ALADIN status overview

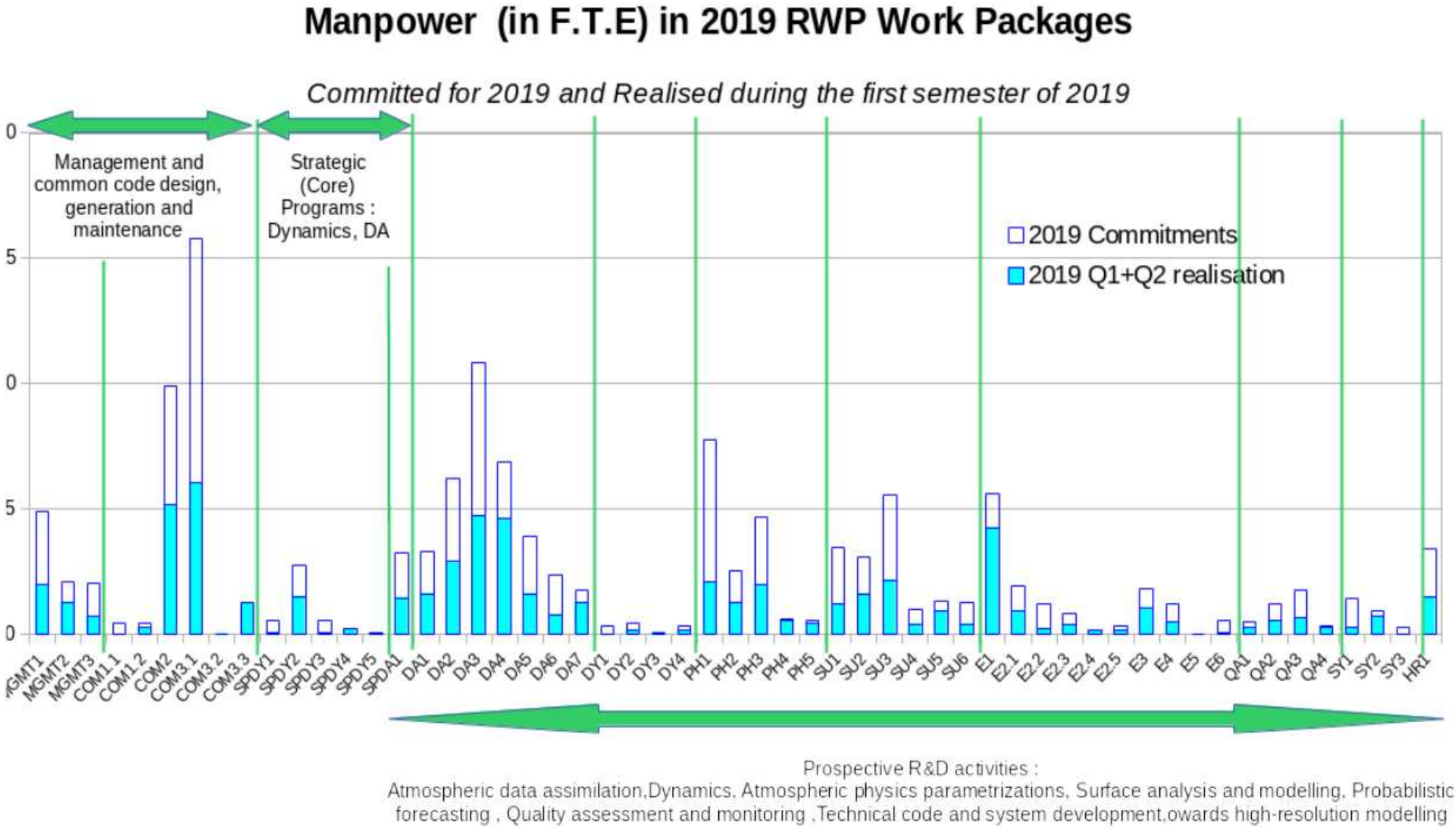
http://www.umr-cnrm.fr/aladin/

ALADIN workshop/HIRLAM ASM, 30 March 2020

Governance: last GA/HC

- High-Level group will further investigate:
  - **Intellectual Property:** legal requirements concerning IP in the different countries, look for compromise solutions;
  - **Voting system**:
    - the CWG will identify a list of decisions and propose the rules for voting each of them (majority needed to make each decision);
    - voting rights: concrete definition of the weight of the vote of each Member and its implementation in the MoU;
  - Settlement of disputes: the **“mediation”** option of the ICC procedure instead of the “arbitration”.
  - The CWG will look for the best formulation and place regarding the obligation for each Member to ensure that it owns the IP of its products and is able to transfer it to other Members.

What we promised and what we actually did ...



