

# EURO1k

The Fine-Scale  
Weather Model  
for Europe

# ABOUT METEOMATICS

## Meteomatics Is the Global Leader in Weather Intelligence

Forecast accuracy and direct, easy access to weather data are the most important criteria for companies seeking reliable weather information. With our Weather Intelligence approach, we aim to take the accuracy of weather forecasts to an entirely new level. To achieve this, we tap into the exceptional skills of our employees to develop unique forecasting technologies and high-resolution weather models such as EURO1k.

By utilizing the world's most accurate weather and climate data, companies can improve operational processes, respond quickly to changing environmental conditions, and better manage extreme weather situations. Meteomatics provides over 20 petabytes of global weather data, ranging from historical weather data to current, forecast, and climate scenario data. This allows companies to access weather information from 1940 to 2100 through a single API interface with the highest degree of flexibility and data delivery speed.

## Company Profile

Meteomatics serves over 600 leading B2B companies worldwide and employs around 150 people in Switzerland, Germany, the United Kingdom and the United States. Headquartered in St. Gallen, Switzerland, Meteomatics is the world's only company to compute a 1 km high-resolution weather model with hourly updates covering all of Europe. Additionally, it is the only company that develops weather drones equipped with de-icing capabilities, capable of autonomous flight at altitudes of up to 6 km.

## GET ACCESS TO EURO1k

EURO1k is available through the Meteomatics Weather API, making integrating cutting-edge forecasts into your workflows easy. The API provides:

- Instant access to real-time and historical weather data.
- Flexible integration with tools like Python, R, and Java.
- Customizable outputs for your specific needs.

EURO1k is not included in regular Weather API packages.

# OUR RESPONSIBILITY



As the world's leading provider of weather information, we know all too well the climate challenges of the century and understand our responsibility towards society and the environment.

Through our services, we promote the use of renewable energies and create innovative solutions that facilitate the energy transition, warn society about dangerous weather events, and help the agriculture industry plan their resources and protect their crops.

## TALK TO OUR EXPERTS TO UNLOCK ACCESS.



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# WHAT IS EURO1k?

EURO1k is Meteomatics' exceptionally high-resolution weather model for Europe, calculated at a scale of just 1 km. This unprecedented precision enables highly accurate spatial and temporal forecasts tailored to the needs of various sectors. EURO1k integrates vast measurement data from across Europe, along with additional weather information, to further enhance forecast accuracy.

Thanks to its high temporal resolution, EURO1k significantly improves the timing of weather event predictions. While most models update every 1 to 6 hours, EURO1k delivers forecasts every 15 minutes—and through interpolation, even down to one-minute intervals.

## HIGH-RESOLUTION EUROPEAN WEATHER MODEL

### Be Ahead of the Weather and the Market with the Finest Weather Data Available in the Industry

Our customers report:

- Improved planning confidence and risk mitigation
- Cost savings (e.g. imbalance cost reduction by 20%)
- Operational continuity
- Better resource allocation
- Increased safety for workforce and assets
- Improved products and services

# ACCURACY OF THE FORECASTS

Regular updates, sophisticated downscaling algorithms, and proprietary measurement technologies enable us to deliver exceptionally accurate weather forecasts. Our experts continuously enhance model performance through rigorous evaluations and refinements.

## Advantages of the European Weather Model EURO1k

In contrast to the standard global weather models, which usually provide spatial resolutions of around 20 km and temporal resolutions of 1 hour, EURO1k sets a new benchmark in weather modeling.

It is the first and only model in Europe to achieve a resolution fine enough to accurately model even the smallest meteorological phenomena, including thunderstorms, hail, and storms.

This level of detail marks a significant advancement in the field of meteorological modeling.

# WHAT MAKES EURO1k SO SPECIAL:

- Spatial resolution of 1 kilometer.
- Temporal resolution of 15 minutes.
- Forecast lead time of up to 72 hours.
- Comprehensive geographical coverage across all of Europe.
- Hourly updates, incorporating all available measurement and observation data from Europe.
- Exclusive integration of weather data collected by Meteodrones (Meteomatics' weather drones).
- Downscaling capabilities providing resolutions as precise as 90 meters.
- Access to over 1,800 weather parameters.
- Real-time data availability.
- Boundary conditions based on ECMWF-IFS.

