National Posters

Belgium

Belgian National Poster

- Overview of operational forecast suite.
- Porting of ACCORD code to GPU.
- ML efforts at RMI.

Croatia

Croatian national poster

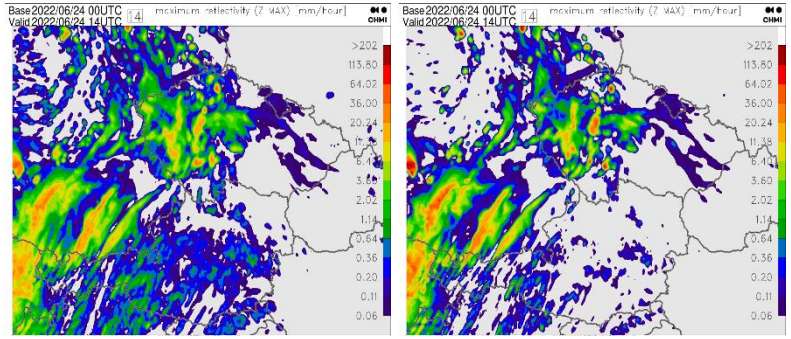
- UTCI
  - Explored the potential of the Universal Thermal Climate Index (UTCI) and Potential Equivalent Temperature (PET) as severe weather-related mortality indicators in Croatia -> assessed on 4 stations for period 2006-2022
- DestinE
  - Synthetic wind speed data was compared with measurements from one coastal wind farm in Croatia. Also, a post-processing of the wind speed forecasts at the location of the wind turbines was carried out using the analog method.
  - Two distinctive 2D analog-based approaches, Point-by-Point and Field-wise, are used to improve the 2-m temperature of AROME hyper-resolution hindcasts.
- Verification of wind speed
  - The ALADIN-HRDA configuration was replaced by the ALADIN-HR20 configuration.
  - Both configurations show similar spatial distribution of maximum 10 m wind speed. However, ALADIN-HR20 forecasts higher maximal wind speed over coastal Croatia.
- **N**eighborhood **e**nsemble **a**ltitude correction (NEA)
  - New method for temperature post-processing which doesn’t require any training.
  - RMSE reduced by about 10 % on average.

Czech Republic

NWP activities

Czech Hydrometeorological Institute

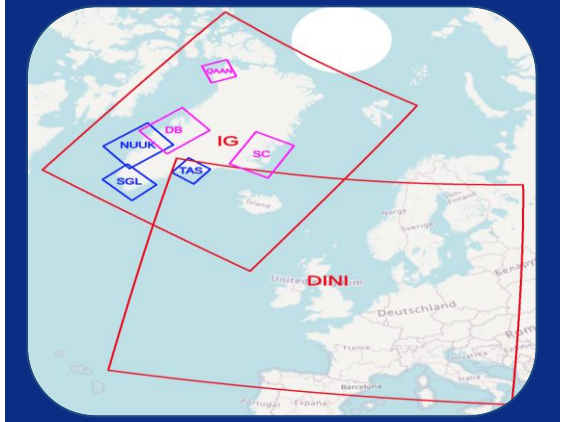
- **Increased frequency of assimilation cycle to 3h**
  - **retuning of surface analysis & new snow treatment - increased amount of snow lead to new tuning of snow fraction (radiative impact) and vegetation roughness (wind impact)**
- **Radar reflectivity developments**
  - **Abel and Boutle rain size distribution in radar reflectivity diagnostics**
  - **OPERA reflectivity data assimilation test using 1D+3D-Var approach**



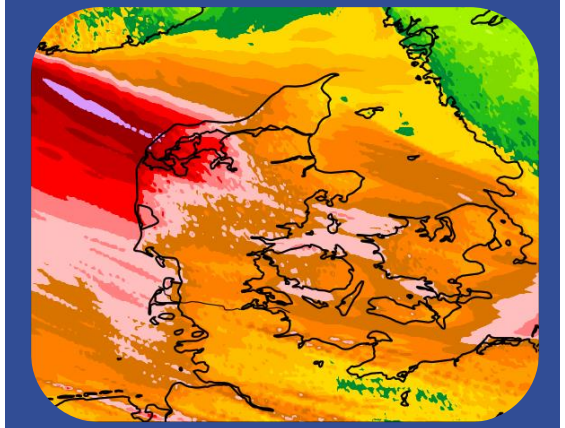
Denmark

NWP activities at DMI

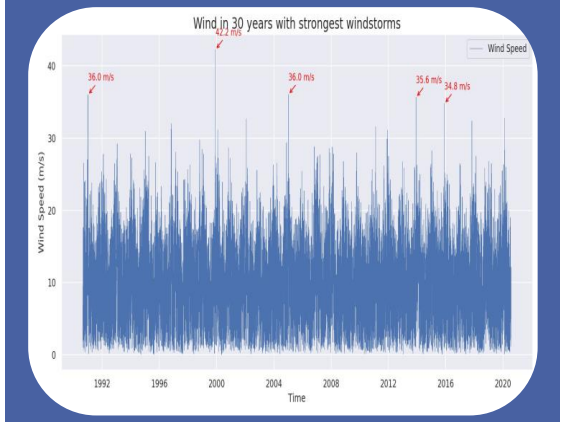
Operational configuration



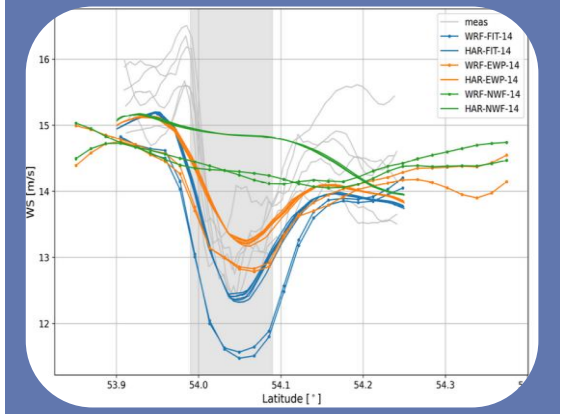
On-demand sub-km modelling



Machine Learning DANRA



Energy forecasting



Finland

ILMATIETEEN LAITOS
METEOROLOGISKA INSTITUTET
FINNISH METEOROLOGICAL INSTITUTE

National Poster

MetCoOp Cooperation:

- MetCoOp members: Norway, Sweden, Finland, Estonia, and Latvia
- 2.5 km ensemble prediction system **MEPS** and rapide refresh cycle **MNWC** based on the **Harmonie-Arome** model.

Aerosol Forecasts:

- External aerosol forecasts integrated into Harmonie-Arome
- Near real-time data from Copernicus Atmospheric Monitoring Services.

Snow Barrels:

- H SAF H32 product data from 100-pixel areas condensed into classifications for **snow**, **no snow**, and **partial snow.**
- Improves snow cover particularly in autumn and spring.

