# Bart Rogiers

I am a research scientist and the R community lead at the Belgian Nuclear Research Centre. My research interests are currently focused around the introduction of probabilistic programming in radiological characterization, and leveraging procedural solid texture synthesis for porous media reconstruction. I furthermore really enjoy introducing people to the modern side of R, and help them adopt it as their main workhorse for more reproducible science.

## PROFESSIONAL EXPERIENCE

Present | 2013
**Research scientist**
Belgian Nuclear Research Centre (SCK CEN) — Mol, Belgium

2024 | 2015
**Board member**
IAH Belgium (BCH-CBH) — Brussels, Belgium

2009 | 2008
**Internship**
Flanders Environment Agency — Brussels, Belgium

**Topic** River restoration of the Zwarte Beek between Beringen and Diest: Evaluation of the impact on the groundwater system.

**Supervisor** Lermytte J

## CONTACT INFO


rogiersbart.github.io
bart.rogiers@sckcen.be
rogiers.bart@gmail.com


## SKILLS

R, Stan, RStudio, Quarto, Bash, Python, git, GitHub, MODFLOW, MT3D, SQL, markdown, CSS, HTML, LaTeX, MS Office

## DOMAINS

Bayesian inference, data science, spatial data, radiological characterization, porous media, hydrogeology


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*Last updated on 2024-10-24.*

## TEACHING EXPERIENCE

2024 | 2023

### R: Handle your data with the {tidyverse}

SCK CEN Learning & development — Mol, Belgium

**Format** 3-day course, with editions in 2023 and 2024.

**Topics** Data reading, cleaning, manipulation and visualization, handling specific types, and iteration and nesting.

2024 | 2023

### R: Get started

SCK CEN Learning & development — Mol, Belgium

**Format** 1-day course, with editions in 2023 and 2024.

**Topics** Installing the required software, tweaking the RStudio IDE, managing contributed packages, binding names to values, working with vectors, subsetting R objects, and using control flow.

2023

### R: Create command line tools with {optparse}

SCK CEN Learning & development — Mol, Belgium

**Format** 1-day course

**Topics** Environment variables, Git Bash, R in a terminal, redirections, command line arguments and options, and automated execution.

2024 | 2017

### Training course on radioactive waste management

SCK CEN Academy — Mol, Belgium

**Format** 45-min lecture “Characterization techniques used at SCK CEN - Uncertainty quantification” during the 1.5-week radioactive waste management course. Contributed to the editions in 2017, 2021 and 2024.

**Topics** Taylor expansion, Monte Carlo error propagation, probabilistic programming, and the state of the art in radiological waste characterization.

2021 | 2020

### Modern R for data science: Up your data viz game

SCK CEN Learning & development — Mol, Belgium

**Format** 1-day course, with editions in 2020 and 2021.

**Topics** More details on {ggplot2}, {scales} and extensions, figure design principles, data visualization types, and animation.

2021 | 2019

### Modern R for data science: The core tidyverse, good practices and our corporate environment

SCK CEN Learning & development — Mol, Belgium

**Format** 4-day course, with editions in 2019, 2020 and 2021.

**Topics** Data reading, cleaning, manipulation and visualization, iteration with functional programming, exporting tables and figures, literate computing, and reproducible workflow.

## JOURNAL PAPERS

2024 Report of RILEM TC 281-CCC: insights into factors affecting the carbonation rate of concrete with SCMs revealed from data mining and machine learning approaches.
Materials and Structures 57: 206

**Authors** Vollpracht A, Gluth GJG, Rogiers B, Uwanuakwa ID, Phung QT, Villagran Zaccardi Y, Thiel C, Vanoutrive H, Etcheverry JM, Gruyaert E, Kamali-Bernard S, Kanellopoulos A, Zhao Z, Martins IM, Rathnarajan S, De Belie N.

