSCLFA
DO JLEV=KTDIA,KLEV-1
DO JLON=KIDIA,KFDIA
ZKH(JLON,JLEV)=ZKTROV(JLON,JLEV)*ZDPHI/
&  (PAPRS(JLON,JLEV)*ZZRTI*RG)
ZKM(JLON,JLEV)=ZKUROV(JLON,JLEV)*ZDPHI/
& (PAPRS(JLON,JLEV)*ZZRTI*RG)
ZRIF(JLON,JLEV)=ZKH(JLON,JLEV)/ZKM(JLON,JLEV)
&*ZRI(JLON,JLEV)
ENDDO
ENDDO
CALL WRSCMR(86,'ZKH',ZKH,KLON,KLEV+1)
CALL WRSCMR(86,'ZKM',ZKM,KLON,KLEV+1)
! END OF MUSC OUTPUT
```

For AROME:
WRAROM (for 2d) and ECR1D

```
SUBROUTINE TURB_VER_THERMO_FLUX(

!*       2.4  Storage in LES configuration
!
! Copie de Kh pour MUSC
  ZA = DZM(PTHLP)
  WHERE (ZA==0.) ZA=1.E-6
  ZA = - ZFLXZ / ZA * PDZZ
  ZA(:,:,IKB) = XCSHF*PPHI3(:,:,IKB)*ZKEFF(:,:,IKB)
CALL WRAROM(86,'ZKH',ZA(:,1,IKB:IKU),IIU,IKE)
CALL WRAROM(86,'WTHL_tur',
              &ZFLXZ(:,1,IKB:IKU),IIU,IKE)
! END OF MUSC OUTPUT
```

How to use the LFA files ?

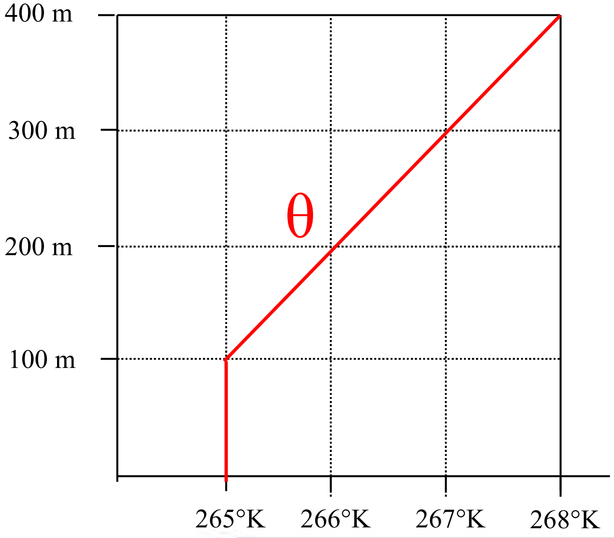
- DDHTOOLBOX:
  - List of utilities : ls lfa*
  - lfaedit : edit a lfafile
  - lfamoy mean_file list_of_file: lfamoy lfa1h Out.010.****.lfa computes the 1h mean between 10h and 11h
  - lfaminm gives the list of the field with min max mean
  - lfadiff F1 F2 FOUT: computes F2-F1 for ALL the fields in the file and creates a lfa file FOUT (lfadiffrelnz)
  - mevol to extract ASCII file for one field .
  - In general a manual (short and some time in French !) is available ex: lfamoy but for mevol it is in english !

```
pxgmap9:/home/bazile/MUSC/GABLS3/OUTPUT_37t1 => lfamoy
 Moyenne de n fichiers LFA.
 Utilisation: lfamoy FMOY F1 F2 [F3 ... Fn]
 avec
                F1 F2 [F3 ... Fn] les n fichiers d'entrée.
                FMOY le fichier de sortie, recevant la moyenne.
