geovariances
A DATAMINE COMPANY

TRAINING CATALOG 2027

For the Mining industry

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TABLE OF CONTENTS

About Geovariances **2**
Who we are 3
Our global offering 3
Meet the team 4
Travel policy 4
Start your journey in mining geostatistics **6**
Mineral resource estimation by linear geostatistics 7
Improve your skills in mining geostatistics **10**
Recoverable resource estimation by nonlinear geostatistics 11
Geostatistical inputs to resource classification 15
Geological modeling by geostatistics 17
Drill Hole Spacing Analysis - DHSA 19
Multiple-point statistics simulations with Isatis.neo - MPS 21
Machine learning applied to geosciences and mining 24
Data analysis, mapping, and subsurface property modeling with geostatistics 26
Boost your proficiency in Isatis.neo and Isatis.py **29**
Isatis.neo fundamentals 30
Isatis.neo scripting 32
Isatis.py hands-on 34
Training schedule **38**
2027 session dates 39

About Geovariances

Who we are

Geovariances: four decades of geostatistics for mining

Geovariances is a globally recognized provider of premium geostatistics solutions for the mining industry, offering advanced software, expert consulting and industry-leading training.

Founded in 1986 as a spin-off from the Center for Geostatistics at the Paris School of Mines (now Mines Paris – PSL), we have led geostatistical innovation for four decades. Our commitment to scientific rigor and technical excellence is reflected in the CFSG specialized geostatistics course, which we still deliver jointly with Mines Paris – PSL.

We help mining companies improve performance and make informed, data-driven decisions by integrating geostatistics into their operations, from exploration to production. Our solutions enable them to evaluate alternative scenarios, better understand deposit complexity, and reduce risks in resource estimation and mine planning.

At Geovariances, we understand the challenges mining professionals face in achieving operational efficiency while managing uncertainty. That's why our team of dedicated experts works closely with clients to tailor geostatistical approaches to their needs, delivering reliable, actionable insights that improve decision-making.

Geovariances has been a Datamine company since 2022.

Our global offering

ISATIS.NEO – THE POWER OF GEOSTATISTICS AT YOUR FINGERTIPS

Isatis.neo is Geovariances' flagship geostatistical software, trusted by leading industry players for its analytical strength, usability, and transparency. With a user-friendly interface, intuitive workflows, and robust algorithms, Isatis.neo delivers deep insight into mineral resource projects while ensuring full auditability and reproducible results.

As the most comprehensive geostatistics desktop solution on the market, Isatis.neo supports a wide range of estimation and simulation methods. It enables users to meet the highest technical standards in resource evaluation and project risk analysis.

TRAINING, CONSULTING & MENTORING SERVICES

Geovariances offers a broad portfolio of training courses in applied geostatistics, delivered by seasoned specialists with deep domain expertise. Whether you are new to geostatistics or seeking to enhance your knowledge in advanced modeling techniques, our training programs are designed to build both theoretical understanding and practical competence.

In addition, we provide customized consulting and mentoring services, supporting clients in areas such as:

– Mineral resource estimation
– Drillhole spacing and sampling strategy
– Risk and uncertainty analysis
– Geostatistical workflow optimization

Our services are available onsite, online, or at Geovariances offices worldwide, ensuring flexible access to world-class expertise.

Learn more at: Geovariances Technical Resources.

Meet the team

DISCOVER OUR EXPERTS

At Geovariances, our strength lies in our instructors' expertise. Our training programs are delivered by expert consultants, recognized for both the quality of their work and their ability to translate advanced geostatistical knowledge into practical solutions across the entire mining value chain, from exploration and resource estimation to project management and operational optimization.



Roberto Rolo, Ph.D. – Data Science and Resource Expert

Roberto is a Mining Engineer from UFOP with a master's and Ph.D. in geostatistics from UFRGS in Brazil. His expertise includes implicit geological modeling, ore grade estimation, and designing simulation workflows that comply with international mineral reporting codes. He is also highly skilled in Python and machine learning applications in the geosciences.



Pedram Masoudi, Ph.D. – Senior Consultant in Geostatistics

Pedram is a specialist in geostatistics and a lead trainer for Isatis.neo. He applies geostatistics to mineral resource estimation and classification in accordance with international standards such as JORC, as well as to geological and domain modeling. His additional strengths include Python programming and machine learning, with broader experience in geotechnical site characterization, petroleum exploration, and contaminated soil studies.

Travel policy

To ensure the health and safety of our employees during travel, Geovariances adheres to the following guidelines:

Air Travel:

We prefer regular passenger aircraft for travel, and if charter planes are necessary, they must meet a minimum standard of twin-turbo engines with at least two crew members. We reserve the right to refuse travel on planes that do not meet this standard, and any resulting delays will be charged to the customer. We will travel in business class or its equivalent for international flights over six (6) hours.

Ground Transportation:

Rental vehicles must be full-size sedans equipped with ABS brakes and a minimum of four airbags. If the vehicles provided do not meet this standard, Geovariances reserves the right to upgrade them, with associated costs to be borne by the client.

Driving Limits:

Daily driving time is limited to a maximum of 10 hours. Any additional costs incurred to comply with this limit will be charged to the contracting party.

Helicopter Travel:

Helicopter transportation will be evaluated on a case-by-case basis, considering safety and operational requirements.

Start your journey in mining geostatistics

Mineral resource estimation by linear geostatistics

Learn the fundamental concepts of geostatistics to confidently estimate your mineral resources.

OBJECTIVES

This course provides a solid foundation in geostatistical methods for mineral resource estimation. The skills you will develop will assist you in:

- **Estimating long-term and short-term resources**,
- **Producing resource models** for mine design,
- **Conducting spatial analysis** of drillhole data.

