

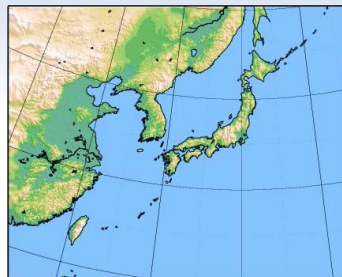
National Posters
EWGLAM/SRNWP Meeting 2023

Development of Limited-Area NWP Systems at JMA

Regional operational NWP systems at JMA

Meso-Scale Model (MSM):

Horizontal resolution: 5km
Vertical levels / top: 96 / 37.5km
Forecast hours (initial times):
78 hours (00, 12 UTC)



Local Forecast Model (LFM):

Horizontal resolution: 2km
Vertical levels / top: 76 / 21.8km
Forecast hours (initial times):
10 hours (00–23 UTC hourly)



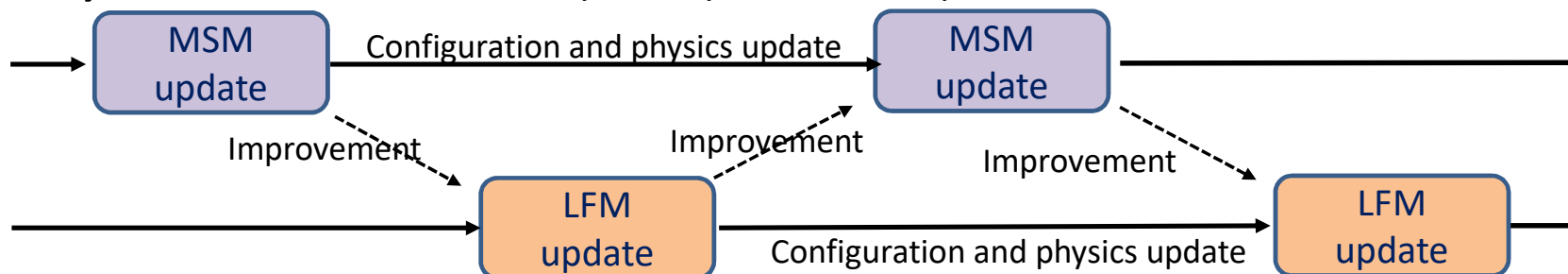
Kohei Aranami, Japan Meteorological Agency
aranami@met.kishou.go.jp

Update of Local Forecast Model (LFM2303)

Highlights:

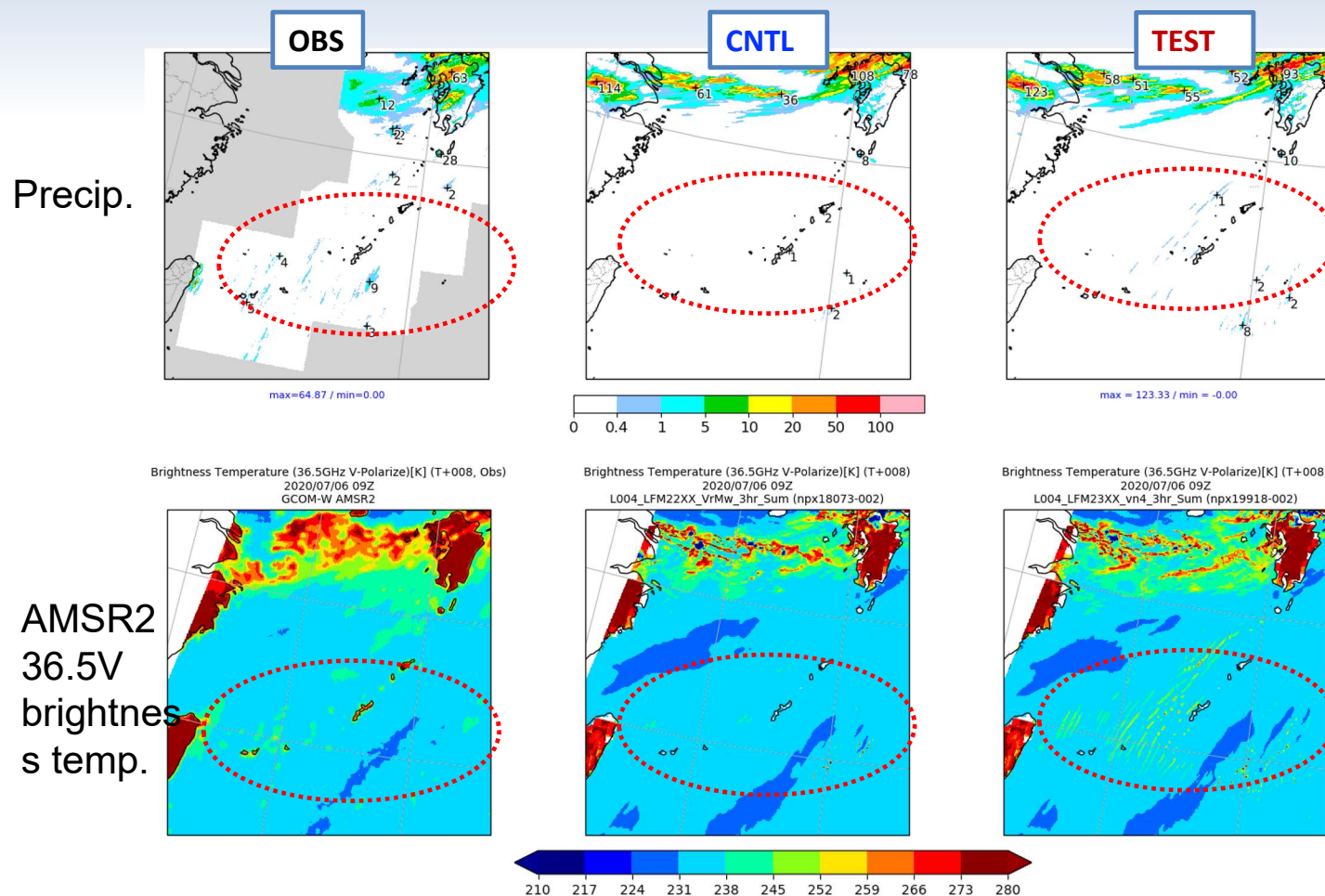
- Improvement on cloud microphysics scheme
- Update of the elevation dataset
- Introduction of a turbulent orographic form drag (TOFD) scheme
- Modification of scale length in the MYNN3 scheme

Update Cycle of MSM and LFM : every other year alternately



Improvement on cloud microphysics

Introduction of the cloud microphysics scheme (Ikuta et al. 2021) used in the MSM, with modifications for 2km resolution model



Score Card

2020/7/2 – 7/15

RMSE / Score Difference (significance)
L004_LFM22XX_VrMw_3hr_Sum (npx18073-002) vs
L004_LFM23XX_vn4_3hr_Sum (npx19918-002)
Meaned from 2020/07/02 00Z to 2020/07/15 21Z

Precip.

