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# A Brief History of Providentia

18/11/2025

Dene Bowdalo

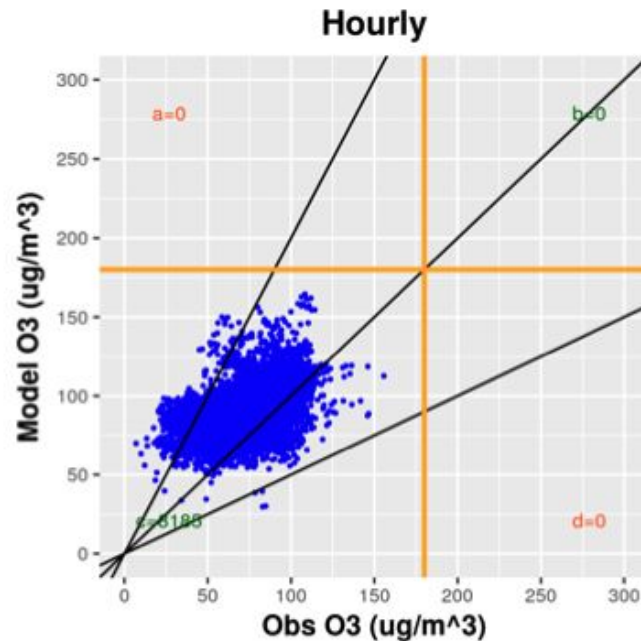
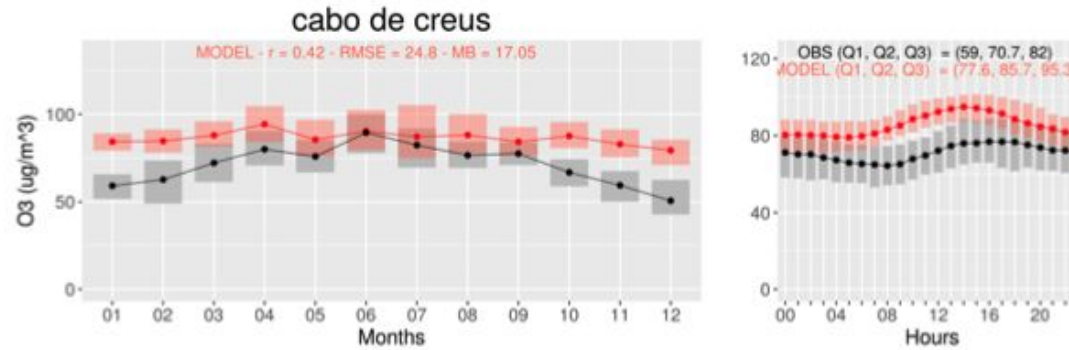
# Timeline



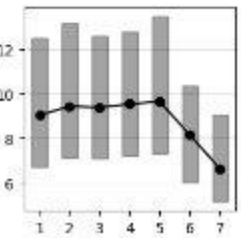
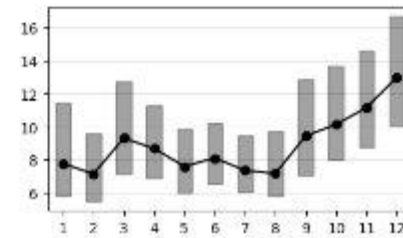
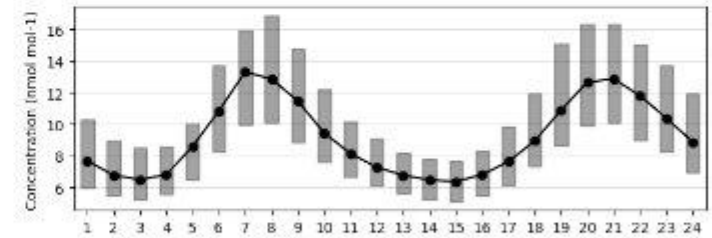
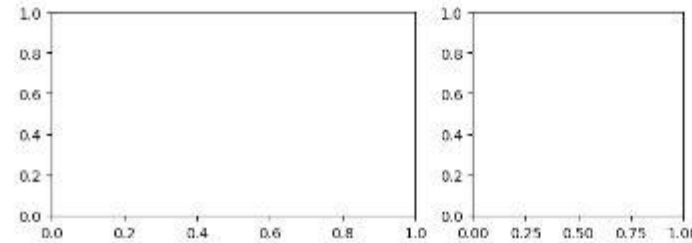
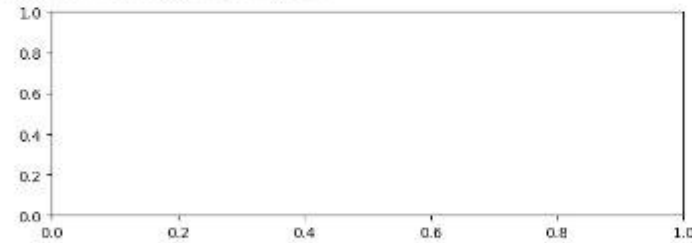
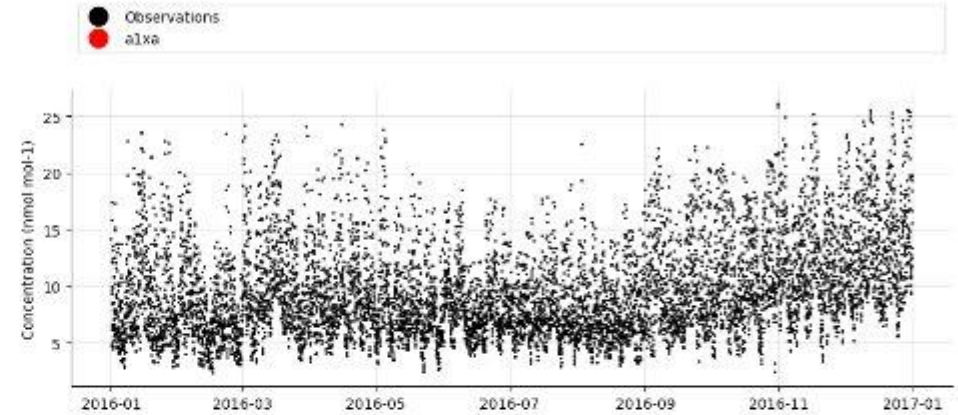
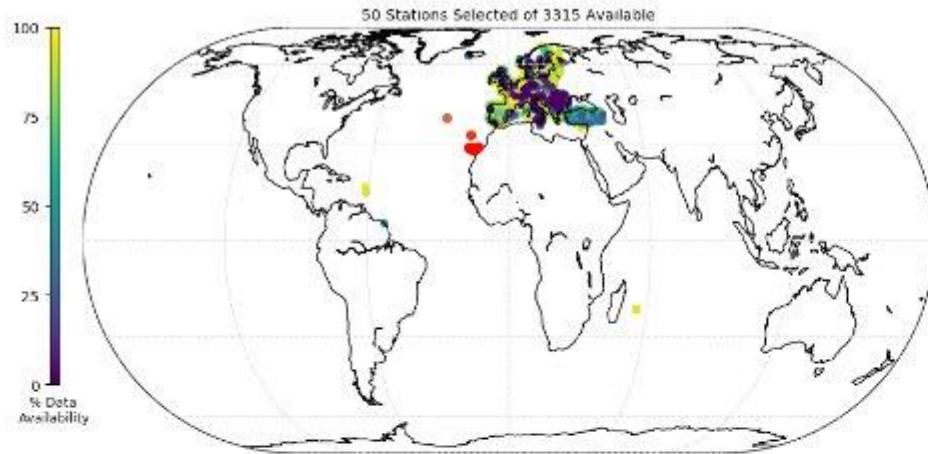
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# The origins: ET (Evaluation Tool) (2018 & 2019)



