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E-colos project Data Management Plan

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Dominique Daudon, Stan Borkowski

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E-colos project Data Management Plan

Data Management Plan created using DMP OPIDoR, based on the "ANR - DMP template (English)" provided by the French National Research Agency (ANR)

Data Management Plan Details

Title	Maison en Terre - BBC Room
Version	1.0
Fields of Science and Technology (From OECD Classification)	Earth and related environmental sciences
Language	English
Creation Date	14/06/2024
Last Modification Date	20/03/2026
License	Creative Commons Attribution 4.0 International CC-BY-4.0

Project Details

Project Title	E-colos project Data Management Plan from the Junior Observatory Project
Acronym	ObsJunior
Abstract	<p>The Maison en Terre (MET) and BBC Room are two research stations in St.Martin d'Hères, Grenoble, France, located on the University of Grenoble Alpes campus. Both are part of the E-colos project, aiming to develop a culture of sustainability through the instrumentation of small buildings.</p> <p>The data collected from these buildings, accessible 24/7, will support various educational initiatives, including in-person and online courses, projects, and even continuing education. This DMP presents how data from both these stations were collected, and treated, where they are saved and published. Collected data includes meteorological data, ecological values, temperature, and air quality, for both sites.</p>

Raw data are processed into netCDF files, sorted by years and themes. They are associated with jupyter notebooks workflows.

Alongside netCDF files, CSV files of each dataset are published to replicate as much as possible the netCDF files.

All data will be published on the national repository recherchedata.gouv.fr.

Funding Faculty of Science, Grenoble Alpes University (UGA)
Start date 2015-09-01
Partners *Academic:* OSUG, IGE (Institut des Géosciences de l'Environnement), 3SR - Sols, Solides, Structures, Risques ,Grenoble INP, CNRS-INSU

Links & IDs *Academic & Research ROR Identifiers:*
OSUG <https://ror.org/03vte9x46>
IGE <https://ror.org/01wwcfa26>
INRIA <https://ror.org/00n8d6z93>
3SR <https://ror.org/03bcdsr62>
Grenoble INP <https://ror.org/05sbt2524>
CNRS-INSU <https://ror.org/04kdfz702>

Research Output

1. Raw CSV data from 2024-2025 collected from Grafana and InfluxDB servers (OSUG) + Raw CSV data from 2018-2024
2. Global netCDF file and grouped by years files: sorted by themes
3. Associated jupyter notebooks (Workflow, netCDF creation for both global and by years files)

Contributors

Contributors

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Marine Blaise	Faculty of science, UGA (02rx3b187)	Data curator	Data curation, analysis, writing	https://orcid.org/0009-0000-6048-5685
Ali Tarhini	Faculty of science	Data curator	Data curation, formal analysis, writing original draft and software developer	
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Stan Borkowski	INRIA "00n8d6z93"	Software engineer	Software desing and instrumentation devices maintenance	

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1 Data description and collection or re-use of existing data

1.1 How will new data be collected or produced and/or how will existing data be re-used?

Data is collected from a network of sensors installed in two sites in Grenoble: the "[Maison en Terre](#)" and the "[BBC room](#)" of the Civil Engineering University Institute of Technology (Saint Martin d'Hères campus). Maison en Terre is a building constructed in 1986 and is part of the [IDEX-Training Platform "e-CoLoS"](#) alongside the BBC room and two other sites in Milan ([Velux Lab](#) and [pôle Sport](#)). This DMP covers the data of the Maison en Terre and the BBC room.

Maison en Terre: Data collection at the Maison en Terre site began in November 2018, utilizing a system that combines the KNX protocol with a RaspberryPi interface, InfluxDB for data storage, and Grafana for visualization. The data was previously hosted on [Inria](#) servers, but they were recently transferred to the OSUG (Observatoire des Sciences de l'Univers de Grenoble) InfluxDB platform. A diagram of the data collection architecture is available in [Figure 1](#). [Figure 4](#) shows a data collection timeline.

