Tour d'ALADIN

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

26th ALADIN General Assembly, 26 November 2020

Algeria

1- AROME Microphysics:

Desert dusts aerosols and microphysics interaction in AROME: LIMA+Dust-init vs LIMA.

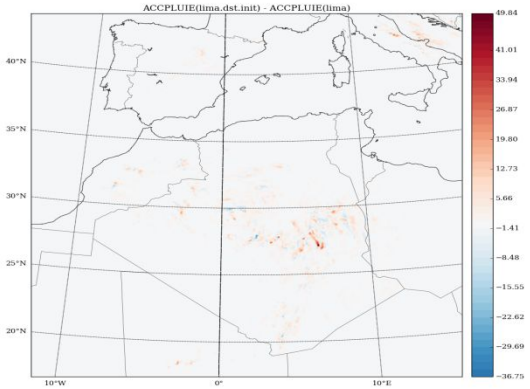


Fig. 1: ACCPLUIE Difference (LIMA(Dustinit) - LIMA).

2- DAsKit Program

Use of three observations (SYNOP,TEMP & AMDAR) with AROME-3Dvar.
Comparison AROME-3dvar vs AROME-OPER: Simulations performed for two weeks period.

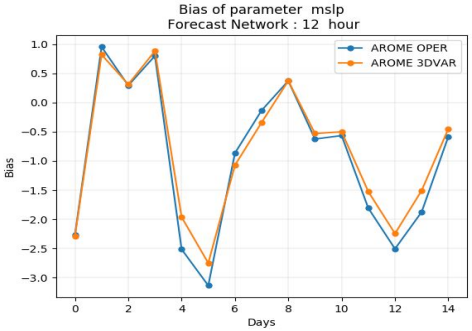


Fig.2: Bias: MSLP

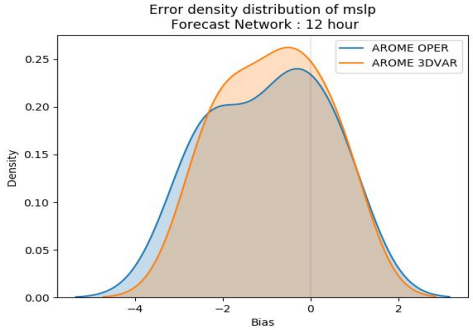
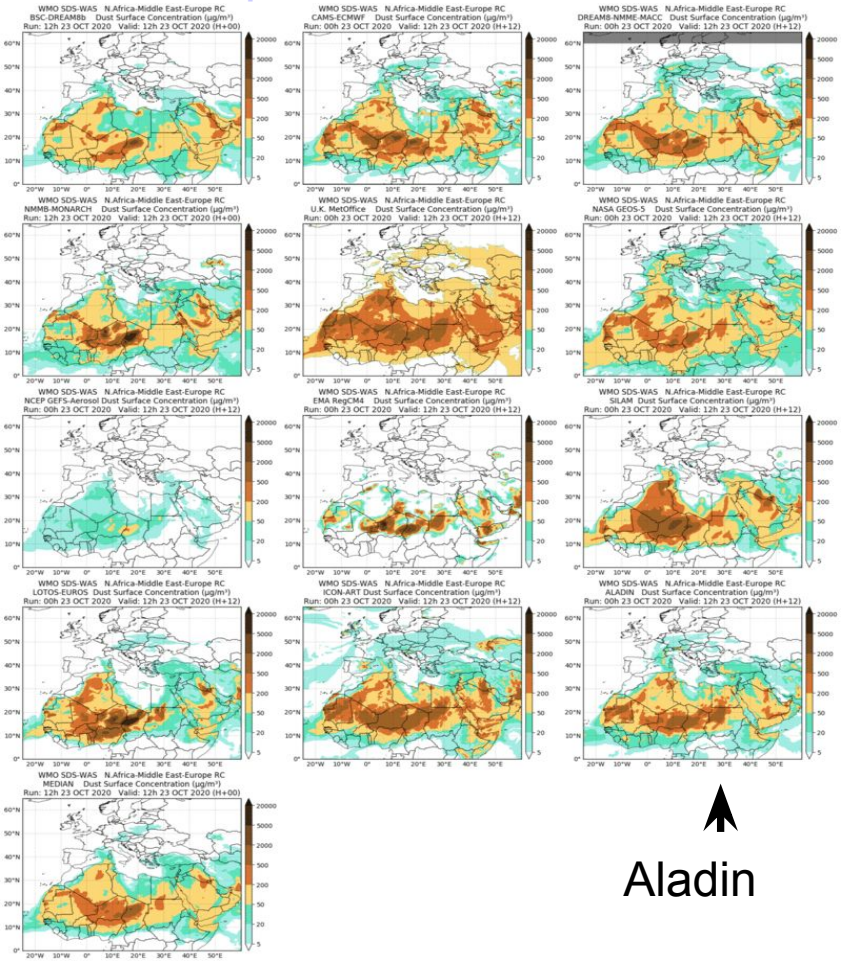


Fig. 3: Error density: MSLP

3- SDS-WAS Project (WMO):

Aladin-dust forecasts are now available on the SDS-WAS website:
https://sds-was.aemet.es/forecast-products/dust-forecasts/forecast-comparison



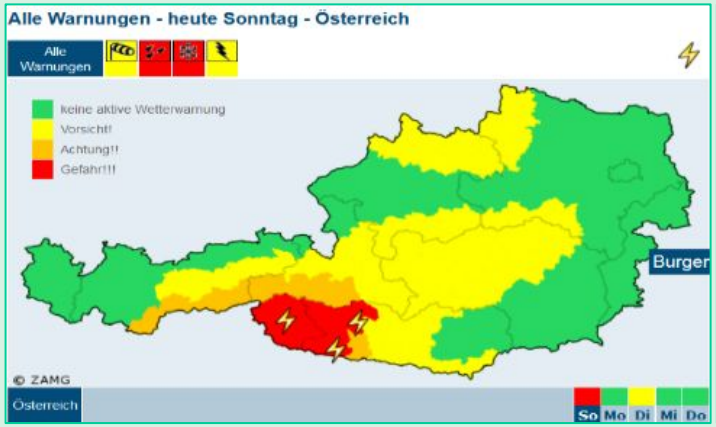
Aladin

Austria

Currently 3 operational AROME-based NWP systems in Austria:

AROME-Aut (2.5km/L90, deterministic model) **oper since 2014**
C-LAEF (2.5km/L90, ensemble system based on AROME-Aut) **oper since 2019**
AROME-RUC (1.2km/L90, deterministic nowcasting model) **oper since 2019**

C-LAEF has become an important backbone of the ZAMG Warning System in 2020



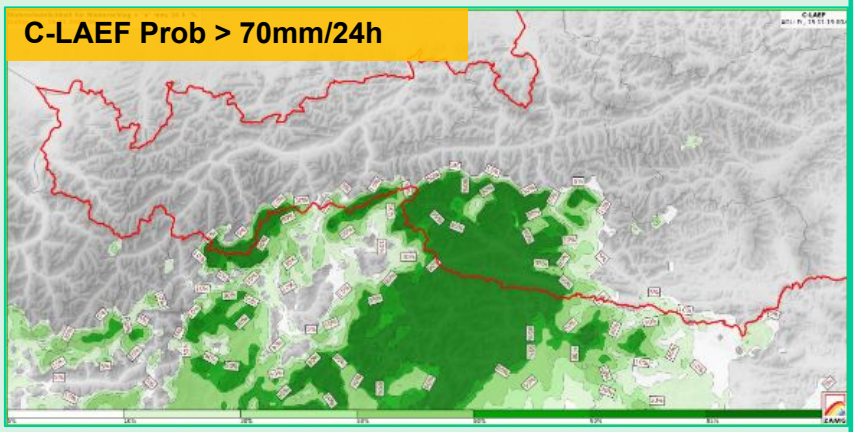


Fig.1 ZAMG warning (red level precipiation (left) C-LAEF propabilities > 70mm/24h (rght)

