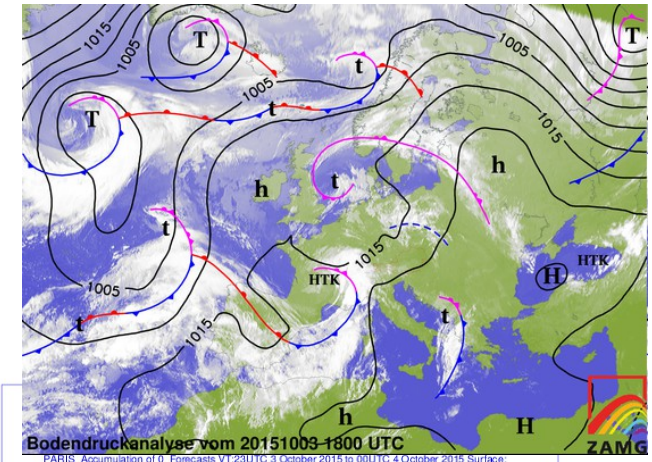
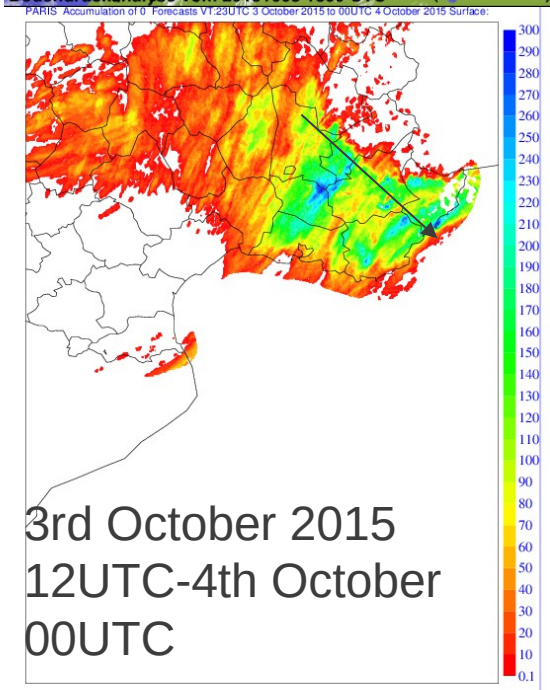
Outline

- Exeriments during stay in MF
- Problems with 3D-Var RADAR assimilation
- Latent heat nudging
- Case studies

Experiments in Météo France with AROME-PI

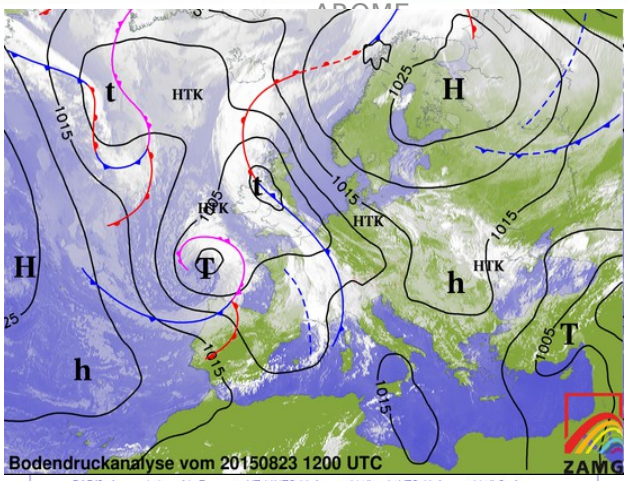


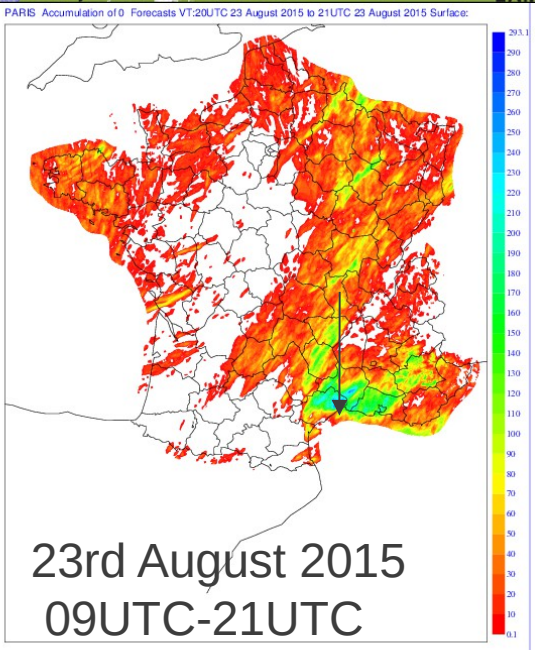


3rd October 2015
12UTC-4th October
00UTC

- 2 Case studies
- testing of different RADAR DA settings in AROME-PI 1.3km

Cannes:
195.5mm/24h
106.8 mm /1h





23rd August 2015
09UTC-21UTC

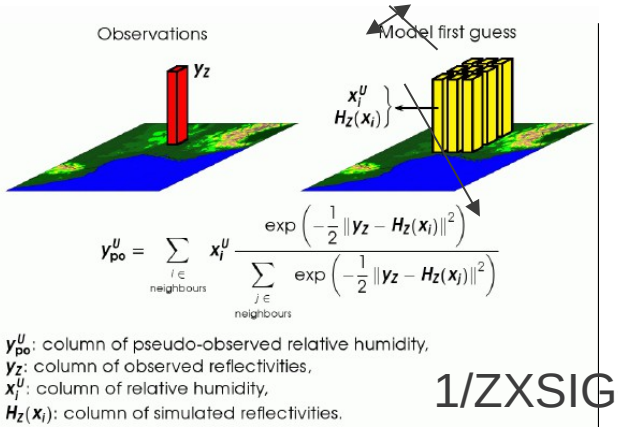
Experiments in Météo France with AROME-PI

- Thinning reduced (ZSAMPL_RADAR (BATOR), RMIND_RADAR, RFIND_RADAR 0.5x normal value
- Modify observation error :SIGMAO_COEF(13)=1.2
- Saturate pseudo humidity observation profile
- Increase search radius for suitable humidity profiles zdist in radar_profs.F90 (200km instead 100km) and increase standard deviation ZXSIG=σ_z=5dBz instead 0.2dBz in inv_refl1dstat.F90
- Replace hydrometeor blending by profile supersaturation

AROME-PI did simulate the events satisfactorly, but:

- Underestimation of maximum precipitation
- Overestimation of area affected by light rain

zdist



1/ZXSIG²

From Montmerle & Wattrelot 2012

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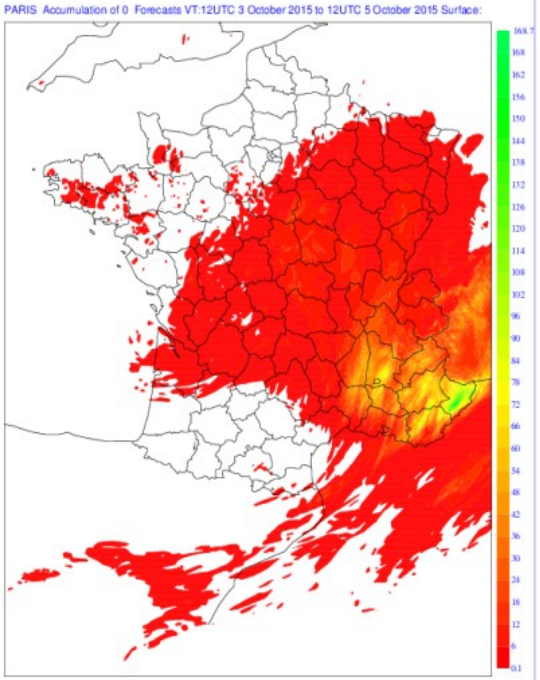
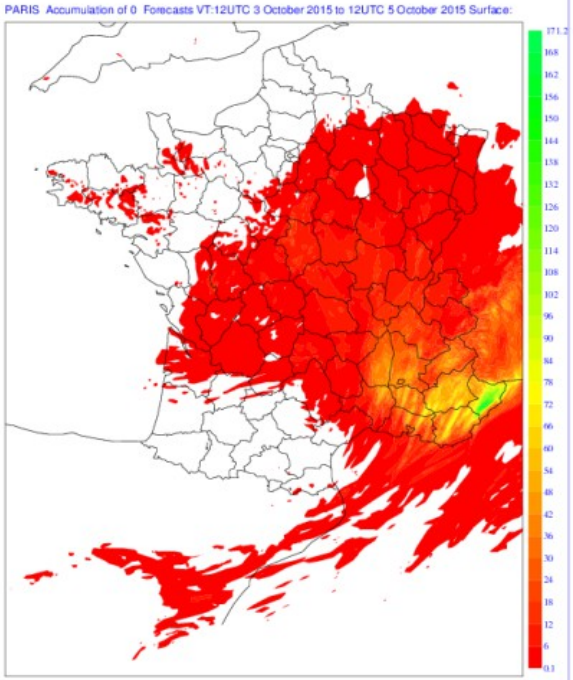
Experiments in Météo France with AROME-PI

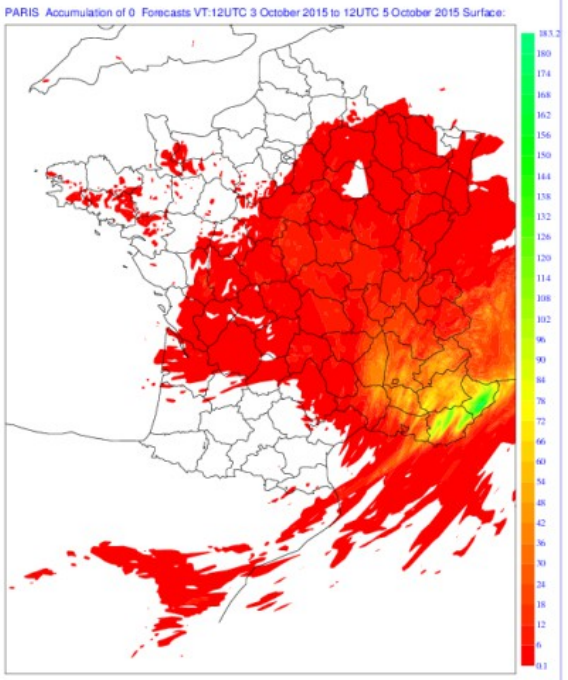
REF



Thinning



OBS error



3rd October 2015

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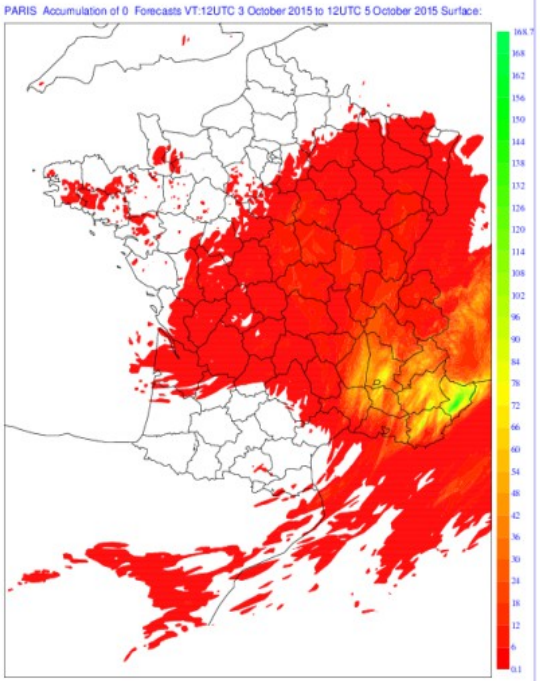
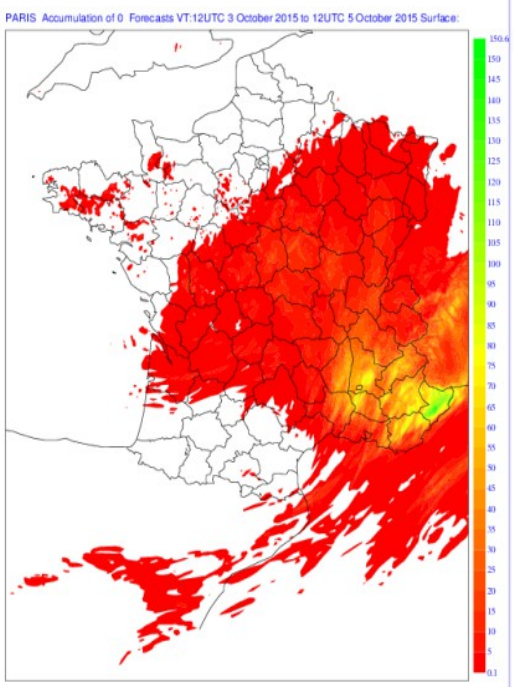
Experiments in Météo France with AROME-PI