The sensor network in Maison en Terre collects 53 distinct measurements, including temperature sensors added in August and September 2023. Data collection was interrupted from June 26 to July 7, 2023, due to a thermal insulation workshop. Additional interruptions have occurred due to equipment malfunctions and network issues. Notably, the south pyranometer provided incorrect readings between August 2020 and October 2021, as the sensor was detached during this period. Students involved in this project created a "corrected" version of the data, in which the values of the south sensor are replaced by the average of the values of the other years at the same dates and times. The Nanosense E4000 near the ceiling was faulty, and data outputs contained errors.

BBC Room: Data collection in the BBC room started in September 2019. Unlike the Maison en Terre, the BBC room records multiple measurements within a single file. There are 39 distinct measurements collected, with details regarding sensor placement provided in [Figure 5](#). A data collection timeline is available in [Figure 6](#).

Data production and collection workflow: More details about the Maison en Terre and the BBC room can be found in the resources in [\[3\]](#) [\[1\]](#) [\[6\]](#) [\[2\]](#) [\[4\]](#).

The data is used in several courses in architecture, statistics, mechanical, and civil engineering. The data have also been used in the study in [\[7\]](#). Building constructions like Maison en Terre is backed up by a study [\[5\]](#).

1.2 What data (for example the kind, formats and volumes), will be collected and produced?

Data has been continuously collected since 2018 in Maison en Terre and 2019 in the BBC room. Each site stores its data in CSV and NetCDF formats. As of July 2019, the data acquisition frequency is standardized at 5 minutes for all sensors, though Maison en Terre previously had varying acquisition intervals (from 1 second to 1 minute). For publishing reasons, all frequencies were standardized to 5min. Data is still collected but ends on 2025-05-15 in CSV and netCDF files. Data is organized into groups and subgroups in the NetCDF files. The files are organized by themes, both for Maison en Terre and BBC room. Organizing this way was decided for better accessibility, grouping data by application domain. It also focuses on global and interdisciplinary data comprehension and is also better for environmental or structural projects.

Maison en Terre

Themes	Contents
Air quality	Contains CO2 (CO2 concentration), and PM (fines particles for particule pollution)
Climatic parameters	Contains temperature, humidity, pyranometer (Solar radiation measurement), and weather station (Wind speed, rain, brightness...)
Energetic performance	Energetic power and consumption
Maison en terre structure	Roof and walls temperature

BBC Room

Themes	Contents
Room environment - Excluding office specific values	Ambient values (temperature, humidity and CO2), indicators (Presence, heating, ventilation and VOC), doors and windows (Opened/closed)
Office values - Specialized	Relative CO2 concentration, relative humidity and relative temperature.
Specialized sensors	Thermocouples sensors (TC1, TC2, TC3 and TC4) for temperature, triosys 1 and 2 for temperature and triosys 1 for humidity.
Solar measurements	South/East/Southeast/West/Southwest Adjustable sunshades (BSO), pyranometer energy and irradiance.
Illuminance	North and south illuminance
Energy	General, heating, kitchen, main and power outlets meter

NetCDF size per file, total netCDF file size and global netCDF file size are calculated after standardization.

Table 2: Data volume for E-colos and BBC Room

Site	CSV size per file	Total CSV files size	NetCDF size per file	Total netCDF files size	Global netCDF file
BBC (Until August 2024)	27.7-41 MB	1.4 GB	4.3-7 MB	249.6 MB	187.1 MB
MET (Until May 2025)	3.3-97.8 MB	1.6 GB	2.7-10.5 MB	482.1 MB	361.3 MB

Sensor	Site	Start Date	Measurements	Unit
Nanosense E4000	BBC	2019-09-18	Ambient Carbon Dioxide Concentration	ppm
			Ambient Relative Humidity	%
			Ambient Air Temperature	°C
			Office Carbon Dioxide Concentration	ppm

