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NWP related activities in AUSTRIA

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The operational forecast system in Austria:

The operational ALADIN version at ZAMG is named ALARO5-AUSTRIA and was set to operations at ZAMG in March 2011. It runs with a horizontal resolution of 4.8km and is coupled to the IFS model. The main characteristics can be summarized as:

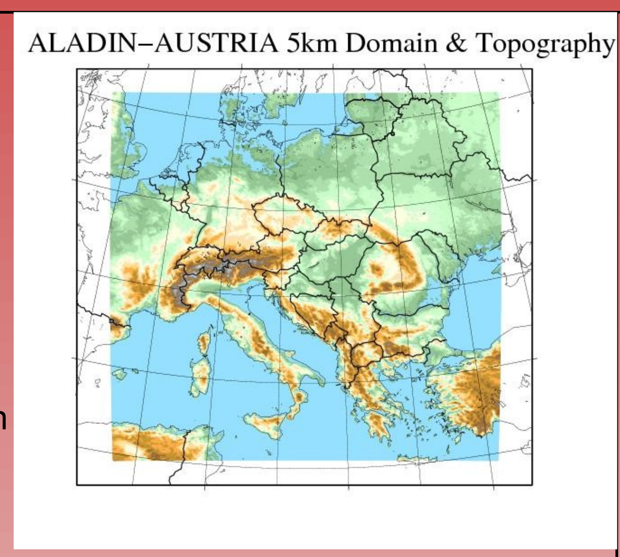

Figure 1: Representation of orography in the operational 4.8km model

Domain:

Gridpoints:	600x540
Horizon. resolution:	4.8km
Levels:	60
Grid:	linear
Orography:	mean

LBC:

Coupl. model:	IFS (time lagged)
Coupl. frequency:	3h
Retrieval:	internet and RMDCN

Model characteristics:

Code version:	CY35T1
Time step:	180s
Integration time:	72h (00, 06, 12 and 18 UTC)
Physics:	ALARO-0 SK-sub inversion scheme
Dynamics:	hydrostatic kernel
Initialization:	CANARI surface assimila tion IFS for 3D fields

New HPC system at ZAMG:

The staff at ZAMG is working extremely hard ;-) in Vienna to replace the old HPC (NEC SX-8R) system by the new one: SGI ICE X with the following specifications ...

5 water-cooled 19'' SGI D-Racks with
252 SGI X Dakota nodes, each with: 2 Intel Xeon Sandy Bridge E5-2670 (8 processor cores), 2.6GHz, 32 GB Memory
2 SGI Summit frontend nodes, each with 2 Intel Xeon Sandy Bridge,..., 64 GB Memory
Pansas ActiveStore 12 Cluster filesystem with 120 TB netto capacity

Total: 4064 cores, ca. 8 TB memory, (theor.) peak perform.: 82 Tflops

Improving stratus forecasts using an empirical sub-inversion cloudiness scheme:

Although the horizontal and vertical resolution of the operational ALARO5-AUSTRIA model at ZAMG was increased, the model still shows deficiencies in predicting typical wintertime low stratus cloudiness by underestimating the extent of the stratus fields.
In order to improve the performance of the operational model an empirical sub-inversion scheme (named SK-scheme) has still to be active in the operational model. The scheme acts by increasing the radiative cloudiness whenever several conditions favouring the building of low stratus are fulfilled.
This approach yields a clear improvement for flatland areas (Figure 2b vs. 2d), while the problems in Alpine regions (valleys, basins) remain unsolved. Therefore the SK-scheme was now revised and some improvements could be achieved (see e.g. regions in the south of Austria in Figure 2c and 2d).
In the revised scheme, an orographical mask (Figure 4) is used to

