Open questions on dynamics

P. Bénard

(Météo-France CNRM/GMAP)

Open questions:

- LB Coupling
- VFE/NH
- Fireworks and Phys/Dyn interaction
- Horizontal diff. and precipitating systems

LB coupling

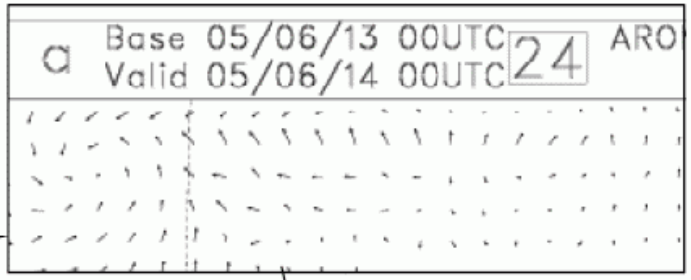
Two main problems:

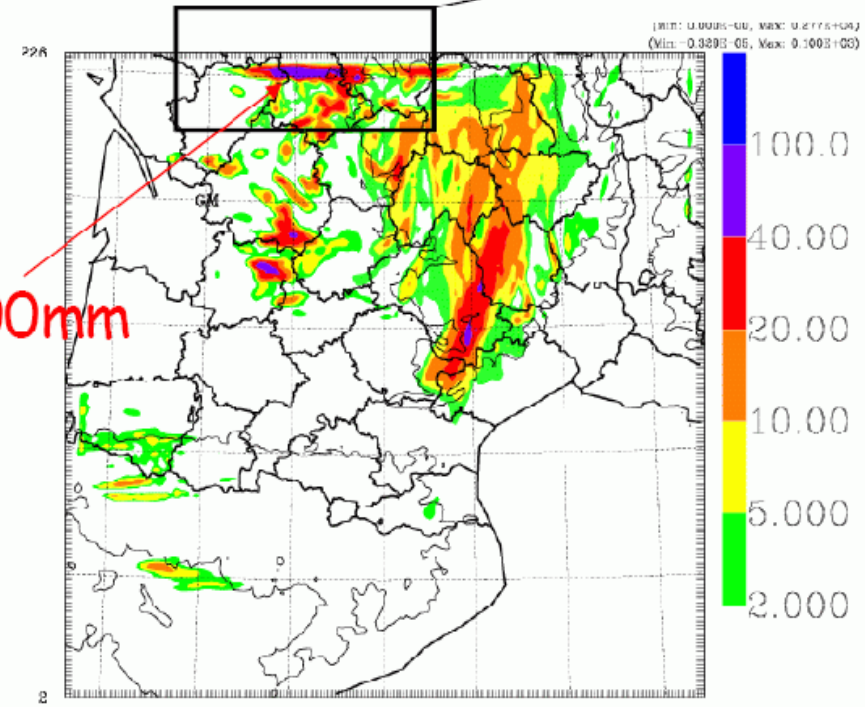
- conflicts at edges
- well posedness

Problems in the coupling area : 13 June 2005

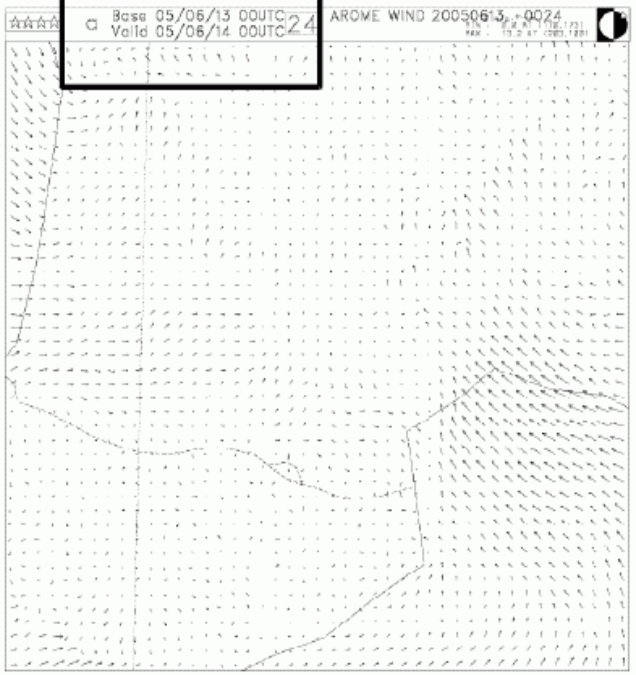
13 June 2005

21-24 TU cumulated rainfalls





>100mm

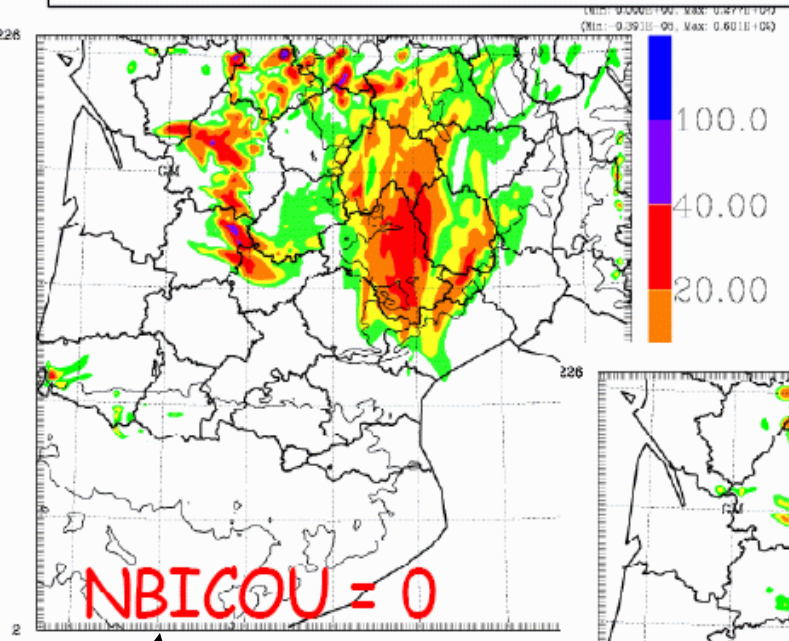


LB coupling

Conflicts at edges: differences between host and guest models

- orography(resolution)
- physics
- dynamics
- coupling frequency
- sharpness of coupling (relaxation) area
- one-way interaction