It comprises two modules that can be taken separately:

- **In Module 1, you will learn and practice the standard workflow for estimating resources in a univariate context**. This module covers in-depth data analysis, detailed variographic analyses, block modeling, grade distribution interpolation using kriging, estimation validation, and unbiased grade-tonnage curves for short-term resources.
- **Module 2 allows you to progress into the multivariate context** by exploring statistical tools such as Principal Component Analysis, applying kriging and co-kriging methods for estimating multi-element orebodies and obtaining multivariate models respecting the ratio between main metals, oxides, and elements.

MODULE 1 – UNIVARIATE CONTEXT COURSE CONTENT

- **Understand the importance of geostatistics** in mineral resource estimation: build a solid foundation for informed decision-making.
- **Explore and analyze your data effectively** using Exploratory Data Analysis (EDA) and spatial data analysis techniques.
- **Assess data stationarity** to ensure consistency and reliability in your estimates.

DURATION

Module 1: 14 hours / 2 days

Module 2: 14 hours / 2 days

LEVEL

Basic

TYPE

Theory and practice

MODE

Online or in-person course

Open or in-company sessions

PRICE

Scheduled session (hybrid): EUR 1,100 / person

On-demand session: price upon request

- **Prepare your data with confidence** using regularization techniques such as compositing and declustering to reduce bias.
- **Master variographic analysis**: variogram clouds, directional variograms, and interpretation of spatial structures.
- **Model variograms** using automatic, semi-automatic, manual, or interactive tools tailored to your needs.
- **Apply the most relevant kriging methods**: ordinary kriging, block kriging, and weight distribution analysis.
- **Build an optimal sample neighborhood** with Kriging Neighborhood Analysis (KNA) to enhance estimation accuracy.
- **Validate your models and estimations** through cross-validation and robust validation techniques.
- **Generate grade-tonnage tables and curves** to support your technical and economic modeling.

MODULE 2 – MULTIVARIATE CONTEXT
COURSE CONTENT

- **Use Principal Component Analysis (PCA)** to extract the most relevant information from complex multivariate datasets.
- **Estimate non-stationary variables** by applying kriging with external drift or universal kriging for more accurate resource modeling.
- **Analyze grade correlations** to understand elements' relationships better and enhance your geostatistical models.
- **Examine joint spatial structure** by calculating and interpreting cross-variograms and cross-covariances, even on purely heterotopic datasets.
- **Interpolate correlated grades** using advanced cokriging methods: ordinary cokriging, collocated cokriging, and rescaled cokriging.

OUTLINES

- **Balanced learning approach**. Theory paired with practical applications, so you understand and apply the concepts.
- **Hands-on software training**. Computer exercises in Isatis.neo on real datasets.
- **Personalized feedback**. Individual guidance from experienced trainers throughout the online sessions.
- **Comprehensive resources**. A temporary software license, documentation, journal files, and datasets to keep and reuse after the course.
- **Certificate of completion** issued at the end of the session.

WHO SHOULD ATTEND

Professionals seeking a sound theoretical and practical knowledge of mining geostatistics.

PREREQUISITES

A basic understanding of resource concepts such as **grade**, **tonnage**, and **cut-off** is recommended. To expand your knowledge, we recommend attending the complementary advanced short course, "*Recoverable resource estimation by nonlinear geostatistics*".

Improve your skills in mining geostatistics

Recoverable resource estimation by nonlinear geostatistics

Develop advanced skills in geostatistics and master nonlinear techniques for recoverable resource estimation and risk analysis.

OBJECTIVES

This course provides a solid foundation in geostatistical methods for recoverable resource estimation. The skills you will develop will assist you in:

- **Estimating long-term resources**,
- **Estimating grade-tonnage curves** during exploration.

It comprises four modules that can be taken separately:

- **Module 1 dives into the importance of nonlinear techniques in generating unbiased grade-tonnage curves**, especially in sparse sampling conditions. You will gain a deep understanding of Uniform Conditioning (UC) and confidently apply it to compute grade, tonnage, and metal quantities across various cut-offs.
- **Module 2 explores Multiple Indicator Kriging and Conditional Expectation**, helping you master when and how to apply each technique effectively.
- **Module 3 introduces two powerful conditional simulation techniques** for continuous variables like grades. You'll also learn how to post-process results to generate accurate grade-tonnage curves.
- **Module 4 covers advanced multivariate modeling techniques**. You will explore trends, decorrelation methods such as PCA, MAF, and PPMT, along with imputation and ratio transforms.

MODULE 1 – APPLYING UNIFORM CONDITIONING COURSE CONTENT

Introduction

DURATION

Module 1: 7 hours / 1 day
Module 2: 10 hours / 1.5 days
Module 3: 10 hours / 1.5 days

LEVEL

Advanced

TYPE

Theory and practice

MODE

Online or in-person course

Open or in-company sessions

PRICE

Scheduled session (hybrid):
Module 1: EUR 550 / person
Module 2: EUR 790 / person
Module 3: EUR 790 / person
Module 4: EUR 550 / person

On-demand session: price upon request

– Why kriging isn't enough: Understand the limitations of kriging and how wide high drill hole spacing can lead to smoothing effects that underestimate variability.
– Master the fundamentals of recoverable resource estimation and learn how to apply them in real-world mining projects.

Transforming data

– **Model the Gaussian anamorphosis**: Transform any distributions into Gaussian ones, a necessary step for nonlinear modeling.
– **Change of support made clear**: Grasp the impact of support size on grade variance—core vs. block grades.

Exploring Uniform Conditioning (UC)

– **Learn the fundamentals of UC** to estimate recoverable resources for different cut-offs.
– **Understand the Information Effect**, how sampling density impacts your estimates, and how to correct them.
– **Localized Uniform Conditioning (LUC)**: Apply UC within panels at the block or SMU level to produce models compatible with mine planning.
– Manage **multi-domain and multivariate deposits**.
– **Produce robust grade-tonnage curves** and generate robust estimates of grade, tonnage, and metal quantities by cut-off grade from UC results to support your resource evaluations.

