



Evaluation of 3MT in ARPEGE, ALADIN-France. Status of DDH.

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Météo-France / CNRM.

Workshop convection in AROME, 24-25 November 2008.

3MT: Modular Multiscale Microphysics and Transport: scheme to compute resolved and subgrid-scale clouds and precipitation

Suitable for models: $\Delta x < 10$ km (grey zone).

3MT

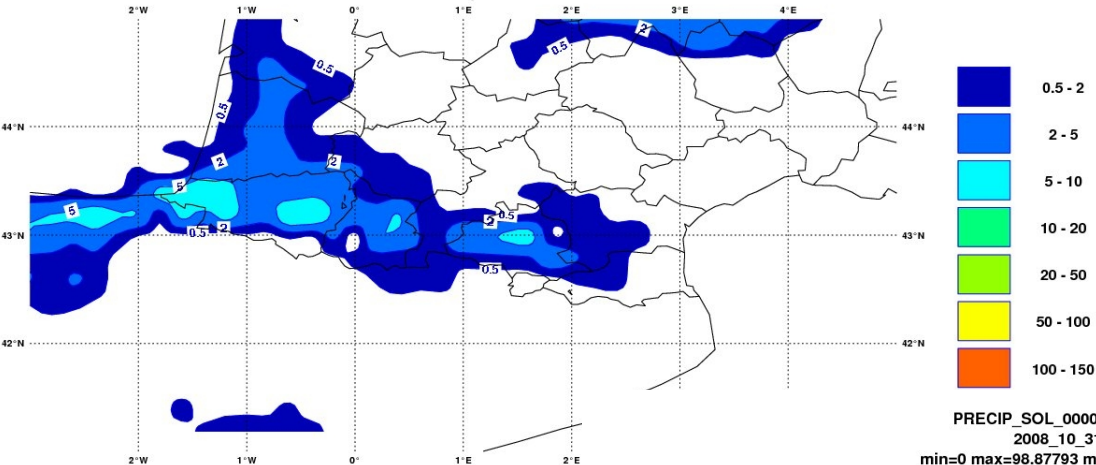
- **Operational in LACE, in Austria, parallel suite in Belgium, ...**
- **Tests in ARPEGE in Toulouse.**

- **Aquaplanet ARPEGE: Olivier Rivière in 2008. Better dependency (lower) in the Tropics, vs the Bougeault scheme.**
- **ARPEGE global zonal tests → zonal means quite similar to operational ones, if radiation used = Morcrette – RRTM**
- **ARPEGE – ALADIN case studies 2008-07-30 case. → ...**

Case 30 July 2008

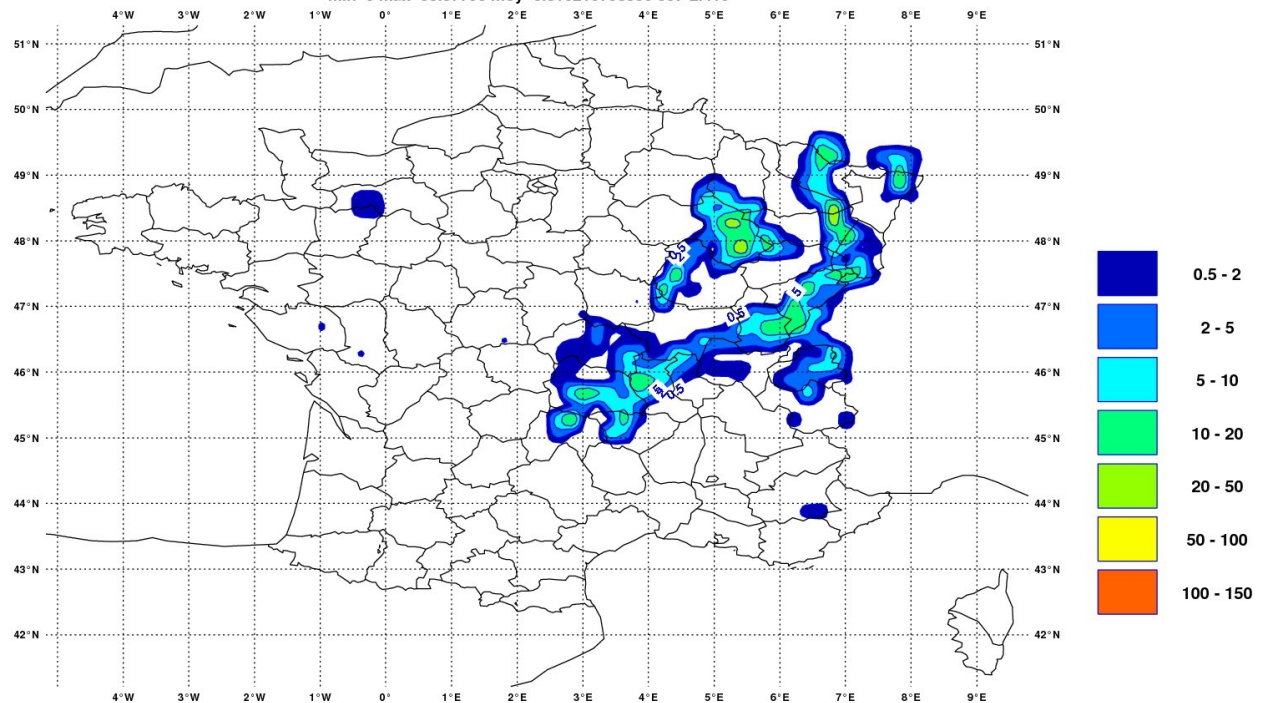
oper+0042-0036_SURFPREC.dta
2008_11_21_Ven_15h20m59s
min=-0.003938 max=10.76421 moy=0.511026284259 ect=1.306

