This project has received funding from the European Union's Seventh Framework Program
for research, technological development and demonstration under grant agreement no. 606888

RAPID ANALYSIS AND SPATIALISATION OF RISK

Deliverable D10.6 Materials to support SME outreach, version no. 1

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Purpose of the Document

ALTAMIRA INFORMATION has developed support materials that describe RASOR and explain its benefits to support SME's in their efforts to market RASOR to national and local stakeholders in the risk management arena. The present document describe the propose material.

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Abbreviations

Abbreviation	Meaning
ALTA	ALTAMIRA INFORMATION
CIMA	CIMA Reseach Foundation, Centro Interuniversitario di Ricerca in Monitoraggio Ambientale
EARSC	European Association of Remote Sensing Companies
IGARSS	IEEE International Symposium on Geoscience and Remote Sensing
RASOR	Rapid Analysis and Spatialisation of Risk
SC	Steering Committee
SME	Small and Medium-sized Enterprises

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1 Introduction

The RASOR Consortium will offer three tracks of services based on adding value through customised exploitation of the RASOR tool for risk management and insurance markets: a global risk assessment service, and SME-led national and local services through innovative partnering arrangements in each national marketplace.

In order to achieve strong regional penetration of markets and to reach the largest possible user base, RASOR has been defined as an open platform that can easily be licensed to local and national SMEs who already work closely with regional stakeholders. This approach guarantees better access to specific in-situ data sets, increases the socio-economic benefits through heightened SME participation and ensures broad regional distribution of benefits.

In order to involve local SMEs on a European scale, RASOR has secured the support of the EARSC, which will use its existing network of contacts to stimulate interest in RASOR uptake at a provider level.

In this framework an SME workshop has been organised in order to attract the interest of SME partners. The workshop was organised during the IGARSS conference on July 30th at the Milano Convention Center.

ALTAMIRA INFORMATION has been in charge to prepare marketing material describing RASOR and its benefits that have been distributed during the workshop and that could be further used to support SME's in their efforts to market RASOR to national and local stakeholders in the risk management arena.

This material is described in the present document and can be downloaded from the RASOR website in the dissemination section (http://www.rasor-project.eu/services/)

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2 Material for SME workshop outreach

2.1 Promotional material

The promotional material prepared by ALTAMIRA INFORMATION consisted in:

- a general brochure describing the RASOR projects and its specificities,
- thematic leaflet that will consider each of the hazards for which risk and impact analysis can be conducted within RASOR,
- a general poster accounting for the fact that as part of dissemination activities of WP12, ALTAMIRA INFORMATION was also presenting a poster on the RASOR project during the conference.

2.1.1 General brochure

A folder brochure was created so that the thematic leaflets could be distributed inside it. The key messages that were considered key to convey are listed:

- Multi hazard element
- High level technology
- Integration (of all existing information/tools)
- Five main areas of impact
- Supporting the full cycle of disaster management
- User oriented approach
- Integration of radar and optical data with in situ data for global and local applications
- Demonstration sites for product validation

The design of the brochure was created at ALTA and provided to CIMA for final feedback. The front and back pages of the folder brochure are shown in Figure 1 and Figure 2.

2.1.2 Thematic leaflets

ALTA proposed moreover to create 2-page (front and back) leaflet by hazards to present the different services/products available on the platform. The services that are not strictly related to hazards: e.g. subsidence, or that are aside from any hazard (e.g. asset mapping) should also be considered in a proper way. It was finally decided to create 4 leaflets considering the services/products that are offered in the platform at that point (Flood, Earthquakes, Volcanoes and Other Geohazards).

In order to make valuable dissemination material, the first step was the identification of the outputs/products susceptible to be content for the leaflets. This selection was carried out together with CIMA. The other partners were asked to provide information on each selected products; in general INGV can serve as a hub for all Geophysical hazards while Deltares if for the water related ones.

The audience of the workshop was also considered to provide useful information in order to decide the best approach for the material.

2.2 Language versions

For the SME workshop printing version will be prepared only in English.

For further stages of the project, CIMA will assess the possibility of producing digital and/or printed versions in other languages.

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Figure 1: Front-page of the folder brochure

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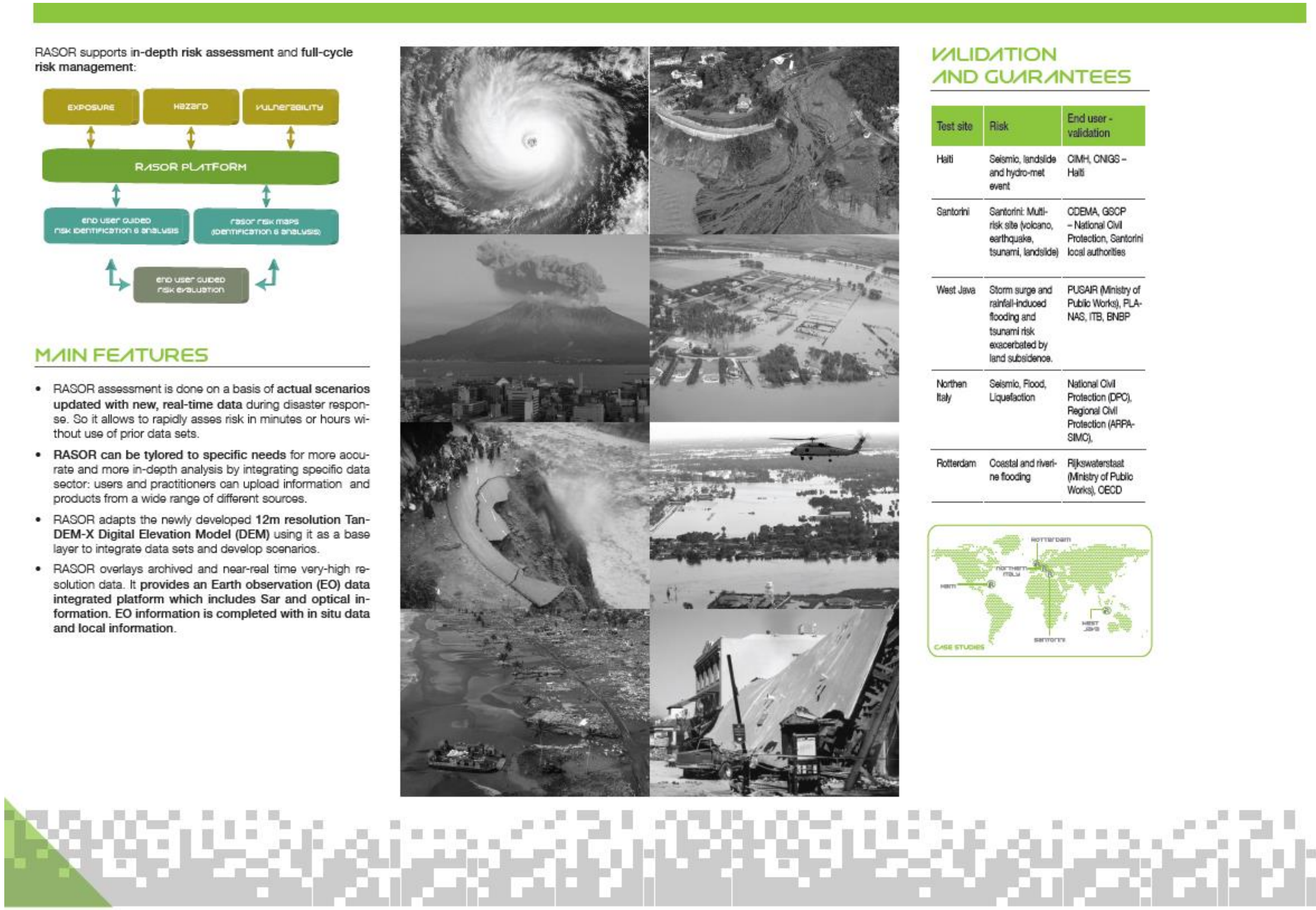

RASOR supports **in-depth risk assessment** and **full-cycle risk management**:

MAIN FEATURES

- RASOR assessment is done on a basis of **actual scenarios updated with new, real-time data** during disaster response. So it allows to rapidly asses risk in minutes or hours without use of prior data sets.
- **RASOR can be tylored to specific needs** for more accurate and more in-depth analysis by integrating specific data sector: users and practitioners can upload information and products from a wide range of different sources.
- RASOR adapts the newly developed **12m resolution TanDEM-X Digital Elevation Model (DEM)** using it as a base layer to integrate data sets and develop scenarios.
- RASOR overlays archived and near-real time very-high resolution data. It **provides an Earth observation (EO) data integrated platform which includes Sar and optical information. EO information is completed with in situ data and local information**.

