LEMONADE project - Final event
Bolzano/Bozen - 23 April 2018

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LEMONADE background

- Natural hazards like earthquakes, volcanic eruptions, landslides, droughts, floods, cyclones and fires threaten people and properties
- These events can happen in any moment and need be studied and monitored

Spatial distribution of landslides that caused fatalities for the period 2004 - 2010
LEMONADE background

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- These events can happen in any moment and need to be studied and monitored.

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Estimated damages (bill. US$) caused by natural disasters in the period 1975-2012

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LEMONADE background

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Landslides in Trentino (a) and Bolzano Province (b) - IFFI project (2015).
LEMONADE background

- Natural hazards like earthquakes, volcanic eruptions, landslides, droughts, floods, cyclones and fires threaten people and properties
- These events can happen in any moment and need be studied and monitored
- The project focused on mass movements and particularly on landslides
- The number of landslide events are largely increasing over the last years, calling for the development of more adequate methods for landslide monitoring
- Use remote and proximal sensing methods to survey, monitor, analyse landslide movements

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LEMONADE project

- LEMONADE - LandslidE MOonitoriNg And Data integration
- Funded by EUREGIO - the European Region Tyrol-South Tyrol-Trentino – Science Fund
- Total budget: 230,727 Eur
- Duration: February 2016 – April 2018 (3 months extensions)
- Consortium:
  - 3D Optical Metrology unit, Bruno Kessler Foundation
  - Institute for applied Remote Sensing, European Academy of Bozen
  - Institute of Interdisciplinary Mountain Research (IGF), Austrian Academy of Sciences
LEMONADE pilot areas

- Reissenschuh landslide (shallow)
- Corvara landslide (complex, earthflow)
- Fortebuso landslide (rock slide)

LEMONADE project

- Cooperation partners
  - Department of Geoinformation, Federal State of Tyrol
  - Christoph Prager, Senior Engineering Geologist (alpS GmbH, ILF Consulting Engineers Austria GmbH)
  - Geological Service, Autonomous Province of Trento
  - Remote Sensing & Topographic LiDAR Research Group, University of Innsbruck

- Implementation

  WP1: PROJECT MANAGEMENT & COORDINATION
  WP2: MEASUREMENT BY SINGLE METHODS
  WP3: DATA INTEGRATION METHODOLOGY
  WP4: COMPARATIVE ANALYSES AND VALIDATION
  WP5: DISSEMINATION
**Objective 1:**
Analyse advantages & disadvantages of remote and proximal sensing methods (GNSS, TLS, ground- / UAV-based photogrammetry, UAV-based LiDAR and satellite remote sensing) for landslide observations.

The challenge: accurate georeferencing of all the data and their management for the successive comparative assessment and integration.

**Objective 2:**
Develop and validate a methodology to integrate data and sensors, exploiting intrinsic benefits, for enhanced landslide monitoring and risk mitigation.

The challenge: deliver a reliable and replicable method usable also in other fields.

**Objective 3:**
Validate the methodology on three test sides located in Trentino, South Tyrol and Tyrol.

The challenge: find a standard approach that could become a regular methodology.

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**LEMONADE objectives**

**LEMONADE sensing methods**

**GNSS monitoring:**
- Ongoing activity since 2013
- 3 permanent stations, measuring 24h
- Monthly measurement campaigns
- Ground validation of remotely sensed data

**Photogrammetry:**
- Terrestrial: SLR Nikon D750
- UAV: Octocopter, Ricoh RGB camera
- Yearly monitoring (2 times)
- Product: DSM, Orthomosaic, DoD

**Terrestrial laser scanner (TLS):**
- Riegel VZ 6000
- Yearly monitoring (2 times)
- Product: DTM, DSM, DoD

**SAR interferometry (InSAR):**
- ESA Sentinel 1, Cosmo Sky-MED
- Displacement along LOS
## LEMONADE event - program

<table>
<thead>
<tr>
<th>Time</th>
<th>Session</th>
<th>Presenter(s)</th>
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</thead>
<tbody>
<tr>
<td>10:30 - 11:00</td>
<td>Arrivals and registrations</td>
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<tr>
<td>11:00 - 11:15</td>
<td>Opening and project overview</td>
<td>Fabio Remondino (FBK Trento)</td>
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<tr>
<td>11:15 - 11:45</td>
<td>TLS for landslide monitoring</td>
<td>Martin Rutzinger, Jan Pfeiffer (AAS Innsbruck)</td>
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<td>11:45 - 12:15</td>
<td>Photogrammetry for landslide monitoring</td>
<td>Isabella Toschi (FBK Trento)</td>
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<tr>
<td>12:15 - 12:45</td>
<td>SAR for landslide monitoring</td>
<td>Mehdi Darvishi (EURAC Bozen)</td>
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<td>12:45 - 14:15</td>
<td>Lunch break</td>
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<tr>
<td>14:15 - 14:45</td>
<td>Data &amp; sensor integration</td>
<td>Thomas Zieher (Univ. of Innsbruck)</td>
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<td>14:45 - 15:05</td>
<td>Experiences from South Tyrol</td>
<td>Volkmar Mair (Geological Services)</td>
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<td>15:05 - 15:25</td>
<td>Experiences from Cartorender</td>
<td>Loris Trentin (Cartorender)</td>
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<td>15:25 - 15:45</td>
<td>Experiences from Land Tirol</td>
<td>Patrick Fritzmann (Geoinformation, Tyrol)</td>
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<td>15:45 - 16:15</td>
<td>Coffee break</td>
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<tr>
<td>16:15 - 16:35</td>
<td>Experiences from Alto-Drones</td>
<td>Thomas Fontana (Alto-drones)</td>
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<td>16:35 - 16:55</td>
<td>Experiences from REDcatch</td>
<td>Hans-Jorg Ragg (REDcatch)</td>
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<td>17:00</td>
<td>Wrap up and closing</td>
<td>Fabio Remondino (FBK Trento)</td>
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