**ARPEGE oper:
precipitation
P36h-42h
(mm)**

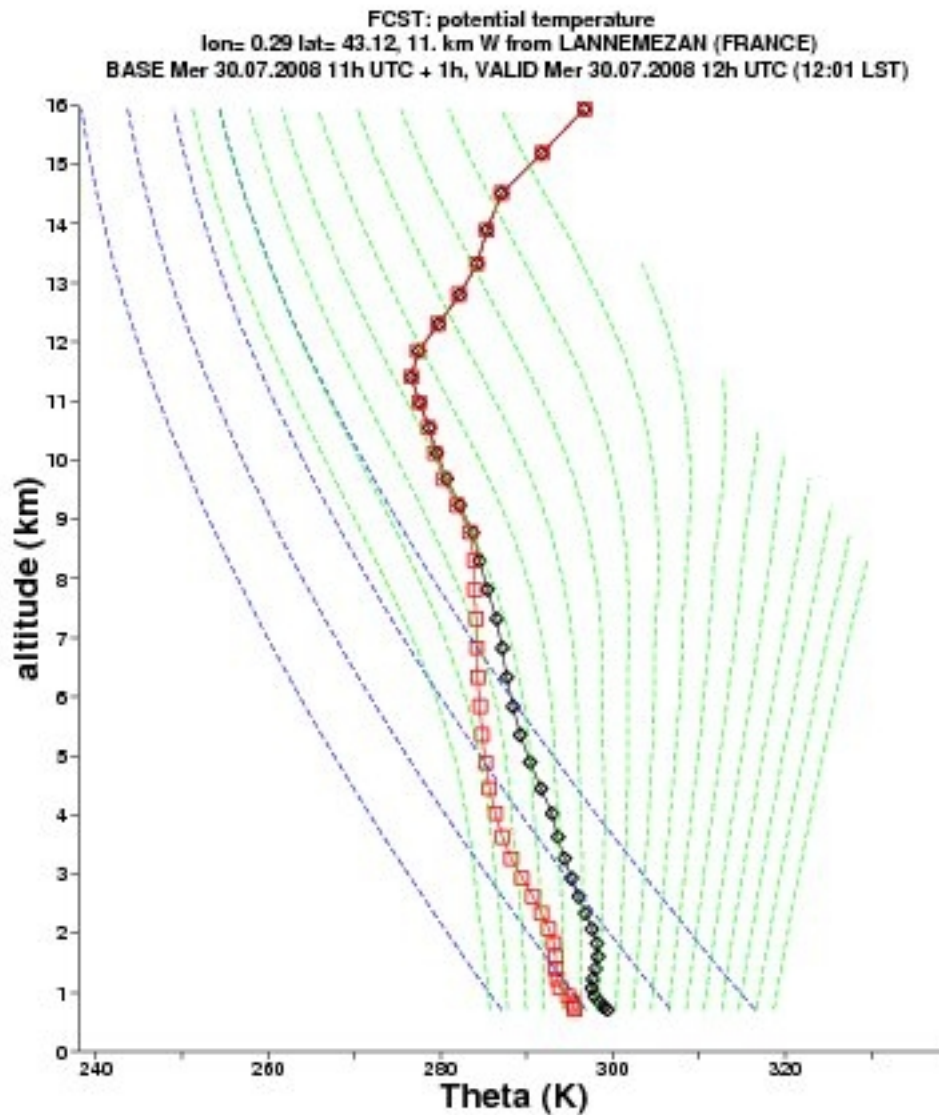


**ANTILOPE
Precipitation
analysis
P36h-42h
(mm)**

PRECIP_SOL_0000_20080730_0012-0018.dta
2008_10_31_Ven_17h30m36s
min=0 max=98.87793 moy=0.310216793858 ect=2.413