Solar Shading	BBC	2020-11-03	East Solar Shading Level	%
			West Solar Shading Level	%
			South Solar Shading Level	%
			Southeast Solar Shading Level	%
			Southwest Solar Shading Level	%
General Meter	BBC	2019-09-18	Main Meter Energy Consumption	kWh
			Heating Meter Energy Consumption	kWh
			Kitchen Meter Energy Consumption	kWh
			General Energy Consumption	kWh
			Power Outlets Energy Consumption	kWh
Window State	BBC	2020-03-11	Northeast Window State	Boolean
			Northwest Window State	Boolean
			South Window State	Boolean
			Southeast Window State	Boolean
			Southwest Window State	Boolean
Office	BBC	2019-09-18	Office Relative Humidity	%
			Office Air Temperature	°C
Illuminance Meter	BBC	2019-09-18	North Illuminance Level	lux
			South Illuminance Level	lux
Door State	BBC	2020-03-11	Northwest Door State	Boolean
			Southeast Door State	Boolean
			Southwest Door State	Boolean
Indicators	BBC	2019-09-18	Presence Detection Indicator	Boolean
			Heating On/Off Indicator	Boolean
			Ventilation Indicator	Boolean
			Volatile Organic Compounds Concentration	ppm
Pyranometer	BBC	2019-09-18	Pyranometer Energy Measurement	kWh
			Pyranometer Irradiance Measurement	W/m ²
Thermocouple	BBC	2019-09-18	Thermocouple 1 Temperature	°C
			Thermocouple 2 Temperature	°C
			Thermocouple 3 Temperature	°C
			Thermocouple 4 Temperature	°C
Triosys	BBC	2019-09-18	Triosys Humidity Sensor 1	%
			Triosys Temperature Sensor 1	°C
			Triosys Temperature Sensor 2	°C
Nanosense E4000	MET	2018-11-16	Carbon Dioxide Concentration E4000	ppm
			Volatile Organic Compounds E4000	ppm
			Absolute Humidity E4000	g/m ³
			Relative Humidity E4000	%
			PM10 Concentration E4000	µg/m ³
			PM1 Concentration E4000	µg/m ³
			PM2.5 Concentration E4000	µg/m ³
Temperature E4000	°C			

			Apparent Temperature E4000	°C
Theben amun 716	MET	2018-11-16	Interior North Carbon Dioxide Concentration	ppm
			Interior South Carbon Dioxide Concentration	ppm
			Interior North Absolute Humidity	%
			Interior South Absolute Humidity	%
			Interior North Temperature	°C
			Interior South Temperature	°C
Zennio KCI 4 SO	MET	2018-11-16	Energy Consumption of Convector	kWh
			Energy Consumption of Lighting	kWh
			Energy Consumption of Outlets	kWh
			Energy Consumption of Ventilation	kWh
			Power Consumption of Convector	W
			Power Consumption of Lighting	W
			Power Consumption of Outlets	W
			Power Consumption of Ventilation	W
Walls	MET	2018-12-14	Wall Temperature 1.1	°C
			Wall Temperature 1.2	°C
			Wall Temperature 1.3	°C
			Wall Temperature 2.1	°C
			Wall Temperature 2.2	°C
			Wall Temperature 2.3	°C
South wall	MET	2023-08-30	South Wall Temperature 1	°C
			South Wall Temperature 2	°C
			South Wall Temperature 3	°C
Roof	MET	2023-09-20	Roof Temperature 1	°C
			Roof Temperature 2	°C
			Roof Temperature 3	°C
Pyranometer	MET	2018-11-16	East Pyranometer Energy	kWh/m ²
			East Pyranometer Irradiance	W/m ²
			North Pyranometer Energy	kWh/m ²
			North Pyranometer Irradiance	W/m ²
			West Pyranometer Energy	kWh/m ²
			West Pyranometer Irradiance	W/m ²
			South Pyranometer Energy	kWh/m ²
			South Pyranometer Irradiance	W/m ²
Weather Sta- tion Metetadata 140S KNX	MET	2018-11-27	Weather Station Azimuth	
			Weather Station Elevation	
			Weather Station Front Light	lux
			Weather Station Right Light	lux
			Weather Station Left Light	lux
			Weather Station Maximum Light	lux
			Weather Station Rain	Boolean
			Weather Station Temperature Sensor State	
			Weather Station Temperature	°C

To produce each dataset and netCDF files, a workflow was established and published using Jupyter Notebooks. It can be consulted in the README.md file for a better understanding, but also in Figure 7 for Maison en Terre and in Figure 8 for BBC room.

