Comparison of the MM5 performance in ECMWF
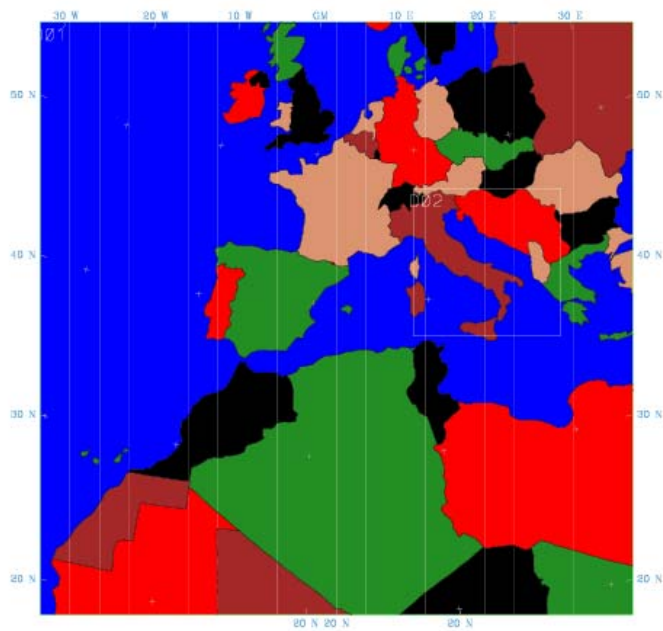# and NCEP driven simulations - 7.5km resolution runs_ part B1

continuation of a part_B…. on two 2 way nested domains (22.5km, 7.5km resolutions)

Simulations performed :
1. KF2-R1
2. KF2-R2
3. KF2-Sh
4. KF-R1
5. KF-R2
6. KF-Sh

Total "Salento" rainfall:
Remainder: Total rainfall on the 13 Salentine locations together equals 1033mm

Fig. 1 shows 36 hour total MM5 simulated rainfalls for the 13 salentine stations summed together, for the parametrization combinations tested (methodology as in part_B). In general amounts, KF2 CPS seems to be better then KF, overall, in high resolution runs too. KF2-R1 is the farmost closest to the truth, other simulations condsiderably underestimate the Salento maximum.
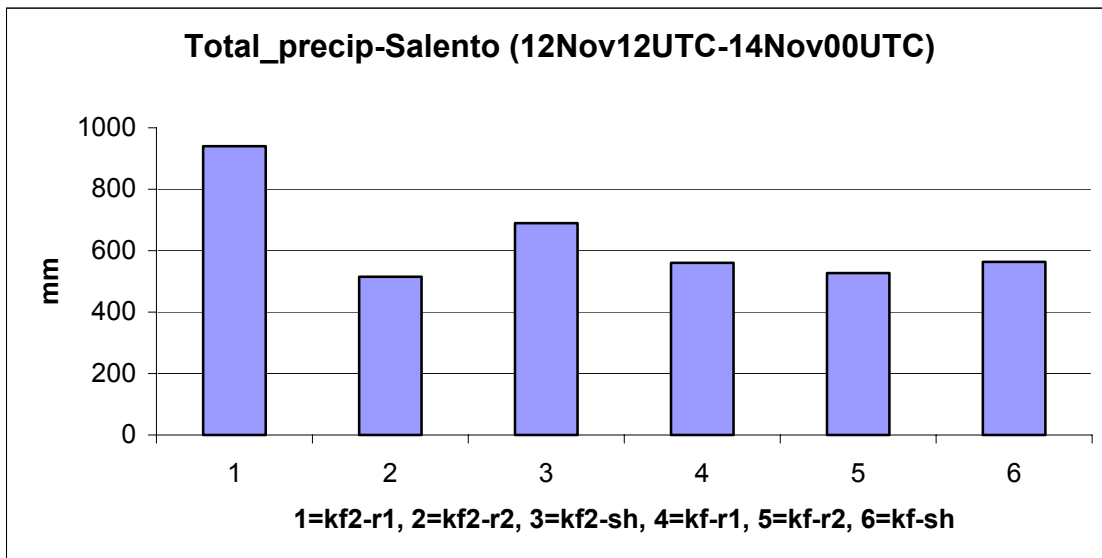

Fig. 1. 36-hour simulated total rainfalls for the 13 salentine stations summed together

