RASOR
RAPID ANALYSIS AND SPATIALISATION OF RISK

OTHER GEOHAZARDS

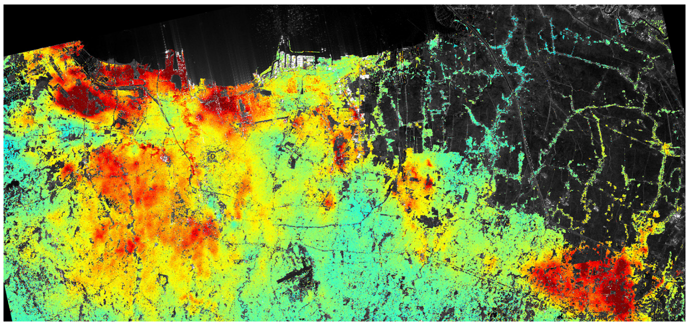
WHETHER GRADUAL AND DIFFUSE OVER LARGE AREAS (SUBSIDENCE), OR RAPID AND CONCENTRATED ON LOCAL AREAS (LANDSLIDES), GROUND MOVEMENTS CAN GENERATE STRONG IMPACTS ON MAN MADE STRUCTURES.

SATELLITE SAR OR OPTICAL IMAGES CAN PROVIDE VERY HIGH RESOLUTION AND ACCURATE MEASUREMENTS OF SUCH MOVEMENTS. THE NEW OPEN ACCESS SENTINEL SATELLITE IMAGES ALLOW A CONTINUOS MONITORING OF THE DEFORMATION FOR SUCH IMPORTANT APPLICATIONS.

LAND SUBSIDENCE MEASUREMENTS

Land subsidence due to underground fluid withdrawal (more commonly water, but also oil and gas) is increasingly more common in all urban areas of the world. Very high ground lowering rates (up to tens of cm/yr) are increasing the risk of sea or river inundation for millions of people in many basin and coastal cities. In these contexts flood prevention measures by Risk Managers need to consider subsidence rates and patterns. The temporal evolution of land subsidence is also an essential parameter for groundwater exploitation planning by city managers.

RASOR can provide accurate subsidence rates using multitemporal InSAR datasets obtained from a variety of satellites, processed using high resolution techniques (e.g. Persistent Scatterers methods).

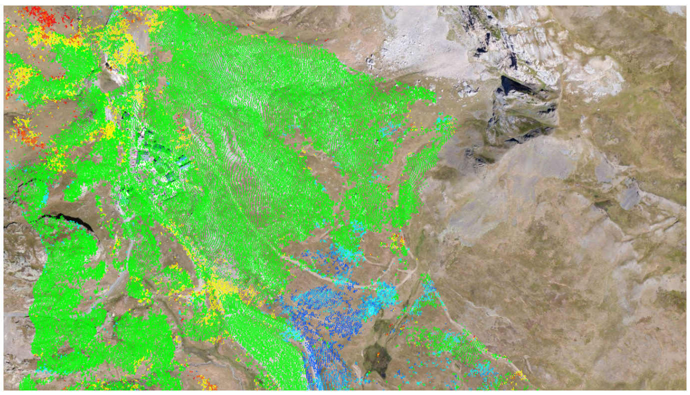


Groundwater extraction induced subsidence, Jakarta (Indonesia).

ACTIVE LANDSLIDE MAP

Landslide deformation and collapse cannot always be measured or predicted, however in many cases large slopes can be affected by slow ground movements which can effectively be measured and used to map and characterise active sliding masses before collapse. In active regions, Risk Managers and local administrators need this information to plan effective prevention measures and implement warning systems.

Since landslide dimensions are normally 1-2 order of magnitude smaller than faults or volcanoes, for this service RASOR provides high resolution ground deformation measurements obtained from Persistent Scatterers InSAR methods. The ground displacement time series for each single scatterer, and its mean velocity are then analysed and interpreted using geological and geomorphological techniques to generate a map of the active slope movements and landslides.



InSAR results for active slopes monitoring, Portalet, Pyrenees (Spain) - Source: LAMPRE FP7 Project.

TRIGGERED LANDSLIDE SCENARIO

In particular geologic conditions landslides triggered by seismic shaking can cause most of the earthquake's damage. The RASOR platform provides a tool to calculate regional triggered landslide scenarios using the sliding-block method developed by Newmark and Ambraseys.

