

EUMETNET

SRNWP-EPS project

Convection-permitting LAM-EPS database

1st ACCORD All Staff Workshop
12 – 16 April 5th 2021
BlueJeans Videoconference



Alfons Callado-Pallarès,
Francesca Marcucci,
Stéphane Vannitsem and
Chiara Marsigli

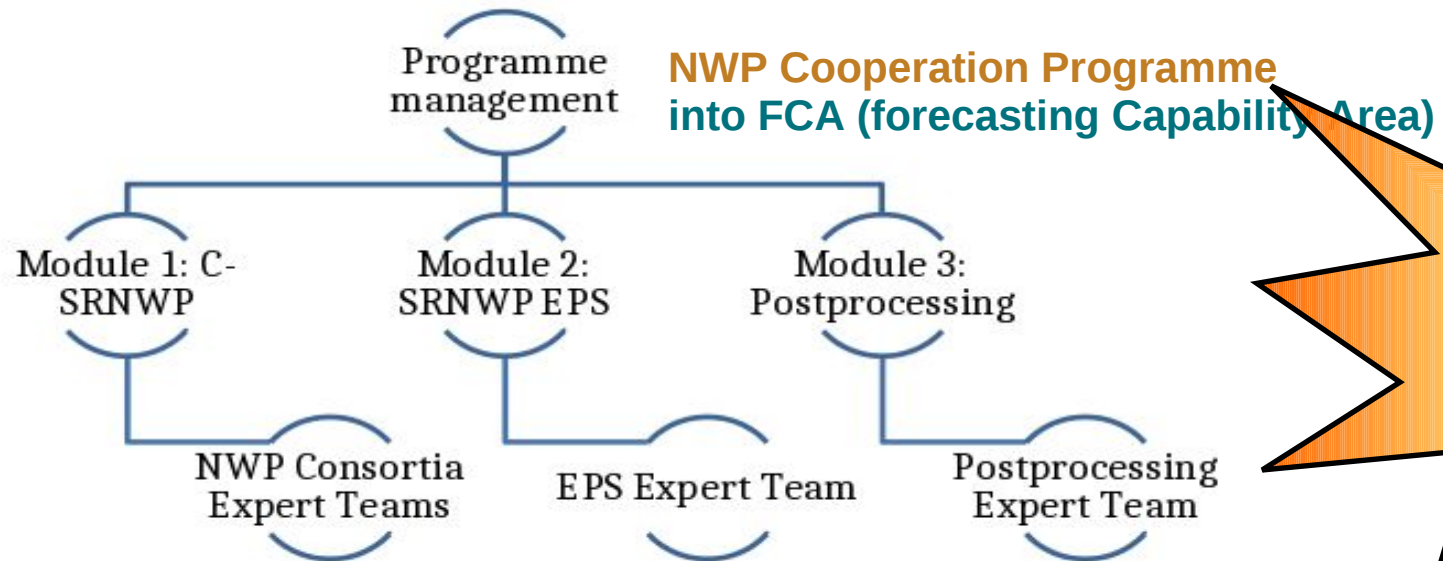
Outline

- **Brief introduction to EUMETNET and SRNWP-EPS**
- **Review of SRNWP-EPS application tasks' status**
 - **Calibration** focused on **extremes** (AEMET): T2m, Wind gust 10m, etc.
 - **Derived/post-processing products** (ItAF-REMET): wind gusts, icing, severe convection, wind storms and turbulence
 - **Extreme Forecast Index** and **SOT** for LAM-EPS (AEMET)
- **Météo-France** new project participant since 2020
- **SRNWP-EPS Convection-permitting LAM-EPS database (srnwpepsDB)**
- **SRNWP-EPS and srnwpepsDB coming events**

EUMETNET and NWP Cooperation Programme

EUMETNET was born and devoted to share and optimise efforts between European National Meteorological and Hydrological Services to have better **observations** for weather forecast. Later the NWP Cooperation Programme was established.

This **cooperation** on Short Range Numerical Weather Prediction (SRNWP) over Europe is essentially organized **around LAM-NWP consortias** (ALADIN, COSMO, HIRLAM, LACE, SEECOP, UKMO) that develop high-resolution prediction models.



**3rd Phase of
EUMETNET
2019-2023**

Transversal activities as *workshops* through all the consortia landscape are organized in the context of EUMETNET in order to **share scientific and technical** issues that are common to all consortia, with the ultimate goal of **improving the forecast skill** at these short time scales.