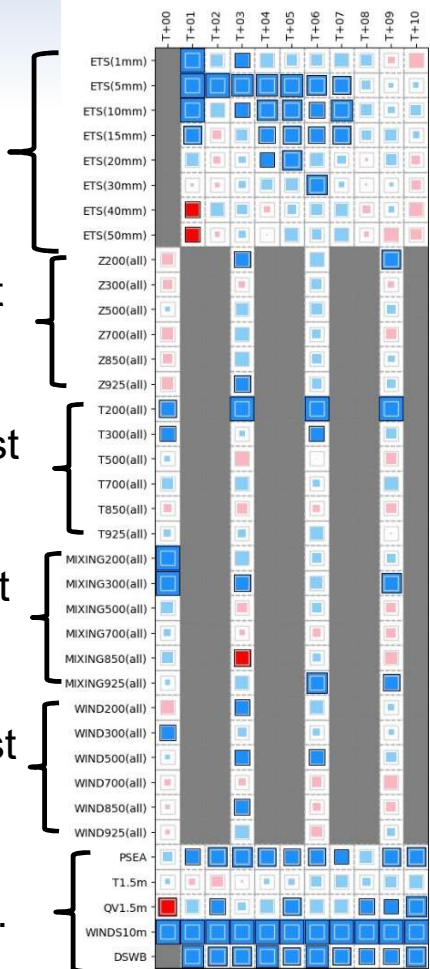
Geopotential height
against sonde obs.

Temperature against
sonde obs.

Mixing ratio against
sonde obs.

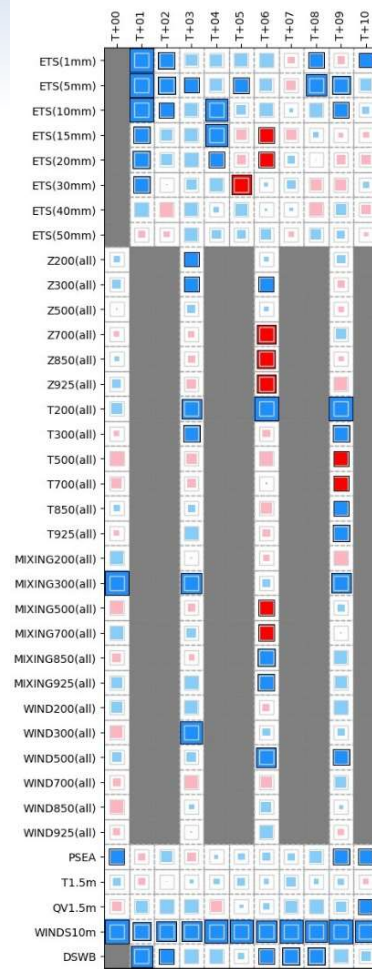
Wind speed against
sonde obs.

against ground obs.



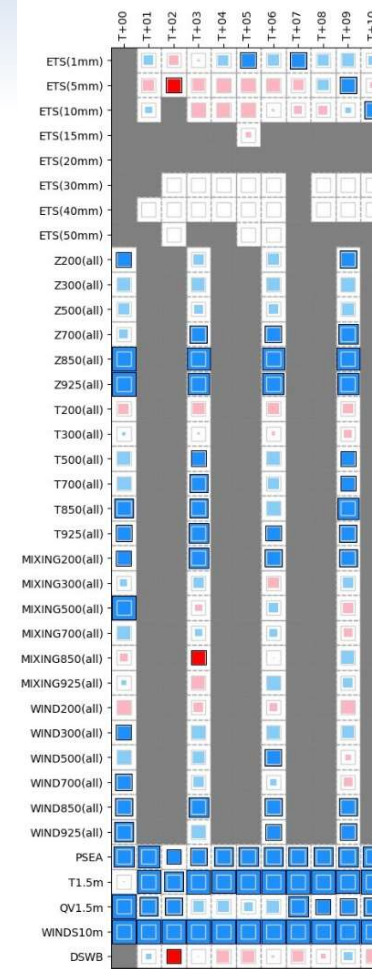
2021/8/11 – 8/15

RMSE / Score Difference (significance)
L004_Lf_CntL_for_LOBS23XX_3hr_Sum2 (npx19486-002) vs
L004obs_LFM23XX_vn4_3hr_Sum2 (npx19924-001)
Meaned from 2021/08/11 00Z to 2021/08/15 21Z



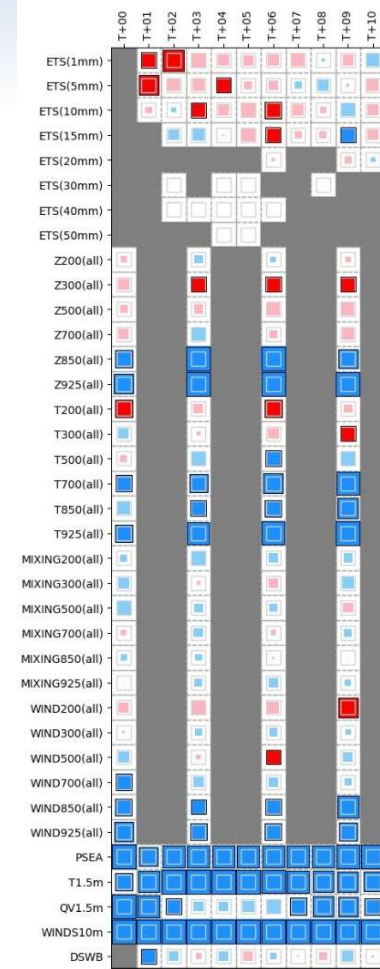
2020/1/11 – 1/21

RMSE / Score Difference (significance)
L004_LFM22XX_VrMw_3hr_Win (npx18098-001) vs
L004_LFM23XX_vn4_3hr_Win (npx19919-002)
Meaned from 2020/01/11 00Z to 2020/01/21 21Z



2022/1/11 – 1/15

RMSE / Score Difference (significance)
L004_Lf_CntL_for_LOBS23XX_3hr_Win (npx19117-001) vs
L004obs_LFM23XX_vn4_3hr_Win (npx19925-001)
Meaned from 2022/01/01 00Z to 2022/01/15 21Z



Austria

Overview operational NWP systems

- AROME-Aut/C-LAEF and AROME-RUC
- Latest upgrade: 09/2023

Towards C-LAEF 1k

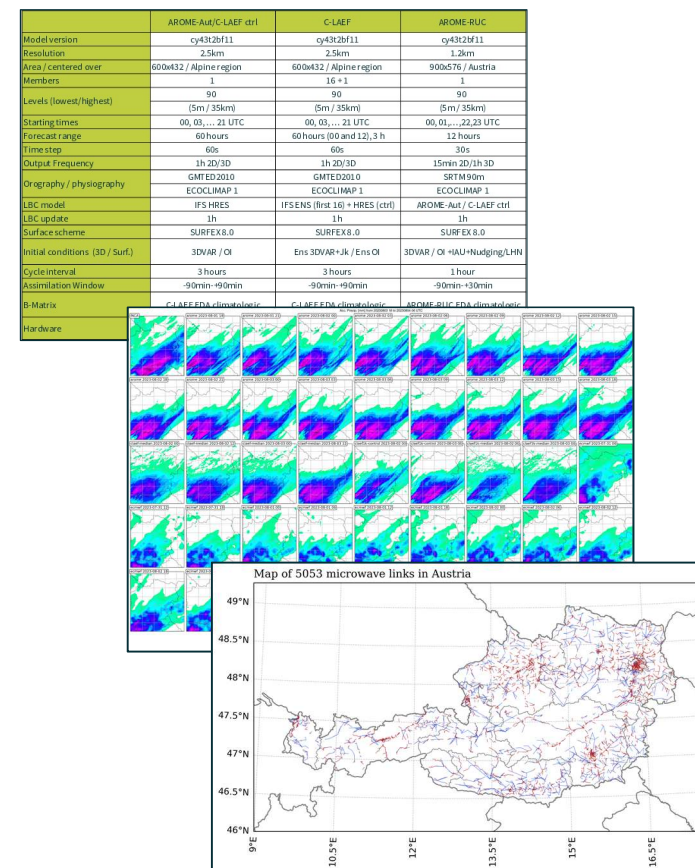
- Current focus: Move to 1km resolution for with operational LAMEPS

