AI Weather Quest ECMWF

Enhancing sub-seasonal predictions with AI/ML: A competition by ECMWF

Testing Period Launch Webinars

Get ready for the Testing Period

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Agenda

- **Presentation (30 minutes)**
  - ✓ The AI Weather Quest in a nutshell
  - ✓ The Testing Period structure
  - ✓ The Testing Period outputs
  - ✓ Participating in the AI Weather Quest: Step-by-step guide
  - ✓ Participating in the AI Weather Quest: Tips and technical support
  - ✓ How to engage with the Quest
  - ✓ Registrations overview

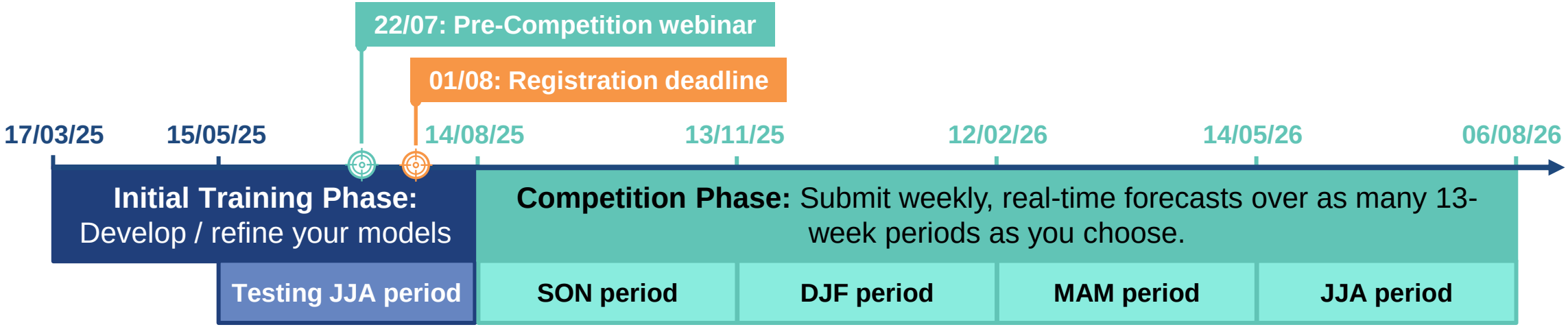
This session is being recorded.
The recording will be made available online after the webinar. If you do not wish to appear, please turn off your camera.

Please mute your microphone.
Please keep yourselves muted during presentations. You are welcome to take the floor or ask questions in the chat during the Q&A.

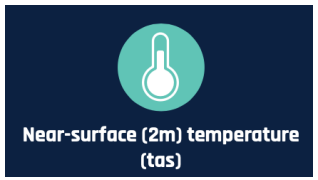
- **Q&A (30 minutes)**

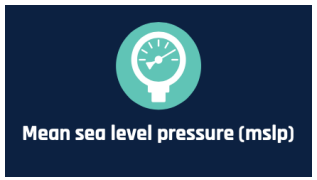
The AI Weather Quest in a nutshell

The AI Weather Quest is a **global competition,** organised by ECMWF and endorsed by WMO, for the **best-performing AI/ML models for sub-seasonal weather predictions**. It is targeted at **anyone who can leverage AI/ML to improve weather predictions!**



Global probabilistic quintile forecasts at a **1.5° resolution**. Two forecast lead times: **Days 19 to 25** & **26 to 32.**





Evaluated against **ERA5T** using **Ranked Probability Skill Scores (RPSS).**

Find detailed information on the **Quest website** & the **Launch webinars recordings**.

The Testing Period structure

15/05/25 — 14/08/25

Testing period | **Competition Phase**

The Testing Period enables participants to **trial forecast submission, visualisation and self-evaluation** in a non-competitive environment.