Using this tool the user is able to calculate the Newmark displacements over an area, and isolate the areas where the amount of displacement is considered able to trigger a landslide. The user can also classify the displacement values according to hazard categories.

RAINFALL INDUCED LANDSLIDES

Rainfall-induced shallow landslides have been widely described by many authors, referring to widespread phenomena occurred both in temperate and tropical regions. Although these landslides mobilize relatively small soil volumes, due to their close proximity to structures and infrastructure, they often cause huge damages and, sometimes, human losses.

Proper assessment and management strategies for a reduction in the impact of these landslides on the environment can be carried through susceptibility maps able to consider the phenomenon on territorial scale.

However, susceptibility maps alone would be insufficient to prefigure possible soil slip scenarios. The need for a dedicated modelling in close correlation with rainfall observed or foreshadowed amounts, is recognized. For this reason, RASOR includes in its algorithms a physically based slope-stability model that simulate the triggering mechanism, on account of the transient dynamical response of the pore water pressure to space–time variability of rainfall in complex terrains to address rainfall-induced land- slide hazard assessment at large spatial scales (Montrasio et al., 2014).

Montrasio, L., Valentino, R., Corina, A., Rossi, L. Rudari, R., (2014) A prototype system for space-time assessment of rainfall-induced shallow landslides in Italy, Nat. Haz., NHAZ-D-13-01016R2.

Sarno, Italy

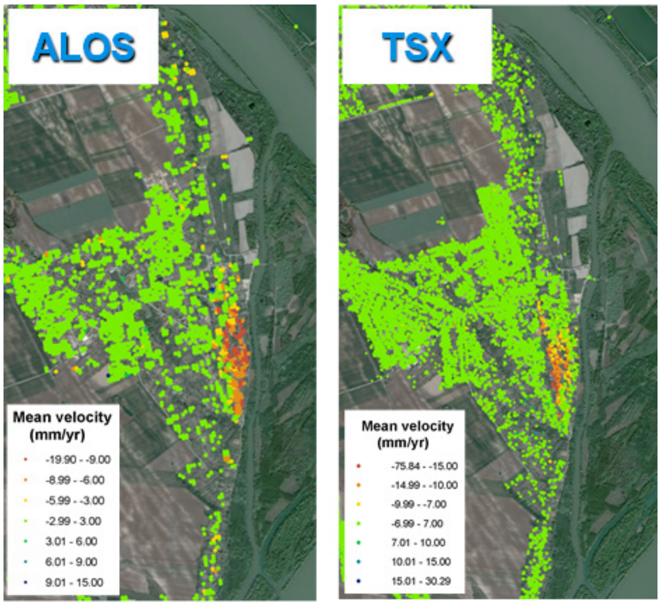
HIGH RESOLUTION GROUND DEFORMATION MAP

Ground deformation is certainly the most evident expression of landslides, however, depending on landslide type, dimensions, and depth, the ground displacements can be effectively monitored to provide useful elements for hazard assessment. For fast soil slumps or mud flows, no more than a post-slide assessment can be done to evaluate the volume of displaced soil. For slow landslides in rock or consolidated materials, multitemporal InSAR provide the best way to progressively monitor the subtle ground movements of the sliding mass. For this product high resolutions satellite data (e.g. X band) and processing methods (Persistent Scatterers), will be used, since the landslide dimensions are often one or two order of magnitude smaller than faults or volcanoes.

This product may require several updates, to monitor the landslide progression.

This product is generated by RASOR partners outside of the system, and it is ingested in the system as an external layer.

Right: High resolution ground motion maps for landslide detection in Racalmas (Hungary) – Source: DORIS FP7 project.



LANDSLIDE FOOTPRINT

Change detection techniques are applied in order to assess the changes induced by a landslide. On the different sites, a reference image will be necessary. At least one scene will be acquired after the event. The algorithm is based on dual- pol classification techniques, it is foreseen that with the operation of Sentinel1, dual-polarisation information will be valuable for mapping landslide.

This product, together with the high resolution ground deformation map, will provide essential inputs for landslide hazard assessment.

OTHER PRODUCTS

Landslide deformation monitoring, Haiti national landslide hazard map and Landslide simulator, Change detection overtime - subsidence map by CM - projected future subsidence.

Copernicus The European Earth Observation Programme

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