RiskChanges

An Open-source Platform for Multi-hazard Risk Assessment

Manzul K. Hazarika, Ph.D.

Director, Geoinformatics Center, AIT

manzul@ait.asia

GIC Geoinformatics Center

Partnership for the Development of RiskChanges

The Asian Institute of Technology (AIT) is an international postgraduate institution, focusing on engineering, environment, and management studies.

- AIT ranks 19th in World in SDG-1 (No Poverty)
- 30 academic programs
- 22,789 alumni from 101 countries

ITC
UNIVERSITY OF TWENTE.

To develop capacity, particularly in less developed countries, and to utilize geospatial solutions to deal with national and global problems.

- Large alumni network
- M.Sc., Ph.D., online
- Development related

Common aspects:

- Large alumni network
- Alumni in leading positions
- Capacity development
- Joint projects

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WORLD BANK GROUP ACP-EU Natural Disaster Risk Reduction Program GFDRR

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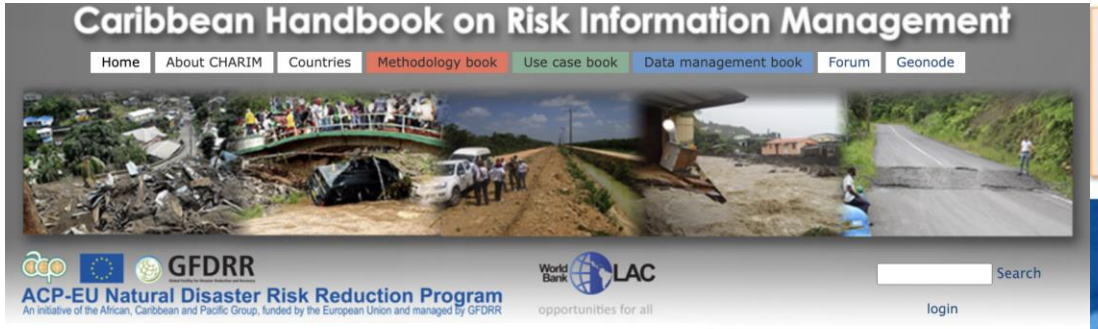
Collaborative Projects AIT & ITC on Risk Assessment

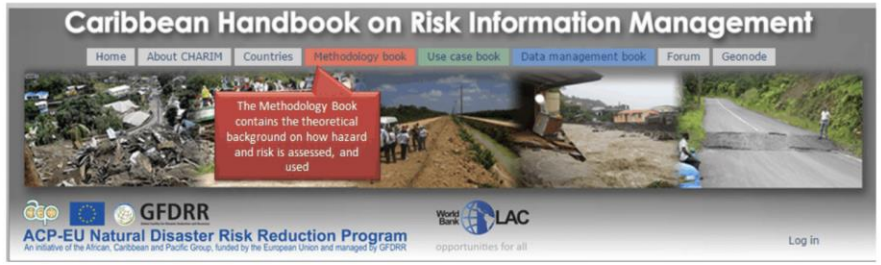
(1) Caribbean Handbook on Risk Info. Management – **Regional** (WB)
(2) Multi-hazard Risk Assessment in Tajikistan – **National** (UNDP)
(3) Developing Risk Sensitive Land Use Plan (RSLUP) – **Local** (USAID)

Caribbean Handbook on Risk Info. Management (Regional-level)



Caribbean Handbook on Risk Management

The aim of this on-line handbook is to support the generation and application of landslide and flood hazard and risk information to inform projects and program of planning and infrastructure sectors, specifically targeted to small countries in the Caribbean region. The methodology centers around a series of use cases, which are practical examples.

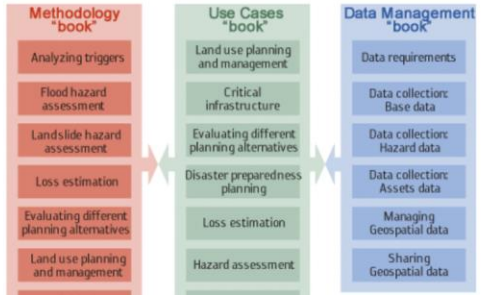


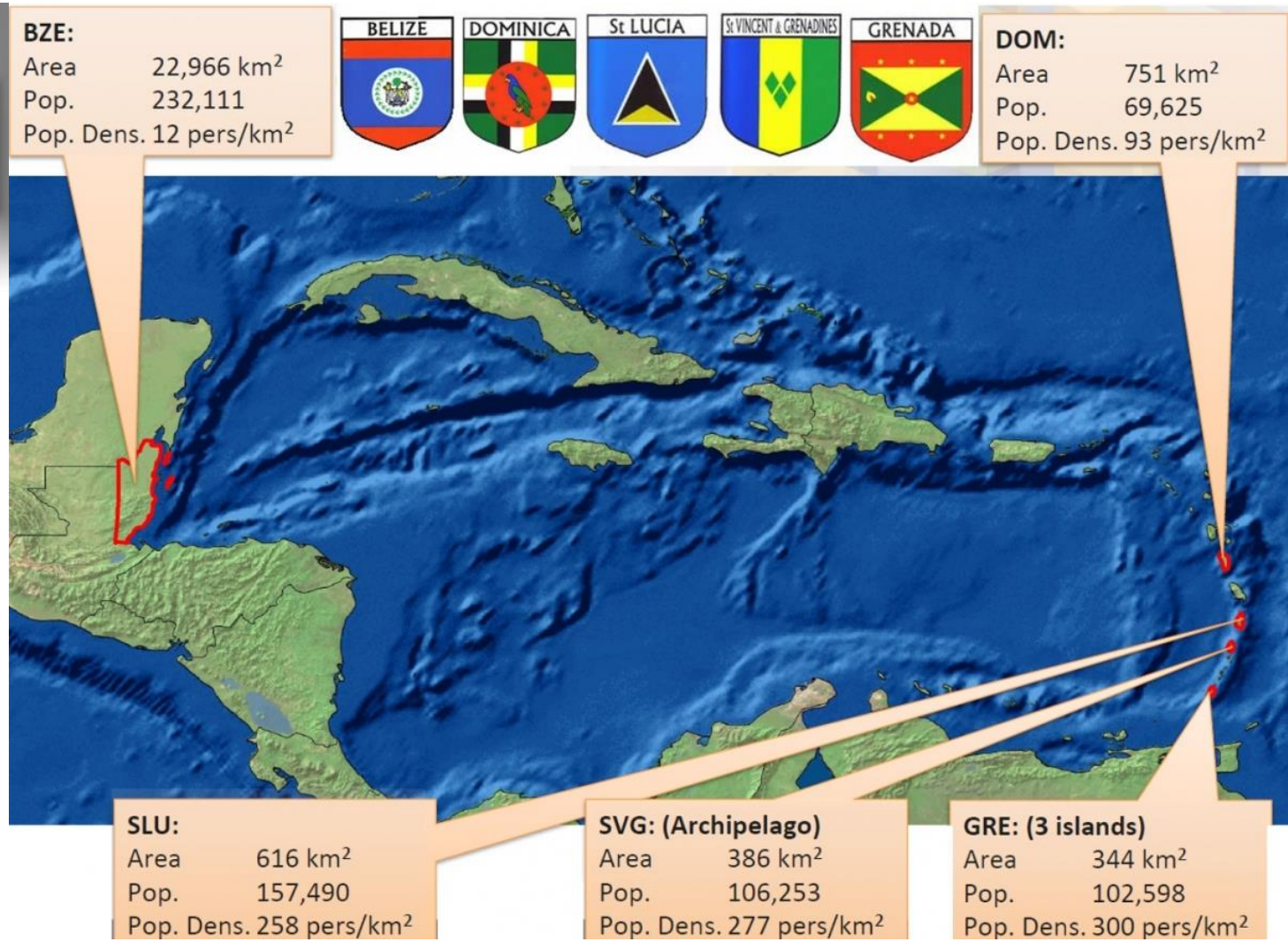
The handbook is made of 3 interlinked components:

Use case book, which illustrates the steps required to use the hazard and risk information in so-called use cases (example) for planning of infrastructure, planning of risk reduction measures, emergency preparedness and emergency response. A number of these examples consist of actual step-by-step exercises which also contain data, and which use an Open source GIS software.