2024 Bayesian inference of coupled groundwater flow and radiogenic helium-4 production and transport at the catchment scale.
Science of The Total Environment 954: 176510

**Authors** Casillas-Trasvina A, Rogiers B, Beerten K, Wouters L, Walraevens K.

2024 Bayesian optimization of a collimated HPGe detector model for Segmented Gamma Scanning.
Nuclear Instruments and Methods in Physics Research Section A: Accelerators, Spectrometers, Detectors and Associated Equipment 169687

**Authors** Casas-Molina VJ, Laloy E, Rogiers B, Dhaene T, Couckuyt I.

2024 First steps towards productionizing probabilistic radwaste characterization.
Nuclear Engineering and Design 424: 113257

**Authors** Laloy E, Rogiers B, Bielen A, Borella A, Gandolfo G, Lepore L, Marzo G, Cherubini N, Perot B, Ducasse Q, Eleon C, Boden S.

2023 Probabilistic radwaste characterization: findings of a multi-method, multi-mockup exercise using interpolation-based surrogate efficiencies.
Annals of Nuclear Energy 194: 110065

**Authors** Laloy E, Rogiers B, Bielen A, Borella A, Kubinski W, Carasco C, Mathonat C, Boden S.

See orcid, scholar, or our institutional repository for more extensive and up to date overviews of my scientific output.

2023 Improving Bayesian radiological profiling of waste drums using Dirichlet priors, Gaussian process priors, and hierarchical modeling.
Applied Radiation and Isotopes 194: 110691

**Authors** Laloy E, Rogiers B, Bielen A, Borella A, Boden S.

2023 Estimation of soil radioactivity-depth profiles using Bayesian inversion of borehole gamma spectrometry data.
Journal of Environmental Radioactivity 257: 107077

**Authors** Hasan MM, Rogiers B, Laloy E, Camps J, Rutten J, Huysmans M.

2023 2D Inversion of in situ gamma-ray spectrometric measurements of 137Cs for site characterization.
Journal of Environmental Radioactivity 256: 107052

**Authors** Hasan MM, Camps J, Rogiers B, Laloy E, Rutten J, Boden S, Huysmans M.

2022 Characterizing groundwater heat-transport in a complex lowland aquifer using paleo-temperature reconstruction, satellite data, temperature-depth profiles, and numerical models.
Hydrology and Earth System Sciences 26: 5577–5604

**Authors** Casillas-Trasvina A, Rogiers B, Beerten K, Wouters L, Walraevens K.

2022 Using helium-4, tritium, carbon-14 and other hydrogeochemical evidence to evaluate the groundwater age distribution: the case of the Neogene aquifer, Belgium.
Journal of Hydrology X 17: 100132

**Authors** Casillas-Trasvina A, Rogiers B, Beerten K, Pärn J, Wouters L, Walraevens K.

2022 Exploring river–aquifer interactions and hydrological system response using baseflow separation, impulse response modelling and time series analysis in three temperate lowland catchments.
Hydrology and Earth System Sciences 26: 3629–3649

**Authors** Lu M, Rogiers B, Beerten K, Gedeon M, Huysmans M.

2022 **Soil radioactivity-depth profiles from regularized inversion of borehole gamma spectrometry data.**
Journal of Environmental Radioactivity — 243: 106807

**Authors** Hasan MM, Rogiers B, Laloy E, Rutten J, Camps J, Vidmar T, Huysmans M.

2021 **Exploring the hydrological effects of normal faults at the boundary of the Roer Valley Graben in Belgium using a catchment-scale groundwater flow model.**
Hydrogeology Journal — 30: 133-149

**Authors** Casillas-Trasvina A, Rogiers B, Beerten K, Wouters L, Walraevens K.

2021 **Towards a scientific-based assessment of long-term durability and performance of cementitious materials for radioactive waste conditioning and disposal.**
Journal of Nuclear Materials — 557: 153201

**Authors** Jacques D, Phung QT, Perko J, Seetharam SC, Maes N, Liu S, Yu L, Rogiers B, Laloy E

2021 **Bayesian inference of 1D activity profiles from segmented gamma scanning of a heterogeneous radioactive waste drum.**
Applied Radiation and Isotopes — 175: 109803