MODULE 2 – APPLYING MIK AND CONDITIONAL EXPECTATION COURSE CONTENT

Introduction

– **Master the fundamentals of recoverable resource estimation** and understand its critical role in resource modeling and mine planning.

Multiple Indicator Kriging (MIK)

– **Dive into MIK theory, workflow, and key variants** to effectively estimate resources.
– **Discover best practices** for applying MIK using Isatis.neo, including key settings and strategic choices.
– **Weigh the pros and cons of MIK** and understand where and when it delivers the best results.
– **Generate accurate grade-tonnage curves** using MIK outputs for confident decision-making.

Conditional Expectation (CE)

– **Learn basic CE principles and theory**, and how the technique fits into the nonlinear estimation toolkit.
– **Explore CE variants**, including their link to multi-Gaussian kriging approaches.
– **Explore Ordinary Multi-Gaussian Kriging** as a foundation for implementing CE in practice.

- **Compare the strengths and limitations of CE** and discover its ideal application domains.
- **Produce robust grade-tonnage curves** from CE results to support your resource evaluations.
- **Get hands-on with Isatis.neo**: Learn the available CE options, including block estimates and multivariate modeling.

MODULE 3 – APPLYING CONDITIONAL SIMULATIONS COURSE CONTENT

Introduction

- **Understand the fundamentals of recoverable resource estimation** and its critical role in resource modeling and mine planning.

Simulations

- **Master general simulation concepts**. Learn the theory.
- **Model the Gaussian anamorphosis**: Transform any distributions into Gaussian ones, a necessary step for nonlinear modeling.
- **Discover two widely used conditional simulation methods**: Turning Bands Simulation (TBS) and Sequential Gaussian Simulation (SGS). Understand their theoretical foundations, practical applications, and where each method performs best.
- **Unlock the power of Direct Block Simulations**: Bypass the traditional point-scale modeling approach with this efficient technique that generates block-scale simulations directly, saving valuable time and disk space without compromising accuracy.

Post-processing of simulation results

- Produce robust grade-tonnage curves from simulations to support your resource evaluations.

MODULE 4 – ADVANCED MULTIVARIATE MODELING COURSE CONTENT

- **Trend modeling**. Two distinct operations that are easy to confuse: modeling the trend itself and estimating with a trend already in place. When to separate them, and what a misplaced trend does to your estimates.
- **Three multivariate decorrelation techniques** – Principal Component Analysis (PCA), Minimum/Maximum Autocorrelation Factors (MAF), and Projection Pursuit Multivariate Transform (PPMT). All three address the same problem: cokriging several correlated variables at once quickly becomes unmanageable, while simulating them separately breaks their relationships. These methods turn the variables into independent factors you can handle one at a time, then transform them back. Where they differ is how far the decorrelation holds — at zero distance only, at two distances, or across the full joint distribution.

- **Multivariate imputation**. Filling the gaps in an incomplete dataset, using the correlations between variables to estimate the values you don't have — so you can run the transforms above without discarding every sample that has a missing assay.
- **Ratio transforms**. For variables bound by a sum or a ratio, such as metal-to-oxide relationships or grades that must total a fixed amount, so the constraint survives estimation and simulation rather than being broken.

OUTLINES

- **Balanced learning approach**. Theory paired with practical applications, so you understand and apply the concepts.
- **Hands-on software training**. Computer exercises in Isatis.neo, on real datasets.
- **Personalized feedback**. Individual guidance from experienced trainers throughout the online sessions.
- **Comprehensive resources**. A temporary software license, documentation, journal files, and datasets to keep and reuse after the course.
- **Certificate of completion** issued at the end of the session.

WHO SHOULD ATTEND

Geologists, Mining engineers, and professionals involved in feasibility studies or medium- to long-term planning who wish to deepen their theoretical and practical knowledge of mining geostatistics.

PREREQUISITES

A basic understanding of linear geostatistics and resource concepts like **grade**, **tonnage**, **and cut-off** - or having completed the course "*Mineral resource estimation by linear geostatistics*", which covers fundamental geostatistics for resource estimation - provides an ideal foundation for this advanced course.

Geostatistical inputs to resource classification

Make resource classification more quantitative and defensible. Use kriging, simulations, and uncertainty measures to apply auditable JORC criteria with greater confidence.

OBJECTIVES

- **Understand resource classification principles.** Gain foundational knowledge of resource reporting and classification frameworks with a specific focus on the JORC Code.
- **Master geostatistical methods for confidence assessment.** Explore geostatistical techniques such as kriging, conditional simulations, and uncertainty quantification to assess the reliability of resource estimates. Identify their strengths, limitations, and suitability for different classification contexts.
- **Apply classification criteria to resource models.** Learn practical approaches to classifying resources using quantitative criteria derived from kriging or simulation results. Develop skills to apply advanced geostatistical tools for robust, auditable classification of resources into Inferred, Indicated, and Measured categories.

COURSE CONTENT

- **Review of JORC definitions regarding mineral resource classification**: Competent Person, inferred-indicated-measured resources, resource reporting, resource classes.
- **Resource classification using the kriging neighborhood parameters**.
- **How to enhance the accuracy of resource estimates** through Kriging Neighborhood Analysis and cross-validation to improve confidence levels.
- **Resource classification using linear geostatistics**: exploration of various classification criteria that can be applied to kriging outputs, such as standard deviation, variance, kriging efficiency, relative variance, variance of estimator, variance of interpolation, and risk index.