Management of the SRNWP-EPS module (2019-2023)

The management of the project/module is organised through an agreement (MoU) between partners:



• **AEMET**

→ The Spanish Meteorological Agency
Alfons Callado Pallarès ⇔ **Project Manager**



• **ItAF-REMET**

→ The Italian Air Force Meteorological Service
Francesca Marcucci (COMET)



• **RMI**

→ The Royal Meteorological Institute of Belgium
Stéphane Vannitsem ⇔ **Manager of Postprocessing project**

DWD in-kind collaboration

Chiara Marsigli collaborates with the project, mainly on scientific research and verification

Previous Phase II (2015-2018) ⇔ It was managed by **José A. García-Moya**



SRNWP-EPS GOAL

The **enhancement of cooperation on LAM-EPS** (Limited-area Ensemble Prediction Systems) was recognised as a **high priority goal by EUMETNET** members when composing the Forecasting Roadmap for the current phase. This is motivated by the fact that the development of **convection-permitting** ensemble prediction capabilities in Europe are recognised to be **crucial for forecasting a range of weather phenomena** and in particular for **IMPROVING HIGH IMPACT WEATHER (HIW) PREDICTION.**

SRNWP-EPS MAIN OBJECTIVES

I) Application oriented objective (R2O) → (Partly) funded

- **LAM-EPS calibration** focused on **extremes** (AEMET): T2m, Wind gust 10m, etc.
- Development of **derived/post-processing products** (ItAF-REMET-COMET): wind gusts, icing, severe convection, wind storms and turbulence.
- **EFI** (Extreme Forecast Index) and SOT development for LAM-EPS (2021-2023)

II) Research oriented objective → Workshops and participants in-kind contribution

- Representation of **model uncertainties** relevant for forecasting HIW
- Organise coordinated testing/research on **LAM-EPS perturbations**
- **Annual workshop** at the end of October: last one with **Post-Processing** project
- To **foster research** has been established the:
 - **SRNWP-EPS Convection-permitting LAM-EPS database**

SRNWP-EPS applications and developments



EUMETNET
EUROPEAN METEOROLOGICAL
SERVICES NETWORK

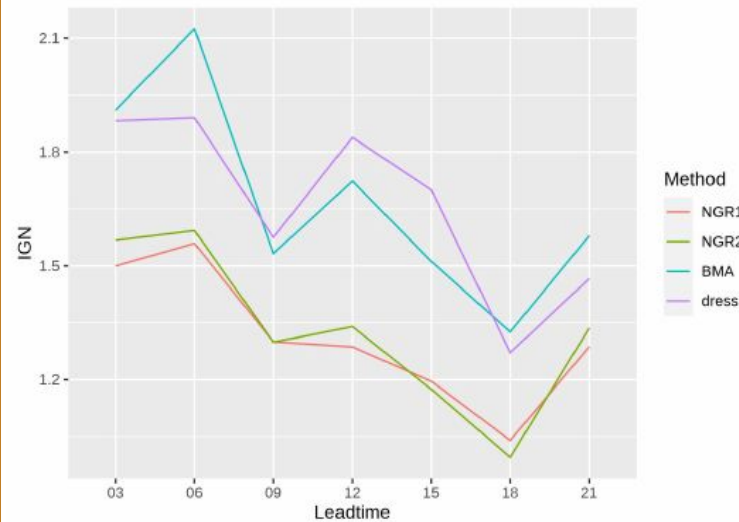
SRNWP-EPS Calibration on extremes (AEMET)

Maria Cortès Simó (contracted ⇔ since June 2020)

- Reviewing and trying the feasibility and performance of distinct methods
 - Collaboration with Post-Processing EUMETNET project
 - RMI Member-by-Member approach will be tried
- Goals:
 - Software to be easily applied to any LAM-EPS
 - Expected parameters:
 - 12-hours/ daily **precipitation**
 - Daily **maximum** and **minimum** 2 meters **temperatures**
 - 12h / daily wind **gust**
 - Test with SRNWP-EPS LAM-EPS database

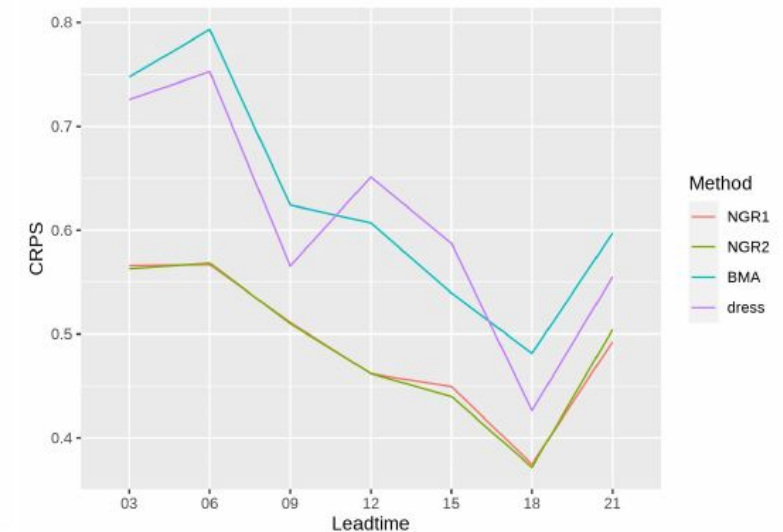
Univariate ensemble postprocessing: Temperature

VERIFICATION



Ignorance Score

?



