

# Cycle 48r1

## Verification, products and technical aspects

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Head of Evaluation

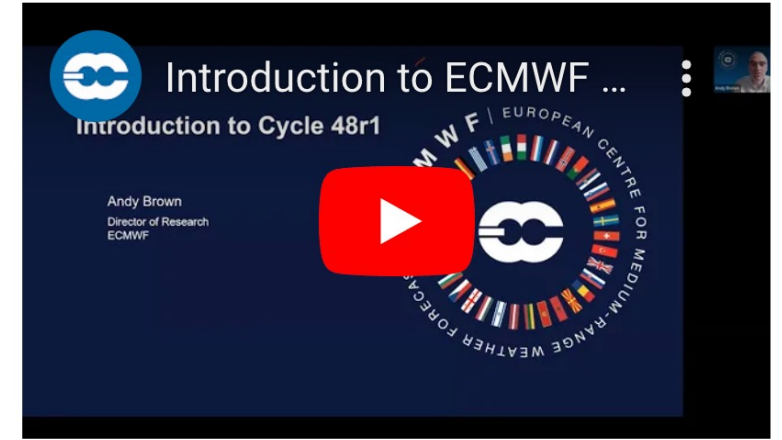
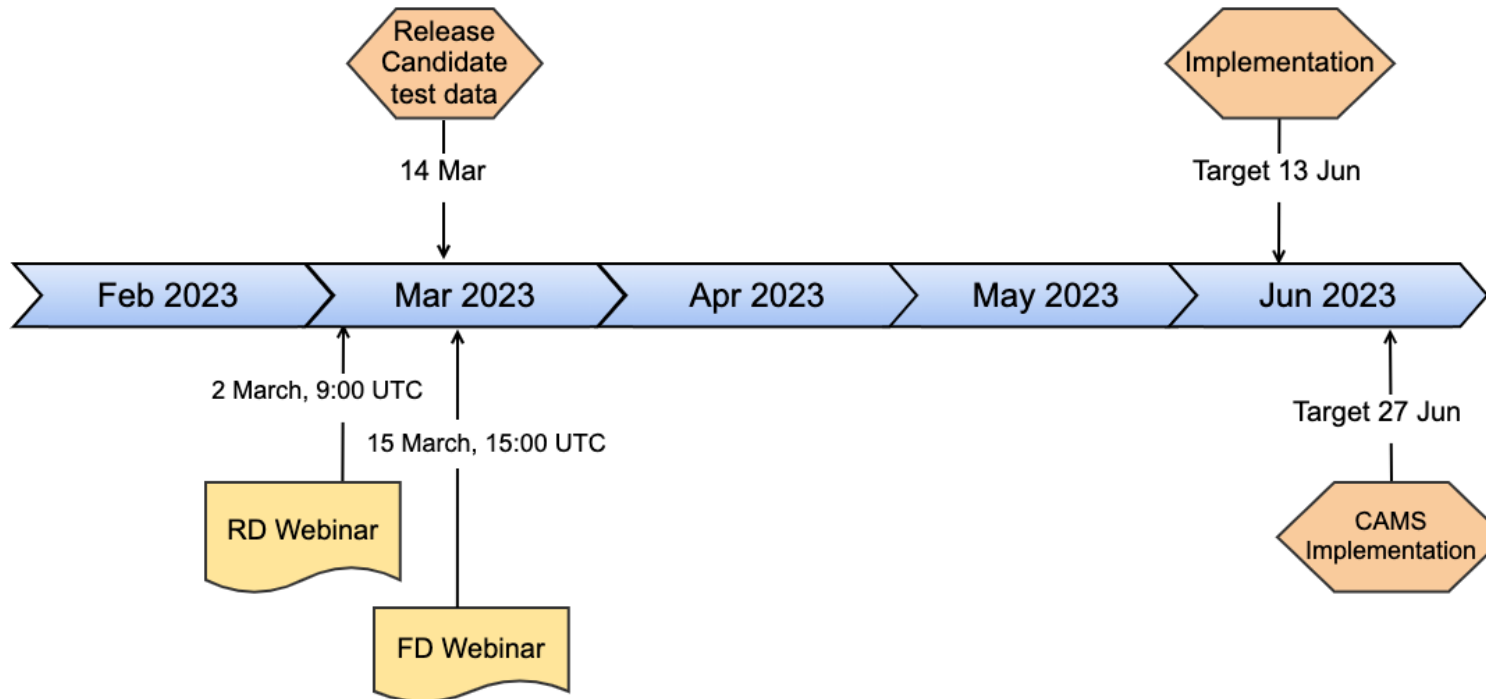
Florian Pappenberger  
Director of Forecasts & Deputy Director-General



#IFS48r1 #newfcsystem @ECMWF



# 48r1 Implementation timeline



Release Candidate Phase started **14 March**

For details "Watch": <https://confluence.ecmwf.int/display/FCST/Implementation+of+IFS+Cycle+48r1>



# Summary of meteorological content (data assimilation/model)

## Data assimilation

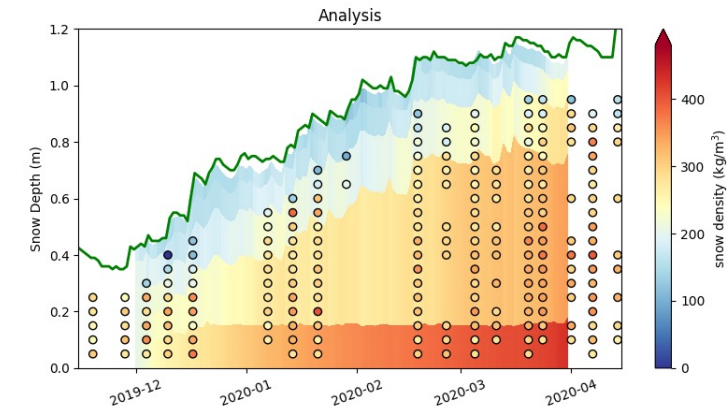
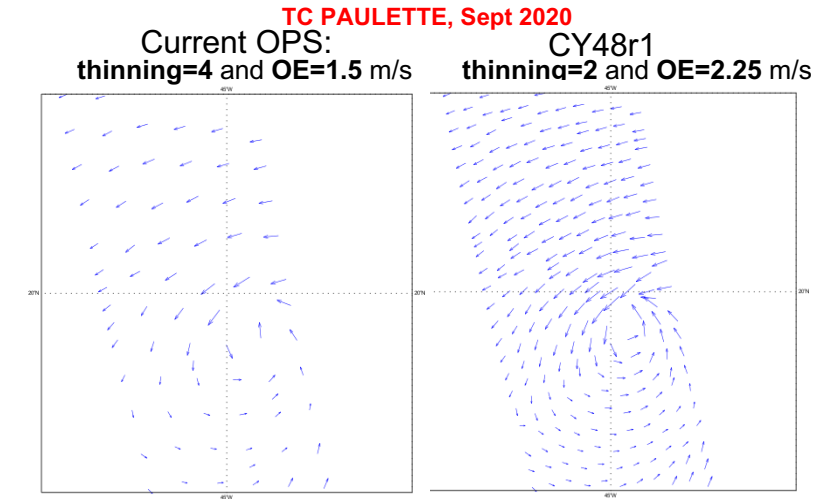
- Increase of HRES 4DVar inner loop resolution to  $T_{L511}$
- Switch to [OOPS](#), the object-oriented prediction system
- Reduced thinning of ASCAT L2 products
- Various optimisations for hyperspectral IR sounders
- Upgrade RTTOV to v13
- ATMS snow, Lambertian, slant-path
- Improved treatment of surface-sensitive channels in all-sky

## Observations

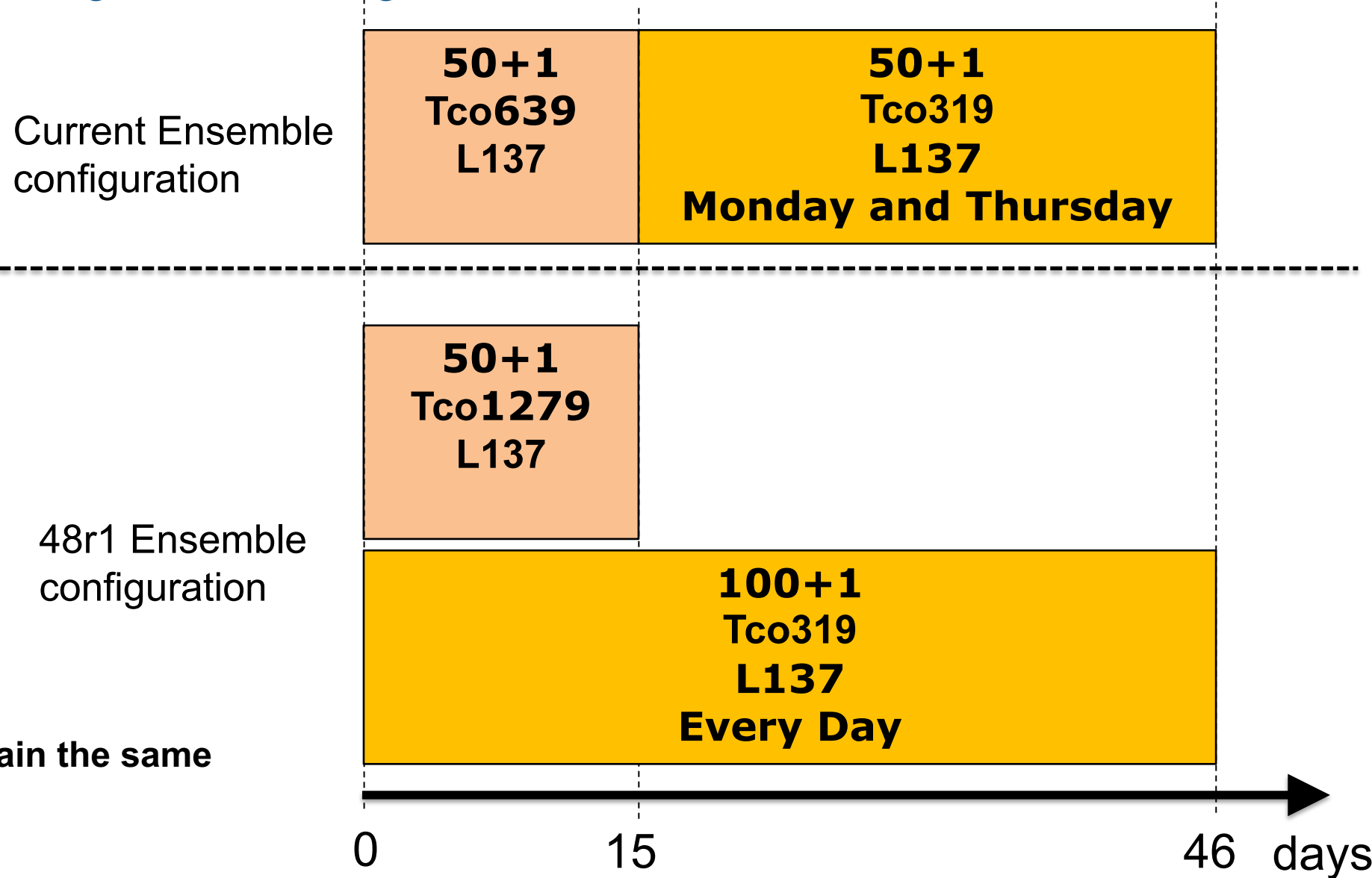
- Improved observation pre-processing
- Assimilation of microwave imagers over land surfaces