Extreme case summer 2023

- Challenging summer for forecasters and NWP -> case study August 2023

Recent research activities

- Several projects ongoing/recently finished related to new observations for DA
- Use of microwave link data in DA



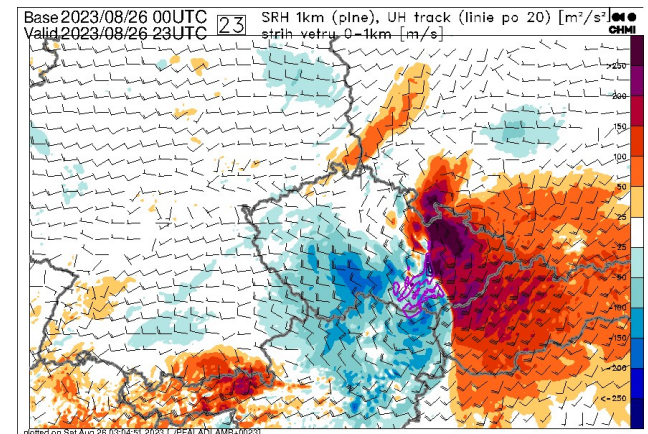
NWP at Croatian Meteorological and Hydrological Service, 2023

- Operational suite
 - ALADIN-HR40 (cy43T2, 4 km), ALADIN-HR20 (cy43T2, 2 km), HRAN (analog-based method)
- Verification of new operational configurations
 - Both configurations outperform the old ones with HRAN being the best
- Temporal and spatial quality control
 - Subjective and objective assessment. Python based
- Destination Earth (DestinE)
 - WP4 – neighbourhood ensemble (finished)
 - analog-based method (starting)
 - WP8 – Power production curve forecast (data gathering and quality control)



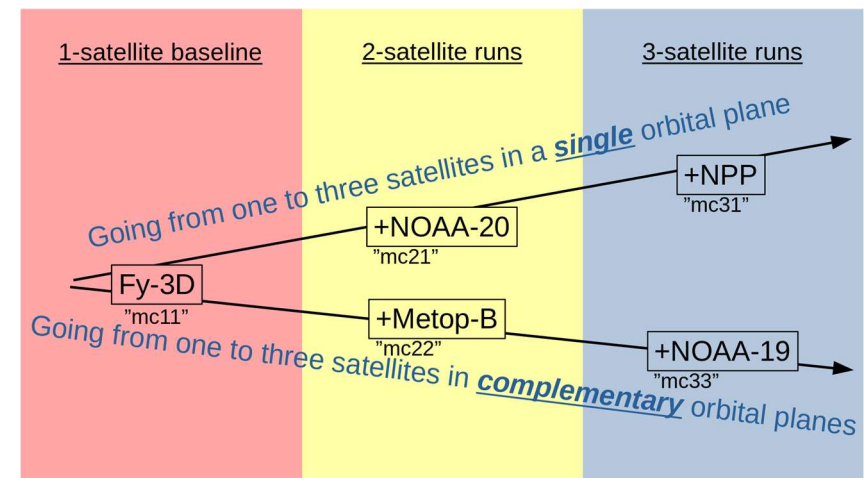
Czech Republic (CHMI)

- The new **model release (cy46t1)** was implemented in April 2023.
- A set of **new convective diagnostics**, including storm relative helicity, updraft and downdraft track, and updraft helicity track, was added in May 2023. These new products are useful for determining the type of convective storms, e.g. squall lines or supercells; eventually for predicting favorable environment for tornado development.
- Soil moisture initialization in surface analysis (Canari): Analysis causes **oscillation in deep soil moisture** in summer followed by oscillations of T2m, RH2m forecast from one run to the next. The solution is to make increments dependent on sun declination (season) and time averaged to remove daily cycle.



SRNWP activities at FMI in 2023

- **Dust and weather 3000 km apart**
 - HARMONIE-AROME experiments with near-real-time aerosol have been run for the case of February 2021 Saharan dust intrusion to Finland. Impacts to radiation and precipitation type distribution are seen
 - Modelling uncertainties increase when n.r.t. aerosols are allowed to influence cloud-aerosol-radiation processes
- **Ductcast**
 - Harmonie-AROME experiments, with varying horizontal resolutions (2500m -> 750m) and number of vertical levels (65 -> 90), were conducted in order to assess the impact of the weather model resolution on the prediction of ducting phenomena
 - The results were compared against traditional and mast observations (the latter at 4m, 7m, 12m, 22m, 32m)
- **Evaluating the impact of microwave-sounding satellite data**
 - The short-range forecast impact of a constellation of future Arctic Weather Satellites (AWS) is estimated in the context of European Space Agency -funded research project
 - Surface-based verification of 4D-Var assimilation experiments indicates measurable benefits in particular when bringing additional microwave sounders into complementary satellite orbits



The setup of the satellite constellation impact study in the MetCoOp operational domain

NWP suites @MF: a few highlights

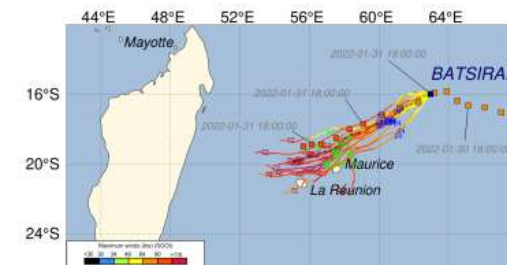
Operationnal suite : CY46T1_op1 (June 2022)

- Arpege EPS and Arome EPS have the same resolution than their deterministic counterpart :
Tl1798 c2.2 L105 and 1.3 km L90
- New Arpege physics : Tiedtke deep convection scheme, 1D sea-ice scheme, etc.
- And much more: assimilation of MW rainy cloudy observations, linear interpolators for hydrometeors and no diffusion, new version of the Ecume oceanic surface fluxes scheme, etc.