**Authors** Laloy E, Rogiers B, Bielen A, Boden S.

2020 **INSIDER UC2: the BR3 biological shield preliminary results and future work.**
EPJ Nuclear Sciences & Technologies — 6: 14

**Authors** Broeckx W, Rogiers B, Mangelschots N, Vandyck R, Verstrepen G, Boden S.

2020 **Development of a user-friendly guideline for data analysis and sampling design strategy.**
EPJ Nuclear Sciences & Technologies — 6: 16

**Authors** Desnoyers Y, Rogiers B.

2020 **The relation between petrophysical and transport properties of the Boom Clay and Eigenbilzen Sands.**
Applied Geochemistry — 114: 104527

**Authors** Jacops E, Rogiers B, Frederickx L, Swennen R, Krooss BM, Amann-Hildenbrand A, Littke R, Bruggeman C.

2019 **Nested multiresolution hierarchical simulated annealing algorithm for porous media reconstruction.**
Physical Review E — 100(5): 053316

**Authors** Lemmens L, Rogiers B, Jacques D, Huysmans M, Swennen R, Urai JL, Desbois G, Laloy E

2018 **Metrology for decommissioning nuclear facilities: Partial outcomes of joint research project within the European Metrology Research Program.**
Applied Radiation and Isotopes — 134: 351-357

**Authors** Suran J, Kovar P, Smoldasova J, Šolc J, Van Ammel R, Miranda MG, Russell B, Arnold D, Zapata-Garcia D, Boden S, Rogiers B, Sand J, Peräjärvi K, Holm P, Hay B, Failleau G, Plumeri S, Beck YL, Grísa T.

2017 **Bayesian inversion of a CRN depth profile to infer Quaternary erosion of the northwestern Campine Plateau (NE Belgium).**
Earth Surface Dynamics — 5: 331-345

**Authors** Laloy E, Beerten K, Vanacker V, Christl M, Rogiers B, Wouters L.

2017 **Model-based classification of CPT data and automated lithostratigraphic mapping for high-resolution characterization of a heterogeneous sedimentary aquifer.**
PLOS One — 12(5): e0176656

**Authors** Rogiers B, Mallants D, Batelaan O, Gedeon M, Huysmans M, Dassargues A.

2017 **Episodic activity of a dormant fault in tectonically stable Europe: The Rauw fault (NE Belgium).**
Tectonophysics — 699: 146-163

**Authors** Verbeeck K, Wouters L, Vanneste K, Camelbeeck T, Vandenberghe D, Beerten K, Rogiers B, Schiltz M, Burow Ch, Mees F, De Graeve J, Vandenberghe N.

2014 **The usefulness of outcrop analogue air permeameter measurements for analysing aquifer heterogeneity: Quantifying outcrop hydraulic conductivity and its spatial variability.**
Hydrological processes — 28: 5176-5188

**Authors** Rogiers B, Beerten K, Smeekens T, Mallants D, Gedeon M, Huysmans M, Batelaan O, Dassargues A.

2014 Multi-scale aquifer characterization and groundwater flow model parameterization using direct push technologies.
Environmental Earth Sciences 72(5): 1303-1324

**Authors** Rogiers B, Vienken T, Gedeon M, Batelaan O, Mallants D, Huysmans M, Dassargues A

2014 High resolution saturated hydraulic conductivity logging of borehole cores using air permeability measurements.
Hydrogeology Journal 22(6): 1345-1358

**Authors** Rogiers B, Winters P, Huysmans M, Beerten K, Mallants D, Gedeon M, Batelaan O, Dassargues A

2014 Demonstrating large-scale cooling in a Variscan terrane by coupled groundwater and heat flow modelling.
Geothermics 51: 71-90

**Authors** Rogiers B, Huysmans M, Vandenberghe N, Verkeyn M

2013 The usefulness of outcrop analogue air permeameter measurements for analysing aquifer heterogeneity: testing outcrop hydrogeological parameters with independent borehole data.
Hydrology and Earth System Sciences 17: 5155-5166

