Tour d'ALADIN

A scan of the activities in the consortium

P. Termonia

A new Doctor in Algeria: Mohamed MOKHTARI CONGATULATIONS Mohamed!

Abstract

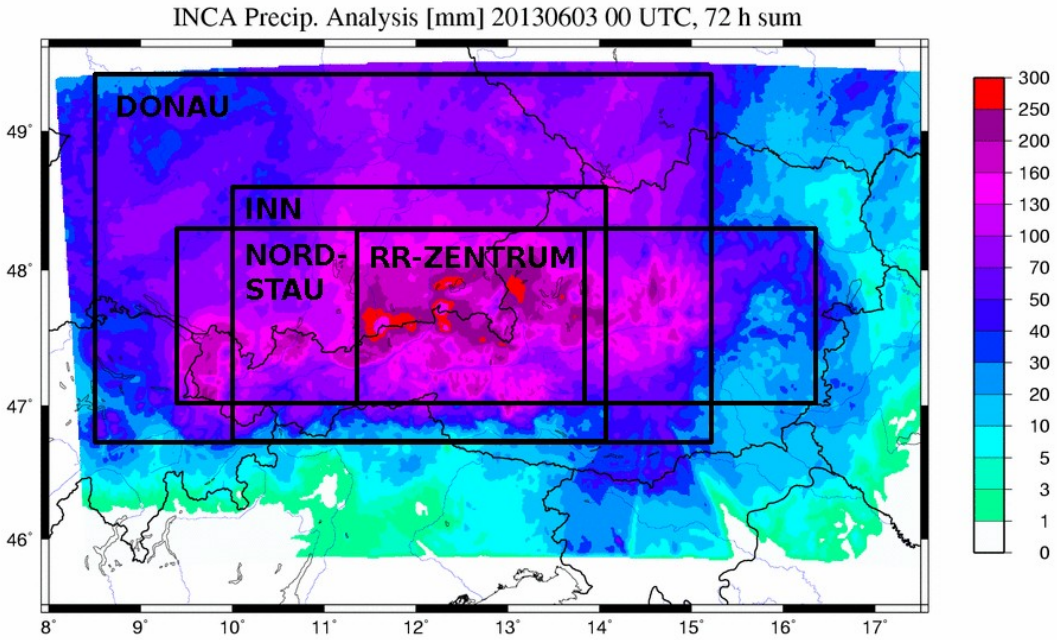
The goal of this PhD work is to improve the numerical modeling of the processes related to the onset, transport and deposition of ground-originating aerosols, namely desert sand dust. The first part of this work is to integrate a global physical parameterization of dust emissions more compatible with ECOCLIMAP and FAO databases used in the surface model SURFEX, taking into account the soil size distribution and soil texture, in order to improve the representation of surface fluxes in SURFEX. The second part is to model the transport and deposition (wet and dry) in the atmospheric model ALADIN. This should ultimately give more reliable predictions of dust concentrations, their optical properties and their feedback on the forecast weather.

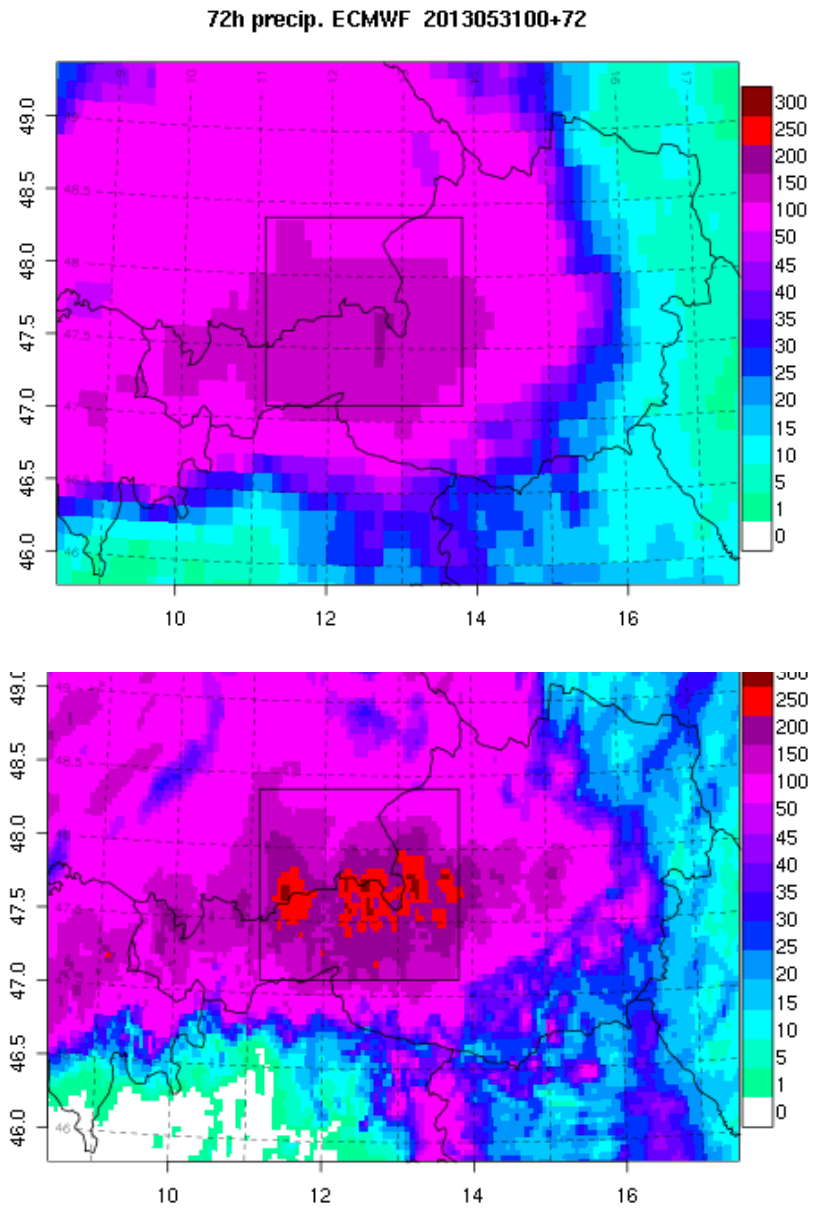
Operational tests of the CE flooing case in 2013

ALARO5-AUSTRIA
IFS / ECMWF
COSMO-EU (DWD)

31.05.2013 00 UTC
01.06.2013 00 UTC
02.06.2013 00 UTC

Operational high resolution vs. global (IFS, ECMWF)





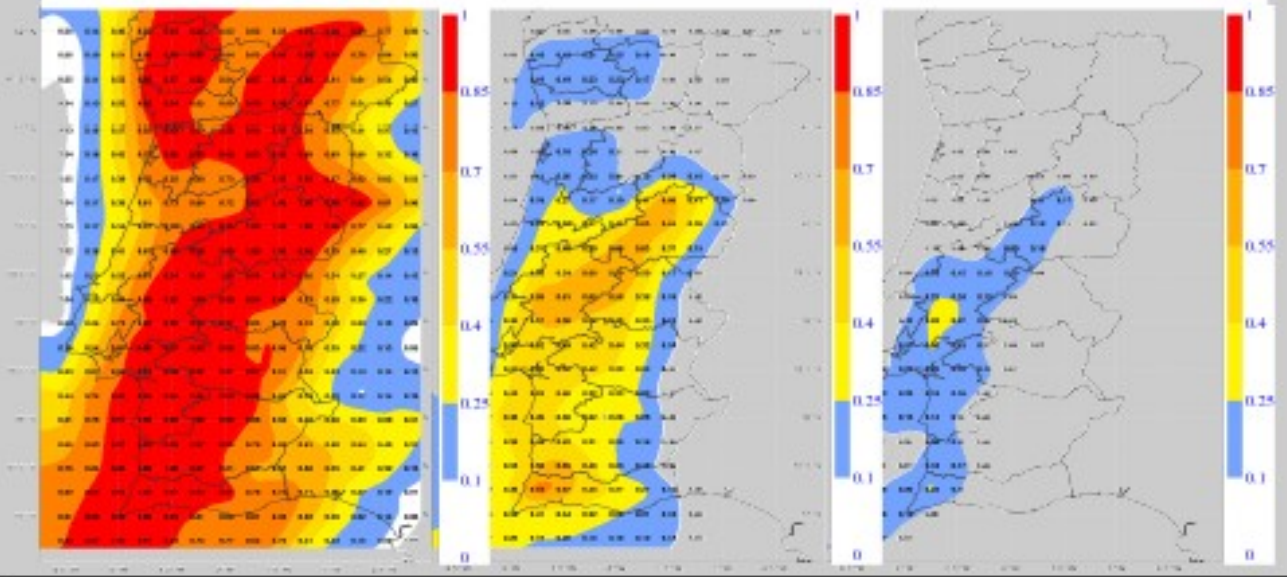
ipma

Portugal

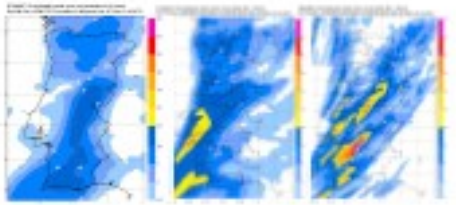
Customers/ forecasters support

NEW PRODUCT: Local Spatial Indicator of the Probability of Occurrence of Strong Events

