International Symposium on Energy Geotechnics

2018

Under the auspices of Technical Committee
TC - 308 of ISSMGE

PROGRAM

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ÉCOLE POLYTECHNIQUE
FÉDÉRALE DE LAUSANNE

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	Monday September 24	Tuedsay September 25	Wednesday September 26	Thursday September 27	Friday September 28	Saturday September 29
9:00	Registration		Registration	Registration	Registration	
			Keynote Lecture Jonny Rutqvist, Berkeley Lab	Keynote Lecture Jean Desroches, Schlumberger	Keynote Lecture Antonio Gens, UPC	
10:00			Keynote Lecture Lyesse Laloui, EPFL	Keynote Lecture Stefan Wiemer, ETHZ	Feature Lecture Maria Victoria Villar, CIEMAT	
			COST GABI Lecture Sébastien Burlon, Terrasol Setec	Feature Lecture Marie Violay, EPFL	Feature Lecture Marcelo Sanchez, Texas A&M	
11:00			Coffee break	Coffee break	Coffee break	
			MS 1 A Analysis and Design of Energy Geostructures MS 1 B Hydraulic Stimulation in Energy Geotechnics MS 1 C Multi-Scale And Multi-Physics Processes in Shales and Soils	TS 5A Energy Geostructures TS 5 B Gas Hydrate Sediments TS 5 C THMC Behavior of Geomaterials	TS 9 A Geotechnics for Offshore Energy Applications MS 9 B Gas Production from Hydrate-Bearing Sediments MS 9 C Computational Waste Management in Geomechanics	
12:00						Mont-Terri Underground Rock Laboratory Visit (optional)
13:00	COST GABI short course How to plan a successful thermoactive geostructure design? (optional)		Lunch	Meeting of the ISSMGE - TC308 Energy Geotechnics Lunch	Lunch	
14:00		Registration	MS 2 A Analysis and Design of Energy Geostructures MS 2 B Hydraulic Stimulation in Energy Geotechnics MS 2 C THMC Behavior of Earth Materials	TS 6 A Energy Geostructures MS 6 B Induced Seismicity TS 6 C THMC Behavior of Geomaterials	TS 10 A Other Geotechnics activities related to the Energy Sector MS 10 B Gas Production from Hydrate-Bearing Sediments MS 10 C Current Advances and Challenges Associated with Geological Disposal	
15:00		Visit of the Laboratory for Soil Mechanics at EPFL (optional)	MS 3 A Analysis and Design of Energy Geostructures MS 3 B CO_2 Geological Storage MS 3 C THMC Energy Geostorage	TS 7 A Energy Geostructures MS 7 B Induced Seismicity TS 7 C THMC Behavior of Geomaterials	TS 11 A Hydraulic Stimulation MS 11 B Gas Production from Hydrate-Bearing Sediments MS 11 C Current Advances and Challenges Associated with Geological Disposal	
16:00		Registration	Coffee break	Coffee break	Coffee break	
17:00		Opening Ceremony Opening Lecture J. Carlos Santamarina, KAUST COST GABI Lecture Fleur Loveridge, Uni Leeds	TS 4 A Energy Geostructures MS 4 B CO_2 Geological Storage TS 4 C THMC Behaviour of Geomaterials	TS 8 A Shallow Energy Geostorage MS 8 B Induced Seismicity TS 8 C THMC Behavior of Geomaterials	Closing Lecture Paul Bossart, Swisstopo	
18:00			Innovation Hub Presentation, exhibition and round table discussions			
19:00		Welcome Reception		Gala Dinner at the Olympic Museum		
20:00		GETE Editorial Board meeting				

Tuesday – September 25

Opening Ceremony 5:15 – 6:45 PM

Lyesse Laloui 5:15 PM
EPFL, Switzerland and Co-Chair of the SEG 2018 Symposium

Alessio Ferrari
EPFL, Switzerland and Co-Chair of the SEG 2018 Symposium

Marcelo Sanchez
Texas A&M University and Chair of ISSMGE TC308

Laurent Pitteloud
President of the Swiss Geotechnical Association

J. Carlos Santamarina 5:30 PM
KAUST, Saudi Arabia

Fractured rock in energy geotechnics

Energy resources and energy waste geostorage involve fractured rock masses in most cases. Fractures control all the physical properties, in particular the geoplumbing of the formation; yet, most laboratory and field studies focus on the intact rock. The presentation starts with fracture formation (ductile-brittle transition, layered-bound fractures) and fracture densities encountered in some reservoirs. Then, we review elastic properties (3D stress field and frequency effects), and thermal properties. Emphasis is placed on fluid flow, including: conductivity and transmissivity (the effect of the stress field and dilation, and consequences on stimulation), mixed fluid conditions, reactive fluids and fines migration. Finally, we explore alternatives for reservoir simulation in fractured rocks.

Fleur Loveridge 6:15 PM
Uni Leeds, England

Urban heat storage using structure and infrastructure foundations

Heat provision in the UK accounts for around one third of all greenhouse gas emissions and 40% of energy consumption, with similar figures across mainland Europe. While recent progress has been made to decarbonise electricity generation, the majority of heating provision comes from the direct burning of fossil fuels. It is therefore clear that ground heat storage is essential for decarbonsiation of heat. Urban ground heat storage systems require a ground heat exchanger (GHE) connected to a heat pump and a low temperature building heating delivery system. GHEs comprise a length of buried heat transfer pipes, which contain a circulating fluid. As the carbon density for electricity (needed to run the heat and circulation pumps) has fallen, so potential emissions savings has increased dramatically. In urban areas, GHEs are typically special purpose boreholes. However, drilling is expensive and high capital cost is a key barrier to uptake. But dual use of buried foundations and other structures removes the need for special purpose drilling. Piled foundations used as GHE were first developed in the 1980's, but are now becoming more routine and initial standardisation has occurred. But, there remains major opportunities to use other underground infrastructure for thermal energy transfer and storage. Retaining walls, tunnels and water/waste water pipes can all potentially be used as so called energy geostructures. This lecture will review the state of the art in the thermal assessment and design of a range of energy geostructures. It will consider what methods are readily available in academia and in practice and examine the barriers to future uptake of the technology. The lecture will draw on UK, EU and International projects, including the work of COST Action GABI and TC308.

Wednesday - September 26

Keynote and Feature Lectures 9:00 - 11:00 AM

Jonny Rutqvist 9:00 AM

Lawrence Berkeley National Laboratory, USA

"Fault activation, seismicity and leakage in geologic CO_2 sequestration"

The potential for activating faults associated with geologic carbon sequestration is currently receiving increased attention among CO_2 sequestration stakeholders as an issue of concern both related to induced seismicity and CO_2 leakage. In the light of these concerns, findings from recent modeling studies and field observations are summarized with emphasis on CO_2 injection and storage in deep sedimentary formations. The model simulations demonstrate the importance of the in situ stress field (magnitude and orientation) and injection location relative to the fault, as well as the critical importance of fault properties. It is shown that a seismic event large enough to be felt by humans requires a brittle fault with kilometer sized continuous permeability that allows for pressurization of a sufficiently large fault patch before rupture. Heterogeneous fault properties which are commonly encountered in faults intersecting multilayered shale/sandstone sequences effectively reduce the likelihood of inducing felt seismicity and also effectively impede upward CO_2 leakage. A number of simulations show that even a sizable seismic event that could be felt may not be capable of opening a new permeable flow path across an overlying caprock and is very unlikely to cross a system of multiple overlying caprock units. These modeling studies and an increasing number of field observations correlating deep fluid injection with induced seismicity, show the importance of the site investigation to characterize in situ stress and rock properties. It may be critical to avoid brittle rock such as crystalline basement or sites in hard and brittle sedimentary sequences that are more prone to injection-induced seismicity and permanent damage.

Lyesse Laloui 9:45 AM

EPFL, Switzerland

"Analysis, Design And Application Of Energy Geostructures From The Building To The City Scale"

This study focuses on the analysis, design and application of energy geostructures for the structural support and the energy supply of built environments, from the building scale to the city scale. The work is based on the results of full-scale in situ tests as well as theoretical analyses addressing fundamental aspects of the multiphysical behaviour of energy geostructures. The analysis and design of energy piles, energy walls and energy tunnels is treated and simplified yet effective design tools for such geostructures are presented. Aspects of primary importance for maximising the energy, geotechnical and structural performance of energy geostructures are presented, and solutions to address this challenge are proposed. Examples of practical analyses and design of energy geostructures from the building to the city scale are described and concluding remarks are highlighted. The goal of this lecture is to increase the confidence of engineers, architects, urban project managers and municipalities on the effectiveness and performance of energy geostructures.