 Remarque: la moyenne est opérée sur les articles
 communs aux n fichiers.
pxgmap9:/home/bazile/MUSC/GABLS3/OUTPUT_37t1 =>
```

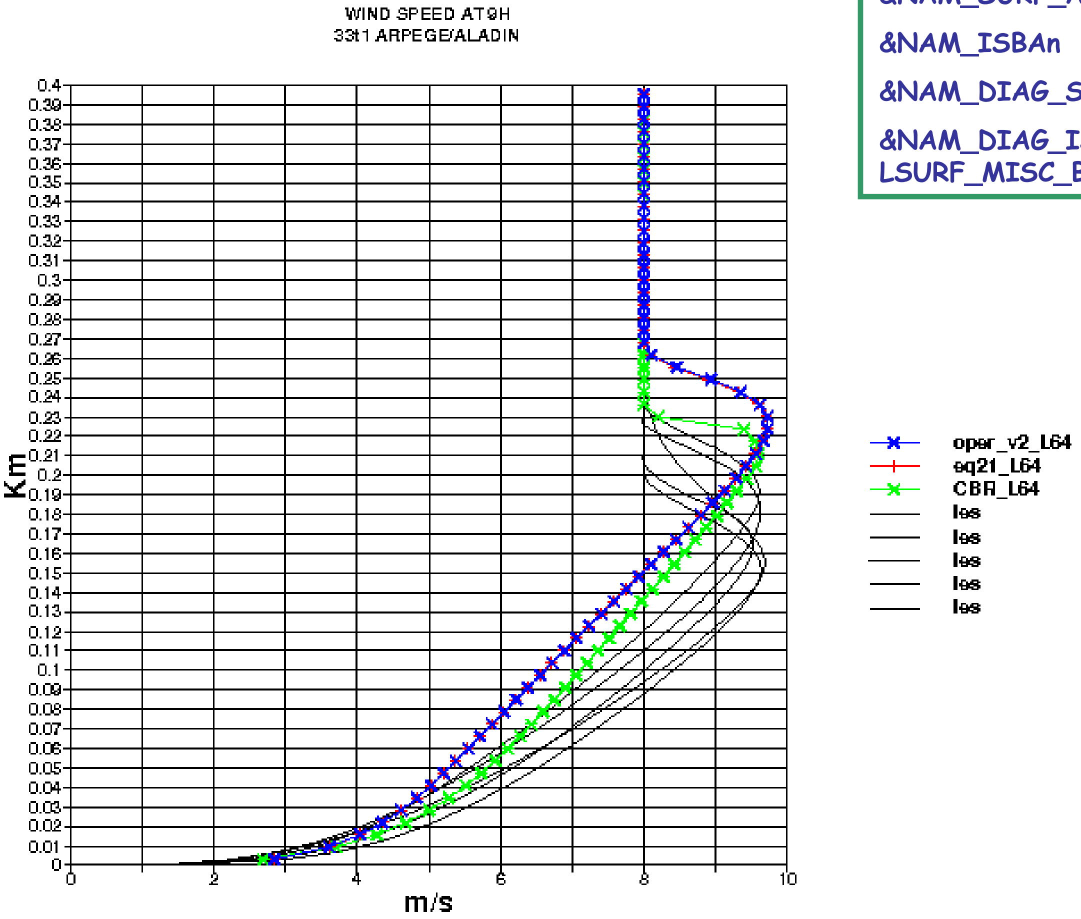
Stable boundary layer: GABLS1, 2 and 3

- **GABLS1 (Cuxart et al (2006)) (+9h):**
  - Boundary layer is driven by an uniform geostrophic wind (Ug=8m/s) and f=1.39E-04 s-1
  - Ts=265K decreasing continuously at a rate of 0.25K/h
  - Radiation is switched off, Roughness length set to 0.1m both for momentum and temperature → mean profile 8h-9h

- **OK in cy33 with surfex 3.3.**