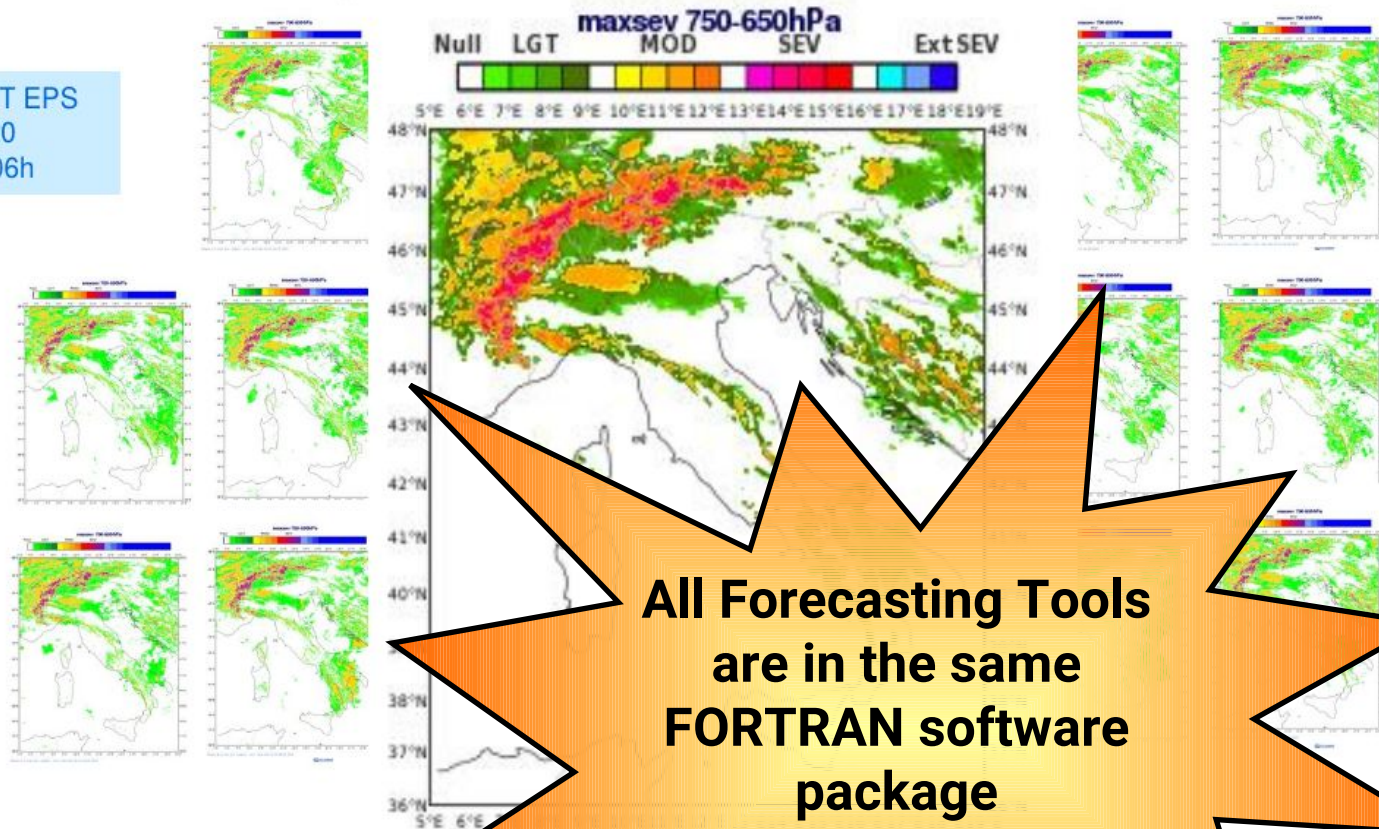
CRPS

SRNWP-EPS Forecasting Tools (ItAF-REMET-COMET)

Francesca Marcucci and Raffaele Golino (contracted)

Ensemble outputs and «most probable» turbulence intensity

COSMO-IT EPS
10/02/2020
00UTC +06h



All Forecasting Tools
are in the same
FORTRAN software
package

Forecasting tools

- Fog
- Thunderstorms
- Aviation
 - Icing
 - CAT

Fog and
Thunderstorms
Forecasting Tools
are available



SRNWP-EPS EFI and SOT LAM-EPS (AEMET) [Extra-fund 2021-23]

