5.3 Verification

P. Termonia

After the 2011 Brussels Strategy meeting, the issue of our end users, became one of the five points of attention. Since then, the problem of the end users has been approached in a threefold way:

develop common tools for verification and validation, and an effort was made to do this as much as possible together with HIRLAM;	Upper air verification included, reported here
perform an end user inquiry among the ALADIN partners;	There was an inquiry carried out to the partners (courtesy J. Rio of IPMA) to make a list of end user needs per sector. It has been mentioned during the 2013 General Assembly meeting that this is a multifaceted issue. And it turns out to be very difficult to draw practical conclusions from this regarding the priorities of the scientific program.
organize a **forecasters meeting** and identify illustrative cases to build a **portfolio**.	A Forecasters meeting was organized this year by our Turkish colleagues, in Ankara

Common verification/validation tools

	Compute scores on the fly	Monitoring of the applications in the countries	Validation of new cycles	Science verification	Verify fields or pointwise
ALADIN Performance Monitoring Tool in Ljubljana (APMT)	yes	yes	no	no	pointwise (station data)
HARP	yes	yes (through APMT)	no	yes	both
HIRLAM verification tool: The HARMONIE system	no	no	yes	yes	pointwise

Quality monitoring of the operational runs
By means of the
ALADIN Performance Monitoring Tool (APMT)

Running in Ljubjana

Monthly Reports

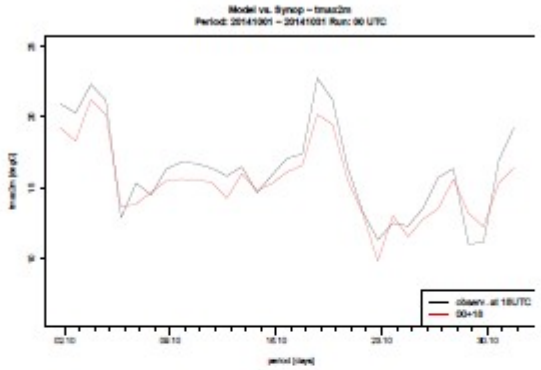
2 December 2014

The APMT aka the “woken beauty”

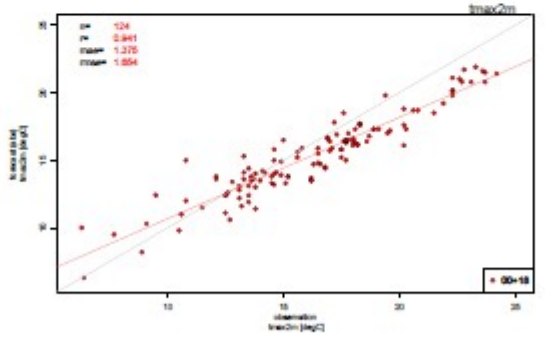
- Monthly reports are now being created (Courtesy J. Woyciechowska and N. Pristov)
- Results currently archived for: Austria, Belgium, Croatia, Czech Republic, Poland, Slovakia, Slovenia, Turkey
- For the screen-level observations since November 2013 to October 2014
- Upper air verification since October 2014

Examples

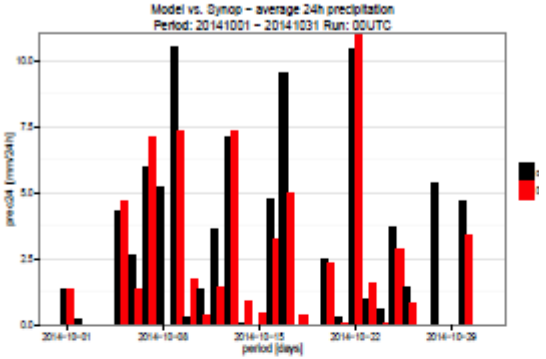
Maximum air temperature at 2m (mean ratios of station



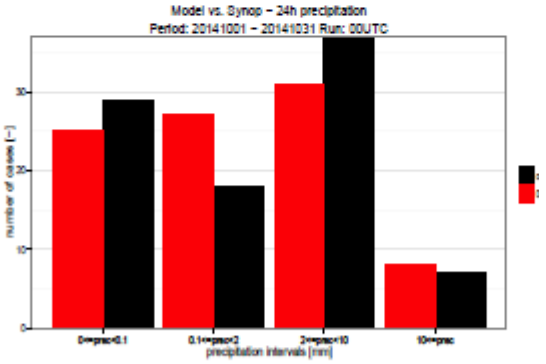
Maximum air temperature at 2m (all stations data)



24hour precipitation (mean ratios of stations



24hour precipitation (all stations data)



24hour precipitation (all ranges, all stations data)

number of cases in particular ranges of precipitation [mm/24h]

mod\obs	0<=prec<0.1	0.1<=prec<2	2<=prec<10	10<=prec	sum fc
0<=prec<0.1	19	4	1	1	25
0.1<=prec<2	8	9	10	0	27
2<=prec<10	2	5	24	0	31
10<=prec	0	0	2	6	8
sum obs	29	18	37	7	91