Case 30 July 2008: vertical profile in Lannemezan (Pyrénées)



Sound. prec = 25.5 mm
No surface temperature available
Alt. top of PBL = 1130 m
PBL depth = 444 m

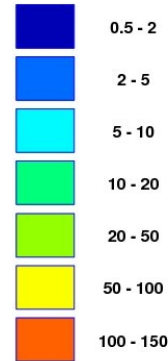
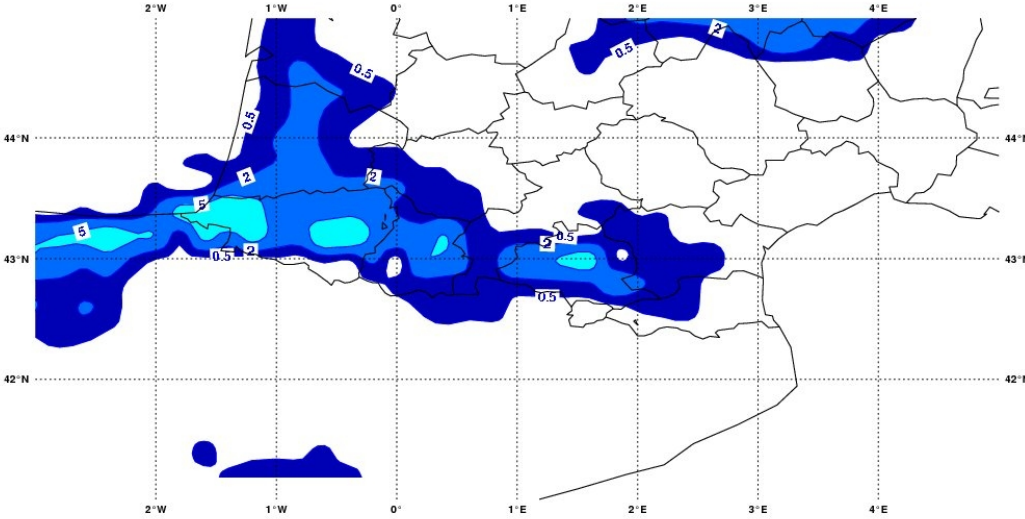
**Conditional
instability,
dry air.**

*Vertical profile (theta,
thetaW) from
AROME France
EDKF*

Alt.= 685. m, CIN= -49. J/kg, CAPE und= 2452. J/kg, start at 0.7 km CAPE dilute = 15. J/kg

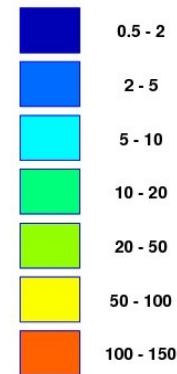
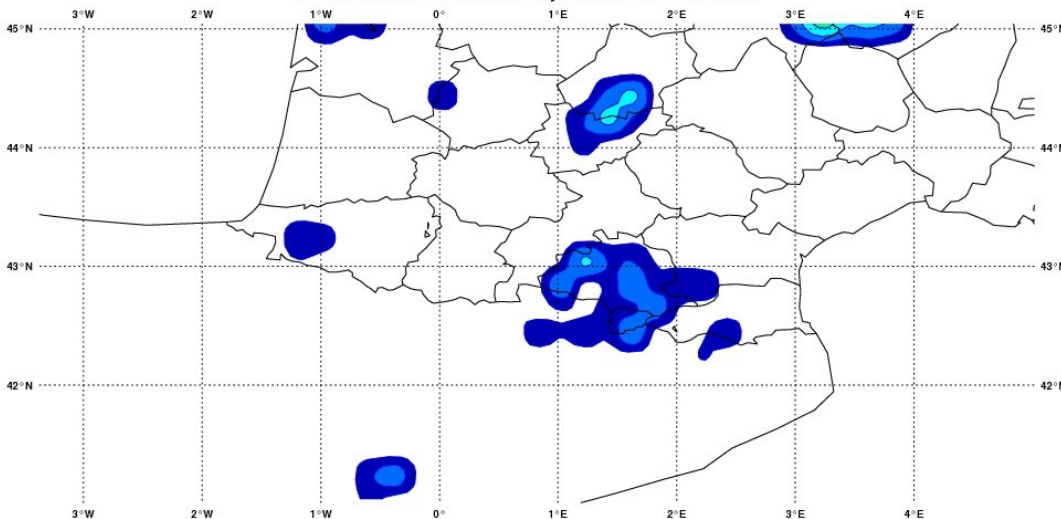
Case 30 July 2008: precipitation