Joan Montolio Llenas (contracted ⇔ just beginning, 6th April)

- It is expected to follow a similar approach as the one developed by Météo-France
- Goals:
 - Software to be easily applied to any LAM-EPS / some parameters
 - Test with SRNWP-EPS LAM-EPS database

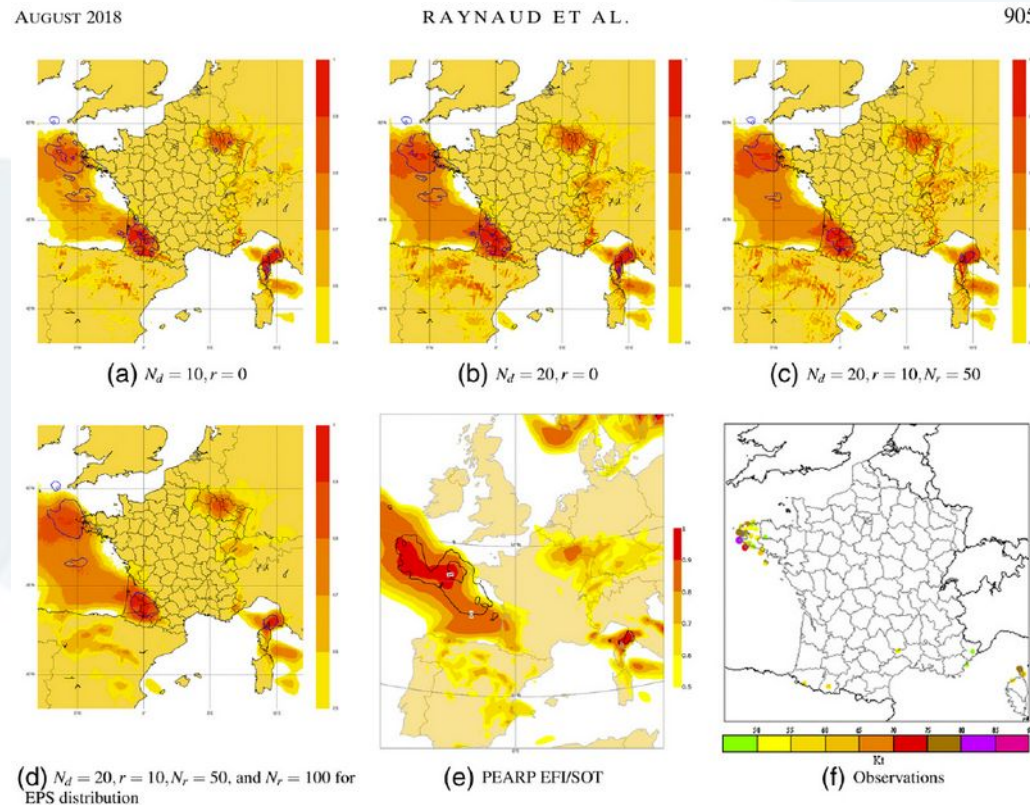


FIG. 3. (a)–(d) EFI (colors) and SOT90 (contours) maps for different climate and AROME-EPS configurations, valid at 0600 UTC 6 Mar 2017. (e) EFI and SOT90 computed from the large-scale PEARP EPS. (f) Observations of 10-m wind gusts (kt).

MétéoFrance EFI and SOT from AROME-EPS

R2O: climate model is the key issue → they show it could be done *without EPS re-forecast* but from LAM-EPS archiving data but with a spatial/temporal *relaxation*

