Towards a Uniform Approach for Risk Assessment due to Volcanoes and Earthquakes

A case study for the Nevado del Ruiz Volcano

CATALINA YEPES-ESTRADA

CITIES ON VOLCANOES (COV11)

JUNE 16, 2022

working together
to assess risk

GLOBAL EARTHQUAKE MODEL

OPENQUAKE

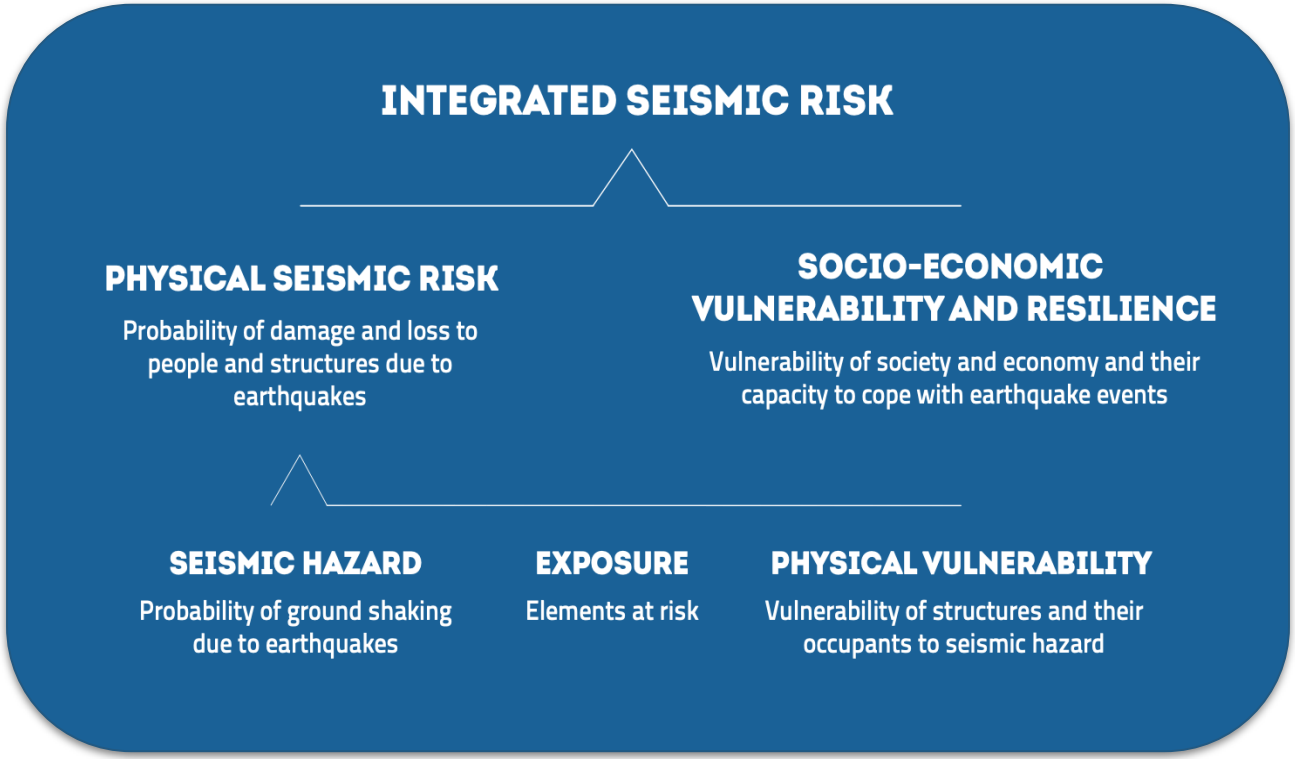
CRAVE PROJECT (2018-2019)

COLLABORATIVE RISK ASSESSMENT FOR VOLCANOES & EARTHQUAKES

- Unified framework for the assessment of losses
- Multi-hazard exposure modelling
- Application to Colombia, Philippines, and Indonesia

The Global Earthquake Model Foundation (GEM)

Earthquake Risk Assessment Framework



OpenQuake applications

Regional hazard and risk analysis:

- SARA
- CCARA
- SHARE
- SERA
- EMME
- EMCA
- SSAHARA
- Southeast Asia

Near real time ground shaking assessment:

- OQ libraries used in the USGS ShakeMaps system
- OQ components used in national projects (Italy, Canada, and Colombia)

National hazard and risk analysis:

- Italy
- Switzerland
- Turkey
- Colombia
- Ecuador
- Taiwan
- New Zealand
- Australia
- Canada
- South Africa

Site-specific studies:

- SSHAC Level 3 PSHA in nuclear power plants (Europe and South Africa)
- Induced seismicity (hazard and risk) (United States, Europe and South Africa)