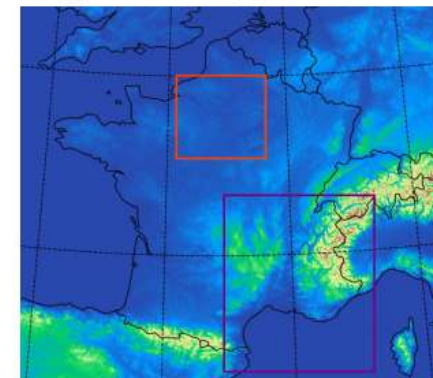
Current e-suite: CY48T1_op1, in operations by S1 2024

- OOPS in 3DVar and 4DVar analyses
- Assimilation : 3DENVAR Arome, hybrid B matrix in Arpege 4Dvar
- Arome EDA : 50 members (instead of 25 currently)
- Physics : EcRad (Arome), use of SST from Mercator-Océan global model and enhancement of Tiedtke deep convection scheme (both for Arpege), change of aerosol and ozone climatologies (from CAMS, Arome)

Arome overseas EPS in operations since February 2023



Arome configurations @500m in NRT



NWP activities at the Hungarian Meteorological Service

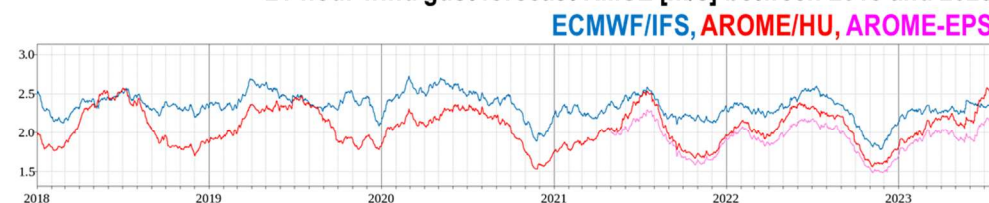
- Motivation: quality problems, reduction in data amount
- Impact studies with involvement of new networks and replacement of SGO1 with BMEG



Revision of GNSS ZTD data in AROME/HU

- Forecasters' feedback about many difficult weather situations this summer
- Study with verification, case studies, comparison with forecasts from the preceding years

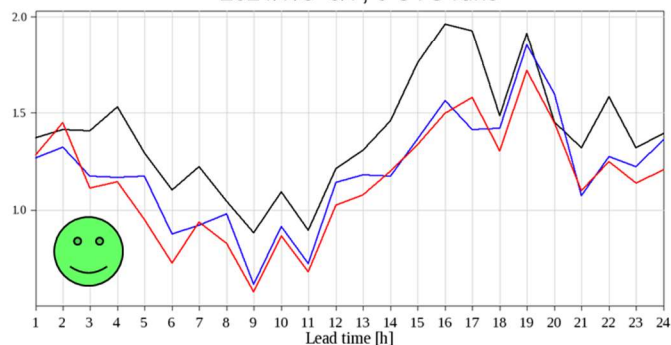
21-hour wind gust forecast RMSE [m/s] between 2018 and 2023



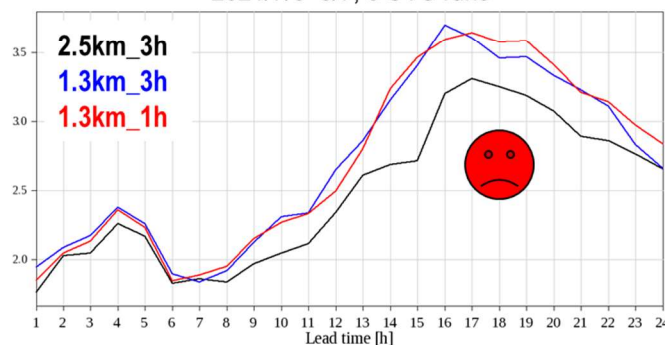
Evaluation of summer forecasts in 2023

Hourly cycled AROME at 1.3kmL90 resolution

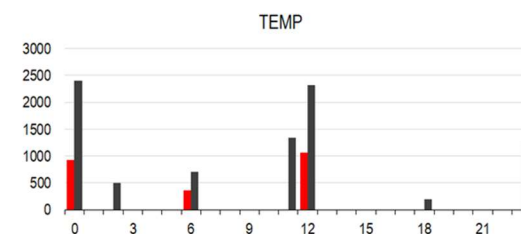
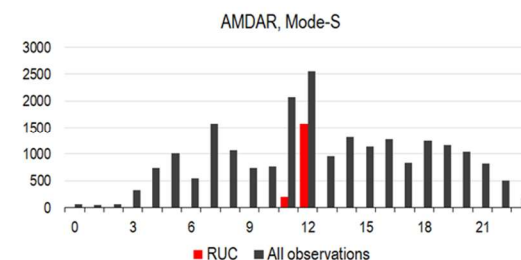
RMSE of 1-hour precipitation forecasts [mm]
2021/7/8–8/7, 0 UTC runs



Wind gust forecast RMSE [m/s]
2021/7/8–8/7, 0 UTC runs



Number of observations in very short cut-off

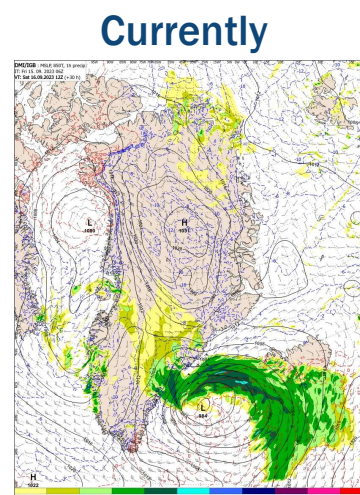


Icelandic Met Office

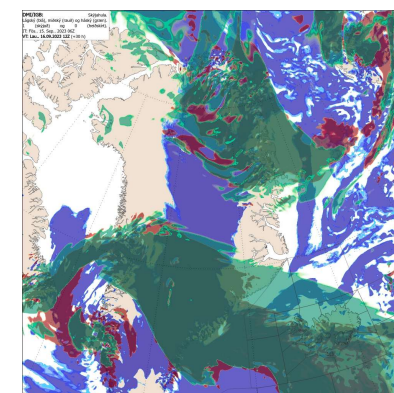
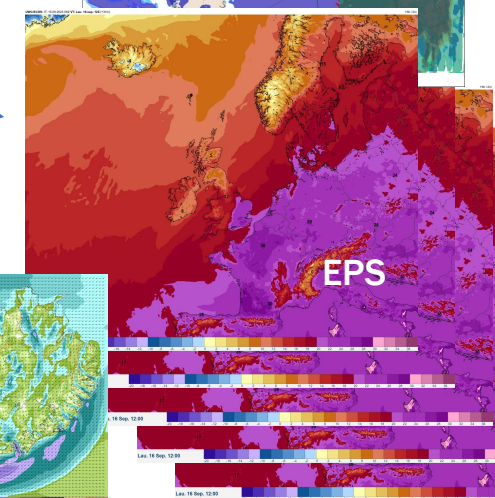
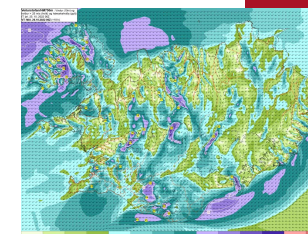


