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stay report

Ljubljana 17.07.2017 – 11.08.2017

Implementation and validation of prognostic graupel computation into ALADIN code cy43t2

Based on the work of Michiel Van Ginderachter and Joris Van den Bergh that was done on ALADIN code cy38, prognostic graupel was phased into ALADIN code cy43t2 (and cy45). List of modified or added routines:

arpifs/adiab/cpg.F90
arpifs/adiab/cptend_new.F90
arpifs/adiab/cputqy.F90
arpifs/module/yomphy.F90
arpifs/namelist/namphy.nam.h
arpifs/phys_dmn/initaplpar.F90
arpifs/phys_dmn/accoll.F90
arpifs/phys_dmn/accvud.F90
arpifs/phys_dmn/acevmel.F90
arpifs/phys_dmn/acacon.F90
arpifs/phys_dmn/accdev.F90
arpifs/phys_dmn/acupm.F90
arpifs/phys_dmn/aplmini.F90
arpifs/phys_dmn/aplmphys.F90
arpifs/phys_dmn/acmodo.F90
arpifs/phys_dmn/mf_phys.F90
arpifs/phys_dmn/acupd.F90
arpifs/phys_dmn/accsu.F90
arpifs/phys_dmn/aplpar.F90
arpifs/setup/su0phy.F90

Source codes with changes for both cycles are available on request.

Prognostic graupel can be activated with key LGRAPRO in NAMPHY (by default LGRAPRO is set to FALSE), and with adding YG GFL to NAMGFL:

```
&NAMPHY
  LGRAPRO=.TRUE.

&NAMGFL
 YG_NL%LSP=.FALSE.,
YG_NL%LGP=.TRUE.,
YG_NL%LGPINGP=.FALSE.,
YG_NL%LADV=.TRUE.,
YG_NL%NREQIN=0,
YG_NL%LREQOUT=.TRUE.,
YG_NL%NCOUPLING=0,
YG_NL%LSLHD=.FALSE.,
YG_NL%LQM=.FALSE.,
YG_NL%LQMH=.FALSE.,
```

Changed code was tested on Meteo France computer prolix with set of mitraillette tests. Results were compered with cy43t2_main. All tests show the same results, only ALARO – 1vA have some differences, due to prognostic graupel switch on.

Cy43t2_main was first tested for ALARO-0 namelist from mitraillette on Polish domain, but in many occasions there was a crash of 001 run with values of some fields out of the range. Then, ALARO-1 namelist from cy40t1 was adapted to work with cy43t2, and then it was further tested on Polish domain with 7 km resolution and 320x320x60 points. Two experiments were prepared, first from cy43t2_main and second with cy43t2_main + prognostic graupel. Results of forecast from 2013 were verified against Polish synoptic stations.

Over the whole 2013, scores for temperature at 2 meters are very similar for both experiments, while relative humidity at 2 meters seems to be have worse scores during the night. For surface precipitation, scores for winter month seems to be better with prognostic graupel, but worse for summer.

Test cases shows less precipitation for experiment with prognostic graupel. For winter days it seems to improve the forecast, as cy43t2_main gives too much precipitation, but for summer convection cases prognostic graupel experiment usually gives not enough of rain.

Some graphs are below, more can be found in Appendix 1. Differences of rain and snow forecasts between cy43t2_main and cy43t2_main + prognostic graupel are presented for few cases in Appendix 2.

Code is now available for further tuning and testing.

References

Joris Van den Bergh: Prognostic graupel and new cloud overlap scheme in ALARO
http://www.umr-cnrm.fr/aladin/IMG/pdf/23-slides_Joris.pdf

Michiel Van Ginderachter: Selected issues in Microphysics
http://www.rclace.eu/File/ALARO/alaro1_wd14vi/alaro1wd_MvG_microphys_may14.pdf

Domain of model:

