Contribution ID: 3c9ed473-4c1f-4579-9626-42d89ee66f72
Date: 14/05/2024 14:11:14

Green Book 2024 - aka Use and verification of ECMWF products in the Member and Co-operating States

Fields marked with * are mandatory.

Introduction

Welcome to ECMWF new "Green Book" online submission system (aka "Use and verification of ECMWF products in the Member and Co-operating States")

This time we have two options for completion:

- Filling out the online questionnaire below (new for this year based on feedback from the Meteorological Representatives meeting in November 2023)
- Producing a single report offline (as done in previous years), and emailing the report as detailed in Section 1.

Both methods ask the same questions, however the questionnaire method requires no formatting and aims to make analysis of all responses easier. The questionnaire option also allows you to part-complete, and save your entries to come back to later (using the "Save as Draft" button in the top right corner of this page). Note that the EUSurvey page will timeout after 60 minutes of no activity, responses are usually saved however to be sure please "Save as Draft" to avoid losing responses.

The deadline for all submissions is 23:59UTC on Wednesday 15th May 2024

A summary of responses will be presented at UEF2024 with a summary report available in the ECMWF Publications library in due course.

Section 1: Background - please fully complete

* **1.1 Which Country is your submission for?**

IT - Italy

* **1.2 Please provide your name(s)**

Alessandro Fuccello

* **1.3 Please provide your organisation**

Italian Air Force Met Service

* **1.4 Please select your preferred submission method:**

- ( ) Producing a single report offline
- (•) Online questionnaire

Online questionnaire

Please answer the following questions, and illustrate your answers, where appropriate, by also uploading clearly annotated images with image/figure numbers (max 1MB per file). More questions or options may appear, depending on answers to particular questions. Mandatory questions are marked with a '*'. Free text boxes appear to have a 5000 character limit (if your answers are longer than this please email them to Becky and they will manually added), answers don't need to fit the box size given, the boxes expand.

Responses to the questionnaire can be saved and returned to at a later date before submitting. To do this click the 'Save as Draft' button on the left, this will provide you with a link which you can return to to continue /complete your submission.

Section 2: Summary of major highlights

* **Please detail major highlights since January 2022**

You may wish to complete this section at the end, after completing all others**.**

- The importance of using the product ‘Point Rainfall’ (95% percentile), ‘probabilities of freezing rain’ and other products with zoom on ecCharts for civil protection purposes;

- The importance of using mean wave period, direction and height just as significant wave height both for this and for total swell and other products in order to support with forecast the track of Wheel On the World campaign and other project;

- The increase of importance and familiarity by operative meteorologists about monthly forecast due to the possibility to find monthly charts every day.

- The importance of using a lot of products all over the world, expecially in complex and remote regions such as Antarctic region, where Italian Air Force Met Service provides aeronautical meteorological support in Terranova and Ross Sea areas.

Section 3: Forecast products

3.1. Please outline what direct use you make of standard ECMWF model products (on ecCharts / OpenCharts / own workstation), for operational duties, in the following 4 categories (noting that new AI model output should be dealt with separately, via question 3.4).

*** a) Medium Range (e.g. for high impact weather forecasting)**

High impact weather forecasting; aeronautical meteorology; maritime meteorology; synoptic maps production; media forecast activities.
in particular
We find useful the products called:
- 'point rainfall' (95% percentile) on ecCharts in order to forecast weather extreme events such as flash floods;
- 'EFI index' for total precipitation extreme forecast and total precipitation shift of tail SOT index at quantile 90;
- 'probabilities of freezing rain' > 0.2 mm combined 'precipitation type'and model orography as background;
- 'probabilities of visibility ≤ 5000 metre combined with 'probabilities of visibility ≤ 1000 metre;
- 'spaghetti plot of fronts' to detect the different type of front when plotting the forecast chart +24H, +36H, +48,+ 60H;
-lot of products all over the world, expecially in complex and remote regions such as Antarctic region, where Italian Air Force Met Service provides aeronautical meteorological support in Terranova and Ross Sea areas.

*** b) Extended Range (monthly)**

producion of 4 weeks forecasts published on our istitutional website (once a week). we use ECMWF Charts catalogue
https://www.meteoam.it/it/previsioni-mensili
We find useful the products called:
- 'weather regimes probabilities' – ensemble forecast to understand the type of weather circulation;
- Hovmöller Diagram to display the propagation of mid-tropospheric ridges and troughs;
- 500 hPa height: weekly mean anomalies;
- Precipitation: weekly mean anomalies;
- Surface temperature: weekly mean anomalies;
- Cluster scenario / 500 hPa Geopotential until T+360;
- Mean zonal wind at 10 hPa to understand the possible stratwarming events.

*** c) Long Range (seasonal)**

we use long range forecasts in order to provide an outlook to Italian Civil Protection mainly for extreme weather events probability (heat waves, drought....), during periodic meetings.

*** d) CAMS and Fire-related output (ecCharts mainly)**

not used

3.2. ECMWF cycle 48r1 went live at the end of June 2023. Changes included a much higher resolution medium range ensemble, and much more frequent monthly forecasts.

* **a) Please describe any positive impacts of model cycle 48r1 for your service**

We find it useful because there is a Monthly FCST run every day and the accuracy of the monthly forecast is greater, especially for the second week where we can find more detail for every run. Besides the possibility to have the charts every day increase the familiarity of operative meteorologists with these products because previously they only focused on them only on Tuesday and Friday.

If you have any annotated graph/diagram/plot that would help clarify your answer to the previous question, please upload here.
File types: most accepted, File Size: max 1MB per file.

* **b) Please describe any negative impacts of model cycle 48r1 for your service**

no significant impacts

If you have any annotated graph/diagram/plot that would help clarify your answer to the previous question, please upload here.
File types: most accepted, File Size: max 1MB per file.

* **c) Have you noticed any systematic changes in forecast output since model cycle 48r1 was implemented?**

- ○ Yes
- ◉ No

* **3.3: Do you modify ECMWF model output to create 'derived fields' (e.g. post-processed output, regimes, probabilities).**

- ◉ Yes
- ○ No

Please describe what you modify and how

The Metview modules FLEXTRA and FLEXPART are used to code 00 and 12 UTC ECMWF atmospheric model runs (from ECMWF dissemination system) and to trace contaminants dispersion in case of nuclear and chemical incident/accident.
Meteorological CBRN messages as well are generated and distributed according to NATO directives and other agreements.

If you have any annotated graph/diagram/plot that would help support your answer to the previous question, please upload here.
File types: most accepted, File Size: max 1MB per file.

* **3.4: Do you currently use Artificial Intelligence (AI) and/or Machine Learning (ML) techniques in your service, in conjunction with standard ECMWF model output?**

- ○ Yes
- ◉ No

* **3.5: Does your NMHS use ECMWF data for modelling purposes - e.g. by providing initial/boundary conditions for limited area model runs, or for hydrological models, or for dispersion models, etc...**

- ◉ Yes
- ○ No

Please describe these activities

For the COSMO-ME (Euro-mediterranean domain) deterministic run are currently used the BC from the 6hour
older HRES run up to +84hours.
For the COSMO-ME EPS run are currently used the BC from 20 randomly selected members from the 6 hours older EPS run up to +84hours.
For the COSMO-IT/ICON-IT (italian domain) deterministic run are currently used the BC from the 6hour older HRES run up to +60hours.
For the COSMO-IT EPS run are currently used the BC from 20 randomly selected members from the 6 hours older EPS run up to +84hours.
For the LETKF data assimilation cycle (first guess production) are currently used as BC the 6 hours older HRES run perturbed using 40 randomly selected members from the 6 hours older EPS run up to +12hours.
For the 3DVAR analysis cycle (first guess production) are currently used as BC the 6 hours older HRES run up to +12hours.

If you have any annotated graph/diagram/plot that would help support your answer to the previous question, please upload here.
File types: most accepted, File Size: max 1MB per file.

* **3.6: In the last year or so ECMWF has made available, on ecCharts and OpenCharts, selected fields from AI models (e.g. Pangu Weather, AIFS). Were you aware of this?**

- ◉ Yes
- ○ No

* **a) What are your views on this initiative?**

we consider this initiative very useful and interesting concerning future developments of new technologies apllied in meteorological fields

* **b) Do you currently use AI forecasts for operational purposes?**

- ○ Yes
- ◉ No

What would you need in order to use AI models in your forecast activities?

Section 4: Verification

ECMWF does extensive verification of its products in the free atmosphere. However, our verification of surface parameters is more limited and can be constrained to only using synoptic observations. More detailed verification of these surface weather parameters by National Services is always valuable to us. We are most interested in results for the last 1 or 2 years. Also, any evidence you have of performance changes since the introduction of cycle 48r1 would be very valuable.

* **4.1 Do you routinely verify raw model output from ECMWF model(s) and/or other operational models /ensembles?**

- ◉ Yes
- ○ No

Please describe your verification activities and show and discuss related scores in the the two lead-time categories shown below, including, where possible, comparisons with your own models /ensembles, and other models/ensembles.
Ideally focus on surface weather parameters in your own territory. Inclusion of conditional verification results is also strongly encouraged - e.g. stratification by a weather type - as these can provide very useful insights into model weaker points.

a) Short Range and Medium Range

Objective scores are computed for ECMWF HRES 00 UTC run (d+1 to d+7) after collecting data retrieved from all available Italian Synop stations, using several stratifications. Plots have been produced for a number of parameters: 2m Temperature, 2m Dew Point Temperature, 10m Wind Speed, MSLP, Total Cloud Cover (ME, MAE, RMSE).
Cumulated precipitation quarterly event scores (POD/FAR, FBI, ETS) with respect to fixed thresholds and for d+1 to d+7 ranges, are computed.
For this report, data covering the 2-year period from MAM 2022 to DJF 2024 have been used for the verification of these parameters and only some selected results are presented in the next pages (see Appendix A), for ECMWF HRES 00 UTC run only.
In order to compute the scores, no interpolation from grid point to observation location is performed. The

“nearest point” method is used, optimized by the “smaller” difference in altitude combined with the horizontal distance between a station and the corresponding grid point. The reference software used for verification purposes is called VERSUS (VERification System Unified Survey), i.e. the former official software used within COSMO model consortium as Common Verification Suite (CVS). The VERSUS system has been developed at Air Force Met service and it is based on DB architecture with a GUI.
A short note on the results is given below.
10m Wind Speed: a general small underestimation is shown in ME, less than 0.7 m/s in absolute value. MAE increases with the forecast time and its values are mainly comprised between 1.4 and 2.1 m/s. RMSE increases with the forecast time and its values are mainly comprised between 2.0 and 2.8 m/s.
2m Temperature: clear diurnal cycle in ME, MAE and RMSE, especially in winter. A general underestimation is shown in ME, especially during the night; some overestimation attitude is present in summer for higher steps. MAE increases with the forecast time and its values are mainly comprised between 1.4 and 2.8 K. RMSE increases with the forecast time and its values are mainly comprised between 2.4 and 4.0 K.
12-h Cumulated Precipitation: regarding the bias (FBI) ECMWF model shows an overestimation for all the seasons for lower thresholds, while tends to underestimate the really higher ones. The discriminant threshold (i.e. FBI = 1) ranges, for example, from 02-10 mm/12h in Summer 2023 to 15-35 mm/12h in Fall 2022 (with a general worsening above 30-35 mm/12h). About the accuracy (ETS), all seasons exhibit the best results mainly for low thresholds and for the first 3-4 days of integration. For all thresholds there is a gradual decrease in accuracy with the integration time.

