

Geothermal

Short Courses - 2012

Iceland GeoSurvey offers geothermal short courses at their headquarters in Reykjavík, Iceland, in 2012.

Lectures are specialists, with decades of experience, both as lecturers, as well as in the various fields of geothermal research and field work.

Geophysical Methods

in Geothermal Exploration for non-experts (ÍSOR 1)

Geochemical Methods

in Geothermal Exploration (ÍSOR 2)

Geothermal Drilling

(ÍSOR 3)

Injection and Production Testing

of High-Enthalpy Geothermal Wells (ÍSOR 4)

Conceptual Model Development

Volumetric Resource Assessment (ÍSOR 5)

Geophysical Methods

in Geothermal Exploration for non-experts (ÍSOR 1)

The course gives an overview of the main geophysical methods applied in geothermal exploration (resistivity, gravity, magnetics and seismics), their strengths and weaknesses. A brief introduction is given to the principles and physical background of each method, fieldwork and data collection, data processing,

and interpretation. Emphasis will be put on which methods are useful in different geological settings and which are not. Emphasis is also on the joint interpretation of different data sets.

After the course the trainees are expected to be better qualified to evaluate and draw conclusions pertaining to geothermal resources from geophysical surveys.

Short course no.: ÍSOR 1

Location: Iceland GeoSurvey (ÍSOR), Grensásvegur 9, 108 Reykjavík, Iceland

Date: January 16 - 20, 2012

Fee: USD 2,500 per person (minimum 6 participants)

Included: Handouts and learning materials, fieldtrip to a geothermal field or drill site, lunch

Registration and information: www.geothermal.is or brj@isor.is

Registration deadline: November 15, 2011

Day 1 Monday	Introductory lectures on geophysical methods in geothermal exploration.	Demonstration of geophysical measurements in the field.
Day 2 Tuesday	Overview of resistivity methods and their interpretation, DC resistivity methods (Schlumberger soundings and head-on profiling).	TEM method. Physical basis, response of a layered earth, field procedures, data processing and interpretation.
Day 3 Wednesday	MT method. Physical basis, response of a layered earth, field procedure, data processing and interpretation, the static shift problem, joint inversion of TEM and MT for static shift correction.	Inversion theory. Maximum likelihood estimation, the Levenberg-Marquardt inversion algorithm, sensitivity analysis.
Day 4 Thursday	The gravity method. Physical basis, field procedure (gravity measurements, GPS positioning), data processing and interpretation	The magnetic method. Physical basis, field procedure, data processing and interpretation.
Day 5 Friday	Seismic methods and passive seismic (micro-earthquakes).	Examples of joint interpretation of complementary data set, and conceptual models.

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Geochemical Methods

in Geothermal Exploration (ÍSOR 2)

The course includes an overview of geochemical methods in geothermal exploration, water-rock interactions, basic geochemical thermodynamics and aqueous geochemistry, reactive components, geothermometry, conservative components, origin of fluids, CO₂ degassing studies, and geothermal exploration. The course includes one day of fieldwork devoted to sampling steam vents and hot springs and measurement of CO₂ flow through soil as well as one day in the laboratory devoted to analyzing steam samples and selected aqueous components.

This course is aimed at junior geochemists, chemists with some background in geosciences, and geologists with some background in chemistry.

Short course no.: ÍSOR 2

Location: Iceland GeoSurvey (ÍSOR), Grensásvegur 9, 108 Reykjavík, Iceland

Date: January 23 - 27, 2012

Fee: USD 2,500 per person (minimum 6 participants)

Included: Handouts and learning materials, fieldtrip to a geothermal field or drill site, lunch

Registration and information: www.geothermal.is or brj@isor.is

Registration deadline: November 15, 2011

Day 1 Monday	Introductory lectures on geothermal resources world wide. Conceptual models of geothermal systems. Geothermal exploration: strategy and methods.	Water-Rock interactions: Hydrothermal alteration. Geochemical thermodynamics.
Day 2 Tuesday	Lectures aqueous solution chemistry and speciation calculations. Introduction to the WATCH program and WATCH program exercises.	Collection and analyses of geothermal fluid samples.
Day 3 Wednesday	Field-trip to a geothermal field near Reykjavík: Collection of geothermal steam and water.	
Day 4 Thursday	Laboratory work Analyses of pH, CO ₂ , H ₂ S, and SiO ₂ in steam and water samples.	Conservative components in geothermal solutions: lecture and exercises.
Day 5 Friday	Geothermometers: Theoretical foundations. Assumptions and limitations. Geothermometers: Solute, gas, and isotope geothermometers. Geothermometers: Graphical methods, mixing models, multiple equilibria. Geothermometers: Exercises.	Diffuse CO ₂ degassing studies in geothermal exploration. Production problems. Environmental concerns.