Sébastien Burlon 10:30 AM

Setec-Terrasol, France

COST GABI Lecture: "GABI: a common European initiative for Geothermal Applications for Buildings and Infrastructure"

The COST ACTION TU1405 GABI (shallow Geothermal Applications for Buildings and Infrastructure) has been launched in 2015 with the objective to build a new European network of researchers and engineers to address the challenges of thermoactive geostructures in terms of thermal and mechanical design. In thermoactive structures, heat exchangers are integrated in the elements of the structure that interface with the ground, such as foundations, tunnels and diaphragm walls. This technique is also particularly attractive because of the inherent cost savings involved in combining a required structural component with the harvesting of geothermal energy. Based on multidisciplinary approaches, this group has the ambition to develop collective understanding, share techniques, facilities and data, and work jointly in disseminating the obtained results across Europe. This lecture includes the main results obtained by this group: THM ground characterisation, thermal and mechanical design of thermoactive structures, interactions between thermoactive structures and other constructions at the scale of the district.

Wednesday - September 26

1st SESSION 11:30 - 12:45 AM

1.A Mini-Symposium : Room 3

Analysis and Design of Energy Geostructures
Organized by S. Burlon, Terrasol Setec; G. Biscontin, Cambridge University

N. Makasis	The application of retaining walls and slabs as energy structures in underground train stations
X. Bao	Large scale model tests and numerical investigations on thermo-mechanical behavior of energy pile in saturated clay
K.S Abubakar	Inlet & Outlet Pipe Heat Interaction in a Contiguous Flight Auger (CFA) Pile
M. Sutman	Load-Transfer Approach for Modeling the Cyclic ThermoMechanical Behaviour of Energy Piles
E. Sailer	Numerical modelling of thermo-active shafts

1.B Mini-Symposium : Room 4

Hydraulic Stimulation in Energy Geotechnics: from Research to Practice
Organized by B. Lecampion, École Polytechnique Fédérale de Lausanne

J. Desroches	Revisiting sleeve fracturing for stress characterization
H. Zia	Modelling planar 3D hydraulic fracture propagation in materials with anisotropic fracture toughness
F.H. Cornet	The use of shear motions for the stimulation of EGS reservoirs
E. Sarris	Investigation of the Influence of Diffusion on the Closure Stress on Particles for Wellbore Strengthening Applications
N. Dutler	Preliminary results of six decameter-scale hydraulic fracturing (HF) experiments at the Grimsel Test Site (GTS)

1.C Mini-Symposium : Room 5

A Multi-Disciplinary Approach to Multi-Scale and Multi-Physics Processes in Shales and Soils
Organized by E. Romero, Universitat Politècnica de Catalunya; G. Musso, Politecnico di Torino; C. Jommi, Politecnico di Milano

J.M. Espitia Lopez	Behaviour of shales under uniaxial compression through suction paths
G. Della Vecchia	A coupled approach for the simulation of HF treatments in low permeability reservoirs
M. Rosone	The residual shear strength of the shaly and sandy facies of the Opalinus Clay
I.C. Bourg	Chemo-mechanical coupling in fine-grained soils and sedimentary rocks
E. Romero	Exploring ice formation and migration in frozen soils

Wednesday - September 26

2nd SESSION 2:00 - 3:15 PM

2.A Mini-Symposium : Room 3

Analysis and Design of Energy Geostructures
Organized by S. Burlon, Terrasol Setec; G. Biscontin, Cambridge University

J. Zannin	Thermal charts and mechanical aspects on Energy Walls
N.P. Lopez Acosta	Numerical analysis of the thermo-mechanical behavior of an energy pile in Mexico
W. Dongyuan	Static Load Testing of Short Pile and FEA Simulations for Utility-Scale Solar Energy Project
N. Woodman	Evaluating the applicability of the radial approximation for pile heat exchangers
A.F. Rotta Loria	Analytical interaction factor models for energy pile groups

2.B Mini-Symposium : Room 4

Hydraulic Stimulation in Energy Geotechnics: from Research to Practice
Organized by B. Lecampion, École Polytechnique Fédérale de Lausanne

S. Salimzadeh	Hydraulic Fracturing In Layered Media
I. Tomac	Proppant Flow and Transport in a Narrow Fracture in Turbulent Flow Regime
R. Rached	Hydraulic fracturing in pre-fractured media
M. Risyad	Naturally Fractured Basement Reservoir Potential Quantification from Fracture Model and Petrophysical Analysis by Leveraging Geostatistics and Seismic Interpretation: A Case Study in Jabung Block, South Sumatra Basin
J. Maury	Modeling of the stress field: from regional to reservoir scale

2.C Mini-Symposium : Room 5

THMC Behavior of Earth Materials
Organized by S. L. Abdelaziz, Stony Brook Universtiy; A.Bouazza, Monash University

Li Yanling	Boundary value level simulation of monotonic and cyclic thermal oedometer tests on natural sensitive clay
A. Gajo	A time marching scheme for injection in a deformable reservoir saturated by three immiscible fluids
Y.S. Kim	Thermal conductivity of controlled low strength material (CLSM)
M. Sedighi	Elevated temperature effects on microstructure of compacted smectite
J. McCartney	Impact of drained heating and cooling on undrained shear strength of normally consolidated clay

Wednesday - September 26

3rd SESSION 3:15 - 4:15 PM

3.A Mini-Symposium : Room 3

Analysis and Design of Energy Geostructures
Organized by S. Burlon, Terrasol Setec; G. Biscontin, Cambridge University

A. Lazaros	Assessment and comparison of soil thermal characteristics by laboratory measurements
A. Di Donna	Preliminary assessment of energy walls efficiency under different underground scenarios
A. Takai	Laboratory tests on thermal improvement of soft clay under elevated temperatures
B. Cousin	Feasibility and energy performance of an energy segmental lining for a subway tunnel

3.B Mini-Symposium : Room 4

CO_2 Geological Storage
Organized by J.-M. Pereira, École des Ponts ParisTech

B. Orlic	Effects of batch-wise CO2 injection on well integrity: a numerical model of cement interface debonding
Yixiang Gan	Numerical Simulation of Liquid Patch Formation and Retention in Porous Media
A.P. Rinaldi	Deep fracture zone reactivation during CO2 storage at In Salah (Algeria) – a review of recent modeling studies
J.M. Pereira	Analysis of modified cement paste in the context of CO2 geological storage

3.C Mini-Symposium : Room 5

THMC Energy Geostorage
Organized by F. Wuttke, Kiel University; D. Smeulders, Eindhoven University; S.Bauer, Kiel University

W.T. Pfeiffer	Hydraulic effects during large-scale hydrogen storage in porous formations
A.S. Sattari	A new lattice element method (LEM) with integrated interface elements to determine the effective thermal conductivity of rock solids under thermo-mechanical processes
H. Hailemariam	Thermal cyclic stability analysis of porous heat storage materials
D. Smeulders	Underground storage of latent heat : Theory and experiments

Wednesday - September 26

4th SESSION 4:45 - 6:00 PM

4.A Technical Session : Room 3

Energy Geostructures

M. Oliaei	Advanced Finite Difference Method For Study Energy Piles Behavior in Temperature Dependent Soils
F. Rognon	Feasibility study on the implementation of geothermal tunnel segmental lining in the lot 3 tunnel on railway Line 16 of the Grand Paris Express
D.D. Cortes	Smart ground-source borehole heat exchanger backfills: A numerical study
Y. Choi	Study on the pavement structure with solar panel
D. Zhang	Thermo-mechanical behavior of geothermal PHC pile

4.B Mini-Symposium : Room 4

CO_2 Geological Storage

Organized by J.-M. Pereira, École des Ponts ParisTech

T. S. Yun	Role of Reynolds Number in Two-Phase Fluid Flow
L. Zhang	Numerical simulation of CO2 injection into Lower Tuscaloosa Co2 storage reservoir in Mississippi, USA with experimentally validated modeling parameters
M. Abdel-Mohsen	Advanced Mineral Carbonation: An Approach to Accelerate CO2 Sequestration Using Steel production wastes and Integrated Fluidized Bed Reactor

4.C Technical Session : Room 5

THMC Behavior of Geomaterials

A. Minardi	Gas shale water imbibition tests with controlled suction technique
G. Melot	Chemo-Hydro-Mechanical analysis of Bituminized Waste swelling due to water up-taking: Experimental and model comparisons
H. Manman	Chemo-mechanical Coupling of Subcritical Crack Propagation via Chemo-elasticity
D. Seyedi	Key parameters controlling thermo-hydro-mechanical pressurization in Callovo-Oxfordian claystone
T. Nishimura	Measurements of strain of bentonite-sand mixture in suction cycles

Wednesday - September 26

Innovation Hub 6:00 - 8:00 PM

Presentations and technology showcasing of the inventors and start-ups 6:00 PM

TTI
Roman Bilak, Kerry Kristiansen, Guowei Xia

Terralog Technologies Inc. provides petroleum and environmental geomechanics services for sustainable resource development. The company developed a Slurry Fracture Injection (SFI) hydraulic fracturing technology, which has been applied to place oilfield wastes, biosolids, and contaminated soils in the deep subsurface.