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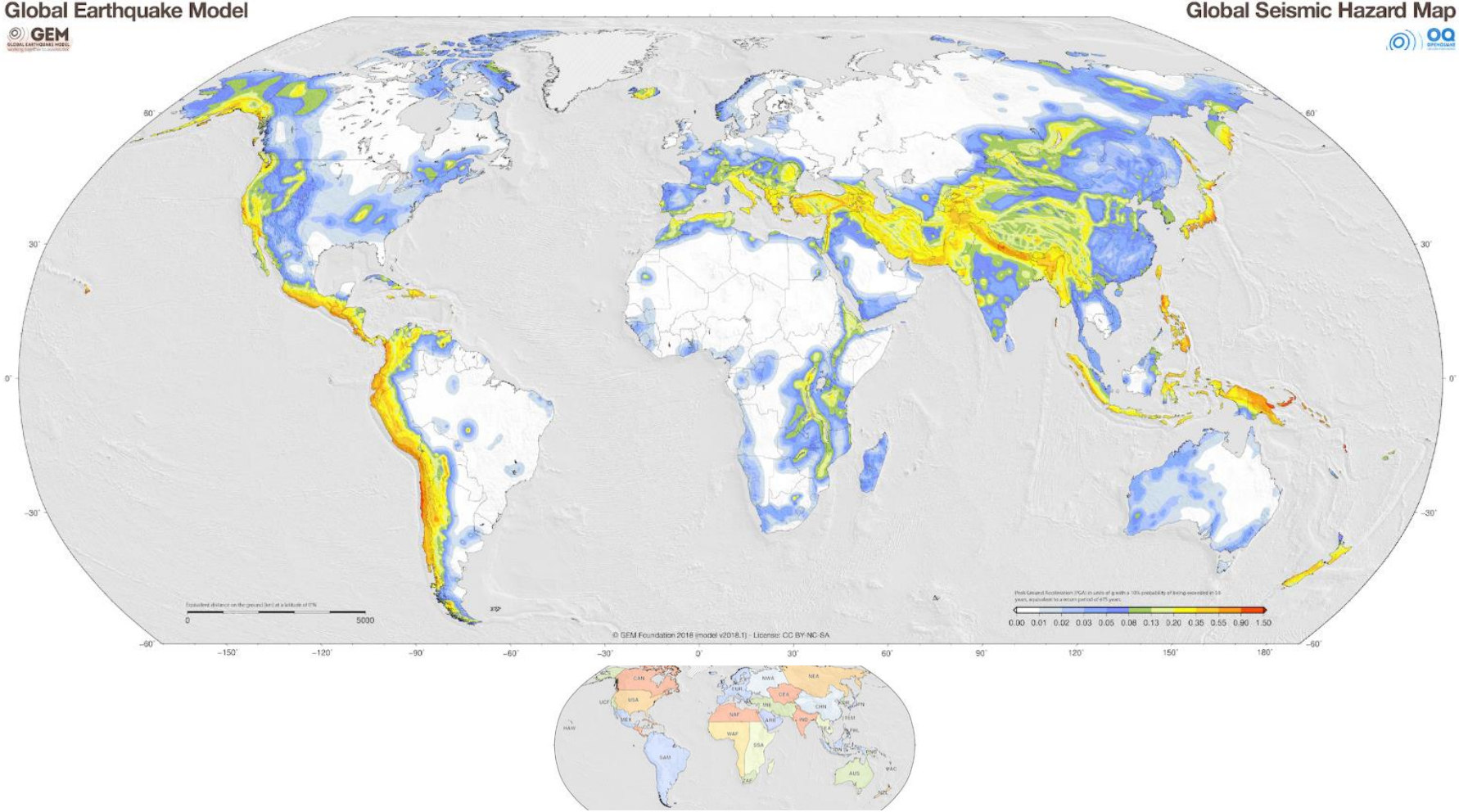

Global Seismic Hazard Map v.2018.1 (https://www.globalquakemodel.org/gem)