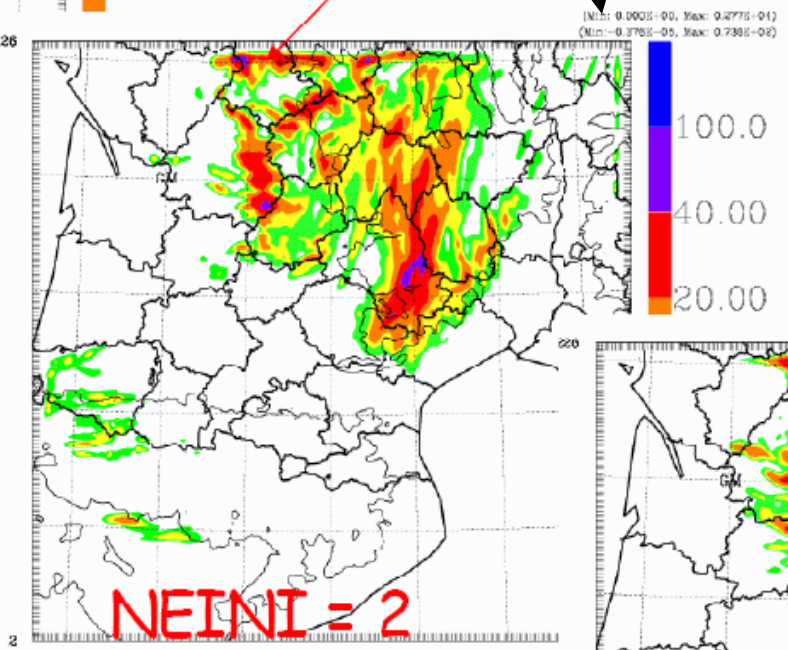
Problems in the coupling area : 13 June 2005



No cpl of wind

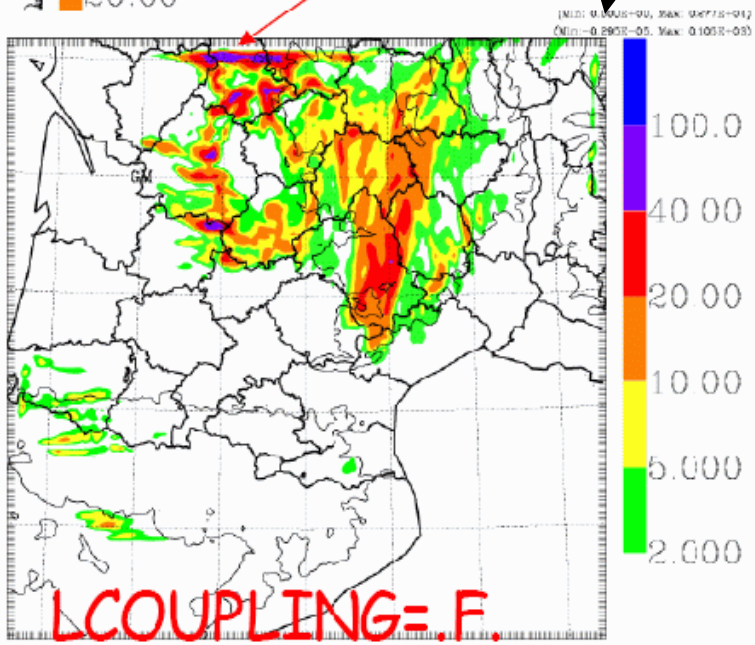
With DFI

< 50 mm



No cpl of GP vars

>100 mm



LB coupling

Immediate (?) proposed solutions:

- Enlarge width of Davies relaxation zone
- Apply relaxation to AROME orography

(wind conflicts might be mainly due to orography conflicts).