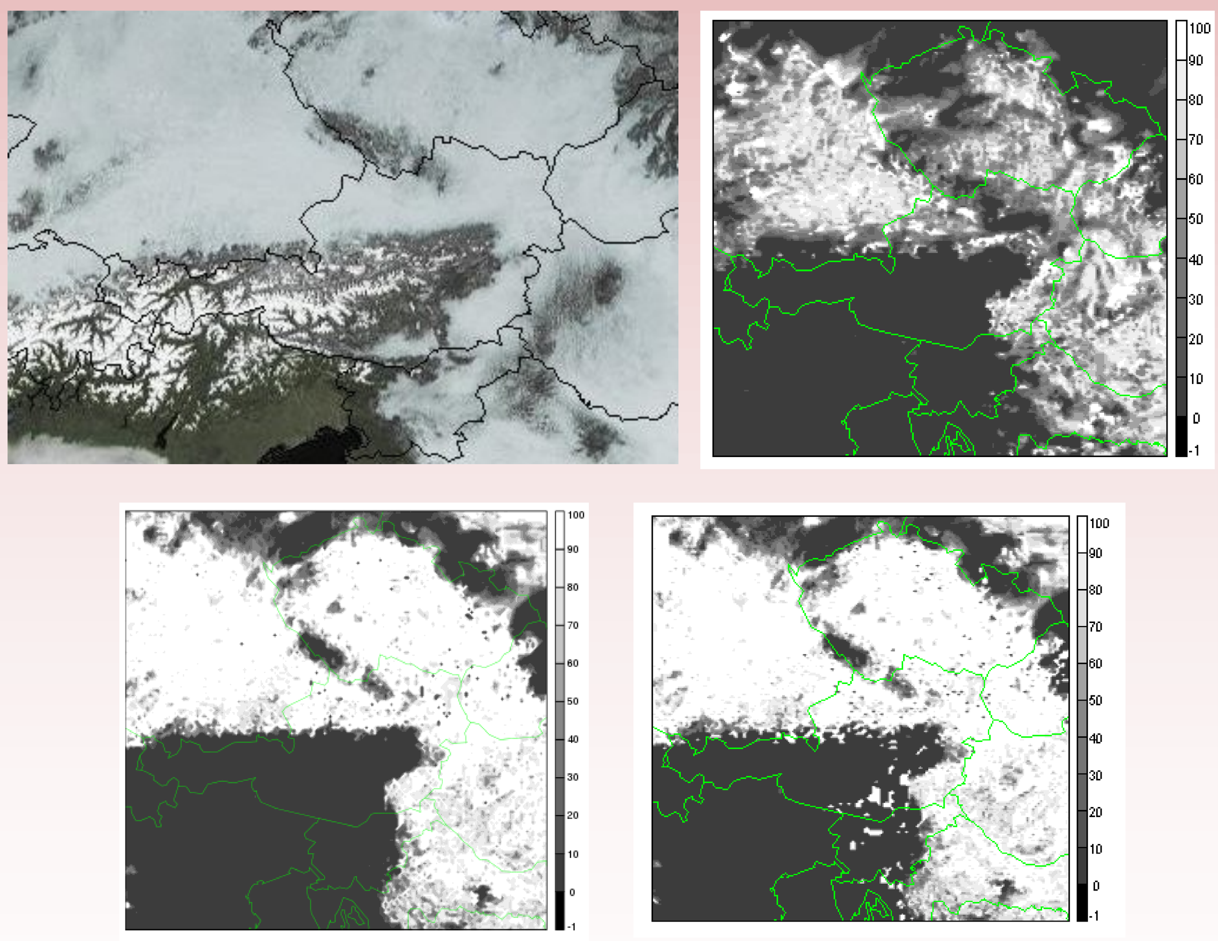

Figure 2a-d: a) Visible MSG for 20110201 12 UTC (upper left); b) ALARO5-AUSTRIA reference (upper right), c) with SK-scheme activated (bottom left); d) with revised SK-scheme (bottom right)

identify regions where the criteria used in the scheme (for inversion strength, level of saturation, etc.) have to be relaxed to allow a faster creation of inversion cloudiness.

The results with the 4.8km model and with AROME on 2.5 km show that there is still a need for empirical schemes on top of existing model physics.

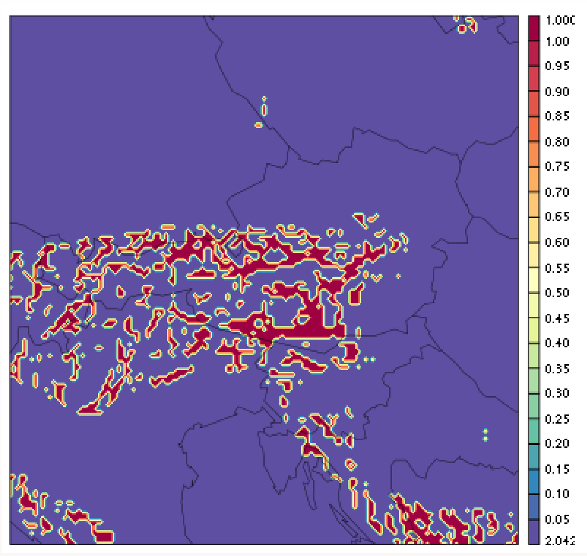

Figure 4 : Orographical mask used in the revised SK-scheme for ALARO

Evaluating different gust parameterizations for deterministic and ensemble forecast systems:

The prediction of near surface gust winds is of major interest for user of NWP forecasts. There exist various approaches to parameterize wind gusts. In order to have more options e.g. for the ALADIN-LAEF ensemble forecasting system or for the deterministic system, several approaches to compute 10m near surfaces wind gusts were implemented and tested:

-) LFACRAF (or v00 in Figure 2): Operational gust parameterization in ALARO5-AUSTRIA (FACRAF=15.0)
-) LRAFBRA (v09, v08): Brasseur-Method (3D TKE based approach following Brasseur, 2001)
-) LRAFTKE or (v07): AROME-Method (TKE based, HTKERAF=20, FAC RAF=3.5)
-) LRAFSC or (v05): TKE based method following Schreur and Geertsema 2009
-) variations of LFACRAF (v02 and v06) using different values for FACRAF (=10 and =5)

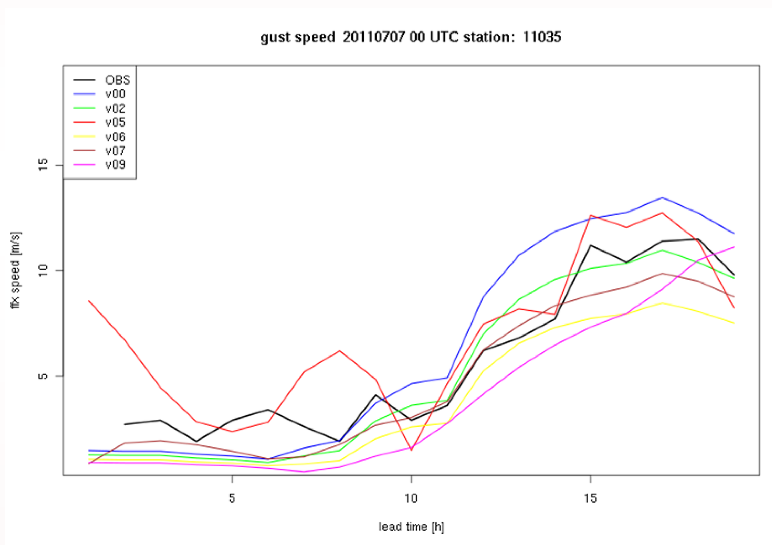

Figure 3: Gust speed forecast and observation (black) line for Vienna (11035) using different parameterization options (see text for further details); "not convective case"

Up to now some case studies were run to examine the characteristics of the various parameterizations. It was found that compared to the operational LFACRAF version, TKE based methods like LRAFBRA and LRAFTKE tend to produce slightly smoother fields over flatland areas (Figure 5a vs 5c+d). As a next step some long-term verification will be carried out to find suitable calibration factors for LRAFBRA. As TKE is an important input field, the use of TOUCANS or other TKE schemes might make it necessary to "reset" calibration work. It is planned to use the different options in the ALADIN-LAEF multi-physics scheme.

