Feedback from the ALADIN Forecasters meetings

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Lisbon

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With help of
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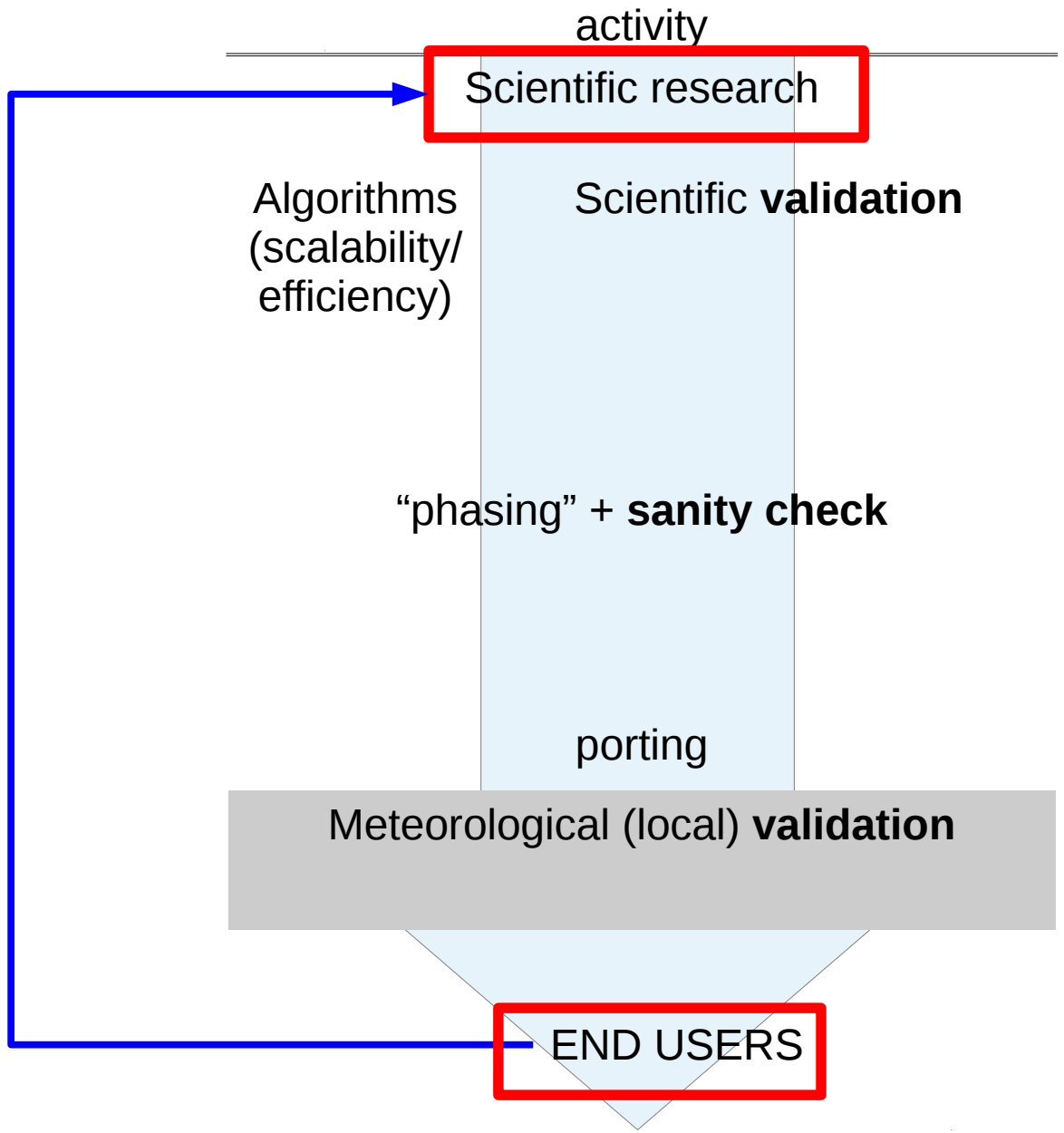
G. Smet, J. Van den Bergh, C. Zingerle