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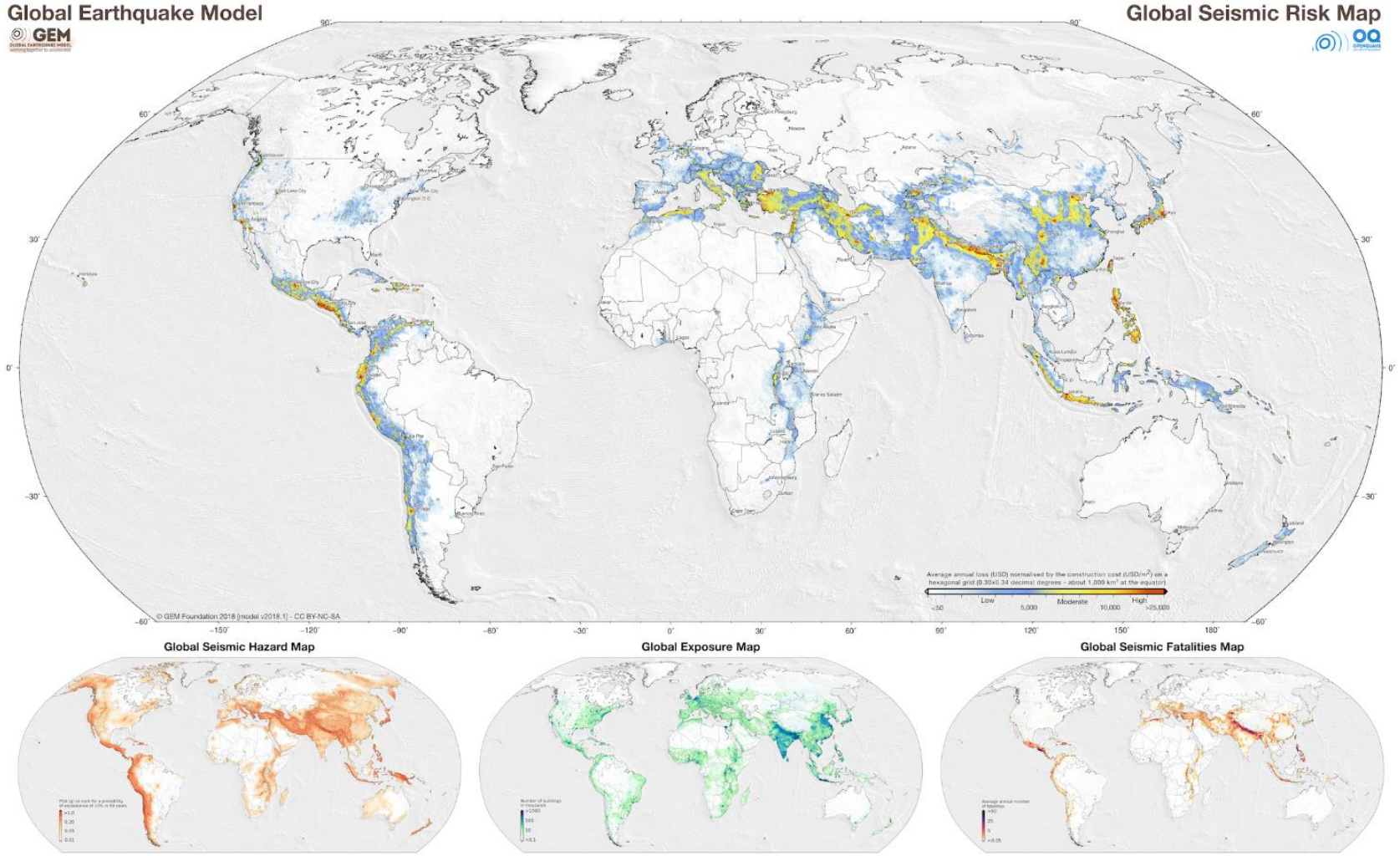
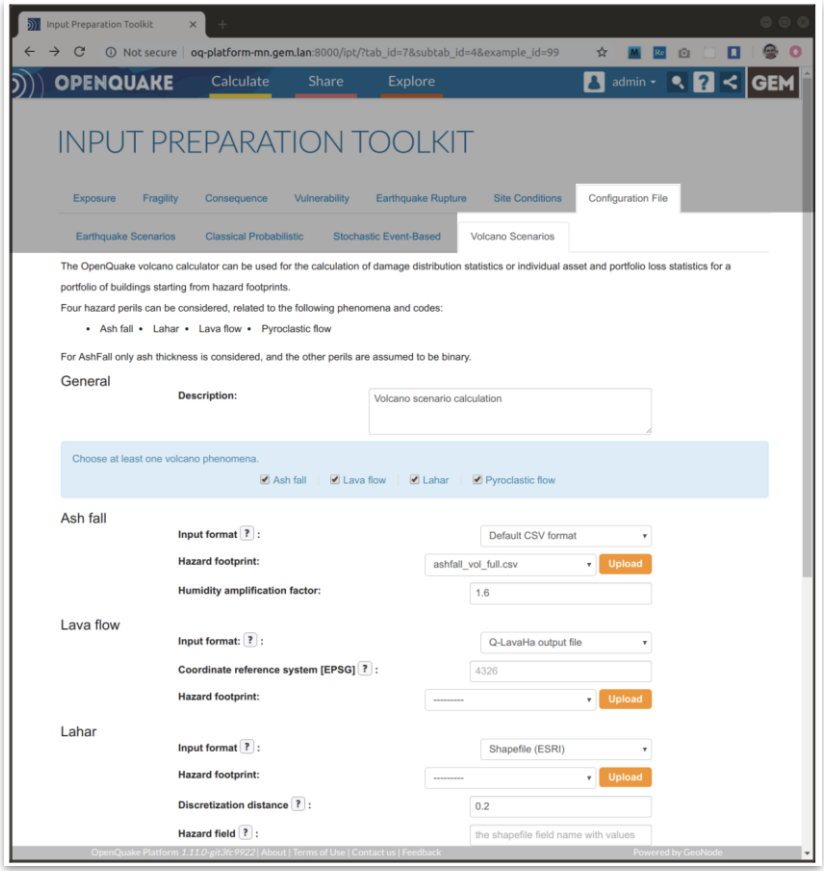


Global Seismic Risk Map v.2018.1 (https://www.globalquakemodel.org/gem)

