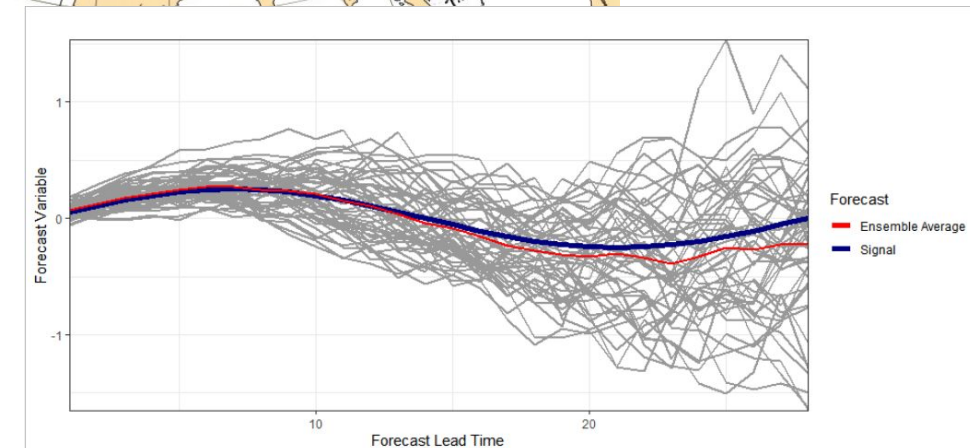
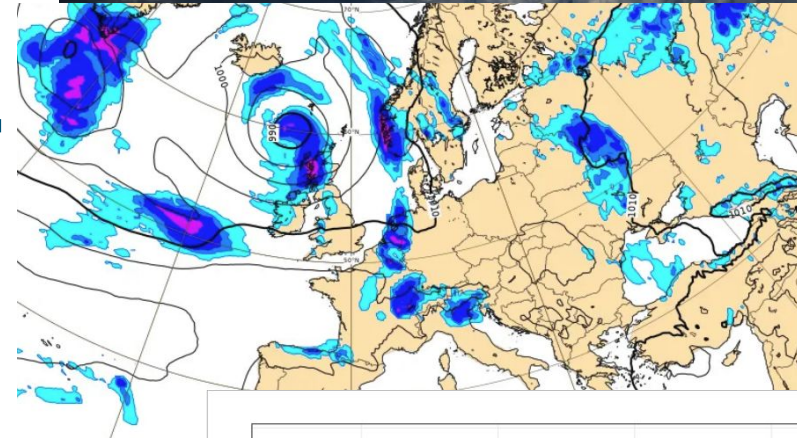
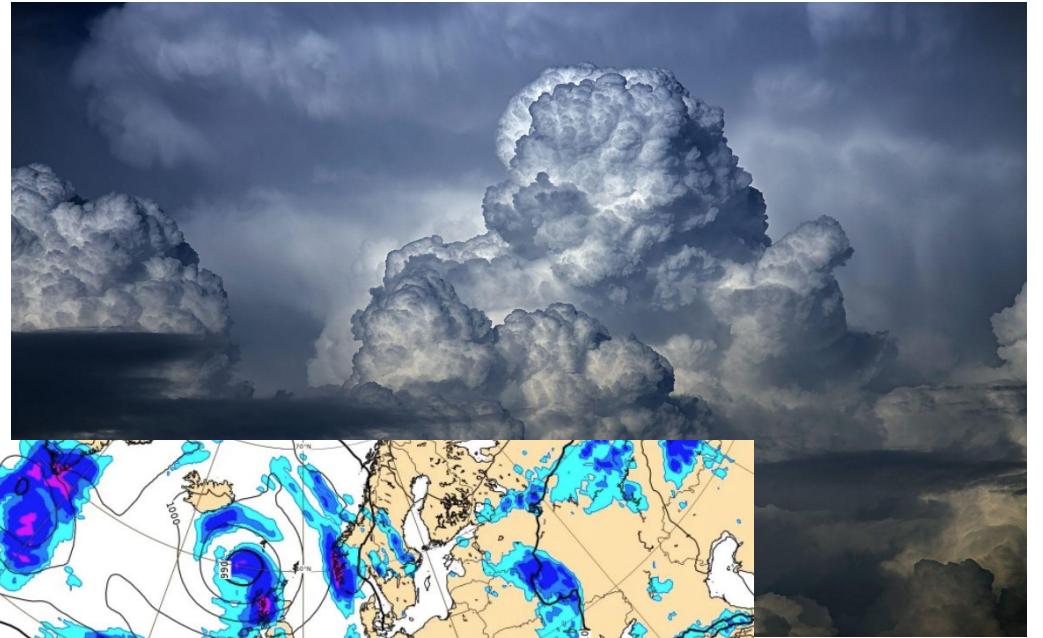