VALIDATION AND GUARANTEES

Test site	Risk	End user - validation
Haiti	Seismic, landslide and hydro-met event	CIMH, CNIGS – Haiti
Santorini	Santorini: Multi-risk site (volcano, earthquake, tsunami, landslide)	CDEMA, GSCP – National Civil Protection, Santorini local authorities
West Java	Storm surge and rainfall-induced flooding and tsunami risk exacerbated by land subsidence.	PUSAIR (Ministry of Public Works), PLANAS, ITB, BNBP
Northen Italy	Seismic, Flood, Liquefaction	National Civil Protection (DPC), Regional Civil Protection (ARPA-SIMC),
Rotterdam	Coastal and riverine flooding	Rijkswaterstaat (Ministry of Public Works), OECD

Figure 2: Back-page of the folder brochure

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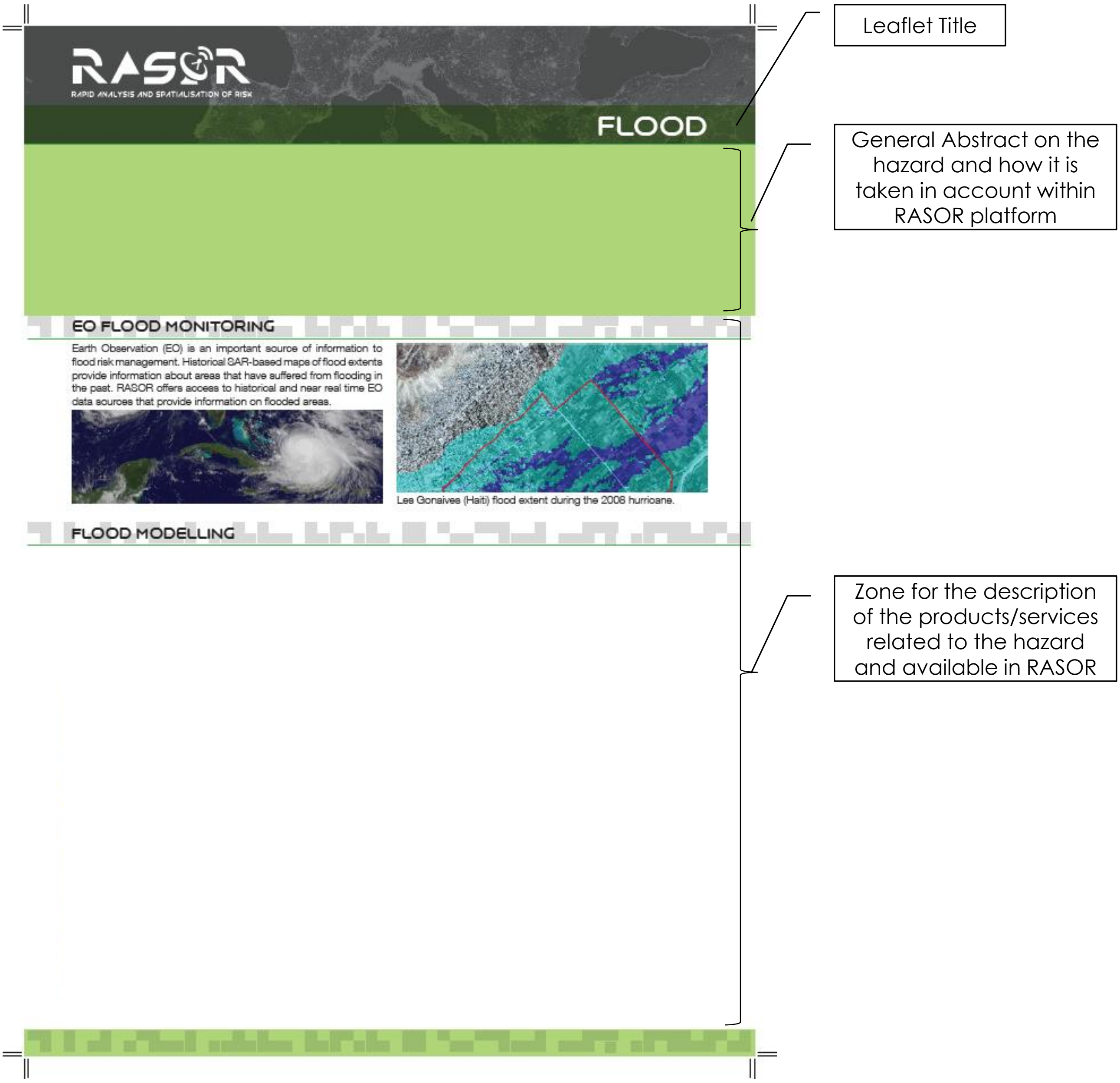
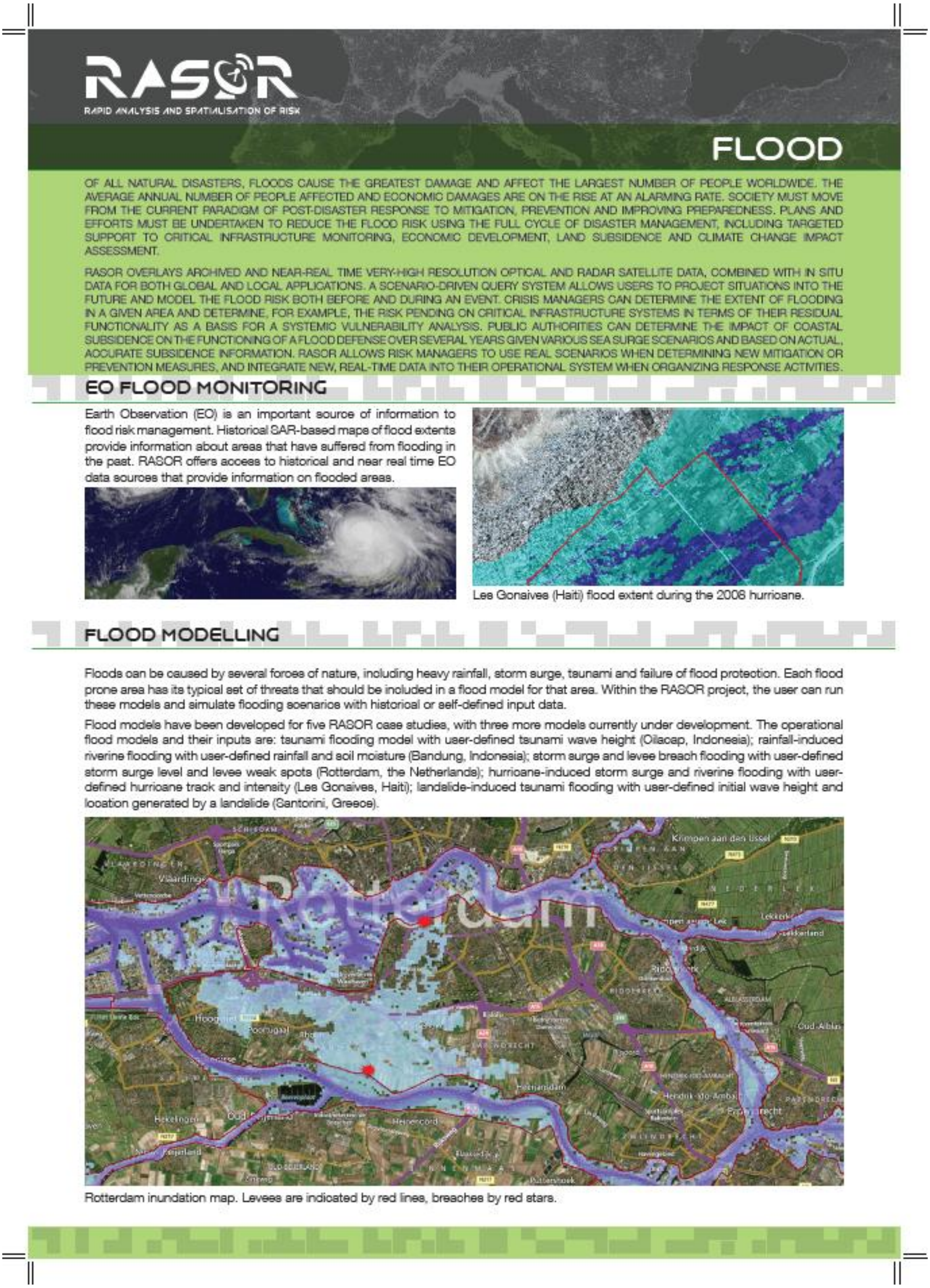
3 Product leaflet design