Prospective R&D activities :
Atmospheric data assimilation,Dynamics, Atmospheric physics parametrizations, Surface analysis and modelling, Probabilistic forecasting , Quality assessment and monitoring ,Technical code and system development,owards high-resolution modelling

Tribute to Jean-François Geleyn

A tribute to

Jean-François Geleyn

6 February 2020

Météo-France Conference Centre

Toulouse, France

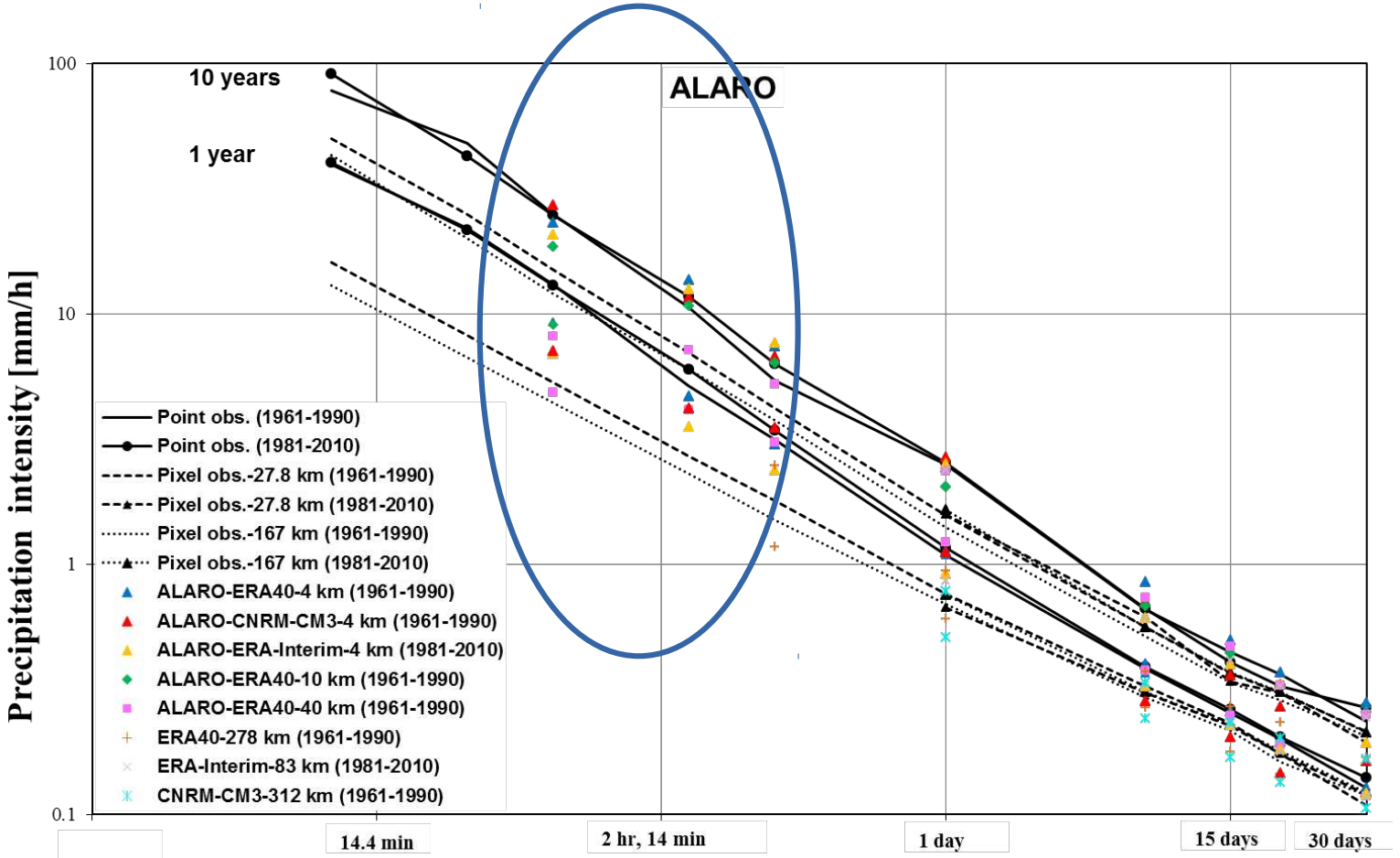
http://www.umr-cnrm.fr/aladin/spip.php?article349

A few lessens we learned from Jean-François, still valid today!

- Care for code developments.
- Consistency of the formulations
- Care for grey zone issues
- Care for the numerics