## Model contributions

- Improved water and energy conservation (dynamics and physics)
- Radiatively interactive prognostic ozone using new HLO scheme
- Multi-level snow scheme
- New precipitation category - freezing drizzle
- Revised climate fields – improved orographic fields for atmospheric drag
- Revised computation of Semi-Lagrangian advection departure points
- New model top sponge layer formulation and semi-Lagrangian vertical filter
- Revised SPPT, removed cloud saturation adjustment from tendency perturbations




# 48r1: key configuration changes

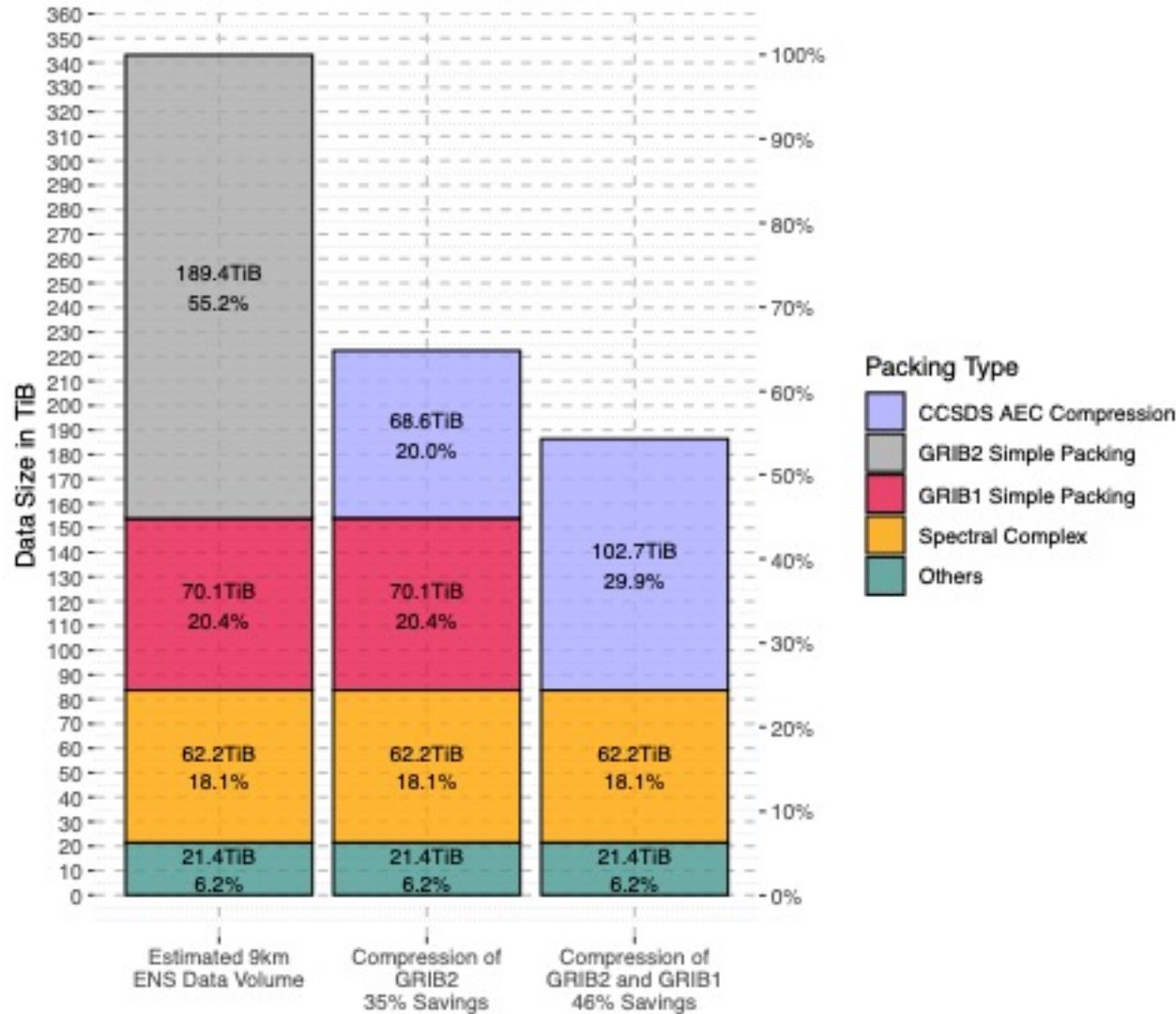


Release times remain the same

## “Check list” for users

- ✓ Study the 48r1 implementation page and  [Watch](#) for updates
- ✓ Do get the test data provided
- ✓ Check that you can handle gridded GRIB2 test data with CCSDS packing
  - Using ecCodes 2.28.0 this should be transparent
- ✓ Check that your processing chains work correctly with the test data
  - Resource requirements and run-times might change
- ✓ For data from MARS/dissemination be aware of the default behaviour reg. packing type
  - Override the default to get e.g. all gridded GRIB2 with CCSDS packing
  - Override the default if you cannot handle CCSDS compressed data
- ✓ If you use extended-range ensemble products
  - Pay attention to configuration change and modify requests accordingly
  - Address the discontinuation of fields from overlap streams efov, efho, weov and ewho
  - If you are a recipients of real-time data, please let us know your intentions via a support ticket
- ✓ Report any issues via the Support Portal

# Compression – Data-volume savings for 9km ENS in 48r1



Volume saved in using GRIB2(*compressed*), from:

- GRIB2(*uncompressed*): **35%**
- GRIB1: **46%**

Scales with resolution!!!

You will not notice any difference if you use ecCodes

Technical Memo



900

Impact of GRIB compression on weather forecast data and data-handling applications.

Eugen Betke, Tiago Quintino, Simon Smart, Tomas Wilhelmsson  
August 2022

## New parameters/revised parameters

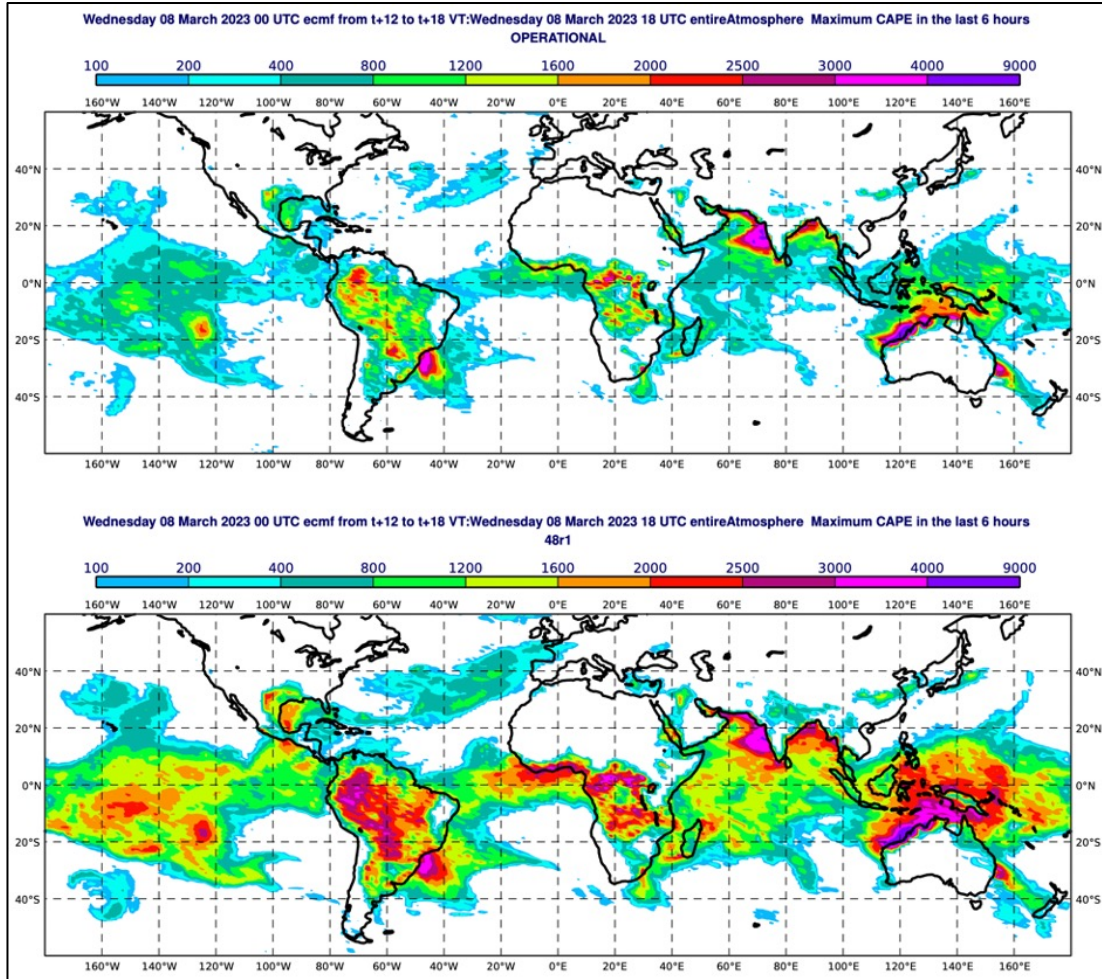
- New precipitation type (code 12 – “freezing drizzle”)
- Most severe/most frequent precipitation type in the last 1h/3h/6h
- More physically consistent CAPE parameters
- Revised snow parameters due to new multi-layer snow scheme

For details, check: <https://confluence.ecmwf.int/display/FCST/Implementation+of+IFS+Cycle+48r1>

