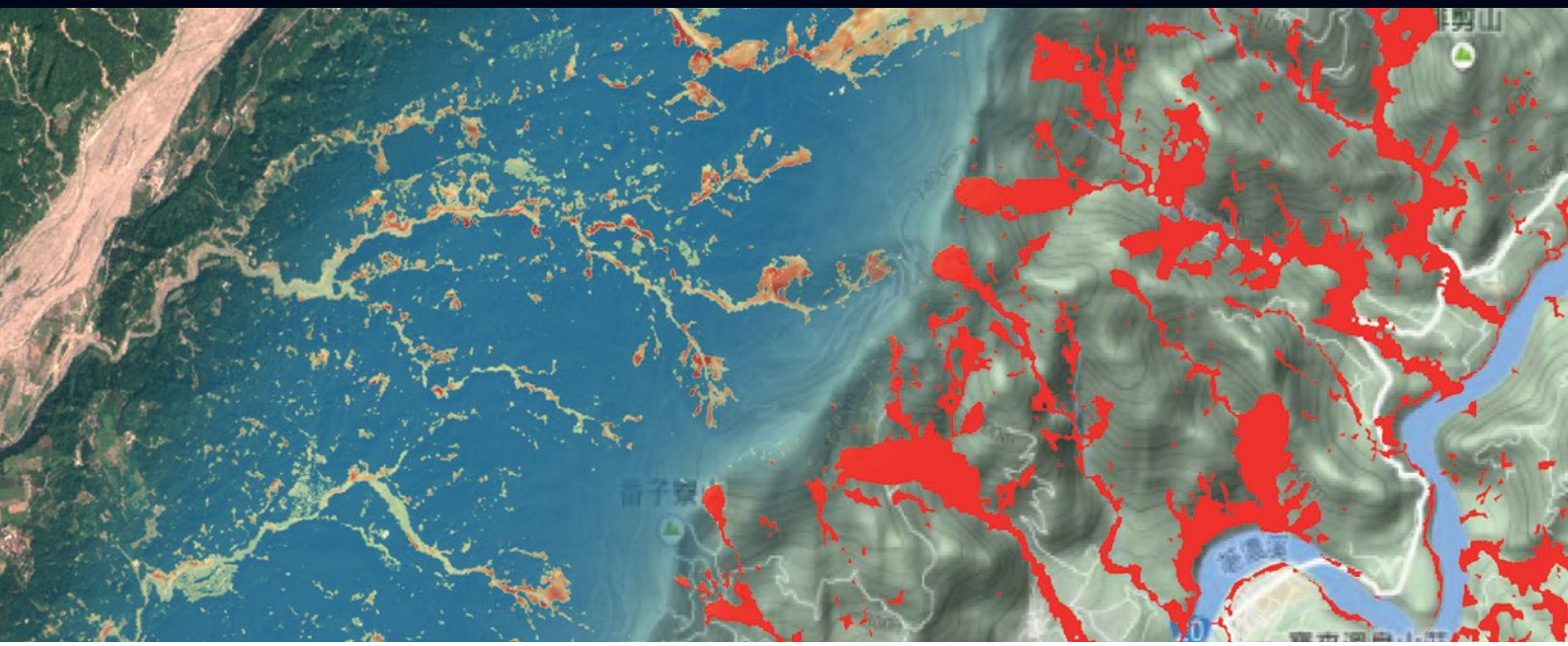
ELIM

Event Landslide Inventory Map

products



Kaopin (Kaohsiung, Taiwan) On the left, the picture shows a FORMOSAT-2 satellite image taken on 14 August 2009 shortly after typhoon Morakot hit the area triggering many landslides and a landslide probability map obtained from the satellite image, on the right, the corresponding event inventory map on a Google Physical map.

WHAT

An Event Landslide Inventory Map (ELIM) shows the location and extent of landslides caused by a specific natural trigger, such as an intense rainfall event, a period of prolonged rainfall, a rapid snowmelt event, or an earthquake. LAMPRE has advanced methods and tools to prepare ELIMs exploiting high and very-high resolution optical satellite images.