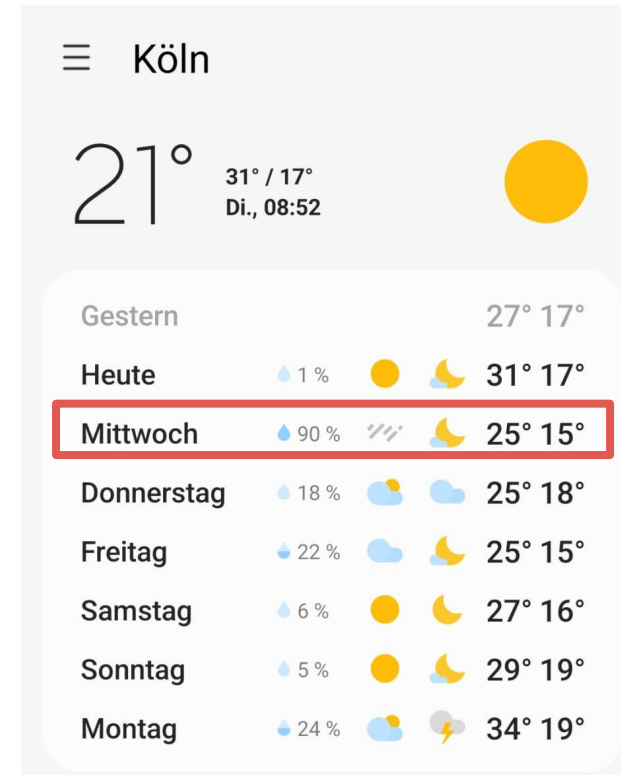
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WEATHER FORECAST CASE STUDY

Luisa Reske and Rubén Vásquez



Motivation



Objectives

- Research question:
 - How does the weather forecast changed and evolved for the 18 of May in the city of Köln?
- Data processing objectives:
 - Data preprocessing, data management and data FAIRness
 - Analysis/processing and visualization of the data
 - Documentation, repository


Structure

Workflow:

1. Sources investigation
2. Creation of repository, Github implementation
3. Download of information
4. Data preprocessing
5. Analysis and visualization.
6. Scripts optimization
7. Function testing
8. Documentation and wrapping

Data

- ECMWF Integrated Forecast System (IFS)
- global atmospheric model: describes dynamical evolution of atmosphere worldwide
- no model can produce precisely correct forecasts \Rightarrow Ensemble forecast
- access with ecmwf-api-client

 ECMWF

Public Datasets

Select dataset

Current activity

Help

Log In

S2S sets

Real time

Reforecasts

Statistical process

Instantaneous and accumulated

Daily averaged

Origins

BoM

CMA

CNRM

CPTEC

ECCC

ECMWF

HMCR

IAP-CAS

ISAC-CNR

JMA

KMA

NCEP

UKMO

Type of level

Potential temperature

Pressure levels

Surface

Type

Control forecast

Perturbed forecast

S2S, ECMWF, Realtime, Instantaneous and Accumulated

Public access to this dataset will be **transitioning** to a new interface, dates to be announced soon. For more information on how to access this data in the future, please consult the dedicated page on **Decommissioning of ECMWF Public Datasets service**.

Please **login** before retrieving data from this dataserver.