24hour precipitation (all ranges, all stations data)

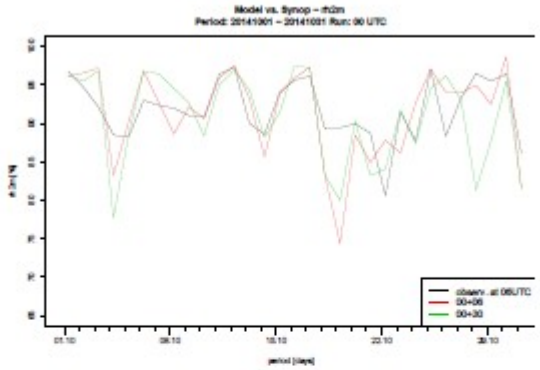
scores for particular ranges of precipitation [mm/24h]

range\score	BIAS	POD	FAR
0<=prec<0.1	0.862	0.655	0.24
0.1<=prec<2	1.5	0.5	0.667
2<=prec<10	0.838	0.649	0.226
10<=prec	1.143	0.857	0.25

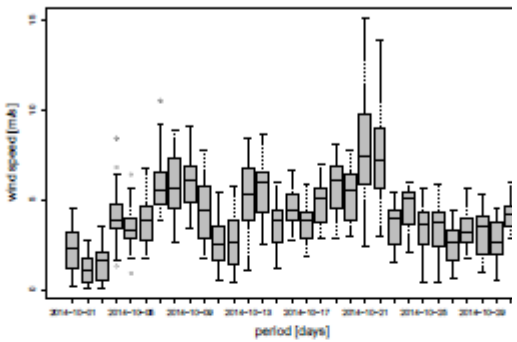
events number: 91 PC=0.637

Examples (II)

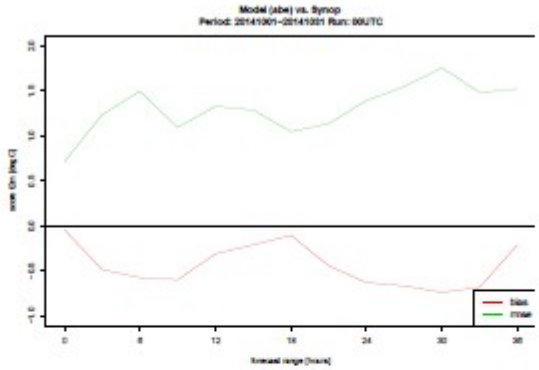
Air relative humidity at 2m at 06UTC (mean ratios of station



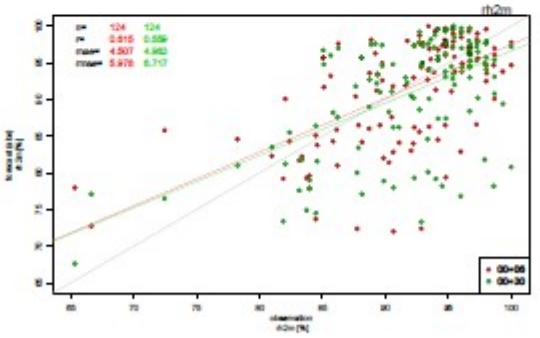
Boxplots of distribution of wind speed at 10m (all ranges, a



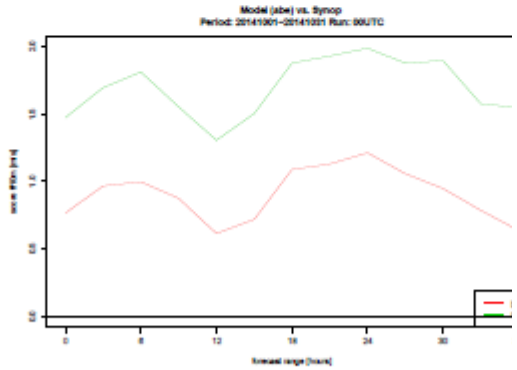
Scores for air temperature at 2m (all ranges, all stations dat



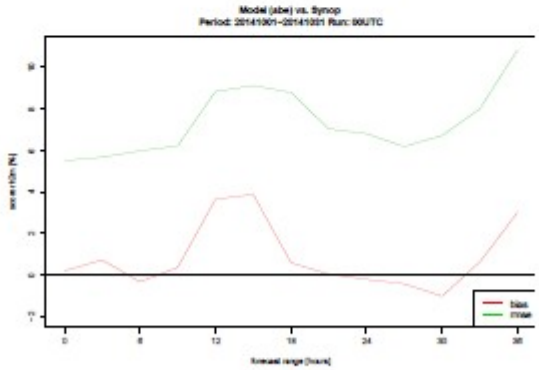
Air relative humidity at 2m at 06UTC (all stations data)