DURATION

17 hours / 2,5 days

LEVEL

Advanced

TYPE

Theory and practice

MODE

Online or in-person course

Open or in-company sessions

PRICE

Scheduled session (hybrid): EUR 1,350 / person

On-demand session: price upon request

- **Resource classification using conditional simulations**: exploration of various classification criteria that can be applied to simulation outputs, such as conditional variance, relative conditional variance, probability of deviation from the mean, and coefficient of variation.
- **Resource classification using advanced quantities** such as the global estimation variance, the Spatial Sampling Density Variances (SSDV), and the related specific volume, coefficient of variation, and risk index.

OUTLINES

- **Balanced learning approach**. Theory paired with practical applications, so you understand and apply the concepts.
- **Hands-on software training**. Computer exercises in Isatis.neo, on real datasets.
- **Personalized feedback**. Individual guidance from experienced trainers throughout the online sessions.
- **Comprehensive resources**. A temporary software license, documentation, journal files, and datasets to keep and reuse after the course.
- **Certificate of completion** issued at the end of the session.

WHO SHOULD ATTEND

Mining professionals who want to learn the geostatistical techniques used to assess resource confidence levels and classify mineral resources accordingly.

PREREQUISITES

Because the course covers advanced geostatistical concepts, participants should have a solid understanding of variography, kriging, and simulation. Alternatively, participants may have completed the "*Mineral resource estimation by linear geostatistics*" training course.

Geological modeling by geostatistics

Build realistic geological models that reflect complexity and uncertainty. Apply indicator kriging, SIS, TGS, PGS, and implicit modeling through hands-on workflows in Isatis.neo.

OBJECTIVES

- **Unlock the skills to build reliable, realistic, data-driven geological models** that capture uncertainty, boosting the credibility of your subsurface interpretations and empowering you to make smarter, more confident decisions.
- **Get hands-on with powerful geostatistical methods**, like Indicator Kriging and simulations (SIS, TGS, PGS), and apply them using Isatis.neo's intuitive tools, including implicit modeling and the Unfolding feature for tackling complex stratigraphy with confidence.

COURSE CONTENT

Foundations & Indicator Kriging

- Discover indicator kriging, how it works, and when to use it.
- Learn how to apply it in practice in Isatis.neo to build geological models and define domains.

Conditional simulations

- Learn about the main facies simulation methods: sequential indicator simulation (SIS), truncated Gaussian simulation (TGS), and multi-Gaussian simulation (PGS).
- Understand their principles, key steps, and differences.
- Implement them in Isatis.neo using the dedicated options.

Implicit modeling

- Explore how to use potential fields to model stratigraphic units or intrusive bodies automatically.
- Create consistent and continuous surfaces from geological data.

Unfolding

- Handle geological structures that have been folded or deformed.

DURATION

21 hours / 3 days

LEVEL

Advanced

TYPE

Theory and practice

MODE

Online or in-person course

Open or in-company sessions

PRICE

Scheduled session (hybrid): EUR 1,650 / person

On-demand session: price upon request

– Learn how to “unfold” these structures and convert complex geometries into a flattened space where continuity is more isotropic and easier to model.

OUTLINES

– **Balanced learning approach**. Theory paired with practical applications, so you understand and apply the concepts.
– **Hands-on software training**. Computer exercises in Isatis.neo, on real datasets.
– **Personalized feedback**. Individual guidance from experienced trainers throughout the online sessions.
– **Comprehensive resources**. A temporary software license, documentation, journal files, and datasets to keep and reuse after the course.
– **Certificate of completion** issued at the end of the session.

WHO SHOULD ATTEND

Ideal for professionals in mineral resource evaluation, geological surveys, geotechnical engineering, and petroleum exploration who want to strengthen their geological or facies modeling skills. Whether you’re aiming to build more robust models or integrate uncertainty assessments into your workflows, this training will help you make better-informed, data-driven decisions.

PREREQUISITES

This course covers advanced geostatistical concepts. Participants should therefore have a solid foundation in variography and kriging. Prior experience with Turning Bands Simulation is highly recommended. Those who have completed the course *“Mineral resource estimation by linear geostatistics”* are adequately prepared to participate.

Drill Hole Spacing Analysis – DHSA

Drill smarter, not more. Learn to quantify grade uncertainty by drill spacing and design cost-effective drilling meshes that improve resource classification and reduce geological risk.

OBJECTIVES

Make smarter drilling decisions by mastering geostatistical simulations. Learn how to quantify grade uncertainty as a function of drill spacing and production volume, and design optimal drilling meshes that balance costs, recovery, and dilution. Gain practical skills to improve resource classification, support strategic mining decisions, and effectively reduce geological risk.

COURSE CONTENT

Theory:

- Review of Turning Bands Simulation (TBS)
- Principles of DHSA
- Recovery versus dilution: evolution of uncertainty as a function of drill hole spacing
- An introduction to the panel as a production domain

Practice in Isatis.neo:

- Review of kriging and its smoothness properties
- Review of TBS and scenario reduction
- Overview of the DHSA workflow
- Defining the production period and calculating associated uncertainties
- Optimizing grade control hole density to improve mining recovery and dilution control
- Optimizing drillhole spacing

OUTLINES

- **Balanced learning approach**. Theory paired with practical applications, so you understand and apply the concepts.

DURATION

14 hours / 2 days

LEVEL

Advanced

TYPE

Theory and practice

MODE

Online or in-person course

Open or in-company sessions

PRICE

Scheduled session (online): EUR 1,100 / person

On-demand session: price upon request

- **Hands-on software training**. Computer exercises in Isatis.neo, on real datasets.
- **Personalized feedback**. Individual guidance from experienced trainers throughout the online sessions.
- **Comprehensive resources**. A temporary software license, documentation, journal files, and datasets to keep and reuse after the course.
- **Certificate of completion** issued at the end of the session.

