

## Geological Risks concentration



### Coordinateurs : Costanza Bonadonna

Geological processes such as landslides, earthquakes and volcanic eruptions are fascinating but complex phenomena with potentially significant impacts on society. These impacts may occur at different levels, local, regional and global.

The geological hazards concentration focuses on the dynamic challenges facing societies worldwide when developing risk reduction measures. This concentration forms on the deep and surface processes that generate geological hazards and on assessment methods of exposure and vulnerability of people and the built environment. Hazard and vulnerability assessments are then combined to conduct the analysis of impacts and associated risks. Through this concentration, students have access to teachers at the forefront of research, to acquisition tools of specific data, as well as to different approaches for modeling and risk analysis. Field works enable to integrate various aspects of risk management. This multidisciplinary concentration offers students the opportunity to acquire skills that make them employable in geological and geotechnical consulting firms, international and nongovernmental organizations, and federal offices.

### PART A3 mandatory: 24 ECTS credits

The mandatory **part A4** includes four modules:

- Petrological processes in geodynamic environments
- Fundamentals of numerical modelling and data analysis
- Spatial analysis applied to geology and risk
- Geophysics across scales for geologists

#### Module Petrological processes in geodynamic environments

Course	Teacher in charge / Speaker(s)	Semester Modality	Evaluation	ECTS credits
<b>Petrological processes in geodynamic environments</b> <i>Processus pétrologiques dans les environnements géodynamiques</i>	<u>U. Schaltegger, O. Müntener</u> S. Pilet, L. Caricchi L. Baumgartner, S. Schmalholz L. Fontboté	Fall 70h C PW E S	Seminars	9
<i>One ECTS credits corresponds to 25-30 hours of actual work</i>				
<i>C: course – PW: Practical work – E: Exercices – S: Seminars – F: Field – d: days (block course) – h: hours (weekly course)</i>				

This module must be followed during the first semester of the Master and then validated during the following exam session. Il est validé et les 9 crédits ECTS attribués si la note de l'évaluation est de 4 au moins. It is validated and the 9 ECTS credits earned if the grade is at least 4.

#### Module Fundamentals of numerical modelling and data analysis

Course	Teacher in charge / Speaker(s)	Semester Modality	Evaluation	ECTS credits
<b>Fundamentals of numerical modelling and data analysis</b> <i>Les fondamentaux de la modélisation numérique et l'analyse de données</i>	<u>Y. Podladchikov</u>			6
Introduction to data analysis with MATLAB <i>(Introduction à l'analyse de données avec Matlab)</i>	G. Simpson	Fall 3d CE	Practical (Report)	1
MATLAB as a language of scientific computing <i>(Matlab comme langage de calcul scientifique)</i>	Y. Podladchikov	Fall 42h CE	Practical (Report)	3
Physics as a basis for modeling <i>(La physique comme base de modélisation)</i>	Y. Podladchikov	Fall 28h CE	Practical (Report)	2

The courses of this module are validated and the 9 ECTS credits earned in a block if the credit-weighted grade average is at least 4 and if the validations are obtained.

**Module Spatial analysis applied to geology and risk**

Course	Teacher in charge / Speaker(s)	Semester Modality	Evaluation	ECTS credits
<b>Spatial analysis applied to geology and risk</b> <i>Analyse spatiale appliquée à la géologie et au risque</i>	<u>M. Sartori</u>			6
Cartographic data management and landslide susceptibility assessment <i>(Structuration des données géologiques et analyses spatiales appliquées aux instabilités de versant)</i>	M. Sartori, C. Frischknecht	Spring 5d CE	Practical (Report)	3
Spatial risk assessment <i>(L'évaluation spatiale du risque)</i>	C. Frischknecht, P. Peduzzi, B. Chatenoux	Spring 5d CE	Practical (Report)	3

The courses of this module are validated and the 9 ECTS credits earned in a block if the credit-weighted grade average is at least 4 and if the validations are obtained.

**Module Geophysics across scales for geologists**

Course	Teacher in charge / Speaker(s)	Semester Modality	Evaluation	ECTS credits
<b>Geophysics across scales for geologists</b> <i>(Géophysique à différentes échelles pour géologues)</i>	<u>György Hetényi</u> , B. Quintal, M. Lupi, A. Moscariello	Fall 28h C PW	Written exam	3

The part A3 is validated if each of the four modules is validated.