- **Problem with MUSC cy35t2 and SURFEX 4.4**
- **Seems ok with cy37t1 and SURFEX V7.1+**
- **Problems with cy38t1 and SURFEX V7.2**



GABLS1

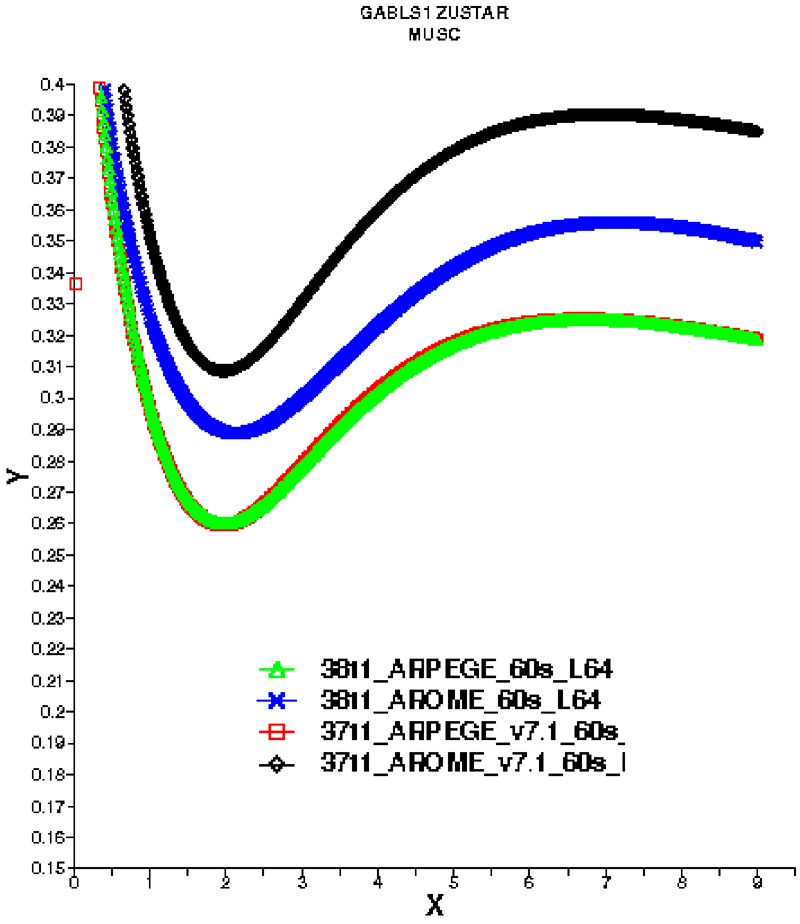


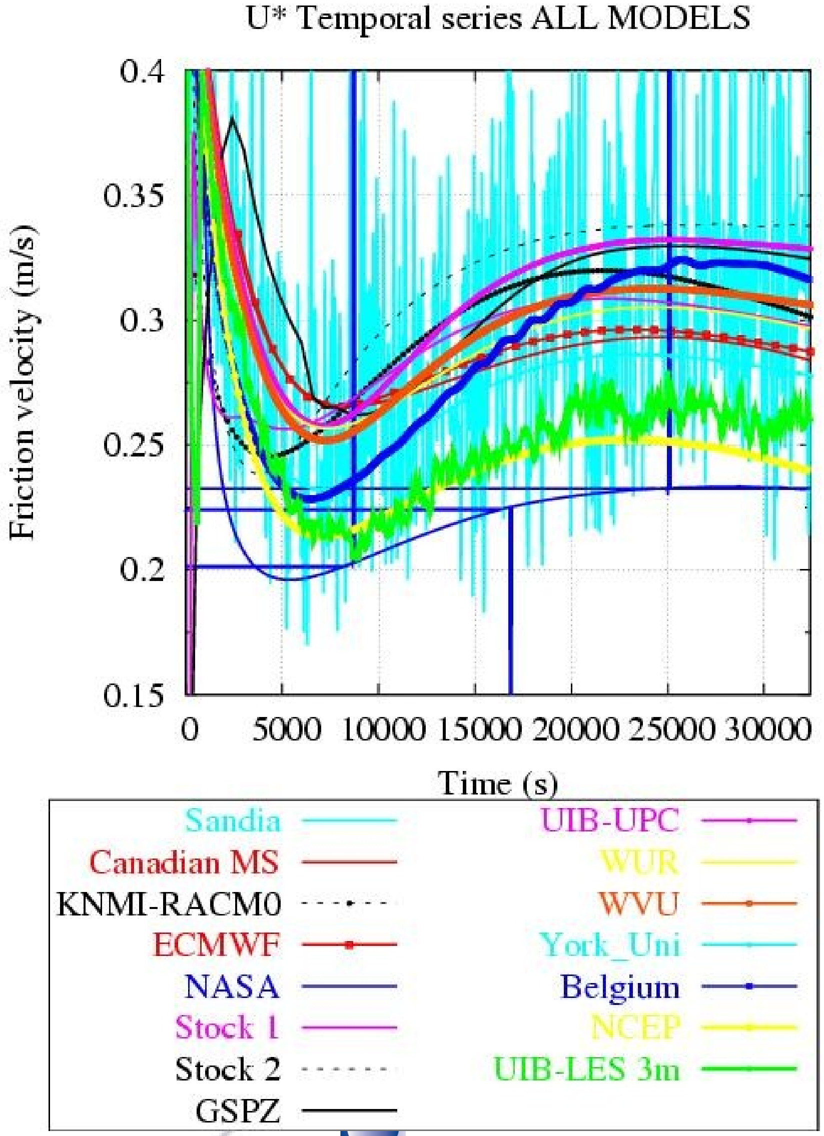
SURFEX

```
&NAM_SURF_ATMn /
&NAM_ISBAn  /
&NAM_DIAG_SURFn LSURF_BUDGET=.TRUE.,N2M=2 /
&NAM_DIAG_ISBAn LSURF_EVAP_BUDGET=.TRUE.,
LSURF_MISC_BUDGET=.TRUE., LPGD=.TRUE. /
```

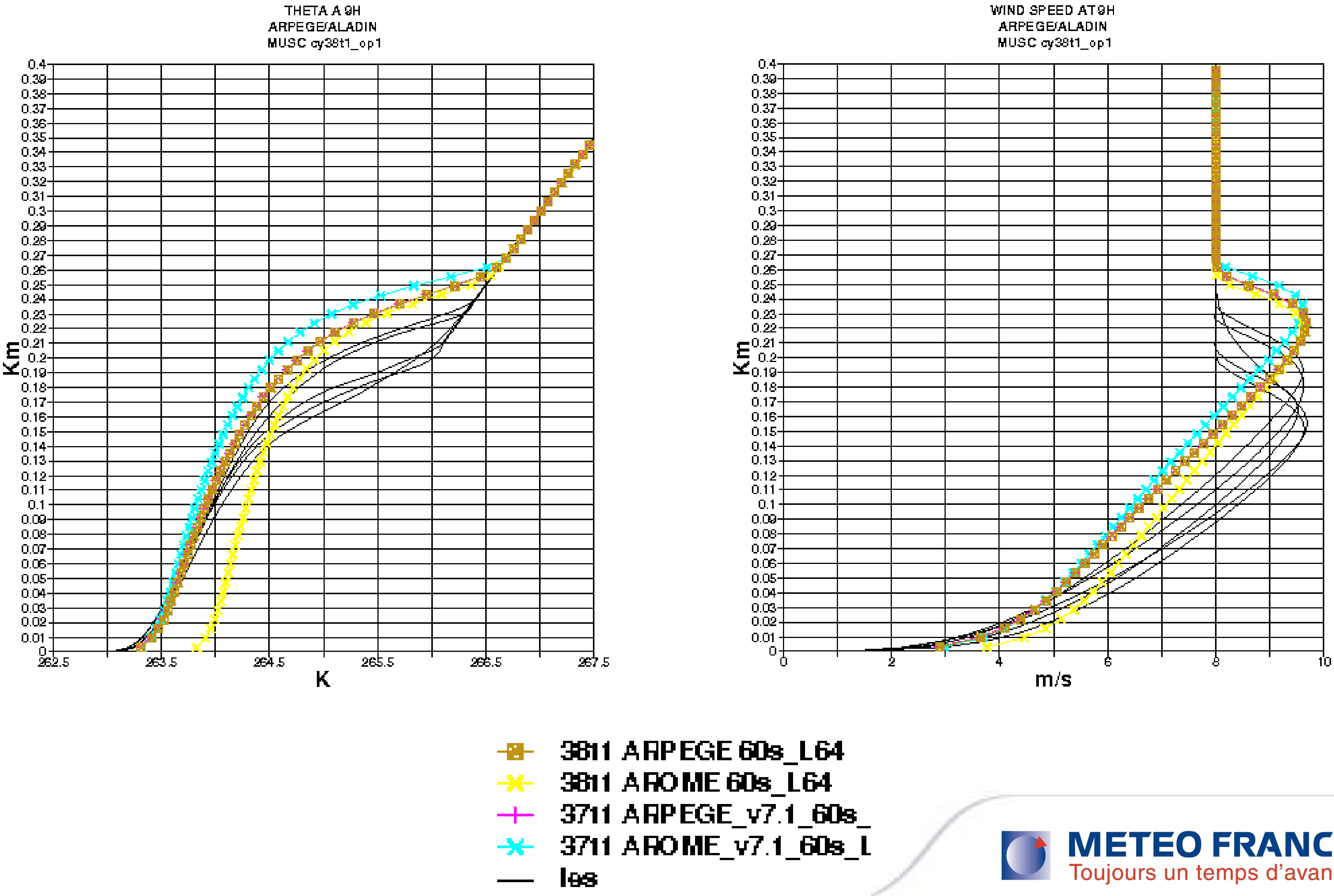
```
&NAMGFL
  NGFL_FORC=2,
  YFORC_NL(1)%CNAME='FORC01',
  YFORC_NL(2)%CNAME='FORC02',
/
&NAMLSFORC
 LGEOST_UV_FRC=T,
 RCORIO_FORC=1.39E-4,