# Interactive Tool First Concept (April 2019)



# A change of name... Providentia is Born (12th August 2019)

## Initial ideas:

- AtmosPy
- PINTA (Python Interactive Tool for Atmospheric data analysis)
- REACTANT (inteRactivE Atmospheric ComposiTiOn dAtA aNalysis Tool)
- CATALYST (interaCtive Atmospheric composiTiOn datA anaLYSis Tool)

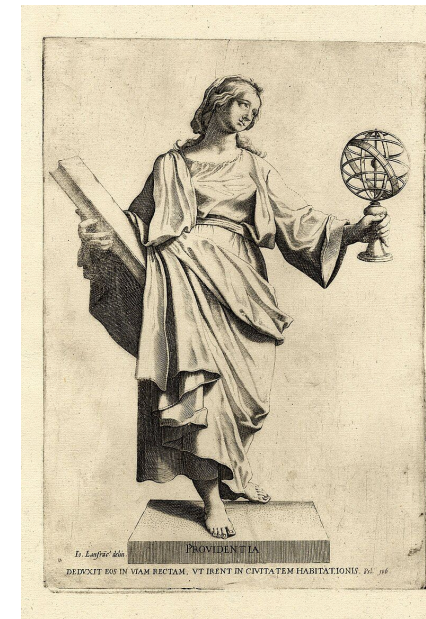
## Mythical God ideas (following other BSC Tools e.g. Caliope/Hermes):

- Providentia --> Roman divine personification of the ability to foresee and make provision
- Athena --> Greek goddess of general wisdom, intelligence, and thoughtfulness
- Aletheia --> Greek goddess personification of the concept of Truth.
- Minerva --> Roman goddess associated with wisdom.
- Veritas --> Roman goddess of Truth.

## And the winner is... Providentia!

## Meaning:

*Providentia* was an important moral and philosophical abstraction in Roman discourse. Cicero says it is one of the three main components of *prudentia*, "the knowledge of things that are good or bad or neither," along with *memoria*, "memory," and *intellegentia*, "understanding."



# Providentia Version 1.0.0 & Amalia Vradi Joins (November 2019)

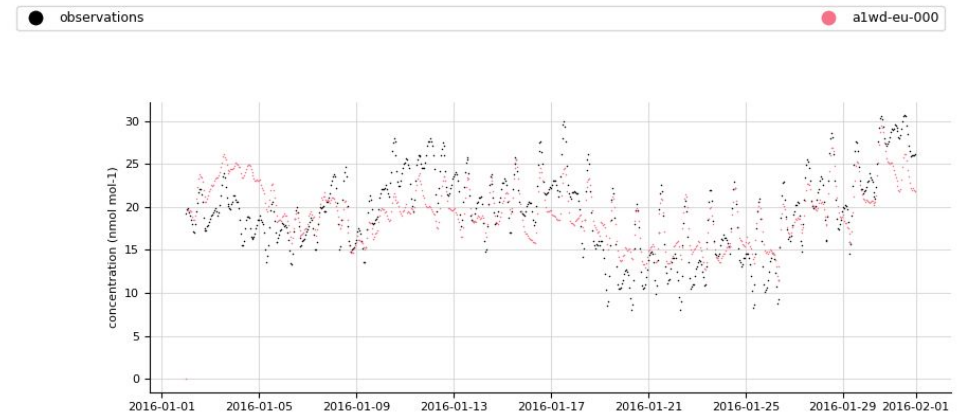
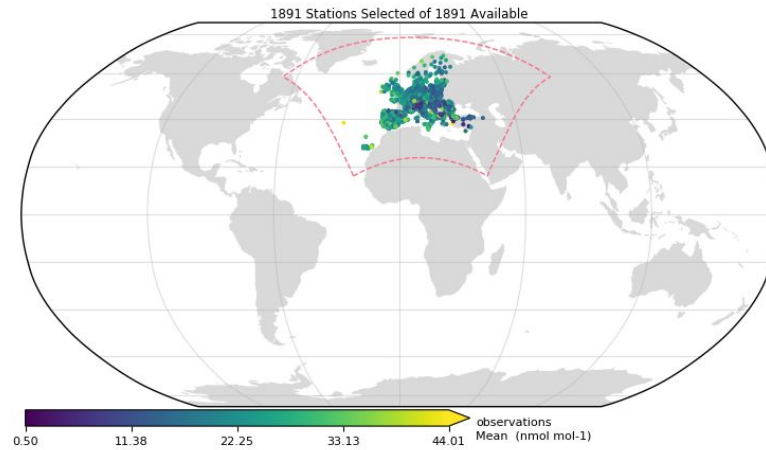


