



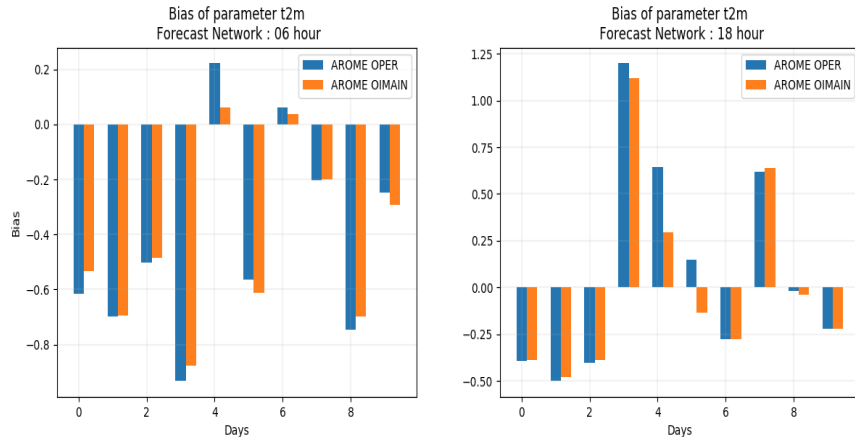
Tour d'ALADIN

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



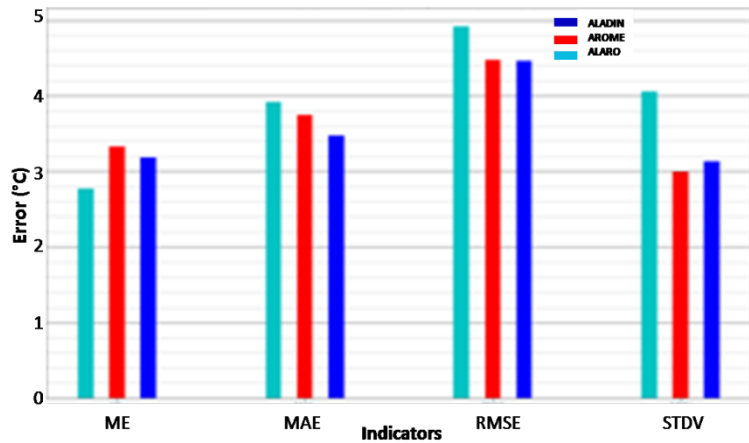
Algeria

1- Validation of CANARI-OIMAIN surface analysis with AROME Algeria (DAsKit program)



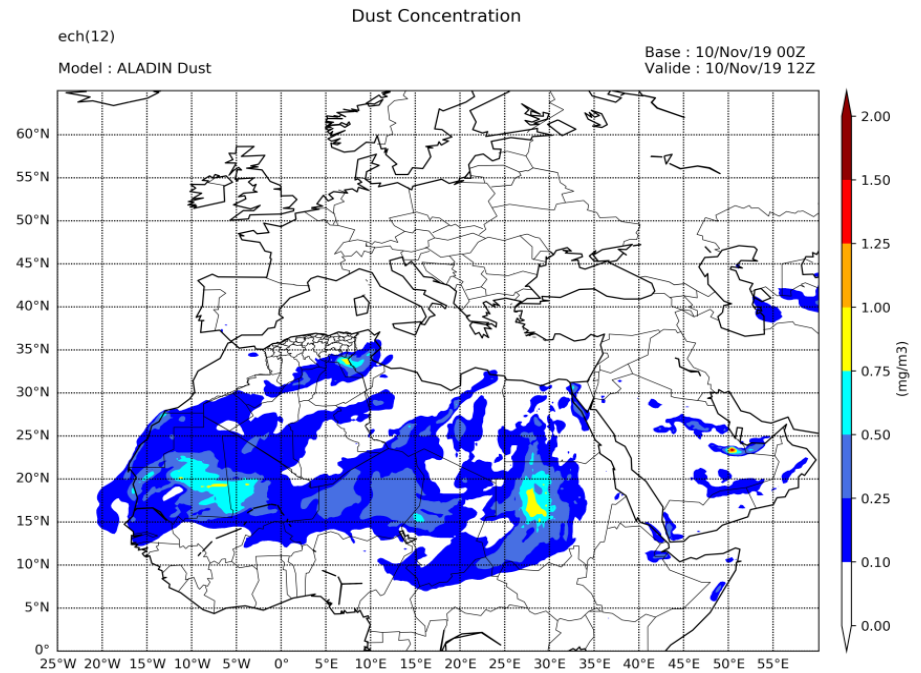
T2m scores for AROME-Oper and CANARI-OIMAIN for the Networks 06h and 18h

2- Validation of ALARO model configuration with cy43t2 over Algeria domain



T2m scores for ALADIN, AROME and ALARO for 00h Network

3- Implementation of ALADIN-DUST configuration over Northern Africa-Middle East-Europe domain for the WMO Sand and Storm Warning Advisory and Assessment System (SDS-WAS) : Project is ongoing



Two major „operational milestones“ in 2019:

- **AROME-RUC:** 1.2km/90L nowcasting system with 24 runs per day (+12h). First system at ZAMG to include 3D radar data (reflectivity and doppler wind) in operational assimilation. **Operational since 11/2019**
- **C-LAEF:** 2.5km/90L ensemble system (16 + 1 member) running 4 times per day (+ 60h for 00 UTC). Includes EDA + Ensemble Jk, stochastic physics scheme (partial tendencies + selected processes) and coupling to ECMWF-ENS. **Operational since 11/2019**

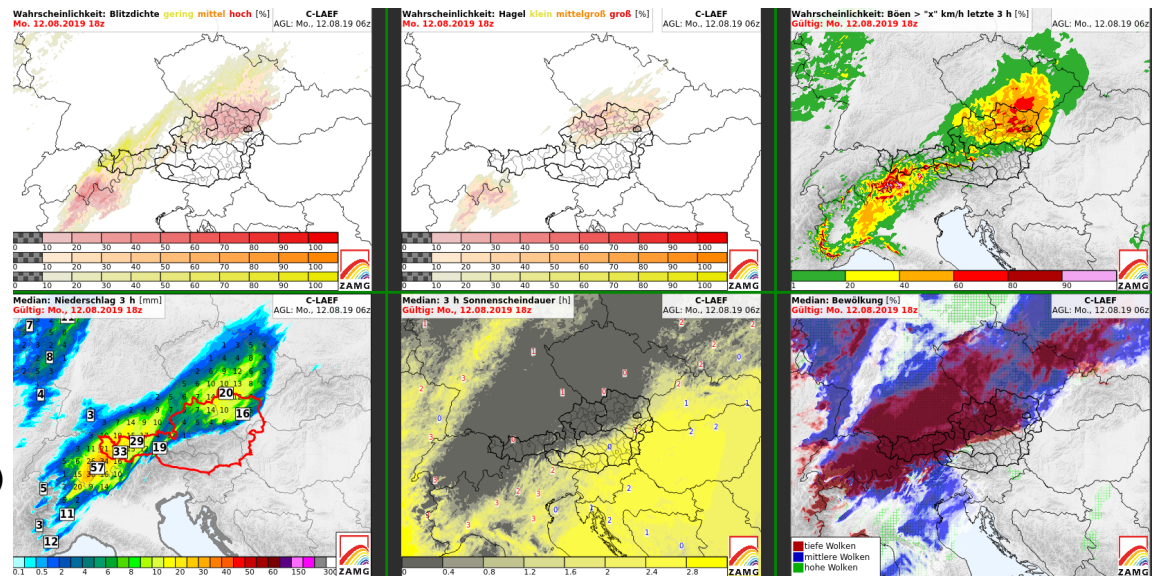


Figure: examples for new C-LAEF (probabilistic) products for hail, lightning, precipitation wind gusts, sunshine duration and cloud cover



