COSMO–LEPS status report

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Regionalisation of weather scenarios

- Despite the recent increase of computer power resources, the accurate forecast of extreme weather conditions, especially if related to intense and localised precipitation structures, is still difficult.
- This limitation is partly due to the inherent low degree of predictability associated to this kind of phenomena.
- Global–model ensemble skill to forecast intense and localised events in the short and medium–range is still nowadays limited.
- How to combine the ability of ensemble systems to highlight a set of possible evolution scenarios with the high spatial detail of LAM forecasts?

LEPS project

$\Rightarrow$ generate Limited–area EPS (LEPS) to improve short to medium–range probabilistic forecasts of localised weather events.

Introduce a probabilistic guidance to identify the possibile occurrence of severe weather conditions in the range:

late short–range to early–medium–range

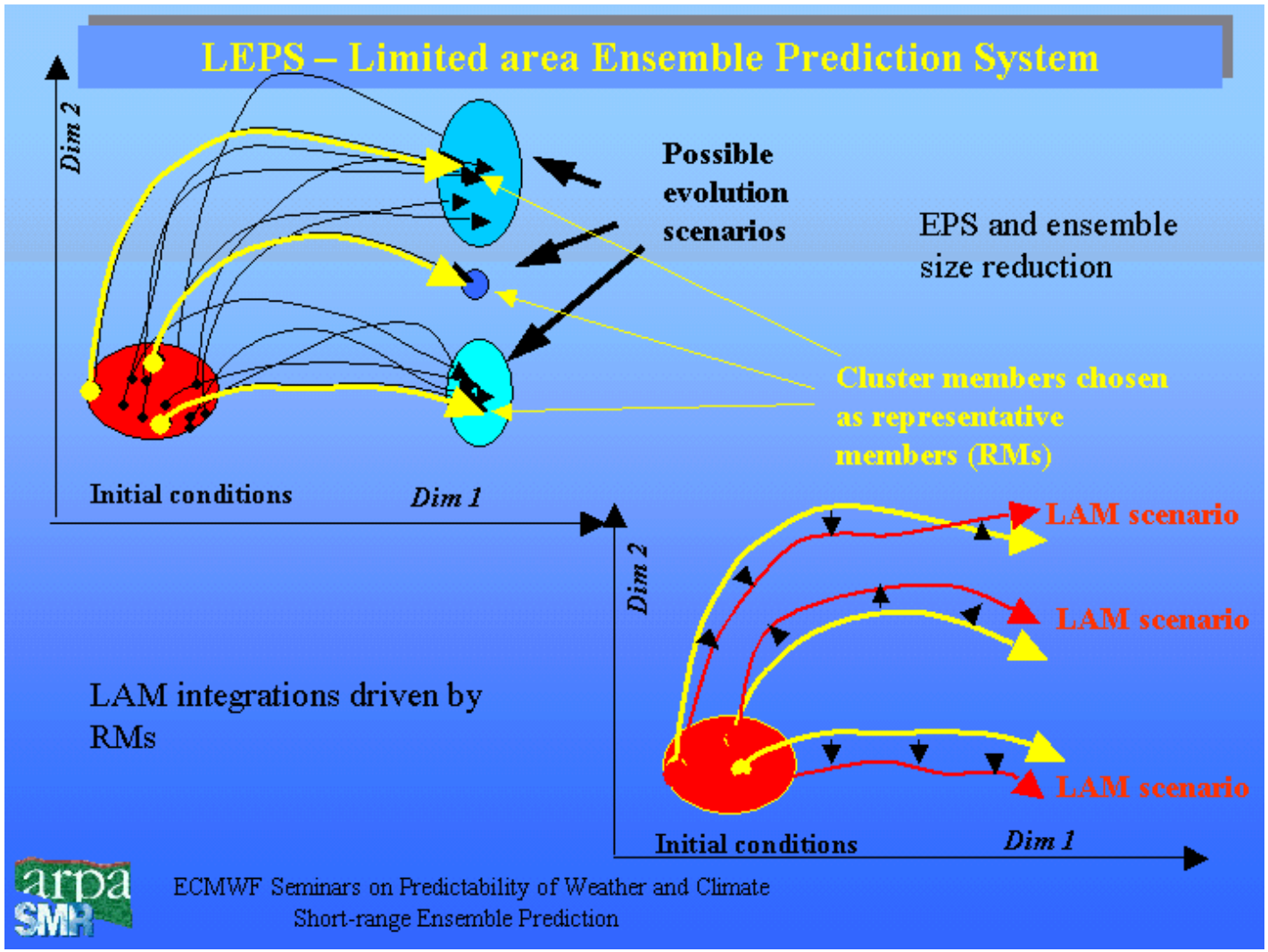
$$48\ h < \Delta t < 120\ h$$

by joining the ability of global–model ensembles to generate a set of evolution scenarios

