

## 01 RISMEAU dataset description

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### Abstract

The RISMEAU project (*RISques liés aux résidus de Médicaments, biocides et antibiorésistance d'origine humaine et vétérinaire sur les ressources en EAU du bassin versant de l'Arve* – Risks related to residues of pharmaceuticals and biocides, and antimicrobial resistance of human and veterinary origin on the water resources of the Arve catchment area) was implanted from 2018 to 2024 on the SIPIBEL observatory. It was devoted to the evaluation of (i) transfers of and processes related to pharmaceutical residues and biocides from both urban sludge and manure spread on fields as fertilisers, and (ii) the environmental impacts of land spreading, in particular the ecotoxicological risks and antimicrobial resistance dissemination. The methodology was based on the physico-chemical, ecotoxicological and antimicrobial resistance (AMR) characterisation of the infiltrated water and soil matrices samples, and focused on organic waste products application at locally representative agronomic rates. This dataset can be reused by other researchers for comparison with their own investigations on this emerging topic under different contexts and conditions, and may contribute to international reviews.

The database includes in total 26217 values, measured on 351 samples of organic waste products (OWP), soil, infiltrated water, earthworms, plants with 3136 usual physico-chemical values, 15469 values on pharmaceuticals and biocides concentrations, 6827 bioassay values (ecotoxicity and phytotoxicity) and 785 values of antimicrobial resistance indicators.

### Keywords

Antimicrobial resistance, ecotoxicological risk assessment, land-spreading, manure, sludge, soil and infiltrated water contamination.

### INTRODUCTION

The RISMEAU dataset provides data on i) usual indicators of sludge, manure, soil and infiltrated water quality and contamination, (ii) pharmaceuticals, biocides and transformation products concentrations in sludge, manure, soil and infiltrated water, (iii) ecotoxicological and dissemination of AMR (antimicrobial resistance) genes indicators that enable the assessment of risks for environment and health:

#### Usual indicators:

OWP – Organic Waste Products (sludge and manure): dry matter, pH, organic carbon content, organic matter content, dissolved organic carbon, ammoniacal nitrogen, total Kjeldahl nitrogen, phosphorous, calcium, magnesium, potassium, cadmium, chromium, copper, mercury, lead, nickel, selenium, zinc content.

Soil: dry matter, pH, organic carbon content, organic matter content, dissolved organic carbon, ammoniacal nitrogen, total Kjeldahl nitrogen, phosphorous, calcium, magnesium, potassium, cadmium, chromium, copper, lead, zinc, manganese, arsenic, iron content.

Infiltrated water (in this paper, infiltrated water stands for soil leachates obtained from soil lysimeters) : dissolved organic carbon, total Kjeldahl nitrogen, total suspended solid, total phosphorous, orthophosphates, pH, ammoniacal nitrogen, nitrates, chemical oxygen demand.

Organic matter fractionation: soluble fraction from particular extractable organic matter ; readily extractable organic matter ; slowly extractable organic matter ; hardly extractable organic matter ; non-extractable organic matter ; fluorescence.

Pharmaceuticals, biocides and transformation products:

Antibiotics: ciprofloxacin, erythromycin, ofloxacin, sulfaguanidin, sulfamethoxazole, sulfathiazole, tetracycline, trimethoprim.

Non-steroidal anti-inflammatory: ketoprofen.

Anthelmintics: doramectin, eprinomectin, flubendazole, levamisole, oxfendazole, pyrantel, pyrimethamine, thiabendazole.

Biocides: bromacil, chlorhexidine, dimethyl-didecyl ammonium, methamidophos, sulfoxaflor, tebuconazole, triclosan.

Transformation products: 3-amino-5-methylisoxazole, 5-hydroxythiabendazole, acetyl-sulfamethoxazole, albendazole-2-aminosulfone, anhydroerythromycin, desmethyl-ofloxacin, epitetracycline, hydroxy-flubendazole, hydroxy-levamisole.