Mitigating reduction of AMDAR data:

- Reduction of incoming AMDAR data by approx. 80-90% in March
- Additional MODE-S EHS data (provided via KNMI) was activated AROME-Aut in May 2020
- MODE-S EHS can partly (over-)compensate AMDAR, except for atmopshere

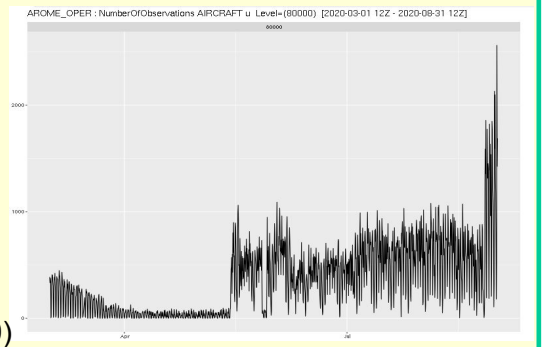


Fig. 2 (nr. of aircraft OBS 03-08/2020)

Belgium

Physically based stochastic perturbations and applied machine learning (AI)

Nonlin. Processes Geophys., 27, 187–207, 2020
https://doi.org/10.5194/npg-27-187-2020

Nonlinear Processes in Geophysics
Open Access
EGU

Simulating model uncertainty of subgrid-scale processes by sampling model errors at convective scales

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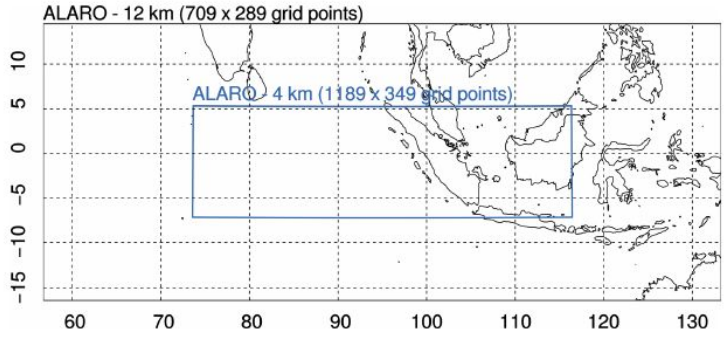
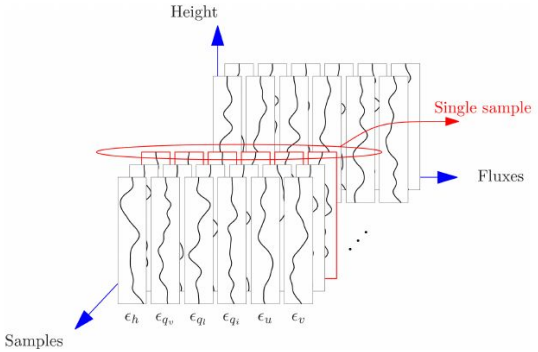
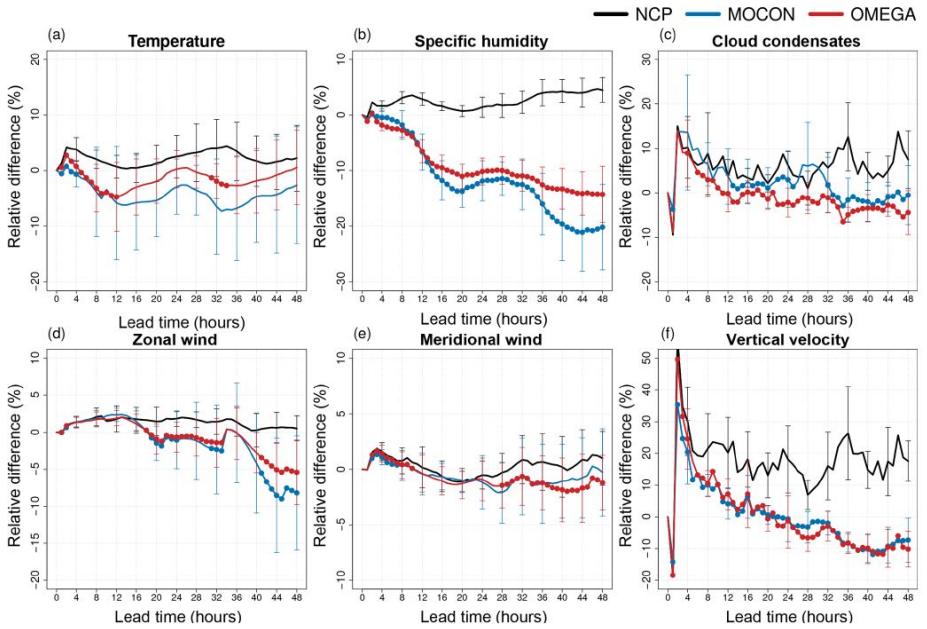
Received: 10 May 2019 – Discussion started: 24 May 2019
Revised: 24 January 2020 – Accepted: 24 February 2020 – Published: 16 April 2020







	No convection parameterization	With convection parameterization	Stochastic perturbation of model errors With random sampling			Machine learning
	NCP	Phys	PC5	PC10	PC20	GAN
RMSE	0.880	0.803	0.806	0.808	0.803	0.832
Bias	-0.308	-0.221	-0.225	-0.230	-0.222	-0.264
Spread	0.305	0.310	0.310	0.309	0.309	0.299
BS	0.272	0.233	0.234	0.236	0.233	0.247
BSS	-1.084	-1.006	-1.004	-1.009	-1.001	-0.994
RMSE	0.845	0.727	0.729	0.732	0.728	0.749
Bias	-0.303	-0.044	-0.048	-0.054	-0.044	-0.066
Spread	0.243	0.238	0.238	0.238	0.237	0.233
BS	0.322	0.215	0.217	0.219	0.216	0.234
BSS	-3.477	-1.313	-1.350	-1.395	-1.321	-1.711

Bulgaria

- Operational suite: two model configurations based on cy43t2 are run twice daily (at 06 and 18 UTC – main runs) and since mid-October 2020, four times daily (at 00 and 12 UTC – additional runs): ALADIN-BG (NFLEV=105, EDELX=5000) with forecast range of 72h for main runs and 48h for additional, and AROME-BG (NFLEV=60, EDELX=2500) with forecast range of 36h.

- DasKIT progress: HARP, surfDAexer and MANDALAY were successfully ported on our Machine; successful tests with SAPP on a local machine. Surface DA with real cycling tests are expected to be performed on new computation machine.

- New Computation Machine: at the end of October 2020 a new machine dedicated mainly for operational NWP at the Institute was delivered. Homogeneous LINUX cluster with 17 nodes, front end server and backup unit. Each node has two processors with 20 cores. The machine is in tuning and acceptance period.

