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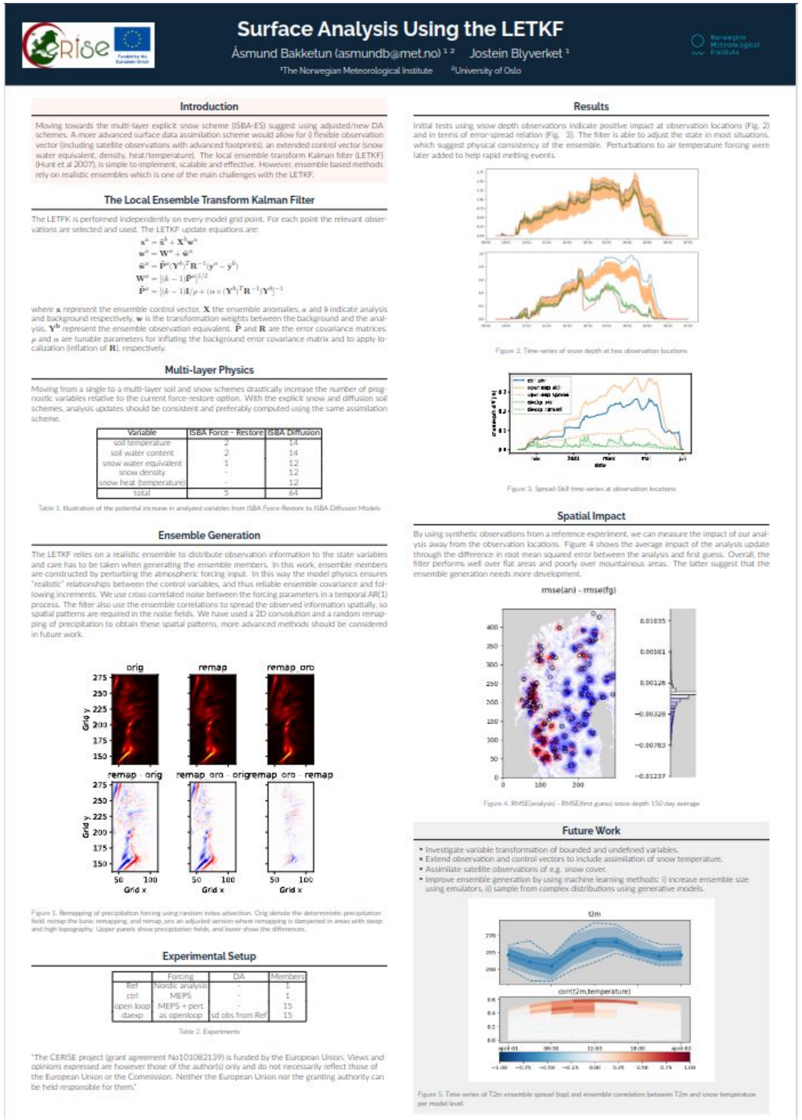
A Consortium for COnvection-scale modelling Research and Development

Posters Session, chaired by Jana Sánchez Arriola

All Staff Workshop 2024

Surface analysis using the LETKF

- Motivated by the multi-layer surface schemes
- The local ensemble transform Kalman filter is used to analyze state variables in the ISBA explicit snow scheme
- Tested with synthetic in situ observations
- Plan to extend with soil state & to include satellite observations
- Main challenges:
    - ensemble quality
    - variables are bounded and sometimes not defined



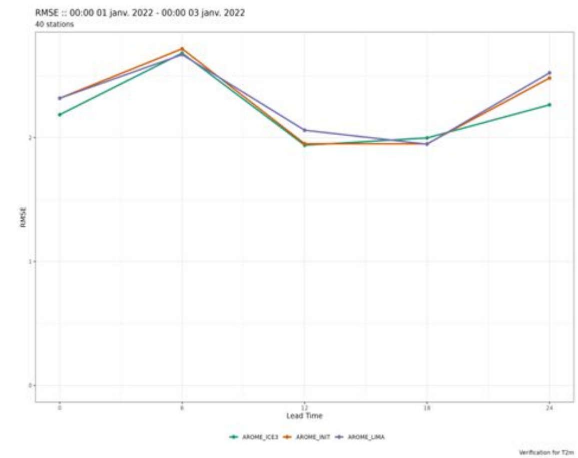
Evaluation of visibility with LIMA

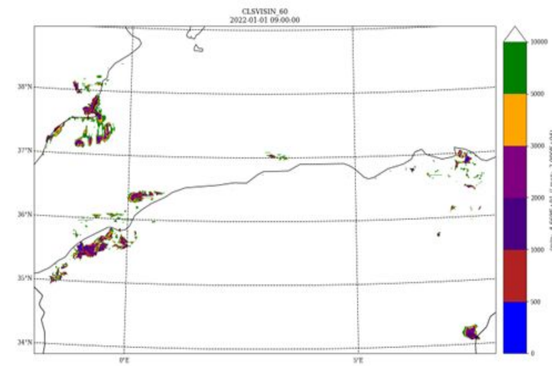
- The current Visibility Scheme depends on the Koschmieder formula : **vis=f(LWC)**
- Adapt the formula to the Lima microphysics scheme :

vis = f(LWC , Nd) (Gultepe et al , 2007) :

$$vis = \frac{1{,}13}{(Nd * LWC)^{0.51}}$$

- Initialization of Aerosols (CCN – IFN) from CAMS to better calculate Nd
- Intercomparison between 3 configurations ICE3 - LIMA - LIMA_Init on a notable 3-day event:
- **More research and validation work needs to be done.**





CHIKHI Walid

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OOPS LIMITED-AREA 4D-VAR

1. Background & Aims

- There is a history of HIRLAM in developing a 4DVAR
- Available in MASTERODB CY46 and being tested -vs- 3DVAR
- To follow the 4DVAR LELAM dev we must adapt it to OOPS

3. Plans and further work

- Port the code modifications to HARMONIE CY49T1h
- Proper documentation
- Discuss with our colleagues in MF about our implementation
- Performance tests comparing the ECMWF and MF cost functions

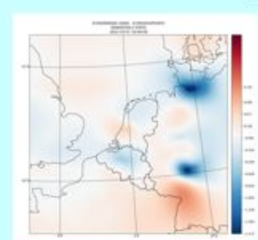
2. Technical work on ECMWF HPCF and CY48T3

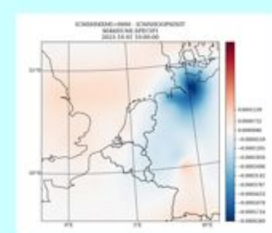
- CY48T3 has been chosen as work release
- Developing work with DAVAI
- DDT has become a basic tool for our development
- Our setup references are 4:

Harmonie-4dvar-CY46
+
Arome-3dvar-OOPS-CY48
+
Arpege-4dvar-OOPS-CY48
+
Arome-Forecast-CY48

→ Harmonie-4dvar-OOPS-CY48

- Coarse domain over Netherlands as working domain
- LELAM mods are reading BCs for the trajectory computation and adaptation of SP2GP/GP2SP routines
- Two cost functions are available in the OOPS code (ECMWF/MF)
- Preliminary results show realistic analysis increments

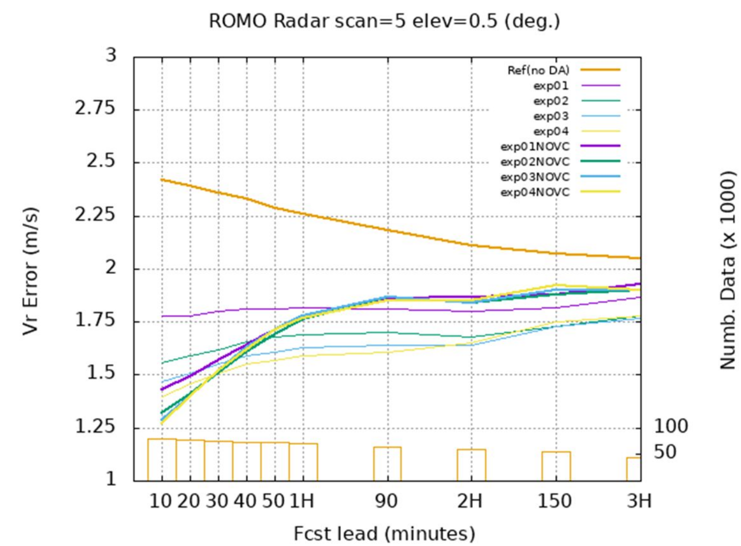




ESCRIBÀ Pau

Initialization Experiments with Sub-Hourly DA of Radar Wind Data in H-AROME

- Initialization algorithms relevant to NWC-NWP
- VC tested with DA of DOW in 10-minutes cycling
- Results confirm VC satisfactory performance
- Tests still restricted to standard 3D-Var
- *New tests to be done with nudging-like configurations*