ECMWF model output compared to other NWP models

ECMWF HRES 00-UTC scores (ETS, FBI) for 12 hours cumulated precipitation have been calculated and graphically compared to those for the 00 UTC run of COSMO-ME model (5 Km resolution) up to step +72h over the italian synop stations. Results are shown in the Appendix A.
Respect to the FBI scores, COSMO-ME and ECMWF HRES show a similar tendency, with an overestimation for the lower thresholds and a general underestimation for the higher thresholds; COSMO-ME model shows better values that are lower and closer to 1 (e.g. for thresholds < 5 mm/12h around 0.6-2.0 in Summer 2022, 1.1-1.5 in Fall 2022, 1.1-1.4 in Winter 2022-23, 1.2-1.8 in Spring 2023) respect to the ECMWF model (e.g. for thresholds < 5 mm/12h around 0.7-3.0 in Summer 2022, 1.1-2.0 in Fall 2022, 1.1-2.0 in Winter 2022-23, 1.3-2.3 in Spring 2023) and more costant in function of the thresholds (at least up to 18-20 mm) . Accuracy, represented here through ETS score, tends to be similar, except for lower thresholds, for both models, for all seasons, showing a behaviour similar to that recorded in previous years.
A further comparison between the two models has been done in terms of mean error and root mean square error (ME,RMSE) for 2m temperature and 10m wind speed.
Results show a tendency of COSMO-ME to overestimate the 2m Temperature in Summer 2022/2023, in Spring 2022 and, for some time steps, in Fall 2022, opposite to the IFS behaviour; for Winter 2022-23 and 2023-24 both models have an underestimation attitude, with a counterphased trend, for the mean error; for Spring 2023 COSMO-ME has a ME close to zero, with a slight overestimation attitude, while it is present a negative bias for ECMWF. Looking at the 10m Wind Speed comparison COSMO-ME model seems to slightly outperform the IFS in terms of ME, especially during daytime, except for Winter 2022-23, where the parameter is pretty similar for both models.

If you have any annotated graph/diagram/plot that would help support your answer to the previous question, please upload here.
File types: most accepted, File Size: max 1MB per file.

4341c4db-bc93-4407-b09b-20c6e2b66ff4/pagine_grafici_MAM2022-DJF2024.pdf

b) Extended Range (Monthly) and Long Range (Seasonal)

no verifications are made

If you have any annotated graph/diagram/plot that would help support your answer to the previous question, please upload here.
File types: most accepted, File Size: max 1MB per file.

* **4.2 Do you routinely verify post-processed products and/or tailored products delivered to users?**

- ○ Yes
- ◉ No

* **4.3 Do you perform any subjective verification of forecasts?**

- ◉ Yes
- ○ No

Please describe and illustrate any activities and results in this area

we make case studies, mainly for severe weather events (see 4.4), with subjective evaluation of the model performance.
we routinely verify TAFs for all military airports: see exemple concerning 2024 march

If you have any annotated graph/diagram/plot that would help support your answer to the previous question, please upload here.
File types: most accepted, File Size: max 1MB per file.

b644ed84-64a9-4912-a8bd-0d86ba5dd630/TAF_verification_Italy_Military_Airport.JPG

4.4: Case Studies. Please describe and illustrate any case study verification you have undertaken. Examples of both good and bad model performance are welcome. Severe weather events (and non-events) are of particular interest to us.

a) Case Study 1 - Please describe the forecast(s) and what happened

Emilia Romagna Flood 16-17 May 2023: a wide area with more than 200 mm/24 h. A deep mediterranean cyclone moving from south Italy to Adriatic Sea

If you have any annotated graph/diagram/plot that would help support your answer to the previous question, please upload here.
File types: most accepted, File Size: max 1MB per file.

aec65f25-be39-4f76-aa28-6074958e8ff6/Emilia_Romagna_Flood_16-17_may_2023.pdf

Case Study 1 is an example of:

- ○ Good model performance
- ○ Bad model performance
- ◉ Mixed (good and bad) model performance
- ○ Other (please describe above)

Add another Case Study?

- ◉ Yes
- ○ No

b) Case Study 2 - Please describe the forecast(s) and what happened

Cyclone Helios 10-11 february 2023 More than 350 mm/36h FCST Wind up to B13 over the Sea

If you have any annotated graph/diagram/plot that would help support your answer to the previous question, please upload here.
File types: most accepted, File Size: max 1MB per file.

0bfc12b5-8e6c-4cd5-9791-19d58a64ef8a/9-10_february_2023_Cyclone_Helios.pdf

Case Study 2 is an example of:

- ◉ Good model performance
- ○ Bad model performance
- ○ Mixed (good and bad) model performance
- ○ Other (please describe above)

Add a third Case Study?

- ◉ Yes
- ○ No

c) Case Study 3 - Please describe the forecast(s) and what happened

15th September 2022 Exceptional convective rainfall over Marche. Peak values: more than 400 mm / 8 hours

If you have any annotated graph/diagram/plot that would help support your answer to the previous question, please upload here.
File types: most accepted, File Size: max 1MB per file.

8b8062a0-c028-4685-ba90-0d729212a4ef/15_sept_2022_Marche.pdf

Case Study 3 is an example of:

- ○ Good model performance
- ◉ Bad model performance
- ○ Mixed (good and bad) model performance
- ○ Other (please describe above)

Add a forth Case Study?

- ◉ Yes
- ○ No

d) Case Study 4 - Please describe the forecast(s) and what happened

A list of severe convective events in Italy in 2023 July

If you have any annotated graph/diagram/plot that would help support your answer to the previous question, please upload here.
File types: most accepted, File Size: max 1MB per file.

f26b4b1b-d4ea-4e72-a8af-8da6fc3704f2/July_2023_Severe_thunderstorms_Italy.jpg

Case Study 4 is an example of:

- ◉ Good model performance
- ○ Bad model performance
- ○ Mixed (good and bad) model performance
- ○ Other (please describe above)

Add a fifth Case Study?

- ○ Yes
- ○ No

Section 5: Output Requests

5. Please describe, and illustrate if necessary, any particular requests you may have for new or modified ECMWF products.

a) Product request 1 - title / summary

Product request 1 - description of request

If you have any annotated graph/diagram/plot that would help support your answer to the previous question, please upload here.
File types: most accepted, File Size: max 1MB per file.

Add another Product Request?

- ○ Yes
- ◉ No

Section 6: References

6. Are there any recent internal or external publications that relate to the questions in this survey? Please list them including the respective link/s. For any publications that cannot be readily downloaded via a link please attach a copy below (or email Becky Hemingway (becky.hemingway@ecmwf.int) and Tim Hewson (timothy.hewson@ecmwf.int) if too large to upload here).

If you have any annotated graph/diagram/plot that would help support your answer to the previous question, please upload here.
File types: most accepted, File Size: max 1MB per file.

Section 7: Additional comments and Feedback

7.1. Please use the box below if you have additional comments on topics that have not been covered in any of the questions above

If you have any annotated graph/diagram/plot that would help support your answer to the previous question, please upload here.
File types: most accepted, File Size: max 1MB per file.

7.2. This is the first time we have used a survey style structure for Green Book submissions. You thoughts and feedback on this process are very welcome

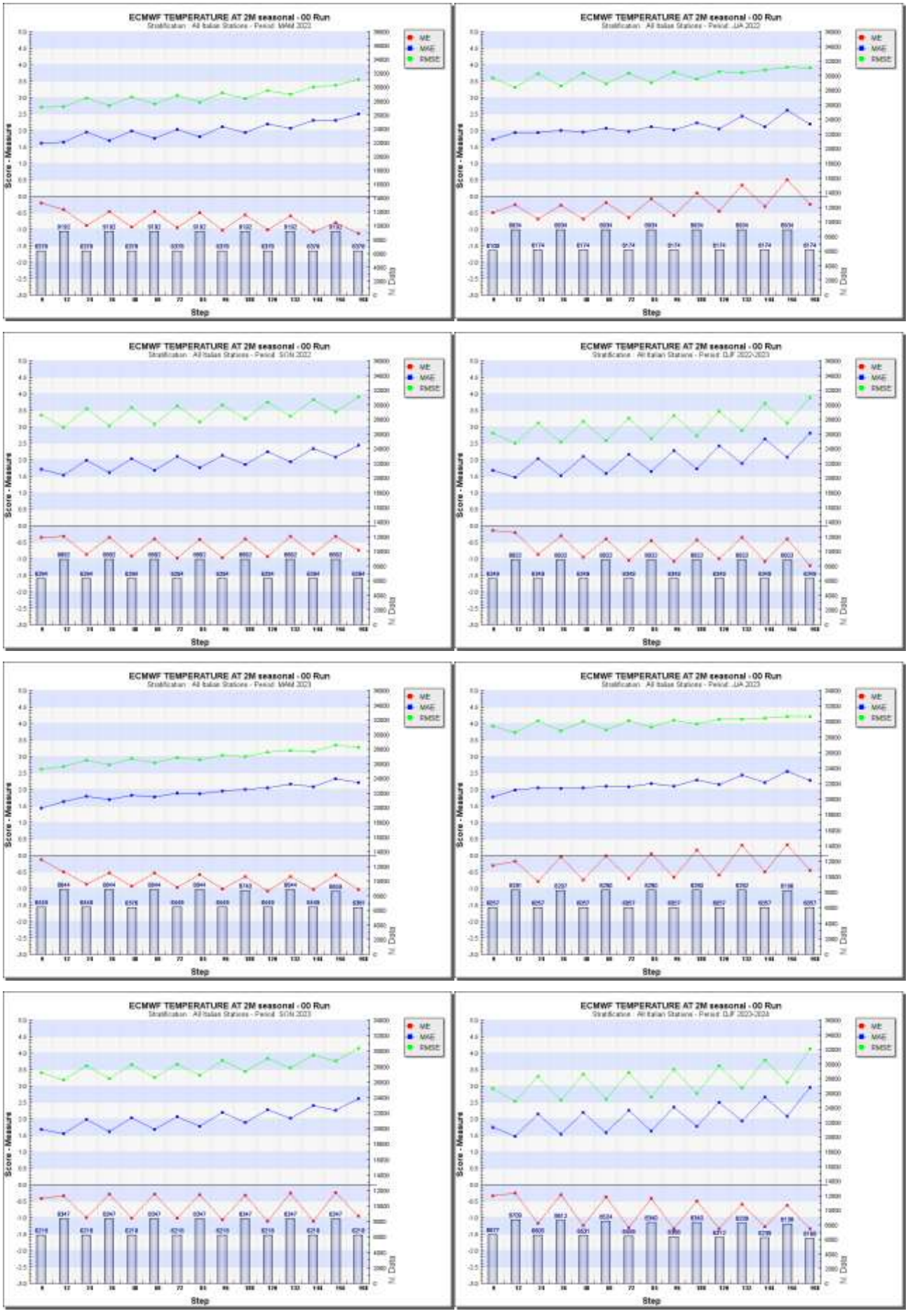
Thank you for taking the time to complete your Green Book report. Your feedback and comments are very valuable to us!