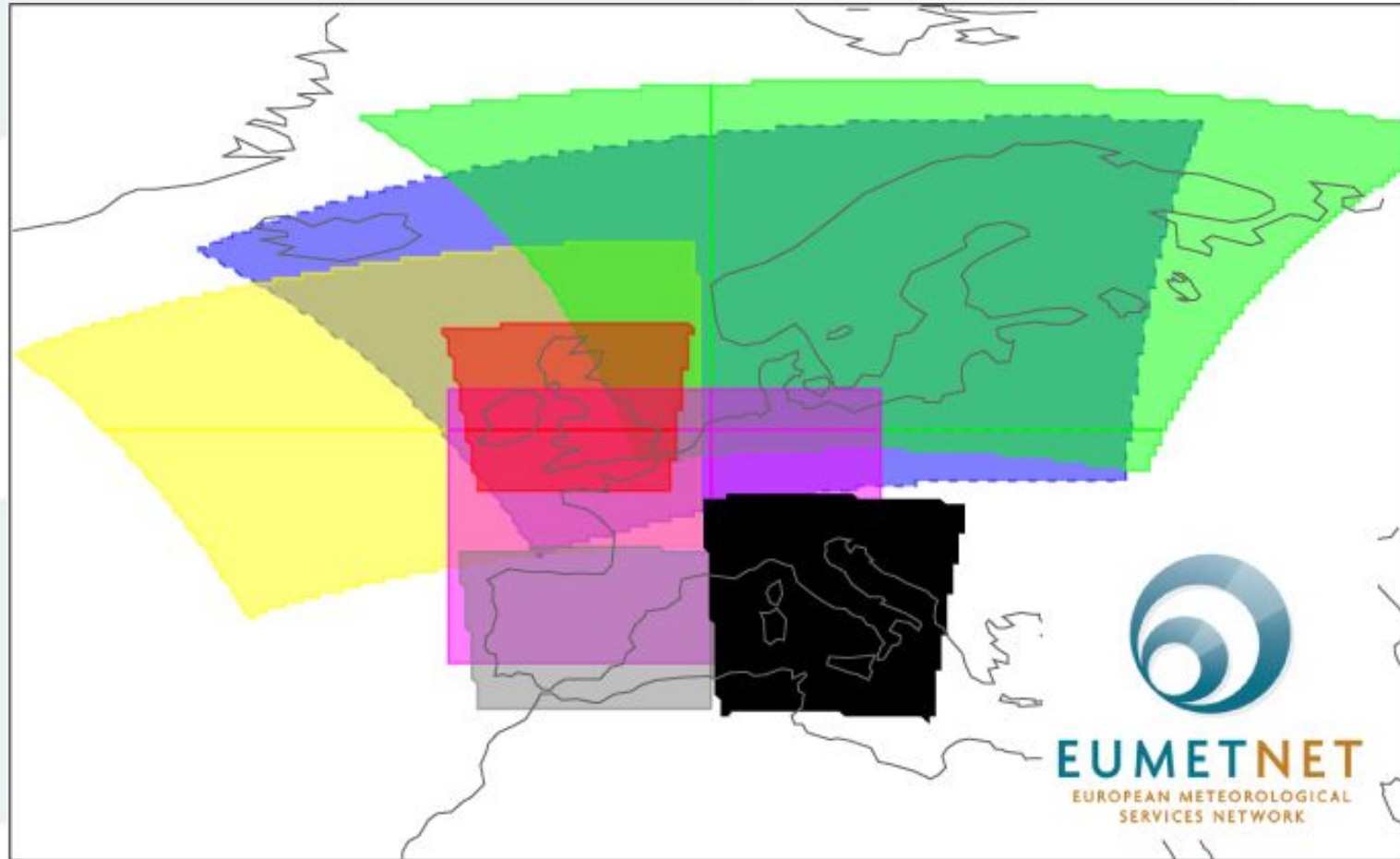
Raynaud, L., B. Touzé, and P. Arbogast, 2018: *Detection of Severe Weather Events in a High-Resolution Ensemble Prediction System Using the Extreme Forecast Index (EFI) and Shift of Tails (SOT)*. *Wea. Forecasting*, **33**, 901–908, <https://doi.org/10.1175/WAF-D-17-0183.1>








SRNWP-EPS convection-permitting LAM-EPS database



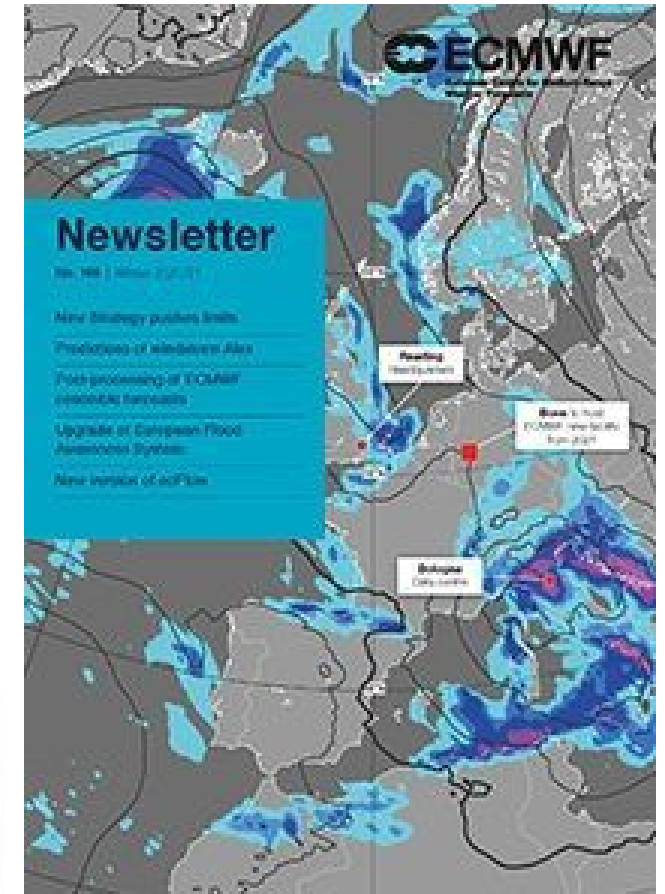
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LAM-PS domains and overlappings