Antimicrobial resistance genes indicators: bacterial concentrations (16S copy number), relative abundance of resistance genes (les citer ??) and mobile genetic elements (class 1, 2 and 3 integrons).

Endocrine disruption potential: androgenic and oestrogenic disrupting effects(YES, YAS, anti-YES and anti-YAS tests)

Ecotoxicology: plant germination and growth test (*Cucurbita Pepo*, *Medicago Sativa* and *Sinapis Alba*), lethality, avoidance, bioaccumulation and reproduction tests with *Eisenia fetida*.

The RISMEAUE dataset on Zenodo includes 5 files listed in Table 1. The column separator of the csv files is the semicolon ‘;’. In the following sections, each csv file is described.

Table 1 : List of the 5 files of the RISMEAUE data set available on Zenodo.

File name	Content
01_RISMEAUE_dataset_description.pdf	Presentation of RISMEAUE project and dataset
02_RISMEAUE_metadata_sampling_points.csv	List and description of sampling points
03_RISMEAUE_metadata_methods.csv	List and description of methods
04_RISMEAUE_dataset_samples.csv	List and description of samples
05_RISMEAUE_dataset_data.csv	Full set of data

The data set is mainly based on two PhD theses : Etienne (2024) and Roques (2023).

## File 01\_RISMEAUE\_dataset\_description

This file corresponds to the present document.

## File 02\_RISMEAUE\_metadata\_sampling\_points.csv

This file contains 19 lines and 6 columns. The columns indicate successively:

1. The identification code for all 20 sampling points, in the format SP\_0xx with xx a two-digit code identifying each sampling point.
2. The sampling point name, with a short description (for the *in situ* lysimeter configuration, see details in the file 01\_RISMEAUE\_data\_paper.pdf).
3. The sample matrix, selected among soil, artificial soil, liquid manure, manure, WWTP (wastewater treatment plant) sludge, infiltrated water, and earthworms.
4. The East longitude of the sampling point. For lab microcosm experiments, ‘NA’ is indicated.
5. The North latitude of the sampling point. For lab microcosm experiments, ‘NA’ is indicated.
6. A comment if appropriate. ‘NA’ indicates there is no comment.

### File 03\_RISMEAU\_metadata\_methods.csv

This file contains 551 lines and 17 columns. The columns indicate successively:

1. The identification code for each method, in the format M\_XXX with XXX a three-digit code.
2. The name of the measured parameter corresponding to each method in column 1.
3. The CAS (Chemical Abstract Service) number if appropriate. 'NA' indicates no CAS number is given.
4. The sample matrix, with additional details compared to basic information given in file 02\_RISMEAU\_metadata\_sampling\_points.csv (column 3).
5. The fraction to which the analysis is applied, selected among 1 – Dissolved fraction ; 2 – Whole water ; 3 – Soil ; 4 – Sludge ; 5 – Soil < 250 µm ; 6 – Whole earthworm ; 7 – Sludge < 250 µm ; 8 – Soil OWP mixture < 250 µm ; 9 – Soil OWP mixture ; 10 – Plant aerial parts ; 11 – Plant root parts ; 12 – Plant ; 13 – Soluble fraction from particular extractable organic matter ; 14 – Readily extractable organic matter ; 15 – Slowly extractable organic matter ; 16 – Hardly extractable organic matter ; 17 – Particulate fraction > 0.45 µm. Note: in the cvs file, the unit “µm” is written “um”.
6. The standard, guideline, or bibliographic reference of each method. For some cases, internal methods were used. The nine necessary references are given in section 6 “References”.
7. The type of methods selected (physico-chemical, ecological, etc.). 'NA' indicated no specific method is given.
8. The limit of detection (LoD). 'NA' indicates no LoD is given.
9. The limit of quantification (LoQ). 'NA' indicates no LoQ is given.
10. The unit of the measured value. 'NA' indicates the value has no unit (like pH, AMR relative abundance, number of worms).
11. The uncertainty at LoQ for a 95 % confidence level. 'NA' indicates no uncertainty is given.
12. The exposure time (in days) of organisms in ecotoxicological tests. 'NA' indicates no organism is exposed.
13. The endpoint of the bioassay. 'NA' indicates no endpoint is assessed.
14. The use of freezing (Yes or No).
15. The sample preparation method. 'NA' indicates that no preparation method is used.
16. The extraction solvent used. 'NA' indicates there is no solvent-based extraction.
17. A comment if appropriate. For bioassays, the soil matrix used is given. 'NA' indicates there is no comment.

