



EUROPEAN CENTRAL BANK

EUROSYSTEM

Network of Experts on Machine Learning

Climate Change Challenge

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ECB-UNRESTRICTED
FINAL



Introduction

The ESCB/SSM Network of Experts on Machine Learning created in 2020 was mandated to foster an exchange of knowledge and best practices as well as to support joint projects on Machine Learning.

Among its initiatives, the Network organized the **Climate Change Challenge**, a hackathon co-organised by the ECB, the Banca d'Italia, the Banque de France and the Copernicus services of the European Commission.

The organisation team was coordinated by the ECB and composed of experts from Machine Learning and Climate Change as well as hackathon organisers.

This **physical event took place at the ECB from the 14th to the 16th of November 2023**

After some coaching sessions during the first afternoon, participants to the event had **24 hours to answer to a specific question.**



Scope of the Hackathon (1/2)

Main question to answer in 24 hours:

What is the impact of droughts and heat stress on industrial and agricultural added value?

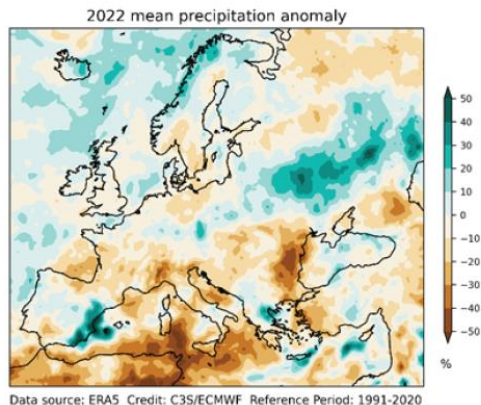
With 2 guiding principles:

- **Explain** – reveal patterns and importance of different features and characteristics of the data (which factors are important and why);
- **Predict** – predict the impact of drought and heat stress on industrial and agricultural production.

Scope of the Hackathon (2/2)

Relying on time series of:

- **Macro-economic data from Eurostat at NUTS3 level** as target variables (sectoral gross value added) but also as control variables (employment, population, GDP) ;
- **Climate data from the European Drought Observatory** (Copernicus services – EC) as **explanatory variables**:
 - Standardized Precipitation Index;
 - Soil Moisture Anomaly;
 - Low Flow Index;
 - Fraction of Absorbed Photosynthetically Active Radiation;
 - Heat Wave Index;
 - Monthly Average of Maximum Daily Temperatures.



Copernicus Climate Change Service
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The participants had at their disposal AWS Cloud platform to execute and share programs within teams.

Composition of the teams

64 participants to the event were allocated to **8 teams**.

The composition of each team took into account that:

- Participants were from **26 institutions** and 23 countries;
- Participants had **different backgrounds**: data science, statistics, computer science, economics, macro/micro prudential risks, climate risks, climate science, ...

The composition of each team was determined by the hackathon organisation team considering **some allocation criteria**.

Evaluation of the winning teams

The evaluation of the winning teams was carried out in 2 steps:

- **A first evaluation** on detailed technical review of the notebooks and assessment of the results **by a panel of 5 experts** (Machine Learning and Climate change);
- **An assessment of the teams' results**, with a focus on policy relevance **by High-level jury** (ECB – DGS & CCC, Bdl, ACPR, Copernicus).

After deliberation of the Jury and the panel of experts, three winning teams were selected. Prizes were awarded by the President of the ECB.

Results and next steps (1/2)

Beyond fruitful discussions on machine learning techniques and data visualization to policy impact analysis and integration of climate considerations into existing models as well as climate risk assessment, **key results of this hackathon** were:

- **Interdisciplinary collaboration** foster new ideas for climate-related challenges in finance;
- Tangible avenues for **relevant climate indicators** built upon granular climate data from Copernicus services;
- Using ML techniques, heat waves and droughts have a **significant impact on the gross value added** in the agricultural and manufacturing sectors.

Results and next steps (2/2)

Next steps beyond the time frame of the hackathon were:

- **Further development and potential integration:** the top winning team collaborates with the ECB and the Copernicus services to expand their research;
- **Knowledge sharing:** the results obtained by the different teams were shared on a collaborative platform;
- **Continued Innovation and future events:** The encouraging results obtained during the hackathon could be enriched with complementary climate datasets and improved with advanced ML techniques;