Contact

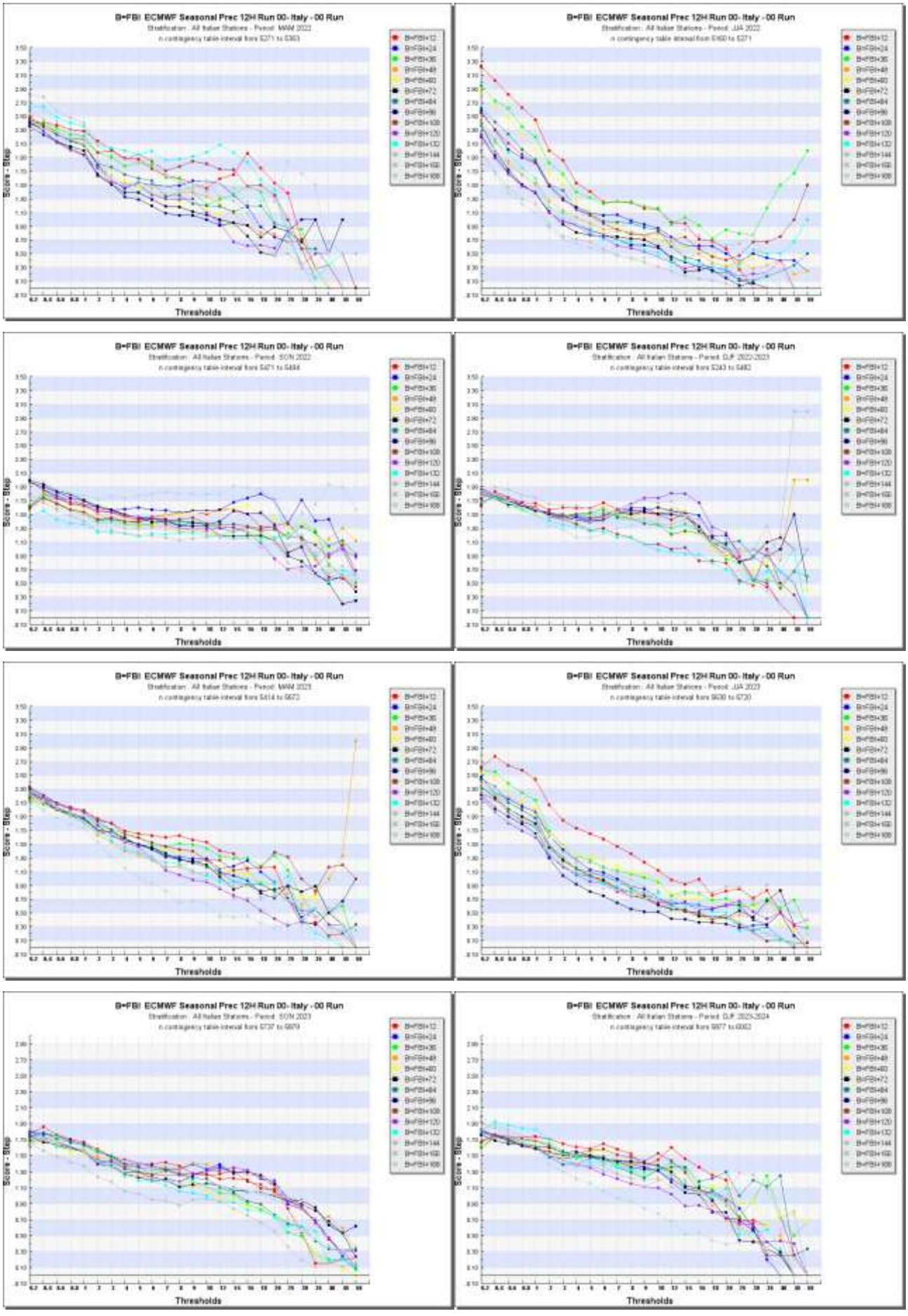
Contact Form

IFS 10m Wind Speed (Mean Absolute Error, Mean Error and Root MSE)

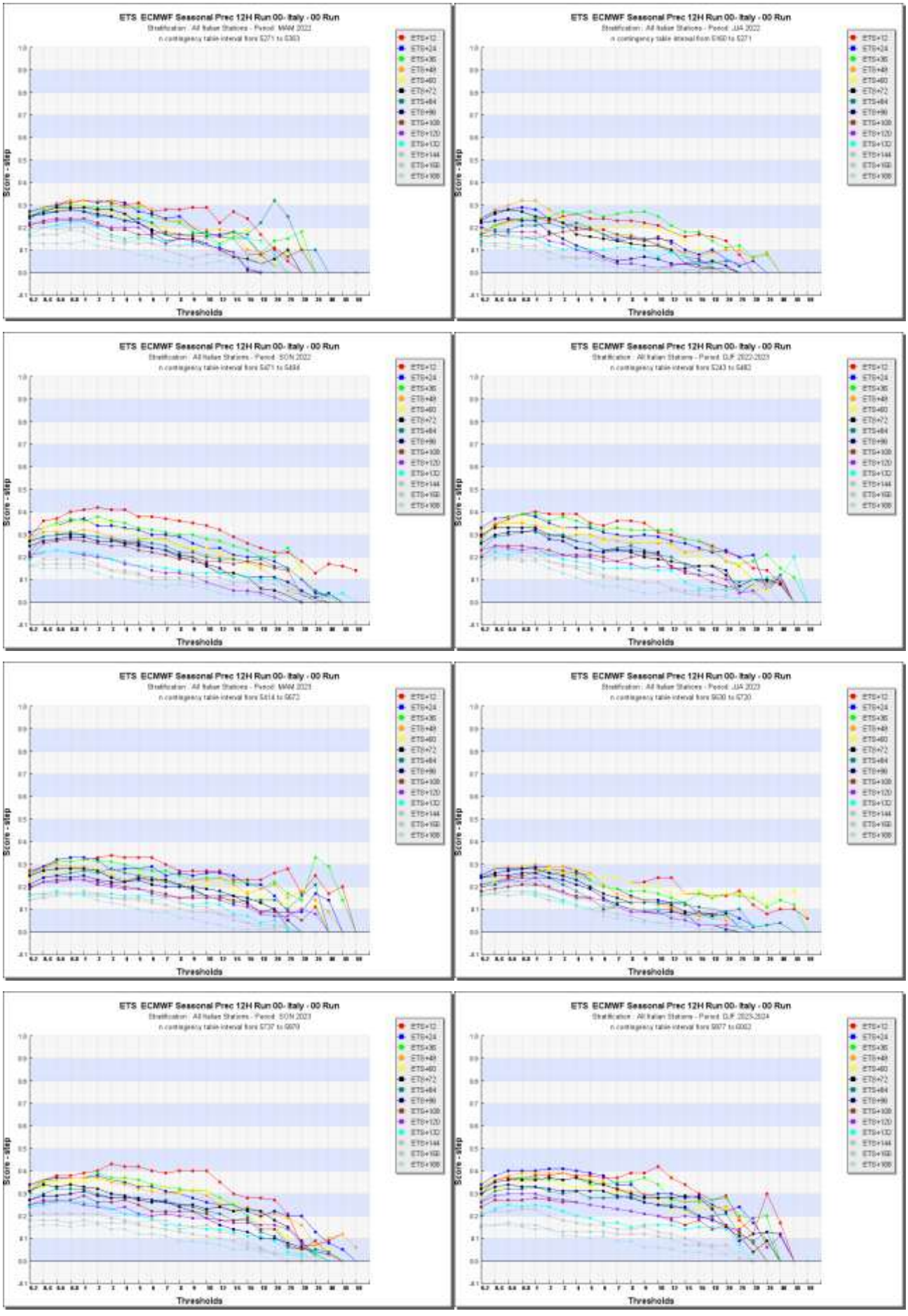
IFS 2m Temperature (Mean Absolute Error, Mean Error and Root MSE)



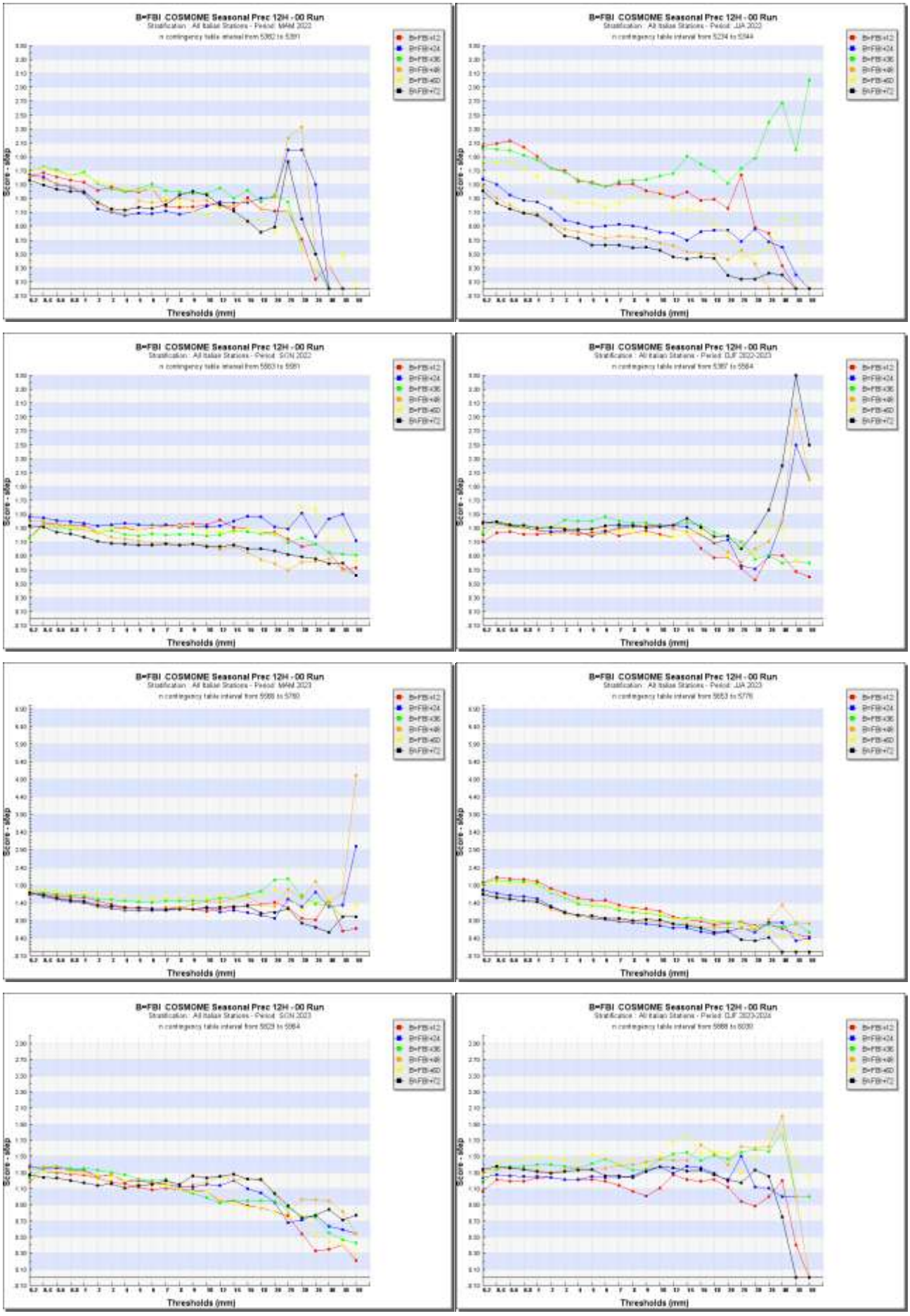
IFS Precipitation in 12 hours - FBI score