Details about the methods are given in the list of references.

### File 04\_RISMEAU\_dataset\_samples.csv

This file contains 349 lines and 4 columns. The columns indicate successively:

1. The identification code for each sample, in the following format:  
For *in situ* samples (see section “Experimental design, materials and methods”):

For OWP (WWTP sludge and manure): YYYYMMDD\_XX\_ZZRS with YYYY the sampling year, MM the sampling month, DD the sampling day, XX the experimental operator (NP stands for Noémie Pernin, OR for Olivier Roques), ZZ the organic waste product added (M1 to M5 for manure, SS for Bellecombe sludge) and RS indicates raw OWP matrices. In addition, three other samples noted YYYYMMDD\_XX\_SwwRS with ww the week number correspond to samples of the Bellecombe WWTP sludge which have been analysed to evaluate how the raw sludge characteristics may evolve during the sludge drying process in the WWTP solar greenhouse.

For soil: YYYYMMDD\_XX\_LLSx\_i with YYYY the sampling year, MM the sampling month, DD the sampling day, XX the experimental operator (NP stands for Noémie Pernin, OR for Olivier Roques), LL the lysimeter sampled (see section “Experimental design, materials and methods”), optional 00 indicates soil sampled outside the lysimeters, Sx the soil layer sampled with a mean depth of x, and i is the replicate indicator.

For infiltrated water: YYYYMMDD\_XX\_LLWL with YYYY the sampling year, MM the sampling month, DD the sampling day, XX the experimental operator (NP stands for Noémie Pernin, OR for Olivier Roques), LL the lysimeter sampled (see section “Experimental design, materials and methods”), optional 00 indicates soil sampled outside the lysimeters, WL or TW indicates respectively infiltrated water leachate or tap water samples.

For lab tests (see section “Experimental design, materials and methods”):

YYYYMMDD\_XX\_ZZ with YYYY the sampling year, MM the sampling month, DD the sampling day, XX the experimental operator (NP stands for Noémie Pernin, OR for Olivier Roques), ZZ the solid matrix analysed (LM: liquid manure, SS: Bellecombe WWTP sludge, SO: soil from the Bellecombe plot, MA: manure, ISO: laboratory prepared soil, AB: soil from the Bellecombe plot with boric acid added).

2. The corresponding sampling point given with its code SP\_0xx (see file 02\_RISMEAU\_metadata\_sampling\_points.csv).
3. Date of sampling (format DD-MM-YYYY).
4. The specific treatment of the sample before experiment.

### File 05\_RISMEAU\_dataset\_data.csv

This file contains 26218 lines and 7 columns. The columns indicate successively:

1. The identification code of the sample (see file 04\_RISMEAU\_dataset\_samples.csv).
2. The identification code of replicate. 'NA' indicates that no sample replicate is given.
3. The identification code of the method applied M\_xxx (see file 03\_RISMEAU\_metadata\_methods.csv).
4. The mass percentage of organic waste products added to soil. 'NA' indicates no mixture of solid matrices.
5. The data value of the parameter, which corresponds either to the measured value or indicates <LoD or <LoQ in cases of data below analytical limits (see file 03\_RISMEAU\_metadata\_methods.csv). 'NA' stand for qualitative endocrine disruptor indicators.
6. The standard deviation of the data value if applicable. 'NA' indicates that no standard deviation is given.
7. Interpretation of the results in case of qualitative endocrine disruptor indicators, 'NA' in the case of quantitative data.

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