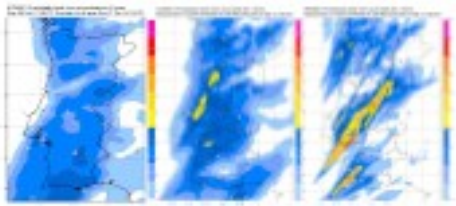
Precipitation thresholds of: 1mm/3h, 10mm/3h and 20 mm/3h
2013.09.27 at 12UTC



3h accumulated precipitation forecast at 12UTC for 2013.09.27. Models: ECMWF, ALADIN, AROME

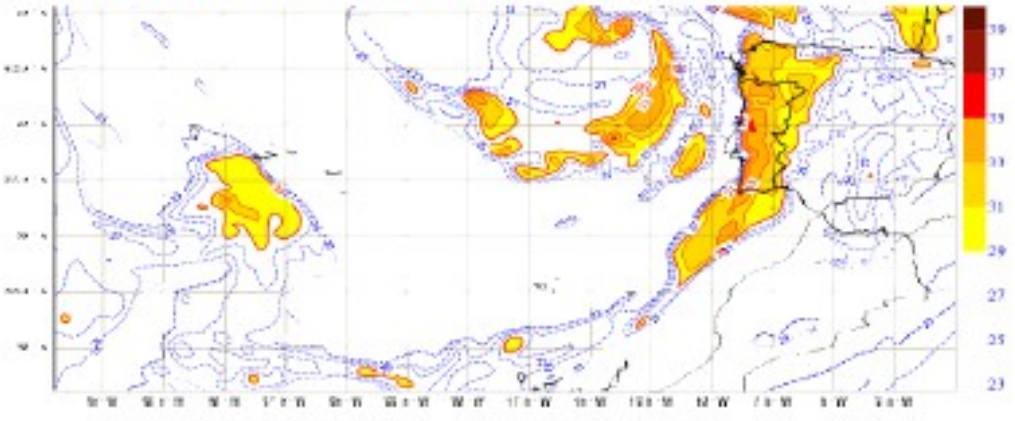


H+36



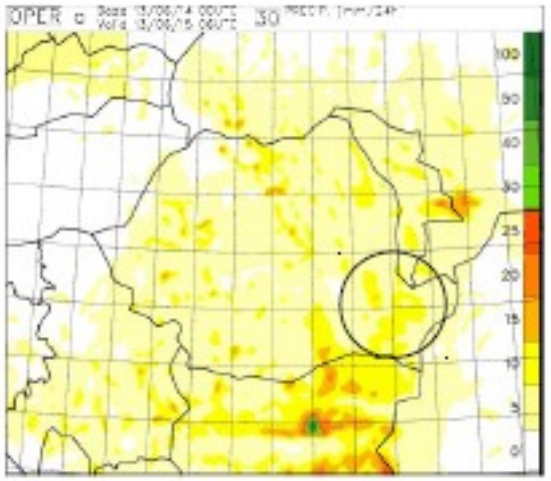
H+48

ALADIN: Jefferson stability index (ºC) 2013.09.27 at 12 UTC

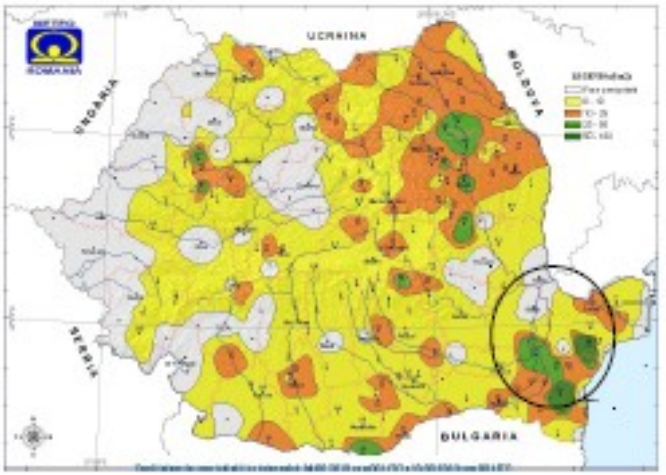


June 14, 2013

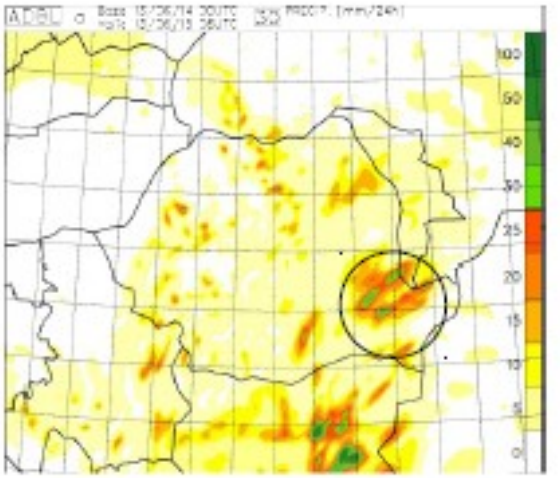
24 h cumulated precipitation



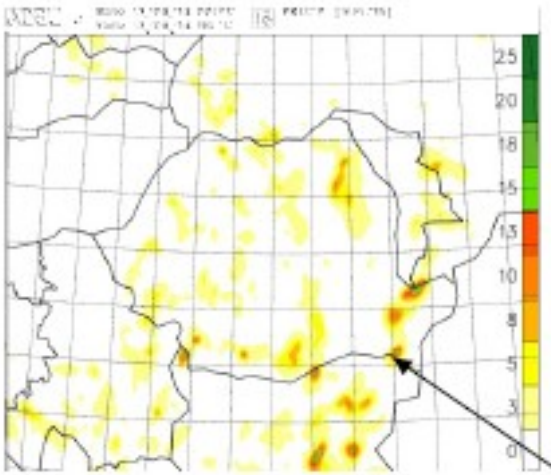
Alaro-operational



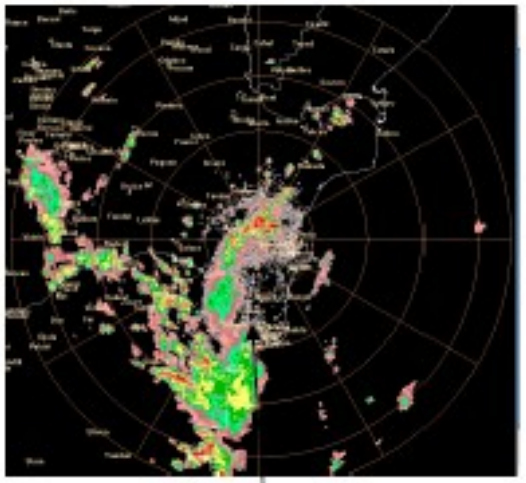
Observations



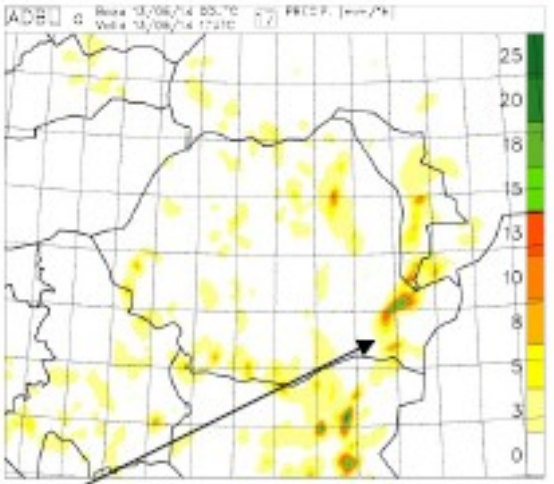
Alaro-0 baseline
future opertional configuration