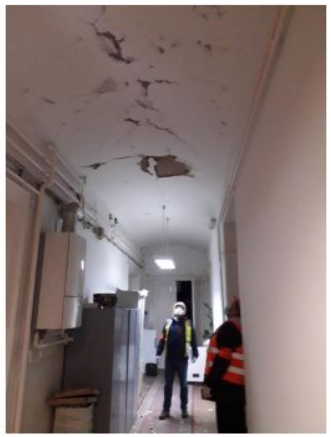
- Scientific publications:

Tsenova, B., Bogatchev, A, 2020, On the use of atmospheric instability indices based on NWP model production for thunderstorm forecast, BJMH, Accepted for Publication

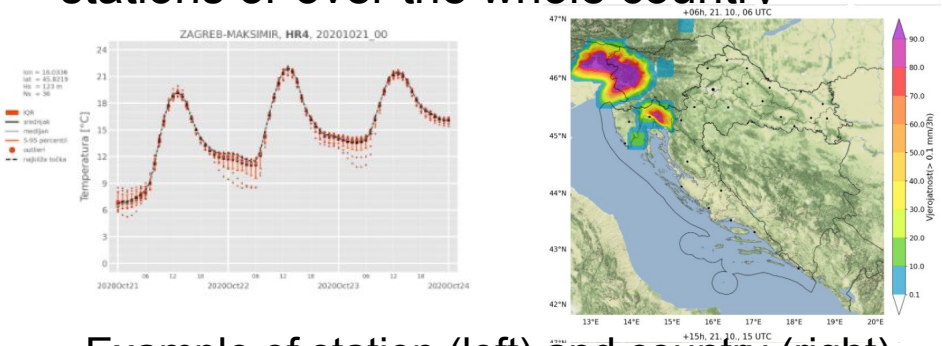
Tsenova, B., Valcheva R., Verification of the regional weather prediction with ALADIN-BG in Bulgaria, Submitted to BJMH

Croatia

- An earthquake hit Zagreb on 22 Mar 2020
- DHMZ's headquarters (where HPC and other servers are located) was severely damaged
- Therefore we have set up a backup of DHMZ's NWP operations on ECMWF's High-Performance Computing Facility
- For some production lines e.g. for exposition of products to forecasters, European Weather Cloud (distributed Cloud Computing infrastructure) was used
- More details can be found in ECMWF newsletter Number 164 - Summer 2020



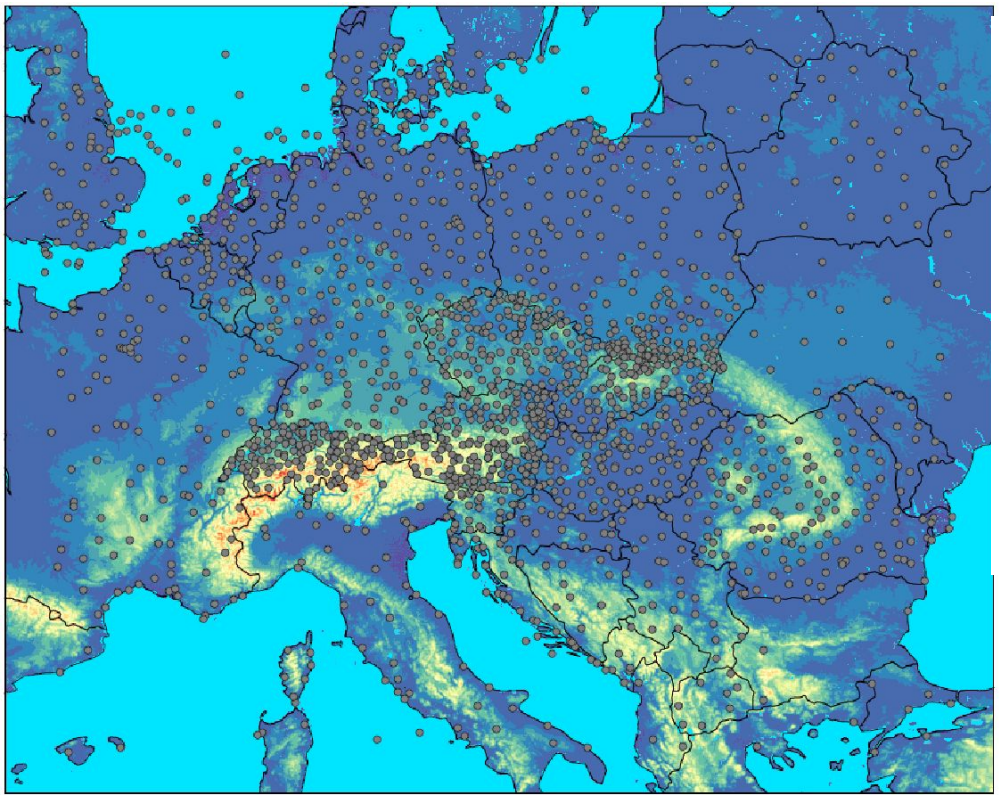
- A lot of effort was put into optimization of operational forecast suite
- ALADIN-HR8 (8km dx) was switched off
- ALADIN HRDA - 2km dynamical adaptation of wind was coupled and optimized to 4km configuration - ALADIN-HR4 (prior ALADIN-HR8)
- E-suite based on cy43 was set up at the beginning of October
- Postprocessing chain was moved mainly to python-based tools
- New postprocessed products: Analog-based statistical postprocessing, time and space neighborhood ensemble for stations or over the whole country



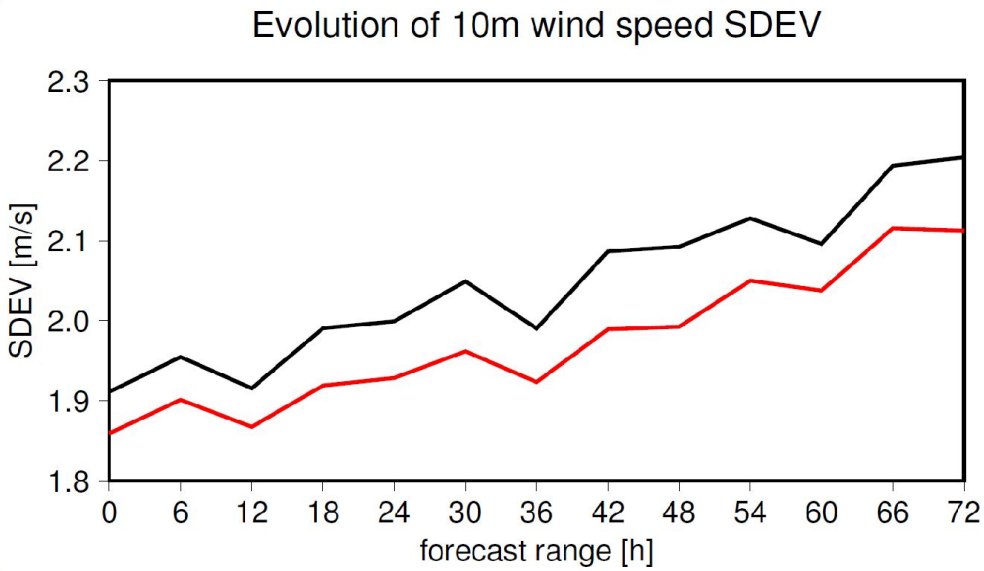
Example of station (left) and country (right) neighborhood ensemble

Czech Republic

- **Surface Assimilation:** operational use of high density national observations exchanged via OP LACE.



- **Surface Physiography:** improvement of orographic roughness (GMTED 2010) and vegetation roughness (ECOCLIMAP II) fields.