oper+0042-0036_SURFPREC.dta
2008_11_21_Ven_15h20m59s
min=-0.003938 max=10.76421 moy=0.511026284259 ect=1.306



ARPEGE oper:
precipitation
P36h-42h
(mm)

ICMSHAROM+0018-0012.tmp.SURFPREC.dta
2008_11_21_Ven_15h22m54s
min=-0.003341 max=61.86688 moy=0.125071728478 ect=1.28



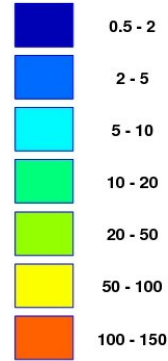
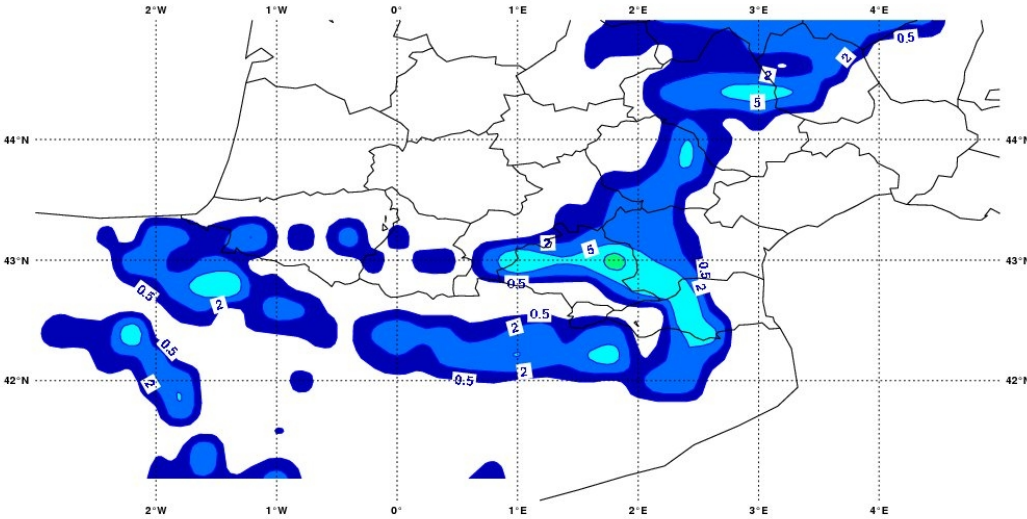
**AROME parallel
suite**
precipitation
P18h-12h
(mm)

Case 30 July 2008: precipitation

c745+0042-0036_SURFPREC.dta

2008_11_21_Ven_15h21m04s

min=-0.00419 max=15.242748 moy=0.601659185686 ect=1.579

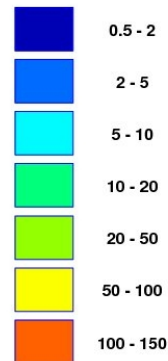
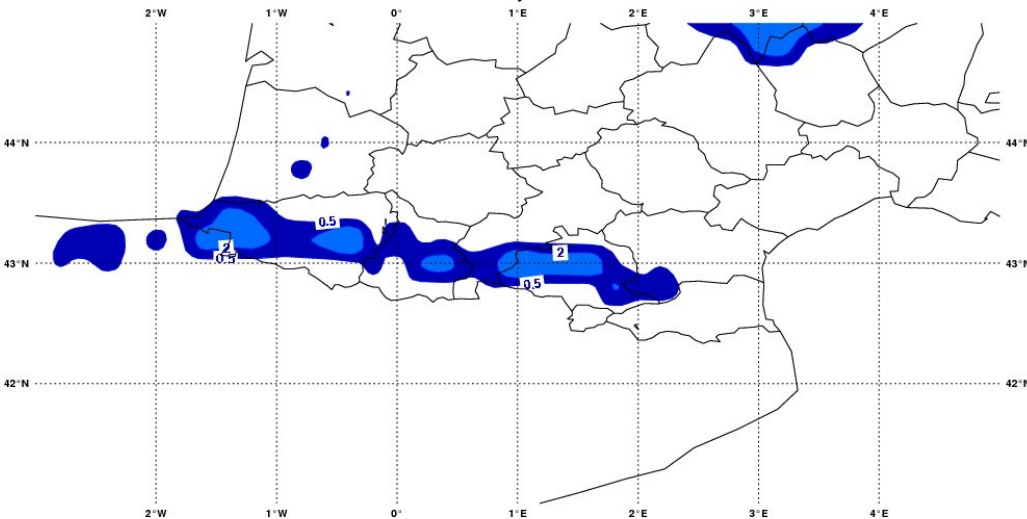