Belgium

Current set-up:

- **ALARO** 4km, downscaling mode
- data assimilation is done 6-hourly in ARPEGE (global model)
- RMI EPS at ECMWF, with 22 members and 3Dvar (not TCF).

New set-up:

Q1 2020: Added to current set-up:

- **AROME** 1.3km with SURFEX
- 3-hourly *surface* data assimilation cycle, 6-hourly forecasts
- Complete rewrite of scripting system for robustness and maintainability
 - Using latest version of ECMWF's EcFlow system

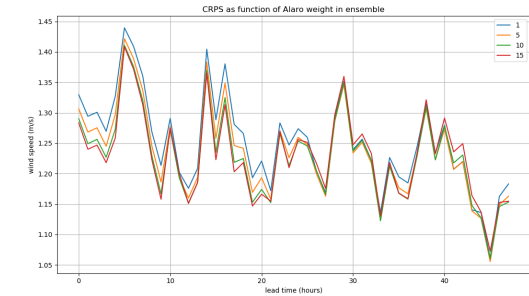
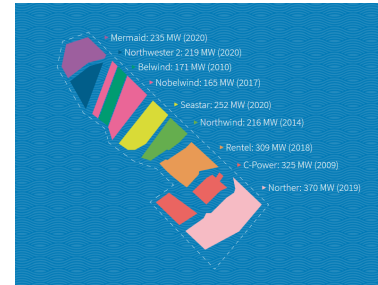
Q2-3 2020: Project IMA v.1: Seamless probabilistic forecasts from 5' to 24h.

- Mini-EPS: **ALARO** 1.3km with ISBA & **AROME** 1.3km with SURFEX, with *surface* data assimilation
- Blending with ensemble nowcasting: **STEPS-BE** (pr) / **INCA-BE** (T2m, RH2m,...)

Late 2020:

- Mini-EPS v2: **ALARO** 1.3km with SURFEX & **AROME** 1.3km with SURFEX
- 3-hourly *upper-air* data assimilation (3DVar), 6-hourly forecasts

Contribute to climate adaption with ALARO: probabilistic operational power output forecasts for wind energy on the North Sea with ALARO and IFS



<https://www.elia.be/nl/grid-data/productie/windenergieproductie>



المعهد الوطني للأرصاد الجوية



Bulgaria

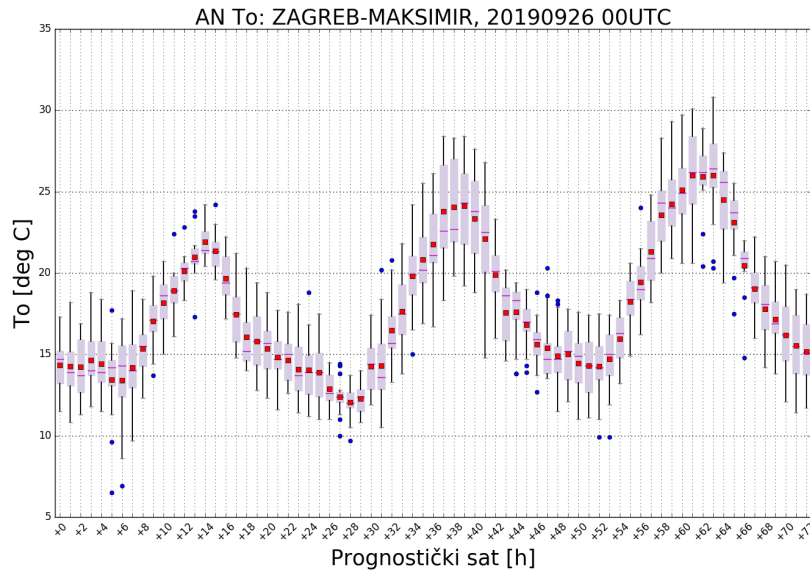
- cy43t2 is operational since 14 November 2019: ALADIN (105L/5km/72h) and AROME (60L/2.5km/36h) run at 06 and 18 UTC; it is expected to add two models run at 00 and 12 UTC
- DaskIT progress: successful run of a two weeks period cycling with Bulgarian SYNOP messages with cy40t1; successful tests on AMDAR on beaufix; it is expected to make all tests on local machine based on the operational cy43t2
- Ongoing work on the improvement of lightning probability forecast; some results were presented at the 10th European Conference on Severe Storms 4 - 8 November 2019



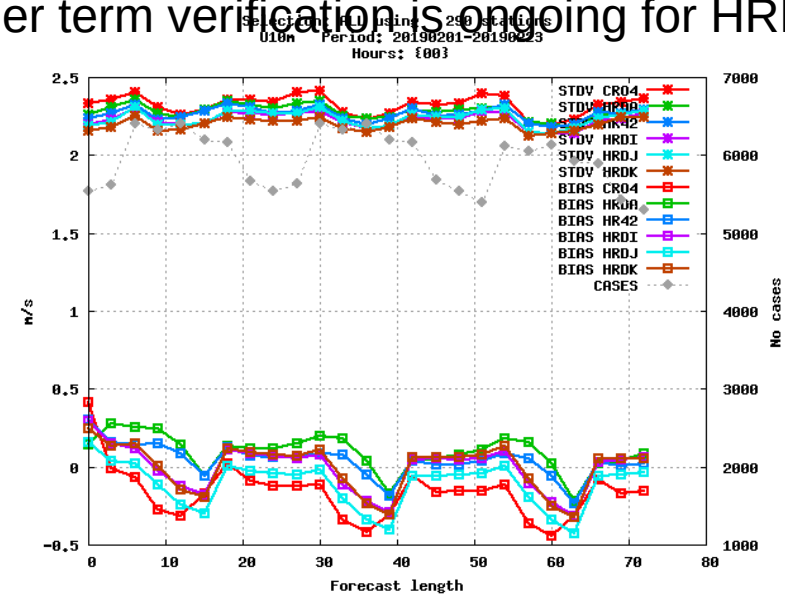
Croatia

- New algorithms are developed and tested to expand the number of locations and the forecast variables for analog-based post-processing method
- The new setup includes 15 members wind speed, wind gusts and temperature ensemble predictions for approximately 50 stations using the 2-year training dataset

- The new setup for ALADIN-HRDA (dynamical adaptation OF wind) was developed USING ALADIN-HR4 (4 km operational model) AS INPUT
- Several DA configurations were TESTED
 - HRDA - operational (coupled to ALADIN-HR8), 2km levels
 - HR42 - coupled to ALADIN-HR4, 2km, 15 levels
 - HRDI - coupled to ALADIN-HR4, 2km, 32 levels
 - HRDJ - coupled to ALADIN-HR4, 2km, 32 levels + new climate files
 - HRDK - as HRDJ, but on 1 km
- Longer term verification is ongoing for HRDJ



The example of analog-based ensemble forecast output for temperature at Zagreb-Maksimir station.

