Survey Lab

Spin off di Sapienza Università di Roma

I satelliti per l'osservazione della Terra: contare i danni e controllare gli edifici

Credits: ESA/NASA

Ing. Silvia Scifoni
Survey Lab

I satelliti **EO monitorano il pianeta e** raccolgono Informazioni sul suo stato di **salute**

ESA/ATG medialab

Le **osservazioni da satellite**
offrono risposte
precise, **affidabili**, **sostenibili**

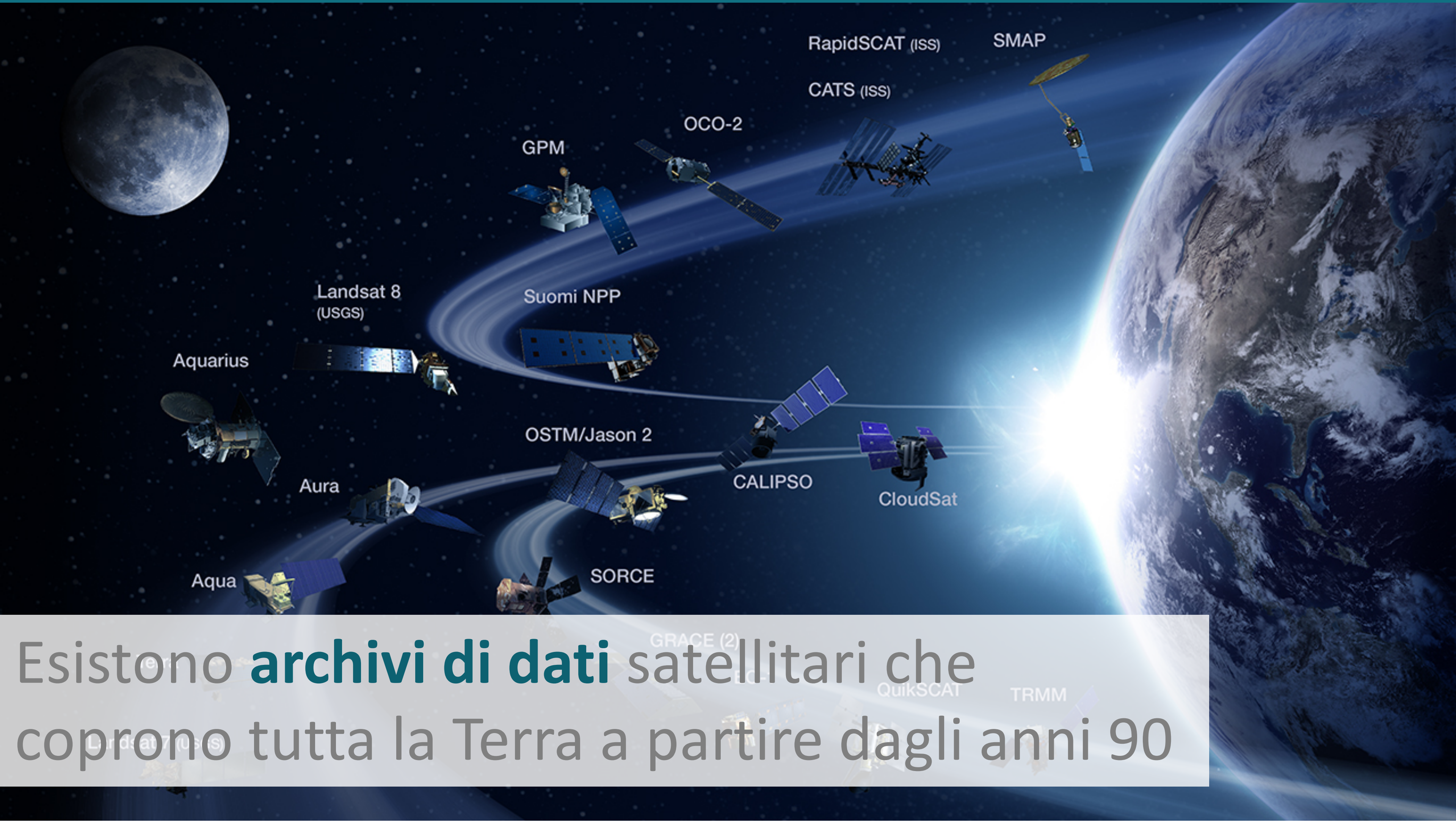
SINOTTICITÀ

I satelliti offrono una **rapida visione d’insieme**

AGGIORNABILITÁ

Gli elementi raccolti, oltre a costituire una **banca dati** di informazioni riguardanti il pianeta,
si **aggiornano costantemente**