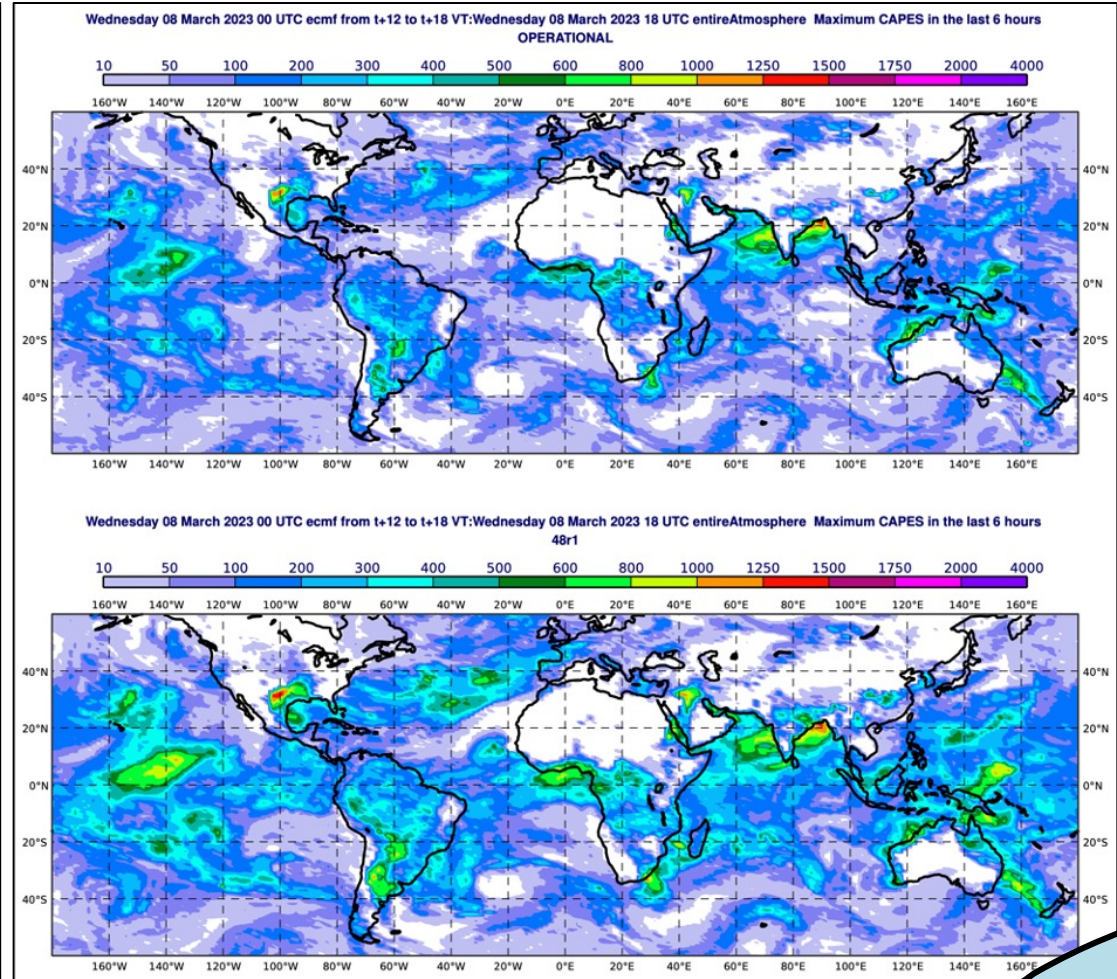


# High impact weather – convective hazards in 48r1

mxcape6 and mxcapes6 use MUCAPE in 48r1



6h max CAPE



6h max CAPE-shear

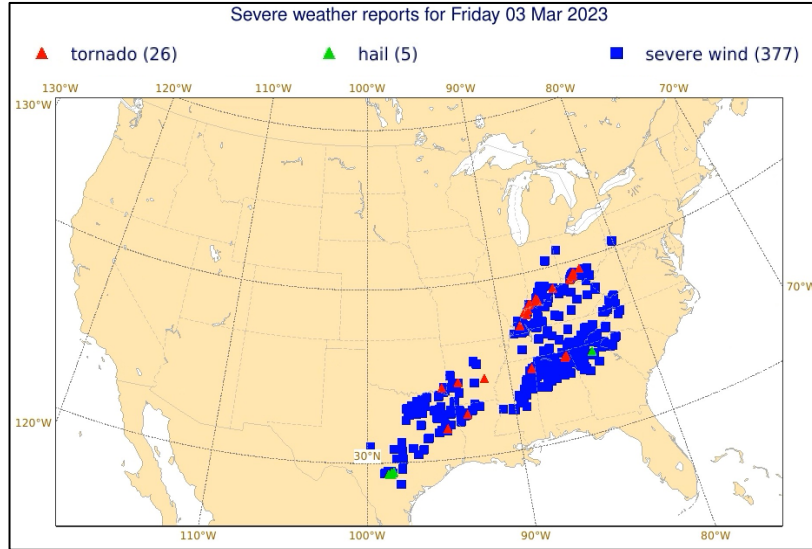
47r3

48r1

*Revised parameters*

# High impact weather – convective hazards in 48r1

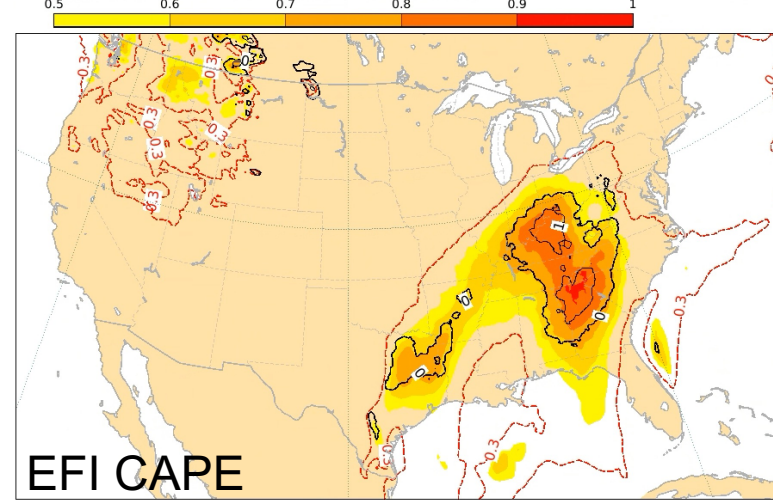
These new MUCAPE-based variables are then inherited into EFI/SOT computations



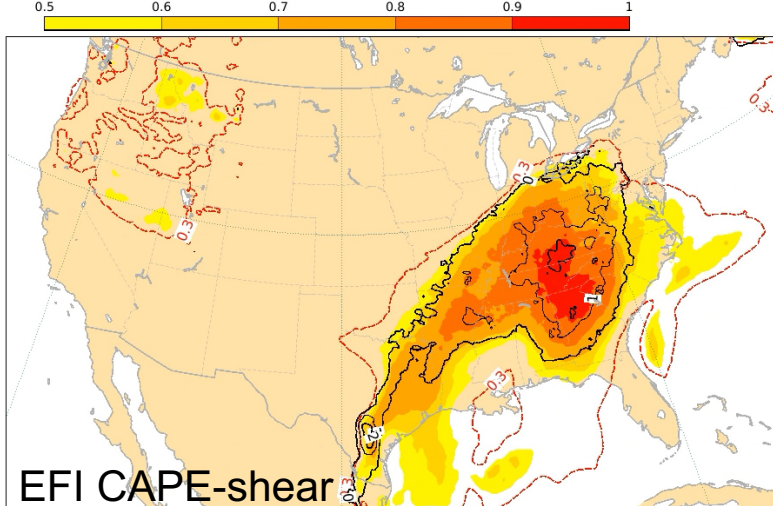
Example: Severe Convection – USA, 2-3 March 2023

Operational = 47r3

Thu 02 Mar 2023 00UTC @ECMWF expver = 1 VT: Fri 03 Mar 2023 00UTC - Sat 04 Mar 2023 00UTC 24-48h  
Extreme forecast index and Shift of Tails (black contours 0,1,2,5,8) for: CAPE

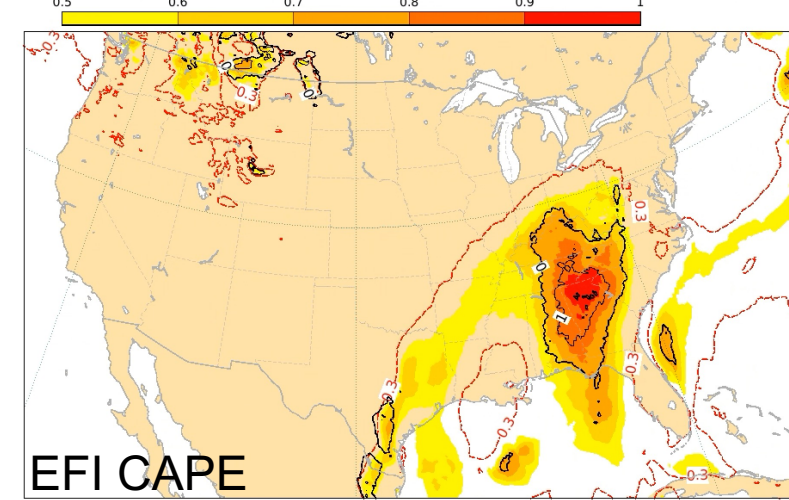


Thu 02 Mar 2023 00UTC @ECMWF expver = 1 VT: Fri 03 Mar 2023 00UTC - Sat 04 Mar 2023 00UTC 24-48h  
Extreme forecast index and Shift of Tails (black contours 0,1,2,5,8) for: CAPE-shear

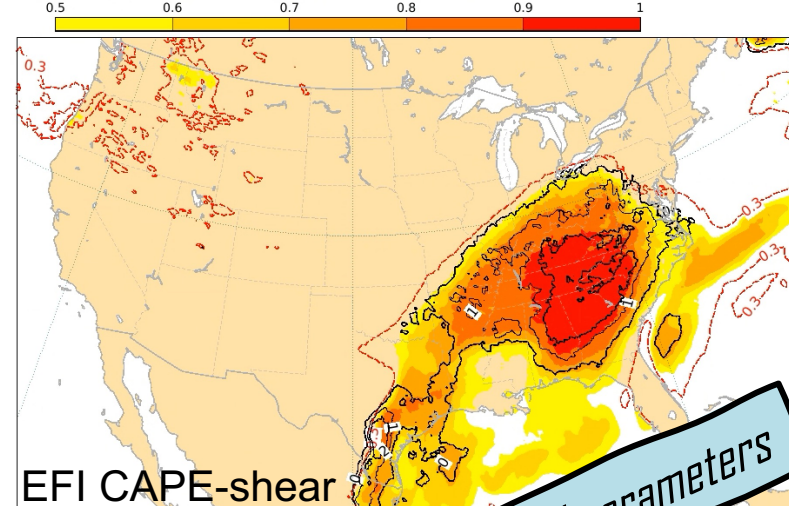


48r1

Thu 02 Mar 2023 00UTC @ECMWF expver = 78 VT: Fri 03 Mar 2023 00UTC - Sat 04 Mar 2023 00UTC 24-48h  
Extreme forecast index and Shift of Tails (black contours 0,1,2,5,8) for: CAPE