10 Issues closed:  
Dashboard

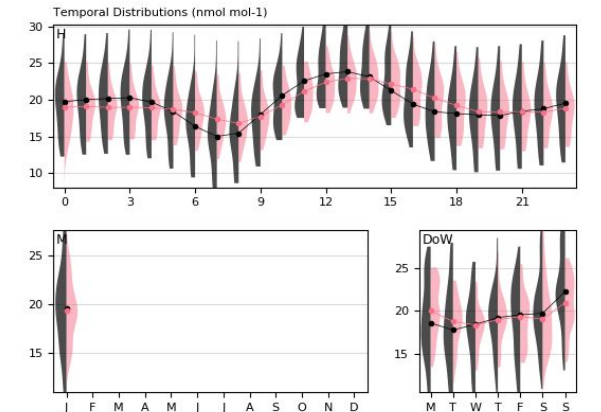
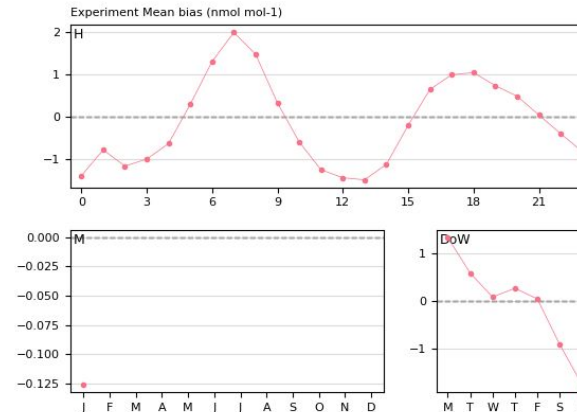
Providentia

Data Selection	<input checked="" type="checkbox"/> Colocate	READ	QA	Filters	RESET	Bounds	Map_Z	Mean	Exp. Bias	Site Select
EEA_AQ_eRe	gas	20160101	FLAGS	% REP	PERIOD	0.0	observations	Aggregated	Aggregated	<input type="checkbox"/> All
hourly	sconco3	20160201	EXPS	META	FILTER	1000.0		Mean	Mean	<input checked="" type="checkbox"/> Intersect

Home Back Forward Zoom In Zoom Out Save



1891 Stations Selected  
 Median Measurement Altitude: 153.00m Median To Coast: -89.00km  
 Median Population Density: 687.4 people/km-2  
 Median Nighttime Lights: 56.0  
 Country: 38 unique elements  
 Area Classification: 6 unique elements  
 Station Classification: background:80.6%, point\_source-industrial:11.4%,  
 point\_source-traffic:8.0%  
 Terrain: complex:70.9%, mountain:0.3%, nan:28.8%  
 Land Use: 22 unique elements  
 MODIS Land Use: 14 unique elements  
 UMBC Anthrome Class: 16 unique elements  
 Measurement Method: differential optical absorption spectroscopy:0.9%, ultraviolet  
 photometry:99.0%, unknown:0.1%  
 Measuring Instrument: 28 unique elements



# Version 1.2.0 (July 2020): First release notes

## Major Features (17 Issues closed):

- Ability to read non-GHOST BSC netCDF files
- Fixed graphical inconsistencies between machines.
- Ability to work on Nord3
- Updated to use GHOST 1.3.1 data

# Version 1.3.0 (March 2021): .conf files

## Major Features (15 Issues closed):

- Configuration files:
  - Ability to export all options used during an evaluation to a configuration file
  - Start Providentia from a configuration file or load a configuration file from within the dashboard

```
[DEBUG]
network = EBAS
species = sconco3
resolution = hourly
start_date = 20180101
end_date = 20190101
experiments = cams61_emep_ph2-eu-000, cams61_monarch_ph2-eu-000, cams61_silam_ph2-eu-000 (EMEP, MONARCH, SILAM)
temporal_colocation = True
spatial_colocation = False
report_type = debug
report_summary = True
report_stations = False
report_title = Providentia Report
report_filename = debug
statistic_mode = Temporal|Spatial
statistic_aggregation = Median
periodic_statistic_mode = Cycle
periodic_statistic_aggregation = Median
timeseries_statistic_aggregation = Median
harmonise_summary = False
harmonise_stations = False

[[Europe]]
longitude = -28, 53
latitude = 35, 72
```