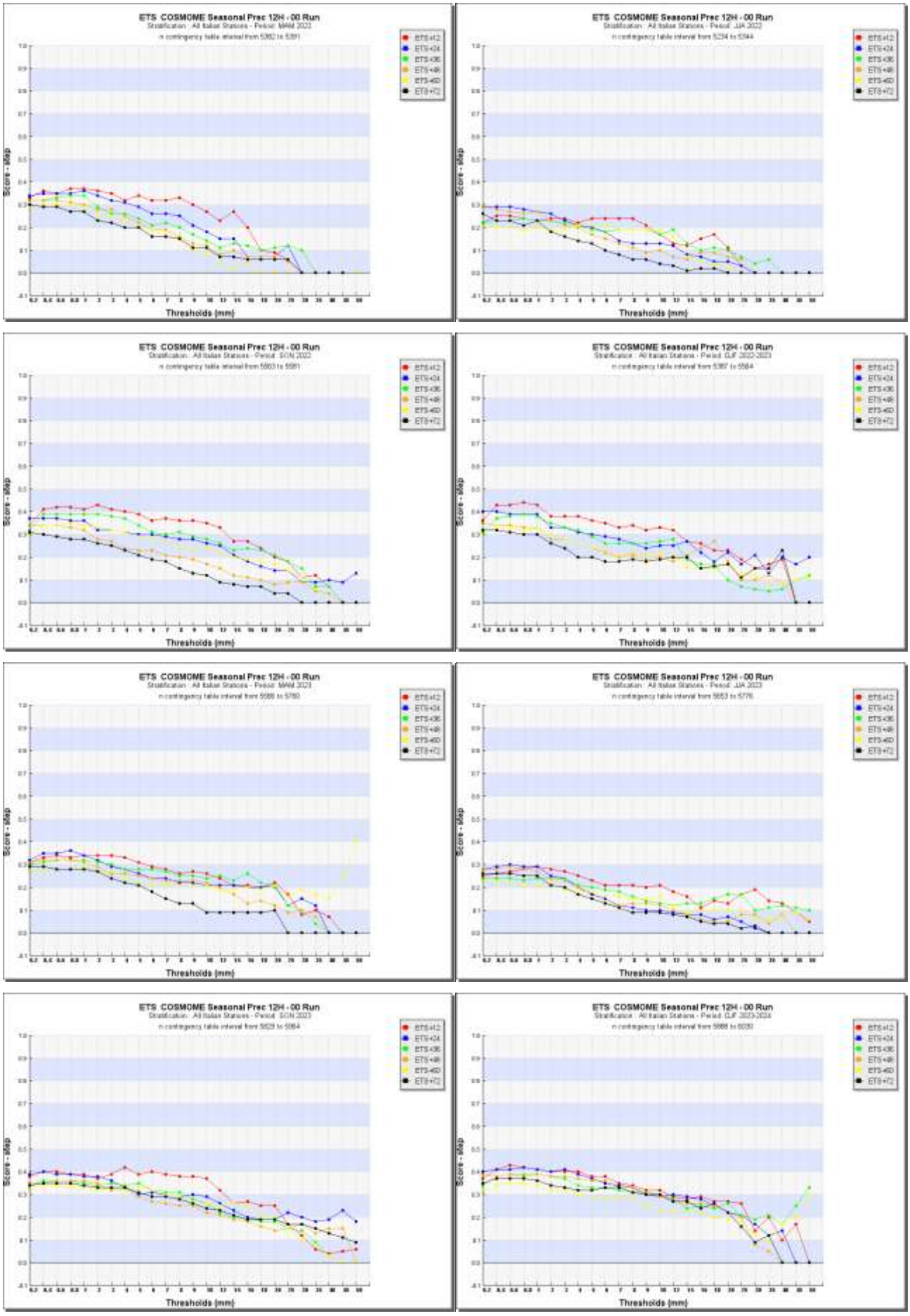
IFS Precipitation in 12 hours - ETS score



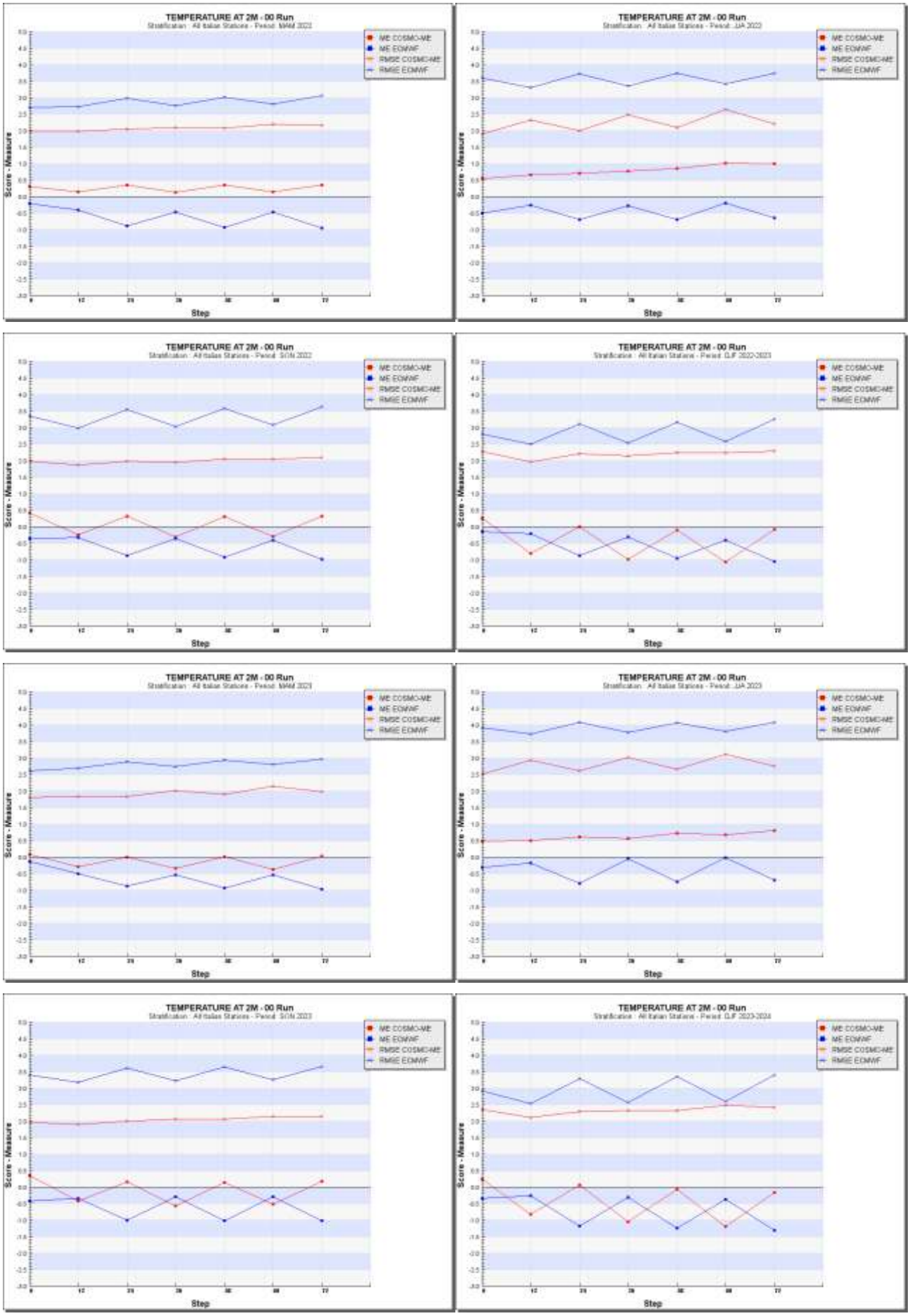
COSMO-ME Precipitation in 12 hours - FBI score



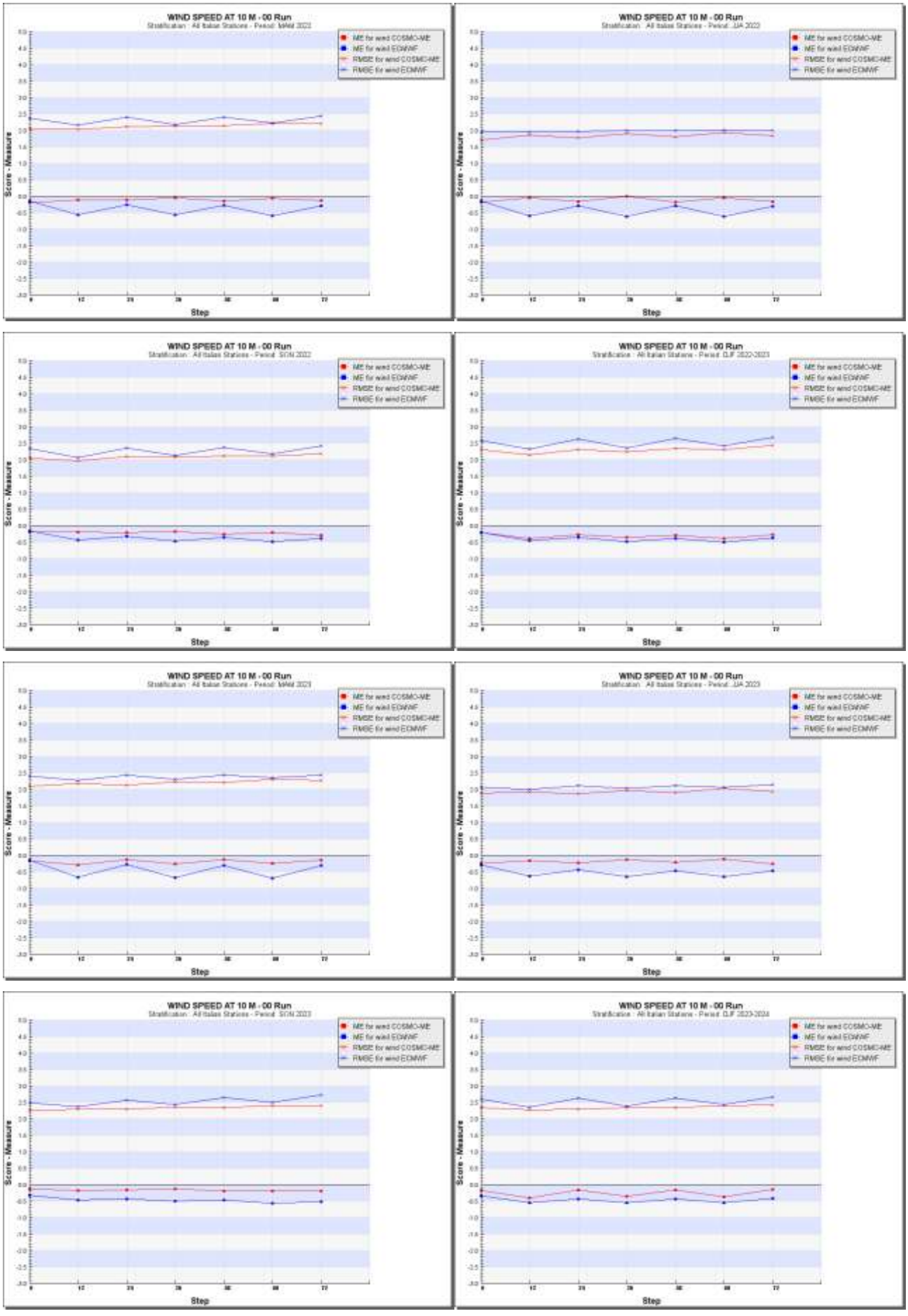
COSMO-ME Precipitation in 12 hours - ETS score



IFS – COSMO-ME comparison: 2m Temperature



IFS – COSMO-ME comparison: 10m Wind Speed



Summary of the percentages of messages within the operationally desirable accuracy range pursuant to ICAO Annex 3

(values below the ICAO thresholds are in red)

March 2024

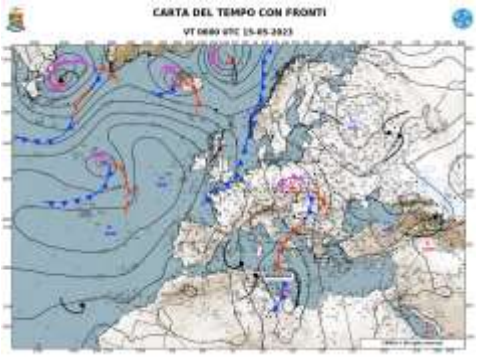
ICAO	Average	Wind Dir	Avg Spd	Visibility	Precip	Cloud Amount	Cloud Height
LIBA	88,76%	81,56%	85,20%	95,15%	99,35%	89,72%	92,00%
LIBN	88,19%	78,36%	80,55%	95,10%	97,43%	89,47%	90,73%
LIBV	82,15%	81,68%	81,74%	84,87%	98,04%	73,80%	80,45%
LICT	89,35%	78,50%	86,06%	97,43%	97,77%	88,85%	91,36%
LICZ	84,92%	76,83%	80,05%	89,31%	98,76%	84,08%	81,31%
LIED	88,89%	85,28%	86,71%	94,61%	96,08%	84,03%	92,53%
LIMN	91,47%	97,49%	97,41%	92,17%	96,56%	83,00%	83,17%
LIPA	89,63%	95,73%	97,21%	94,89%	96,48%	83,87%	77,84%
LIPC	87,36%	79,63%	88,34%	94,28%	98,65%	85,27%	84,37%
LIPI	88,43%	92,95%	98,86%	91,22%	98,86%	81,55%	73,49%
LIPL	81,71%	92,10%	92,55%	76,40%	91,62%	76,00%	69,98%
LIPS	78,89%	94,17%	95,48%	74,41%	91,35%	66,40%	61,87%
LIQW	93,88%	91,91%	95,24%	97,96%	98,61%	90,59%	89,49%
LIRE	85,95%	76,52%	84,41%	96,08%	95,53%	84,81%	86,52%
LIRG	91,51%	88,74%	90,51%	94,88%	97,26%	90,36%	91,33%
LIRH	91,58%	87,83%	94,73%	91,67%	98,40%	86,80%	91,63%
LIRL	89,57%	82,31%	84,71%	97,92%	97,55%	90,30%	85,64%
LIRM	84,65%	83,59%	86,32%	93,74%	96,36%	81,50%	79,26%
LIRP	80,82%	84,17%	89,14%	84,62%	94,37%	70,90%	65,65%
LIRS	82,28%	79,10%	81,62%	96,79%	95,26%	79,02%	80,12%
LIRV	85,54%	80,57%	87,27%	93,92%	97,23%	79,13%	79,04%