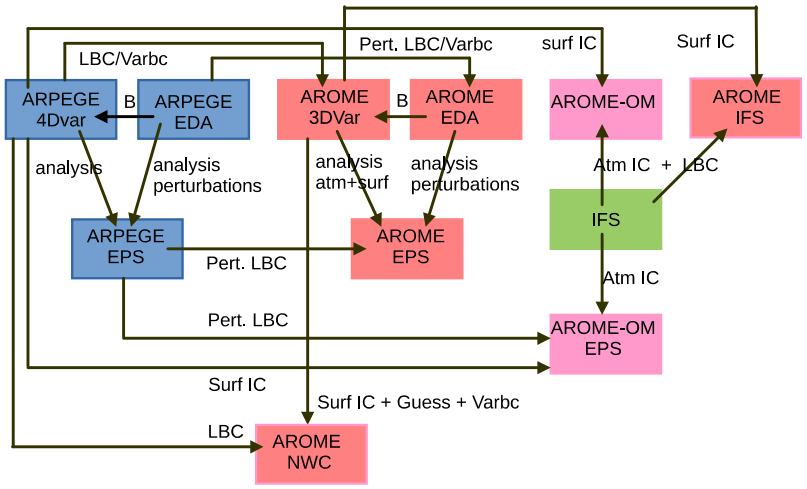
Stochastically Perturbed Parametrizations (SPP):

- Adds noise to uncertain processes in the model physics.
- Increases variability in mixed-phase precipitation forecasts, especially for solid-state hydrometeors like snow.

France

NWP systems @MF: quick overview

Dependencies between NWP systems



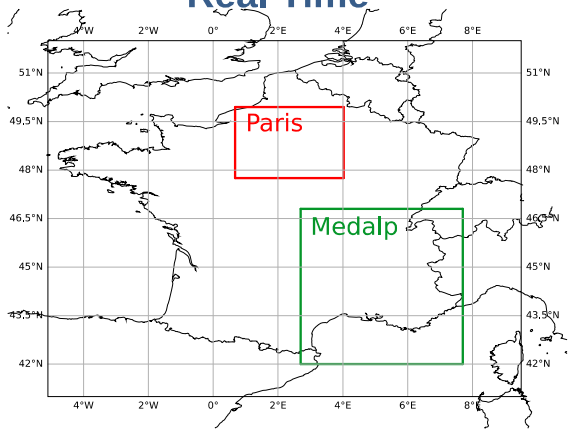
Current e-suite CY48T1_op1 (in operation around october 2024)

- OOPS in 3DVar and 4DVar analyses
- 3DEnVAR Arome, hybrid B matrix in Arpege 4DVar
- Arome EDA with 50 members (instead of 25)
- EcRad, SST from Mercator-Ocean global model (Arpege/Arome), change of aerosol and ozone climatologies from CAMS (Arome)
- Direct assimilation of microwave radiances in all sky conditions , assimilation of GNSS-RO data (Arpege/Arome), assimilation of Mode-S data (Arome)
- Singme precision in Arome production forecasts

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 configurations @500m in Near Real Time



Pierre Brousseau : 4DEnVar scheme for Arome-France

Eric Bazile: Preliminary evaluation of AROME 500m during the Olympic Games and potential improvement with pseudo 3D turbulence

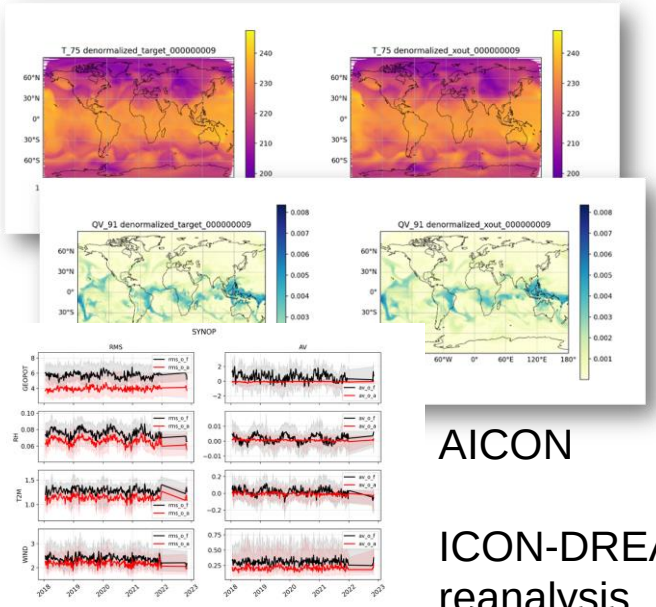
Germany

Numerical modelling at DWD: Operational status and selected R&D activities

Deutscher Wetterdienst
Wetter und Klima aus einer Hand

NWP model chain

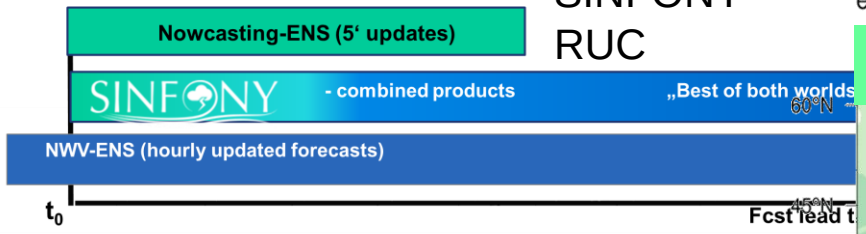
ICON Global Non-Hydrostatic	ICON-EU 2-way-nest	ICON D2 LAM Convective Scale	ICON-D2 RUC Convective Scale
Det **13 km** Resolution EPS 26 km Resolution 120 level	Det **6.5 km** Resolution EPS 13 km Resolution 74 level	Det **2 km** Resolution EPS **2 km** Resolution 65 level	Det **2 km** Resolution EPS 2 km Resolution 65 level
40 member	40 member	40/20 member	40/20 member
Analysis every **3h**	Analysis every 3h	**Analysis every 1h**	**Analysis every 1h**
EnVAR + LETKF	EnVAR + LETKF	KENDA: 4D-LETKF	KENDA: 4D-LETKF
Forecasts **180h: 00,12 UTC** **120h: 06, 18 UTC** **51h: 03, 09, 15, 21UTC**	**Forecasts** **120 h: 00, 06, 12, 18 UTC** **51 h: 03, 09, 15, 21 UTC**	**Forecasts** **48h: 00, 03, 06, 09, 12, 15, 21 UTC**	**Forecasts** **8h: 06, 07, 08, … 17, 18 UTC**

