Strategy (update)

Based on the discussions during the strategy meeting in Brussels 27-29 September 2011 with some additional input

P. Termonia

Proposal in PAC for the strategy meeting

- An <u>update</u> of the 10-y ALADIN strategy document (2008-2017) taking into account

    - The outcome of the Brac-HR meeting (+post-Brac discussions group of 4, PAC discussion)

    - Some extra input on DA and EPS, **up to the judgment of the CSSI chair and the PM**

    - A technical analysis of the overlap/disjoint goals between the ALADIN and the HIRLAM strategy

Short-term issues to keep the strategy *on track*, see my strategy note

- Code: design/development/maintenance
- SURFEX
- Collaboration
- Funding
- End user and verification

Consensus strategic goals

- Radar DA

- Consensus on the way forward after the Brac-HR.

- Diagnostics/Validation/Verification: there is still in my view some opportunity for settling where regarding the diagnostics and validations.

One can start the strategy planning from many (high-level) angles

|	
Organizational: The merge of HIRLAM-ALADIN and collaboration	Within our two consortia: we control this
The evolution to probabilistic forecasting	
Collaboration and training	
Code design and maintenance	Within meteorology, or at least strongly related, involving modeling (we speak the same language), but modeling carried out outside of our two consortia (IFS, OOPS, different communities)
The widing of applications (chemistry, nowcasting, climate)	
New data (radar, GPS, ADM Aeolus, what will there be in 2015?)	Meteorology, but departments that are also driven by applications that do not involve modeling, who speak a different language.
Our users	The client is king, but it is still *our* client.
What will the HPC machines look like in 2025.	We don't control the market!!!
Others Depending on the starting point you will end up with different strategies	

THREAT?