From science to operations



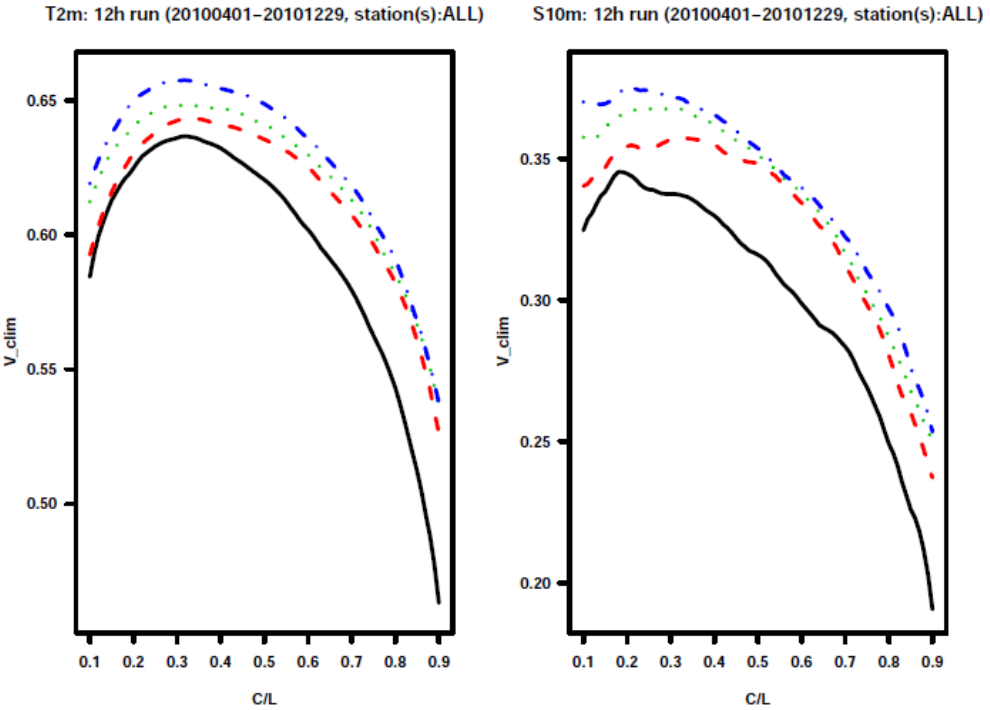
ALADIN
New demands

Added value

- What does LAM output add with respect to global model output?
- Convection-permitting model output is intrinsically stochastic.
- Will open data policy force us to more “local” national weather services? EPS offers a way to optimize this.

Added value w.r.t. the global models

- 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

End user enquiry 2012, courtesy J. Rio

- By the middle of May 2012, 9 out of 16 countries had replied to the end-user enquiry. The data received until 22 of May 2012 has been reviewed and a preliminary analysis is given below.
- To have an overview of the replies, the answers of all the countries have been added for each item/sector.
- The information contained in the tables are the range, resolution, type of forecast and its updating frequency, the variables and a final comment.
- After presenting all the tables, some comments are made on the information sent by the ALADIN members.

A1. Hydrological models
A2. Transport and dispersion models
A3. Ocean models
B1. Aviation
B2. Renewable energies (wind, solar, waves)
B3. Energy management
B4. Public/private companies (construction, transports)
B5. Events (*e.g.* sports, festivals)
B6. Tourism
B7. Media
B8. Agriculture
B9. Civil protection

A1. Hydrological models

Country	Range	Resolution	Forecast	Update	Variables	Comment
Austria	72 h	All	Det; field	15 min INCA; 6 h	Precip (type)	Verification in catchments (classical)
Croatia	72 h	> 7km	Det; field	12 h		
Czech Republic	72 h	>4 km	Det+EPS; field	6h Det; 12h EPS	Precip (rain+snow)	24h precip accumulation in catchments
Poland	54 h	>7 km	Det; point+field	12 h		
Portugal	72 h	>7 km	Det; field	12 h		
Romania	72 h	>7 km	Det; field	5 h	Radiation	
Slovenia	72 h	>7 km	Det+EPS; point+field	24 h		
Slovakia	72 h	<4km	Det+EPS; field	6h/nowcasting	Precip (type), level 0°C	SAL
Turkey						

x what weight?

Comments, courtesy J. Rio, 2012

- Most of the countries have their model output given as an input to the other applications. Apart from Turkey, all the countries seem to run hydrological and transport/dispersion models, even if it is done by a third party;
- As expected, countries without coast do not run wave/circulation models; this is probably one of the biggest difference between members;
- The range of the forecasts is usual 72 hours; the resolution varies between the over 7 km of ALADIN, the 4-5 km of ALARO and the 2.5 km of AROME;
- Most of the countries provide deterministic forecasts of their LAM. Countries like Austria and Slovakia are among the ones that use the most the EPS forecasting system;
- The forecasts are provided as fields or point-wise, depending on the type of product; some products require a “field view” and others would like even a higher resolution (*e.g.* wind energy);
- The update of the forecasts is usually 12h. However, depending on the products, this value can range between 6 hours (*e.g.* Austria, Czech Republic) and a daily update (*e.g.* Slovenia, Slovakia);
- Most of the variables identified in the forms are the usual ones. Some of the less frequent are: PBL height, MOCON, TKE, cloud water and ice, visibility, convection index, probability of occurrence of thunderstorms, forest fire index; bio-meteorological index;

Comments cntd.