**PART B3 : a choice of 24 ECTS credits**

The student must select four modules among those proposed in this part:

- Advanced petrology and volcanology
- Risk Management
- Volcanic and seismic risk
- Hazards and risks of slope movements
- Advanced risks
- Pratique de la géologie environnementale
- Practical seismic reflection
- Introduction to fluid flow for geologists

**Module Advanced petrology and volcanology**

Course	Teacher in charge / Speaker(s)	Semester Modality	Evaluation	ECTS credits
<b>Advanced petrology and volcanology</b> <i>Pétrologie et volcanologie avancée</i> <i>(Courses of this module cannot be taken separately)</i>	<u>L. Caricchi</u> , L. Pioli, C. Bonadonna, S. Pilet			6
Volcanic rocks ( <i>Roches volcaniques</i> )	L. Pioli, C. Bonadonna	Fall 28h C	Seminar	2
Volcano petrology ( <i>Pétrologie volcanique</i> )	L. Caricchi, S. Pilet	Printemps 28h C	Séminaire	2
Volcano fieldtrip ( <i>Excursion volcanique</i> )	L. Caricchi, C. Bonadonna, S. Pilet, L. Pioli	Printemps 5j T	Pratique (Rapport)	2

The courses of this module are validated and the 6 ECTS credits earned in a block if the credit-weighted grade average is at least 4 and if the validations are obtained.

**Module Risk Management**

Course	Teacher in charge / Speaker(s)	Semester Modality	Evaluation	ECTS credits
<b>Risk Management</b> <i>Gestion des risques</i>	<u>S. Menoni</u> , C. Gregg, F. Romerio and teachers of the CERG-C	Fall 84h C	Written exam	6
<i>In this module, courses are in English</i>				

**Module Volcanic and seismic risk**

Course	Teacher in charge / Speaker(s)	Semester Modality	Evaluation	ECTS credits
<b>Volcanic and seismic risk</b> <i>Risques volcaniques et sismiques</i>	<u>C. Bonadonna</u>			6
Volcanic risk ( <i>Risque volcanique</i> ) <i>Pré-requis : Module Risk Management</i>	<u>C. Bonadonna</u> et enseignants du CERG-C	Spring 6d C F	Written exam Practical (Report)	3
Seismic Risk ( <i>Risque sismique</i> )	<u>D. Fäh</u> , B. Duvernay	Spring 6d CE	Written exam	3
<i>In this module, courses are in English</i>				

The courses of this module are validated and the 6 ECTS credits earned in a block if the credit-weighted grade average is at least 4 and if the validations are obtained.

**Module Hazards and risks of slope movements**

Course	Teacher in charge / Speaker(s)	Semester Modality	Evaluation	ECTS credits
<b>Hazards and risks of slope movements</b> <i>Dangers et risques de mouvements de versants</i>	<u>M. Jaboyedoff</u>			6
Erosion and slope movements ( <i>Erosion et mouvements de versants</i> )	M. Jaboyedoff	Spring 56h CE	Written exam	4
Hazards and risks of slope mass movements: field camp I ( <i>Risques et dangers liés aux mouvements de versants: terrain I</i> )	MH Derron, M. Jaboyedoff	Spring 5d T	Practical (Report)	2
<i>Prerequisite: Natural risks and hazards (BSc) – Numerical modelling (BSc) or equivalent</i>				

The courses of this module are validated and the 6 ECTS credits earned in a block if the credit-weighted grade average is at least 4 and if the validations are obtained. 3 supplementary credits can be obtained in the student's elective part by taking the course «Hazards and risks of slope mass movements: field camp II ».

