

Configuration of AROME prototype for Hungary

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1. Summary

The aim of the stay was to prepare the configuration of AROME prototype (i.e. clim files of target domain, initial conditions, scripts, namelists etc.) and to learn the technical details how to run the model because we plan to install the prototype in Hungary on our IBM machine.

At the beginning of my stay I was working with the preparation of initial conditions for the AROME run. In the remaining time some test runs were done.

Below some descriptions are given how the initial conditions should be created, describing also the problems that one may face during this work.

2. Initialization

Figure 1 shows, on the left, the domain we plan to use for running AROME. For coupling we will use our ALADIN-HU operational forecast .

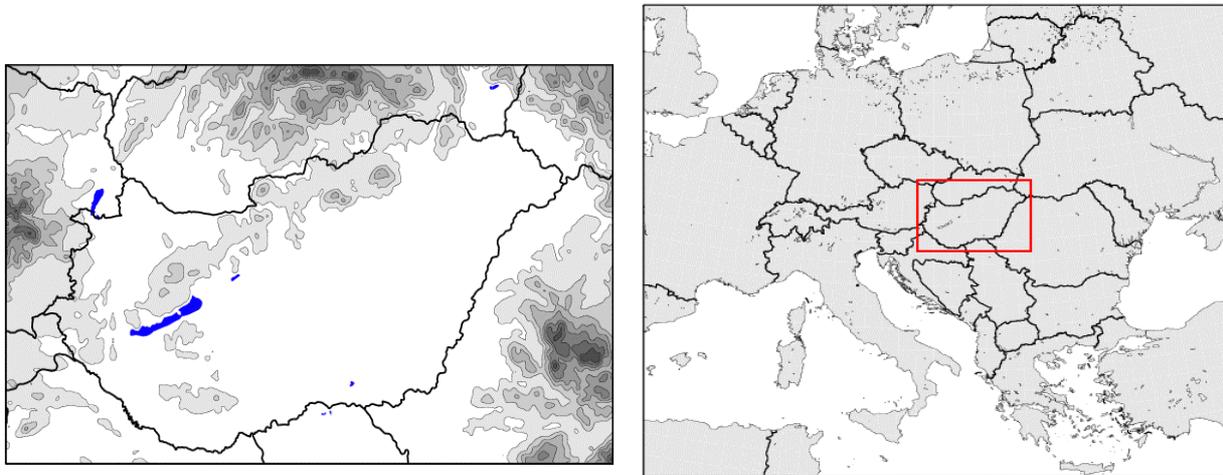


Fig 1. The domains used to run AROME. On the left is the domain for AROME integration (2.5km horizontal resolution, 260x150 points, 49 level). On the right is the current operational ALADIN-HU domain (8km resolution, 360x320 points, 49 level) that will be used to couple AROME.

To create the climatological, the initial surface and LBC files one should use the method created by Jean-Marc Audoin. It contains 3 steps: 923, 927, and surfex initialization. The first 2 step is running on tora but the last one is done on local PC.

- Create namelist for the definition of target domain (NAMDIM, NEMDIM, NEMGEO). It is important that both NDGL/NDLON and NDGUX/NDLUX should be fourier numbers.
- Run the script *prep_exp*. It will ask some question about initial date, location of input clim file, input ICMSH files for 927, etc. It will create the scripts for the 3 steps (923, 927, prep_surfex). Lunch the first one: e923_quad, which will, after finishing, automatically lunch the next script.

2.1. Clim files

- c923_quad: creates quadratic truncated clim file containing only orography on the target domain.
- c923_lin: creates linear truncated clim files, containing all the usual fields. The orography is read from the file created in the previous step.
- c923_aero: adds the aerosol and ozone variables to the clim file.

2.2. Coupling files

- 927: Makes interpolation from initial domain (which is in our case the coupling domain ALADIN-HU) to the target AROME domain. Some variables had to be modified (in the automatically created script) since e.g. it is hardcoded that the number of levels is 41 (in our case it is 49), and also we had to apply the INIOZONE procedure which adds the ozone field to the file. (In the script it is assumed that if a file has the date newer than 2005 it already has the ozone field.)