- From the sample of answers, the verification made at the several institutes ***can be considered to be mainly classical (forecast point vs observation point*)**. Even though not explicit, some countries are expected to have implemented some kind of fuzzy methods (Poland, Portugal) to address the double-penalty problem inherent to the validation of high resolution forecasts;

- CHMI and ZAMG make verification for catchment areas. Austria and Slovakia appear to be the only ones to make use of SAL (object-oriented verification method);

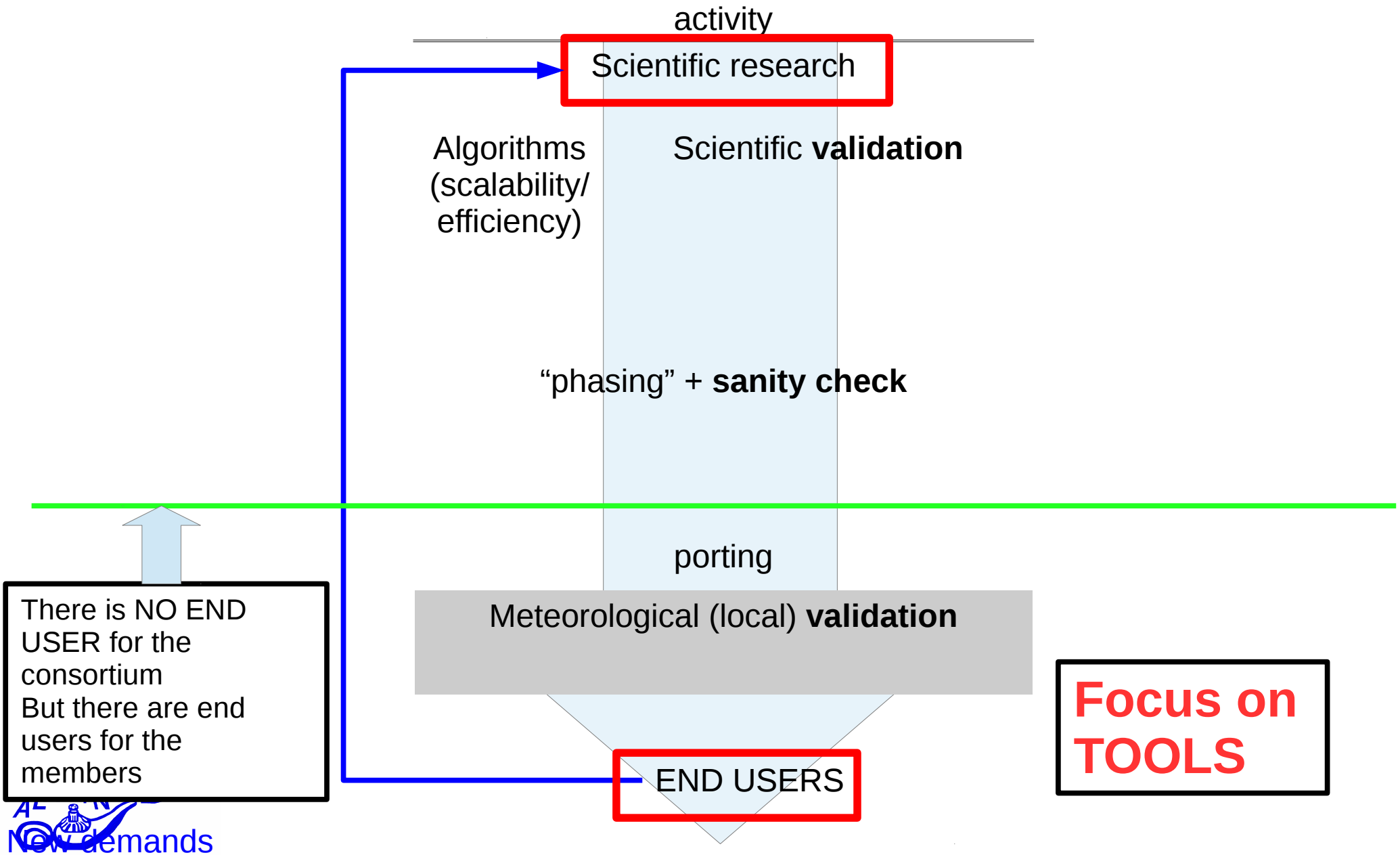
- All or most of the countries supply forecasts for the following sectors: aviation, renewable energies, energy management, public/private companies (construction, transports) and civil protection;

- In the remaining sectors there are apparently some differences: (1) some institutes have products for specific clients - public and / or private (*e.g.* at ZAMG), while (2) others supply only general information (*e.g.* CHMI, Romania), directly from NWP or via their weather center (*e.g.* Portugal, Romania);

- Some examples of decisions taken by clients, based on forecast products, are: (1) hydrological warnings based on water level thresholds, (2) concentration of pollutants; (3) airport and sea/harbor/port operations, (4) type and amount of energy production either for consumption or trading, (5) winter road/rail maintenance, (6) security of outdoor events, both in land and sea, (7) estimate of visitors at selected locations and (8) irrigation and protection against severe weather in agriculture.

So what does our end user look like ...?

Who is our END USER?