Current and near-future operational short range NWP

- **Current operational model: IGB [2,5 km] t+66h**
 - Joint development with DMI
 - Operated by DMI on their HPC at Icelandic Met Office
- **IMO is a part of UWC-West**
 - Operational collaboration with Met Éireann, DMI and KNMI
- **Near-future operational runs:**
 - UWC-W IG (Iceland-Greenland) [2 km]
 - UWC-W DINI EPS [2 km]
 - IMO national application [750 m]
 - Iceland and surrounding sea banks
 - New physiography
 - LBC from HRES w/hydrometeors



Near-future

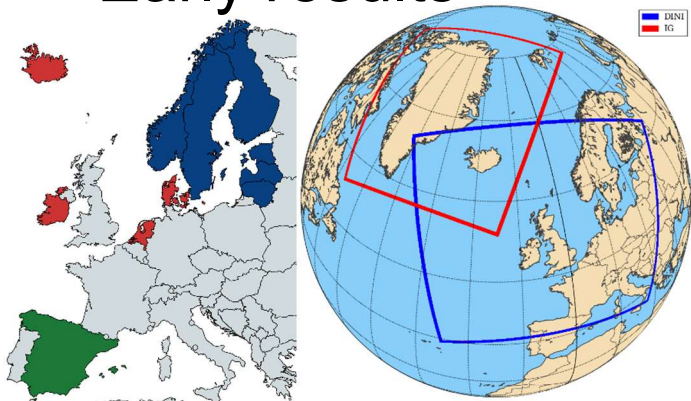
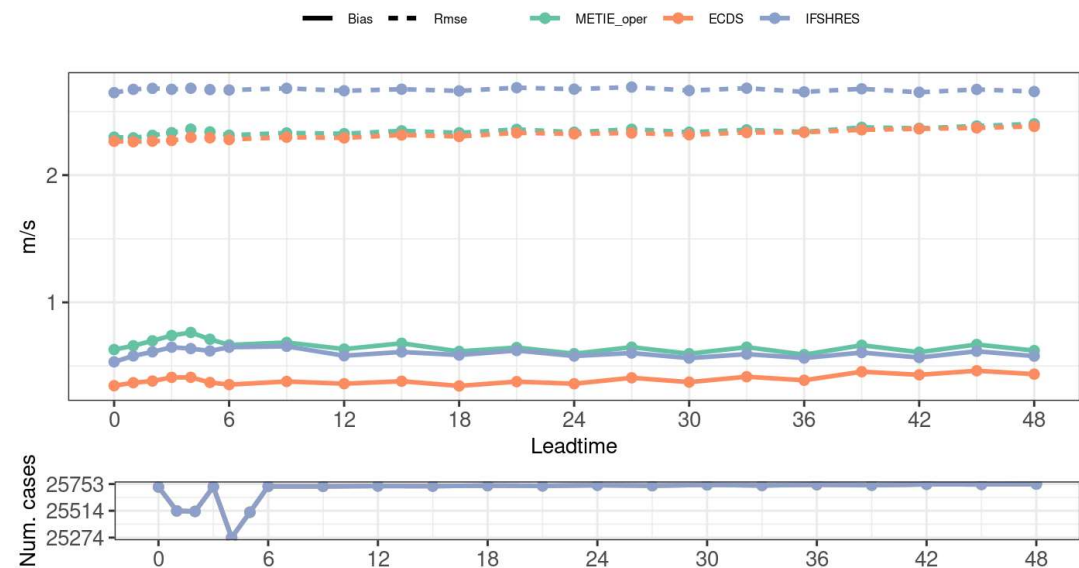


UWC-W Status

- Infrastructure status
- Suite configurations
- NWP Issues
- Early results

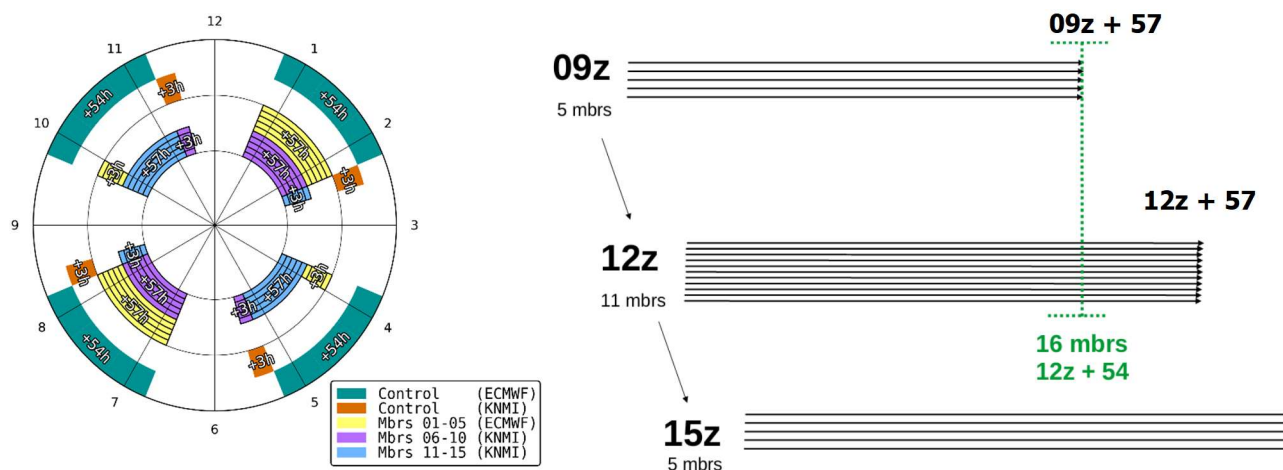
Bias, Rmse : S10m : 2023-02-01-00 - 2023-02-28-18

All stations (232) : All cycles used

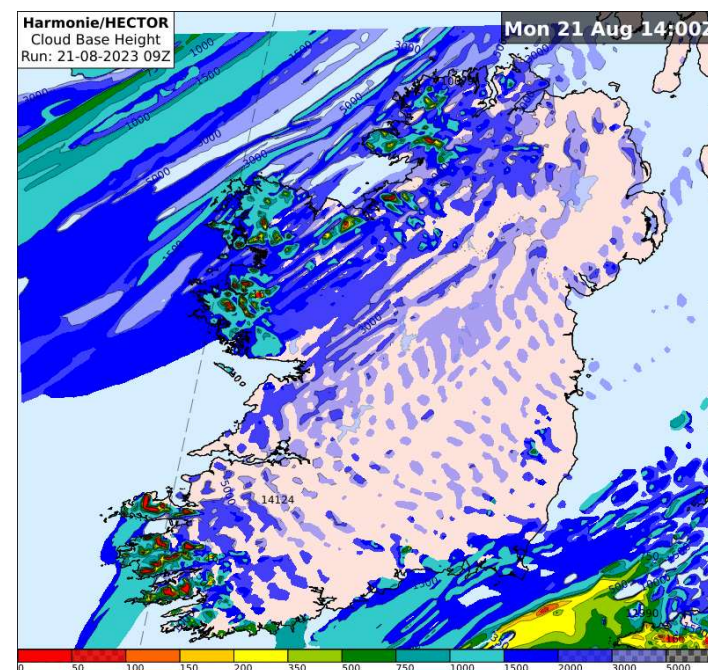


Operational NWP at the Irish Meteorological Service

- IREPS still based on harmonie-43h2.1



- Hectometric HECTOR coming soon



- Operational configuration - ALARO-v1B NH 4.0 km and AROME 2.0 km and operational machine characteristics
- Boundary layer drone and balloon soundings in Kraków (Vistula) valley – project CoCO2
- CO₂ , CH₄ and wind vertical measurements
- Machine learning based postprocessing method and its influence at RMSE error and Skill Score statistics depending on circulation type in Poland
- Suszek 11 Aug, 2017 case of derecho in Poland and the analysis of predictions of current versions of ALARO and AROME models.