AROME
11/10/16

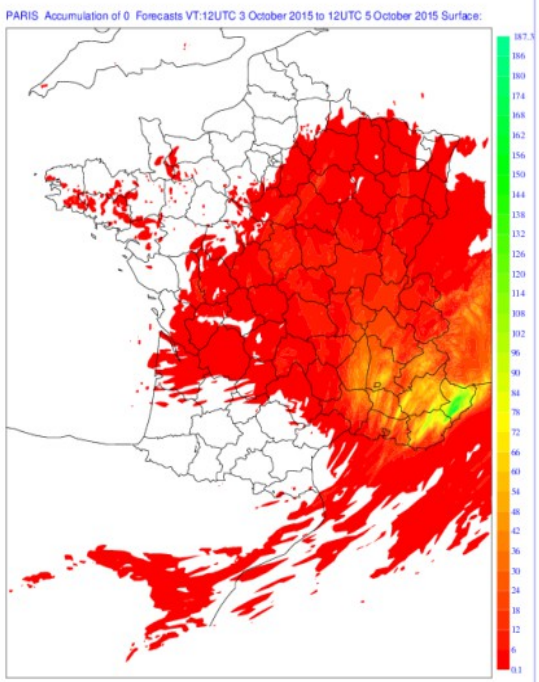
REF



Saturation



Zdist+ZXSIG



3rd October 2015

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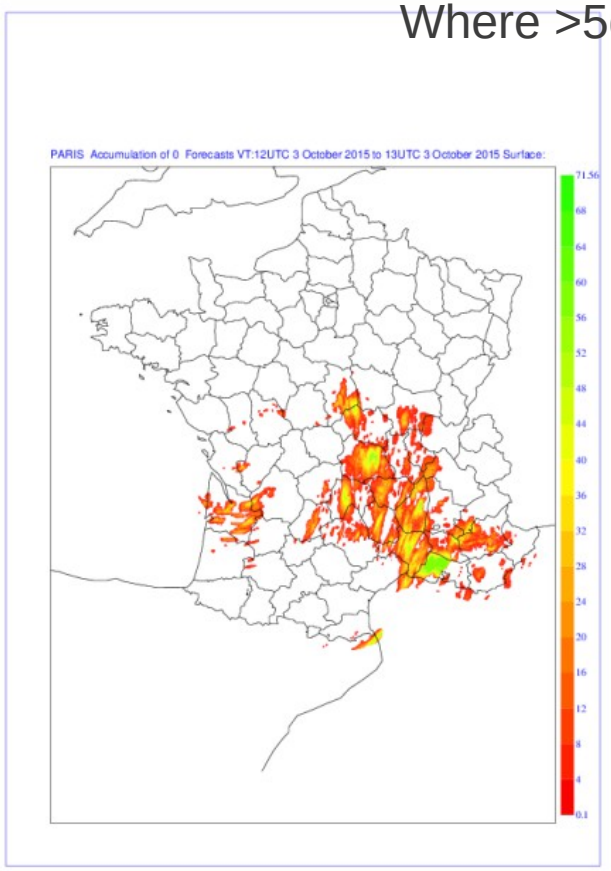
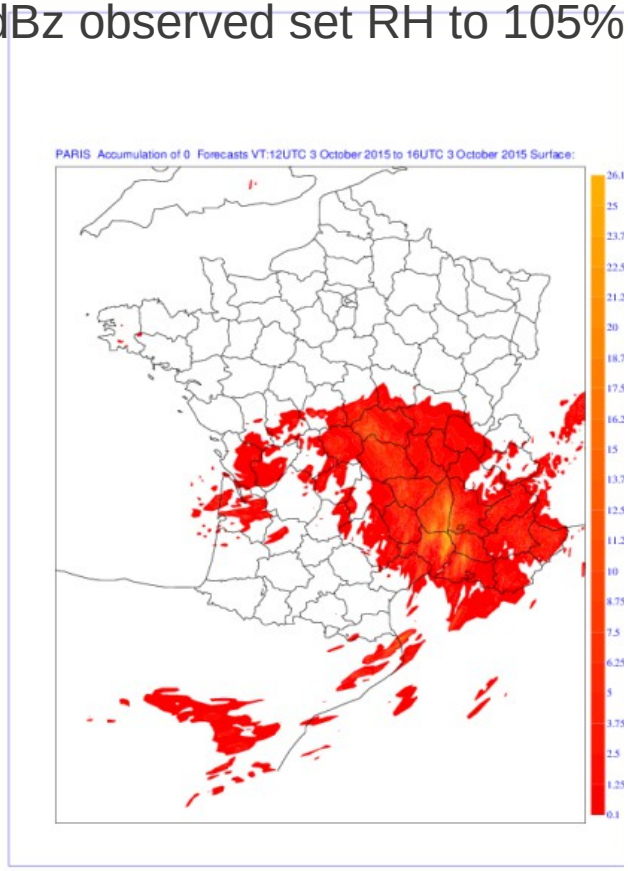
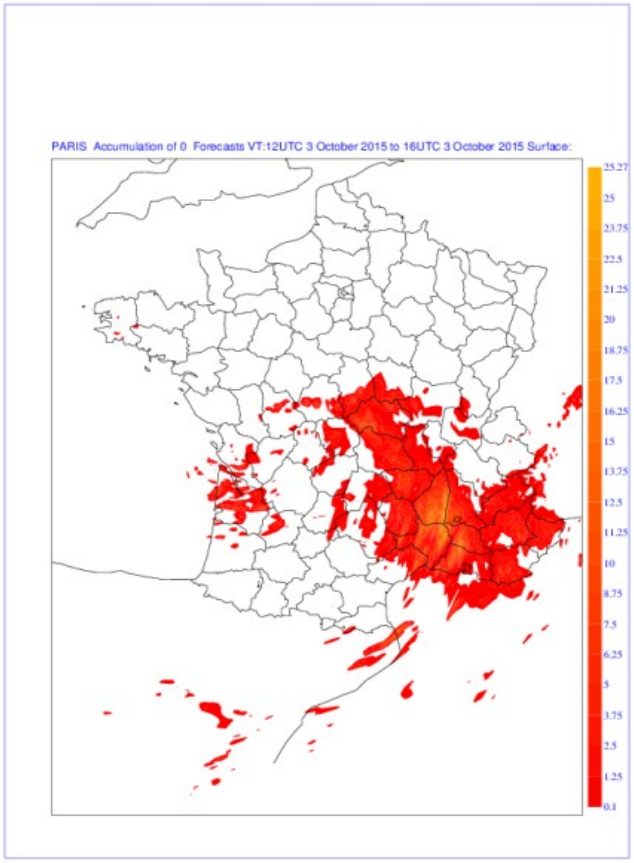
Experiments in Météo France with AROME-PI

AROME

Where >5dBz observed set RH to 105%







OBS

Replace hydrometeor blending

3rd October 2015 12-13UTC

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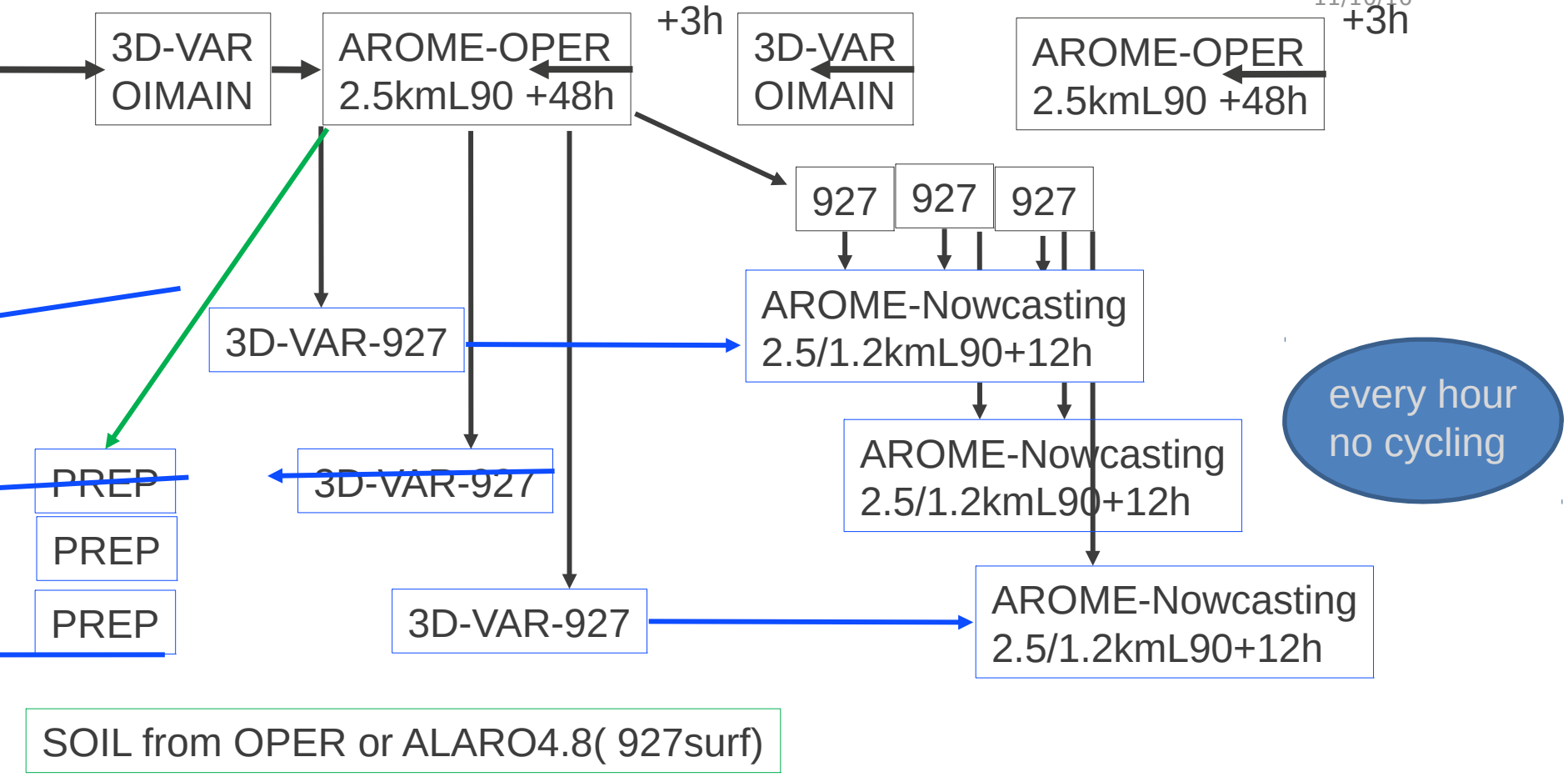
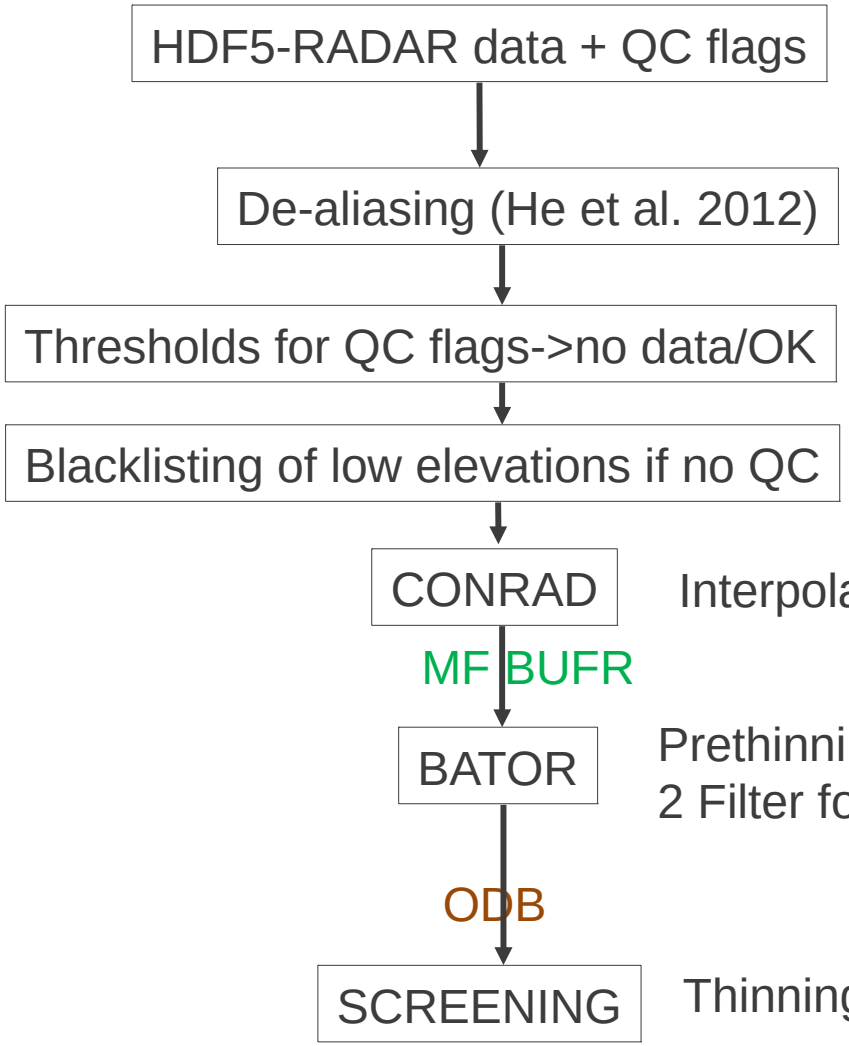
Schematic picture of AROME-Nowcasting at ZAMG



