

ENV-445

Geomonitoring

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Cursus	Sem.	Type
Energy Management and Sustainability	MA1, MA3	Opt.
Environmental Sciences and Engineering	MA1, MA3	Opt.
Mineur STAS Russie	H	Opt.

Language of teaching	English
Credits	5
Session	Winter
Semester	Fall
Exam	Oral
Workload	150h
Weeks	14
Hours	4 weekly
Courses	2 weekly
Exercises	2 weekly
Number of positions	

Summary

The students learn several techniques for spatial measurements, such as geodesy, aerial photogrammetry and laser scanning. They will be able to collaborate with geologists and civil engineers to master natural risks (landslides, avalanches) and to maintain infrastructures.

Content**Surveying techniques**

- geodetic networks
- analogical and numerical aerial imagery
- photogrammetry
- terrestrial and airborne laserscanning
- GNSS phase measurement
- interferometry / InSAR

Coordinate systems and frames

- internal and external orientation
- classical aerotriangulation = indirect georeferencing
- with GPS, GPS+IMU = direct georeferencing
- orthophoto without aerotriangulation

Data quality

- geometrical and qualitative image analysis
- quality indicators for the positions

Specific applications

- mapping with a drone, Pix4D software package
- data for agriculture and forestry
- constructions: roads, bridges, dams
- combined monitoring methods

Keywords

Natural hazard, terrain movement, stability of constructions

Learning Prerequisites**Recommended courses**

Statistics, Photo interpretation, Quantitative methods, Geodetic Engineering, Satellite positioning

Important concepts to start the course

Matlab programming, 3D data, least squares

Learning Outcomes

By the end of the course, the student must be able to:

- Describe various methods for spatial measurement of the environment
- Detect terrain movements within a project
- Design a monitoring scheme for natural hazards
- Design a monitoring scheme for natural hazards and construction sites

Transversal skills

- Summarize an article or a technical report.
- Make an oral presentation.
- Use both general and domain specific IT resources and tools
- Set objectives and design an action plan to reach those objectives.

Teaching methods

Lectures *ex cathedra* and exercises, partly in computer room.

Expected student activities

- Regular attendance at lectures
- Active participation in small groups for exercises

Assessment methods

50% continuous control during the semester (exercises and projects)
50% oral exam (20 min) during the exam session

Supervision

Office hours No

Resources

Bibliography

Chris McGlone (Editor-in-Chief) "Manual of photogrammetry", Amer. Soc. Phot. Rem. Sens.
Michel Kasser & Yves Egels "Photogrammétrie numérique", Collection ENSG – IGN (2001)
Karl Kraus "Photogrammetry: Geometry from Images and Laser Scans", de Gruyter (2007)
Articles divers, notes de cours, mode d'emploi des logiciels

Ressources en bibliothèque

- [Manual of photogrammetry /](#)
- [Cours de photogrammétrie / Kölbl](#)
- [Manuel de photogrammétrie / Kraus](#)

Notes/Handbook

- Méthodes d'estimation - Bertrand Merminod - dès 2012
- Localisation par satellites - Pierre-Yves Gilliéron - dès 2011

Prerequisite for

Advanced Satellite Positioning, Sensor Orientation