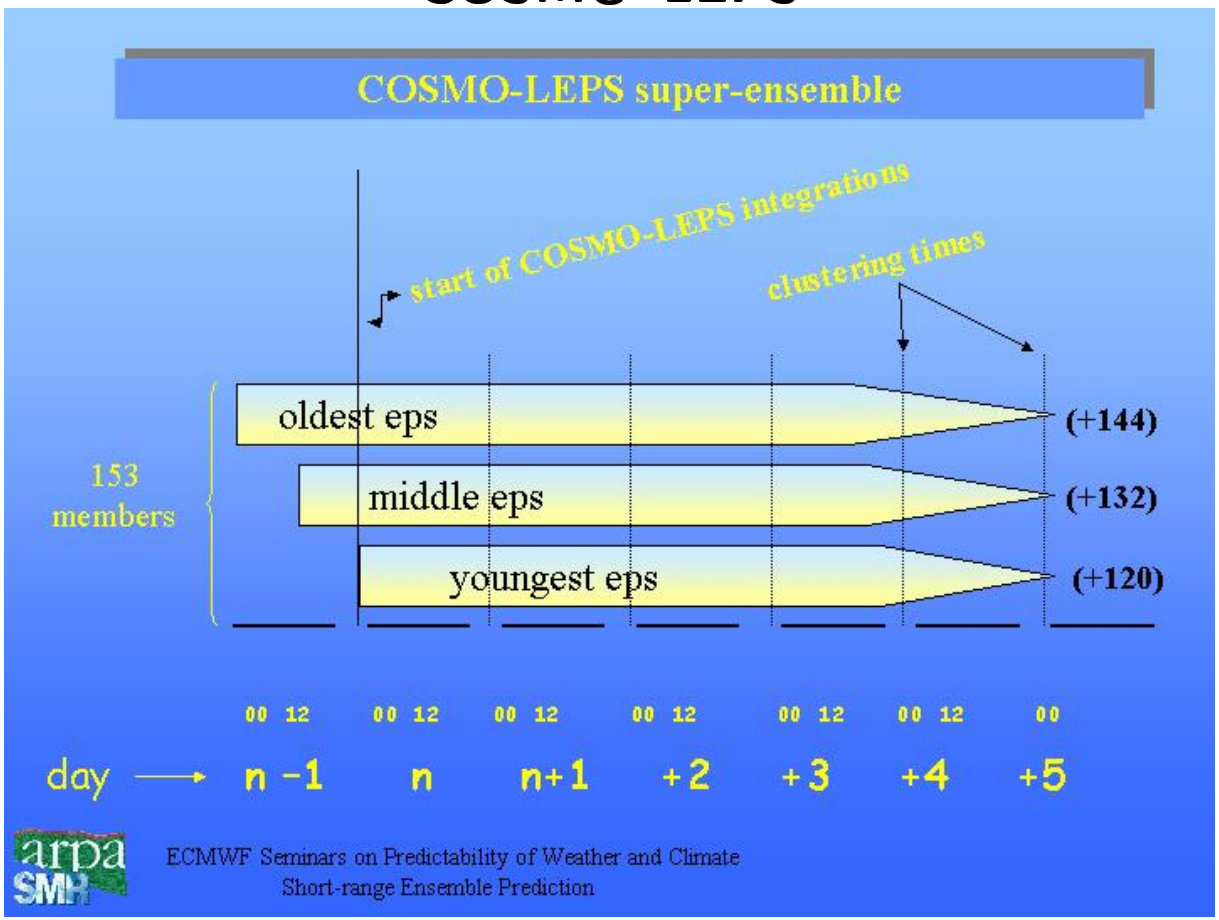
with

the capacity of LAM to detail atmospheric phenomena on local scales.