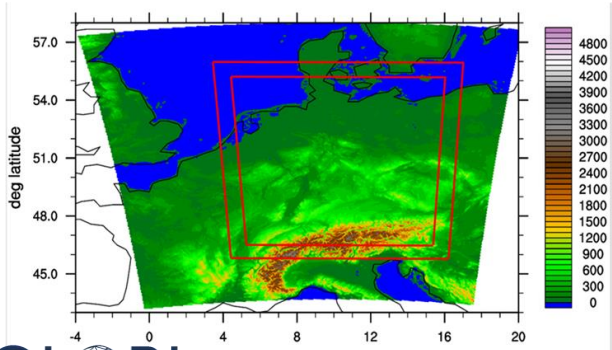


AICON

ICON-DREAM reanalysis

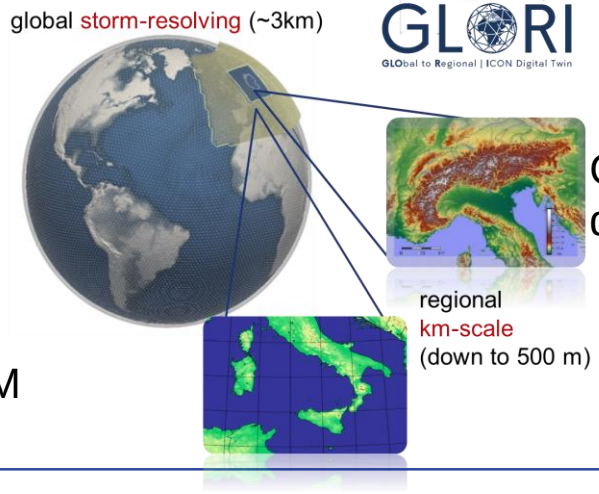
SINFONY-RUC





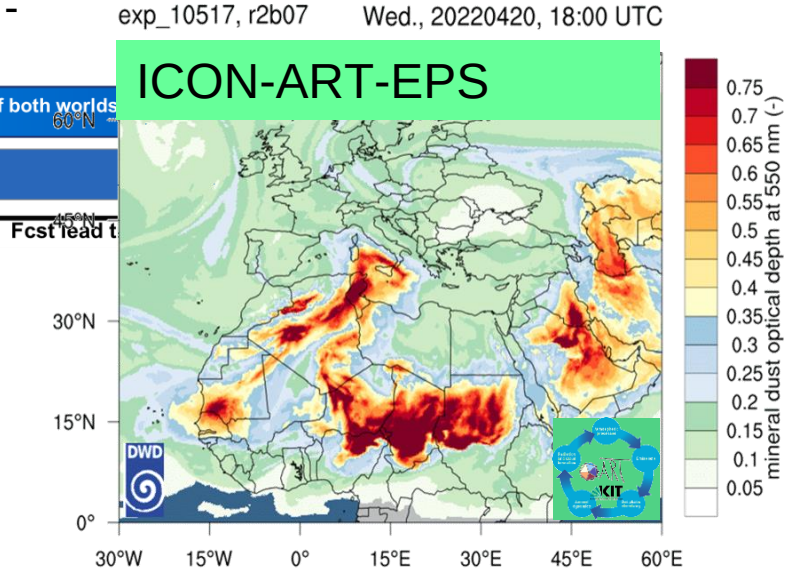
GLORI
GLObal to Regional | ICON Digital Twin

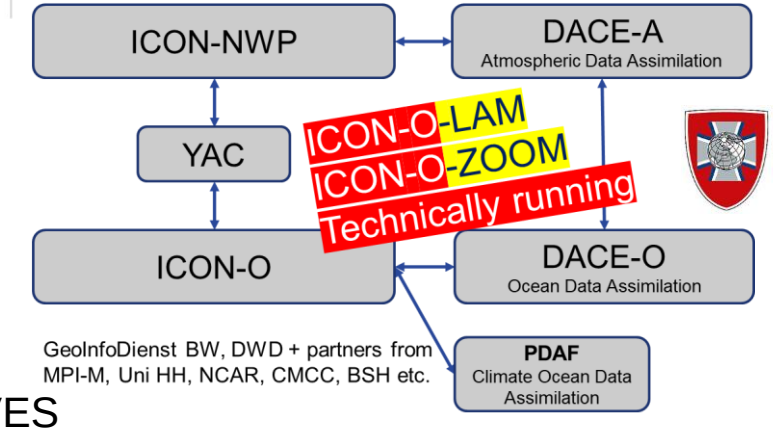
ICON@500m



GLORI digital twin

ICON-O
ICON-WAVES





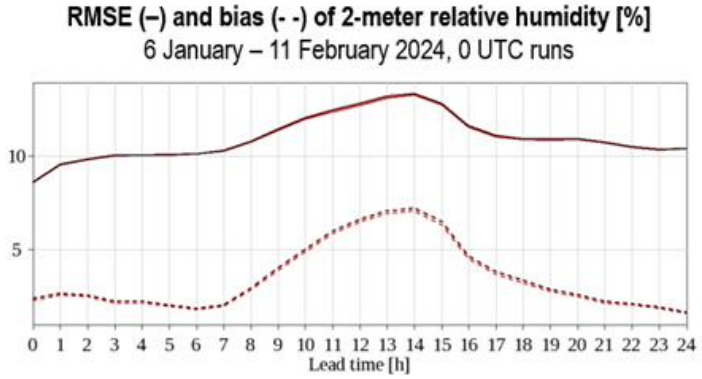
Hungary

NWP activities at the Hungarian Meteorological Service

HungaroMet
Hungarian Meteorological Service

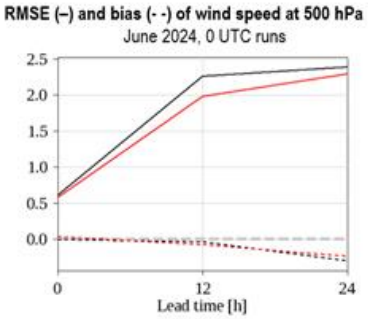
Ongoing cycle change in AROME/HU to cy46t1

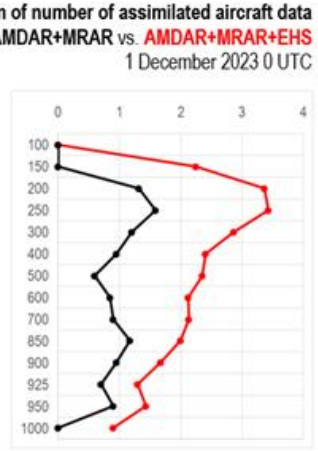
- Mostly neutral impact in summer and winter experiments
- After real time testing by forecasters it is scheduled to be operational in Q1 2025



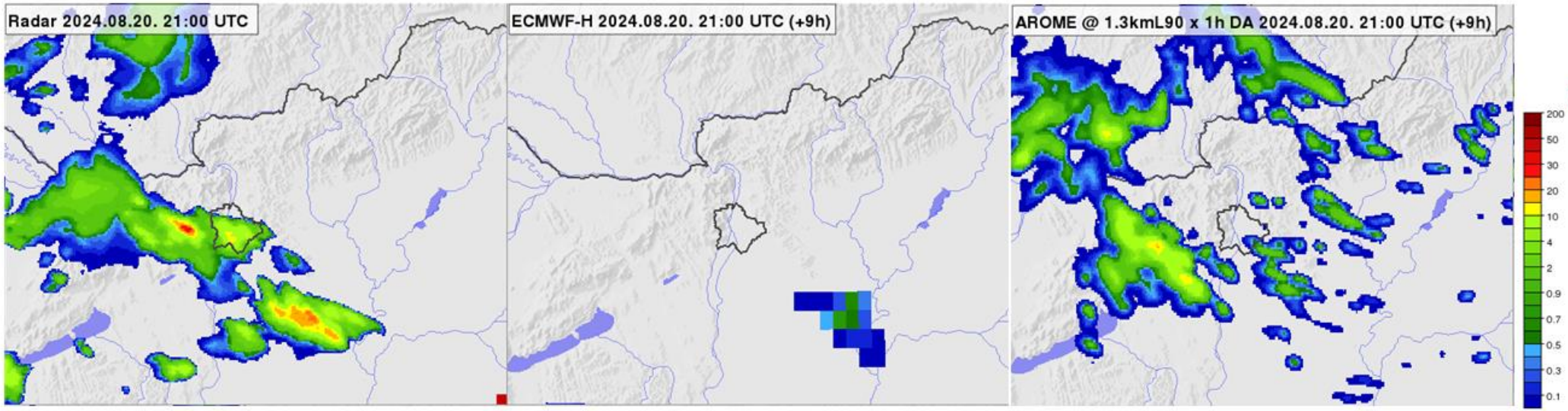
Assimilation of Mode-S EHS in AROME

- Assimilation of EMADDC EHS data with box-thinning
- Mostly neutral results @ 2.5 km resolution and with 3-hourly DA