WHO SHOULD ATTEND

Mining professionals - including resource, exploration, and mine geologists, as well as mining engineers and consultants - who aim to develop cost-effective sampling strategies and optimize drill programs to achieve more reliable short-term grade estimations, greater classification confidence, and reduced risk.

PREREQUISITES

This course covers advanced geostatistical concepts. We recommend that participants have a solid foundation in variography and kriging. The course *"Mineral resource estimation by linear geostatistics"* provides an excellent foundation.

Multiple-point statistics simulations with Isatis.neo – MPS

Model complex geological patterns beyond traditional two-point methods. Learn MPS simulation with DeeSse in Isatis.neo, from training images to realistic uncertainty-aware realizations.

OBJECTIVES

This course introduces you to Multiple-Point Statistics (MPS), a powerful simulation technique for **modeling complex spatial variability using training images**. Developed in collaboration with the University of Neuchâtel, the course combines **theoretical foundations with hands-on practice using Isatis.neo and its integrated DeeSse engine**.

You will learn how to select suitable training images, prepare conditioning data, and **generate realistic categorical and continuous subsurface models**. The course is particularly relevant to applications in mining, hydrogeology, remote sensing, and reservoir modeling. MPS enables you to assess uncertainty and reproduce complex geological features, such as channelized permeability, stratigraphic structures, and ore grades in vein deposits.

COURSE CONTENT

General introduction

- Introduction to the geostatistical approach
- Understanding conditioning data and training images
- General principles of Multiple-Point Statistics
- Introduction to the Direct Sampling algorithm

Hands-on exercises:

- Introduction to Isatis.neo fundamentals
- First application of DeeSse to stationary categorical and continuous cases

From stationary to non-stationary simulations

- Understand the main DeeSse parameters

DURATION

14 hours / 4 half-days

LEVEL

Intermediate

TYPE

Theory and practice

MODE

Online or in-person course

Open or in-company sessions

PRICE

Scheduled session (hybrid): EUR 1,100 / person

On-demand session: price upon request

– Learn why training images are needed and how to obtain or generate them
– Identify the essential properties of a suitable training image
– Handle non-stationarity within the simulation grid
– Explore multivariate simulations

Hands-on exercises:

– Complete a practical case study based on the Areuse delta
– Generate a training image and an orientation trend to control simulations
– Perform the joint simulation of two variables

Applying MPS to real-world data

– Handle non-stationarity using analog data
– Use secondary attributes to improve simulation results
– Explore examples involving climate data, an Australian bauxite mine, bedrock topography, and geophysical data
– Apply the Direct Sampling technique to time-series simulations

Hands-on exercises:

– Complete a two-dimensional case study using secondary variables from the Herten fluvioglacial aquifer
– Fill gaps in satellite images using multivariate and multi-temporal techniques

Modeling with elementary training images

– Understand elementary training images and invariances
– Explore an application example from a mining site in South Africa
– Discover multi-scale simulations based on Gaussian pyramids

Hands-on exercises

– Complete simple applications using elementary training images and invariances
– Explore Gaussian pyramids
– Build a first two-dimensional fluvioglacial facies model using the Herten aquifer case study

Overview of advanced MPS methods

– Cross-validation
– Multi-scale simulations on unstructured grids
– Inequality and block conditioning
– Connectivity conditioning

Complementary hands-on exercises: modeling a fluvioglacial deposit

– Build elementary training images
– Get introduced to Python programming for task automation
– Build a stratigraphic model
– Model a fluvioglacial aquifer from borehole data

OUTLINES

- **Balanced learning approach**. Theory paired with practical applications, so you understand and apply the concepts.
- **Hands-on software training**. Computer exercises in Isatis.neo, on real datasets.
- **Personalized feedback**. Individual guidance from experienced trainers throughout the online sessions.
- **Comprehensive resources**. A temporary software license, documentation, journal files, and datasets to keep and reuse after the course.
- **Certificate of completion** issued at the end of the session.

WHO SHOULD ATTEND

Professionals and researchers involved in spatial modeling who want to enhance their ability to simulate complex geological structures and facies distributions using Multiple-Point Statistics (MPS). Ideal participants include:

- **Geologists & geomodelers**

Working in mining, oil & gas, or hydrogeology, those who need to model intricate geological patterns – such as channels, fractures, or stratigraphy – often find it challenging to capture with traditional variogram-based approaches.

- **Reservoir engineers**

Focused on building realistic facies or property models that improve reservoir characterization and flow simulations.

- **Environmental & hydrogeological scientists**

Needing to simulate spatial heterogeneities in aquifer systems with geological realism.

- **Geostatisticians and data scientists**

Looking to deepen their expertise in MPS and apply advanced simulation techniques using training images and high-resolution geological analogs.

- **Consultants and technical advisors**

Supporting clients with subsurface modeling projects who want to stay at the forefront of geostatistical innovation.

- **Researchers and academics**

Engaged in spatial data analysis, stochastic simulation, or geoscientific modeling who want to explore MPS in practical workflows.

PREREQUISITES

None. A theoretical understanding of geostatistical approaches is an advantage. This will help participants make the most of the course.

Machine learning applied to geosciences and mining

Put machine learning to work on real geoscience and mining challenges. Build, evaluate, and apply classification and regression models by connecting scikit-learn with Isatis.neo.

OBJECTIVES

- Define geological and geometallurgical domains with unsupervised learning and assess the quality of the clusters you obtain.
- Build, validate, and tune supervised models, and know when a model is fit to be applied.
- Predict grades and lithology with neural networks, using Deep Kriging.
- Run the full workflow from Python and scikit-learn into Isatis.neo.