AGGIORNABILITÁ

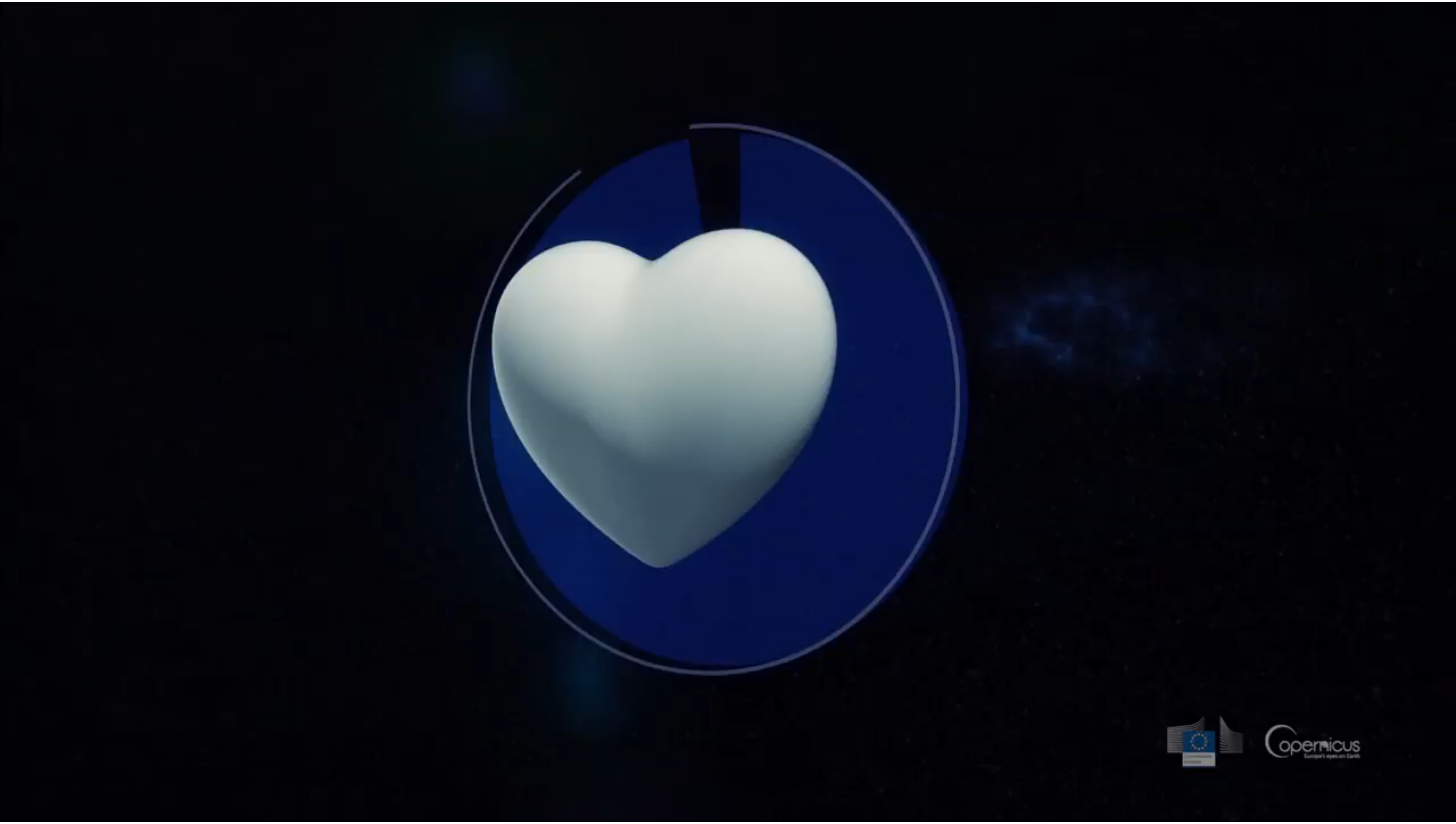

RapidSCAT (ISS)
SMAP
CATS (ISS)
OCO-2
GPM
Landsat 8 (USGS)
Suomi NPP
Aquarius
OSTM/Jason 2
CALIPSO
CloudSat
Aura
Aqua
SORCE
GRACE (2)
QuikSCAT
TRMM