- A good number of interesting natural extensions for this line of work

    Physics and initialization

    VC for QE dynamics

    DA of lightning data, …

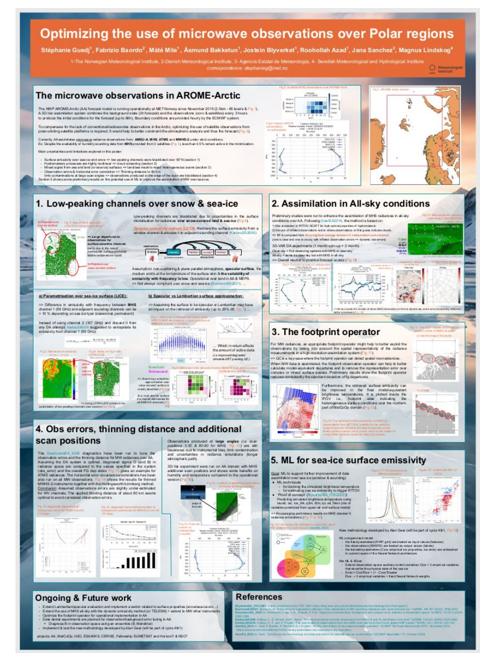
Optimizing the use of microwave observations over Polar regions

- Microwave observations in AROME-Arctic (NWP system running at MET Norway) to compensate for the lack of conventional observation in Polar regions.
- Instruments such as AMSU-A, MHS, ATMS or MWHS2 are designed to provide crucial information on the surface & tropospheric humidity and temperature.

=> usage/assimilation is still very limited (around 0.5% of active MHS)

Challenges:

- surface emissivity over sea-ice and snow-covered surfaces
- cloud-affected radiances
- heterogeneous scenes within the footprint (coast, sea-ice edges)
- observation error (& correlation) diagnostics
- additional observations at the edge of the scan ?
- new ML learning method for surface emissivity



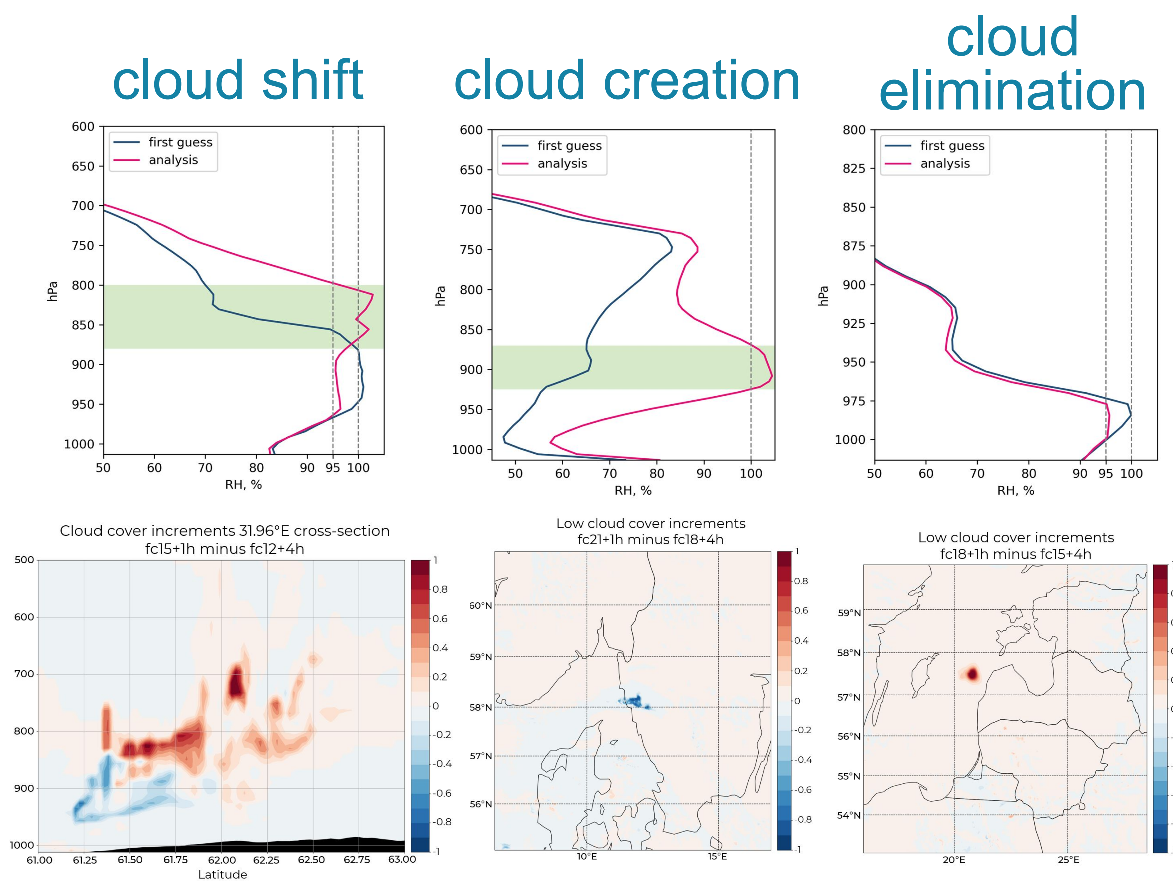
Cloud DA using observation operator defined by the penalty function. Proof of concept.

Scheme of cloud data assimilation based on the concept of defining the observation operator through the penalty function

We construct the observation penalty function, which penalizes:

- too low RH values inside the cloud layer
- too high RH values outside the cloud layer

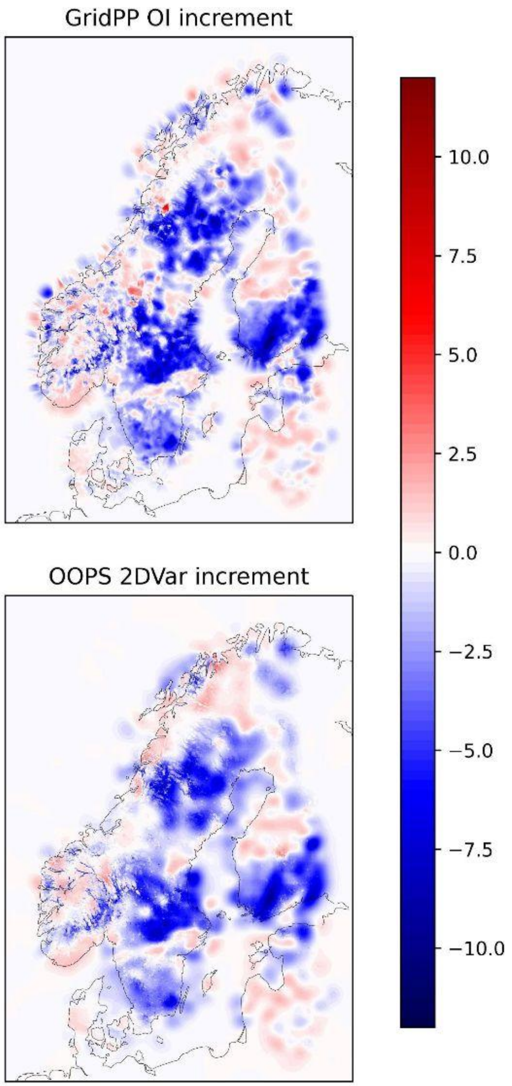
3 single observation experiments



LERNER-VILU Alina

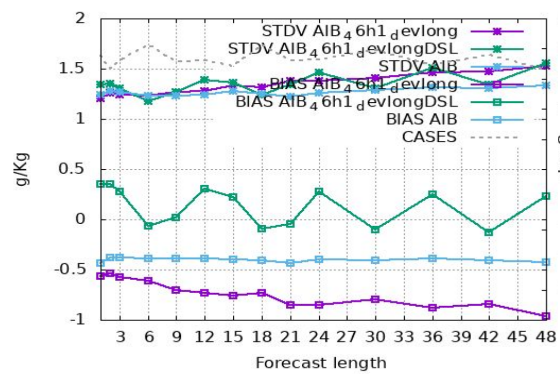
Making OOPS easier to use for new systems