Thu 02 Mar 2023 00UTC @ECMWF expver = 78 VT: Fri 03 Mar 2023 00UTC - Sat 04 Mar 2023 00UTC 24-48h  
Extreme forecast index and Shift of Tails (black contours 0,1,2,5,8) for: CAPE-shear



Revised parameters

# High impact weather – “Freezing drizzle” in 48r1

*Revised parameter*

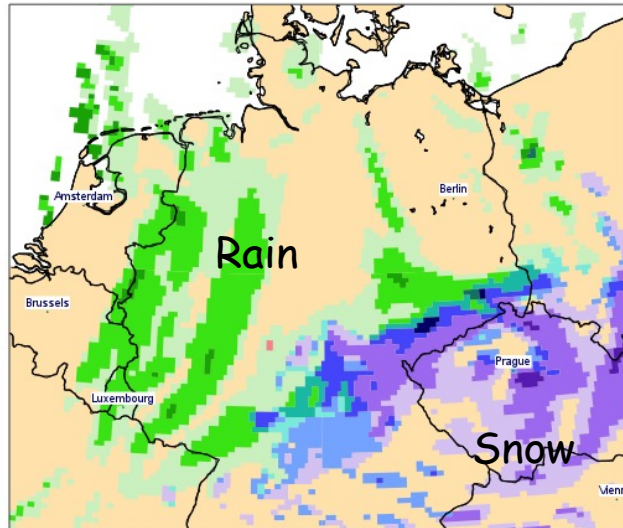
**Freezing drizzle** (= supercooled warm-rain process at sub-0°C temperatures)

- Often light but prolonged precipitation can create icy surface, hazardous weather!
- Different formation process to freezing rain, **pre-48r1 freezing drizzle is not predicted in the IFS**
- New/revised microphysics in **48r1 allows freezing drizzle prediction**
- New **WMO code 12** in “Precipitation Type” parameter: will appear in ENS Precip-Type Meteograms, and on related map plots

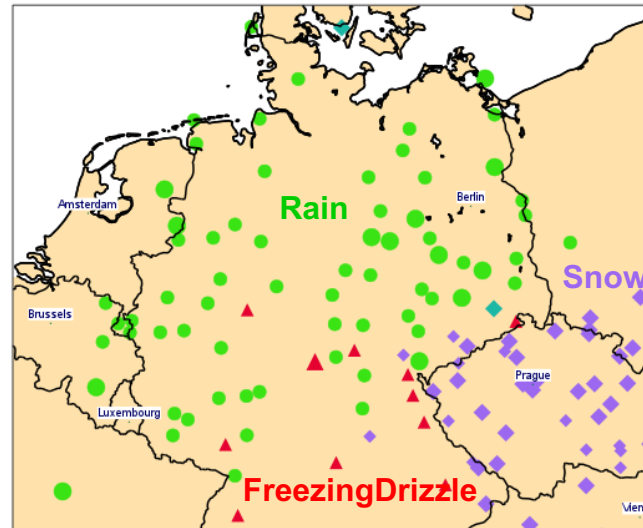
Example case study: Germany 19 December 2017

## Operations at the time

No indication of freezing drizzle



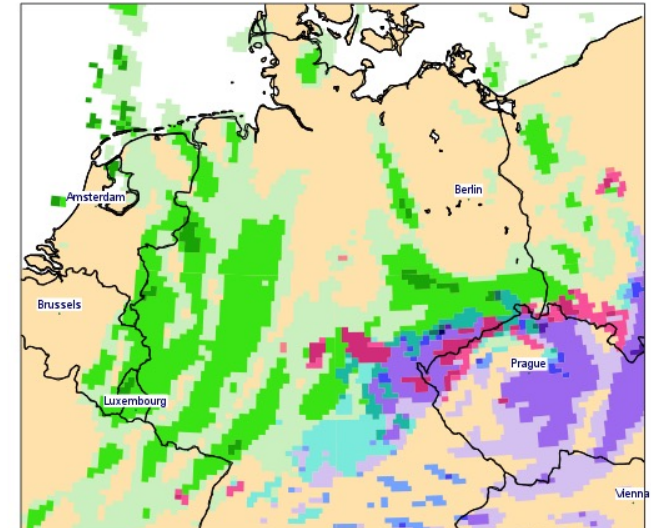
## Observed precipitation-type



rain / mix rain-snow / wet snow / snow / ice pellets / freezing rain / freezing drizzle

## New physics in 48r1

Freezing drizzle predicted in the area



# New parameters for precipitation type

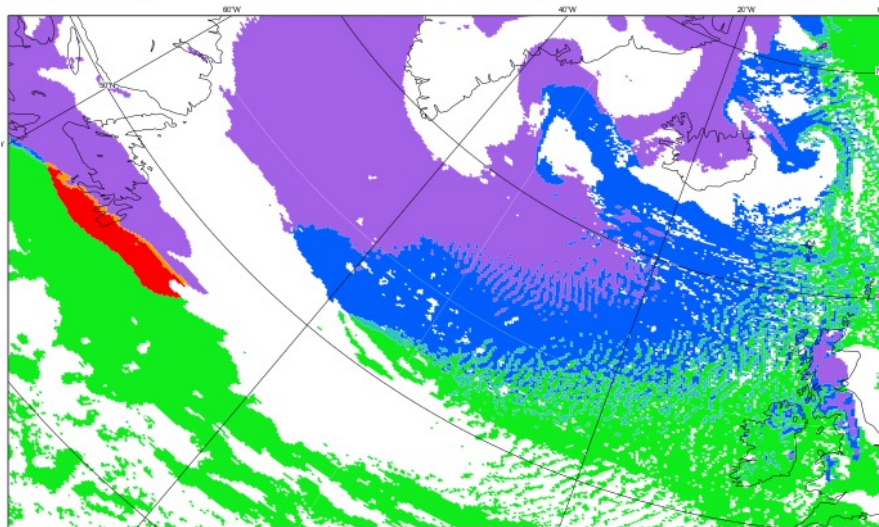
"Precipitation type" is only valid at the output time,

New parameters store the "**most frequent**" and "**most severe**" precipitation type occurrence in the last 1 hour, 3 hours or 6 hours, depending on forecast lead time.

6 new parameters:

**Precipitation type (most severe)** in the last 1/3/6 hours

**Precipitation type (most frequent)** in the last 1/3/6 hours



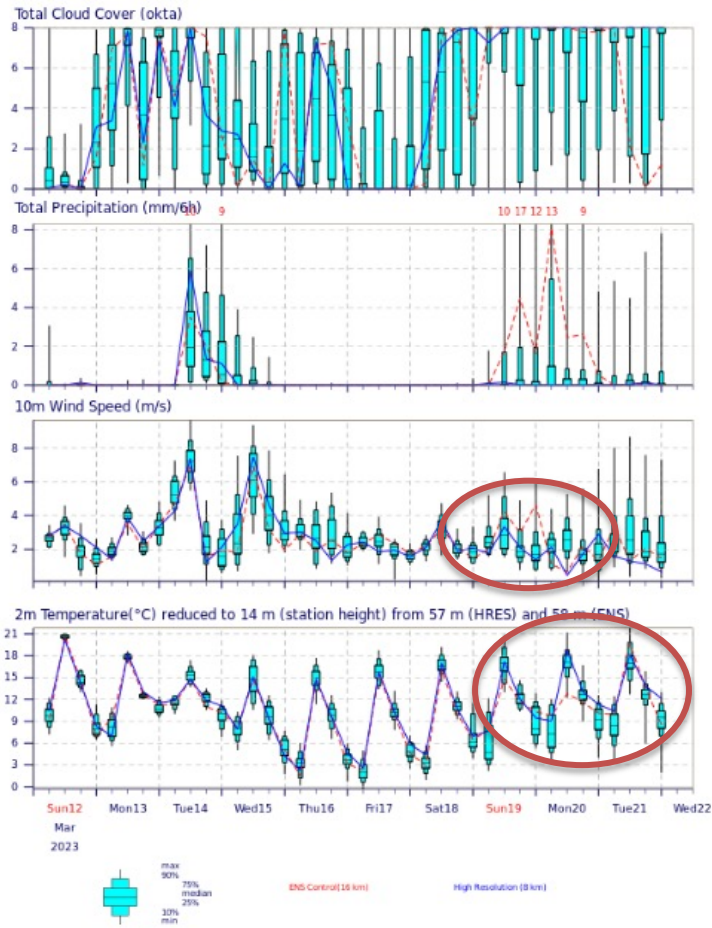
Precipitation types in the IFS and order of severity

Code	Precipitation Type	Severity
3	Freezing rain	7
12	Freezing drizzle	6
6	Wet snow	5
5	Snow	4
8	Ice pellets	3
7	Mixture of rain and snow	2
1	Rain	1
0	No precipitation	0

*New parameters*

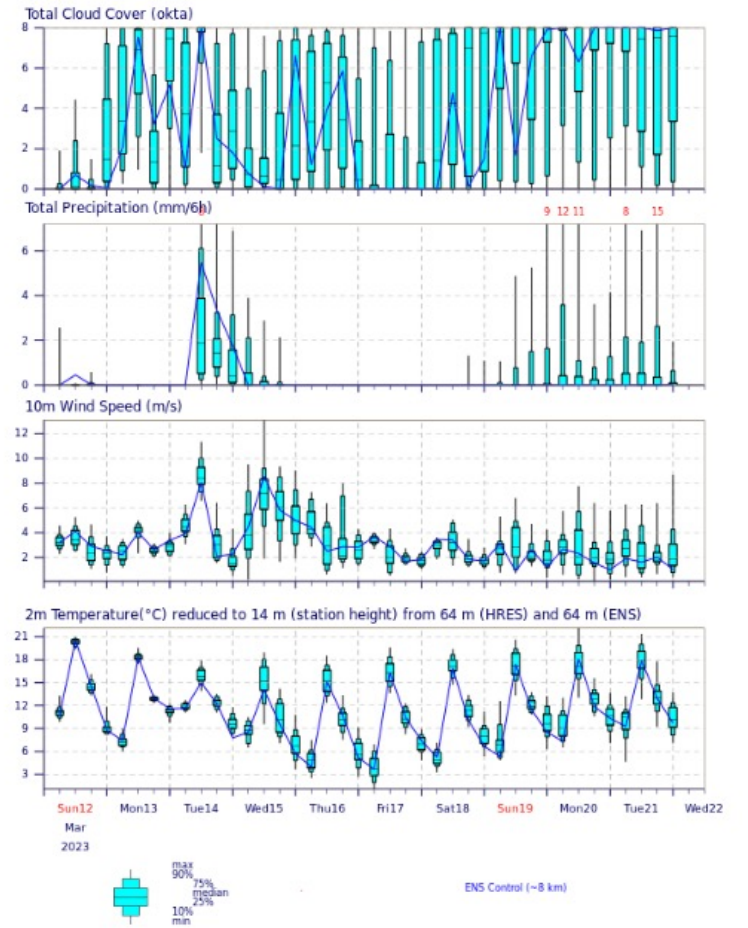
# 10-day meteograms

ENS Meteogram  
 Roma - Latium - Italy 41.96°N 12.49°E (ENS land point) 14 m  
 High Resolution Forecast and ENS Distribution Sunday 12 March 2023 00 UTC