# 1st Providentia Training Session (March 2021)



## Providentia Training Session

Amalia Vradi

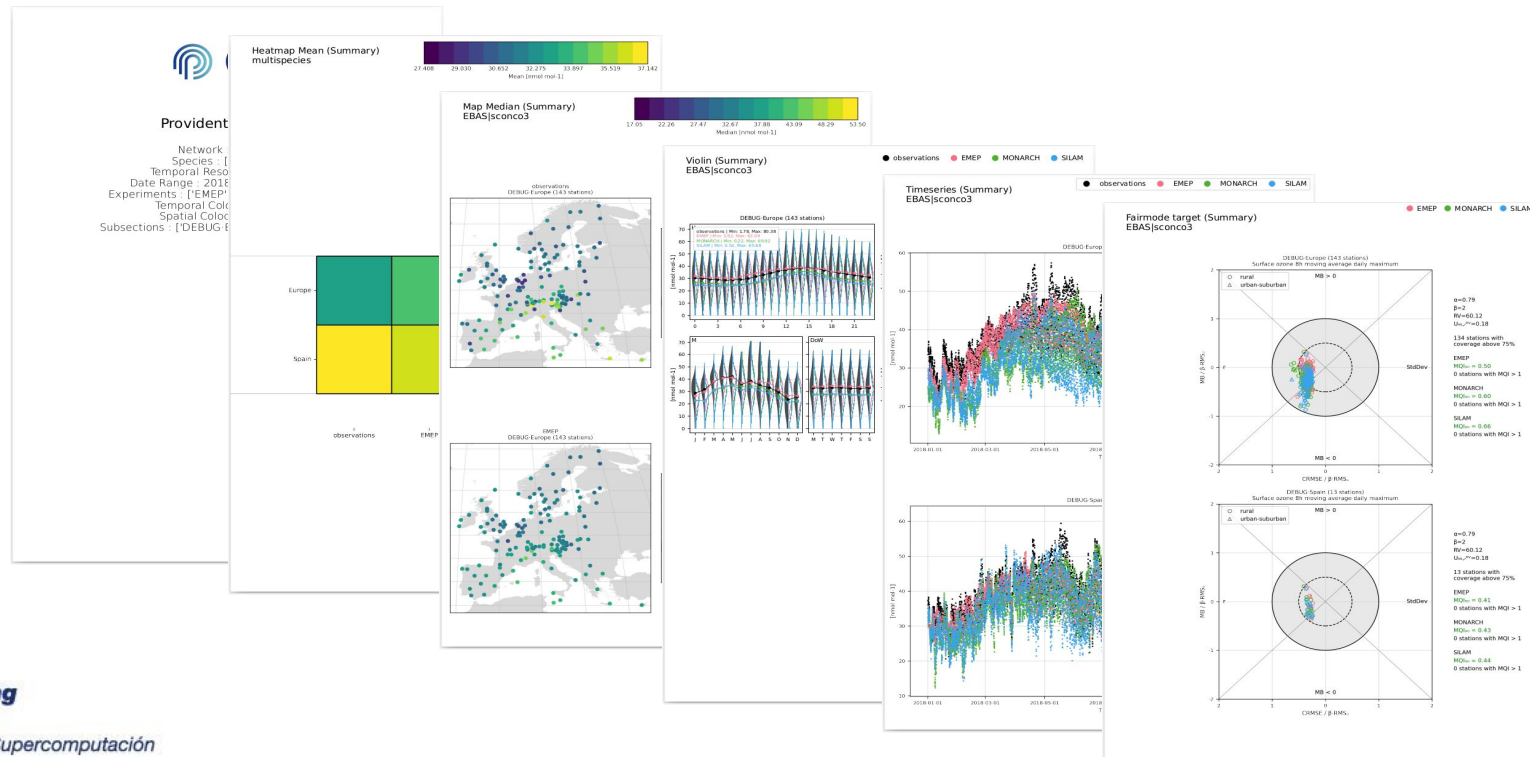
Dene Bowdalo

Wednesday, March 24th

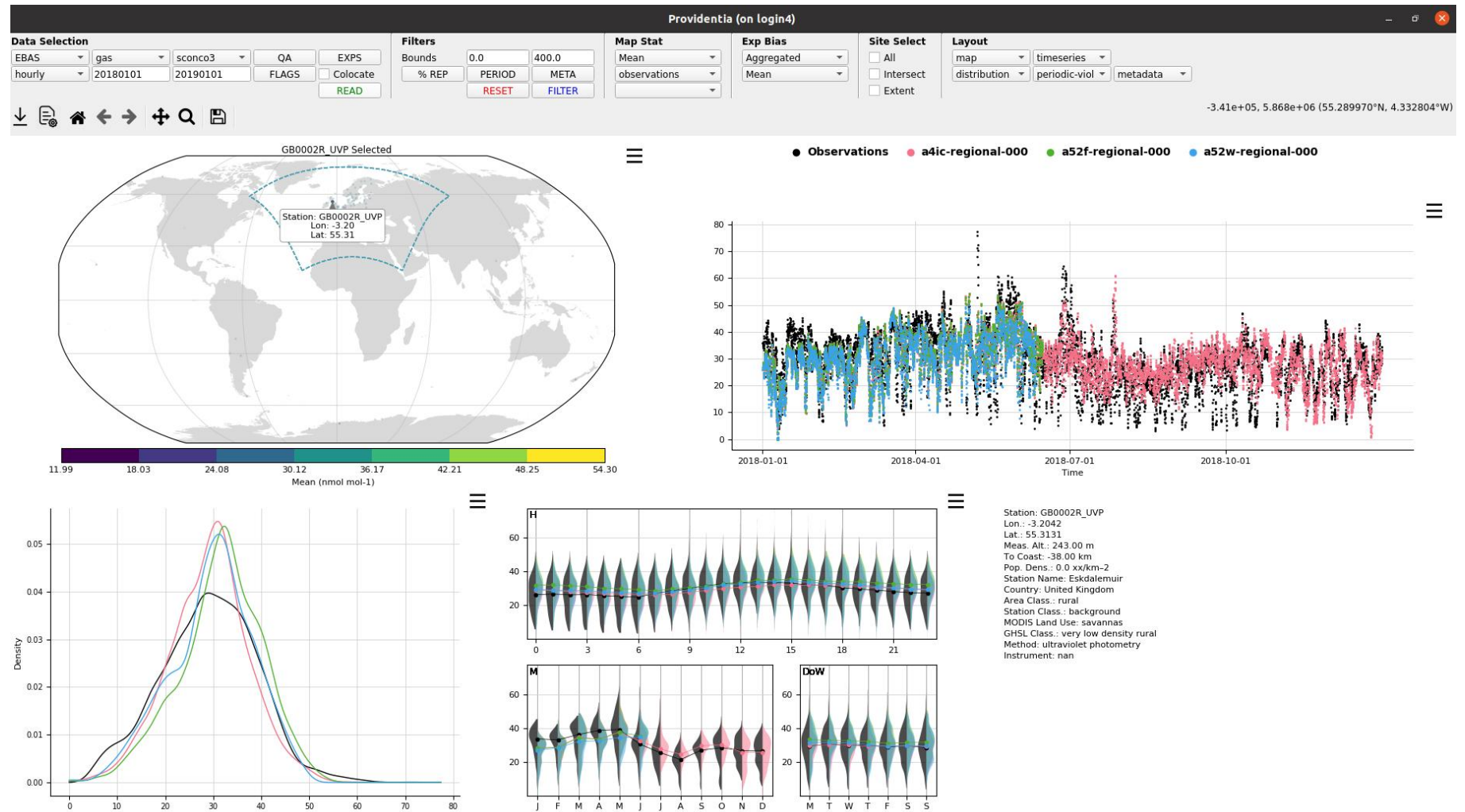
# Version 1.3.1 (October 2021): Offline reports

## Major Features (9 Issues closed):

- Introduces the option to run Providentia as an offline tool (report mode)