1. Operational status of COSMO PL and ICON PL models.

Domain of ICON PL was extended on the South West, runs 4 times per day. A forecast range of COSMO PL 7 and COSMO PL 2.8 was extended up to 96h and up to 60h respectively.

2. PT EPOCS - Evaluate Personal Weather Station and Opportunistic Sensor Data CrowdSourcing

The main scientific aim of this PT is focused on the development and testing data Quality Control (QC) algorithms as well as on the evaluation of quality and usefulness of this data for potential applications in nowcasting, NWP and model forecast verification. A preliminary results of QC applications and usefulness of precipitation estimation based on attenuation of Commercial Microwave Links are presented.

3. PP CITTA - City Induced Temperature change Through A'dvanced modeling

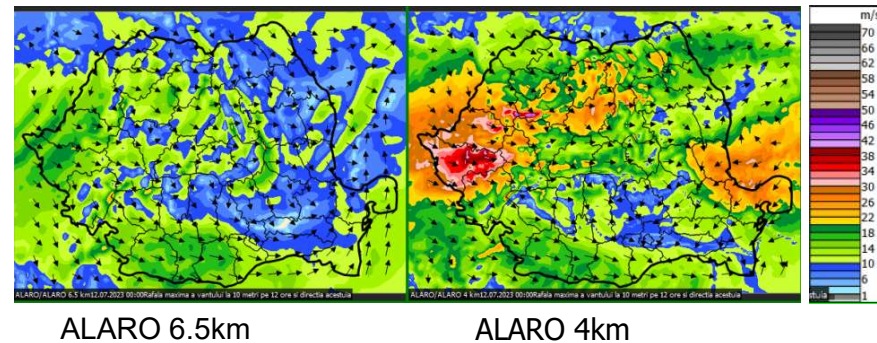
The project aims to implement the urban canopy parameterisation TERRA_URB and its external parameters from the COSMO atmospheric model to the ICON model. A preliminary results of using Local Climate Zones as a proxy for the urban canopy parameters as well as the performance of TERRA_URB scheme for Warsaw area are presented.

ROMANIA – National poster

aladin@meteoromania.ro

- Operational configurations
- Preliminary results of surface data assimilation using CANARI (ALARO 4km, L60)
- Testing new climate files for ALARO 4km, L60
- - motivation: forecasters's reports regarding unrealistic values of wind gusts
- - example: 12 July 2023

Maximum wind gust
over 12 hours (06-18 UTC):



- The visualisation system Visual Weather
- MOS for ALARO 4km, L60

NWP related activities at SHMÚ

M. Belluš, M. Derková, M. Imrišek, M. Neštiak, A. Otruba, J. Pecho, M. Petraš, I. Prcúch, A. Simon, O. Španiel, V. Tarjáni, R. Zehnal, H. Hlaváčiková, Z. D. Shenga, K. Hrušková, D. Štefánik

Operational highlights

April 2023: 3D-Var operational. May 2023: ALA2e operational

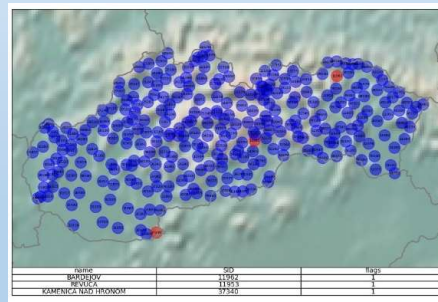
Research highlights

DFI and IAU tests, Slant Total Delays assimilation and wet snow/ice accretion phased into CY49t0, quality control methods

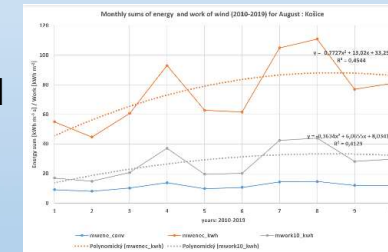
Examples:

A-LAEF case study:
Heavy precipitation event
Italy, May 16, 2023

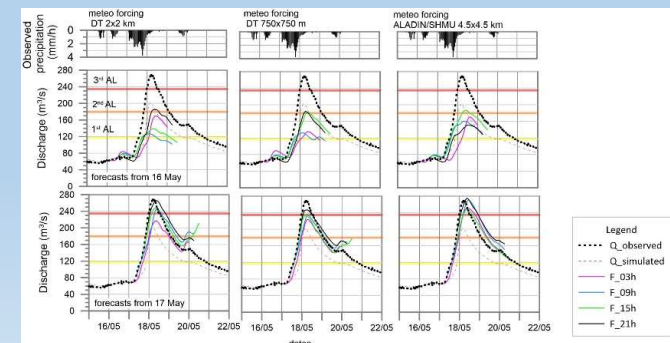
Quality control with HARP and titanlib:



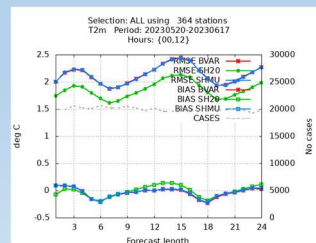
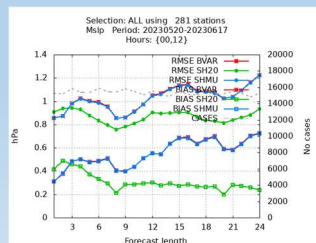
Project URANOS
Maximum subgrid wind
reanalyses 2010-2019



DE_330_MF Use case for modelling
floods in central Slovakia, May 2021



Upgrade of BVAR to cy46



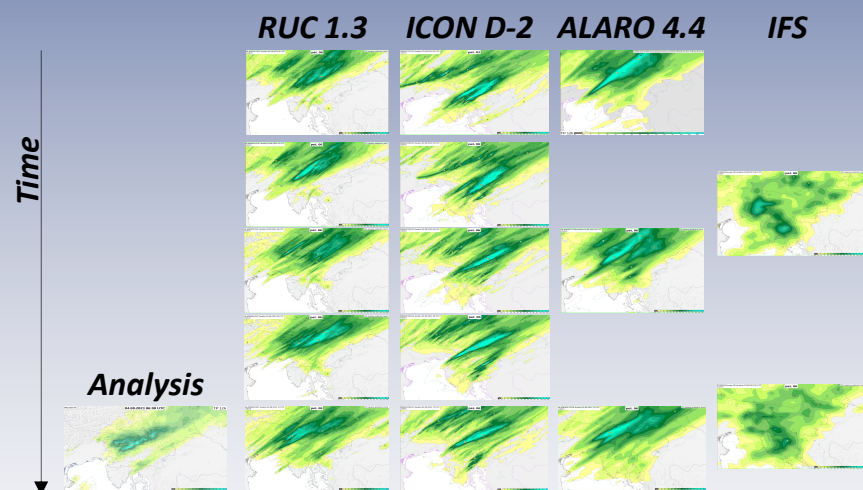
NWP activities at ARSO (Slovenia)