- | | | | |
|---------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------|
|  COMEPS |  IREPS |  MEPS |  MF-AROME-EPS |
|  MOGREPS |  γSREPS |  IT-EPS | + ICON-D2-EPS |

Domains



Newsletter No. 166 - Winter 2020/21

EUMETNET convection-permitting ensemble database hosted at ECMWF

EUMETNET SRNWP-EPS Convection-permitting LAM-EPS database

Quick summary

- *Off-line flexible* database archiving relevant **surface parameters** in GRIB format (editions 1 and 2)
 - Currently some LAM-EPS archiving a **few upper-levels fields** for synoptic/mesoscale diagnosis
- Main goal: **to foster research and collaboration in order to improve European LAM-EPS**
 - Focussing on **high-impact weather (HIW)** and **convection**
- Hosted at ECMWF **ECFS** (located at **ec:/srnwpeps**)
- Currently:
 - It was started with a 1st *testbed* 3-month **period from 1st June to 31st August 2020 (8 LAM-EPS)**
 - But it was decided to try to archive **continuously** until the **31st December 2023** (the end of current EUMETNET 2019-2023 phase)
 - **9 LAM-EPS participants: mogreps-uk** (MetOffice), **MEPS** (MetCoOp), **gSREPS** (AEMET), **IT-EPS** (ItAF-REMET), **IREPS** (Met Eireann), **COMEPS** (DMI), **MF-AromeEps** (MétéoFrance), **RMI-EPS** (RMI) and **ICON-D2-EPS** (DWD)
- How is used? Through SRNWP-EPS **research sub-groups** with common goals and/or LAM-EPS overlappings
- **Open to EUMETNET: e.g. ET from C-SRNWP as Verification and Physics, Postprocessing, etc.**
 - Open/available to other research/teaching institutions (with non-commercial purposes)

EUMETNET SRNWP-EPS Convection-permitting LAM-EPS database

Documentation available (example)

LIST OF SURFACE PARAMETERS	<p>Pmsl: mean sea level pressure Psurf: surface pressure T2m: screen level temperature T2mMAX and T2mMIN: daily maximum and minimum T2m U10m and V10m: the two components of 10 metres wind G10m: wind gust speed at 10m RH2m and/or Q2m: relative and/or specific humidity at 2m AccPcp: total accumulated precipitation from leadtime 0 TCC: total cloud cover VIS: visibility LTG: lightning</p> <p><i>Following particular's participants interest, 2 or 3 more parameters could be archived (document them into GRIB Table)</i></p> <p><i>Additional precipitation parameters related to convection as hail and/or graupel will be welcome</i></p>
CONSTANT PARAMETERS	<p>ORO: orography LSM: Land-Sea mask</p>

**Flexible
archiving
specifications**

srnwpepsDB STATUS

What is archived ?

Horizontal resolution
between 2 and 2.5 km

LAM-EPS	Cycles	Mbrs	Every / up to	Grid size	GRIB edition/packing	Gb per day	Index
gSREPS AEMET sp0w	2 00/12	20	60 / 3	469x565	2 / 40 JPEG2000	2.0	1.0
IT-EPS ItAF-REMET cm1	2 00/12	20	48 / 1	576x701	1 / simple packing	12.7	1.8
mogreps-uk frar Met Office	2 00/12	18	66 / 1	546x421	2 / 0 simple packing	7.5	1.5
IREPS Met Eireann duah	2 00/12	11	54 / 1	989x889	2 / 0 simple packing	26	2.7
MEPS MetCoOp snh	2 00/12	30	54 / 1	949x1069	2 / 42 packing	50.0	1.7
MF-AromeEps rmb MétéoFrance	2 21/09	16	45 / 3	1121x717	2 / second order	2.8	0.8
COMEPS DMI nhf	2 00/12	19	48 / 3 1 AccPcp	1189x1069	1 / simple packing	28	3.1
ICON-D2-EPS gd0 DWD	1 00	20	27 / 1	542040	2 / simple packing	2.6	1.4
Total						129	

srnwpepsDB STATUS

2020 Joint EPS-PP workshop
 → decision to archive continuously



What we have archived ? **8 LAM-EPS**

LAM-EPS	Jun 2020	Jul	Aug	Sep	Oct	Nov	Dec	Jan 2021	Feb	Mar	Apr	Months / %
gSREPS AEMET sp0w												11 100%
IT-EPS ItAF-REMET cm1				+6 days		+2 days						3 75%
mogreps-uk frar Met Office												3 27%
IREPS Met Eireann duah				+7 days		+10 days						8 78%
MEPS MetCoOp snh				+13 days								3 31%
MF-AromeEps rmb MétéoFrance												7 100%
COMEPS DMI nhf												8 73%
ICON-D2-EPS gd0 DWD												3 27%

