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Providentia: an evaluation software package for the atmospheric modelling community

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²Catalan Institution for Research and Advanced Studies (ICREA), Barcelona, Spain

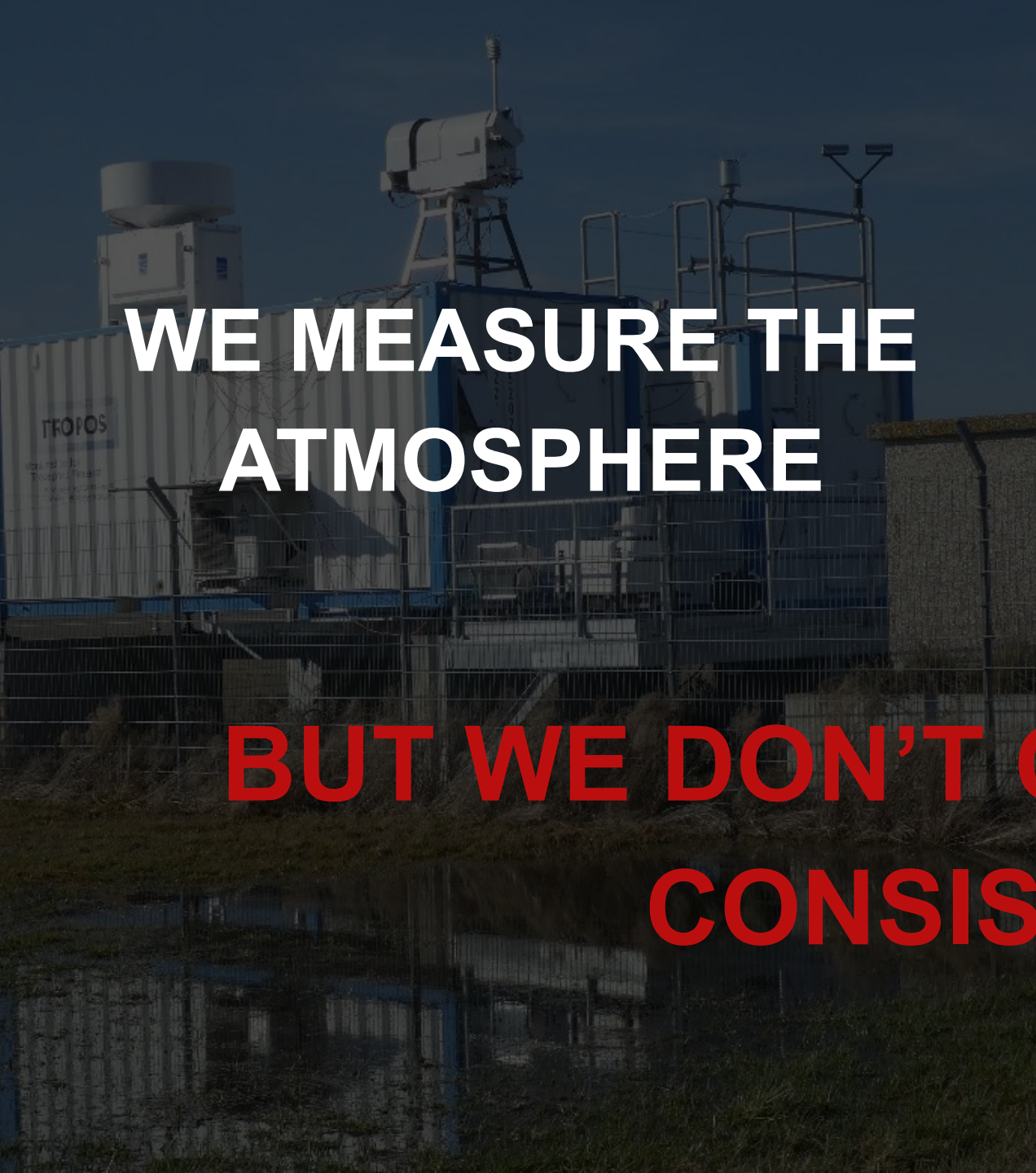
05/05/2026



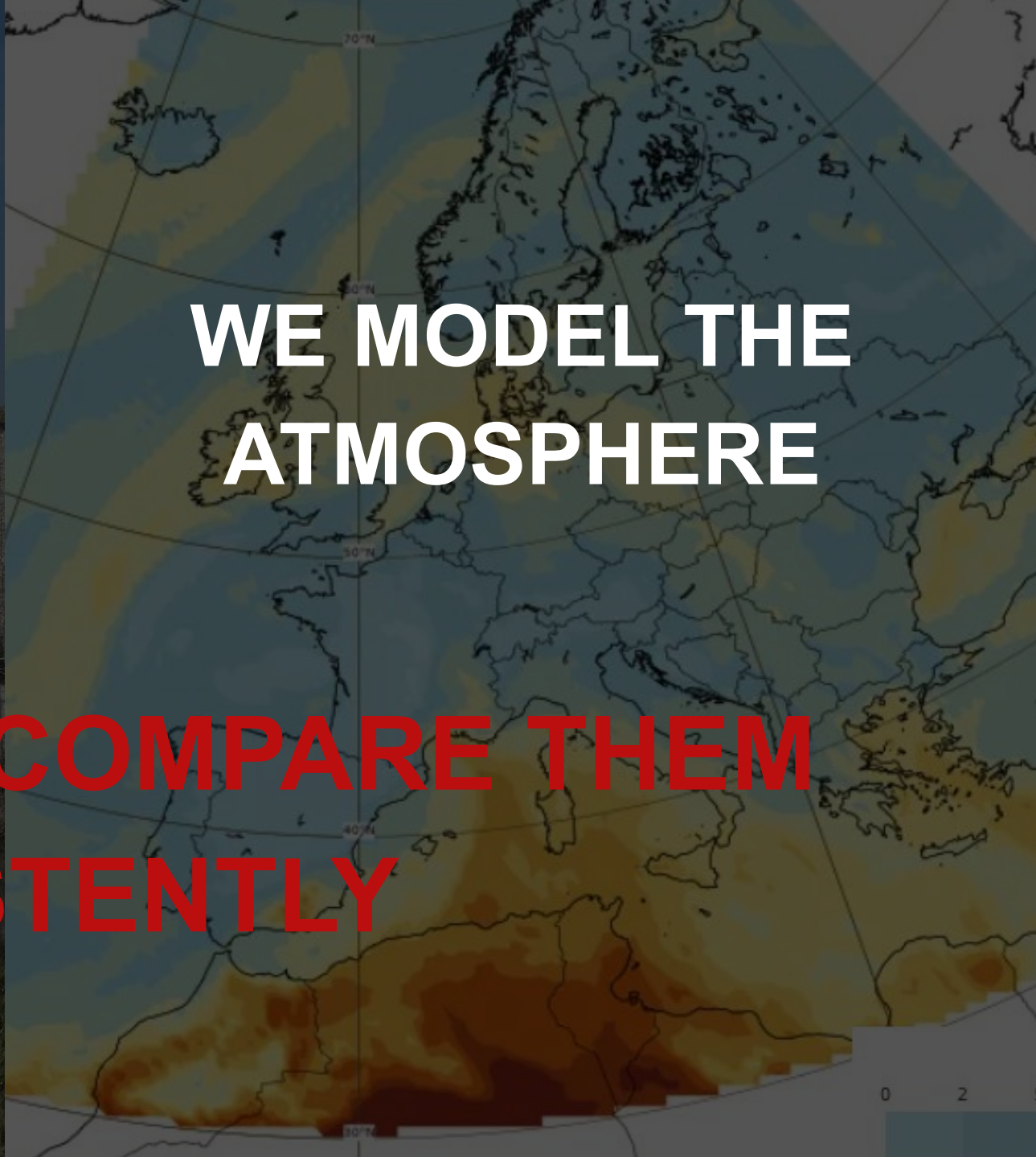
Financiado por
la Unión Europea
NextGenerationEU