RASOR
RAPID ANALYSIS AND SPATIALISATION OF RISK

FLOOD

OF ALL NATURAL DISASTERS, FLOODS CAUSE THE GREATEST DAMAGE AND AFFECT THE LARGEST NUMBER OF PEOPLE WORLDWIDE. THE AVERAGE ANNUAL NUMBER OF PEOPLE AFFECTED AND ECONOMIC DAMAGES ARE ON THE RISE AT AN ALARMING RATE. SOCIETY MUST MOVE FROM THE CURRENT PARADIGM OF POST-DISASTER RESPONSE TO MITIGATION, PREVENTION AND IMPROVING PREPAREDNESS. PLANS AND EFFORTS MUST BE UNDERTAKEN TO REDUCE THE FLOOD RISK USING THE FULL CYCLE OF DISASTER MANAGEMENT, INCLUDING TARGETED SUPPORT TO CRITICAL INFRASTRUCTURE MONITORING, ECONOMIC DEVELOPMENT, LAND SUBSIDENCE AND CLIMATE CHANGE IMPACT ASSESSMENT.

RASOR OVERLAYS ARCHIVED AND NEAR-REAL TIME VERY-HIGH RESOLUTION OPTICAL AND RADAR SATELLITE DATA, COMBINED WITH IN SITU DATA FOR BOTH GLOBAL AND LOCAL APPLICATIONS. A SCENARIO-DRIVEN QUERY SYSTEM ALLOWS USERS TO PROJECT SITUATIONS INTO THE FUTURE AND MODEL THE FLOOD RISK BOTH BEFORE AND DURING AN EVENT. CRISIS MANAGERS CAN DETERMINE THE EXTENT OF FLOODING IN A GIVEN AREA AND DETERMINE, FOR EXAMPLE, THE RISK PENDING ON CRITICAL INFRASTRUCTURE SYSTEMS IN TERMS OF THEIR RESIDUAL FUNCTIONALITY AS A BASIS FOR A SYSTEMIC VULNERABILITY ANALYSIS. PUBLIC AUTHORITIES CAN DETERMINE THE IMPACT OF COASTAL SUBSIDENCE ON THE FUNCTIONING OF A FLOOD DEFENSE OVER SEVERAL YEARS GIVEN VARIOUS SEA SURGE SCENARIOS AND BASED ON ACTUAL, ACCURATE SUBSIDENCE INFORMATION. RASOR ALLOWS RISK MANAGERS TO USE REAL SCENARIOS WHEN DETERMINING NEW MITIGATION OR PREVENTION MEASURES, AND INTEGRATE NEW, REAL-TIME DATA INTO THEIR OPERATIONAL SYSTEM WHEN ORGANIZING RESPONSE ACTIVITIES.

EO FLOOD MONITORING

Earth Observation (EO) is an important source of information to flood risk management. Historical SAR-based maps of flood extents provide information about areas that have suffered from flooding in the past. RASOR offers access to historical and near real time EO data sources that provide information on flooded areas.

Les Gonaives (Haiti) flood extent during the 2008 hurricane.

FLOOD MODELLING

Floods can be caused by several forces of nature, including heavy rainfall, storm surge, tsunami and failure of flood protection. Each flood prone area has its typical set of threats that should be included in a flood model for that area. Within the RASOR project, the user can run these models and simulate flooding scenarios with historical or self-defined input data.

Flood models have been developed for five RASOR case studies, with three more models currently under development. The operational flood models and their inputs are: tsunami flooding model with user-defined tsunami wave height (Cilacap, Indonesia); rainfall-induced riverine flooding with user-defined rainfall and soil moisture (Bandung, Indonesia); storm surge and levee breach flooding with user-defined storm surge level and levee weak spots (Rotterdam, the Netherlands); hurricane-induced storm surge and riverine flooding with user-defined hurricane track and intensity (Les Gonaives, Haiti); landslide-induced tsunami flooding with user-defined initial wave height and location generated by a landslide (Santorini, Greece).

Rotterdam inundation map. Levees are indicated by red lines, breaches by red stars.

Figure 3: Front page of the "Flood" leaflet

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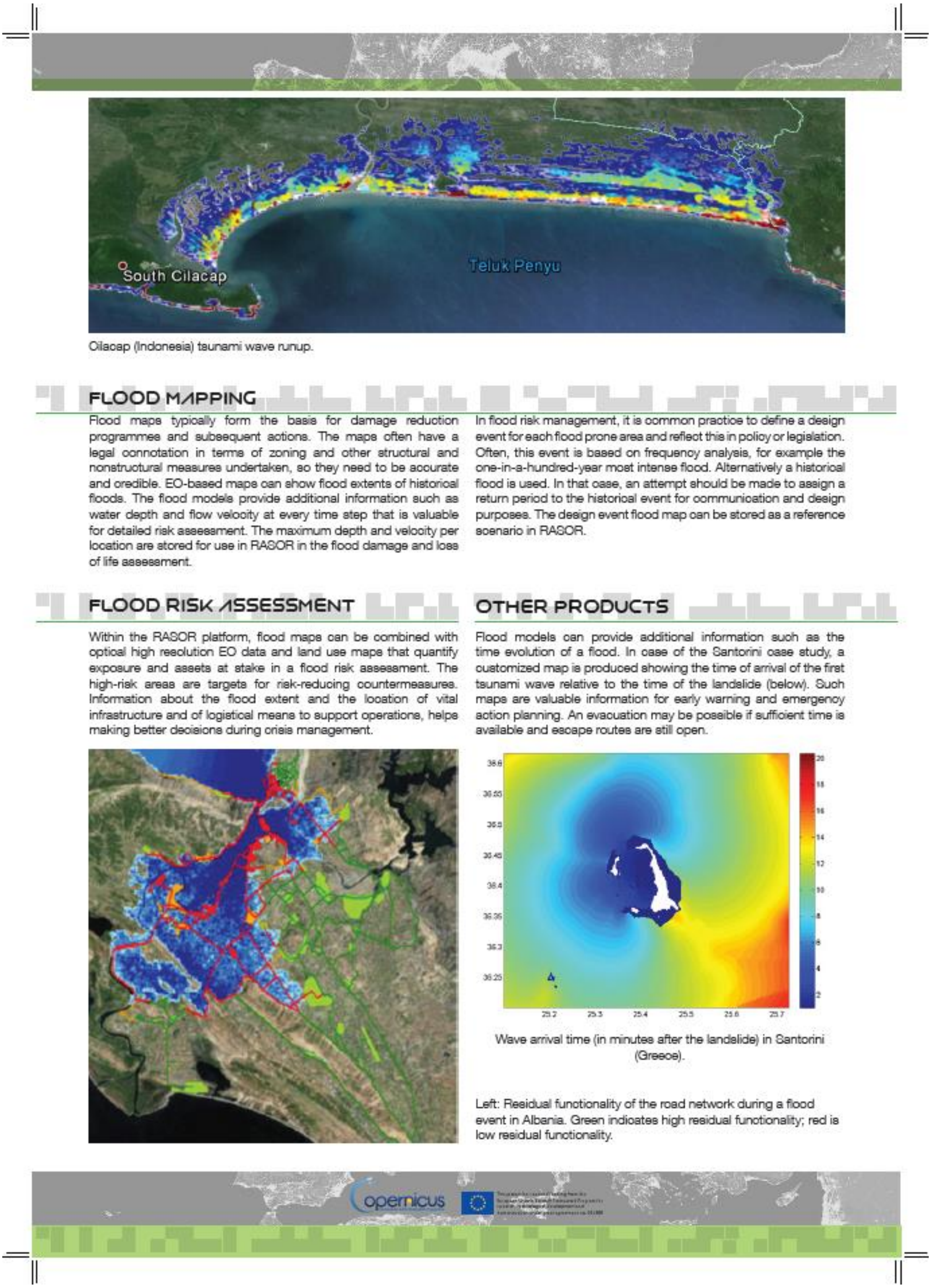