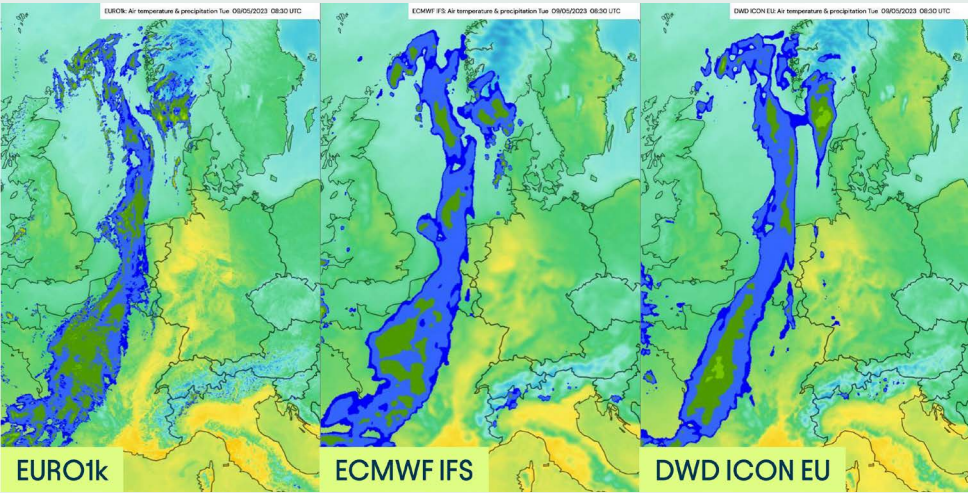




# MODEL COMPARISON: EURO1k VS. ECMWF AND ICON EU

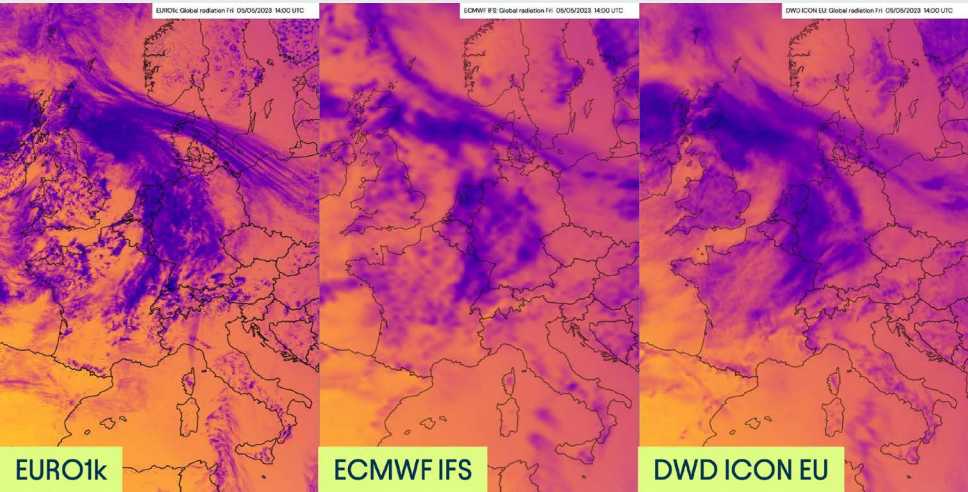
## Graphical Comparison of Weather Models

Below, we compare the spatial resolution of EURO1k with ECMWF and DWD ICON EU. The comparison reveals the superior resolution of EURO1k, showcasing the finest and most granular weather details across all parameters.