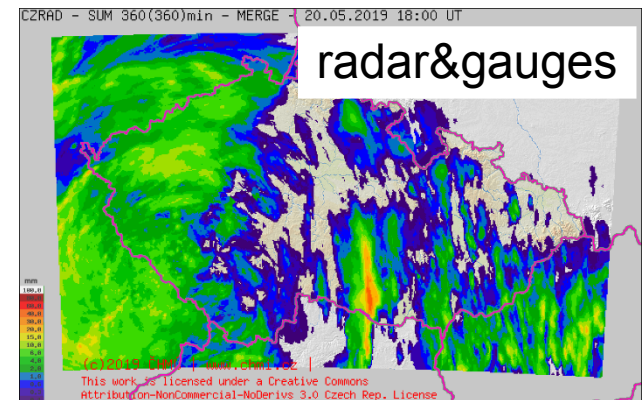
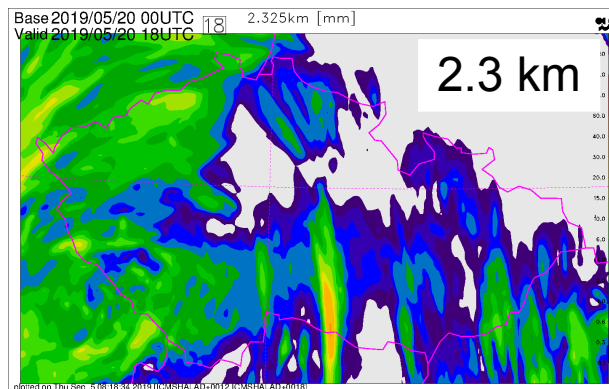
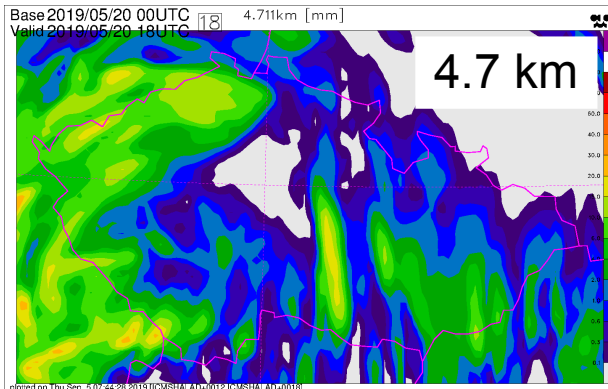
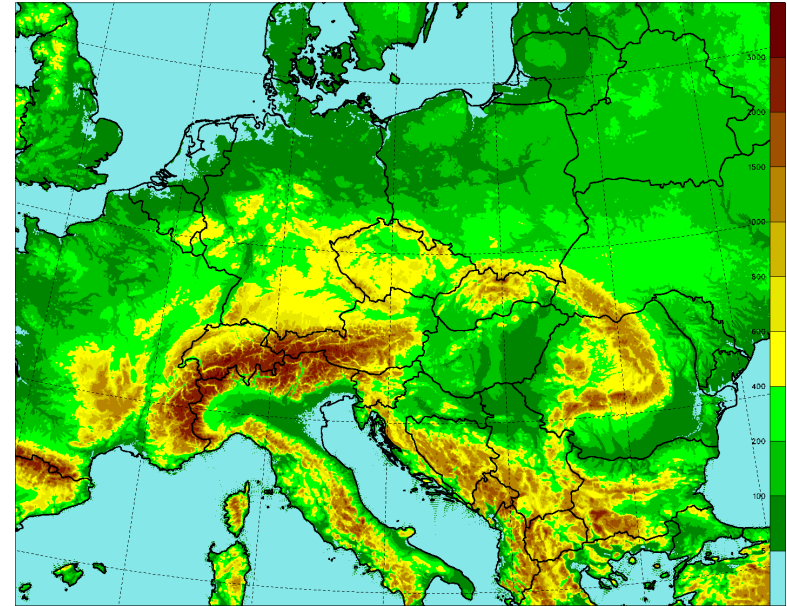