2.3. Surface initial file

- c927surf: makes a fullpos to extract the surface fields from the first coupling file. (The file is still on the input domain, so no interpolation is done.) And it creates a GRIB file from that.
- The last part of the job is done on local PC. The script terminator runs PGD (creation of physiographic fields). It needs a namelist containing the coordinates of the target domain, and some surface data bases (gtopo, ecoclimats, etc.). The output is an lfi file (PGDTEST.lfi). The next part is to run PREP (initialization of the values of surface). Two input is needed: PGDTEST.lfi (output of previous step) and the GRIB file that was created by c927surf.

When first tried with the default procedure, the PREP part was aborted. The conclusion was that maybe the size of the input domain is too large (remember that the GRIB file is on the input domain). So in this case at the step where c927surf is applied one should modify the script that it should interpolate the surface fields on some smaller domain.

After doing so and re-running PREP it was not aborted but finally it turned out that there is a problem in the lfi file. Although when looking with some visualization tool (diaprog) it seems to be ok but when running AROME with this initial file the model aborts in the first time steps. If one looks the norms one can see that the norms for temperature on the lowest levels are unrealistic high.

So we applied an other method to prepare initial surface files. The preparation of scripts should be done on the machine andante but finally it will submit the jobs on fujitsu. The essence of the method is the same as was described in the previous step: create PGD file, make a grib file from an ALADIN/ARPEGE forecast, and finally run PREP using these 2 files. The steps are the following

- PGD: you need 3 files: PRE_PGD1.nam, prepmodelrc, tosupcrc
 - ✗ namelist PRE_PGD1.nam contains the coordinates of your domain: (for an example in andante:/opt/local/MESONH/example/MASDEV*/PRE_PGD1.nam) the name of the output file.
 - 1. in the *prepmodelrc* config script you may define which version of mesonh library you want to use (BIBMASTER and BIBBUGFIX), name of your namelist, the directory on delage where the output file is placed, etc. It will create a script *outprep_pgd* which will be submitted by the command: *tosupc outprep_pgd*. The file *tosupcrc* configures the settings for the submission.
- GRIB: One can either choose an operative ARPEGE/ALADIN forecast, or one's own forecast. One has to fill in the script *extractarpegerc*: date of forecast, etc. and run *extractarpege* which automatically submits the script on tora.
- PREP: the final step which is very similar to step PGD => namelist, prepmodelrc, tosupcrc. (Again see example of namelists in /opt/local/MESONH/example/MASDEV*)

With this second method it was finally possible to run the prototype.

To check if the run is reasonable we compared the output of AROME with the couplings (our ALADIN-HU forecast). The differences were almost negligible except for precipitation. AROME gave 3 times less precipitation after 24 hours (see Fig 2). Finally it turned out when compared with observation that the problem is in the coupling and not in AROME.

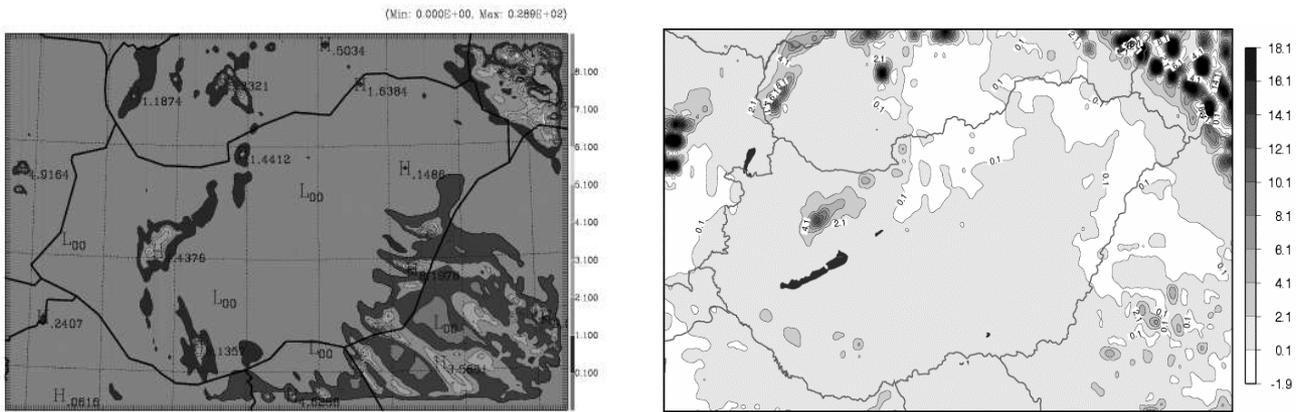


Fig 2. Total precipitation after 24h integration. Left result of AROME run, right results coming from the coupling. In the coupling there were almost 3 times more precipitation than in AROME.

