Hydrological Risk

Master of Science in Civil Engineering for Risk Mitigation from Natural Hazards (HYRIS)
PhD in Understandig and Managing the Extremes (UME)
PhD in Sustainable Development and Climate change (SDC)
a.y. 2022-2023 - from the 5th to the 27th of October 2022

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IUSS Pavia Marelli - 2nd floor - ROOM 1
https://goo.gl/maps/HC1HTybd78Fapmsw8

zoom link https://iusspavia.zoom.us/j/82261419034

OBJECTIVES
The objective of the course is to introduce students to the main hydrological hazards (fluvial flood, flash flood, excess of rainfall and drought) and the consequent risks. The course aims at providing to the students an overview of the main approaches to assess the hydrological risk and of the main modelling techniques to quantify it.

DESCRIPTION
1. Introduction to hydrology and flood risk, 2. The main processes of the hydrological cycle, 3. Modelling approaches to compute the discharge in a river, 4. Definition of flood, 5. Statistical methods to describe the extreme events, 6. The Intense-Duration-Frequency curve, 7. The Flood Frequency Curve, 8. Anatomy of a Flood Risk Model, 9. Models for hazard estimation, 10. 1D and 2D hydraulic models, 11. Simplified geomorphological models, 12. The role of the hydraulic defenses, 13. Models for the vulnerability estimation, 14. Models for the exposure, 15. Generation of flood events, 16. Flood risk analysis, 17 Definition of drought, 18. Main modelling approach to assess the drought risk.
During the course there will be presentations on specific applications: the estimation of the defence failure effects, the downscaling of the exposure model, the computation of building damages due to flood, models for drought estimation over large areas, simple tools for the estimation of the extreme events distribution.

REQUIREMENTS
Basic knowledge of Hydrology and Probability and Statistics.

REFERENCES

Eslamian, Saeid. Handbook of Engineering Hydrology, Boca Raton, FL: CRC Press Taylor & Francis Group, 2014
Yacov Haimes, Risk Modelling, Assessment and Management, Wiley, 2016
Zakai Sen, D. Chase, D. Savic, W. Grayman, S. Beckwith, and E. Koelle (2003). Apply Drought Modelling, Prediction and Mitigation. Elsevier, 2015
Kirsten Mitchell-Wallace, Matthew Jones, John Hillier, Matthew Foote, Natural Catastrophe Risk Management and Modelling: A Practitioner's Guide, Wiley, 2017
J.C. Gaillard, Natural Hazards and Disasters, Wiley, 2017

ASSESSMENT
Assignments will be handed over and graded during the course. The final examination will consist of a presentation of a study case. Students will be admitted to the final exam based on a satisfactory performance in the assignment.

TIME SCHEDULE

Modules:
General Theory
Flood Applications
Drought Applications
Modelling and Visualising
Project work

		Tue 4	Wed 5	Thu 6
Week 3-7 Oct	09:00-11:00			Risk Theory 2
	11:00-13:00		Course introduction	Hazard Component 1
	15:00-17:00		Risk Theory 1	Systemic Risk 1
		Tue 11	Wed 12	Thu 13
Week 10-14	09:00-11:00			Risk Analysis 1
	11:00-13:00	GIS & Mapping 1	Hazard Component 2	Risk Analysis 2
	15:00-17:00	Drought 1	Vulnerability	Systemic Risk 2
		Tue 18	Wed 19	Thu 20
Week 17-21	09:00-11:00			Project definition
	11:00-13:00	GIS & Mapping 2	Flood Application 2	Climate Risk
	15:00-17:00	Drought 2	Risk Analysis 3	Systemic Risk 2
		Tue 25	Wed 26	Thu 27
Week 24-28	09:00-11:00			Project
	11:00-13:00	GIS & Mapping 3	Putting the pieces back together	Project
	15:00-17:00	Drough application 1	Drough application 2	Project