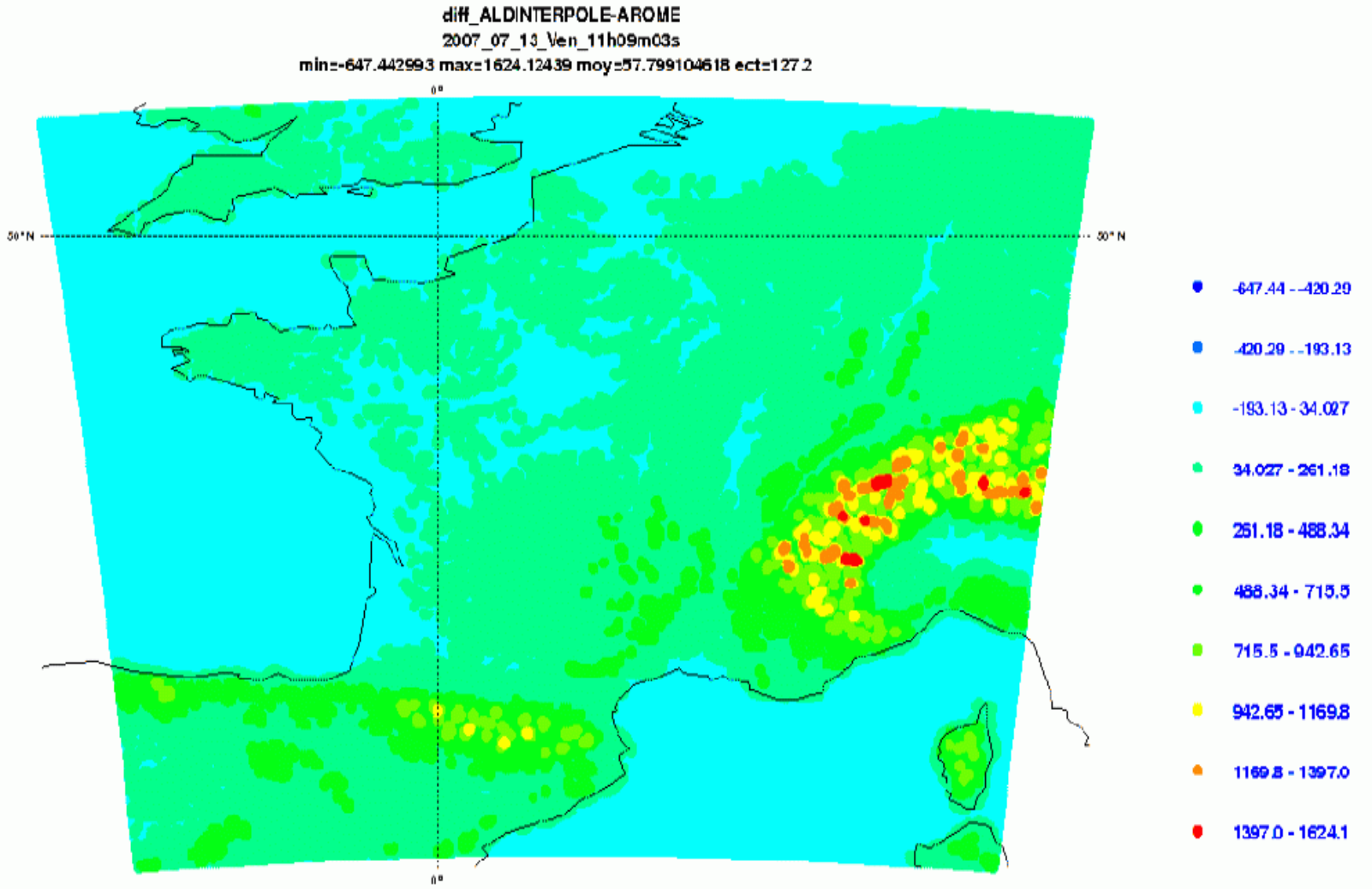


Figure 3.1 : Différence entre l'orographie grande échelle (ALADIN) et l'orographie petite échelle (AROME)

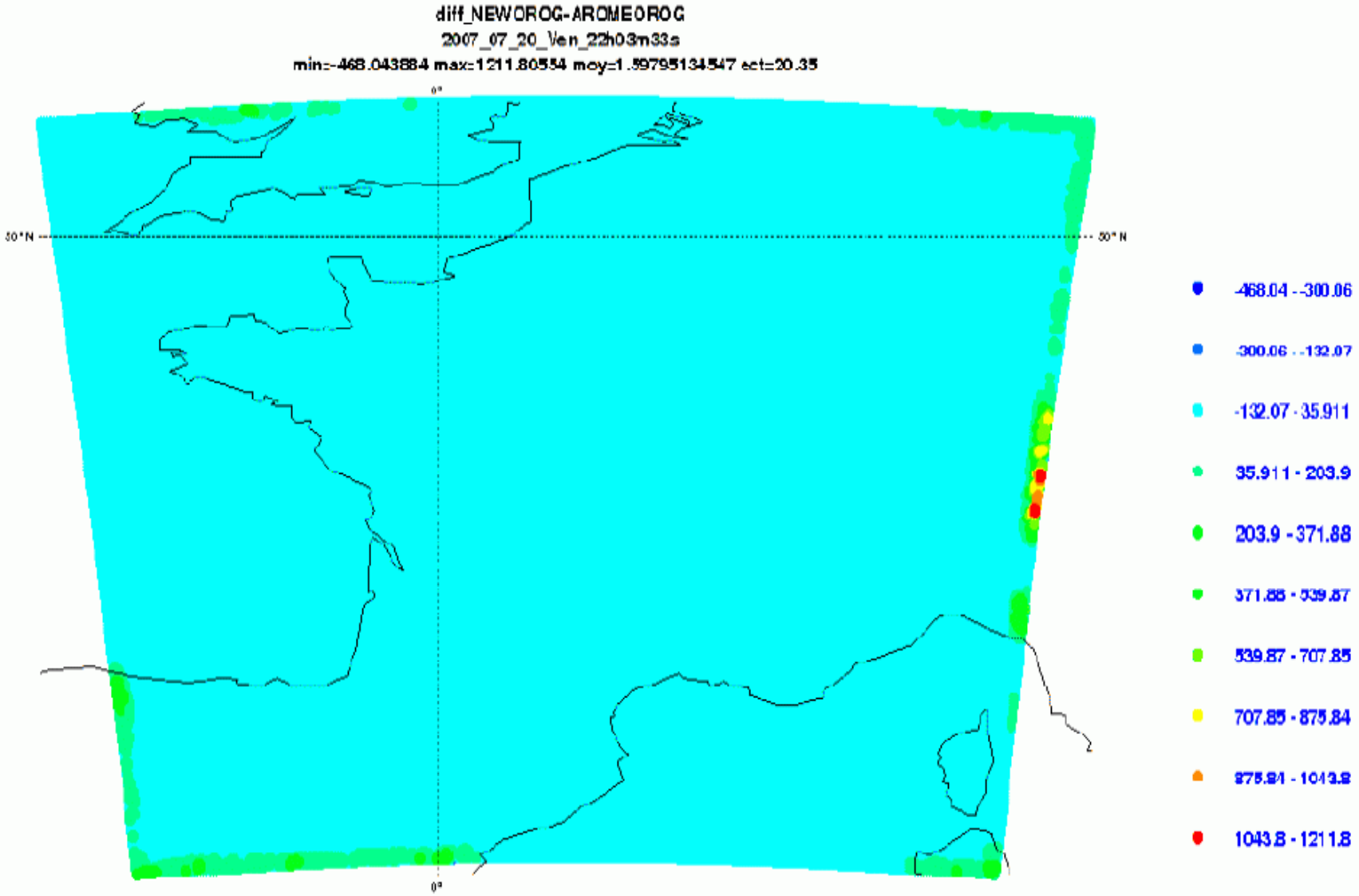


Figure 3.2 : Différence entre la nouvelle orographie et l'orographie AROME

Well-posedness of LB coupling

What's that ?