ENS Meteograms

ENS Meteogram [0078]  
 Roma - Latium - Italy 41.93°N 12.43°E (ENS land point) 14 m  
 Control Forecast and ENS Distribution Sunday 12 March 2023 00 UTC



Prototype

ENS meteograms (Next model version - IFS cy48r1)

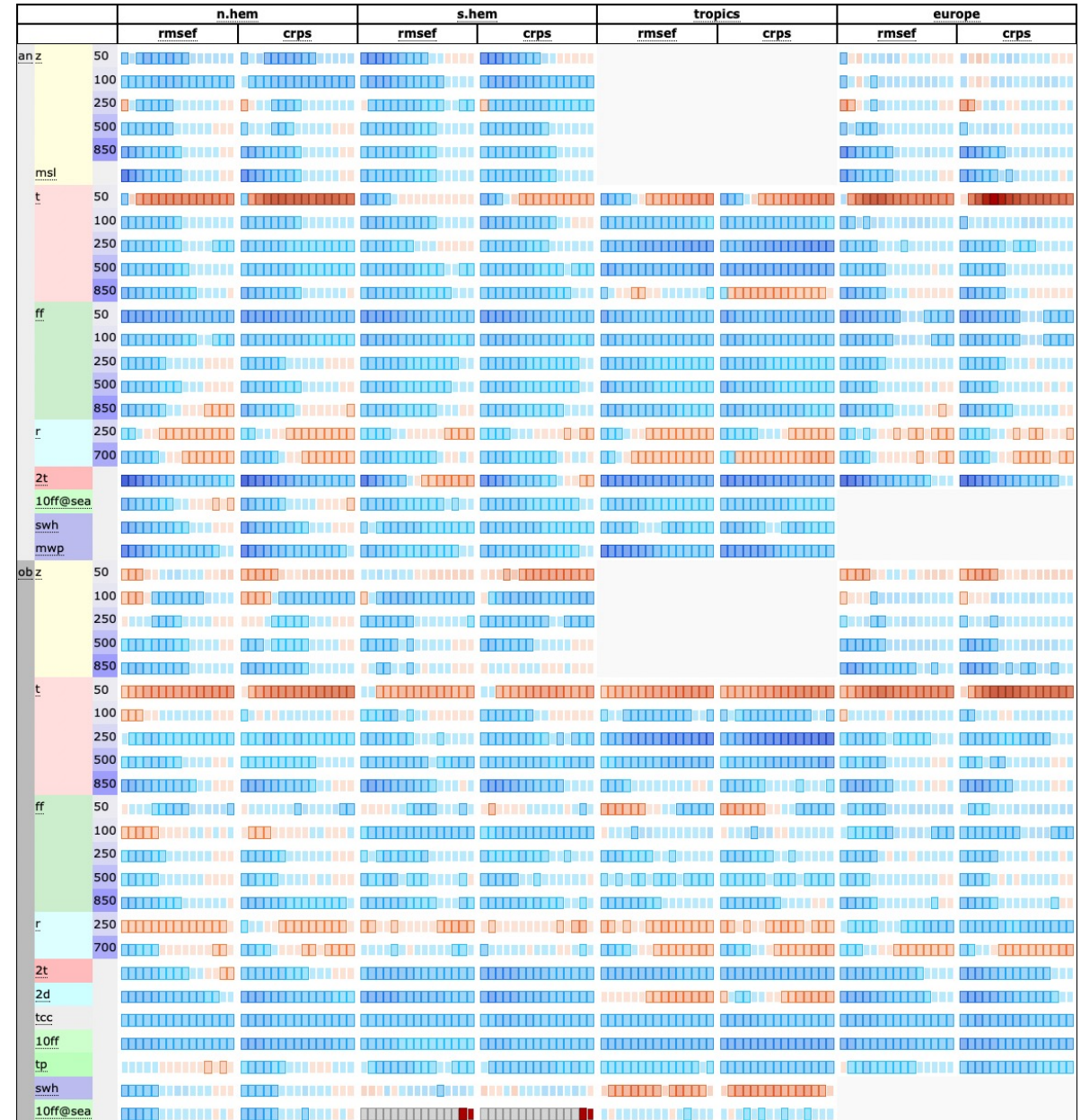
# Verification

# 48r1 latest ENS scorecard

e-suite

ENS 00Z

2020-06-02 – 2023-03-12 (~370 runs)



# 48r1 latest ENS scorecard

e-suite

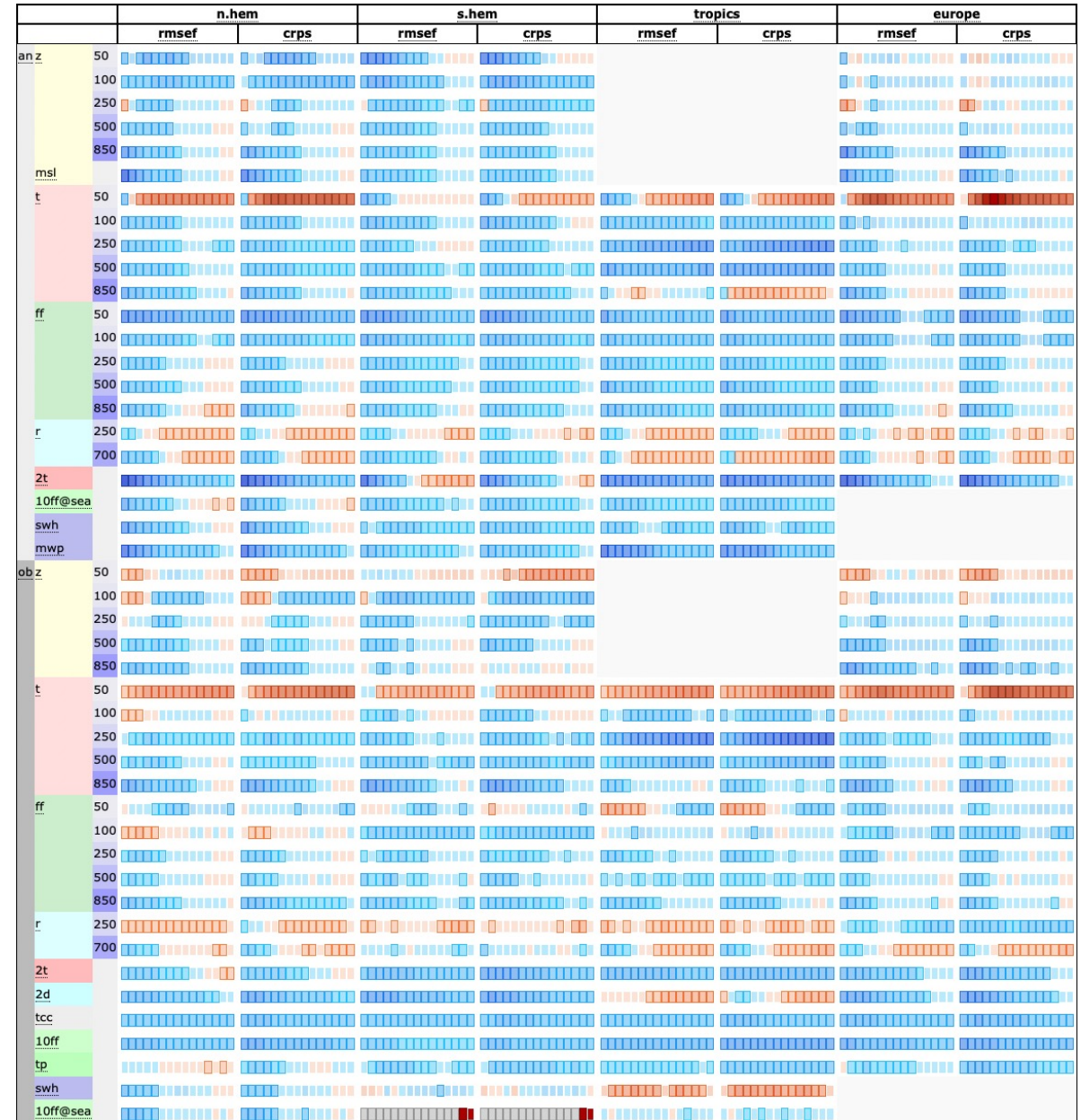
ENS 00Z

2020-06-02 – 2023-03-12 (~370 runs)

Verification against own analysis

Verification against observations

**red** = the experiment (esuite) **is worse** than the control.  
**blue** = the experiment (esuite) **is better** than the control.



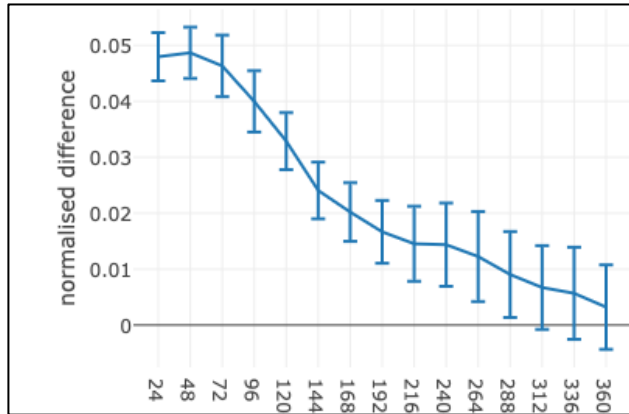


# 48r1 latest ENS scorecard

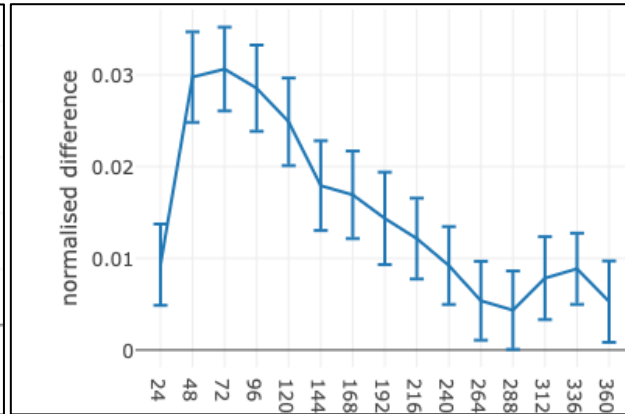
e-suite

ENS 00Z

2020-06-02 – 2023-03-12 (~370 runs)