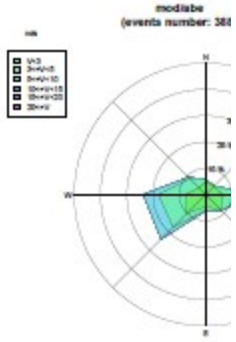


Tools (for quality control): APMT, HARP, HARMONIE system tools

	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

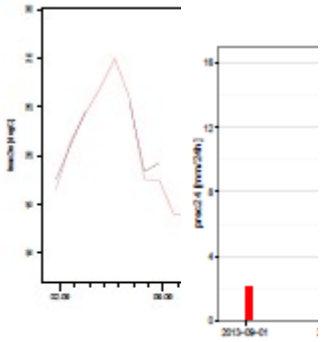
Example APMT Monthly Report (extract to give you an idea of the output)

Wind rose for forecasted wind speed (all 6h ranges, station 6447)



BIAS air temperature at 2m (00+06)

Maximum air temperature at 2m (mean ratios of stations)

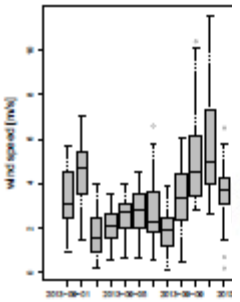


24hour precipitation (al

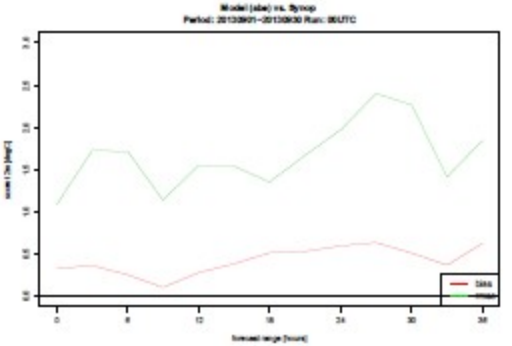
number of cases in particul

modobs	0<=prec<0.1	0.1<=prec<2
0<=prec<0.1	25	3
0.1<=prec<2	4	4
2<=prec<10	0	6
10<=prec	0	0
sum obs	29	13

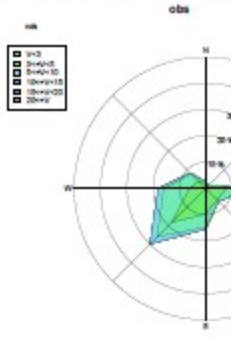
Boxplots of distribution of wind speed at 10m (all ranges, all stations data)



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



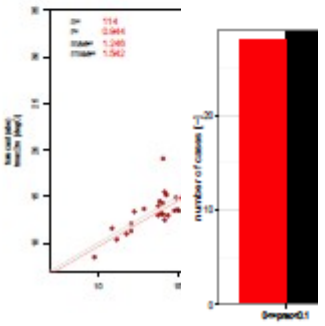
Wind rose for observed wind speed (all



RMSE air temperature

Maximum air ten

24hou



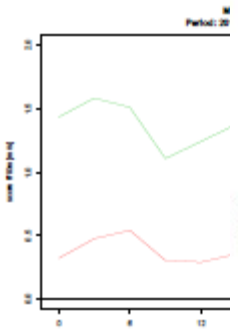
24hour precipitation (al

scores for particul

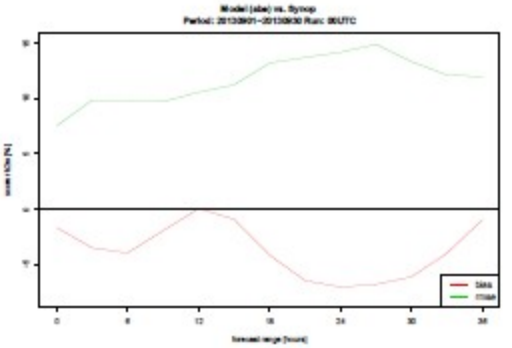
range\score	BIAS
0<=prec<0.1	0.966
0.1<=prec<2	0.923
2<=prec<10	0.852
10<=prec	2

events

Scores for wind speed



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



Forecasters meeting Ankara 10-11/9/2014

- 20 participants, 10 countries sent a forecaster.
- The meeting conisted of a few scientific presentations and report from the forecasters.It was concluded witha discussion session.
- Many cases were reported in the presentations.
- Biggest concern: ALERTS
- *Forecasters need guidance to interpret high-resolution model output. This was a recurring problem during the discussions and emphasized by several forecasters. This is related to the intrinsic stochastic nature of clouds and microphysics processes. It was also concluded that the human eye is not capable of interpreting a weather map in a probabilistic sense; i.e. it is not possbile to interpret spatial vairation in forecast patterns as probabilities over a wider area.*

Link:

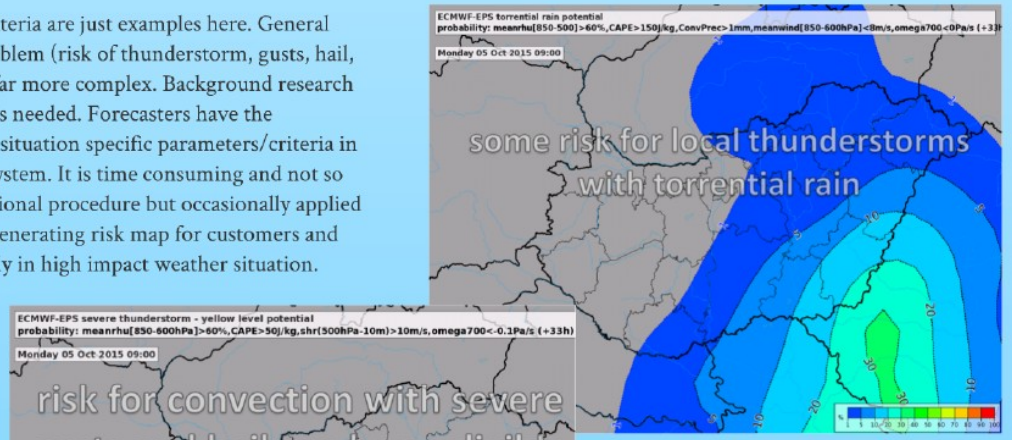
Forecasters meeting Lisbon 21-23/9/2015

- 20 participants
- Same format but we included and exercise on the use of probabilistic model output
- Conclusion: forecasters have a traditional top-down way of thinking, starting from the global model output.
- This thinking is based on classical synoptic-scale: parameters: Mslp, wind shear, theta_E, geopotential at standard level, even quasi-geostrophic Q vector analysis, mean omega, laspe rates, humidity, ...

Global model: risk for alerts, based on combinations of the classical parameters

3. Coexistence of ingredients (ECMWF EPS, ALADIN-EPS)

Parameters and criteria are just examples here. General solution of the problem (risk of thunderstorm, gusts, hail, torrential rain) is far more complex. Background research and development is needed. Forecasters have the opportunity to set situation specific parameters/criteria in the visualization system. It is time consuming and not so adequate as operational procedure but occasionally applied and used also for generating risk map for customers and the public especially in high impact weather situation.



Prezi

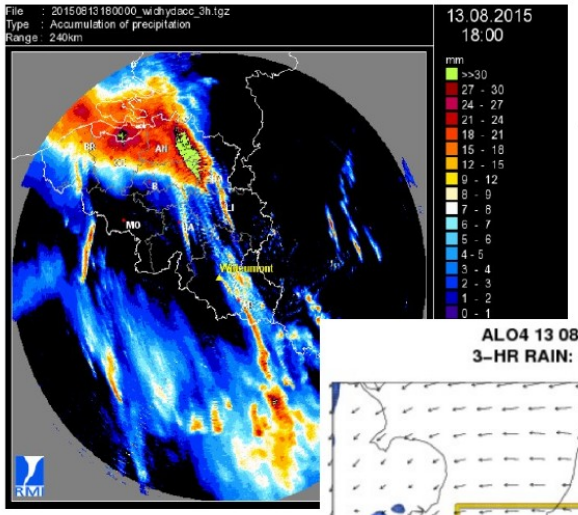
Once there is a potential risk for an alert situation the forecast looks for “confirmation” in the LAM.

Courtesy Kornél Kolláth, OMSZ

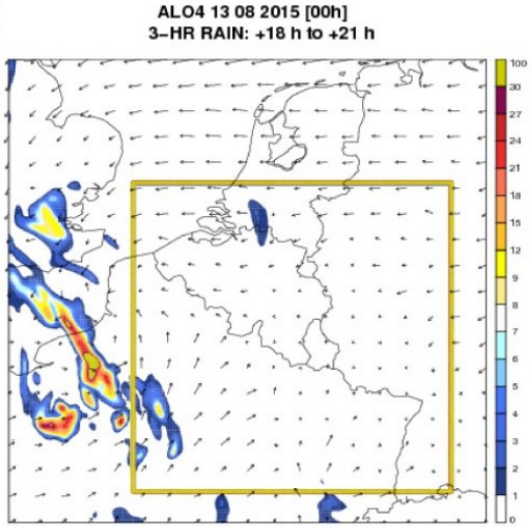
Forecasters exercise

- The forecasters were asked to redo 3 forecasts from the RMI weather offcie where the deterministic model missed the alert.
- Forecasters only got probabilistic output: HM EPS and GLAMEPS.

13 Aug:Warning for thunderstorms for the late afternoon and evening. Especially the risk for large amounts of rain (20-30 mm) is mentioned. Orange for western part of the country.



The radar image shows the very active line of thunderstorms in the north of Flanders. Remark the large amounts of rain over Limburg, east Vlaams-Brabant. Alaro did not expect any thunderstorm activity over Belgium at that time.



- After a hot day (up to 34 degrees) the expected thunderstorm activity started around 6 at the western border of the country. The storms lined up and came together with intense lightning and large amounts of rain. Surprisingly enough most rain fell in the eastern part of the country (Bilzen 64 mm, Diest 44 mm) where (after the first line) some new thunderstorms popped up. The thunderstorms caused little damage but they were hyped by the media.
- The ALARO-4km run did expect some active cells (but not the large organized system that we observed) over Northern-France and after midnight they would enter Belgium in a weakened form. This forecast was far from the reality. The noon-sounding over Trappes did look quite realistic, it is not very clear why the forecast failed.