Make the initial-boundary problem similar to the continuous mathematical one.

Avoid over-specification of LB information

Theories about what must be supplied only exists in linear context

Well-posedness of LB coupling

LBCs should be introduced on a single row (no relaxation zone)

LBCs must be specified implicitly (otherwise unstable)

Not easy to conciliate (because implicit computations are solved in spectral space)

Some viable algorithms found (iterative), but (very) expensive

No immediate solution !!

VFE-NH

Starting from IFS VFE scheme (hydrost)

Extending VFE scheme to NH model

Specificity of NH system: vertical derivatives and vertical integrals

Not easy to control the eigen values of the normal modes with this discretisation

Possibility of FD or VFE treatment of terms

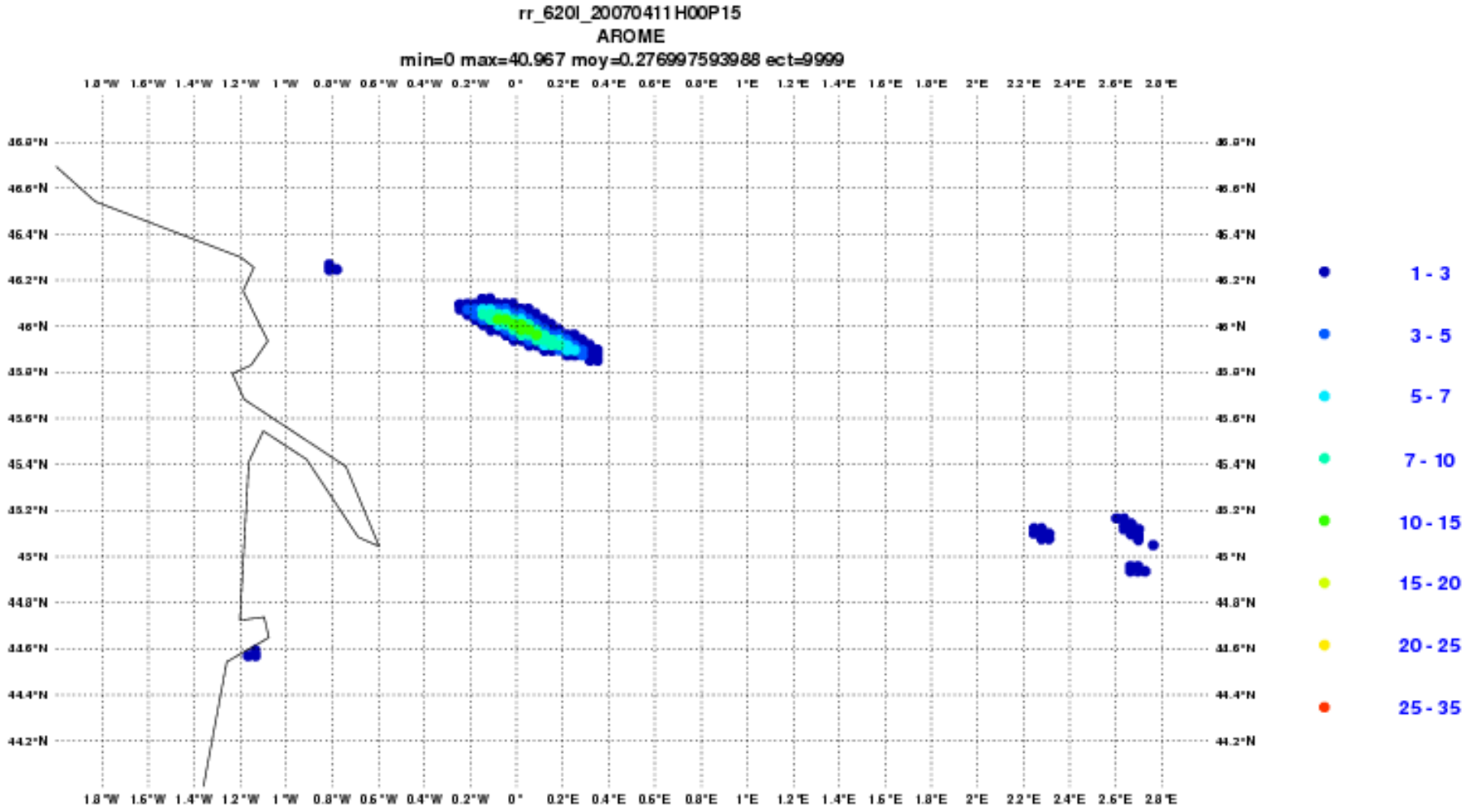
"Fireworks"