The problem of the High-Performance Computing, reduced to its core essence

We need for instance the difference in pressure between two grid points

Processor 1

Processor 2

Processor 3

Processor N

Slow communication
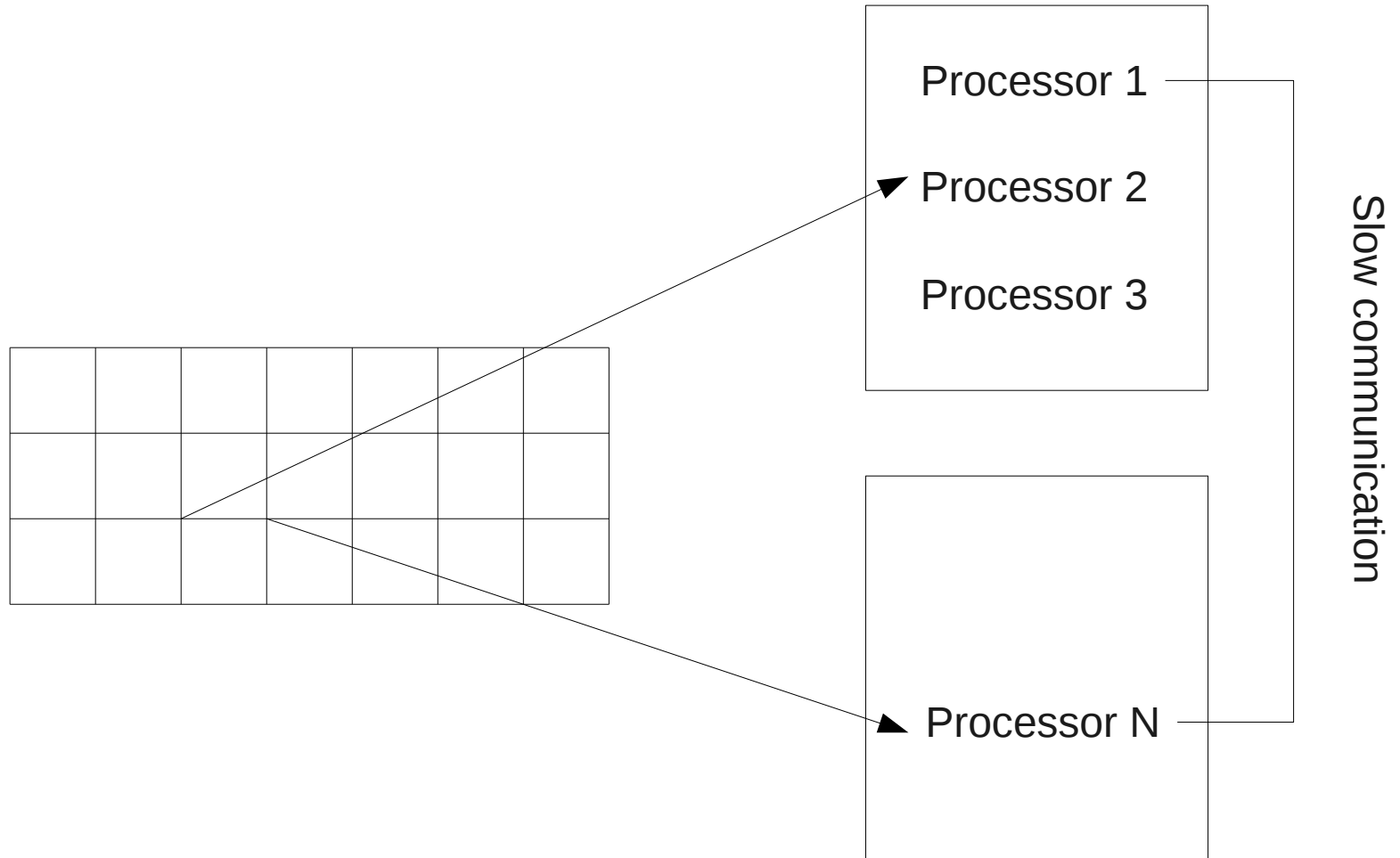
Dynamics Evolution of HPC
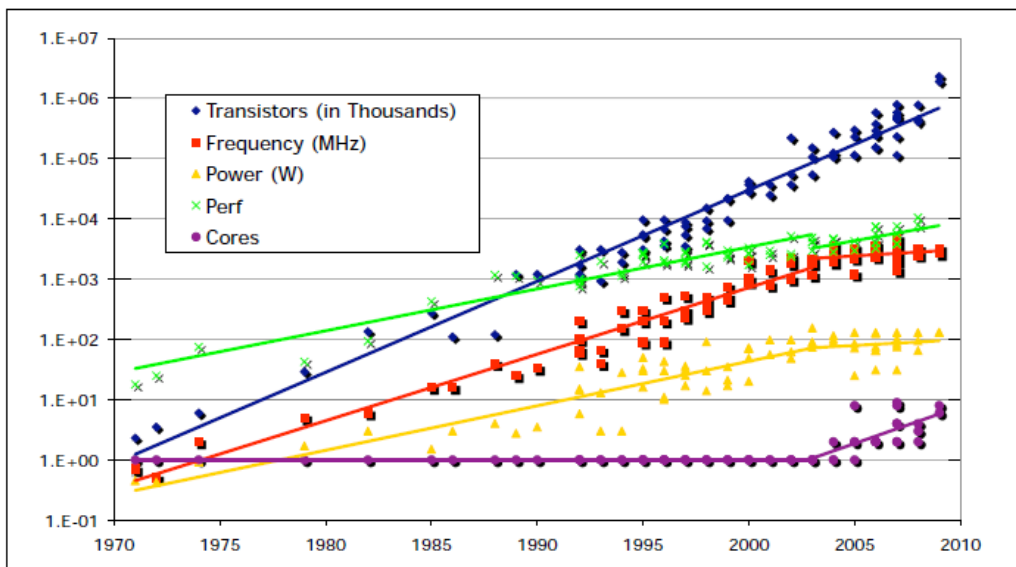
Informations gathered from some high performance computing vendors:

- ► processor **clock period** ⇓,
- ► **memory** available to nodes ⇓,
- ► processor **instruction set** ⇓,
- ► **number of processor** and of nodes ⇑,
- ► the I/O bottleneck partly solved by specializing processors (but then, the code does not take advantage of this automatically).

