The future will be urban –

Capabilities and solutions from remote sensing for risk assessment and management

H. Taubenböck
The future will be urban!
Risk = f(Hazard, Vulnerability)

- Where are exposed areas?
- What would be affected?
- How many people would be affected?
- Who would be affected?
- How large will be the damage?
Risk = f(Hazard, Vulnerability)

- Where are exposed areas?
- What would be affected?
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Where are exposed areas?

Legend
Slope

10°
20°
30°
40°

Probabilistic hazard map

45,1 – 100 %
15,1 – 45 %
5,1 – 15 %
0,1 – 5 %
0 %
Where are exposed areas?

Urbanized areas:
- **1989**
- **2000**
- **2009**
Risk = f(Hazard, Vulnerability)

- Where are exposed areas?
- What would be affected?
- How many people would be affected?
- Who would be affected?
- How large will be the damage?
Land cover classification

Legend

- Water
- Streets
- Buildings
- Grassland
- Trees
- Bare soil
- Sealed area

Ikonos imagery, 2005
Three-dimensional city model
$Risk = f(\text{Hazard, Vulnerability})$

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Semantic classification

„Idea of semantic classification aims at a first assumed interrelation between physically homogeneous sectors within the complex urban morphology and the socioeconomic characteristics of people residing there“.

Correlation of remotely sensed results and punctual field work data provided by UNU-EHS
Semantic classification
Risk = f(Hazard, Vulnerability)

Timeline

Pre-disaster

- Where are exposed areas?
- What would be affected?
- How many people would be affected?
- Who would be affected?
- How large will be the damage?

Disaster Event

Post-disaster
Interdisciplinary approach of civil engineering and remote sensing

<table>
<thead>
<tr>
<th>No.</th>
<th>Structural stability components</th>
<th>Weighting</th>
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<tbody>
<tr>
<td>1</td>
<td>Building height</td>
<td>4</td>
</tr>
<tr>
<td>2</td>
<td>Material of the main structural element</td>
<td>10</td>
</tr>
<tr>
<td>3</td>
<td>Material type of the wall</td>
<td>2</td>
</tr>
<tr>
<td>4</td>
<td>The foundation of main structures</td>
<td>5</td>
</tr>
<tr>
<td>5</td>
<td>Existence of a tie beam</td>
<td>7</td>
</tr>
<tr>
<td>6</td>
<td>Existence of column</td>
<td>8</td>
</tr>
<tr>
<td>7</td>
<td>Dimension of the main column</td>
<td>5</td>
</tr>
<tr>
<td>8</td>
<td>Main bending reinforcement of the main column</td>
<td>8</td>
</tr>
<tr>
<td>9</td>
<td>Diameter of the reinforcement of the main column</td>
<td>2</td>
</tr>
<tr>
<td>10</td>
<td>Number of reinforcement of the main column</td>
<td>2</td>
</tr>
<tr>
<td>11</td>
<td>Existence of stirrup</td>
<td>5</td>
</tr>
<tr>
<td>12</td>
<td>Stirrup diameter of the main column</td>
<td>2</td>
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<tr>
<td>13</td>
<td>Spacing of the stirrup of the main column</td>
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<tr>
<td>14</td>
<td>Average value of the Hammer test of the main column</td>
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<tr>
<td>15</td>
<td>Practical (Complimentary) column</td>
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<tr>
<td>16</td>
<td>Existence of main beam (for storey building)</td>
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<tr>
<td>17</td>
<td>Dimension of the main beam</td>
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<tr>
<td>18</td>
<td>Existence of perimeter (ring) beam</td>
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<tr>
<td>19</td>
<td>Material of the roof</td>
<td>2</td>
</tr>
<tr>
<td>20</td>
<td>Damage due to previous earthquake</td>
<td>4</td>
</tr>
<tr>
<td>21</td>
<td>Type of the builder</td>
<td>6</td>
</tr>
</tbody>
</table>
Risk = f(Hazard, Vulnerability)

Where are exposed areas?
What would be affected?
How many people would be affected?
Who would be affected?
How large will be the damage?
What is the current situation?
30.09.2009: Earthquake of magnitude 7.9
Risk = f(Hazard, Vulnerability)

- Where are exposed areas?
- What would be affected?
- How many people would be affected?
- Who would be affected?
- How large will be the damage?
- What is the current situation?
- Which reaction is necessary?
- How can rehabilitation be organized?
Which reaction is necessary?

- identification of rescue areas, transport lines, etc.
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Summary – DLRs Earth Observation Activities for Risk- and Vulnerability Assessment

- Where are exposed areas?
- What would be affected?
- How many people will be affected?
- How large will be the damage?
- What is the current situation?
- Which damage grades can be identified?
- Which reaction is necessary?
Center for Satellite Based Crisis Information
– Emergency Mapping & Disaster Monitoring –

Thank you very much for your attention!