 NGEOST_U_DEB=1,
 NGEOST_U_NUM=1,
 NGEOST_V_DEB=2,
 NGEOST_V_NUM=1,
 LT_ADV_FRC=F,
 LQV_ADV_FRC=F,
 LSW_FRC=F,
 /
```

GABLS1


GABLS1 ZUSTAR
MUSC
0.4
0.39
0.38
0.37
0.36
0.35
0.34
0.33
0.32
0.31
0.3
0.29
0.28
0.27
0.26
0.25
0.24
0.23
0.22
0.21
0.2
0.19
0.18
0.17
0.16
0.15
Y
0
1
2
3
4
5
6
7
8
9
X
3811_ARPEGE_60s_L64
3811_AROME_60s_L64
3711_ARPEGE_v7.1_60s_
3711_AROME_v7.1_60s_l


U* Temporal series ALL MODELS
0.4
0.35
0.3
0.25
0.2
0.15
Friction velocity (m/s)
0
5000
10000
15000
20000
25000
30000
Time (s)
Sandia
Canadian MS
KNMI-RACMO
ECMWF
NASA
Stock 1
Stock 2
GSPZ
UIB-UPC
WUR
WVU
York_Uni
Belgium
NCEP
UIB-LES 3m

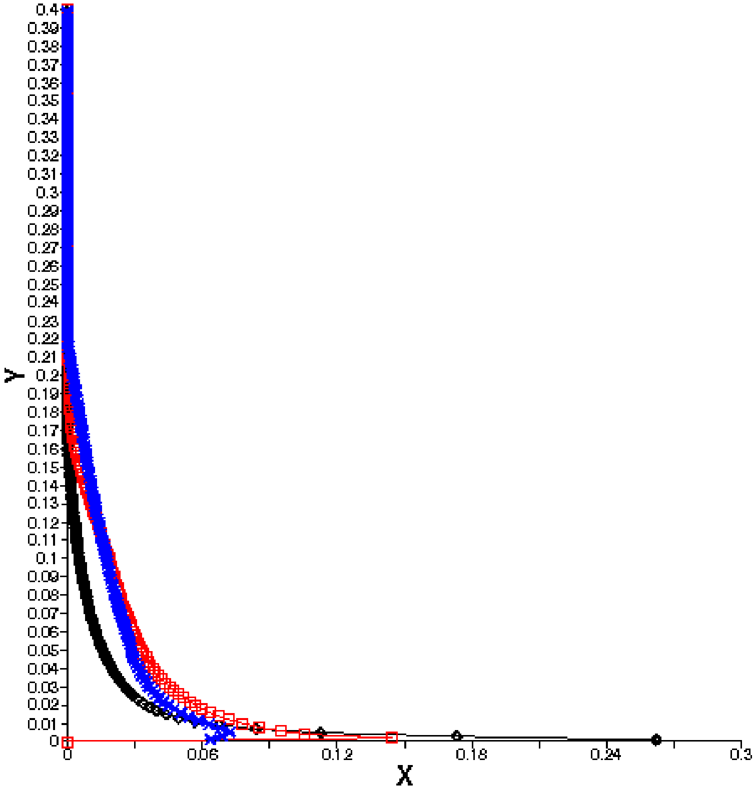
GABLS1

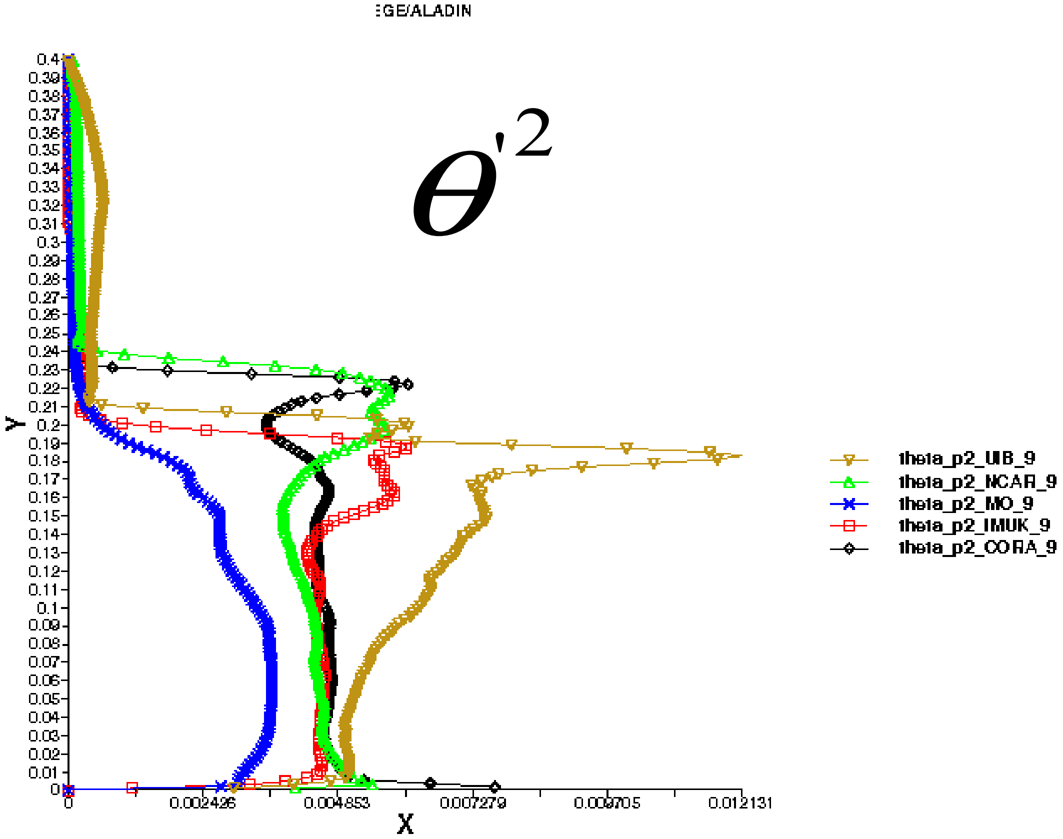


METEO FRANCE
Toujours un temps d'avance

GABLS1 LES output for validation

TKE m2/s2



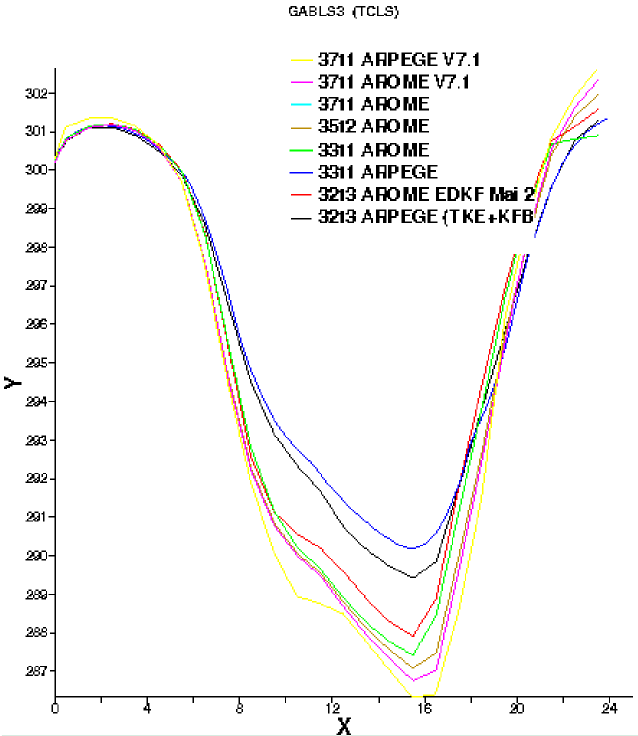


Stable boundary layer: GABLS1, 2 and 3

- **GABLS2 (Svensson et al (2010)) (+60h):** Diurnal cycle with a prescribed Ts, constant geostrophic wind and W (time dependant). no radiation : Not available in MUSC

- **GABLS3 (Bosveld et al in prep) (+24h):** Diurnal cycle with all the physics parameterization (surface scheme included) geostrophic wind, hor. Adv for T and Q (Time dependant), vertical velocity AVAILABLE in MUSC since cy32 → CY37T1+V7.1

GABLS3



SURFEX V7.1

```
&NAM_SURF_ATMn /
&NAM_ISBAn  /
&NAM_DIAG_SURFn LSURF_BUDGET=.TRUE.,
LSURF_VARS=.TRUE., N2M=2 /
&NAM_DIAG_ISBAn LSURF_EVAP_BUDGET=.TRUE.,
LSURF_MISC_BUDGET=.TRUE., LPGD=.TRUE. /
&NAM_CH_ISBAN CCH_DRY_DEP='NONE' /
&NAM_READ_DATA_COVER LREAD_DATA_COVER=.FALSE. /
```

```
&NAMGFL
NGFL_FORC=48,
YFORC_NL(1)%CNAME='FORC001',
YFORC_NL(2)%CNAME='FORC002',
..