10 m wind speed BIAS and STDEV for different experiments



CZ: ALARO NH at 2.3 km

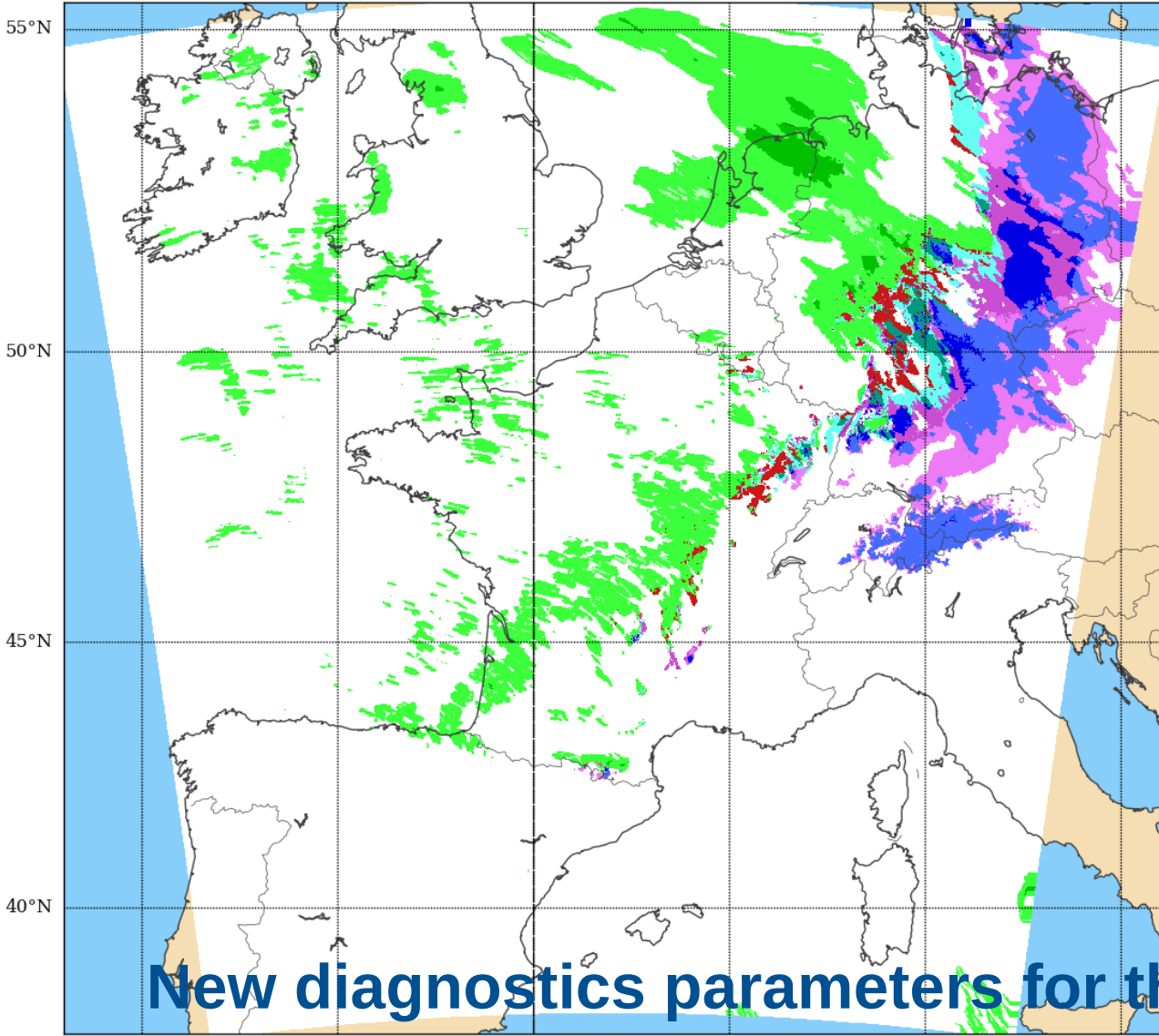
- **2.3 km** and 87 levels over **large Central European domain**;
- **NH dynamics & 90 s time-step**;
- **Multi-scale ALARO physics**;
- **DF Blending+3DVAR data assimilation**.



6h precipitation sum forecast shows sharper structures at high resolution (middle panel) than the forecast at previous lower resolution (left). It is better fitting the observations (right).



France : AROME precipitation types



Rain	1	
Freezing rain	3	
Dry snow	5	
Wet snow	6	
Rain snow mixture	7	
Ice pellets	8	
Graupel/small hail	9	
Hail	10	
Drizzle	11	
Freezing drizzle	12	
Moist snow/sleet	193	
Intermittent rain	201	
Intermittent dry snow	205	
Intermittent wet snow	206	
Intermittent rain snow mixture	207	
Intermittent moist snow/sleet	213	

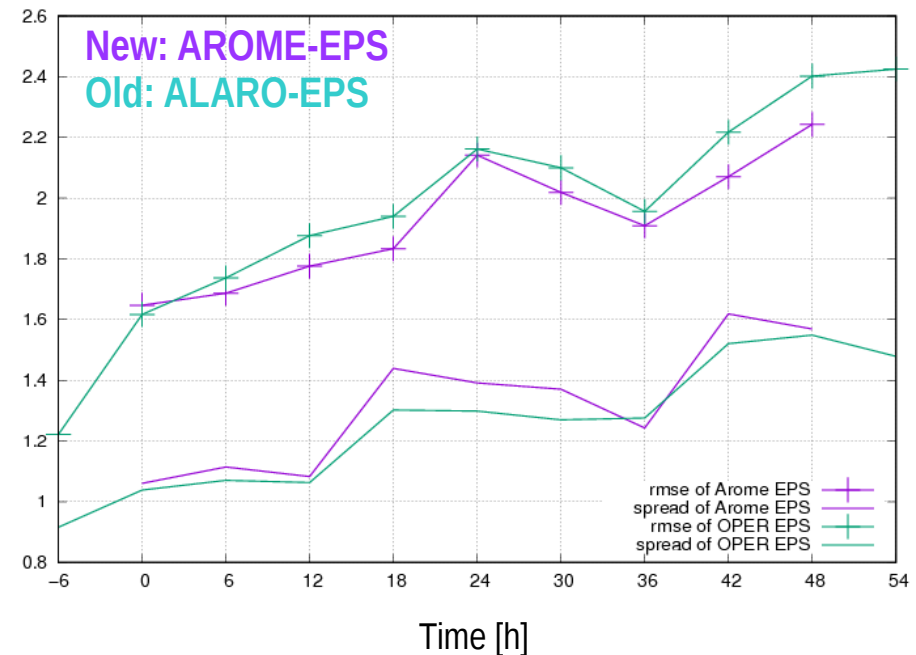
New diagnostics parameters for the weather forecast developed for ARPEGE and AROME, shared with Partners



Hungary

- Upgrade of HPC system → porting and testing ALARO cycle 40 in May 2019
- **Quasi-operational convection-permitting limited area EPS with 11 ensemble members based on AROME – switch to operational in February 2020**
- Test experiments, preparatory steps:
 - Hourly data assimilation in AROME
 - Perturbations from ensemble data assimilation
 - Assimilation of new observations (Mode-S, radar)
 - Increase the number of vertical levels in AROME (60 → 90)
 - Daily updated LAI in AROME

RMSE & spread for 850 hPa wind speed [m/s]

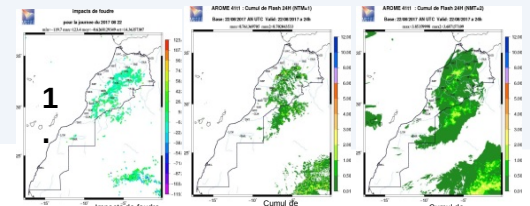




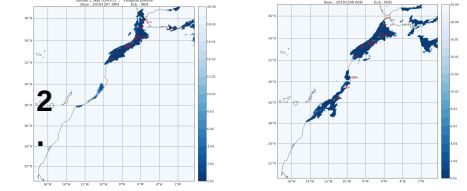
Morocco

1. Evaluation of the cumulative flash diagnostic scheme :

Test and evaluation of three approaches proposed by Eugene W. McCaul Jr and All (2009). The first approach which estimates the number of impacts based on the vertical velocity, the mixture ratio of graupel and hail allows to better predict, in terms of density and location, lightning impacts

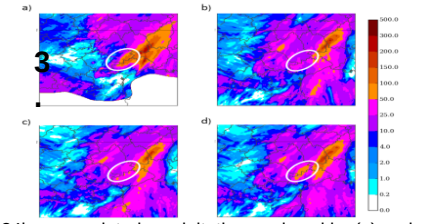


2. Evaluation of the implementation of a test configuration of Arome 500m to improve forecasts of dangerous weather events near airports : tuning of physical settings.