SOIL from OPER or ALARO4.8(927surf)

Setting till summer 2016

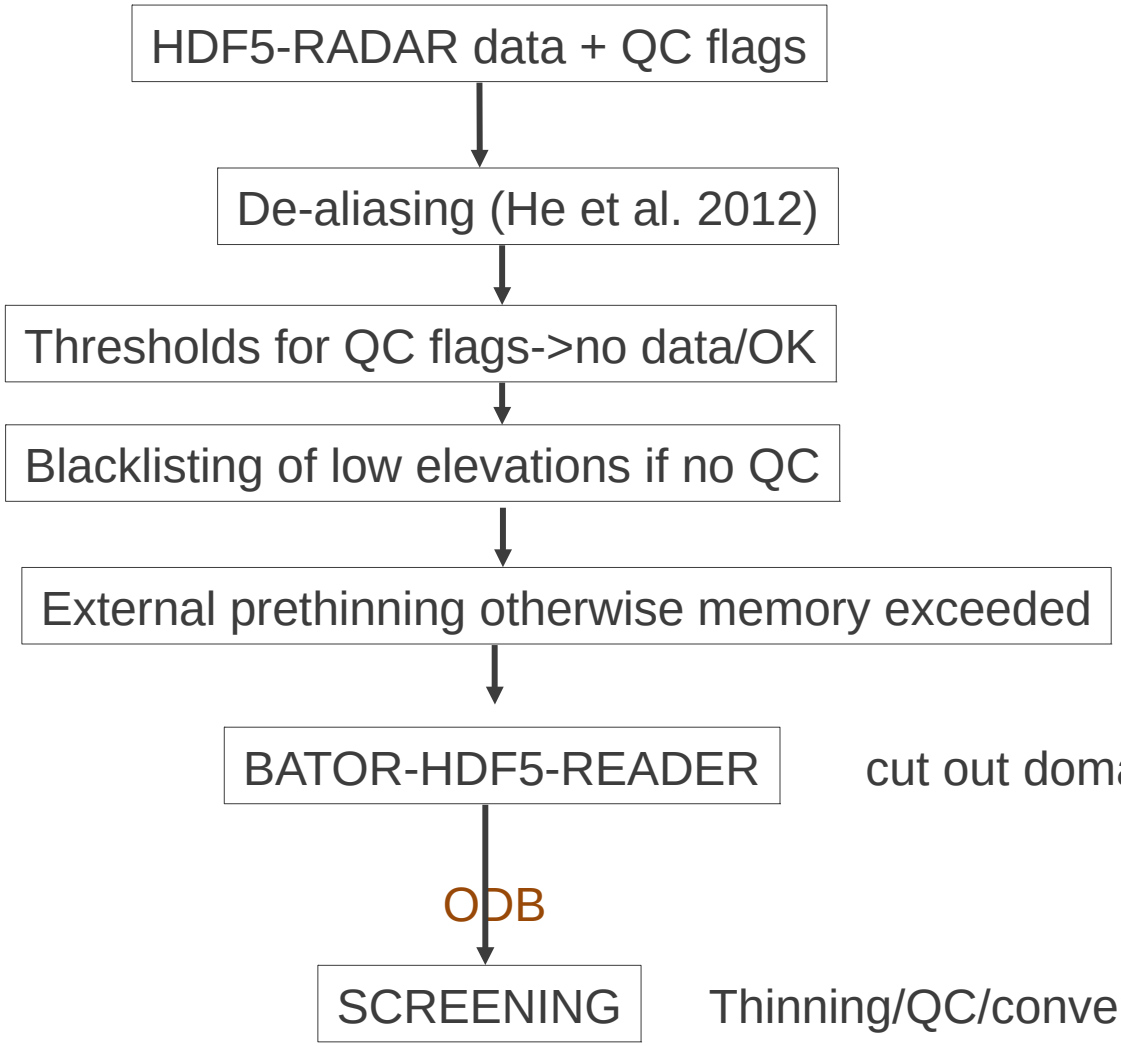


Interpolation to carthesian grid

Prethinning: zsampl_RADAR
2 Filter for DOW, cut out domain

Thinning/QC/convert to RH pseudo OBS

Setting since summer 2016



Use_HDF5
compiler setting
Link HDF5 lib
bator_decodhdf5
bator_lecture
For us wrong sign of Doppler wind!

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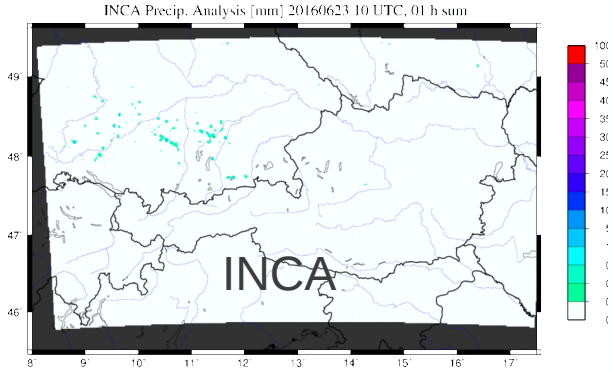
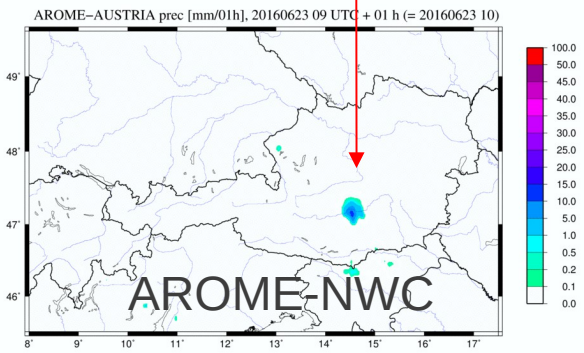
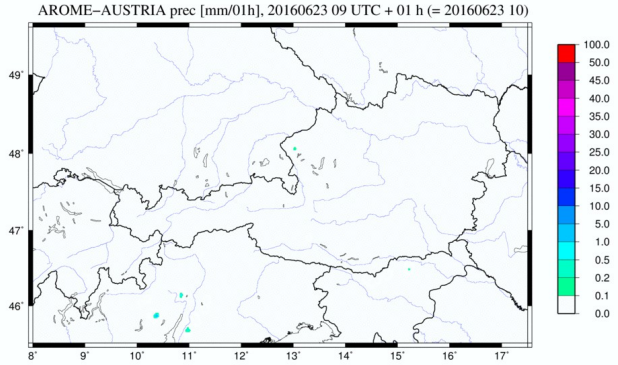
Problems with Austrian RADAR data in 2016

- In autumn 2015 HDF5-RADAR flags were changed: no_data -1 ->255, undetect 0 ->254 also gain and offset changed, but the changes were not fed into CONRAD





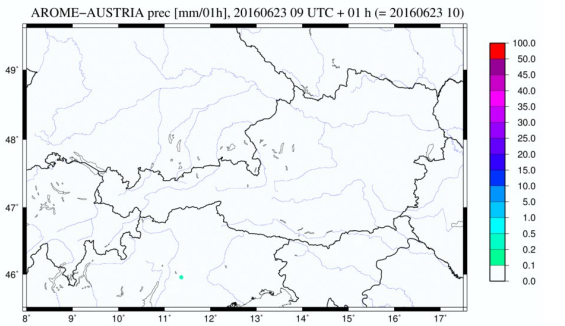


AROME-NWC
no Doppler used

dry case: 20160623 09UTC +1h

same sign everywhere
obviously wrong

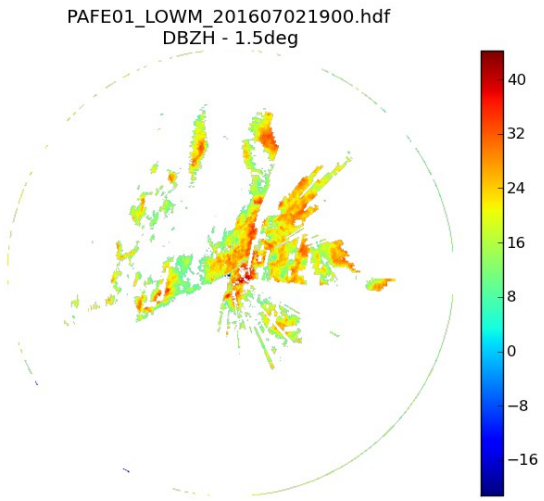
Doppler winds in minimization

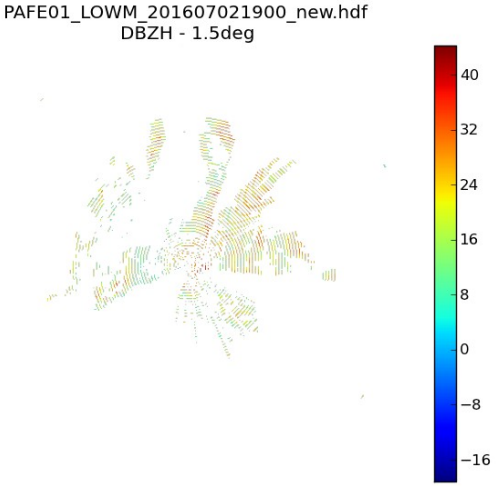


AROME-NWC
replace flags by old values

Better but:
no_data=-1 not really coded
->no_data->0=undetect
0->undetect
still hard coded values
in CONRAD , distinction
undetect/no_data unclear

External pre-thinning C-routine, might be later replaced by HARMONIE superobs script