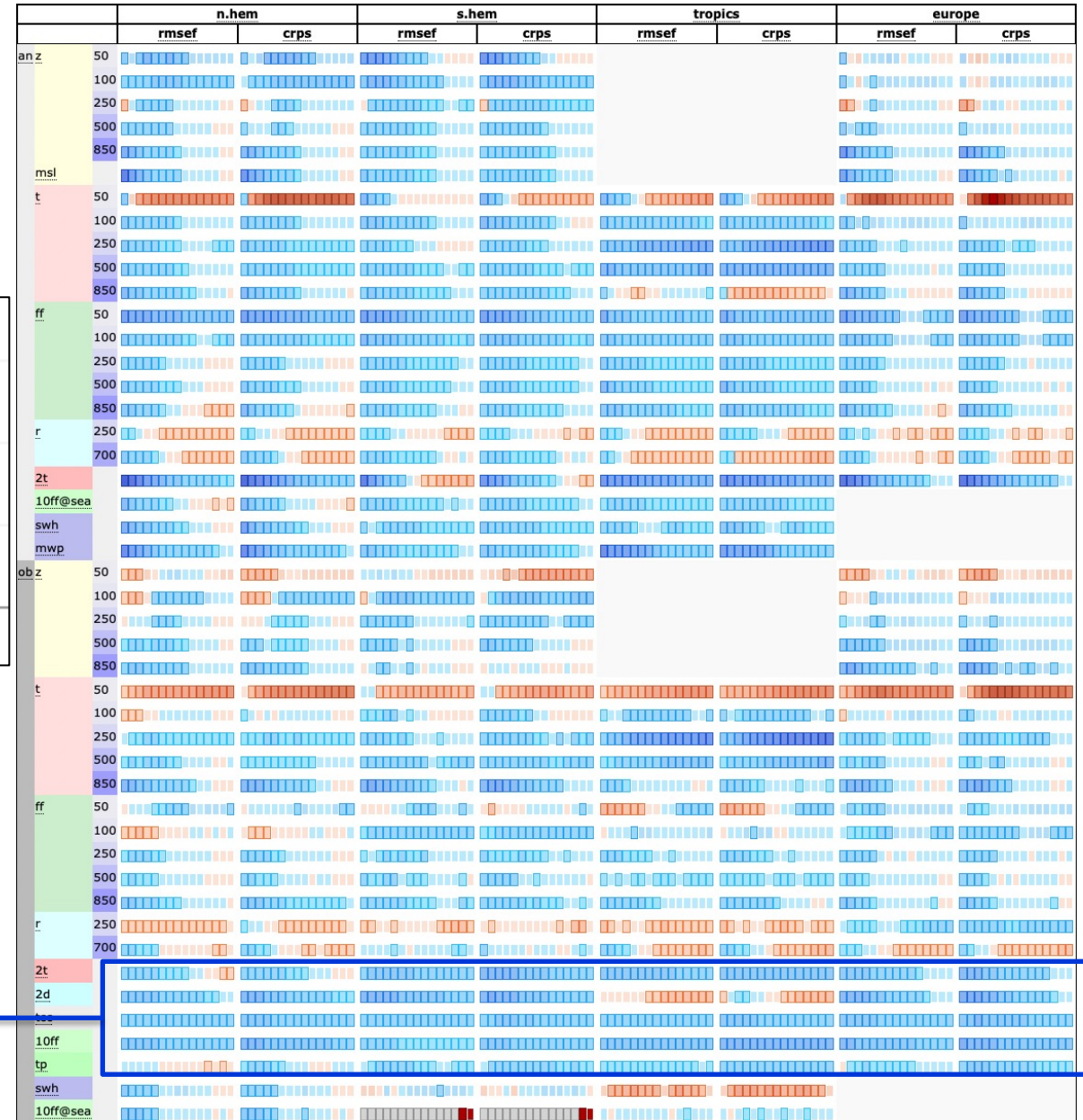


2m-Temperature,  
Europe, CRPS



Total precipitation,  
Europe, CRPS

Surface: mostly improved



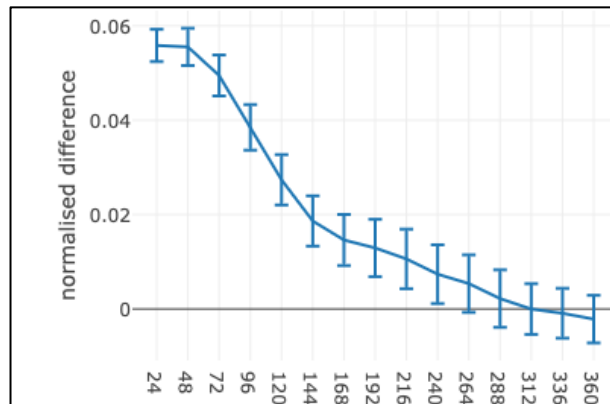
# 48r1 latest ENS scorecard

e-suite

ENS 00Z

2020-06-02 – 2023-03-12 (~370 runs)

**Tropospheric upper air: mostly improved**



T850, NHem, CRPS

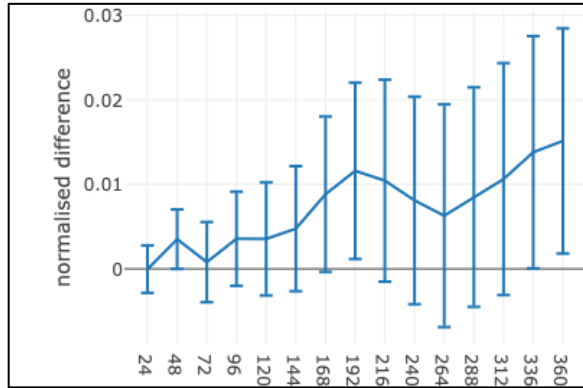


# 48r1 latest ENS scorecard

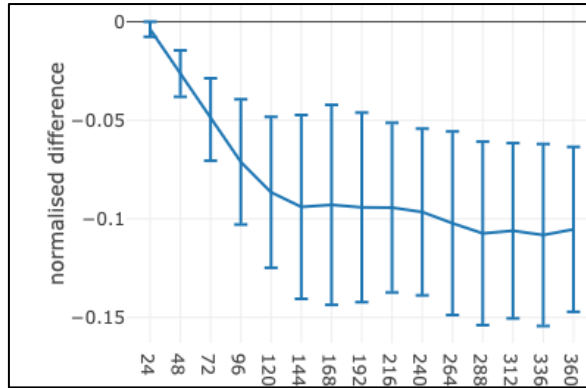
e-suite

ENS 00Z

2020-06-02 – 2023-03-12 (~370 runs)