Methodology book, which focuses on the methods for generating landslide and flood hazard and risk information for different scales (nationwide, and for detailed areas) and taking into account different situations of data availability.

Data management book, which indicates the aspects related to use collection, management and sharing of spatial data related to





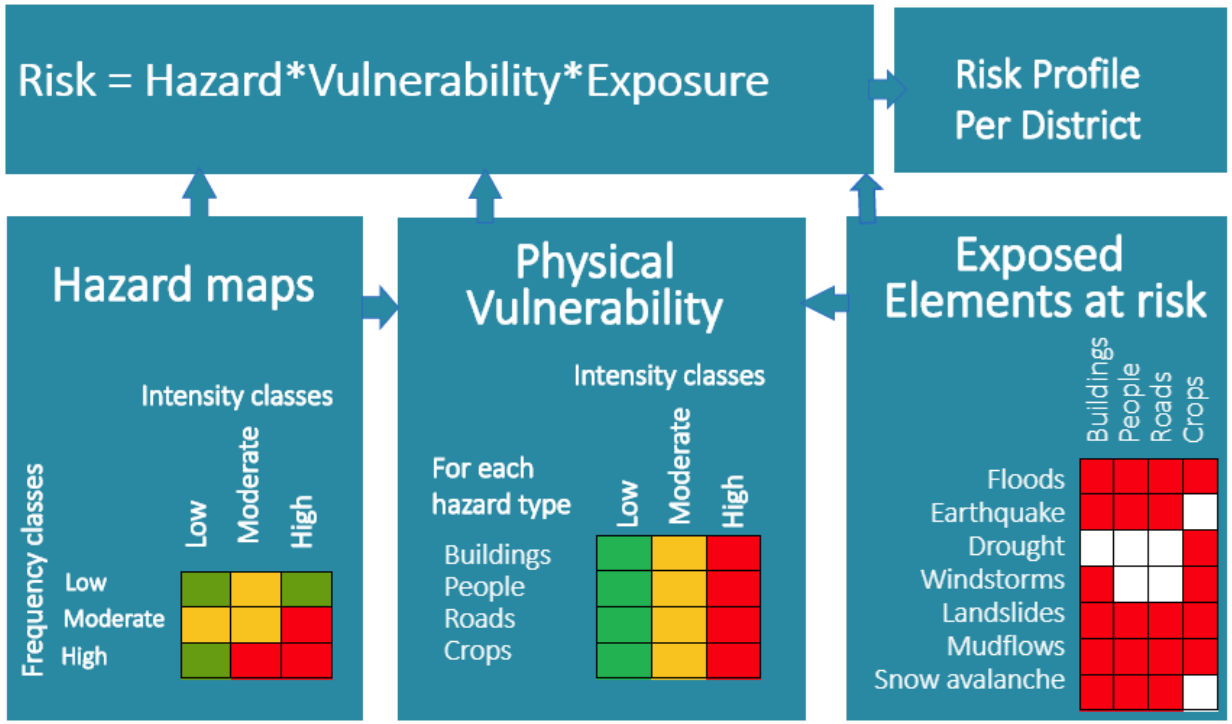
Multi-Hazard Risk in Tajikistan (National-level)

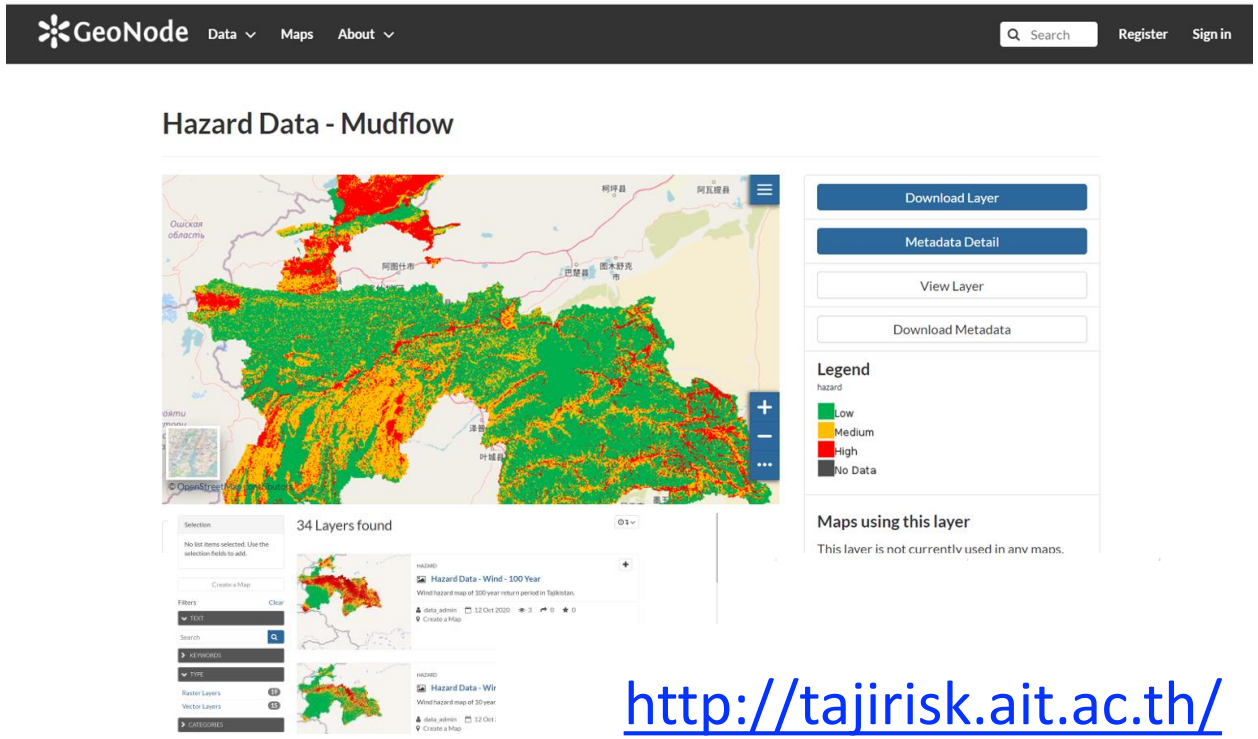
Limitations

- Data poor region / lack of data sharing
- No intensity maps for all hazards
- Limited historical hazard data