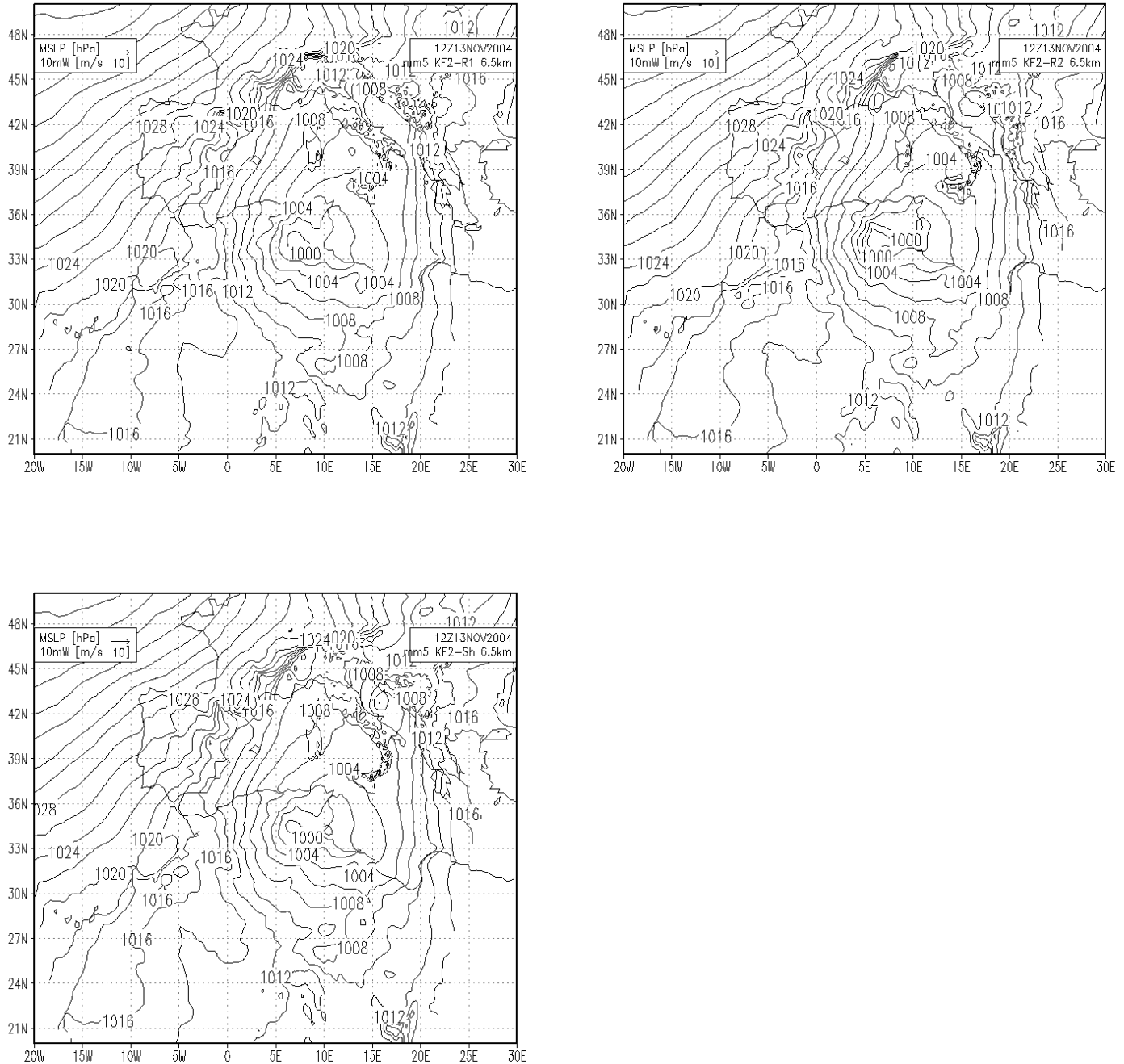Comparison of the simulations with KF2 CPS and R1,R2 or Sh MPS

