Broadband Simulation for a Hypothetical $M_w$ 7.1 Earthquake on the Enriquillo Fault in Haiti

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HAZARD

EXPOSURE + VULNERABILITY

5 km
Plate boundary-parallel velocity (mm/yr)

- **Enriquillo Fault**:
  - 12 mm/yr
  - 7 mm/yr

- **Septentrional Fault**:
  - >450 yr
  - ~300 yr
  - 17th Cent.

- **Locations**:
  - Cuba
  - Hispaniola
  - Enriquillo F.
  - Septentrional F.
7 mm/yr x 250 yrs = 1.8 m of slip deficit
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Ten Brink et al. 2012

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Mw 7.2 if released in single event
7 mm/yr x 250 yrs = 1.8 m of slip deficit

Mw 7.2 if released in single event
Coulomb Stress Change on Nearby Faults due to the 2010 Haiti Earthquake
List of Hypothetical Stations

Douilly et al., GJI, 2017
Fault Geometry and Computational Parameters

Douilly et al., GJI, 2017

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>1D Velocity structure</td>
<td>(Douilly et al. 2013)</td>
</tr>
<tr>
<td>Slip Weakening Parameter</td>
<td>0.3 m</td>
</tr>
<tr>
<td>Radius of nucleation zone</td>
<td>2500 m</td>
</tr>
<tr>
<td>Element size</td>
<td>250 m</td>
</tr>
<tr>
<td>Orientation of maximum principal stress</td>
<td>50°</td>
</tr>
<tr>
<td>Initial shear stress (MPa)</td>
<td>21.64</td>
</tr>
<tr>
<td>Sliding stress (MPa)</td>
<td>17.80</td>
</tr>
<tr>
<td>Failure stress (MPa)</td>
<td>30.52</td>
</tr>
<tr>
<td>Static friction</td>
<td>0.60</td>
</tr>
<tr>
<td>Dynamic friction</td>
<td>0.35</td>
</tr>
</tbody>
</table>

Scenario A

Scenario B

Douilly et al., GJI, 2017
Horizontal and Vertical Displacement

Douilly et al., GJI, 2017
High Frequency Simulation

Specific Barrier Model

Papageorgiou and Aki, (1983, 1985)
High Frequency Simulation

Douilly et al., GJI, 2017

**Scenario VA1**

**Scenario VB1**

Douilly et al., GJI, 2017
Comparison of Average Horizontal PGA with the GMPE Proposed by BA08

UNIFORM

Douilloy et al., GJI, 2017
Comparison of Average Horizontal PGA with the GMPE Proposed by BA08

VARIABLE
Conclusions

• Low frequency simulations show that a vertical Enriquillo generates higher horizontal displacement compare to a south dipping fault.

• Stations located north of the ruptured segment experience larger horizontal permanent displacements for a rupture on a vertical fault than for a rupture on a south-dipping fault.

• Higher permanent vertical displacement is observed for a south-dipping fault compare to a vertical fault.

• Broadband ground motion simulation revealed that station in Port-au-Prince could experience a PGA of ~0.35g for a south dipping Enriquillo fault and ~0.45g for a vertical Enriquillo fault.

• A potential future earthquake on this segment of the Enriquillo fault could be more disastrous than the 2010 Haiti earthquake.