Hourly cycled AROME at 1.3kmL90 resolution

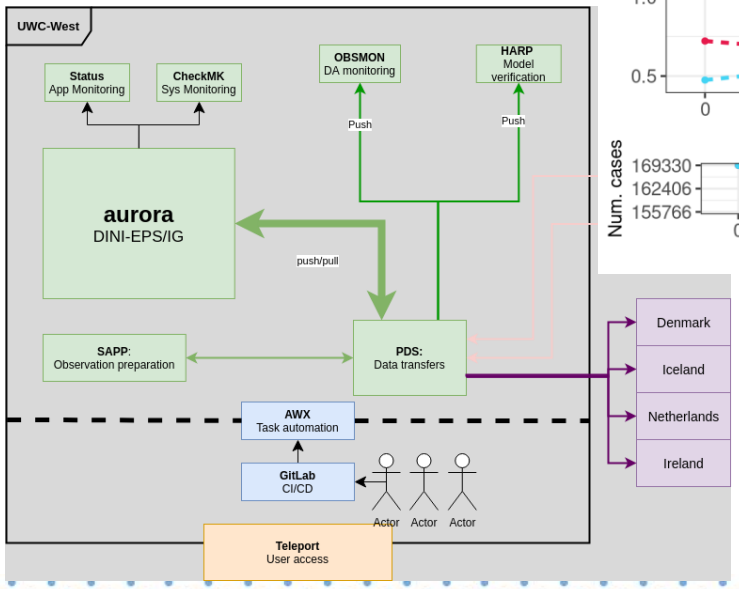


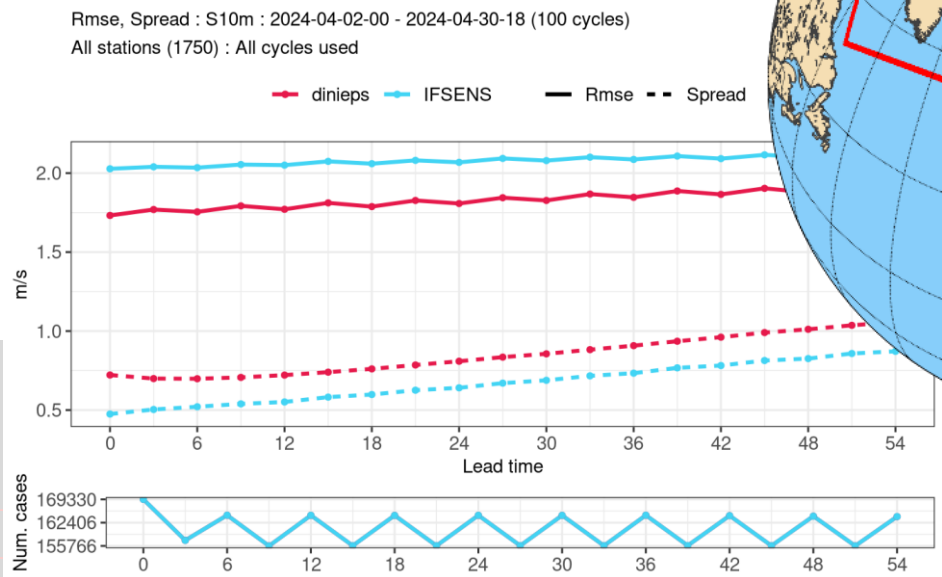
3-hour precipitation amount
18–21 UTC
20 August 2024