Plan de Recuperación,
Transformación y Resiliencia

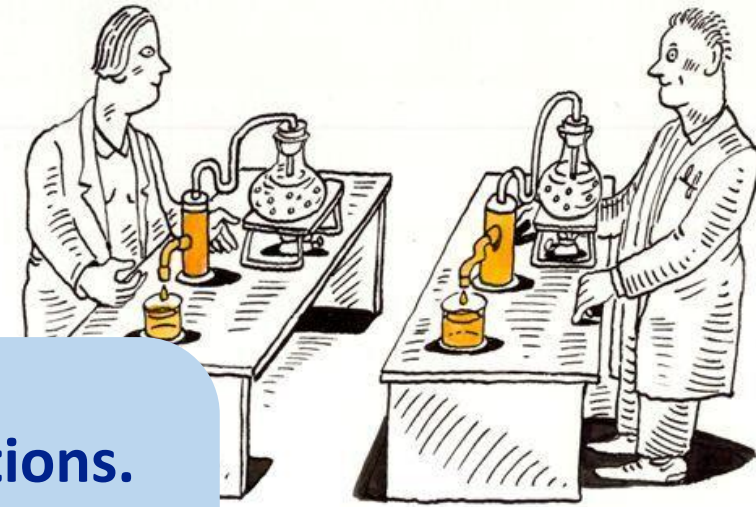
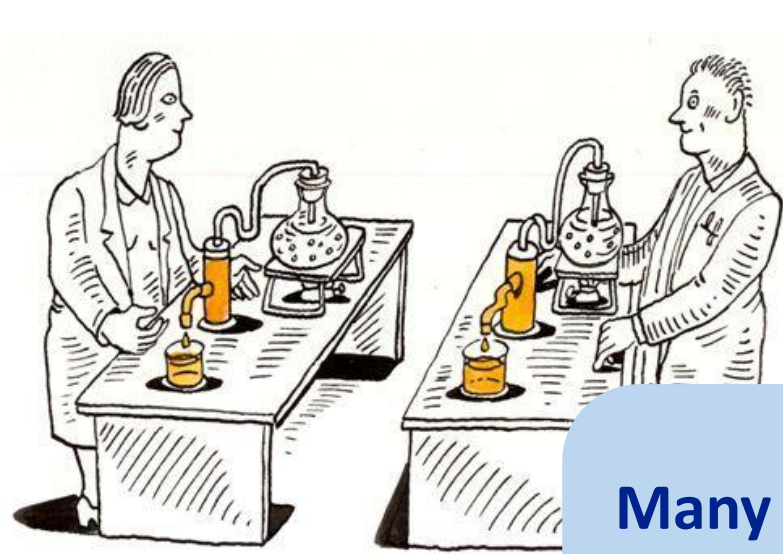


**WE MEASURE THE
ATMOSPHERE**

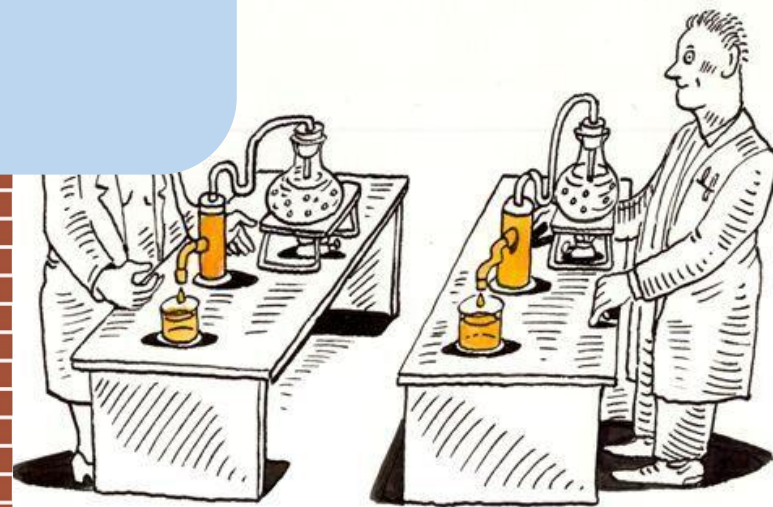
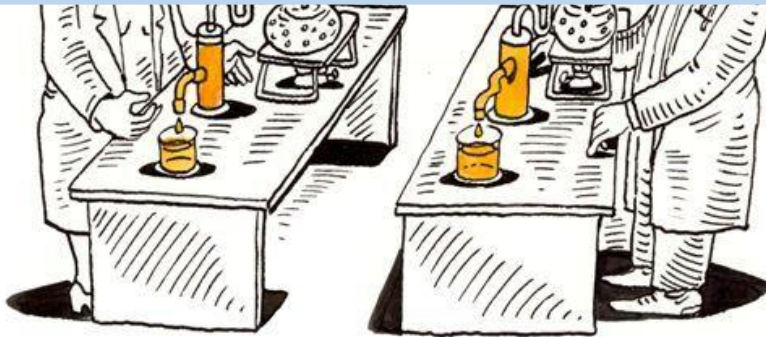
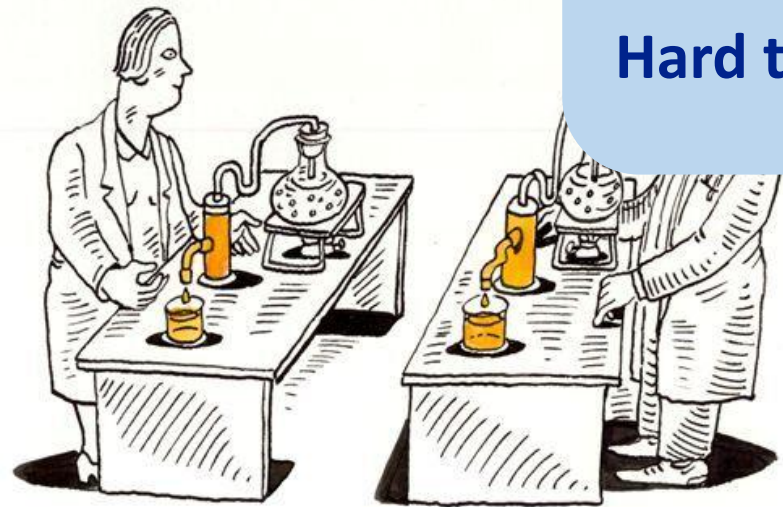