1. MSLP

Fig.2.a-c MSLP at 13Nov 12UTC for KF2-R1 (upper-left, "UL"), KF2-R2 (upper-right, "UR") and KF2-Sh (lower-left, "LL"). Resolution 22.5km (not 6.5km as specified in the graph box, sorry for that). As in 1 domain runs, KF2-R2 MSLP values 2 hPa deeper- 998hPa, exactly as in ECMWF analysis.
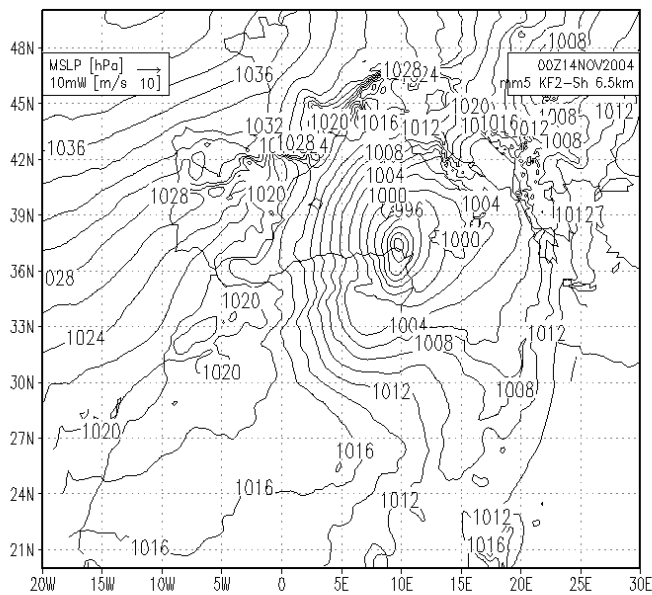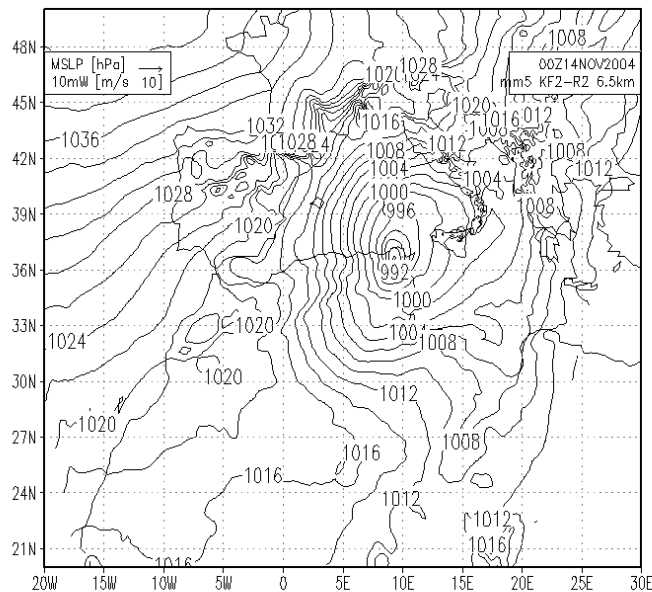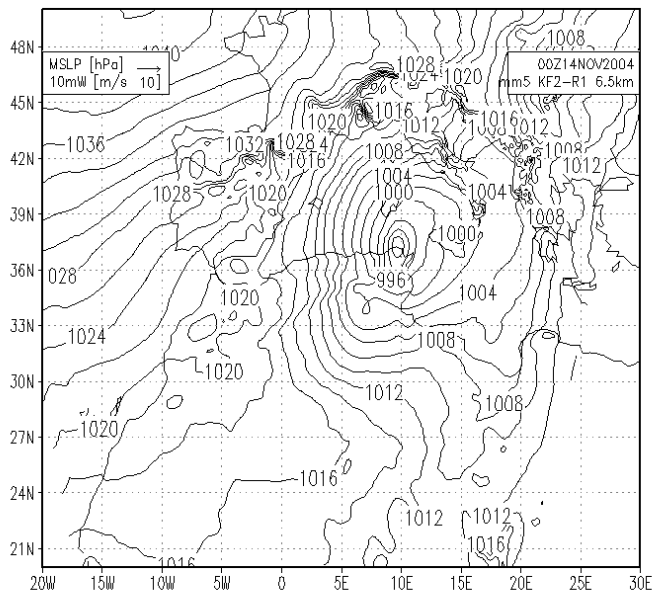
Fig.3.a-c MSLP at 14Nov 00UTC for KF2-R1 (upper-left, "UL"), KF2-R2 (upper-right, "UR") and KF2-Sh (lower-left, "LL"). Resolution 22.5km (not 6.5km as specified in the graph box, sorry for that). KF2-R1=992hPa, KF2-R2=988hPa, KF2-Sh=990hPa. The KF2-Sh MSLP value at the cyclone centre has a very good match with the BUFFR station 60715 (990.7hPa), while