This dataset is available daily. [Read more](#)

Select a month

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2015	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	2016	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
2017	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	2018	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
2019	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	2020	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
2021	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	2022	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
2023	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	2024	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Select number

<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5	<input type="checkbox"/> 6	<input type="checkbox"/> 7	<input type="checkbox"/> 8	<input type="checkbox"/> 9	<input type="checkbox"/> 10	<input type="checkbox"/> 11	<input type="checkbox"/> 12	<input type="checkbox"/> 13	<input type="checkbox"/> 14	<input type="checkbox"/> 15
<input type="checkbox"/> 16	<input type="checkbox"/> 17	<input type="checkbox"/> 18	<input type="checkbox"/> 19	<input type="checkbox"/> 20	<input type="checkbox"/> 21	<input type="checkbox"/> 22	<input type="checkbox"/> 23	<input type="checkbox"/> 24	<input type="checkbox"/> 25	<input type="checkbox"/> 26	<input type="checkbox"/> 27	<input type="checkbox"/> 28	<input type="checkbox"/> 29	<input type="checkbox"/> 30
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Select All or Clear

Select step

<input type="checkbox"/> 0	<input type="checkbox"/> 6	<input type="checkbox"/> 12	<input type="checkbox"/> 18	<input type="checkbox"/> 24	<input type="checkbox"/> 30	<input type="checkbox"/> 36	<input type="checkbox"/> 42	<input type="checkbox"/> 48	<input type="checkbox"/> 54	<input type="checkbox"/> 60	<input type="checkbox"/> 66	<input type="checkbox"/> 72
<input type="checkbox"/> 78	<input type="checkbox"/> 84	<input type="checkbox"/> 90	<input type="checkbox"/> 96	<input type="checkbox"/> 102	<input type="checkbox"/> 108	<input type="checkbox"/> 114	<input type="checkbox"/> 120	<input type="checkbox"/> 126	<input type="checkbox"/> 132	<input type="checkbox"/> 138	<input type="checkbox"/> 144	<input type="checkbox"/> 150
<input type="checkbox"/> 156	<input type="checkbox"/> 162	<input type="checkbox"/> 168	<input type="checkbox"/> 174	<input type="checkbox"/> 180	<input type="checkbox"/> 186	<input type="checkbox"/> 192	<input type="checkbox"/> 198	<input type="checkbox"/> 204	<input type="checkbox"/> 210	<input type="checkbox"/> 216	<input type="checkbox"/> 222	<input type="checkbox"/> 228

Select parameter

- ☐ 10 metre U wind component
- ☐ Convective precipitation
- ☐ Mean sea level pressure
- ☐ Snowfall water equivalent
- ☐ Surface long-wave (thermal) radiation downwards
- ☐ Surface net short-wave (solar) radiation
- ☐ Surface runoff
- ☐ Surface short-wave (solar) radiation downwards
- ☐ Time-integrated northward turbulent surface stress
- ☒ Total Precipitation

- ☐ 10 m
- ☐ Max
- ☐ Mini
- ☐ Surf
- ☐ Surf
- ☐ Surf
- ☐ Surf
- ☐ Time
- ☐ Top
- ☐ Wat

[< Return to selection](#)

request

Estimated number of fields: 87

Python script

[MARS request](#)

For more information on how to retrieve data programmatically, in Python, please go to [Access ECMWF Public Datasets](#).

[Select All](#) or [Clear](#)

View data retrieval request

Retrieve GRIB

```
#!/usr/bin/env python
from ecmwfapi import ECMWFDataServer
```

```
server = ECMWFDataServer()
```

```
server.retrieve({
    "class": "s2",
    "dataset": "s2s",
    "date": "2024-02-01/to/2024-02-29",
    "expver": "prod",
    "levtype": "sfc",
    "model": "glob",
    "number": "1",
    "origin": "ecmf",
    "param": "228228",
    "step": "0/6/12",
    "stream": "enfo",
    "time": "00:00:00",
    "type": "pf",
    "target": "output"
})
```