3. Some tests

3.1. Smoothing the spectral orography

Some tests were done to see the impact of smoothing the spectral orography of the target domain. Initially when created the clim file (script: c923_quad) the settings: LNEWORO=T, LNWEORO2=F, NLISSP=0, NLISSR=0 were used (for more explanation see the report of Jadviga Woyciechowska 2003). Here some other settings was also tried, namely:

- a) NLISSP=2, LNEWORO=T, FLISSA=0.125, FLISSB=0.99 and
- b) NLISSP=0, LNEWORO=T, NLISSR=2.

(Also other parameters were tested but they gave some unrealistic results. E.g. setting NLISSR=10 will smooth totally the orography, almost no mountains remain...) The impact of the smoothing on the output fields was studied. Both above mentioned cases had the main impact on precipitation. (Unfortunately the amount of precipitation was not high.) As one can see from Fig 3. the zone of the precipitation was shifted, but the amount was not changed (only the case a) is shown).

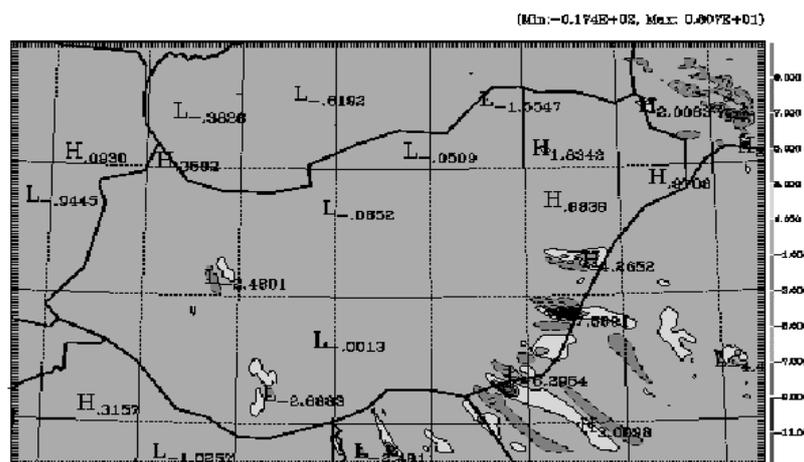


Fig 3. Precipitation difference after 24h hours between: basic settings to create orography and case a) NLISSP=2. The differences are small, but what can be seen is that the zones are shifted. (In the difference field there is a positive and a negative area (dashed contour) next to each other.)

3.2. ISBA diffusion scheme

Finally it was tried to run AROME with ISBA diffusion scheme. To do it one has to redo the PGD/PREP procedure, since the initialization depends on what scheme we use). However it was not possible to do it for version masdev4_5 (we used earlier) so one has to switch to version 4_6. A new namelist has to be created (again see example in `andante:~mrpe735/SURF/PGD` or in `/opt/local/MESONH/example/MASDEV4_6`). In the new PGD namelist add the line `CISBA='DIF'` in `&NAM_ISBA`. And redo PGD/PREP.

- Running AROME with the new initial files was aborted already in the setup level. The problem is the following:

The routine `read_default_surf_atm_n` reads the TEST.des file (created by PREP). There it finds the namelist: `&NAM_CH_SURFN` and reads the contents:

```
CALL POSNAM(ILUDES,'NAM_CH_SURFN',GFOUND,ILUOUT)
IF (GFOUND) READ(UNIT=ILUDES,NML=NAM_CH_SURFn)
```

It finds the variable `CCHEM_SURF_FILE` but according to the code this variable does not belong to this namelist, since according to the module: `modn_surf_atm_n` it belongs to an other namelist

```
NAMELIST/NAM_CH_CONTROLn/CCHEM_SURF_FILE
NAMELIST/NAM_CH_SURFn/LCH_SURF_EMIS
```

- We used the simplest solution, i.e. deleted `&NAM_CH_SURFN` from TEST.des and rerun the model. In this case it went through this routine without problem but in the first time step it aborted in the subroutine `snow3ltransf`. Unfortunately there was no time to study what is the cause.
- When the initial surface field was created with version masdev4_6 but the diffusion scheme was not switched on (`CISBA='3-L'` which is the default) the model was running without any problem. Of course also in this case one has to remove the namelist `&NAM_CH_SURFN` from TEST.des file.

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