Spurious low-level circulations in convective areas

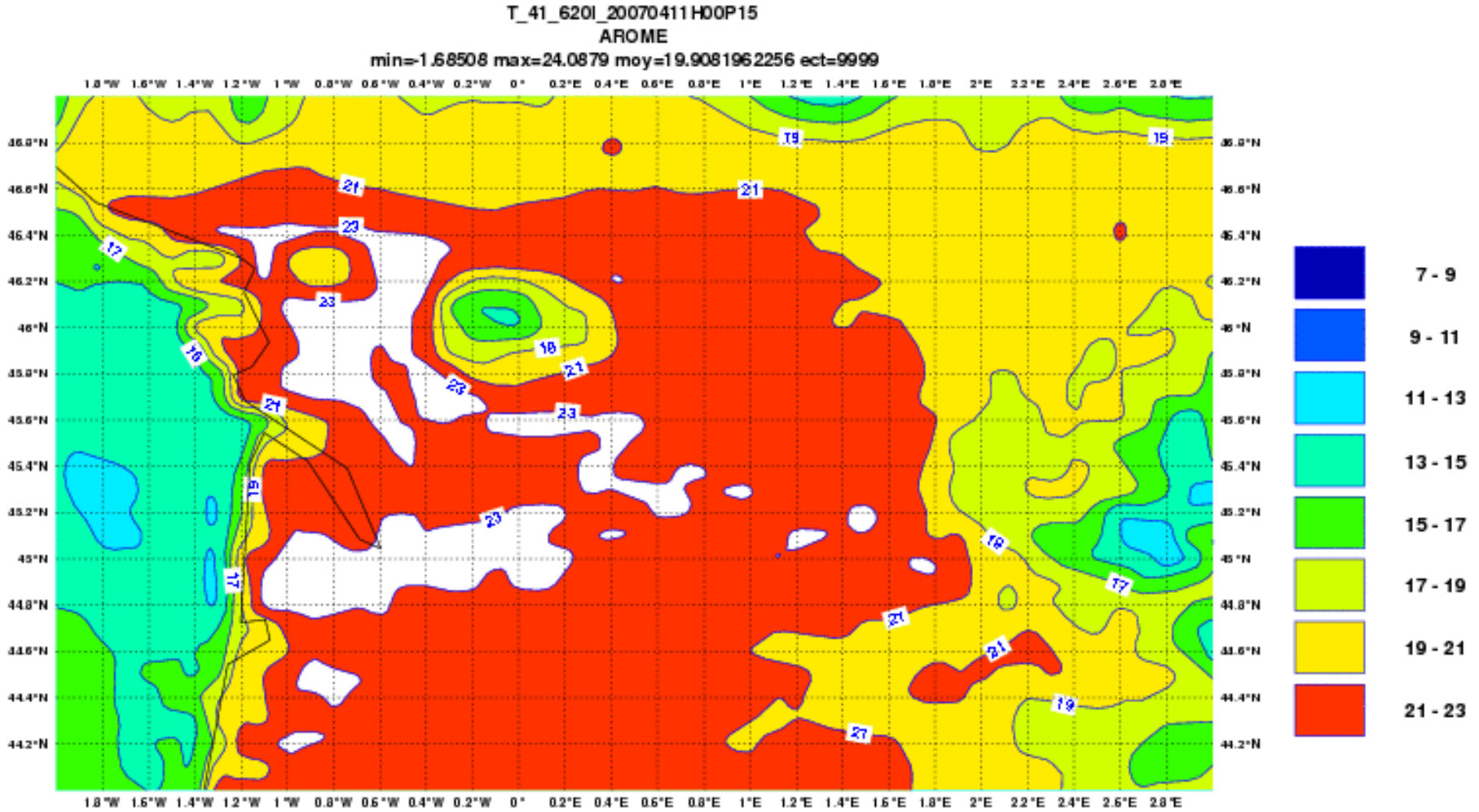
Low-level winds have a strong divergent pattern (under the precipitative areas)