16-17th May 2023

Emilia Romagna Flood

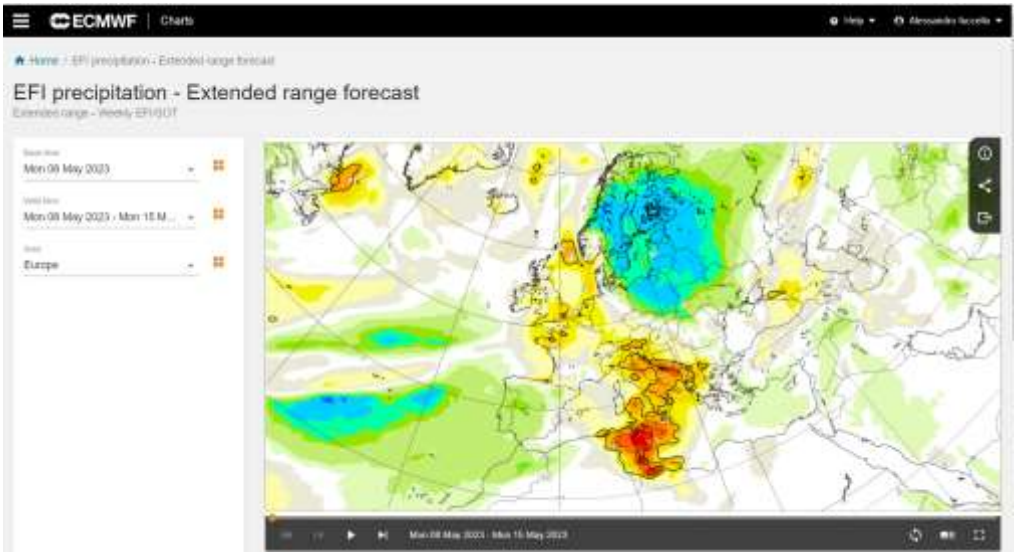
14 dead and 15000 evacuated

Synoptics 16 - 17 May

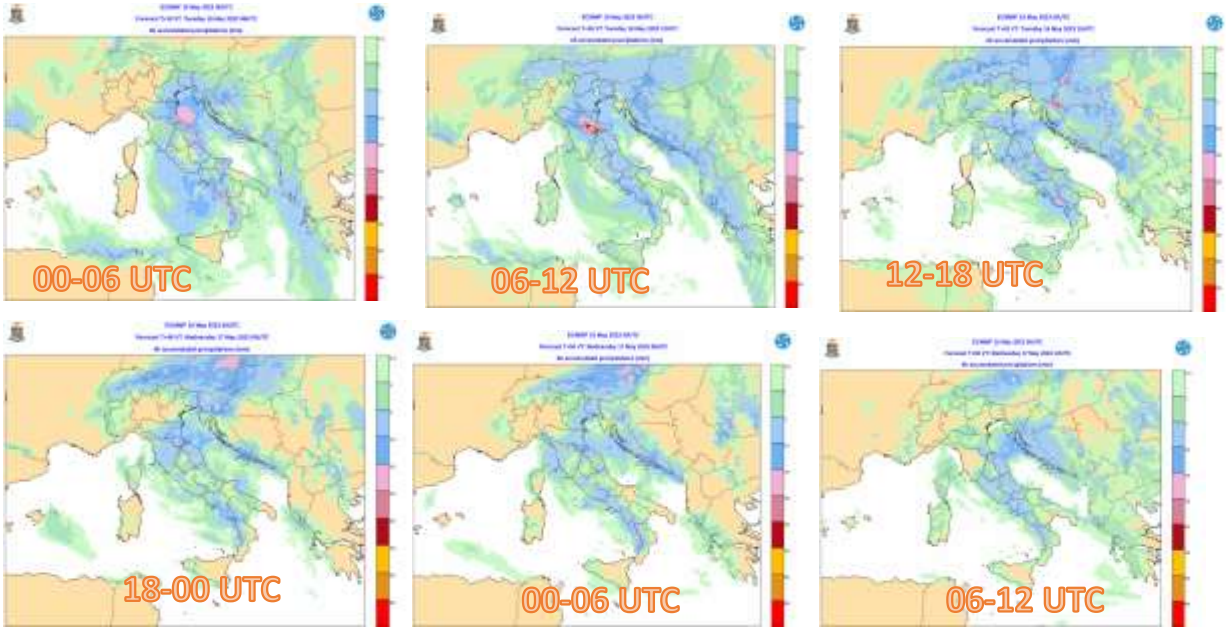


- **Atlantic Blocking;**
- **Minerva storm, forming over Strait of Sicily;**
- **Strong baroclinicity at the initial stage (see next slide)**

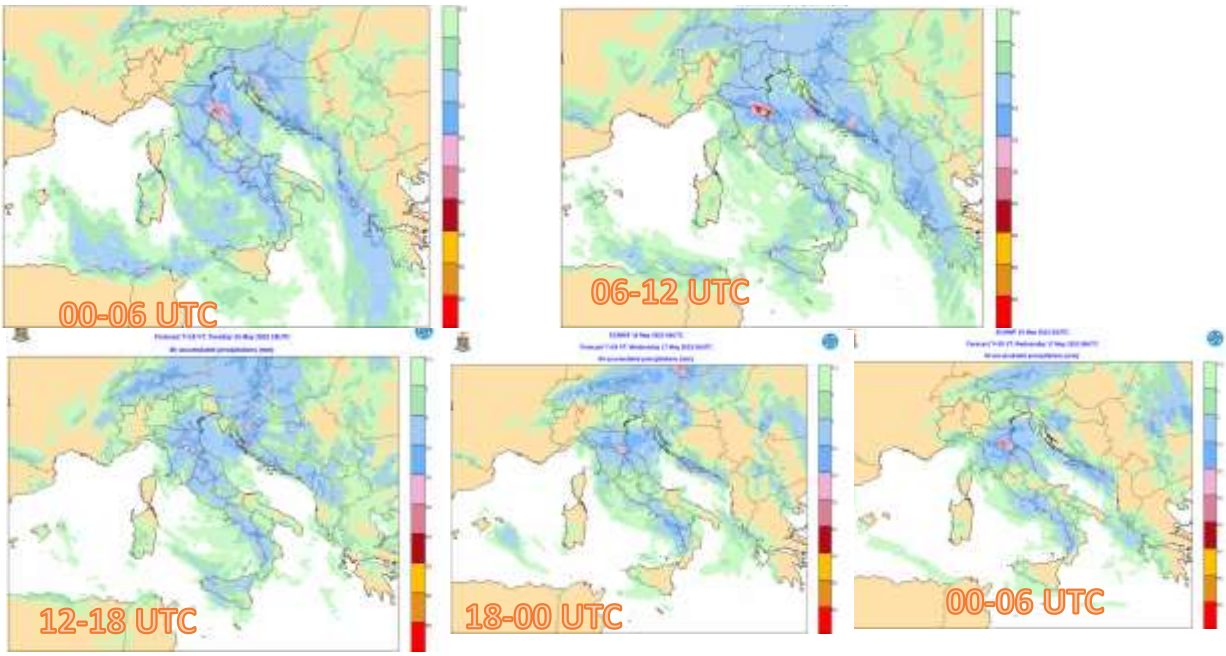
ECMWF Extende Range 8th may - **run** VT: 8-15th sept



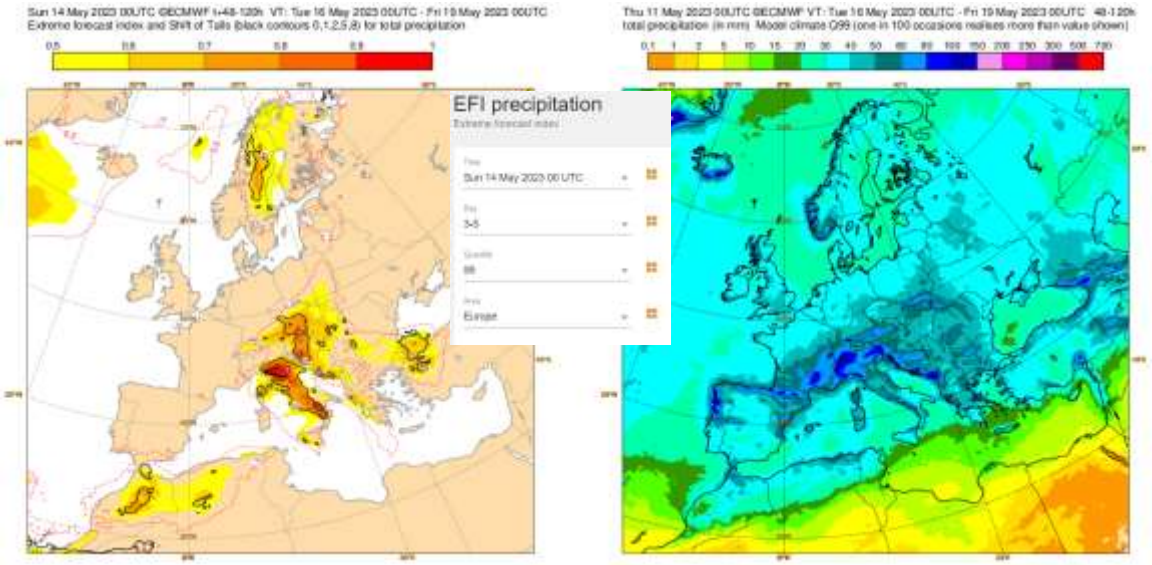
ECMWF total precipitation 15th may - **00 UTC run** VT: 16-17th sept



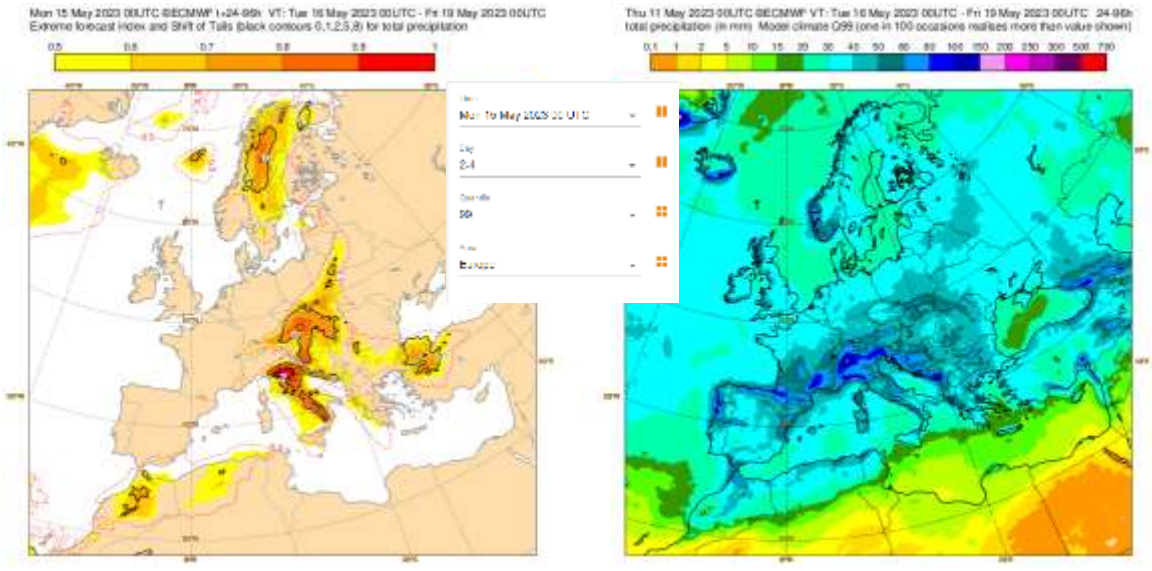
ECMWF total precipitation 16th may - **00 UTC run** VT: 16-17th sept