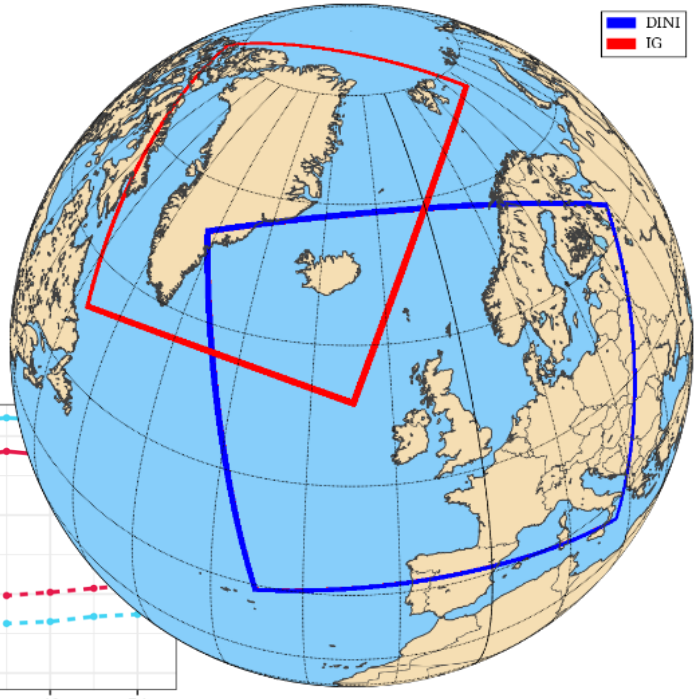
Ireland

UWC West is operational

- Infrastructure
- Configurations
- More Issues
- Results
- Plans

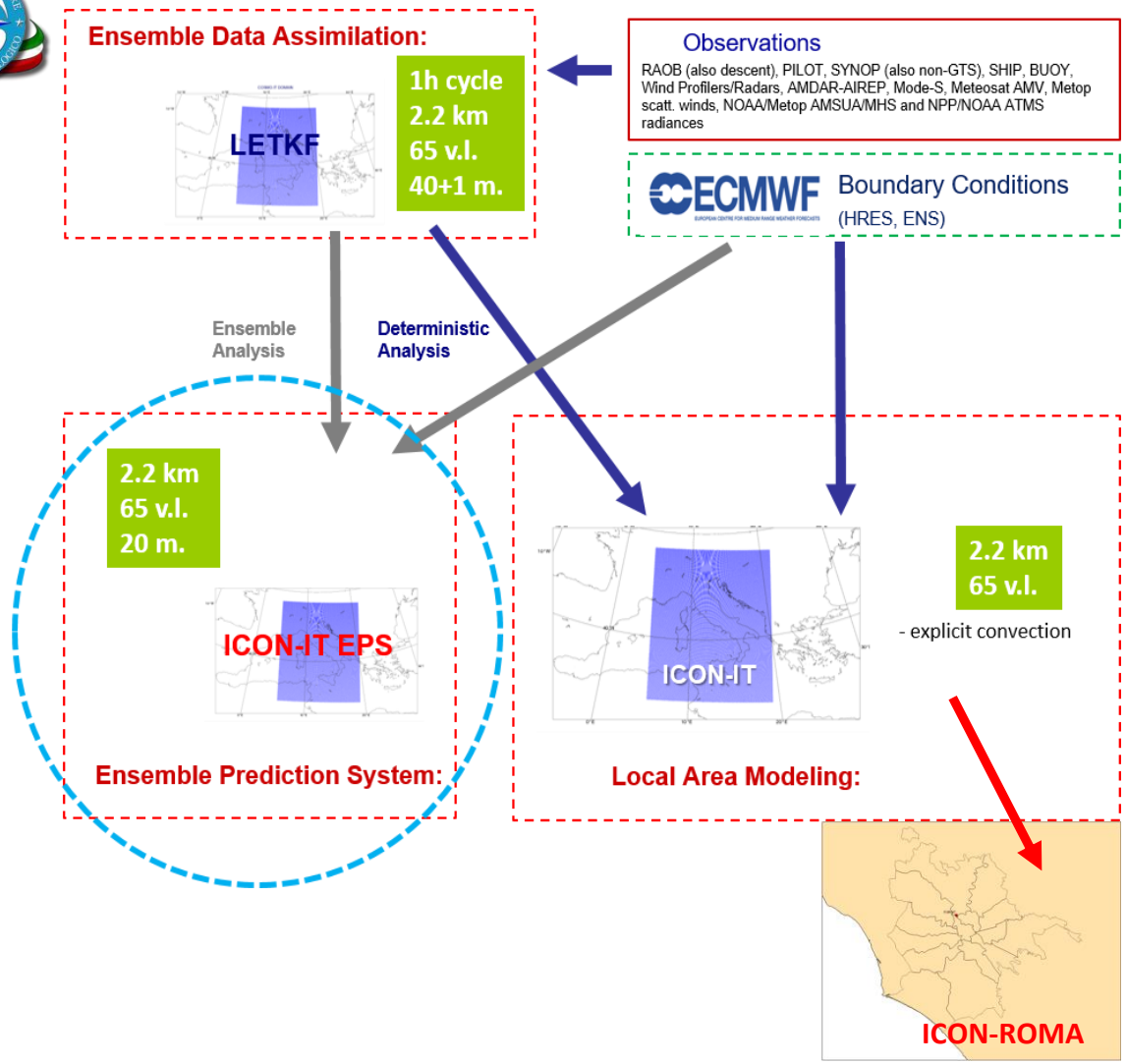






Italy

Operational ICON-IT @ CNMCA - ITALY



- The **ICON** model (1h DA cycle + 00/12 UTC model runs) is fully operational at the Italian Met Service since **jul 2020** on ECMWF-HPC and available to forecasters for daily use;
- **ICON-IT EPS**: the implementation process is ongoing (on ECMWF-HPC or on local hpc);
- **ICON-MED** tests on ECMWF-HPC (around 2.5 km and 5 km resolution);
- **ICON-ROMA**: experimental 2 way nesting at 500m resolution;
- **KENDA-LETKF** provides analyses at a 1-hourly interval;
- Assimilation of reflectivity obs from Radar Italian Network operational since August 2024 (**verification scores in the poster**); assimilation of radial winds ongoing.

Poland - ACCORD

NWP in Poland

- Analysis of snowmelt during thaw episodes in various SURFEX snow schemes.
- Verification of the new version of the ALARO model and the impact of boundary conditions on the quality of the forecast
- Ensemble forecasts using AI global weather models.

Piotr Sekuła

Poland - COSMO

Numerical Weather Prediction at IMGW-PIB

Joanna Linkowska, Jaczewski A., Jurczyk A., Ośródka K., Szturc J., Wyszogrodzki A., Mazur A., Interewicz W.
IMGW-PIB, Department of Numerical Weather Prediction - COSMO, Warsaw

Status of the operational suite

- **COSMO-CE PL v. 5.05 (COSMO-EULAG)** 2.8 km mesh size, domain size [grid points]: 380 x 405, 4 x per day (00, 06 12,18 UTC) up to +60 hours, time step: dt=20s, LBCs: COSMO-PL 7, update interval 1h, Nudging Assimilation scheme
- **COSMO PL – TLE-MVE** (ensemble) 20 members at 2.8 km mesh size, domain size [grid points]: 380 x 405, 4 x per day up to +36 hours (00, 06 12,18 UTC), time step: dt=20s, LBCs: COSMO-PL 7 (lagged), no data assimilation scheme
- **ICON PL v. 2.6.2.2** – equivalent surface resolution ~2.5 km, icon-2.6.2.2 + icontools-2.4.12, R2B10, 14x14deg, NP -161.0, 38.0 65 vertical levels, time step dt=24s 4 x per day up to +48 hours, nested in R3B7 ICON Global (~13km equivalent), no data assimilation scheme, 3h LBC update interval

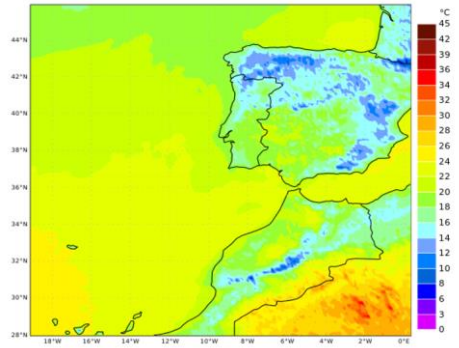
Research and Development

- **PP-CITTA – City Induced Temperature change Through A'dvanced modeling (COSMO Priority Project)**
  - This work presents the results of evaluating NWP hindcasts scales for Warsaw agglomeration (the capital city of Poland, with population estimated at 1.8 million residents within a greater metropolitan region of 3.1 milion). An observed temperature increase is due to urban development. Land use changes lead to, a.o., flash flood hazards.
- **PT-EPOCS – Evaluate Personal Weather Station and Opportunistic Sensor Data CrowdSourcing (COSMO Priority Task)**
  - The aim – assessment of the applicability of alternative weather data acquired by the Personal Weather Stations (PWS) and other Opportunistic Sensors (OS) into a research and operations activities at the level of national weather services (NWS); the development and testing data Quality Control (QC) algorithms, evaluation of the quality and applicability of the products developed from these data for the purpose of use in nowcasting and application to NWP forecasts and verification.
- **PT-EGALITE – Early warninG and AnaLysIs sysTEm for release and dispersion of contaminants (COSMO Priority Task)**
  - aims at gathering/exchange the experience available among COSMO partners on the connection: numerical weather forecasts – pollutant dispersion modeling in favor of new- and/or of existing EWAS (Early-Warning Systems) that respond to the threat(s) related to releases of contamination, dangerous due to its nature (i.e., radioactive, toxic…) and/or emission intensity.

Portugal

New ATOS machine:

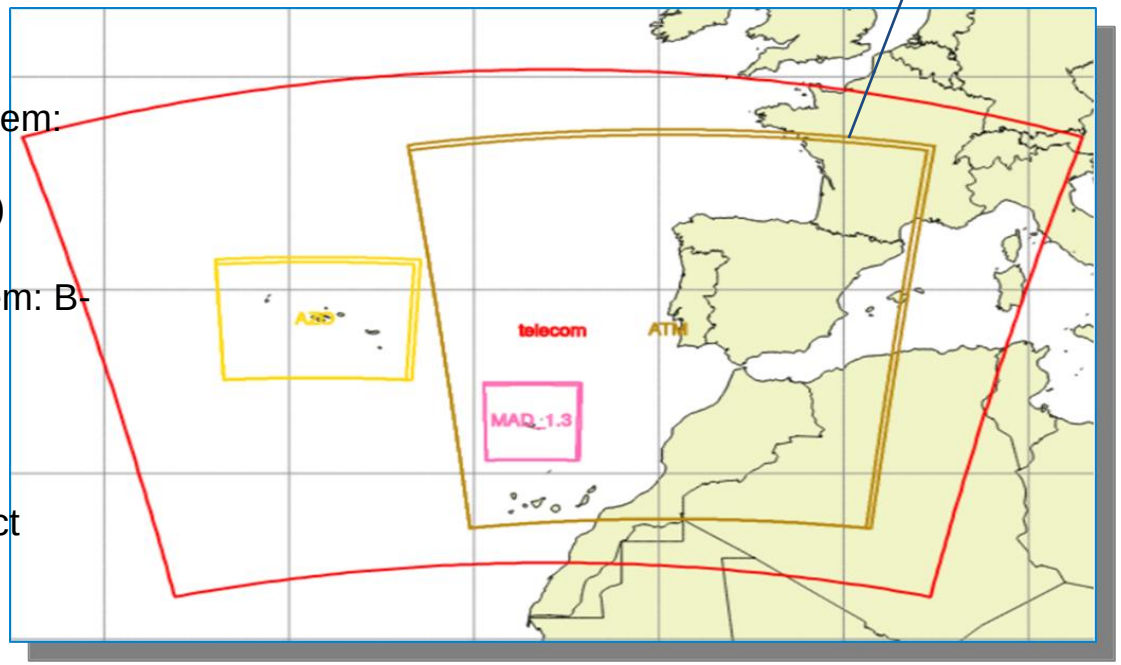
- 30 computing nodes (2AMD EPYC7763 processors with 64 cores@2.45GHz and 256 RAM
- 160TG raw Lustre storage