Accomplishments

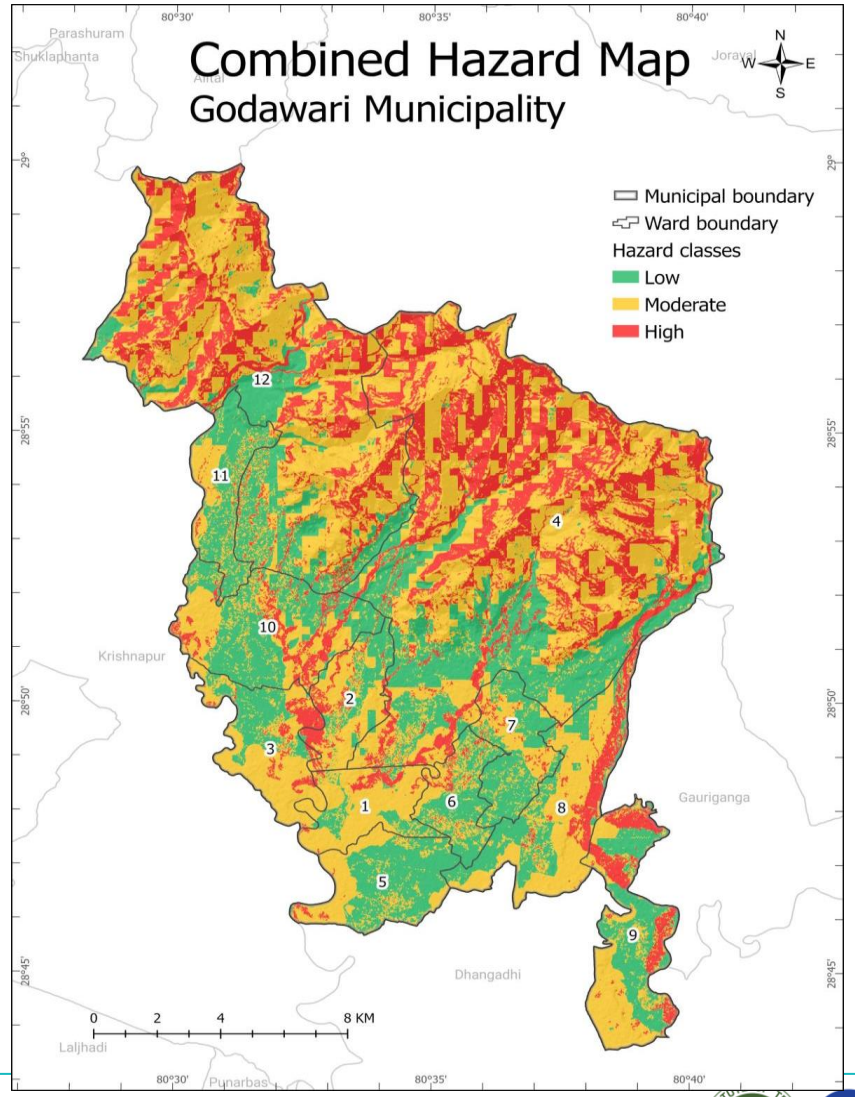
- Established the GeoNode to input / output data
- Hazard susceptibility maps
- Density of phenomena per return period





http://tajirisk.ait.ac.th/

Developing Risk Sensitive Land Use Plan – Local Level (Municipality)



AVERAGE ANNUAL LOSSES FOR THE VARIOUS HAZARDS AND ELEMENTS-AT-RISK COMBINATIONS FOR WARDS IN GODAWARI MUNICIPALITY

HAZARD	FLOOD				LANDSLIDE				EARTHQUAKE			WIND	
Ward	**Number of buildings damaged**	**Number of people killed/injure**	**Crops damaged (hectares)**	**Roads damaged (km)**	**Number of buildings damaged**	**Number of people killed/injure**	**Crops damaged (hectares)**	**Roads damaged (km)**	**Number of buildings damaged**	**Number of people killed/injure**	**Roads damaged (km)**	**Number of buildings damaged**	**Crops damaged (hectares)**
W1	8	0	2	0	0	0	0	0	6	2	0.03	10	5
W2	5	0	2	0	0	0	0	0	5	2	0.03	6	4
W3	8	1	2	0	0	0	0	0	5	3	0.02	10	4
W4	12	1	5	0	1	0	0	0	6	4	0.05	17	16
W5	3	0	4	0	0	0	0	0	3	2	0.03	6	12
W6	7	1	4	0	0	0	0	0	3	3	0.01	9	8
W7	5	1	3	0	0	0	0	0	3	3	0.02	8	7
W8	6	1	3	0	0	0	0	0	3	3	0.02	12	11
W9	13	1	5	0	0	0	0	0	4	3	0.03	15	11
W10	8	1	4	0	0	0	0	0	4	3	0.02	12	9
W11	6	1	4	0	0	0	0	0	3	3	0.02	7	7
W12	6	1	3	0	0	0	0	0	3	3	0.02	7	6
Total	**87**	**9**	**41**	**0**	**1**	**0**	**0**	**0**	**47**	**33**	**0.30**	**119**	**100**

Motivation for Developing RiskChanges

- Non-availability of multi-hazard risk assessment tools at local level
- Often too complex
- Too data intensive
- Some are country or region specific
- Some of them require to link with external software and/or data
- No multi-hazard interactions and don't provide loss and risk information
- Do not include risk reduction alternatives
- Do not include future scenarios

Examples:

InaSAFE

RiskScape

OPENQUAKE
calculate share explore

CAPRA
Probabilistic Risk Assessment Platform

Motivation for Developing RiskChanges

- Open-source
- Web-based and data processing in cloud
- Generic (for hazards, Elements-at-risk, scale)
- Based on multi-hazard concept
- Loss estimation (physical & population)
- Risk assessment (by spatial/admin units)
- Analyze current and future risk
- Analyze risk reduction alternatives

- Designed for users with limited expertise in modeling
- Flexible in terms of data requirement
- Integrate expert opinion when data is not sufficient
- Perform cost-benefit analysis
- Availability of multi-criteria evaluation

What is it about?

In order to understand more about the tool and the various components, the best is to follow the tutorial video below, which will explain the basics of the systems and the various components. Throughout the system there will be similar videos that explain how the individual components work.

Watch video tutorial

RiskChanges

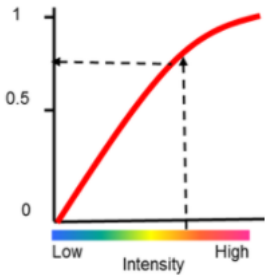
An open-source Spatial Decision Support tool for the analysis of Dynamic Multi-Hazard risk: Visualize and compare your results in different ways

You need to log in

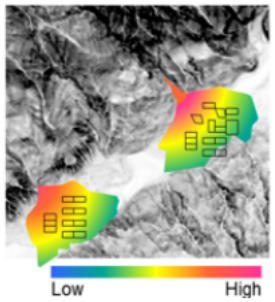
The tool allows you to do the risk calculation in the cloud, and you can store your own data (up to a maximum of 1 GB) for free. You can create a project and collaborate with other colleagues on the project. For this you need to have your own user account. You can be an administrator (create and your own projects) or normal user.