Visibilité prévue à 06h de la journée du 07/12/2018 (à gauche) et à 06h de la journée du 08/12/2018. Les stations synoptiques pointées en couleur rouge : Présence d'un événement réduisant la visibilité, les stations pointées en couleur Gris : aucun événement observé.

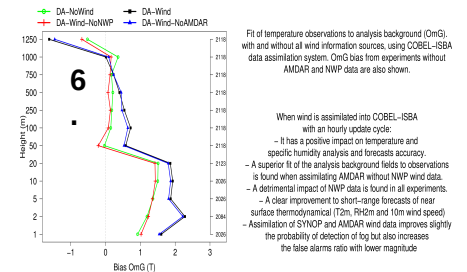
3. Configuration and testing of 1Dvar + 3Dvar assimilation of radar precipitation in AROME Framework



24h accumulated precipitation analysed by (a) and simulated by AROME (b,c,d)

4. Variational assimilation of local ground-based GPS

- Impact of the Variational assimilation of ground-based GPS Zenith Total Delay into AROME-Morocco model, Article under review in Tellus
- Configuration and tests of the 3DVAR assimilation of GPS gradients in the AROME framework

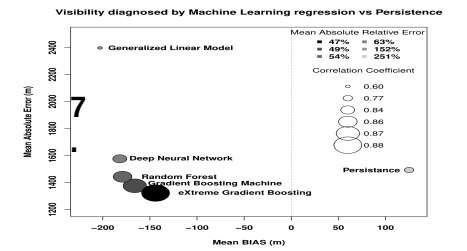


5. Local validations of Integrated Water Vapor from AROME using GPS-IWV

High Impact weather case studies

6. Wind assimilation in COBEL-ISBA using AMDARs, Synop observations and AROME

A Preliminary Impact Study of Wind on Assimilation and Forecast Systems into the One-Dimensional Fog Forecasting Model COBEL-ISBA over Morocco, Article published in ATMOSPHERE



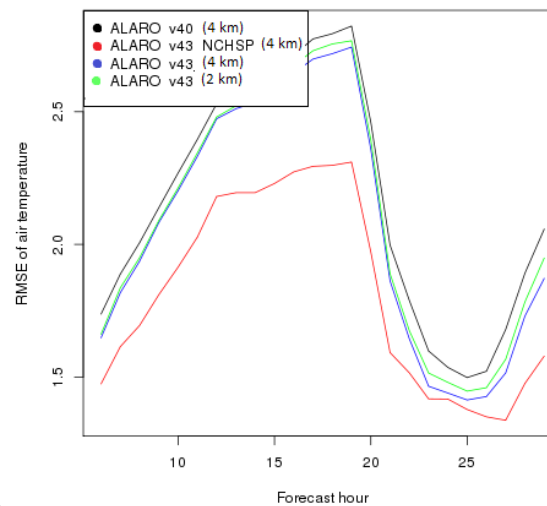
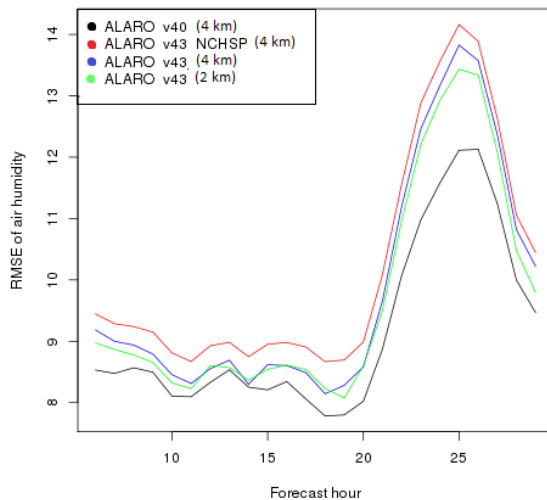
7. Use of Big data and Artificial intelligence in NWP

Study : Benchmark of the impact of the platform and the machine learning technique on the performance of the model developed: Case of a regression problem

Tests of cy43 in Poland

Cycle 43t2 was implemented at euros cluster and tests of ALARO1-vB model were performed. Both hydrostatic and non hydrostatic configurations were verified against observational data. Two model resolution 4 km and 2 km were examined:

- ALARO NHYD v.43 – res. 4 km + new snow parametrization
- ALARO NHYD v.43 – res. 4 km
- ALARO NHYD v.43– res. 2 km
- ALARO HYD v.40– res. 4 km



RMSE of air humidity (left) and air temperature (right)

for period 1-14.01.2017 (60 synoptic stations)

Conclusions:

- Improved air temperature during occurrence of snow cover
- No significant difference for wind speed and direction
- No significant changes for period in summer season.

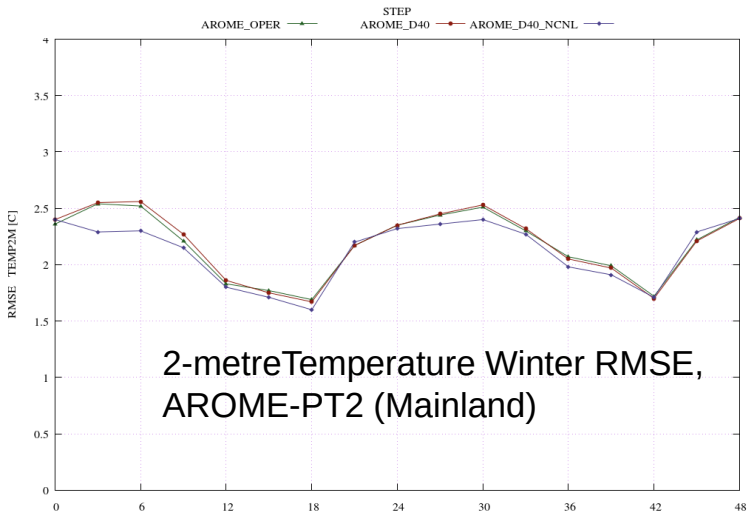
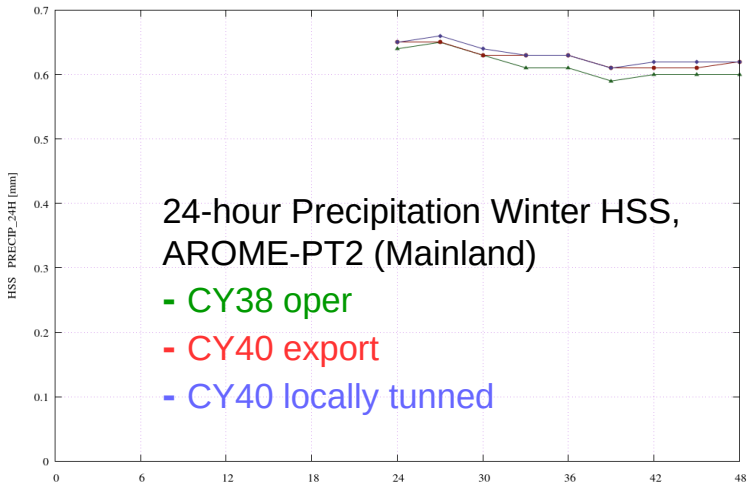