Methodology

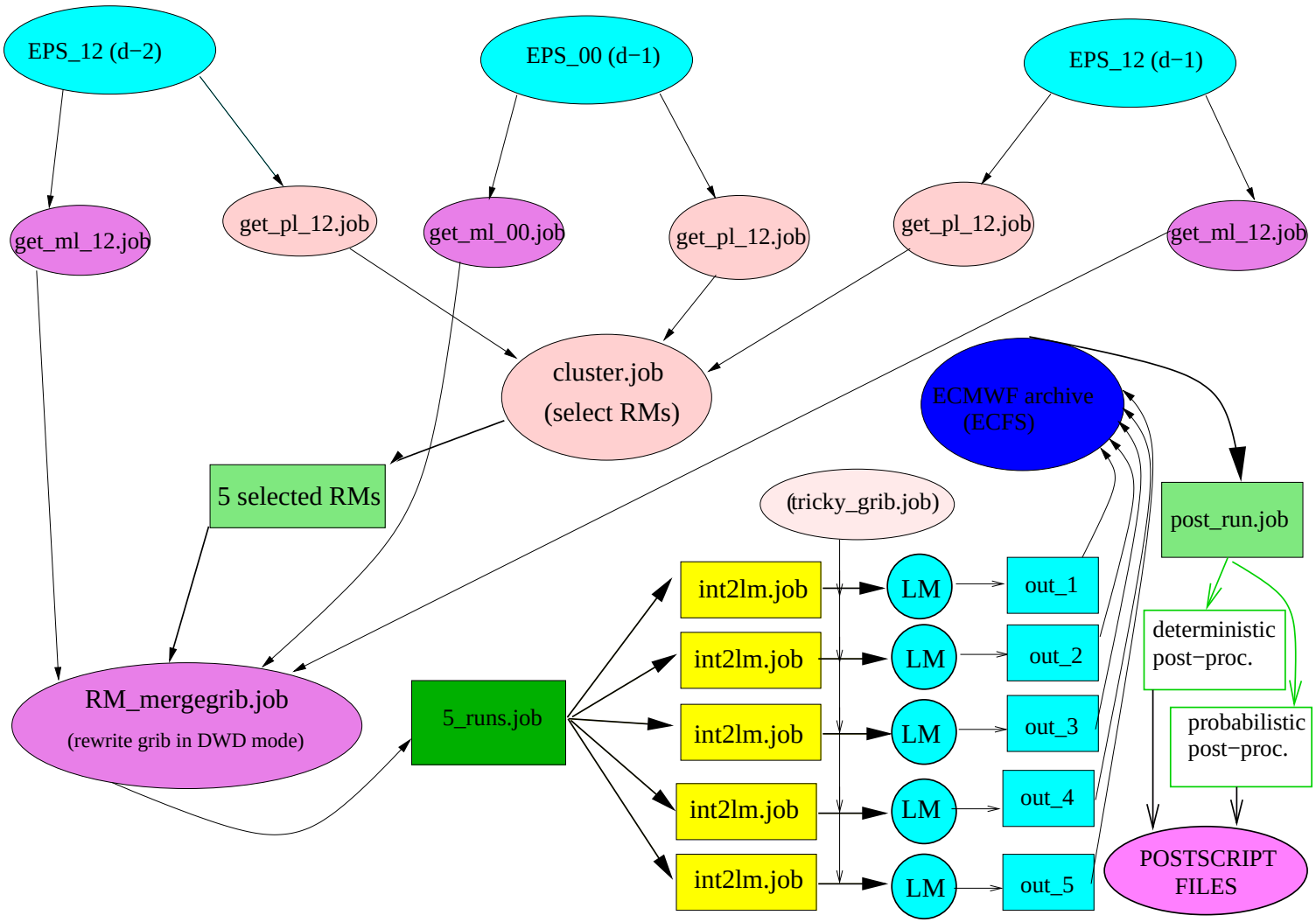


COSMO–LEPS



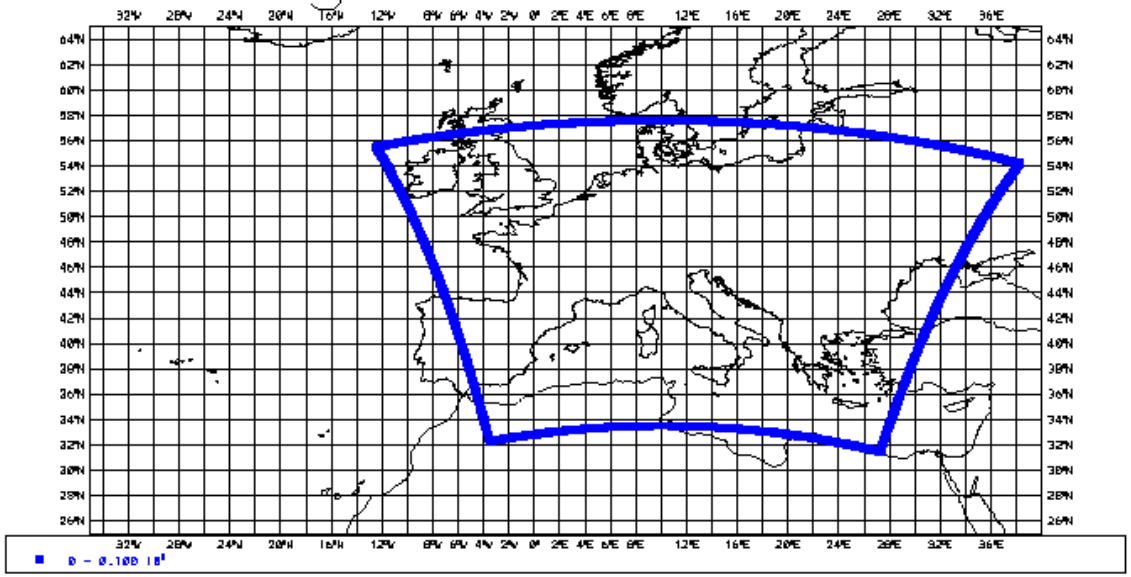
- 00–12–00 configuration (last EPS ready by 14 UTC); LM runs finished in the early evening.
- **12–00–12 configuration (last EPS ready by 1 UTC)**; **LM runs finished in the late morning**; at this time, more availability of ECMWF computers (hopefully!).