The RMI alert: based on all models available including IFS

Waarschuwingen

Begin : 13/08/2015 17H - (lokale tijd)
Einde : 14/08/2015 05H - (lokale tijd)

KMI

IRM

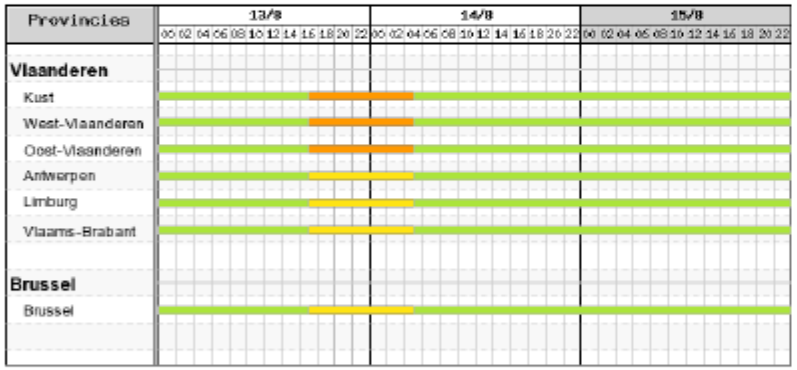
Avertissements

Début : 13/08/2015 17H - (heure local)
Fin : 14/08/2015 05H - (heure local)

Onweer Wind Regen - Orage Vent Pluie

In de loop van donderdagnamiddag, donderdagavond en tijdens de nacht van donderdag op vrijdag verwachten we felle buien vanaf de Franse grens.
Die buien kunnen gepaard gaan met onweer, plaatselijk hagel en rukwinden.

In westen (West- Vlaanderen en het westen van Oost- Vlaanderen en Henegouwen) kan er veel neerslag op korte tijd vallen. Plaatselijk kan er tussen 20 en 30 l/ m2 vallen.



groen : Er worden geen significante problemen verwacht ten gevolge van onweer.
geel : Er is plaatselijk kans op onweer. Een lokaal onweer is niet zonder gevaar. Er is kans op intense regenval, hagelbuien, blikseminslagen en/ of felle rukwinden die lokaal voor overlast kunnen zorgen.
oranje : Er is verspreid kans op hevig onweer met mogelijk overlast op meerdere plaatsen. Intense regenval, hagelbuien, blikseminslagen en/ of hevige rukwinden kunnen vrij grote schade veroorzaken. Overvloedige regen is mogelijk en kan voor wateroverlast zorgen. Er is ook kans op vallende bomen(takken). Wees dus op uw hoede en begeef u zo weinig mogelijk in het wegverkeer.
rood : Er is een grote kans op hevig onweer met waarschijnlijk overlast op meerdere plaatsen. Intense regenval, hagelbuien, blikseminslagen en/ of hevige rukwinden kunnen grote schade veroorzaken. Overvloedige regen is mogelijk en kan voor wateroverlast zorgen. Er is ook kans op vallende bomen(takken). Wees dus op uw hoede en blijf in de mate van het mogelijke binnen.

Jeudi dans l'après- midi, jeudi soir et encore la nuit de jeudi à vendredi, nous prévoyons des averses intenses à partir de la frontière française.
Ces averses pourront être accompagnées d'orage, localement de grêle et de rafales de vent.

Dans l'ouest (la Flandre Occidentale et l'ouest de la Flandre Orientale et du Hainaut) on prévoit de fortes précipitations en peu de temps. Localement des quantités comprises entre 20 et 30 l/ m² seront possibles.l

vert : On ne prévoit pas de problèmes significatifs suite aux orages.
jaune : Il y a un risque d'orage local. Un orage local n'est pas sans danger. Des pluies intenses, des averses de grêle, des impacts de foudre et/ ou de fortes rafales de vent peuvent provoquer des problèmes localement.
orange : Il y a un risque répandu d'orages violents et des problèmes sont possibles en plusieurs endroits. Des pluies intenses, des averses de grêle, des impacts de foudre et/ ou de fortes rafales de vent peuvent causer des dégâts assez importants. Des pluies abondantes sont possibles et peuvent conduire à des inondations. Il y a également un risque de chute (de branches) d'arbres. Soyez donc sur vos gardes et évitez autant que possible de prendre la route.
rouge : Il y a un risque élevé d'orages violents avec probablement des problèmes en plusieurs endroits. Des pluies intenses, des averses de grêle, des impacts de foudre et/ ou de fortes rafales de vent peuvent causer des dégâts importants. Des pluies abondantes sont possibles et peuvent conduire à des inondations. Il y a également un risque de chute (de branches) d'arbres. Soyez donc sur vos gardes et évitez autant que possible de sortir.