Re-design of the Portuguese (SR)NWO system:

1. dynamical adaptation (pre-operational)

1. combined OI_MAIN +3D-Var DA system: B-matrix computation (on-going)



Contribution to the DE_330 (ECMWF) project

Romania - ACCORD

Romania

- Operational configurations
- Local data assimilation results
- Evaluation of ALARO forecasts for cy43_bf11

Slovak Republic

Development of NWP models at SHMÚ in 2023/2024

M. Belluš, M. Derková , M. Imrišek, M. Neštiak, A. Otruba, J. Pecho, M. Petraš, A. Simon, O. Španiel, V. Tarjáni, R. Zehnal, J. Holec

Operational highlights

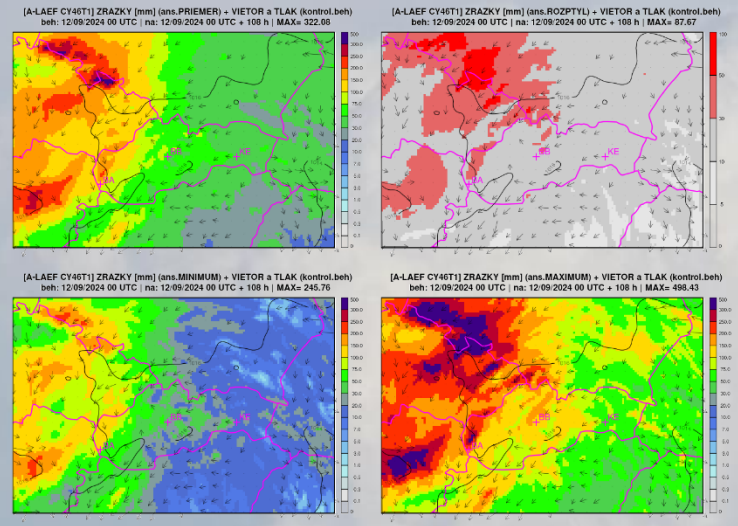
Upgrade of ALA2e to CY48T3 and RUC1 to CY46T1
RUC1: independent poster on this EWGLAM

Research and development highlights

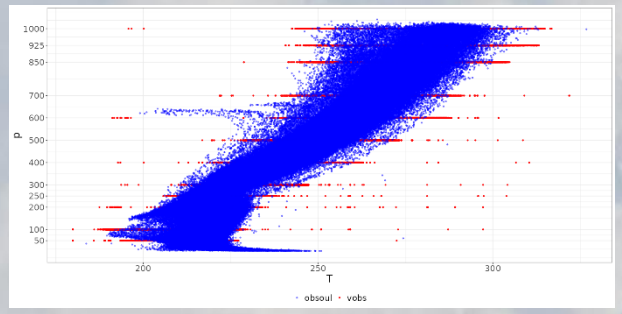
OOPS system for data assimilation in CY48T3, A-LAEF in CY46T1+, probabilistic computation of SPEI, oscillation reduction in SURFEX

Examples:

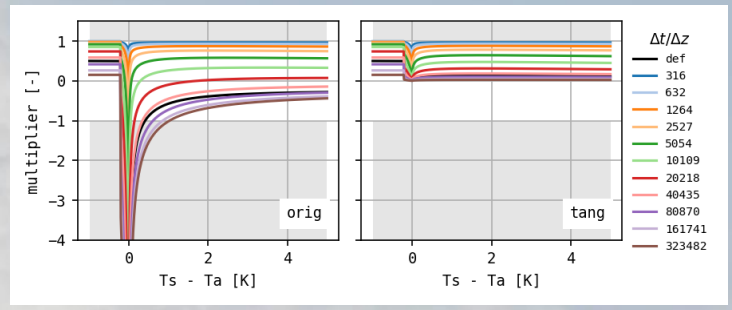
A-LAEF tests of the CY46T1+:
New multiphysics (e.g. mixing lengths), enhanced diagnostics
Flood situation in Central Europe
12-16 September 2024



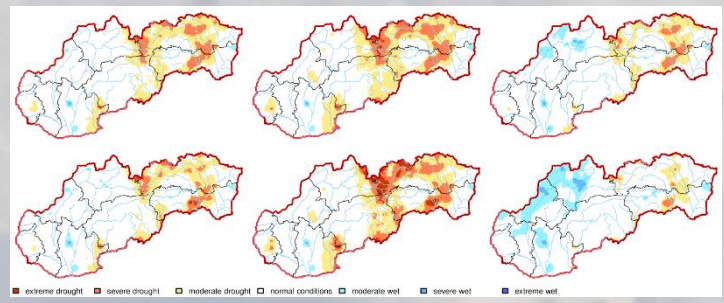
HARP IO for OBSOUL TEMP:
Higher vertical data density



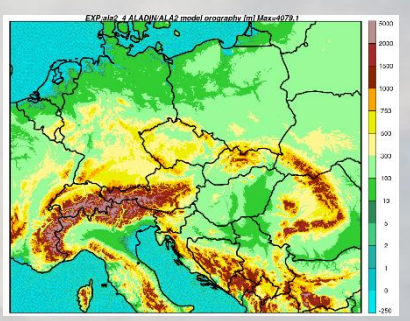
Offline SURFEX: improved stability for snow schemes with tangent linear approximation in SHBE

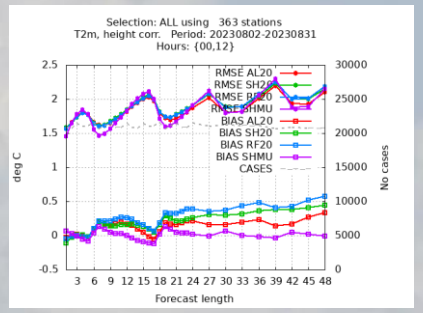


Probabilistic computation of SPEI index:
Drought research, upon A-LAEF, uncertainty



ALA2E: Large domain tests





Spain

Spain

- Nowcasting NWP suite operational: 1.25 km resolution, Harmonie-Arome nesting, 3DVar hourly cycle with +23 min cut-off time. H+12 each hour. The early delivery is able to compensate the fewer obs entering the analysis

- Deterministic suite in an unified domain with enhancements in satellite DA

- Validation of sub-km setups for severe convection cases

Sweden

Highlights from the recent research and operational activities at the Swedish Meteorological and Hydrological Institute

SMHI

- Advancing algorithmic developments to meet the needs of high-resolution modeling
  - Hybrid Ensemble Variational scheme for analysis of cloud hydrometeors
  - Ensemble based land surface data assimilation scheme for SURFEX soil ISBA-diff model

- Improving use of information från satellite instruments
  - Sensitivity to Lambertian versus Specular reflection in assimilation of clear-sky low-peaking microwave channe
  - New high resolution atmospheric motion vectors product från polar satellites
  - In-house satellite precipitation product at high latitudes

- Employing machine learning technologies in data processing for NWP applications
  - Uncertainty estimation in Ensembles across CARRA-2 domain

Welcome!