4 RADARs DOW+REF: Pre-thinning length set to 4km

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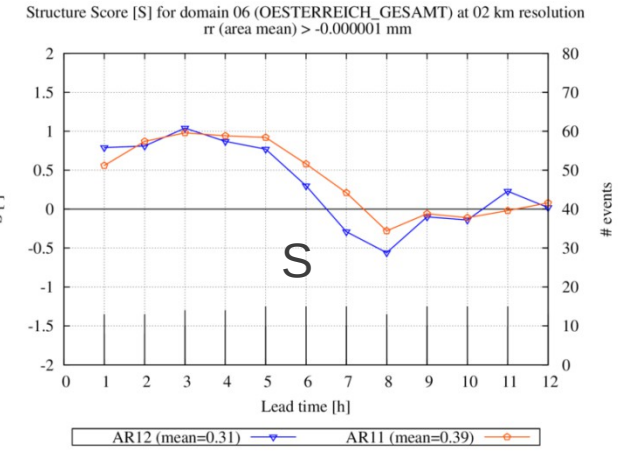
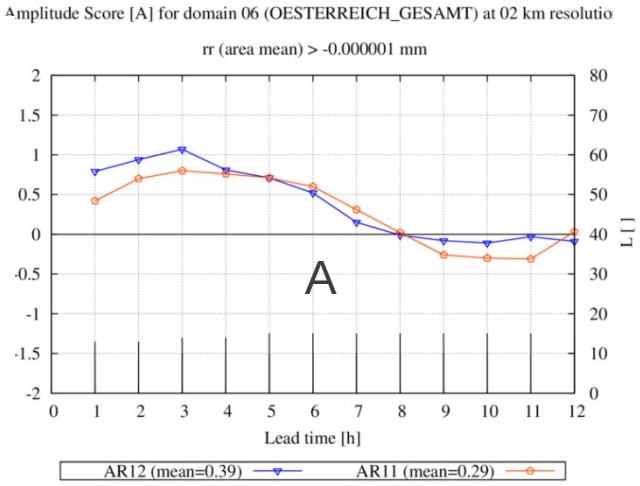
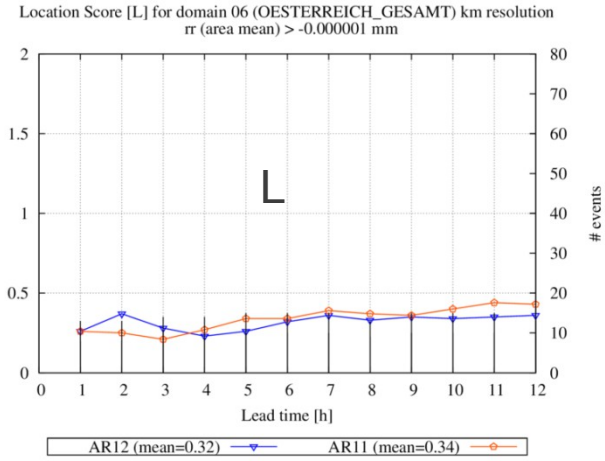
Verification: SAL-Score

HDF5-READER
CONRAD wrong flags

AROME

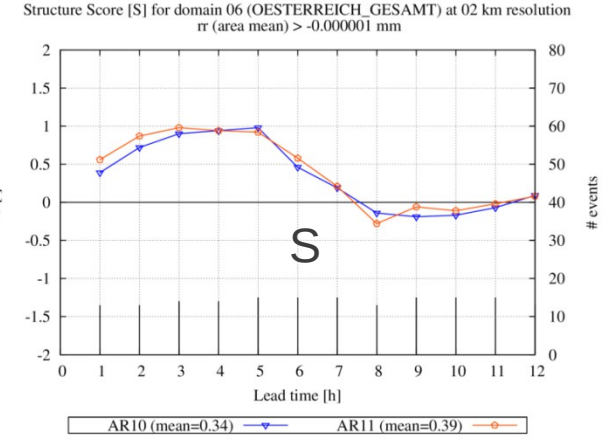


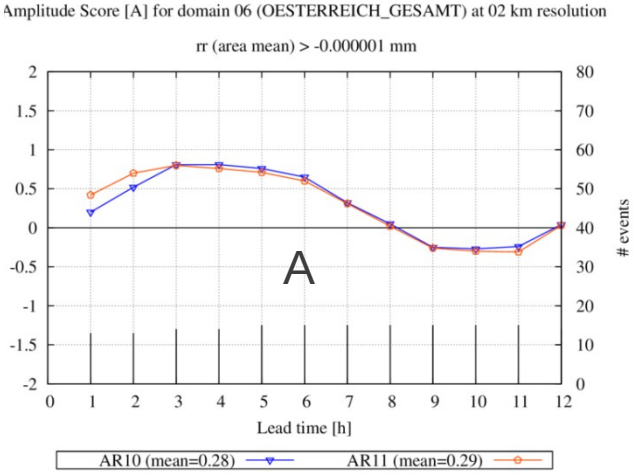


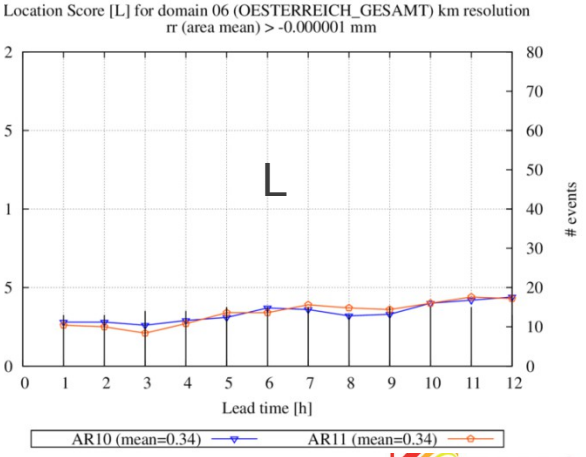


Thres=0.0mm

HDF5-READER
CONRAD-old flags







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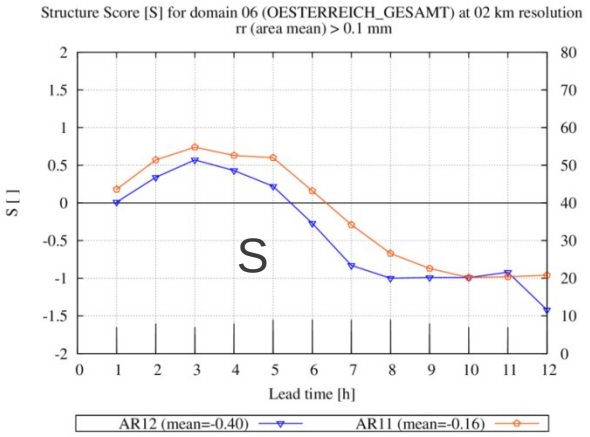
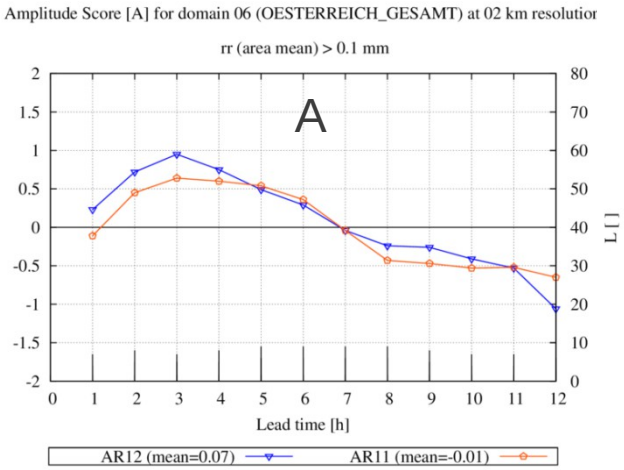
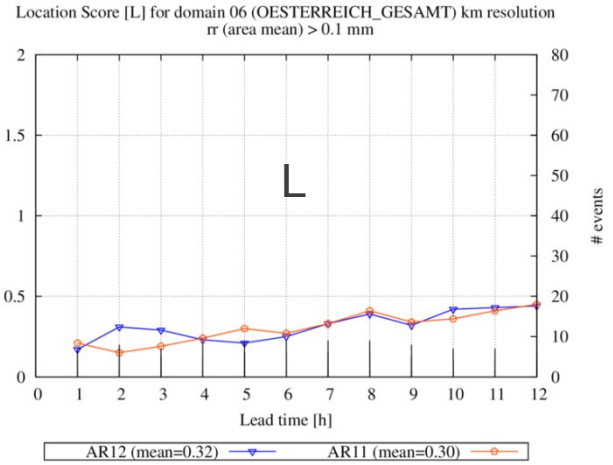
Verification: SAL-Score

HDF5-READER
CONRAD wrong flags

AROME

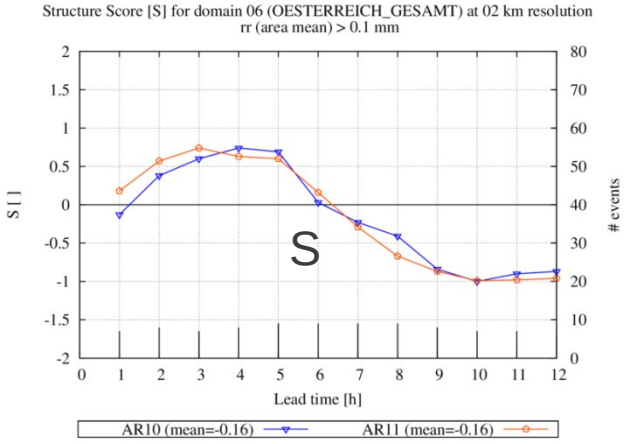


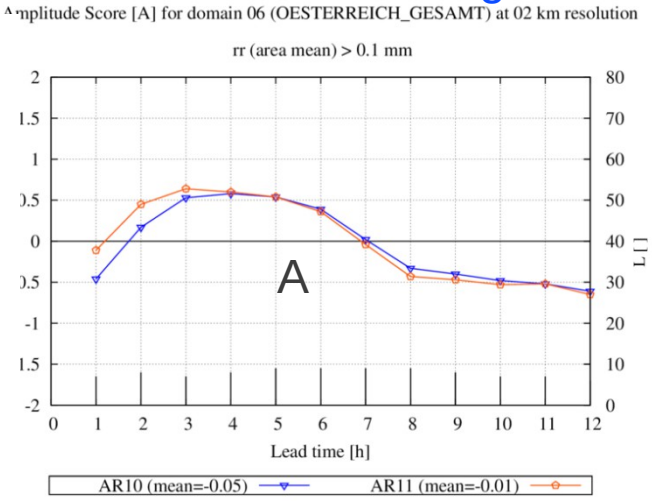


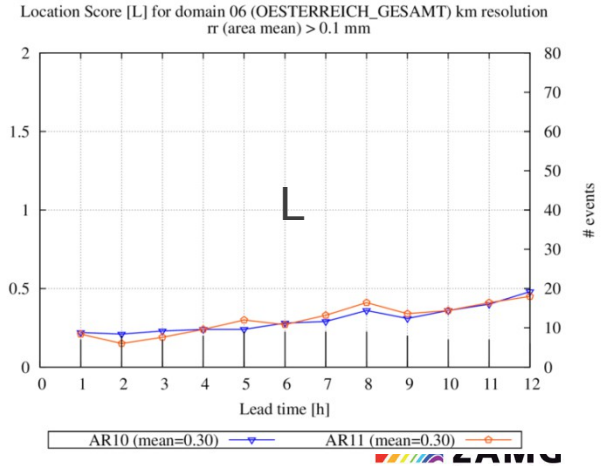


Thres=0.1mm

HDF5-READER
CONRAD-old flags







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“Latent Heat Nudging” with AROME cy38t1/cy40t1

- Method of Jones & Macpherson 1997 (UM, COSMO-Modell, WRF)

idea:

Error of 2D precipitation on the ground is proportional to the error of 3D latent heat release -> correct latent heat release by the ratio of observed and modelled precipitation on the ground -> improved forecast of rain/temperature?

$$\Delta\theta_{LHN} = \Delta\theta_{phys} \frac{RR_{obs} - RR_{model}}{RR_{model}}$$ (Jones & Macpherson)

Advantages:

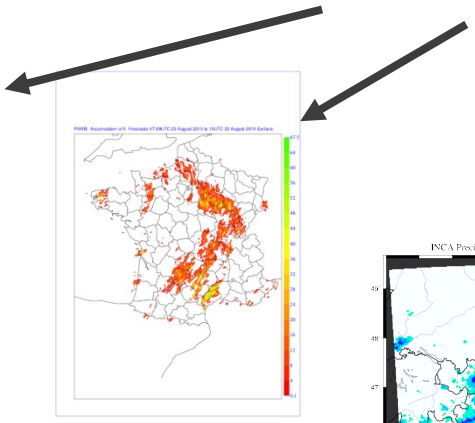
- Only 2D-RADAR data necessary, no B-Matrix needed
- Very efficient
- 4D-assimilation: observations at different time stamps can be applied

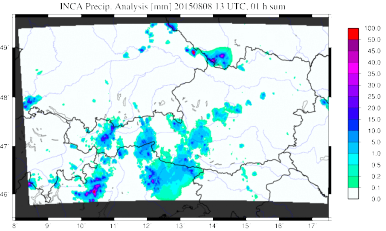
Disadvantages:

- No real 3D information used
- Balances might be violated could cause model „explosions“
- In case of „no rain“ in model an artificial LHN profile is needed
- Time shift between observed (accumulated rain and application of LH tendency)