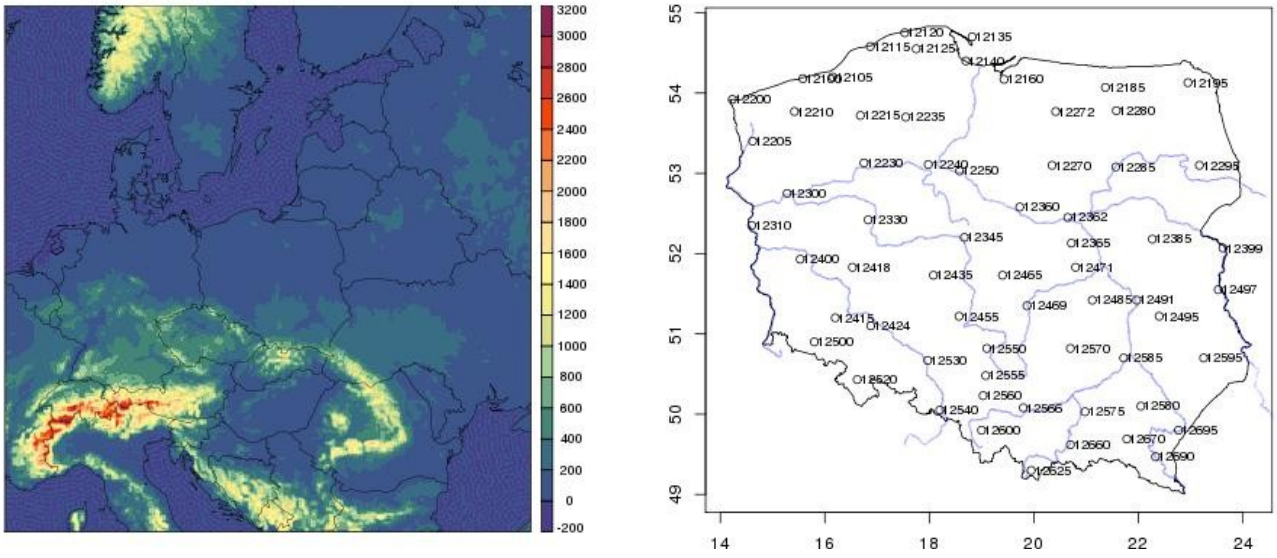
resolution:	7.4 km
vertical levels:	60 vertical levels
points:	309x309 (320x320)
start of forecast:	00 UTC

Observational data:

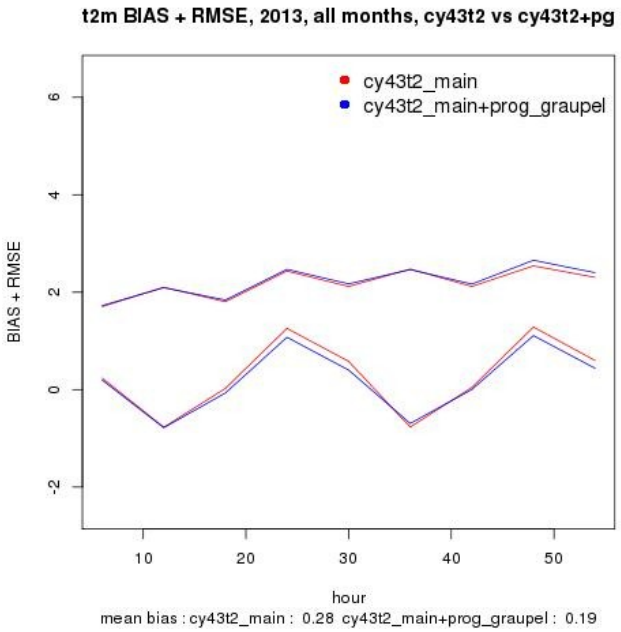
synoptic stations:	61 stations in Poland
time of experiment:	2013

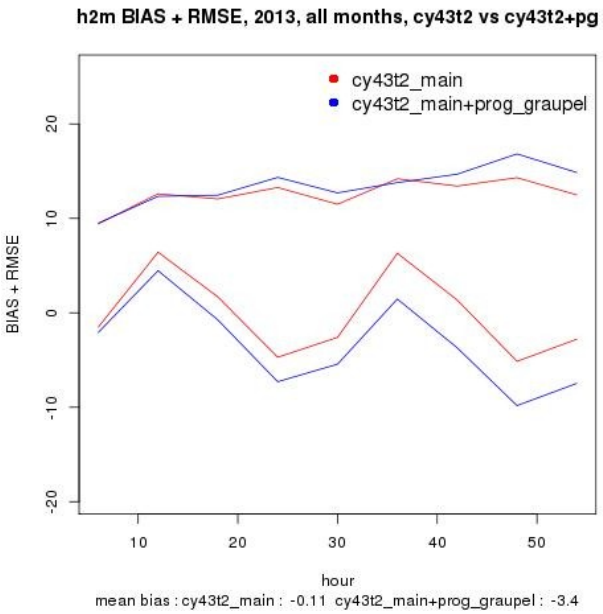
Verification:

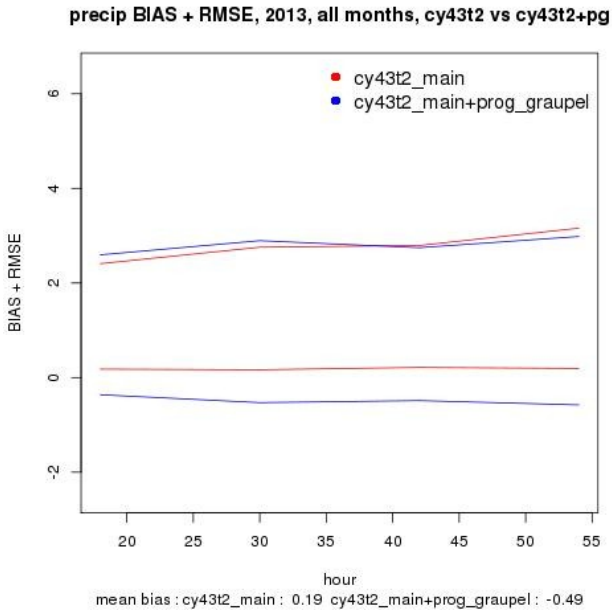
Point to point verification, closest node of model domain for all synoptic stations.