HYBRID PARALLELLISM

# About supporting different physics and perhaps dynamical cores?

- Currently our system can be run with essentially two physics packages: AROME and ALARO, but they have one common dynamical core.

- Experience from other consortia shows that maintaining different physics packages is feasible, but maintaining different dynamical cores is difficult.

- Besides the spectral methods there exist many gridpoint methods, see next slide (taken from the MetOffice presentation in the EWGLAM meeting in Exeter) ...
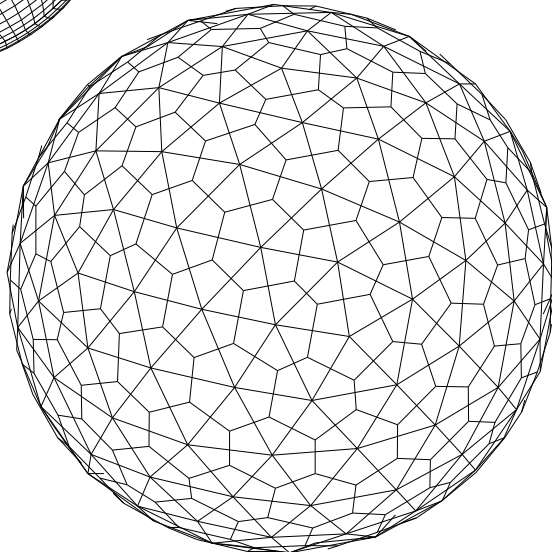
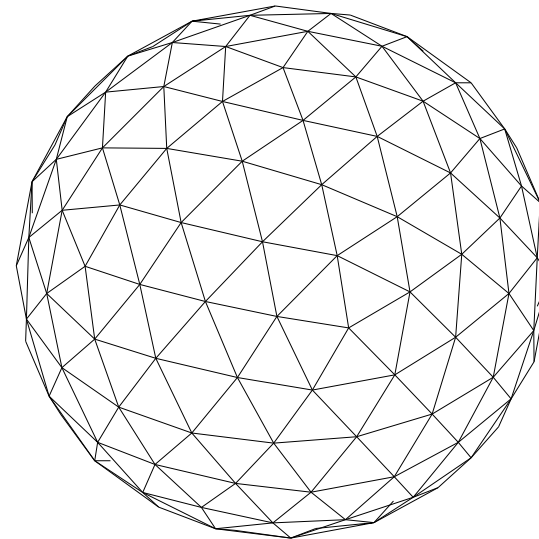# Exotic Grids being considered by the MetOffice for the future
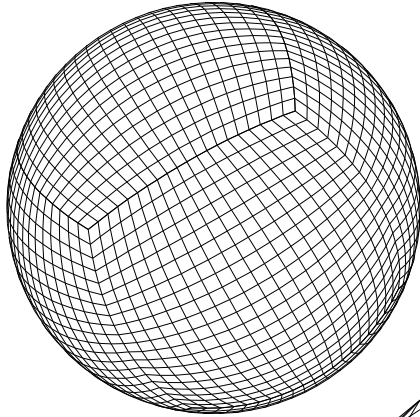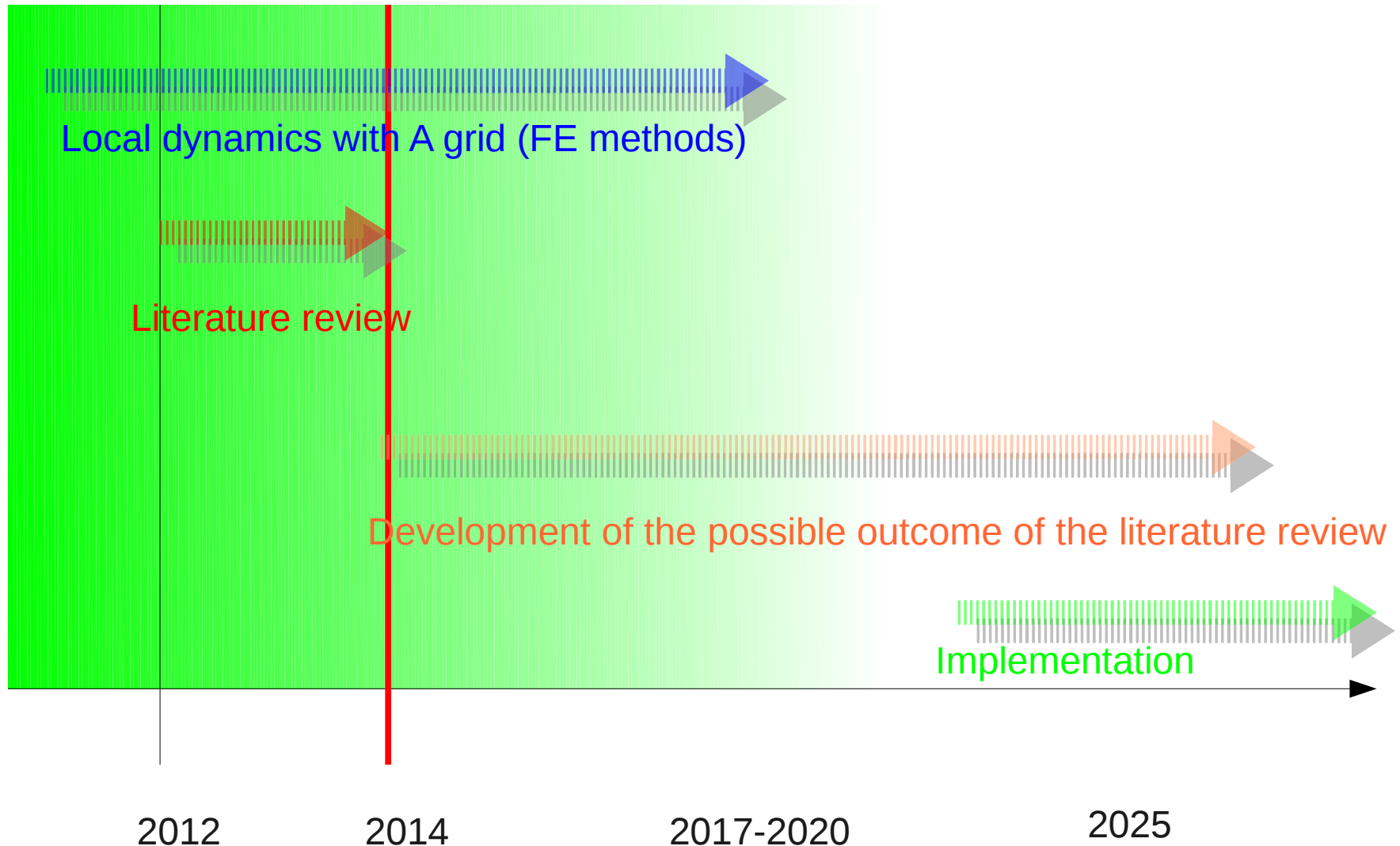
Cubicsphere
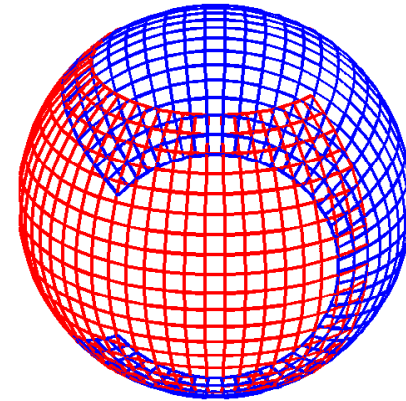
YinYang