WHERE

The methods and tools developed by LAMPRE allow preparation of an ELIM anywhere recent landslides have left discernible signs captured in the optical satellite images. The methods and tools work best in vegetated terrain where the event landslides have removed the vegetation, and are applicable in areas ranging from a few to a few hundred square kilometres.

WHEN

LAMPRE can prepare an ELIM within hours to days after a landslide triggering event, provided adequate satellite imagery is taken shortly after the event.

WHO

Civil Protection authorities use ELIMs in the aftermath of an event for improved rescue and recovery operation.

Planning & development authorities use ELIMs to identify areas recently affected by landslides, and avoid dangerous areas.

Transportation authorities & utility managers use ELIMs to evaluate the impact of landslides on transportation or utility network.

Agricultural & forest agencies use ELIMs to assess the impact of landslides on crops and forests.

Scientists use ELIMs to prepare multi-temporal inventories useful for erosional studies, and to determine the statistics of landslide areas.

SPECIFICATIONS

LAMPRE prepares ELIMs at scales ranging from 1:25,000 (smaller scale) to 1:5000 (larger scale) in periods ranging from hours to days after the delivery of the high resolution (HR) and very-high resolution (VHR) optical satellite images. LAMPRE uses pre- and/or post-event satellite images, and delivers ELIMs in raster and vector formats.

Copernicus Programme Taxonomy

	Land Monitoring	Emergency Management
Relevant for rush		
Relevant for non rush		

Key References

Guzzetti et al. (2012) doi: 10.1016/j.earscirev.2012.02.001
Mondini et al. (2013) doi: 10.1016/j.geomorph.2013.06.015
Mondini et al. (2014) doi: 10.5194/nhess-14-1749-2014

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LAndslide Modelling and tools for vulnerability assessment Preparedness and REcovery management

LAMPRE

APPLICATIONS IN LAMPRE TEST SITES

LAMPRE has prepared ELIMs for different test sites ranging in areas from 25 to 80 square kilometres, including two ELIMs for the Kaopin area (Taiwan), two ELIMs for the Pogliaschina area (Liguria, Italy) and an ELIM for the Giampilieri area (Sicily, Italy).

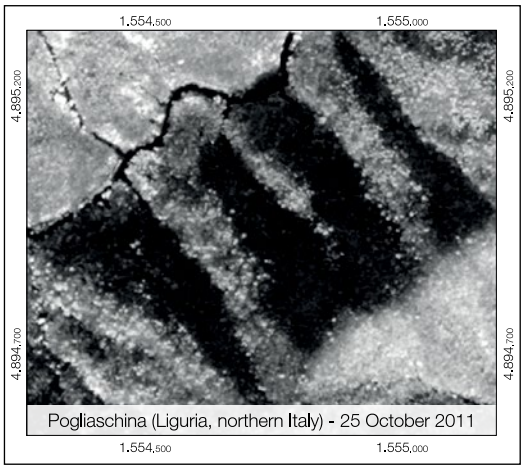

Fig. A - NDVI image obtained processing a WorldView-2 satellite image taken after a rainfall event.

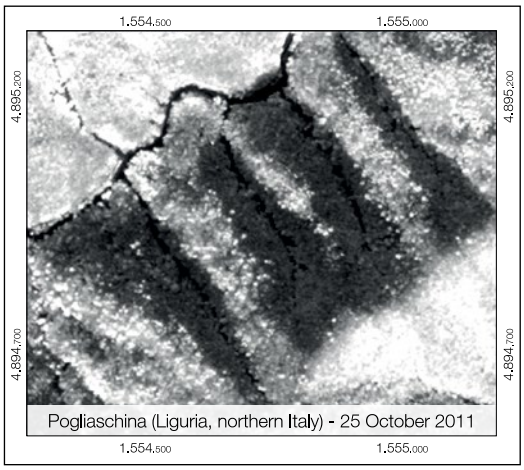

Fig. B - Enhanced NDVI image. Landslides previously obscured by shadow are now visible.