Watch video tutorial

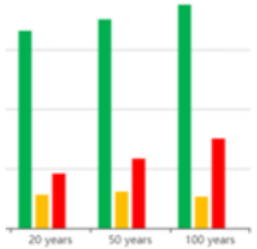
Data Management
Upload your own data hazard data, asset data and administrative units, using shapefiles or GeoTiffs. Or link to web-databases



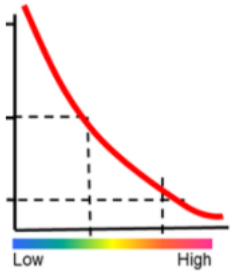
Vulnerability Curves
Upload or create your own curves, or use existing ones from a database for different hazard types



Exposure Analysis
Calculate the hazard intensity for individual asset components. Can be used as basic risk maps if no other data is available



Loss analysis
Calculate losses by integrating exposure and vulnerability for specific combinations of hazards and assets. For individual units, or aggregated in administrative units



Risk Analysis
Calculate single or multi-hazard risk. Define hazard interactions. Using risk curves

Visualization
Visualise single or multiple input maps, exposure and risk maps

RiskChanges

RiskChanges | About | Contact | Documentation | Discussion | Login

Many Tasks, One System

Major Features of the RiskChanges SDSS are:

Multi-Hazard

Analyze the risk for multiple natural and man made hazards and their interactions

Multiple Assets

Analyze the risk for multiple asset types with varying spatial characteristics

Vulnerability Database

Access a database of physical vulnerability curves and share your own ones

Multi User

Different users provide input data to the same project

Compare Risk

Compare current risk with future scenarios and planning alternatives

Spatial Analysis

Spatially analyze risk using a web-based map interface

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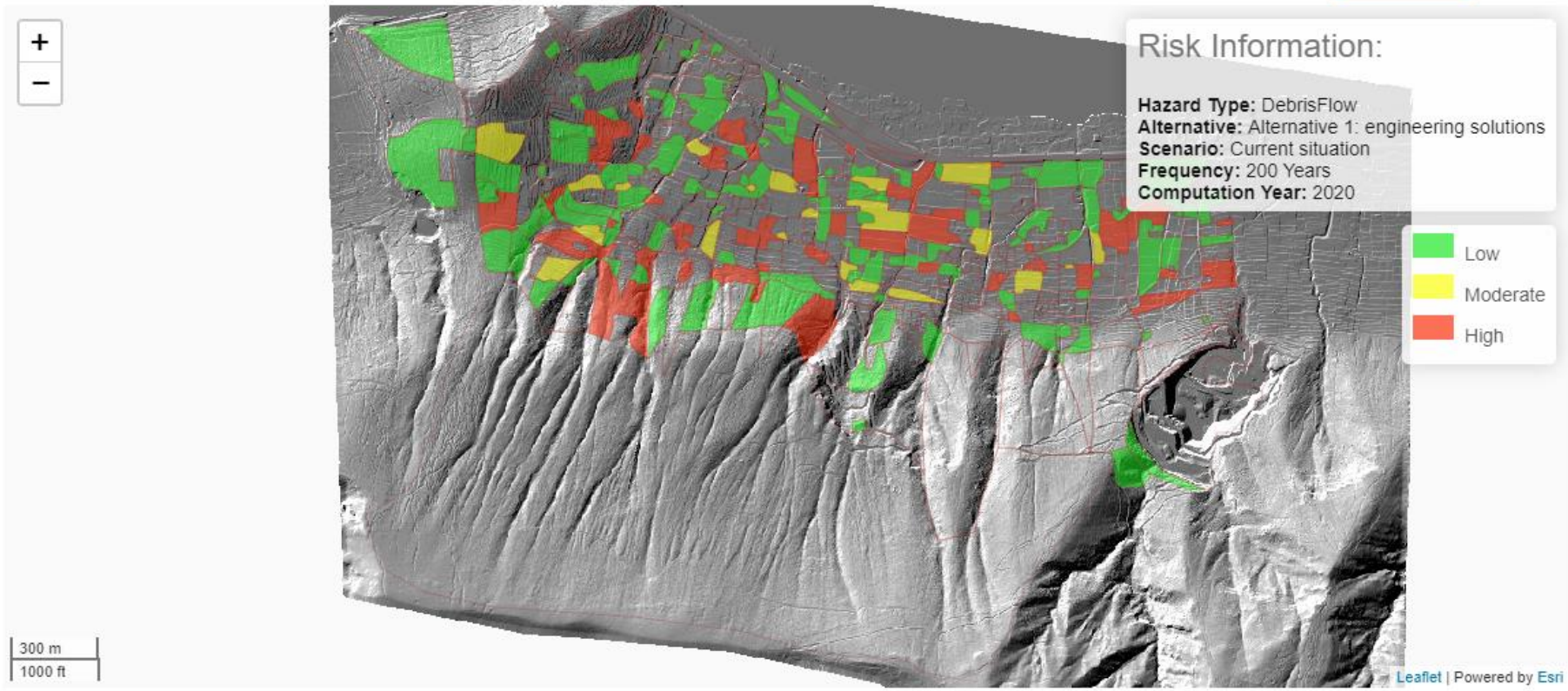
Try RiskChanges

This small application, for a hypothetical study area, allows you to view the results of loss estimations for three types of hazards (floods, debris flows and landslides), four frequencies (20 to 200 years Return Period), and for different scenarios (related to climate change and land use change) and risk reduction alternatives. Make your own selection and see how the risk pattern changes.

DebrisFlow | 200 Years | Current situation | Alternative 1: engineering solutions | Load Data



Hazard Maps

Debrisflow (DF) hazard

Impact pressure (IP)

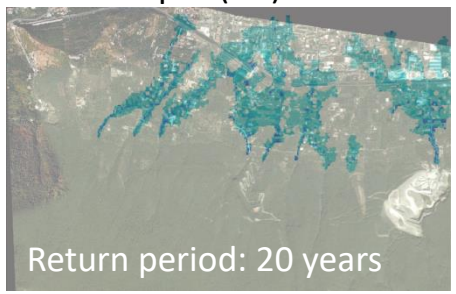
DF_IP_20_A0

DF_IP_50_A0

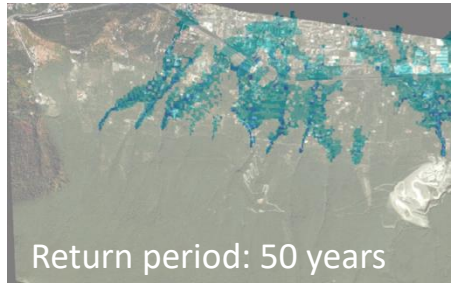
DF_IP_100_A0

Flashflood (FL) hazard

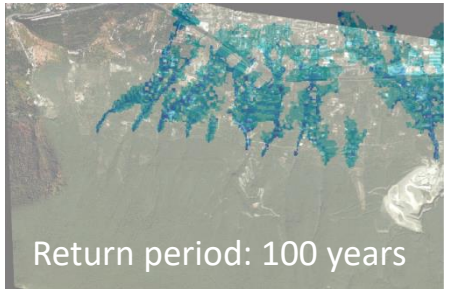
Water depth (DE)