KF2-R1 corresponds well to ECMWF analysis (992hPa), KF2-R2 bit deeper then BUFR or ECMWF analysis data – refer to part_A Error is greater in locations of the cyclone centres (compared to ECMWF analysis), then in MSLP values.
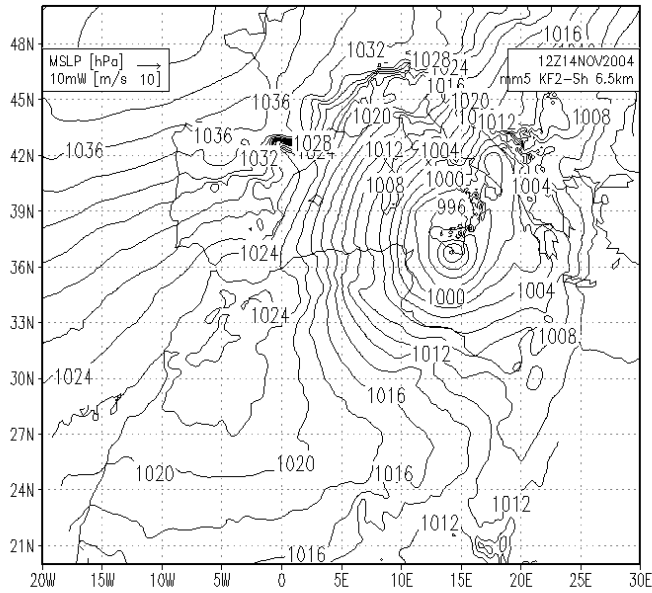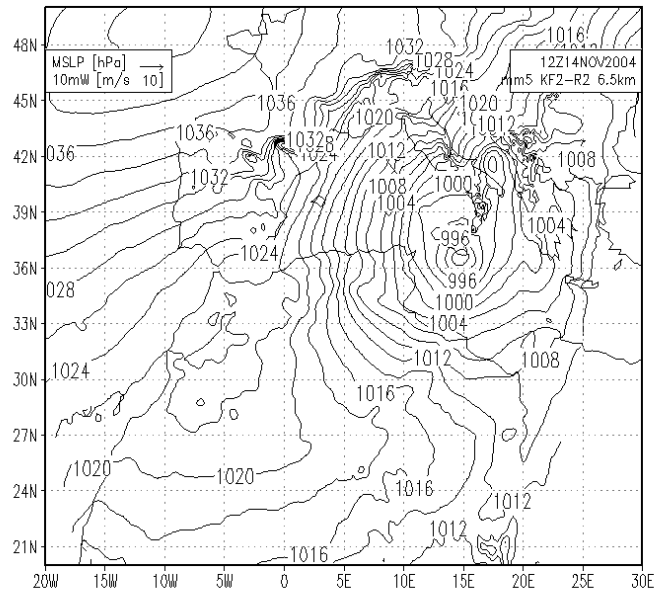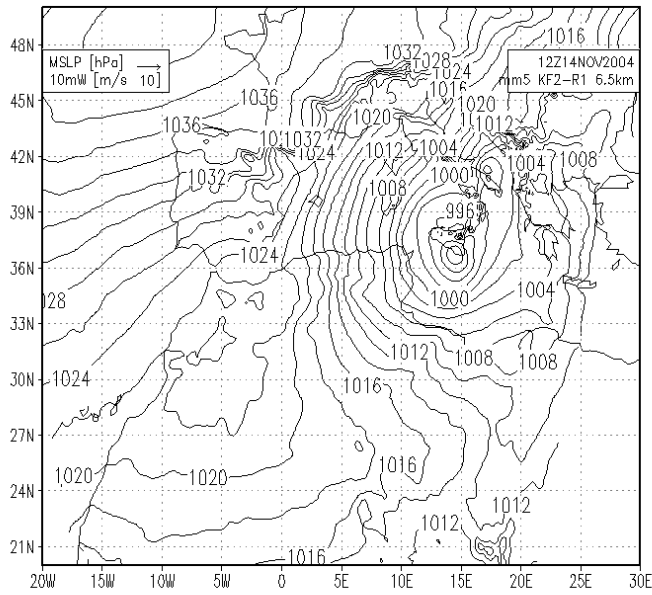
Fig.4.a-c MSLP at 14Nov 12UTC for KF2-R1 (upper-left, "UL"), KF2-R2 (upper-right, "UR") and KF2-Sh (lower-left, "LL"). Resolution 22.5km (not 6.5km as specified in the graph box, sorry for that). KF2-R1=KF2-R2=KF2-Sh=992hPa, exactly as in ECMWF analysis. Error in position though, that probably influenced precipitation distribution and intensity in Southern Italy (in ECMWF analysis cyclone center E-NE from Sicily).