1h precip. 15-16 UTC



reflectivity 14:37 UTC



1h precip. 16-17 UTC

Convective line

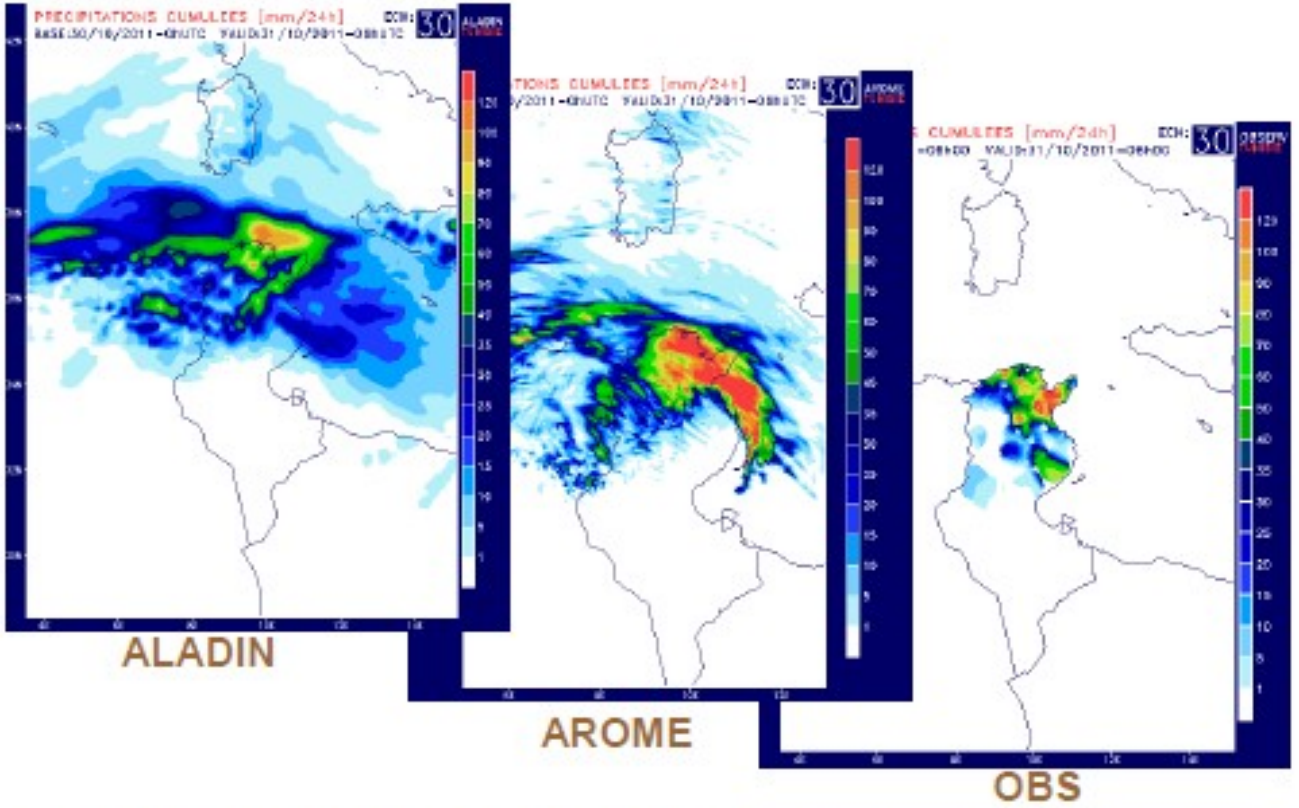
National Institute of Meteorology, Tunisia

AROME prototype of Tunisia

18th GA, Tunis 14-15/11/2013

INM

Case of Octobre 30th, 2011



- ALADIN provides a cumulative rain over 24 hours not exceeding 60 mm in the north and center of Tunisia.
- AROME triggers a core of rain centered on the north-east of Tunisia, with an intense rainfall exceeding 120mm. Which is closer to the observations.

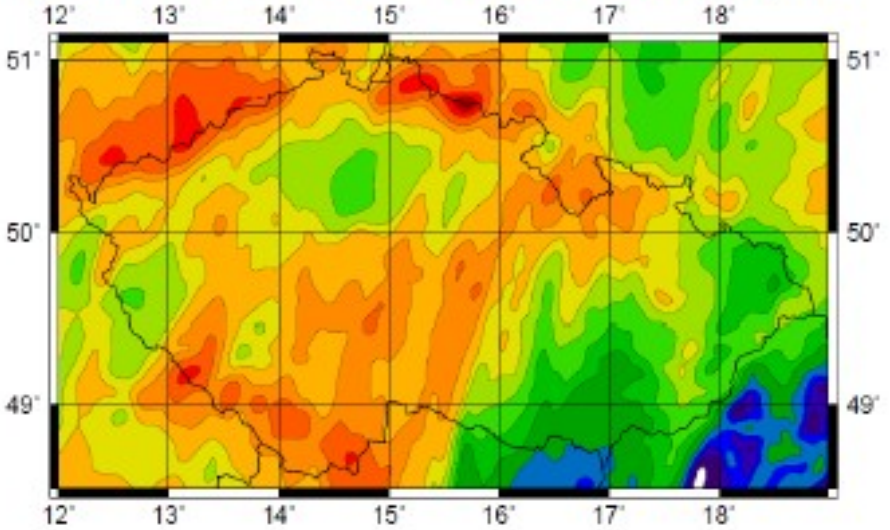
R.BEN ROMDHANE

Going to the convection-permitting resolutions pays off in several cases,

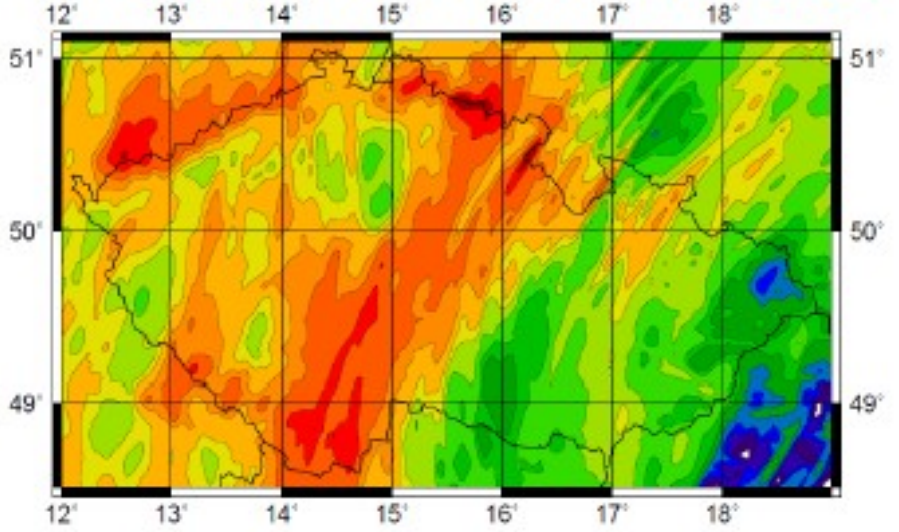
Even more, we can adapt our code and make it tailor made; 2 examples

Floods June 2013 – 24h precipitation amounts from 06 UTC June 1 to 06 UTC June 2

Operational model forecast **P24h**, 4,7km

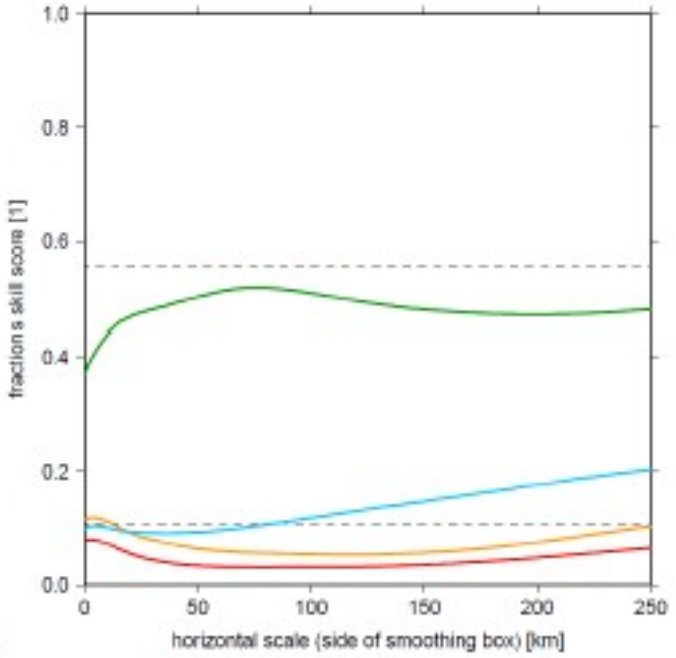


Run at 2,2km from 4,7km analysis, **P24h**

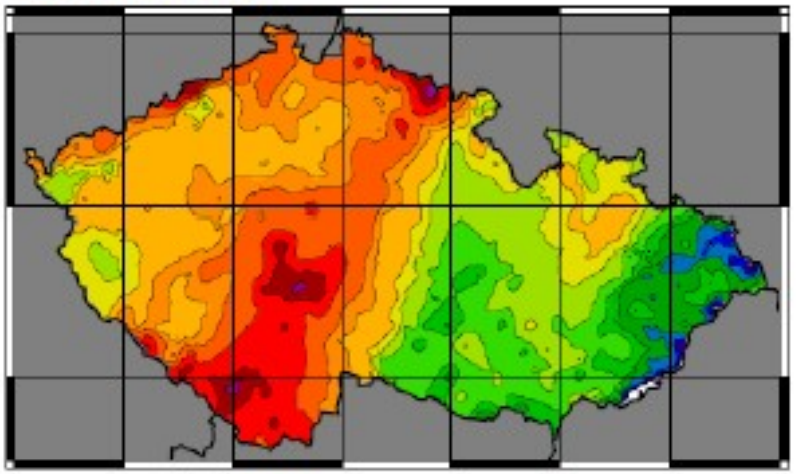


Fractions skill score for **RR>60mm/24h**

- ALADIN 4,7km
- ALADIN 2,2km global analysis
- ALADIN 2,2km 4,7km analysis
- ALADIN 2,2km 4,7km analysis, no convection parameterization