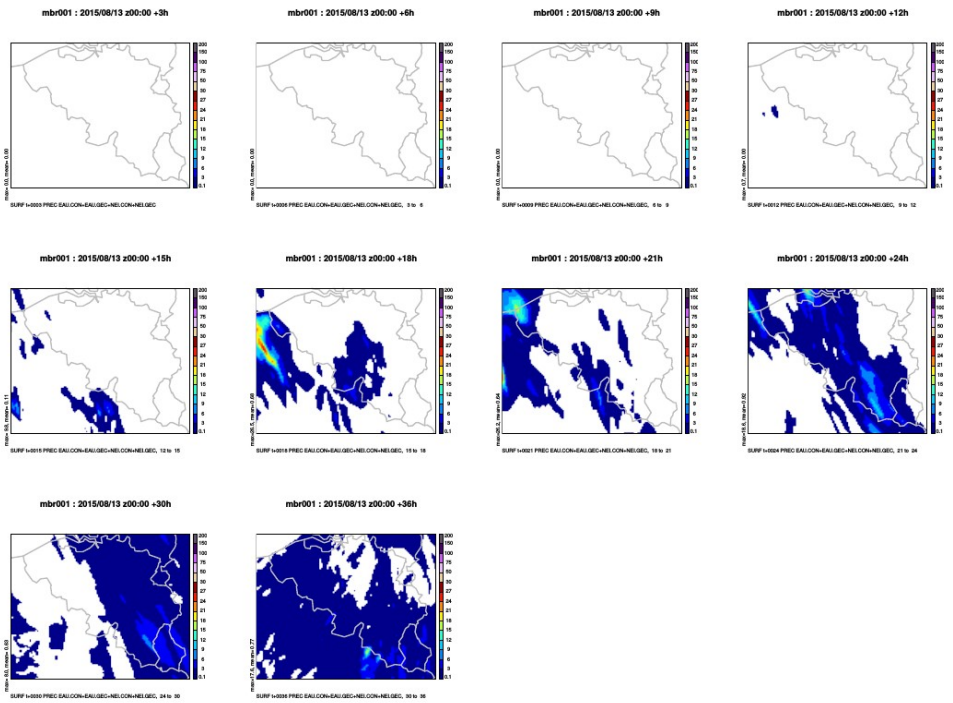
ALADIN

RMI EPS based on Harmon EPS

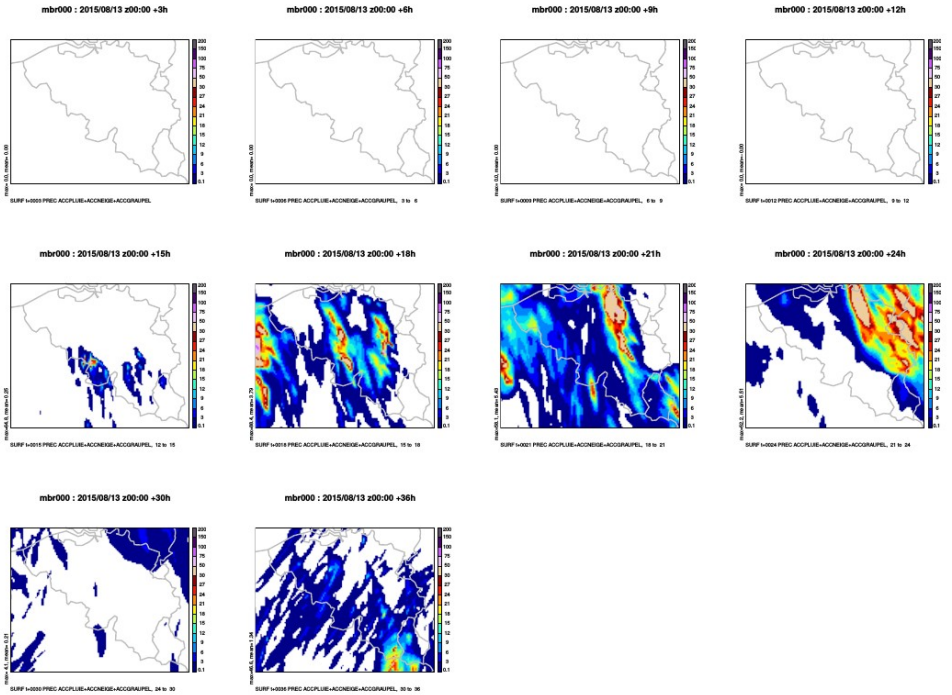
- AROME and ALARO models (both at 2.5km) are coupled to ECMWF ENS.
- 22 limited area ensemble members:
  10+1 from ALARO and 10+1 from AROME
  (cy38h1.1, both with SURFEX).
- Forecast range: 36 hours (at 00 and 12 UTC).
- Surface assimilation cycle (CANARI) + 3DVar upper-air data assimilation for control members.

RMI-EPS 2.5-km prototype based on Harmon EPS stamps: there is a signal.