2. PRECIPITATION

Fig. 5.a-c: 24hr model simulated total precipitation in cm (12 Nov 00 UTC – 13 Nov 00 UTC) for MM5-ECMWF 7.5 km resolution KF2-R1 (UL), KF2-R2 (UR) and KF2-Sh (LL) simulations. These figures should be compared to Fuccello data on 12 Nov (attached).

Fuccello data (refer to last email attachments) has 2 maximums for period 12Nov00UTC-13NovUTC. In Calabria ~100mm/24hr and at northeastern tip of the Taranto bay ~250mm/24hr. KF2-R2 does not do so well in identifying 2 maximas, KF2-R1 shows 2 maximas although Taranto one displaced, while KF2-Sh shows two maximas pretty well, but has one in Salento region (which is not present in Fuccello data).
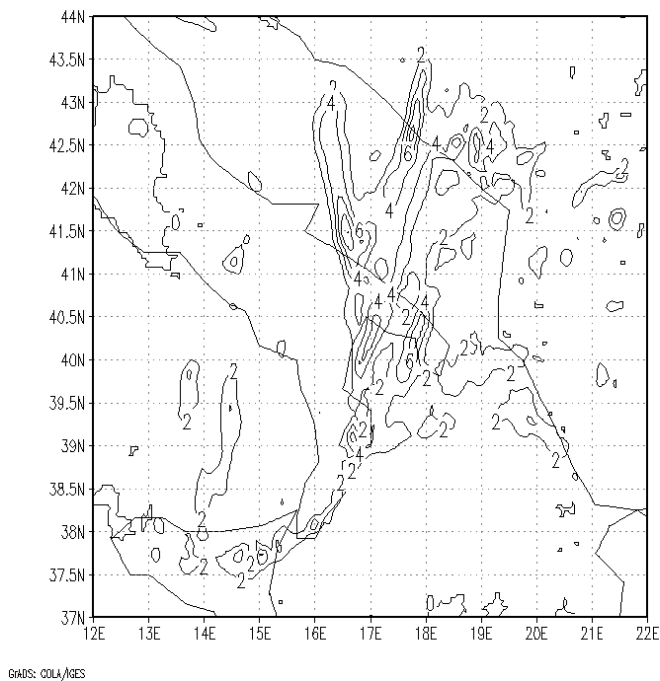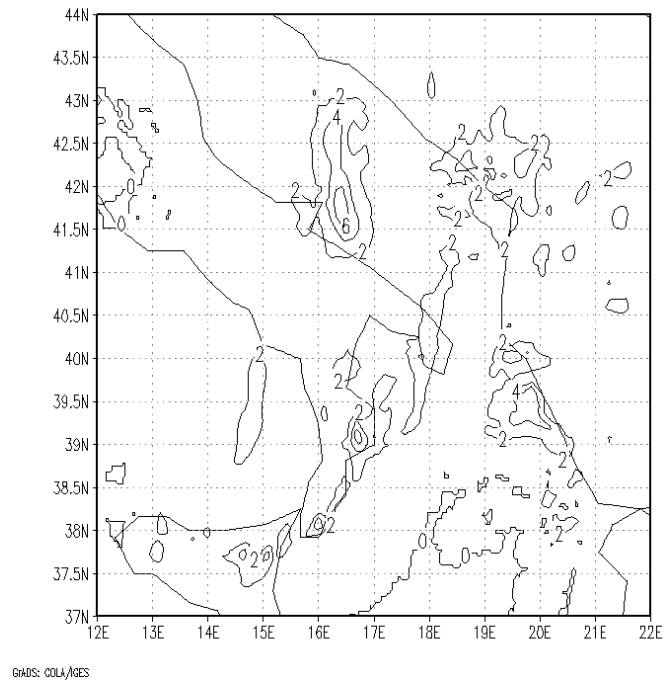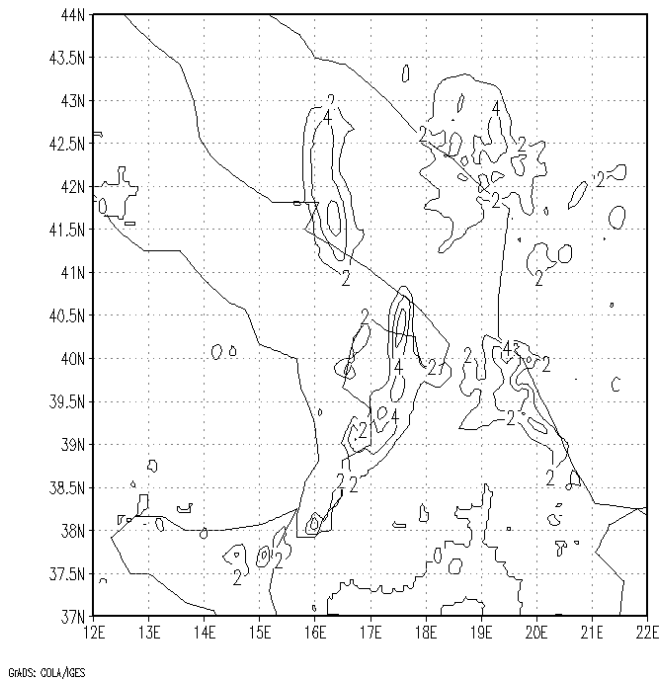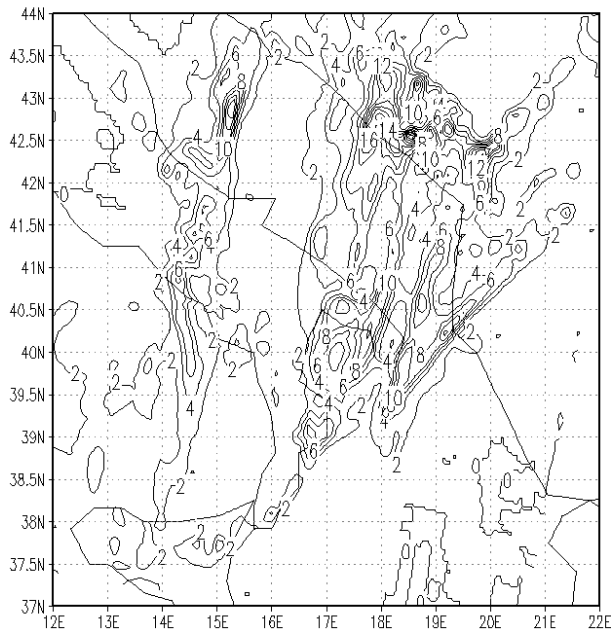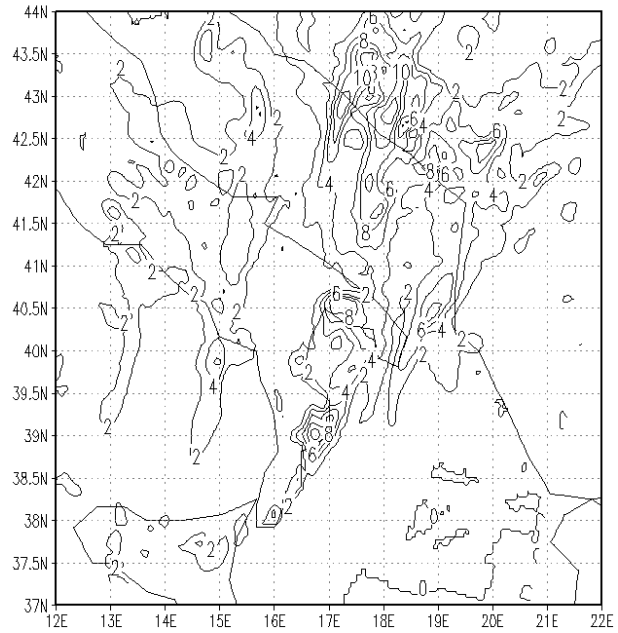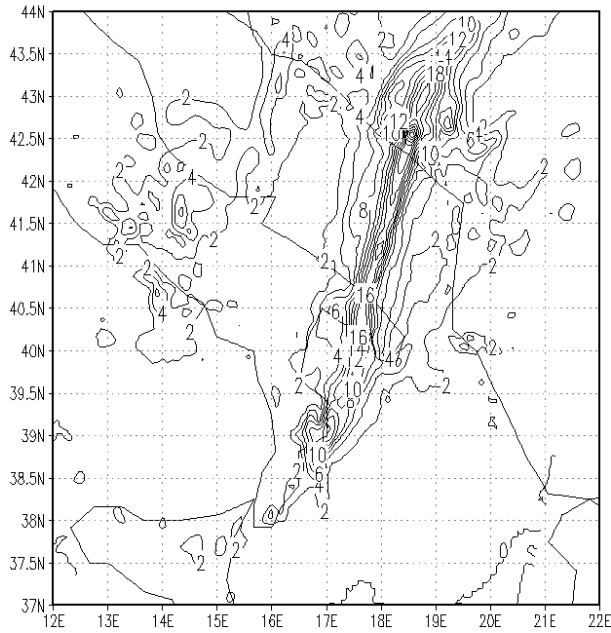