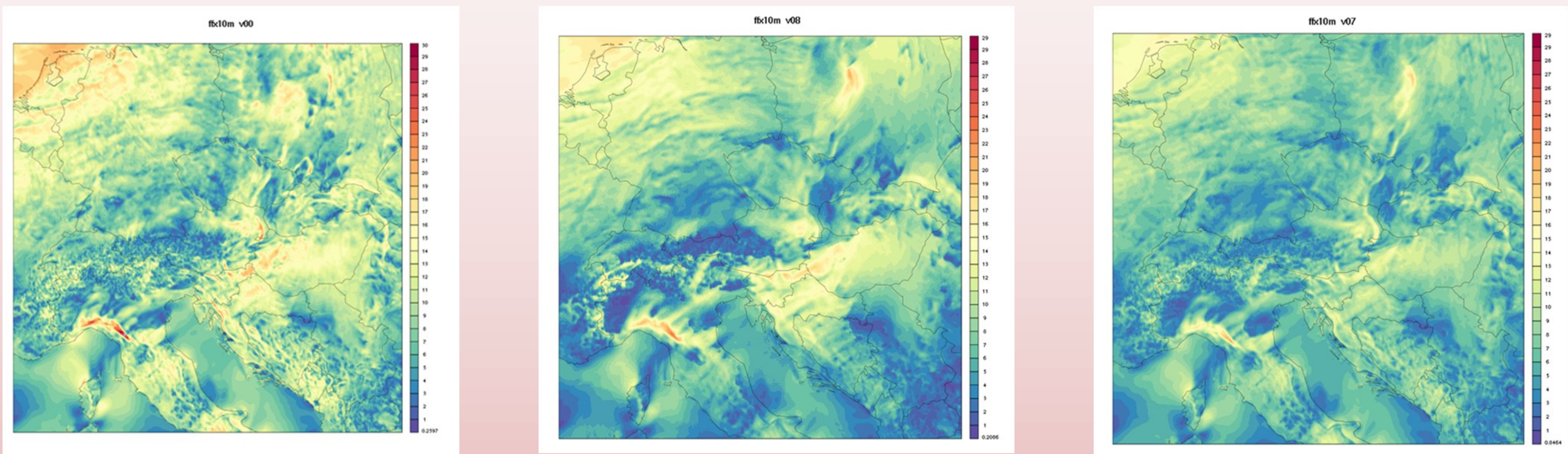

Figure 5a-c: Gust speed forecast for central Europe using 3 different gust parameterizations: a) LFACRAF (left), b) LRAFBRA (middle), c) LRAFTKE (right), "convective case" over north-eastern part of Austria

Plans for upgraded version of ALADIN-LAEF:

For the end of this year an upgrade of ALADIN-LAEF system is planned. The new version will be implemented on the new IBM Power 7 HPCF at ECMWF which will be available this summer. Computational cost at ECMWF will increase up to 20 Million SBU/per year.

New features of ALADIN-LAEF:

- Enhanced resolution of 11km in the horizontal with 45 levels
- Revised multiphysics scheme, optimized for new resolution
- Stochastic perturbation of surface fields
- Surface data assimilation with perturbed observations