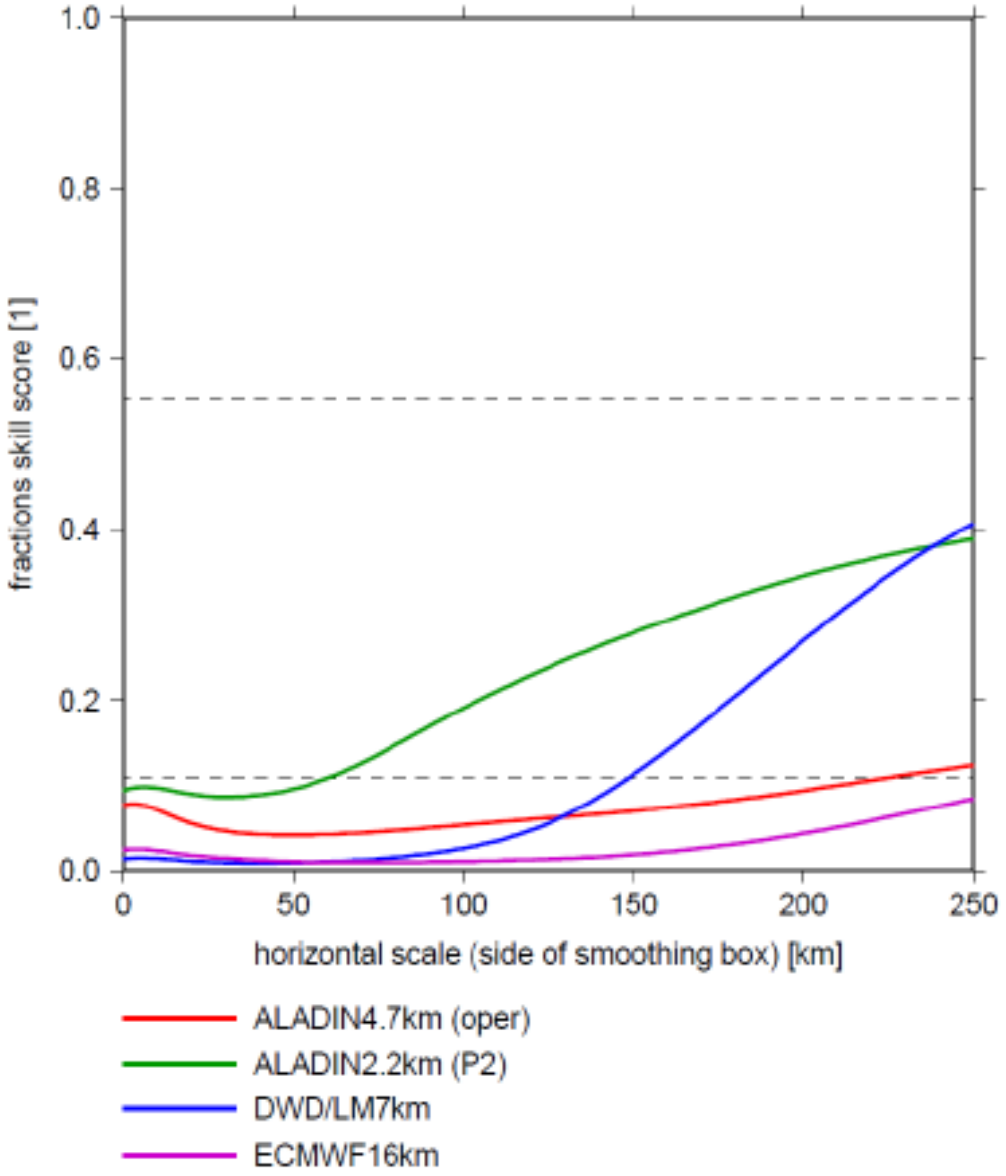
observations



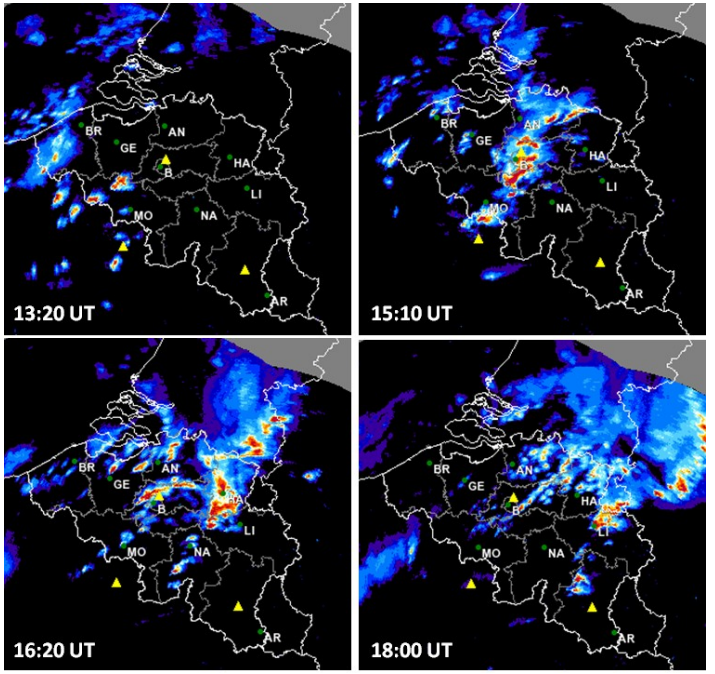
Floods June 2013 – 24h precipitation amounts from 06 UTC June 1 to 06 UTC June 2

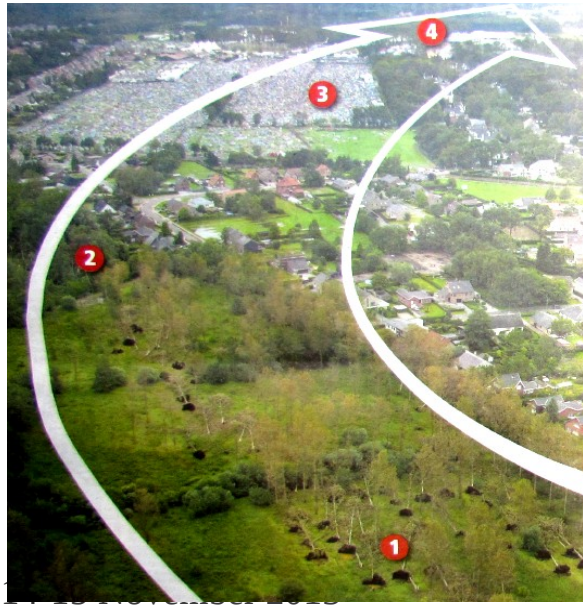
Fractions skill score
for **RR>60mm/24h**

Lead time +30h



The Pukkelpop festival, Belgium





Source: "*Het belang van Limburg*"

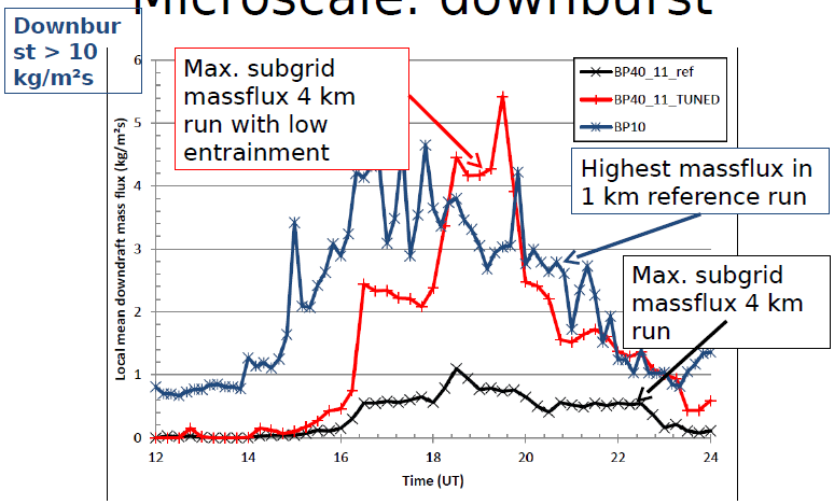
Downburst ~ 100 m

Operational NWP model RMI: 4 km

- **Predictability of Pukkelpopstorm at 4 km resolution?**
- **What is the "truth"?**

Reference run at 1 km (taken at the limit of current operational computational resources)