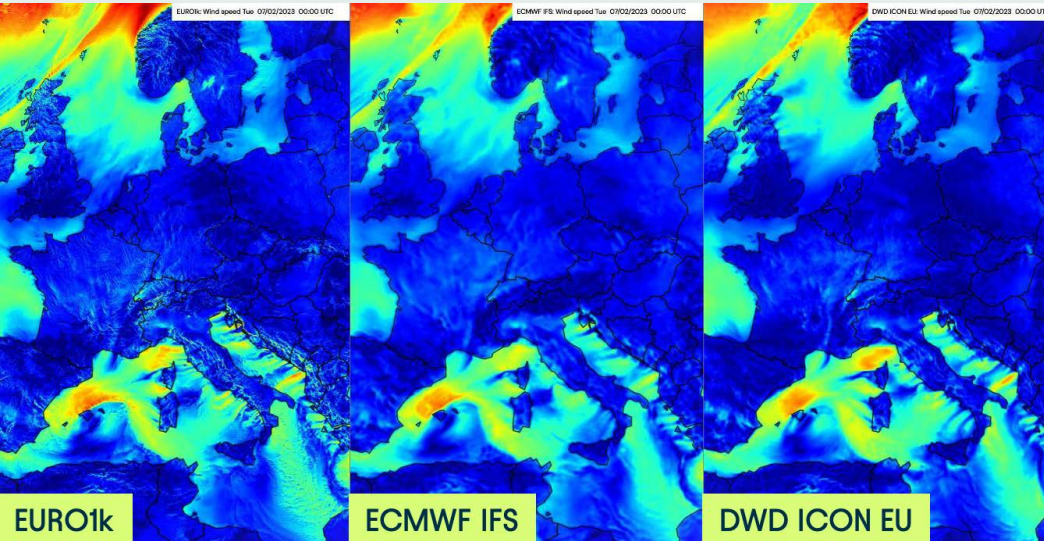
## Comparison of Precipitation and Temperature

EURO1k reveals significantly finer precipitation and temperature patterns across Norway compared to ECMWF and DWD ICON.



## Comparison of Global Radiation

EURO1k reveals fine-scale radiation patterns with greater clarity than ECMWF and DWD ICON, as shown on the left map. This level of detail is critical for precise solar power forecasting.



## Comparison of Wind Speed

Compared to ECMWF and DWD ICON, EURO1k reveals fine-scale wind speed patterns, clearly visible on the left map, particularly in coastal and alpine areas. This detailed wind speed forecast data is essential for accurate wind power predictions.



# HOW DOES EURO1k WORK?

## Boundary Conditions

The accuracy of a weather model depends heavily on its initial conditions, making high-quality input data essential for precise calculations.

Since EURO1k relies on data from beyond Europe for its boundary conditions, we use the ECMWF-IFS global model, renowned for its exceptional forecast quality. This model's native resolution typically ranges from 9 to 18 kilometers.

## Key specifications of ECMWF-IFS:

- Spatial resolution: 0.1° (approximately 9 km)
- Temporal resolution: up to 1 hour
- Forecast lead time: 10 days (with detailed forecasts up to 90 hours at 6 and 18 UTC)
- Frequency of updates: 4 times per day

## Downscaling and Calibration

Our model outputs are postprocessed through downscaling, refining the 1 km resolution to 90 m by integrating the NASA terrain model into the calculations. This integration provides detailed data on elevation, land cover, and terrain features globally, enabling the model's algorithms to deliver even more accurate forecasts, particularly for mountainous regions and coastlines.

In the final step, we calibrate the model's data with the most recent observational data, allowing for more frequent adjustments and providing even more refined and up-to-date forecasts.

## Rapid Refreshes – Be Ahead of the Market

For energy traders, the next 24 to 48 hours are critical, making detailed weather data indispensable for intraday and day-ahead energy trading. EURO1k's rapid refresh cycles and 72-hour lead time provide highly precise short-term forecasts, ensuring traders stay informed with the latest weather insights. As bidding depends on accurate projections of energy production and demand, reliable weather forecasts are key to their decision-making.



