

# *Testing and Validation of ALARO Model*

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## 1 Summary

The aim of the stay was to validate ALARO model at different resolutions (in the so called grey zone) on as many cases as possible. After some problems with creation of initial files for ALARO run, it was discovered that the model was not behaving as expected with the parametrization of convection scheme switched on. After adding some minor changes to the code that were proposed by Gwen (there was a bug in summation of precipitation in case of switched on convection), those results were much better than before. However the results of runs without the parametrization of convection were still better than with the convection scheme switched on. Especially the amount of precipitation with switched on convection is much too low for the Gard case (and also in the case of MCS over Czech Republic) in comparison to not using the parametrization of convection.

## **2 Technical issues**

The procedure for running ALARO is similar to procedure for running ALADIN, but not completely. The most different part is the creation of initial surface fields.

### **2.1 Creation of files for initial and boundary conditions**

ALARO climatological files are needed for creating coupling files. Climatological files are the same as the ALADIN ones. They are produced with configuration 923. Different than with ALADIN, the coupling files need to be expanded by adding new variables. These new variables are TKE and hydrometeors. These are needed only for initial files and are at the beginning set to 0 (for hydrometeors) or  $10^{-6}$  (for TKE).

The first idea to create initial files for surface was to do it on local machine. However this did not work. So this was performed on andante. The procedure is to first run extractarpege utility to create a grib file in model grid points from corresponding ALADIN France run. Independent to that a .pgd file is created by running prepgd programme (this is part of MesoNH package). Prepgd should use the same geographical parameters in namelist as are the ones used in ALADIN climatological file. This .pgd file is some sort of MesoNH counterpart of ALADIN climatological file. The two (this .pgd file and the grib file coming from extractarpege) are then used by another MesoNH utility – preprealcase. The output of preprealcase should be a very big .lfi file and a small .des, which are renamed to TEST.lfi and TEST.des and are used as initial file for surface. These .lfi files contains all the needed surface data. They also contain upper air fields (produced with lots of interpolations), but those are however not used by MesoNH.

A detailed description of locations of scripts and output files is in section 4.