**ARPEGE V2 (TKE
prog. + KFB)
precipitation
P36h-42h
(mm)**

c736+0042-0036_SURFPREC.dta

2008_11_21_Ven_15h20m54s

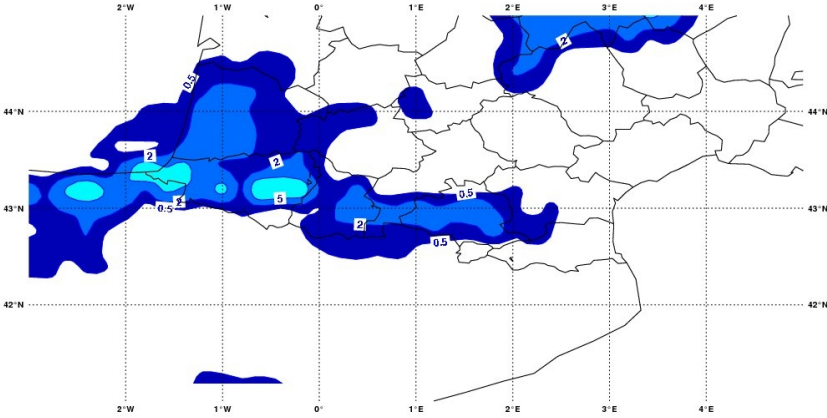
min=-0.00477 max=5.542766 moy=0.119143015081 ect=0.5955



**ARPEGE 3MT
precipitation
P36h-42h
(mm)**

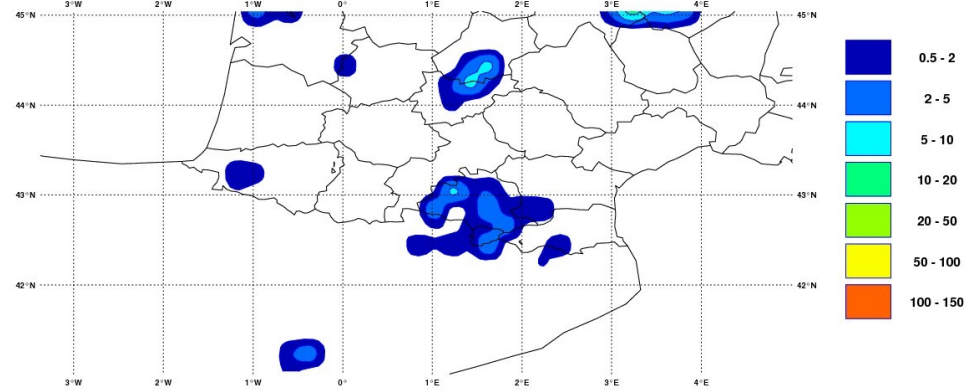
Case 30 July 2008: precipitation P12h-P18h (mm)

oper+0018-0012_SURFPREC.dta
2008_11_21_Ven_15h19m59s
min=-0.00101 max=10.1188 moy=0.461410193245 ect=1.215