# Alba Vilanova Joins (March 2022) & Version 2.0.0 (December 2022)



# Version 2.0.0 (December 2022)

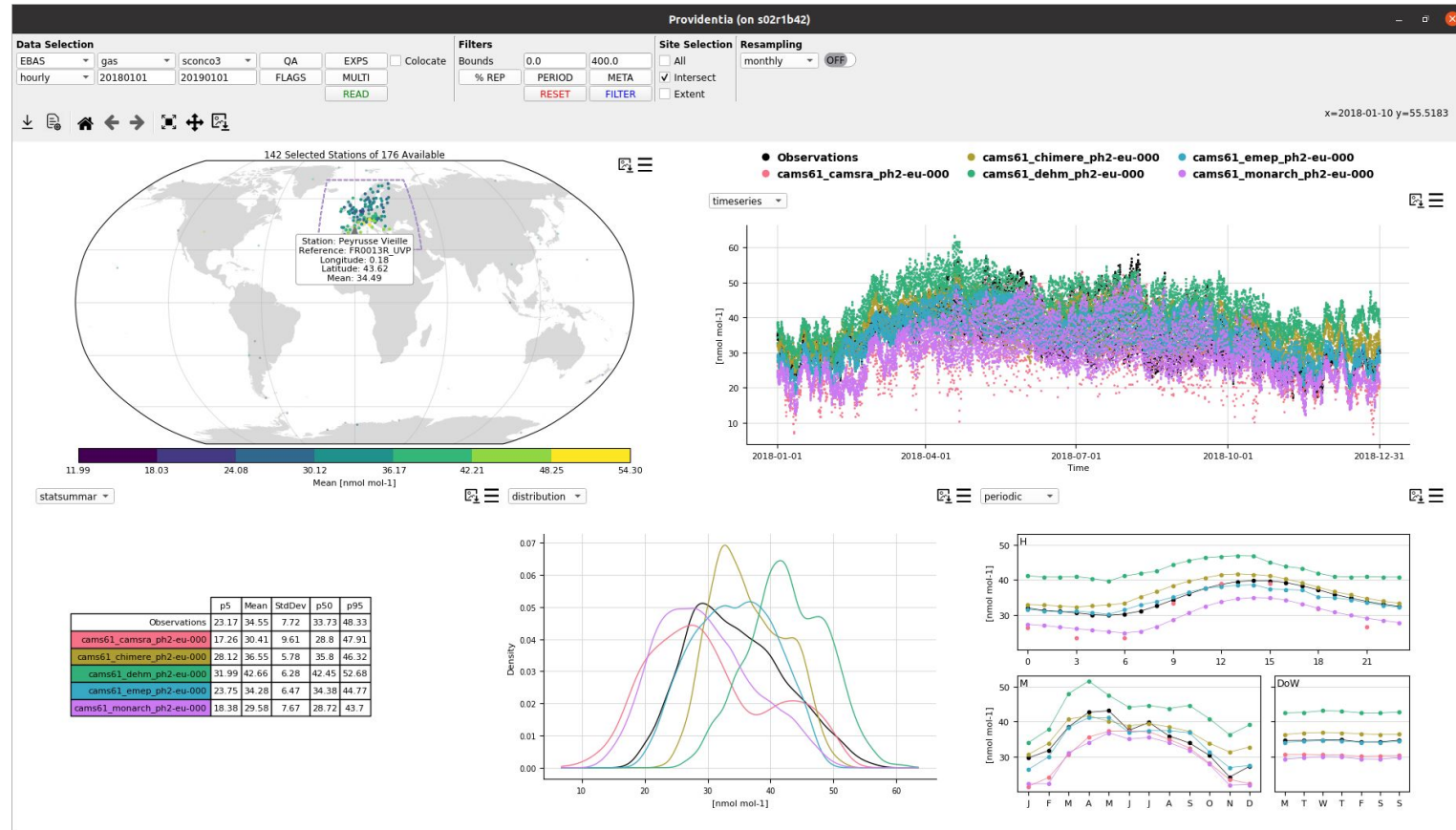
## Major Features (78 issues closed)

- Code harmonisation between dashboard and offline reports:
  - unified reading, filtering, statistics, and plotting functions
  - unified configuration files
- Multispecies filtering
- Spatial colocation
- New plots: boxplot, scatter, distribution, periodic (non-bias), statsummary, heatmap, table
- Multispecies plots
- Dashboard plots interchange
- Dashboard plot settings button (e.g. marker size)
- Dashboard interactive plot features (e.g. hover pop-ups)
- Creation of report templates

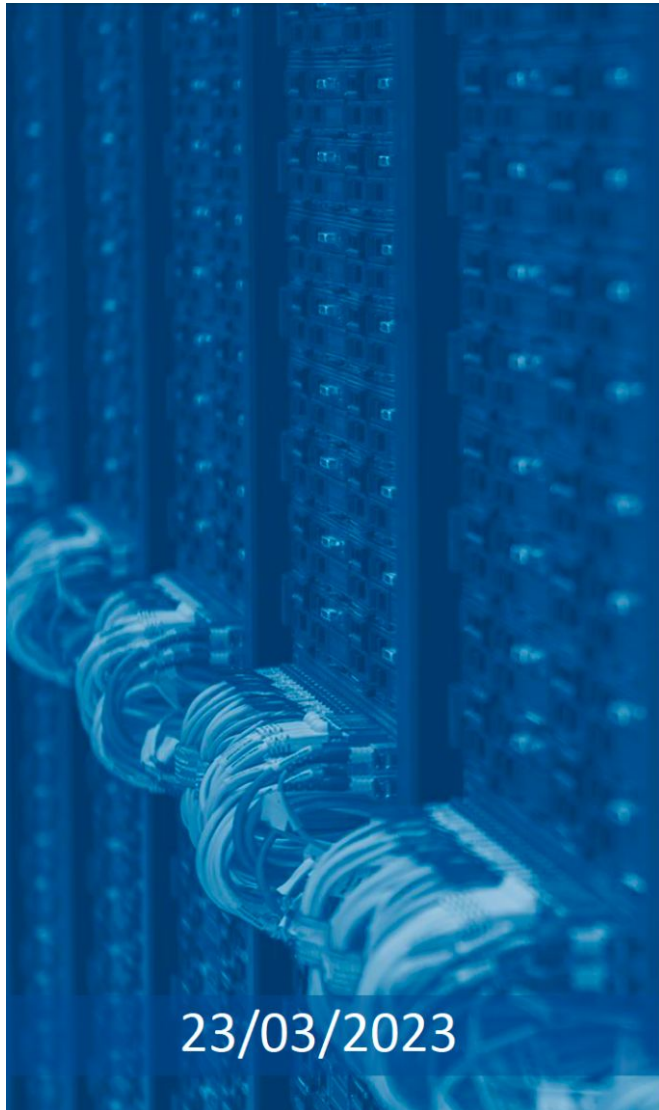
# Version 2.1.0 (March 2023):

## Major Features (46 issues closed):

- Temporal resampling added
- Added calibration factor
- Ability to export filtered station data
- Dashboard timeseries smoothing slider
- Dashboard multispecies filtering
- Dashboard error message boxes



# 1st Providentia User Meeting (March 2023):



23/03/2023



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## Providentia v2.1 User Meeting