2 Documentation and data quality

2.1 What metadata and documentation (for example the methodology of data collection and way of organizing data) will accompany the data?

The dataset will be accompanied by detailed documentation, both in the form of internal reports and versioned code repositories on Gitlab. Upon final publication, associated jupyter notebooks and documentation will be shared publicly on Recherche data gov.

Metadata is saved into csv files. These files are used to add the metadata to the NetCDF files of the dataset. Therefore any changes or additions of new metadata fields are reflected automatically in the NetCDF dataset files. Metadata is organized into two files:

- **Global level:** Metadata for each dataset, following the [Attribute Convention for Data Discovery \(ACDD\)](#) standard .
- **Measurement level:** Each measurement will include metadata as per the [NetCDF Climate and Forecast \(CF\) Metadata Conventions](#) (Table 4).

Table 4: Measurements metadata

Metadata	Description
long_name	The name of the measurement
standard_name	CF standard name if it exists
cf_standard_name	Boolean to indicate if the standard name exists in the CF standard names
unit	The unit of the measurement
units_metadata	Indicates if the measurement is on-scale or difference
time_coverage_start	The start time of the data collection
time_coverage_end	The end time of the data collection
sensor	The name of the sensor
sensor_website	Link to the website of the sensor
description	Description of the measurement

2.2 What data quality control measures will be used?

Data quality is ensured through:

- Regular maintenance of sensors, including automatic notifications in case of malfunction or interruptions.
- A data processing phase, during which outliers are detected and removed, and NetCDF files are used for data and metadata diffusion. The dataset is carefully reviewed before publication.

3 Storage and backup during the research process

3.1 How will data and metadata be stored and backed up during the research?

Data management and storage is currently provided by Inria laboratory, and now stored on InfluxDB servers at OSUG. The data management architecture for the Maison en Terre is shown in Figure 1. Storage and backup for the data were transferred to the OSUG in 2024, and we used backup facilities provided by OSUG.

3.2 How will data security and protection of sensitive data be taken care of during the research?

The data doesn't include any personal information other than the contact information of the contributors. Therefore, consent was obtained, providing contributors with the opportunity to refuse, modify, or request the deletion of their information.

The data includes measurement of CO₂ levels. This can be used as a direct indicator of the presence and the number of people on the site. It is therefore considered a mildly sensitive data.

4 Legal and ethical requirements, code of conduct

4.1 If personal data are processed, how will compliance with legislation on personal data and on security be ensured?

To comply with the General Data Protection Regulation (GDPR), we will implement the following:

- Obtain initial consent from individuals regarding the use of their personal contact information, upon first publication.
- Instead of periodic reminders, participants are informed at the time of data collection that they retain the right to access, rectify, or request the deletion of their personal information at any time. To exercise these rights, they can contact the datasets authors through the contact information provided on RDG.

4.2 How will other legal issues, such as intellectual property rights and ownership, be managed? What legislation is applicable?

Intellectual property

As the produced data is funded by public subsidies, in accordance with the Law for a French Digital Republic (LOI n° 2016-1321 du 7 octobre 2016 pour une République numérique), it is obligatory for the data to be open, accessible and available as soon as the processing is done (usually on an annual basis).

Data is freely reusable, with the condition of acknowledging its authors according to the sentence indicated here below:

”This data was acquired within the Junior Observatory of Université Grenoble Alpes, a teaching framework where students build and use observational time series of techno- and socio-ecosystems of interest to their studies, with expert support of OSUG (Observatoire des Sciences de l’Univers de Grenoble).”