Spurious cooling of low-levels temperatures

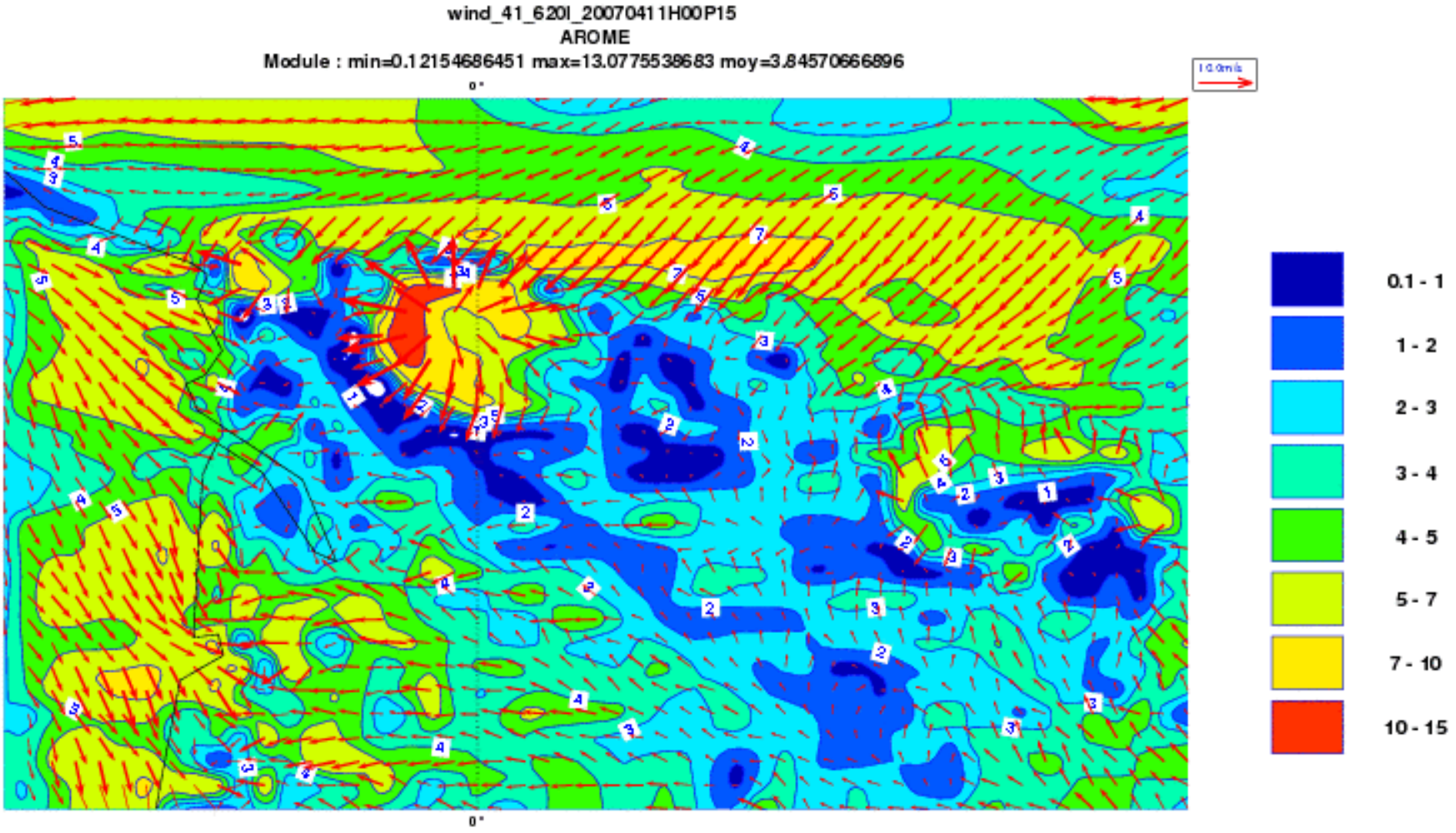
Fireworks


rr_620l_20070411H00P15
AROME
min=0 max=40.967 moy=0.276997593988 ect=9999
1 - 3
3 - 5
5 - 7
7 - 10
10 - 15
15 - 20
20 - 25
25 - 35

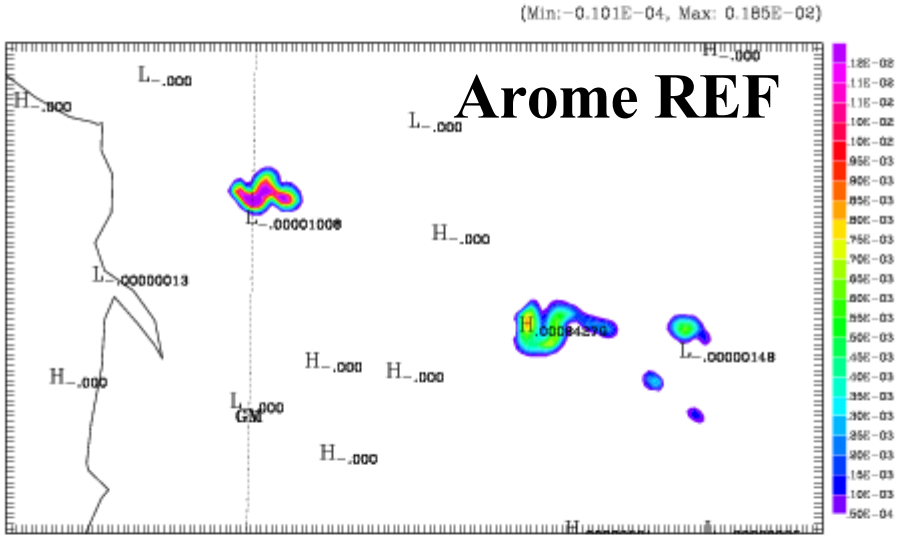
Fireworks

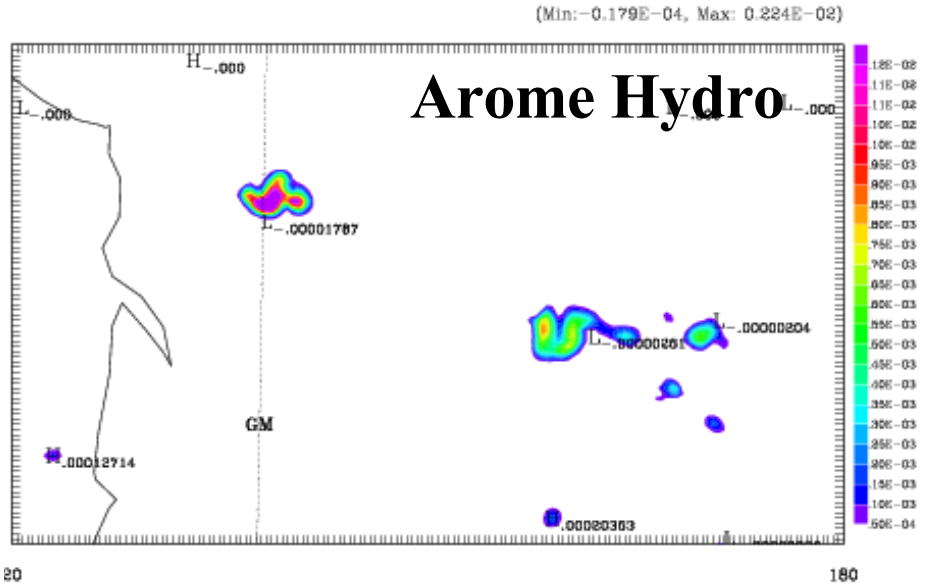

T_41_620I_20070411H00P15
AROME
min=-1.68508 max=24.0879 moy=19.9081962256 ect=9999
7 - 9
9 - 11
11 - 13
13 - 15
15 - 17
17 - 19
19 - 21
21 - 23