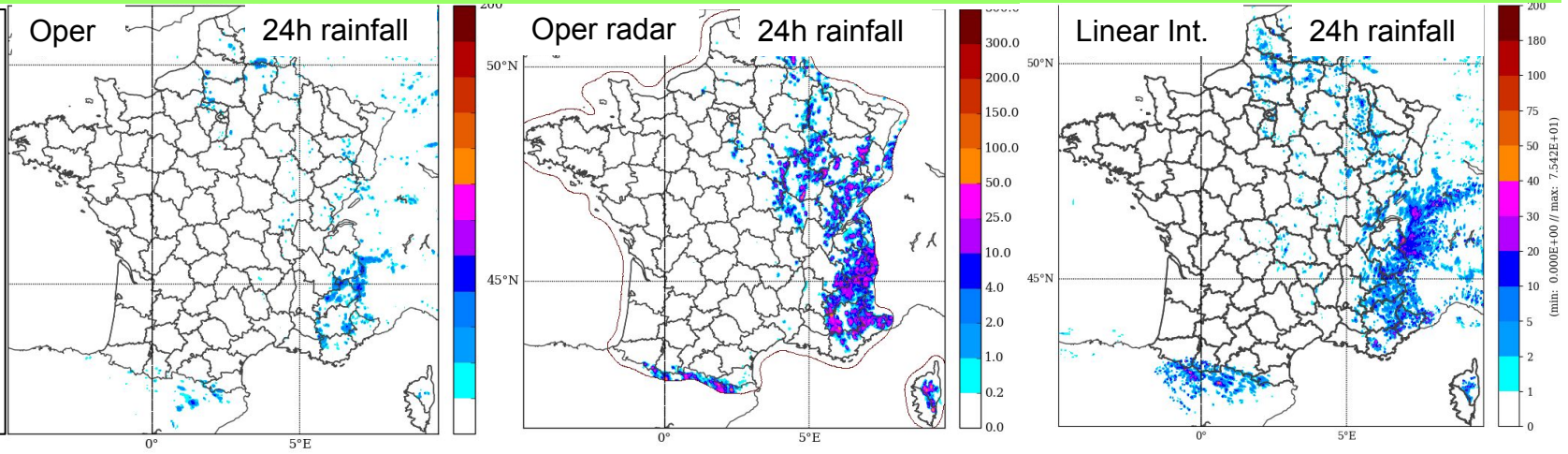


Decrease of the random error of 10 m wind speed (**red line**) w.r.t. the reference (**black line**). Operational since June 2020.

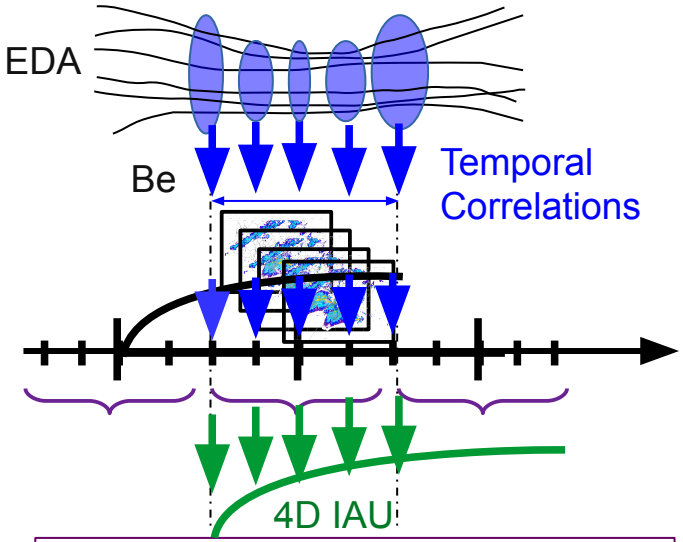
France

Mass conservation problem fixed by changing Semi-Lagrangian interpolators from quasi monotone to linear

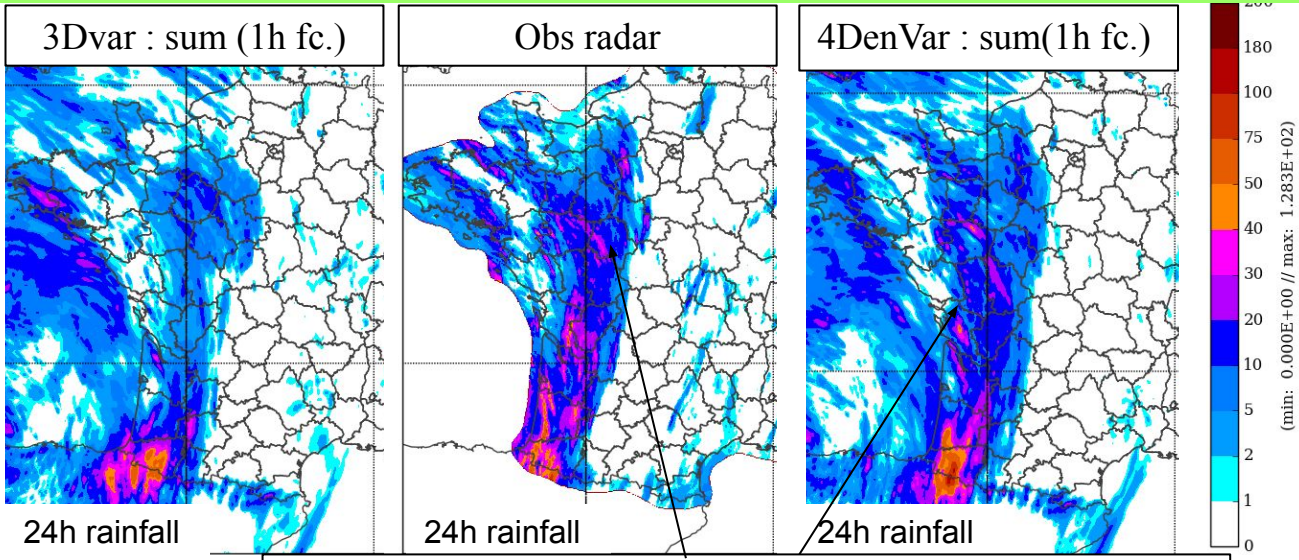
Thanks to a idealized AROME configuration, a mass conservation problem (+50%) for the cloud and precipitation variables due the SL interpolators was fixed. Using linear one instead of quasi-monotone for the 5 species improves the precipitation: in the next AROME Oper



Development and test of a hourly 4DEnvar assimilating observations every 15 minutes : encouraging results



- 4DEnvar, 1-h Cycle with 15mn time slot

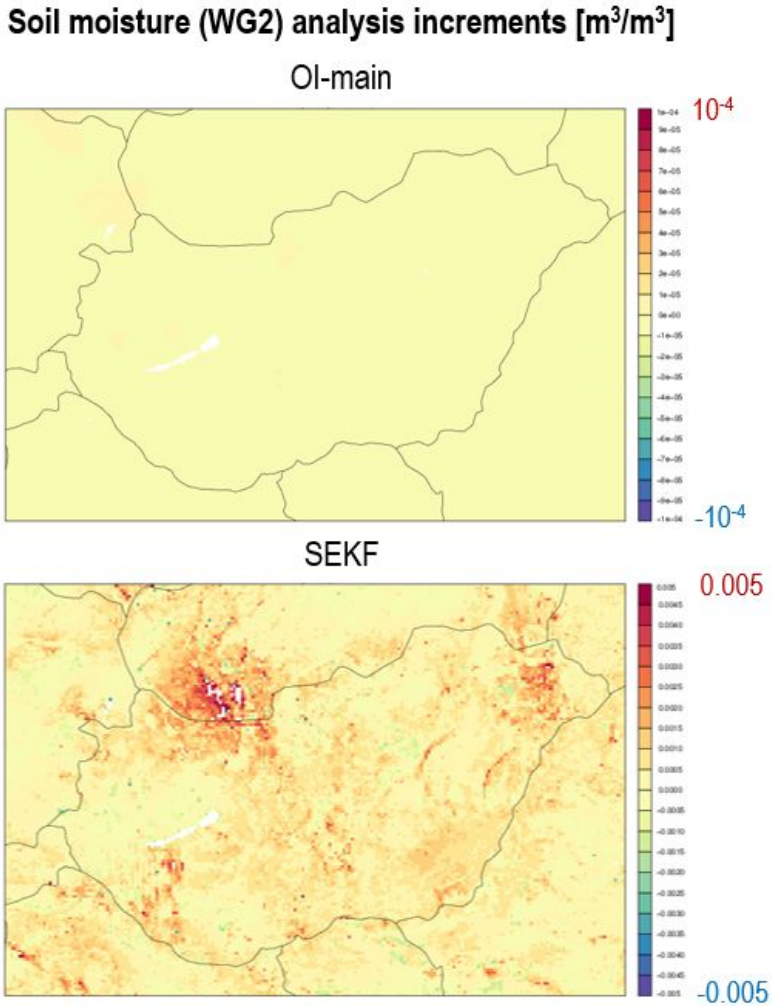


Clear improvement of the 24 1h rain forecast with 4DEnVar

Hungary

- Operational convection-permitting limited area EPS with 11 members based on downscaling ECMWF-ENS with AROME since February 2020