Alba Vilanova | Dene Bowdalo

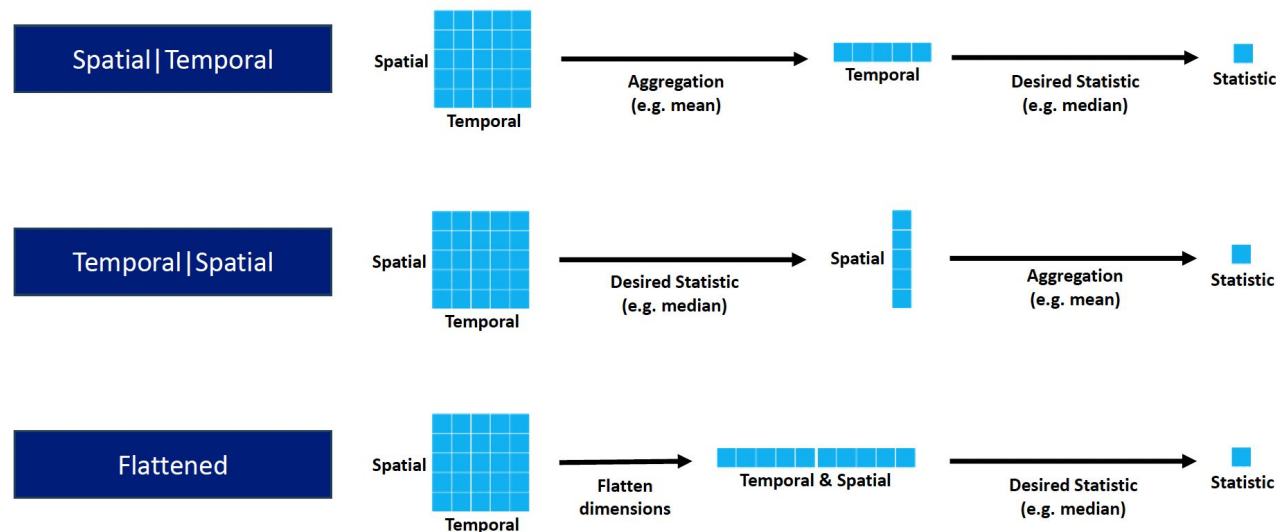


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# Version 2.2.0 (September 2023)

## Major Features (43 issues closed)

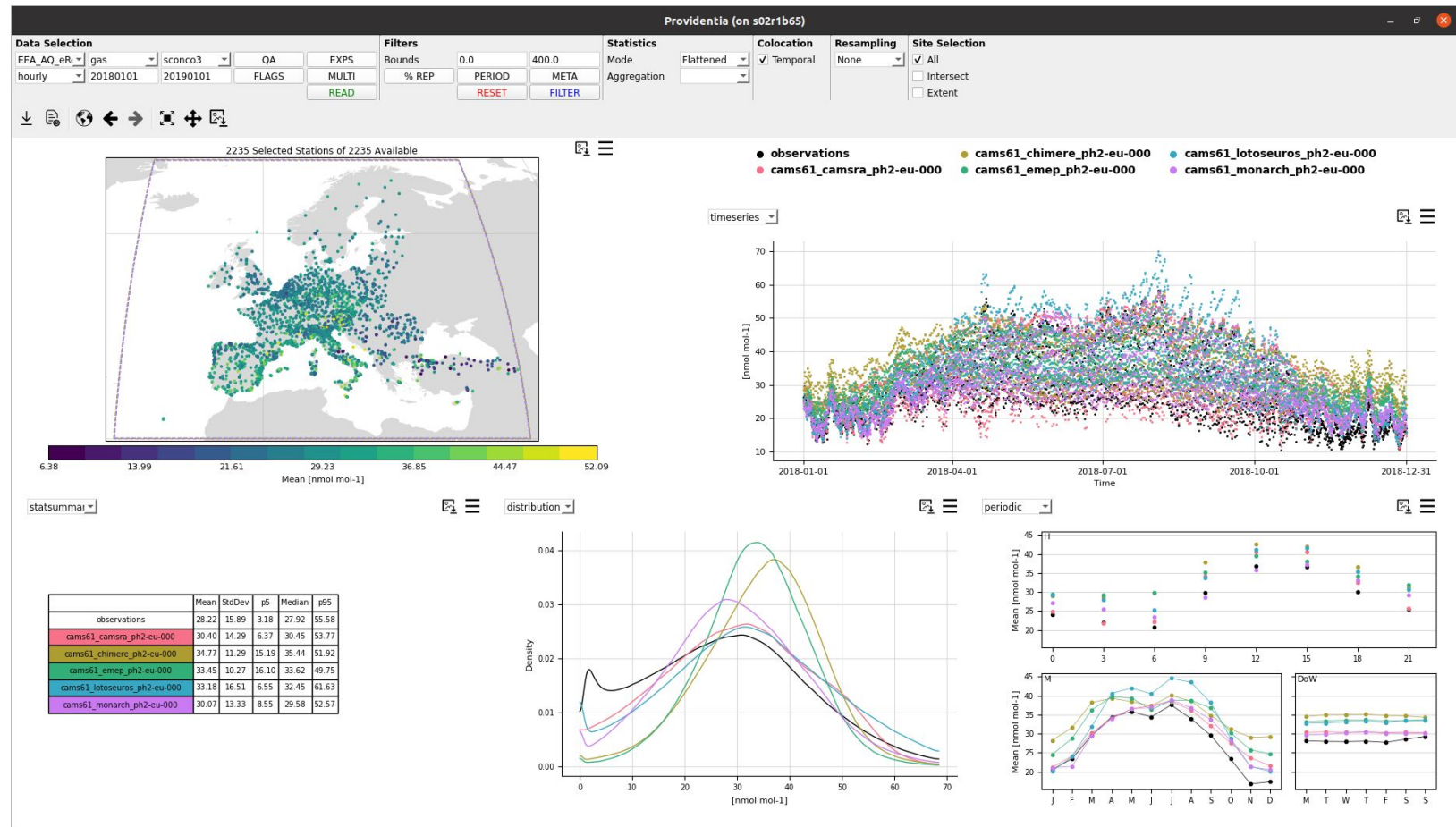
- Addition of statistical modes: Flattened, Spatial|Temporal and Temporal|Spatial
- Addition of periodic statistic modes: Independent and Cycle
- Creation of debug mode
- Report compression
- Stacking of heatmaps, tables and statsummaries
- Use of external files for custom plot characteristics