Scores for wind speed at 10m (all ranges, all statio

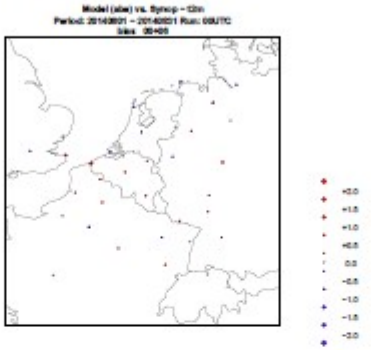


Scores for relative humidity at 2m (all ranges, all stations dat

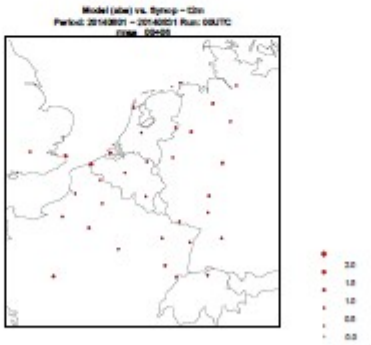


Examples (III)

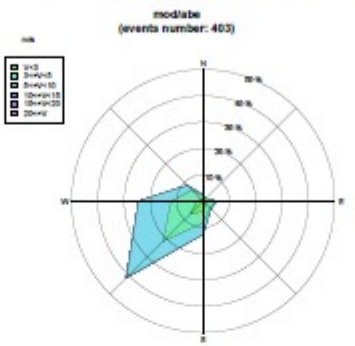
BIAS air temperature at 2m (00+06)



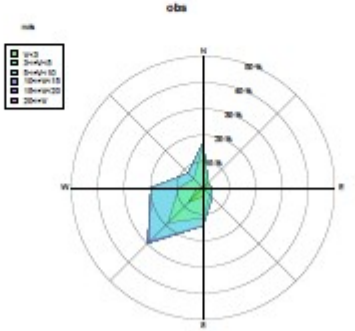
RMSE air temperature at 2m (00+06)



Wind rose for forecasted wind speed (all 6h ranges, station 6400)

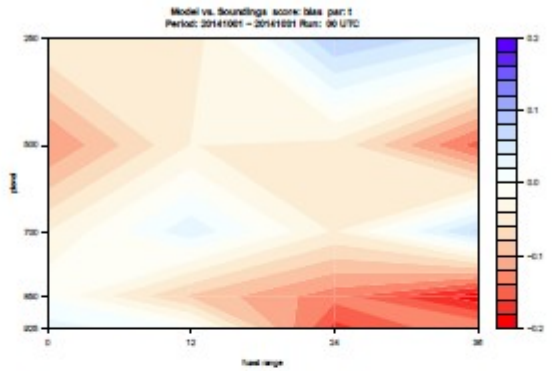


Wind rose for observed wind speed (all 6h ranges, station 6400)

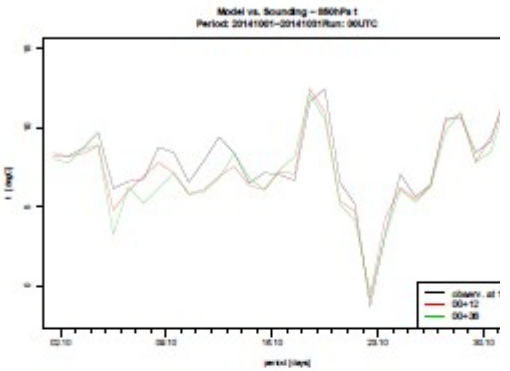


New this years: TEMPS

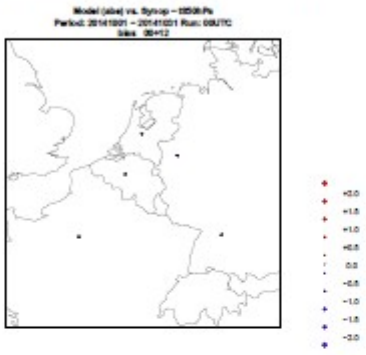
bias for air temperature (pressure levels vs forecast ranges, all statio



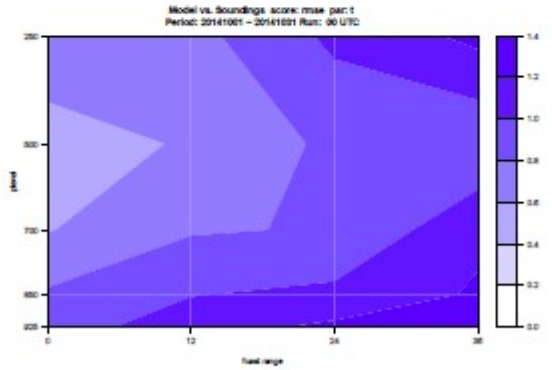
Air temperature at 850hPa at 12:00UTC (mean ratios