- Ongoing studies and developments:
  - Assimilation of Mode-S MRAR, AMV data in AROME/HU
  - **Case studies with SEKF**
  - Implementation of cy43t2_bf11
- Plans for 2021 (and beyond):
  - Hourly data assimilation cycle
  - Assimilation of new data: radar, Mode-S etc.
  - Resolution upgrade: 2.5L60 □ 1.3L90
  - Daily updated LAI
  - Perturbations from ensemble data assimilation in AROME-EPS



Morocco

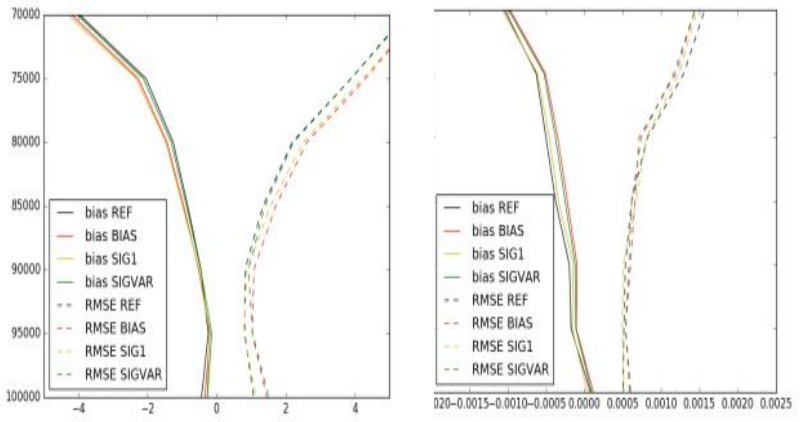
1. Installation of the new cycle 43t1 on new HPC

2. 1Dvar + 3Dvar assimilation of radar precipitation in AROME Framework
Sensitivity of 1D-Var inversion of radar precipitation to bias correction and observation error

3. Towards an implementation of a new AROME-Maroc Ensemble Prediction System

4. Predictability of convective situations in MOROCCO: Integration and modifications of the ECMWF scheme in ALADIN-MAROC.

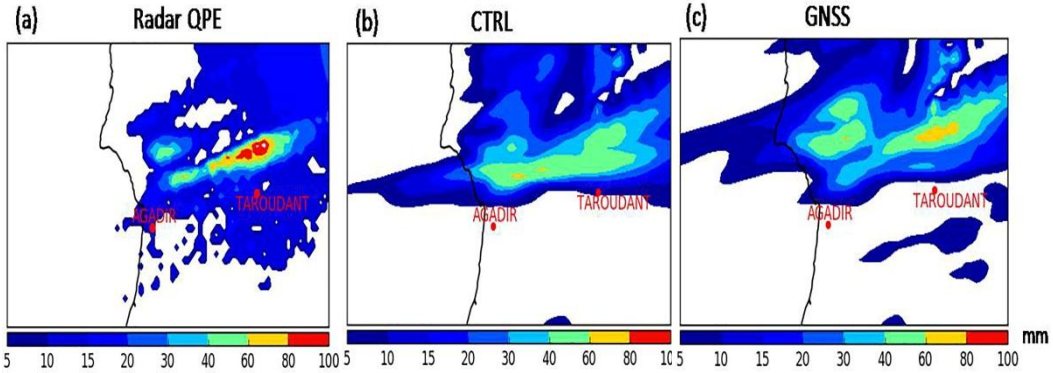
2.



T and Q Profiles Verification using Radio-soundings

5. Variational assimilation of local ground-based GPS

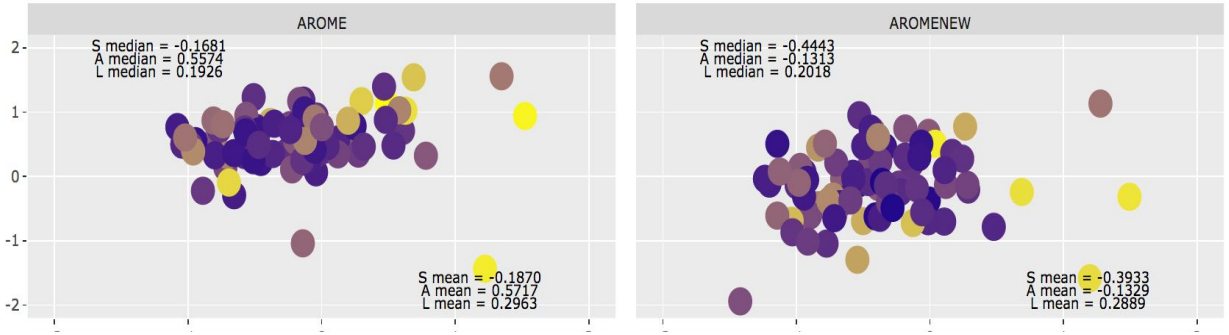
Impact of the variational assimilation of ground-based GNSS zenith total delay into AROME-Morocco model, ***Article published in Tellus journal***



6. Coding of direct observation operator, tangent linear and its adjoint for GPS tropospheric gradients assimilation in AROME

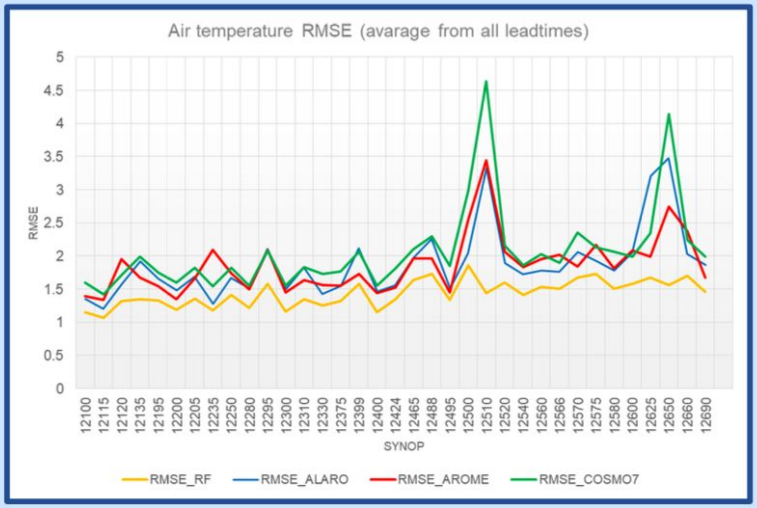
Poland

AROME cy43t2 operational since February 2020. Verification scores shows improvement, especially in precipitation forecasts. New version brings improvement as seen on SAL score (A component decreased from 0.5 [left] to -0.1 [right]) and on same case study.