# Version 2.2.1 (November 2023):

## Major Features (11 issues closed):

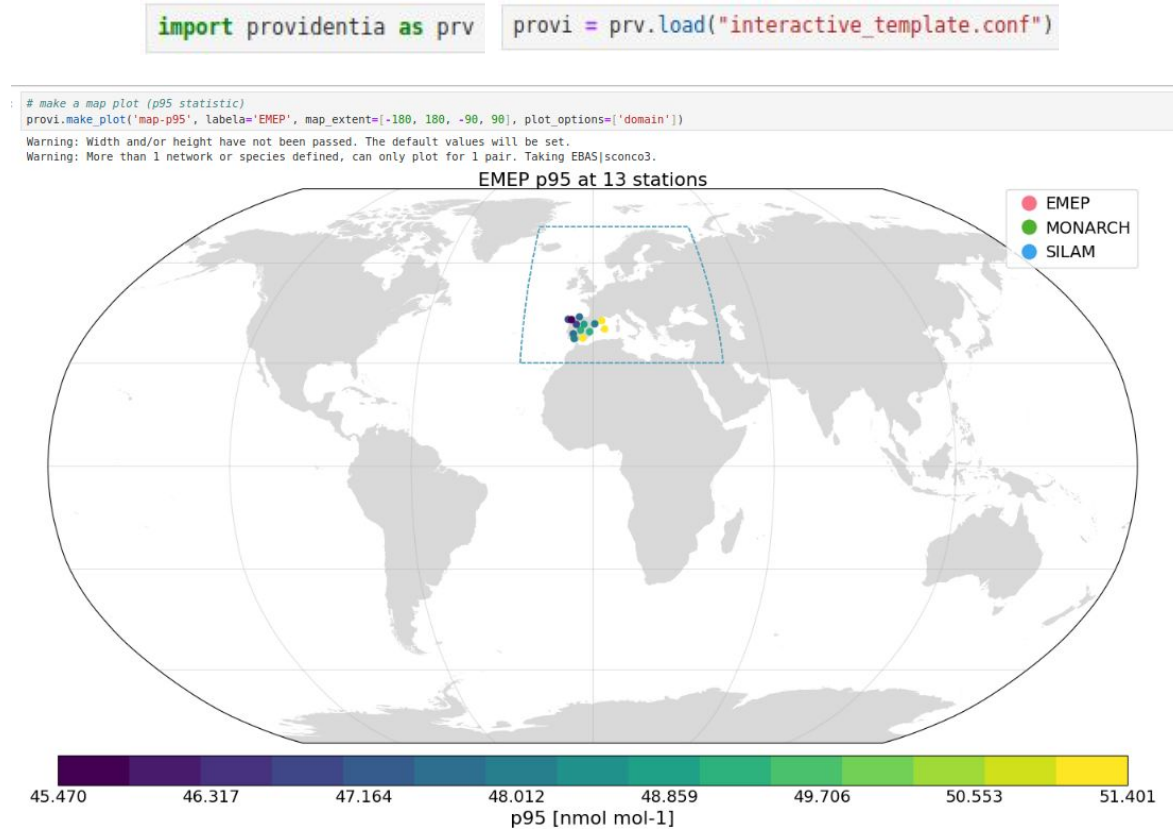
- Major code refactoring
- Update to GHOST version 1.5



# Version 2.3.0 (January 2024)

## Major Features (24 issues closed):

- Implementation of interactive mode (library)
- New customisation features to remove extreme stations, define bounds and cmap by pollutant, and set exceedances thresholds.
- New plot options: domain and hidedata.
- Implementation of custom plot characteristics, where users can put the specific formatting they need.



# Paula Serrano Joins (March 2024) & Version 2.4.0 (September 2024):

## Major Features (137 issues closed)

- Creation of download mode, to download data locally from esarchive or Zenodo.
- Enable Providentia to run locally on Linux and MacOS machines
- Migrate Providentia to work on MN5
- Nested Providentia Interpolation inside Providentia
- Began use of conda environments
- Began use of testing pipelines