FL_DE_20_A0



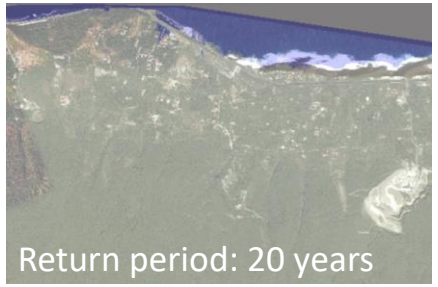
FL_DE_50_A0



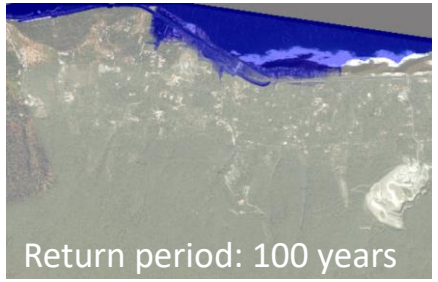
FL_DE_100_A0

Tsunami (TS) hazard

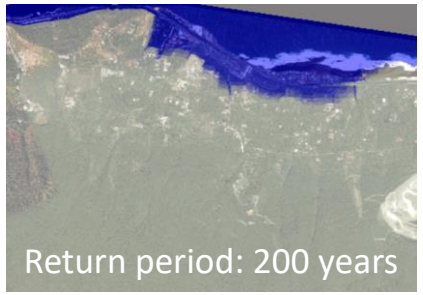
Water Depth (DE)



TS_DE_20_A0



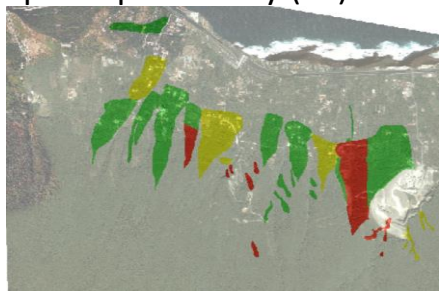
TS_DE_100_A0



TS_DE_200_A0

Landslide (LS) Susceptibility

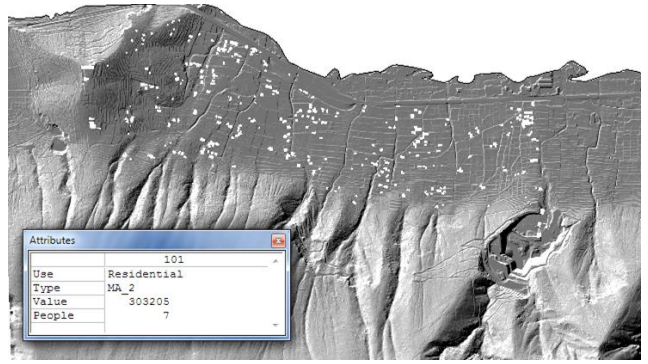
Spatial probability (SP)

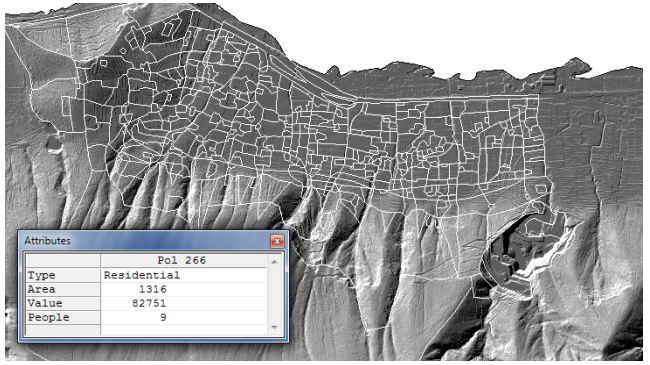


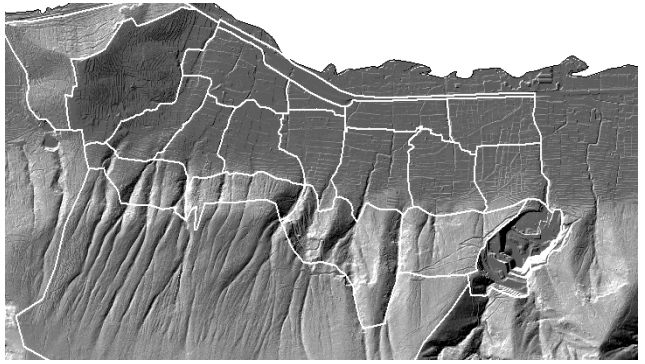
Return Period	Susceptibility	Density
20	Low	
	Moderate	
	High	
50	Low	
	Moderate	
	High	
100	Low	
	Moderate	
	High	

Which Elements-at-risk

- **Point data**
  - Specific objects (essential facilities, cultural heritage, high potential loss facilities)
- **Line data**
  - Transportation networks, electricity, communication, water, gas, oil
- **Building footprints**
  - Most standard approach
- **Land parcels**
  - Land cover, agriculture, forest, for future projections
- **Raster grids**
  - Population density over large areas.