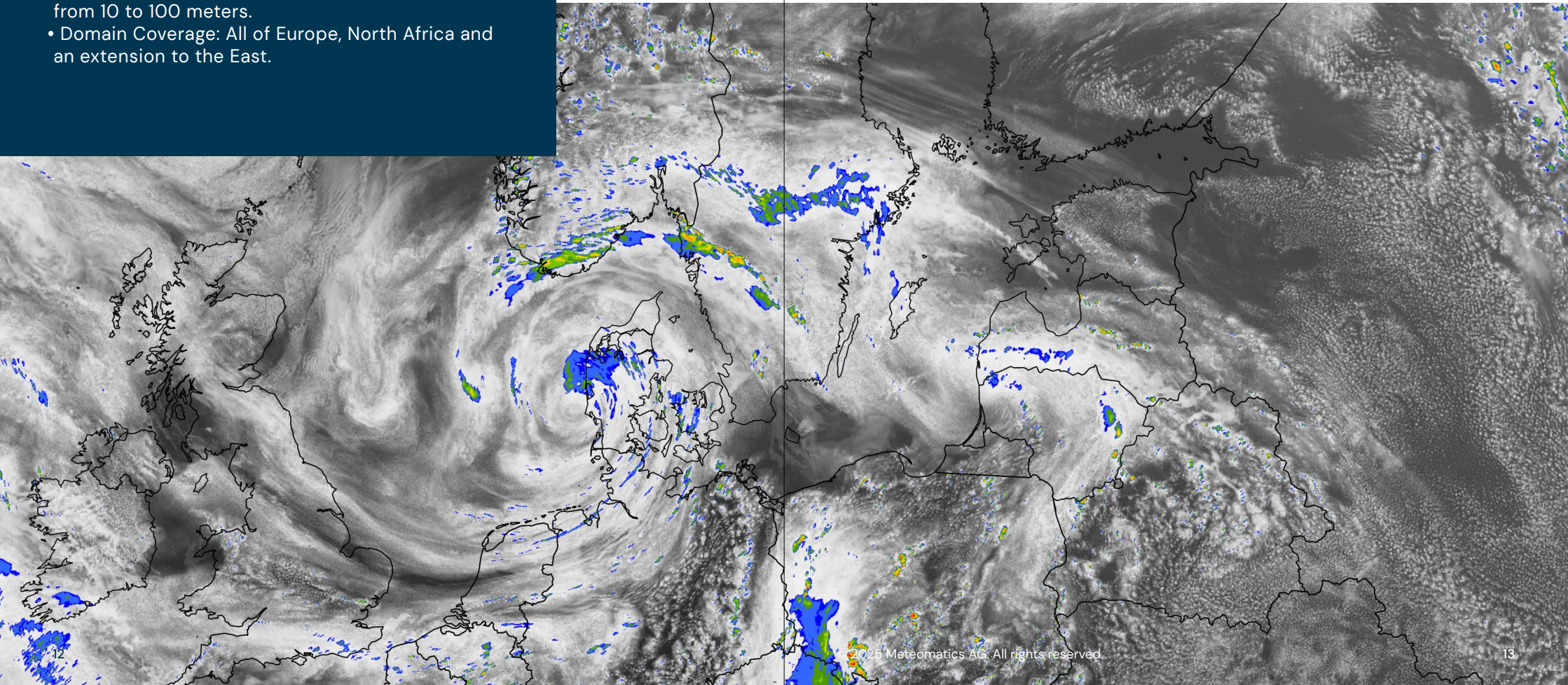


# TECHNICAL SPECIFICATIONS

- Computing effort: ~60,000 CPUs used 24/7.
- Data volume: Around 1.5 TB is produced for each run (one model computation of EURO1k), accumulating to approximately 1,000 TB per month.
- Input data: Wide range of observation sources (ground stations, radars, satellite data, Meteodrone data, etc.) and ECMWF as boundary condition.
- Model Coverage in Grid Points: Approximately 4600 (north-south) x 4300 (east-west), resulting in around 20 million grid points.
- Vertical Levels: 80 levels with intervals ranging from 10 to 100 meters.
- Domain Coverage: All of Europe, North Africa and an extension to the East.

## Technical Details of the EURO1k

As the model is calculated at a high resolution, it needs a lot of computing power—specifically, 60,000 CPUs. Meteomatics' high-performance computers with robust infrastructure ensure seamless processing, making all data available in real time.







## EURO1k: A GAME CHANGER FOR INTRADAY TRADING

With a lead time of 72 hours, EURO1k is the perfect weather model for intraday and day-ahead trading, as well as hyper-local short-term weather forecasts with a high level of accuracy.

In the following study, we compare EURO1k wind power forecasts and ECMWF/DWD ICON wind power forecasts with actual feed-in data from the wind farm.

