Introduction

Resource Modeling Solutions Ltd. is delivering Short Courses in Geostatistics for 2025 that are divided into: (1) a series of online modules, comprised of complementary theoretical and practical training sessions, and (2) an advanced in-person training session, comprised of five full days consisting of theoretical lectures and practical demonstrations.

Online Modules on Fundamentals of Geostatistics

Each module is separated into two dedicated sessions on theory and practical implementation. Theory modules include three hours of lectures, provided from 8:30am to 12 noon Mountain time (30 minutes for breaks). Practical sessions include 2.5 hours of lectures, provided from 8:30am to 12 noon Mountain time (one hour for breaks and practice). Each participant will have access to the recorded lecture for personal use.

Theory	Practice	
May 16	May 23	**Introduction:** high level overview of modern geostatistics including workflows
May 30	June 6	**EDA and outliers:** exploratory data analysis including multivariate and outlier management
June 13	June 20	**Variograms:** calculation, interpretation, and modeling for continuous and categorical variables
July 11	July 18	**Kriging:** estimation including validation and setup for different model applications
Aug 15	Aug 22	**Simulation fundamentals:** Gaussian background, normal score transform, simulation

Practical sessions include worked exercise solutions and a temporary RMSP license, allowing for attendees to experiment with the demonstrations/exercises and potentially extend to their own data. Jupyter Notebooks and RMSP are used for all demonstrations and exercises, which embed inline results and annotation with Python code, allowing for rapid prototyping of workflows and transparent scripts/documentation once composed. A series of pre-recorded and optional videos that introduce Python, Jupyter Notebooks, and RMSP, will be provided to all course attendees.

In-Person Courses on Advanced Geostatistics

Five full days of lectures and hands-on sessions are planned. These will be presented in Denver, Colorado, USA, by senior staff. Optional pre-course and post-course materials will be made available. Participants with basic geostatistics training (or the online Fundamental of Geostatistics Short Courses) and some experience will gain the most from these in-person sessions. See detailed syllabus at end of document.

October 13	Practical simulation: simulation with a trend, parameter uncertainty, and multiple variables
October 14	Domain simulation: surface (boundary) simulation and simulation of categories with HTPG
October 15	Workflows: simulation workflows for disseminated porphyry and tabular deposits
October 16	Classification and drillhole spacing workflow: optimize drill hole spacing and VOI
October 17	Machine learning for geometallurgical modeling: practical techniques and applications

Pricing

The pricing for online modules is per session:

Theory	$500 (CAD)
Practice	$350 (CAD)
Combined	$700 (CAD)

The advanced training course is $4000 (CAD) (note available discounts that follow). This pricing accounts for all costs involved in the five full days.

The following discounts are cumulatively applied to all courses:

Early Registration (by March 16, 2025)	20%
RMSP Licensee	20%

Contact Resource Modeling Solutions at contact@resmodsol.com with any questions. Detailed course descriptions and course registration are available at https://resourcemodelingsolutions.com/training.

Terms

To cancel your registration, please email support@resmodsol.com. Resource Modeling Solutions Ltd reserves all rights regarding courses and may cancel registrations at our discretion. In the event of a canceled course, Resource Modeling Solutions Ltd will issue a 100% refund for course fees but is not responsible for any other fees incurred by registrants.

Online Courses Syllabus

Introduction

- **Theory:** high level overview of modern geostatistics including workflows for long range resources, drill hole spacing and classification, grade control and geometallurgical modeling. This is suitable for a wide audience including managers, staff from other disciplines who want to know about geostatistics and those that want a refresher.
- **Practice:** introduce RMSP and utilize it for loading and processing drill data, performing wireframe flagging, defining a block model, and visualization. These results will be input to subsequent session exercises, as each practical session will incrementally build an estimation workflow (data management in this session, EDA and capping in the next, etc.).

EDA and Outliers

- **Theory:** exploratory data analysis including multivariate and outlier management. Statistical displays and summary statistics for univariate and multivariate continuous and categorical variables. Outlier management by visual, statistical and geostatistical simulation-based methods are presented with examples.
- **Practice:** load processed data, wireframes, etc. from the prior session and perform exploratory analysis including duplicate removal, bias analysis, domaining analysis, outlier analysis/capping, and contact analysis/boundary definition.

Variograms

- **Theory:** calculation, interpretation, and modeling for continuous and categorical variables. The practical steps to obtain a geologically realistic and suitable variogram for all required variables are covered. Combining general geological knowledge with sparse drill data for the best possible variogram is reviewed. Change of support will be summarized.
- **Practice:** load the capped data from the prior session and perform basic variography, including analysis of the nugget effect, directional experimental variograms, and variogram model fitting. Details on directional analysis, including variogram spheres, neutral models, and variogram volumes/maps are then reviewed.

