UNDER THE AUSPICE OF

On-site/Online Course 2025

the PEST course

Application & Theory

Ente di Formazione Accreditato

Online: October 10th & December 19th **Onsite: November 10th -14th, Italy**

Course overview

This short course is intended to help those who use a graphical user interface (GUI) for model setup to gain familiarity with some of the principles and practicalities of calibration and uncertainty analysis. It is designed to help you get the most out of this interface when using PEST/PEST++. The course also shows how a modeler can gain access to extra inversion and uncertainty analysis functionality by going beyond the interface when required. (This is not as hard as it sounds.) Finally, it provides an overview of new data assimilation and uncertainty analysis technologies that will have a profound effect on the way in which decision-support modelling is undertaken, but that are actually quite easy to implement.

The course is informal. We have a plan for what we want to cover. However, in times such as these when technology is changing fast, it is easy to feel overwhelmed and confused. So, some of what we talk about, and how we talk about it, will be governed by you, the audience. So, feel free to come along and discuss your problems. We will do our best to meet you where you are at.

Pre-course online session is dedicated to introducing the course, getting to know each other, and solve any software installation issues.

Day 1 deals with preliminary data processing, and the basics of modelling with MODFLOW 6, introducing the free Graphical User Interface ModelMuse with simple exercises.

Day 2 and 3 focus on model calibration and linear/nonlinear sensitivity/uncertainty analysis using PEST and the PESTPP-IES ensemble smoother. We will access this functionality from the GUI and then show you how to access it from the command line. Usage options and theory will be explained.

Day 4 is a little different. We present a simple explanation of some new technologies – most of them ensemble-based in one way or another. These are not as scary as they seem and are actually relatively easy to use if you are prepared to go beyond the GUI. On day 4, we also invite you to talk about your own site problems, and how to decompose these problems so that they can be easily addressed through modelling. (Problem decomposition is the key to successful modelling.)

Post-course online session: doubts and questions are more likely to arise *after* rather than *during* the course. The session discusses doubts and issues that have "matured" through the "try-it-yourself" process.

School of hydrogeological Modelling & Project-related strategies

Connect with us on LinkedIn

website info@hydrosymple.com telegram +39.0761.481622 LinkedIn

UNDER THE AUSPICE OF

Italian Chapter

On-site/Online Course 2025

the PEST course

Application & Theory

Ente di Formazione Accreditato

Online: October 10th & December 19th **Onsite: November 10th -14th, Italy**

Course Programme

October 10 (10 am – 1 pm CET)
On-line preliminary session

- Presentations
- Introduction to the course
- Instructions for installing the software and access the e-learning platform
- A test model is provided to check that everything runs fine
- What to read to get a "foretaste" of PEST
- Assignment: videos and tutorials are provided to build a simple model with ModelMuse

November 10 (2-6 pm)

Introduction to history matching

- Aspirations and metrics for decision-support modelling, and how this type of modelling differs from explanatory modelling.
- The role of simulation-support software in achieving decision-support modelling metrics.
- Overview of MODFLOW 6 and usage of MODFLOW 6 through the ModelMuse graphical user interface.

Workshop 1
Model building in ModelMuse.

November 11 (9 am -1 pm; 2-6 pm)

Model Calibration

- The difference between model calibration and history-matching.
- How regularization achieves uniqueness.
- Short introduction to geostatistics
- The advantages of highly parameterized inversion.
- Tikhonov regularization and singular value decomposition
- Pilot points as a parameterization device.
- Use of PEST in model calibration.

Workshop 2
MODFLOW 6 settings in ModelMuse.

November 12 (9 am -1 pm; 2-6 pm)

Sensitivity and Uncertainty Analysis

- Difference between sensitivity analysis and uncertainty analysis
- Bayes equation
- Linear uncertainty analysis
- Use of PESTPP-IES for nonlinear uncertainty analysis

Workshop 3 Post-calibration linear analysis.

November 13 (9 am -1 pm; 2-6 pm)

Recapitulation and looking to the future

- More on ensemble methods
- Data space inversion
- Ensemble space inversion
- Principles of optimization (under uncertainty)
- Discussion

Workshop 4
Nonlinear analysis of predictive uncertainty.