“Latent Heat Nudging” with AROME cy38t1/cy40t1

- Interpolation of INCA-5min analyses (+5-+25min) and INCA-forecasts +30-+45min (divided by 3 to get also 5min accumulation periods) to AROME-Nowcasting domain („nearest neighbour“)
- Save in a FA file
- Read FA file and namelist at the beginning of 001
- Apply LHN during integration 001 at defined time steps





INTERRROBS3.F90

RROBS+5min → S001RAIN
RROBS+10min → S002RAIN
RROBS+15min → S003RAIN
…
…
S090RAIN

RROBS1.fa

3D-Var+RADAR

AROME 001

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Verification: SAL-Score

RADAR+LHN
RADAR but no LHN

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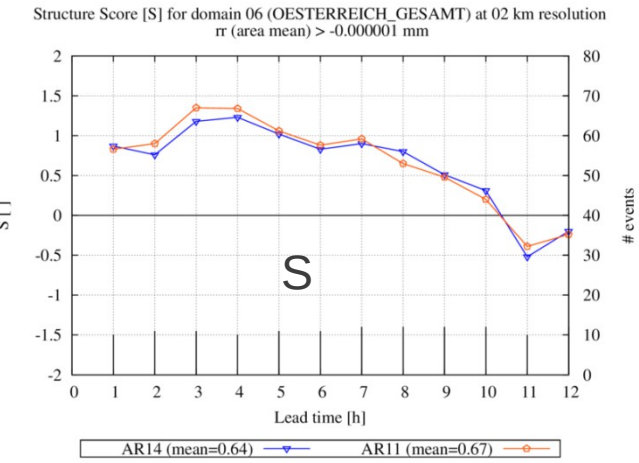
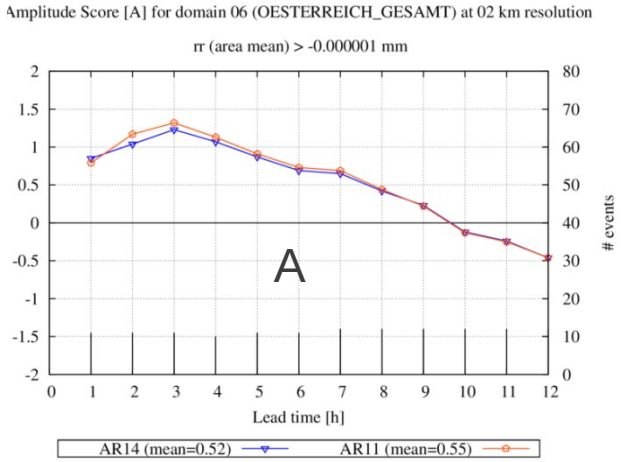
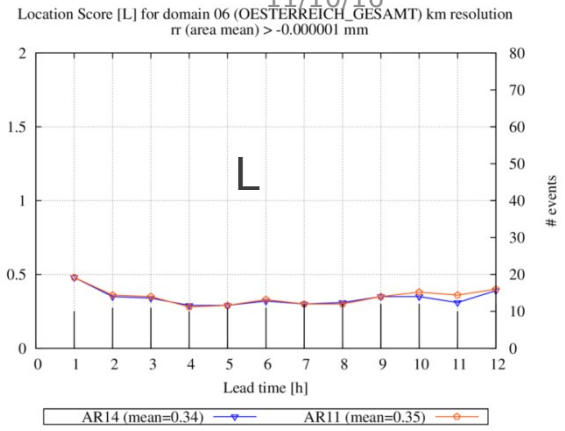
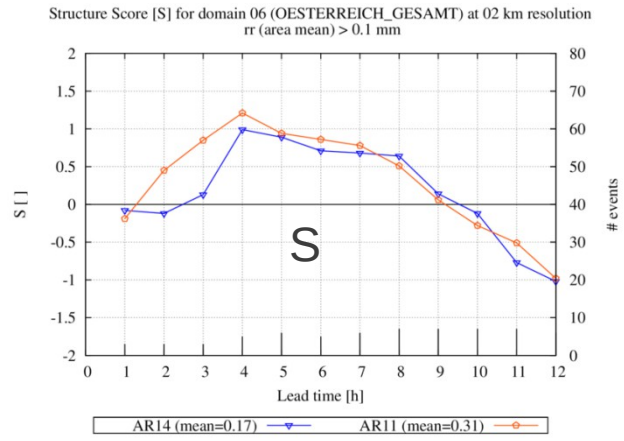


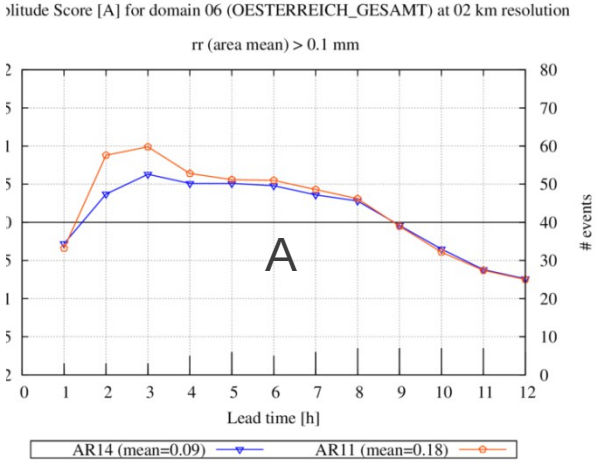


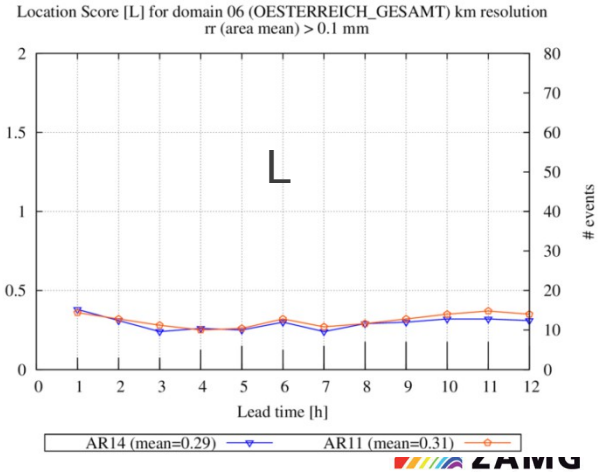


Thres=0.0mm

20160630-20160712 09UTC







Thres=0.1mm

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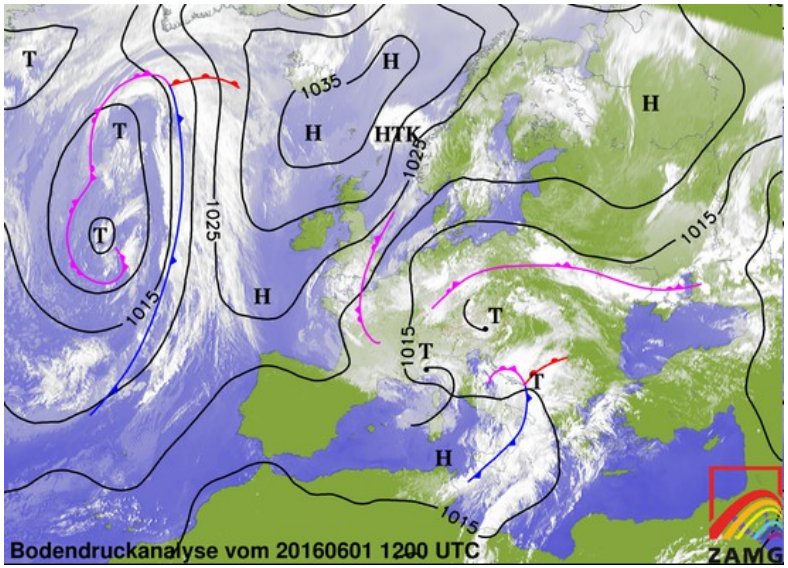
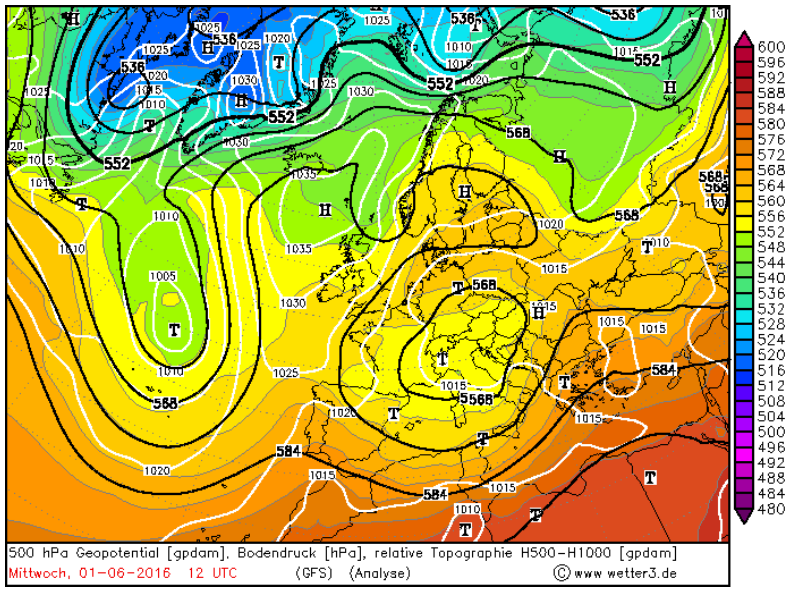
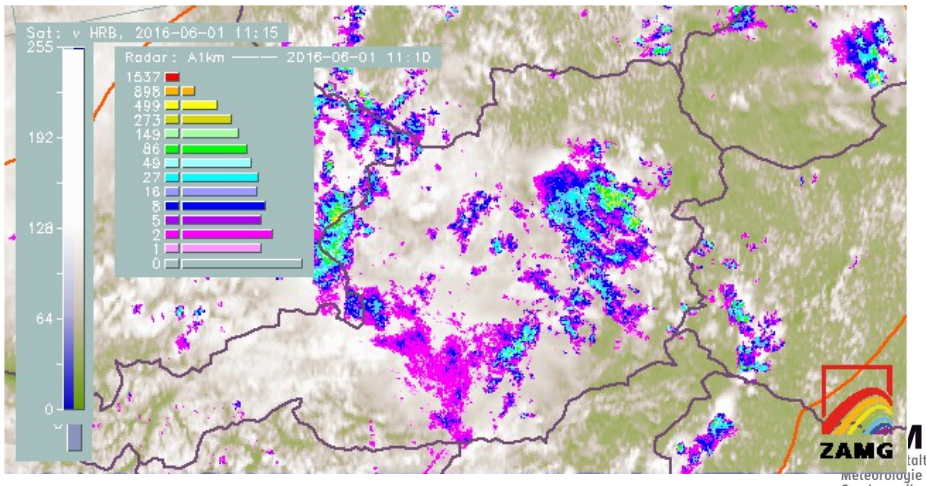
Case studies: 1st June 2016 Simbach/Braunau



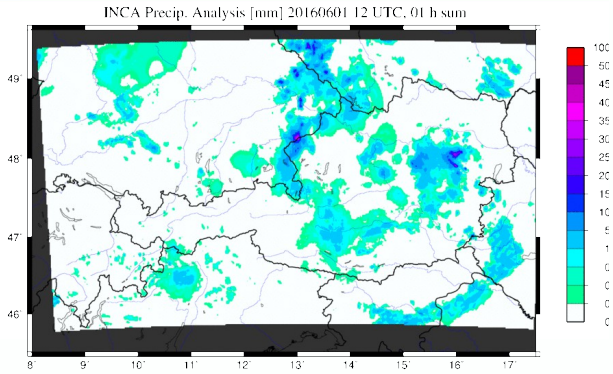
Quelle:BFK Braunau

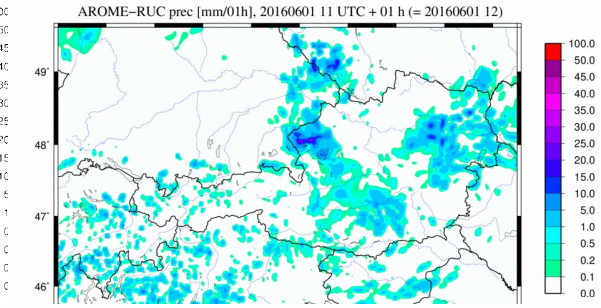


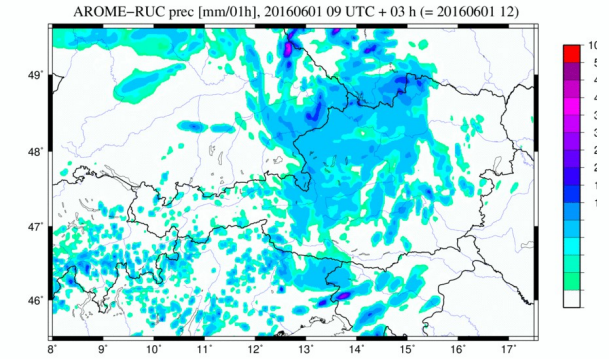


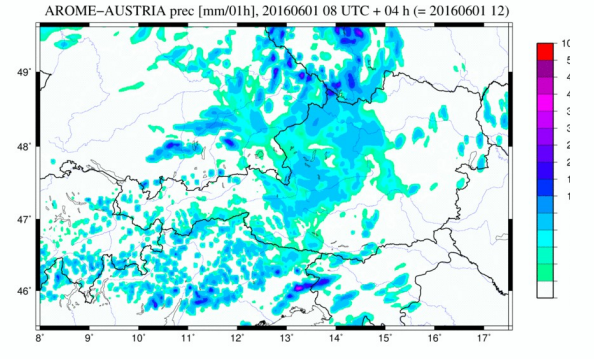
1st June 2016 flashflood Simbach/Braunau