Jansen
Dietmar Alge, Benjamin Pernter, Benjamin Haymoz

JANSEN offers innovative solutions for geothermal energy exploitation by incorporating their 60 years of experience in plastic pipe production. The Swiss company promises reliability, high quality, and innovative solutions as well as significant reductions in the installation costs.

4EE
Gregorius Riyan Aditya, Guillermo A. Narsilio, Nikolas Makasis

4EE provides a complete solution, encompassing design, construction and optimisation of shallow geothermal systems at any scale which include large infrastructure projects, greenfield housing developments and new build commercial buildings that seek innovation recognition and benefits.

ENERTUN: energy tunnel segmental lining
Marco Barla, Alessandra Insana, Matteo Baralis

ENERTUN is an improved precast segmental lining to be used for tunnels excavated by Tunnel Boring Machine (TBM) patented by Politecnico di Torino. The segments are made of concrete and equipped by a net of pipes through which a heat carrier fluid can circulate and exchange heat with the ground.

MeduSoil: Earth bio-reinforcement solutions (EPFL spin-off)
Dimitrios Terzis

Medusoil's mission is to design and deliver solutions for earth reinforcement and stabilization through the innovative biochemically active carriers, developed and patented at EPFL, incorporating technical innovation, economic efficiency and environmental responsibility.

KENOTEQ (Heriot-Watt University spin-off)
Gabriella Medero

KENOTEQ is a clean technology spin out company of Heriot-Watt University, specialising in high quality recycled building products. KENOTEQ's first product is an unfired construction brick made from 90% recycled demolition and construction waste, helping to drive waste reduction in the construction sector.

Round table discussions with panel experts 7:15 PM

Anil Sethi (ETH Zurich, Chair of Entrepreneurship)
Andrea Crottini (EPF Lausanne, Technology Transfer and Intellectual Property Manager)

Thursday – September 27

Keynote and Feature Lectures 8:45 – 10:45 AM

Jean Desroches 8:45 AM

Schlumberger, France

"Hydraulic fracturing, more than a reservoir stimulation technique: from measuring stresses to mine preconditioning"

Hydraulic fracturing has recently received a lot of attention, as it unlocked the production potential of hydrocarbon source rocks (aka "shales"). Hydraulic fracturing, however, has been a core technique for stimulating hydrocarbon production in oil and gas reservoirs for nearly 70 years, as it is the preferred means to create a permeable conduit in a tight rock formation. Furthermore, the associated knowledge and understanding that has been developed is now being used for rather different applications in the subsurface. In this lecture, a wide-ranging review of hydraulic fracturing will be attempted. We will first describe the coupled physical processes underlying the most basic expression of hydraulic fracturing: pressure-driven fluid flow, rock deformation, and creation of new fracture surface, and show that the coupling between these processes gives rise to a unique system, whose specificities have been carefully studied during the last 25 years – starting with the studies of dykes. A short venture will then be made in the associated transport of solids via suspensions of complex Non-Newtonian fluids, as the tailoring of these fluids is a key lever to achieve the desired geometry and conductivity of a hydraulic fracture. In the second part of this lecture, we will focus on lesser known, though potent, uses of the hydraulic fracturing technique: Small-scale hydraulic fracturing is the only direct method to measure stresses at great depth, through the combination of creation of new fractures and reopening of pre-existing fractures. Examples of estimating the complete state of stress through this technique will be discussed. The use of hydraulic fracturing in mining will be presented, not only to remove coal gas ahead of the mining front, but also to induce safe caving of the roof rock. Finally, the use of hydraulic fracturing in the context of geothermal reservoirs will be considered.

Stefan Wiemer 9:30 AM

ETH Zürich, Switzerland

"Tailor-made risk governance for induced seismicity of geothermal energy projects"

Fully open or partly open geothermal systems can induce potentially damaging seismicity. How this seismicity should be addressed depends on the geothermal system, its operational characteristics, the geological context, exposed buildings, existing infrastructure and populations, and social concern. We have developed an initial screening tool, called Geothermal Risk of Induced seismicity Diagnosis (GRID), for estimating to what extent induced seismicity is of concern for a specific project. A framework for tailor-made risk governance measures is then recommended, including hazard and risk assessment, social site characterization, seismic monitoring, insurance, structural retrofitting, traffic light systems, information and outreach, and public and stakeholder engagement. In this presentation, I will first outline this framework and then focus on traffic light systems (TSL) that are today an essential ingredient of induced seismic risk management. Their simplicity and robustness make them indispensable components of future GeoEnergy projects at risk of inducing felt earthquakes. However, classical TLS are purely reactive and inherently heuristic. They do not take into account the wealth of information available in near real-time. We are currently developing the next generation of TLS, Adaptive Traffic Light Systems (ATLS), which are data driven, model-based and risk-based . In this presentation I will review the key ingredients of ATLS, discuss the performance based on retrospective analyses and the roadmap towards real-time applications.

Marie Violay 10:15 AM

EPFL, Switzerland

"Coupled Hydro-mechanical processes in fault zones, implications for deep geothermal reservoirs"

Fluids play an important role in fault zone and in earthquakes generation. Fluid pressure reduces the normal effective stress, lowering the frictional strength of the fault, potentially triggering earthquake ruptures. Fluid injection induced earthquakes in deep geothermal reservoirs are direct evidence of the effect of fluid pressure on the fault strength. Although simple in theory, the mechanisms that govern the nucleation, propagation and arrest of these earthquakes remain poorly constrained, and our ability to assess the seismic hazard associated with induced events remains limited. Here, thanks to friction tests, we investigate the effect of fluid pressure and fluid thermo-physical properties on fault co-seismic weakening and healing. We demonstrate that in silicate-bearing rocks: at low fluid viscosity, during rupture acceleration, initial fault weakening is governed by the flash heating mechanism and is delayed in the presence of water. This mechanism is influenced by fluid thermophysical properties. Therefore, the presence of low viscosity fluids might delay or inhibit the rupture nucleation and propagation depending on pressure and temperature conditions; at high fluid viscosity, during rupture acceleration, the initial weakening mechanism is governed by elasto-hydrodynamic lubrication. For small slip events, high fluid viscosity increases the energy dissipated during rupture processes and might delay or inhibit the rupture propagation. As seismic slip increases, the fault becomes more prone to slip in presence of high viscous fluid; during rupture deceleration, fluid pressure enhanced frictional healing rate by water cooling. Obtaining a fundamental understanding of the dynamics of a fault system and its associated energy budget is important to assess the seismic hazard of induced earthquakes in geothermal reservoirs.

Thursday – September 27

5th SESSION 11:15 – 12:30 AM

5.A Technical Session : Room 3

Energy Geostructures

F. Casini	Interaction between photovoltaic panel foundation and frost heaving soils
R. Saggu	Base Displacement Response of Group of Geothermal Energy Piles
M. Peltier	Influence of airflow conditions and convective heat transfer coefficient on urban energy tunnels performance
A.R. Vasilescu	Impact of temperature cycles at soil – concrete interface for energy piles
Y. Delerablee	Assessment of thermal performance and interaction for thermoactive geostructures – A physical scale model approach

5.B Technical Session : Room 4

Gas hydrate Sediments

L. Yang	Analysing the Effects of Inhomogeneity on the Permeability of Porous Media Containing Methane Hydrates
R. Yan	Modeling the behaviors of hydrate-bearing sediment at different pore pressure and temperature environment
G. Han	Migration and clogging of silty fines by two-phase flows and its effect on sediment permeability
Y. Wu	Simple Modelling of the Mechanical response of Methane Hydrate-bearing Sediments

5.C Technical Session : Room 5

THMC Behavior of Geomaterials

Y. Yukselen-Aksoy	The Effect of Colemanite and Ulexite Additives on the Shear Strength Behavior of Sand-Bentonite Mixtures Under High Temperature
E. Cassini	A macroscopic chemo-mechanical model for smectite based materials from atomic Clay-Ions-Water interactions
L. Douma	Impact of water saturation on the mechanical properties and elastic anisotropy of the Whitby Mudstone
K. Liu	Evaluation of reconstruction and segmentation techniques on high temporal resolution µCT scans for geotechnical applications
E. Gerolymatou	Borehole stability in the brittle and ductile regime