ARSO METEO
Slovenian Environment Agency

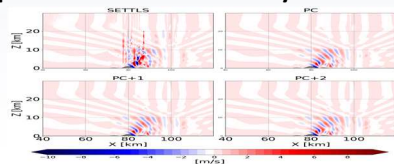
The challenging weather of summer 2023

Fast moving and long travelling storms, record hail, wind gusts
Extreme flash flood event: beginning of August
(over 200 mm in 24 hours across many stations)



Stability analysis of a non-hydrostatic model

Academic 2D experiments to analyze the stability of 2 TL SI schemes



Evolution of the non-hydrostatic
vertical wind over an orographic
barrier after one hour, calculated
by different schemes

DE_330 related activities (DestinE)

Monitoring of available observations for possible use in
DA within local DE twin (mainly from ECMWF and
OPLACE), with 30 min and 12 h cut-off time

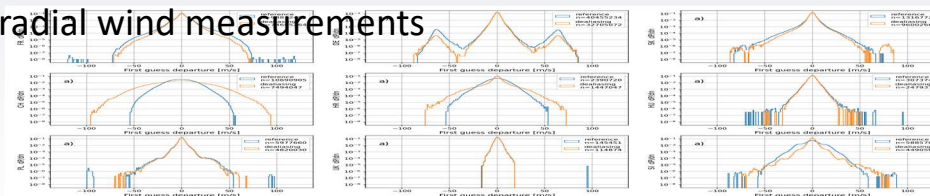


Increasing number of available surface stations included in the European
Observation Monitoring for DE_330 project:
combined and rapidly available (30 min)

Validation of wind dealiasing

Dealiasing using torus mapping method (Haase 2004),
analysis over year 2021:

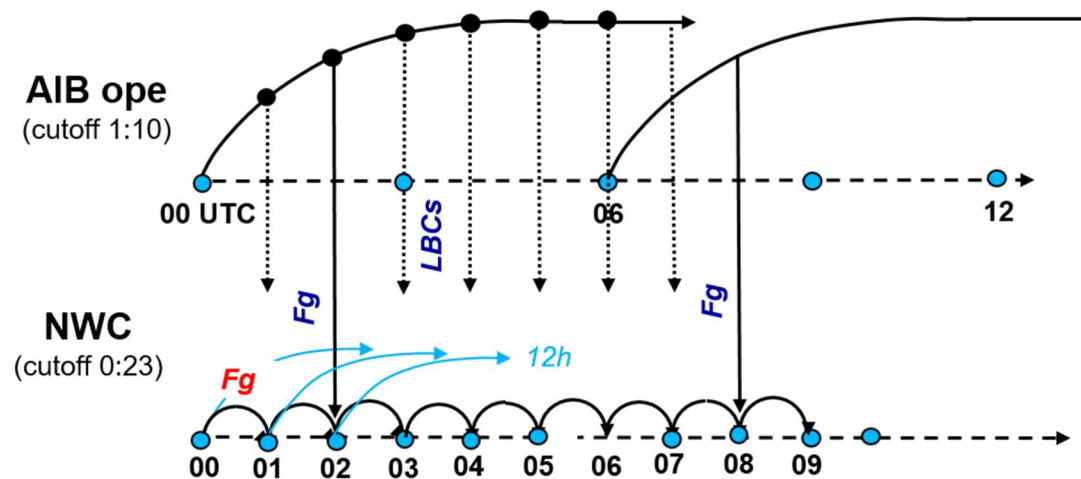
Torus mapping is robust, but dependent on noise, correctly
dealises ~90% of data, significantly improves quality of
radial wind measurements



Distributions of first guess departures for aliased (blue) and dealiased
(orange) data for radar networks for each of the countries considered

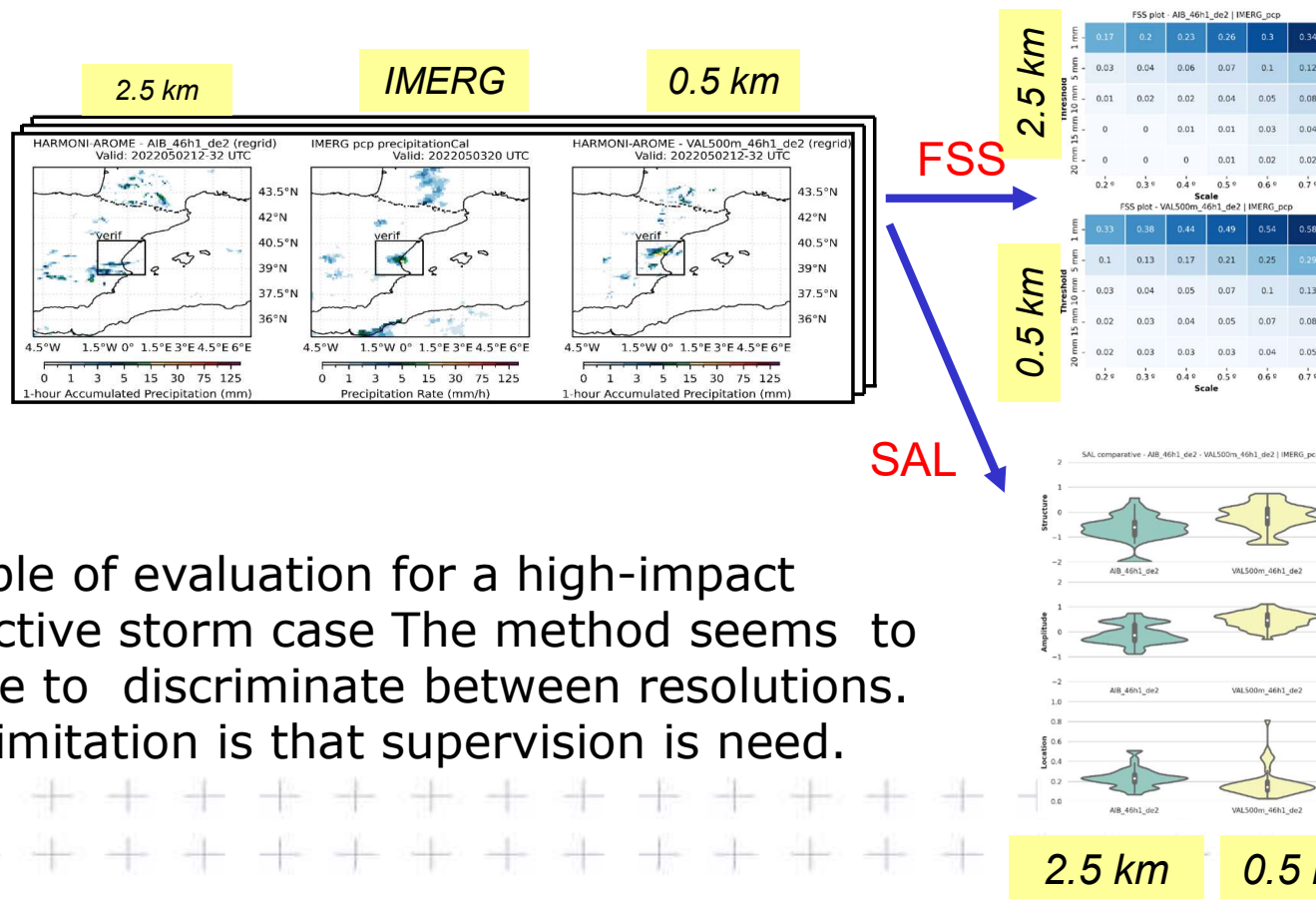
AEMET (Spain) Highlights (1)