**Authors** Rogiers B, Beerten K, Smeekens T, Mallants D, Gedeon M, Huysmans M, Batelaan O, Dassargues A.

2013 Derivation of flow and transport parameters from outcropping sediments of the Neogene aquifer, Belgium.
Geologica Belgica 16(3): 129-147

**Authors** Rogiers B, Beerten K, Smeekens T, Mallants D, Gedeon M, Huysmans M, Batelaan O, Dassargues A

2013 Efficient posterior exploration of a high-dimensional groundwater model from two-stage MCMC simulation and polynomial chaos expansion.
Water Resources Research 49(5): 2664-2682

**Authors** Laloy E, Rogiers B, Vrugt JA, Mallants D, Jacques D

2013 Determination of Cs-137 contamination depth distribution in building structures using geostatistical modelling of ISOCS measurements.
Applied Radiation and Isotopes 79: 25-36

**Authors** Boden S, Rogiers B, Jacques D

2013 A critical review of laboratory and in-situ hydraulic conductivity measurements for the Boom Clay in Belgium.
Applied Clay Science 75-76: 1-12

**Authors** Yu L, Rogiers B, Gedeon M, Marivoet J, De Craen M, Mallants D.

2012 Estimation of hydraulic conductivity and its uncertainty from grain-size data using GLUE and artificial neural networks.
Mathematical Geosciences 44(6): 739-763

**Authors** Rogiers B, Mallants D, Batelaan O, Gedeon M, Huysmans M, Dassargues A

2011 Evaluating the impact of river restoration on the local groundwater and ecological system: a case study in NE Flanders.
Geologica Belgica 14(3-4): 265-276

**Authors** Rogiers B, Lermytte J, De Bie E, Batelaan O.

## EDUCATION

2013 | 2009

### PhD in Geology

SCK CEN & KU Leuven — Mol, Belgium

**Thesis** Conditional Stochastic Simulation of Groundwater Flow and Contaminant Transport in a Sandy Aquifer at Mol/Dessel.

**Supervisory committee** Batelaan O, Mallants D, Gedeon M, Huysmans M, Dassargues A

**Additional members of the jury** Vandenberghe N, Swennen R, Vanderborght J, Dietrich P

2009 | 2007

### Master of Science in Geology

KU Leuven, magna cum laude — Leuven, Belgium

**Thesis** Interpretation of the heat-flow density in the deep wells Soumagne, Grand-Halleux and Havelange in Belgium, by means of a numerical coupled heat transport and groundwater flow model.

**Promoters** Vandenberghe N, Huysmans M

2007 | 2004

### Bachelor of Science in Geology, Option Physics

KU Leuven, cum laude — Leuven, Belgium

**Thesis** The meaning of heat-flow density measurements in the wells Grand-Halleux, Soumagne, Meer and Havelange.

**Promoters** Vandenberghe N, Huysmans M

## PEER REVIEWING

- Water Resources Research (4)
- Hydrogeology Journal (3)
- Mathematical Geosciences (2)
- Computers & Geosciences (2)
- Journal of Hydroinformatics (2)
- Toxics (2)
- IEEE transactions on nuclear science (2)
- Journal of African Earth Sciences (2)
- Advances in Water Resources (1)
- Earth Science Informatics (1)
- Environmental Earth Sciences (1)
- Frontiers in Earth Science (1)
- Journal of Environmental Quality (1)
- Journal of Hydrology and Hydromechanics (1)
- Vadose Zone Journal (1)

See orcid for an up to date overview.