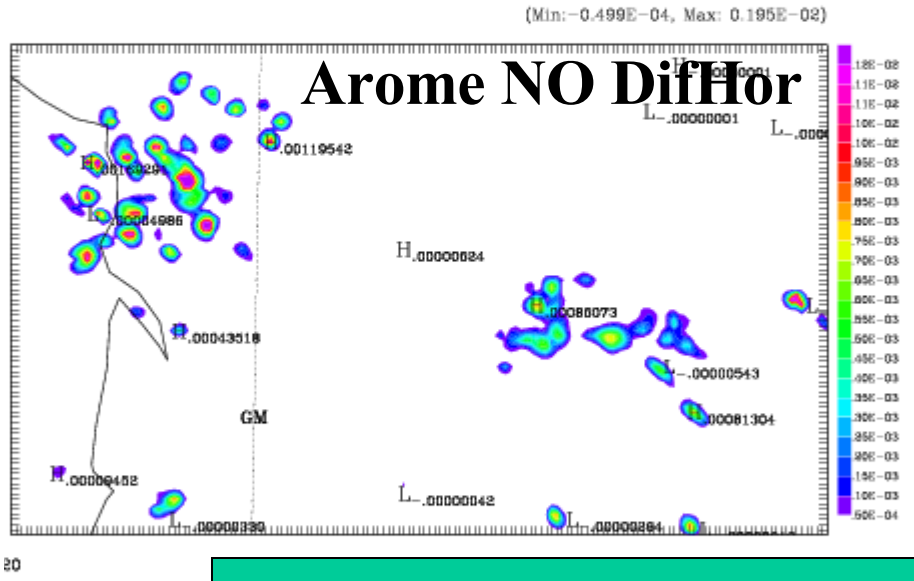
Fireworks

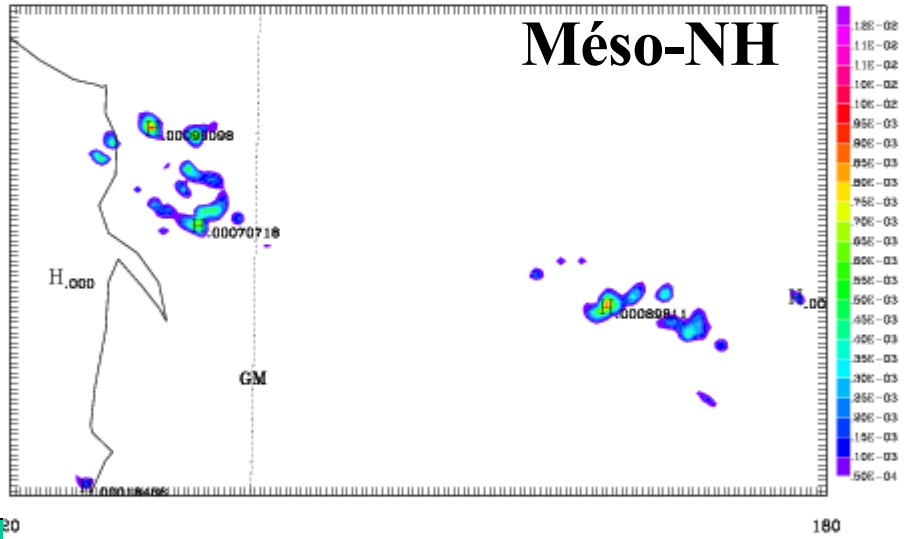

wind_41_620l_20070411H00P15
AROME
Module : min=0.12154686451 max=13.0775539683 moy=3.84570666896
0.1 - 1
1 - 2
2 - 3
3 - 4
4 - 5
5 - 7
7 - 10
10 - 15

Fireworks









Instantaneous rainfalls

Fireworks

Decreasing HDIFF strength by a factor of 4
(for limiting "Fireworks" occurence)

HDIFF strength similar to MesoNH

No HDIFF on NH pressure variable

No HDIFF on vapour and hydrometeors (GP fields)

Hdiff and precipitations

Decreasing HDIFF strength by a factor of 4

(for limiting "Fireworks" occurence)

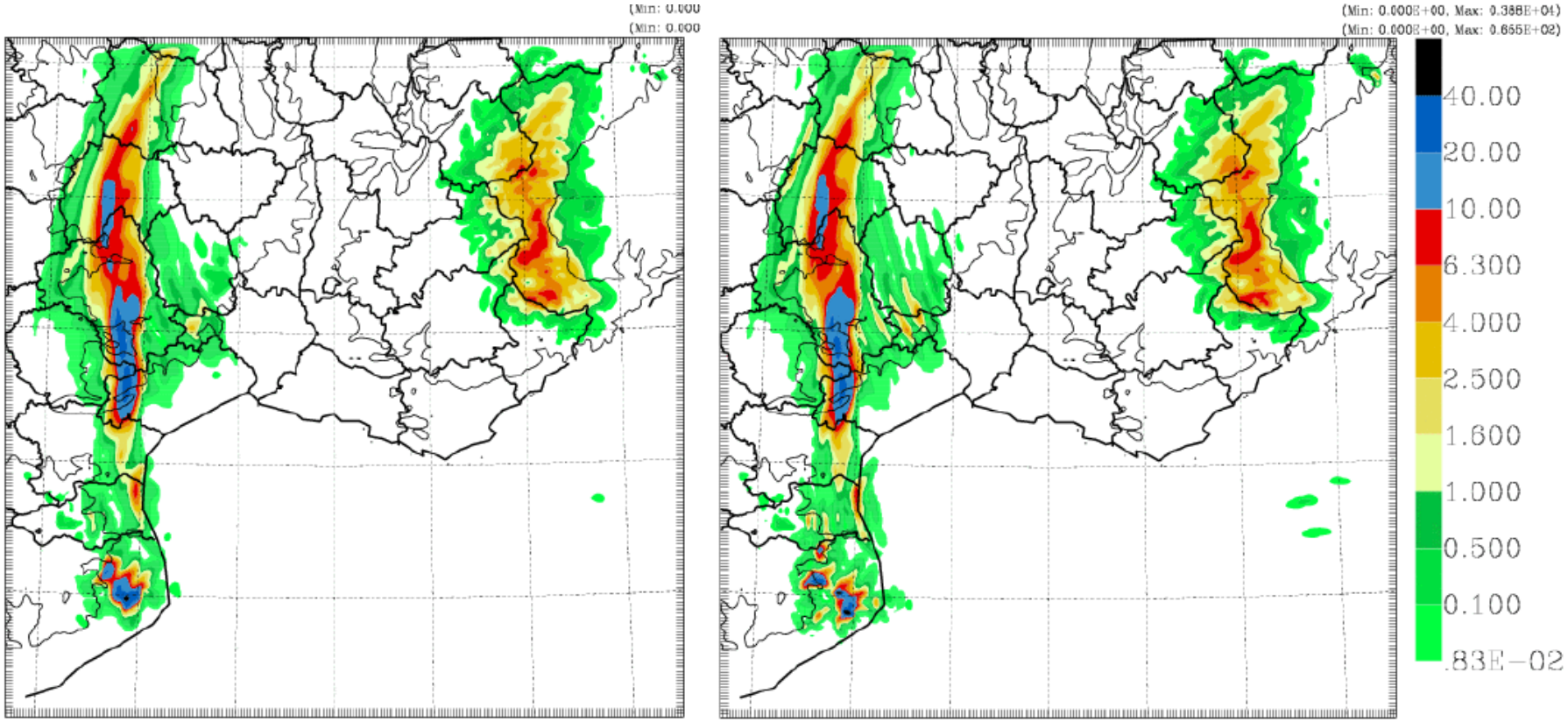
Small impact on convective precipitations events