Week number	Day of week						
	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday
0				1	2	3	4
1	5	6	7	8	9	10	11
2	12	13	14	15	16	17	18
3	19	20	21	22	23	24	25
4	26	27	28	29	30	31	32
5	33	34	35	36	37	38	39
6	40	41	42	43	44	45	46

Forecast submission window | First forecast period | Second forecast period | Publication of evaluation results

Key dates:
Submission window: **Days 1 to 4**
Publish successful submissions: **Day 5**
Publish forecast scores: **Day 37**

Week	Initialisation date (Day 1)	Submission closes (Day 4)	Publication of submitted model names (Day 5)	Week 3 commencing date (Day 19)	Week 4 commencing date (Day 26)	Publish dynamical RPSSs & self-evaluate (Day 37)
-13	Thursday 15-May	Sunday 18-May	Monday 19-May	Monday 2-Jun	Monday 9-Jun	Friday 20-Jun
... 8 weeks ...						
-5	Thursday 10-Jul	Sunday 13-Jul	Monday 14-Jul	Monday 28-Jul	Monday 4-Aug	**Friday 15-Aug**
-1	Thursday 7-Aug	Sunday 10-Aug	Monday 11-Aug	Monday 25-Aug	Monday 1-Sep	Friday 5-Sep
1	**Thursday 14-Aug**	Sunday 17-Aug	N/A	Monday 1-Sep	Monday 8-Sep	Friday 19-Sep (with AI/ML models)

Opportunities before competition phase

8 weeks to compare with dynamical sub-seasonal forecasts.
13 weeks to check forecast submission is successful.

The Testing Period outputs

Week	Initialisation date (Day 1)	Submission closes (Day 4)	Publication of submitted model names (Day 5)	Week 3 commencing date (Day 19)	Week 4 commencing date (Day 26)	Publish dynamical RPSSs & self-evaluate (Day 37)
-13	Thursday 15-May	Sunday 18-May	Monday 19-May	Monday 2-Jun	Monday 9-Jun	Friday 20-Jun
...						
-1	Thursday 7-Aug	Sunday 10-Aug	Monday 11-Aug	Monday 25-Aug	Monday 1-Sep	Friday 5-Sep

Excel spreadsheets will be published on the **AI Weather Quest Forum** during the testing period.

Every Monday

An excel file will be updated weekly to include the **model names of all successful submissions**.

Competition week	Forecast Initialisation Date
6	20250320
Team name	**Model name**
LP	LPM
dynamicalECMWF	subseasonalFORECAST

Each variable and forecast window will be organised into **separate sheets**.

fcwin1_tas	fcwin1_mslp	fcwin1_pr
fcwin2_tas	fcwin2_mslp	fcwin2_pr

Every Friday

RPSSs from dynamical forecast models will be shared in a similar format, with the addition of aggregated and average scores.

We are currently assessing available dynamical models for evaluation. At a minimum, results from ECMWF IFS will be shown.

Participating in the AI Weather Quest: Step-by-step guide

A Python Package named **AI-WQ-package** has been created to support:

- Forecasts submission
  `forecast_submission.py`
- Forecasts visualisation
  `plotting_forecast.py`

AI-WQ-package 1.0.0

```
pip install AI-WQ-package
```

Days 1 to 4

- Forecasts self-evaluation
  `retrieve_evaluation_data.py`
  `forecast_evaluation.py`

>= Day 37

Week number	Day of week						
	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday
0				1	2	3	4
1	5	6	7	8	9	10	11
2	12	13	14	15	16	17	18
3	19	20	21	22	23	24	25
4	26	27	28	29	30	31	32
5	33	34	35	36	37	38	39
6	40	41	42	43	44	45	46

Forecast submission window | First forecast period | Second forecast period | Publication of evaluation results

Read the Docs — Detailed **ReadtheDocs** documentation.

Installation of **AI-WQ-package**

```
python3 -m pip install AI-WQ-package
```

After installing Python 3 and pip.

To use all the tools associated with the Python Package, you must be registered to the **AI Weather Quest**!

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Participating in the AI Weather Quest: Step-by-step guide

Forecast submission

```
1 from AI_WQ_package import forecast_submission
2 forecast = forecast_submission.AI_WQ_create_empty_dataarray(variable, fc_start_date, fc_period,
                                                              teamname, modelname, password)
3 forecast.values = saved_forecast_values
4 forecast_submit = forecast_submission.AI_WQ_forecast_submission(forecast, variable, fc_start_date,
                                                                  fc_period, teamname, modelname, password)
```

1. Import module.
2. Create an empty *xarray.DataArray*.
3. Populate empty *xarray.DataArray* with forecast probabilities.
4. Submit your forecast to the AI Weather Quest.