Portugal

Operational Activities

Porting AROME-Portugal to CY40T1:
Mainland, Madeira, Azores

ALL_CITIES : 2018121000 - 2019021000



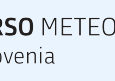
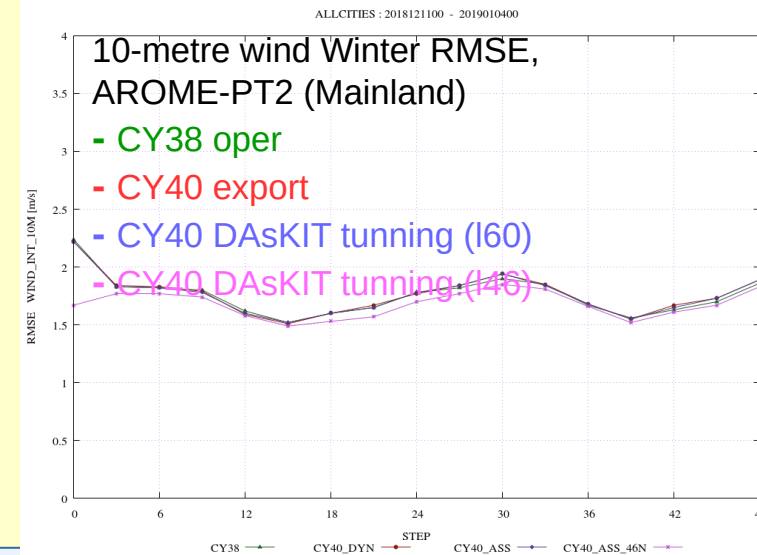
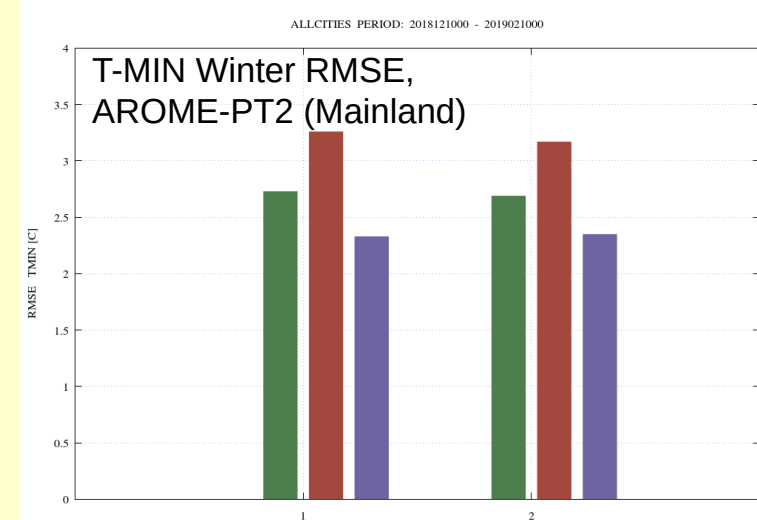
Data Assimilation Activities

Local implementation, tuning & validation of 3-hour cycling surface DAsKIT (CY40T1, 60- & 46-levels, regional Iberian SYNOP data)

Foreseen activities:

Joint validation of a combined DAsKIT surf+3D-Var DA with conventional observations at CY43T2

Add Portuguese and Spanish radar OIFS data

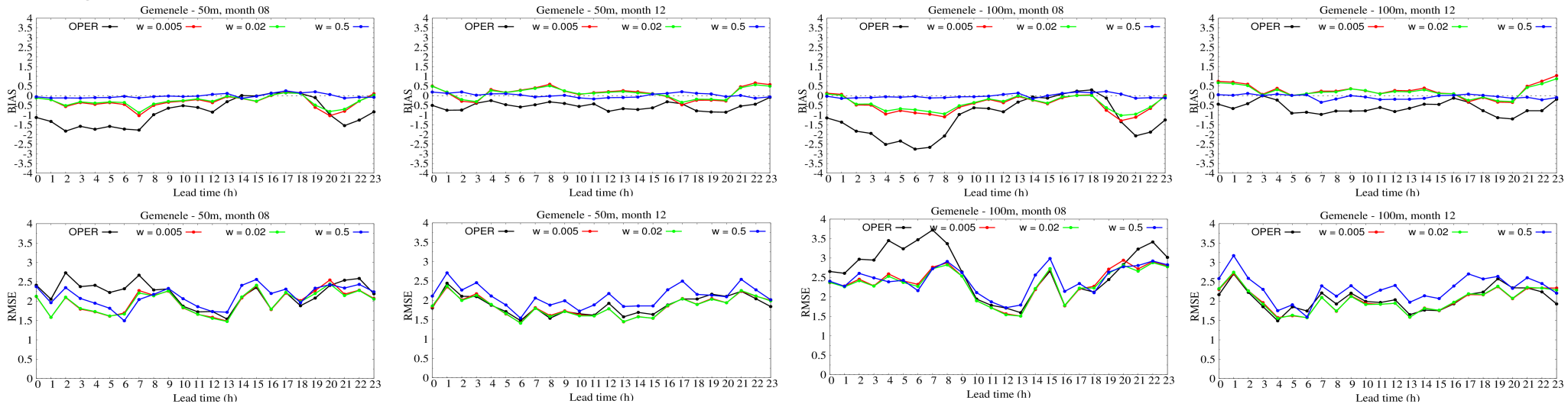


المعهد الوطني للرصد الجوي



Romania : Bias correction for wind speed forecast

- a bias correction method (Cui et al, 2012) was applied to wind speed forecast
- weights used in the method are: 0.005, 0.02, 0.5
- ALARO simulated data + wind speed measured at tower located in a wind farm in SE Romania
- period: March - December 2015, hourly data, 00 run, up to 24 forecast range
- 2 height levels 50 and 100 m