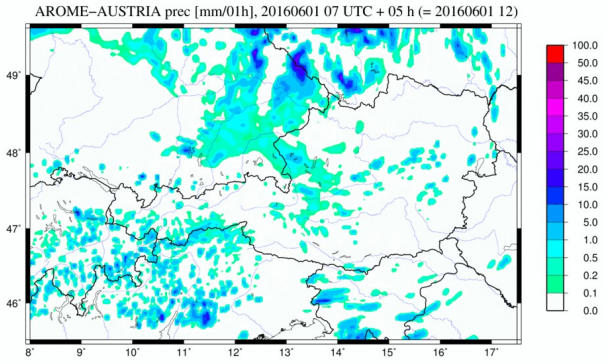
AROME
11/10/16

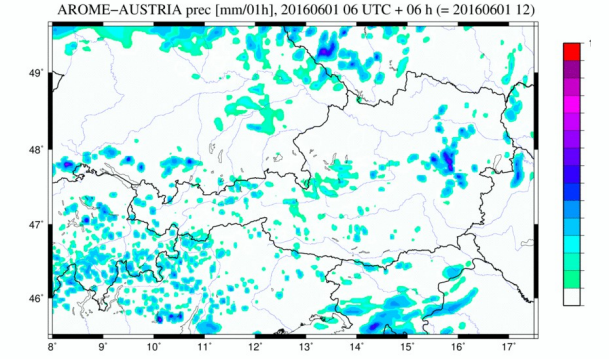


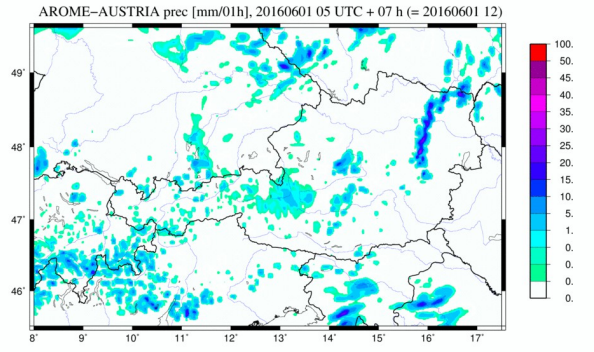


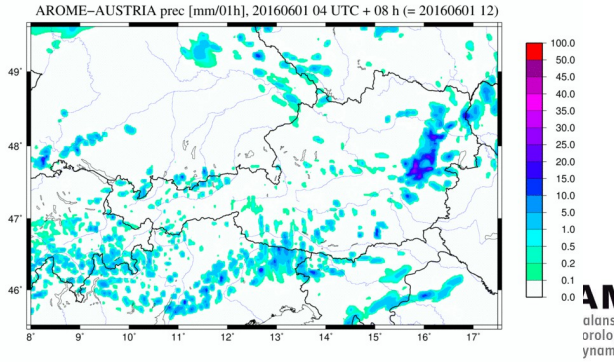












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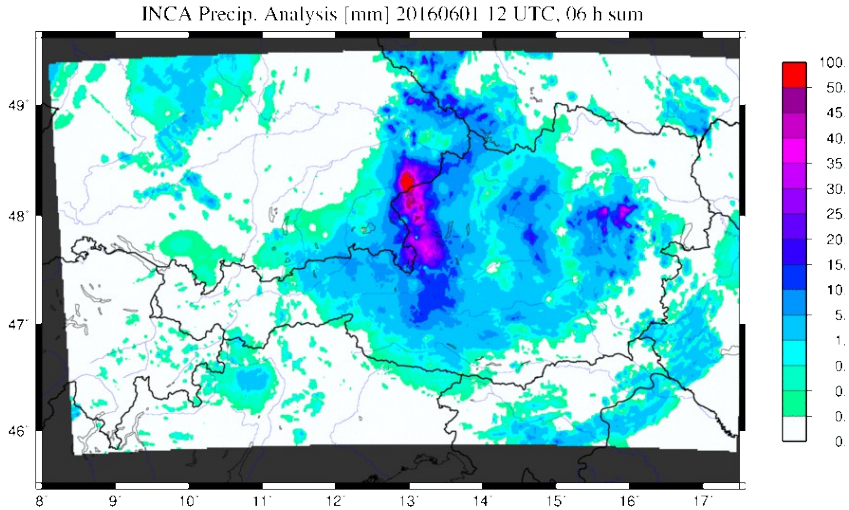

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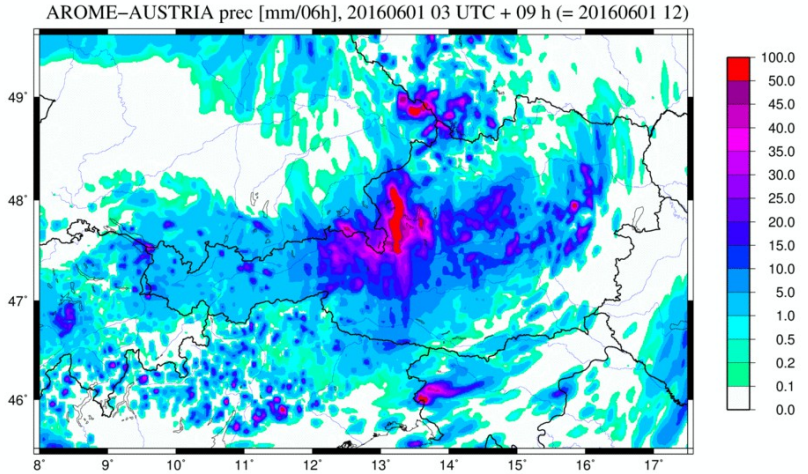
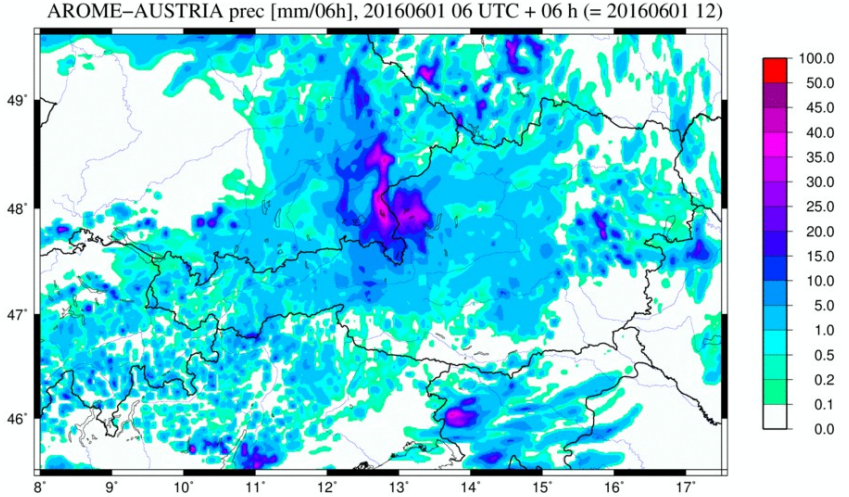
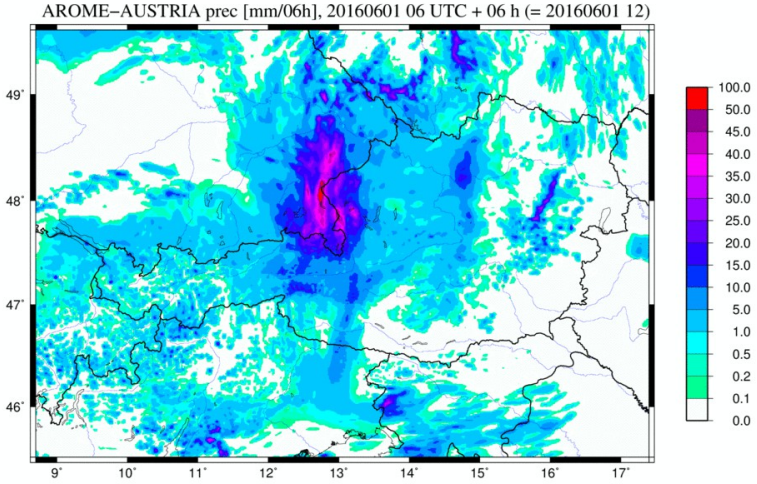


AROME-OPER 03UTC



AROME-NWC 06UTC 2.5km



AROME-NWC 06UTC 1.2km

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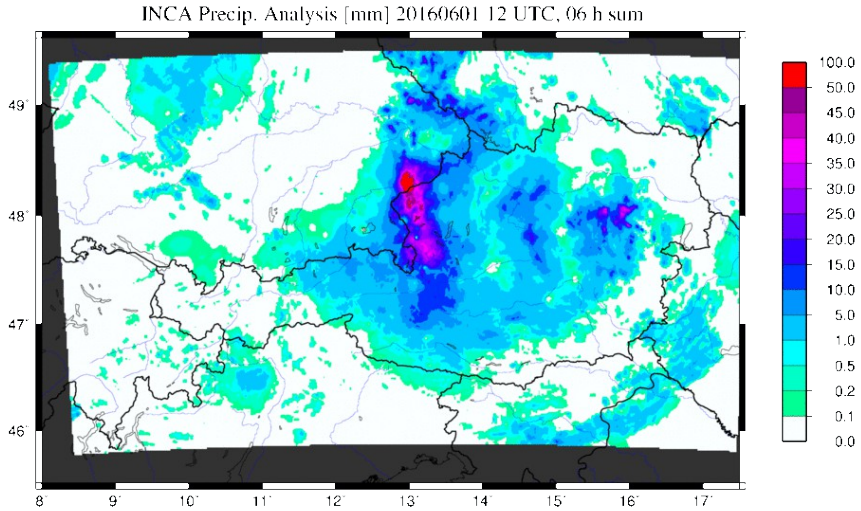
1st June 2016 flashflood Simbach/Braunau