Esistono **archivi di dati** satellitari che coprono tutta la Terra a partire dagli anni 90

RIPETIBILITÁ

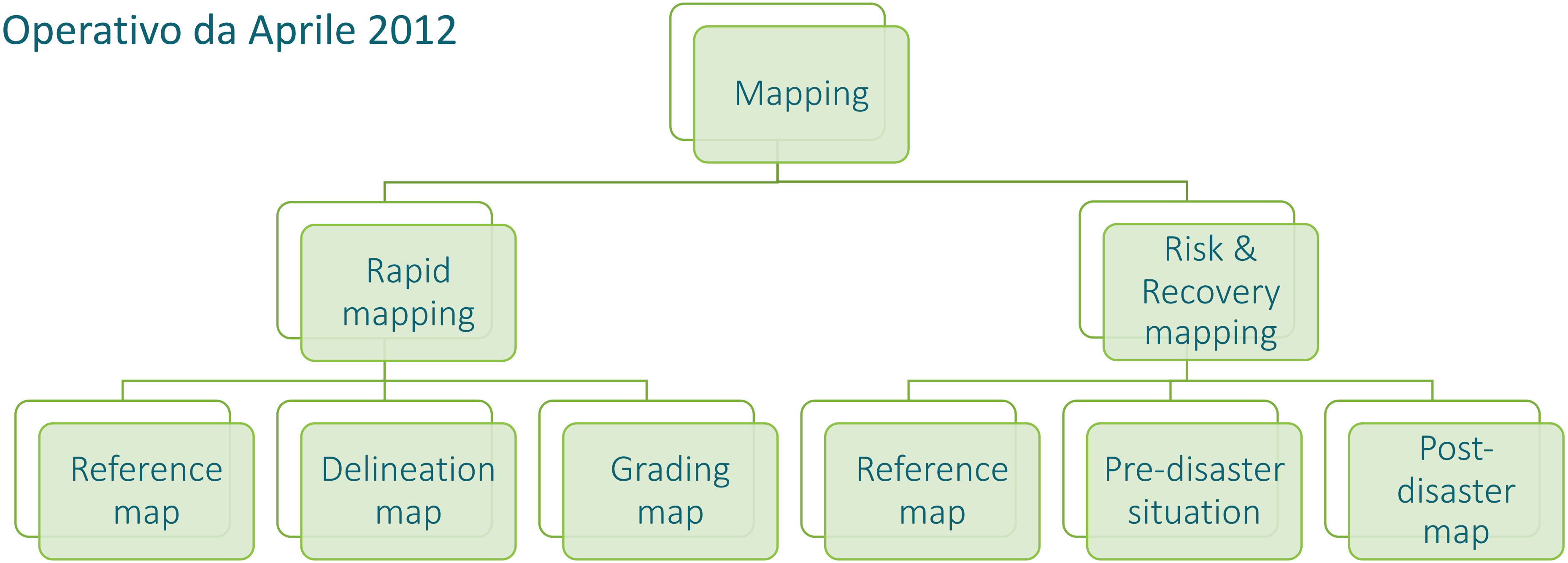
Raccolgono informazioni nel tempo
che possono essere **confrontate e integrate**