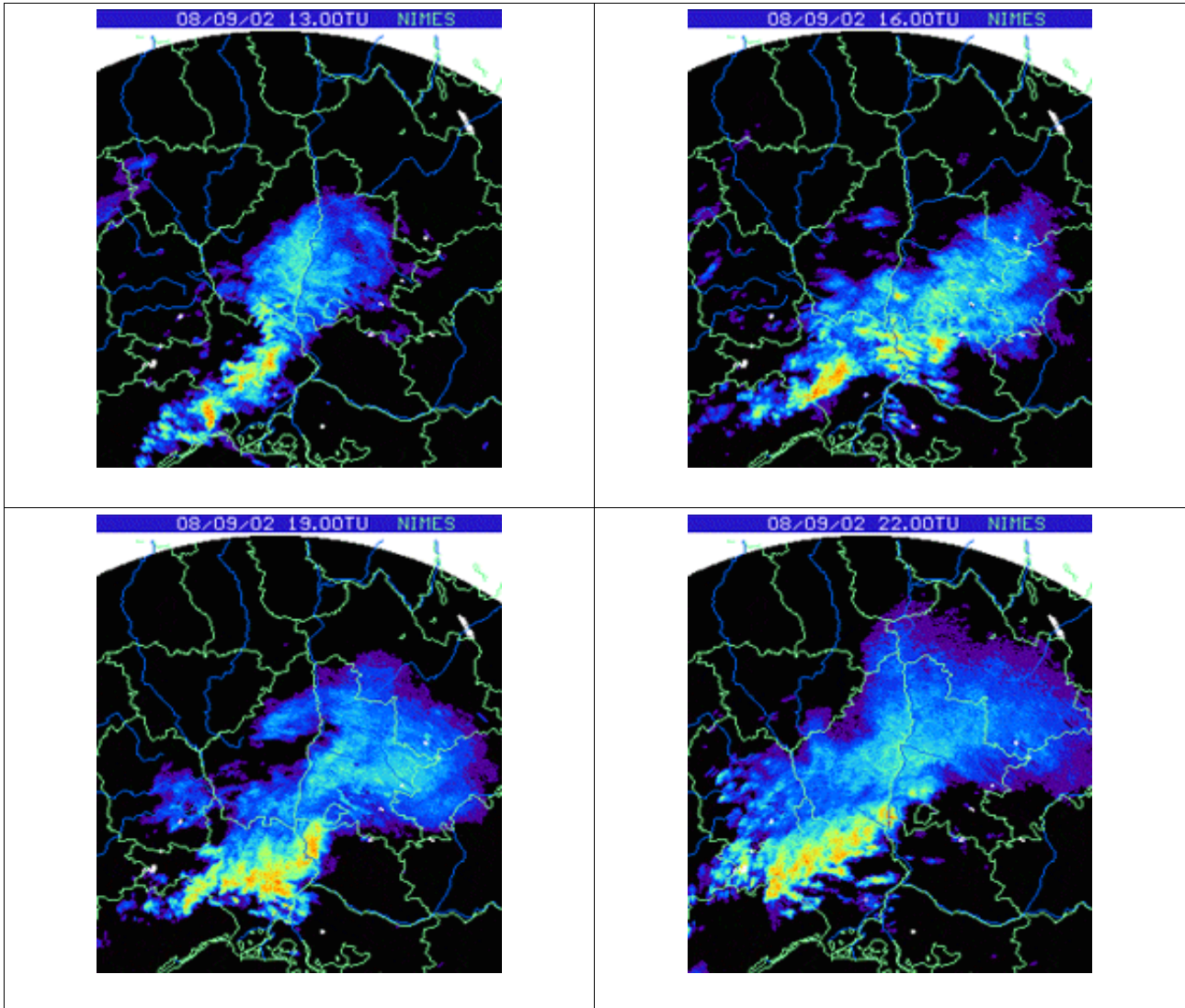
## **3 Performed experiments**

Four different experiments for each of the two cases chosen cases were performed. The two chosen experiments were the famous Gard floods – 8/9/2002 (MCS developed in Languedoc region of France and caused great floods) and an MCS over western part of Czech Republic that has developed with the cold front passing through central Europe on 8/7/2004. Two different resolutions were used (5 km and 7 km) and the parametrization of subgrid convection was either switched on or off. In both cases initialization was performed at 12:00 UTC and the driving model was ALADIN France.