COURSE CONTENT

- **General aspects of machine learning** and an introduction to the Python language.
- **Unsupervised learning**

  Data transformations, clustering techniques in theory and practice, and cluster quality assessment.
- **Supervised learning**

  Predictive models in theory and practice, model validation, hyperparameter tuning, and model application.
- **Deep Kriging**

  Estimating grades and lithology with neural networks.

OUTLINES

- **Balanced learning approach**. Theory paired with practical applications, so you understand and apply the concepts.
- **Hands-on software training**. Computer exercises in Isatis.neo, on real datasets.
- **Personalized feedback**. Individual guidance from experienced trainers throughout the online sessions.

DURATION

21 hours / 3 days

LEVEL

Intermediate

TYPE

Theory and practice

MODE

Online or in-person course

Open or in-company sessions

PRICE

Scheduled session (hybrid): EUR 1,650 / person

On-demand session: price upon request

– **Comprehensive resources**. A temporary software license, documentation, journal files, and datasets to keep and reuse after the course.
– **Certificate of completion** issued at the end of the session.

WHO SHOULD ATTEND

This course assumes you know your geology and your geostatistics and teaches you machine learning.

It suits resource geologists and geomodelers who define domains and estimate grades; exploration geologists working on lithology classification and targeting; geometallurgists building domain models from process data; geostatisticians looking to extend their methods beyond kriging; and consultants, researchers and postgraduate students working on mineral resource problems.

PREREQUISITES

A working knowledge of statistics, algebra and geostatistics is recommended. Familiarity with Python is optional.

Data analysis, mapping, and subsurface property modeling with geostatistics

Turn spatial data into sound decisions. Learn to analyze datasets, map surfaces, model subsurface properties, and quantify uncertainty with practical geostatistical workflows.

OBJECTIVES

- **Enhanced data insight**: Develop a deep understanding of your data through advanced geostatistical analysis, leading to more informed decision-making.
- **Improved mapping quality**: Learn to create high-quality maps by integrating various data types, ensuring comprehensive spatial representations.
- **Uncertainty quantification**: Master techniques to quantify uncertainties in your models, providing a clear assessment of confidence levels in your results.
- **Technique selection**: Understand the assumptions underlying different geostatistical methods to select the most suitable approach for your data.

COURSE CONTENT

DAY 1: ANALYZING DATA AND THEIR VARIABILITY IN SPACE AND MAPPING

Introduction to geostatistics:

- **Understanding the role of geostatistics** compared to deterministic spatial interpolation methods and identifying scenarios where it offers real added value.
- **Reviewing common deterministic interpolation methods** (nearest neighbor, moving average, inverse distance, etc.) and highlighting their strengths and limitations.

DURATION

14 hours / 2 days

LEVEL

Fundamentals

TYPE

Theory and practice

MODE

Online or in-person course

Open or in-company sessions

PRICE

Scheduled session (hybrid): EUR 1,100 / person

On-demand session: price upon request

Exploratory data analysis (EDA) and validation:

- **Using statistical tools** to analyze, control quality and detect outliers: mean, variance, histograms, correlation coefficients, linear regression, etc.
- **Visualizing data in 2D and 3D** to better understand their distribution and spatial structure.

Spatial variability assessment:

- **Calculating, interpreting, and modeling** the experimental variogram to identify the spatial structures present in the data.
- **Presentation of key theoretical variogram models** and learning how to adjust them to the data.

Interpolation by kriging:

- **Fundamental principles and properties of kriging**, including its characteristic effects, such as smoothing.
- **Optimizing the kriging neighborhood**: single or moving neighborhood, search size, number of samples, etc.
- **Analyzing kriging weights** based on interpolation parameters (position, neighborhood, nugget effect, etc.).

DAY 2: REFINING THE MAPS

Cross-validation:

- **Implementing cross-validation** to assess variogram models and confirm the accuracy of interpolation results.

The different variants of kriging:

- **Discovering and applying different types of kriging**, such as simple, ordinary, and measurement error kriging, to identify the most appropriate method for your data.

Multivariate geostatistics:

- **Analyzing correlations between variables**, whether quantitative or semi-quantitative (such as remote sensing, DTM, land use, physico-chemical models, pollutants, etc.), using scatter plots and correlation coefficients.
- **Examining spatial relationships between variables** with cross-variograms.
- **Incorporating secondary variables** into interpolation through cokriging and collocated cokriging: principles, applications, and benefits over traditional kriging.

Non-stationary geostatistics:

- **Considering spatial trends and drifts** using methods tailored for non-stationary conditions.

Simulations and risk analysis:

- **Introduction to geostatistical simulation methods** for quantifying uncertainties and analyzing risks, illustrated with practical examples.

Practical exercises:

- **Exercises applied to real-life cases** to reinforce theoretical knowledge and enhance practical skills that can be used immediately.

OUTLINES

- **Balanced learning approach**. Theory paired with practical applications, so you understand and apply the concepts.
- **Hands-on software training**. Computer exercises in Isatis.neo, on real datasets.
- **Personalized feedback**. Individual guidance from experienced trainers throughout the online sessions.
- **Comprehensive resources**. A temporary software license, documentation, journal files, and datasets to keep and reuse after the course.
- **Certificate of completion** issued at the end of the session.

WHO SHOULD ATTEND

This course is ideal for professionals working with spatial data across various fields, including:

- Geoscientists and reservoir engineers involved in geomodeling and reservoir characterization and looking for a practical, synthetic, and pragmatic introduction to geostatistical methods for reservoir characterization.
- Environmental consultants and engineers aiming to enhance data analysis and mapping capabilities.
- Academics and researchers.
- Agricultural engineers, air quality specialists, climatologists, epidemiologists, foresters, geotechnical engineers, soil scientists, and others interested in spatial data analysis.

PREREQUISITES

No prior knowledge of geostatistics is required; however, a basic understanding of elementary statistics is recommended to help you understand the concepts.