IL PROGRAMMA COPERNICUS


Copernicus
Europe's eyes on Earth

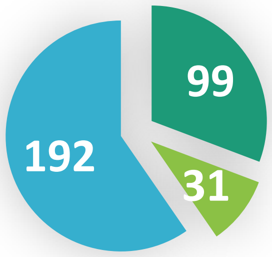
SERVIZIO MAPPING DEL COPERNICUS EMS

Operativo da Aprile 2012



- Mapping
  - Rapid mapping
    - Reference map
    - Delineation map
    - Grading map
  - Risk & Recovery mapping
    - Reference map
    - Pre-disaster situation
    - Post-disaster map

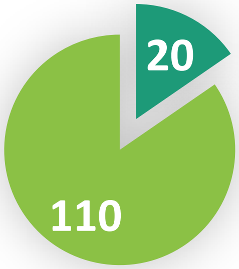
Attivazioni totali 12



🟩 Ref. Maps 🟩 Delin. Maps 🟦 Grading Maps

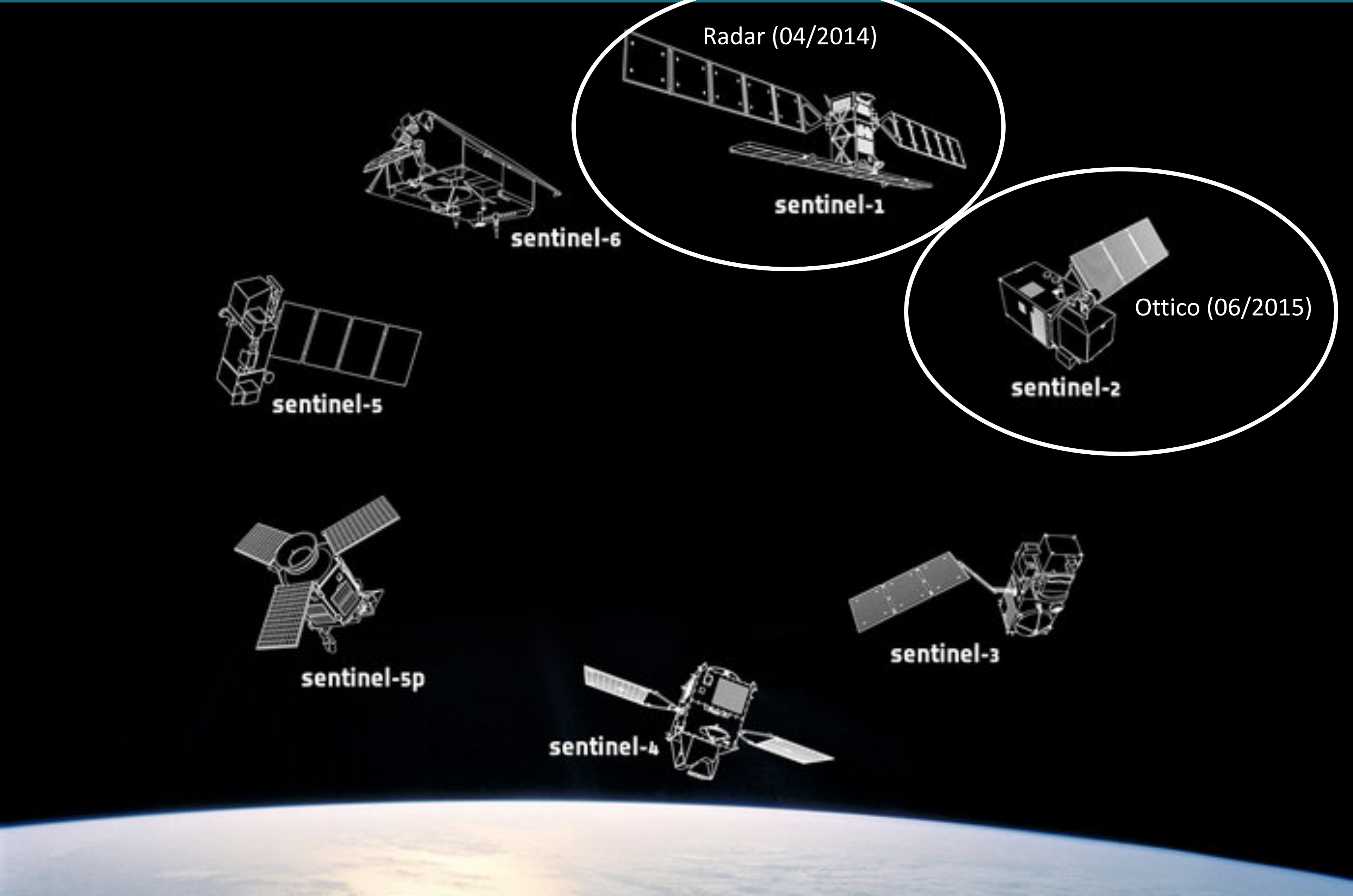