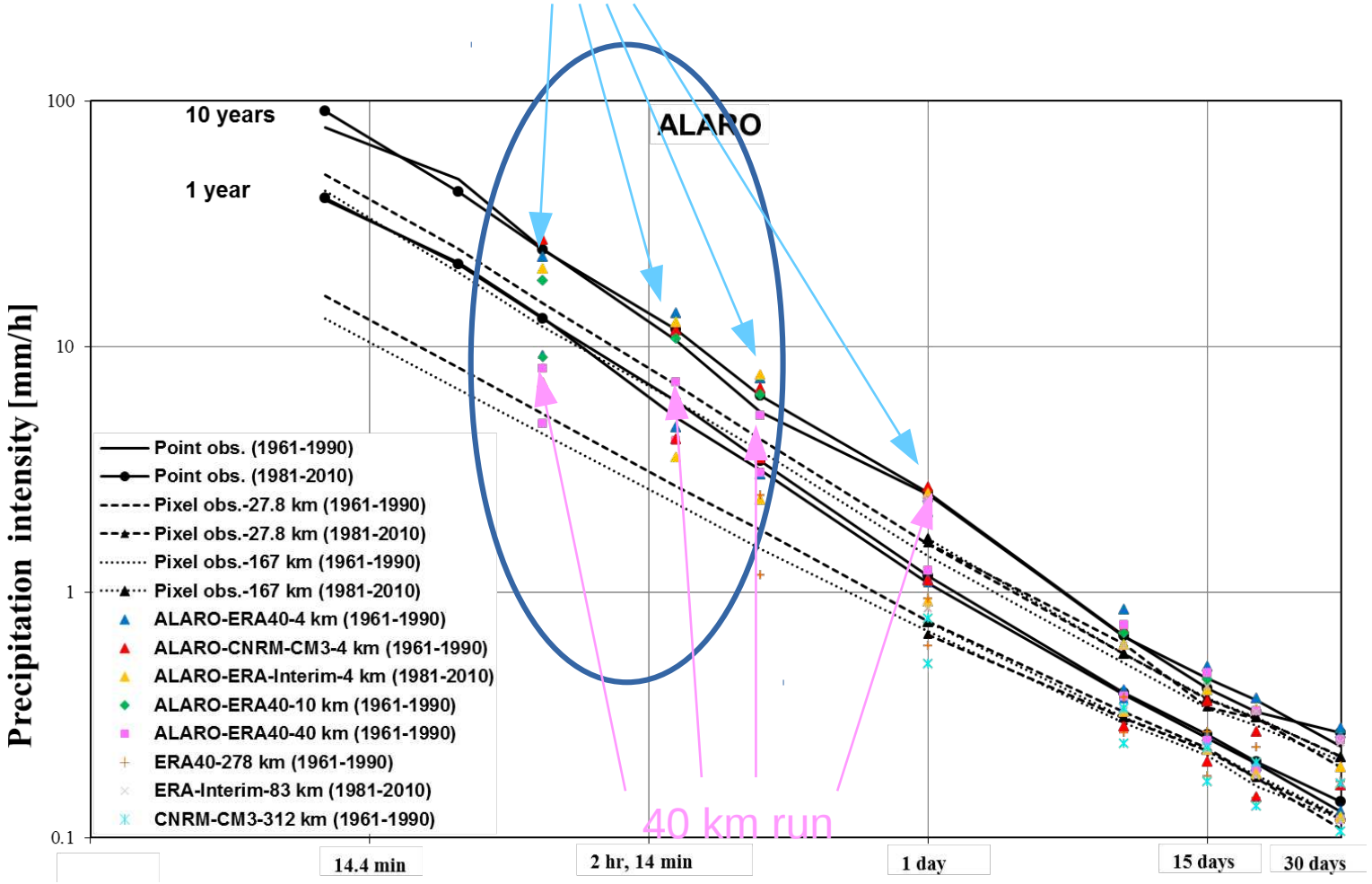
Going through the grey zone of deep convection

Increasing the resolution to 4-km adds value at the convective subdaily scales!