ARPEGE oper

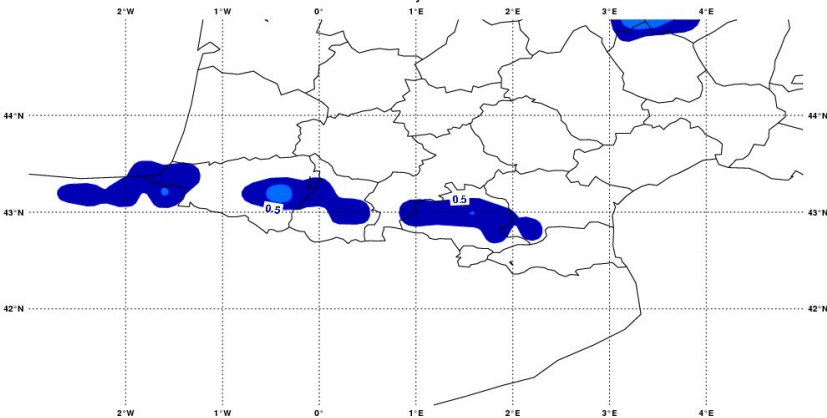
ICMSHAROM+0018-0012.Imp.SURFPREC.dta
2008_11_21_Ven_15h22m54s
min=-0.003341 max=61.86688 moy=0.125071728478 ect=1.28



AROME KFB

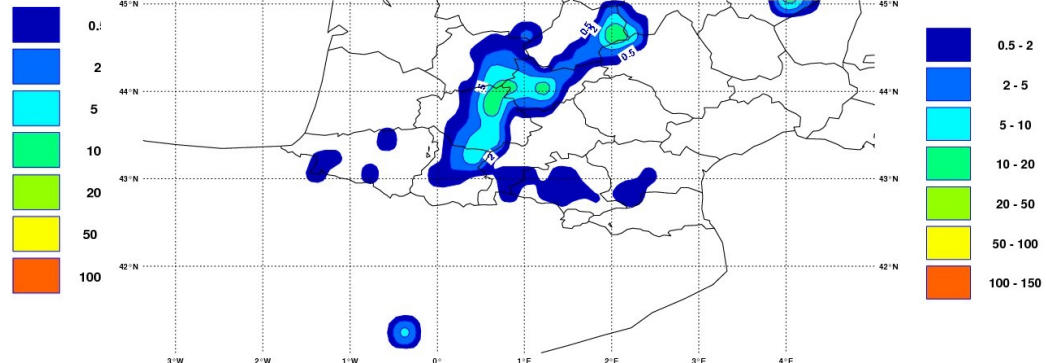
ARPEGE 3MT

c738+0018-0012_SURFPREC.dta
2008_11_21_Ven_15h20m04s
min=-0.001867 max=6.074592 moy=0.0645409899511 ect=0.3863



AROME EDKF

ICMSHFST+0018-0012.Imp.SURFPREC.dta
2008_11_21_Ven_15h24m06s
min=-0.001976 max=49.07134 moy=0.274590870427 ect=1.783