- Upgrade of the HPC (ATOS-Bull): $2 \times (140 + 48)$ compute nodes system
- **Nowcasting suite:** 1.25 km resolution, Harmonie-Arome nesting, 3DVar hourly cycle with +23 min cut-off time. H+12 each hour



AEMET (Spain) Highlights (2)

- **Spatial Verification:** In the context of DE_330. Evaluate possible added value of Very High resolution runs

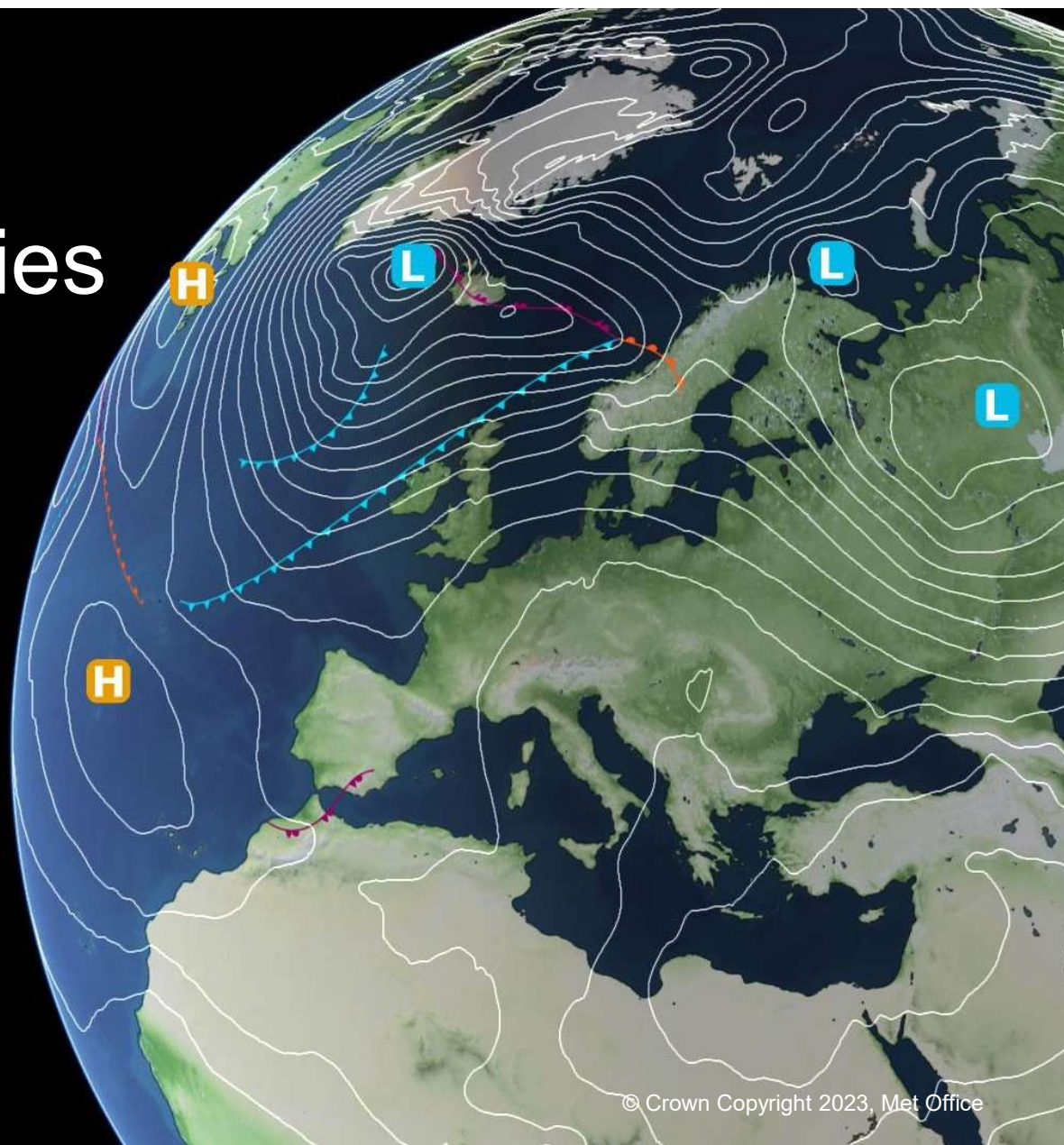


- Example of evaluation for a high-impact convective storm case The method seems to be able to discriminate between resolutions. Main limitation is that supervision is need.

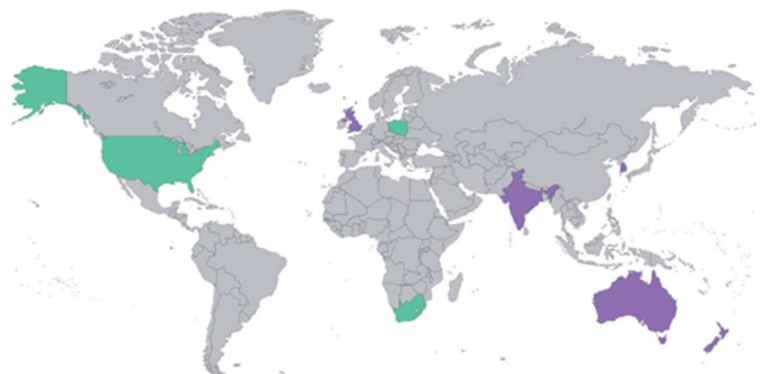
Met Office LAM activities EWGLAM 2023

Marco Milan, Gareth Dow, Lee Hawkness-Smith, Bjoern Fock, Paul Field, Anke Finnenkoetter, Mike Bush, Carlo Cafaro, Stuart Webster, David Walters, Joshua Lee¹

¹Meteorological Service Singapore



The Unified Model Partnership



CORE PARTNERS



ASSOCIATE PARTNERS



RAL → going through a unified version of the model. One for all partners.

Previously one for the tropics and one for the middle latitudes.

Model development

- New microphysics scheme with additional ice particle (ice crystals).

Data assimilation

- Operational Large - Scale Blending. The LAM DA can concentrate only on the scales that it can represent.

MOGREPS - UK:

- Activities centered on study the ensemble spread.

Met Office plan:

- Transition to ensemble-based forecasting systems