"Gard 2005" (flood) event 6 september 2005

0h-3h cumulated rr

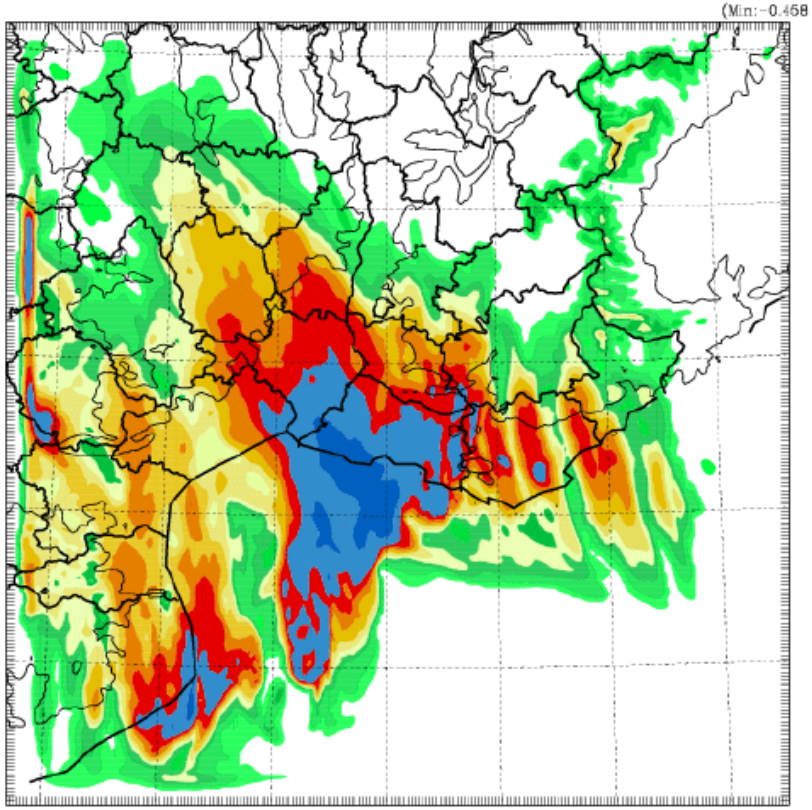
stronger diff

weaker diff

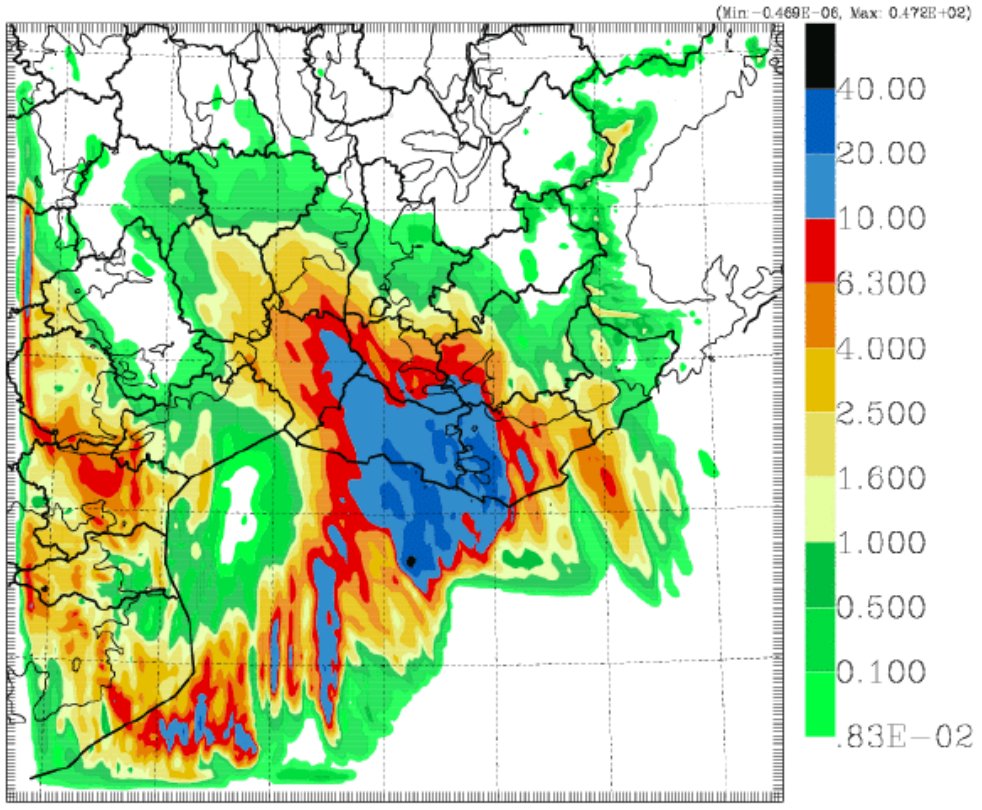


21-24 h cumulated RR

stronger diff



weaker diff



0h-24h cumulated RR

stronger diff

weaker diff