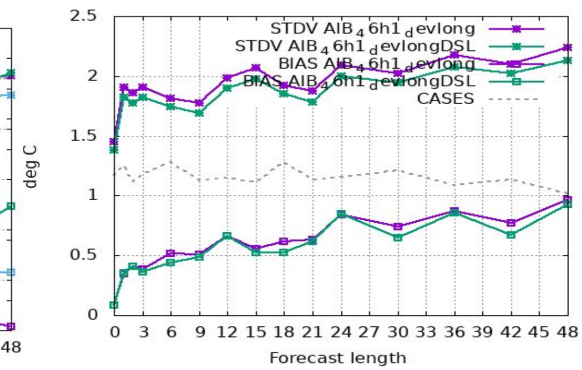
- OOPS (Object-Oriented Prediction System) has been around for over 10 years!
- It is a powerful model-agnostic data assimilation software that can be interfaced with different systems.
- Currently it works with the Lorenz model (L95), the QG model, IFS/Harmonie and... that's it.
- Its JEDI cousin - same name but different code - is interfaced with numerous models: FV3, MPAS, UFS, LFRic, MOM6, NEPTUNE, etc.
- Within ACCORD, other models could benefit from the OOPS infrastructure (e.g. surface analysis, land surface, ocean, air quality), but writing interfaces is difficult.
- QUENCH is a new generic file-based interface (no 4D-Var) that makes using OOPS much easier!



Testing a Dry Soil Layer scheme in SURFEX and Harmonie-Arome (H-A)

- H-A tests with DIF+ES+MEB show dry-bias wrt OPER in near-surface humidity variables pointing to excessive Evapotranspiration in PATCH1 (low vegetation).
- We test in H-A a Dry Soil Layer scheme recently introduced in SURFEX which adds a soil resistance to ground evaporation (E_g) from 1st soil layer
- The scheme reduces E_g keeping first soil layers moister, which helps in the 2m humidity diagnostics
- Enhancement of transpiration in the period where vegetation is more active is limited in areas where veg=f(LAI) (mainly crops).





— NO DSL — DSL

— OPERATIONAL

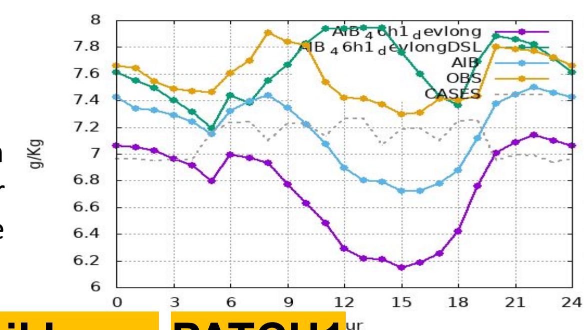
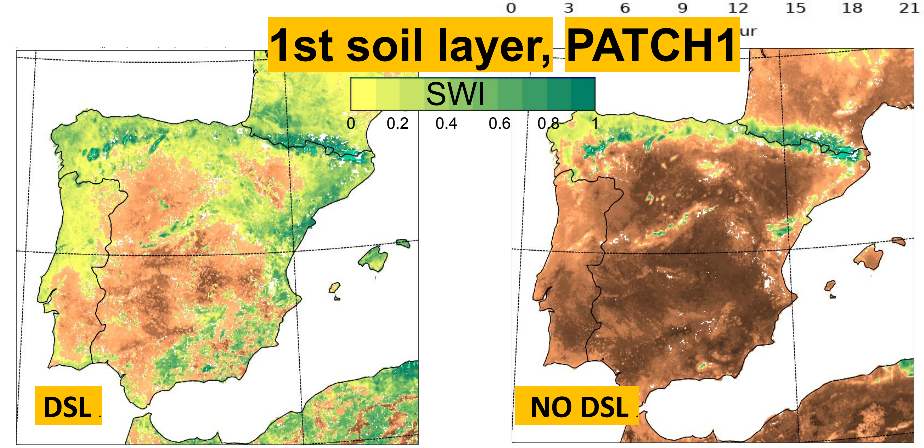


Figure 1. Scores for Q2m and T2m in May'22 (5 months after coldstart) for stations where the fraction of bare soil for PATCH1 (1-*veg*) > 0.7.



VIANA Samuel

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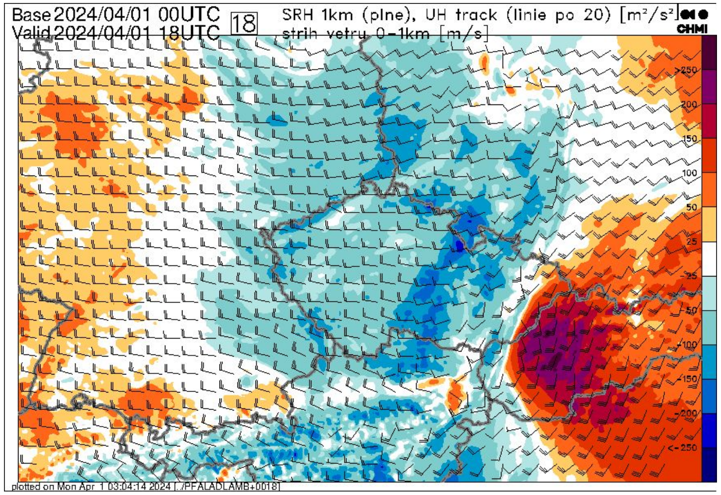
Numerical Weather Prediction at CHMI

- **New convective diagnostics were implemented, such as storm relative helicity, updraft helicity track, etc, see the picture for 01/04/2024;**
- **Improvements were applied in CANARI when switching to the 3h cycling, especially regarding snow water equivalent;**
- **Increased amount of snow lead to new tuning of snow fraction (radiative impact) and vegetation roughness (wind impact) leading to better scores.**



BROZKOVA Radmila

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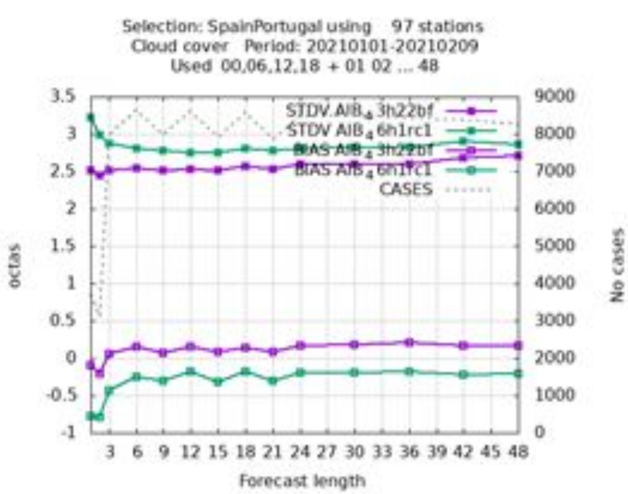
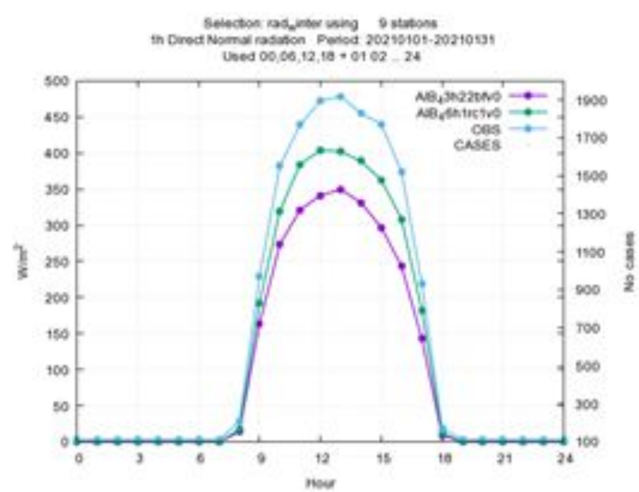
AEMET NWP activities

- Nowcasting suite operational: 1.25 km resolution, Harmonie-Arome nesting, 3DVar hourly cycle with +23 min cut-off time.
- Enhancements on satellite Data Assimilation (slight positive impact)
  - SEVIRI water channels over land
  - ATMS for Soumi-NPP and NOAA-20 and MWHS-2 for FY-3D sounders
- Validation of cy46h1: quite neutral impact in general compared to cy43 except in low cloud cover (reduction)