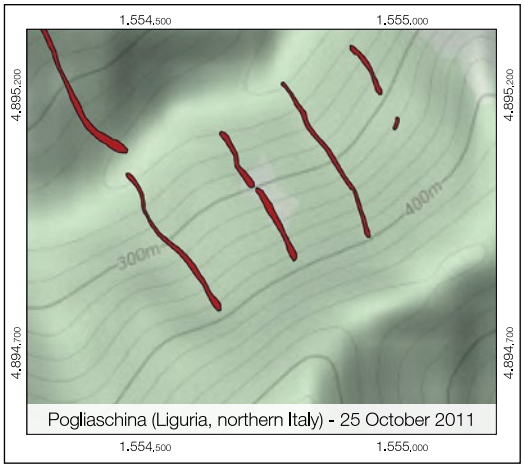

Fig. C - Event landslide inventory map showing debris flows and a soil slip on a Google Physical map.

To prepare the ELIMs, LAMPRE experimented with different methods and techniques, depending on the types and number of landslides, the extent of the study area, and the type and quality of the satellite imagery.

For the **Kaopin area (Taiwan)**, LAMPRE has obtained two ELIMs exploiting a post-event Formosat-2 image. The first ELIM was obtained adopting a Bayesian approach that couples the landslide class membership resulting from the landslide spectral properties captured by the satellite image with the frequency distribution of geo-environmental factors in past landslides in the same general area. The second ELIM was obtained by coupling the same landslide class membership to an existing landslide susceptibility model.

For the **Pogliaschina catchment (Italy)**, LAMPRE has exploited a pair of VHR stereoscopic images taken by the WorldView-2 satellite shortly after a rainfall event that triggered hundreds of landslides. In the non-shadowed areas, the ELIM was prepared semi-automatically through a standard classification of the VHR images. In the shadowed areas, landslides were not visible in the images (Figure A). By stretching the Normalized Differential Vegetation Index (NDVI) the traces left by the landslides became apparent (Figure B). Exploiting stereoscopy, a 3D model was prepared to facilitate the recognition of the event landslides, allowing for their accurate mapping (Figure C).

For the **Giampilieri area (Italy)**, LAMPRE prepared an ELIM (Figure D) through the visual interpretation of pre-event and post-event stereoscopic and pseudo-stereoscopic aerial photographs, aided by field surveys carried out in October and November 2009, shortly after the landslide triggering rainfall event. The ELIM can be used for post-event recovery and reconstruction.

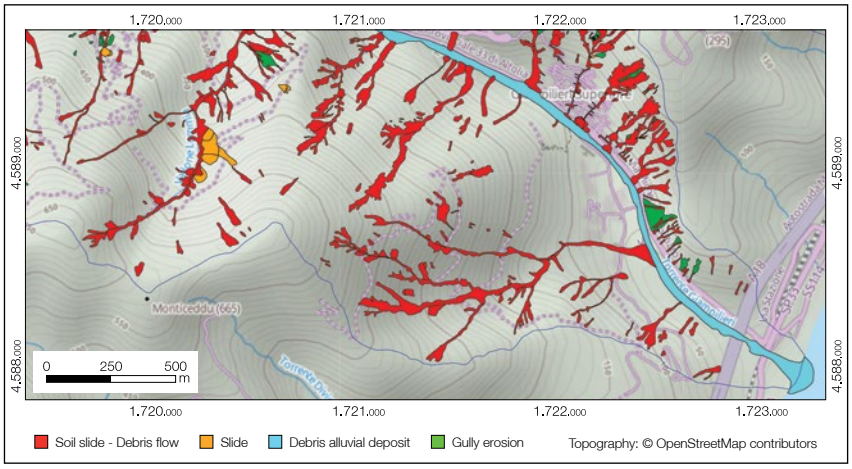

Fig. D - Giampilieri (Sicily, southern Italy). ELIM showing landslides triggered by the 1 October 2009 intense rainfall event and geomorphologic features related to fluvial processes and slope movements.

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