Fig. 5.a-c: 24hr model simulated total precipitation in cm (12 Nov 00 UTC – 13 Nov 00 UTC) for MM5-ECMWF

7.5 km resolution KF2-R1 (UL), KF2-R2 (UR) and KF2-Sh (LL) simulations. These figures should be compared to "Salento" data on 12 Nov see (part_A).

In terms of Salento maximum (>150mm/36hr) R1 is probably the closest to the truth, but has a remarkable precip pattern all across the Southern Adriatic that can not be verified by our data. R2 does not do well in Salento maximum. Sh has around 100mm at the Salento maximum location which is quite good, although looks "noisy" all together.

Summed over 2 days (12Nov00UTC – 14Nov UTC) we should thus have 3 maximas: Calabrian (~100mm), NE Taranto tip (~250mm) and Salento (~150-200, depending on the data taken). Let's take a look how high resolution simulations performed in total for that period.
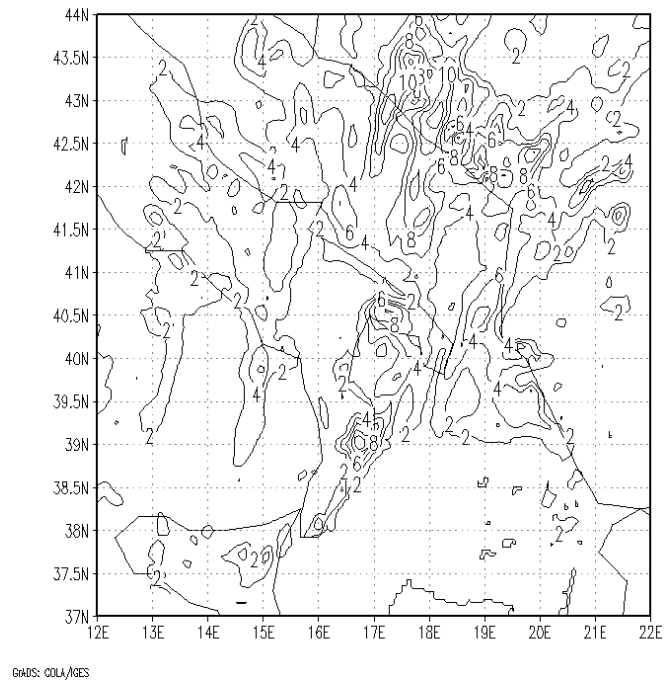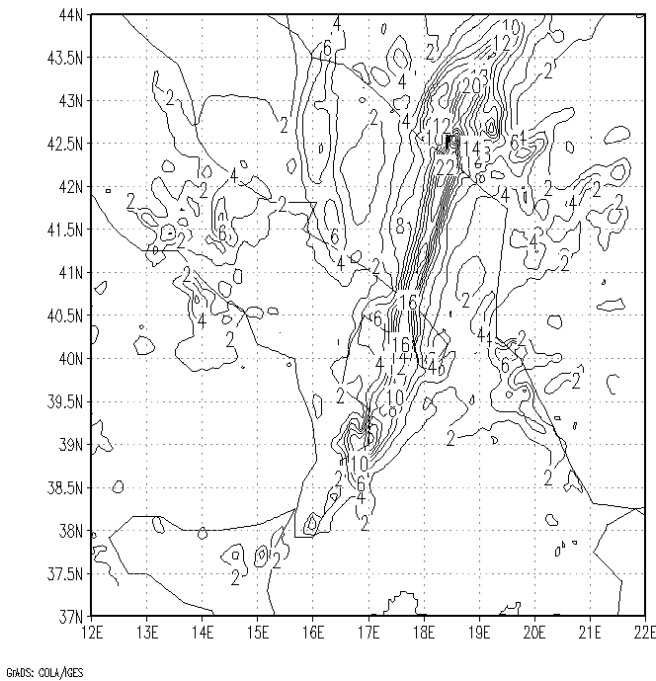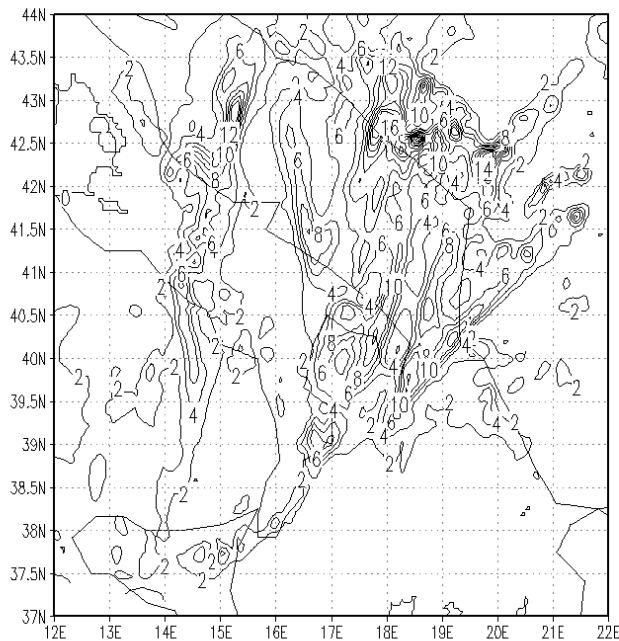
GrADS: COLA/IGES