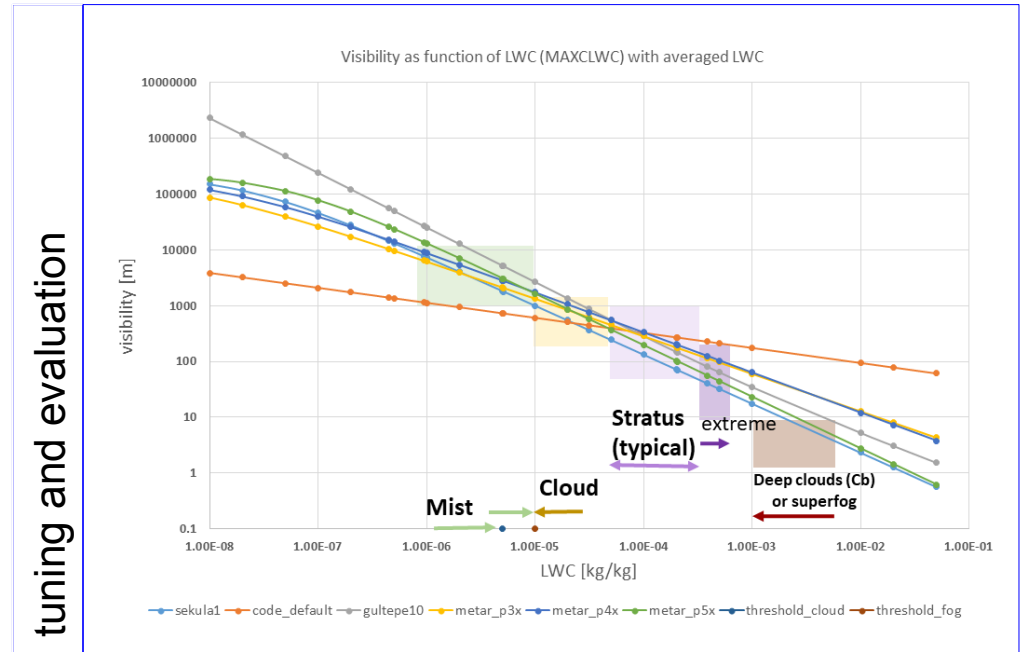
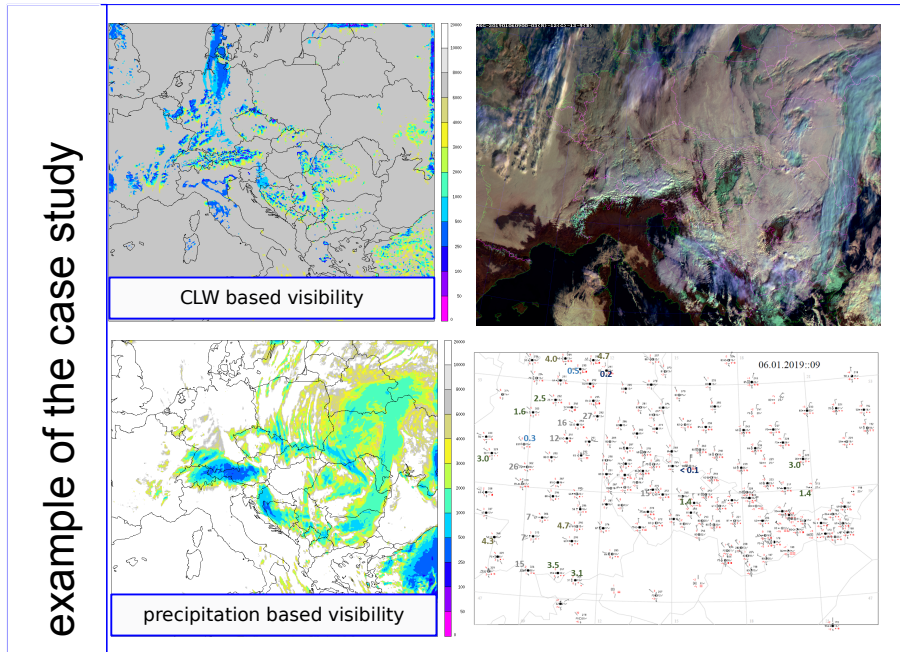
- monthly scores (bias and RMSE) shown for August and December
- slightly larger bias is observed at 100 m for the raw forecast
- similar performance for the corrected forecast for both 50 and 100 m
- the post-processed forecasts lead to decrease in bias
- there are no significant differences regarding RMSE

Cui B, Toth Z, Zhu Y, Hou D (2012) Bias Correction for Global Ensemble Forecast. *Weather and Forecasting* 27:396-410, <https://doi.org/10.1175/WAF-D-11-00011.1>



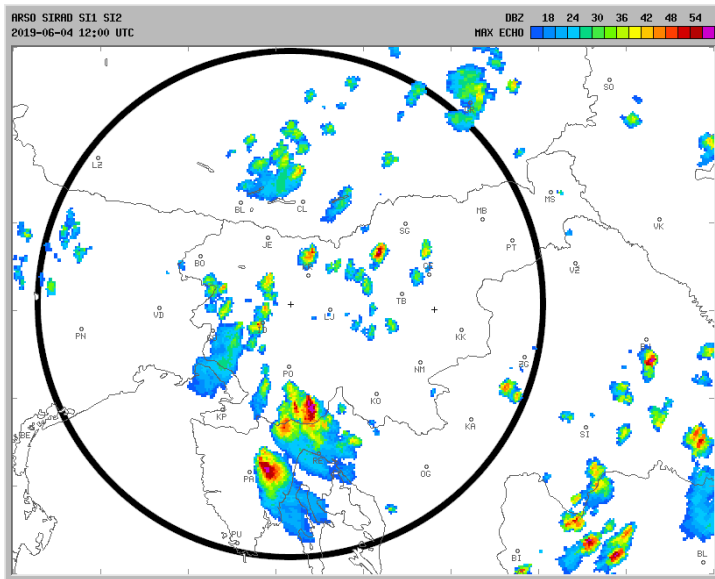
Evaluation of the visibility (diagnostic parameter) in ALARO/SHMU

- Visibility based on cloud liquid water (fog) and precipitation was studied
- Code adapted for ALARO CY43T2 @ SHMU (after Dombrowski-Etchevers – Brozkova – Sekula)
- Default settings & tuning according to the literature review and real measurements (SYNOP, METAR) were evaluated in the case studies (2017-2019)

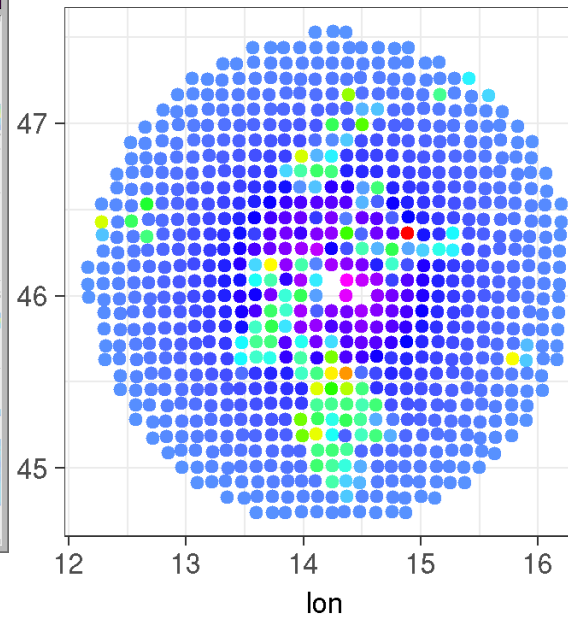


- Conclusion: visibility parameter fcst seems reasonable, with some limitations => available in ALARO/SHMU 2km/L73
- Link with “radiation cloudiness” will be investigated in future work.
- The Training on code developments and validation, Toulouse 2019 is acknowledged.
- More details: A. Simon & M. Dian, 2019: *Report on visibility tests with ALARO on cycle 43T2bf10 at SHMU*. Available on www.rclace.eu.