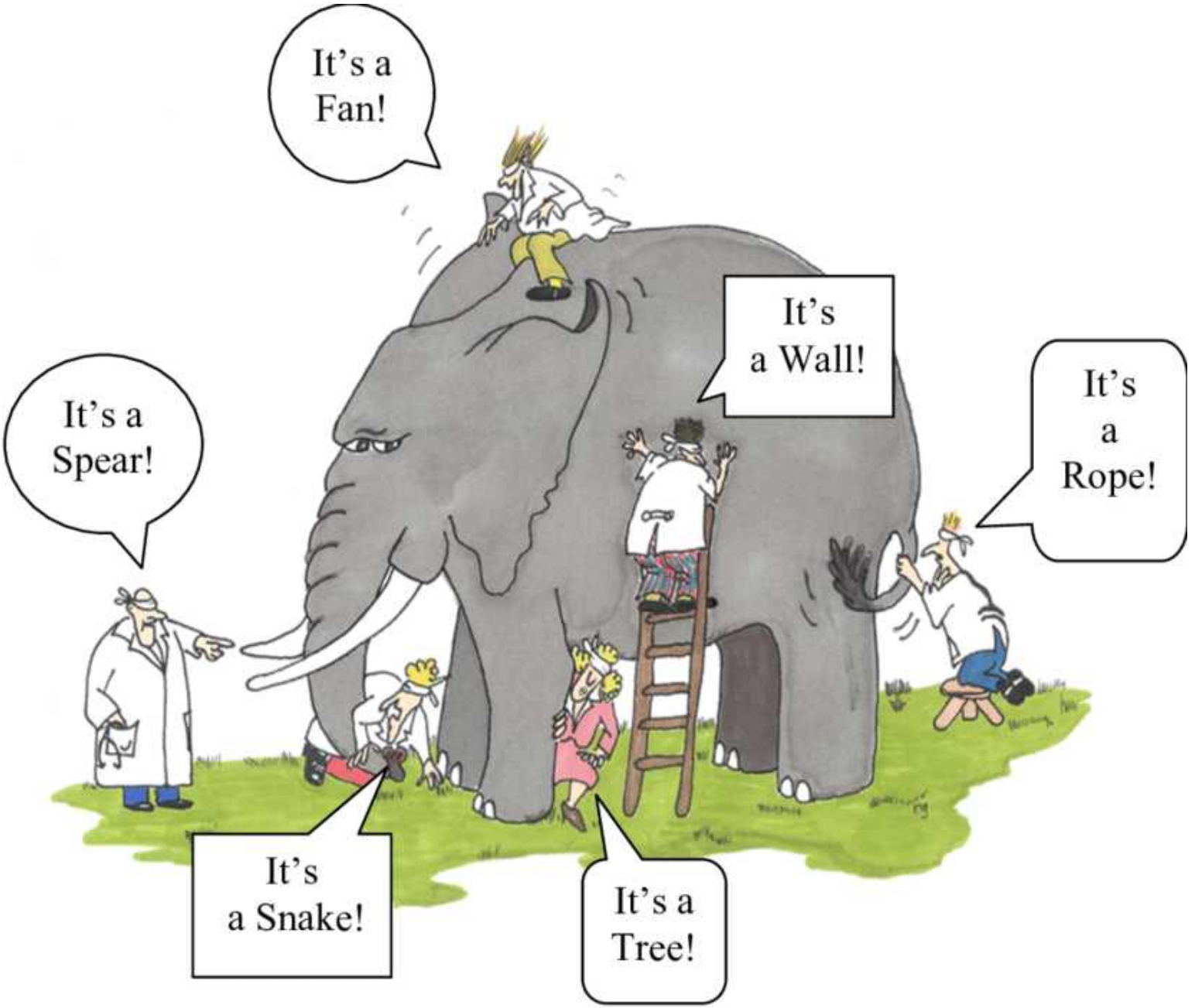


Going through the grey zone in climate runs

Increasing the resolution to 4-km adds value at the convective sundaily scales!