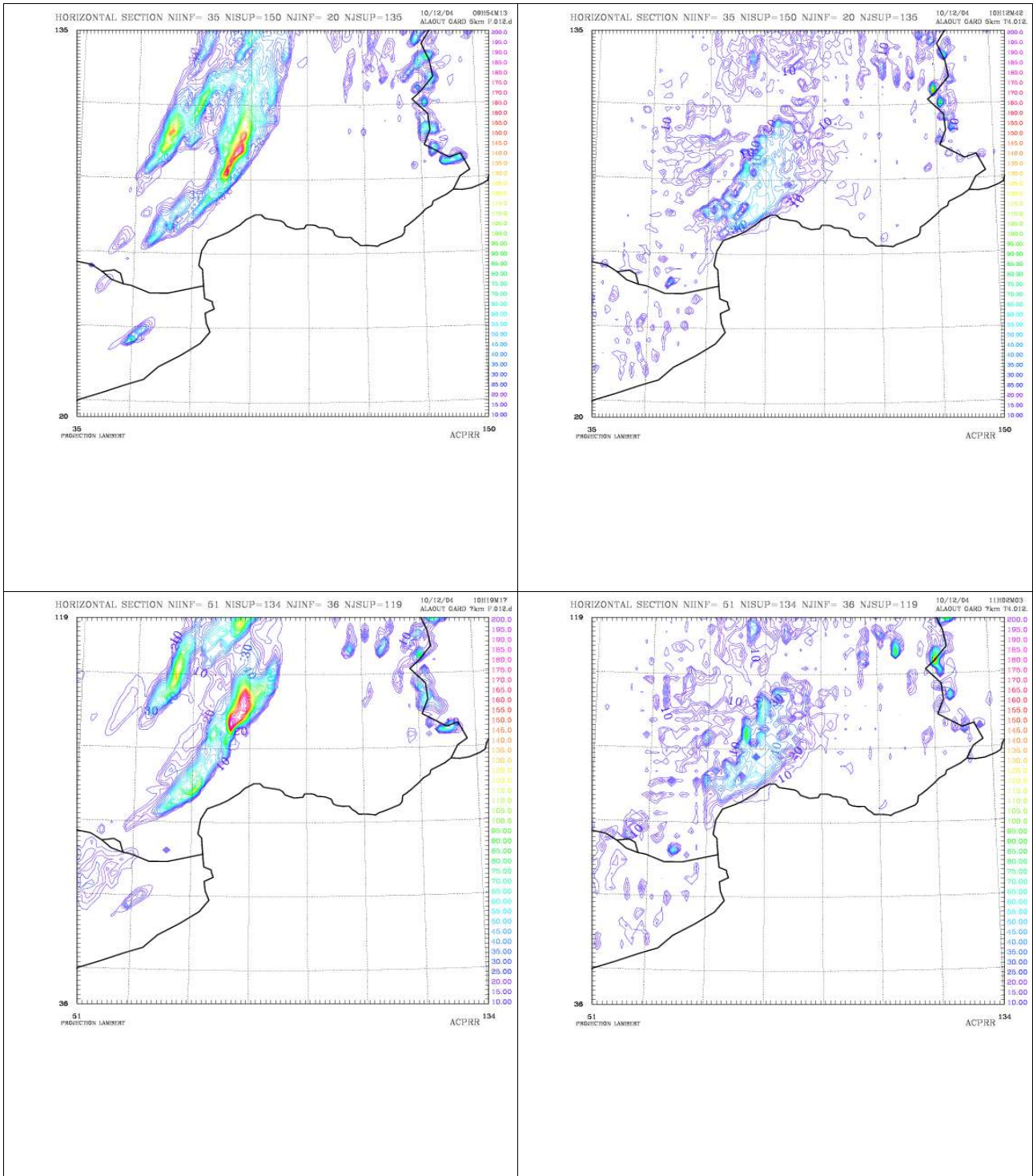
### **3.1 Gard case**

In this case switching off convection produces better estimates of 12 hour total precipitation amounts and positions these peaks more in agreement with radar. Not only are the peak values better positioned (more to the north), they are also more clear and from the forecaster's point of

view more useful. This is true for both used resolutions (5 km and 7 km). Switched on parametrization of convection produces a much smaller amount of precipitation and the field is much more noisy. On the other hand, it does produce some precipitation in the south eastern part of Languedoc region (ahead of the main peak of precipitation in the no convection case). Such a signal can not be seen in figures of simulations with convection parametrization switched off. Four radar images (at 13 UTC, 16 UTC, 19 UTC and 22 UTC) of the event are presented in **Figure 1**. Twelve hour accumulated precipitation with and without parametrization of convection for both resolutions (5 km and 7 km) can be seen on **Figure 2**.