SYNOP cc





DNI

CALVO Javier

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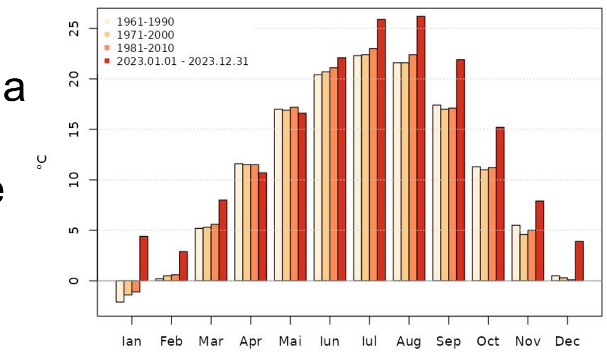
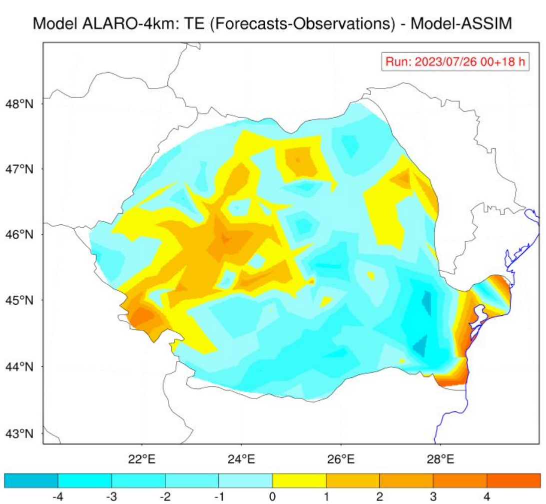
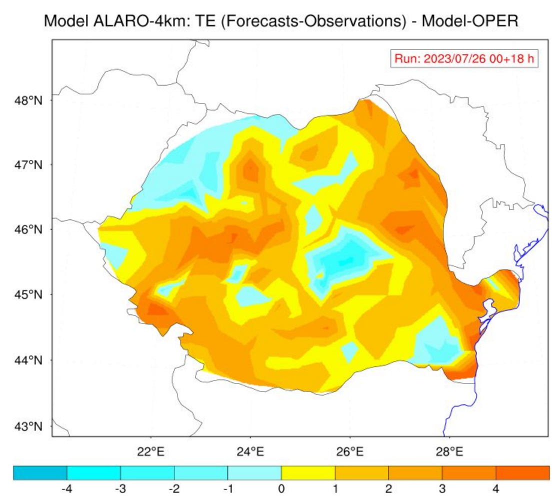
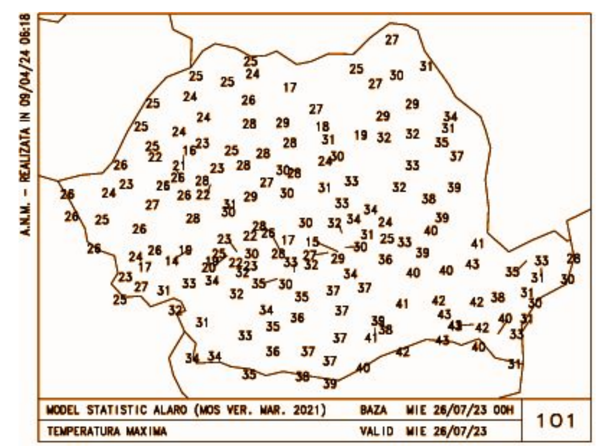
National poster Romania

- ➔ Operational configurations
- ➔ Evaluation of the ALARO temperature forecast for Romania
- ➔ Impact of the surface data assimilation on the temperature forecast
- ➔ Analysis of the MOS forecast for these situations









CRĂCIUN Alexandra

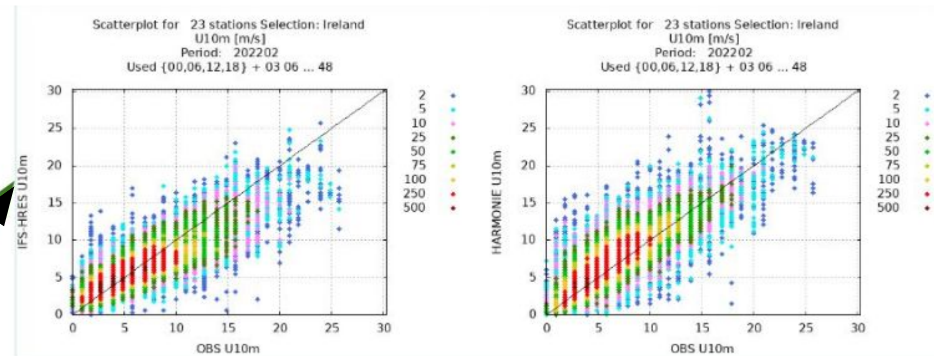
Operational NWP at Met Éireann

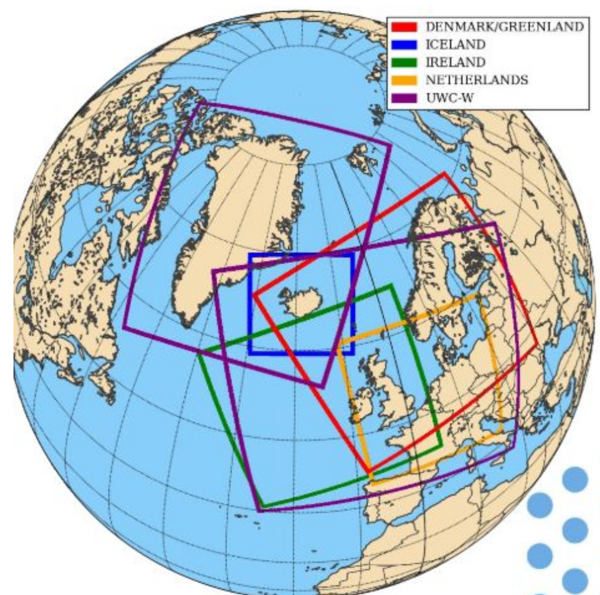
Overview of operational NWP suite
- Model configuration
- Ensemble details

Operational verification
- Scorecard
- Stormy period (spring 2022)

Experiments
- Single precision
- Vertical resolution

Future plans
- High resolution nowcasting
- UWC-West Joint operations



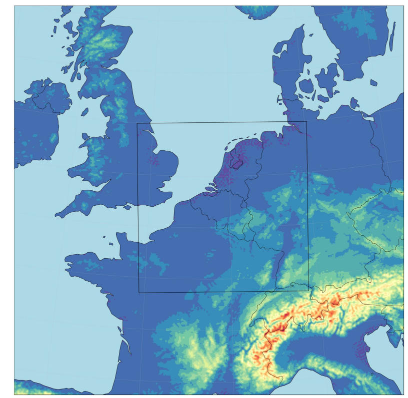


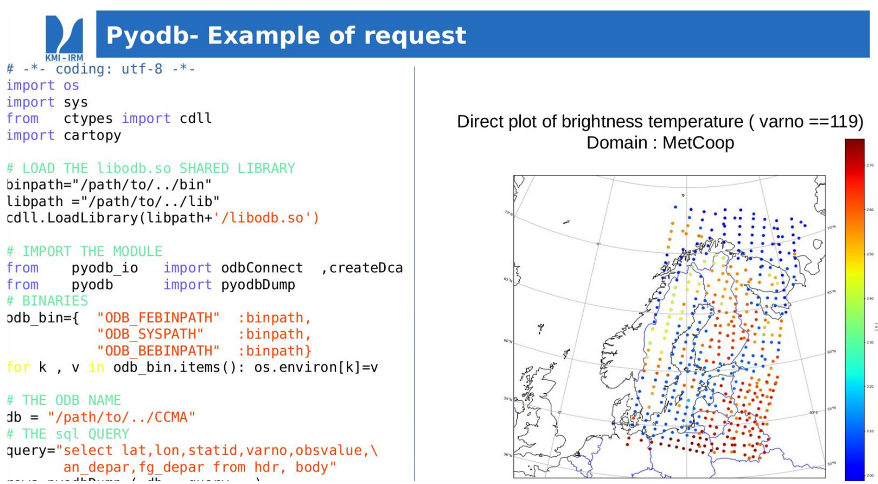
United Weather Centres

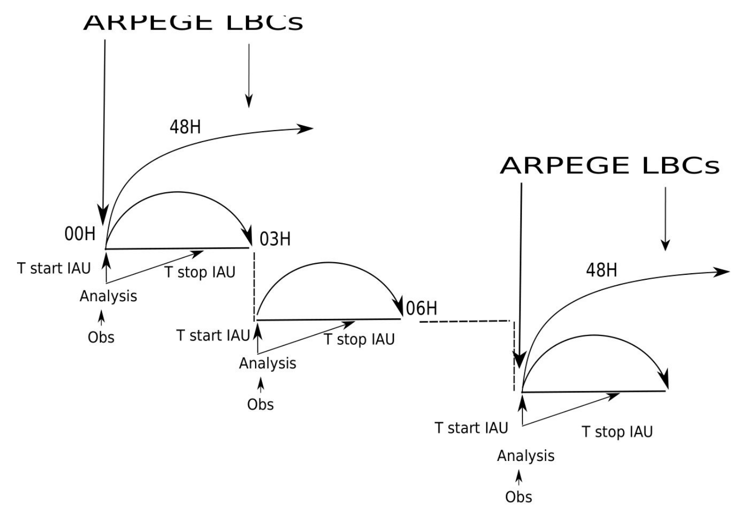
DARCY Rónán

Belgian national poster

- Operational forecasts ported to ECMWF.
- Developing a 3D-Var RUC suite
- New PyODB interface