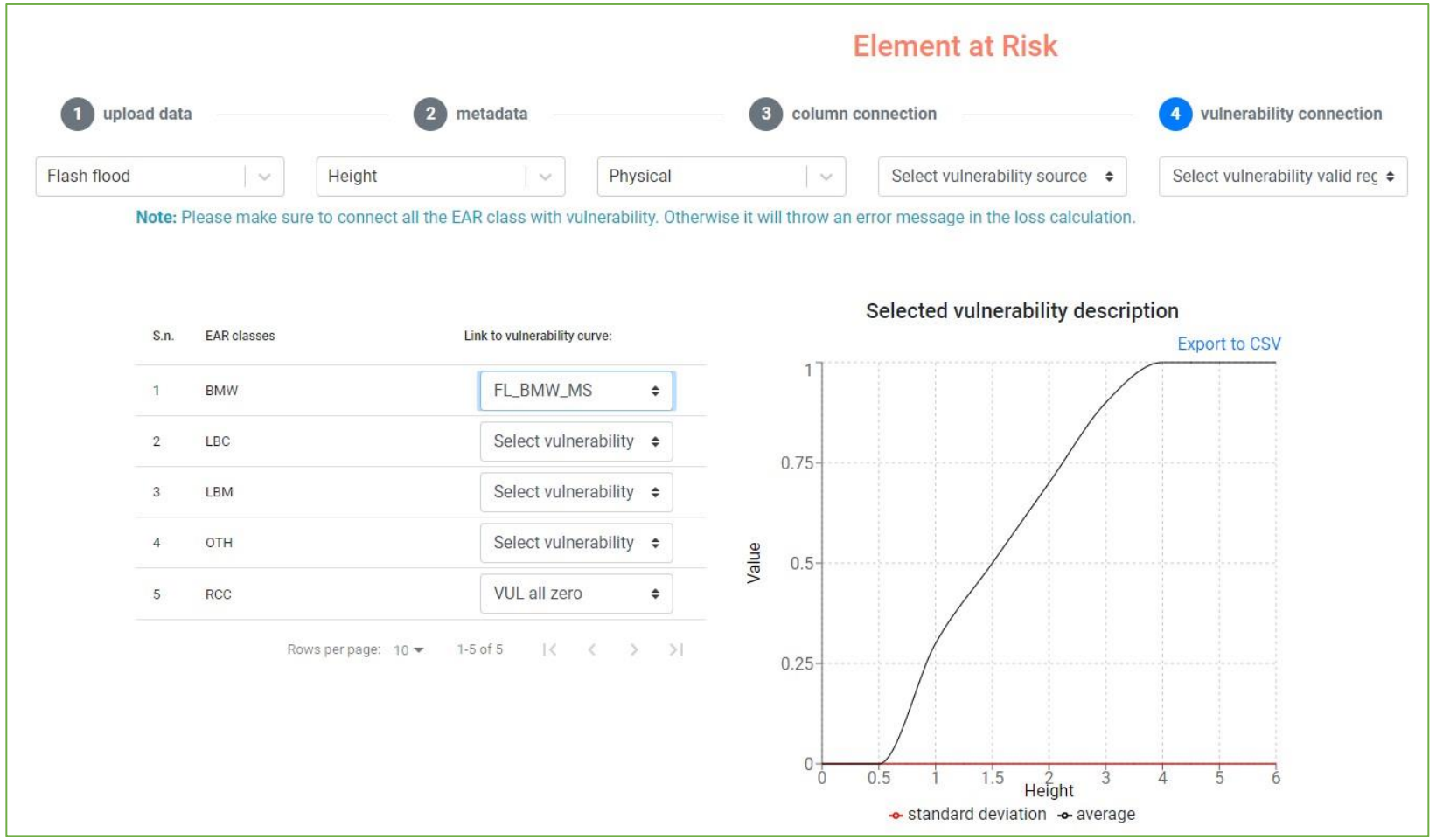




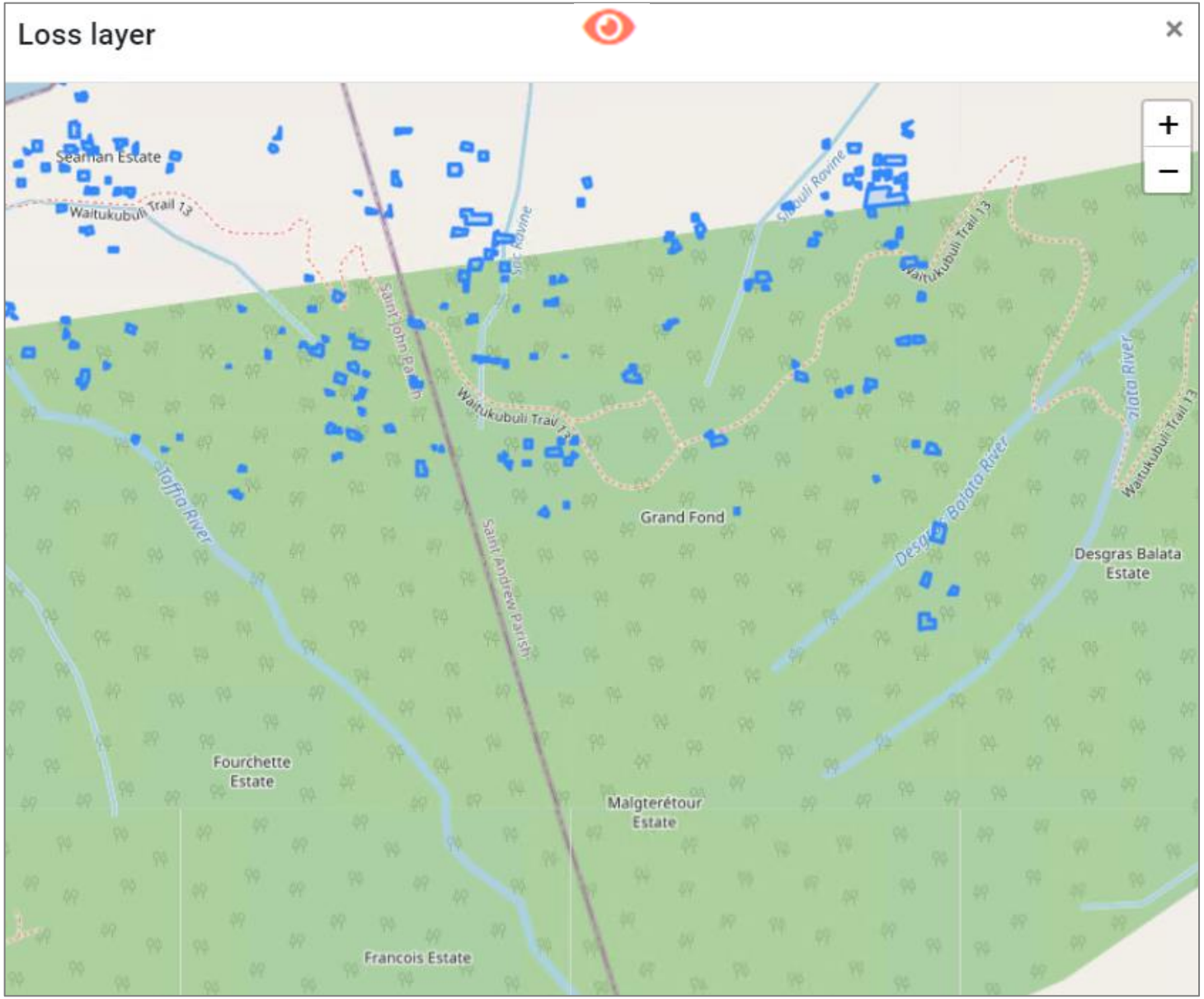


Vulnerability Curve Database

- Vulnerability types:
  - Physical
  - Population
- Use existing curves
- Upload new curves



Modelling Module: Loss



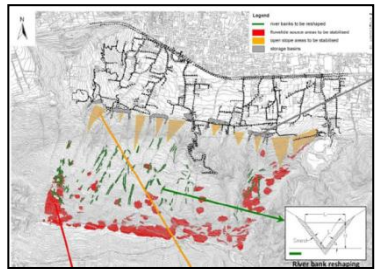
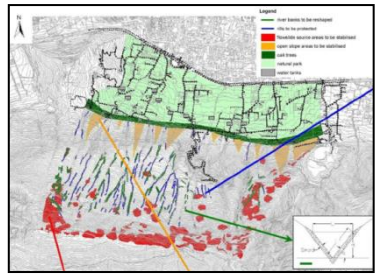
Loss value

S.n.	geom id	loss id	Total loss
1	0	59	0
2	1	59	0
3	2	59	0
4	3	59	75225
5	4	59	96370
6	5	59	0
7	6	59	0
8	7	59	0
9	8	59	0
10	9	59	0

Rows per page: 10 1-10 of 333

Close

Alternatives for risk reduction

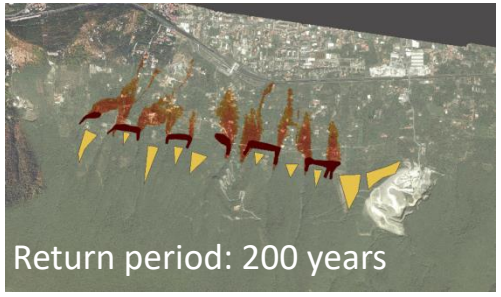
	Items related to construction cost	Hazard changes	Elements-at-risk changes	
Alternative 1: Engineering solutions	•Storage basins •Slope stabilization •Expropriation of land and existing buildings where construction will take place	Yes	No	
Alternative 2: Ecological solutions	•Expropriation of land and existing buildings where construction will take place •Slope stabilization •Water tank construction	Yes	Partly	

Hazard maps for alternative 1: Engineering

Debrisflow (DF) hazard
Impact pressure (IP)

DF_IP_20_A0

DF_IP_50_A0



DF_IP_100_A0

Flashflood (FL) hazard
Water depth (DE)

FL_DE_20_A0

FL_DE_50_A0

FL_DE_100_A0

Landslide (LS) hazard
Spatial probability (SP)