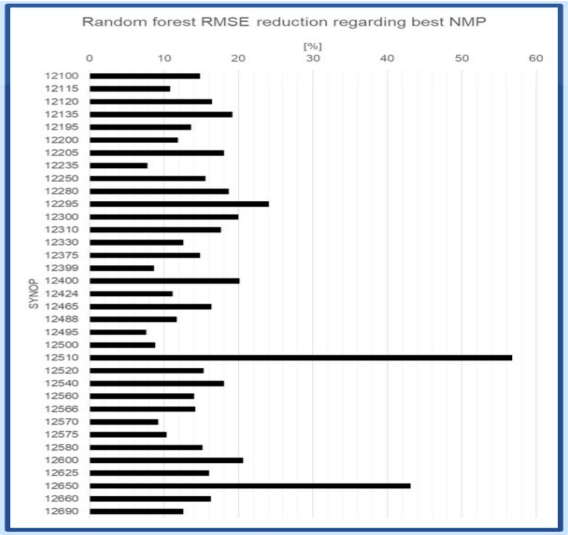


AROME cy40t1 AROME cy43t2

Experiments with machine learning. In the experiment forecasted 2m temperatures from three operational models (ALARO 4km, AROME 2km and COSMO 7km) were compared with observed 2m temperature sinop values. A machine learning algorithm *Random Forest Approach* was applied to improve forecasts.



Averaged for each synop station (on all leadtimes and test days) 2m temperature RMSE of ALARO, AROME, COSMO forecasts and random forest (RF).



Comparison of random forest RMSE with respect to best performing model RMSE for certain station.

significant reduce of RMSE for all stations, especially in mountains:
Sniezka (1613 m a.s.l)
Kasprowy Wierch (1987 m a.s.l)

Tested period – Jan - Aug 2020

Portugal

DAsKIT coordination

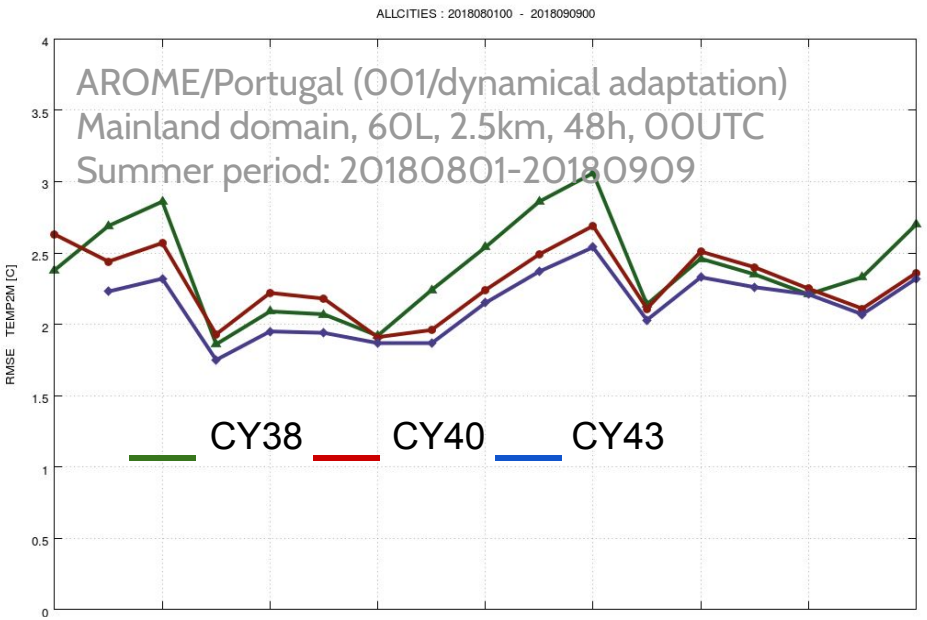
step-by-step towards an operational combined surface + upper-air DA solution (CY43T2)

. local impl. or porting & validation of the 3 configurations(*): **001, OI_MAIN, 3D-Var**

. local impl. of tools for pre-processing, monitoring & verification: SAPP, OBSMON, HARP

. article: **Monteiro et al., 2020, *The DAsKIT programme: status and plans*, ALADIN-HIRLAM NL 15, June**

* 001/dynamical_adaptation

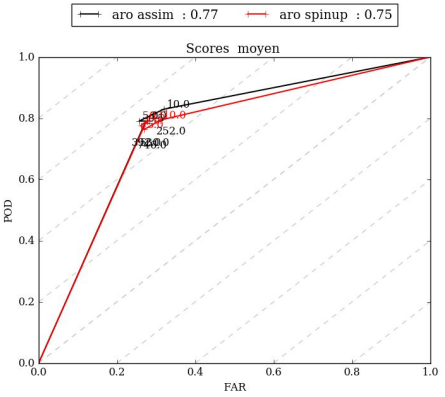


comparison over recent code cycles shows a decrease of 2-metre temperature forecast error with latest model version implementation, during a Summer month period

* OI_MAIN+3D-Var/combined DA

@ Météo-France: feasibility studies have shown an added value of Iberian radars on precipitation forecasts

@ECMWF: 3-h cycling of an OI_MAIN + 3D-Var DA solution, with conventional (SYNOP, TEMP, AMDAR) + Iberian OPERA radar. The system is under validation for AROME/Portugal (Mainland)

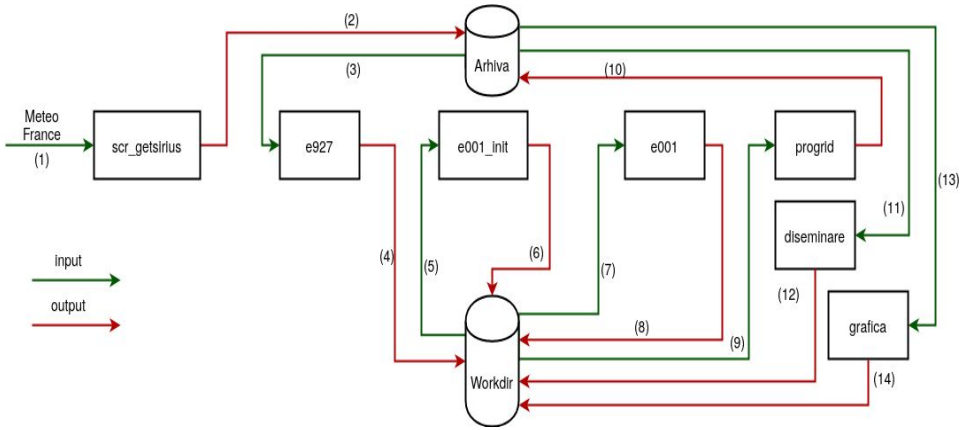


@IPMA: on-going impl. of SAPP & OBSMON

Romania

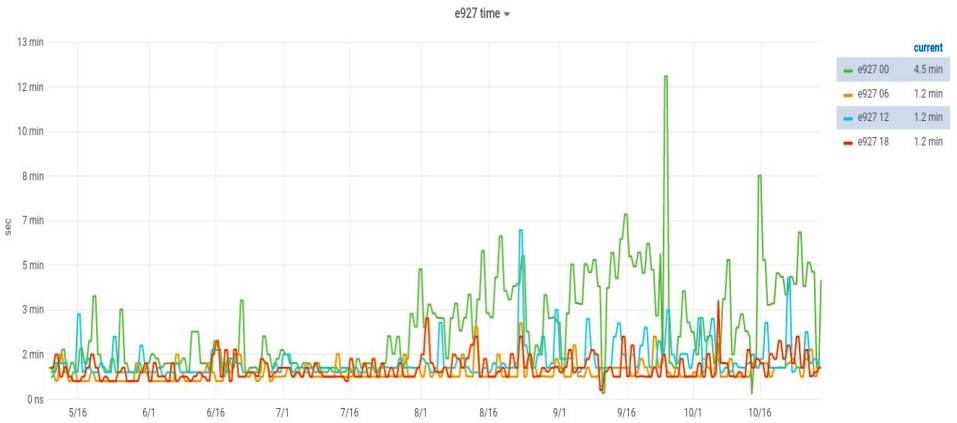
- Rewriting and optimization of the local operational scripts and processes
- Creating a backup solution of the scripting system using GitHub

