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Sustainable  
Development  
Goals

# Geohazards Report

**Carlos Alberto Vargas,  
Team Leader of Geohazards - IGCP, UNESCO  
Open Session of IGCP Council (February 21<sup>st</sup>, 2019)**



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# *Carlos Alberto Vargas* **2019-2022**



INTERNATIONAL GEOSCIENCES PROGRAMME-IGCP

- Professor, Department of Geosciences, Universidad Nacional de Colombia at Bogota.
- BSc Geology, MSc Physics, PhD Geophysics.
- Areas of expertise: Geodynamics, Geophysics, Seismotectonics, Natural resources.
- Vicepresident of the Colombian Academy of Exact, Physical and Natural Sciences; Academy Representative in the Geosciences Program of the COLCIENCIAS (NSF).



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# ***Geohazard Risk Reduction***

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Geohazards are geological and environmental conditions and involve long-term or short-term geological processes. Geohazards include ...



**EARTHQUAKE**



**TSUNAMI**



**VOLCANO**



**CYCLONE**



**LANDSLIDE**

Earth scientists undertake research to better understand these hazards and contribute to risk management policies related to social and technical issues associated with geohazards as well as disaster mitigation.



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# UNESCO's work on Geohazard Risk Reduction

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- It operates in accordance with the four Priorities for Action of the Sendai Framework for Disaster Risk Reduction 2015-2030:
- **Priority 1:** Understanding disaster risk
- **Priority 2:** Strengthening disaster risk governance to manage disaster risk
- **Priority 3:** Investing in disaster risk reduction for resilience
- **Priority 4:** Enhancing disaster preparedness for effective response and to Build Back Better in recovery, rehabilitation and reconstruction.
- In particular, UNESCO focuses its activities on:

	Reduce	Increase
7 GLOBAL TARGETS	<b>Mortality/</b> global population 2020-2030 Average << 2005-2015 Average	<b>Countries with national &amp; local DRR strategies</b> 2020 Value >> 2015 Value
	<b>Affected people/</b> global population 2020-2030 Average << 2005-2015 Average	<b>International cooperation to developing countries</b> 2030 Value >> 2015 Value
	<b>Economic loss/</b> global GDP 2030 Ratio << 2015 Ratio	<b>Availability and access to multi-hazard early warning systems &amp; disaster risk information and assessments</b> 2030 Values >> 2015 Values
	<b>Damage to critical infrastructure &amp; disruption of basic services</b> 2030 Values << 2015 Values	





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# Team of evaluators

## INTERNATIONAL GEOSCIENCES PROGRAMME-IGCP

<p>Mr. Hamish Campbell, BSc Geology, MSc Geology, PhD Geology</p>	<p>GNS Science</p>	<p>New Zealand</p> 
<p>Mr. Andy Cundy BSc, PhD, FGS, FRGS</p>	<p>University of Brighton</p>	<p>United Kingdom</p> 
<p>Mr. Manuel Sintubin BSc, MSc, PhD Geology</p>	<p>Katholieke Universiteit Leuven</p>	<p>Belgium</p> 
<p>Ms. Maria João Batista BSc Geology, MSc Geochemistry, PhD Geosciences</p>	<p>National Laboratory of Energy and Geology</p>	<p>Portugal</p> 
<p>Mr. Vimal Singh BSc, MSc, MPhil., PhD</p>	<p>University of Delhi</p>	<p>India</p> 
<p>Mr. Yirgu Gezahegn BSc, MSc, PhD Geology</p>	<p>Addis Ababa University</p>	<p>Ethiopia</p> 
<p>Ms. Irasema Alcántara Ayala BSc, PhD Geomorphology</p>	<p>National Autonomous University of Mexico</p>	<p>Mexico</p> 
<p>Mr. Mohsen Ghafory-Ashtiany BSc, MSc, PhD Earthquake Engineering</p>	<p>Institute of Earthquake Engineering and Seismology</p>	<p>Iran</p> 



