

Forecasters meeting

The end user enquiry

P. Termonia

Ankara, 10-11 October 2014



Strategy meeting 2011

- investment in code design/development/maintenance;
- the replacement of the old ISBA scheme by SURFEX;
- collaboration;
- external funding;
- **and to launch an effort to “define” our users and to coordinate a project on addressing the end user requirements.**



Outline

- End users?
- J. Rio (Pt) coordinated an enquiry on the requirements by our end users
- We made a wrap up of this during a verification meeting in Lisbon in 2013.
- I report about his work here.



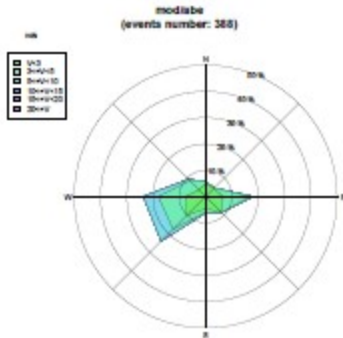
Tools (for quality control): APMT, HARP, HARMONIE system tools

	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

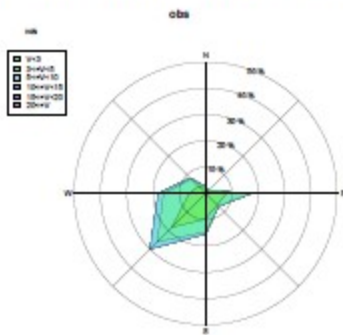


Example APMT Monthly Report (extract to give you an idea of the output)

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

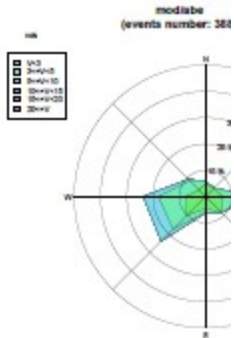


Wind rose for observed wind speed (all 6h ranges, station 6447)

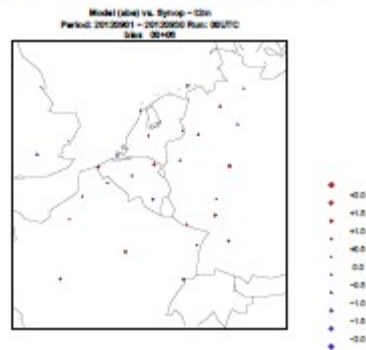


Example APMT Monthly Report (extract to give you an idea of the output)

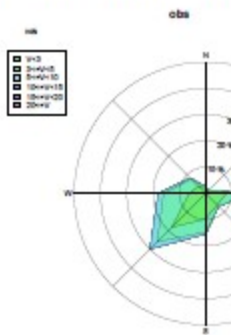
Wind rose for forecasted wind speed (all 6h ranges,
station 6447)



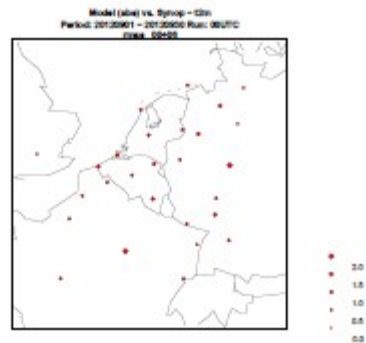
BIAS air temperature at 2m (00+06)



Wind rose for observed wind speed (all

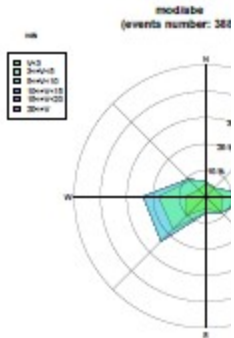


RMSE air temperature at 2m (00+06)



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

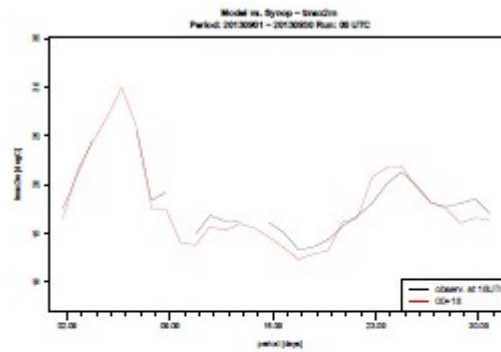
Wind rose for forecasted wind speed (all 6h ranges, station 6447)