South Cilacap
Teluk Penyu

Cilacap (Indonesia) tsunami wave runup.

FLOOD MAPPING

Flood maps typically form the basis for damage reduction programmes and subsequent actions. The maps often have a legal connotation in terms of zoning and other structural and nonstructural measures undertaken, so they need to be accurate and credible. EO-based maps can show flood extents of historical floods. The flood models provide additional information such as water depth and flow velocity at every time step that is valuable for detailed risk assessment. The maximum depth and velocity per location are stored for use in RASOR in the flood damage and loss of life assessment.

In flood risk management, it is common practice to define a design event for each flood prone area and reflect this in policy or legislation. Often, this event is based on frequency analysis, for example the one-in-a-hundred-year most intense flood. Alternatively a historical flood is used. In that case, an attempt should be made to assign a return period to the historical event for communication and design purposes. The design event flood map can be stored as a reference scenario in RASOR.

FLOOD RISK ASSESSMENT

Within the RASOR platform, flood maps can be combined with optical high resolution EO data and land use maps that quantify exposure and assets at stake in a flood risk assessment. The high-risk areas are targets for risk-reducing countermeasures. Information about the flood extent and the location of vital infrastructure and of logistical means to support operations, helps making better decisions during crisis management.

OTHER PRODUCTS

Flood models can provide additional information such as the time evolution of a flood. In case of the Santorini case study, a customized map is produced showing the time of arrival of the first tsunami wave relative to the time of the landslide (below). Such maps are valuable information for early warning and emergency action planning. An evacuation may be possible if sufficient time is available and escape routes are still open.

Wave arrival time (in minutes after the landslide) in Santorini (Greece).

Left: Residual functionality of the road network during a flood event in Albania. Green indicates high residual functionality; red is low residual functionality.

Figure 4: Back page of the "Flood" leaflet

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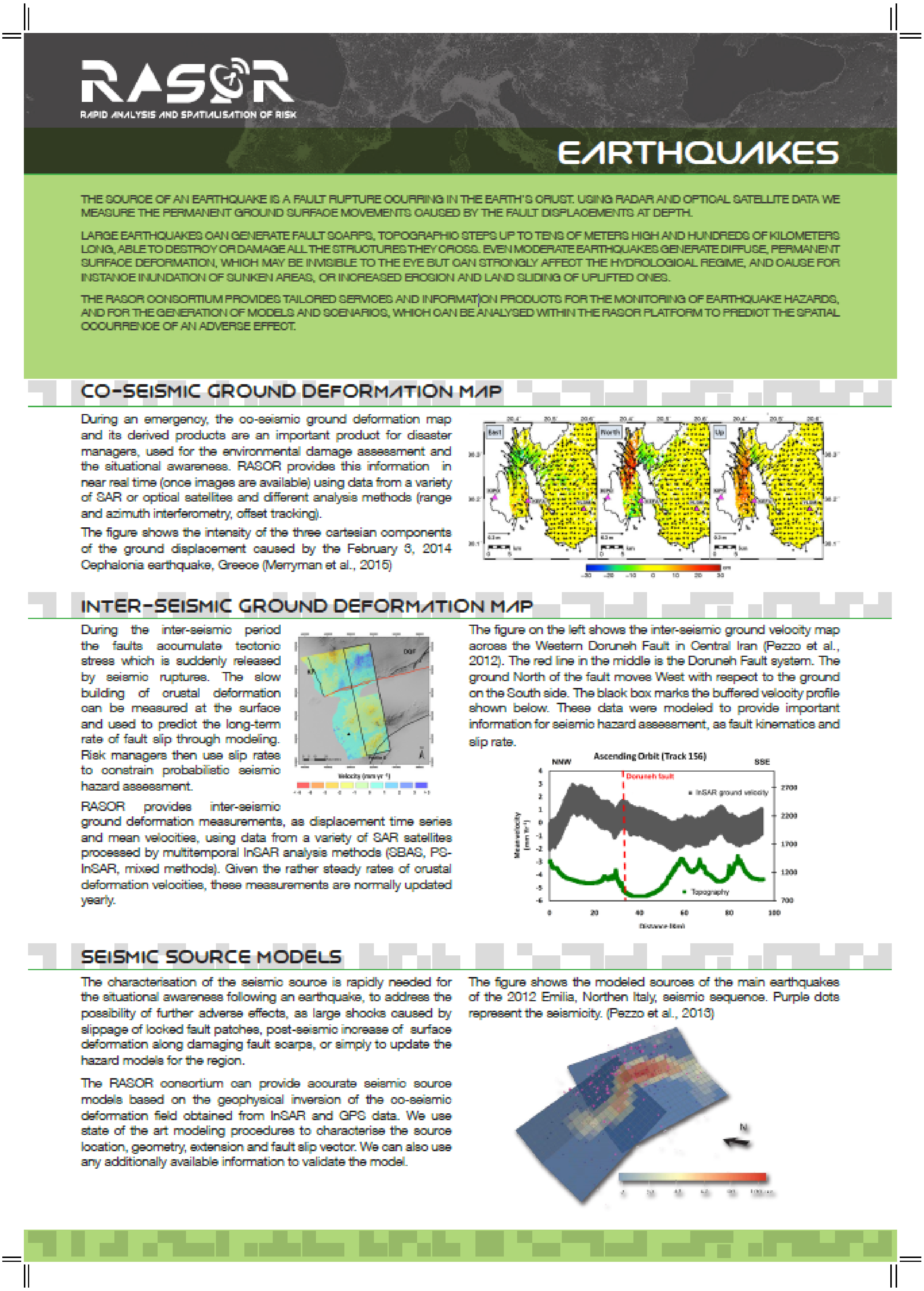

RASOR
RAPID ANALYSIS AND SPATIALISATION OF RISK

EARTHQUAKES

THE SOURCE OF AN EARTHQUAKE IS A FAULT RUPTURE OCCURRING IN THE EARTH'S CRUST. USING RADAR AND OPTICAL SATELLITE DATA WE MEASURE THE PERMANENT GROUND SURFACE MOVEMENTS CAUSED BY THE FAULT DISPLACEMENTS AT DEPTH.

LARGE EARTHQUAKES CAN GENERATE FAULT SCARPS, TOPOGRAPHIC STEPS UP TO TENS OF METERS HIGH AND HUNDREDS OF KILOMETERS LONG, ABLE TO DESTROY OR DAMAGE ALL THE STRUCTURES THEY CROSS. EVEN MODERATE EARTHQUAKES GENERATE DIFFUSE, PERMANENT SURFACE DEFORMATION, WHICH MAY BE INVISIBLE TO THE EYE BUT CAN STRONGLY AFFECT THE HYDROLOGICAL REGIME, AND CAUSE FOR INSTANCE INUNDATION OF SUNKEN AREAS, OR INCREASED EROSION AND LAND SLIDING OF UPLIFTED ONES.