3MT tests on the 2008-07-30 Pyrénées case: summary

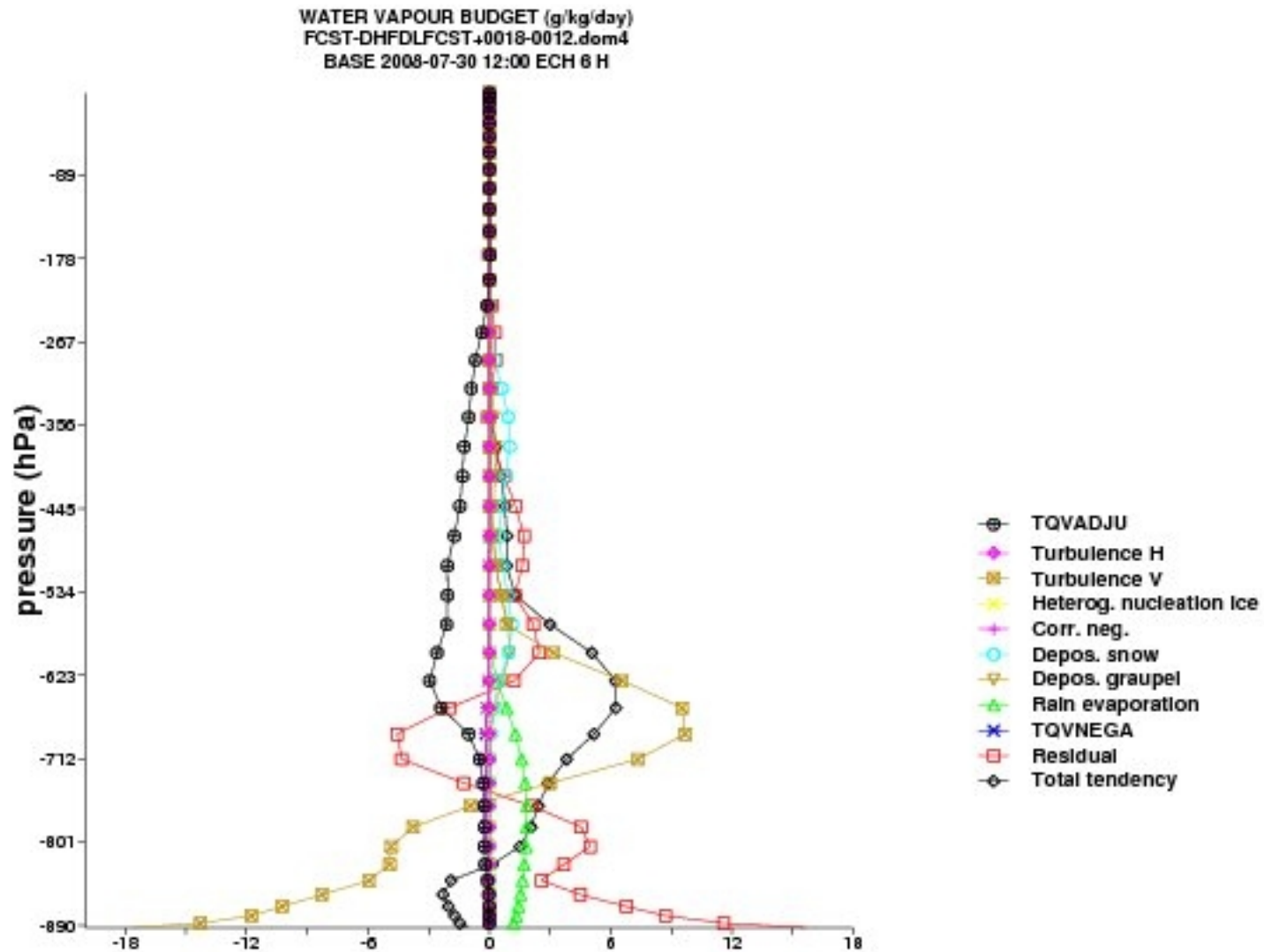
- **3MT: encouraging results on this case (lower precipitation rates on the orography).**
- **3MT: tests to be continued: prognostic entrainment, closure. Run 3MT with TKE prog. + KFB (as in ARPEGE parallel suite).**
- **AROME EDKF: better results than AROME KFB over the orography on this summer case.**

DDH: Diagnostics on Horizontal Domains: a generic tool to provide budget of prognostic variables, to develop physics, understand physico-dynamical interactions, in ARPEGE, ALADIN, AROME.

DDH tool: used in ARPEGE and ALADIN since 1992, for research and operations.