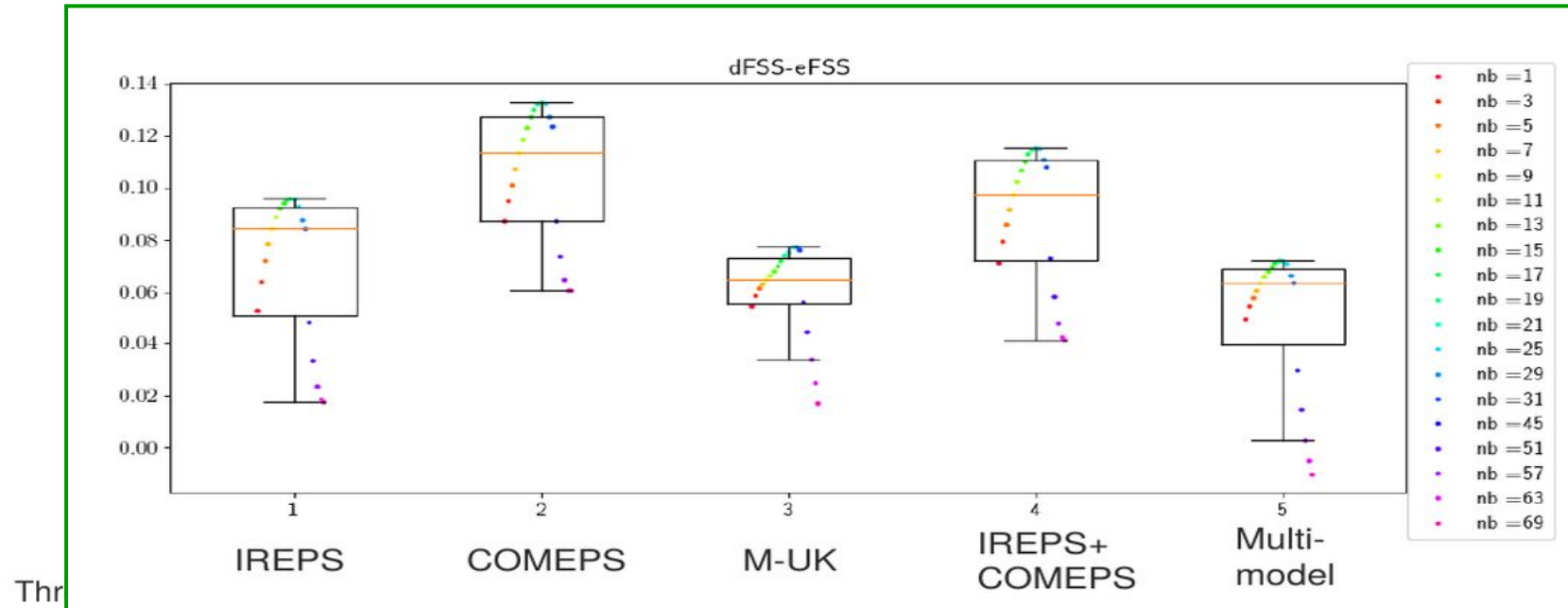
AGREE TO: archive continuously until the end of EUMETNET 2019-2023 phase → 31st December 2023