# Providentia Logo (September 2024):



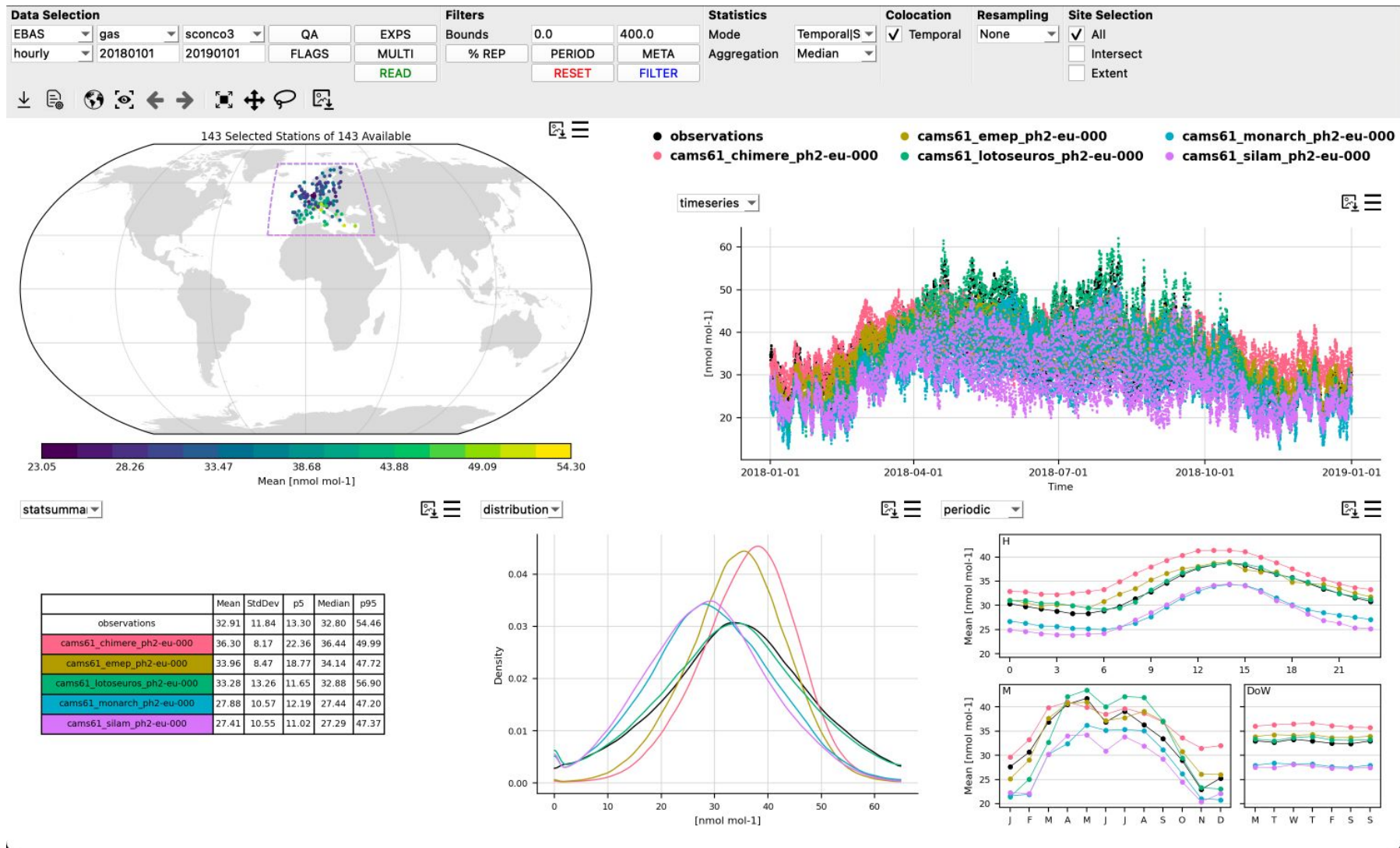
# Providentia 3.0.0: Public Release



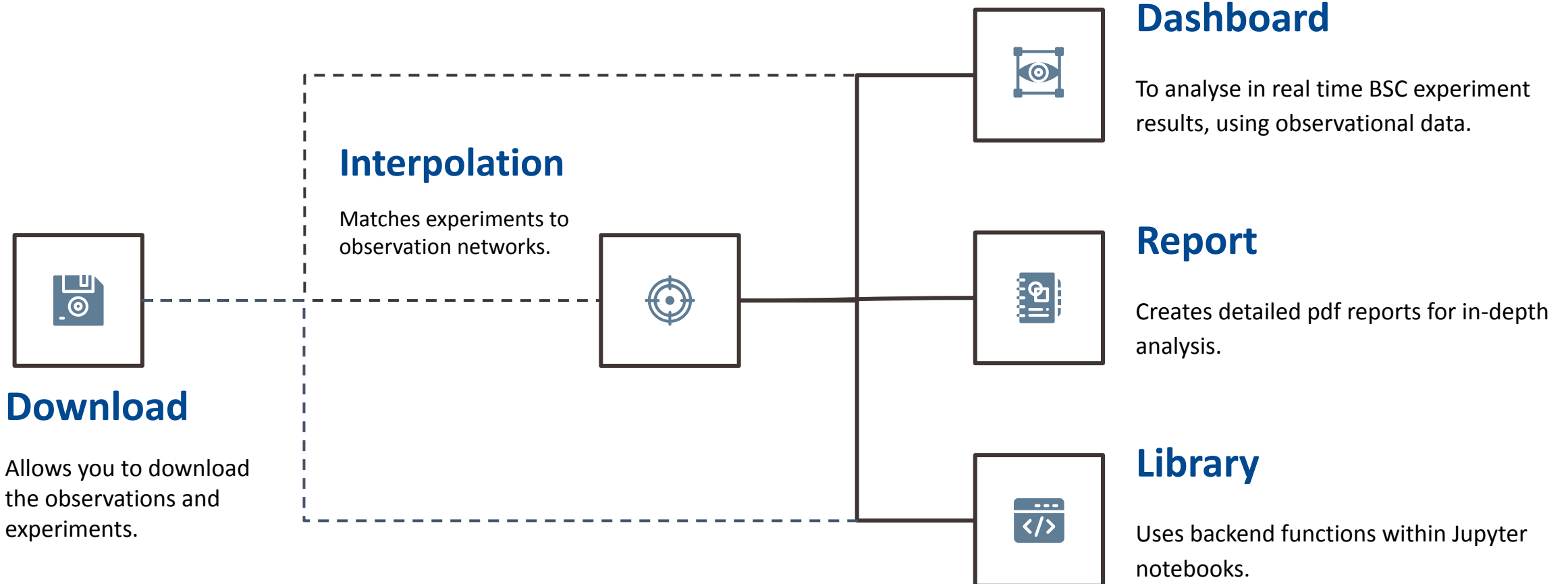
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# Version 3.0.0 (2025):



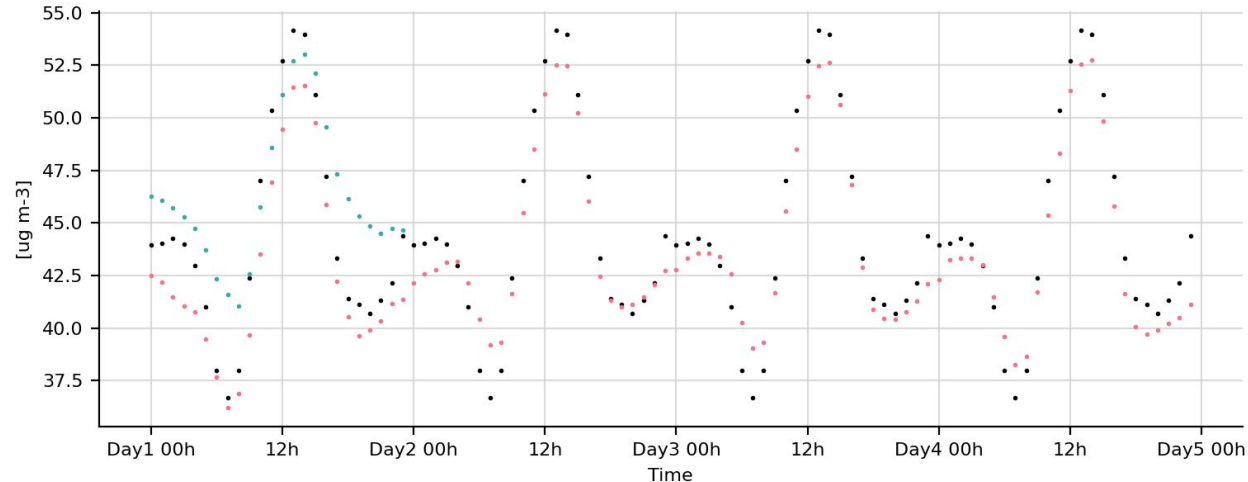
# Structure



# Version 3.0.0 (November 2025): Public Release

## Major Features (175 Issues closed):

- Ability to download, format and use ACTRIS observations from their API
- Handling of forecast model data
- Ability to download, format and interpolate CAMS regional and global forecast, analysis and reanalysis data.
- Allow all Providentia modes to be used from library.



# Looking to the future...

- Version 3.0.0 will be the 13th version release of Providentia.
- To date we have closed 669 issues in total, with 97 currently open.
- We have held 4 Providentia training sessions and 4 user meetings.
- Thank you to all Providentia developers, Amalia, Alba, and Paula, for such hard work over the years!
- Thanks also goes to key others who helped in various ways, specifically Francesco Benincasa with the .conf files, Carles Tena with the interpolation, and Miriam Olid implementing Providentia in auto systems.
- Thanks also to all users for putting up with the bugs, beta testing, and waiting patiently for features to implemented.
- And thank you to Oriol and Carlos finally, for believing in my crazy idea.



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# Thank you for your attention!

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