Microscale: downburst

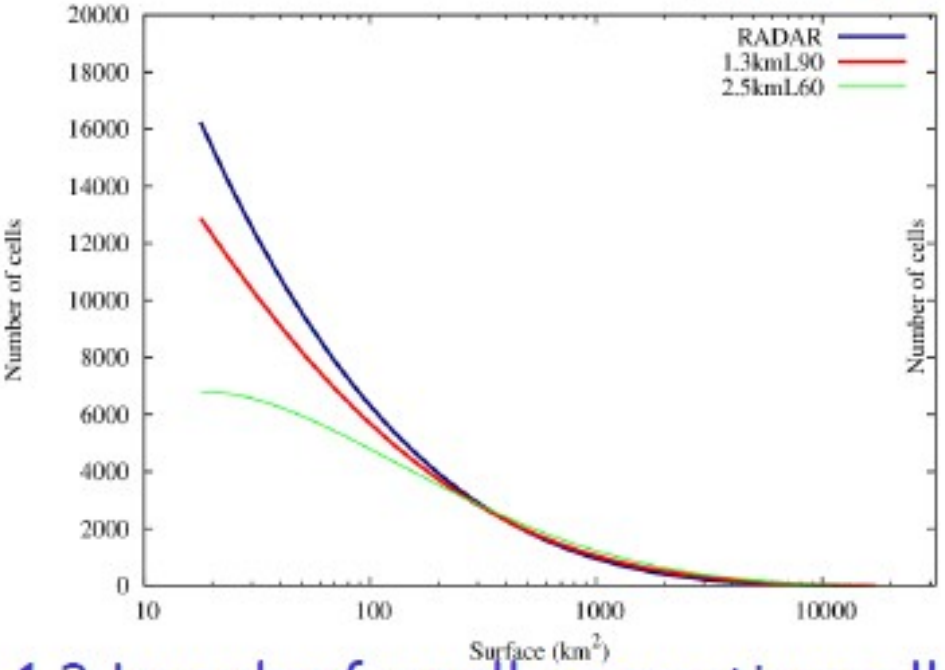


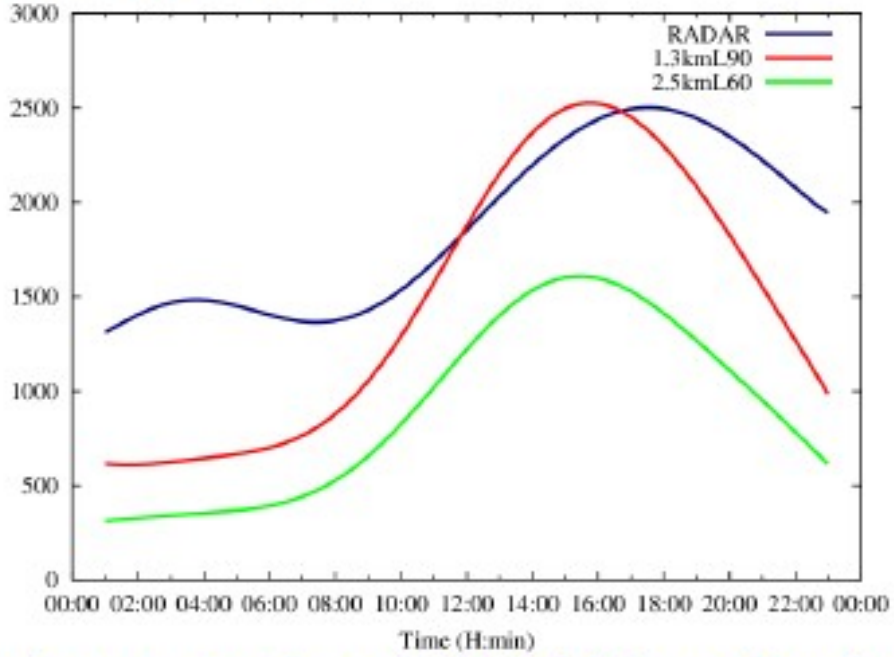
… and prepare for even higher resolutions ...

Automatic detection of convective cells

NWC SAF "RDT" software (Morel et al., 2002) to detect convective cells based on simulated reflectivity. Threshold used at 40 dBz.

48 convective days in 2012





1.3 km: nb of small convective cells increased and nb of big cells decreased

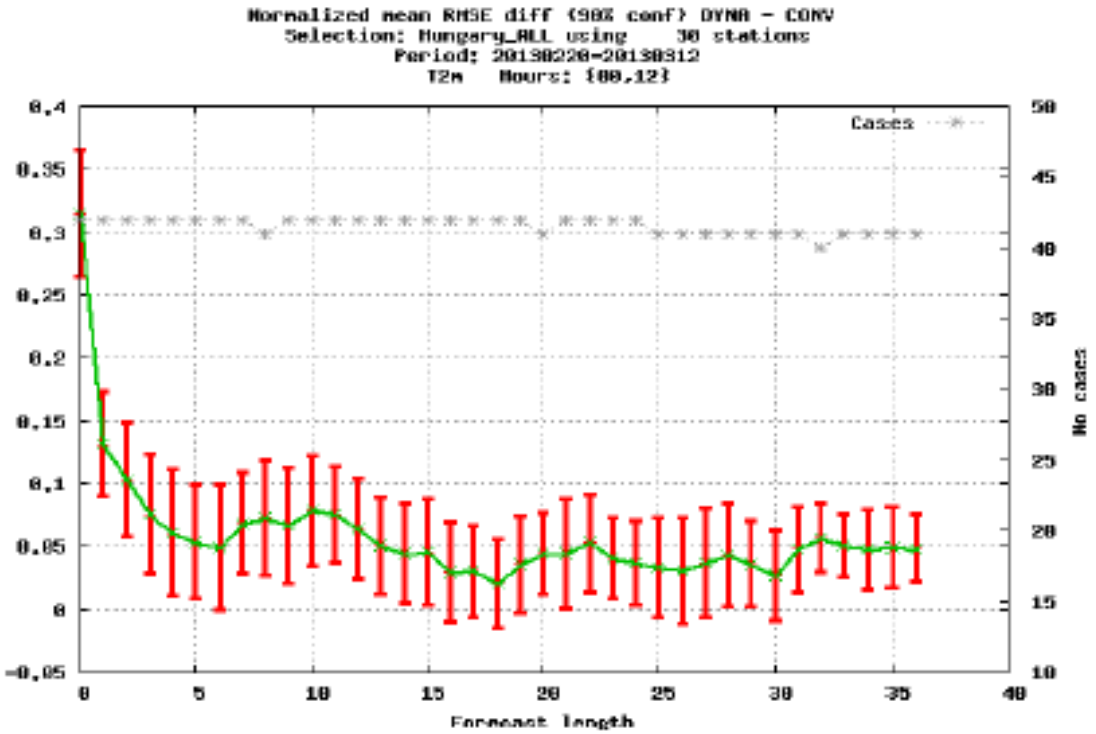
1.3 km: closer to observed radar reflectivity

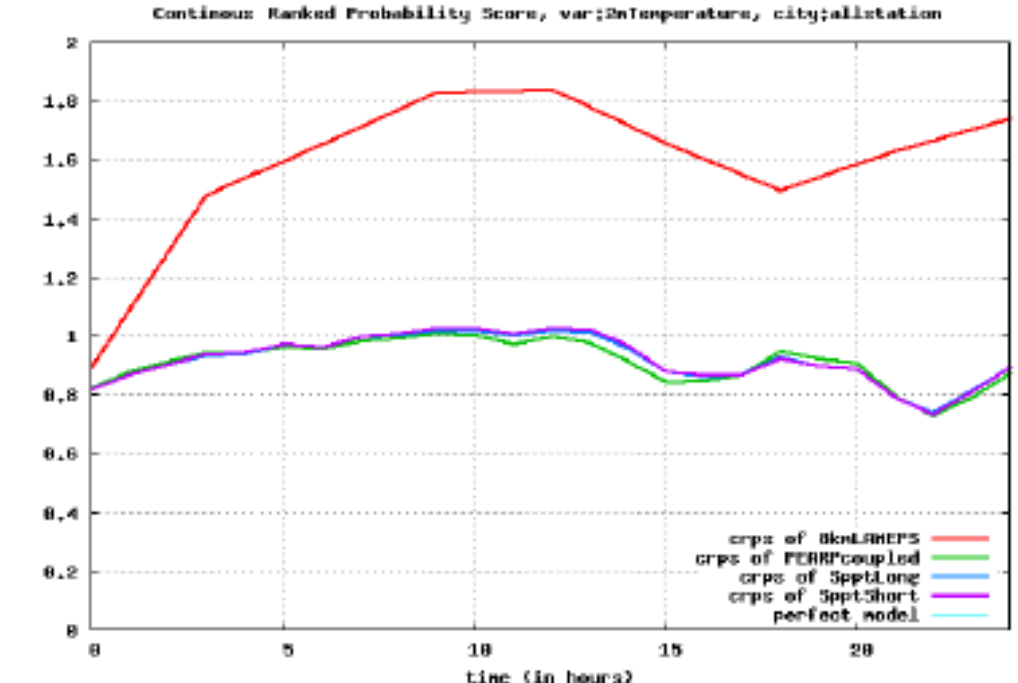
(J. Léger, D. Ricard, Y. Seity)

METEO FRANCE
Toujours un temps d'avance

Data assimilation and preparation of assimilation of high-resolution data

Hungary





Local 3DVAR data assimilation in AROME:

- Operational implementation in March 2013 (before AROME was initialized from interpolated ALADIN 3DVAR analyes)
- Significant improvement in short range forecasts (see an example on the left for 2m temperature, CONV: 3DVAR, DYNA: previous operational)
- Windpower and windspeed estimation for power-plants based upon AROME
- Radar data assimilation under development

Experimental AROME EPS system:

- CPU resources based on an ECMWF Special Project (in partnership with Meteo France)
- AROME EPS coupled to PEARP, attempts to represent LAM model uncertainty (SPPT), attempts to represent initial uncertainty (EDA)
- AROME EPS improves the probabilistic forecasts compared to the operational ALADIN EPS (see an exapmple of CRPS on the left for 2m temperature, Red: ALADIN EPS, Green: AROME EPS)

GPS data Assimilation In ALADIN-MAROC

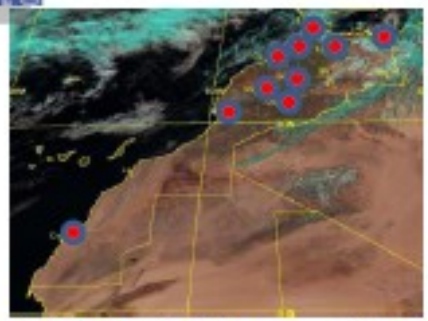


Figure 1: Network of Moroccan GPS stations

- Meteorological service of Morocco have installed a network of 10 GPS stations serving weather needs.
- Data from these stations are processed locally using the BERNESE software to calculate ZTD (Zenith Total Dealy).