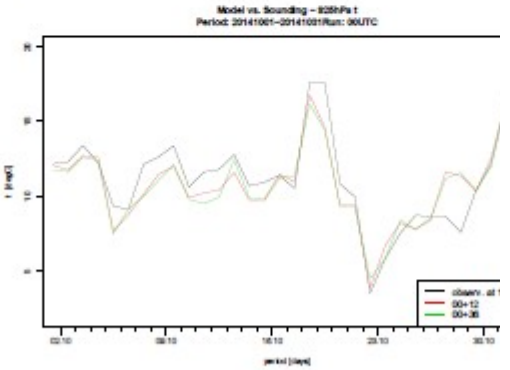
BIAS air temperature at 850hPa (00+12)



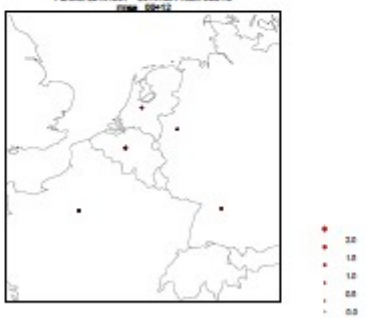
rmse for air temperature (pressure levels vs forecast ranges, all statio



Air temperature at 925hPa at 12:00UTC (mean ratios



RMSE air temperature at 850hPa (00+12)



Monthly reports

- We do not perform comparisons between the different countries: plots will only contain one country at a time. It does make sense to compare a flat country to one with Alps.
- All stations are used to compute the scores for one country (i.e. all stations per country vs. limited the model(s) of the country), then create documents, store them to a file system and send them by E-mail to the LTMs without cross country exchange (i.e. the LTMs will only receive the reports for their own country).
- Synthetic qualitative conclusions may be drawn by CZ and PT for PAC/GA meetings. ***Currently nothing is to be reported, the reports will be sent to the LTMs shortly (after the GA).***

End user issues:

Forecasters meeting

Portfolio

- A forecasters meeting was organized last September by the Turkish colleagues of the TSMS. A specific goal discussed during that meeting was the proposal for building a portfolio with specific cases where the high-resolution models add value with respect to the global models; This portfolio could then be arranged in a form that would allow of the countries to make brochures or catalogues to be used by their services for providing information about the model use for their end users and policy makers. Examples of useful cases are
- the 2013 CE flooding case, the Belgian Pukkelpop festival, EV scores of LAEF and GLAMEPS w.r.t ECMWF

Les modèles atmosphériques à l'IRM

Les maths au service des prévisions climatiques et météorologiques

IRM Institut Royal Météorologique

Un modèle atmosphérique est un modèle mathématique se basant sur les lois d'évolution régissant les variables atmosphériques (température, précipitations, vitesse du vent, etc.). Dans la pratique, les processus physiques en jeu sont trop compliqués (par exemple la micro-physique des gouttelettes nuageuses) que pour pouvoir être implémentés très précisément dans les modèles de prévision. Dès lors ces processus sont approximés au travers de formules mathématiques simplifiées. Un modèle numérique discrétisé dans l'espace et le temps (voir encadré ci-dessous) est alors établi et implémenté sur un ordinateur, permettant ensuite de faire des prévisions du temps à court et moyen terme (quelques jours).

Ces équations d'évolution constituent également la base de la réalisation des projections à l'échelle climatique, c.à.d. des prévisions à plus long terme. Dans ce cadre, il est toutefois très important d'incorporer des processus agissant à long terme, tel que par exemple l'accroissement des gaz à effet de serre (et les effets radiatifs qui y sont liés), les échanges avec les océans, ou encore l'évolution de la cryosphère.

Les modèles atmosphériques quadrillent l'atmosphère d'un ensemble de points de grille à distance régulière les uns des autres. Les équations mathématiques qui forment la base des modèles sont alors résolues pour chacun de ces points de grille et pour une succession (limitée) d'instants.

En réduisant la zone d'intérêt (par exemple l'Europe), on peut obtenir des informations plus détaillées pour la région étudiée grâce à une augmentation de résolution. Cette approche peut également permettre de réduire les temps de calcul sur ordinateur. Ces derniers modèles sont qualifiés de modèles régionaux ou à aire limitée, comme le modèle ALARO de l'IRM.

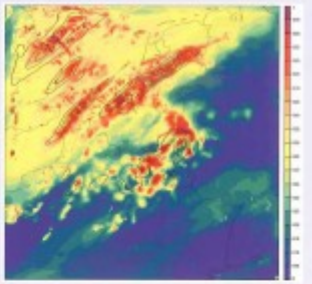
◇ Alaro

L'IRM a son propre modèle atmosphérique qu'il utilise aussi bien pour les prévisions du temps que pour les études climatologiques.