## PROFESSIONAL DEVELOPMENT

2024 **Statistics: Basic training course**
Claesen J, Amsterdam UMC, --03-01, ---08, ---15
Mol, Belgium

2023 **Python: Basic training course**
Gupta S, SCK CEN learning & development, --10-19
Mol, Belgium

2023 **Learning facilitator (Train the trainer)**
Ceelen N, Progress Consulting, --01-16, ---23, --02-16
Mol, Belgium

2021 **Train-The-Trainer webinars**
Clarijs T & Van Puyvelde L, SCK CEN learning & development, --05-28,--06-03, ---15, ---21, ---25, ---28, ---30
Online

2019 **Email - Go for 0 Inbox**
Loontiens S, Shortcuts, --06-06
Mol, Belgium

2019 **Organize your time**
Loontiens S, Shortcuts, --05-06
Mol, Belgium

2018 **Querying Data with transact-SQL**
RealDolmen, --11-14/15, ---27
Mol, Belgium

2018 **Making 3D drawings with Sketchup | Fundamentals**
Mangelschots N, SCK CEN Learning & development, --11-12
Mol, Belgium

2017 **Git version control**
Van Robbroeck K, RealDolmen, --09-27/28
Mol, Belgium

2016 **MCNP - basic training course**
SCK CEN Academy, --11-08
Mol, Belgium

2014 **An introduction to Bayesian computing with INLA**
Rue H, --07-08
Mines ParisTech, France

2014 **Advanced stochastic simulations**
Lantuéjoul C, Romary T, --07-07
Mines ParisTech, France

2014 **Short course on underlying R&D for the disposal of radioactive waste**
SCK CEN Academy, --03-19/20
Mol, Belgium

Note I am using the ISO 8601:2000 standard for truncated date (interval) notation.

2013 **Version control with subversion**
Bex G-J, ICTS KU Leuven, --02-26 — Leuven, Belgium

2013 **HPC introduction**
Oldenhof M, ICTS KU Leuven, --02-19 — Leuven, Belgium

2012 **Advanced R programming topics**
Wijffels J, BNOSAC, --10-18/19 — Leuven, Belgium

2012 **Upgrade your written English**
Vermeire A, --04-19, --05-03/04 — Mol, Belgium

2012 **LaTeX - introduction**
ICTS KU Leuven, --03-29/30 — Leuven, Belgium

2012 **Data mining in practice**
CS KU Leuven, --02-06/07 — Leuven, Belgium

2011 **Speedreading**
Lernout B, --10-11 — Mol, Belgium

2011 **Scientific writing & speaking**
Vermeire A, --03-02, ---09, ---21, ---28 — Mol, Belgium

2010 **Global sensitivity analysis techniques for probabilistic groundwater modeling**
Mishra S, --09-21 — Valencia, Spain

2010 **2nd summer school on flow and transport in porous and fractured media**
CNRS, --08-16/28 — Cargèse, France

2010 **Inverse modelling in earth and environmental sciences**
Vrugt J, Huisman S, --07-26/29 — Leuven, Belgium

2010 **Meet the expert in hydrology - Round tables among young and established scientists**
Carrera J, --05-05 — Vienna, Austria

2010 **Short course on geostatistical analysis of environmental data**
Goovaerts P, --03-08/12 — Gainesville, FL, USA

2010 **Introduction to R**
ICTS KU Leuven & LStat, --02-22/23 — Leuven, Belgium

2010 **Multivariate data analysis, with applications**
ICTS KU Leuven & LStat, --02-08/10 — Leuven, Belgium

2010 Hydrological modelling and uncertainty analysis

Buytaert W, --01-18 Louvain-la-Neuve, Belgium

## GRANTS

2013 | 2009

**SCK CEN PhD scholarship**
SCK CEN Academy PhD program

Mol, Belgium

## STAYS ABROAD

2013 **CSIRO Land & Water and Flinders University**
Scientific visit, --05-22/06-15 Adelaide, Australia

## STUDENT SUPERVISION

*University promoter in italic.*

Present | 2023

### Aouf A, PhD
SCK CEN & UCLouvain

**Topic** Deep learning for 3D porous media reconstruction of clay and cement-based materials

**Supervisors** *De Vleeschouwer Ch*, Laloy E, Rogiers B

Present | 2023

### Casas Molina V, PhD
SCK CEN & Ghent University

**Topic** Machine learning for accurate and efficient uncertainty quantification in radiological waste characterization

**Supervisors** *Couckuyt I*, Laloy E, Rogiers B

2022 | 2018

### Casillas A, PhD
SCK CEN & Ghent University

**Topic** Assessment of unconventional state variables to constrain groundwater flow models of the Neogene Aquifer in the Campine Basin in Belgium