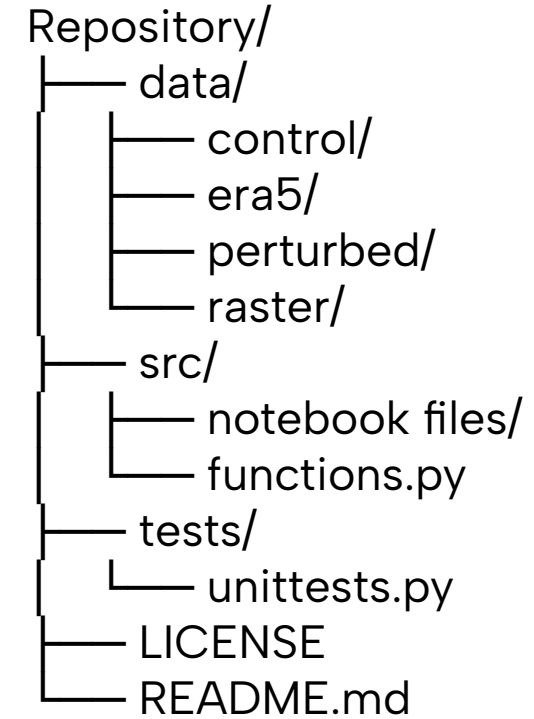


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Repository Structure

⇒ Link to Git

https://github.com/RubenVasquezArr/Weather_forecast_case_study/tree/main



DATA ANALYSIS AND VISUALIZATION



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Institute of Geophysics and Meteorology / Fundamentals of Earth System Data
Processing / Final Project

05.08.2024

Regionwide Forecast: Mean Ensemble

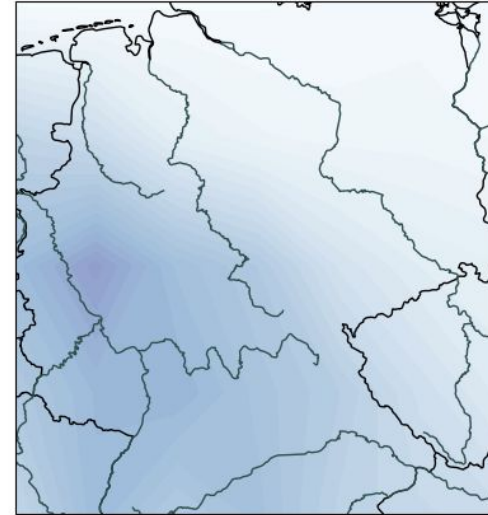
Mon 18/05/2024 18:00



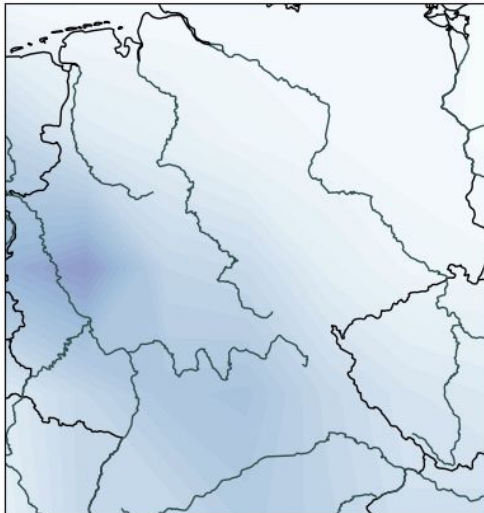
Tue 18/05/2024 18:00



Wed 18/05/2024 18:00



Thu 18/05/2024 18:00



Fri 18/05/2024 18:00



Sat 18/05/2024 18:00

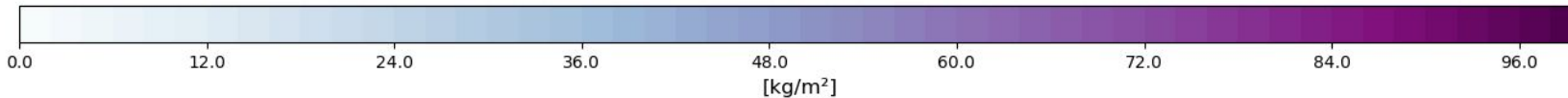


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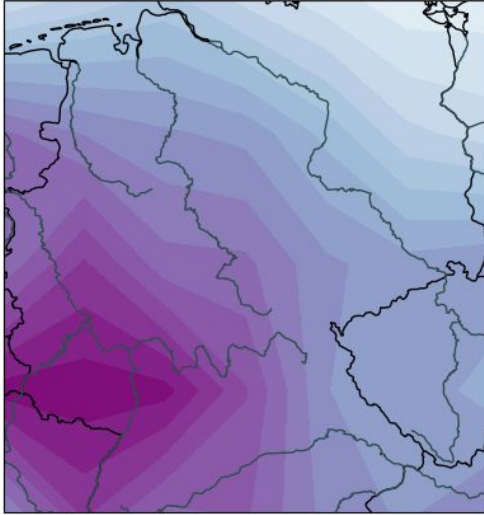