Ce modèle, nommé ALARO, est conçu pour travailler avec de hautes résolutions ou, autrement dit, pour simuler des phénomènes météorologiques de dimension de quelques kilomètres ou plus. Le modèle ALARO a été développé par le consortium européen ALADIN, une coopération internationale à laquelle l'IRM participe.

Ce consortium se compose des instituts météorologiques de 16 pays et a pour ambition que les pays membres puissent utiliser un modèle « état de l'art » pour leurs besoins nationaux.

Une autre finalité du consortium est de créer le savoir-faire nécessaire pour la recherche sur le climat et la météorologie.



Modèle ALARO du 18 août 2011.
Les couleurs montrent la couverture nuageuse. La nébulosité maximum est en rouge. Les contours en noir sont les zones de pluie. Les zones rouges au-dessus des Pays-Bas et la blanche forment un front. Dans le sud-ouest de la Belgique nous voyons des averses orageuses.

Le modèle ALARO est utilisé pour les prévisions du temps journalières par les prévisionnistes du bureau du temps de l'IRM, entre autres. C'est surtout en cas d'avertissements pour conditions météorologiques extrêmes (orages, tempêtes, canicule, fortes chutes de neige) que le modèle ALARO a prouvé son utilité.

◇ Projections climatiques

Les chercheurs de l'IRM ont testé le modèle atmosphérique sur des périodes plus longues afin de valider les évolutions du climat. C'est ainsi qu'ils ont comparé les données de température et de précipitation, sur une période de 1961 à 1990, avec les observations.

Cette étude a donné suffisamment de crédit au modèle pour que l'IRM décide en 2011 de démarrer l'étude de l'impact du changement de climat au niveau national.

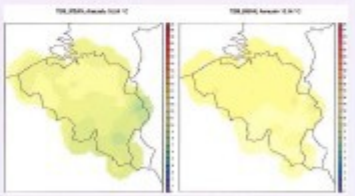


Illustration d'un résultat de modèle.
Cette figure montre la température moyenne au sol pour le climat actuel (à gauche de 1961 à 1990) et le climat futur (à droite de 2071 à 2100).
Le modèle montre sur une période de 30 ans une température moyenne annuelle au sol de 10.54° pour le climat actuel et de 13.14° pour le climat futur.

Forecasters meeting, in summary

- Other cases were identified besides the ones that were initially proposed.
- The meeting was felt to be very useful and it was decided to organize one next year.
- The meeting was considered to be too short. Forecasters would appreciate more time for discussions.
- Since this meeting was the first one (during the present MoU) the scope was kept rather open. It was decided that for the next meeting it would be better to be clear about it, so forecasters can better prepare their presentations.
- The main identified problem is the fact that the human eye (so, de facto forecasters) is not capable to smoothing out spatial variations at the convection-permitting scales to interpret high-resolution maps in a probabilistic spatial sense. **This means that the development of convection-permitting EPS system should get priority** (this will be reported in the ALADIN workshop next year). It was decided to organize a Forecasters meeting focused on that topic next year.

Next step(s)

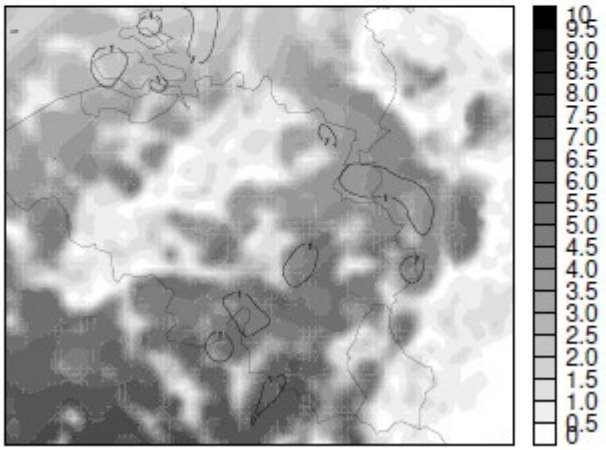
- We can provide a prototype of a common ALADIN folder. As an example, the RMI centenary folder of its modeling activities is attached here. A similar folder could be made.
- The next step is to select a few cases from the forecasters meeting to illustrate the added value of the ALADIN consortium and to provide a first example of a folder that could be used by all of the ALADIN partners.
- However, there is no funding foreseen in the consortium for such visibility issues, so the GA is asked to comment.
- E.g. use the surplus of this year … see later on the agenda.

