Risk assessment and advance warning for landslides in Brazil

SEG Foundation
Geoscientists Without Borders®

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Gabriela Melo, Alison Malcom - MIT
The project

• **Name:** Risk Assessment and Advance Warning for Landslides in Brazil

• **The problem:** Landslides in the Região Serrana of the Rio de Janeiro state

• **Goal:** To study, classify, and monitor areas that pose a high risk of landslides in the Região Serrana of the Rio de Janeiro state

• **Duration:** Aug/2011 – Aug/2013
The team

- Laura C. Azevedo, M.Sc. candidate – University of Houston
  - Dr. Aibing Li, Associate Professor of Geophysics - University of Houston
- Gabriela Melo, Ph.D. candidate – MIT
  - Dr. Alison Malcolm, Assistant Professor of Geophysics - MIT

- UH (University of Houston):
  - Dr. Andre Ferreira, graduate student of Geophysics
  - Dr. Stuart Hall, Professor of Geophysics
- MIT (Massachusetts Institute of Technology) - EAPS:
  - Dr. Taylor Perron, Assistant Professor of Geology
  - Dr. Ken Ferrier, Postdoc of Geology & Geophysics
  - Paul Richardson, graduate student of Geology & Geophysics
- UFRJ (Universidade Estadual do Rio de Janeiro) - COPPE/UFRJ:
  - Dr. Webe Mansur, Professor of Civil Engineering
  - Dr. Nelson Fernandes, Professor of Geology
  - Dr. Otto Rotunno, Professor of Civil Engineering
  - Dr. Claudio Mahler, Professor of Civil Engineering
- UNICAMP (Universidade Estadual de Campinas) – DMA/IMECC:
  - Dr. Jörg Schleicher, Professor of Applied Mathematics
  - Dr. Maria Amélia Novais Schleicher, Professor of Applied Mathematics
- UFF (Universidade Federal Fluminense) – Dept. of Geology and Geophysics:
  - Dr. Cleverson Guizan Silva, Professor of Geology & Geophysics
  - Dr. Marco Cetale, Professor of Geophysics
  - Dr. Adalberto da Silva, Professor of Geology
  - Dr. Guilherme Borges Fernandez, Professor of Geography
- UFPA (Universidade Federal do Pará) - CPGf
  - Dr. Jessé Carvalho Costa, Associate Professor of Geophysics
- OAB (Ordem dos Advogados do Brasil) – Order of Brazilian Lawyers:
  - Dr. Maira Fernandes, lawyer
- ON TARGET – Non-profit Strategy and Management Consulting firm
  - Jefferson Nascimento
Main steps

- Perform slope stability calculations for selected sites using Digital Elevation Model (DEM) data
- Perform detailed geophysical, geological, and geotechnical investigations to characterize the field and general structure of the subsurface
- Using the results from site surveying, perform landslide prediction modeling and collect any additional field measurements necessary to more accurately constrain the model
- Calculate a final distribution of landslide risks using all data
- Implement monitoring systems aiding in the current warning system that is based on meteorological data only
Starting point

• Megadesastre da Serra
  – Produced by SERVIÇO GEOLÓGICO DO ESTADO DO RIO DE JANEIRO and researchers from PUC-RIO, UFRJ, and UERJ.
  – broad area diagnostic of the landslides and floods
  – large compilation of the geological and meteorological conditions of the Região Serrana
Região Serrana (Regiao Serrana) of Rio de Janeiro state. Regions with little to no vegetation are the result of landslide scars and are ubiquitous.
Most damaged cities in the landslide/flood event of Janeiro de 2011
Estimated regions of high risk for landslides, in red, and regions to be further investigated, in yellow.
Current landslide-risk distribution for Petropolis district.
# The Project – Milestones / Chronogram

## Project Timetable

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**USA team**

**Brasil team**

**Both Brasil and USA teams**
Expected outcome

• Computer model for estimating risks of landslide in a certain location as function of as many relevant factors as possible

• Training people from UFF, UFRJ, and INPE and governmental institutions to use this model.

• Implementation of additional monitoring systems

• Education program for the population
Seminar for government agents in Rio de Janeiro
Kick-off meetings

• Two meetings
  • Brazilian Academic team
  • Rio de Janeiro government
• Government interested in using our project as a pilot project
• Website gathering all landslide related projects
• Symposium in Rio de Janeiro to make everyone aware of existing projects
Acknowledgments

- Society of Exploration Geophysicists – SEG
- Global Geophysics
- Schlumberger
- UH, MIT, UFRJ, UFF, USP, UNICAMP, UFPA
- OAB
- Target Consulting