✔flexible platform
✔ not dependent on single user/computer



dissem	dissem/script/scr_ciulnita	last month
docs	git-101.md	3 months ago
e001	Cleanup scripts (#58)	2 months ago
e001_init	Using modulefiles for aladin model in scripts (#50)	4 months ago
e927	Using modulefiles for aladin model in scripts (#50)	4 months ago
getsirius	change ncftp name	21 days ago
progrid	conf_progrid.sample	2 months ago
tools/gribtools	Gribw aladin grib tool - ADDENDUM	last month
utils	Configure monitoring environment (#42)	6 months ago
.DS_Store	Update diagram	6 months ago
README.md	Update readme	7 months ago
cleanup.sh	Cleanup scripts (#58)	2 months ago
oper.sh	oper.sh	2 months ago

- Preparation of monitoring schedules for the development of operational processes and the status of HPC nodes

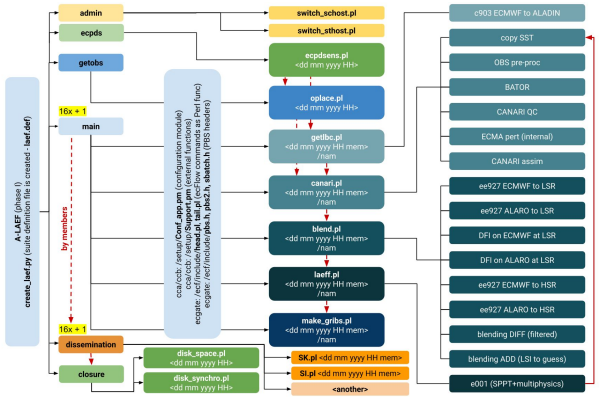


Slovakia

A-LAEF = common RC LACE EPS system based on ALARO physics

@ECMWF

- 4.8 km/L60, 16+1 members
- 00 & 12 UTC +72 h runs
- ESDA+blending IC perturbation
- surf-SPPT+ALARO-1vB model pert.
- coupled to ECMWF ENS via c903
- **TC2 status since 22 July 2020**
- gribs distributed to SI, SK, RO, PL, (CZ)

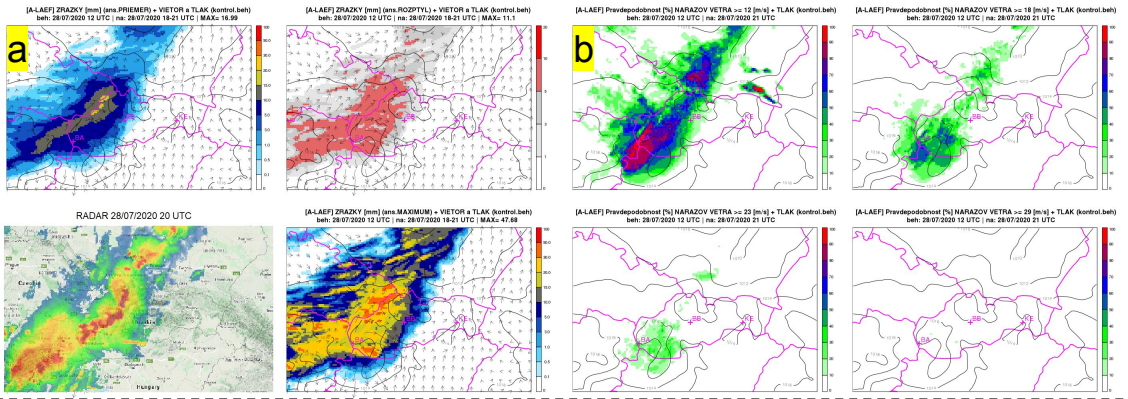


@SHMU

Local visualisation based on R and Perl

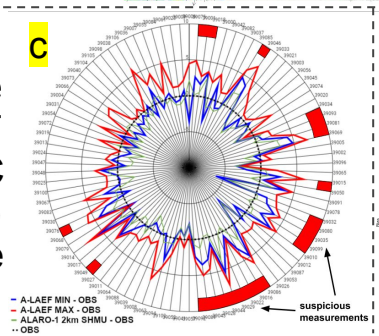
URL: http://www.shmu.sk/webapps/#/sk/nwp/alaef

An example of A-LAEF products is shown for a case study of night storms on undulated cold front associated with strong wind gusts (28/07/2020): precipitation totals (mean, spread, max), RADAR image [a], and wind gust probabilities for significant thresholds [b].



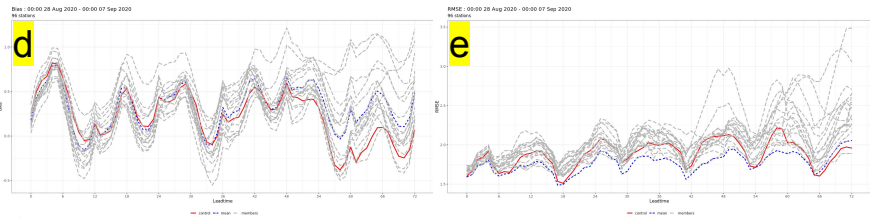
Local QC based on A-LAEF

A physically consistent spread of the meteorological fields provided by the A-LAEF ensemble can be used in an automatic QC procedure of the AWS measurements to identify suspicious values that are out of the A-LAEF spread. T2m example [c].



Local A-LAEF verification in HARP

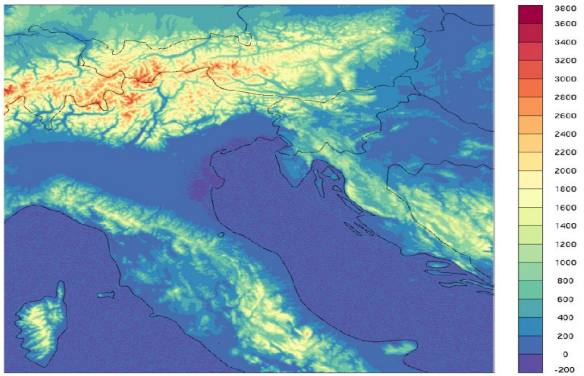
wrt SK stations under implementation [d,e]



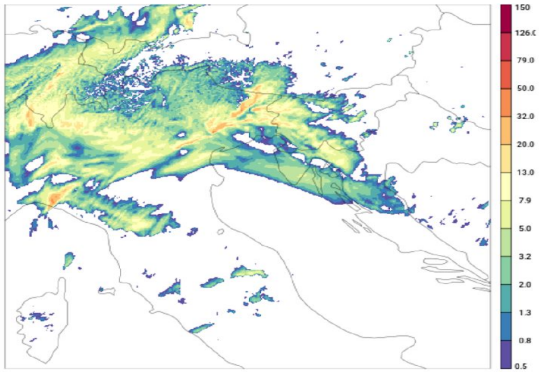
Slovenia

An **upgrade of the HPC** system (doubling of CPU) to be able to run the **NWP-based hourly nowcasting system**:
- non-hydrostatic ALARO @1.3 km,
- hourly assimilation cycle with 3DVar and OI, radar data assimilation,
- current status: regular daily runs, validation of results.