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# *Geohazards' projects*

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IGCP N°	Project Title	Duration Period	First project leader
640	Significance of Modern and Ancient Submarine Slope and Landslides	2015-2019	Lorena Moscardelli (USA)
641	Deformation and fissuring caused by exploitation of subsurface fluids	2015-2018	Dora Carreon-Freyre (Mexico)
659- new in 2018	Seismic Risk Assesement in Africa	2018-2021	Prof. Mustapha Meghraoui (France)
672-new in 2018	Himalayan glaciers and risks to local communities	2018-2022	Adina E. Racoviteanu (UK)



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# IGCP-640: S4SLIDE

## Countries: 30 – Participants: 74

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### Significance of Modern and Ancient ~~Submarine~~ Slope LandSLIDES

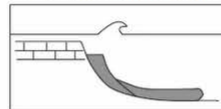
**Important:**

- Risk for coastal communities and offshore infrastructure
- Economic significance (oil and gas exploration)
- Interaction between current-controlled vs gravity driven processes
- Among many others.

e.g.: 2018 Sulawesi earthquake

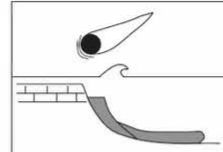


Carbonate Platform MTDs



South China Sea  
V ~ 1 to 100 km<sup>3</sup>  
Janson et al. (2010)

Meteorite Triggered MTDs



Montagnais MTD (Canada)  
A ~ 93000 km<sup>2</sup>  
Deptuck and Campbell (2012)



e.g.: Anak-Krakatau event

Volcanic MTDs



Lake Geneva  
V ~ 0.001 to 0.25 km<sup>3</sup>  
Kremer et al. (2015)

Coastal and Fjord MTDs

Shelf Delta MTDs

Shelf-Edge Delta MTDs

Mid-Oceanic Ridge MTDs

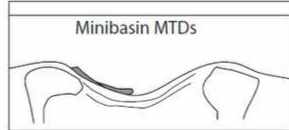
Mid-Atlantic Ridge  
Kane Transform  
V ~ ? km<sup>3</sup>  
Gao (2006)

Wailau MTD (Hawaii)  
V ~ 1000 km<sup>3</sup>  
Moore et al. (1989)

St. Lawrence Estuary  
Debris Lobe (Unit 5)  
V ~ 1 km<sup>3</sup>  
Cauchon-Voyer et al. (2008)

Eastern offshore Trinidad  
Attached and Detached  
V ~ 11.3 to 2017 km<sup>3</sup>  
Moscardelli et al. (2006)

Southern North Sea  
MTD 4-4  
V > 33.1 km<sup>3</sup>  
Benvenuti et al. (2012)



Espiritu Santo Basin  
V ~ 0.34 to 2.6 km<sup>3</sup>  
Gamboa and Alves (2016)

- A need to improve our understanding of:**
- Causal Mechanisms
  - Pre-conditions
  - Prediction efforts (modeling)



**Complex issues like these can only be addressed via a multidisciplinary approach**



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# IGCP-641: M3EF3

## Countries: 16 – Participants: 60

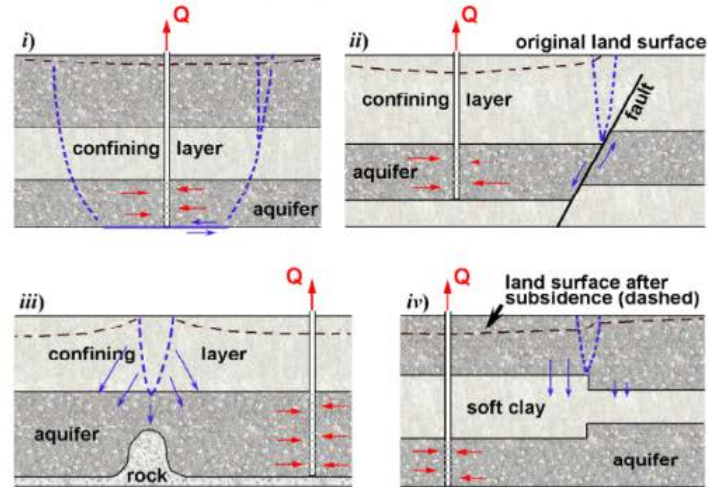
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Deformation and fissuring caused by exploitation of subsurface fluids

### INFORMATIVE MATERIAL

Graphical representation of the main mechanisms



Sketch of the mechanisms inducing ground ruptures: (i) horizontal displacement due to shearing on the plane of weakness or to tensile failure; (ii) reactivation of an existing fault caused by horizontal displacements; (iii) tensile fracture above a bedrock ridge; (iv) differential compaction due to heterogeneous thickness of aquifer (rigid)/aquitard (compressible) layers.