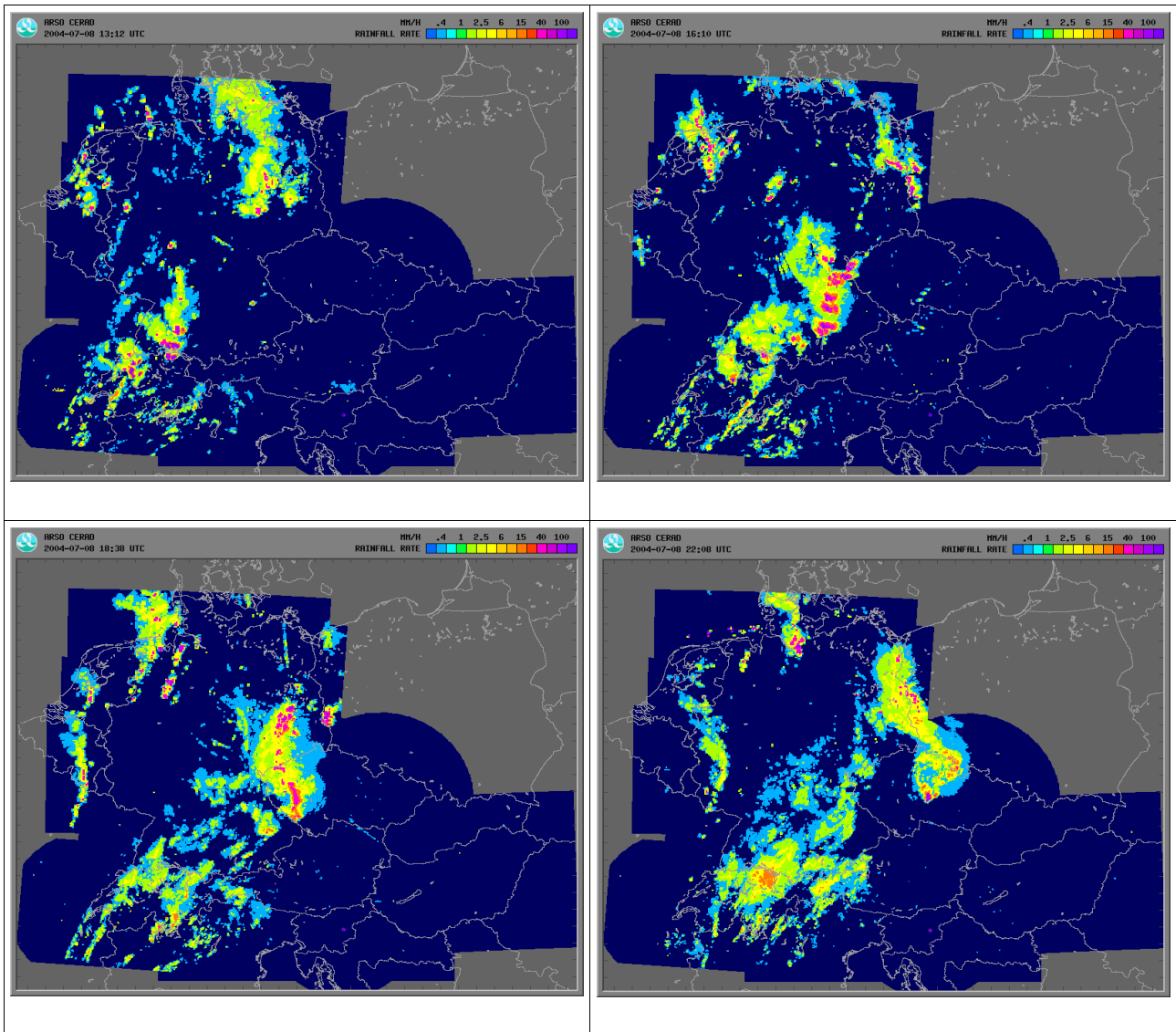
**Figure 1:** Nimes radar images of 8/9/2002 case. Top left at 13 UTC, top right at 16 UTC, bottom left at 19 UTC and bottom right at 22 UTC.