Boost your proficiency in Isatis.neo and Isatis.py

Isatis.neo fundamentals

Turn geostatistical knowledge into confident Isatis.neo practice. Import and explore real data, model variograms, run kriging, validate results, and take your first steps with simulation.

OBJECTIVES

Isatis.neo offers a streamlined, powerful environment for exploring spatial data, creating accurate models, and easily quantifying uncertainty. This course ensures that, in just one day, you'll feel confident in boosting your analysis and incorporating best-practice geostatistics into your daily projects.

COURSE CONTENT

- **Getting around Isatis.neo**
  The interface, the 3D viewer, the Python calculator, and the batch tools: what each one is for, and where it fits in a working session.
- **Bringing data in**
  Import points, block models, and wireframes, and prepare a dataset for analysis.
- **Exploring the data**
  Quality control with histograms and scatter plots. Detect outliers, analyze trends, and assess anisotropy. Variogram calculation and modeling, in 2D and in 3D.
- **Estimating**
  Set up a neighborhood, run point and block kriging, then check results with cross-validation and model validation.
- **A first look at simulations**
  What conditional simulation gives you that a single estimate does not: a set of equally probable outcomes, and a way to read uncertainty from their spread.

OUTLINES

- **Balanced learning approach**. Theory paired with practical applications, so you understand and apply the concepts.
- **Hands-on software training**. Computer exercises in Isatis.neo, on real datasets.

DURATION

7 hours / 1 day

LEVEL

Basic

TYPE

Practice

MODES

Online or in-person course

Open or in-company sessions

PRICE

On-demand session only

Price upon request

- **Personalized feedback**. Individual guidance from experienced trainers throughout the online sessions.
- **Comprehensive resources**. A temporary software license, documentation, journal files, and datasets to keep and reuse after the course.
- **Certificate of completion** issued at the end of the session.

WHO SHOULD ATTEND

This course is ideal for professionals with a foundation in geostatistics who want to take full control of their spatial data workflows in Isatis.neo, whether they work in mining, petroleum, or environmental science.

PREREQUISITES

This course focuses on practical exercises with Isatis.neo, and it will not include theoretical reminders on geostatistics. Participants must therefore have a fundamental knowledge of geostatistics.

Isatis.neo scripting

Turn repetitive tasks and project-specific logic into robust, reusable workflows. Build tailored data processing and integrate Python libraries to work faster and consistently across projects.

OBJECTIVES

- **Save time, reduce manual errors, and standardize recurring processes in Isatis.neo**. By the end of this course, you will know how to create flexible batch files that adapt to different datasets, domains, and variables.
- **Extend Isatis.neo's capabilities with Python-based calculations tailored to your data and workflows**. By the end of this course, you will be able to write, test, and run scripts directly within Isatis.neo.

COURSE CONTENT

The course consists of two modules that can be attended independently:

Module 1: Working with batch files

- Understand the structure of an Isatis.neo batch file.
- Record workflows using the batch recorder.
- Replace fixed parameters with variables and arrays.
- Use loops to process multiple variables or domains.
- Add conditions and stopping rules to control execution.
- Adapt, run, and maintain reusable workflows.
- Apply these techniques through guided exercises based on realistic projects.

Module 2: The Isatis.neo Python Calculator

- Discover the Python Calculator environment and its different execution modes.
- Learn the Python concepts needed to create calculations in Isatis.neo.
- Access and manipulate project data through scripts.

DURATION

Module 1: 3 hours / 0.5 day

Module 2: 3 hours / 0.5 day

LEVEL

Intermediate

TYPE

Practice

MODE

Online or in-person course

Open or in-company sessions

PRICE

On-demand session only

Price upon request

– Write reusable routines for customized data processing.
– Import and apply external Python libraries.
– Combine calculations, conditions, and functions to address project-specific requirements.
– Test and refine scripts through guided practical exercises. Explore and experiment with different scripting modes and options.

OUTLINES

– **Balanced learning approach**. Theory paired with practical applications, so you understand and apply the concepts.
– **Hands-on software training**. Computer exercises in Isatis.neo, on real datasets.
– **Personalized feedback**. Individual guidance from experienced trainers throughout the online sessions.
– **Comprehensive resources**. A temporary software license, documentation, journal files, and datasets to keep and reuse after the course.
– **Certificate of completion** issued at the end of the session.

WHO SHOULD ATTEND

This training course is designed for any Isatis.neo user who wants to improve their automation and Python programming skills or optimize their workflows using Python's computing capabilities.

PREREQUISITES

Familiarity with Isatis.neo is recommended, which you can gain by completing the "*Isatis.neo fundamentals*" course. Prior experience with scripting or Python is helpful but not required.

Isatis.py hands-on

Need maintainable geostatistical automation? Learn Python fundamentals and use Isatis.py libraries to turn recurring technical tasks into clear, reusable scripts.

OBJECTIVES

Manual technical procedures become difficult to maintain when data or parameters change. You will learn to write Python-based workflows integrating the Isatis.py geostatistical library and external scientific libraries. You'll start by learning to **interpret and write Python scripts** (module 1), then apply them to **data preparation** and **Exploratory Data Analysis** (module 2), **variography** and **kriging** (module 3), **conditional simulations** (module 4), **multivariate modeling** (module 5), and **categorical variable modeling** (module 6). You'll also explore how to integrate **Isatis.py** into your projects to generate visuals, streamline processes, and efficiently manage large datasets, benefiting from its built-in multi-threading and parallel computing capabilities.

COURSE CONTENT

The course consists of six modules that you can complete independently.

Module 1 – Introduction to Python

Set up the Python environment

– Explore the basics of Anaconda and Python.
– Read and interpret Python code before creating a first script.

Build reusable scripts

– Define variables and arrays that can be adapted to different domains or datasets.
– Use loops and conditional statements to control automated workflows.