Thursday – September 27

6th SESSION 2:00 – 3:15 PM

6.A Technical Session : Room 3

Energy Geostructures

G. Kong	Thermal response test of floating energy pile in China: Case study
F. Villalobos	Monitoring in a district heating pipeline system
S.H. Lines	Analysis of groundwater advection and ground-heat exchanger spacing on intermittent ground-source heat pump operation
Y. Guo	Numerical study on the long-term thermal performance and ground temperature variation of energy pile in multi-layered soil
G.R. Aditya	Full-scale instrumented residential ground source heat pump systems in Melbourne, Australia

6.B Mini-Symposium : Room 4

Induced Seismicity

Organized by M. Violay, École Polytechnique Fédérale de Lausanne

A. Mignan	Autonomous decision-making against induced seismicity in deep fluid injections
Y. Zhu	Simulation on Reservoir-induced Seismicity Considering Thermo-hydro-mechanical Couplings
C. Cornelio	Fluid viscosity controls earthquakes nucleation
C. Noël	Experimental study of reservoir seismicity using different injection strategies
M. Acosta	Rock /fluid interaction during induced earthquakes: Where does frictional heat go?

6.C Technical Session : Room 5

THMC Behavior of Geomaterials

M. Ondrasik	Simple method of rock pore structure determination presented with the most common rock types quarried in Slovakia
F. Wuttke	Modelling EM heating of porous media with lattice element method
S. B. Giger	Reconciling static and dynamic elastic properties of Opalinus Clay at multiple scales
M.M. Arzanfudi	A Thermo-Hydro-Mechanical Model for Soil Freezing/Thawing
X. Sun	The comparison of MICP between two different bacteria strains in low temperature condition

Thursday – September 27

7th SESSION 3:15 – 4:30 PM

7.A Technical Session : Room 3
Energy Geostructures

J. Epting	Waste heat recovery – Considerations for the management of thermally polluted urban groundwater resources
P. Conti	Thermal characterization of energy pile dynamics
X. Yu	Development of a CO_2 Heat Pipe for Hydronic Heated Bridge Decks
R. Debasree	Numerical analysis of geothermal system for Delhi silt soil in India
A.A. Garakani	A Feasibility Study on Implementing the Energy Piles in Electric Power Industries

7.B Mini-Symposium : Room 4
Induced Seismicity
Organized by M. Violay, École Polytechnique Fédérale de Lausanne

B. Fryer	The effect of permeability loss on induced seismicity during depletion-induced reservoir compaction
M. Broccardo	A Bayesian Hierarchical Framework for Induced Seismicity Hazard Associated with Deep Underground Fluid Injection
P. Giacomel	Experimental studies of frictional instabilities of basalts triggered by injection of pressurized H_2O- and CO_2- rich fluids for CO_2 storage purposes
L. Cauchie	Analysis of persistent seismic multiplets at the EGS reservoir of Soultz-Sous-Forêts, France
E. Spagnuolo	Frictional instability under fluid stimulation: insights from load-controlled experiments on pre-existing faults.

7.C Technical Session : Room 5
THMC Behavior of Geomaterials

Z. Ye	Study on fracture evolution of unsaturated red clay during drying process
N. Al-Mohamadi	Time-dependent deformations of chalk marl under triaxial state of stress
M. Ziccarelli	The permeable concrete: a low energy consumption solution for deep draining tranches
A. Tuttolomondo	An effective stress framework for clayey geomaterials
I. Stefanou	Combined role of the size of the microstructure and of Thermo-Hydro-Mechanical couplings on stability and fault reactivation

Thursday – September 27

8th SESSION 5:00 – 6:15 PM

8.A Technical Session : Room 3
Shallow Energy Geostorage

E. Passaris	Geomechanical analysis of salt caverns used for underground storage of hydrogen utilised in meeting peak energy demands
E. Al Hajri	Feasibility Study and Experimental Investigation of Heat and Mass Transfer in Dry and Moisturised Sand for Energy Savings
L. Paci	Geotechnical challenges for a High Temperature Energy Storage in the greater Copenhagen area (Zealand, Denmark)
O. Pedchenko	Long-term thermal performance of a borehole heat exchanger installed near an open fracture for a range of hydrogeological scenarios
M. Schuck	Experimental investigation of dynamic behaviour of borehole heat exchanger by gas sparging technology

8.B Mini-Symposium : Room 4
Induced Seismicity
Organized by M. Violay, École Polytechnique Fédérale de Lausanne

S. Wiemer	On the variability of the seismic response during multiple decameter-scale hydraulic stimulations
C. Brooks	Evaluating Ground Motion Prediction Equations Currently Used in North Sea Probabilistic Seismic Hazard Assessment with Consideration of Induced Seismicity
C. Nussbaum	Fault criticality and leakage below the Coulomb plastic limit: insights from hydraulic stimulations in the Opalinus Clay, Mont Terri rock lab., Switzerland
M. Lesueur	Three-scale multiphysics framework modelling fault reactivation
Wei Wu	Overpressured fluid injection and fault slip triggering

8.C Technical Session : Room 5
THMC Behavior of Geomaterials

S. Yu	Experimental study on erosive effects of sodium hydroxide solution on compacted clay
C. Lijie	Experimental study on strength characteristics of red clay under different particle size of calcium carbonate
T. Orlander	Using Biot's coefficient in estimation of thermal conductivity of sandstones
M. Pasand	Modeling of oil transport in porous media using multiscale method with adaptive mesh refinement
P. Baryla	The influence of the different hydro-mechanical paths on final macroscopic properties and local homogenity of compacted MX80 bentonite samples

Friday – September 28

Keynote and Feature Lectures 9:00 – 10:45 AM

Antonio Gens 9:00 AM

Technical University of Catalonia, Spain

"Underground research laboratories in nuclear waste containment"

The favoured long-term solution for the disposal of high-level radioactive waste generally involves the construction of deep geological repositories. The development of such facilities pose important challenges from the point of view of scientific understanding, rock exploration and engineering construction. The lecture reviews the significant role played by Underground Research Laboratories (URLs) in this field. The key functions of URLs comprise the characterization of the host rock and the potential effects of excavation, the demonstration of the feasibility of construction and operation of the repository, and the enhancement of the understanding of the complex coupled phenomena that will take place in such an environment. A review of the main URLs located in different counties and continents will be presented, distinguishing between generic laboratories and site-specific ones, since their operations exhibit a number of differences. Distinction will also be made between purpose-built laboratories from pre-existing ones where the laboratory has taken advantage of previously constructed facilities. The changing emphasis of the work performed in the laboratories as research has progressed over the years will also be discussed. Experiments in the URLs often have special characteristics that will be examined. For instance, some test are carried out over (comparatively) very long periods, sometimes longer than a decade. Test are also performed over a variety of scales involving, in some instances, full-scale disposal schemes. Some characteristic experiments will be reviewed focusing mainly in the hydro-mechanical and thermo-hydro-mechanical behaviour of seals, barriers and the near field. Observations obtained upon dismantling will be given special attention.

María Victoria Villar 9:45 AM

CIEMAT, Spain

"Hydro-chemo-mechanical interactions in compacted bentonite"

The behaviour of a nuclear waste repository is determined to a large extent by the changes that may occur in the properties of the bentonite-based buffer as a result of the combined effects of the heat generated by the radioactive decay and of the water and solutes supplied by the surrounding rock. These thermo-hydraulic gradients lead to changes in the bentonite physical state (water content, dry density) and geochemistry (movement of soluble species by advection and diffusion, changes in the composition of the cation exchange complex), all of them affecting its hydro-mechanical behaviour. Some of the properties to be taken into account to assess the correct performance of the barrier are its permeability, water retention capacity and swelling ability, which in turn depend mainly on dry density, water content, temperature and the physico-chemical interactions between the clay particles and the pore fluid chemistry. The hydro-chemo-mechanical interactions that control the behaviour of the bentonite barrier system can be approached in complementary ways: i) Small-scale laboratory tests in which the influence of chemical factors (solution and bentonite geochemistry) on bentonite hydro-mechanical properties is checked. These allow to identify major factors and look for fundamental explanations to them. ii) Tests in thermo-hydraulic (TH) cells that simulate the conditions of the sealing material, providing online measurements of the evolution of e.g. temperature, moisture, suction and pressures. However, the online monitoring of geochemical parameters has proved to be problematic, and hence, the chemical changes and their possible effects on hydro-mechanical properties have to be checked post-mortem. iii) Large-scale tests performed in underground research laboratories. These tests are closely representative of the barrier conditions, but are complicated and expensive and the boundary conditions in them are not always well known. They provide similar online information as the TH cells and rely as well on the post-mortem analyses to assess the chemical changes and interactions. Since these tests are designed to last for long (several years), the post-mortem information available from them is yet limited.