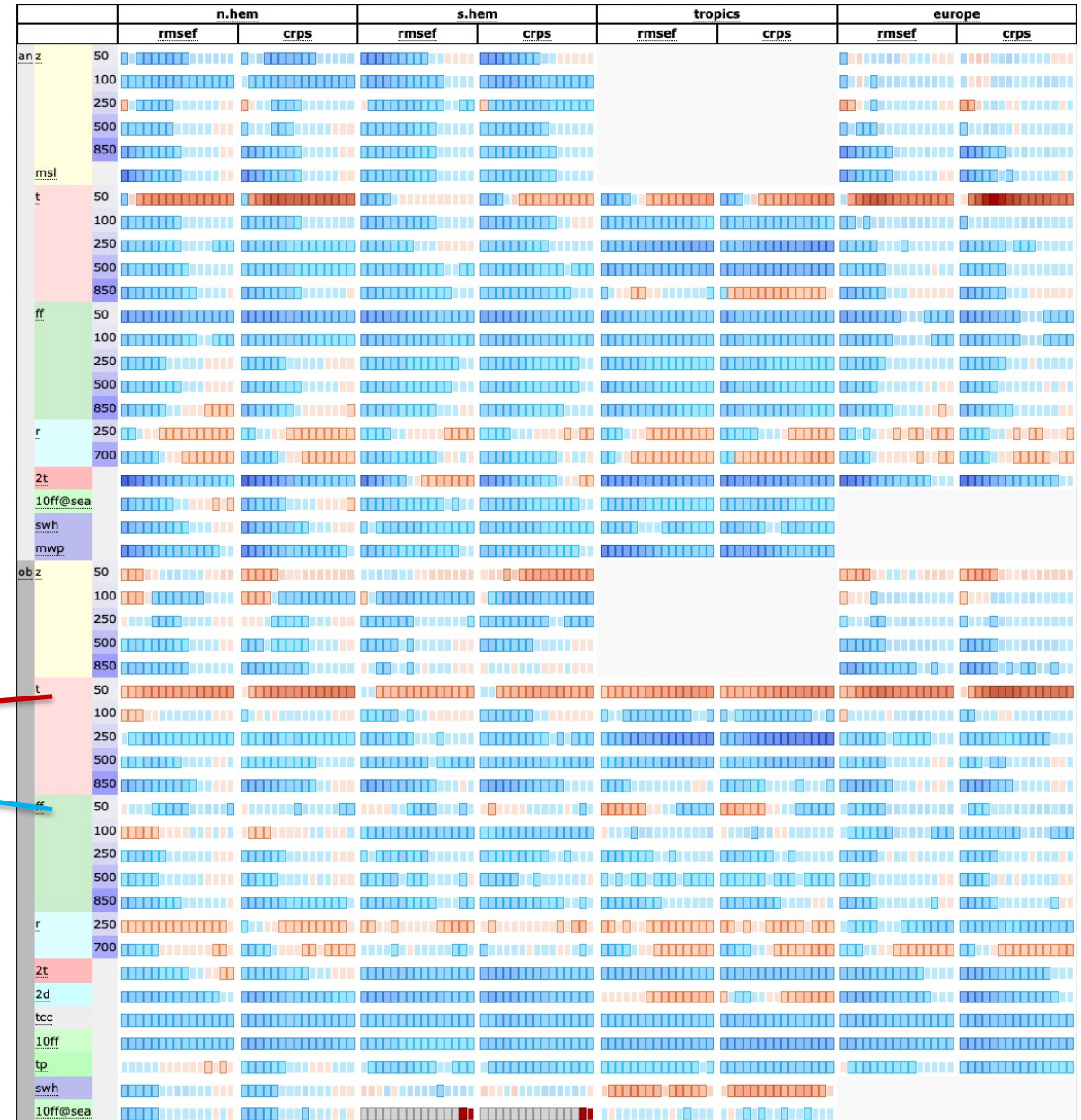


FF50, NHem, CRPS



T50, NHem, CRPS

**Stratospheric upper air:**  
improved winds, degraded  
temperatures

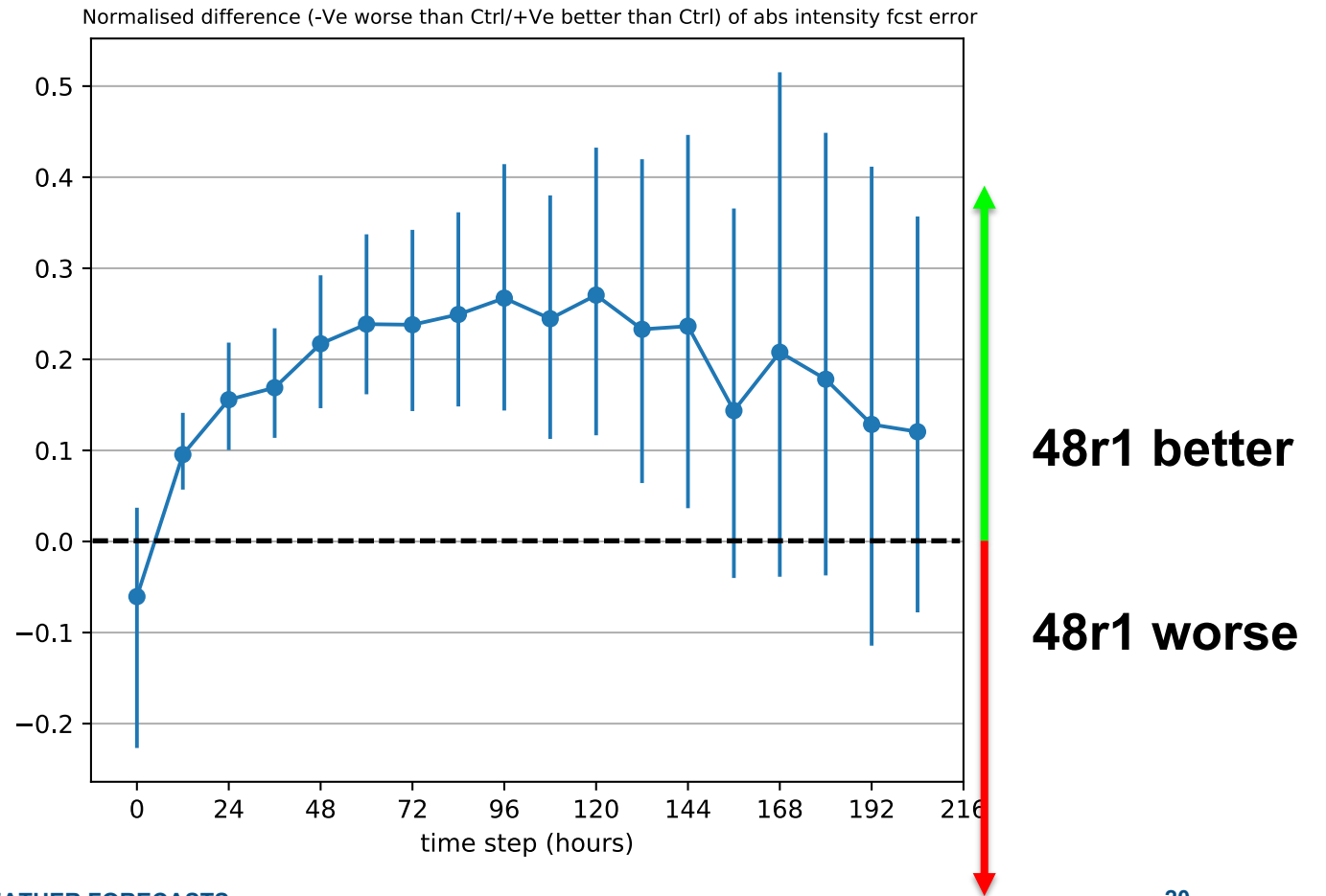
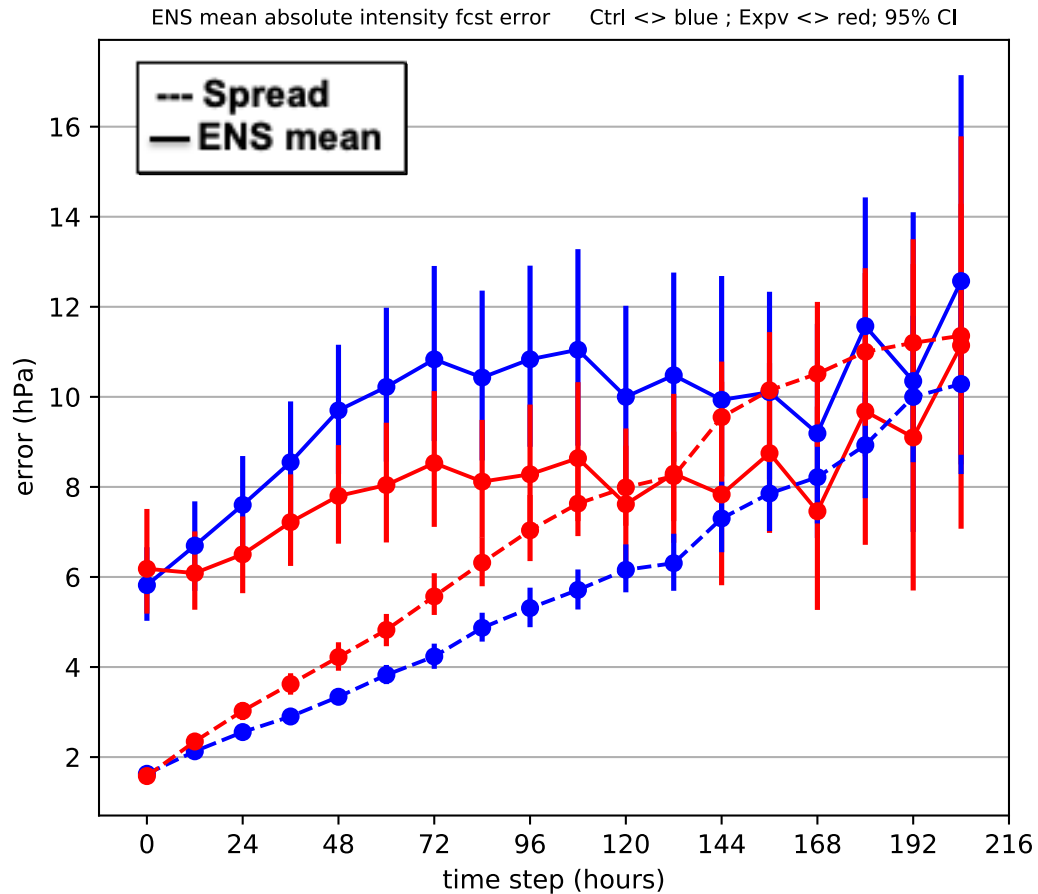


# 48r1 – ENS Tropical Cyclone forecasts

## Intensity

ENS mean absolute intensity error (hPa)  
**48r1/47r3**  
 Homogeneous samples;  
 All basins;  
 95% CI bootstrapping

- >20% improvement of EM mean abs errors;
- Underspread ENS for intensity

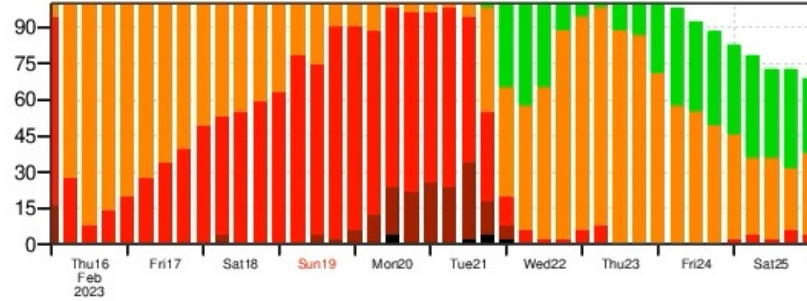


**OPER**

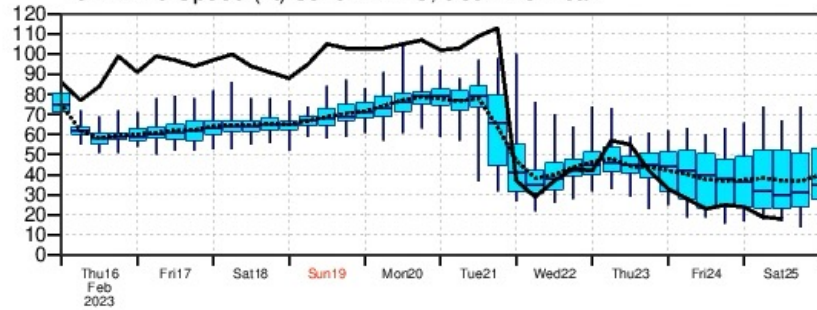
# FREDDY (07S) Forecast 16<sup>th</sup> Feb 2023 00Z

**48r1**

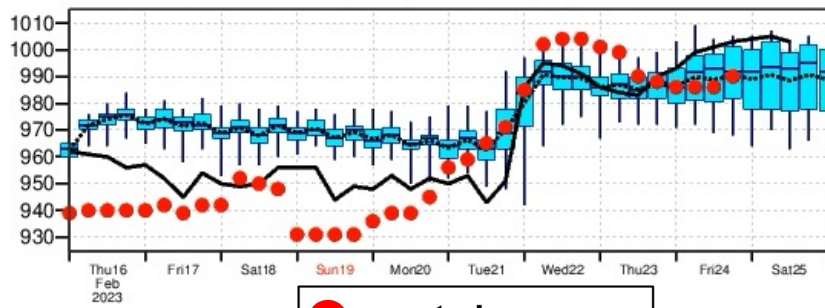
Probability (%) of Tropical Cyclone Intensity falling in each category  
TD [up to 33] TS [34-63] HR1 [64-82] HR2 [83-95] HR3 [> 95 kt]



10m Wind Speed (kt) solid=HRES; dot=Ens Mean

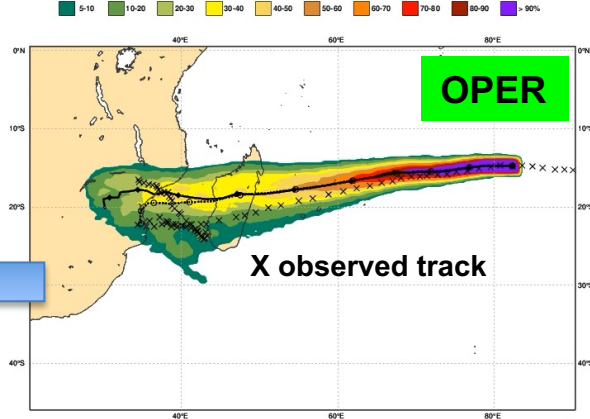


Mean Sea Level Pressure in Tropical Cyclone Centre (hPa) solid=HRES; dot=Ens Mean