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Geothermal Drilling

The course covers a broad range of topics on geothermal drilling practices and on well designs, for low and high-temperature wells. The drilling program for high-temperature wells is covered as is the required infrastructure. The casings and wellheads of standard and large diameter production wells are explained as well as slimhole designs. Drilling topics include: specifications of drilling equipment and tools, vertical and directional drilling, use of mud motors and measurements while drilling (MWD) tools, time estimates and benchmarking, blow-outs and preventers, casing cementing and placement of cement plugs, well stimulation. How to deal with common drilling problems such as loss of circulation, sticking of the drill string and cementing long casing strings. Well logging to define the reservoir and aid in solving drilling problems. Data collection and the various reports such as daily reports, special operations, well completion reports, etc. Case histories are presented for fast drilling as well as for problem wells

Short course no.: ÍSOR 3

Location: Iceland GeoSurvey (ÍSOR), Grensásvegur 9, 108 Reykjavík, Iceland

Date: To be announced later

Fee: USD 2,500 per person (minimum 6 participants)

Included: Handouts and learning materials, fieldtrip to a geothermal field or drill site, lunch

Registration and information: www.geothermal.is or brj@isor.is

Registration deadline:

Injection and Production Testing

of High-Enthalpy Geothermal Wells (ÍSOR 4)

The course will review the role and purpose of injection-tests, conducted at the end of well drilling, and production tests, conducted after well heating-up. The specifics of planning and executing such tests will be presented, in particular all aspects of the associated data collection (well logging, flow-measurements, enthalpy-measurement, etc.). The methods of data analysis employed will be presented, through the introduction of appropriate software. These aim at estimating reservoir properties, well production/injection characteristics and well production capacity. The course will be based on a combination of lectures, case-history review, and hands-on training based on real data.

After the course the participants should be able to play an active role in the planning and execution of high-enthalpy injection and production testing and the associated data analysis and evaluation.

Short course no.: ÍSOR 4

Location: Iceland GeoSurvey (ÍSOR), Grensásvegur 9, 108 Reykjavík, Iceland

Date: February 6 - 10, 2012

Fee: USD 2,500 per person (minimum 6 participants)

Included: Handouts and learning materials, fieldtrip to a geothermal field or drill site, lunch

Registration and information: www.geothermal.is or brj@isor.is

Registration deadline: November 15, 2011

Day 1 Monday	Introductory lectures on geothermal wells, well-logging, well-testing and two-phase flow monitoring.	Presentation of ÍSOR logging equipment and tracer flow-measurement tool.
Day 2 Tuesday	Lectures on temperature- and pressure-logging and interpretation of such logging data; case history review.	Hands-on training in temperature- and pressure log interpretation using the Icebox software package.
Day 3 Wednesday	Lectures on well-test analysis with emphasis on injection testing at well completion. Introduction to the well-test analysis software WellTester.	Hands-on training in interpretation of well test data, including utilization of WellTester.
Day 4 Thursday	Lectures on the different aspects of production testing, including execution, pressure monitoring as well as flow- and enthalpy measurements.	Field-trip to a geothermal field near Reykjavík.
Day 5 Friday	Continuation of lectures on injection- and production test interpretation and review of various case histories.	Hands-on training in interpretation of production test data, including flow- and enthalpy estimations Wrap-up discussion.

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Conceptual Model Development

and Volumetric Resource Assessment (ÍSOR 5)

The course will review the procedures used to develop conceptual models for geothermal systems. It will examine the multi-disciplinary information needed for this with particular emphasis on estimating reservoir size, temperature conditions, and overall permeability structure. Results of resistivity surveying, chemical data, and formation temperature estimates based on well logging and geological mapping play a key role in conceptual model development. They also provide the basis for volumetric resource assessments of production capacity, which will be covered in detail by the course. The Monte Carlo method of assigning probability to volumetric resource assessment results will also be reviewed. The course will be based on a combination of lectures, case-history review, and hands-on training based on real data.

After the course the participants should be able to take part in the development of conceptual models and to calculate simple volumetric assessments.

Short course no.: ÍSOR 5

Location: Iceland GeoSurvey (ÍSOR), Grensásvegur 9, 108 Reykjavík, Iceland

Date: February 13 - 17, 2012

Fee: USD 2,500 per person (minimum 6 participants)

Included: Handouts and learning materials, fieldtrip to a geothermal field or drill site, lunch

Registration and information: www.geothermal.is or brj@isor.is

Registration deadline: November 15, 2011

Day 1 Monday	Introductory lectures on geothermal resources worldwide and assessment methods.	Lectures on basics of geological, geophysical and geochemical exploration.
Day 2 Tuesday	Lectures on temperature- and pressure-logging and assessment of formation temperature and pressure.	Hands-on training in estimating formation temperature and initial pressure.
Day 3 Wednesday	Lectures on the estimation of reservoir parameters (permeability, storativity, etc.) Lectures on conceptual model development.	Field-trip to a geothermal field near Reykjavík.
Day 4 Thursday	Review of conceptual models of various geothermal systems worldwide (case histories). Lectures on different resource assessment methods with emphasis on the volumetric assessment method.	Hands-on training in using the volumetric method, review and discussion of different case histories.
Day 5 Friday	Lectures on the utilization of the Monte Carlo method in volumetric assessment with special emphasis on variable estimation with uncertainty distributions; case history review.	Hands-on training in applying the Monte Carlo method in volumetric resource assessments. Wrap-up discussion.

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