THE RASOR CONSORTIUM PROVIDES TAILORED SERVICES AND INFORMATION PRODUCTS FOR THE MONITORING OF EARTHQUAKE HAZARDS, AND FOR THE GENERATION OF MODELS AND SCENARIOS, WHICH CAN BE ANALYSED WITHIN THE RASOR PLATFORM TO PREDICT THE SPATIAL OCCURRENCE OF AN ADVERSE EFFECT.

CO-SEISMIC GROUND DEFORMATION MAP

During an emergency, the co-seismic ground deformation map and its derived products are an important product for disaster managers, used for the environmental damage assessment and the situational awareness. RASOR provides this information in near real time (once images are available) using data from a variety of SAR or optical satellites and different analysis methods (range and azimuth interferometry, offset tracking).

The figure shows the intensity of the three cartesian components of the ground displacement caused by the February 3, 2014 Cephalonia earthquake, Greece (Merryman et al., 2015)

INTER-SEISMIC GROUND DEFORMATION MAP

During the inter-seismic period the faults accumulate tectonic stress which is suddenly released by seismic ruptures. The slow building of crustal deformation can be measured at the surface and used to predict the long-term rate of fault slip through modeling. Risk managers then use slip rates to constrain probabilistic seismic hazard assessment.

RASOR provides inter-seismic ground deformation measurements, as displacement time series and mean velocities, using data from a variety of SAR satellites processed by multitemporal InSAR analysis methods (SBAS, PS-InSAR, mixed methods). Given the rather steady rates of crustal deformation velocities, these measurements are normally updated yearly.

The figure on the left shows the inter-seismic ground velocity map across the Western Doruneh Fault in Central Iran (Pezzo et al., 2012). The red line in the middle is the Doruneh Fault system. The ground North of the fault moves West with respect to the ground on the South side. The black box marks the buffered velocity profile shown below. These data were modeled to provide important information for seismic hazard assessment, as fault kinematics and slip rate.

Ascending Orbit (Track 156)
NNW
SSE
Doruneh fault
InSAR ground velocity
Topography
Mean velocity (mm yr⁻¹)
Distance (km)

SEISMIC SOURCE MODELS

The characterisation of the seismic source is rapidly needed for the situational awareness following an earthquake, to address the possibility of further adverse effects, as large shocks caused by slippage of locked fault patches, post-seismic increase of surface deformation along damaging fault scarps, or simply to update the hazard models for the region.

The RASOR consortium can provide accurate seismic source models based on the geophysical inversion of the co-seismic deformation field obtained from InSAR and GPS data. We use state of the art modeling procedures to characterise the source location, geometry, extension and fault slip vector. We can also use any additionally available information to validate the model.

The figure shows the modeled sources of the main earthquakes of the 2012 Emilia, Northen Italy, seismic sequence. Purple dots represent the seismicity. (Pezzo et al., 2013)

Figure 5: Front page of the "Earthquakes" leaflet

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RAPID ANALYSIS AND SPATIALISATION OF RISK

SLIP RATE ON ACTIVE FAULTS

The slip rate of a fault is defined as the total fault slip occurring during large earthquakes divided by the recurrence interval over geological times. The slip rate provides the long term representation of the fault activity, and is an important quantity for seismic hazard assessment. It can also be estimated from crustal deformation rates obtained from InSAR and GPS geodetic data, and geophysical modeling procedures.

The RASOR consortium can provide estimates of fault slip rates for large active faults for which satellite measurements of surface deformation can be obtained. We also provide validation of the present day slip rate with all the available ancillary information from geological and geomorphological data.

CO-SEISMIC GROUND DEFORMATION SCENARIO

Simulations of the static co-seismic surface deformation induced by earthquakes are used by Risk Managers to assess the effects of earthquakes on man made structures, and take appropriate prevention measures.

In the RASOR platform we provide a tool for the generation of co-seismic ground deformation scenarios. They are obtained through the elastic modeling of the rupture causing the earthquake. The User can select an existing fault, or directly draw one, define the rupture parameters (e.g. based on historical earthquake magnitudes), and simulate the ground displacement in the three cartesian components.

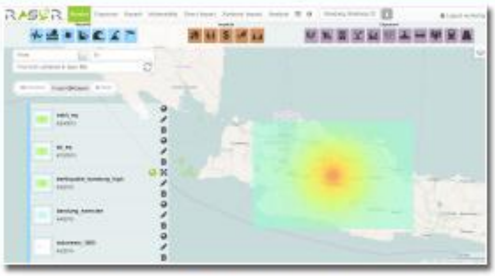
The figure shows the co-seismic ground displacement scenario simulated for a magnitude 6.8 earthquake on the Lembang Fault, West Java Indonesia.

SEISMIC SHAKING SCENARIO

The maximum possible seismic shaking intensity, expressed as Peak Ground Acceleration (PGA) or Peak Ground Velocity (PGV) is the main parameter to be estimated during seismic hazard assessment, associated to a probability of occurrence during a specified time period.

We have implemented in the RASOR platform the ShakeMap code developed by USGS. By defining a point or finite source (earthquake or fault) in a given region, the user can simulate the seismic shaking (PGA, PGV, macroseismic intensities) in any point of the surrounding areas.

The figure represents a seismic shaking scenario for a magnitude 7 earthquake on the Lembang fault in West Java, Indonesia.



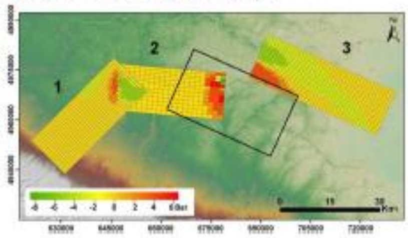
STRESS TRANSFER ON FAULTS SURROUNDING A LARGE EARTHQUAKE

During the sudden crustal rupture process which causes an earthquake, a portion of the pre-existing tectonic stress is redistributed in the crust, and where it adds to a pre-existing stress level, aftershocks are normally triggered. As shown by several examples worldwide, after large earthquakes, further shocks have a higher probability to occur in areas of positive stress variations. Further research is needed to use this scientific result in a quantitative way. However for Disaster Managers the imaging of high post-seismic stress level variations in an area may provide support to important decisions. For instance an increased stress level on a fault located near relief camps can prompt the generation of a shaking scenario to verify the actual safety levels.

In RASOR we provide a geophysical modeling tool to calculate the stress variations caused by a seismic rupture on the nearby active faults.

The stress calculation tool needs as input a seismic source model. The user can select one or more receiving faults on which the differential stress is calculated. These receiving faults can be selected from a fault database of defined by the User on the fly.

The figure below shows stress variations caused by the 2012 Emilia, N. Italy, main rupture (black rectangle) on nearby active faults. Rupture of the fault no.2 occurred 9 days after the mainshock and caused increased casualties and damage.



OTHER PRODUCTS

Seismic hazard map, Damage assessment, Affected population, Active fault map, Event monitoring, Off-platform generation of geohazard field data, models, simulations, scenarios for earthquakes and volcanic hazards, Seismological study (network installation and data analysis for a 3-6 month duration), GNSS monitoring (equipment and data analysis), Geophysical surveys and underground map generation, Fault mapping using field work.