..
YFORC_NL(48)%CNAME='FORC048'
/
&NAMLSFORC
LMUSCLFA=.T.,
 LGEOST_UV_FRC=T,
 RCORIO_FORC=1.E-4,
 NL_GEOST_UV_TIME(1)=0 ,
 NL_GEOST_UV_TIME(2)=21600 ,
 NL_GEOST_UV_TIME(3)=39600,
 NL_GEOST_UV_TIME(4)=54000 ,
 NL_GEOST_UV_TIME(5)=64800 ,
 NL_GEOST_UV_TIME(6)=86400 ,
 NGEOST_U_DEB=1,
 NGEOST_U_NUM=6,
 NGEOST_V_DEB=7,
 NGEOST_V_NUM=6,
LT_ADV_FRC=T,
 NL_T_ADV_TIME(1)=0 ,
 NL_T_ADV_TIME(2)=46800 ,
 NL_T_ADV_TIME(3)=46860 ,
 NL_T_ADV_TIME(4)=64800 ,
 NL_T_ADV_TIME(5)=64860 ,
 NL_T_ADV_TIME(6)=86400 ,
 NT_ADV_DEB=13 ,
 NT_ADV_NUM=6,
```

```
LQV_ADV_FRC=T,
NL_QV_ADV_TIME(1)=0 ,
NL_QV_ADV_TIME(2)=32400 ,
NL_QV_ADV_TIME(3)=32460 ,
NL_QV_ADV_TIME(4)=43200 ,
NL_QV_ADV_TIME(5)=43260 ,
NL_QV_ADV_TIME(6)=50400 ,
NL_QV_ADV_TIME(7)=50460 ,
NL_QV_ADV_TIME(8)=61200 ,
NL_QV_ADV_TIME(9)=61260 ,
NL_QV_ADV_TIME(10)=86400
NQV_ADV_DEB=19 ,
NQV_ADV_NUM=10,
LUV_ADV_FRC=T,
NL_UV_ADV_TIME(1)=0 ,
NL_UV_ADV_TIME(2)=21600 ,
NL_UV_ADV_TIME(3)=21660 ,
NL_UV_ADV_TIME(4)=39600 ,
NL_UV_ADV_TIME(5)=39660 ,
NL_UV_ADV_TIME(6)=54000 ,
NL_UV_ADV_TIME(7)=54060 ,
NL_UV_ADV_TIME(8)=86400 ,
NU_ADV_DEB=29 ,
NU_ADV_NUM=8,
NV_ADV_DEB=37 ,
NV_ADV_NUM=8,
LSOMEGA_FRC=T,
NL_LSOMEGA_TIME(1)=0 ,
NL_LSOMEGA_TIME(2)=18000,
NL_LSOMEGA_TIME(3)=25200,
NL_LSOMEGA_TIME(4)=86400,
NLSOMEGA_DEB=45,
NLSOMEGA_NUM=4,
```

Conclusions

- The new subgrid vertical mixing (TKE + KFB), implemented in ARPEGE/ALADIN (Feb 2009):
  - positive impact on the temperature and the relative humidity in the PBL, improves the low level jet in stable case
  - Better representation for the low-level clouds (fog) and the transition between strato-cumulus to deep convection along the GPCI transect
  - requires new tunings for the deep convections scheme → improves the precipitation distribution and QPF
- 1D experiment are very useful even if the final tuning requires to going back and forth between 1D and 3D
- Problems: warm bias during winter over snow, critical Ri ?
- Try to use the EFB Closure in AROME/ARPEGE