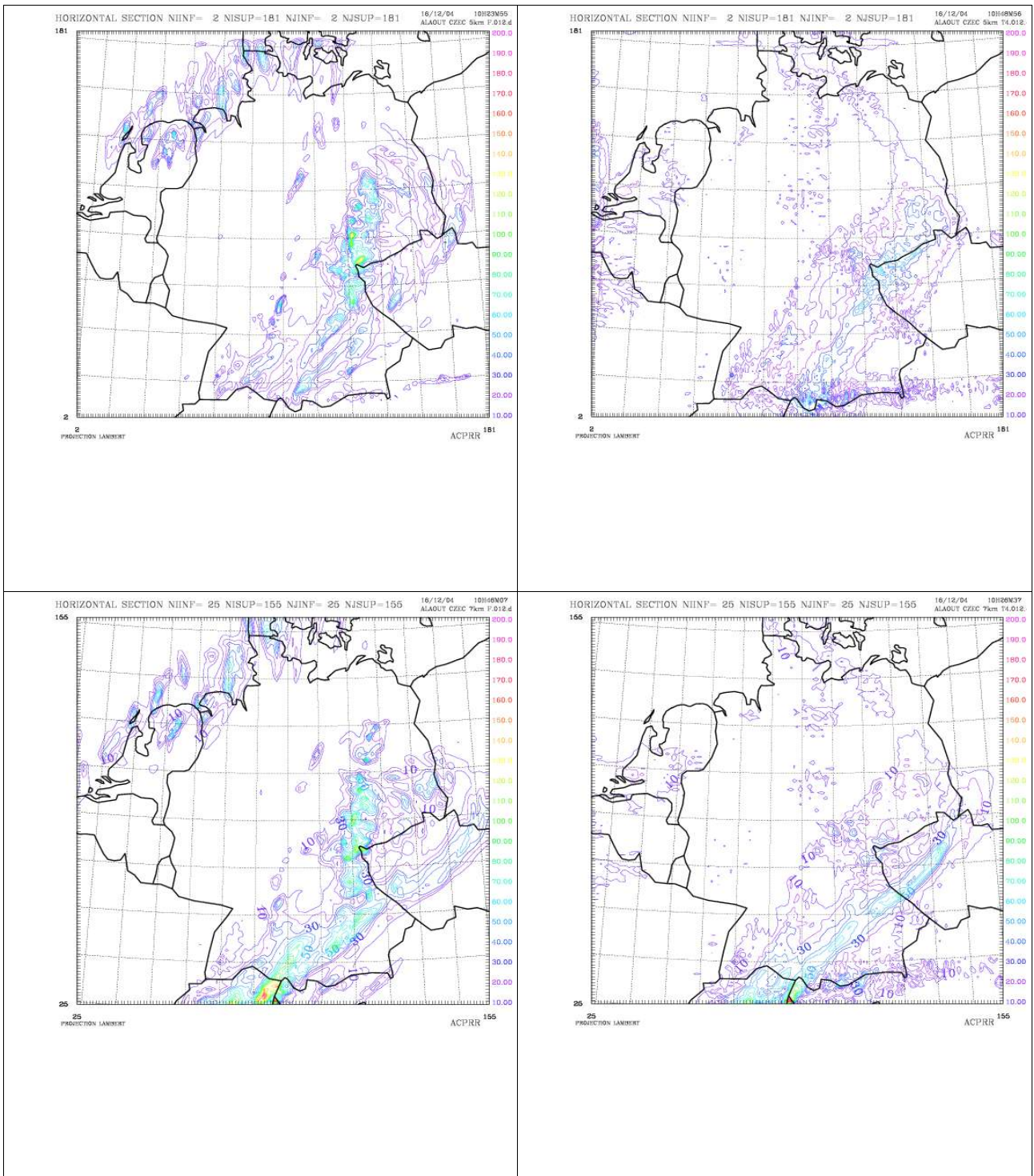
**Figure 2:** Gard case. Figures show 12 hour (from 8/9/2002 12 UTC to 9/9/2002 00 UTC) accumulated precipitation. Above are the results at 5 km resolution, below at 7 km resolution. On the left side the convection scheme in the model is switched off and on the right side it is switched on. Initialization at of all the experiments was on 8/9/2002 at 12 UTC.