Kites

Icosahedral

Evolution of HPC

- MetOffice: maintenance of three dynamical cores is very heavy (during EWGLAM it was said: "maintaining different physics is very easy")

- One of the dynamical cores in one of the consortia (ALADIN/HIRLAM, COSMO, UKMEt Office) could be the best approach for the long-term scale evolution. We don't know.

- Proposal: intercomparison tests on HPC infrastructure (e.g. PRACE) become active in FP7, and later FP8 funding.

- Here is a good role for EUMETNET:

- SRNWP dynamics ET and system ET for the scientific aspects (i.e. watch dog to guarantee the spirit of European "friendly competition")

- Link with the European Commission (Eumetrep?)

- So there are three aspects:

  - Science: writing project proposals, define clean tests (without being competitive) a job for the consortia;

  - Monitoring the calls and administration (find a person within ALADIN);

  - Link with EU.

Dynamics: road map

Local dynamics with A grid (FE methods)

Literature review

Development of the possible outcome of the literature review

Implementation

2012   2014   2017-2020   2025

Eliminitating the A grid means we have to overhaul the whole system.
We stay with the current system at least for the term of the current strategy plan (green area).

Other issues

- Fog and visibility

- Chemistry (enviro HIRLAM), Nowcasting,

- EPS and DA

- Merge between ALADIN and HIRLAM

User requirements

Wind energy:
Economic value of EPS systems

Could this be extended to other consortia:
The role of EUR-EPS in EUMETNET?

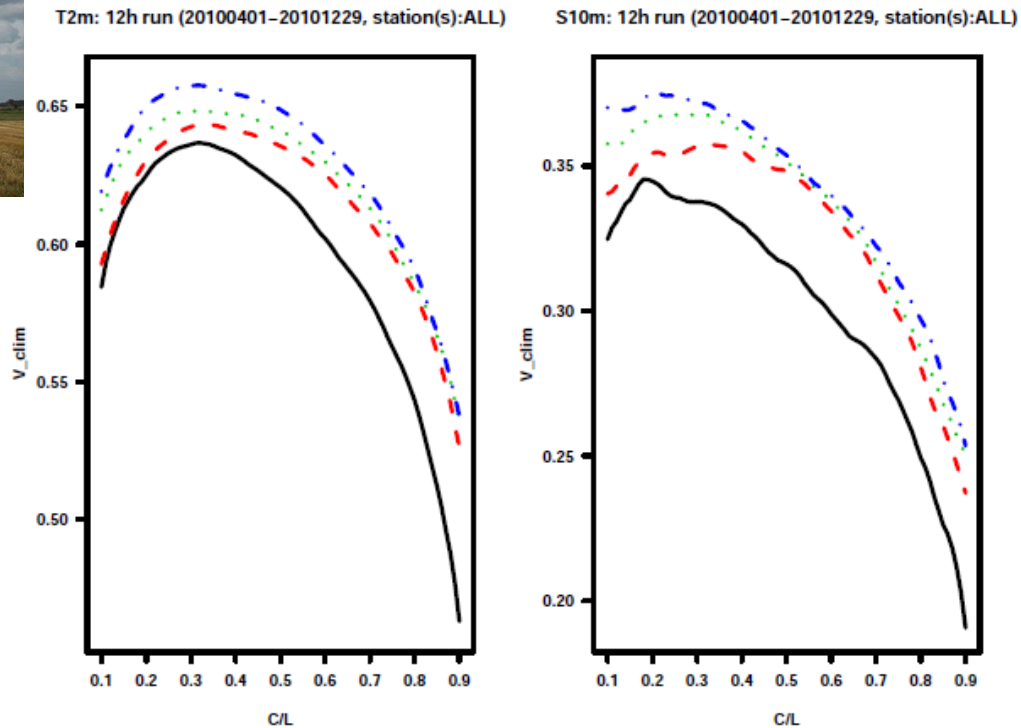T2m: 12h run (20100401–20101229, station(s):ALL) S10m: 12h run (20100401–20101229, station(s):ALL)

Figure 9. Potential 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 T_{2m} and S_{10m} (run = 12h, lead time = 42h).

But who is our end user?