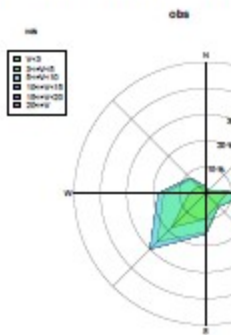
BIAS air temperature at 2m (00+06)



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



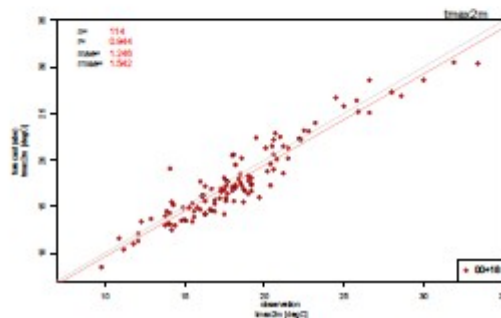
Wind rose for observed wind speed (all



RMSE air temperature

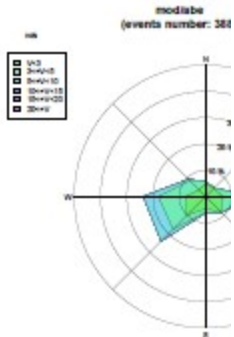


Maximum air temperature at 2m (all stations data)



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

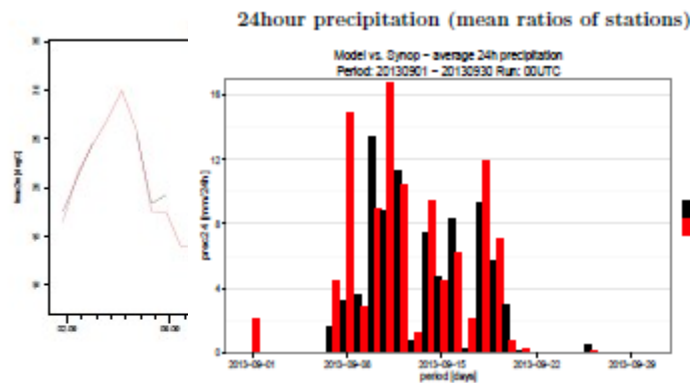
Wind rose for forecasted wind speed (all 6h ranges, station 6447)



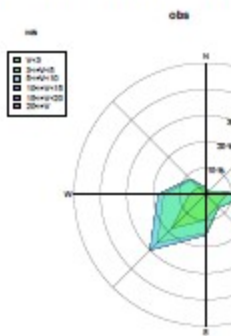
BIAS air temperature at 2m (00+06)



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



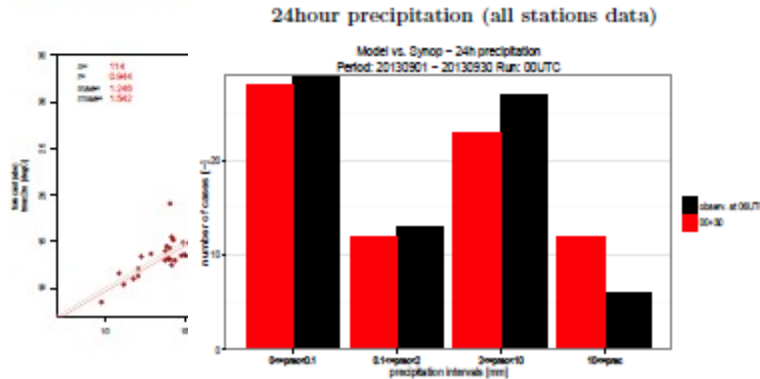
Wind rose for observed wind speed (all



RMSE air temperature

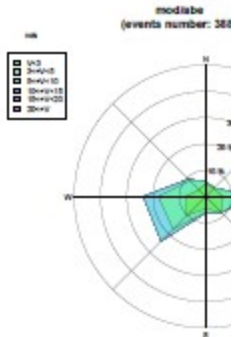


Maximum air ten



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

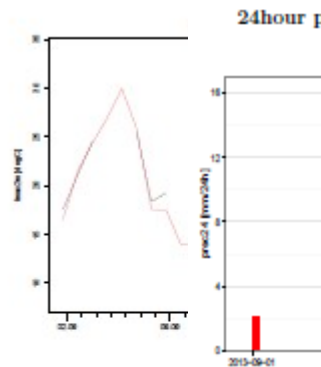
Wind rose for forecasted wind speed (all 6h ranges, station 6447)



BIAS air temperature at 2m (00+06)