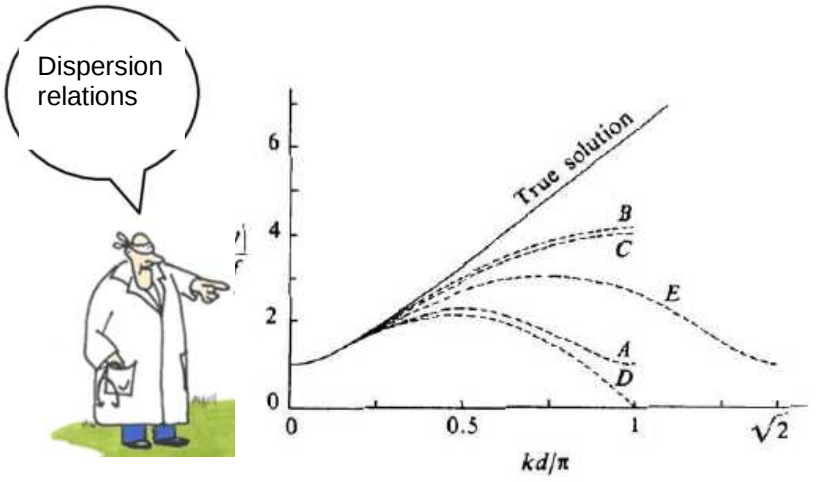


Brac-HR 2010: blind men and an elephant

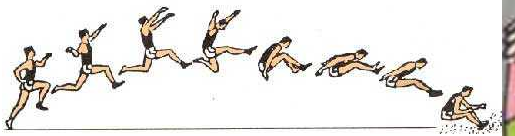


Blind men and a dynamical core

A grid	Spectral discr.	Semi-Lag Adv.	Semi-implicit solver



$$\frac{\partial \rho}{\partial t} + \nabla \cdot (\rho \mathbf{U}) = 0$$

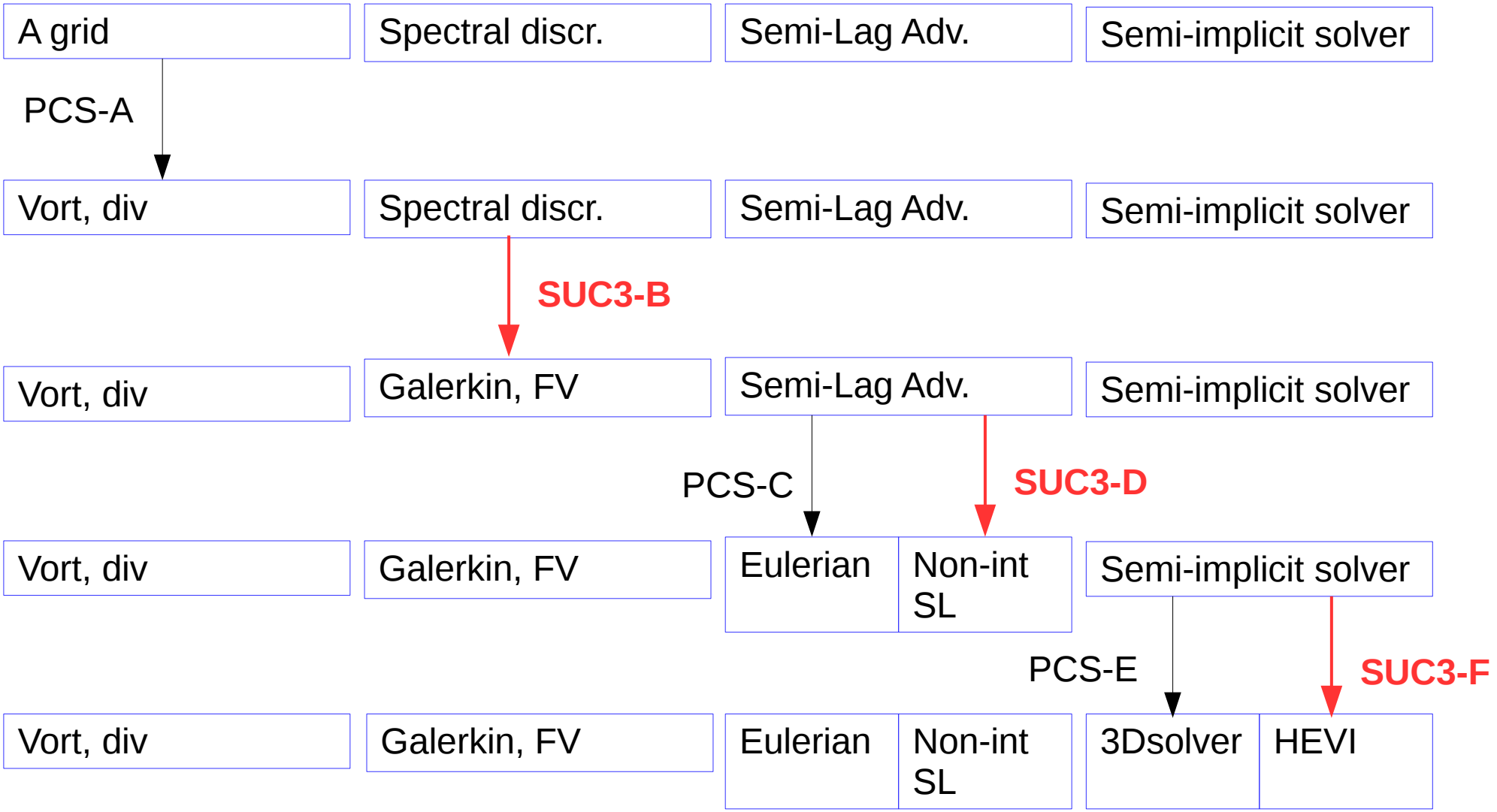


Steep slopes!

Long time steps!

Scalability!

Blind men and a dynamical core: how to not fool oneself



- Set up clean comparison conditions:
  - **B**: At what scales do we need locality?
  - **D**: How will SL behave at high resolution + fall back solution
  - **F**: Stability (efficiency) of Euler and/or HEVI

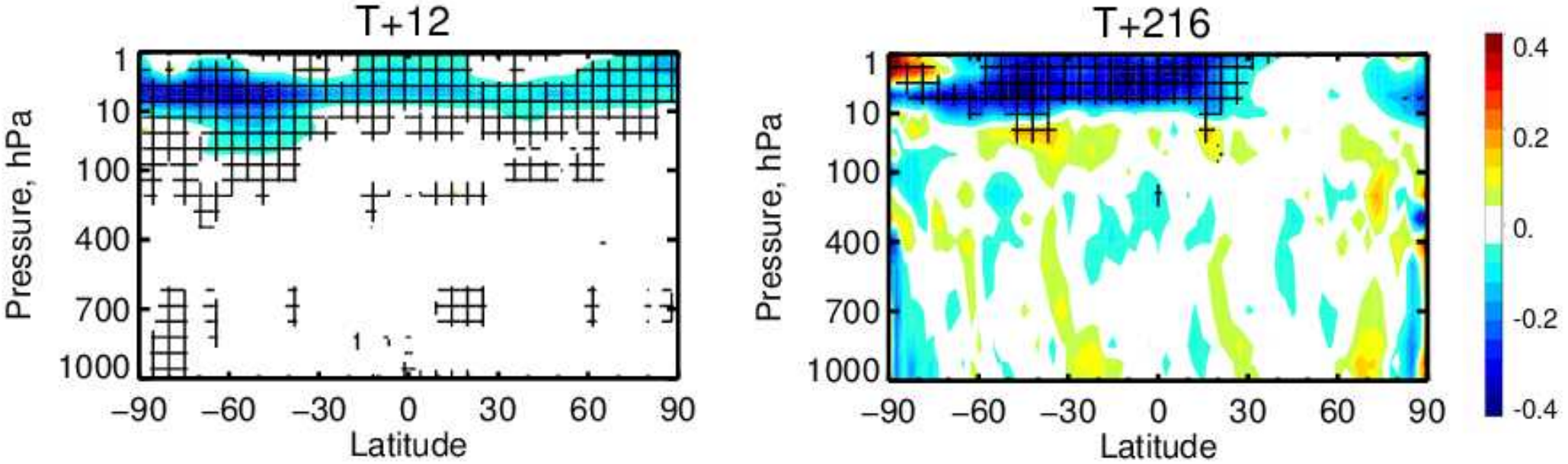
Strategy meeting

- Is part of the work of the CWG.
- Strategy meeting took place in Toulouse on 3-4 February 2020.
- A first draft of the strategy document has been prepared.
- First draft was sent to the LTMs to get input on prospects for man power commintments and comments, **will be discussed this week**
- Will be discussed during the PAC and HAC meeting on 14 and 15 May 2020.
- Will be the basis for the content of the management.