Integrate libraries and automate tasks

– Install and use external scientific libraries to add functionality and generate visuals and graphics.

DURATION

3 hours per module

LEVEL

Intermediate

TYPE

Practice

MODE

Online or in-person course

Open or in-company sessions

PRICE

On-demand session only

Price upon request

– Record and automate simple recurring tasks as input data changes and for audit purposes.
– Practice the scripting workflow through hands-on exercises using Isatis.py.

Module 2 – Exploratory Data Analysis

Script dataset visualization

– Create two-dimensional and three-dimensional data visualizations with Isatis.py.

Configure data-preparation operations

– Run declustering operations to address the effect of preferential sampling.
– Script drillhole desurveying and interval compositing for subsequent analysis

Assemble the analysis pipeline

– Configure Principal Component Analysis (PCA) to investigate multivariate structure.
– Run contact analysis on the mineral deposit dataset.
– Organize the confirmed operations as a clear, interpretable Python workflow.

Module 3 – Kriging

Configure continuity inputs

– Script the calculation and review of experimental variograms for the estimation workflow.

Run estimation operations

– Configure and run simple kriging and ordinary kriging in Isatis.py.
– Build a two-dimensional contamination-mapping workflow from pollution data.
– Build a three-dimensional modeling workflow for an iron deposit.

Validate outputs and control domains

– Run the confirmed validation steps on estimation outputs.
– Implement data selection within polygons to manage domain limits in the three-dimensional model.
– Organize the operations as clear, interpretable Python scripts.

Module 4 – Continuous Simulations

Prepare the scripted simulation inputs

– Implement data selection from meshes for the simulation workflow.
– Configure anamorphosis before Gaussian simulation.
– Set up Hierarchical Data Format version 5 (HDF5) file handling for large datasets and outputs.

Configure continuous-simulation operations

– Run Turning Bands Simulation and Sequential Gaussian Simulation through Isatis.py.
– Configure point-support and block-support simulations.

– Configure simulations with local anisotropies.

Validate and deliver workflow outputs

– Run the confirmed validation steps on generated realizations.
– Generate Isatis.py outputs and graphics for spatial-uncertainty visualization.
– Organize the complete pipeline as clear, interpretable Python scripts.

Module 5 – Multivariate Estimation

Configure multivariate inputs and estimators

– Configure and run ordinary cokriging and rescaled cokriging through Isatis.py.
– Implement the workflow for heterotopic datasets in which variables are not sampled at all the same locations.

Script transformation and imputation

– Integrate the Projection Pursuit Multivariate Transform (PPMT) into the pipeline.
– Configure multivariate data imputation where values are missing.

Generate and check multivariate outputs

– Run multivariate simulations in Isatis.py.
– Check whether the resulting outputs reproduce complex relationships among variables.
– Organize the hands-on mineral deposit workflow as clear Python scripts.

Module 6 – Indicator Estimation and Simulation

Configure categorical estimation

– Configure and run indicator kriging on categorical data through Isatis.py.

Script categorical simulations

– Configure and run Plurigaussian Simulation (PGS).
– Configure and run Sequential Indicator Simulation (SIS).

Generate and review facies outputs

– Combine the three operations in a hands-on Python workflow based on the confirmed mineral deposit dataset.
– Generate and review facies models from categorical variables.

OUTLINES

– **Balanced learning approach**. Theory paired with practical applications, so you understand and apply the concepts.
– **Hands-on software training**. Computer exercises in Isatis.py, on real datasets.
– **Personalized feedback**. Individual guidance from experienced trainers throughout the online sessions.

- **Comprehensive resources**. A temporary software license, documentation, journal files, and datasets to keep and reuse after the course.
- **Certificate of completion** issued at the end of the session.

WHO SHOULD ATTEND

Company developers, geoscientists, and data scientists with Python scripting experience and a recommended practical geostatistics background who implement geostatistical workflows with lsatis.py.

PREREQUISITES

Except for the first module, which introduces Python coding, you need Python scripting experience. Practical geostatistics knowledge is also recommended, as this course focuses on implementing workflows rather than teaching methods.

Training schedule

2027 session dates

– *Mineral resource estimation by linear geostatistics*
Module 1: Univariate Context
April 5-6 & **July 5-6**

– *Mineral resource estimation by linear geostatistics*
Module 2: Multivariate Context
April 7-8 & **July 7-8**

– *Recoverable resource estimation by nonlinear geostatistics*
Module 1: Uniform Conditioning
April 19 & **July 19**

– *Recoverable resource estimation by nonlinear geostatistics*
Module 2: Multiple Indicator Kriging and Conditional Expectation
April 20-21 (1,5 days) & **July 20-21** (1,5 days)

– *Recoverable resource estimation by nonlinear geostatistics*
Module 3: Simulations
April 21-22 (1,5 days) & **July 21-22** (1,5 days)

– *Recoverable resource estimation by nonlinear geostatistics*
Module 4: Advanced Multivariate Modeling
April 23 (1,5 days) & **July 23** (1,5 days)

– *Data analysis, mapping, and subsurface property modeling with geostatistics*
April 26-27 & **September 27-28**

– *Drill Hole Spacing Analysis - DHSA*
May 3-4 & **August 2-3**

– *Geostatistical inputs to resource classification*
May 10-12 (2,5 days) & **August 9-11** (2,5 days)

– *Geological modeling by geostatistics*
May 17-19 & **October 4-6**

– *Multiple-point statistics simulations with Isatis.neo - MPS*
June 14-17 (4 half-days) & **October 18-21** (4 half-days)

– *Machine learning applied to geosciences and mining*
June 21-23 & **November 15-17**

ⓘ Note that Isatis.neo fundamentals, Isatis.neo scripting and Isatis.py practical courses are available **upon request**.

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