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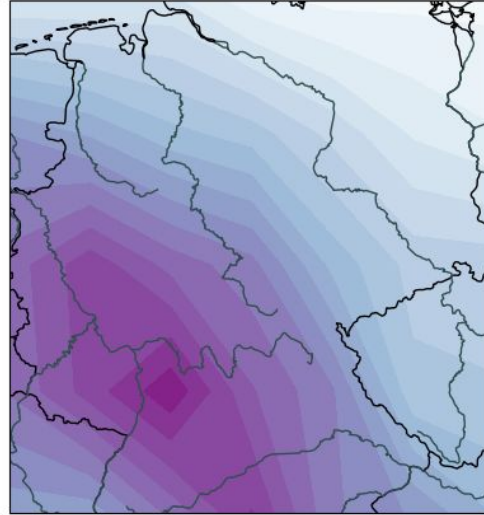


Regionwide Forecast: Standard Deviation Ensemble

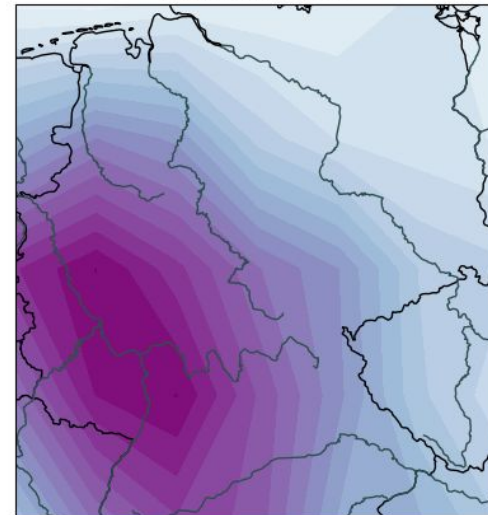
Mon 18/05/2024 18:00



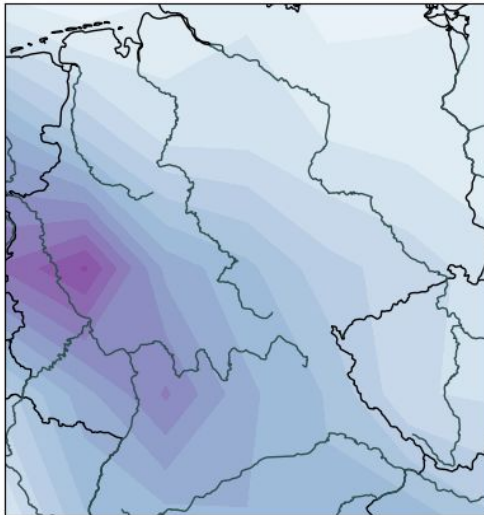
