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ZAMG
Zentralanstalt für Meteorologie und Geodynamik

36th EWGLAM and 21st SRNWP Meeting, 29.9.-2.10.2014, Offenbach
NWP related activities in AUSTRIA

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1. Operational Status

Three NWP systems are currently in operations at ZAMG: Two deterministic (ALARO, AROME) and one ensemble system (LAEF).

ALARO (5 km):

The operational model version at ZAMG is run with a grid mesh size of approx. 5km using the ALARO-0 physics package. It is operated since 2011, while a major upgrade of the system took place in 2013. The model runs four times per day and is coupled to the IFS model. The main characteristics of the model setup can be summarized as:

Domain		Model characteristics		LBC	
Grid points:	600x540	Code version:	CY36T1	Coupl. model:	IFS
Horizon. resolution:	4.8km	Time step:	180s	Coupl. frequency:	3h
Levels:	60	Integration time:	72h (00, 06, 12,18UTC)	Retrieval:	Internet/
Grid:	linear	Physics:	ALARO-0 baseline,		RMDCN
Orography:	mean	Dynamics:	hydrostatic kernel		
		Initialization:	CANARI for surface		
			IFS for 3D fields		
			digital filter initialization		

Table 1: ALARO model setup

AROME (2.5 km):

The first operational version of AROME finally started in the beginning of 2014. In summer 2014, an extensive upgrade of the system was performed:
- extension of the domain (see Figure 1)
- increase of vertical resolution
- extension of the forecast range (to 48h)
- upgrade of the model version

In contrast to ALARO (only surface assimilation), AROME is also running with its own 3DVAR atmospheric assimilation system.

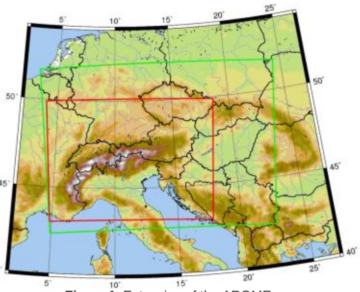

Figure 1: Extension of the AROME domain (old=red vs. new=green)

Domain		Model characteristics		LBC	
Grid points:	600x432	Code version:	CY37T1	Coupl. model:	IFS
Horizon. resolution:	2.5km	Time step:	60s	Coupl. frequency:	3h
Levels:	90	Integration time:	48h (00, 03,...,21 UTC)	Retrieval:	Internet/
Grid:	linear	Physics:	AROME		RMDCN
Orography:	mean	Dynamics:	non-hydrostatic kernel		
		Initialization:	OI for surface		
			3DVAR for atmosphere		

Table 2: AROME model setup

LAEF (11 km):

LACE nwp central europe

ALADIN-LAEF, the limited area ensemble system operated at the HPC facilities of ECMWF, is being developed at ZAMG in cooperation with LACE members and the National Weather Service of Turkey. The main characteristics of the current system are:

Domain		Model characteristics		LBC	
Grid points:	500x600	Code version:	CY36T1	Coupl. model:	ECMWF-EPS
Horizon. resolution:	10.9km	Time step:	450s	Coupl. frequency:	6h
Levels:	45	Integration time:	72h (00, 12UTC)	Dissemination:	AUT,TR, SLO, SK, CZ
Grid:	quadratic	Physics:	Multi-physics		
Orography:	mean	Initialization:	**CANARI** with perturbed		
			observations for surface		
			Breeding-Blending for		
			atmosphere		

Table 3: LAEF system setup

2. HPC System

SGI ICE-X (in operations since 2013)
252 nodes (à 2x8 processor cores, 32 GB RAM, Intel Sandy Bridge)
2 frontend nodes (à 2x8 processors, 64 GB RAM, ...)
Panasas file system (120 TB netto capacity)
Total: 4064 cores, 8 TB memory, theor. peak perform.: 82 Tflops