Marcelo Sanchez 10:15 AM

Texas A&M University, USA

"Behavior of Gas Hydrates Bearing Sediments: Geomechanical and Numerical Modeling"

Methane hydrates are ice-like compounds made of gas methane and water. Hydrates are stables under low temperature and high pressure conditions constraining their occurrence in sediments to marine and permafrost settings. A shift from the stability conditions triggers an endothermic hydrate dissociation with the associated release of gas and water, impacting (amongst others) on sediment pore pressure, temperature, and deformations. Therefore, the behavior of hydrate bearing sediments (HBS) is controlled by strongly coupled thermo-hydro-chemo-mechanical (THCM) actions. The analysis of available data from past field and laboratory experiments, and the optimization of future field production studies require a formal and robust numerical framework able to capture the complex behavior of this type of soil. The lecture presents different problems involving HBS, from laboratory experiments involving natural hydrate samples to gas production tests. A comprehensive and fully coupled THCM framework to tackle problems involving HBS is briefly described. The analyses show the complexity of the THCM phenomena associated with this type of system and assist to gain a better understanding on HBS behavior.

Friday - September 28

9th SESSION 11:15 - 12:30 AM

9.A Technical Session : Room 3

Geotechnics for Offshore Energy Applications

L. Thorel	Effect of the soil undrained cohesion profile on the response of a sliding subsea foundation : centrifuge tests
M. Mehravar	Geotechnical Performance of Suction Caisson Installation in Multi-layered Seabed Profiles
W. Zhou	Dynamic responses of jacket foundation offshore wind turbine considering the cyclic loading effects
H. Wang	Comparison of monotonic and cyclic lateral response between monopod and tripod bucket foundations in medium dense sand
K. Faizi	Finite element modelling of the performance of hybrid foundation systems for offshore wind turbines

9.B Mini-Symposium : Room 4

Challenges of Gas Production from Hydrate-Bearing Sediments
Organized by S. Dai, Georgia Institute of Technology

J. Y. Lee	Experimental study on sanding and fine migration during gas production from gas hydrate deposits
H. Iwai	A constitutive model for gas hydrate-bearing soils considering hydrate morphology
Z. Liu	The dynamic characteristics of hydrate-bearing sands measured by resonant column under controlled stress and strain
J. Zhao	Enhancing the gas production from depressurized methane hydrate deposits via warm brine injection
S. Uchida	Sand migration analysis in heterogeneous gas hydrate-bearing sediments during depressurization

9.C Mini-Symposium : Room 5

Computational Waste Management in Geomechanics
Organized by T. Nagel and F. Parisio, Helmholtz Centre for Environmental Research – UFZ

S.V. Churakov	Efficient cross-scale modelling of geochemical interactions for nuclear waste geological disposal
D. Jaeggi	Predictive HM-modeling in the heterogeneous Opalinus Clay of the Mont Terri rock laboratory
J. Rutqvist	Long-term modeling of thermo-hydro-mechanical processes of geologic carbon storage
B. François	Hydro-mechanical modelling of the Boom Clay excavation, convergence and contact with concrete lining

Friday - September 28

10th SESSION 1:45 - 3:00 PM

10.A Technical Session : Room 3

Other Geotechnical Activities Related to the Energy Sector

T.-P. Tsai	Large Diameter Pile Combined with Micropiles to Improve Stabilization of Transmission Tower Foundation
S.F.I. Al Abdullah	Behavior of free and fixed headed piles subjected to lateral soil movement
I. Mirsayapov	Calculation models of bearing capacity and deformation of soil foundations with vertical elements reinforced under regime cyclic loading
J.C. Santamarina	The Hydro-Mechanical Response of Pre-Structured Reservoirs Subjected to Hydraulic Fracture
P. Psarropoulos	Designing Onshore and Offshore Energy Projects in Seismic Areas

10.B Mini-Symposium : Room 4

Challenges of Gas Production from Hydrate-Bearing Sediments
Organized by S. Dai, Georgia Institute of Technology

L. Yanlong	Gravel Sizing Criteria for Hydrate Exploitation Wells and Its Application
T. X. Le	Mechanical properties of synthetic methane hydrate-bearing sand
A. Alavoine	Using numerical homogenization to compute the mechanical response of Gas Hydrate Bearing Sediments
C. Deusner	Mechanical behaviour of gas hydrate-bearing sediments: Effects from changing gas hydrate-sediment fabrics and nonhomogeneous gas hydrate distributions
D. Sheng	Effects of hydrate in sediments on sand crushing

10.C Mini-Symposium : Room 5

Current Advances and Challenges Associated with Geological Disposal
Organized by M. V. Villar, CIEMAT; M. Sanchez, Texas A&M Universtiy

B. Pomaro	Coupled THM analyses of nuclear waste barriers incorporating different model assumptions
M.V. Villar	Experimental investigation of gas transport in the shaly facies of Opalinus Clay
A. Madaschi	Mechanical anisotropy of Opalinus Clay shale: a multiscale approach
M. Sanchez	THM Modelling of Expansive Clays incorporating Uncertainty Quantification

Friday - September 28

11th SESSION 3:00 - 4:15 PM

11.A Technical Session : Room 3

Hydraulic Stimulation

K. Teeratorn	Investigation on the Productivity Behaviour in Deformable Heterogeneous Fractured Reservoirs
J.C. Choi	Prediction of leak-off pressure in Norwegian offshore using NPD database and deep neural network
V. H. Tran	Numerical assessment of the near-well rock matrix permeability gain due to thermal stimulation
J. Justo	Influence of temperature on the fracture toughness of several rocks
A. Blaisonneau	Adapted modelling strategy developed to support EGS deployment

11.B Mini-Symposium : Room 4

Challenges of Gas Production from Hydrate-Bearing Sediments
Organized by S. Dai, Georgia Institute of Technology

J. Yoneda	Gas hydrate reservoir characterization through pressure core analysis
S. Kimoto	Time dependent behavior of CO_2 hydrate-bearing sediments and its modelling by an elasto-viscoplastic model
K.A. Alshibli	Gas driven fracture during gas production using 3D synchrotron computed tomography
J. Shen	A composite constitutive model for methane hydrate-bearing soils using equivalent granular void ratio

11.C Mini-Symposium : Room 5

Current Advances and Challenges Associated with Geological Disposal
Organized by M. V. Villar, CIEMAT; M. Sanchez, Texas A&M Universtiy

S. Sato	Measurement of strain of bentonite-sand mixture in suction cycles
Q. Wang	Volume change behaviour of compacted GMZ bentonite upon wetting/drying cycles
P. Braun	A laboratory testing procedure for the determination of coupled thermo-poromechanical properties of low permeable geomaterials
E. Crisci	Anisotropic behaviour of shallow Opalinus Clay

Friday – September 28

Closing Lecture 4:45 PM

Paul Bossart
Swisstopo, Switzerland

"The international Mont Terri rock laboratory: research in the field of radioactive waste disposal and CO_2 sequestration"

Rock laboratories are considered as research platforms to carry out experiments, develop new technologies, and demonstrate activities in support of the development of deep geological repositories for disposal of radioactive waste and/or CO_2. The Mont Terri rock laboratory is just such a facility. The laboratory is located in an extended section of the security gallery of the Mont Terri motorway tunnel, close to the town of St-Ursanne in Canton Jura, Switzerland. The main objective of the research of the 16 partners is the hydrogeological, geochemical and rock mechanical characterisation of the Opalinus Clay, an over-consolidated claystone of Lower Jurassic age. The test results over the last 20 years show that the Opalinus Clay is capable of confining radioactive substances over very long times and isolating them from the biosphere. In recent years, we have adapted and transferred the techniques, measurement methods, and expertise that were developed in the field of radioactive waste disposal to CO_2 sequestration experiments, mainly in the field of wellbore and caprock integrity in claystones.

There are 3 major topics to improve the knowledge of the evolution of a potential repository in the Opalinus Clay:

1) understanding the characteristics, processes, and mechanisms in undisturbed clays before construction,
2) understanding the repository-induced perturbations during and after construction, and
3) conducting experiments related to the demonstration of repository implementation technology.-

We also present experiments in the field of CO_2 sequestration focused on wellbore- and fault integrity and borehole sealants in the Opalinus Clay caprock. This latter is especially important considering that CO_2 stored in a lower aquifer could migrate along artificial and natural flow paths through an upper laying caprock.