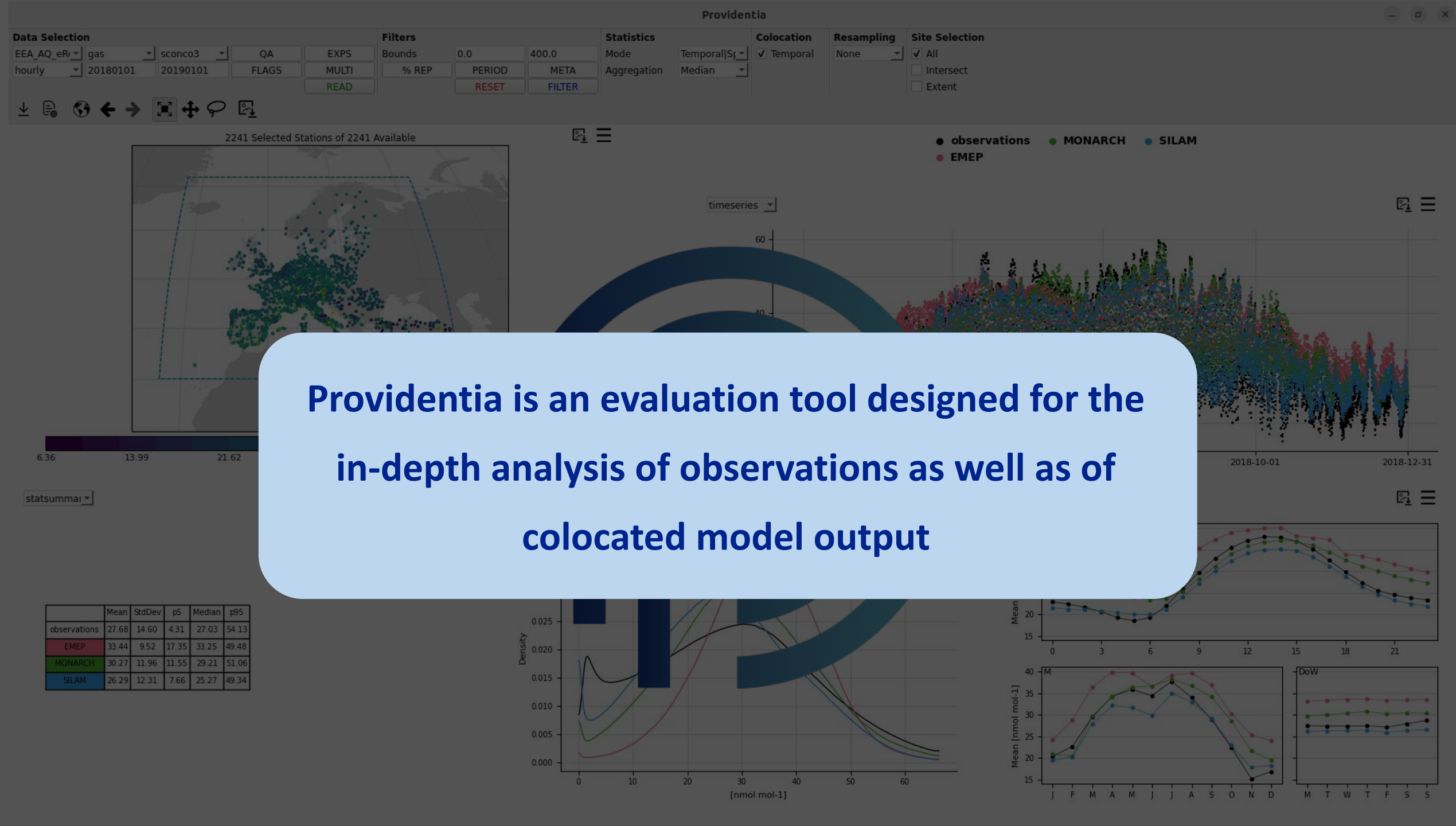
**WE MODEL THE
ATMOSPHERE**

**BUT WE DON'T COMPARE THEM
CONSISTENTLY**



**Many try to combine models and observations.
But each group does it differently.
Hard to reproduce. Hard to compare.**





Modes



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Structure

Pre-processing



Download

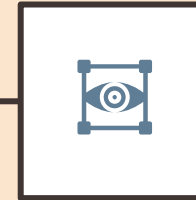
Downloads and formats the models and observations.



Interpolation

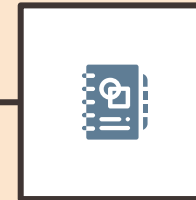
Matches spatially models to observation networks.

Analysis



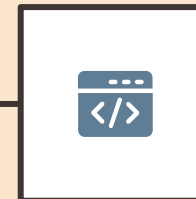
Dashboard

Performs interactive analyses of model results, using observational data.



Report

Creates detailed pdf reports for in-depth analysis.



Library

Uses backend functions within scripts.

Data



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ACTRIS

The Aerosol, Clouds and Trace
Gases Research Infrastructure

In-situ atmospheric
measurements



GHOST

Globally Harmonised
Observations in Space and Time

N° Processed
Measurements:

~7.3 billion

N° Components:

227

N° Networks:

38

Temporal range:

1970-2023

 Facilities 

 ACTRIS National Facility - In Progress 

ERA5 reanalysis

Weather and climate variables
Global dataset



Climate
Change Service

climate.copernicus.eu

CAMS forecasts and reanalyses

Atmospheric composition
variables
Global + European dataset



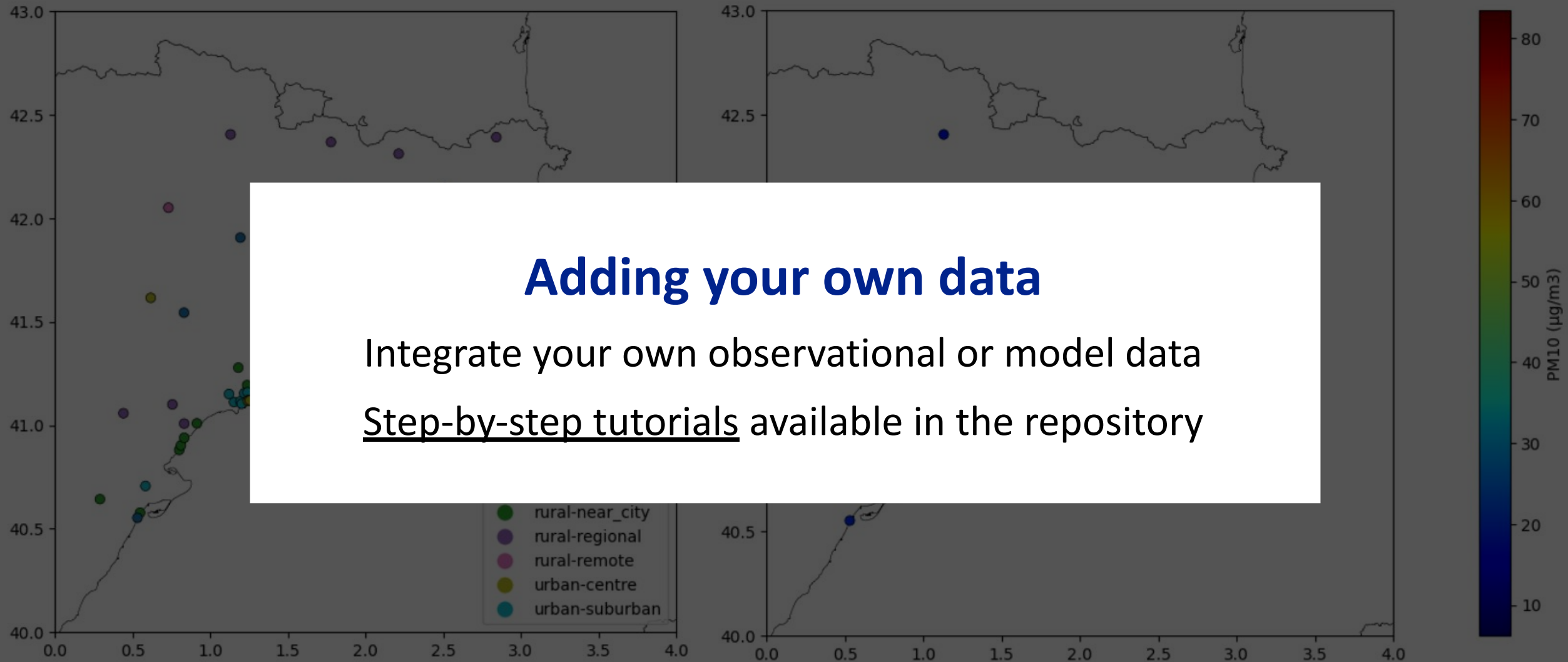
Atmosphere
Monitoring Service

atmosphere.copernicus.eu

Adding your own data

Integrate your own observational or model data

Step-by-step tutorials available in the repository



Interpolation



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Dashboard



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GHOST

gas

sconco3

hourly

20180101

20180201

QA

FLAGS

MODELS

SPECIES

READ

Bounds

COVERAGE

PERIOD

METADATA

RESET

FILTER

Statistics

Mode

Temporal

S

Aggregation

Median

Colocation

☒ Temporal

Resampling

None

Site Selection

☐ All

☐ Intersect

☐ Extent

↓

📄

🌐

🔍

←

→