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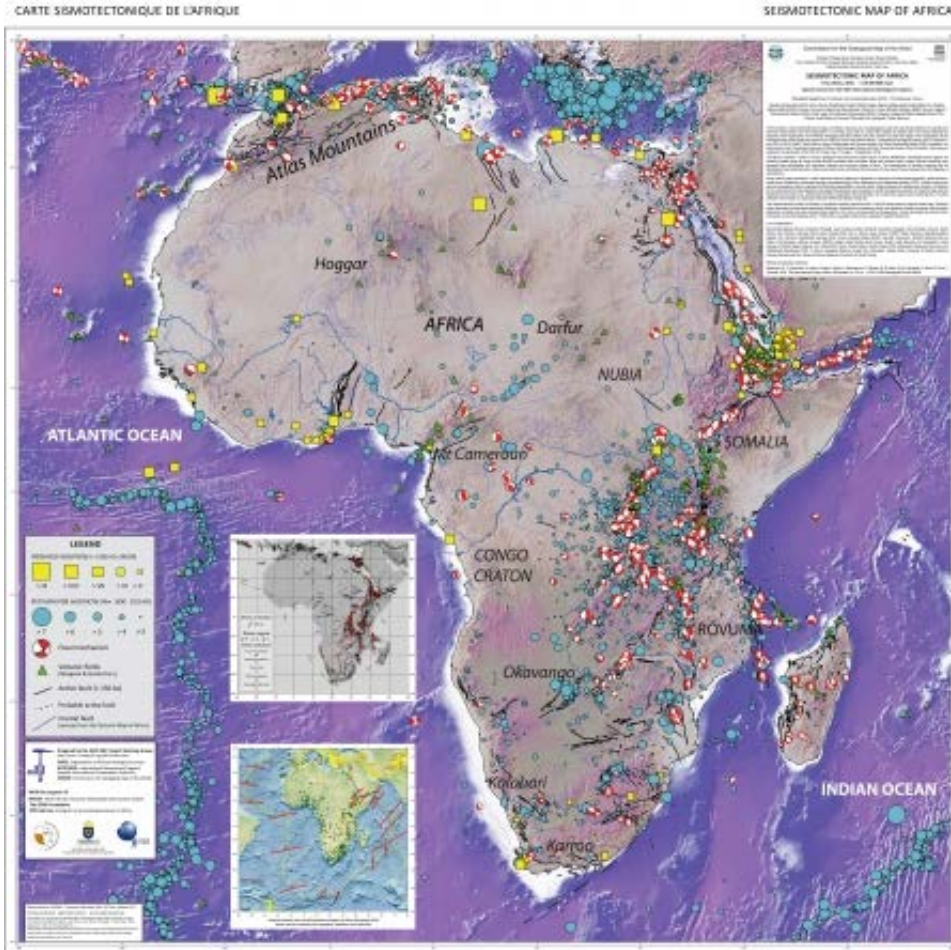
# IGCP-659:

## Seismic Risk Assessment in Africa

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### General goal

The constitution of a robust database for the deterministic and probabilistic seismic hazard assessment for each African capital cities located in seismically active regions. The programme aims at studying the seismic source characteristics, local site effects, subsurface characterization, seismic hazard and risk analysis.



	TNS	NMS	NFS
NPS	29	16	13
NYS (<35)	8	5	3
NSDC	24	11	13

2018-2021



# IGCP-672: Himalayan glaciers and risks to local communities

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## General goals

Refinement and automating of the glacier lake hazard assessment scheme using high-resolution satellite data, climate data, moraine material, socio-economic information, etc. The project will transmit these techniques to local institutions, and training students to conduct field measurements to improve the accuracy of the ranking scheme.

	TNS	NMS	NFS
NPS	50	23	27
NYS (<35)	42	17	25
NSDC	50	23	27

2018-2022