EUMETNET SRNWP-EPS Convection-permitting LAM-EPS database

First sub-group research on multi-Ensemble



Evaluate ensemble subjectively



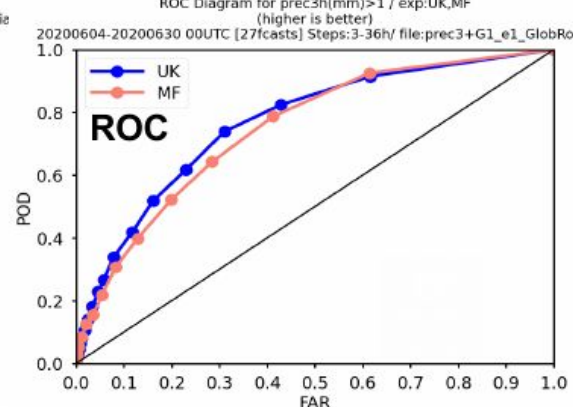
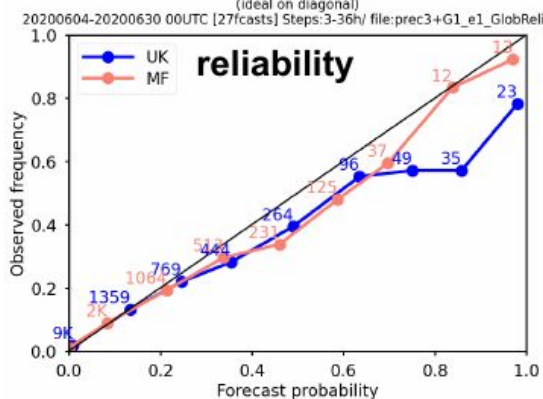
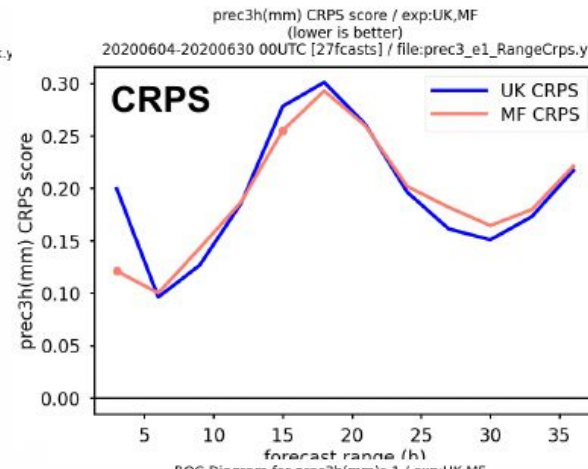
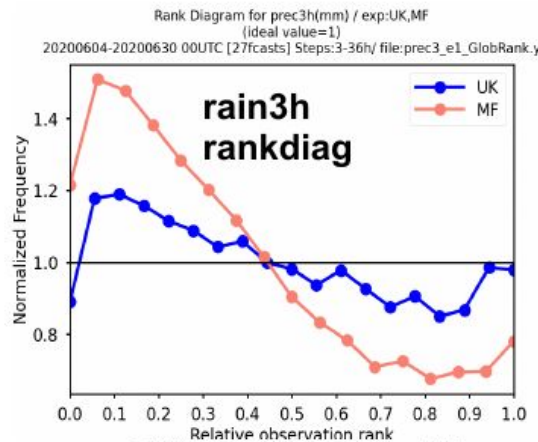
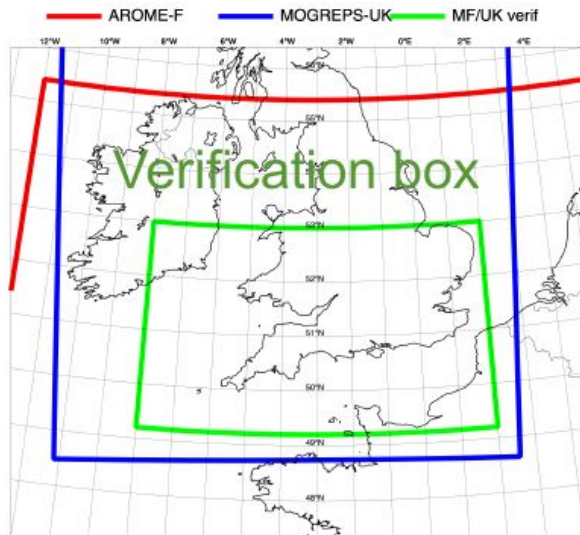
Managed by
Aurore Porson
(MetOffice)

- Development of subjective and objective metrics suitable for ensemble comparison and assessments, as viewed from the operational meteorology
- Fractions Skill Score analysis
- Comparison of rainfall structure, rainfall intensity and development of convection metrics

EUMETNET SRNWP-EPS Convection-permitting LAM-EPS database

Another research: LAM-EPS comparison on overlapping zones

- Arome-France-EPS and MOGREPS-UK are compared over June 2020 using same observations, over geographical overlap zone : (T2m, HU2m, ff10m, rain)
- ranges (T=00utc to T+36h), Nmembers (16 vs 18), analysis times (21utc vs 19-00utc).



Research done by
François Bouttier
(Météo-France)

SRNWP-EPS and srnwpepsDB FORSEEABLE FUTURE

srnwpepsDB

- Show at ASW ACCORD (April) and EMS meeting (September)
- Open to more LAM-EPS:
 - Ask LACE to participate (commented by next EUMETNET Executive Director Klemen Bergant)

SRNWP-EPS

- May → Research Expert Team meeting (one day)
 - Opportunity to present sub-groups research results using srnwpepsDB: e.g. A.Porson, F.Bouttier
- Annual Workshop (End of October 2021)
 - At some point with Nowcasting project

**The LAM-EPS probabilistic products
are the present and future of high impact weather forecasting**

Thank you for your attention

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