DECKMYN Alex

National poster Morocco

Operational suite CY43T1

- 3dvar for upper air
- OI-Main for surface
- Ensemble B-Matrix
- Assimilation of SYNOP, TEMP, AMDAR
- Acquisition and Preprocessing observations by SAPP

SAPP Implementation

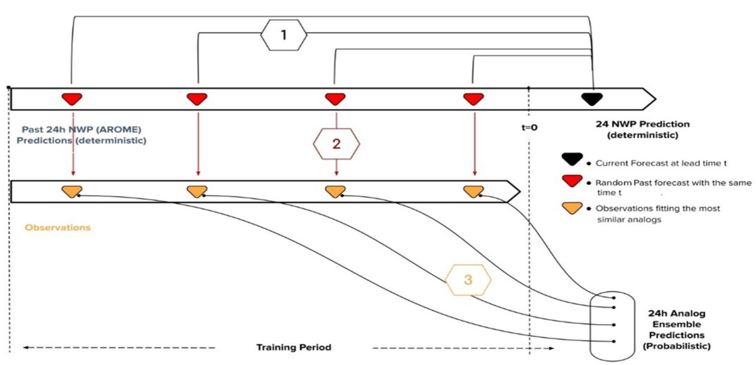
- Operational implementation since the end of 2023
- observation extraction every three hours
- extracted observations are: SYNOP, TEMP, AMSUA, MHS, HIRS

Monitoring with OBSMON

- Local Installation of OBSMON : the observation post-processing and the shiny web interface
- Operationally used to monitor synoptic and automatic stations and to update the local blacklist file

Analog Ensemble Forecasting System for Low-Visibility Conditions and Surface Weather Parameters over the Main Airports of Morocco

- new predictors weighting strategy based on machine learning
- seasonal restriction
- wide specter of predictors: 8 surface weather parameters and liquid water content for reduced visibility



Ongoing/Future work

- New suite at 1.3km resolution and with hourly assimilation
- Assimilation of satellite data
- Setting up an Ensemble AROME system.
- New AI applications in NWP

HDIDOU Fatima

NWP systems @Météo-France : a quick overview

Operationnal suite CY46T1_op1 (June 2022)

- Same resolution for Arpege EPS and Arome EPS than their deterministic counterpart : T1798c2,2L105 and 1,3km L90
- New Arpege physics : Tiedtke deep convection scheme, 1D sea-ice scheme …
- And much more : assimilation of MW rainy cloudy observations, new version of the Ecume oceanic surface fluxes schemes ...

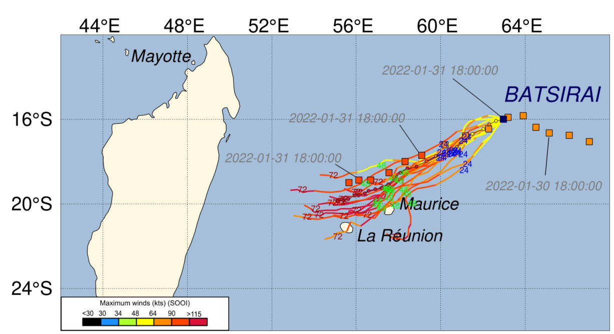
Current e-suite CY48T1_op1 (in operation by the end of 2024)

- OOPS in 3DVar and 4DVar analyses
- 3DEnVAR Arome, hybrid B matrix in Arpege 4DVar
- Arome EDA with 50 members (instead of 25)
- EcRad (Arome), SST from Mercator-Ocean global model (both for Arpege), change of aerosol and ozone climatologies (from CAMS, Arome)
- Assimilation of Mode-S data (Arome)

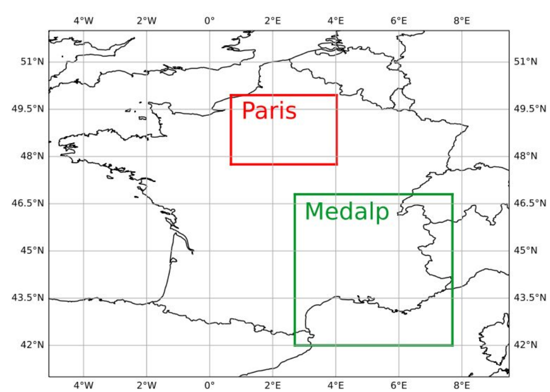
Next e-suite CY49T1_op1 (2025-2026)

- 4DEnVar +SDL (Arome), perturbations of physic's parameters with Random Parameter Method (Arpege EDA)
- 3DEnVar +SDL (Arome EDA)
- Some tunings in Arpege physic, Ocean Mixing Layer (Arpege)
- Single Precision for all uncycled Arpege forecasts and PEARP forecasts

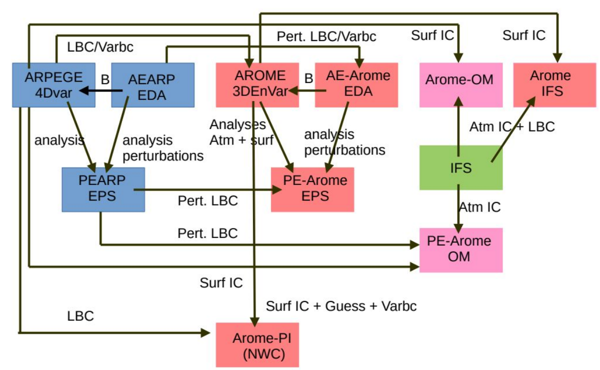
Arome overseas EPS in operation since February 2023



Arome configurations @500m in Near Real Time



Dependencies between NWP systems



LOO Cécile

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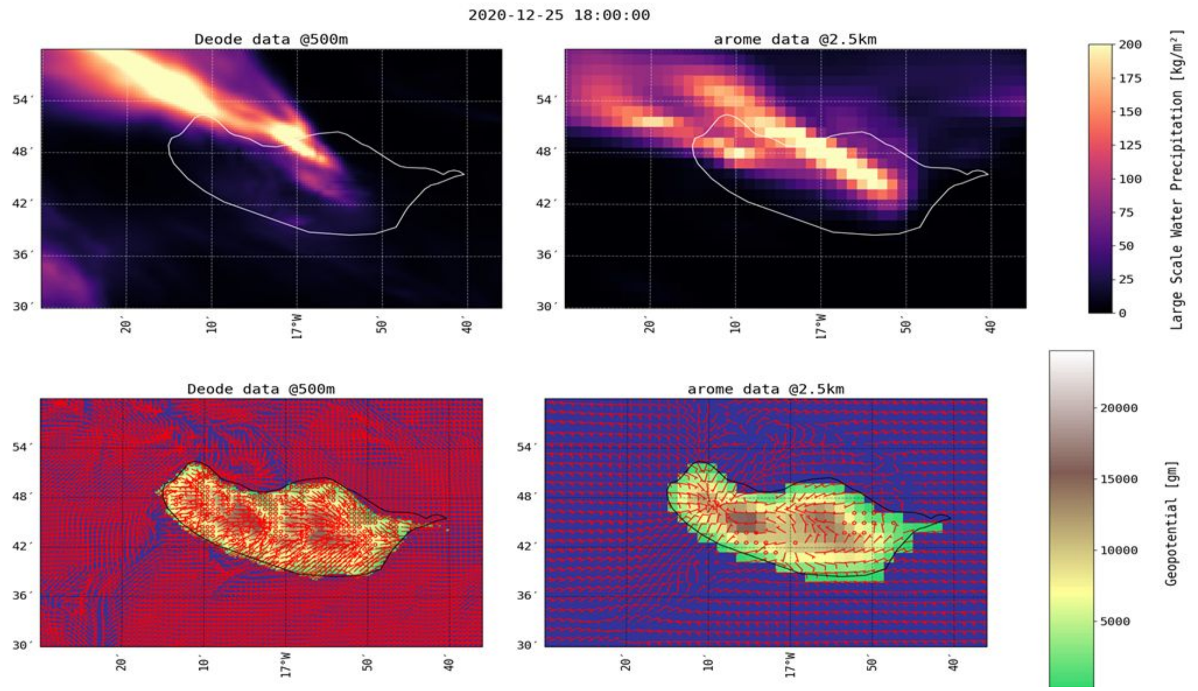
NWP activities at IPMA