Earthquake

Attivazioni in Italia 3



🟩 Ref. Maps 🟩 Grading Maps

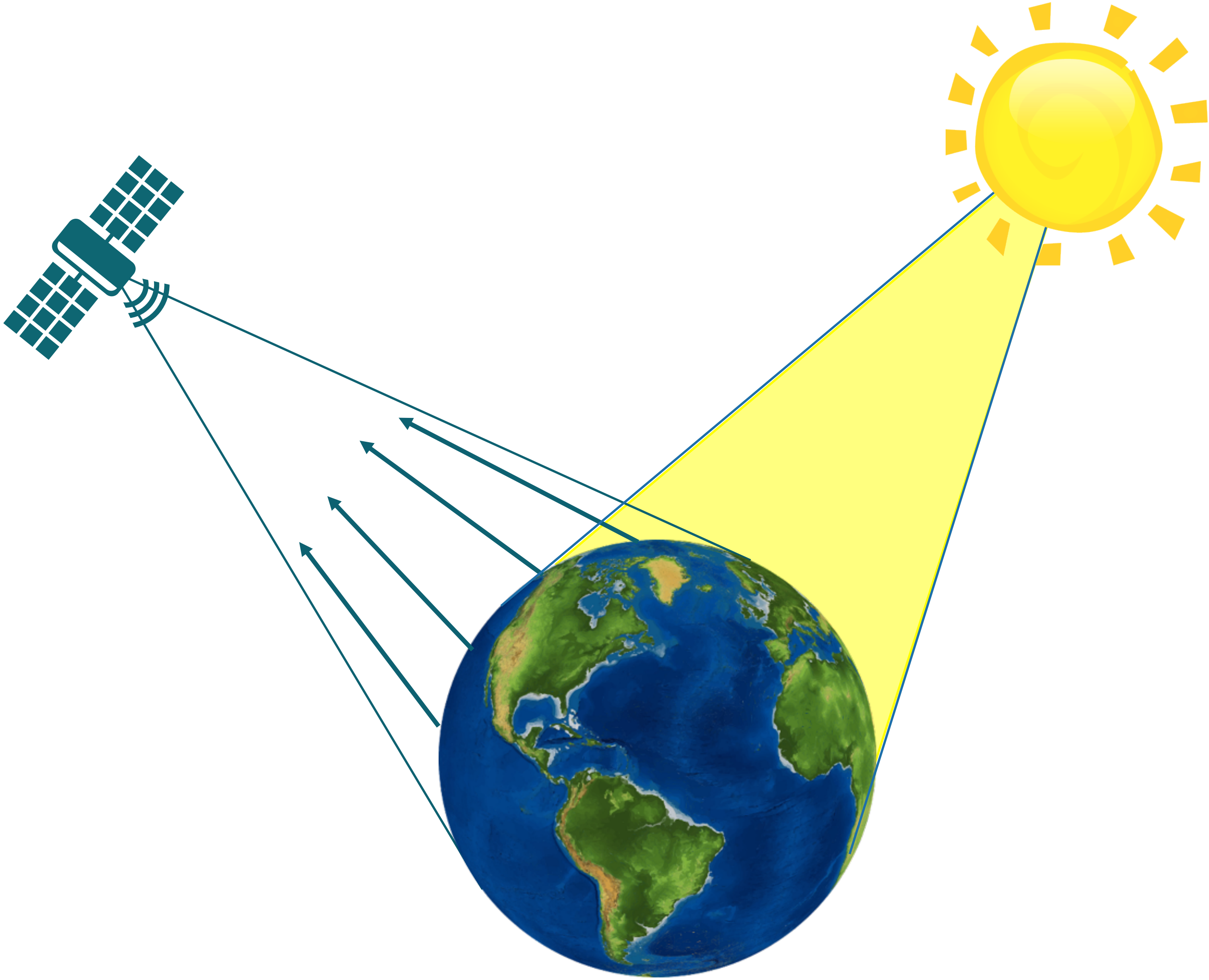
LE SENTINELLE


sentinel-1
sentinel-2
sentinel-6
sentinel-5
sentinel-5p
sentinel-4
sentinel-3

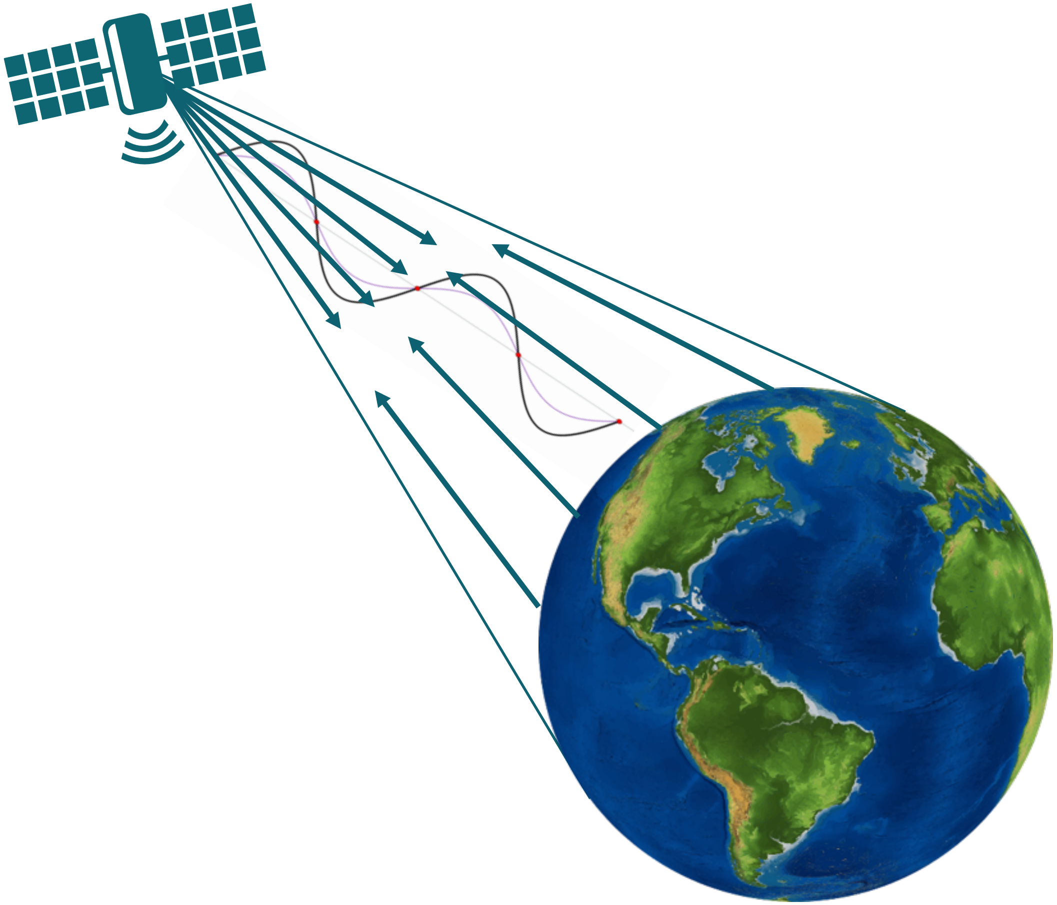
Radar (04/2014)