End User	Référence explicite au modèle ALADIN dans le contrat	Description du produit généré sur base du modèle ALARO (7 km)
OUTPUT ALARO → Secteur "Pollution" via IRCEL- CELINE (Intergewestelijke Cel voor het Leefmilieu / Cellule Interrégionale de l'Environnement). **Produit commun : prévisions relatives aux conditions défavorables à la dispersion des polluants.**		
IBGE – BIM (Région de Bruxelles-Capitale)	oui	a) Graphique d'évolution du profil vertical de la longueur de transport, comprenant aussi - l'analyse automatique du critère sur la longueur de transport ; - la spécification de la période au cours de laquelle les conditions météorologiques seraient défavorables ; - une mention explicite lorsque les critères de la procédure d'alerte sont satisfaits. b) Tableau détaillé des niveaux d'avertissements (niveaux basés sur les valeurs de la longueur de transport dans les 500 premiers mètres de l'atmosphère). c) Météogramme des principales variables météorologiques : température, humidité relative, vitesse et direction du vent horizontal, pression atmosphérique en surface, nébulosité, précipitations. Produits établis pour Bruxelles. 2 envois/jour.
VMM – IRCEL (Région flamande)	oui	Mêmes produits mais établis pour la Région flamande : Antwerpen, Brugge, Dessel, Gent, Geraardsbergen, Hasselt, Kortrijk, Lanaken, Leuven, Oostende. 2 envois/jour.
DGRNE (Région wallonne) → SPW (Service Public de Wallonie)	oui	Mêmes produits mais établis pour la Région wallonne : Liège, Namur. 2 envois/jour.

- In the RMI we keep track of the users of data created by ALARO

- In principle such a database should allow us to define our user

- I propose to extend such exercise to the other countries (if the information is not confidential)

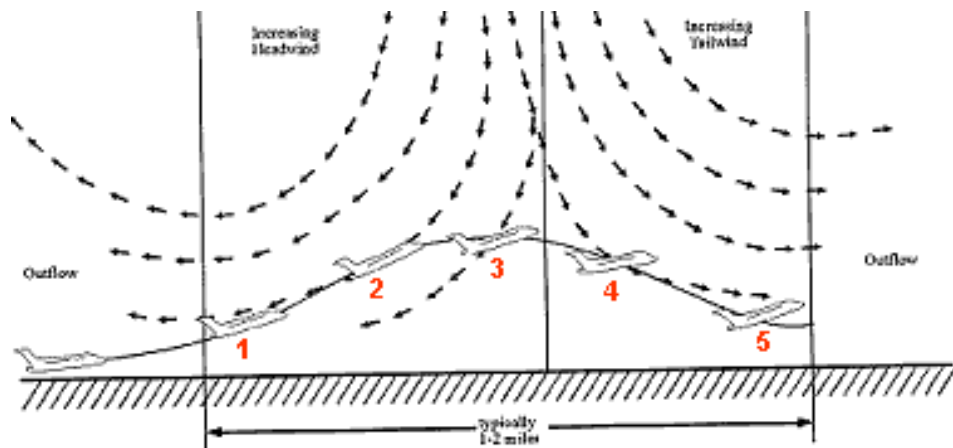- This should not be necessarily carried out by a scientist.