- Operational system unchanged
- Pre-operational CY43T2 in new HPC machine
- New domain configuration tested successfully

Destination Earth activities - case studies with prototype



LOPES Nuno

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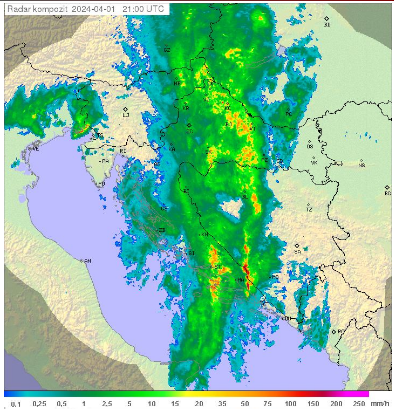
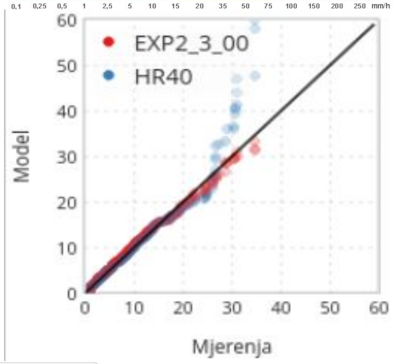
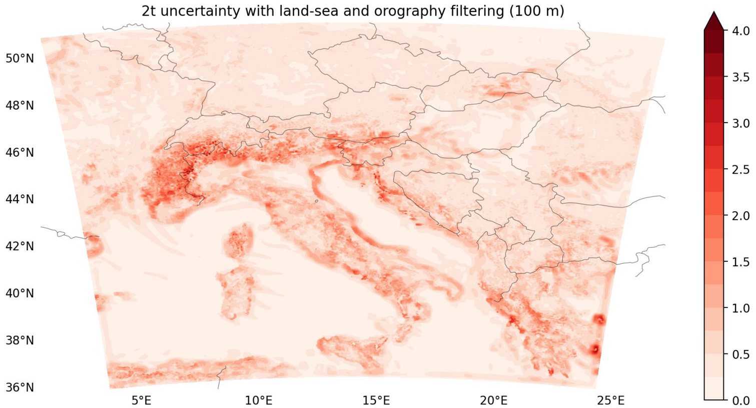
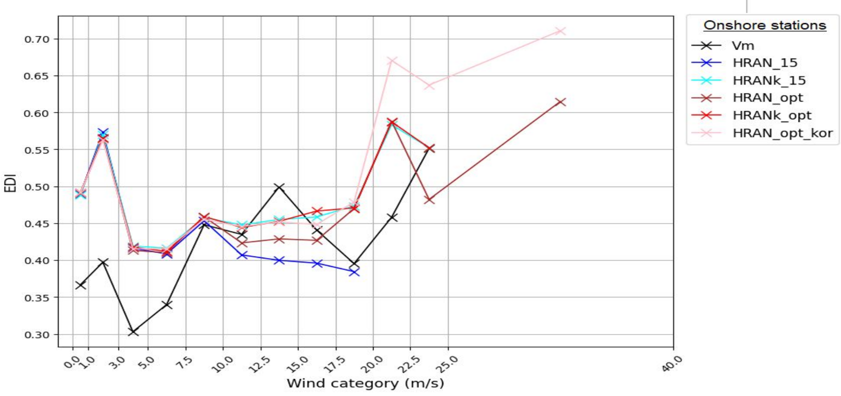
The NWP activities at Croatian Meteorological and Hydrological Service in spring 2024



- **Assimilation of OPERA radar reflectivities tested for local implementation - operational from the end of 2023**
- **Method to generate ensemble forecast for locations of interest and/or to provide uncertainty for the deterministic model using neighbouring model points**
- **Universal Thermal Climate Index to determine temperature-related mortality using mortality data and data from nine Croatian stations**
- **New approaches to analog-based postprocessing methods for wind speed forecasts were explored**







PANEŽIĆ Suzana

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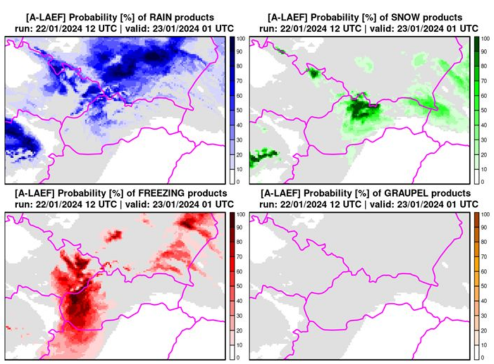
NWP related activities in 2023-2024 at SHMU

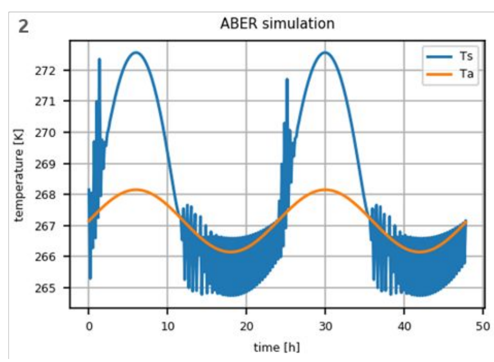
Operational highlights: Upgrade of ALADIN/SHMU and RUC1 to CY46T1

Ongoing developments:

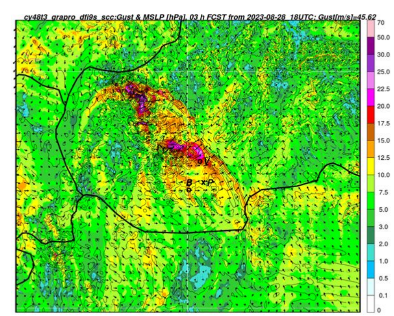
A-LAEF: upgrade to CY46T1 (with support of CHMI), new products (precipitation types)
ALADIN/SHMU: Increasing the number of vertical levels (63L ➪ 87L)
HARP: OBSOUL implementation
SURFEX: Investigation of numerical oscillations
VHR: Tests with cycle 48T3, graupel scheme, etc. on a case of severe convective storm
End-products: new interactive EPSGRAMS, HEC-HMS hydrological model



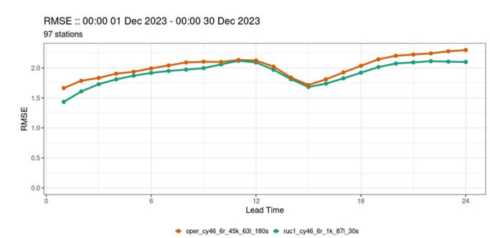
A-LAEF freezing rain case, precipitation types in CY46