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

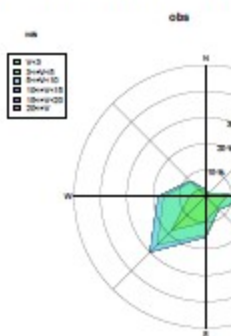


24hour precipitation (all ranges, all stations data)

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 fo
0<=prec<0.1	25	3	0	0	28
0.1<=prec<2	4	4	4	0	12
2<=prec<10	0	6	15	2	23
10<=prec	0	0	8	4	12
sum obs	29	13	27	6	75

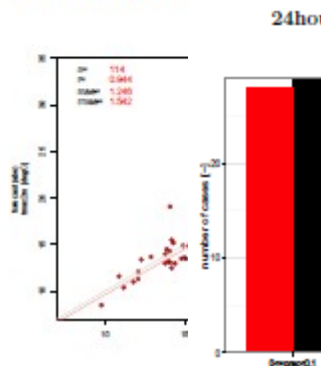
Wind rose for observed wind speed (all



RMSE air temperature



Maximum air ten



24hour precipitation (all ranges, all stations data)

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

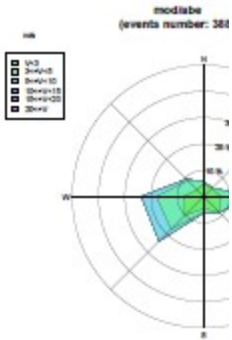
range/score	BIAS	POD	FAR
0<=prec<0.1	0.966	0.862	0.107
0.1<=prec<2	0.923	0.308	0.667
2<=prec<10	0.852	0.556	0.348
10<=prec	2	0.667	0.667

events number: 75 PO=0.64



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

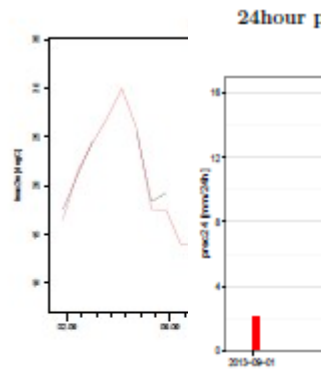
Wind rose for forecasted wind speed (all 6h ranges, station 6447)



BIAS air temperature at 2m (00+06)



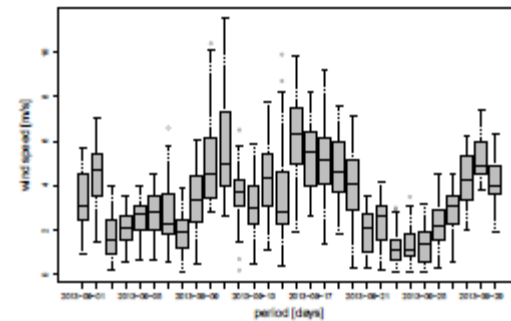
Maximum air temperature at 2m (mean ratios of stations)



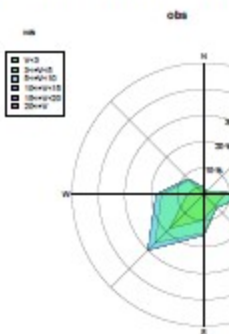
24hour precipitation (all number of cases in particu

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)



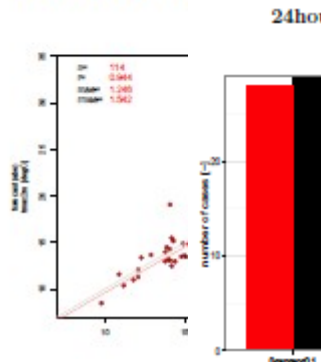
Wind rose for observed wind speed (all



RMSE air temperature



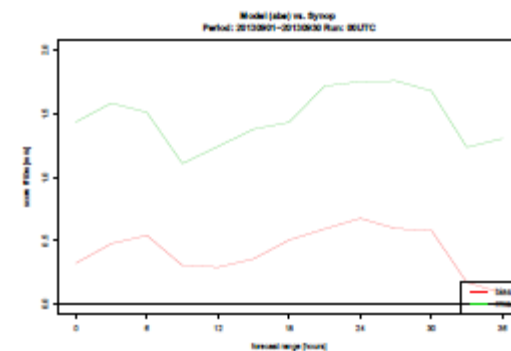
Maximum air ten



24hour precipitation (all

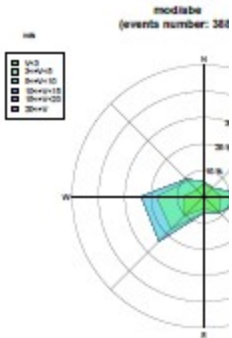
range	score for particu
0<=prec<0.1	0.966
0.1<=prec<2	0.923
2<=prec<10	0.852
10<=prec	2