**Module Advanced risks**

Course	Teacher in charge / Speaker(s)	Semester Modality	Evaluation	ECTS credits
<b>Advanced risks</b> <i>(Risques avancés)</i>	<u>M. Jaboyedoff</u>			6
Advanced quantitative risk and vulnerability <i>(Risques avancés quantitatifs et la vulnérabilité)</i>	M. Jaboyedoff	Fall 28h C 14h E	Written exam Continuous assessment	3
Communication on environmental risks <i>(Communication sur les risques environnementaux)</i>	M. Jaboyedoff, K. Südmeier-Rieux, S. Rondic	Fall 16h C 16h E	Practical (Report)	3
<i>Prerequisite: Environmental hazards (BSc) or equivalent</i>				

The courses of this module are validated and the 6 ECTS credits earned in a block if the credit-weighted grade average is at least 4 and if the validations are obtained.

**Module Pratique de la géologie environnementale**

Course	Teacher in charge / Speaker(s)	Semester Modality	Evaluation	ECTS credits
<b>Pratique de la géologie environnementale (in French)</b>	<u>S. Girardclos</u>			6
Sites contaminés: application géologique et environnementale	S. Girardclos, J. Poté	Spring 5d C PW	Practical	3
Gestion, traitement et entreposage des déchets ( <i>Management, processing and storage of waste</i> )	J. Poté, S. Girardclos, M. Patel, G. Giuliani	Spring 5d C PW	Practical	3

The courses of this module are validated and the 6 ECTS credits earned in a block if the credit-weighted grade average is at least 4 and if the validations are obtained.

**Module Practical seismic reflection**

Course	Teacher in charge / Speaker(s)	Semester Modality	Evaluation	ECTS credits
<b>Practical seismic reflection</b> <i>Sismique réflexion - pratique</i> ( <i>Courses of this module cannot be taken separately</i> )	<u>A. Moscariello</u> , D. Ariztegui			6
2D and 3D interpretation (Petrel and Kingdom) ( <i>Interprétation 2D et 3D - Petrel et Kingdom</i> )	A. Moscariello	Fall 28h C PW	Practical	3
Marine seismic acquisition, interpretation and data integration ( <i>Acquisition, interprétation et intégration de données sismiques marines</i> )	D. Ariztegui	Spring 8d F	Practical	3

The courses of this module are validated and the 6 ECTS credits earned in a block if the credit-weighted grade average is at least 4 and if the validations are obtained.

**Module Introduction to fluid flow for geologists**

Course	Teacher in charge / Speaker(s)	Semester Modality	Evaluation	ECTS credits
<b>Introduction to fluid flow for geologists</b> <i>Introduction pour géologue aux écoulements des fluides</i>	<u>M. Lupi</u> , L. Pioli	Spring 5d C 5d F	Practical	6

### PART C3 : 12 student's elective ECTS credits

The student completes his curriculum by selecting courses among those proposed in the Master in Earth Sciences or in other Master's programs (for example: Master in Environmental science, UNIGE; Master in Environmental geosciences, UNIL; Master in biogeosciences, UNIL/UNINE).

The list of courses can contain courses of the Bachelor-level, for a maximum of 5 ECTS credits.

An internship in an enterprise can be validated in this part, as provided by the rules and regulations (art. 15, al. 6).

The student must draw up a list of courses selected in agreement with his Master's thesis supervisor. Here are some suggestions of additional courses that don't appear in the other parts of the study plan:

Course	Teacher	Semester Modality	Evaluation	ECTS credits
Biom mineralization ( <i>Biominéralisation</i> )	A. Meibom	Fall 42h C TP	Report Oral presentation	4
Hazards and risks of slope mass movements: field camp II ( <i>part I of the field of the module «Hazards and risks of slope movements» mandatory</i> )	M. H. Derron, M. Jaboyedoff	Spring 5d F	Practical (report)	3
Internship in a company (validated by the Master's thesis supervisor)				6
Modules or courses of the curriculum of the Master in Earth Sciences*				
Courses proposed by the MUSE (UNIGE), Environment MSc (UNIL), Biogeosciences MSc (UNIL-UNINE)*				
Courses proposed by another academic institution*				
Courses of the Bachelor-level*			5 ECTS credits, at most	
<b>Total of the credits to validate</b>				<b>12 ECTS credits</b>

\*: for these courses, the evaluation and the number of attributed ECTS credits are those contained in the curriculum from which they are taken.

In the part C3, courses are individually validated if their grade is equal of at least 4.0/6 or if the validation is obtained.