UNIVERSITÀ
DEGLI STUDI DI MILANO-BICOCCA

# SYLLABUS DEL CORSO

## 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