Time spent for model integration (conf 001):
ALARO approx. 10min (on 1024 cores)
AROME approx. 18min (on 1536 cores)

Figure 2: SGI at ZAMG

3. Flood Event 2014

In May 2014, a flood event took place in Austria affecting mainly the northern upslope precipitation belts of the Alps. Figure 3 shows the INCA precipitation analysis for a 72 hour period covering the main precipitation event. Peak values higher than 250mm were recorded, whereas a major part of the precipitation was falling within 12 hours. An evaluation of model forecasts shows that the regional models used at ZAMG could outperform the IFS model for this event while still missing the local peak values by approx. 10-20%. In Figure 4, different model forecasts (ECMWF, ALARO and AROME) for an affected catchment area are shown together with the corresponding analysis (ANA). The selected 12 hour period is characterized by the highest precipitation rates during the entire event. AROME is the model with the best performance in this case.

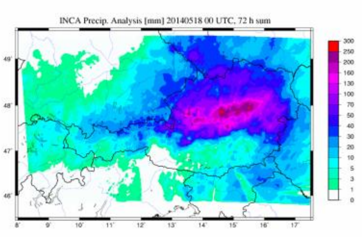

Figure 3: INCA precipitation analysis (72h, 15.05. 00 - 18.05. 00 UTC)

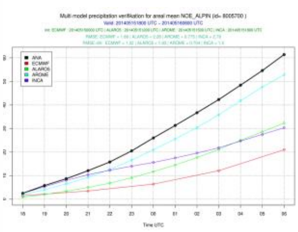

Figure 4: Accumulated areal precipitation mean (analysis and different model forecasts, see text) for a 12 hour period.

4. VFR Experiments

In the framework of a project funded by the Austrian Space Application Program (ASAP) a 1km AROME version was set up and is undergoing first evaluations. Several case studies covering different types of severe convection (local, organized, mixed type, etc.) were selected for testing and finally feeding the nowcasting system INCA. The 1km AROME is run with different coupling models (AROME 2.5km, ALARO 5km and IFS) and evaluated with main focus on precipitation and wind fields.

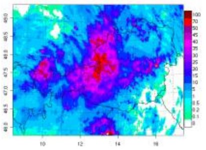

Figure 4: 24h precipitation INCA analysis 20140725

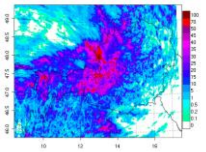

Figure 5: AROME 1km coupled to ALARO 5km

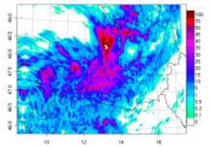

Figure 6: AROME 1km coupled to AROME 2.5km

5. Radar Assimilation in AROME

The assimilation of radar data (reflectivity, radial winds) within the AROME 3DVAR system is currently one main target area of the NWP team. Together with the Remote Sensing section at ZAMG substantial progress was made in 2014 to ingest the data from the Austrian radar network , see Figure 7). After finalizing the observation pre-processing part (incl. the de-aliasing of the Doppler velocities) the impact of the radar assimilation was tested in several case studies an finally for a 1 month period. The results show that while the impact of the radar data is quite big in several cases for the first 6-12 hours, the overall tendency in the scores indicates just a slight improvement (Figure 8).
The implementation of a quality control system for the radar data now remains the missing brick before getting operational with radar assimilation.

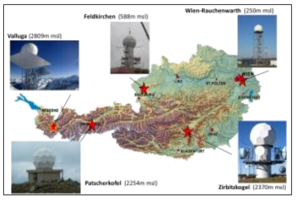

Figure 7: Radar network (dual pol) of Austria

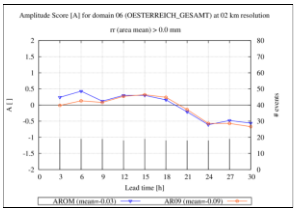

Figure 8: Amplitude Score (0=perfect, AROME with radar assimilation = red)