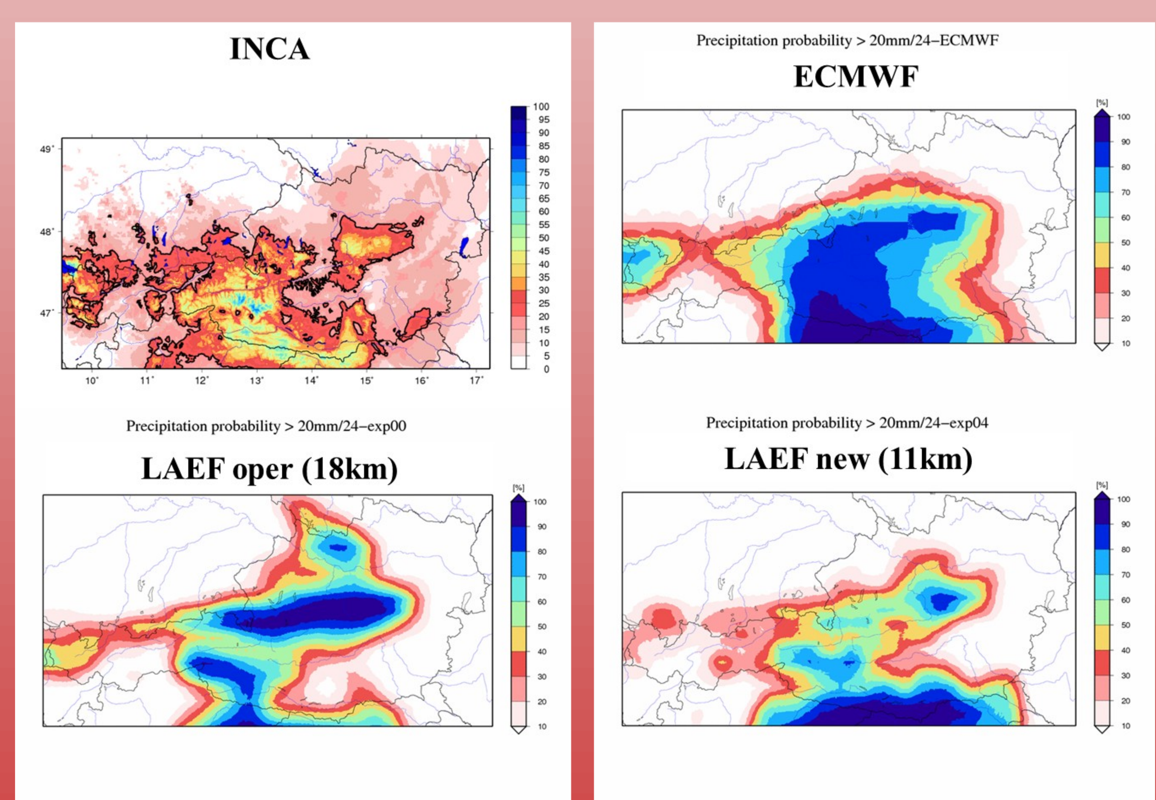

Figure 6a-d : Example of probability charts for strong precipitation event. Upper left panel: INCA analysis, upper right: Probability of precipitation > 20mm in 24h of ECMWF-EPS. Lower left panel,: LAEF operational (18km), lower right: LAEF new.

Technical details of upgraded ALADIN-LAEF:

Ensemble size:	17 (16 perturbed, 1 control)
Forecast range:	72h
LBC:	16 ECMWF-EPS members every 6 hours.
Perturbation model:	Revised Multiphysics scheme
Perturbation surface:	Non-cycling breeding-blending for surface fields. Arpege analysis will be ex changed by CANARI with perturbed observations
Perturbation upper air:	Breeding-Blending cycle (blending of small scale perturbations from ALADIN-Bred Vectors into ECMWF-EPS IC)
Availability:	By the use of time lagged coupling files ALADIN-LAEF products will be available much earlier
Archive:	Data archived in MARS

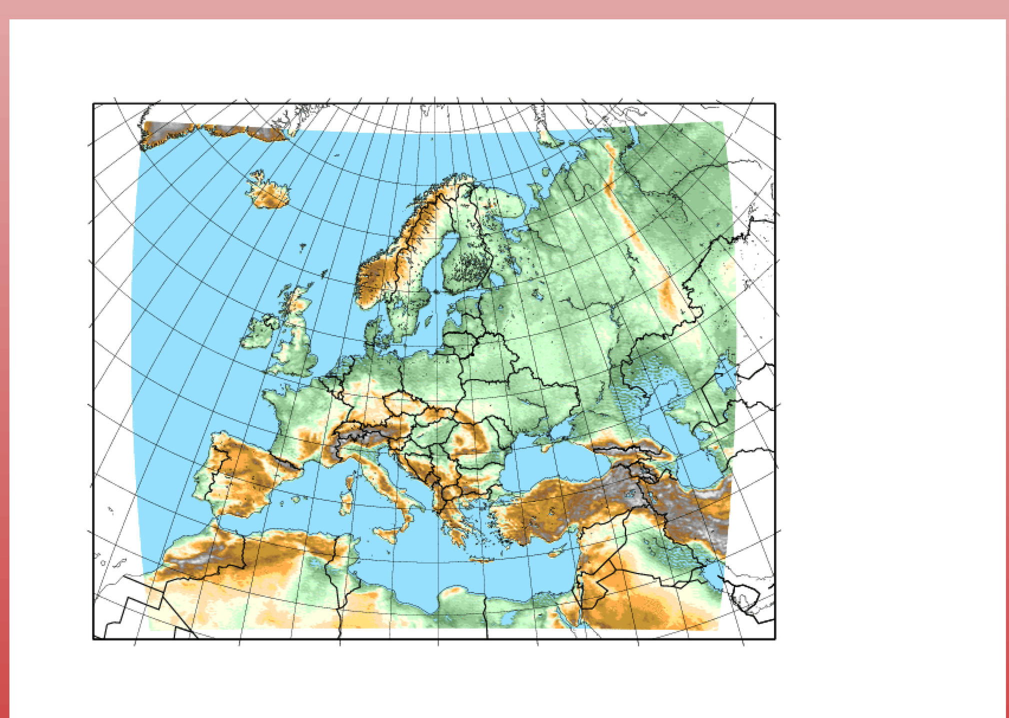

Figure 7: New ALADIN-LAEF integration domain (500x600 Grid Points)