ALARO members



AROME members

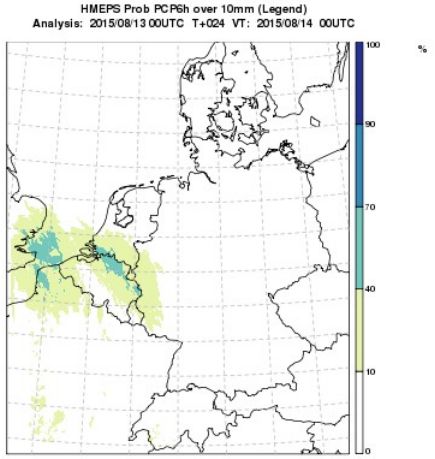


INDRA (INtegrateD RMI Alert system)

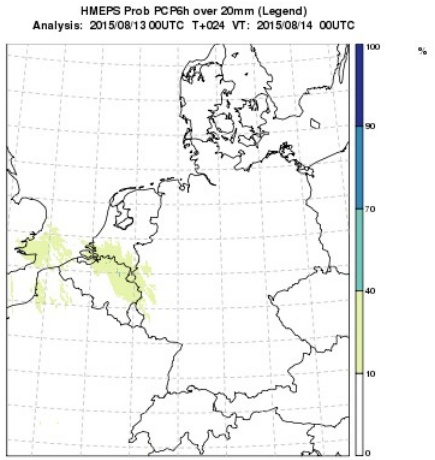
Indra (/ˈɪndrə/), also known as Śakra in the Vedas, is the leader of the Devas or gods and the lord of Svargaloka or heaven in Hinduism. He is the god of rain and thunderstorms.

The Integrated RMI Alert system (INDRA)

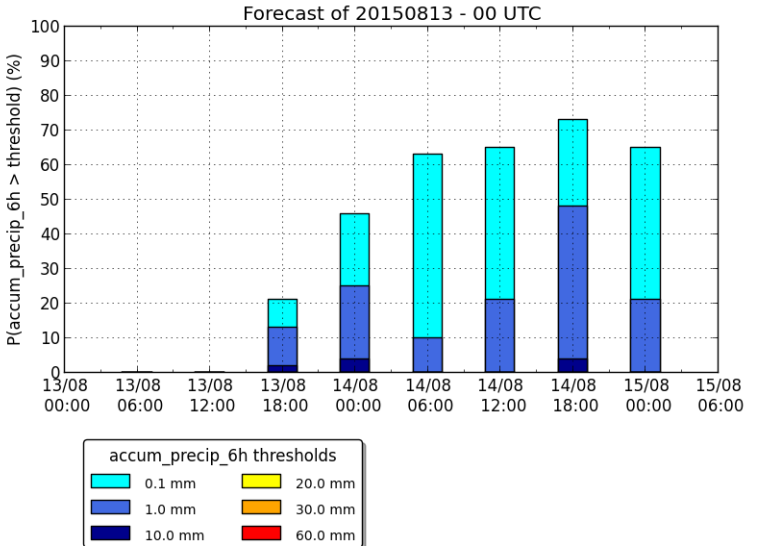
RMI HM EPS Threshold 10 mm



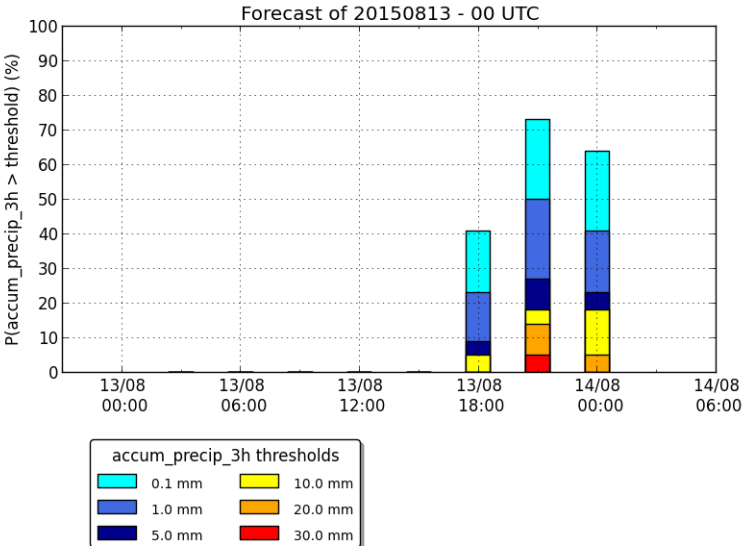
RMI HM Threshold 20 mm



GLAMEPS output (6-h accum)



RMI HM EPS (3-h accum)



Dilemma

- The exercise moved the forecasters far out of their ***comfort zone*** by not providing global model output.
- But, to my surprise, the forecasters during the meeting gave an orange alert! They used the fields of GLAMEPS as proxies for the global fields.
- It was quite impressive how they could correct for the lack of global data.
- But: *Forecasters use the LAMs as a means to confirm their conclusions.*

Conclusions

- Addressing the needs of the end users is addressed by means of tools and support.
- It was decided (ALADIN PAC) to focus on delivering value to our weather offices.
- Forecasters can not smoothen out probabilities on maps by eye balling (see our signal as noise).
- Last year we did the experiment to give them purely probabilistic output data, without global IFS or ARPEGE data! This mooved them out of their comfort zone.
- BUT they could give the correct alerts if if the determistic forecasts missed the alert.
- How do we convince forecasters that LAMs are not there to “confirm” their idea's?