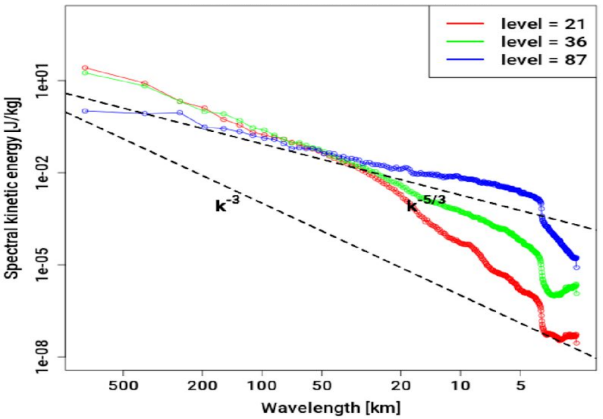
Domain (589x589 points)



Simulated radar reflectivity



Kinetic energy spectra

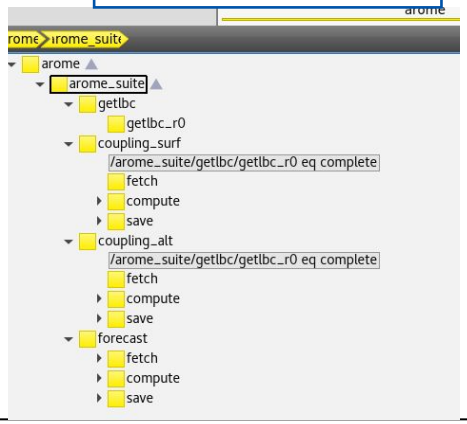


Météo-Algérie
الديوان الوطني للأرصاد الجوية
Office National de la Météorologie
ZAMG
IRM
DHMZ
METEO FRANCE
OMSZ
MAROC METEO
IPMA
Instituto Português do Mar e da Atmosfera
METEO ROMANIA
SHMU
ARSO METEO Slovenia
المعهد الوطني للرصد الجوي
METEOROLOJİ

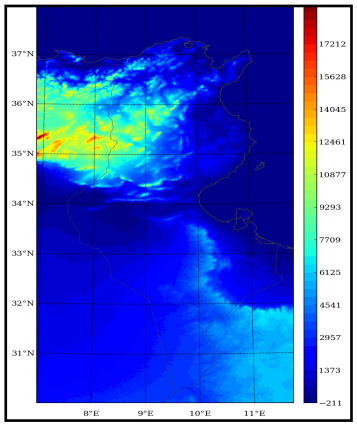
Tunisia

AROME-Tunisie Suite on the HPC

ECFLOW Monitoring



HPC System **DELL HPC**	
Node /processor	16 computing Nodes PowerEdge C6420 Per Node: 2 Intel Xeon GOLD 6148 Processor: 2.4 Ghz, 20 core, 40 threads 2 Large memory nodes 2 Login nodes 2 Master nodes
Operating system	Redhat Linux
New Storage System: **ISILON Cluster A200**	
Performance	600 To Cpus 12 cores RAID6 disk



AROME-Tunisie Domain

AROME-TUNISIE	
Version	CYCLE 43
Resolution	1.3 km
Number of Points NLON*NLAT	384 X 720
Vertical Level	90
Coupling Model	ARPEGE
Time step	45 s

Operational & Parallel Suites

Models implemented on the HPC

	ALADIN operational	AROME 2.5	AROME 1.3
Spatial Resolution	7.5 km	2.5 km	1.3 km
Vertical Levels	70	60	90
Boundaries	ARPEGE 10km	ARPEGE 10km	ARPEGE 10km
Time step	450 s	60 s	45 s

3DVAR Data Assimilation Implementation

- 6H Cycling
- Observations: OPLACE + Local: Synop, Temp, Amdar
- B matrix computed with Ensemble Data Assimilation method
- Work on progress with implementing Jk blending method with AROME to overcome the observation low density and the size of the domain.

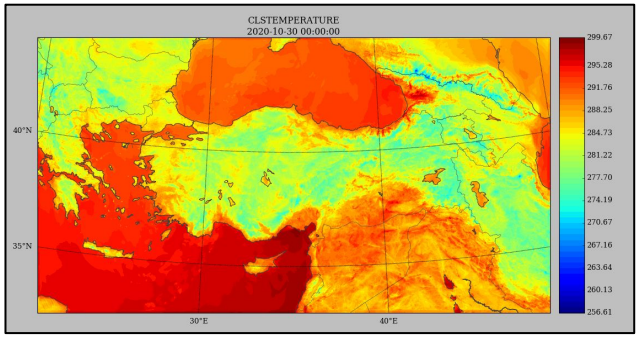
Micro-Physics with AROME-Tunisie

- Work on progress with testing and validating ICE 4 and LIMA microphysical schemes over Tunisia.

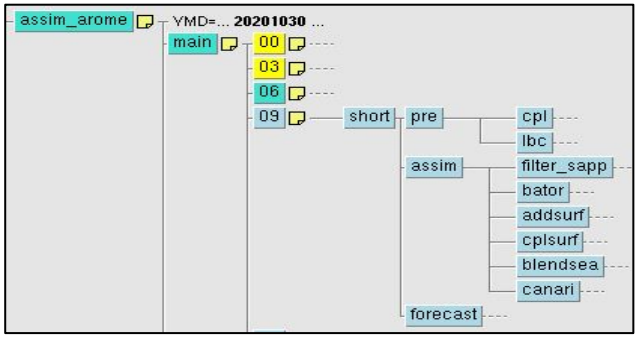
Turkey

DAsKIT Activities with AROME-TURKEY

- AROME-Turkey is running with 3hrly RUC using CANARI-OI surface assimilation system in pre-operational mode since mid-October 2020.
- Surface assimilation system uses synop obs obtained from SAPP (Scalable Acquisition and Pre-processing System).
- Domain 1.7 km, 1500*800, cy43t2-bf10
- 72 vertical levels, time step=60
- 3h coupling with IFS
- Forecasts up to 24h every 3hours



Integration domain of AROME-Turkey with 3 hrly RUC



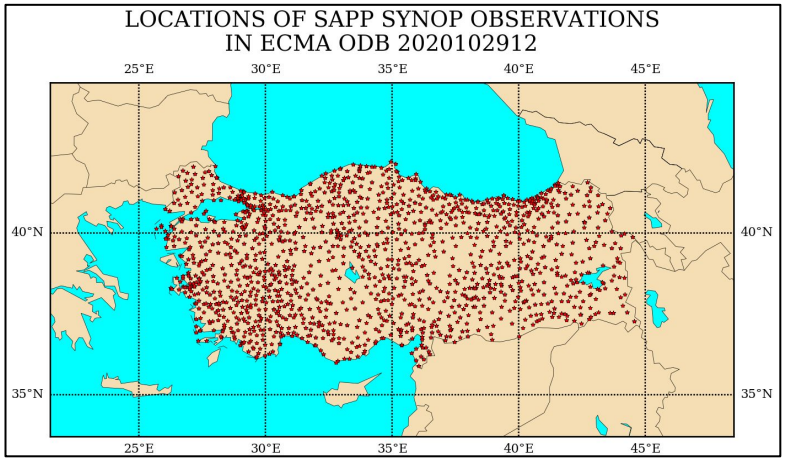
Eccflow of AROME-Turkey with 3hrly RUC

SAPP (Scalable Acquisition and Pre-processing System) at TSMS

- Synop, temp, airep, amdar, ship obs available at GTS and also data from automatic stations located in TURKEY are collected by SAPP servers and then converted to bufr format.
- Since August 2020, synop observations processed by SAPP have been using by AROME-Turkey surface assimilation system.

19 May 2020 Observations obtained from SAPP system at TSMS (Cengiz et al., 2020)

Observation Type	Total Daily Observations	Total Daily Stations/Observation Point
Synoptic	64484	5937
Local Awos	12062	1497
Temp	983	487
Ship	130	63
Airep	11606	704
Metar	53324	2775
Metar Auto	106947	2906



Locations of SAPP synop observations read by BATOR

References

Cengiz, Y., Akdağ, G. H., Sert, M., Sezer, M.,. (2020, June). SAPP (Scalable Acquisition and Pre-processing System) at TSMS. ALADIN-HIRLAM Newsletter, No 15, 63-65. https://www.umr-cnrm.fr/aladin/IMG/pdf/nl15.pdf