Forecasting downbursts using a novel version of the 3MT scheme for a high-impact event: Pukkelpop

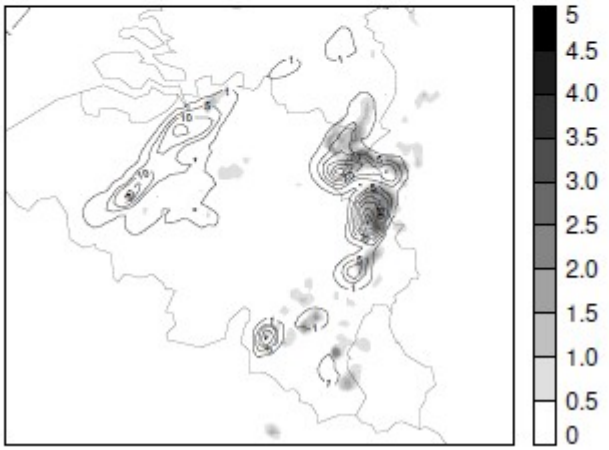
Unsaturated downdrafts

Predicting the unpredictable

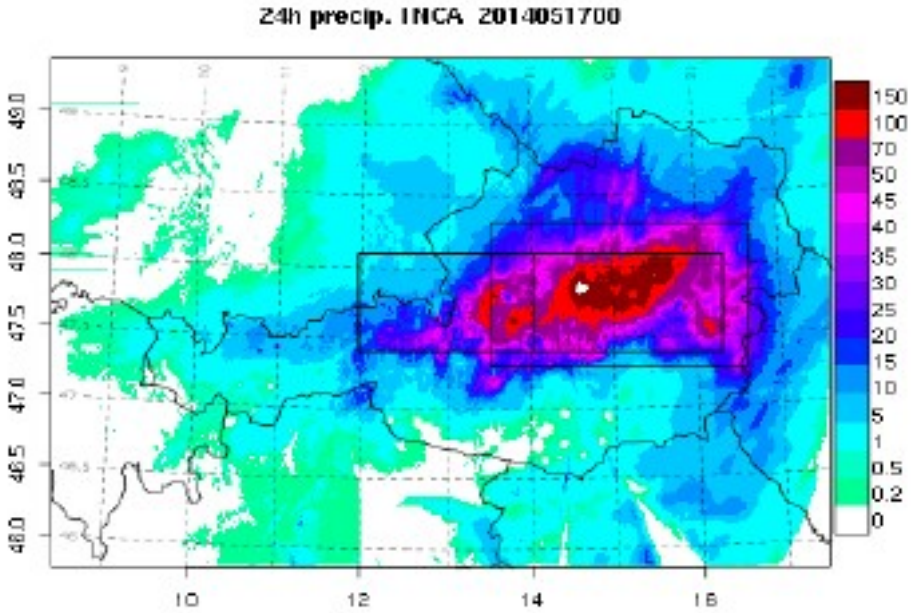
ald_op Omega_DD mass flux (kg m...^{2} s...^{1}) 18.08.2011 17 UTC