Physics conclusion of the Physics Task Team

- Many of scientific topics are already ongoing: LIMA, CAMS, etc:
  - Important to keep in mind exchangeability between CMC's
  - Need for better communication and collaboration platforms
- What would the physics look like in 5 years from now: probably much the same as today, **BUT**
- Major developments lie ahead, but face severe practical, technical and scientific challenges:
  - maintaining relation with other codes (IFS, ARPEGE, MESO-NH)
  - code restructuring for true 3D physics
- no guarantee that such developments would lead to more accurate forecasts

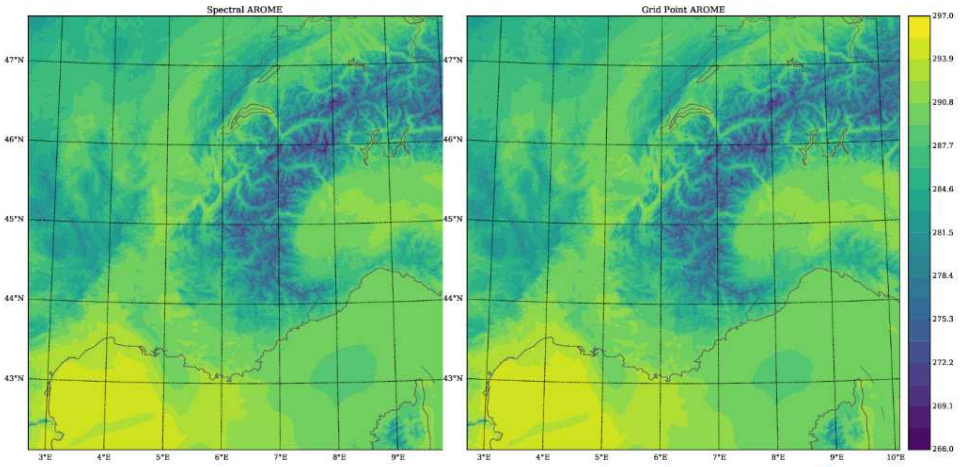
- NH dynamics as a departure from HPE [Jozef Vivoda]
- VFE new formulation for HPE [Jozef Vivoda]
  - VFE implemented in hydrostatic IFS in 2002 (Untch and Hortal)
  - extension of VFE to NH dynamics in 2013 (Vivoda and Smolíková) with new formulation of vertical integral and derivative operators with prescribed boundary conditions
  - in hydrostatic dynamics only vertical integral is needed
  - the new formulation of vertical integral together with a revised definition of explicit vertical coordinate may be beneficial for hydrostatic IFS, implemented in 2019



RMSE for T in IFS, Nov 2018 - Feb 2019, Tco1279: new VFE compared to the reference VFE. [**improved**, **deteriorated**, **++ statistically signif.**]

Strategic Program Dynamics

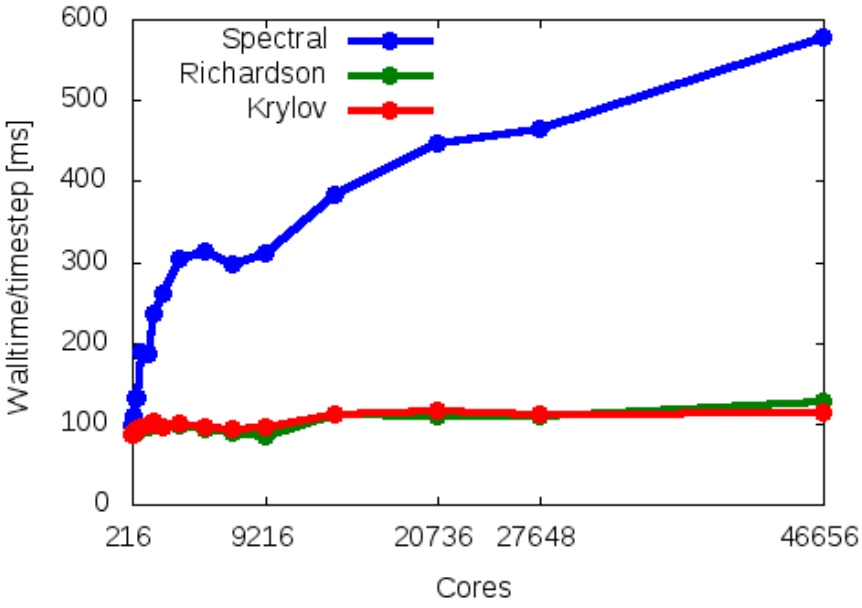
- ALADIN dynamics currently use a constant-coefficient semi-implicit spectral Helmholtz solver
- To address scalability and steep slopes, an alternative, non-spectral iterative Helmholtz solver is considered
- ***Thanks to the LAM geometry and constant-coefficient formulation, convergence speed is known beforehand ⇒ Important for operational use***
- Weak scalability test with ~50'000 cores shows superior scalability w.r.t. spectral solver



T80, $\delta t = 50\ s$, $T = 2\ h$, $\Delta x = 1.3\ km$, $N_{iter} \approx 13$, 8^{th} order