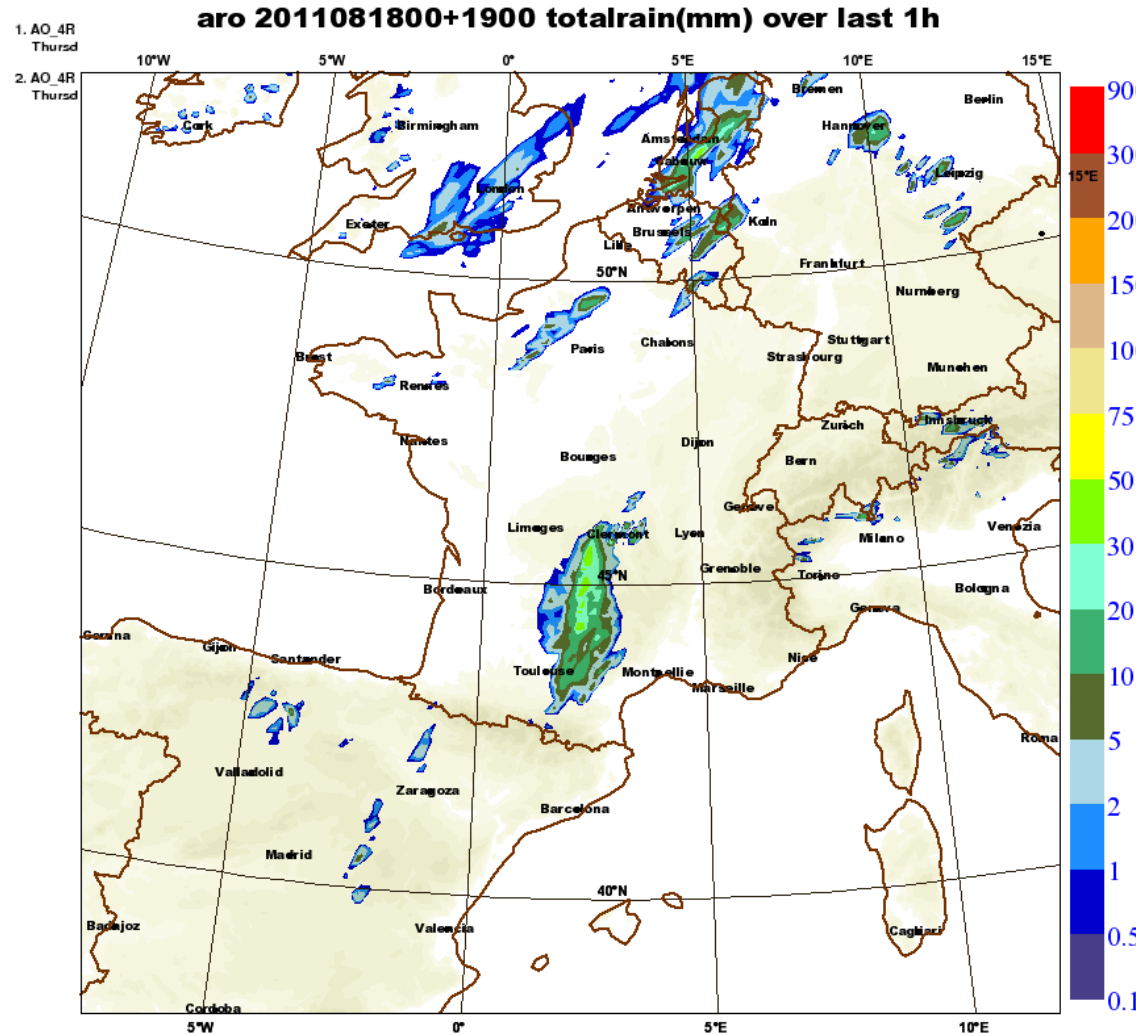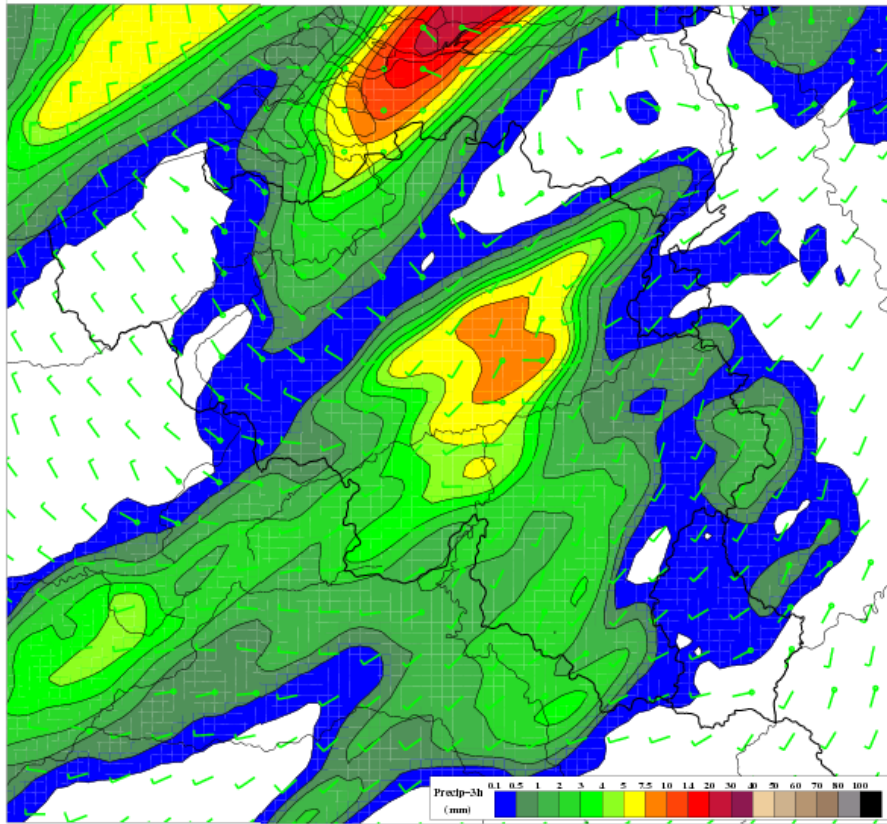# Diagnostics