ECMWF EFI INDEX 14h may - **00 UTC run** VT: 16-17th sept



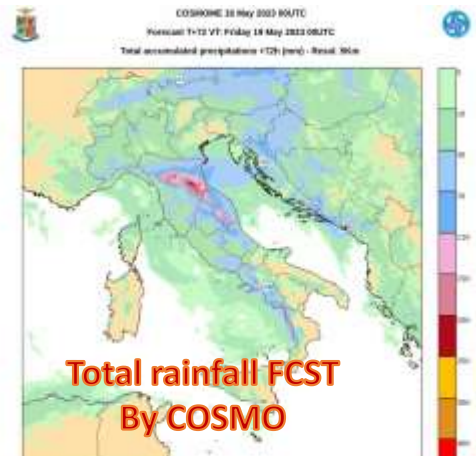
ECMWF EFI INDEX 15h may - **00 UTC run** VT: 16-17th sept



Observations

REMARKS

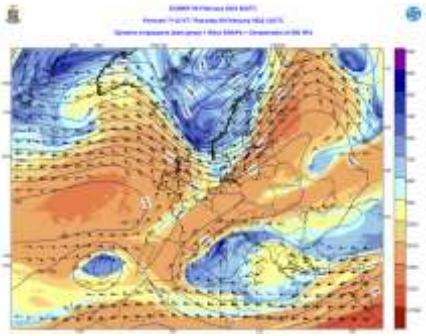
- **Continuous rain due to an occlusion; convection only near to the coast; orographic amplification of precipitation;**
- **Good localization and time phasing of precipitation;**
- **Underestimation of peaks by ECMWF, better score by COSMO / ICON;**



Cyclone Helios
10-11 february 2023

More than 350 mm/36h
FCST Wind up to B13 over the Sea (to be confirm by OBS)

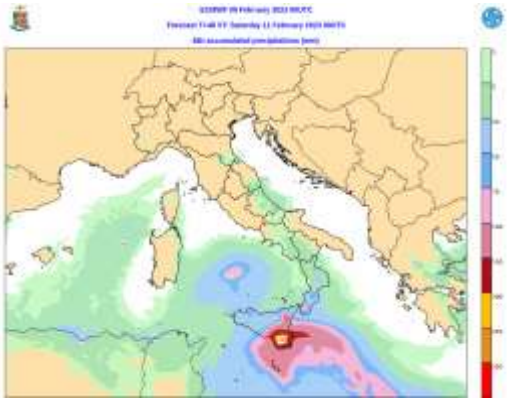
Synoptics



- **Polar airmass from Balkans;**
- **Subtropical airmass from Libya;**
- **Interaction Polar and Subtropical Jetstream;**
- **Strong baroclinicity and strong pressure gradient over Sicily street;**

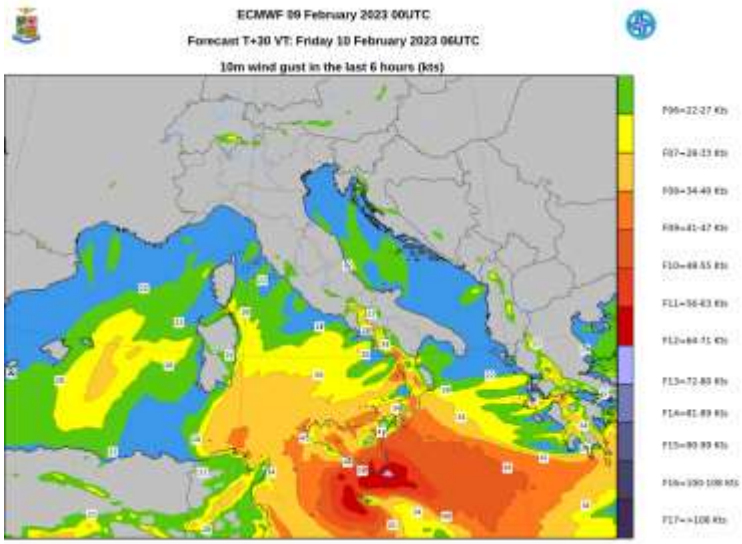
NWPs

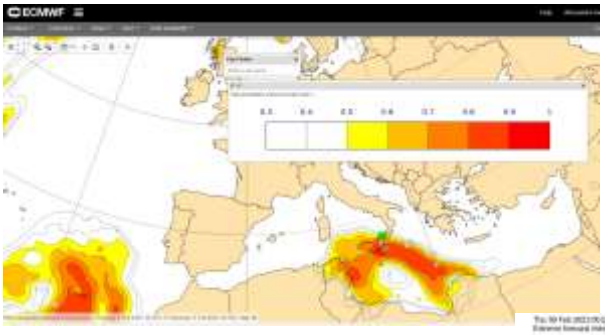
ECMWF 48 h precipitation
8th feb - **00 UTC run**
VT: 9-10th sept



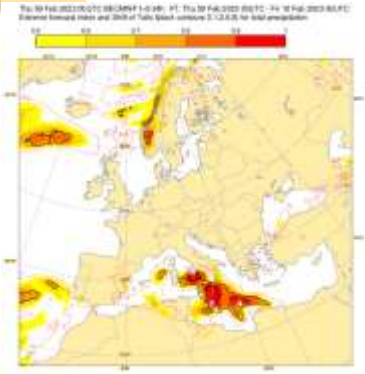
ECMWF 48 h precipitation
9th feb - **00 UTC run**
VT: 9-10th sept

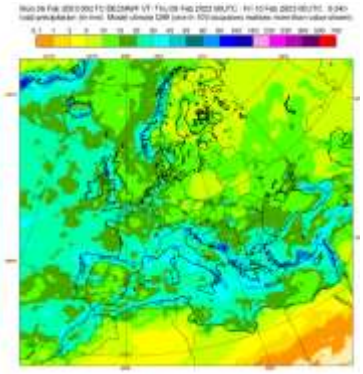
ECMWF max wind gust
9th feb - **00 UTC run**
VT: 10th feb 06 UTC