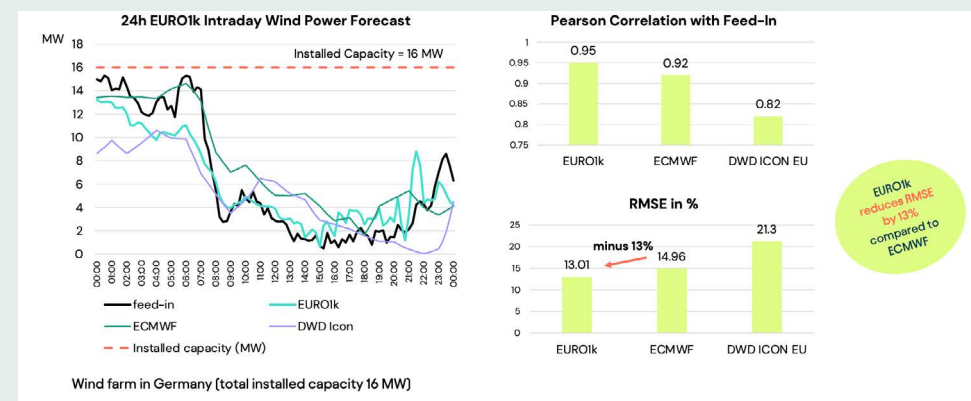
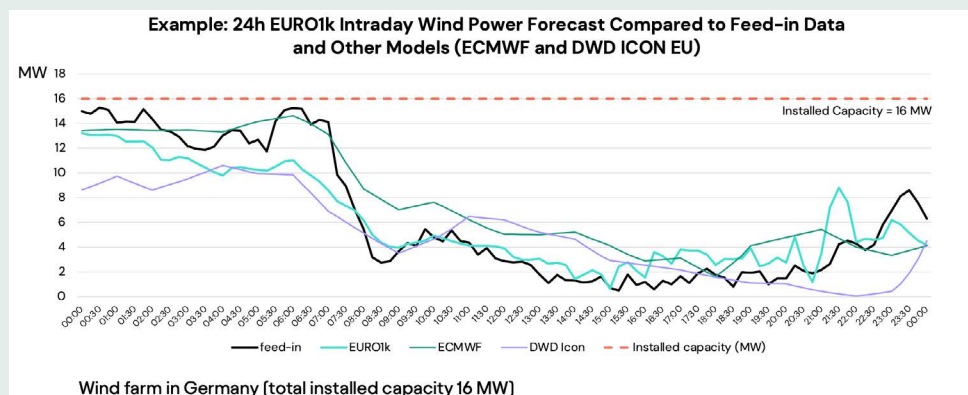
The results indicate that EURO1k demonstrated the highest forecast accuracy for wind power, with a forecast of 588 MWh closely matching the observed feed-in value of 617 MWh. In contrast, the ECMWF overestimated with 739 MWh, and the DWD ICON EU model underestimated with 484 MWh, both showing greater deviations from the observed values.

These differences underscore the superior performance of EURO1k in accurately predicting wind power feed-in, as the other models exhibited significantly larger errors over the 24-hour forecast period.

**Compared to ECMWF and DWD ICON EU, the EURO1k forecast is by far the closest to the observed wind power feed-in values.**

The EURO1k model showed the best performance among the three weather models in predicting wind power feed-in values for the 24-hour forecast period. It had the lowest RMSE of 13.01%, which is about 13% lower compared to ECMWF, indicating better accuracy compared to the other models. Additionally, the EURO1k model achieved the highest

Pearson correlation coefficient of 0.95, indicating a stronger positive relationship between its predicted values and the observed feed-in values. These results highlight the EURO1k models superior performance and closer alignment with the actual wind power feed-in values compared to the ECMWF and DWD ICON EU models.