LS_SP_20_A0

LS_SP_50_A0

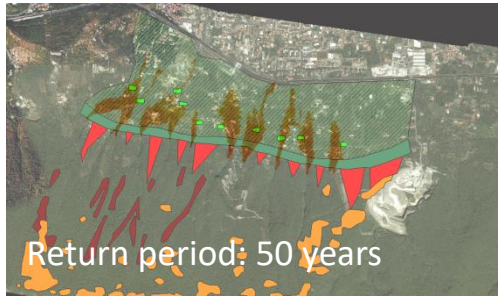
LS_SP_100_A0

Hazard maps for alternative 2: Ecological

Debrisflow (DF) hazard

Impact pressure (IP)

DF_IP_20_A0



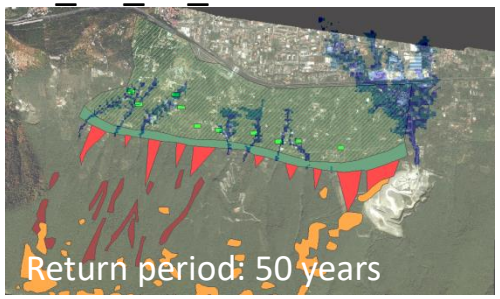
DF_IP_50_A0

DF_IP_100_A0

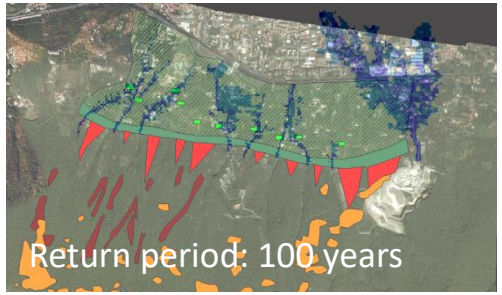
Flashflood (FL) hazard

Water depth (DE)

FL_DE_20_A0



FL_DE_50_A0

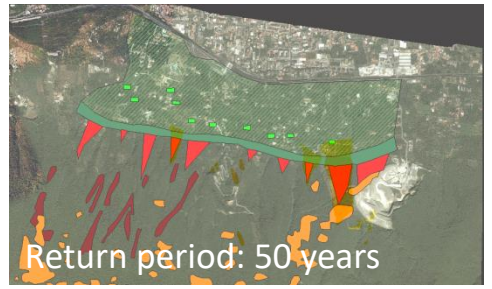


FL_DE_100_A0

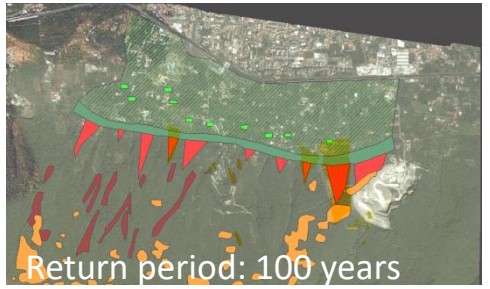
Landslide (LS) hazard

Spatial probability (SP)