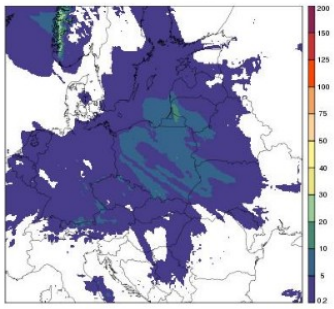
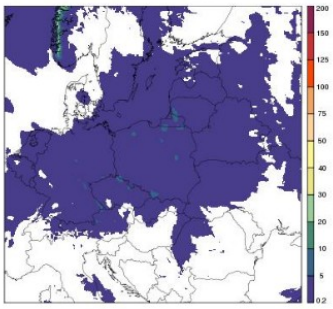
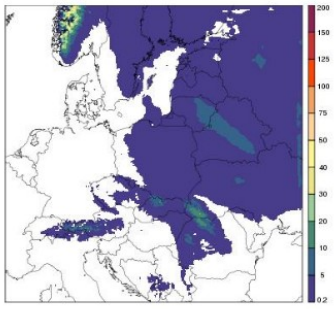
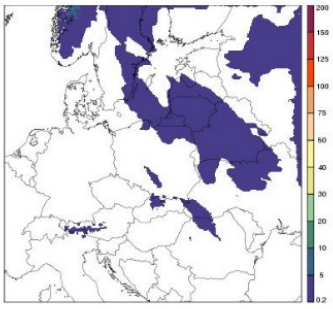


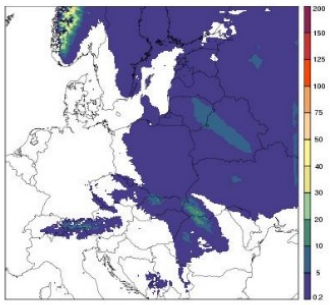
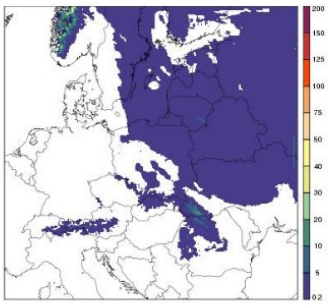
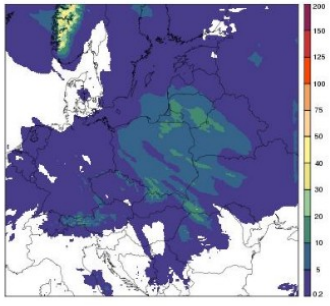
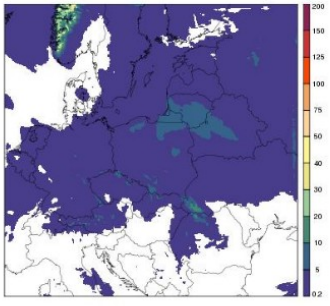
Domain for experiments (left) and synoptic stations used for verification (right)


t2m BIAS + RMSE, 2013, all months, cy43t2 vs cy43t2+pg
cy43t2_main
cy43t2_main+prog_graupel
BIAS + RMSE
hour
mean bias : cy43t2_main : 0.28 cy43t2_main+prog_graupel : 0.19


h2m BIAS + RMSE, 2013, all months, cy43t2 vs cy43t2+pg
cy43t2_main
cy43t2_main+prog_graupel
BIAS + RMSE
hour
mean bias : cy43t2_main : -0.11 cy43t2_main+prog_graupel : -3.4


precip BIAS + RMSE, 2013, all months, cy43t2 vs cy43t2+pg
cy43t2_main
cy43t2_main+prog_graupel
BIAS + RMSE
hour
mean bias : cy43t2_main : 0.19 cy43t2_main+prog_graupel : -0.49

	cy43t2_main	cy43t2_main + prognostic graupel
Rain vs Rain		
Snow vs Snow		

Snow vs Graupel		
Total vs Total		

During the stay the modset for Additional fullpos parameters for convection forecasting (code pack for the cycle CY38T1.bf3) was phased into cy40t1, modset is also available. List of changed files:

arpifs/setup/sucape.F90
arpifs/setup/suafn1.F90
arpifs/setup/suafn2.F90
arpifs/setup/suafn3.F90
arpifs/namelist/namfpc.nam.h
arpifs/namelist/namafn.nam.h
arpifs/pp_obs/pos.F90
arpifs/fullpos/endpos.F90
arpifs/fullpos/fpdiagflash.F90
arpifs/fullpos/fpsrh.F90
arpifs/fullpos/fpstrmm.F90
arpifs/fullpos/sufpc.F90
arpifs/fullpos/phymfpos.F90
arpifs/fullpos/fpshear.F90
arpifs/fullpos/vpos.F90
arpifs/fullpos/fpcica.F90
arpifs/module/yomfpc.F90
arpifs/module/yomcape.F90
arpifs/module/yomafn.F90