Copernicus

Figure 6: Back page of the “Earthquakes” leaflet

Copernicus

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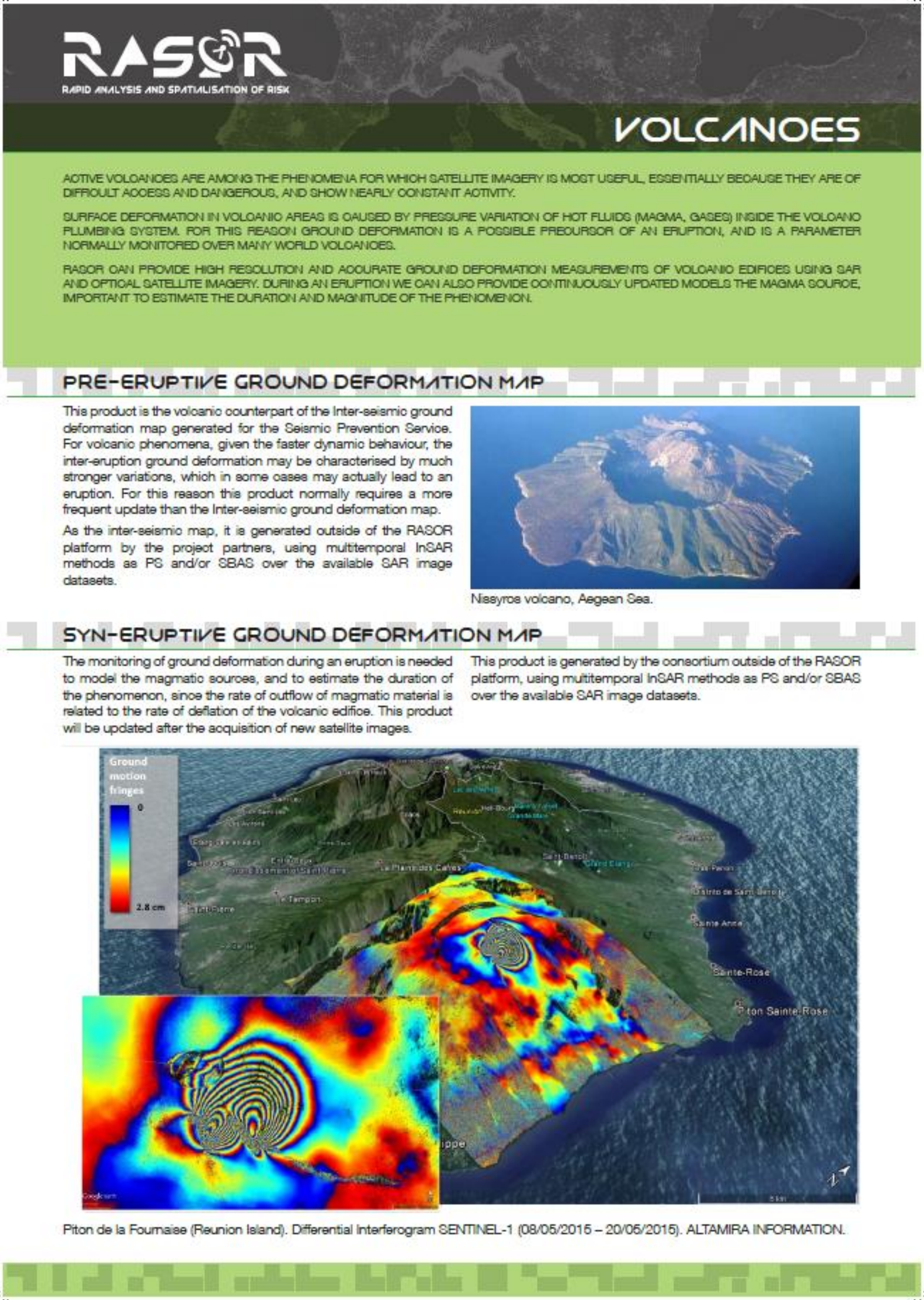

RAPID ANALYSIS AND SPATIALISATION OF RISK

VOLCANOES

ACTIVE VOLCANOES ARE AMONG THE PHENOMENA FOR WHICH SATELLITE IMAGERY IS MOST USEFUL, ESSENTIALLY BECAUSE THEY ARE OF DIFFICULT ACCESS AND DANGEROUS, AND SHOW NEARLY CONSTANT ACTIVITY.

SURFACE DEFORMATION IN VOLCANIC AREAS IS CAUSED BY PRESSURE VARIATION OF HOT FLUIDS (MAGMA, GASES) INSIDE THE VOLCANO PLUMBING SYSTEM. FOR THIS REASON GROUND DEFORMATION IS A POSSIBLE PRECURSOR OF AN ERUPTION, AND IS A PARAMETER NORMALLY MONITORED OVER MANY WORLD VOLCANOES.

RASOR CAN PROVIDE HIGH RESOLUTION AND ACCURATE GROUND DEFORMATION MEASUREMENTS OF VOLCANIC EDIFICES USING SAR AND OPTICAL SATELLITE IMAGERY. DURING AN ERUPTION WE CAN ALSO PROVIDE CONTINUOUSLY UPDATED MODELS THE MAGMA SOURCE, IMPORTANT TO ESTIMATE THE DURATION AND MAGNITUDE OF THE PHENOMENON.

PRE-ERUPTIVE GROUND DEFORMATION MAP

This product is the volcanic counterpart of the Inter-seismic ground deformation map generated for the Seismic Prevention Service. For volcanic phenomena, given the faster dynamic behaviour, the inter-eruption ground deformation may be characterised by much stronger variations, which in some cases may actually lead to an eruption. For this reason this product normally requires a more frequent update than the Inter-seismic ground deformation map.

As the inter-seismic map, it is generated outside of the RASOR platform by the project partners, using multitemporal InSAR methods as PS and/or SBAS over the available SAR image datasets.

Nissyros volcano, Aegean Sea.

SYN-ERUPTIVE GROUND DEFORMATION MAP

The monitoring of ground deformation during an eruption is needed to model the magmatic sources, and to estimate the duration of the phenomenon, since the rate of outflow of magmatic material is related to the rate of deflation of the volcanic edifice. This product will be updated after the acquisition of new satellite images.

This product is generated by the consortium outside of the RASOR platform, using multitemporal InSAR methods as PS and/or SBAS over the available SAR image datasets.

Piton de la Fournaise (Reunion Island). Differential Interferogram SENTINEL-1 (08/05/2015 – 20/05/2015). ALTAMIRA INFORMATION.