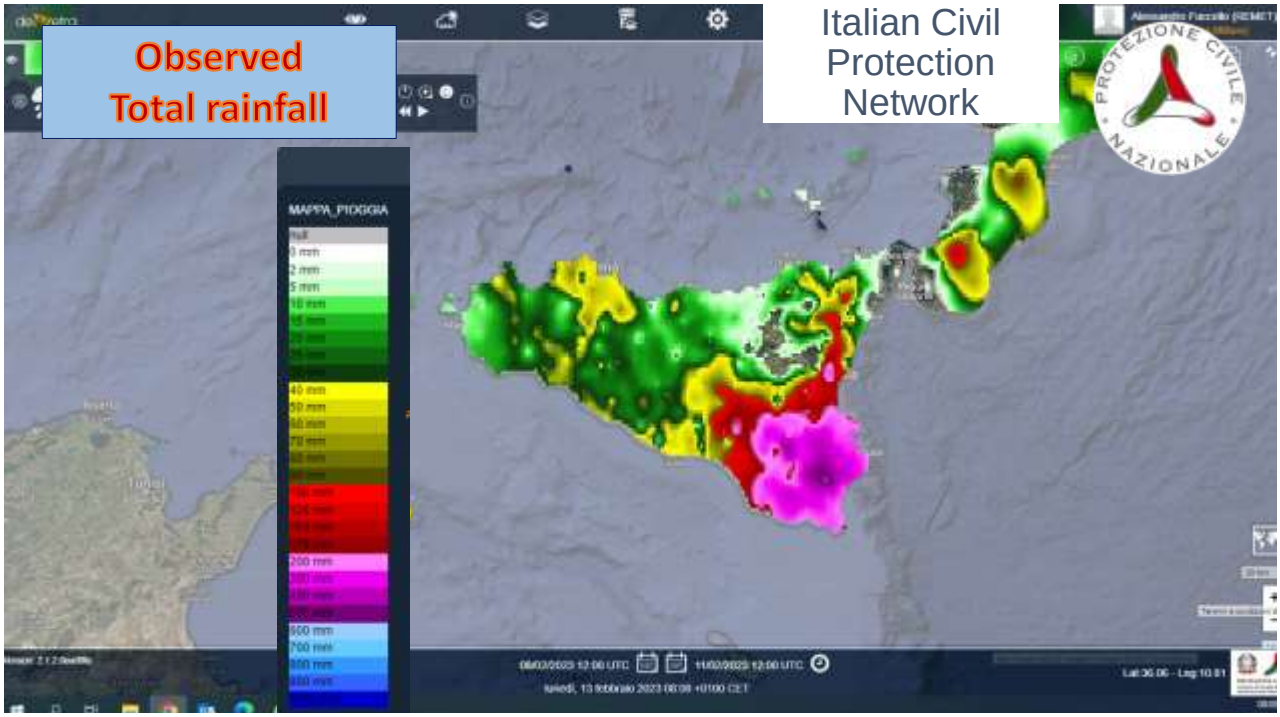


EFI

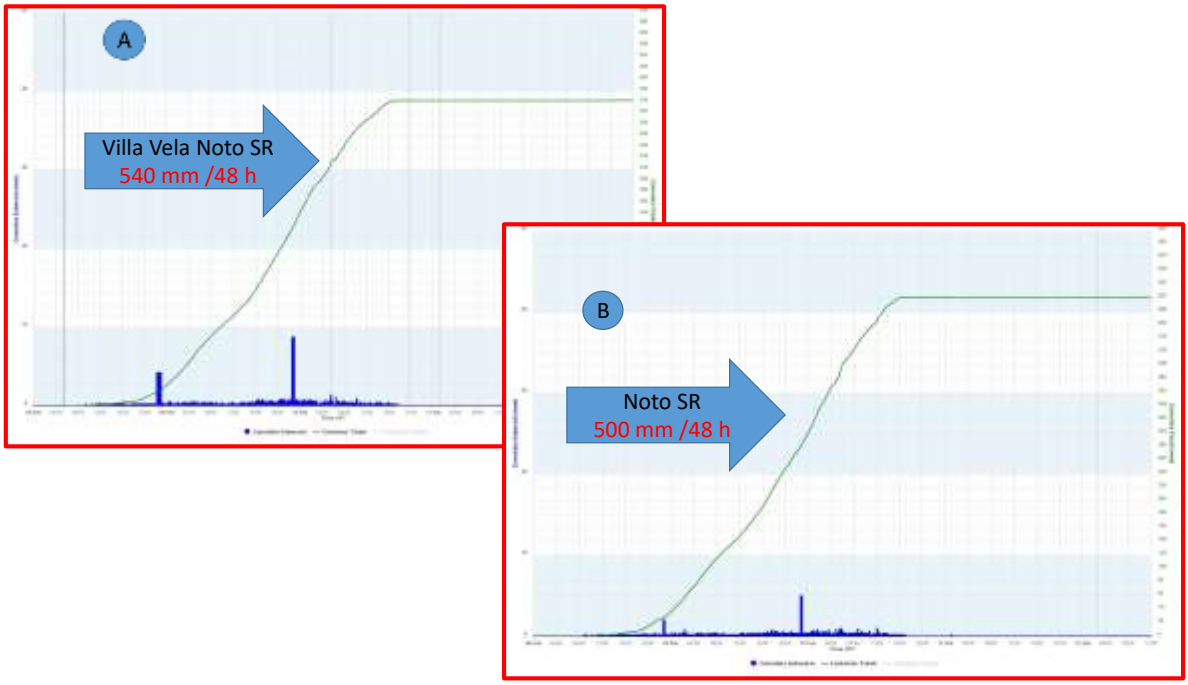


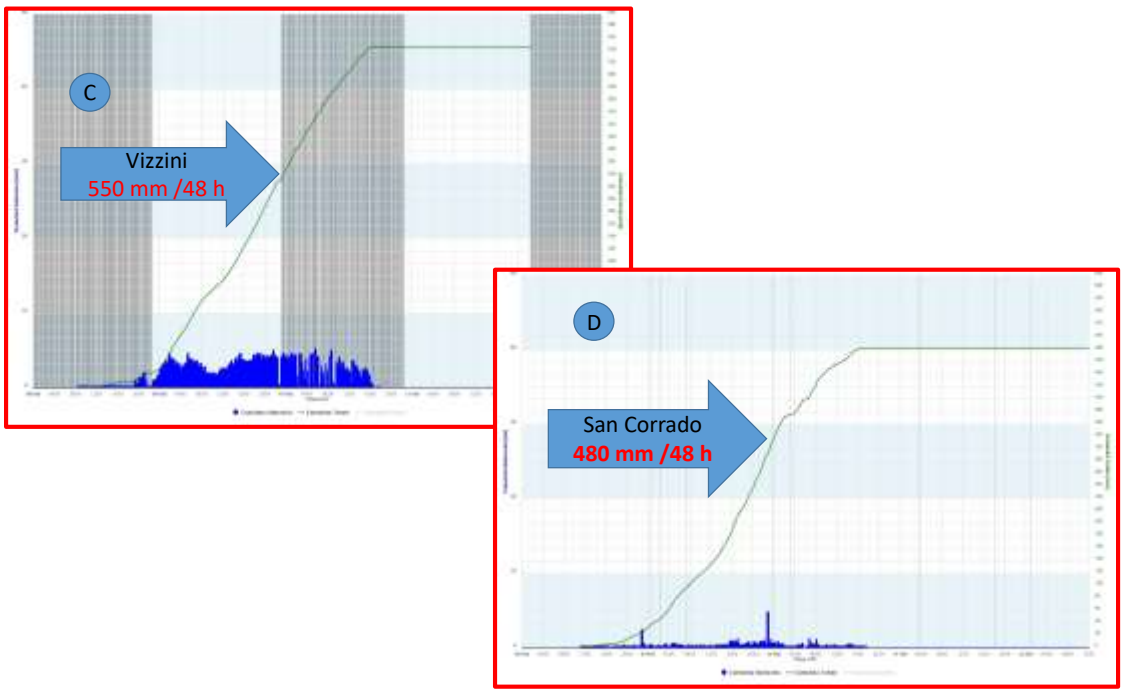


Observations


Observed
Total rainfall
Italian Civil Protection Network
MAPPA_PIOGGIA


PLUVIOMETRI
Mappa di Pioggia
MAPPA_PIOGGIA
C
B
A
D


A
Villa Vela Noto SR
540 mm /48 h
B
Noto SR
500 mm /48 h


C
Vizzini
550 mm /48 h
D
San Corrado
480 mm /48 h

SFC Wind 10 feb 06 UTC

Catania Airport NE 41 KT Gust 54kt

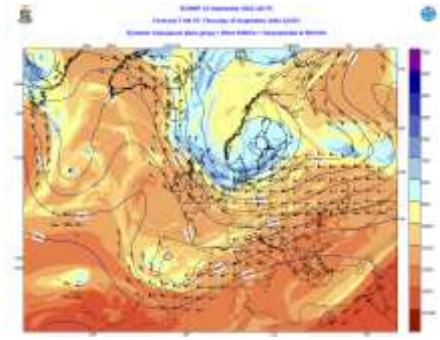
REMARKS

- **Extratropical Cyclone , not a Medicane (baroclinicity and role of JetStream);**
- **Very unusual synoptic pattern for the season (more typical for late summer or autumn);**
- **Influence of SST ? An open question;**
- **Excellent performance of ECMWF.**

15th September 2022
Exceptional convective rainfall over Marche

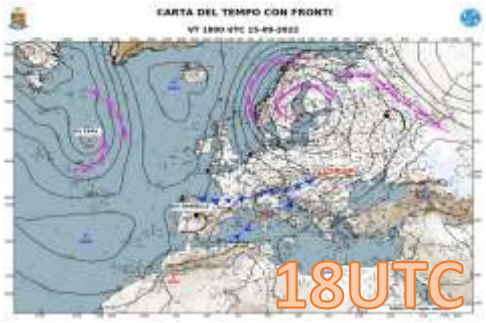
11 dead and 2 missing

Synoptics



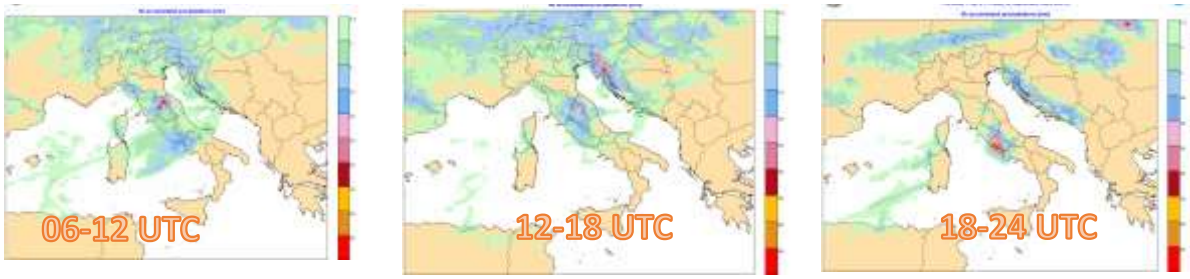
12UTC 15sept- 18UTC 15sept

- **Upper level southern flow ;**
- **Low level baroclinicity over central Italy.**

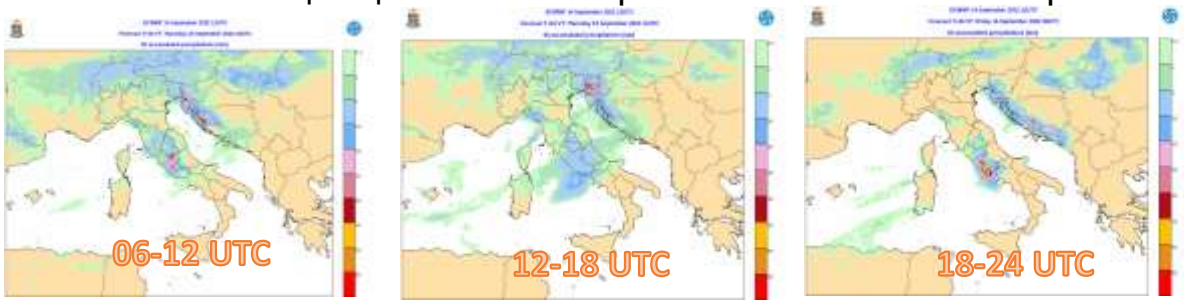


NWPs

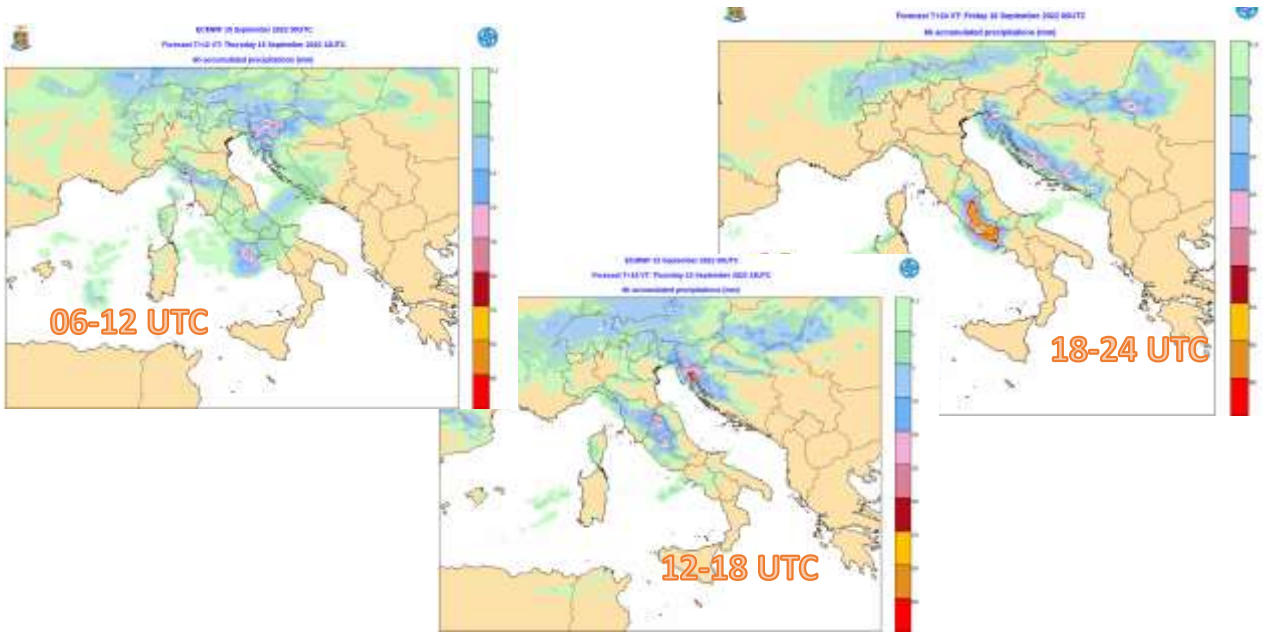
ECMWF total precipitation 14th sept - **00 UTC run** VT: 15th sept



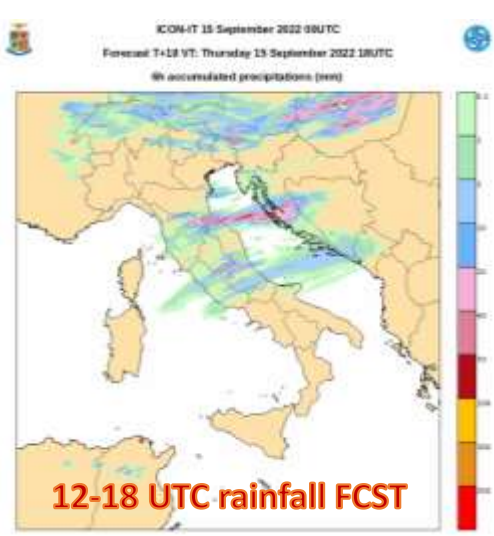
ECMWF total precipitation 14th sept - **12 UTC run** VT: 15th sept