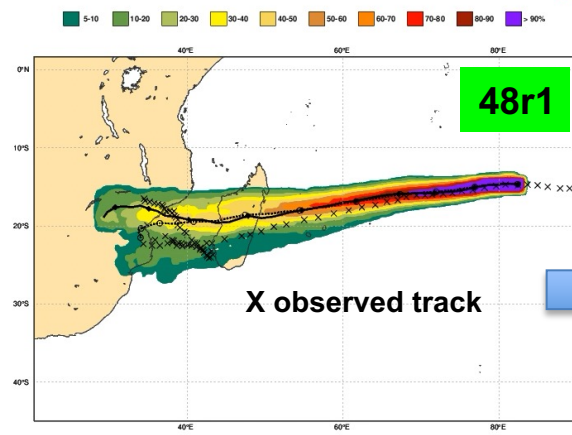


● reported pressure

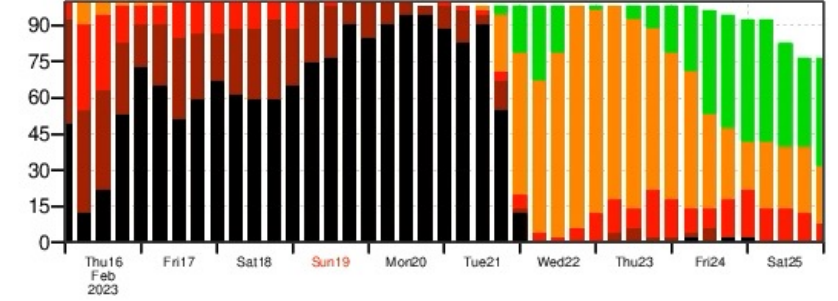
Date 20230216 00 UTC @ECMWF  
Probability that **FREDDY** will pass within 120 km radius during the next 240 hours  
tracks: solid=HRES; dot=Ens Mean [reported minimum central pressure (hPa) 939 ]



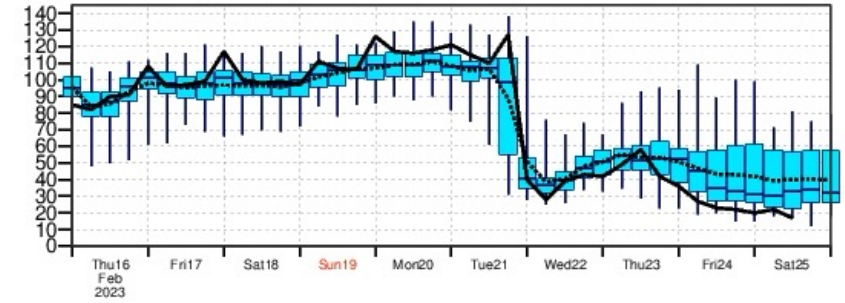
Date 20230216 00 UTC @ECMWF  
Probability that **FREDDY** will pass within 120 km radius during the next 240 hours  
tracks: solid=HRES; dot=Ens Mean [reported minimum central pressure (hPa) 939 ]



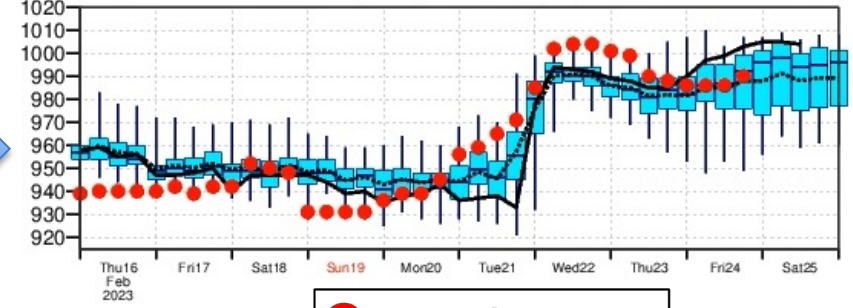
Probability (%) of Tropical Cyclone Intensity falling in each category  
TD [up to 33] TS [34-63] HR1 [64-82] HR2 [83-95] HR3 [> 95 kt]



10m Wind Speed (kt) solid=HRES; dot=Ens Mean



Mean Sea Level Pressure in Tropical Cyclone Centre (hPa) solid=HRES; dot=Ens Mean

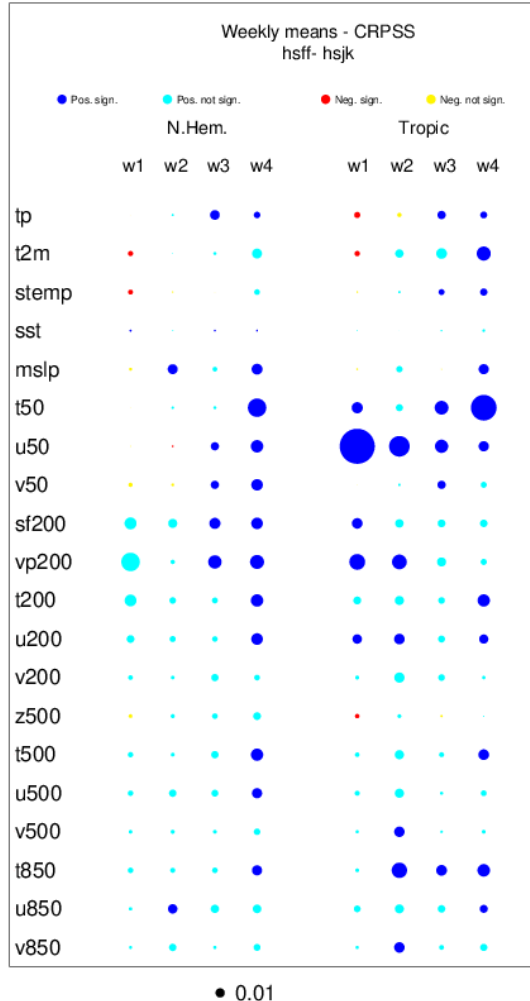


● reported pressure

# Change to Extended-range forecast configuration in 48r1

47r3

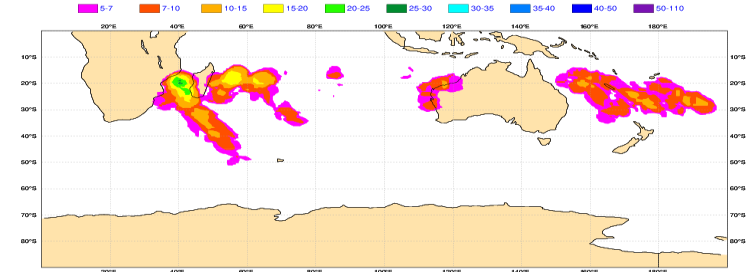
101-member Tco319 vs 51-member Tco639/Tco319 (“47r3-like”) experiments



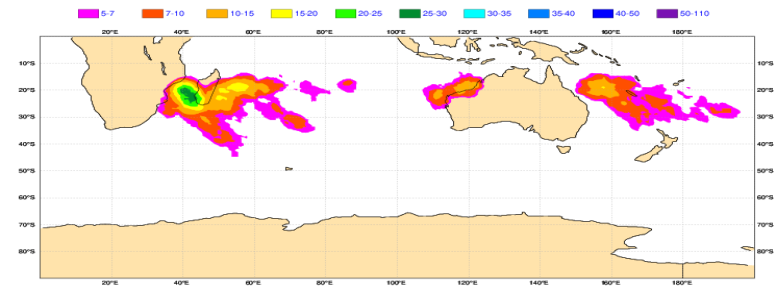
Positive impact for weeks 3 and 4, in addition to improvements due to more frequent forecasts and possibility of creating lagged ensembles

Tropical cyclone strike probability map – 7 January 2021 - Week 4

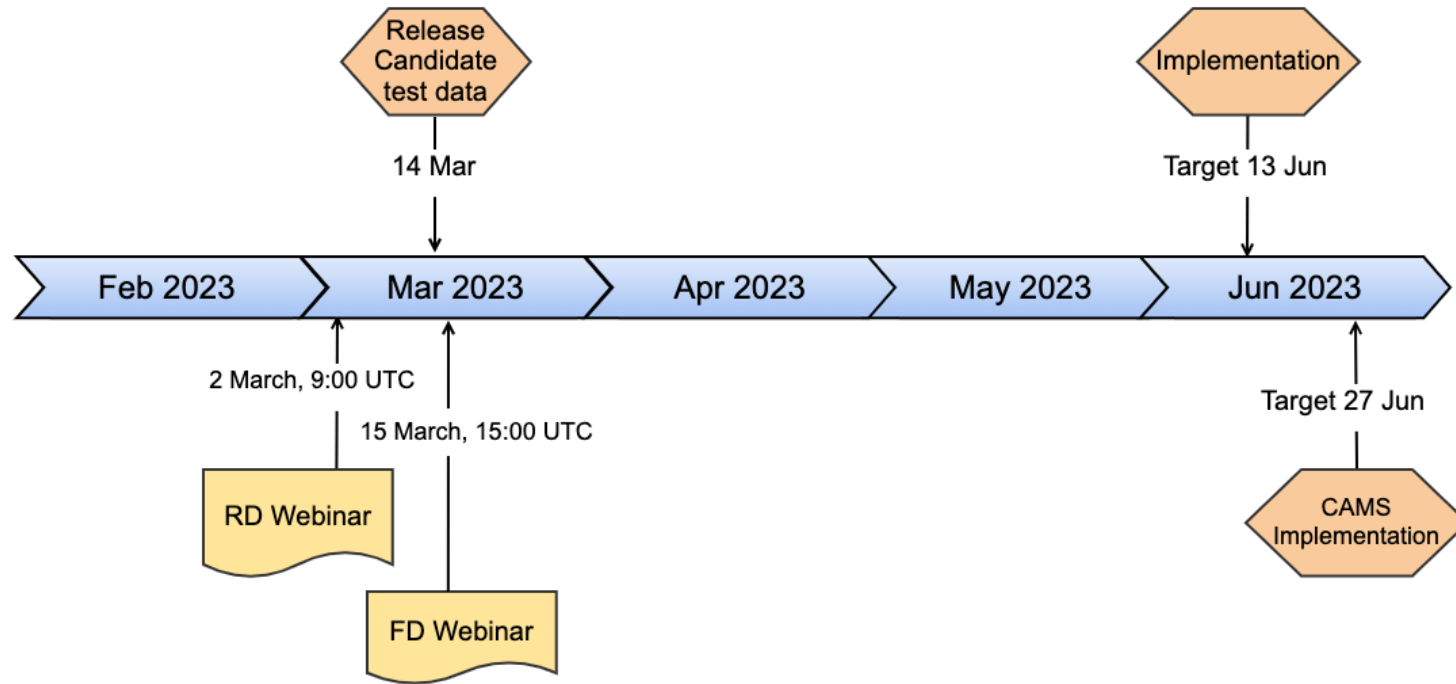
51 members



101 members



# Questions?



Matthieu Chevallier

Head of Evaluation

Florian Pappenberger

Director of Forecasts & Deputy Director-General

& all ECMWF staff

Release Candidate Phase started **14 March**

For details “Watch”: <https://confluence.ecmwf.int/display/FCST/Implementation+of+IFS+Cycle+48r1>

Edit

Save for later

Watching

Share

...