### 3.2 Czech case

For the case of intense cold front passing through central Europe and an MCS developping in front of it, the results are also in favour of runs with the parametrization of convection switched off. The part of precipitation occurring in eastern part of Germany very poorly captured in both experiments with convection scheme switched on. The MCS heading north-east through western part of Czech Republic is surprisingly better simulated in experiments at lower resolution (7 km results seem better than 5 km ones). Its path can be most clearly seen in case of convection switched on at 7 km resolution (oval area of >30 mm stretching from south-west to north-east). However, as already mentioned, the runs with convection scheme on did not perform well in simulating precipitation in Germany. Composite radar images of precipitation at 13 UTC, 16 UTC, 19 UTC and 22 UTC in Central Europe can be seen in **Figure 3**. Twelve hour accumulations of precipitation for the performed experiments can be seen on **Figure 4**.



**Figure 3:** Radar composite images of 8/7/2004 case. Top left at 13 UTC, top right at 16 UTC, bottom left at 19 UTC and bottom right at 22 UTC. The hours of the images are not exact ( $\pm 15$  minutes).



**Figure 4:** Case with strong cold front in Central Europe. Figures show 12 hour accumulated precipitation (from 8/7/2004 12 UTC to 9/7/2004 00 UTC). Above are two runs at 5 km resolution, below at 7 km resolution. On the left side the convection scheme in the model is switched off and on the right side it is switched on. Initialization of the model was on 8/7/2004 at 12 UTC.

#### **4 Technical appendix: Locations of scripts, namelists and output files**

- Scripts and namelists for creating clim files are on tora:~mrpa669/arome923, and then selecting either czec or gard directory.
- Scripts and namelists for running EE927 are on tora:~mrpa669/aromeEE927
- Scripts and namelists and everything else for creating initial files are on andante: ~mrpa669/AROMEsurf\_oldway, there are three directories bellow (extractarpege, pgd, real) and in each of are the needed things for either of parts of preparing initial files (according to description above).
- Scripts and namelists for integration are in ~mrpa669/arome\_aladin/cases/gard and ~mrpa669/arome\_aladin/cases/czec.

Namelists and scripts have a special naming convention. Each namelist or script ends with four characters: three letters and one number. First letter corresponds to case (A is for Gard, B is for Czech), second letter is for hydrostatics (A is for a nonhydrostatic run, B for hydrostatic one), third letter is for resolution (A is for 5km, B is for 7km), fourth character is a number (1 corresponds to switched off convection (LKFBCONV=.F.), 2 is before the discovery of the BUG with LKFBCONV=.T., 3 is with LKFBCONV=.T. and with multiplication by ZDT and finally 4 is for LKFBCONV=.T. and multiplication by PDT). The X instead of A or B or whatever is if the namelist is good for both cases.

These strange abbreviations correspond to directory names of results stored on cougar (for instance: cougar:~mrpa669/arome/cases/gard/results). Besides directory names, different experiments reflect also on the names of the output files: first four letters are description of case (GARD or CZEC), followed by resolution, followed by T for convection or F for run without convection. There can be an additional number, saying "the iteration of development in convection" - corresponding to above 1 (or if this number is missing), 2, 3 and 4.

Example: a filename GARD\_7km\_T4+0720, means this is for Gard case at 7 km resolution with LKFBCONV=.T. with multiplication of prec. fluxes by PDT. It should be in directory cougar:~mrpa669/arome/cases/gard/results/AAB4.

Some of the results files for upper air are also converted to MesoNH format. This is done by a simple script in tora:~mrpa669/conv\_FA2LFI.

All the figures are on my local machine. In lxgmap17:~cedilnik/arome\_tests. Again the nomenclature is the same.

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