Scores for wind speed at 10m (all ranges, all stations data)



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

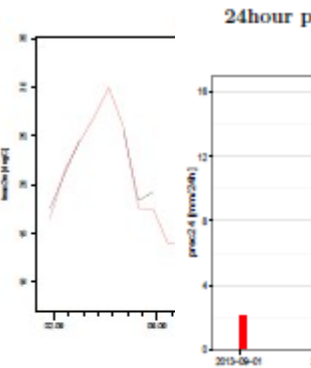
Wind rose for forecasted wind speed (all 6h ranges, station 6447)



BIAS air temperature at 2m (00+06)



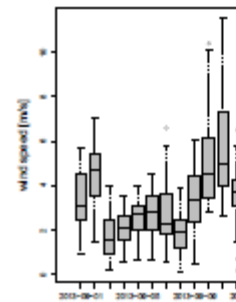
Maximum air temperature at 2m (mean ratios of stations)



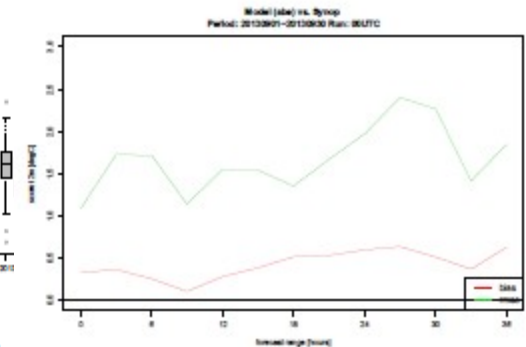
24hour precipitation (all number of cases in partic:

mod:obs	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

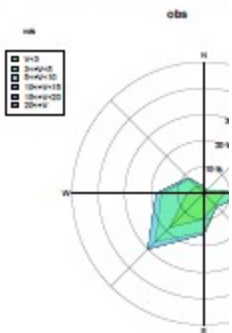
Boxplots of distribution of wind speed at 10m (all ranges, all stations data)



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



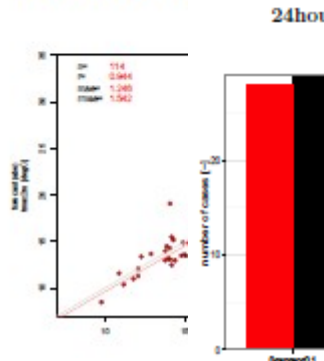
Wind rose for observed wind speed (all



RMSE air temperature



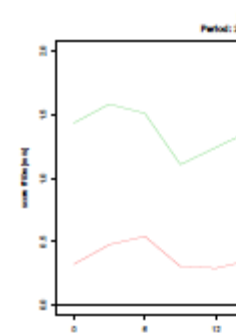
Maximum air ten



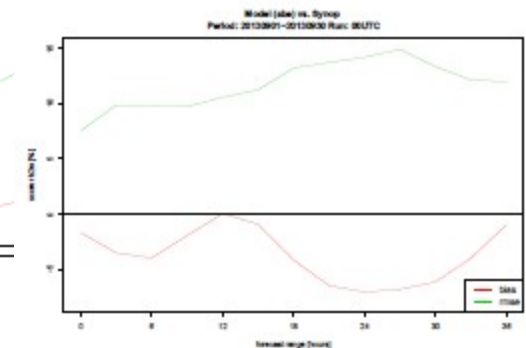
24hour precipitation (al

range/score	scores for particu:
	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)



End user enquiry



End user enquiry

- By the middle of May 2012, 9 out of 16 countries had replied to the end-user query. 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. To avoid over-loading the tables with unnecessary information, the column *variables* will be blank unless some non-trivial variable was given. Trivial variables are assumed to be, for example, the 2 m temperature and relative humidity, 10 m wind, precipitation, cloudiness, etc.
- The column *comment* will have any relevant information regarding scores/verification as well as any other remark. Again, to avoid too much information, one should notice that classical verification scores for continuous and categorical variables (RMSE, BIAS, POD, FAR, Hit rate, Heidke Skill Score, Equitable Threat Score, etc) have been clearly avoided, as to enhance the visibility of additional methodologies.
- After presenting all the tables, some comments are made on the information sent by the ALADIN members.