LM @ ECMWF


EPS_12 (d−2)
EPS_00 (d−1)
EPS_12 (d−1)
get_ml_12.job
get_pl_12.job
get_ml_00.job
get_pl_12.job
get_pl_12.job
get_ml_12.job
cluster.job
(select RMs)
ECMWF archive
(ECFS)
5 selected RMs
(tricky_grib.job)
post_run.job
int2lm.job
LM
out_1
deterministic
post−proc.
int2lm.job
LM
out_2
RM_mergegrib.job
(rewrite grib in DWD mode)
5_runs.job
int2lm.job
LM
out_3
probabilistic
post−proc.
int2lm.job
LM
out_4
int2lm.job
LM
out_5
POSTSCRIPT
FILES

COSMO-LEPS DOMAIN

integration domain



- $\Delta x \simeq 10$ km (306 $\times$ 258 = 78948 grid points); 32 model levels; time–step: 60 sec;
- forecast length: 120 hours; for each LM run, elapsed time: about 60 minutes (12 proc. of VPP5000);
- total CPU time $\approx$ 12 h (+ a few minutes for int2lm.job).
- In the near future, VPP5000 replaced by new IBM $\Rightarrow$ performances will change.

LM output

probabilistic products

(fc +48–72, fc+72–96, fc+96–120):

- prob of 24h rainfall exceeding 20, 50, 100, 150 mm;
- prob of 24h Tmax exceeding 20, 30, 35, 40 C;
- prob of 24h Tmin below -10, -5, 0, +5 C;
- prob of 24h Vmax (max horizontal wind speed) exceeding 10, 15, 20, 25 m/s;
- prob of 24h snowfall above 1, 5, 10, 20 cm of equivalent water (to be checked);

deterministic products

for each LM run (fc+60, fc+84, fc+108):

- TP and MSLP;
- Z700 and T850;

LM archiving

For the time–being, LM is archived on ECFS. For each LM run, it is archived:

TP (c24, c48, c72. c96, c120)

Tmax (p24, p48, p72, p96, p120)

Tmin (p24, p48, p72, p96, p120)

Vmax (p24, p48, p72, p96, p120)

MSLP (p0, p12, p24, p36, . . . p120)

Z500 (p0, p12, p24, p36, . . . p120)

Z700 (p0, p12, p24, p36, . . . p120)

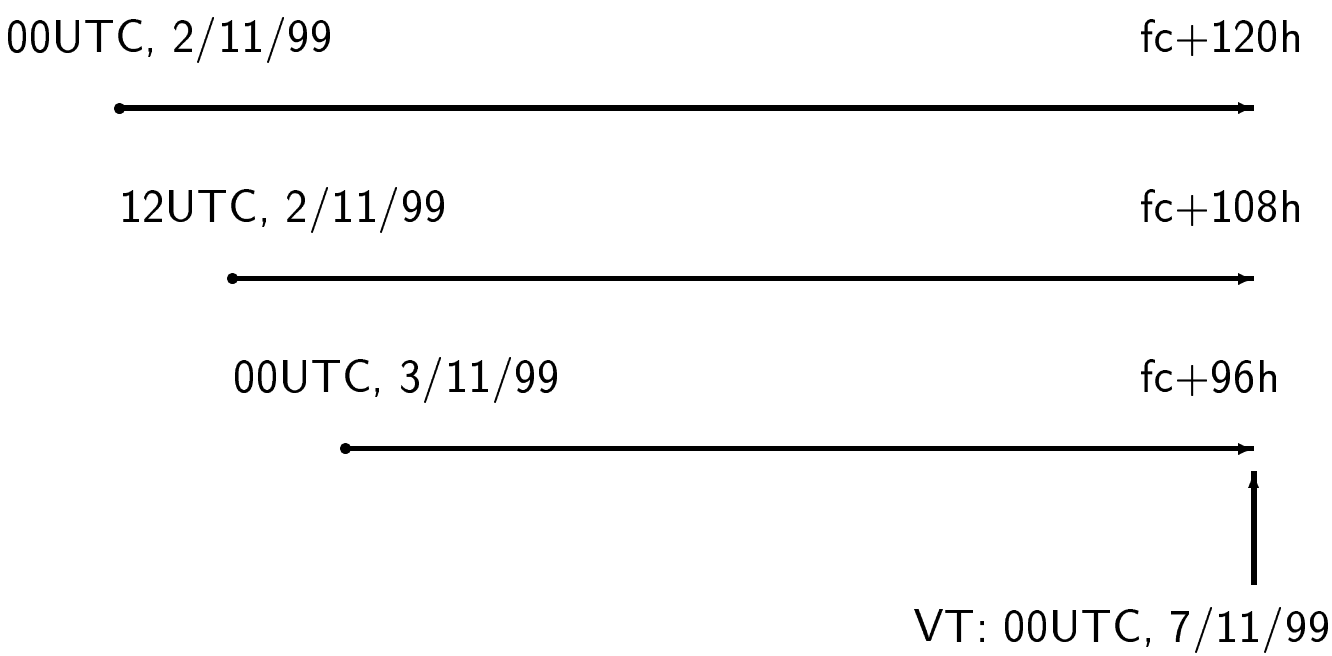
T850 (p0, p12, p24, p36, . . . p120)