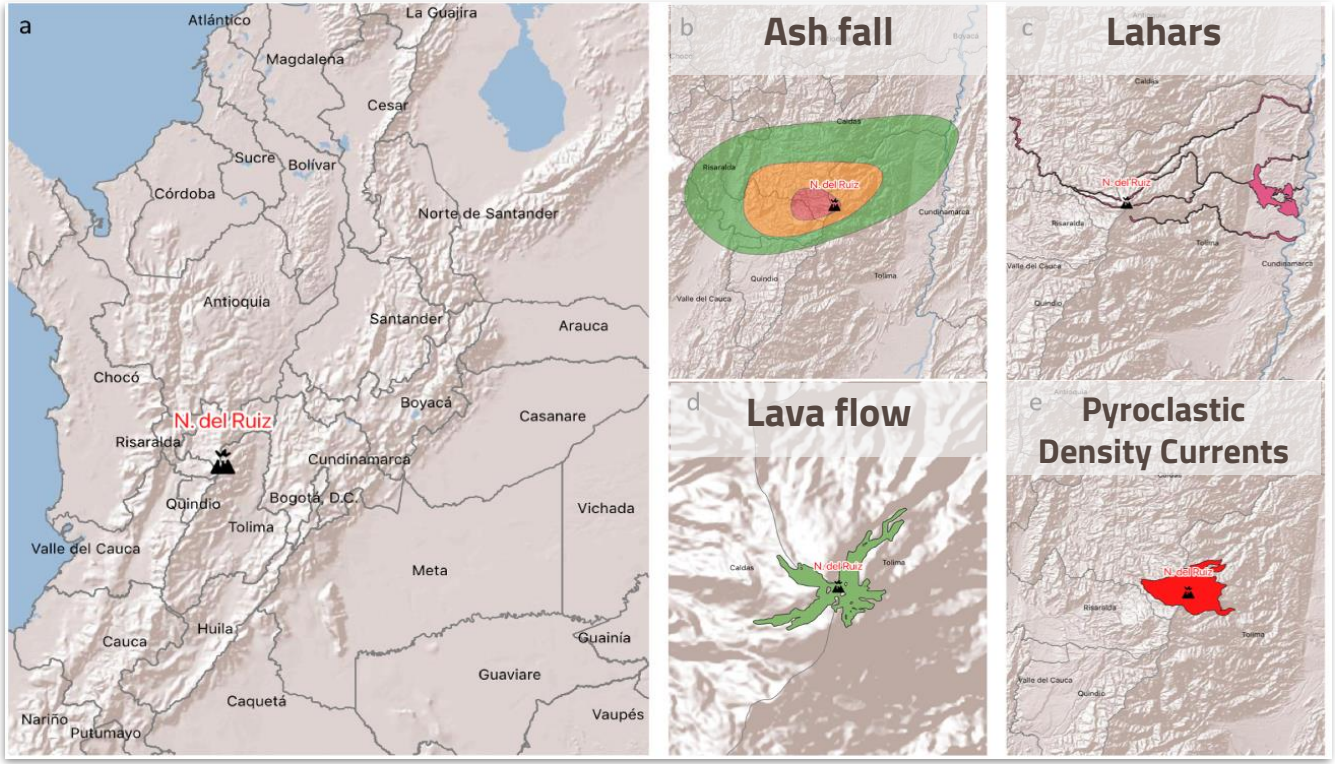
Volcanic Scenarios using OpenQuake

Implementation of a new calculator in the OpenQuake Engine called **'multi_risk'**

Hazard Peril	Software	Organization	Intensity
Ashfall	Ash3d	USGS	Ash thickness and load
Lava Flow	Q-LavHa	Vrije Universiteit Brussel	Binary (1- affected, 0- not affected)
Pyroclastic Density Currents	Titan2d	Vhub and Buffalo University	Binary (1- affected, 0- not affected)
Lahar	LaharZ	USGS	Binary (1- affected, 0- not affected)



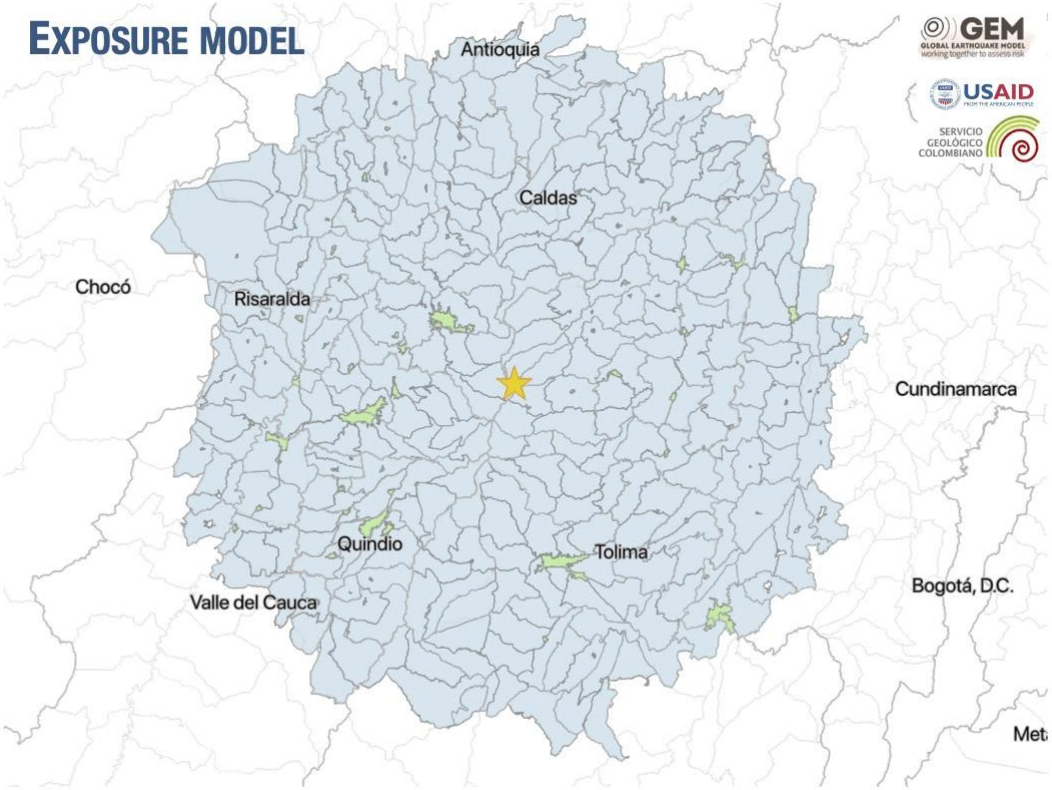
Pilot case: El Ruiz Volcano in Colombia



Volcanic hazard footprints for El Ruiz Volcano

(Monica Arcila, Julián Andrés Ceballos, Luis Jerónimo Valencia, Carlos Andrés Laverde, SGC)

Pilot case: El Ruiz Volcano in Colombia



Exposure model:
Number of buildings with structural characteristics:

- Construction material
- Number of stories
- Roof type
- Number of occupants
- Location (lon, lat)

Development of multi-hazard models (SGC and GEM)