Tue 18/05/2024 18:00



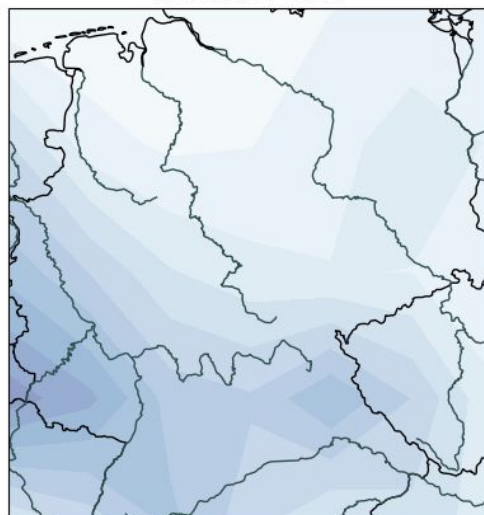
Wed 18/05/2024 18:00



Thu 18/05/2024 18:00



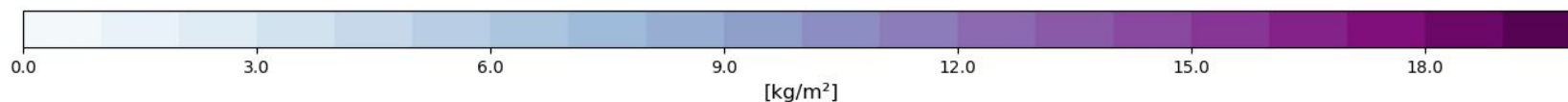
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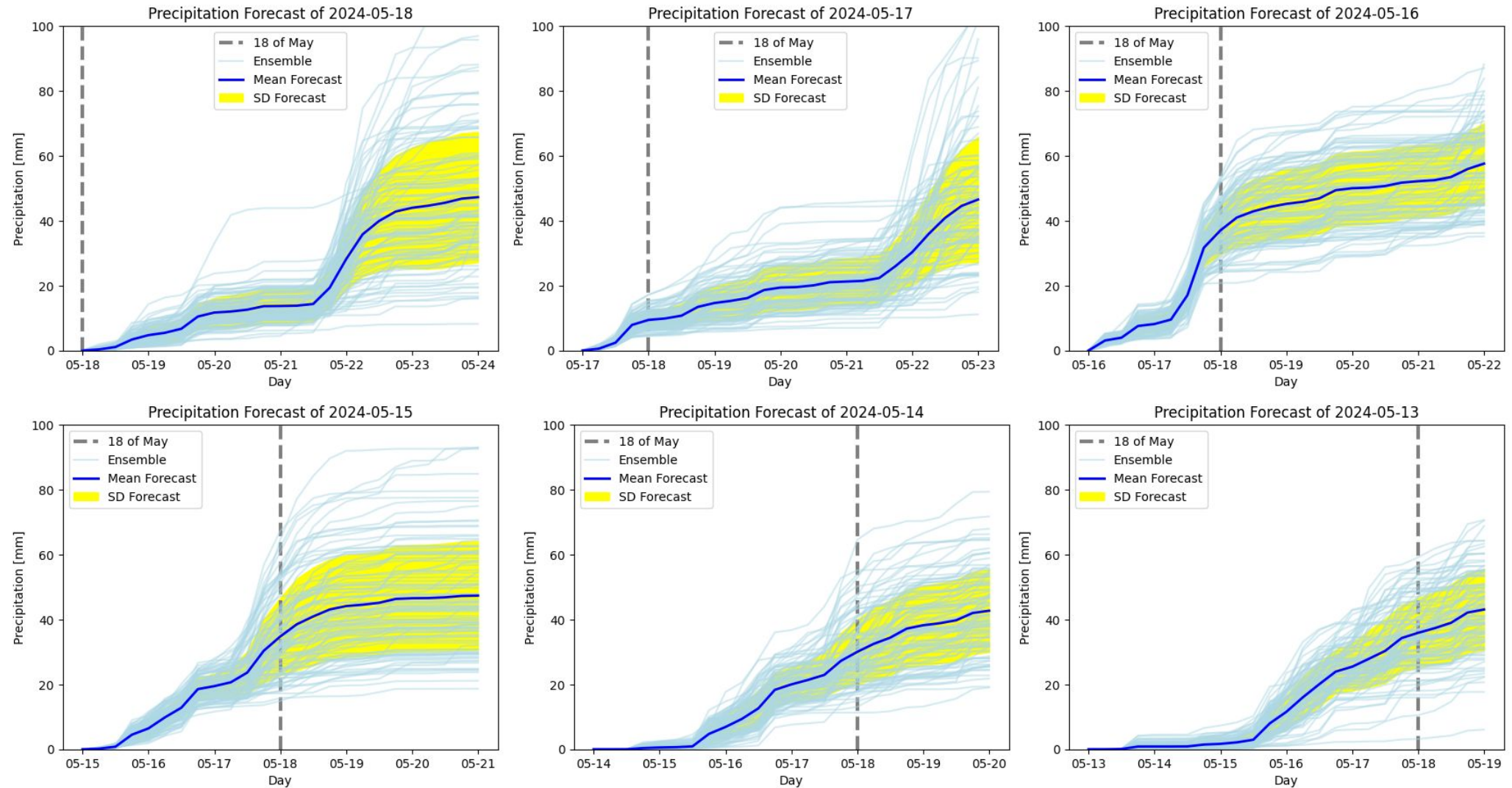
Sat 18/05/2024 18:00