Figure 7: Front page of the "Volcanoes" leaflet

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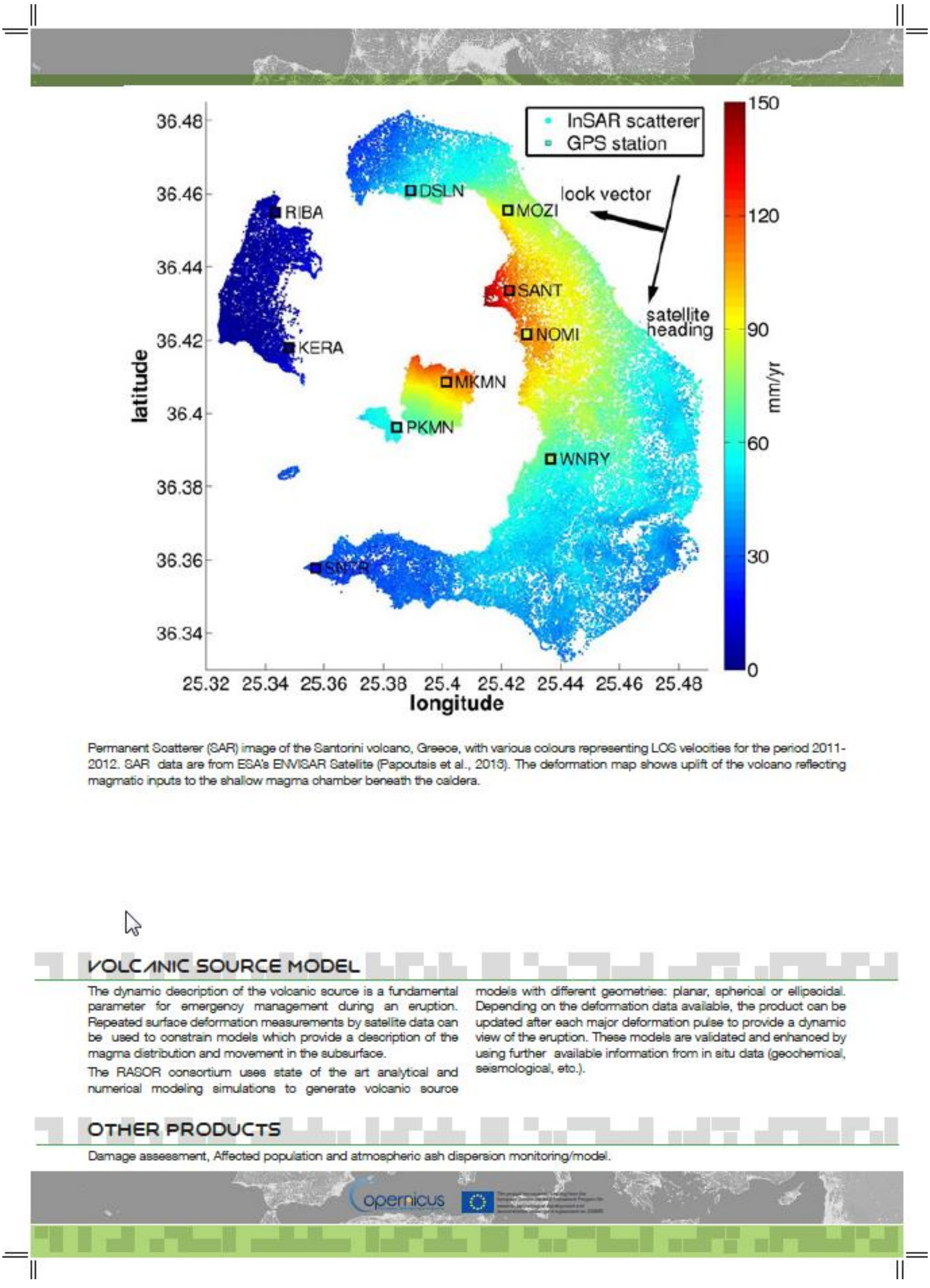

Permanent Scatterer (SAR) image of the Santorini volcano, Greece, with various colours representing LOS velocities for the period 2011-2012. SAR data are from ESA's ENVISAR Satellite (Papoutsis et al., 2013). The deformation map shows uplift of the volcano reflecting magmatic inputs to the shallow magma chamber beneath the caldera.

VOLCANIC SOURCE MODEL

The dynamic description of the volcanic source is a fundamental parameter for emergency management during an eruption. Repeated surface deformation measurements by satellite data can be used to constrain models which provide a description of the magma distribution and movement in the subsurface.

The RASOR consortium uses state of the art analytical and numerical modeling simulations to generate volcanic source models with different geometries: planar, spherical or ellipsoidal. Depending on the deformation data available, the product can be updated after each major deformation pulse to provide a dynamic view of the eruption. These models are validated and enhanced by using further available information from in situ data (geochemical, seismological, etc.).

OTHER PRODUCTS

Damage assessment, Affected population and atmospheric ash dispersion monitoring/model.

Figure 8: Back page of the "Volcanoes" leaflet

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RASOR
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OTHER GEOHAZARDS

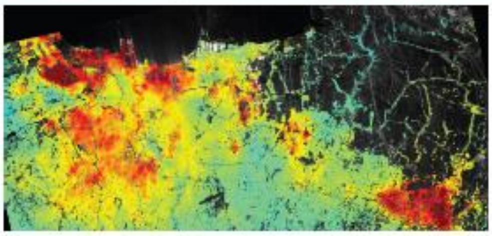
WHETHER GRADUAL AND DIFFUSE OVER LARGE AREAS (SUBSIDENCE), OR RAPID AND CONCENTRATED ON LOCAL AREAS (LANDSLIDES), GROUND MOVEMENTS CAN GENERATE STRONG IMPACTS ON MAN MADE STRUCTURES.

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).

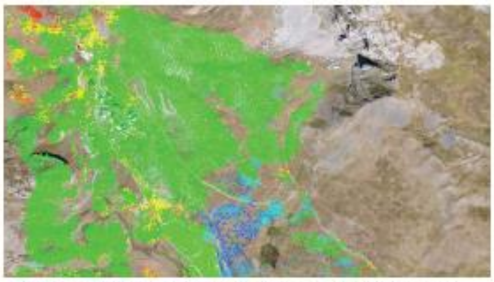


Groundwater extraction induced subsidence, Jakarta (Indonesia).

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.

Figure 9: Front page of the "Other geohazards" leaflet

This project has received funding from the European Union's Seventh Framework Program for research, technological development and demonstration under grant agreement no. 606888

RASOR

RAPID ANALYSIS AND SPATIALISATION OF RISK

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

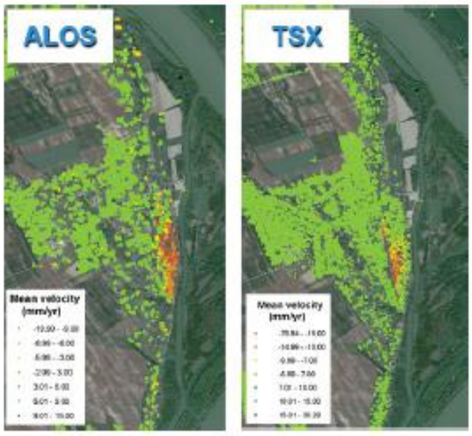
HIGH RESOLUTION GROUND DEFORMATION MAP

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.

opernicus

Figure 10: Back page of the "Other geohazards" leaflet

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4 IGARSS A4 leaflet and RASOR Poster

A leaflet was prepared to be distributed to the all IGARSS conference, together with the rest of the conference kit. This leaflet presents the RASOR project and its objectives.

The announcement of the SME workshop is also made and the agenda is also provided. The leaflet is shown in Figure 11 and Figure 12.

In the framework of RASOR dissemination activities, a A0-poster on the RASOR project was presented on Thursday July 30th after the SME Workshop. The design that has been developed for the SME workshop material was used in order to recall the event. The poster is shown in Figure 13.

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RASOR

RAPID ANALYSIS AND SPATIALISATION OF RISK

AN UNIQUE AND GLOBAL PLATFORM TO PERFOM MULTI-HAZARD RISK ANALYSIS

The Rapid Analysis and Spatialisation Of Risk (RASOR) project has developed a platform to perform multi-hazard risk analysis to support the full cycle of disaster management, including targeted support to critical infrastructure monitoring and climate change impact assessment. RASOR uses the 12m resolution TanDEM-X Digital Elevation Model (DEM) for risk management applications. The DEM serves as a base layer, and is combined with other exposure, hazard and vulnerability data sets to develop specific disaster scenarios. RASOR overlays archived and near-real time very-high resolution optical and radar satellite data, combined with in-situ data for both global and local applications. Initially, RASOR is available with full functionality over five case study areas. The global tool will be available in 2016 for upload of user data sets and user risk assessment activities. Ultimately, the RASOR Consortium will offer global services to support in-depth risk assessment and full-cycle risk management.

RISK ASSESSMENT MAPPING : FIVE MAIN AREAS OF IMPACT

RASOR uses a scenario-driven query system to allow users to simulate future scenarios based on existing and assumed conditions, to compare with historical scenarios, and to model multi-hazard risk both before and during an event. Managers can, for example, determine the extent of flooding in a given area and assess risk to Critical Infrastructure Systems in terms of the residual functionality of a given system (e.g. energy, transport, health). Public authorities can determine the potential impact of sea surge scenarios based on actual, accurate subsidence and its effect on flood defence infrastructure. RASOR allows managers to use real scenarios when determining new mitigation or prevention measures, and integrate new, real-time data into their operational systems during response activities.

The RASOR Consortium is an open partnership of concerned organizations, working together to improve risk management through an open source, freely available tool. The Consortium is inviting other interested organizations to partner as RASOR Associates and increase the availability of data and tools to manage risk.