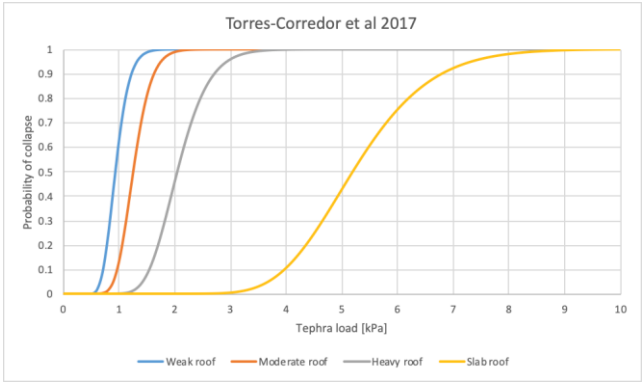
Scenario risk estimates

OpenQuake input files:

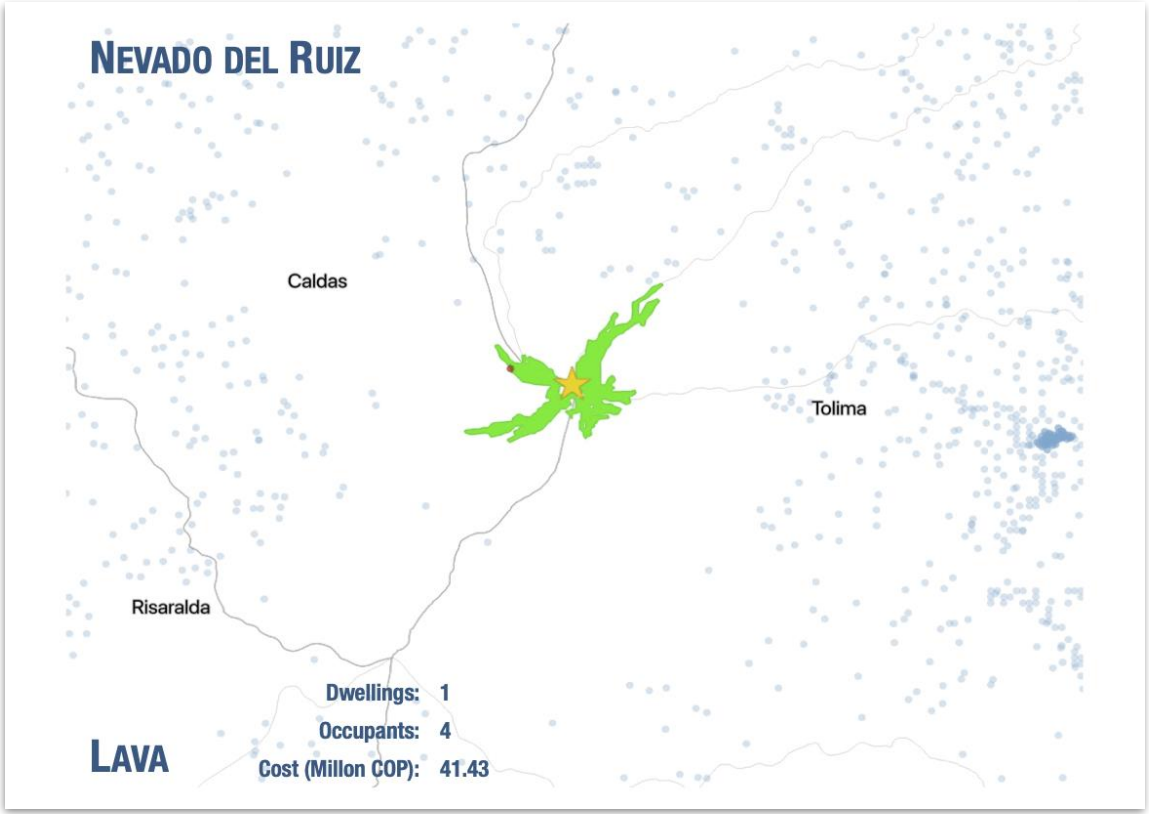
- Volcanic hazard footprints
- Exposure model
- Vulnerability model (for ash fall)

OpenQuake output files:

- Affected population
- Damage to the building stock
- Economic losses to the built environment
- ...
- Which other outputs will be useful?