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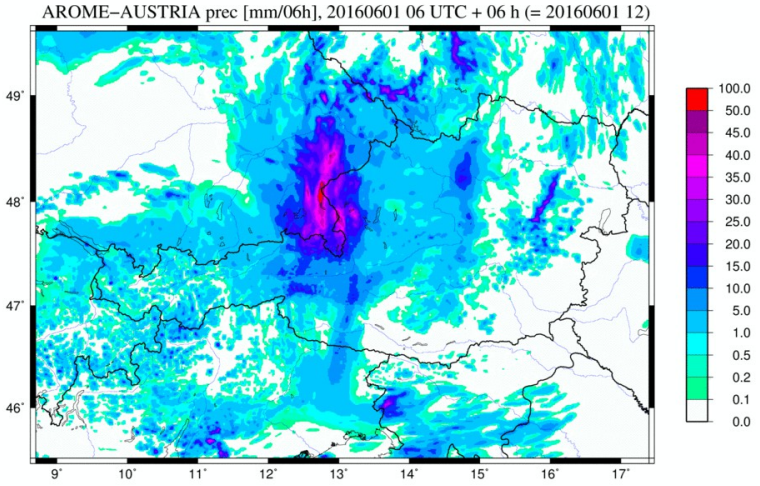
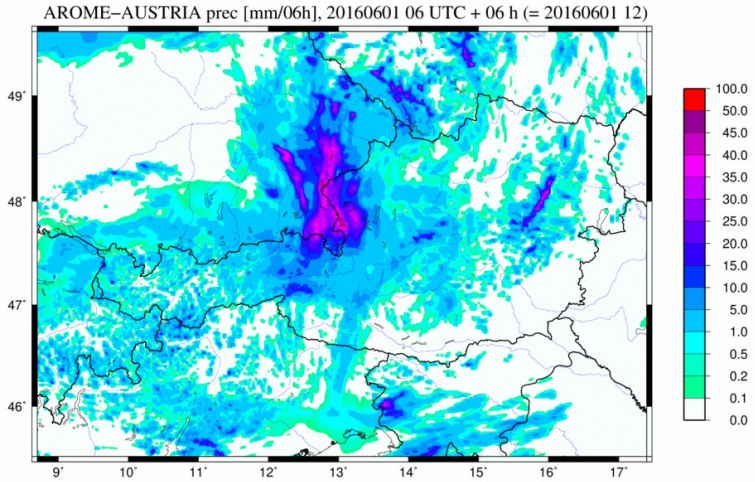
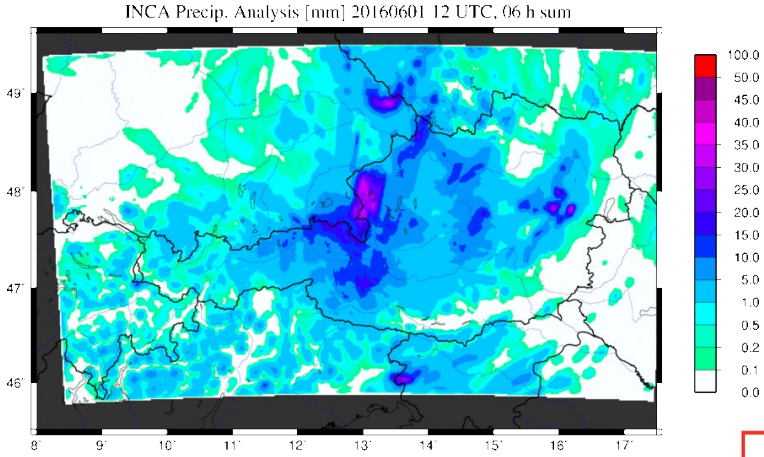


AROME-NWC 06UTC 1.2km



AROME-NWC without LHN



INCA-AROME-forecast

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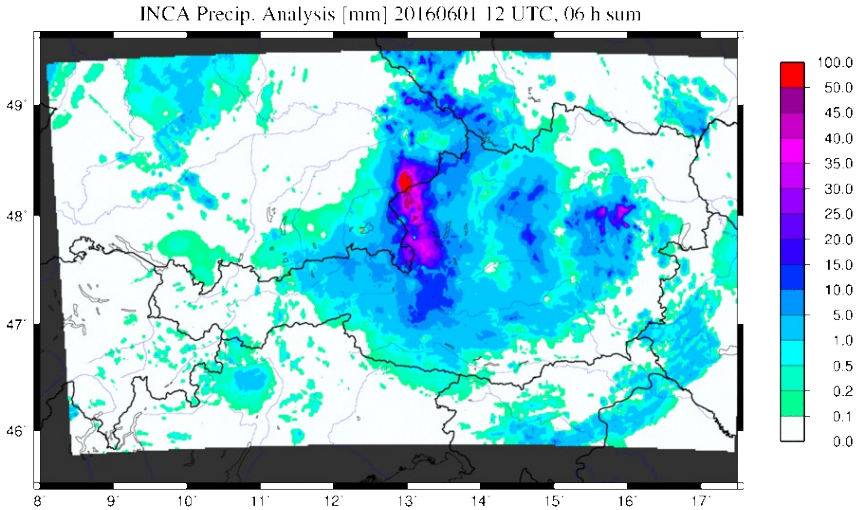

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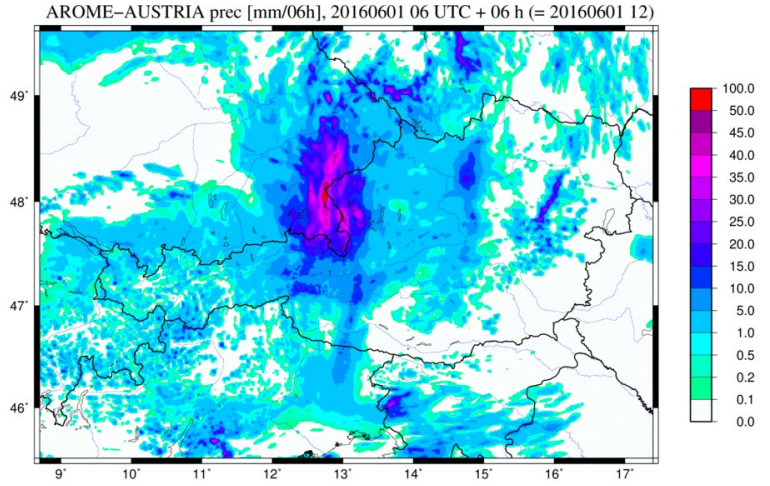
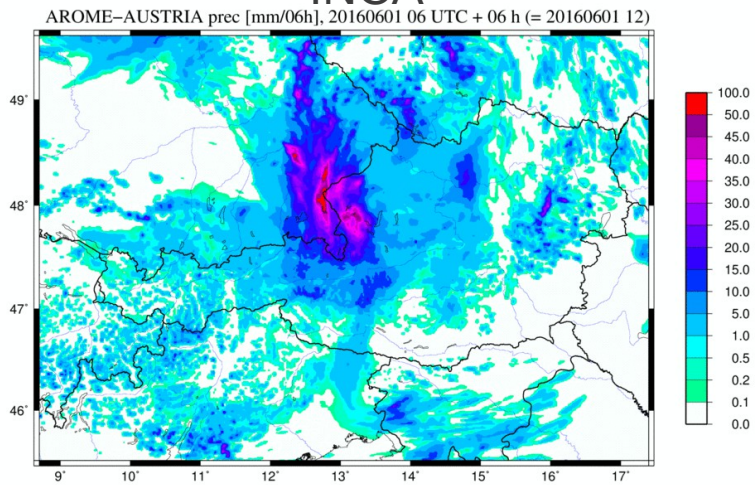
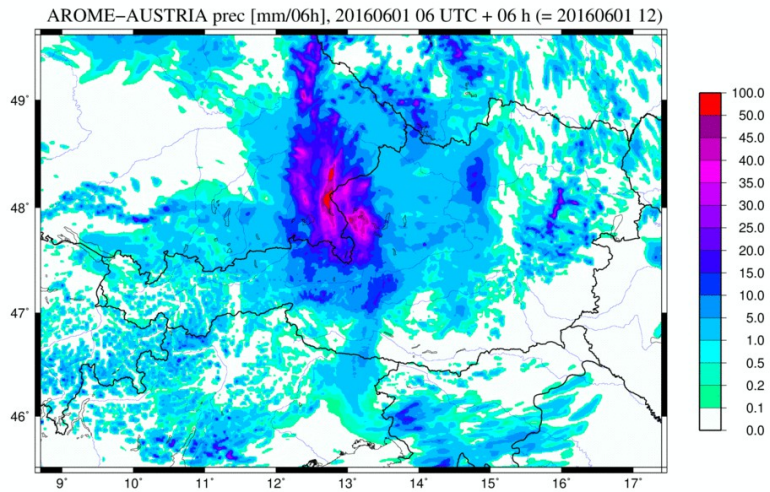