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						

A2. Transport and dispersion models

Country	Range	Resolution	Forecast	Update	Variables	Comment
Austria	72 h	<=7 km	Det; field	12 h	q	
Croatia	72 h	>7 km	Det; field	12 h	Cape,mocon,pbl height, theta e,...	
Czech Republic	72 h	4-7 km	Det; field+point	6h	Pressure and model levels	
Poland	54 h	>7 km	Det; point	12 h		
Portugal						ECMWF forecasts (not LAM)
Romania	48 h	4-7 km	Det; field	24 h	Surface pressure, vorticity	Experimental for MOCAGE
Slovenia	48 h	4-7 km	Det; field	24 h	TKE, cloud ice and water	
Slovakia	24 h	<4 km	Det+EPS; field	24 h		SAL
Turkey						

A3. Ocean models

Country	Range	Resolution	Forecast	Update	Variables	Comment
Austria						
Croatia	72 h	>7 km;<4 km (addin)	Det; field	12 h		
Czech Republic						
Poland						
Portugal	72 h	<4km;>7km	Det; field	12 h		
Romania	72 h	>7 km	Det; field	12/24 h	Surface fluxes (solar and thermal radiation, latent heat, evaporation)	
Slovenia	72 h	4-7 km	Det; field	24 h	Radiation fluxes	
Slovakia						
Turkey	72 h	4-7 km	Det; field	12 h	Wind	

B1. Aviation

Country	Range	Resolution	Forecast	Update	Variables	Comment
Austria	72 h	4-7 km	Det; field+point	6 h	visibility, convection index	object oriented (SAL)
Croatia	72 h	>7 km;<4 km (addin)	Det; field+point	12 h	TKE, vertical velocity, q (species)	
Czech Republic	48 h	4-7 km	Det; field+point	6h		
Poland	24 h	>7 km	Det; field	12 h		
Portugal	72 h	<4km;>7km	Det; field+point	12 h		
Romania	48 h	4-7 km	Det; field	5 h	cape	
Slovenia	72 h	>7 km	Det, point			
Slovakia	24 h	<4 km	Det; field	3 h		
Turkey	72 h	4-7 km	Det; field+point	12 h		

B2. Renewable energies (wind, solar, waves)

Country	Range	Resolution	Forecast	Update	Variables	Comment
Austria	72 h	All	Det+EPS; point	1h INCA; 6h	U,v,TKE (up to 150m),gusts, radiation,clouds	
Croatia	72 h	>7 km;<4 km (addin)	Det; point	12 h	10 m wind	
Czech Republic	48 h	4-7 km	Det; field+point	6h	Global solar radiation, clouds	
Poland	54 h	>7 km	Det; point	12 h		
Portugal	72 h	<4km;>7km	Det; point	12 h	Air density	
Romania	72 h	4-7 km	Det; point	6 h	30,80,100 m wind speed/dir	Wind speed >=4 m/s
Slovenia						
Slovakia	72 h	<4 km	EPS; point	24 h	Wind at 10,100,200 m, global radiation	

B3. Energy management

Country	Range	Resolution	Forecast	Update	Variables	Comment
Austria	72 h	All	Det; points	1h INCA; 6h		
Croatia	72 h	>7 km;<4 km (addin)	Det; point	12 h		
Czech Republic	72 h	4-7 km	Det; field+point	6h		
Poland						
Portugal	72 h	<4km;>7km	Det; field	12 h	Probability of thunderstorms	
Romania	72 h		MOS; point			
Slovenia	72 h	>7 km	Det			
Slovakia	72 h	<4 km	EPS; point	24 h		
Turkey	72 h	4-7 km	Det, points	24 h		

B4. Public/private companies (construction, transports)

Country	Range	Resolution	Forecast	Update	Variables	Comment
Austria	72 h	<= 7 km	Det; field+point	15 min INCA; 6h	Precip (type), Temp (surface,2m)	
Croatia	72 h	>7 km;<4 km (addin)	Det; point+field	12 h	Gusts above 60,90,120 km/h	
Czech Republic	72 h	4-7 km	Det; field+point	6h		
Poland						
Portugal						Weather center
Romania						Regional center
Slovenia	72 h	>7 km	Det+EPS; field+point	24 h		
Slovakia	72 h	<4 km	Det; point	6 h		
Turkey	48 h	4-7 km	Det, points	6 h	Surface temperature	