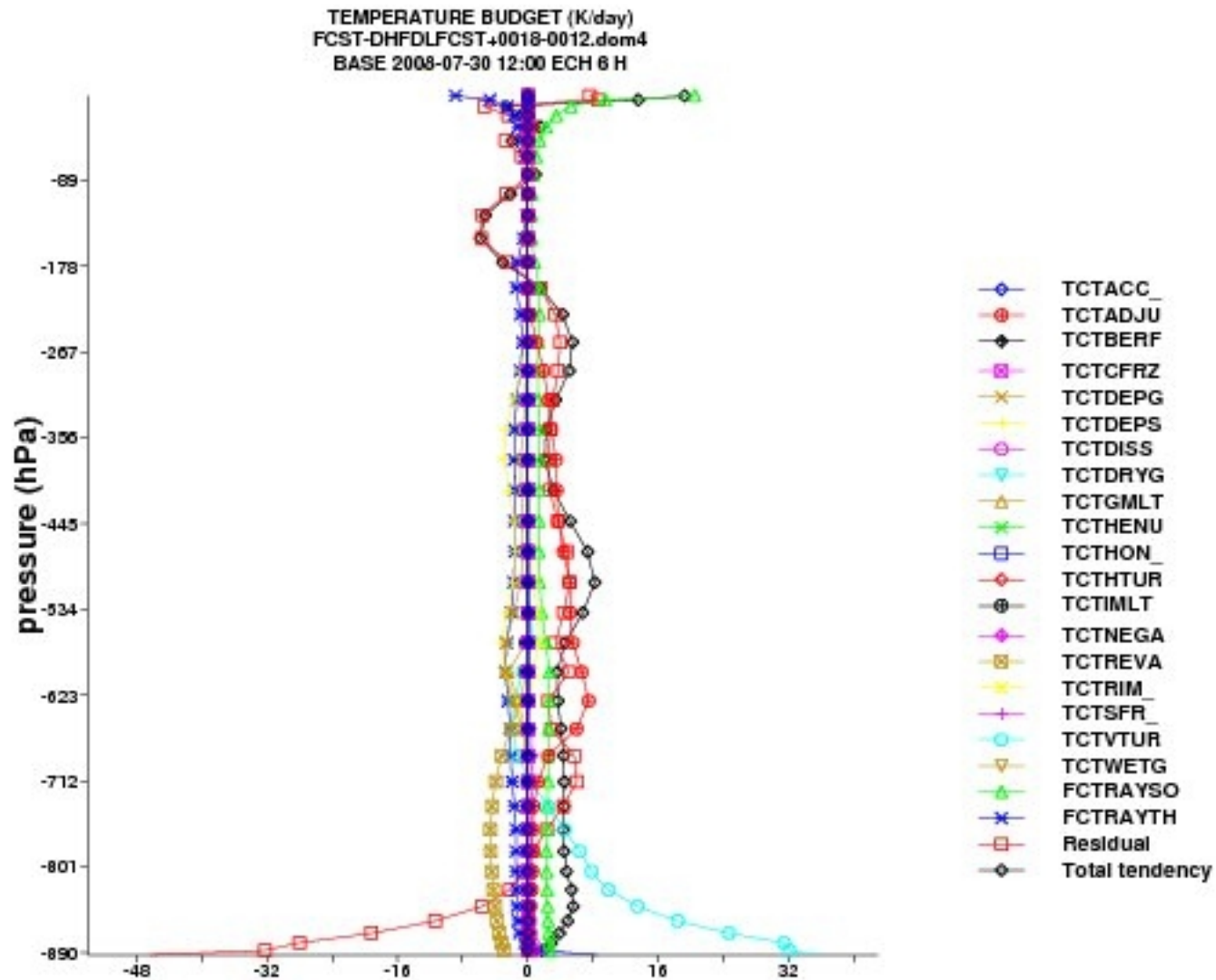
Available now in AROME (cy35t1, introduced by Olivier Rivière and Tomislav Kovacic).

AROME France, DDH budget, Pyrénées domain



AROME France EDKF, domain over Pyrénées, 2008-07-30 P12h-P18h

AROME France, DDH budget, Pyrénées domain



AROME France EDKF, domain over Pyrénées, 2008-07-30 P12h-P18h

- **AROME DDH Available to the community by cy35t1 + bf.**
- **ARPEGE – ALADIN - AROME DDH: Tools to generate budget plots, cumulate or interpolate files, on PCs...
→ ddhtoolbox.**
- **DDH documentation: translated into English, including the ddhtoolbox.**

Fin

DDH: code and documentation

DDH used at CNRM, used in the ALARO community, soon in the HIRLAM community: « Convergence ».

Three aspects to provide DDH diagnostics:

3. Codes (called during model integration) extracting variables, tendencies and fluxes from model physics and dynamics, operating horizontal and temporal mean, writing on files.
4. Codes (called after model integration) to cumulate, differentiate DDH files, intercompare physical packages, plot final budgets. These codes are named « ddhtoolbox ».
5. The DDH documentation, including user interface, scientific equations, ddhtoolbox, algorithmical aspects, software maintenance and installation.

Ongoing efforts on the 3 aspects.

DDH: actual developments

- **AROME DDH (Olivier Rivière, Tomislav Kovacic, Jean-Marcel Piriou): works, to enter cycle CY35T1, new DDH data flow from physics or dynamics to DDH meaning operators. (99% done).**
- **Extend DDH budget to the whole semi-lagrangian dynamics (Fabrice Voitus, Jean-Marcel Piriou, Pierre Bénard, Karim Yessad): advection terms, horizontal diffusion, semi-implicit. (5% done).**
- **« Budget packages »: the ddhtoolbox has been translated in English, a new Makefile environment (Jean-Marcel Piriou), includes a new « ddhb » tool (Alex Deckmyn, Jean-Marcel Piriou, Tomas Kral), to deal with different physical packages and models (ARPEGE ALADIN AROME). (100% done).**
- **Documentation: translated in English, including the ddhtoolbox (Jean-Marcel Piriou, Jean Maziejewski).**

DDH: perspectives

DDH designed for the « convergence », can be used by different communities, models, physics.

- **Extend DDH budget to the whole semi-lagrangian dynamics.**
- **Extend the new AROME DDH dataflow to the other models (ARPEGE - ALADIN, IFS).**
- **Use DDH AROME extensively!**