📐

⛶

💬

🖨️

(x, y) = (0.397, 0.11)

✎

Report



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Report

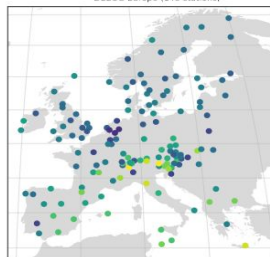
EVALUATION REPORT

Network: EBAS
Species: O3
Temporal resolution: Hourly
Date range: 01/01/2018 - 01/07/2018
Models: EMEP, MONARCH
Subsections: DEBUG-Europe,

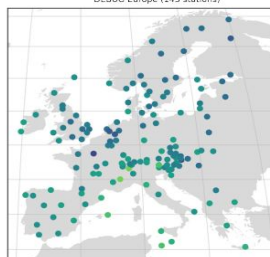
Map Median (Summary)
EBAS|sconco3



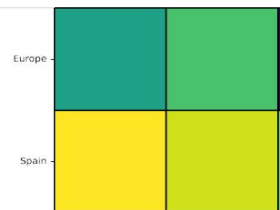
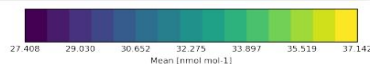
observations
DEBUG Europe (143 stations)



EMEP
DEBUG Europe (143 stations)



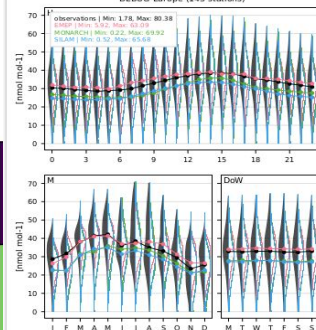
Heatmap Mean (Summary)
multispecies



Violin (Summary)
EBAS|sconco3

● observations ● EMEP ● MONARCH ● SILAM

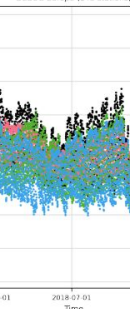
DEBUG Europe (143 stations)



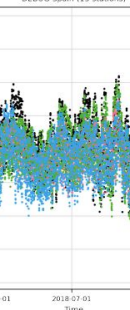
Timeseries (Summary)
EBAS|sconco3

● observations ● EMEP ● MONARCH ● SILAM

DEBUG Europe (143 stations)