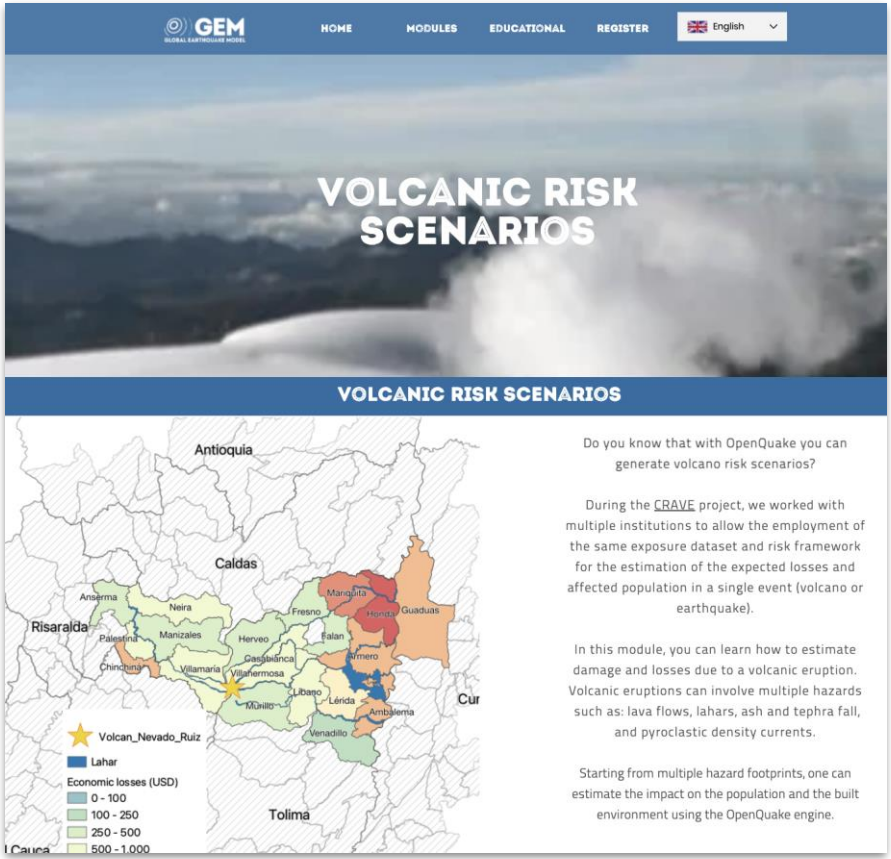


Pilot case: El Ruiz Volcano in Colombia



Results of a Volcanic Scenario Risk Assessment

Online workshop for volcanic risk scenarios in OpenQuake



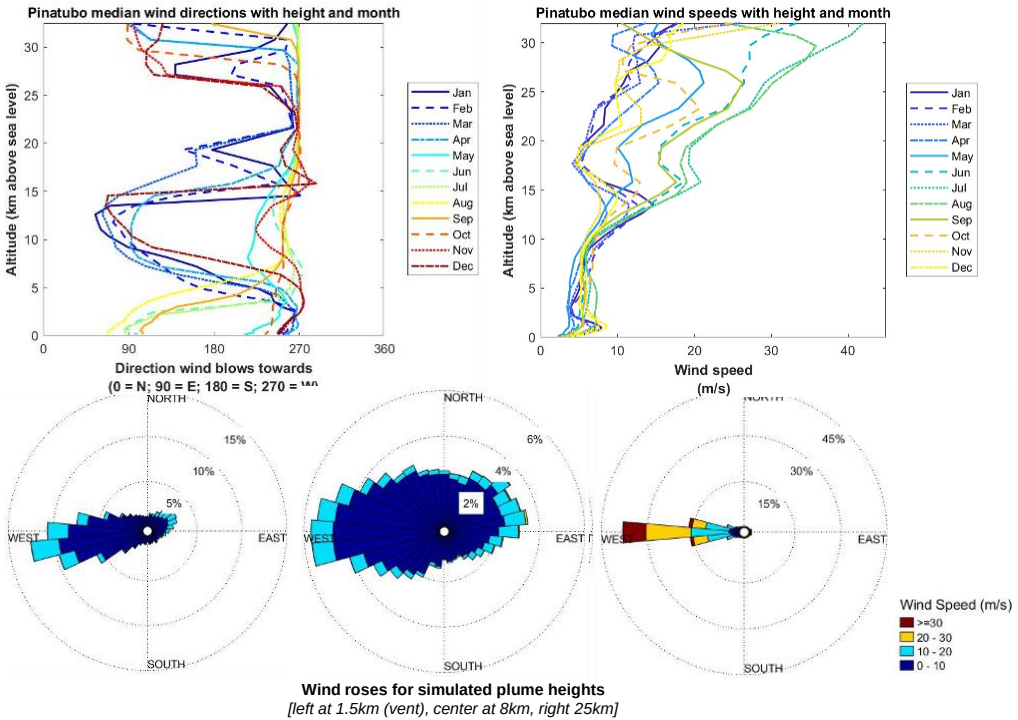
Friday, July 8th 2022

Online session (3 hours) with hands-on examples.

Registration available at:

www.training.openquake.org

Towards probabilistic scenario risk assessment: Pinatubo Volcano, Philippines



Wind roses for simulated plume heights
[left at 1.5km (vent), center at 8km, right 25km]

Tephra hazard foodprints:

5,000 footprints from simulations for:

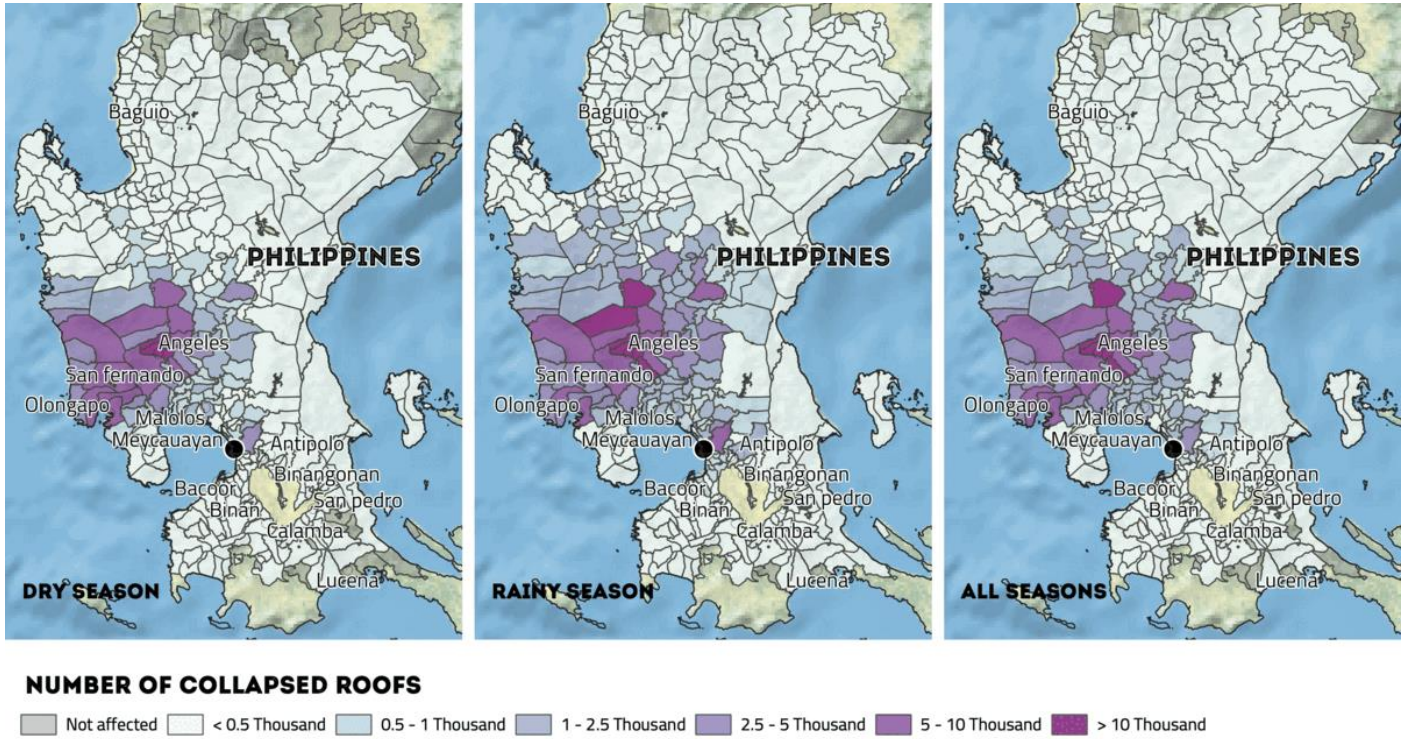
- Each of the whole year
- Rainy seasons
- Dry seasons

Total of 15.000 simulations

Probabilistic scenario tephra dispersal modelling for a VEI 6 eruption scenario

(Susanna Jenkins, Sébastien Biass and Chow Jun Rui, EOS)