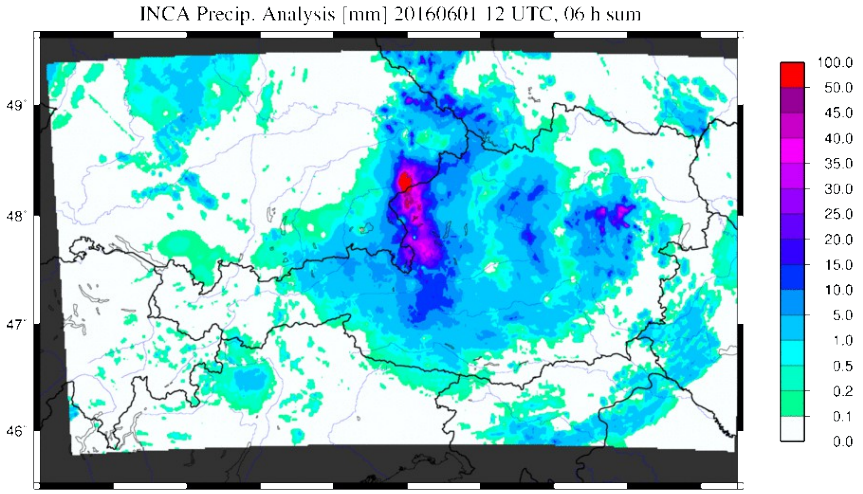
AROME-NWC +MODE-S KNMI

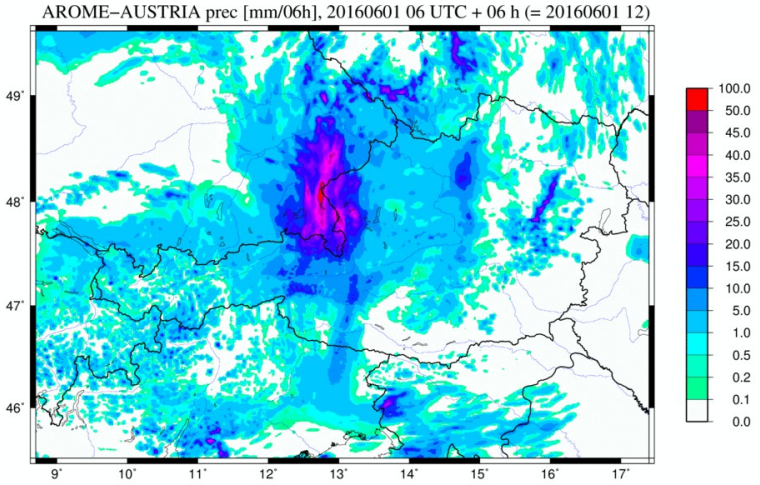


AROME-NWC +MODE-S KNMI-AMDAR-Q

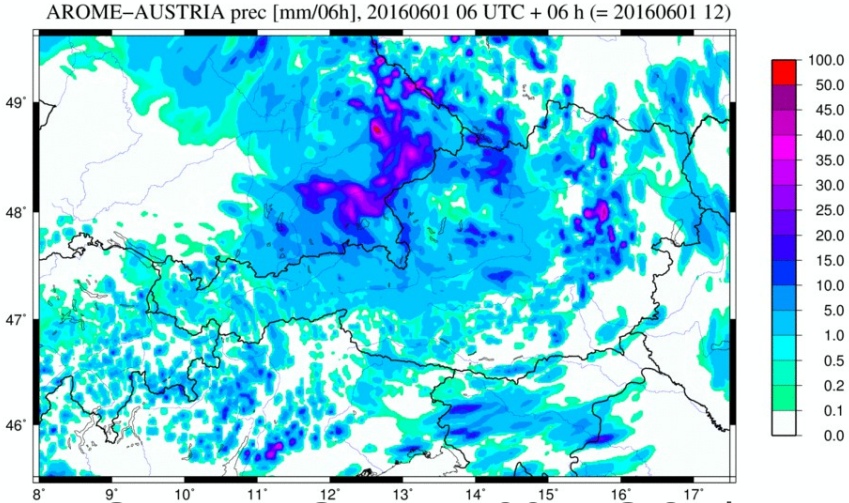
Geodynamik

1st June 2016 flashflood Simbach/Braunau

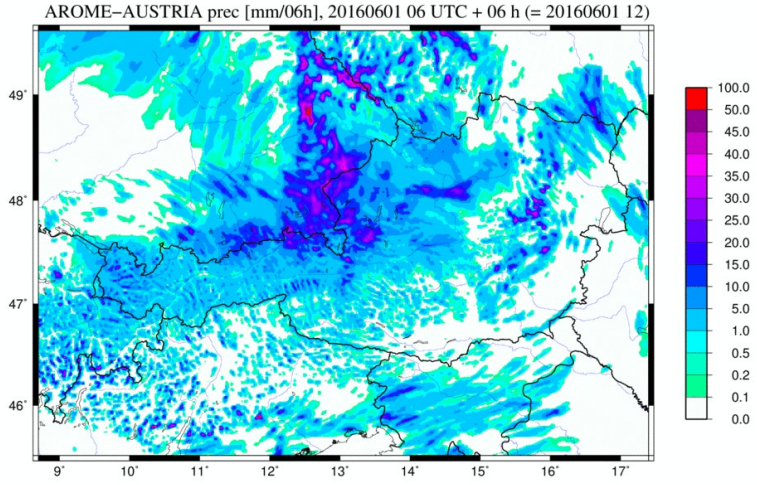




AROME-NWC 06UTC 1,2km



AROME-NWC-HDF5 06UTC 2.5km



AROME-NWC-HDF5 06UTC 1.2km

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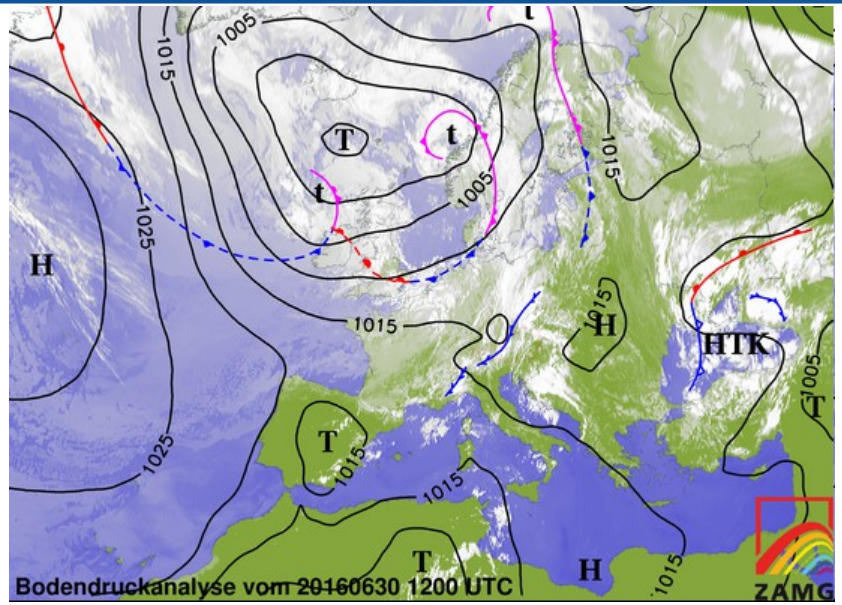
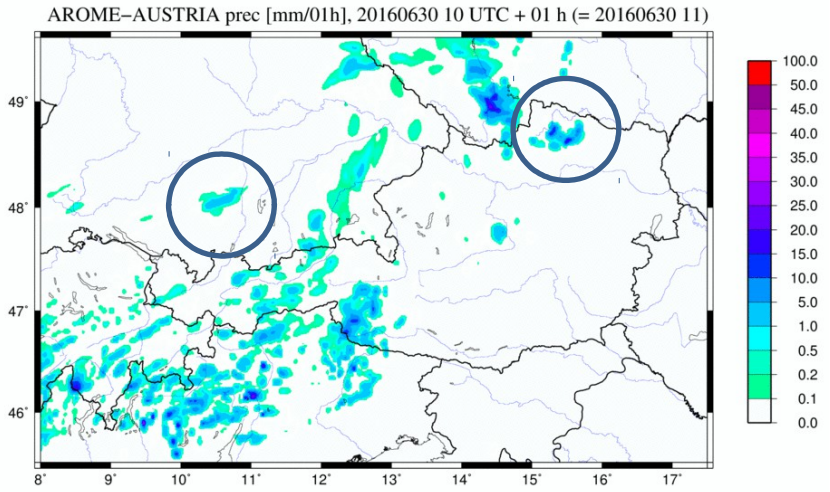
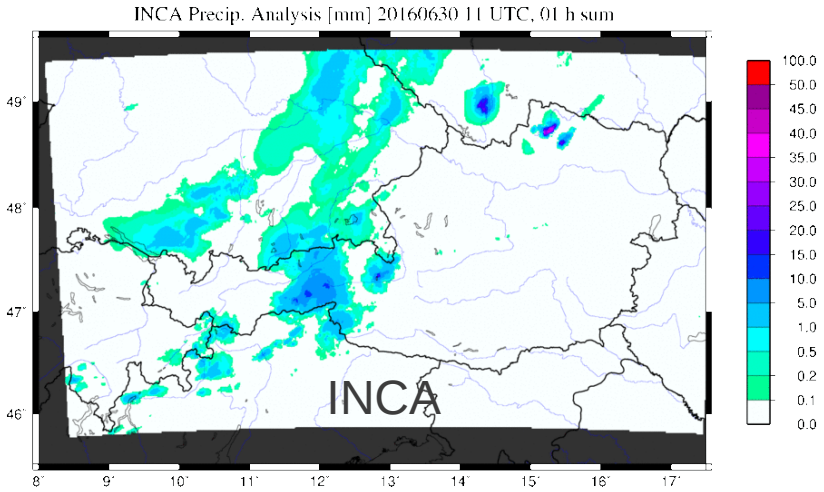
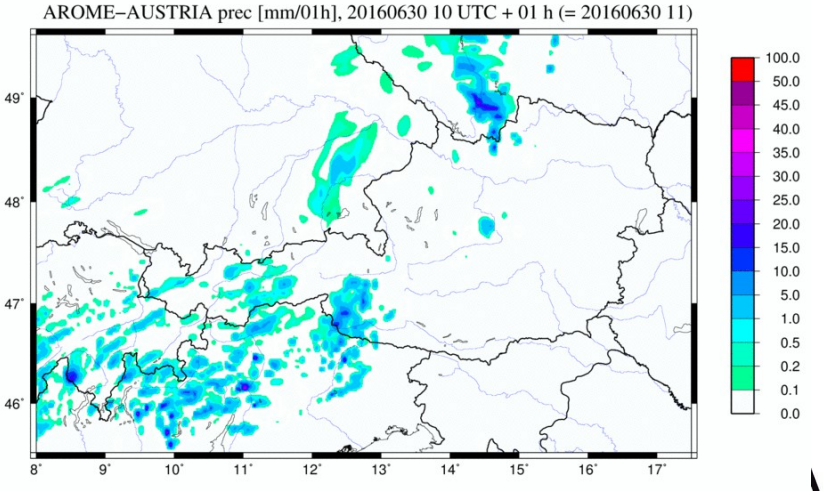
local convection over NE Austria 30th June 2016





AROME-NWC 10UTC +1h





No LHN

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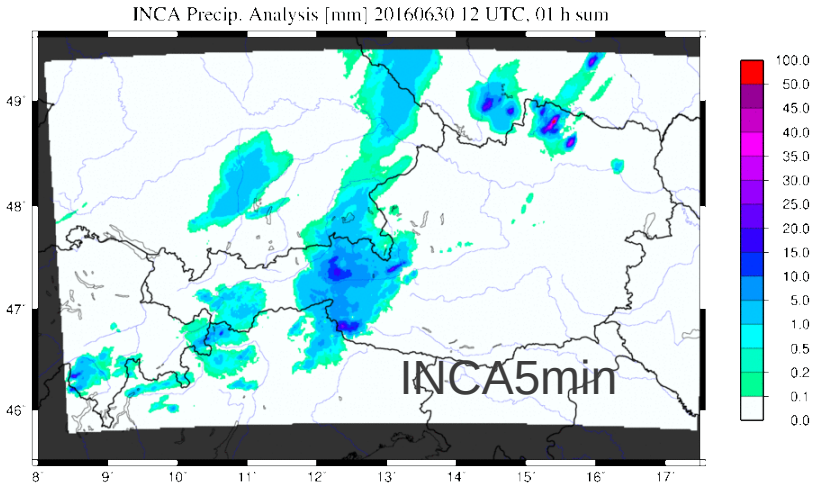
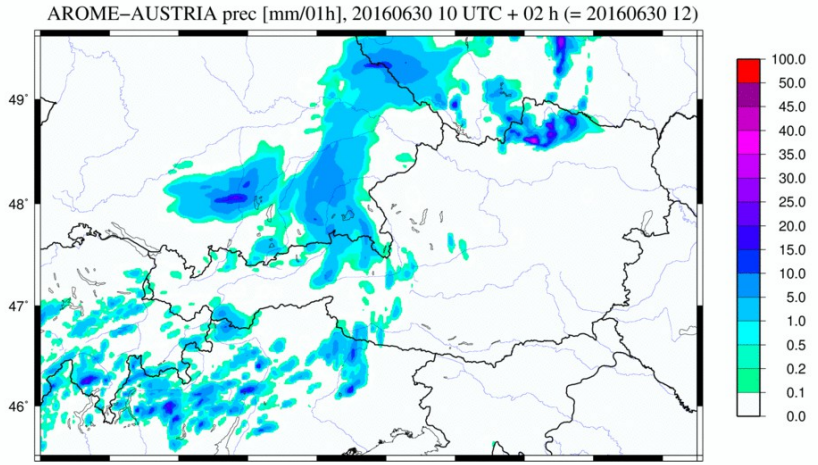
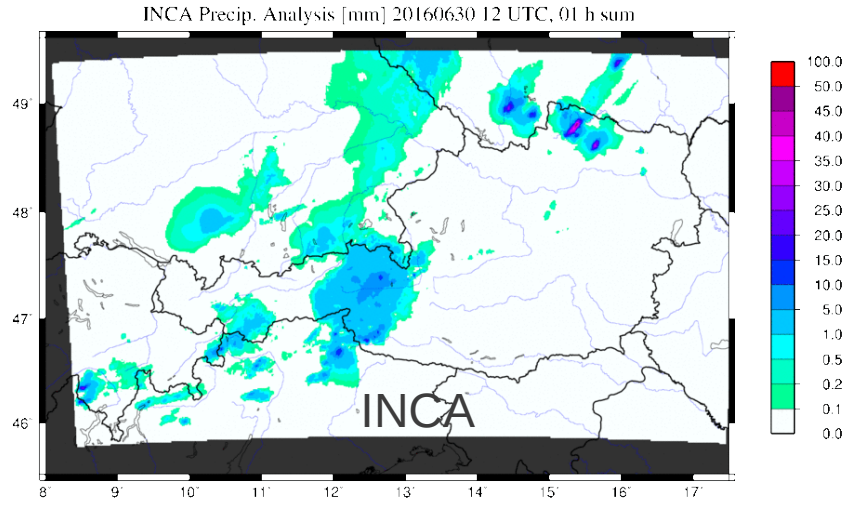
local convection over NE Austria 30th June 2016

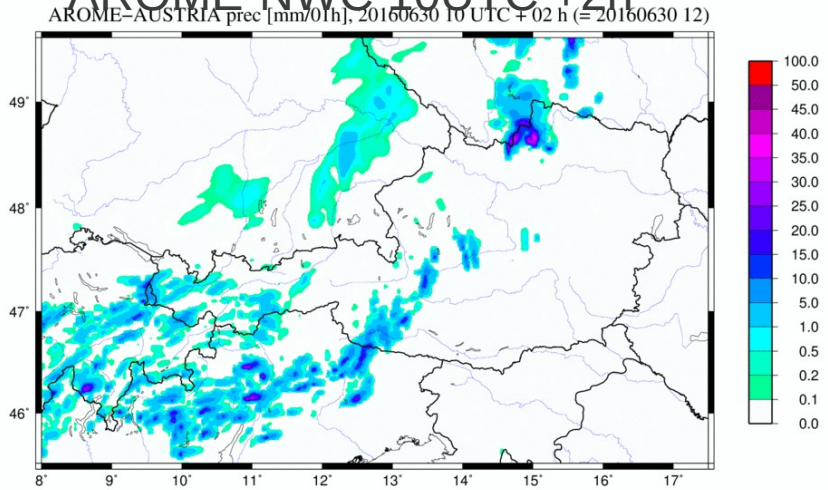
AROME
11/10/16





AROME-NWC 10UTC +2h





No LHN

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Conclusions

- Experiments from MF stay should be tested for longer period
- Switch to HDF5-reader is OK even if there is still some work to do
  - Optimisation of pre-thinning, Doppler filter from bufr reader (are they necessary?), treatment of quality flags
- LHN shows impact till about +6h: positive in several cases, but neutral to slightly negative (overestimation) on 2 week period – better tuning needed?
- AROME 1.2km is quite promising compared to 2.5km in several cases