For more information about RASOR,
contact roberto.rudari@cimafoundation.org
or attend the RASOR SME Workshop
at IGARSS on 30 July, 2015
(9:00 am in room 4+5)

Figure 11: Front-page of the SME workshop announcement leaflet

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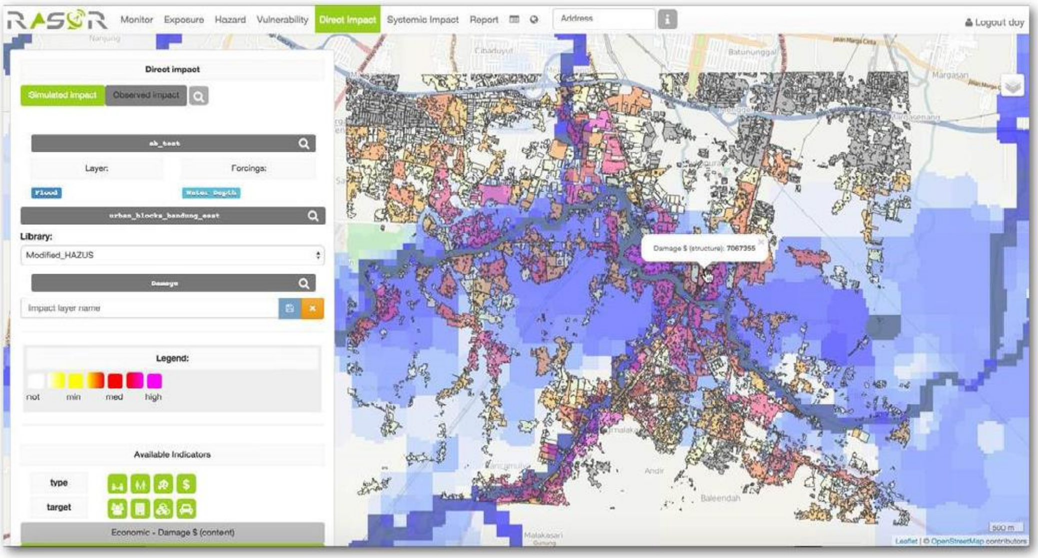

RASOR platform

Agenda
IGARSS SME Workshop - Milan, July 30th 2015

MiCo – Milano Congressi, Meeting Rooms 4+5, Level -1

EARSC

08:45 – 09:00	**Arrival**	
09:00 – 09:15	**Welcome, Objectives of meeting**	Roberto Rudari CIMA Foundation, RASOR Project Coord. Mónica Miguel-Lago EARSC
09:15 – 09:40	**EARSC Overview and Role of SMEs in European Space Sector**	Mónica Miguel-Lago EARSC
09:40 – 10:10	**RASOR Overview presentation**	Andrew Eddy Athena Global, RASOR Project Manager
10:10 – 10:30	**Coffee**	
10:30– 11:15	**RASOR Platform and Services Demonstration**	Roberto Rudari CIMA Foundation
11:15 – 11:45	**Presentation on Prospective Markets, and Invitation to Partner**	Clement de Alcala ALTAMIRA INFORMATION
11:45 – 12:30	**Open discussion**	
12:30 – 13:30	**Lunch**	
13:30 – 17:00	**One-on-one RASOR meetings and private demonstration** 30 min private meetings to be scheduled on 1st come 1st served basis Contact christiane.maasburg@athenaglobal.com	
17:00	**End of SME Workshop**	

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Figure 12: Back-page of the SME workshop announcement leaflet

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RASOR

RAPID ANALYSIS AND SPATIALISATION OF RISK

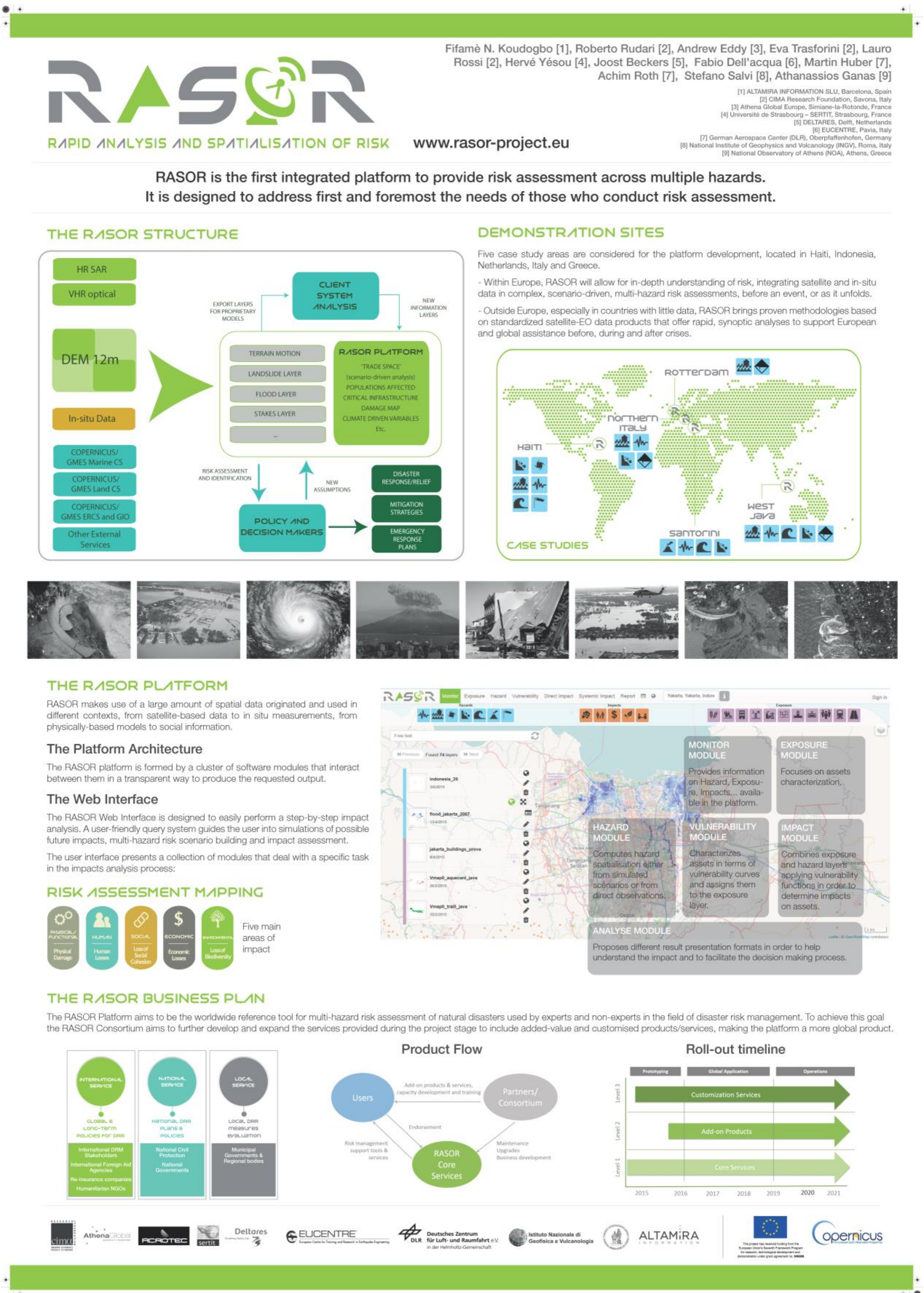

Figure 13: RASOR poster presented during the IGARSS 2015 "Monitoring Natural Disaster I" poster session

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5 Conclusions/Implications for RASOR

Material for support to the RASOR SME workshop was entirely designed at ALTAMIRA INFORMATION. While the design of the material is quite consolidated, the leaflet and their content will be updated constantly in order to reflect the functionalities offered by the RASOR platform.

This material will also be used during the roll-out activities with end-users and final version will be used as promotional material for the start of RASOR commercialization phase at the end of the FP7 project.

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HTTP://WWW.RASOR-PROJECT.EU