Jelena Bojarova, SMHI

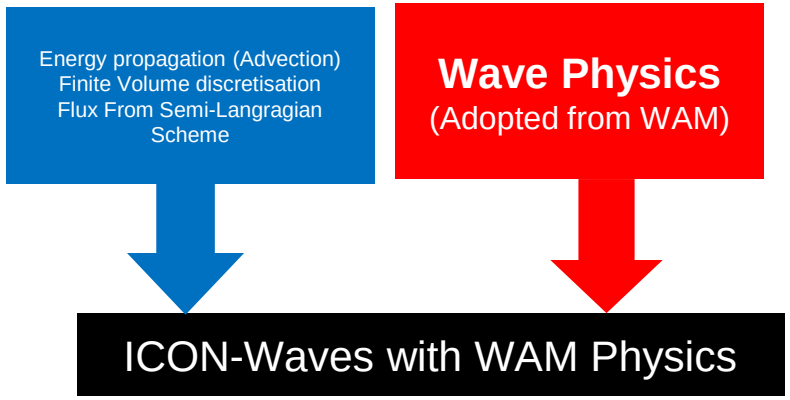
Thematic Posters

Aamir Nadeem:
“ICON-Waves Regionalization”

ICON-Waves Regionalization

The Main aim of ICON-WAVES regionalization is to expand scope of the wave modelling system for high resolution prediction

$$\frac{\partial E}{\partial t} + \nabla \cdot \left(c_g E\right) = s_{in} + s_{nl} + s_{dis} + \ldots$$



- **ICON-WAVES-LAM IMPLIMENTATION**

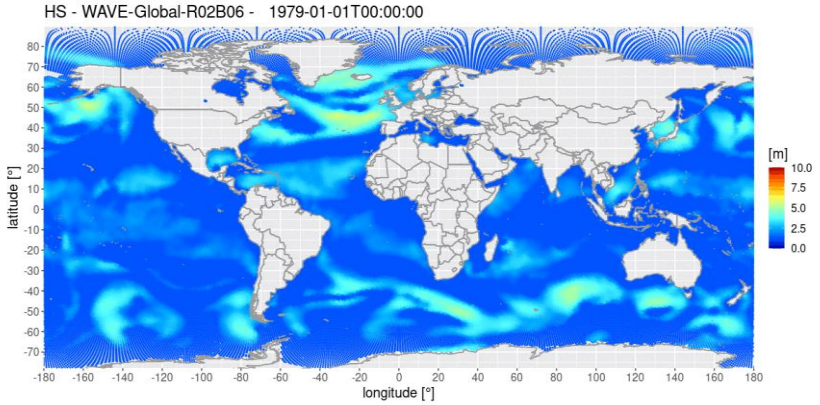
-LAM Grid generation (ICON grid generator)

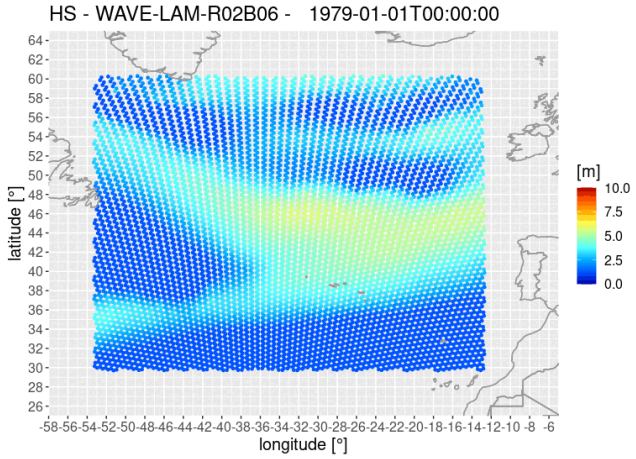
-Generation of external parameter

-Global run for initialization of LAM and boundary data

-Temporal interpolation for LAM boundary coded

-Differences between local and global runs tested and visualized after LAM simulation





Andrzej Mazur:
“Early Warning systems (EWAs) - operational use of results of meteorological model(s) to provide information on the atmospheric dispersion of contaminants and pollutants”

Andrzej Mazur, Marcin Grzelczyk
IMGW-PIB, Department of Numerical Weather Prediction - COSMO, Warsaw

- Following the Chernobyl accident in April 1986 (and other emission incidents), there was a need to use proven models of atmospheric transport and land deposition. The International Nuclear Safety Advisory Group (INSAG) of the International Atomic Energy Agency (IAEA) recommended that "...the IAEA, in cooperation with the World Meteorological Organization (WMO), should review and intercalibrate models of short and long range atmospheric transport of radionuclides and of radionuclide deposition on land surfaces and establish a database for model validation studies." This recommendation led to the launch of several research projects, including ATMES (Atmospheric Transport Model Evaluation Study) and ETEX (European Tracer Experiment, I and II), which became the basis for further research on Early Warning Systems to cope with potential emission incidents and environmental pollution threats.
- The above-mentioned IAEA recommendation is still relevant and should not be limited to radioactive contamination. Other emission sources (volcanoes, forest fires) also pose a threat to the environment or population.
- The RIOT (RIng Of Threats) system has been operationally launched at IMGW, which forecasts the model (idealized) course of the spread of pollutants/contamination from the emission source (it does not consider the actual emission size) for a selected location that is (or may be) a place of release of dangerous pollutants.
- The COSMO consortium launched the EGALITE project, which aims to exchange experiences in COSMO member countries (IMWM, DWD, MeteoSwiss). Its aim is to compare the performance of models both in the domains of individual systems and in the common part of such domains. The air pollution models used in the project include both Lagrangian models (FLEXTRA, FLEXPART, etc.) and Eulerian models (e.g. EMEP or the Eulerian part of the RIOT system used in IMWM – see below). The meteorological conditions will come from the global ICON model, as well as COSMO and ICON-LAM NWP forecasts.

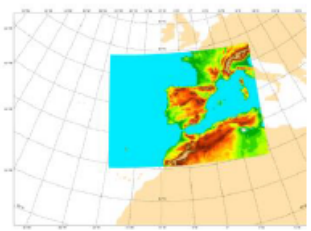
Jana Sanchez-Arriola, M. Lindskog, E.Whelan, J. Campins, B. Menetrier, D. Schönach, R. Eresmaa: “Status and Plans for evaluation of Harmonie-AROME cy46 data assimilation tunable settings”

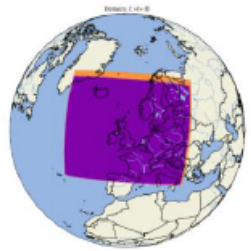
Status and plans for the evaluation of Harmonie-AROME cy46 data assimilation tunable settings

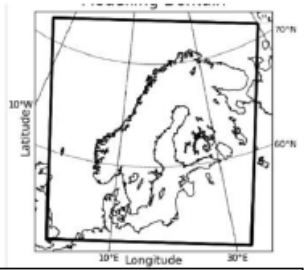
J. Sanchez-Arriola, M. Lindskog, E. Whelan, J. Campins, B. Menetrier, D.Schönach, R. Eresmaa

ACCORD
A Consortium for COnvection-scale modelling Research and Development

Parallel data assimilation and forecast experiments with the latest **HARMONIE-AROME cy46 version**, aimed for future operational use, were carried out over 3 different domains corresponding to the currently operational domains of MetCoOp and AEMET and the planned operational domain of UWC-west.