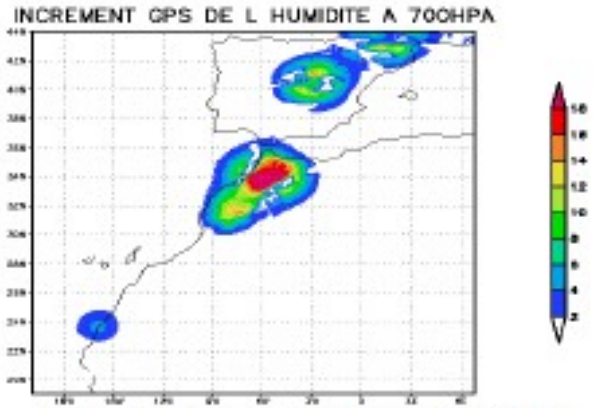


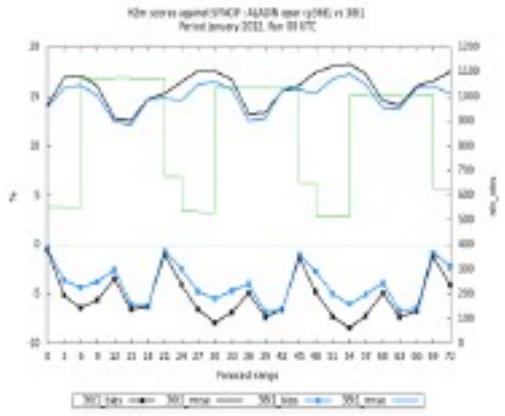
Figure 2: Increments of humidity 700hpa for 28/03/2013 at 00 UTC

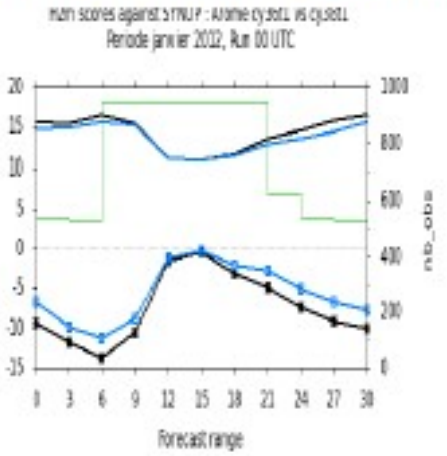
the impact of GPS Zenith Total Delay (ZTD) measurements on mesoscale weather forecasts is studied. GPS observations from a permanent Moroccan network are assimilated into the ALADIN-MAROC using its three-dimensional variational assimilation (3DVAR) system.

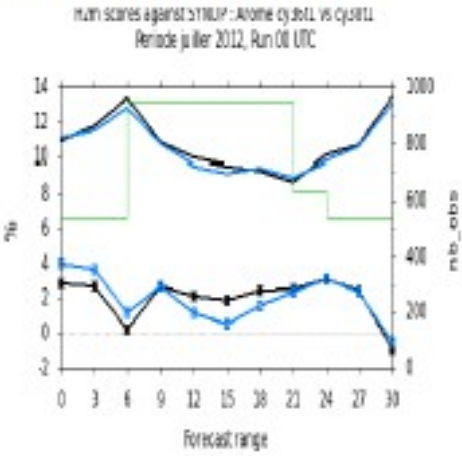
The impact is significant concerning relative humidity on several vertical levels (Figure 2)

Installation of cy38t1 in Morocco

Comparison between cy38t1 and Cy36t1 for ALADIN- MAROC and AROME-MAROC







Slovenia

Operational

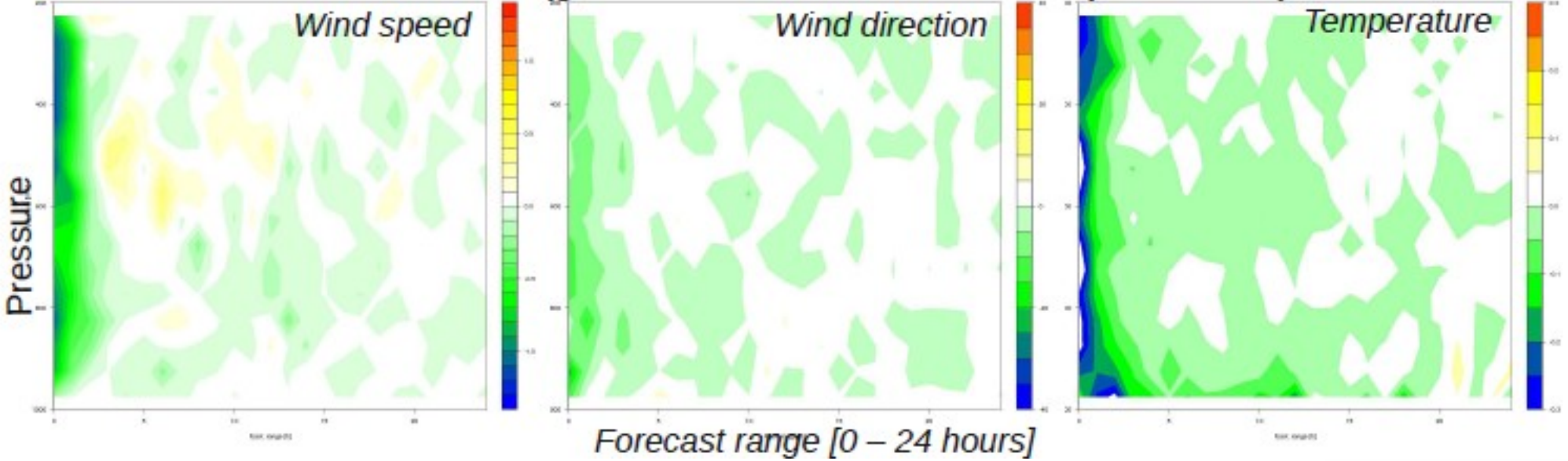
- **New HPC**: SGI ICE X (992 compute cores).
- Migration and **upgrade of the operational suites** in progress (**3-hourly analysis&forecast**, improved vertical resolution).

Research and development

Assimilation of Mode-S MRAR (Meteorological Routine Air Report)

- Direct wind and temperature observations collected at Ljubljana airport.
- Good quality with respect to AMDAR and radiosondes.
- Impact in 3-hourly data assimilation setup (2 months) shows **systematically positive impact in the nowcasting range**: wind till around T+3 hours and temperature up to T+4 (free atmosphere) and up to T+12 hours (near the surface).
- Currently only 5% of all aircraft provide observations (data from Airbus and Boeing missing !).

RMSE reduction (green and blue colors indicate improvements)

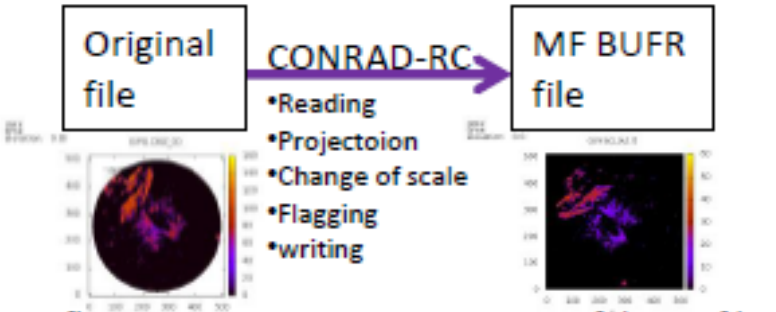


Radar data assimilation in Croatia.

The first step when applying radar data assimilation in ALADIN is to convert data into MF BUFR format.

We developed CONRAD –RC

- Software for conversion of radar data from any format ot MF BUFR format.
- CONRAD core library, developed in Norway, provides writting of data in MF BUFR.
- CONRD-RC provides an easy way to develope reading of radar data given in any format.
- Adding new format shouldn't take more than one week.
- CONRAD-RC is tested on Austrian, Croatian, Portuguese and Slovenian data.
- CONRAD-RC is available from HIRLAM repository.
- Plan: to add OPERA's ODIM HDF-5 format.



Reflectivity image. Image of data in file.

Testing radar data assimilation for ALARO

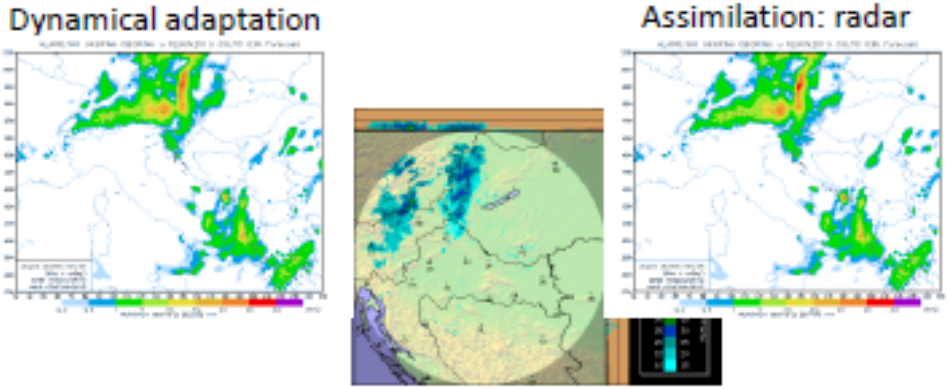
•**Model**: 8 km, 37 levels, hydrostatic, ALARO physics

• Assimilation of radar data is technicaly correct . Cycling over two weeks period was successful.

•Validation on two week period has started.