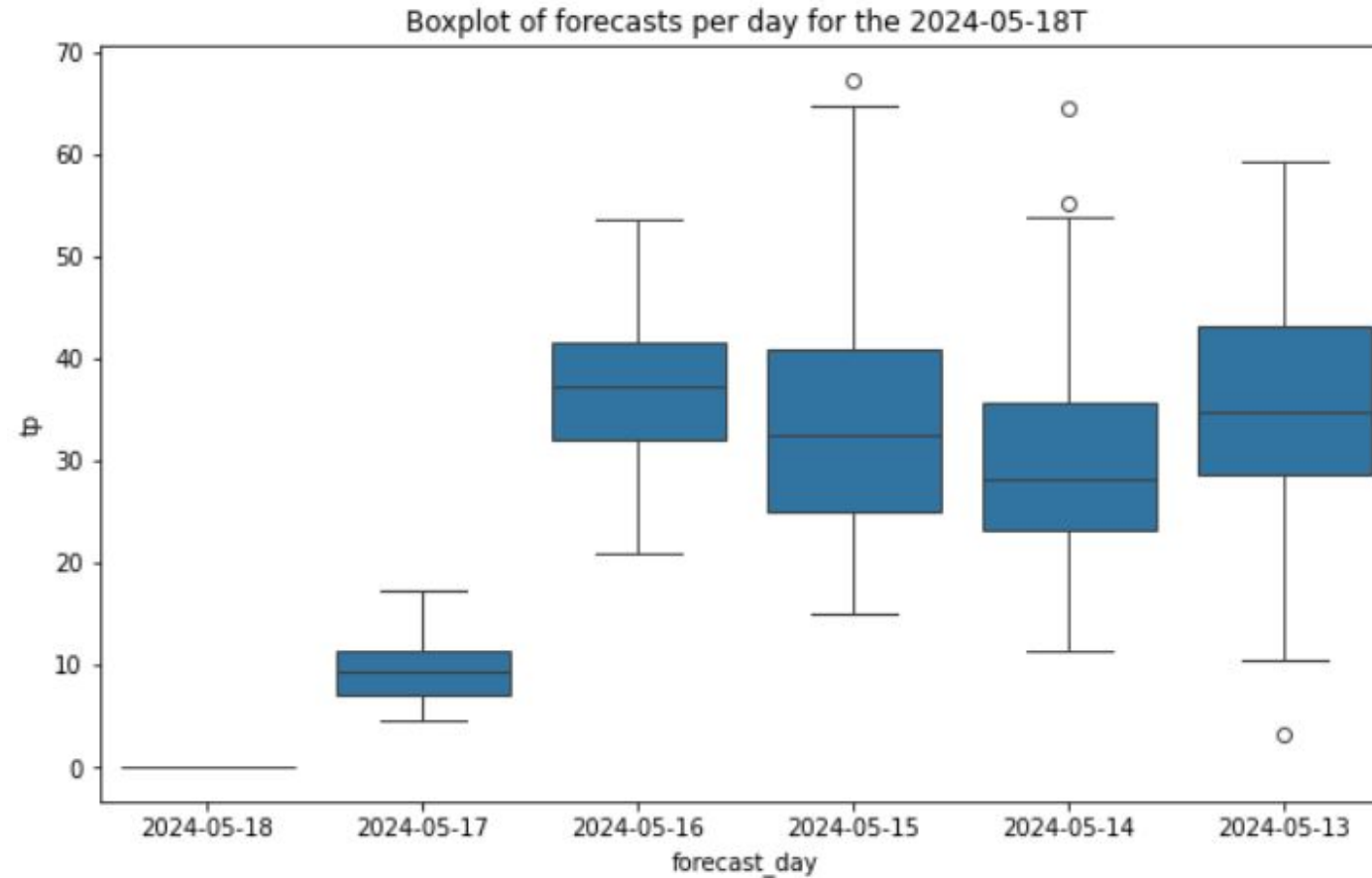
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Forecast City of Cologne



Forecast City of Cologne



Comparison to Reanalysis Data

[Interactive map](#)

Conclusion

Incorrect forecasts due:

- initial conditions uncertainties
- model uncertainties
- boundary condition uncertainties
- atmosphere is a chaotic system

Further improvements:

- comparing to other forecast model (e.g. from DWD)

Conclusion to project and Issues

- Biggest challenges:
 - Information search
 - Data comprehension and processing
 - standardization of functions
- Biggest learnings:
 - Github is a powerful tool to share and co-create projects.
 - Thinking for others and the future: documentation and FAIR principles.