The Mont Terri rock laboratory is an essential element in the dissemination of information and improving communication among implementers, safety authorities, and regulators. Based on feedback by visitors, we also address the question of whether rock laboratories increase the public acceptance of radioactive waste disposal and CO_2 storage.

Lecturers

J. Carlos Santamarina

Fractured rock in energy geotechnics

J. Carlos Santamarina (Professor - KAUST) graduated from the Universidad Nacional de Córdoba, and completed graduate studies at the University of Maryland and Purdue University. Before KAUST, he taught at NYU-Polytechnic, the University of Waterloo (Canada), and Georgia Tech. His former students are academicians, researchers, or practicing engineers at leading institutions around the world. The team's research results are summarized in two books and more than 300 publications. Dr. Santamarina is a member of the Argentinean National Academies (Sciences and Engineering), a recipient of two ASTM Hogentogler Awards, was the 2012 British Geotechnical Association Touring Lecturer, and delivered the 50th Terzaghi Lecture in 2014.

Fleur Loveridge

COST GABI Lecture: Urban heat storage using structure and infrastructure foundations

Dr Fleur Loveridge is a Royal Academy of Engineering Research Fellow and University Academic Fellow based at the University of Leeds. Her research focuses on two main topics: (i) storage of thermal energy in the ground, especially using novel ground heat exchangers such as structure and infrastructure foundations; (ii) the resilience of transport infrastructure, especially earthworks. She is task force leader for ISSMGE TC308 on energy geostructures and storage of thermal energy in the ground, working group leader for energy efficiency for the EU COST Action GABI on Geothermal energy Applications in Buildings and Infrastructure, and was one of the authors of the UK Ground Source Heat Pump Association Thermal Pile Standard. Prior to returning to academia at the University of Southampton in 2009, Fleur spent almost a decade as a consulting engineering in engineering geology and geotechnical engineering working on a range of innovative infrastructure and development projects throughout the world. She is a Chartered Engineer and a Chartered Geologist.

Jonny Rutqvist

Fault activation, seismicity and leakage in geologic CO_2 sequestration

Dr. Jonny Rutqvist (http://eesa.lbl.gov/profiles/jonny-rutqvist/) is a Senior Scientist at the Lawrence Berkeley National Laboratory, Berkeley, California. His research is focused on modeling of geomechanics as well as coupled thermal, hydraulic, mechanical and chemical (THMC) processes in geological media for a wide range of geoscientific and geoengineering applications, including geologic carbon sequestration, geothermal energy extraction, gas hydrate production, underground compressed air energy storage, nuclear waste disposal, and shale gas extraction. Dr. Rutqvist has co-authored over 500 technical publications on the subject, including over 180 peer-reviewed journal papers and book chapters. He is the original developer of the TOUGH-FLAC simulator, which has turned out to be a very versatile tool for modeling coupled multiphase fluid flow and geomechanics. Using TOUGH-FLAC he was one of the pioneers applying coupled fluid flow and geomechanical modeling to geologic carbon sequestration, such as at the In Salah CO_2 storage project, and more recently on the issue of injection-induced seismicity.

Lyesse Laloui

Analysis, Design and Application of Energy Geostructures from the Building to the City Scale

Dr. Lyesse Laloui is chaired professor and Director of the Soil Mechanics Laboratory at the Swiss Federal Institute of Technology, EPFL, Lausanne, where he developed a major research group in the areas of Soil Mechanics, Geoengineering and CO_2 sequestration. He is also adjunct professor at Duke University, USA, and advisory professor at Hohai University, China. He edited 10 books and published over 300 peer reviewed papers. He is the Editor in Chief of the International journal Geomechanics for Energy and the Environment. He is the recipient of the "Excellent Contributions Award" of the International Association for Computer Methods and Advances in Geomechanics, the "2012 Vardoulakis Lecture" from the University of Minnesota, the "12th G.A. Leonards Lecture" from the University of Purdue and the "2016 RM Quigley Award" from the Canadian Geotechnical Society. He has been involved as an expert in several international projects and acts as a consultant in civil, geotechnical and geothermal engineering, including legal and arbitration cases. The patented "Geosynthetic element for soil bio-improvement" is currently being developed in the context of a start-up.

Sébastien J. Burlon

COST GABI Lecture: GABI: a common European initiative for Geothermal Applications for Buildings and Infrastructure

Dr. Sébastien Burlon, is currently working in the French company Setec-Terrasol. Civil engineer graduated from École Nationale des Travaux Publics de l'État (ENTPE, Lyon, France) in 2003, he obtained a PhD in Civil Engineering from Lille University in 2007 and an HDR (Accreditation to Direct Research) from Paris-Est University in 2016. During the last 15 years, mainly for IFSTTAR (The French Institute of Science and Technology for Transport, Development and Networks), as geotechnical engineer and researcher, he has been involved in many expertises, research projects and standardization projects (Eurocode 7) dealing with soil-structure interactions and numerical modelling. He is the Chair of the COST Action TU1405 GABI (Geothermal Applications for Buildings and Infrastructure) with 25 European countries involved: the main objective of this Action is to build a new European network of researchers and engineers to address the challenges of thermoactive geostructures in terms of thermal and mechanical design.

Jean Desroches

Hydraulic fracturing, more than a reservoir stimulation technique: from measuring stresses to mine preconditioning

Jean Desroches has worked on various aspects of hydraulic fracturing since 1985, starting with using tiltmeters to monitor the extent of hydraulic fractures, especially in geothermal environments. He has been working for Schlumberger since 1990, and has held various R&D positions in the UK, the US and France. He has been developing hydraulic fracturing combined with packer fracturing for measuring earth stresses in wellbores, as well as heading efforts to model the various processes associated with hydraulic fracturing as a reservoir stimulation technique. He has directed engineering for well integrity as well as for CO_2 storage. More recently, he has been involved in methods to better take into account rock mechanics information – from rock fabric to geological structure to tectonics - for completing hydraulically fractured wells in complex settings.

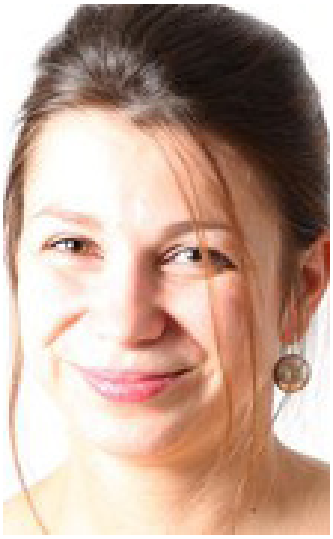
Jean has coauthored more than 50 scientific publications and 8 patents. He holds a degree in Geological Engineering from École Nationale Supérieure de Géologie, Nancy (France) and a PhD in Rock Mechanics from Institut de Physique du Globe de Paris.

Stefan Wiemer

Tailor-made risk governance for induced seismicity of geothermal energy projects

Prof. Dr. Stefan Wiemer is the chair of seismology at the department of Earth Sciences, ETH Zurich, and the director of the Swiss Seismological Service (SED, www.seismo.ethz.ch). Born in 1967 in Germany, he graduated from the Ruhr University in Bochum in 1992 and earned his PhD in geophysics from the University of Alaska in Fairbanks in 1996. In 1997, he was awarded a fellowship by the German Alexander von Humboldt Foundation and moved to Tsukuba, Japan. In 1999, he progressed to the SED as a research associate, where he initiated and led research groups on statistical seismology and induced seismicity. He was promoted to titular professor in 2007 and appointed as a full professor and SED director in 2013. His expertise and research interests include probabilistic seismic hazard and risk assessment, time-dependent processes, earthquake predictability and operational earthquake forecasting, earthquake early warning and induced seismicity related to GeoEnergy applications. He published more than 132 articles in international peer reviewed journals since 1994 and supervised 16 PhD students at ETH.

Marie Violay



Coupled Hydro-mechanical processes in fault zones, implications for deep geothermal reservoir.

Marie VIOLAY has been working as an assistant professor at EPF (CH)L since July 2015. She obtained her PhD in 2011 from the University of Montpellier (Fr), under the supervision of Dr. Pezard and Dr. Gibert, working on petrophysical properties of basalt with implications for deep geothermal energy. She served as a post-doctoral research associate at INGV (It) between 2011 and 2013 under the supervision of Prof. Di toro. Then, she moved to ETHz (CH), and worked as senior scientist in collaboration with Prof. Burg between 2013 and 2015. Her research aims at better understanding the role of fluids on the mechanics of the Earth's crust, especially ruptures. She is interested in developing inter-disciplinary approaches that combine 1) rock mechanics, 2) microstructural/geochemical investigations, and 3) borehole geophysical observations to study earthquakes, and geological reservoirs. Marie Violay is currently an ERC starting Investigator in mechanical BEhavior of Fluid Induced Earthuqake (BEFINE) at EPFL.

