Scientific Investigation and Monitoring
Result of Potential Large Scale Landslide

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Vision
- Past: Trace the mechanism and history of large-scale landslide with modern scientific and technological methods. Identify potential locations of high-risk, conduct relevant observations and detailed investigations, optimize appropriate observation methods and integrate analysis of observational data. Identify and control the precursory conditions of different-scale landslide. Detect the landslide processes with new technology, and propose early warning conditions and influences.

Potential slides 50 years before

Global ground deformation acquire from SAR
- Same location TOP pairs are captured from fringes of each pairs with ALOS-2
- Suggesting field investigation and sensor alignment

UAS LiDAR DSM vs. DEM

Airborne vs UAV LiDAR (1/2)
Airborne vs UAV LiDAR (2/2)

Field investigation/verification

Geological investigation – 2D geological profile

Core identification

Horizontal and vertical long-term linear velocities with respect to t0

\[
y(t) = a + b t + c \sin(2\pi t) + d \cos(2\pi t) + \sum_{j=1}^{g} H_t - T_{gj} + \sum_{k=1}^{j} \exp(-t - T_{kj}) \tau_{kj} + \nu_i
\]
Long-term monitoring for typhoon and ground shaking effect

- Green line – typhoon
- Dotted line – $M_L \geq 5$ earthquakes within 100 km
- Blue bar – Daily rainfall
- Red dots – $dv/v$ measurements at that station
- Gray dots – $dv/v$ measurements at other stations for comparison

Optical fiber water pressure

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Electric resistance window in field

Electric resistance profiles during typhoon Megi (2016)

Rainfall and earthquake events (1/3)

Rainfall and earthquake events (2/3)
Rainfall and earthquake events (3/3)

2D numerical simulation

<table>
<thead>
<tr>
<th>EPN</th>
<th>R1</th>
<th>R2</th>
<th>R3</th>
<th>R4</th>
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<tbody>
<tr>
<td>Rain</td>
<td>70</td>
<td>59.5</td>
<td>7.5</td>
<td>30</td>
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<tr>
<td>Sun</td>
<td>5</td>
<td>80</td>
<td>5</td>
<td>30</td>
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<tr>
<td>Response</td>
<td>36</td>
<td>80</td>
<td>5</td>
<td>30</td>
</tr>
</tbody>
</table>

3D numerical analysis

3D runout simulation

Preliminary sliding threshold for LanTai site

- Deformation
  - 2mm/day including ground surface and underground
- Precipitation
  - 300mm for ground surface deformation
  - 800-1000mm for underground deformation (Lushan experience)
  - 350mm from temporal GPS displacement
- Groundwater
  - Underground 20m/10m

Thank you!