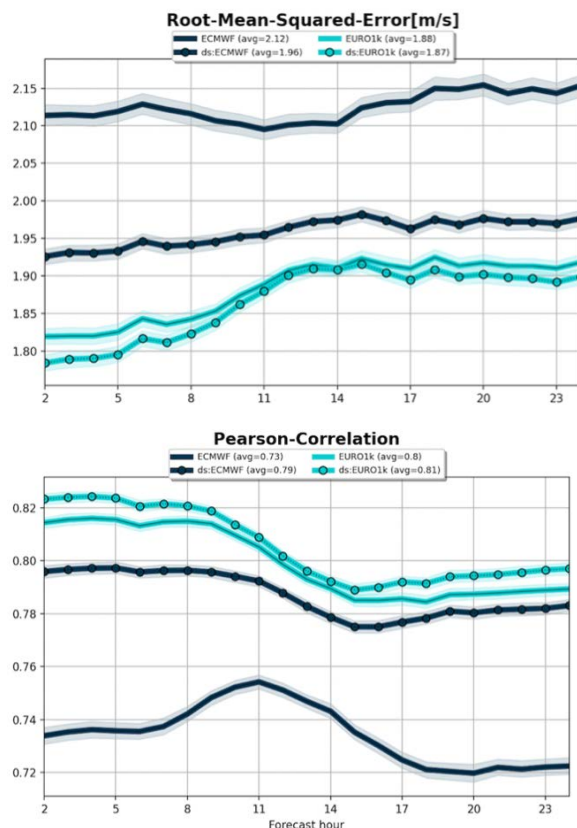




# VERIFICATION FOR 10M WIND SPEED ACROSS EUROPE

The downscaled EURO1k data (blue-dotted line) demonstrated the highest correlation value of 0.81 and the lowest RMSE value of 1.87, indicating a better overall performance compared to the other outputs. The original EURO1k data (blue line) closely follows with a correlation value of 0.8 and an RMSE value of 1.88. The downscaled ECMWF (black-dotted line) model performed slightly worse with a correlation value of 0.79 and an RMSE value of 1.96. The original ECMWF data (black line) showed the lowest correlation value of 0.73 and the highest RMSE value of 2.12, indicating a comparatively weaker performance in predicting 10m wind speed across Europe.

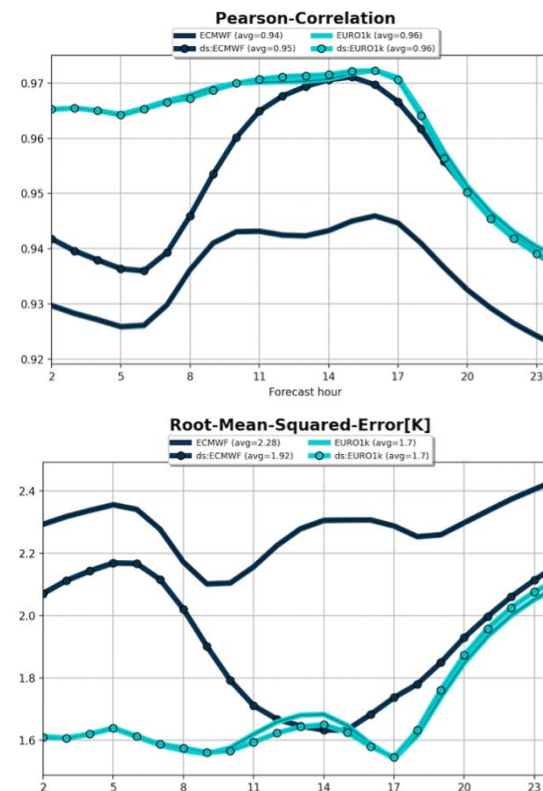
Time period: 01.01.23 – 31.03.23  
Number of weather stations: 4869 across Europe



# VERIFICATION FOR 2M TEMPERATURE ACROSS EUROPE

Both the downscaled EURO1k data (blue-dotted line) and the original EURO1k data (blue line) demonstrated high correlation values of 0.96, indicating a strong relationship between their predicted and observed 2m temperatures. Additionally, both models achieved low RMSE values of 1.7, indicating accurate predictions. The downscaled ECMWF data (black-dotted line) also performed well with a correlation value of 0.95 and an RMSE value of 1.92. However, the original ECMWF data (black line) showed a slightly lower correlation value of 0.94 and the highest RMSE value of 2.28, indicating a comparatively weaker performance in predicting the 2m temperature across Europe.

Time period: 01.01.23 – 31.03.23  
Number of weather stations: 4869 across Europe



Talk to our experts  
to learn more about  
the accuracy of  
EURO1k forecasts



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# EURO1k FAQ AND ACCESS



## HOW OFTEN IS EURO1k UPDATED?

EURO1k is updated hourly, incorporating all available measurement and observation data from across Europe.

## WHAT MAKES THE PREDICTIONS SO ACCURATE?

The exceptional accuracy of EURO1k comes from its high resolution of 1 km across Europe. This fine-grained resolution captures numerous weather details, with data points available every kilometer, significantly enhancing the precision of forecasts across the region.

Furthermore, the use of data assimilation enhances accuracy by continuously adjusting the model to reflect the actual state of the atmosphere, effectively minimizing errors.

## OVER WHAT PERIOD OF TIME CAN ACCURATE WEATHER FORECASTS BE MADE WITH EURO1k?





With hourly updates and high resolution, the model maintains extremely low error rates in the first 6 to 12 hours after each initialization. Even beyond this period, it continues to deliver high accuracy compared to other models, thanks to its finer resolution. The EURO1k model is particularly well-suited for short-term forecasts, providing reliable predictions for up to 72 hours.





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