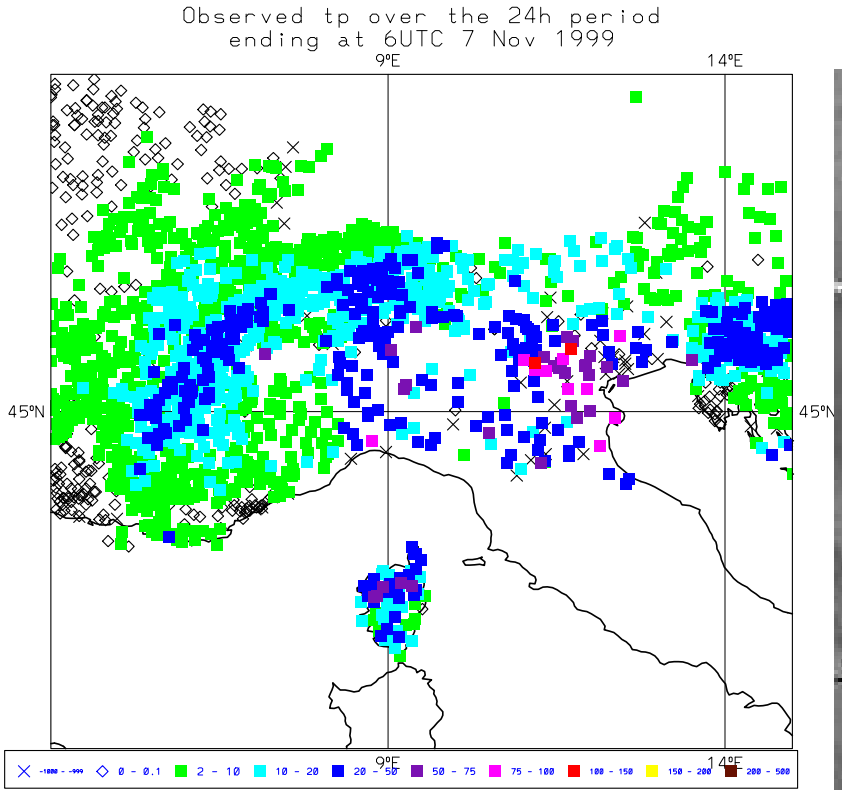
... anything else?

