Identifying Global Natural Disaster Hotspots

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Abstract

• The World Bank and Columbia University have developed a report on and global database of natural disaster ‘hotspots’ (areas where the risk of natural disasters are particularly high). The report assesses two outcomes – mortality and economic losses – based on the global distribution of six hazards: earthquakes, volcanoes, landslides, floods, drought, and cyclones. The database includes the sub-national geographic distribution of the six hazards, population, and economic productivity, as well as national-level hazard-related mortality and economic impacts. This presentation will describe the layers collected in the database, methods used in the integration of these layers, and summarize the results.
Data Inputs

• Hazards:
  – Earthquakes
  – Volcanoes
  – Landslides
  – Floods
  – Drought
  – Cyclones

• Exposure
  – Land Area
  – Population
  – Economic Activity
  – Agricultural Activity
  – Transportation Density
Earthquakes

Source: Global Seismic Hazard Assessment Program
Volcanoes

Source: National Geophysical Data Center
Landslides

Source: Norwegian Geotechnical Institute
Floods

Source: Dartmouth Flood Observatory
Drought

Source: International Research Institute for Climate Prediction
Cyclones

Source: UNEP/GRID PreView Project
Population

Source: CIESIN’s Socioeconomic Data and Applications Center (SEDAC)
Economic Activity

Source: The Earth Institute at Columbia University and The World Bank
Agricultural Activity

Source: The Earth Institute at Columbia University and The World Bank
Transportation Density

Source: VMAP Level 0
Input Data Transformations

• Hazard data:
  – Vector data were gridded as count surfaces
  – Raster data were resampled to a common resolution (2.5 arc-minutes)
  – Masked to include only inhabited or agricultural areas
  – Sliced into deciles (SLICE function in GRID with equal area option)

• Exposure data:
  – Resampled to common resolution (2.5 arc-minutes)
Drought Deciles
Earthquake Deciles

Risk Deciles

- 1st - 4th
- 5th - 7th
- 8th - 10th
Volcano Deciles
Flood Deciles
Landslide Deciles
Identifying Multihazard Areas

• All 6 hazard deciles were combined (COMBINE function in GRID).
• Only the top 3 deciles (extremes) were kept.
• Exposure values were calculated using the ZONALSTATS functions (number of persons, GDP value, Agricultural GDP value, land area, and linear km of road and rail exposed to each hazard).
Population Exposure

Exposure to All Hazards
Top 3 Deciles With:
- Low Population Density
- Medium Population Density
- High Population Density

Low: 5-14.49, med: 14.5-51.49, high: 51.5 + persons per km²
Hazard Groups

Geophysical includes volcano and earthquake hazards; hydro includes cyclone, flood, and landslide hazards.
Disaster Risk: Mortality

• Hazard-specific regional mortality rates (per 100,000 persons) were derived from EM-DAT.
• These rates were applied on a per-hazard basis to the population of grid cells in exposed areas to produce single-hazard mortality layers.
• The single-hazard results were summed to estimate mortality from all 6 hazards.
Disaster Risk: Mortality
Disaster Risk: Economic Losses

- Hazard-specific economic loss rates were derived from EM-DAT.
- These rates were applied on a per-hazard basis to the GDP of grid cells in exposed areas to produce single-hazard economic loss layers.
- The single-hazard results were summed to estimate economic loss from all 6 hazards.
Proportional Economic Loss

[Map showing all-hazard proportional economic loss risk deciles]
For More Information and Data Access:

Center for Hazards & Risk Research at Columbia University

http://www.ldeo.columbia.edu/chrr/research/hotspots/
hotspotsdata@ciesin.columbia.edu

For the Full Hotspots Report:

Data Sources

- Global Seismic Hazard Assessment Program: Earthquakes
  - [http://www.seismo.ethz.ch/GSHAP/](http://www.seismo.ethz.ch/GSHAP/)

- National Geophysical Data Center: Volcanoes

- Norwegian Geotechnical Institute: Landslides
  - [http://www.ngi.no/english/default.asp](http://www.ngi.no/english/default.asp)

- Dartmouth Flood Observatory: Floods
  - [http://www.dartmouth.edu/~floods/](http://www.dartmouth.edu/~floods/)

- International Research Institute for Climate Prediction: Drought

- UNEP/GRID PreView Project: Cyclones
Data Sources

• CIESIN: Population and Land Area

• Center for Research on the Epidemiology of Disasters: EM-DAT

• National Geospatial Intelligence Agency: VMAP Level 0

• Earth Institute and World Bank: GDP and Agricultural Productivity data
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