To technically enforce reuse conditions mentioned above, datasets will be distributed under the Creative Commons Attribution 4.0 International (CC BY 4.0) license. This legal framework guarantees that anyone can share and adapt the data, provided they give appropriate credit through the mandatory acknowledgment.

4.3 What ethical issues and codes of conduct are there, and how will they be taken into account?

The primary ethical consideration is ensuring the appropriate handling of personal information related to contributors.

5 Data sharing and long-term preservation

5.1 How and when will data be shared? Are there possible restrictions to data sharing or embargo reasons?

There are no restrictions to data sharing nor embargo.

Following the quality assurance, the data will be publicly available and accessible after the yearly dissemination on the [Recherche Data Gouv](#) repository. Data will be shared on a yearly basis, after necessary time for data processing and quality assurance.

5.2 How will data for preservation be selected, and where data will be preserved long-term (for example a data repository or archive)?

Data selection for preservation

The preserved data will include the original raw and processed data.

Data preservation

The data will be disseminated and preserved on the [Recherche Data Gouv](#) repository. In addition, data is stored thanks to InfluxDB servers at OSUG, which is a mid-term data storage solution. It is a service provided by the University Grenoble Alpes (UGA) and the Observatoire des Sciences de l'Univers de Grenoble (OSUG).

There are no plans for long-term preservation of the data.

5.3 What methods or software tools are needed to access and use data?

The data will be stored in NetCDF (Network Common Data Form) files, an open format, which are commonly used for multidimensional scientific data. It is a combined data and metadata standard, well suited for environmental sciences. Access and utilization require:

- **NetCDF File Viewers:** Viewers like Panoply or ncview for visualizing NetCDF data.
- **Programming Environments:** Python, R, or MATLAB for scripting and analysis, leveraging their NetCDF support.
- **NetCDF Software Libraries:** Use libraries like netCDF4 in Python, R's ncd4, or MATLAB's built-in functions for reading and manipulating NetCDF files.

The data will be openly shared via the [Recherche Data Gouv](#) repository, the national research data portal provided by the french ministry for higher education.

5.4 How will the application of a unique and persistent identifier (such as a Digital Object Identifier (DOI)) to each data set be ensured?

A DOI will be assigned to each dataset once the data is deposited at the Research Data Gouv repository.

6 Data management responsibilities and resources

6.1 What resources (for example financial and time) will be dedicated to data management and ensuring that data will be FAIR (Findable, Accessible, Interoperable, Re-usable)?

With funding from the Faculty of Science of the University Grenoble INP-UGA, a Data Curator is contracted for a duration of 24-month with the responsibility to insure the data is FAIR in this project and others within the OSUG (Observatoire des Sciences de l'Univers de Grenoble), in the framework of the Junior observatory.

The first contributor and writer stayed for about 8 months in the project, and the second

contributor is currently working on the project. The first data curator was responsible for the first cleaning, curation and collection of all data across both sites. The second data curator is responsible for the data management and curation of the data, as well as the publication of the data on the [Recherche Data Gouv](#) repository.

The second data curator is also responsible for future updates of data, and written documentation and code repositories.

To ensure the long-term sustainability of the project and facilitate knowledge transfer after their departure, a comprehensive knowledge base has been established.

Documentation includes detailed instructions on how to replicate, update, and maintain the dataset.

Furthermore, it thoroughly details the data processing workflow and associated code repositories, empowering and encouraging future participants to take over data management and continue observational time series.