LS_SP_20_A0

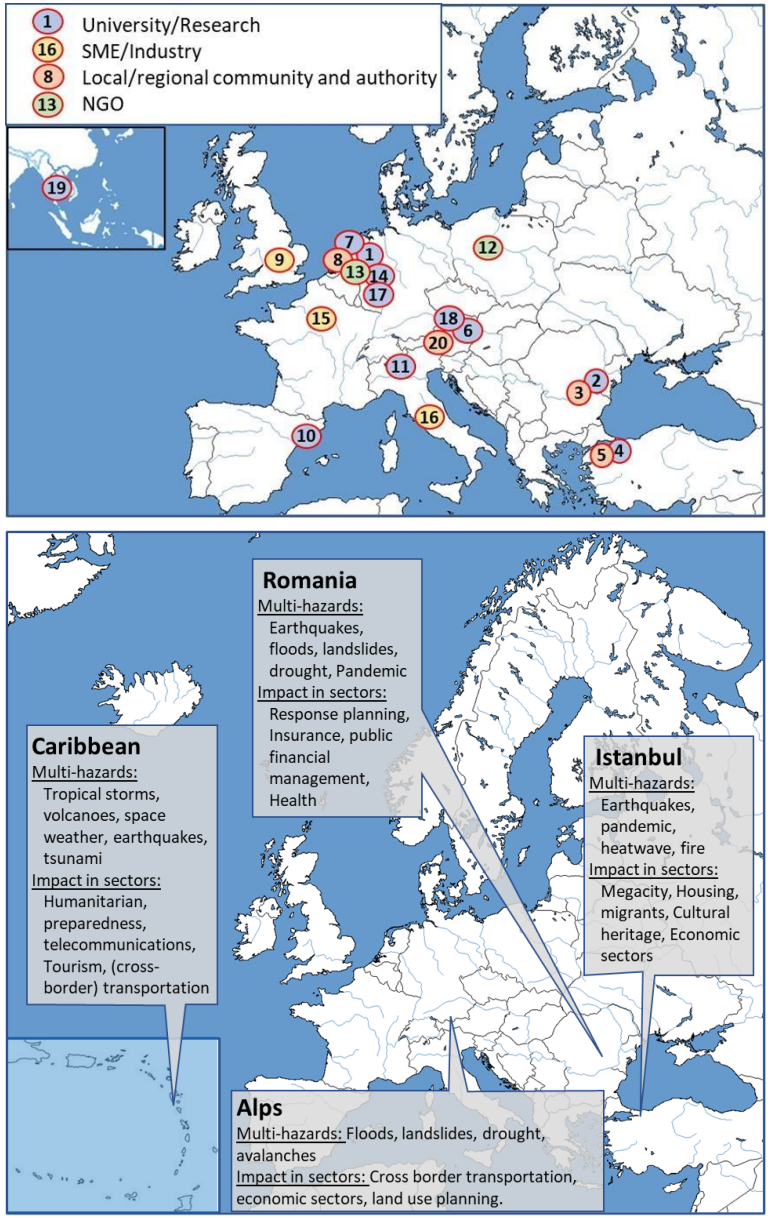


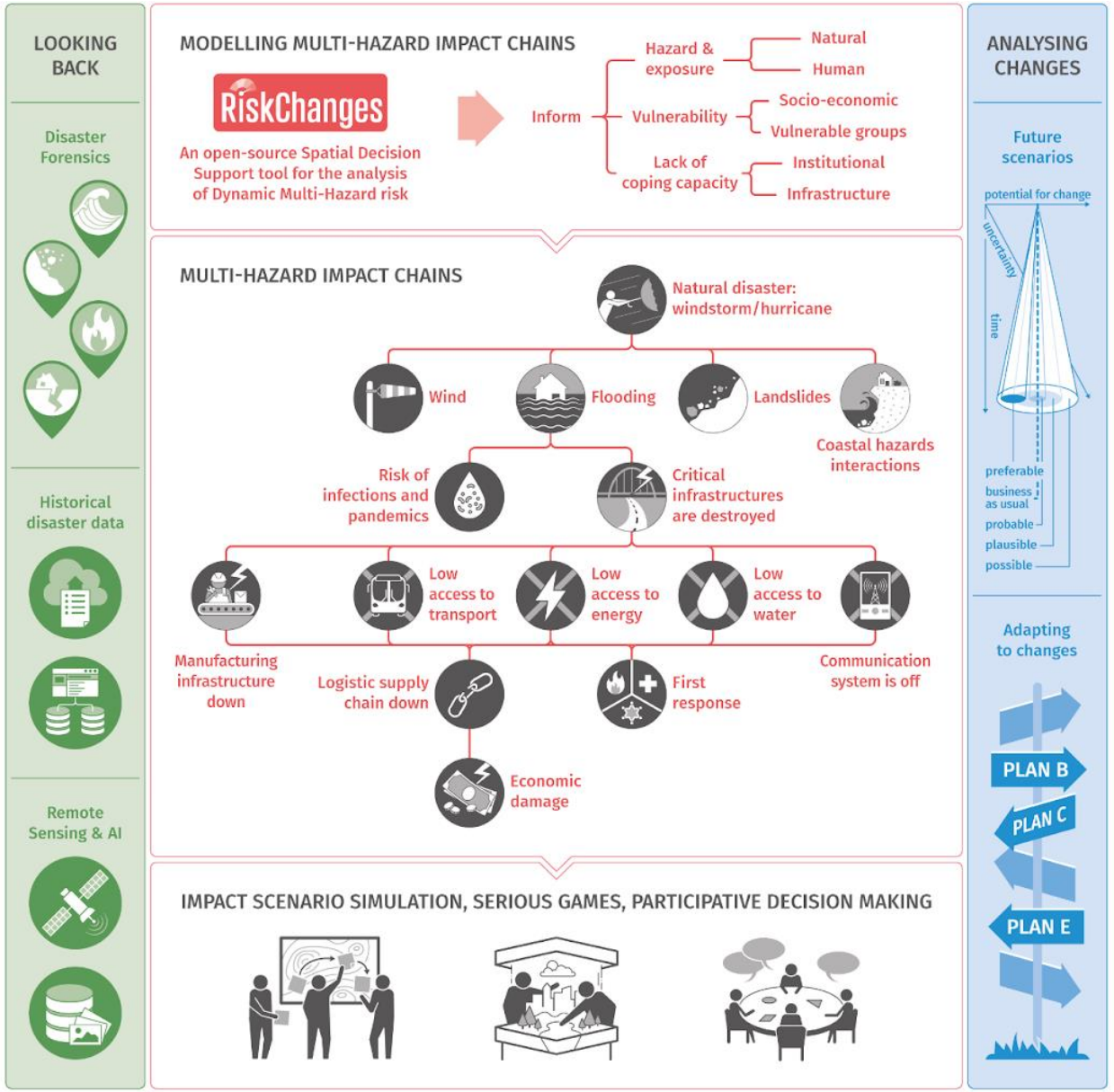
LS_SP_50_A0



LS_SP_100_A0

Deploying RiskChanges in PARATUS Project (EU)





Our Team

Prof. Dr. Cees Van Westen

Team Lead UT-ITC

Dr. Manzul Kumar Hazarika

Team Lead GIC-AIT

Syams Nusurullah

Risk Management Expert

Anish Ratna Shakya

GUI Bug Testing and Documentation

Ashok Dahal

System Development

Tek Kshetri

System Development

Sahara Sedhain

Training and Documentation

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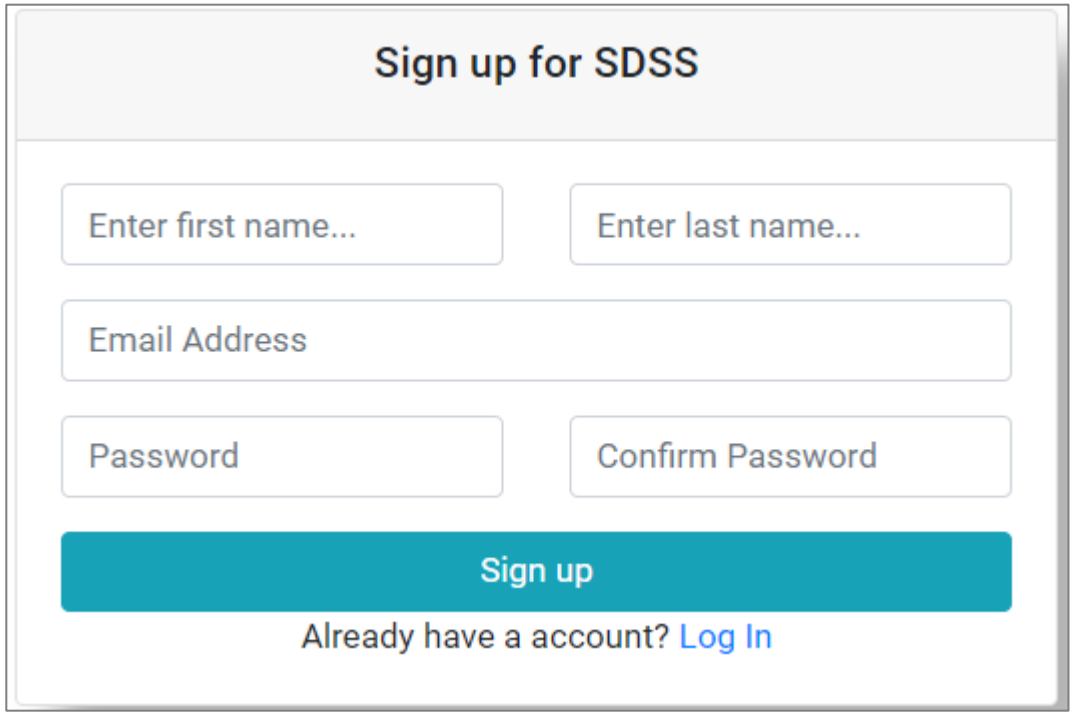
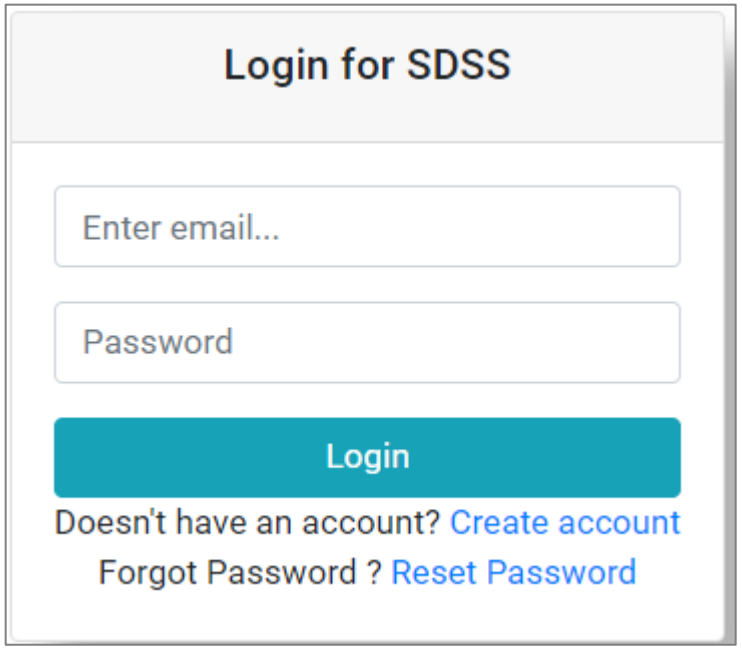
System Development

Sign Up or Log In

Sign Up



Log In



THANK YOU

Geoinformatics Center, Asian Institute of Technology