Ente di Formazione Accreditato

School of hydrogeological modelling & Project-related strategies

Field Hydrogeology Course

The first "run" of a numerical model
is actually a walk... in the field!

Onsite sessions: Viterbo, October 21st-24th, 2024
Online sessions: October 15th, October 31st, 2024

SYMPLE proposes a comprehensive, applied, internet-based School of Hydrogeological Modelling. Through undertaking the courses, participants can acquire practical knowledge of effective model deployment in different decision-making contexts. Anyway, no modeller can disregard the fact that *no matter how sophisticated is her/his model*, the bottle neck of the whole process is the *quality and quantity of field data*. And quality is not enough seen as a huge source of uncertainty that can be easily contained.

"Errors" in field measurements generate repercussions at different level, easy to understand if we enquire what "errors" means in modelling context:

1. Banal erroneous reading/reporting of the measured value, switch of ID numbers between points, wrong coordinates assignation, etc.
2. Lack of knowledge of technical details influencing the measurement value (depth of a well, screen elevations, screen clogging, ground elevation a.s.l., etc);
3. Lack of knowledge of "boundary conditions" influencing the measurement value (surrounding pumpings, aquifer interconnections, active dewatering systems, leakage from pipes/channels/ponds, etc.).
4. Selection of insignificant points/type of measurements according to the problem to be enquired.

> *"While all 'standard' textbooks on hydrogeology discuss the theoretical principles that underlie the hydraulic head, few of them provide a comprehensive discussion about how it should be measured. Given that hydraulic head measurements form the basis of most, if not all, hydrogeologic studies, this lack of treatment is somewhat surprising."*
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> *Post & von Asmuth, 2013*

Just to make a simple example (points 1-3): imagine measuring a well while a nearby well is unsuspectedly active. Level would be lower than the real undisturbed one. Now, let's use this measurement to calibrate the parameters of a numerical model. We "adjust" the value of hydraulic conductivity up to when we match the observation. The parameter value in this case is higher than what it should be. Now, let's use this perfectly calibrated model to make a prediction based on wrong premises.

Point 4 is a little bit more insidious. You might be full of professionally taken head measurements, with all the checks tipped, QC/QA, etc, but... you are completely ignoring the existence of a nearby river that drains the aquifer. The lack of even a rough estimate of the aquifer discharge towards the river, makes your heads very easy to match, but the "calibrated" parameters quite pointless.

Hydrogeological field methods are essential in the training of hydrogeologists and modellers. Groundwater projects rely on data and appreciating how they are collected is an imperative. The present course aims at transmitting the critical thinking necessary to recognize the uncertainties and pitfalls hidden in data collection. Each single measurement should be seen in a wider picture, the monitoring strategy should be able to capture the information we need to solve a problem, we should know how the numbers that we collect will constrain a parameter value in a numerical model. And if that number is not properly recorded, the "information flow" is distorted generating incongruencies, making useless (in the best case, misleading in the worst case) all the subsequent modelling efforts and the final model prediction.

Trainers

Francesca Lotti (SYMPLE), Elisabetta Preziosi (CNR-IRSA), Thomas Reimann (TU Dresden), Luigi Lana (Kataclima).

The Site

The investigation site is a landfill located at NW of Viterbo, virtuously managed by the company Ecologia Viterbo srl, that also conducts a nearby treatment (TMB) and composting plant.
The landfill covers approximately 0.5 km^2 and is divided into three lots, one of them currently cultivated. The monitoring network is constituted by 25 piezometers, intercepting an unconfined aquifer hosted in pyroclastic rocks, part of the Vulsini hydrogeological system.

Useful Documentation

- Videos from the iNUX Project: a variety of short videos and interactive material covering hydrogeological investigation theory and practice are suggested as integration of the on-site course.
- Techniques of Water-Resources Investigations Reports: USGS reports divided in 9 books, covering collection techniques, instrumentation, analysis and processing of field data.
- Field open-data databases – search for your regional on-line sources.