References

- [1] Université Grenoble Alpes. *La Maison en terre du campus UGA Toujours Plus “e-colos !”*. Université Grenoble Alpes. July 2023. URL: <https://www.univ-grenoble-alpes.fr/actualites/a-la-une/actualites-formation/la-maison-en-terre-du-campus-uga-toujours-plus-e-colos--1274169.kjsp>.
- [2] Miriam Baumbach, Jean-Martial Cohard, and Dominique Daudon. “Confort thermique d’une construction terre : méthodologie d’étude pédagogique en Master 2”. In: *Academic Journal of Civil Engineering* 40.1 (June 2022), pp. 254–257. DOI: [10.26168/ajce.40.1.62](https://doi.org/10.26168/ajce.40.1.62). URL: <https://journal.augc.asso.fr/index.php/ajce/article/view/3163>.
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- [7] Magda Posani et al. “Integrating Moisture Dynamics into Architectural Design Workflows: A grasshopper plugin to grasp the benefits of moisture buffering materials”. In: *RILEM Spring Convention & Conference on Advance Construction Materials and Processes for a Carbon Neutral Society*. 2024.

7 Appendix

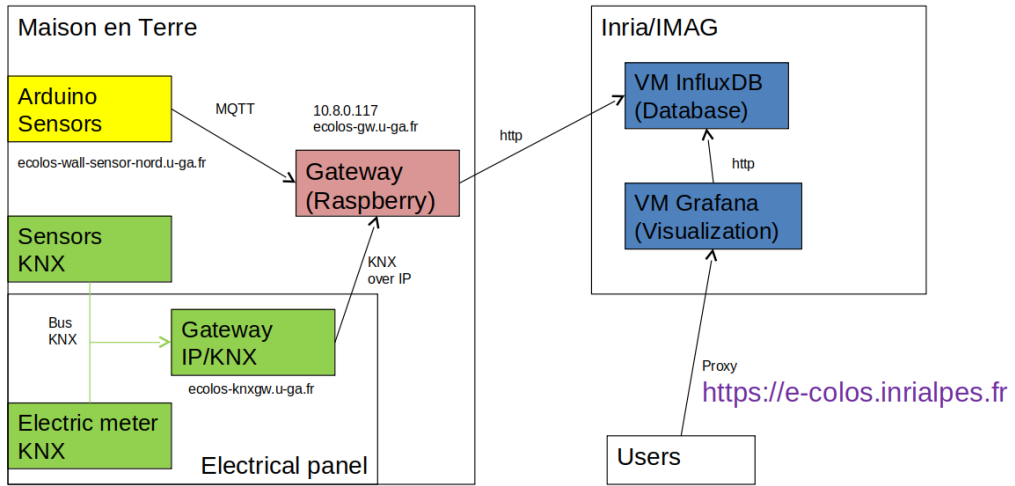


Figure 1: Maison en Terre data management architecture

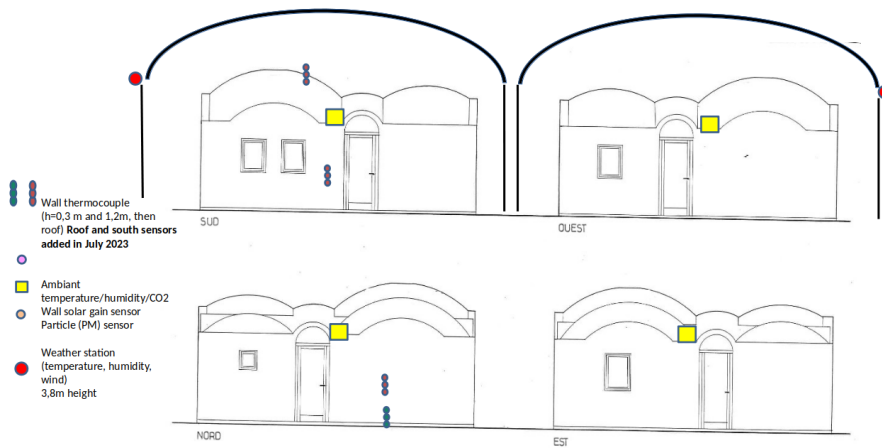


Figure 2: Front view of the sensors positions in the Maison en Terre

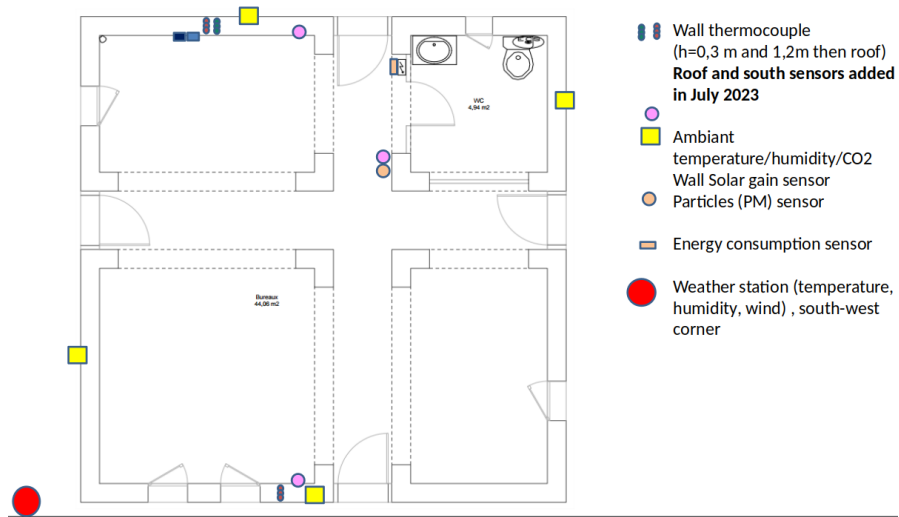


Figure 3: Top view of the sensors position in the Maison en Terre

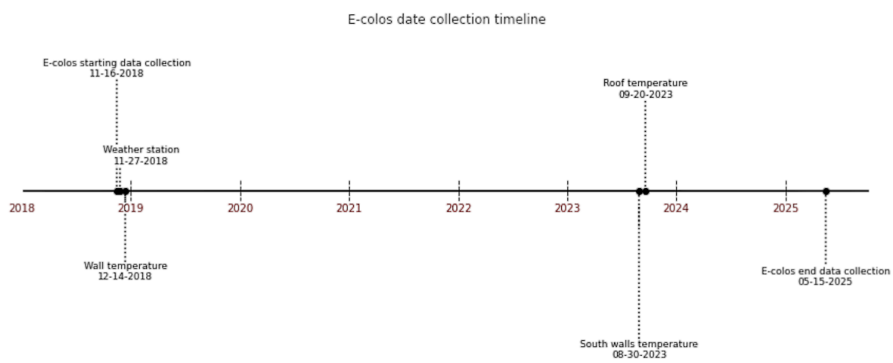