Fig. 6.a-c: 48hr model simulated total precipitation in cm (12 Nov 00 UTC – 14 Nov 00 UTC) for MM5-ECMWF 7.5 km resolution KF2-R1 (UL), KF2-R2 (UR) and KF2-Sh (LL) simulations. These figures should be compared to a sum of Fuccello data for 12Nov and 13Nov (plots attached in my last email).

Table 1: Precipitations (roughly) 12Nov00UTC-14Nov00UTC in 7.5km resolution simulations

Simulation:	Calabria	NE tip of Taranto	Salento
KF2-R1	14	6 (no maximum)	16
KF2-R2	10	10	6(slight maximum)
KF2-Sh	8	10	12
Fuccello data	10	28	20

So, the only simulation that reproduced so-so all 3 maximums is KF2-Sh – actually it seems to produce more then 3 and tends to be the most "noisy" simulation. KF2-R1 seems to forecast something special and scroll down for satellite pictures (Fig 7.), which does not give proof of that. KF2-R2 seems to be most "normal" in terms of precip pattern, although it seems to reproduce just 2 maximas (although with a careful look we might see something resembling a 6cm maximum just W to Salento, not detached from Taranto maximum though).

I am not an expert in analyzing satellite pictures, but I would say that cloud image on Meteosat imagery is not so lined-up as in KF2-R1 simulation. In fact, it seems to me that the heavy precipitation goes from W-E and that we should expect significant rain amounts in the region 40-42N east of the Albanian coast too (that part of coastline most parallel with longitudes). KF2-R1 gives there maybe 4cm, KF2-R2 8cm, and KF2-Sh 10cm and the longest "parallel-to-coast" precipitation zone.
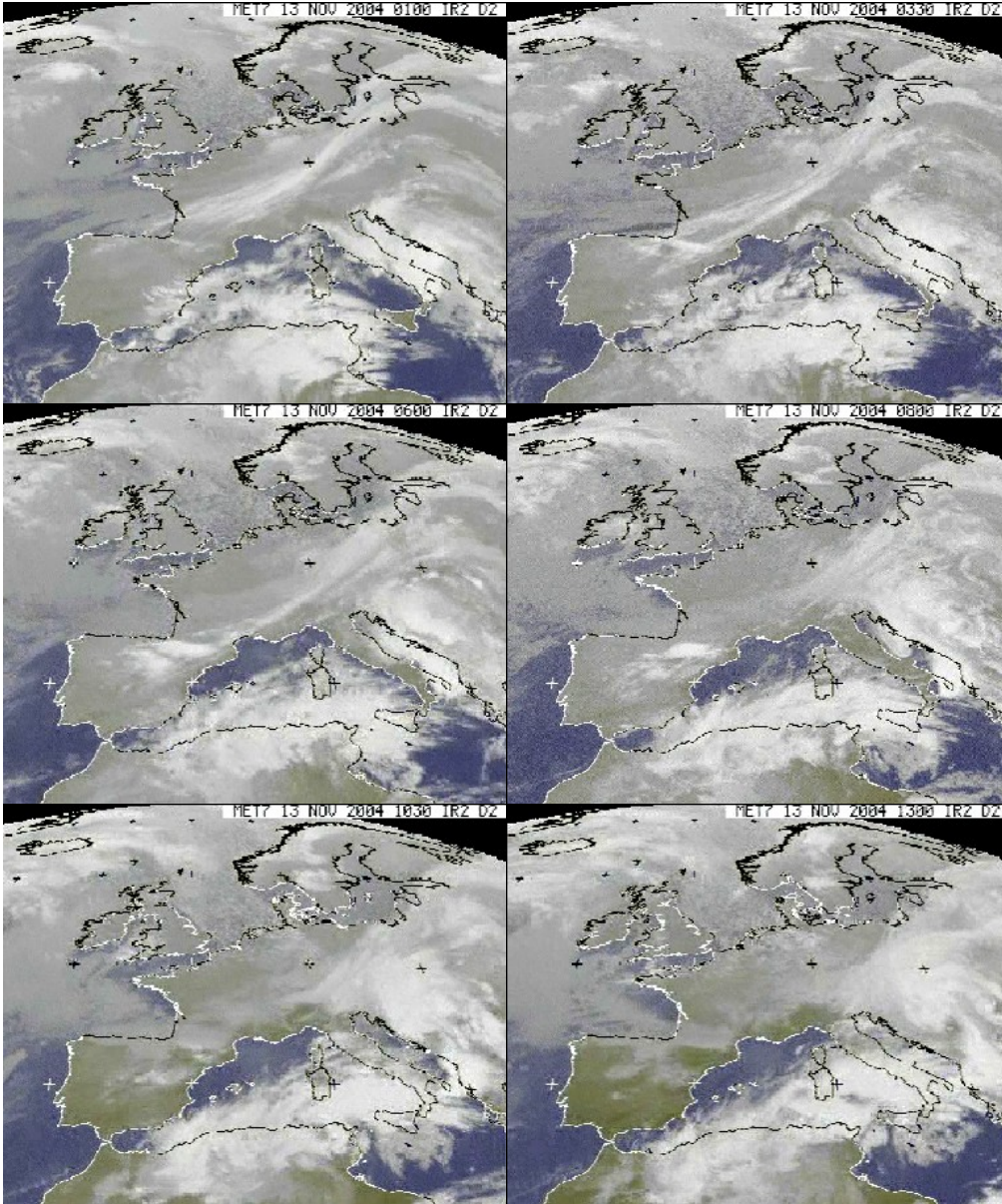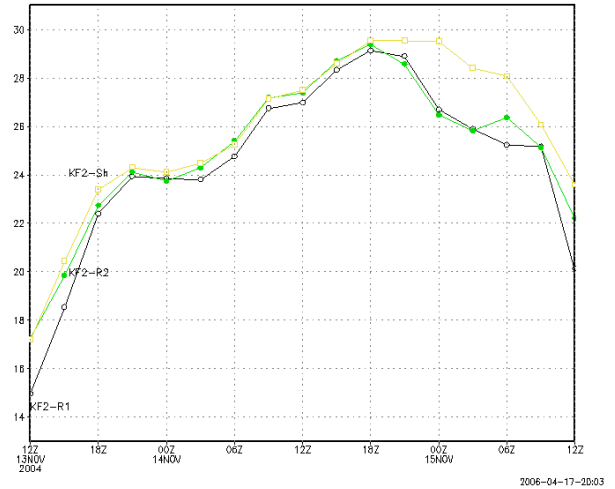
Fig 7. Meteosat imagery on 13Nov 01UTC, 03:30UTC, 06UTC, 08UTC, 10:30UTC, 13UTC (courtesy of Daniele Mastrangelo).

3. BURA (at 7.5km reslution)

Southern Adriatic -Split

Note: it is not so bad as it looks (namely time scale is different, sorry for that), but it is still pretty poor (12 hour difference in maximum wind speed timing)

Summary

In terms of MSLP, maybe KF2-Sh was the best, but the differences are small and non-significant.

In terms of rainfall:
   a) KF2-R1 produced the most accurate rainfall amount as compared to Salento data, but has just two maximas and a "scary" intensive precipitation line across Adriatic (seems to me is not verified by satellite pictures).
   b) KF2-R2 was moderate in terms of amounts – however, it has the most smooth pattern, with 2 maximas approx. at the right place, and has some indication of Salento maximum
   c) KF2-Sh has reproduced all 3 maximas and some more above the sea, maybe realistic maybe not, and looks "noisy"

In terms of bura, differences are not significant. Note however 7m/s difference for bura in southern Adriatic in one domain simulation and with added second 7.5km resolution domain.

In terms of simulation cost, on 4 processors simulations lasted 21 hours, and on 8 processors 12 hours. Simulations are quite expensive, at least with a big second domain, in which I chose to put the whole eastern Adriatic coast (local-patriotism for bura).

I am learning that precip verification is indeed a hard work.

I am really not sure that my choice in the end is the best simulation, but I will give it a try.

Thus, I would first take aside a bit extreme simulation KF2-R1 for its super-intensive precipitation line that I could not verify from satellite pictures. Secondly, I think when comparing to the data KF2-Sh simulation showed a bit better results then KF2-R2, although its "noisy" pattern is what might be questionable. On the other hand, data also suggests some bounded and discrete precipitation maximas (combine Fuccello data in Salento region on 13Nov and Salento data as an example). You have seen much more precipitation patterns then I did, so if you think that this precipitation pattern looks perfectly normal and is not "noisy", my option then would be Shultz –otherwise, it would be Reisner2.