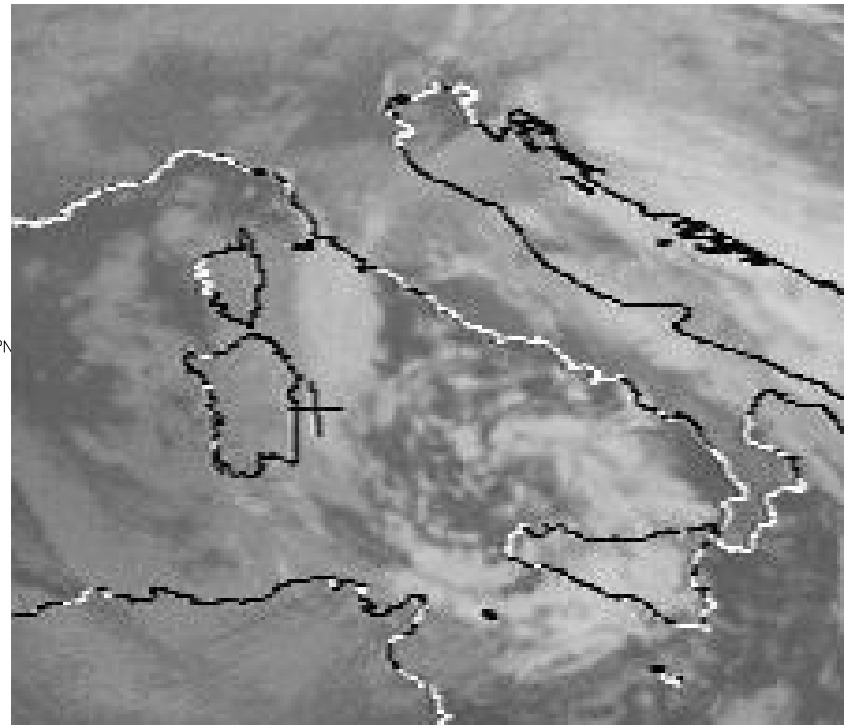
CASE STUDY

MAP IOP 15 (Alpine region) on 6–7 November 1999

- 3 global ensembles: T_L255 L40 EPS ($\Delta x \simeq$ 80 km);
- LEPS: LM ($\Delta x \simeq$ 7 km) nested on RMs of EPS.



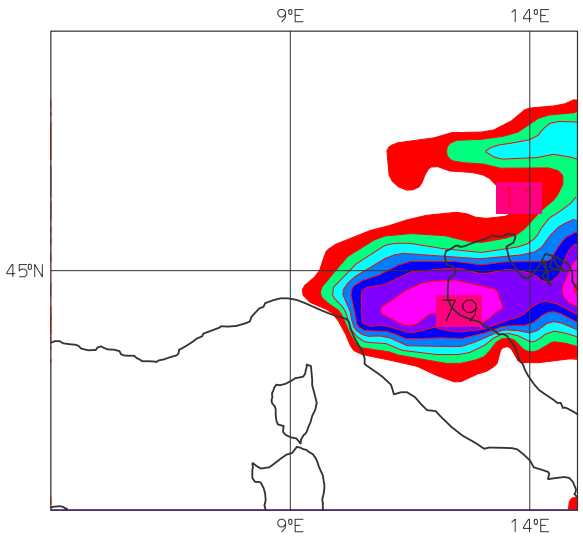

Observed tp over the 24h period
ending at 6UTC 7 Nov 1999
9ºE
14ºE
45ºN
45ºN
9ºE
14ºE
-1000 - -999
0 - 0.1
2 - 10
10 - 20
20 - 50
50 - 75
75 - 100
100 - 150
150 - 200
200 - 500



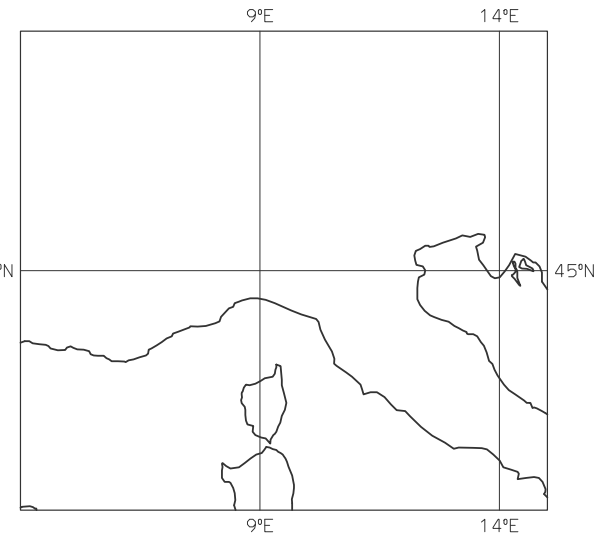
ECMWF PROBABILITY MAPS ($\Delta x \simeq 80$ km)

fc + 102h (VT: 7/11/1999, 6GMT)