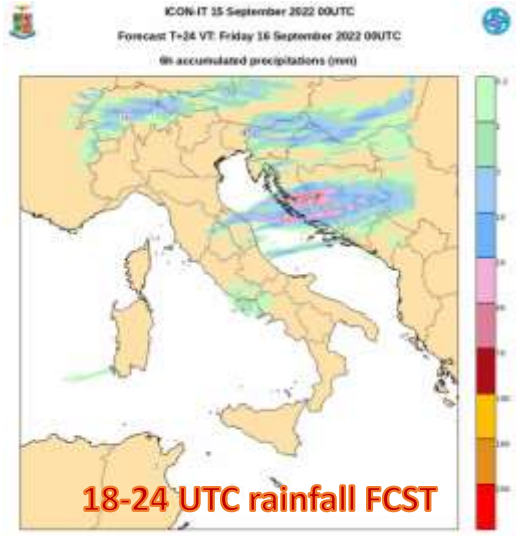


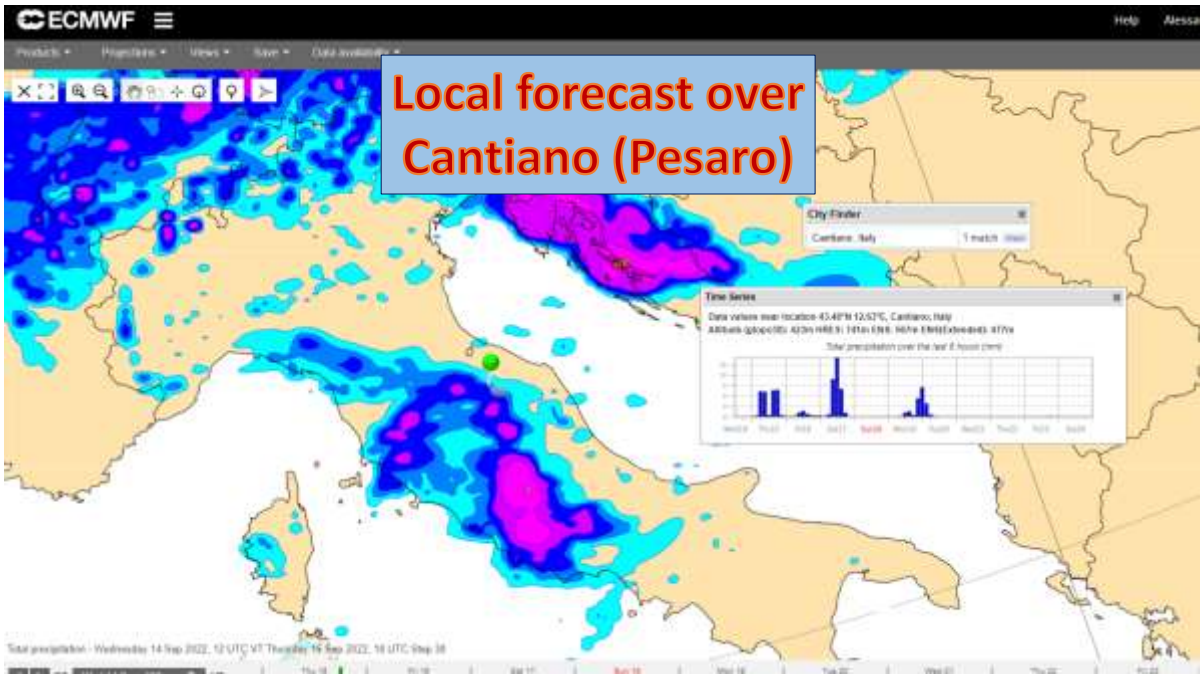
ECMWF total precipitation 15th sept - **00 UTC run** VT: 15th sept



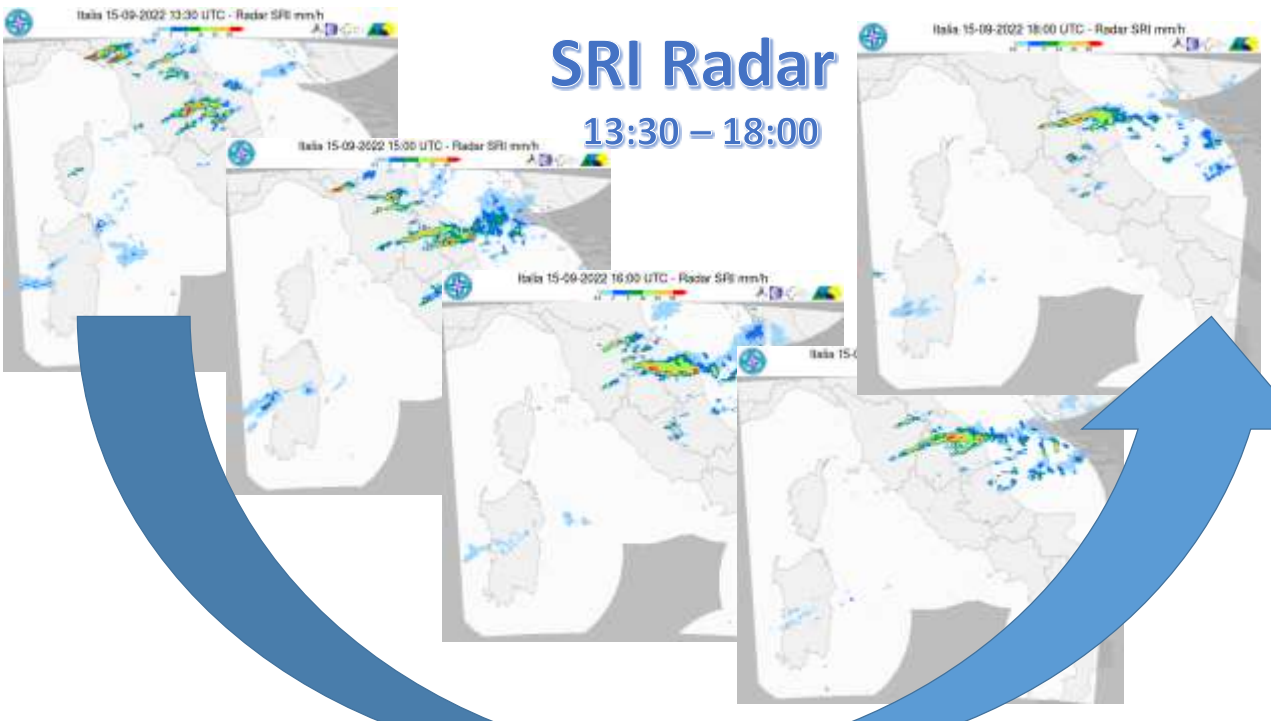
COSMO - ICON IT total precipitation 15th sept - **00 UTC run** VT: 15th sept

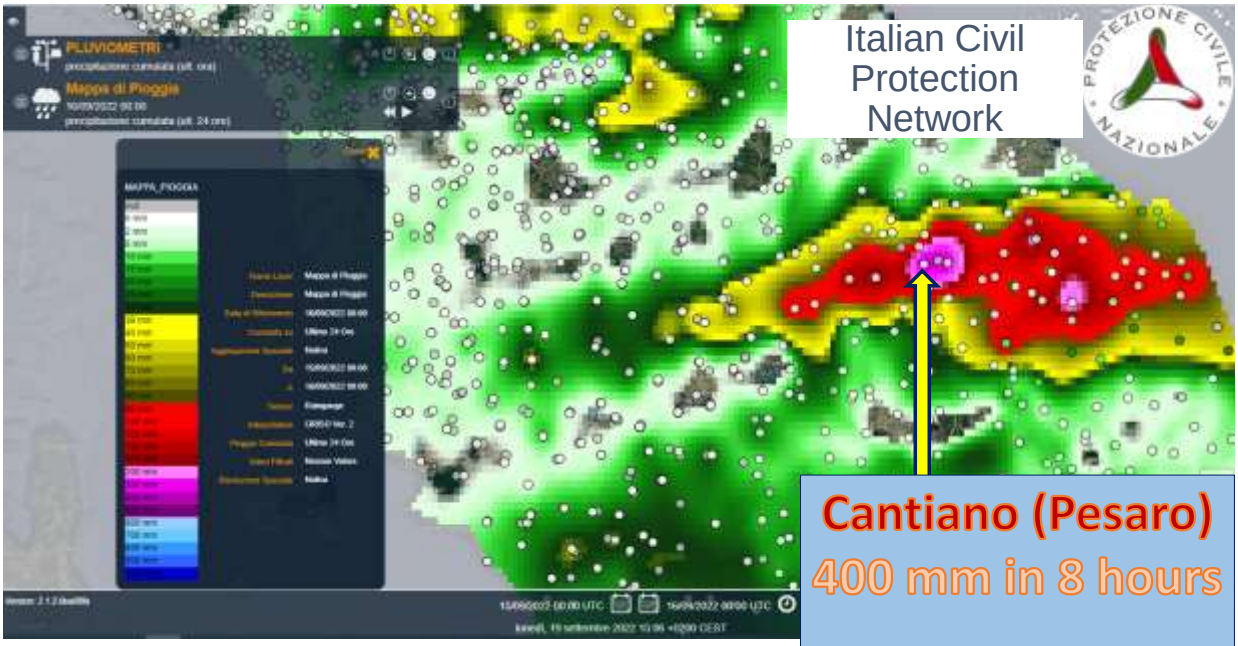




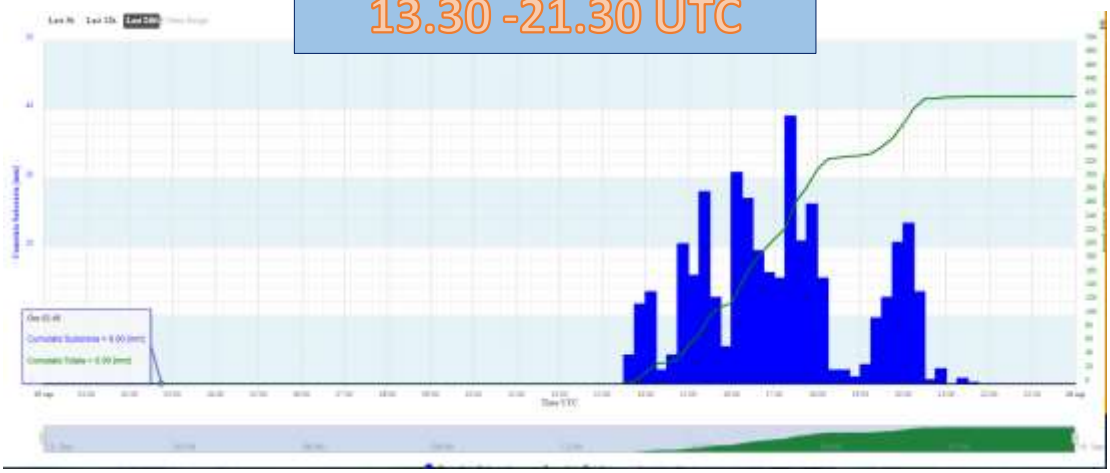


Observations



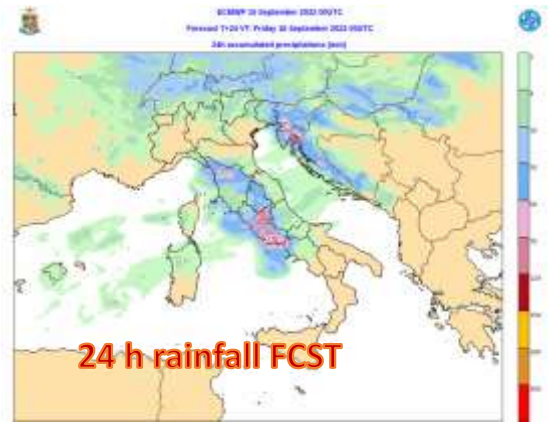


Cantiano (Pesaro)
400 mm in 8 hours
13.30 -21.30 UTC



REMARKS

- **Convective System for about 8 hours;**
- **Bad localization of precipitation and underestimation of peak, better estimation by ICON IT;**
- **Heavy rain forecast over Latium, not observed.**



July2023	Area	UTC	Phenomena	COSMO IT 00 run	ICON IT 00 run	ICON D2 03 run	COSMO 2I 00	C-LAEF 00 run	ECMWF 00 RUN
04	Po-Valley	2000-2330	Large hail			ICONEU 00 OK			
06	Po-Valley	1200-1400	Large hail		ok 2 hous later				
11	STirol Ticino	2000-2100	Giant hail 9 cm					AROME 1.3 00 RUN OK	Ticino
18 Vaia2	TTA & FVG	1500-1600	Large hail & DBurst			Not 00 RUN			
19	Zagreb	1600	DBurst						
19	Po-Valley	1940-2100	Giant hail 12 cm			ICONEU 00 OK			
21	Po-Valley	0210-0340	Giant hail 10 cm	20/00 run	20/00 run	ICONEU 20/00 OK			
21	Po-Delta	2310	Giant hail 8,5 cm			ICONEU 00 OK			
22	ER	1300-1330	Giant hail DB TOR						
23	Ticino Varese	0320-0630	43mm/1h	22/00UTC run underest.	22/00UTC	22/03UTC		Wrong location	Wrong location
24	FVG	2100	**Hail record 19cm**						
25	Milan	0140	QLCS gusts			00 run OK			
29	Po-Valley	2330-0100	Dburst			ICONEU 00 OK			
25/08	Locarno	1920	Large hail 7cm			ICONEU &D2 00 OK		AROME 1.3 00 RUN OK	
27/08	Liguria	0930-1030	Heavy rain 62mm/1hr			ICONEU 00 OK		AROME 1.3 00 RUN OK	