Antonio Gens

Underground research laboratories in nuclear waste containment

Antonio Gens is professor of Geotechnical Engineering at the Technical University of Catalonia in Barcelona where he has been Head of the Department of Geotechnical Engineering and Geosciences and member of the Governing Council of the University. He has been involved in geotechnical research, consulting and education for more than 30 years and he is the author or co-author of more than 300 scientific papers.

He has received numerous awards such as the ICE Telford Medal (twice), the George Stephenson Medal (twice) and the Honour Medal of the Institution of Civil Engineers in Spain. In 2007, he delivered the 47th Rankine Lecture. He is a Fellow of the UK Royal Academy of Engineering and Doctor Honoris Causa by the University of Grenoble. He was Vice-President for Europe of the International Society for Soil Mechanics and Geotechnical Engineering (ISSMGE) for the period 2013-2017. The ISSMGE awarded him the Kevin Nash Gold Medal in 2017.

Maria Victoria Villar

Hydro-chemo-mechanical interactions in compacted bentonite

María Victoria Villar has a Ph.D. in Geology and is working since 1989 at CIEMAT, a Spanish research centre for energy, environment and technology. She is an experimentalist, currently head of the Soil Mechanics Laboratory and of the research group on Thermo-hydro-mechanics and geochemistry of geomaterials.

Her work has focussed on the characterization and assessment of behaviour of host rocks and barrier materials for the disposal of radioactive waste and has been carried out mainly in the framework of projects financed by the European Commission and by Enresa, the Spanish agency for nuclear waste management.

Marcelo Sanchez

Behavior of Gas Hydrates Bearing Sediments: Geomechanical and Numerical Modeling

Dr. Marcelo Sanchez is a Professor in the Zachry Department of Civil Engineering TAMU. He obtained his first degree in Civil Engineering from the Universidad Nacional de San Juan (Argentina). His Master and Ph.D. (2004) degrees are from the Universidad Politecnica de Catalunya (UPC, Barcelona, Spain). His expertise lies in the analysis of Thermo-Hydro-Mechanical and Chemical (THMC) coupled problems in geological media and unsaturated soil mechanics. The main applications of his research are related to Energy Geotechnics, Environmental Geotechnics and Transportation Geotechnics His has published more than 100 peer review papers. He is acting as an Associated Editor of six International Journals. He is one of the recipients of the "George Stephenson Medal 2012" (ICE, UK), and other awards. He is the Chairman of the ISSMGE Technical Committee TC308 on "Energy Geotechnics". More info about Dr. Sanchez' activities can be found at http://ceprofs.civil.tamu.edu/msanchez/

Paul Bossart

The international Mont Terri rock laboratory: research in the field of radio-active waste disposal and CO_2 sequestration

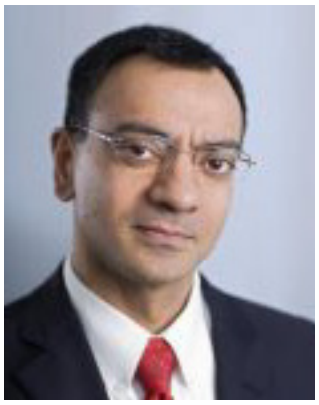
Paul Bossart works for the Swiss Geological Survey at swisstopo, as director of the international Mont Terri rock laboratory. He received his Ph.D at the ETH Zürich in 1986 (tectonic structure of the Hazara-Kashmir Syntaxis in Northern Pakistan), and holds an MBA of the University of St.Gallen (2004). He was and is involved in several research projects in rock laboratories, such as the Grimsel Test Site (Switzerland), Aespoe (Sweden), Kamaishi (Japan), and the Mont Terri rock laboratory (www.mont-terri.ch).

Innovation Hub

A platform to bring practitioners, engineers, researchers and technology or service providers together to foster the debate around building the sustainable infrastructure systems and technology of tomorrow.

Experts on our roundtable:

Andrea Crottini,
EPFL Technology Transfer and Intellectual Property Manager



Anil Sethi,
ETH Zurich Chair of Entrepreneurship

Contributors :

TTI Terralog Technologies Inc.

JANSEN Configure to Inspire

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Monday - September 24

COST Action TU 1405 – GABI Short Course 9:00 AM - 6:00 PM

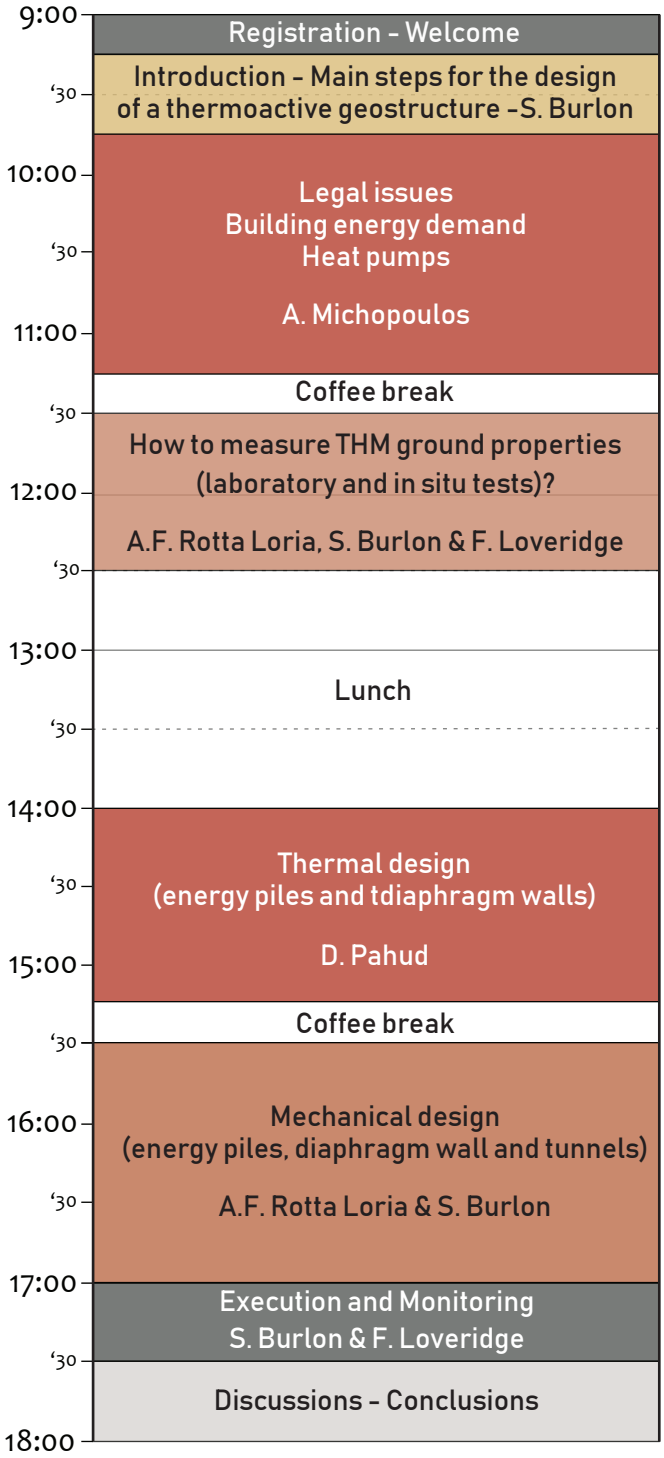
How to plan a successful thermoactitve geostructure design?

S. Burlon, Terrasol-Setec, France
F. Loveridge, Leeds University, UK
A. Michopoulos, Cyprus University of Technology, Cyprus
D. Pahud, School of Management and Engineering Vaud, Switzerland
A.F. Rotta Loria, EPFL, Switzerland

Despite the significant number of operating energy geostructures in Europe, the development of specific design rules and dimensioning approaches has been slow. Attempts to provide a set of recommendations for piles, diaphragm walls and tunnels subjected to temperature variations were carried out starting from 2005 in Switzerland, Germany, United Kingdom and France. However, most of this documentation provides only general indications and does not allow the adoption of this technology across Europe for a wider range of projects.

This short course organised the COST ACTION TU1405 GABI (Geothermal Applications for building and infrastructures) under the auspices of EPFL aims to synthesize research and practice-based knowledge from across national and disciplinary boundaries in order develop better understanding and more widespread use of this technology.

A certificate of attendance will be delivered at the end of the course.