RAINFALL $>$ 20 mm



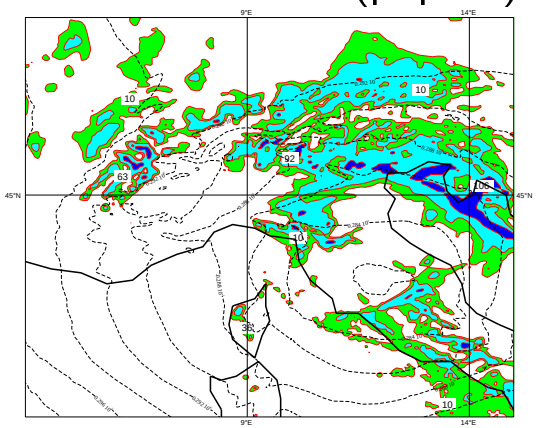
RAINFALL $>$ 50 mm



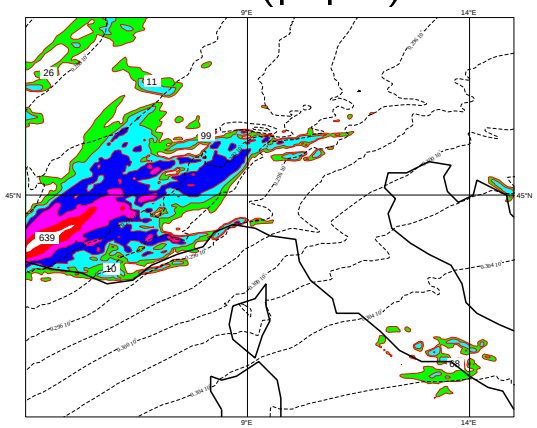
LM REPRESENTATIVE MEMBERS ($\Delta x \simeq 7$ km)

Z700, TP (fc + 102h; VT: 7/11/1999, 6GMT)

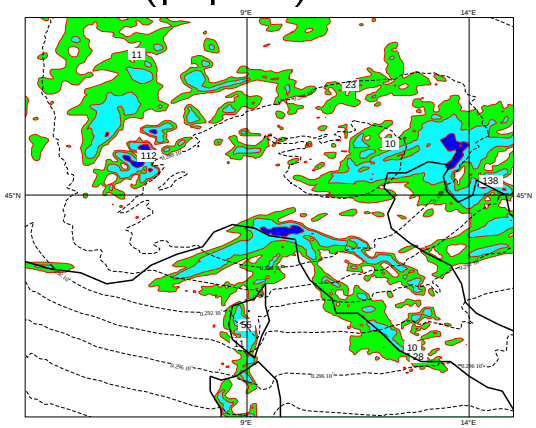
RM 1 (pop 78)



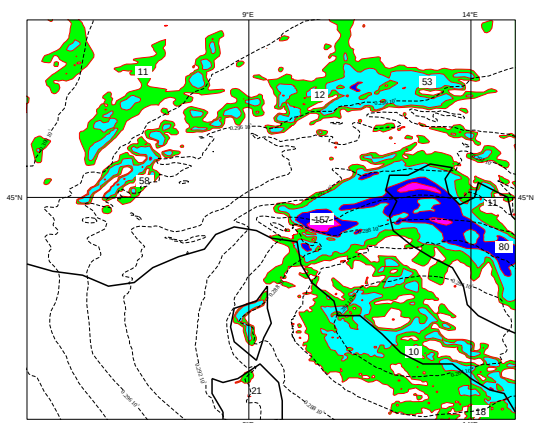
RM 2 (pop 3)



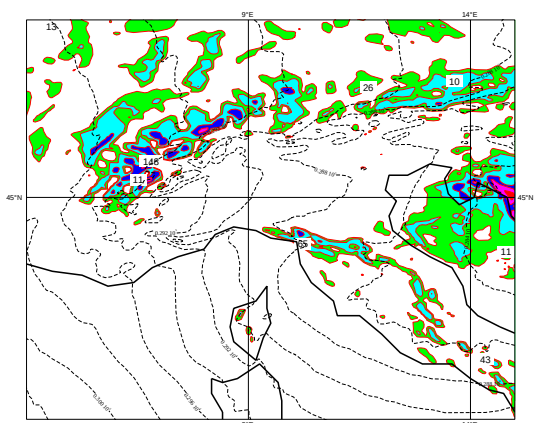
RM 3 (pop 13)



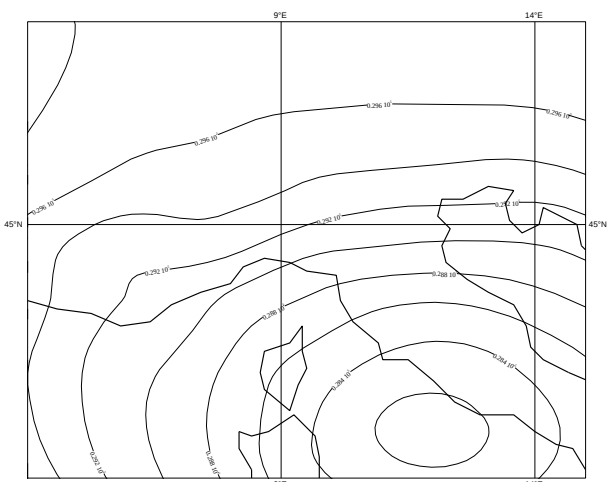
RM 4 (pop 40)



RM 5 (pop 19)