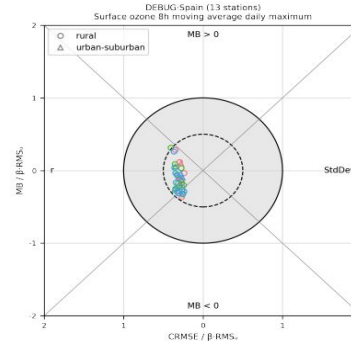
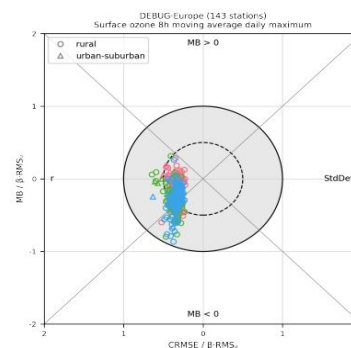


DEBUG Spain (13 stations)



Fairmode target (Summary)
EBAS|sconco3

● EMEP ● MONARCH ● SILAM

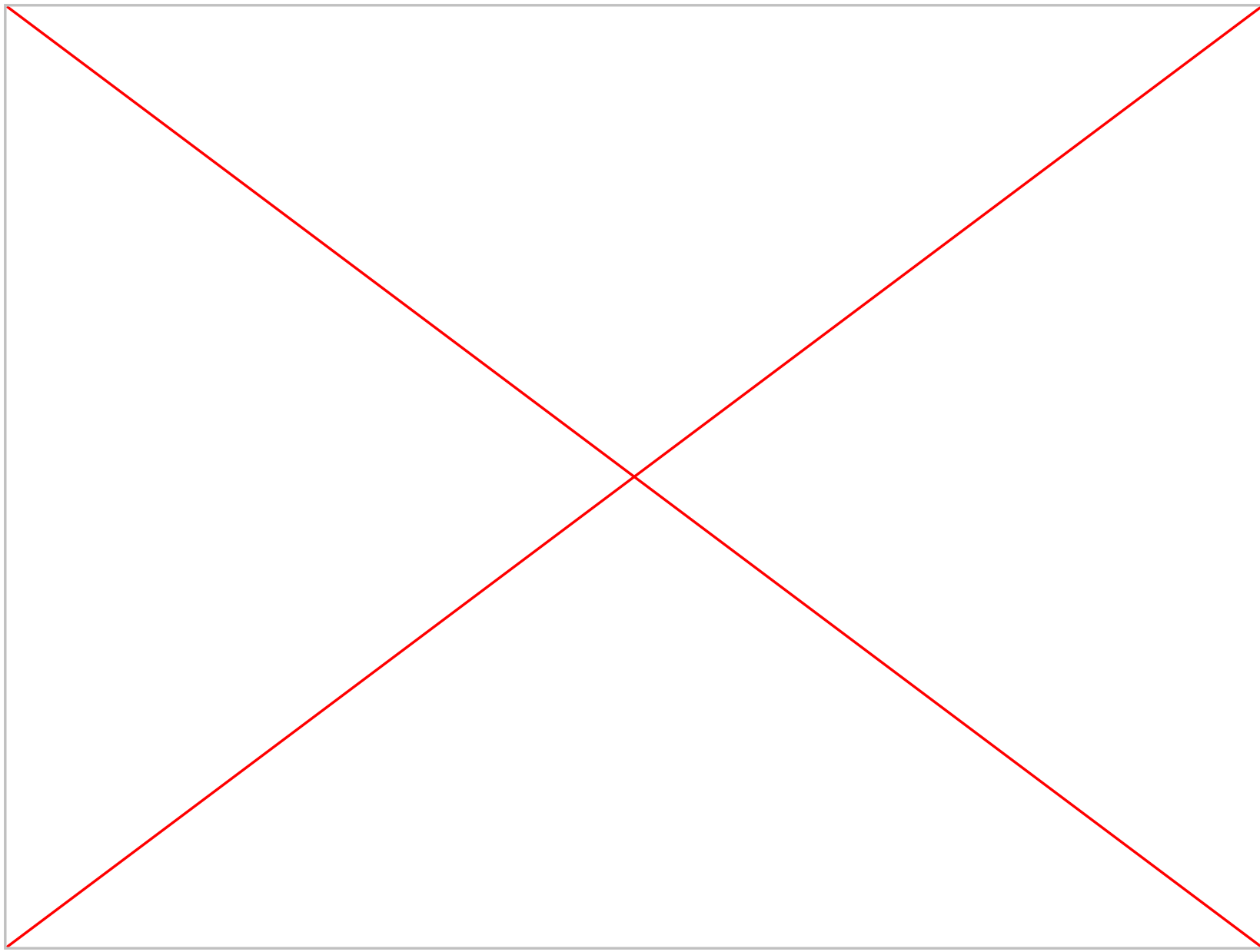


Library

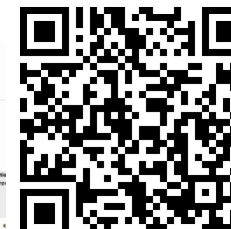
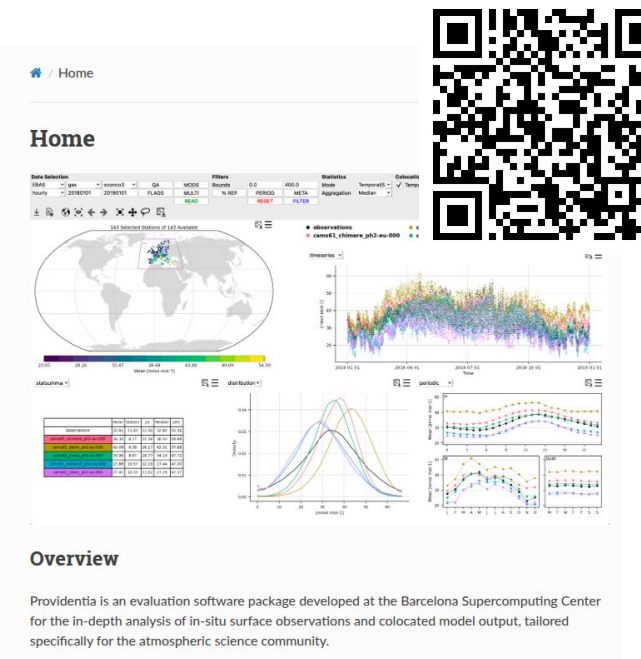
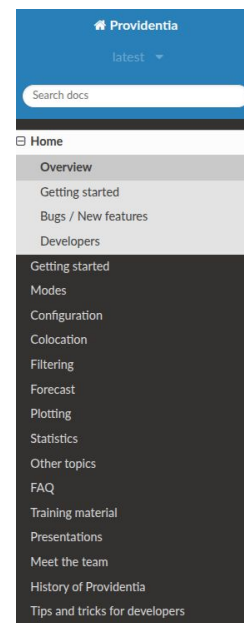
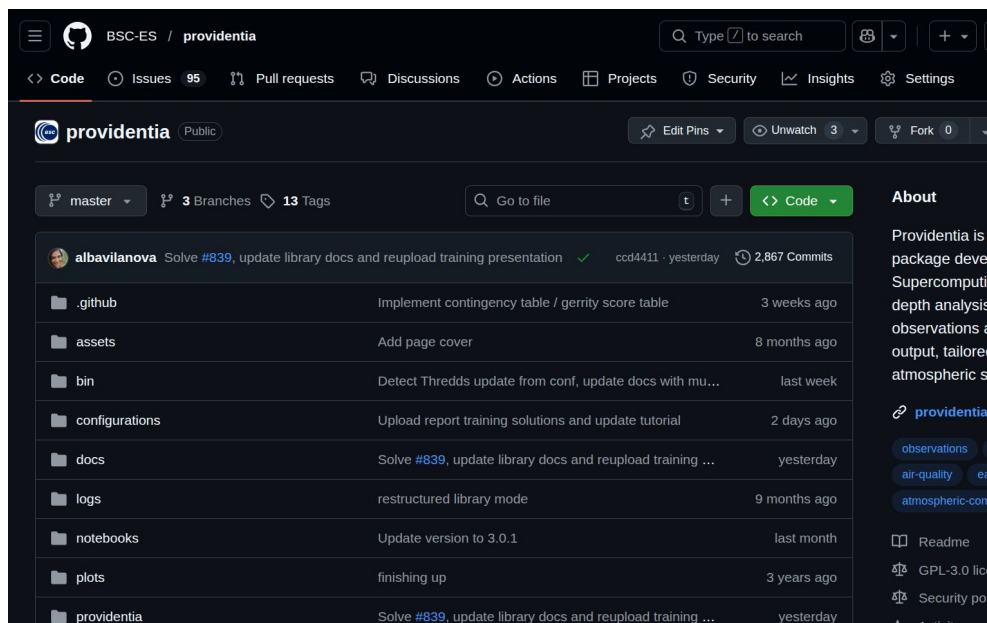


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Access



Repository: <https://github.com/bsc-es/providentia>

Documentation: <https://providentia.readthedocs.io/en/latest/>

OS: Linux and Mac. On Windows through WSL and virtual machines.



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Thank you for your attention!

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