Figure 4: Data collection timeline for Maison en Terre - E-colos data project

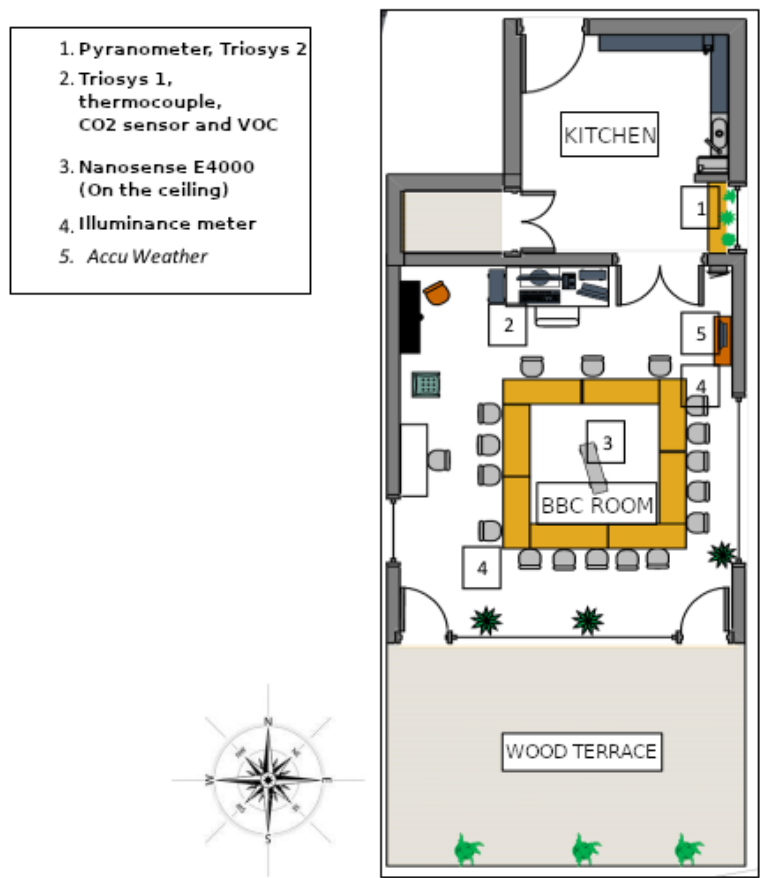


Figure 5: BBC sensors locations

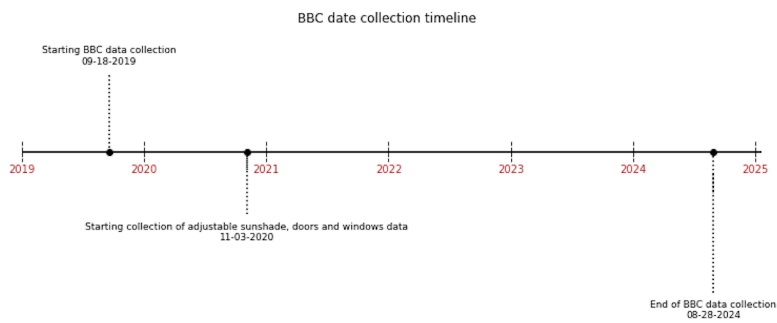


Figure 6: Data collection timeline for BBC room

Data collection and processing workflow PLEASE REFER yourself to the Readme.md file to fully grasp this workflow
From collection to netCDF : E-colos data

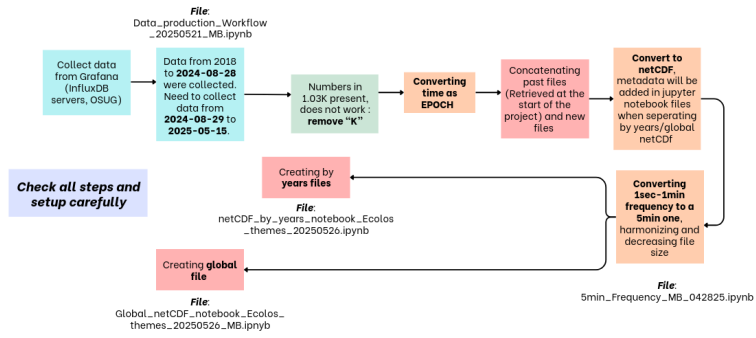


Figure 7: Workflow for Ecolos data

Data collection and processing workflow PLEASE REFER yourself to the Readme.md file to fully grasp this workflow
From collection to netCDF : BBC room data

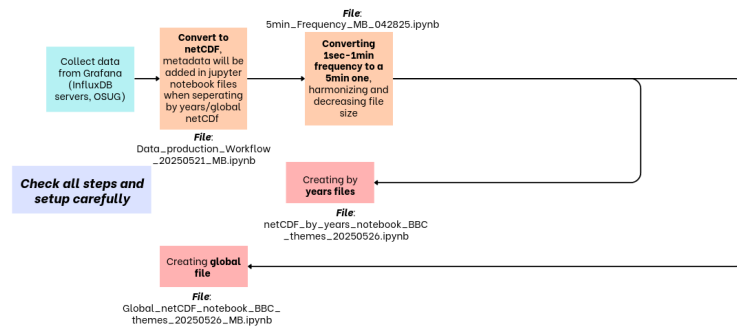


Figure 8: Workflow for BBC room data