



UNIVERSITÀ
DEGLI STUDI DI MILANO-BICOCCA

COURSE SYLLABUS

Geo-Hydrological Risk

2223-1-F7401Q109

Module description

General introduction to the hydrosphere and fluids

- Water on Earth; oceans, glaciers, rivers, lakes; groundwater and atmosphere
- Rivers and canals: basic principles, canal types, erosion, transport and sedimentation
- River dynamics and hydraulics. Chezy equation, Manning equation and other speed-slope relationships
- Sedimentary transport (*)

Statics and dynamics of fluids: basics

- Introduction to fluid dynamics
- Equation of conservation of momentum applied to fluids; Navier-Stokes and continuity equations (*)
- Newtonian and non-Newtonian fluids
- Rheology
- Applications to natural hazards

Introduction to landslides and their dynamics

- Types of landslides and mass movements (outline)
- Notes on slope stability; triggering factors (*)
- Introduction to granular materials
- Equations of motion: from sliding rigid bodies to granular materials
- Introduction to rock avalanches
- Case studies on rock avalanches

The debris flows

- Hyper-concentrated flows
- Rheology of debris flows
- Dynamics of debris flows
- Examples and case studies
- Special cases: lahar, GLOF, quick clay
- Numerical modeling of castings (*)

- Case studies on debris flows

Other hydrogeological risks related to closed basins and rivers

- Flooding
- Breaking of large dams
- Physical modeling of catastrophic waves in hydrological basins; de-Saint Venant equation (*)
- Landslides in large hydroelectric basins and lakes
- Study cases

Other hydrogeological risks related to seas and oceans

- Coastal dangers (*)
- Submarine landslides: generation and propagation
- Tsunami: generation, risk
- Physics of tsunamis; waves in shallow water; dispersion relations; diffraction and propagation of tsunami waves, run-up on land
- Study cases

Risks related to snow and ice (*)

- Introduction to snow and ice
- Glaciers: flow, dynamics, balance
- Snow avalanches: types, description, and formation
- Dynamics of snow avalanches
- Ice avalanches; collapsing glacial fronts; seracs; hanging glaciers
- Ice-climate relationship in glaciers
- Study cases

Epilogue

- Defense strategies (notes)
- Extreme catastrophes in the history of the Earth and of humanity also in relation to the climate ()
- *Extreme global events in the future ()*

Learning goals

Elements of hydrogeological risks,
with some quantitative insights into the risks caused by water
on continents and in the oceans

General goal

Specific skills and competences

Sustainable Development Goals of the 2030 UN Agenda

Breakdown of meetings

2 hours-meetings

Number of participants

3

Language used in meetings

Italian and English

Delivery period of the module

Second Semester

Methods of assessing the outcomes of the learning process

Modalità esame

- Esame scritto intermedio

Esame basato su esercizi e esposizione scritta e eventualmente colloquio

Department of affiliation of the teacher

DISAT

Sustainable Development Goals

QUALITY EDUCATION