SURFEX oscillations in snow surface temperature



0.25 km resolution simulation of severe windstorm



HARP verification using OBSOUL data

DERKOVÁ Mária, SIMON André

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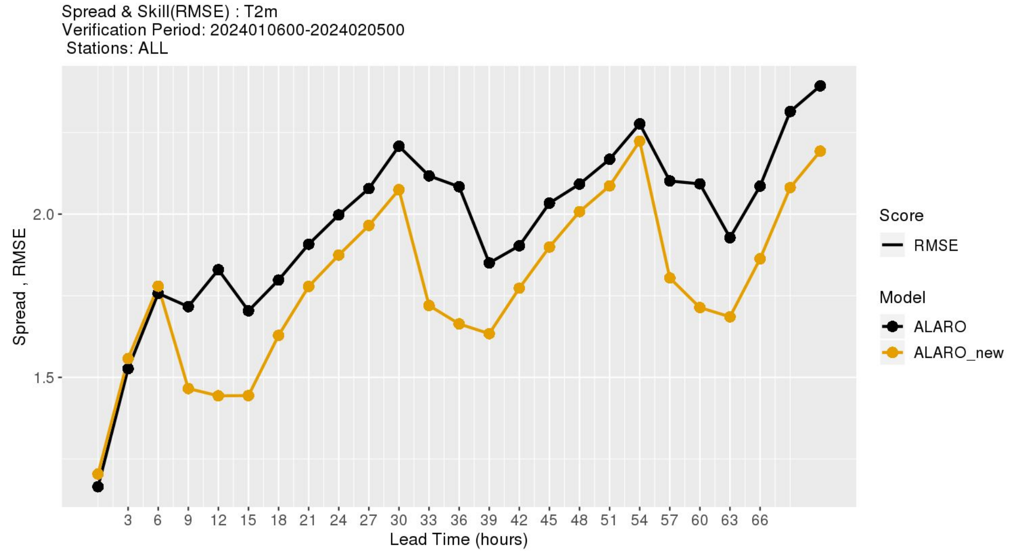
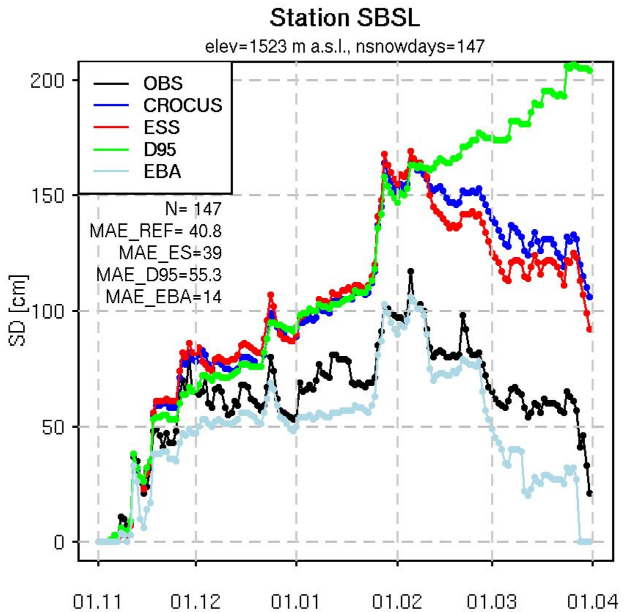
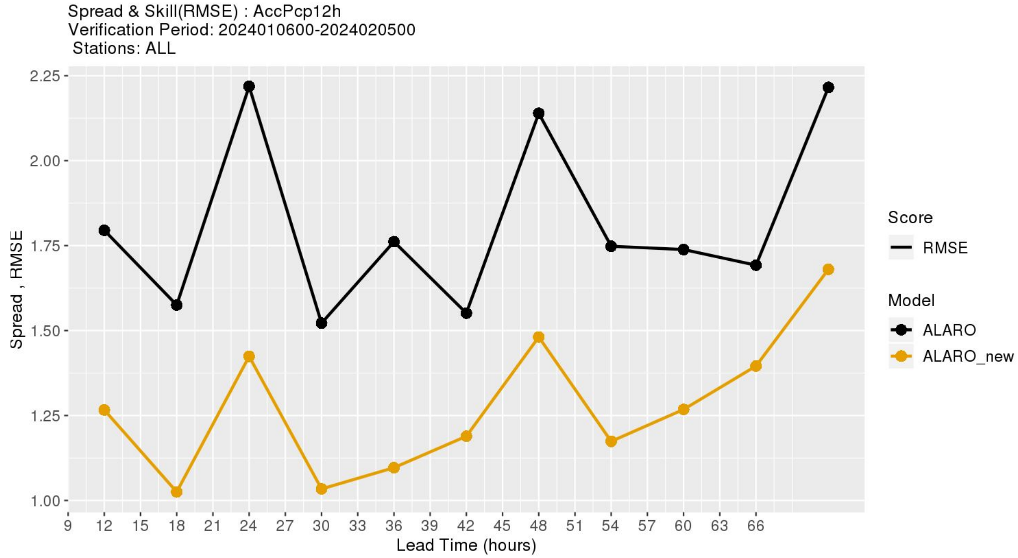
NWP in Poland

- no changes in operational suite
- testing data assimilation in ALARO (CY43t2)
- post-processing using copulas
- comparison of snow schemes performance in SURFEX







STACHURA Gabriel

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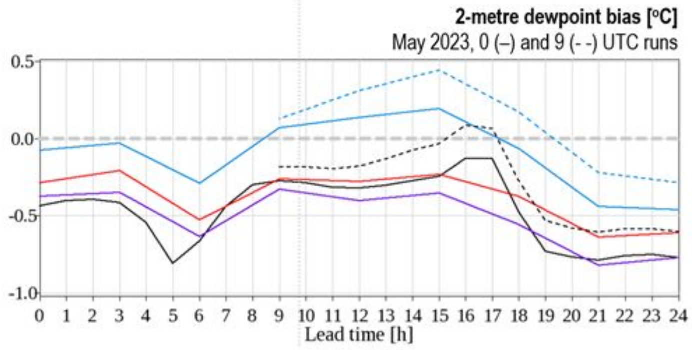
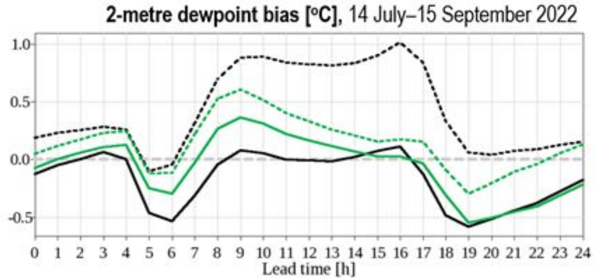
NWP activities at the Hungarian

- Assimilation of SYNOP T2m, RH2m at 0,3,6,12,15 UTC, **ASCAT** or **SYNOP** at 9,18,21 UTC in SEKF
- Obs & model errors based on **de Rosnay et al.** (2013); **Mahfouf** (2010)



Testing assimilation of ASCAT soil moisture

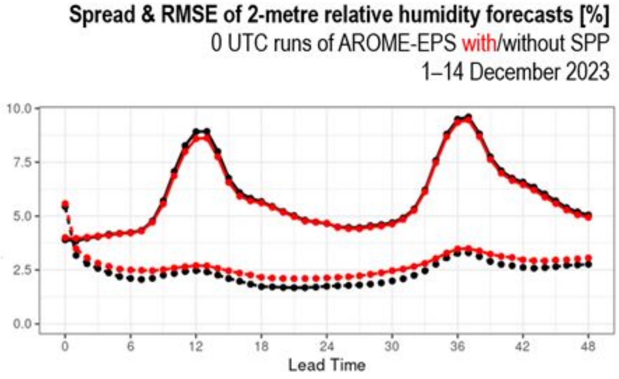
- Severe drought in 2022 over East Hungary
- Update in cloud diagnostics of AROME/HU in 2023 (- -)
- 2m dewpoint error due to overestimated transpiration is reduced by **prognostic LAI**



Daily updated LAI using SURFEX ISBA-Ags

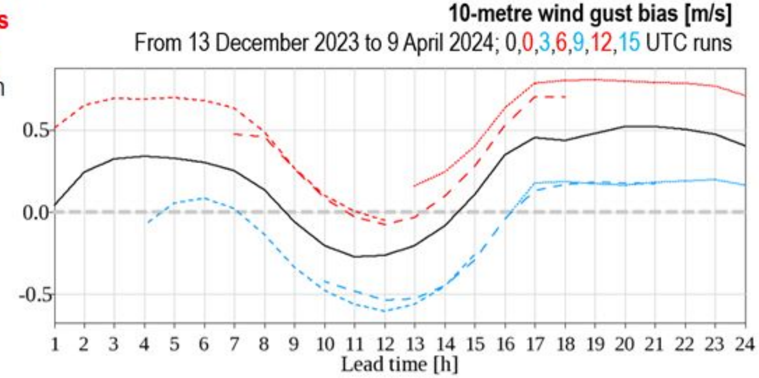
Testing SPP in AROME-EPS

- Experiment for 1-14 December 2023
- 10 perturbed parameters mostly following Wimmer et al. (2022)
- Slight increase of spread, neutral to positive impact on CRPS, RMSE



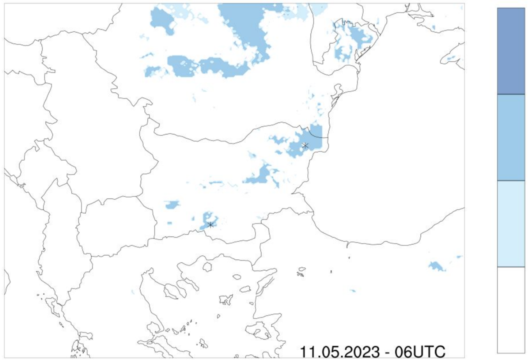
E-suite at 1.3kmL90 resolution and with hourly assimilation