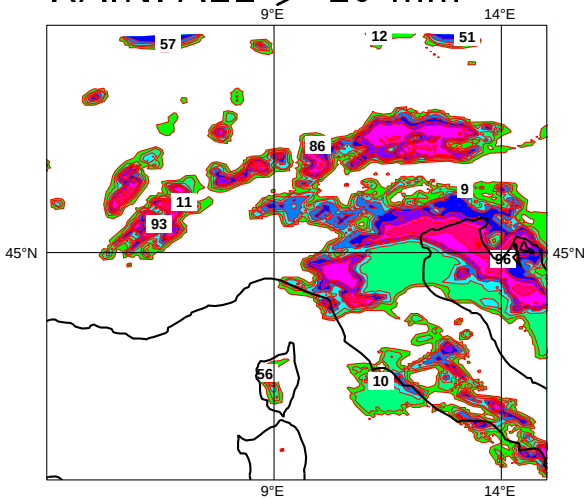
ECMWF ANA



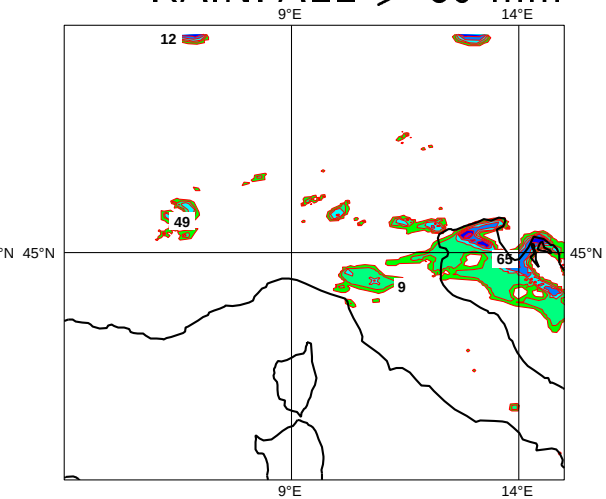
LM PROBABILITY MAPS ($\Delta x \simeq 7$ km)

fc + 78–102h (VT: 7/11/1999, 6GMT)

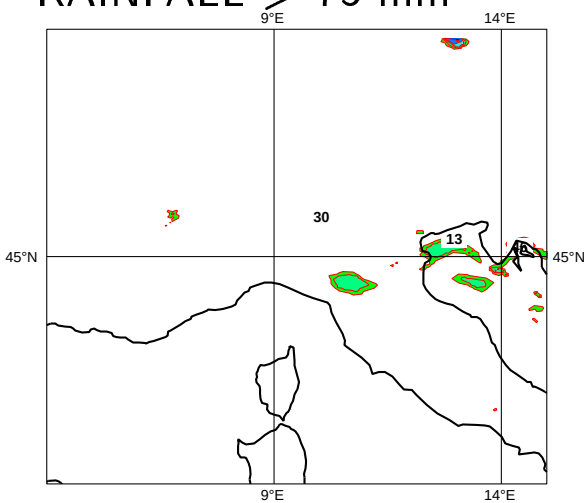
RAINFALL > 20 mm



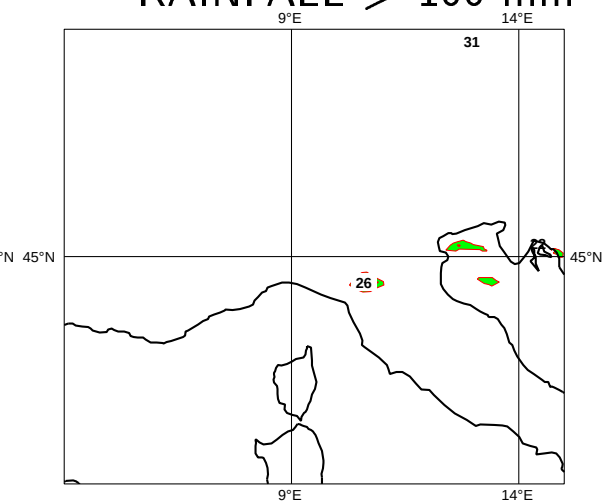
RAINFALL > 50 mm



RAINFALL > 75 mm



RAINFALL > 100 mm



Results and future development

- better performance of LEPS system against EPS for flood cases in the early and medium–range;
- from October 2002, COSMO–LEPS (based on Lokal Model at 10 km, 32 vertical levels) running on an operational basis at ECMWF;
- generation of forecast products from t+48h to t+120h to be faxed/email to COSMO community (grib or maps?);
- assess impact on ensemble size on forecast accuracy; test 10–member LEPS: 5 LM + 5 LAMBO (very cheap and runs on 1 processor);
- generation of "smart products" (e.g. probability maps of freezing rain);
- **COSMO–LEPS is very expensive; is it worth? $\Rightarrow$ need data for verification!!!**