•Radar reflectivity and radial wind were assimilated.

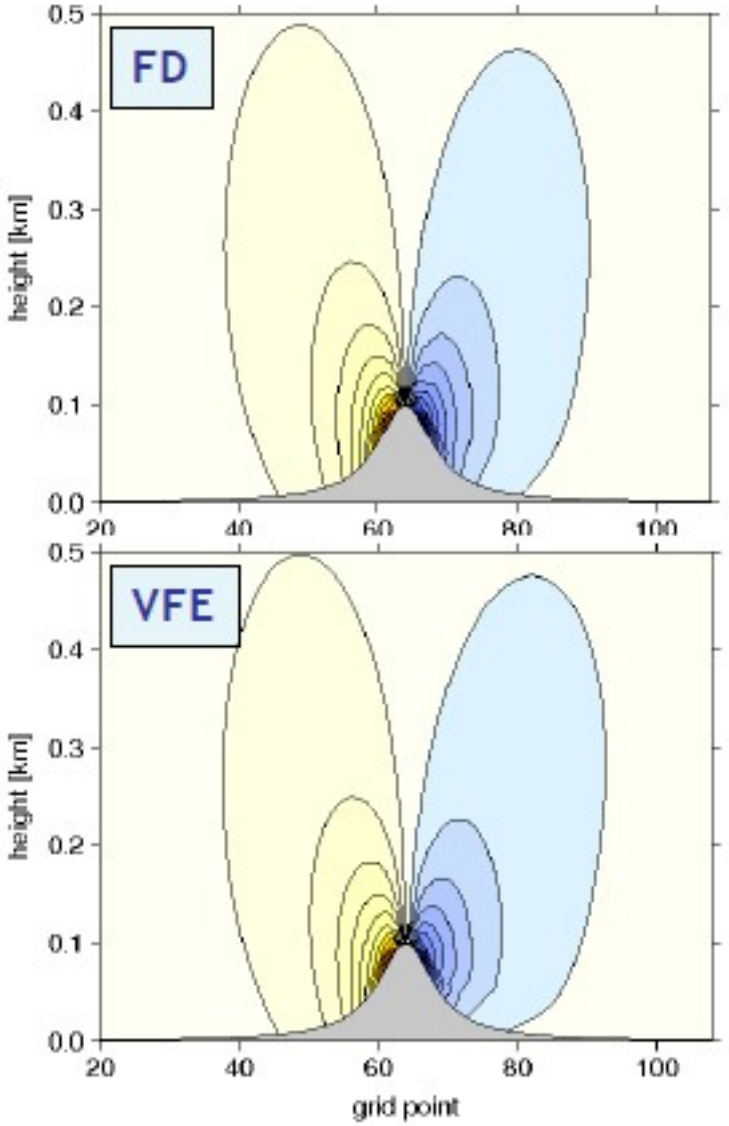
Accumulatd precipitation. Forecast: +3H.



Radar reflectivity.

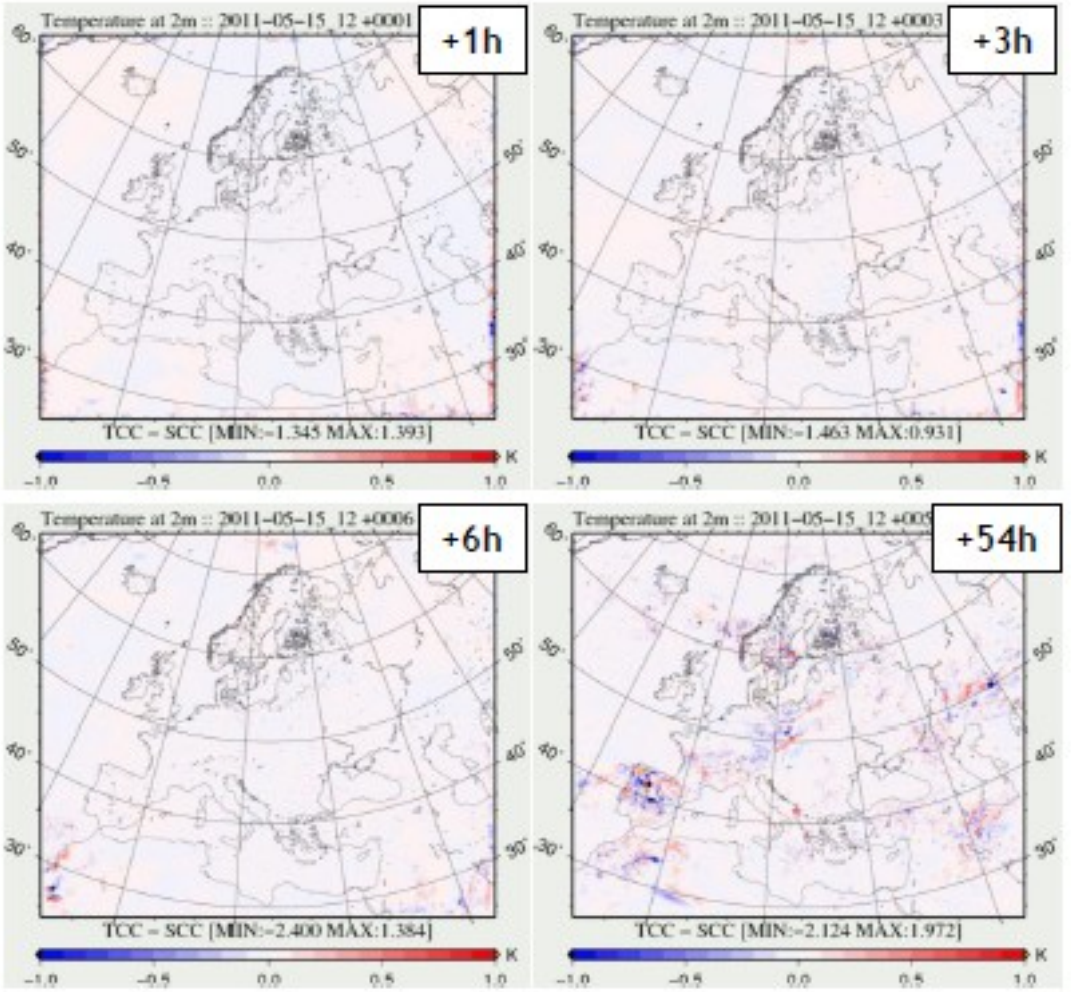
Finite element vertical discretization for ALADIN non-hydrostatic dynamics (J. Vivoda, P. Smolikova@CHMI)

Example of idealized Straka test (potential flow: Θ after 500s): satisfactory accuracy & stability properties. 3D real test also OK (not shown).



LAEF: Experiments with different coupling strategies for initial state (M.Bellus)

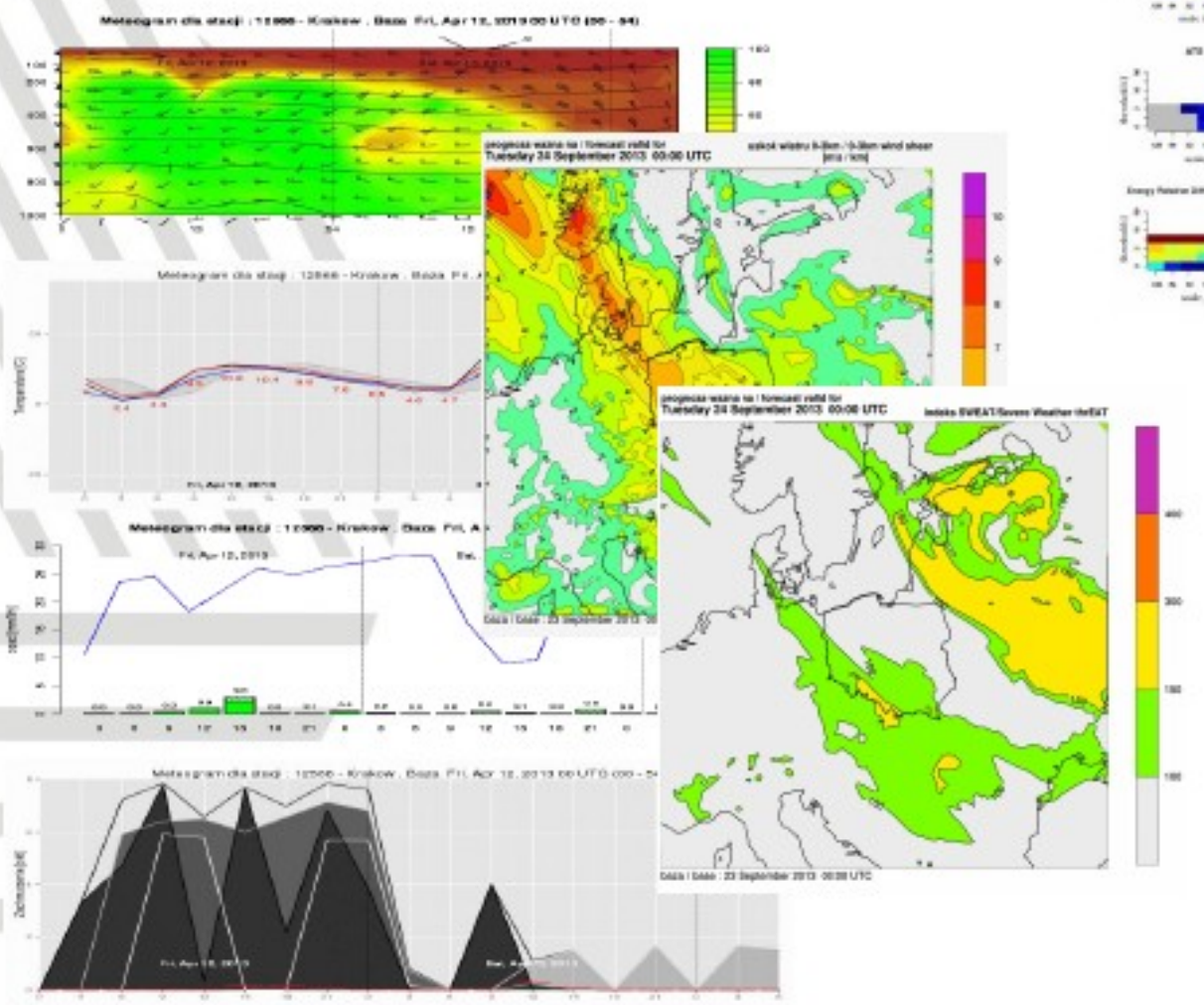
2m T differences between time consistent & space consistent coupling setup: signal propagates from the boundaries inside the domain with bigger amplitudes in weather-active areas; neutral wrt verification scores => possibility to create targeted LAM perturbations?