- 30 minute short-cutoff
- **12-hours forecasts**
- **Wind gust tuning** in every second run

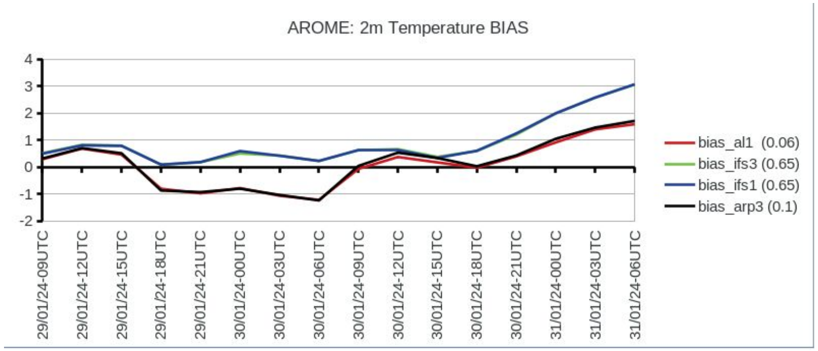


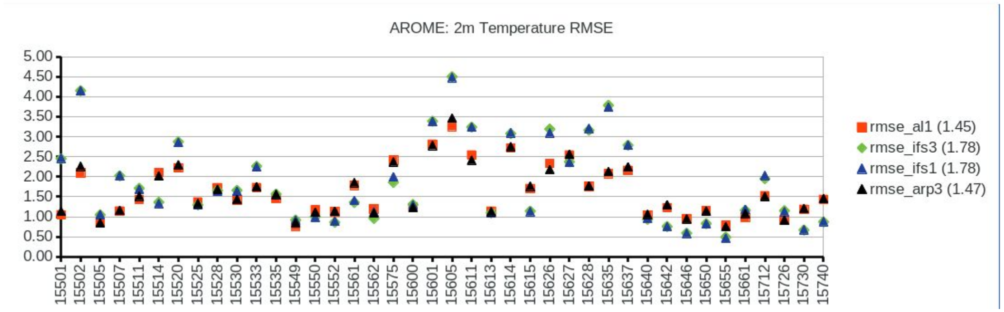
SZEPSZO Gabriella

NWP in Bulgaria



1. Operational Suite
2. Operational Cluster
3. Verification Scheme
4. NWP Forecast End-users
5. Some Specific NWP postprocessing
   - lightning probability forecast based on AROME microphysics
   - spring frost probability forecast based on ML technique using ALADIN output as predictors
6. Some ongoing tests on the use of different LBCs



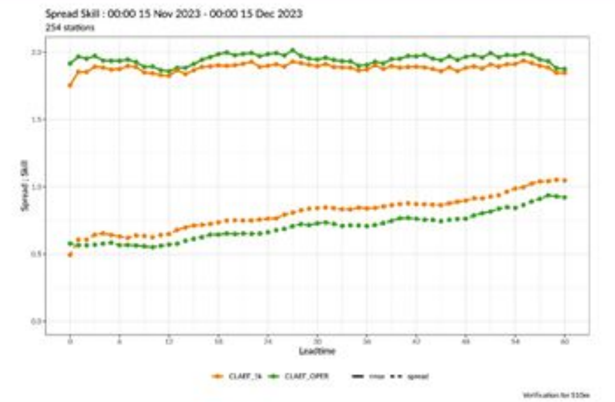


TSENOVA Boryana

National Poster Austria

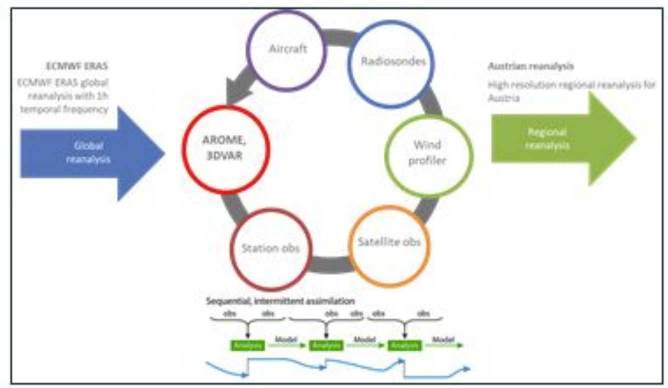
Toward C-LAEF 1k and 3D-EnVar:

- Aim to upgrade C-LAEF to horizontal resolution of 1km (2025)
- Full parallel suite (16+1) was run from Summer 2023 to February 2024
- Additional control run with 3D-EnVar was included for several months
- Different setups for 3D-EnVar were tested in a case study



ARA – high resolution reanalysis ensemble:

- 10+1 Member ensemble
- 3h assimilation cycle
- Coupled with ERA5
- Target period 2013 – 2023



WEIDLE Florian

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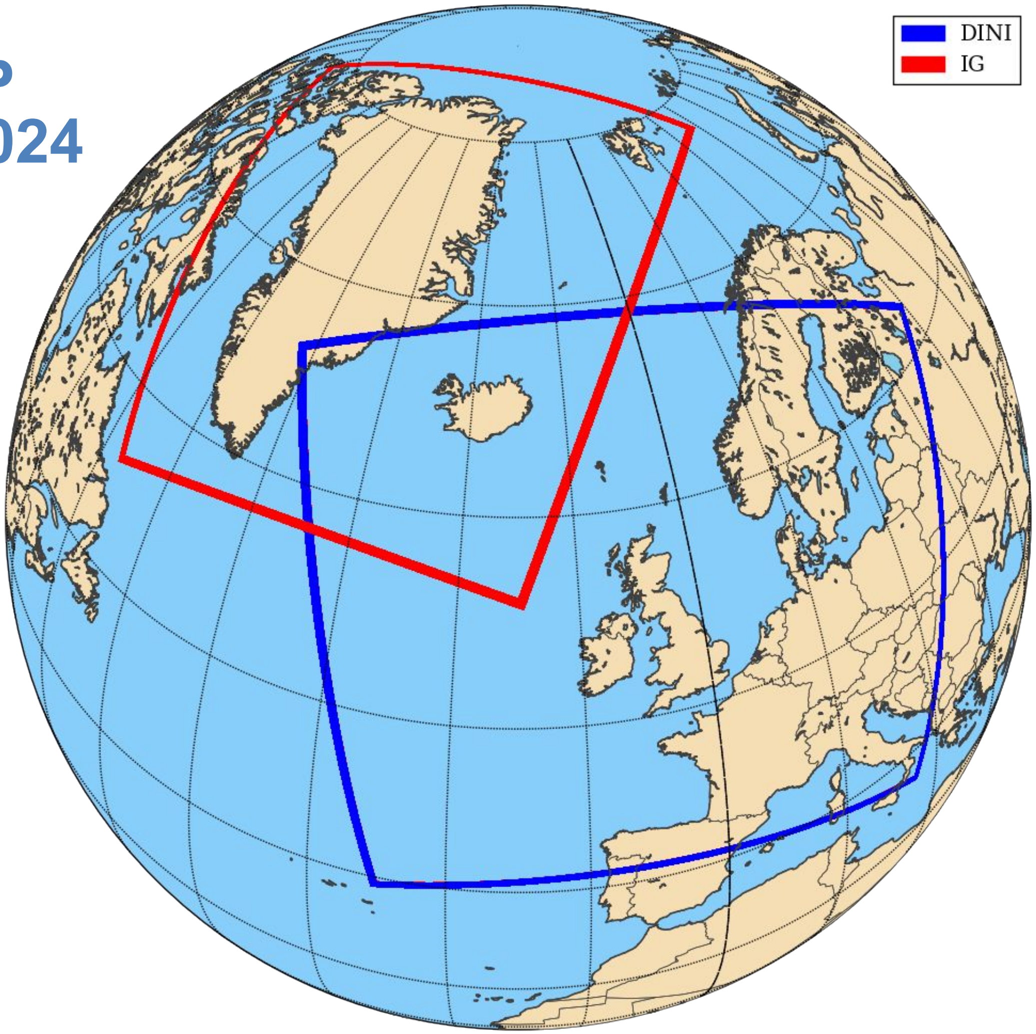
UWC-W operational configuration

- Common Operational NWP commenced March 19th 2024
- Harmonie-Arome 43h2.2
- Two domains:
    - DINI-EPS
    - IG-Det
    -
- Improvements
    - Cloud
    - U10
    - T2 for some
    - Snow melt
- Issue with PMSL



WHELAN Eoin

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