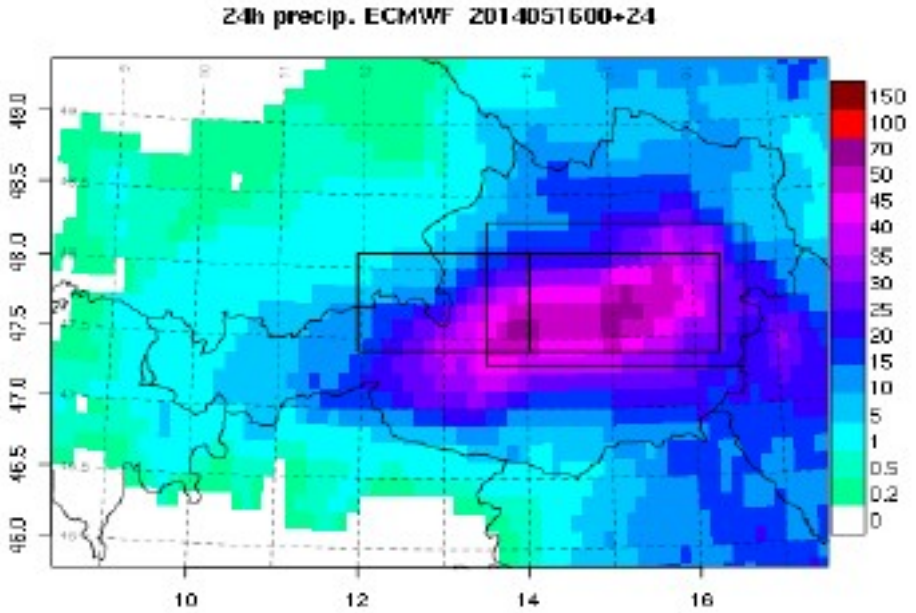


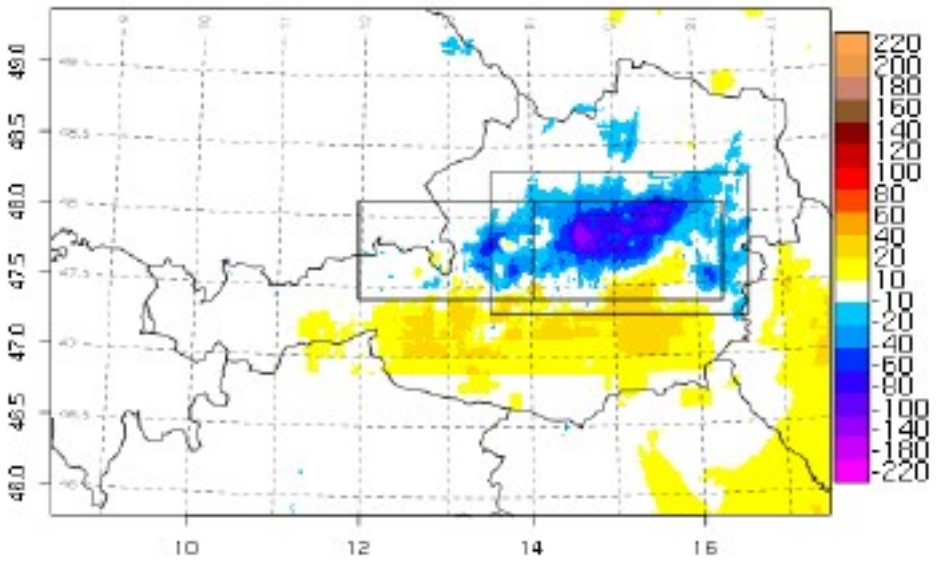
cy36o7_tll Omega_DD mass flux (kg m...^{2} s...^{1}) 18.08.2011 17 UTC



AROME – AUSTRIA: examples of performance







SAL für Region NORDSTAU_NOE_OOE:

Structure:	0.74	Mean Sum Forecast [mm]:	36.89
Amplitude:	-0.35	Mean Sum INCA [mm]:	52.37
Location:	0.05		

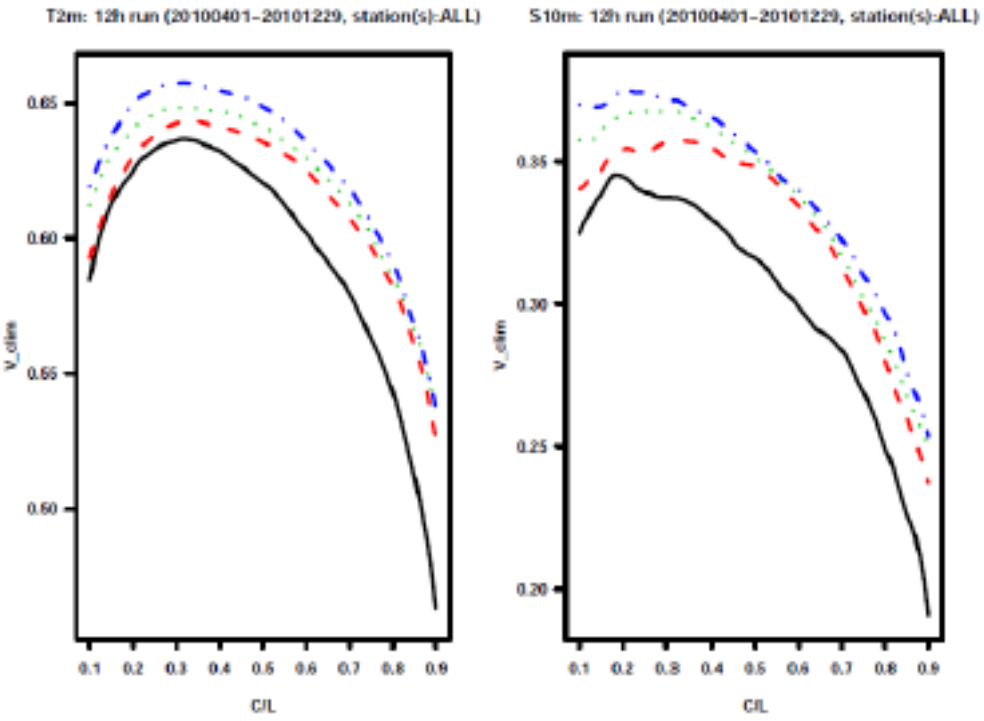
Contingency Table %: Threshold=50mm

Hits:	0.04
False Alarms:	0.01
Missed:	0.4
Corr. Negatives:	0.54

RR-class: 4 - Convective Large-Scale

LAM EPS

- ***WE ARE PRODUCING EXTRA SKILL ON TOP OF ECMWF!***
- We have different EPS systems running: GLAMEPS and LAEF (not time to give details)
- A novel score: Potential Continously Ranked Economic Value (CREV) relative to (sample) climatology of ECEPS (**black full line**), GLAMEPS (**red dashed line**), GLAMEPS-LAEF (**green dotted line**) and ECEPS-GLAMEPS-LAEF (**blue dash dotted line**) for bias corrected T2m and S10m (run = 12h, lead time = 42h).