Several checks are made before submission including:

- Forecast initialisation date is a Thursday and within **days 1 to 4** of the forecast workflow.
- Coordinates have the correct shape and values.
- Summed quintile probabilities are equal to 1.0±0.2.

Function parameter	Description
variable	Forecasted variable (*tas*, *mslp* or *pr*)
fc_start_date	Forecast initialisation date (*YYYYMMDD*)
fc_period	The selected forecasting window (*1* or *2*)
teamname	Registered team name
modelname	Registered model name
password	Forecast submission password

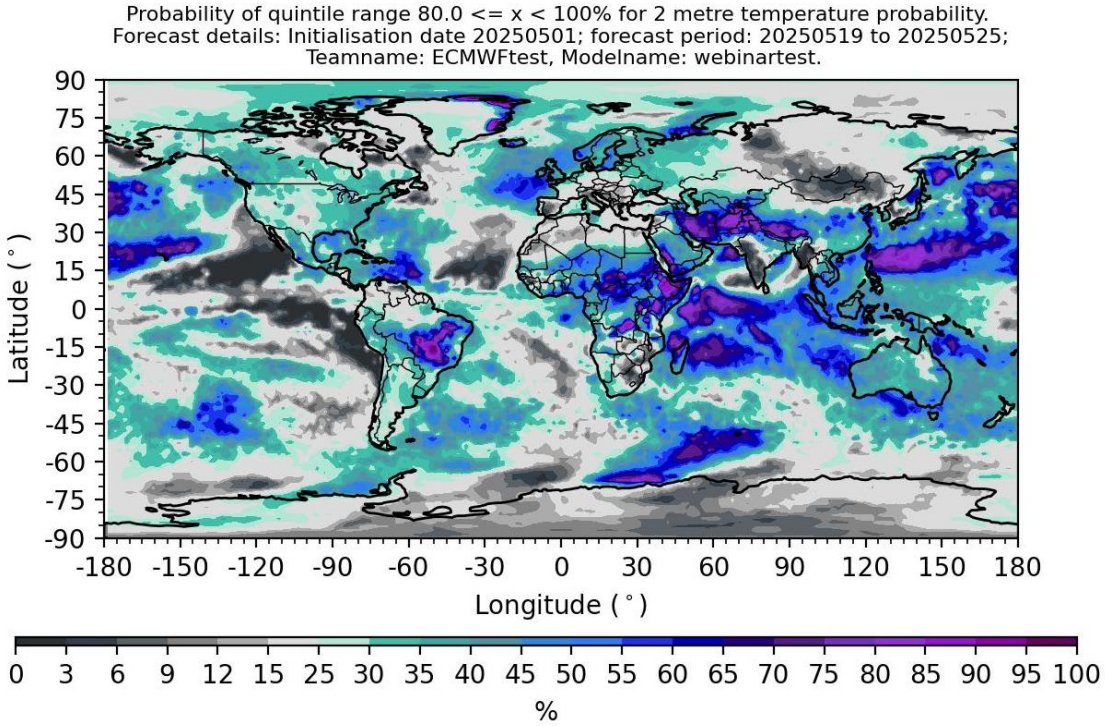
Participating in the AI Weather Quest: Step-by-step guide

Forecast visualisation

```
1 from AI_WQ_package import plotting_forecast
2 plotting_forecast.plot_forecast(forecast,quintile_num,local_destination=None)
```

1. Import module.
2. Plot a global sub-seasonal probability forecast.

Function parameter	Description
forecast	Probability forecast.
quintile_num	Index of quintile where 1 refers to < 20%, 2 refers to 20 <= x < 40% etc.
local_destination	The local destination to save figure.



Similar format to **ECMWF-hosted** forecasting portal

This visualisation code is **only compatible** with an *xarray.dataarray* created using the AI Weather Quest Python Package.

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Participating in the AI Weather Quest: Step-by-step guide

AI Weather Quest ECMWF

Forecast evaluation

```
1  from AI_WQ_package import retrieve_evaluation_data, forecast_evaluation
2a obs = retrieve_evaluation_data.retrieve_weekly_obs(date,variable,password)
2b quintile_clim = retrieve_evaluation_data.retrieve_20yr_quintile_clim(date,variable,password)
2c land_sea_mask = retrieve_evaluation_data.retrieve_land_sea_mask(password)
3  obs_pbs = forecast_evaluation.conditional_obs_probs(obs,quintile_clim)
4  global_RPSS = forecast_evaluation.work_out_RPSS(submitted_forecast,obs_pbs,variable,land_sea_mask)
```

1. Import modules.
2. Download data including (a) observations, (b) quintile climatology (ERA5T) and (c) land-sea mask.
3. Compute observed probabilities.
4. Derive the RPSS.