Books

- Sanders, L.L. (1998). A Manual of Field Hydrogeology.
- Weight, Willis D., ed. (2001). Manual of Applied Field Hydrogeology. 1st ed. New York: McGraw-Hill.
- Moore, J.E. (2011). Field Hydrogeology: A Guide for Site Investigations and Report Preparation, Second Edition (2nd ed.). CRC Press. https://doi.org/10.1201/b11056
- Kennedy, G.W., 2022, Water Well Record Databases and Their Uses. The Groundwater Project, Guelph, Ontario, Canada.

Programme		Activity	
Online	*October 15* *3 pm – 6 pm*	• *Overview of investigation methods.* • *Types of boreholes, constructions details.*	• *Site description, analysis of site material, GIS and available data.*
Day 1	October 21 2 pm – 7 pm	• Measurement of borehole elevation, position and depth. • Video inspection of boreholes to define screen elevations. • Comparison with the available documentation. • Manual head monitoring. • Automatic diver set up and	• installation (to be left in the boreholes up to the end of the pumping test). • Vertical logging of EC and temperature. • How to sample from a piezometer and from a well, according to the purpose of the sampling.
Day 2	October 22 9 am – 7 pm	• Organization of the manual measurements. • Geostatistical processing to obtain a potentiometric map according to different software and methods.	• Possible review of the automatic monitoring points. • Planning of a pumping test, preparation and check of the devices and data forms.
		• Pumping test start, troubleshooting, pumping test execution, troubleshooting, various attempts… etc. • Level monitoring in wells and piezometers.	• Discharge monitoring through different methods. • End of pumping, automatic monitoring of recovery during the night.
Day 3	October 23 9 am – 7 pm	• Manual check of the levels. • Removal of the divers.	• Selection of points to perform slug-tests.
		• Download of the diver data, adjustments. • Organization of the manual measurements. • Processing of data according to different software and methods.	• Methods of river flow measurements. Planning of river discharge measurements, selection of meaningful sections.
Day 4	October 24 9 am – 3 pm	• Upstream section preparation. • Measurement of river flow with flow meter and other devices.	• Downstream section preparation. • Measurement of river flow with flow meter and other devices.
Online	*October 31* *9 am – 6 pm*	• *Organization of the measurements.* • *Processing of the data according to different methods and comparison of results. Comparison of the different investigations results*	• *Estimate of aquifer parameters from river. Discussion about parameters, role of heterogeneity and how to transfer the acquired information into numerical models.*
		• *Discussion about "measurement noise" and how to translate it into "weights".* • *How to parametrize the aquifer properties in a numerical model.*	• *Sources of uncertainty.* • *Update of the conceptual model.* • *Definition of the modelling strategy, preparation of the model input datasets.*

Assignment: development and calibration of a site numerical model - on-line discussion of results.

Registration

Attendance

The site is nearby the medieval town of Viterbo, Italy. We are arranging accommodation agreements for the whole group (ask for details before booking). Trips to and from the site/classes are organized by SYMPLE. The course is in English and Italian.

Purchase

The course can be purchased on the SYMPLE Store at the price of 1400 € (exempt from VAT).
SYMPLE is an Accredited Training Organization (EFA). Prices are exempt from VAT under article 10 of Presidential Decree 633/72.

What is included in the Course fee:

- Transportation to the field sites
- Light lunches & coffee breaks
- Didactic material
- Access to the e-learning platform with didactic material, field forms, recordings of main operations, participants forum/chat

Cancellation policy

For a full refund, written cancellations must be received 30 days prior to the start date of the training. Cancellations received 10 days prior to the start date of the training are entitled to a 50% refund. Cancellations received less than 10 days prior to the start date are not entitled to a refund. This policy is due to the high level of customization involved in our trainings, which is based on the number of people that have registered as well as space limitations. If the program is cancelled by SYMPLE, a full refund will be provided.
In case of bad weather, the course is not cancelled. In case of VERY bad weather, the daily timetable might be re-arranged. But be prepared to get wet and enjoy a muddy walk!

On request:

- Pickup service from Fiumicino Airport or Orte train station.