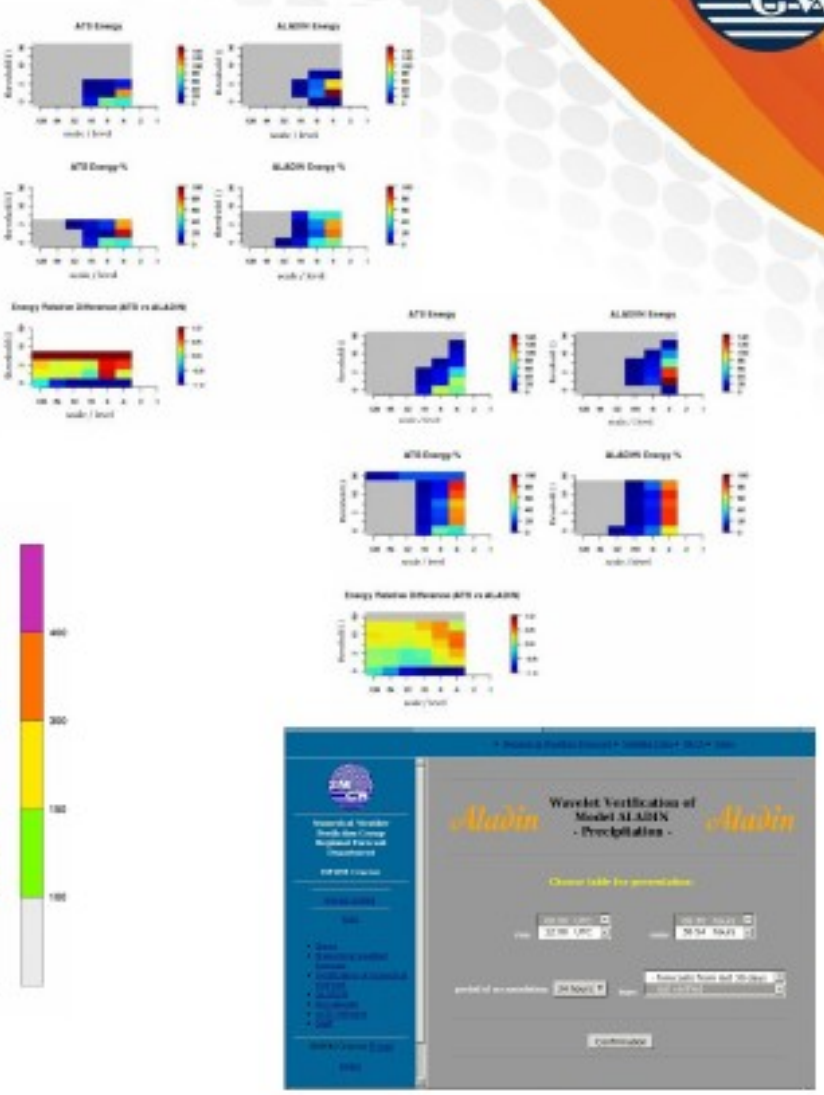


Verification, validation and code work

Instytut Meteorologii i Gospodarki Wodnej

Państwowy Instytut Badawczy





At IMWM activities were mainly focused in 2013 on preparation of wide palette of new visualization products, development of operational, wavelet-based verification system and testing of new computational cluster

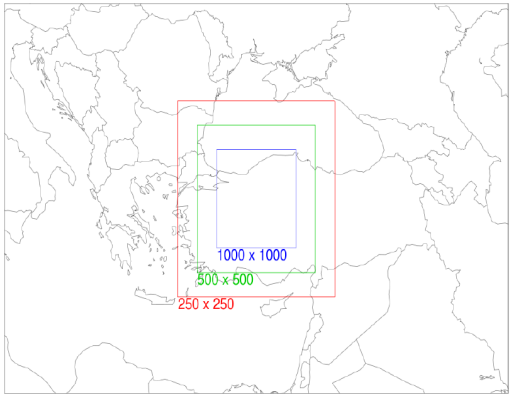
POGODYNKA.PL

TSMS

PREP and PGD optimization in terms of NWP

• Using PREP to interpolate from operational Turkish domain (709 x 439) to domains of different dimensions

- Oper@4.5km
- 250@4km
- 500@1.5km
- 1000@0.5km
- 1500@0.5km

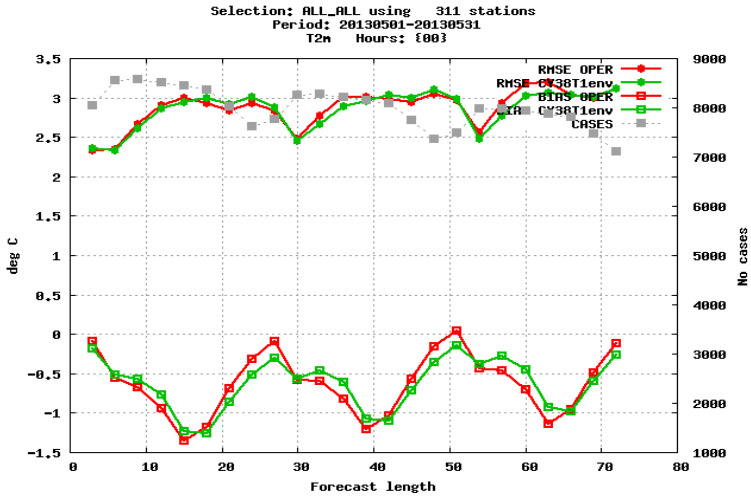


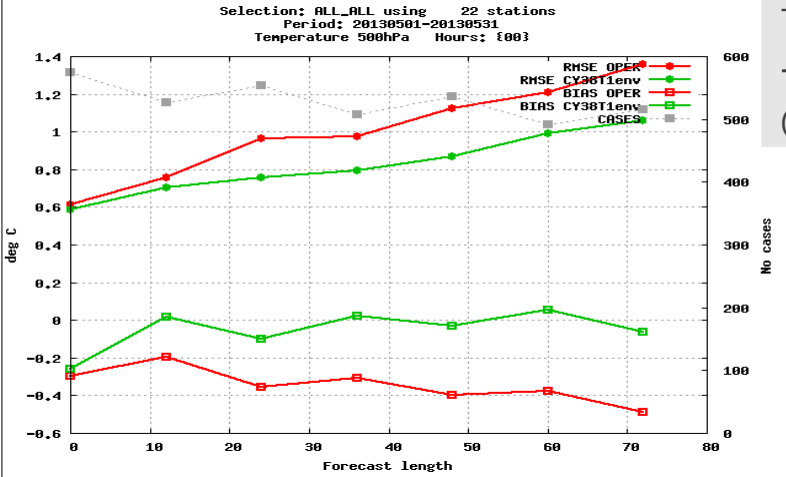
*** 1500 domain coincides with 500 domain

Creating PGD files for large domains (e.g. 2000 x 2000) were problematic especially in terms of memory consumption.

Cpu optimization is manly done by looping on existing covers and replacing the loop over the vegetation types (12) by a loop over the patch types (1). This is also reduce the memory consumption.

Compilation of the export version (38T1bf3) versus current operational model by using Harmonie tools





Current operational suite:

Model version: cy36T1

ALARO-0 with 3MT

- 4.5 km horizontal resolution
- 60 vertical model levels
- Digital filter initialization
- ARPEGE LBC
- hydrostatic

(38T1bf3 is non-hydrostatic)

ALADIN

A number of conclusions

- Extra skill w.r.t. ECMWF in the convection-permitting resolutions, shown three examples
  - CE flooding,
  - Portugal, and even
  - Tunesia.
- Extra “control” to handle our “own” parameterizations; e.g. ALARO for the CE flooding case, the unsaturated downdrafts scheme to get more useful “downdrafts” for the Pukkelpop case.
- Some potential was shown for going to 1-km resolution.
- We are preparing for convection-permitting EPS (prototype building).
- Data assimilation in several (even “small”) countries (examples of Hu and Hr), even GPS in Morocco!
- Introduction of more fancy verification tools …
- Code work.