Saturday – September 29

Mont-Terri Underground Rock Laboratory Visit

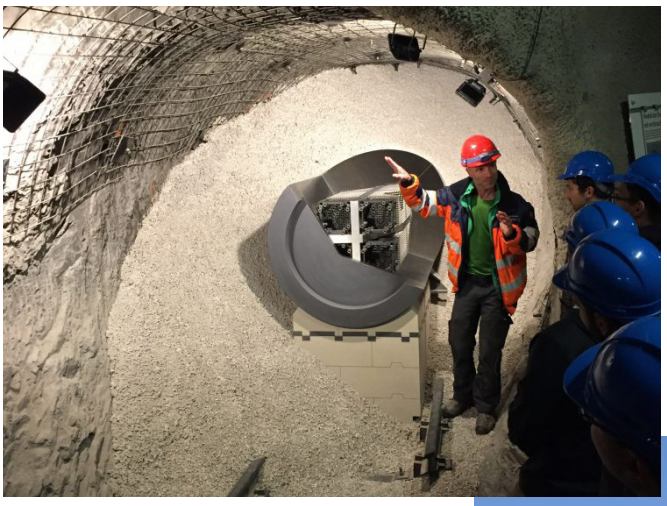
7:15AM – 4:30 PM

Just after the symposium (on the 29th of September 2018) there will be a visit to the Mont-Terri Underground Rock Laboratory, located in the canton of Jura, 300 m underground. Numerous experiments are carried out here on the Opalinus Clay, which is, among other things, a potential host rock for future nuclear waste storage activities in Switzerland.

The tour will then begin with a short presentation and discussion about the work being performed at Mont-Terri. After the discussion, we will tour the actual facilities and visitors will be able to see how many of the experiments are being performed. Finally, we will have an apéro at the visitors centre in the early afternoon before returning back to EPFL.

VISIT SCHEDULE

- 7:15 Meeting of the participants
- 7:30 Bus departure
- 10:00 Visit of the Underground Rock Laboratory
- 13:00 Apéro at the Mont – Terri visitors centre
- 14:00 Departure from Mont – Terri
- 16:30 Arrival to Lausanne

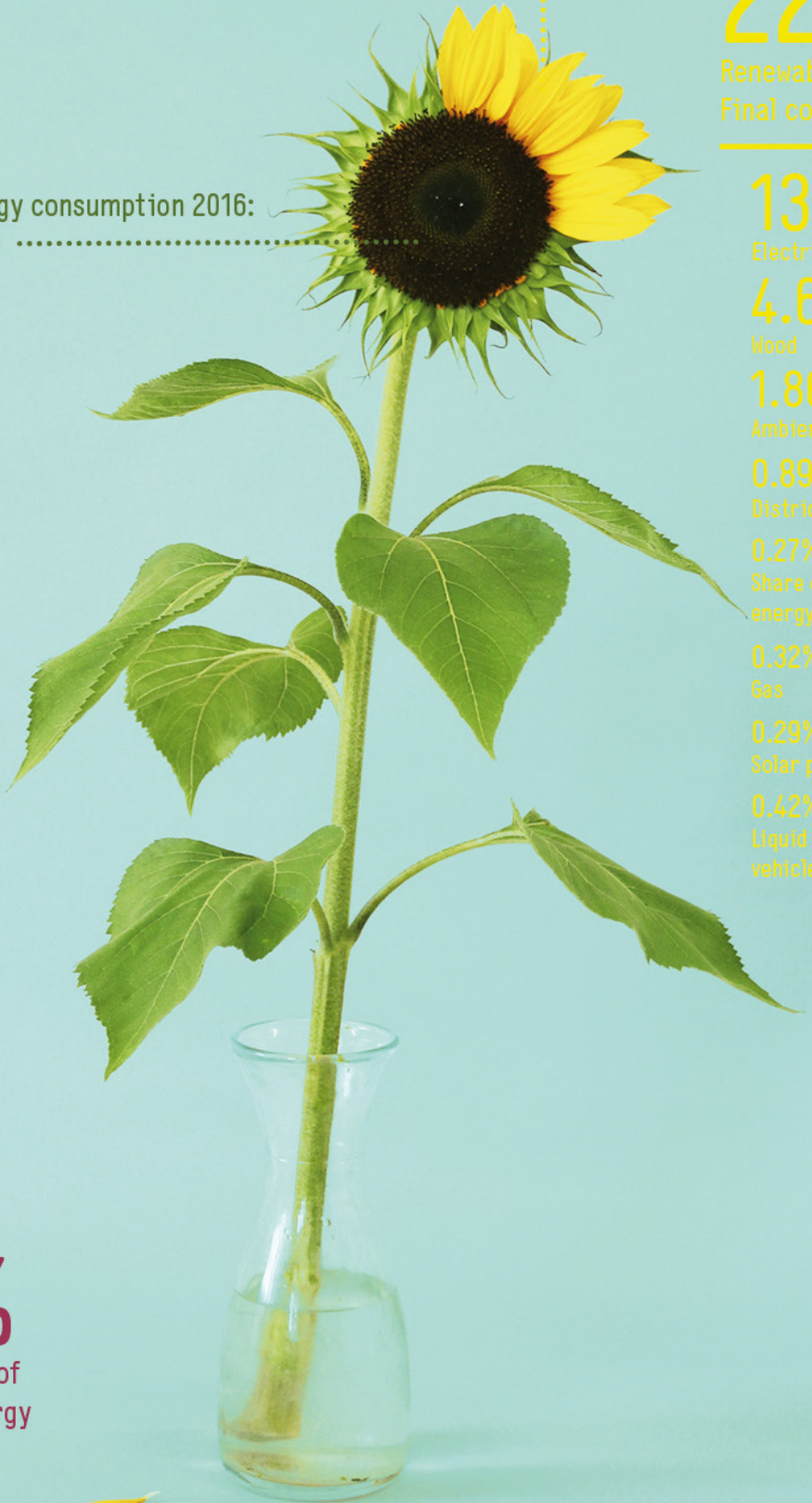


Total final energy consumption in Switzerland in 2016 with shares of renewable energy

22.1%
Renewable energy
Final consumption

Final energy consumption 2016:
854'300 TJ

- **13.4%** Electricity
- **4.62%** Wood
- **1.86%** Ambient heat
- **0.89%** District heating
- **0.27%** Share of renewable energy from waste
- **0.32%** Gas
- **0.29%** Solar power
- **0.42%** Liquid biogenic vehicle fuels



77.9%
Final consumption of non-renewable energy

Schweizerische Eidgenossenschaft
Confédération suisse
Confederazione Svizzera
Confederaziun svizra

Swiss Federal Office of Energy SFOE

SFOE, 2016 / Layout: heyday

Wille Geotechnik® - the first choice in manufacturing high quality material testing equipment for research and practice

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Field of application

- Geotechnical equipment for field and laboratory testing in civil engineering, in particular for advanced soil mechanic testing
- Static and dynamic material testing machines for soil, aggregates and bituminous materials
- Testing equipment for geosynthetics
- Customized solutions for all applications
- Upgrading and modernization of existing testing devices

Conventional and unsaturated triaxial testing system

Selection of our product range

- All kinds of shear apparatus (direct, ring, simple, vane tester, triaxial, hollow cylinder)
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Large direct shear testing system

Advanced soil analyser (ASA systems)

Resonant column apparatus

Static and dynamic ring shear apparatus

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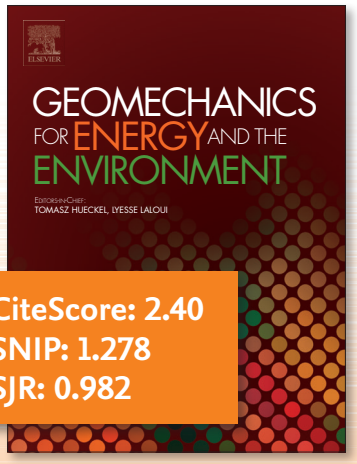
ROMANDE ENERGIE

FLOATING SOLAR PARK PROJECT, MOORED STRUCTURE AT THE SHORES OF THE LAKE
LAC DES TOULES (VS), PHOTOMONTAGE

Geomechanics for Energy and the Environment



CiteScore: 2.40
SNIP: 1.278
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Publish research results of the highest quality and of lasting importance on the subject of **geomechanics**, with the focus on applications to **geological energy production** and **storage**, and the **interaction of soils and rocks** with the **natural and engineered environment**.

Special attention is given to concepts and developments of new **energy geotechnologies** that comprise intrinsic mechanisms protecting the **environment** against a potential **engineering induced damage**, hence warranting **sustainable usage of energy resources**.

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