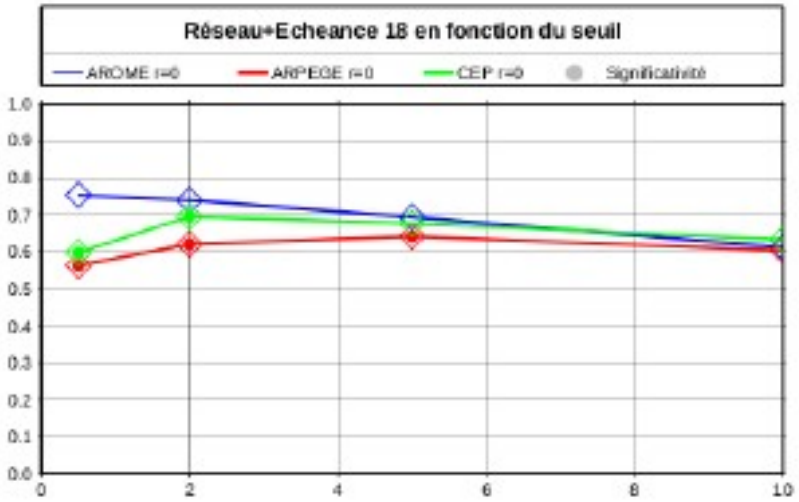


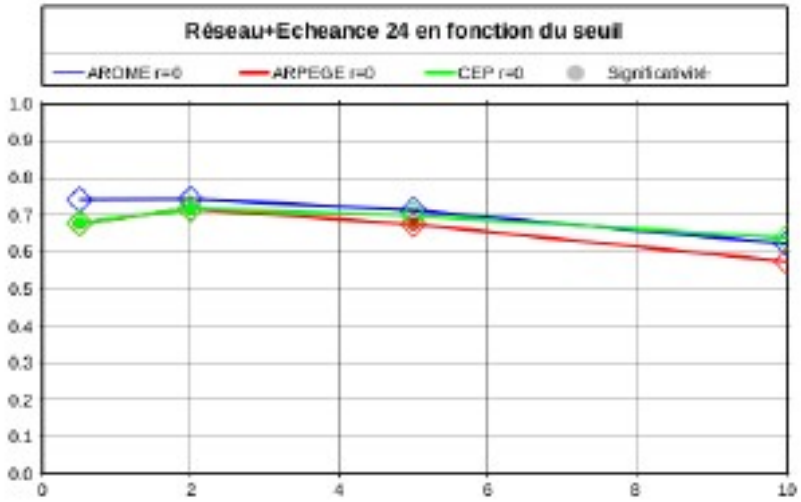
Smet, G., P. Termonia and A. Deckmyn, 2012: Added economic value of limited area multi-EPS weather forecasting applications Tellus , A , 64 , 18901

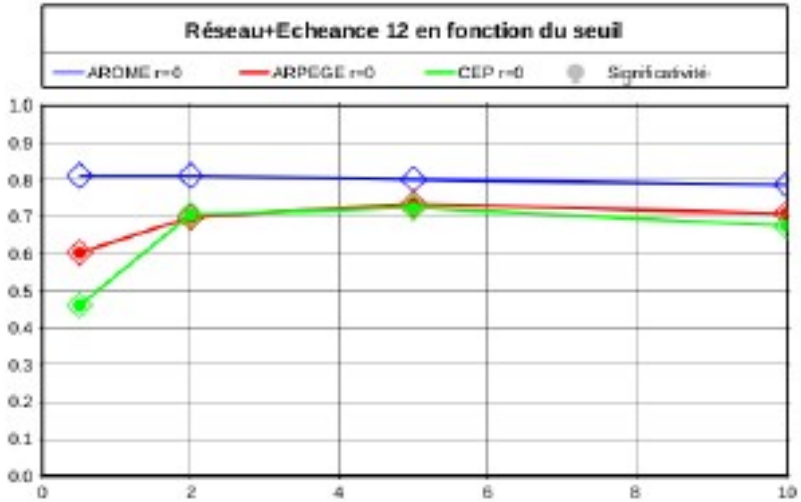
Results of fuzzy probabilistic evaluation for precipitation of AROME

Contrôle probabiliste des précipitations 6h : Comparaison des modèles Scores annuels Voisinage 52.8km

Grille FRANGP0025 BSS_NO / Période 201305 – 201404 Référence BDCLIMH







Météo-France Dprévi/COMPAS
Actualisé le 06/05/2014

TEO FRANCE
rs un temps d'avance

How?

- Scores vs. cases
- Make templates or make a folder for all?