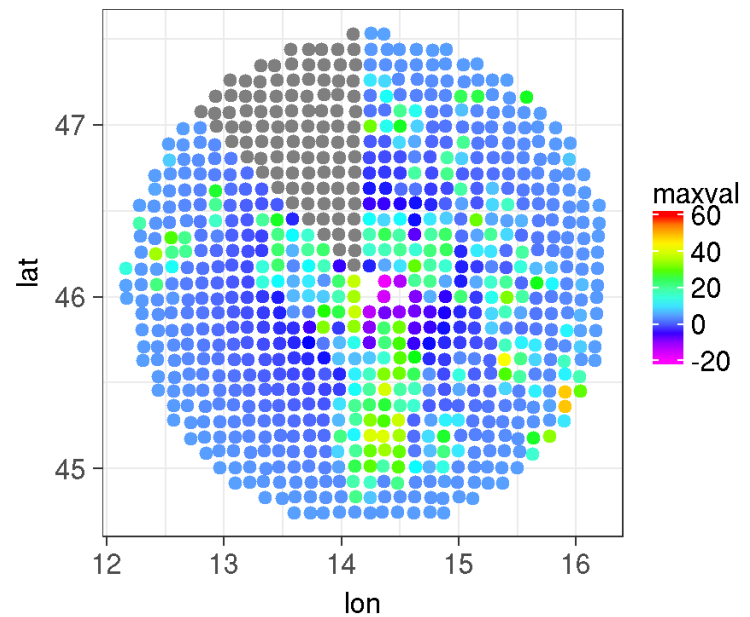
Evaluation of OIFS/OPERA radar data for 3D-Var Impact study of reflectivity assimilation



Radar composite over Slovenia [DBZ max] with marked range of radar at Mt. Pasja Ravan



Thinned radar observations as input to 3D-Var.



Model first guess at observation locations.



Tunisia

Operational & Parallel Suites

- Models implemented on the HP research computer

	ALADIN operational	AROME 2.5	AROME 1.3	HARMONIE
Spatial Resolution	7.5 km	2.5 km	1.3 km	2.5 km
Vertical Levels	70	60	90	65
Boundaries	ARPEGE 10km	ARPEGE 10km	ARPEGE 10km	ALADIN 7.5km
Time step	450 s	60 s	45 s	60 s

New HPC & Next operational suite

The new 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

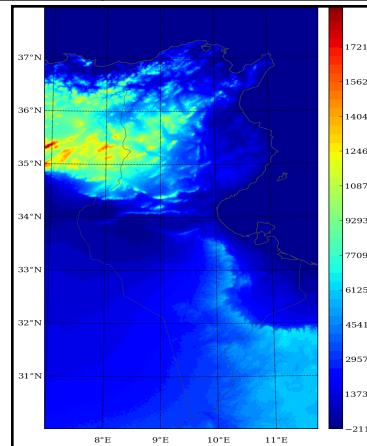


3DVAR Data Assimilation Implementation

- 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.

AROME-TUNISIE Configuration

	AROME-TUNISIE 1.3 km
Version	CYCLE 42
Resolution	1.3 km
Number of Points NLON*NLAT	384 X 720
Vertical Level	90
Coupling Model	ARPEGE
Time step	45 s

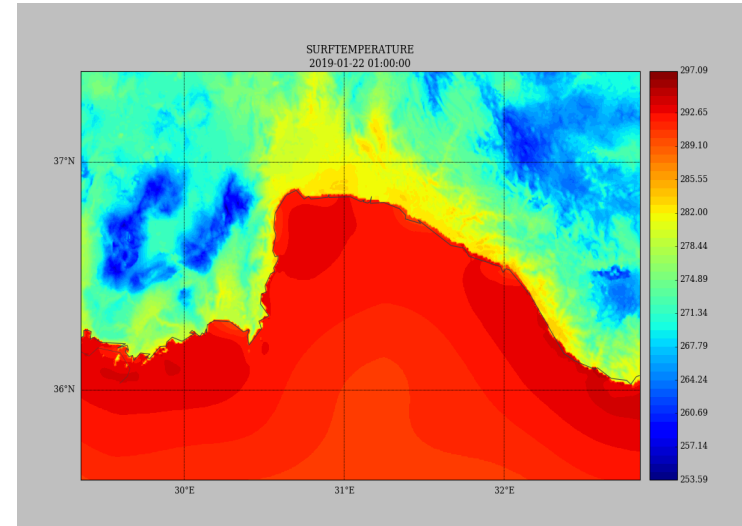
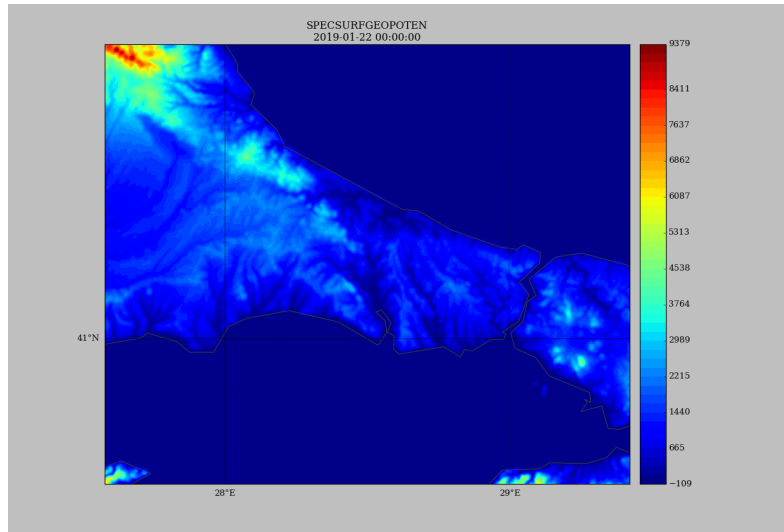


AROME-Tunisie Domain

Micro-Physics with AROME-Tunisie

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

- cy43t2 is operational since September 2019 for AROME (72L, 1.7km and 48h lead time), ALARO is running with cy40 (60L, 4.5km and 72h lead time) also ALARO is running with 3Dvar+CANARI in test mode with the same configuration as operational one.
- DasKIT work : AROME surface assimilation is tested successfully with CANARI and now running in test mode with synop observations.
- AROME 500m : AROME (cy43t2, 60L, coupled with ALARO and 30h lead time) is running for two airports namely İstanbul and Antalya with 500m horizontal resolution. Further tests are still being done to improve the results.



Figures of AROME 500m İstanbul Airport (left) and Antalya Airport (right)