Towards probabilistic scenario risk assessment: Pinatubo Volcano, Philippines



Probabilistic scenario tephra dispersal modelling for a VEI 6 eruption scenario

Volcanic Scenario Profiles, Quito - Ecuador

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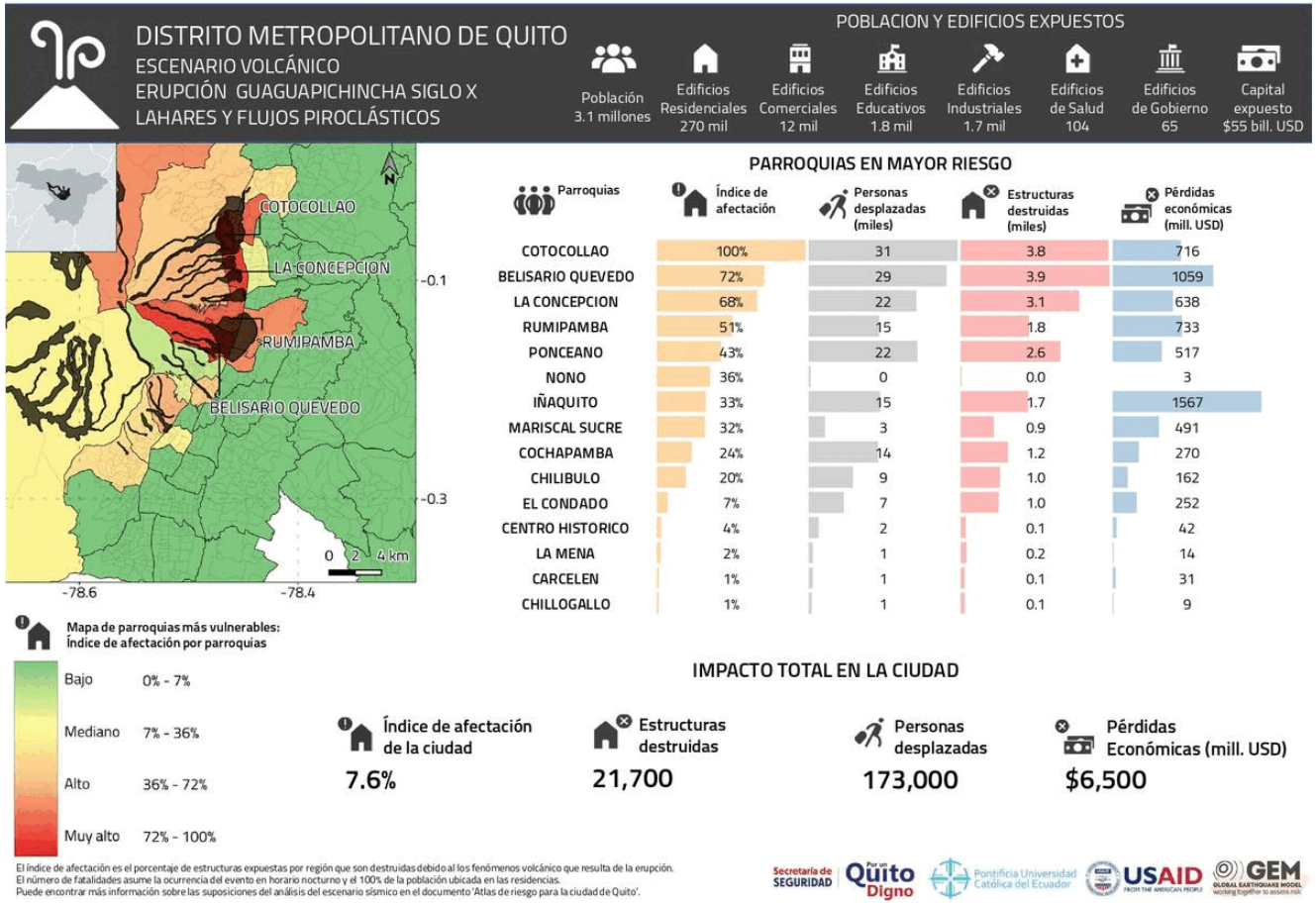
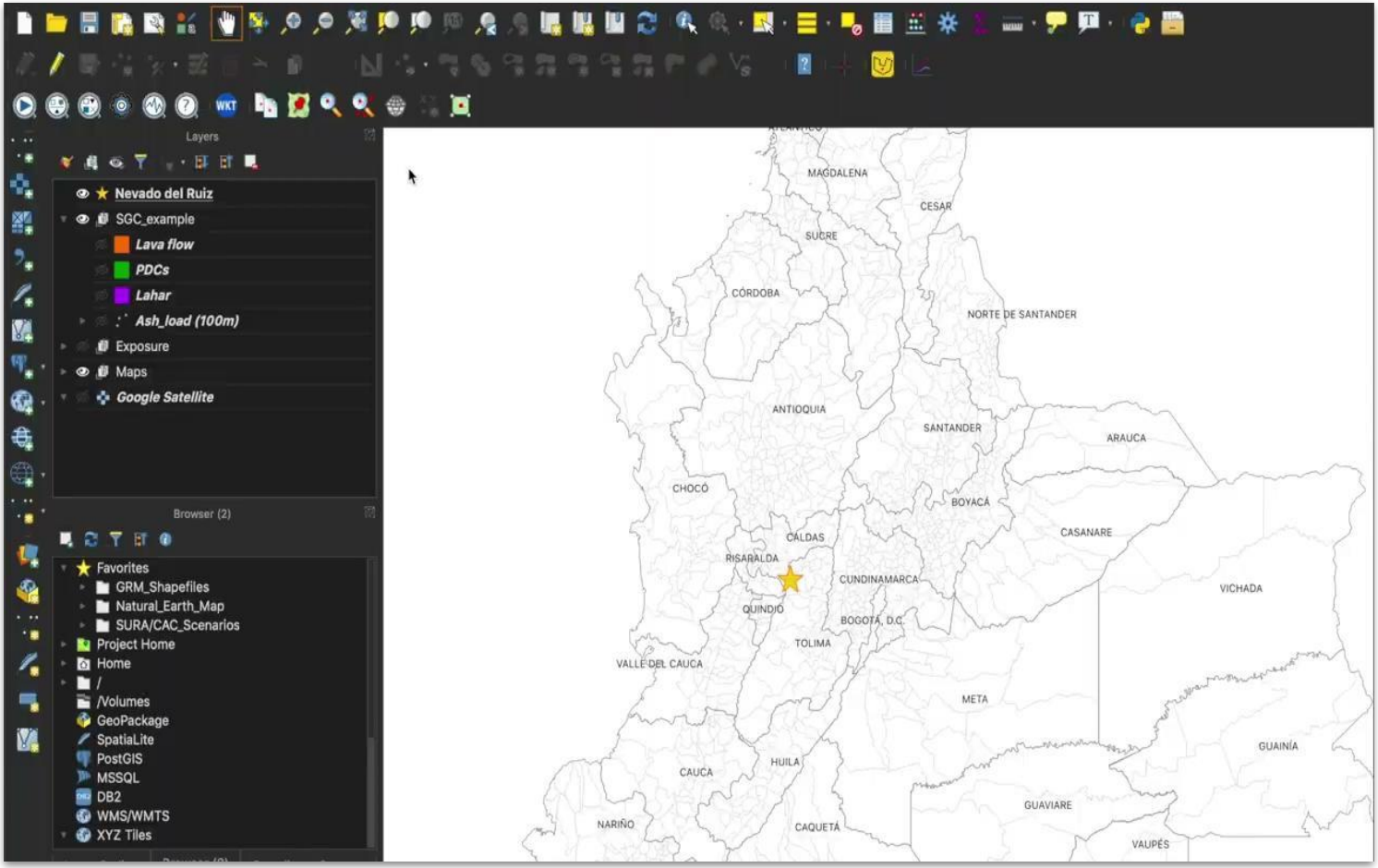
Training and Communication for Earthquake Risk Assessment



Volcanic Scenarios:

- Atacazo
- Guagua Pichincha
- Cotopaxi


Layers
Nevado del Ruiz
SGC_example
Lava flow
PDCs
Lahar
Ash_load (100m)
Exposure
Maps
Google Satellite
Browser (2)
Favorites
GRM_Shapefiles
Natural_Earth_Map
SURA/CAC_Scenarios
Project Home
Home
/
/Volumes
GeoPackage
SpatiaLite
PostGIS
MSSQL
DB2
WMS/WMTS
XYZ Tiles
MAGDALENA
CESAR
SUCRE
CÓRDOBA
NORTE DE SANTANDER
ANTIOQUIA
SANTANDER
ARAUCA
CHOCÓ
BOYACÁ
CASANARE
CALDAS
RISARALDA
CUNDINAMARCA
VICHADA
QUINDÍO
BOGOTÁ, D.C.
TOLIMA
VALLE DEL CAUCA
META
GUAINÍA
CAUCA
HUILA
GUAVIARE
NARIÑO
CAQUETÁ
VAUPÉS

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Thank you!

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working together to assess risk

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