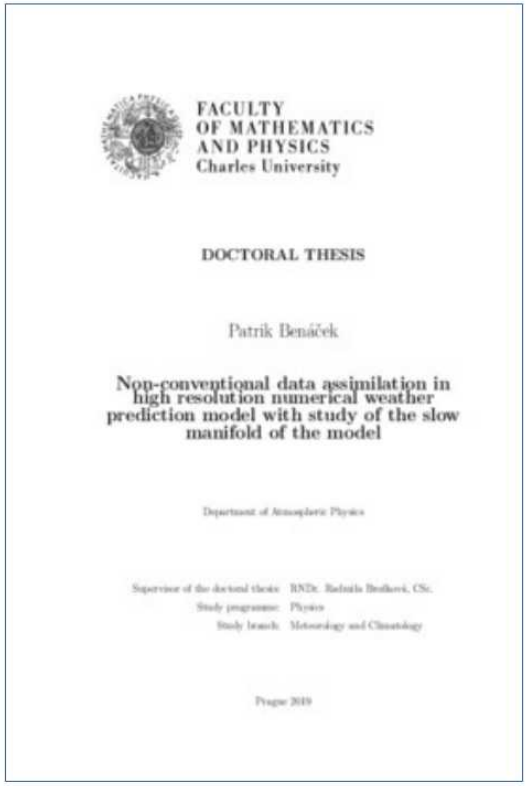
The long-term dynamical core strategy is based on a twofold approach:

- **Develop a LAM solution based on a finite-volume approach following the FVM developments of ECMWF.**
- **Finalize a gridpoint dynamics solver as a scientific testbed, as a backup solution and as an alternative to the spectral dynamics.**



Data assimilation suites

PhD and Paper



FACULTY
OF MATHEMATICS
AND PHYSICS
Charles University

DOCTORAL THESIS

Patrik Benáček

Non-conventional data assimilation in high resolution numerical weather prediction model with study of the slow manifold of the model

Department of Atmospheric Physics

Supervisor of the doctoral thesis: RNDr. Radmila Brožková, CSc.
Study programme: Physics
Study branch: Meteorology and Climatology

Prague 2019

Operational suites in LACE countries

DA	AUSTRIA ALARO	AUSTRIA AROME	AUSTRIA AROME-RUC	CROATIA ALARO	CZECH REP. ALARO	HUNGARY ALARO	HUNGARY AROME	SLOVAKIA ALARO	SLOVENIA ALARO	ROMANIA ALARO (prep.)
Resol.	4.8L60	2.5L90, 600 x 432	1.2L90 900 x 576	4.0L73 480 x 432	2.3L87 (NH) 1069 x 853	8L49	2.5L60	4.5L63	4.4L87 432 x 432	6.5L60
Cycle	40t1	40t1	40t1	38t1_bf8	43t2_bf8	40t1	40t1	40t1	43t2	40t1
LBC	IFS 3h (lagged)	IFS 1h (lagged)	AROME 1h	IFS 3h (lagged)	ARP 3h	IFS 3h (lagged)	IFS 1h (lagged)	ARP 3h	IFS 1h/3h (lagged)	ARP 3h
Method	OI + dyn. adapt	OI_main MESCAN + 3d-Var	OI_main MESCAN + 3d-Var + LHN + FDDA + IAU	OI + 3D-Var	OI + BlendVar	OI + 3D-Var	OI_main + 3D-Var	OI + DF Blending	OI + 3D-Var	OI + 3D-Var
Cycling	6h	3h	1h	3h	6h	6h	3h	6h	3h	6h
B matrix	-	Downscaled LAEF 11 km	Static ENS from AROME-RUC EDA	NMC method	Downscaled AEARP	ALARO EDA	AROME EDA	-	Downscaled ECMWF ENS	Downscaled AEARP
Init.	DFI	No (SCC)	No	No (SCC)	IDFI in production, SCC	DFI		No	No (SCC)	No (SCC)
Obs.	Synop + AS	Synop + AS Amdar Geowind Temp Pilot Seviri AMSUA/ MHS/HIRS ASCAT Snowgrid/ MODIS snowmask	Synop + AS Amdar/MRAR/EHS Geowind Temp Pilot Seviri AMSUA/MHS/HIRS/ATMS ASCAT Radar RH/Dow INCA + AS at hig.freq. MODIS snowmask.	Synop Amdar/ MRAR Geowind Temp Seviri	Synop Amdar/MRAR/ EHS Geowind Temp Seviri	Synop + AS Amdar Geowind Temp Seviri AMSUA/ MHS	Synop + AS GNSS ZTD Amdar/ MRAR/EHS Temp	Synop	Synop + AS Amdar/ MRAR/EHS Geowind Temp Seviri AMSUA/ MHS/IASI ASCAT	Synop, Temp, Seviri AMSUA/ MHS

- further work and operational assimilation of radar data (ALARO Slovenia, AROME Austria)
- assimilation of GNSS data (AROME and ALARO Slovakia, E-GVAP in Slovenia)
- MRAR data assimilation
- exploring other new data types