Assignment
An optional exercise will be proposed as homework. This will test assimilation of the course contents, and how to overcome the most common obstacles for beginners. Assistance is provided in case you get totally stuck.

November 14 (9 am -1 pm)

Practicalities, examples and discussion

- The effect of model defects
- Formulation of an appropriate objective function
- Direct predictive hypothesis testing
- When to be simple and when to be complex
- When to calibrate and when not to calibrate
- Examples
- Getting the most out of PEST and PEST++

December 19 (9.30 am -1 pm)
On-line session

Q&A session
The aim of the last session is to evaluate the assignment, to discuss issues encountered, and to answer the questions that have arisen after completing the exercise by yourself.

website info@hydrosymple.com telegram +39.0761.481622 LinkedIn

UNDER THE AUSPICE OF

Italian Chapter

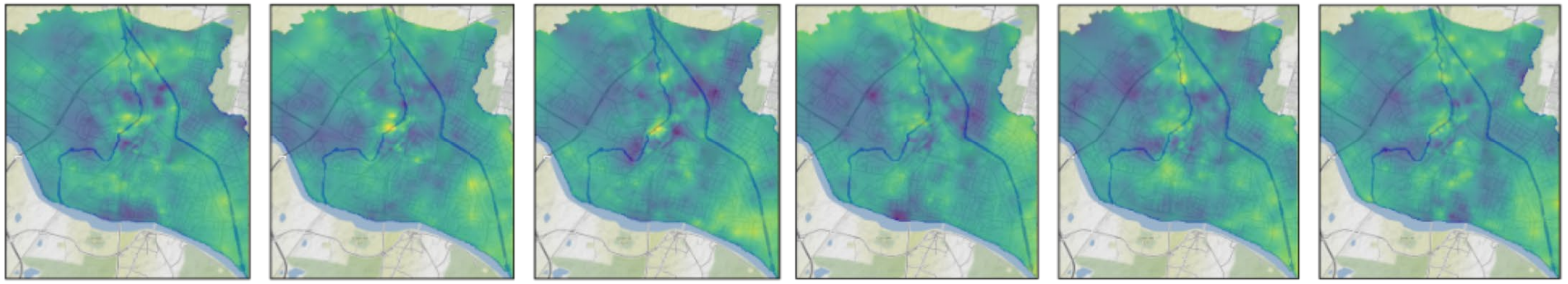
On-site/Online Course 2025

the PEST course

Application & Theory

Ente di Formazione Accreditato

Online: October 10th & December 19th **Onsite: November 10th -14th, Italy**



What is included

- Access to live lessons (both in the on-site classroom and remotely)
- Software and installation instructions provided 1 month before the course
- Material to carry out the exercises
- Access to our e-learning platform to watch again the recorded lessons with no limit of time
- *APC credits* for Italian Geologists
- Coffee breaks and light lunches.

Remote/Live Attendance

The course can be attended blended (online and onsite sessions) or completely by remote. Lessons are recorded. The venue is located in Vetralla (VT), Italy (60 km from Rome).

Costs

SYMPLE is an Accredited Training Organization, VAT is not due (art. 10 DPR 633/72).

- Regular: 1000 €
- IAH/SGI: 800 €
- Students/ECHN: 500 €
- Scholarships available for the attendees of the SYMPLE School
- Installments available

We live in a wonderful place, surrounded by wild woods and nearby the volcanic Lake Vico… For accommodation suggestions and "how to get there" advises, just ask us!

Other opportunities to "meet" PEST

- See roadmaps, videos, webinars, tutorials and frequently asked questions that are accessible for free through the PEST web pages.
- Further training material is available on the GMDSI web pages.

Registration link

Register preferably before September 8, 2025

OUR MISSION

SYMPLE is an Innovative Start-up founded by Francesca Lotti in 2021 that intends to **promote and facilitate the understanding, use and evaluation of hydrogeological numerical models through a multidisciplinary program associated with the use of strategies aimed at solving specific problems**.

website info@hydrosymple.com telegram +39.0761.481622 LinkedIn