Kriging

- **Theory:** estimation including validation and setup for different model applications (implicit modeling/visualization, final estimates/ore control, interim estimates/resource models, and probabilistic prediction). The theory will be briefly reviewed. Attention will be given to practical application, parameter selection and validation of results. Measures of performance are reviewed.
- **Practice**: load capped data, block model, and variogram models from prior sessions, before performing ordinary kriging of the block model, and in cross-validation mode. Construct nearest neighbor and inverse distance models and perform basic checking. More details on kriging calibration, multi-pass, and high-yield practices are then reviewed.

Simulation Fundamentals

- **Theory:** the fundamental principles of simulation and, in particular, Gaussian simulation are covered including prerequisite steps such as the normal score transform. Unconditional simulation and conditioning by kriging are presented. Alternative implementations such as turning bands, sequential, and spectral will be reviewed.
- **Practice:** data, parameters, and estimates (for checking/declustering) will be loaded from prior sessions. A standard simulation workflow is then performed, involving normal score transformation, trend modeling and removal, simulation, and back-transformation. The realizations are carefully checked, before being block averaged to the required support scale. Localized conditional simulation (LCS) will be briefly reviewed.

Online Courses Details

Cancellations received 2 weeks prior to the online module start date are entitled to an 85% refund. The other 15% may be applied to future Resource Modeling Solutions classes within 1 year of the originally scheduled course. We are unable to cancel and refund registration fees if requests are received later than 2 weeks prior to the module offering.

In-Person Courses Syllabus

Day 1 – Practical simulation: trend modeling and removal for the simulation of non-stationary variables has emerged as a staple of modern geostatistics. The theory, implementation details and examples of optimizing trend models and modeling with a trend will be covered. The use of Gaussian mixture models and stepwise conditional transform is presented. The multivariate spatial bootstrap will be presented for quantifying and transferring parameter uncertainty. The second half of the module will focus on multivariate simulation and checking.

Day 2 – Categorical simulation: simulation workflows in preceding sessions focus on characterizing the uncertainty of continuous attributes (e.g., grade, deleterious elements, etc.). Realistic uncertainty characterization of mineral resources typically requires that uncertainty associated with geological domains and boundaries (e.g., lithofacies, alterations, stratigraphic surfaces, etc.) are also incorporated. Hierarchical truncated pluriGaussian (HTPG) is introduced, which provides a practical and effective approach to simulating categories. The simulation of surfaces, thicknesses, and boundaries is reviewed. General theory on categorical parameterization, simulation, checking, and post-processing is also covered.

Day 3 – Workflows: simulation concepts introduced incrementally will be applied in practice, as full workflows that combine categorical/geometry and continuous simulation. Simulated realizations will be post-processed to calculate probabilistic resources, as well as classified resource estimates suited to typical disclosure frameworks. Other practical topics, such as localization, will be introduced. Full workflows will be provided as exercise solutions, providing all steps (data loading through post-processing) for porphyry and vein deposits.

Day 4 – Classification and drillhole spacing workflow: the practice and a full-worked case study to optimize drill hole spacing (and placement) considering local factors and value of information are presented with examples. The solution will include all steps of resampling and resimulation, model construction, model validation and analysis of uncertainty versus drill hole spacing.

Day 5 – Machine learning for geometallurgical modeling: practical techniques and applications for machine learning applied to metallurgical property modeling are covered with an emphasis on regression using many data types (assays, scans, geochemistry, geologic logs). Techniques to manage non-additive variables, unequally sampled data, and managing limited test work are presented. Appropriate workflows are developed and presented to integrate geometallurgical predictions into a probabilistic or deterministic resource model.

In-Person Courses Details

The in-person course is intended to provide an intensive overview of the theory and practice relating to advanced geostatistical tools and workflows. Attendees are encouraged to participate in the Fundamental Online Modules if not familiar with those topics, as they serve to introduce prerequisite concepts. Each topic (day) will be divided into a morning and afternoon session. All days are expected to follow a similar planned schedule.

Start	End	Duration	Description
9:00	10:30	90 min	Lecture
10:30	11:00	30 min	Break
11:00	12:30	90 min	Lecture
12:30	13:30	60 min	Lunch break
13:30	14:30	60 min	Lecture
14:30	15:00	30 min	Break
15:00	17:00	120 min	Demonstration and hands-on

The theory and application sessions would use RMS datasets relevant to each topic. In the hands-on sessions, attendees would have the option of experimenting with the provided datasets from the demonstrations, or extending methods to their own datasets and work. The latter approach would be recommended for students when feasible.

Coffee, snacks and lunch would be catered for all days of the workshop. The final venue will be subject to attendance requirements but would be in reasonable proximity to the Denver downtown (hotel center) and international airport. Note that cancellation of workshop registration by the attendee will lead to the following refunds:

- Prior to 45 days before workshop commencement: 75%
- Between 45 and 30 days before workshop commencement: 50%
- Less than 30 days before workshop commencement: 50% credit for future courses

This refund schedule reflects financial commitments to venues and other logistical requirements.