B5. Events (e.g. sports, festivals)

Country	Range	Resolution	Forecast	Update	Variables	Comment
Austria	72 h	<= 7 km	Det+EPS; point	15 min INCA; 6h	Wind speed+ gusts, precip (type), storm probability	
Croatia	72 h	>7 km;<4 km (addin)	Det; point+field	12 h		
Czech Republic	72 h	4-7 km	Det; -	6h		Occasional, not NWP directly
Poland	72 h	>7 km	Det; point+field	12 h		
Portugal	72 h	<4km;>7km	Det; field+point	12 h		
Romania	72 h		Det+EPS			Occasional
Slovenia	72 h					
Slovakia	72 h	<4 km	EPS; point	6h; nowcasting	Precip (type), wind/gusts	
Turkey	24 h	4-7 km	Det, points	24 h		

B6. Tourism

Country	Range	Resolution	Forecast	Update	Variables	Comment
Austria	72 h	<= 7 km	Det	15 min INCA; 6h	Wind speed+ gusts, precip (type)	
Croatia	72 h	>7 km;<4 km (addin)	Det; point+field	12 h		
Czech Republic	72 h	4-7 km	Det; field+point	6h		No particular clients; general info
Poland						
Portugal						Weather center
Romania						All available forecasts - weather center
Slovenia						
Slovakia	72 h	<4 km	EPS; field	24 h	Precip (type)	

B7. Media

Country	Range	Resolution	Forecast	Update	Variables	Comment
Austria	72 h	All	Det; field+point	6 h	T2M, RH2M, clouds, wind, precip	
Croatia	72 h	>7 km;<4 km (addin)	Det; point+field	12 h		
Czech Republic	72 h	4-7 km	Det; field+point	6h		
Poland						
Portugal						Weather center
Romania	72 h	4-7 km	Det; field			Locations on mountainous areas
Slovenia						
Slovakia	72 h	4-7 km	Det; field	24 h		
Turkey						

B8. Agriculture

Country	Range	Resolution	Forecast	Update	Variables	Comment
Austria	72 h	all	Det; field+point	15min INCA; 6 h	Precip, cloud, T2M, RH2M, potential evaporation	
Croatia	72 h	>7 km;<4 km (addin)	Det; point+field	12 h	Fire weather index	
Czech Republic	72 h	4-7 km	Det; field+point	6h		
Poland						
Portugal	72 h	<4km;>7km	Det; field	Daily	Phase of development of crops; soil water balance; frost damage forecast	
Romania	72 h	4-7 km				Forecasts available at specific department
Slovenia	72 h	>7 km	Det; point	24 h		
Slovakia	72 h	<4 km	EPS; field	24 h		
Turkey	48 h	4-7 km	Det; field	24 h	Frost temperature	

B9. Civil protection

Country	Range	Resolution	Forecast	Update	Variables	Comment
Austria	72 h	All	Det+EPS; Field+Point	Continuous	U,v,precip,heat stress+cold stress, forest fire index	
Croatia	72 h	>7 km;<4 km (addin)	Det; point+field	12 h	Biometeorological index	Meteo alarm thresholds
Czech Republic	48 h	4-7 km	Det; field+point	6h		
Poland						
Portugal	72 h	<4km;>7km	Det; field+point	12 h		
Romania	72 h	4-7 km	Det; field+point			
Slovenia	72 h	>7 km	Det; field+point	24 h		
Slovakia	72 h	<4 km	Det+EPS; point+field	6 h, nowcasting		
Turkey						

Comments, courtesy J. Rio

- 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;
- 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.



Conclusion

The applications and the use of the model output is too “dispersed” to be able to define an

END USER ...

It is below the red line on the next slide,

But a a common toolbox and a portfolio seem feasible



From science to operations summarized on 1 sheet

activity	ALADIN governance	Link with HIRLAM	Actions undertaken	
Scientific research	CSSI	Common work plan	No stimulus needed	common code
<div style="border: 2px solid red; padding: 5px; display: inline-block;">Algorithms (scalability/efficiency)</div> Scientific validation	CSSI	Add-hoc discussions during the ASM/workshop	Action on ACRANEB2; Physic-dynamics interaction; HARP	
“phasing” + sanity check	MF + CSSI + ACNA	Close link with the HIRLAM system PL		
porting	ACNA			Different governances: split responsibilities, but common tools
Meteorological (local) validation	LTMs		HARMONIE system (Ankara action)	



END USERS