RESULTS

When using **Desroziers Tool** to diagnose the **observation and background standard deviation** used by the 3 operational domains for 2 seasons some differences in currently used values were found:

•Currently used sigmab values in the **MetCoOp** domain have been found to be correct. Results suggest to slightly reduce currenty used **AEMET** and **UWC-West** ones

•In general, for existing error statistics we give more weight to wind observations than for temperatures from conventional types of observations within our assimilation system. And we see that the σo for radiosonde humidity varies with temperature, being high in summer season.

When using **Andersson & Järvinen Tool** to diagnose he qualiy control **rejection limits for First Guess Check** for the 3 domains and the 2 seasons showed that while for surface and upper air conventional observations, as well as for satellite based measurements, they seem to be adequate, for GNSS ZTD and RADAR RH a reduction of its values has been recommended.

FUTURE WORK

- Finalize the work with **deriving thinning distances** for all the operational domains and various types of observations, specially for satellite data. In addition we aim to improve and further develope the tools and evaluated impact of revised tuning parameters in model runs.

- For **control of Rejection Limits for First Guess Check**, in longer future we see room for improving the quality control procedure by using adoptive methods (VarQC, flow dep sigmab, AI/ML).

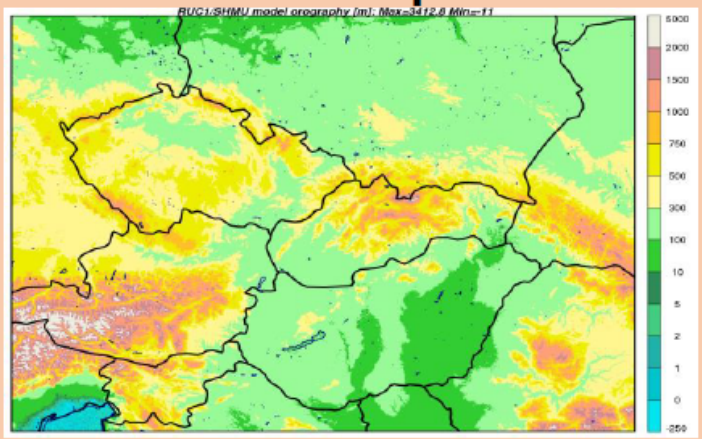
Michal Nestiak, Andre Simon, Maria Derkova, Martin Imrisek: “Rapid update cycle at SHMU”

Rapid update cycle at SHMU

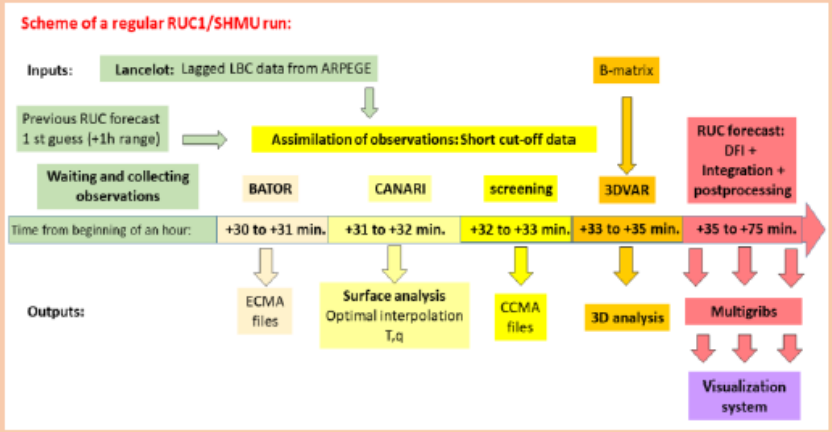
M. Neštiak, A. Simon, M.Derková, M. Imrišek, L. Méri

- Regularly run at SHMU since 2022 at 1 km horizontal resolution (RUC1), up to +12/24h ahead
- CANARI+3DVAR, 1h cycling, non-hydrostatic, ALARO-1vB physics

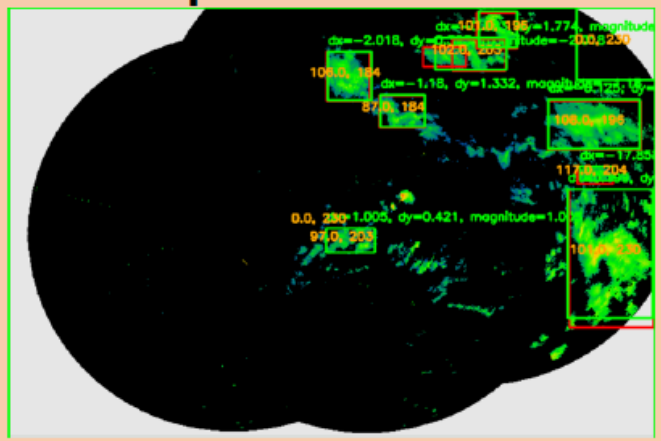
Domain of computation



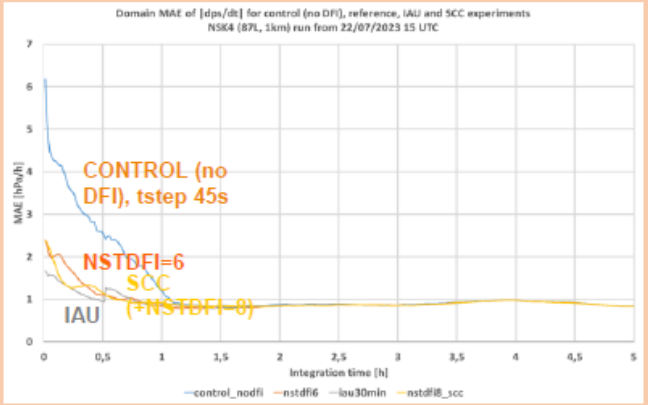
Time management



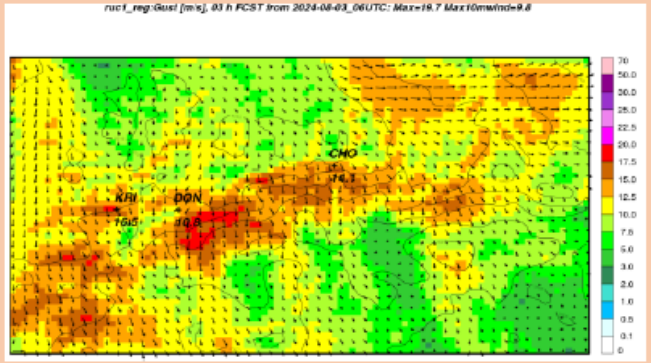
Development



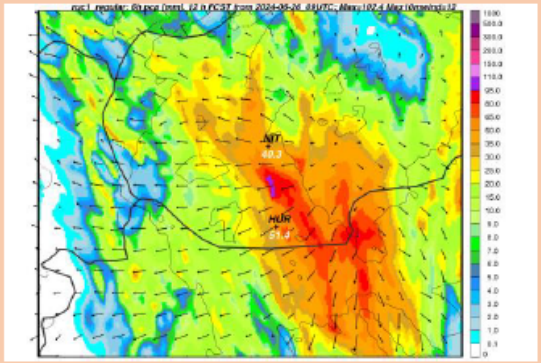
Stability tests



Non-convective cases (wind)



Convective cases (precipitation)



Stefan Dinicila:
“Numerical Weather Prediction using ICON-LAM-2.8km for Romanian territory”

Numerical Weather Prediction using ICON-LAM-2.8km for Romanian territory

Stefan Dinicila, NMA

- ICON RO -2.8km operational suite
- Verification results
- Testing dedicated products for forecaster