**Supervisors** *Walraevens K*, Rogiers B, Beerten K, Wouters L

2024 | 2017

### Lu M, PhD
SCK CEN & KU Leuven

**Topic** Quantifying and predicting river-aquifer exchange in lowland floodplains (Nete, Demer and Dijle).

**Supervisors** *Huysmans M*, Gedeon M, Beerten K, Rogiers B

2022 | 2017

### Moudud H, PhD
SCK CEN & Vrije Universiteit Brussel

**Topic** In situ methods for high resolution mapping of radioactive soil contamination

**Supervisors** *Huysmans M*, Vidmar T, Rogiers B

Present | 2016

### Lemmens L, PhD
SCK CEN & KU Leuven

**Topic** 3D Porous media reconstruction for natural and engineered radioactive waste confinement barriers – A multiresolution-multiphase approach.

**Supervisors** *Huysmans M*, Rogiers B, Laloy E

2016 **Neyens C, MSc thesis**
Faculty of Science, KU Leuven

**Topic** Analysis of pumping tests in a sandy aquifer in Northern Belgium.

**Supervisors** *Huysmans M*, Gedeon M, Laloy E, Rogiers B

2015 **Janssens L, BSc thesis**
Faculty of Science, KU Leuven

**Topic** Omzetting van digitale foto's van ontsluitingen in hydraulische conductiviteit, met behulp van beeldanalyse en luchtpermeameter datasets.

**Supervisors** *Huysmans M*, Rogiers B

2015 **Hoedemaekers T, BSc thesis**
Faculty of Science, KU Leuven

**Topic** Slug- en dilutietesten in de Neogene aquifer, in en rond de nucleaire zone te Mol-Dessel- Geel.

**Supervisors** *Huysmans M*, Rogiers B, Gedeon M

2014 **Bennett G, MSc thesis**
Faculty of Engineering, Vrije Universiteit Brussel

**Topic** Integration of detailed borehole core measurements and pump test data from the aquifers below the Boom Clay in a groundwater flow model.

**Supervisors** *Huysmans M*, Rogiers B, Vandersteen K

2014 **Potums L, BSc thesis**
Faculty of Science, KU Leuven

**Topic** Gedetailleerde karakterisatie van boorkernen uit de diepe aquifers rond de Boomse klei, met behulp van een luchtpermeameter.

**Supervisors** *Huysmans M*, Rogiers B

2012 **Winters P, BSc thesis**
Faculty of Science, KU Leuven

**Topic** Haalbaarheidsstudie voor de gedetailleerde opmeting van de hydraulische conductiviteit op boorkernen, met behulp van een luchtpermeameter.

**Supervisors** *Huysmans M*, Rogiers B

## EXAMINATION COMMITTEES

2022 — **Nick Janssens, PhD**
Department of Earth and Environmental Sciences, KU Leuven

**Thesis** Three-dimensional superresolution models for fluid flow simulation, developed for computed tomography (CT) scans for continental carbonates.

2022 — **George Bennett, PhD**
Department of Geology, Ghent University

**Thesis** Hydrogeological investigation of a volcanic aquifer system on the flanks of Mount Meru, Northern Tanzania.

2016 — **Nhu Viet Ha, PhD**
Department of Hydrology and Hydraulic Engineering, Vrije Universiteit Brussel

**Thesis** Spatio-temporal prediction of land subsidence using GIS-based 3D geological, geotechnical and groundwater flow models in Hanoi city (Vietnam).

2013 — **Nafyad Serre Kawo, MSc**
Interuniversity programme: Master of Science in Physical Land Resources, Universiteit Gent - Vrije Universiteit Brussel

**Thesis** Model Based Evaluation of the Protection Zones around the WaterGroep Public Drinking Water Well Field in Huiskens (Korbeek-Lo), Belgium.