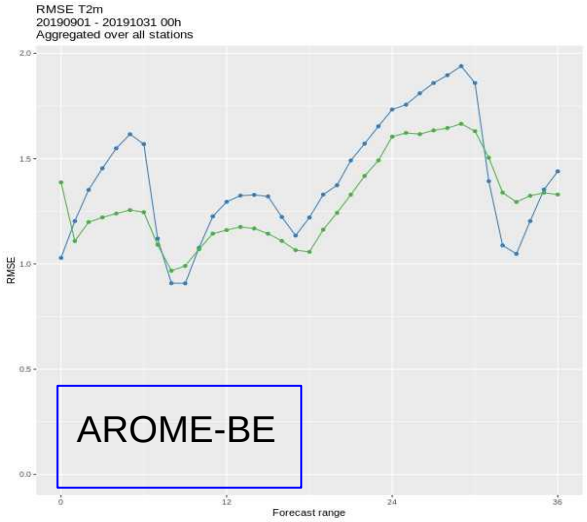
DAsKIT: Milestones & Achievements

2018

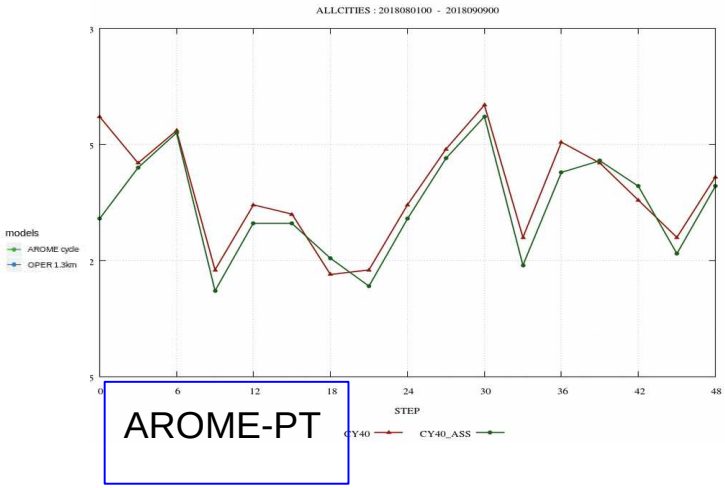
DAsKIT KICK-OFF → Surface DA KIT (SYNOP)

2019

DAsKIT (surface) local implementation; tuning & start joint validation



AROME-BE



AROME-PT

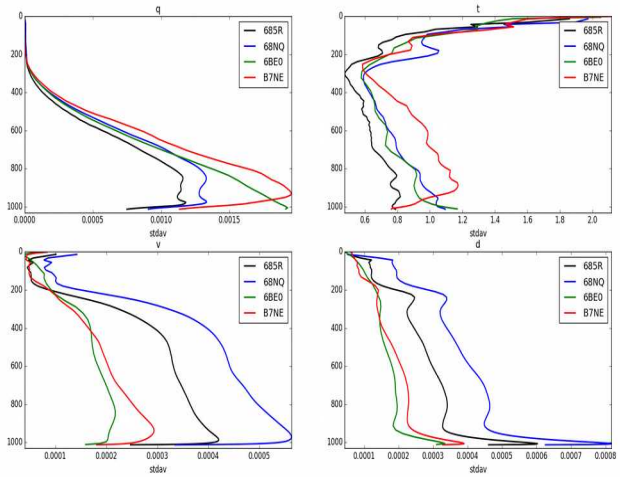
2020

DAsKIT step-by-step combined (OI_MAIN+3D-VAR)

Algeria & Portugal & France

Ensemble B-matrix modeling studies:

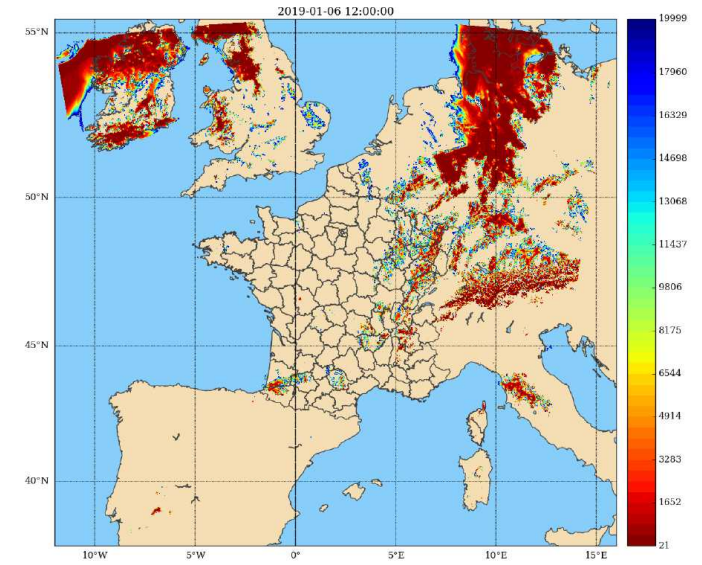
Flow-dependence aspects using climatological B-matrix



Model output postprocessing (new in RWP2020: **PH5**)

- Visibility diagnostics based on microphysics using cloud liquid,cloud ice, rain, snow water content …
- But no aerosols.
- An alternative approach: use ML techniques.

Visibility (min 1h), AROME 2019-01-06 00UTC + 12h



Ingrid Etchevers

A comparison of datamining tools: visibility estimation from AROME-Morocco outputs by Machine Learning regression

Driss BARI [(1)] and Mohamed AMEKSA [(2)]
[1] DMN, CNRMSI/SMN, Casablanca, Morocco
[2] University Hassan II, ENSAM, Casablanca, Morocco

Table 1: Mean absolute error (m) of the best model per datamining algorithm, per platform

	Mean absolute Error (m) of the best models			
	Deep Learning	Random Forest	Gradient Boosting Machine	XGBoost
scikit-learn	1563	1221	1186	1272
H2O.ai	1552	1245	1189	1382
WEKA	1903	1222		
Keras	1506			

Thank you for your attention!