Need for high-resolution NWP?
Pukkelpop 18 August 2011

- 5 deaths during the Pukkelpop festival of 18 August 2011.

- The immediate question: ``Was it correctly predicted''?

- It turned out to be a case of a very strong local downburst. The scale of the trace on the location is about 50-100 m.

J. Clim. Appl. Meteorol., 25, (1986), p. 1399

ALARO and AROME output

aro 2011081800+1900 totalrain(mm) over last 1h

The RMI issued an alert based on the ALARO output.

Next steps

- Run meso-NH at very high-resolution and investigate whether some useful resolved downdrafts van be found.

- If so this can be taken as a *diagnostic target*, in other words our truth. A parameterization should produce downdrafts with the same intensity and occurrence. For instance not all the time in convective systems, because then we would have to cancel festivals all the time.

- When increasing the resolution to hectometric scales meso-NH then becomes our scientific target, both in ALARO and AROME.

- ***Extra funding for implementing academic meso-NH science in an NWP context could be justified to our policy makers.***

Next steps

- For this the following issues have to be addressed:

  - Attention should be payed to flexibility-modularity-generality (as mentioned in our ALADIN strategy 2008-2017), which is already part of the short-term actions mentioned above, specifically with the work on testing 3MT in ARPEGE.

  - I perceive a certain confusion in the minds of our experts between scientific methodology and algorithmic processes. This requires a better articulation of this distinction based on concrete examples.

  - Take some special care about our upstream scientific sources (i.e. scientific literature), which have provided and will provide many benefits, but which we should not forget to clearly identify.

A word about scientific evolutions: joining **4** streams of scientific research: ALARO-1

- MT (Piriou 2007) → 3MT (Gerard *et al.* 2007) → hydrostatic ALARO-0 → NH ALARO-1 and PCMT (Piriou): **multiscale treatment of deep convection** (see talk of Neva)

- Piotrowksi *et al.* (2009) → **physics-dynamics interaction (?)** → Work of Lisa (Bengsston) on cellular automata, currently coded with ALARO-0.

- The discovery of **non-zero turbulent diffusion in the stable regimes** concluded from Quasi-normal-mode-elimination techniques of Sukoriansky *et al.* (2005): TOUCANS (see talk of Filip)

- Lilly (1968) → Betts (1973)→ Marquet (2011)'s new moist thermodynamical variable theta_1s → Marquet, Geleyn (2011) -> treat **shallow convection as part of the vertical diffusion** → TOUCANS?

Seamless systems

- Within the modeling communities there is a growing interest in "seamless" approaches, be it the temporal scales (from nowcasting to climate) or in the spatial scales.

- An example is given by Walters *et al.* (2011), Geosci. Model Dev., **4**, 1213-1271.

- The aim of the previous steps is to investigate how far we can go in our system to provide a diversity of model configurations that can be considered as a seamless approach across the different spatial scales.

What is expected from GA:

- Take note that a concrete way forward has been proposed for the two open issues of the Brač-HR strategy meeting in 2010.

- · Regarding a strategic open issue of the diagnostics and validation of our systems: "should we take MF's academic meso-NH model" as our scientific target? (The question does not necessarily have to be answered now) This can be discussed with your experts.

- · Endorse or comment on the PM's proposal for analyzing the best way to realize this.