Read the Docs

Includes an example of calculating aggregated RPSSs.

Function parameter	Description
date	Forecasted week 3 or week 4 start date (*YYYYMMDD*).
variable	Forecasted variable (*tas*, *mslp* or *pr*).
password	Forecast submission password.
submitted_forecast	Forecast submitted to the AI WQ.

Go live!

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Participating in the AI Weather Quest: Tips and technical support

Check that inputted variables into AI WQ package functions match online registration details.

ERA5driven ≠ era5driven

Update to the latest version of the AI-WQ Python Package.

V2 just released!

```
python3 -m pip install --upgrade AI-WQ-package
```

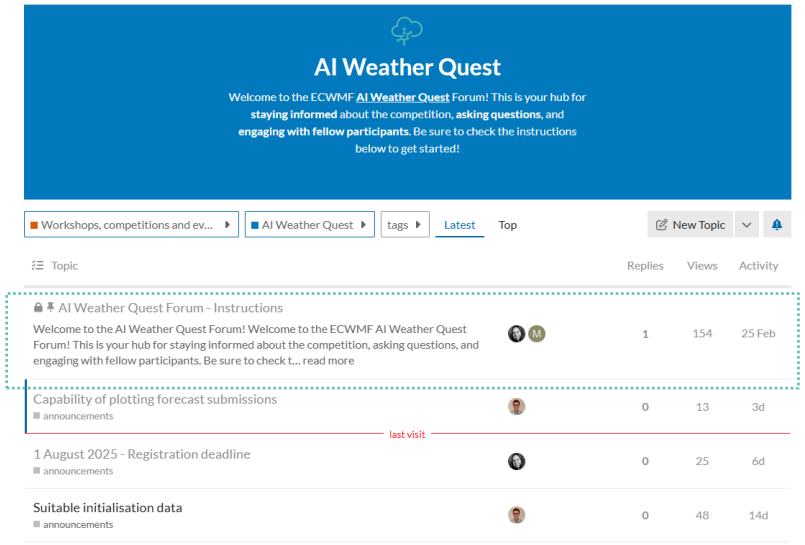
Detailed step-by-step guides can be found in ReadtheDocs.

Do not hesitate to get in touch via AI Weather Quest Forum or email.

AI Weather Quest

aiweatherquest@ecmwf.int

How to engage with the Quest



How to Engage:

✅ **Reply to existing conversations** by filtering discussions with the **right tags:**

- 📢 **Organisers announcements** – Stay updated with official news
- 🤝 **Find teammates** – Connect with others to form or join a team
- 💬 **Discussions between teams** – Share insights on data, models, rankings, and more
- ❓ **General questions** – Get clarifications on competition timeline, team's registration, etc.
- ❓ **Technical questions** – Ask about data access, computing tools, submission formats and processes, forecast scoring and assessment criteria, etc.

✅ **Start a new conversation** and **assign the relevant tag** to keep discussions organised.

Now

Visit the forum and **log in with your ECMWF account** (also used for this webinar registration).

During the Testing Period

Check via the ***Successful submissions*** topic (on Mondays) and the ***Dynamical models scores*** topic (on Fridays) the **teams & models names for which forecasts have been successfully submitted** along with the **RPSSs from the dynamical models.**

\+ For individual matters, **participants** can reach out through the **contact form.**

\+ For keeping up with the Quest, **observers** can subscribe to the **Newsletter.**

Registrants overview

260

Number of registrants

100

Number of teams

Not registered yet? **Join the Quest before August 1st** to compete across the full competition period and be eligible for annual awards!

Q&A

Feel free to ask your questions!

- *Raise your hand to speak*
- *Type your questions in the chat*

Thanks!

To everyone involved in the organisation of the AI Weather Quest.

See you for the next webinar!

The Pre-Competition webinar will take place on July 22nd 2025.