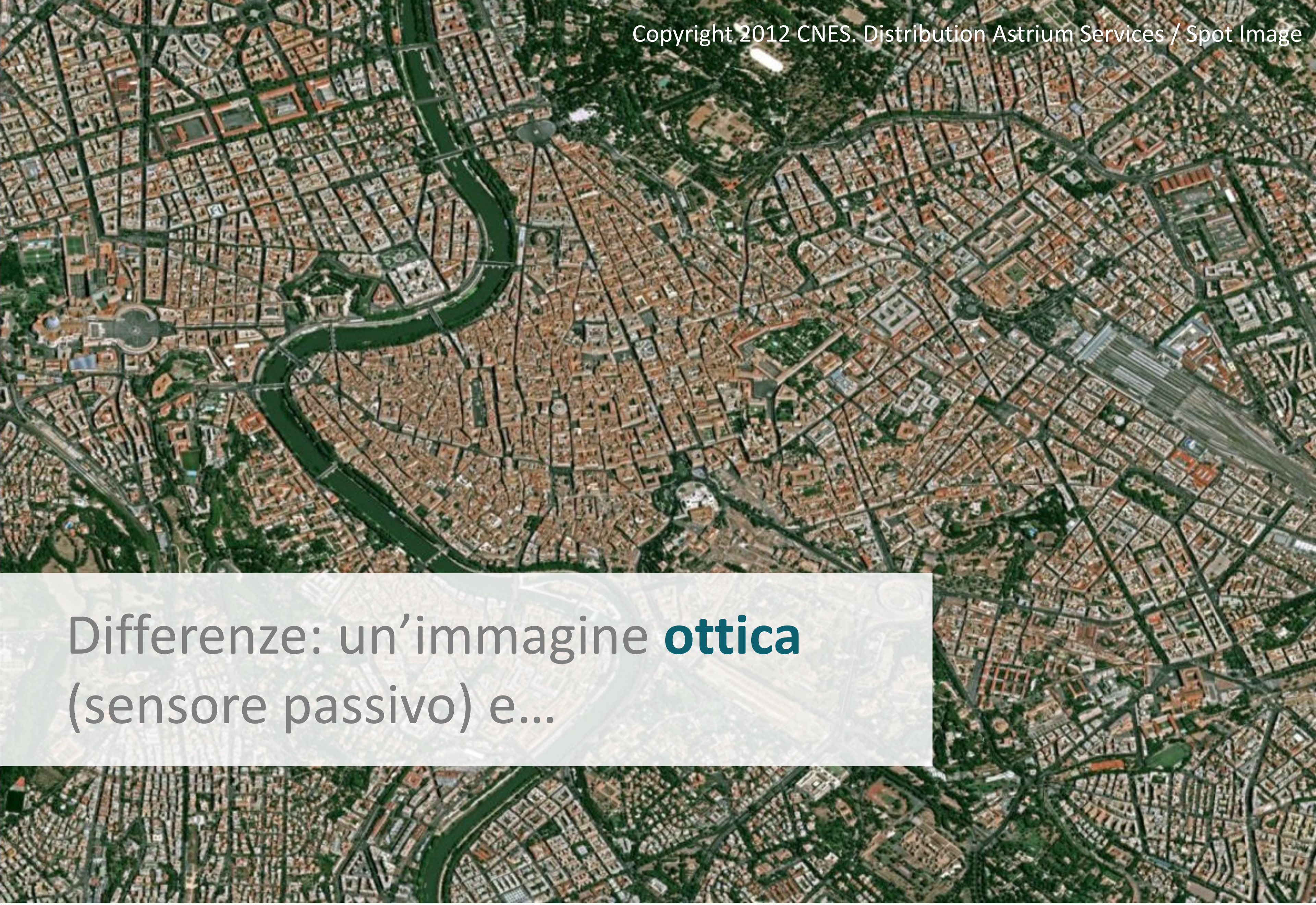
Ottico (06/2015)

I SENSORI OTTICI



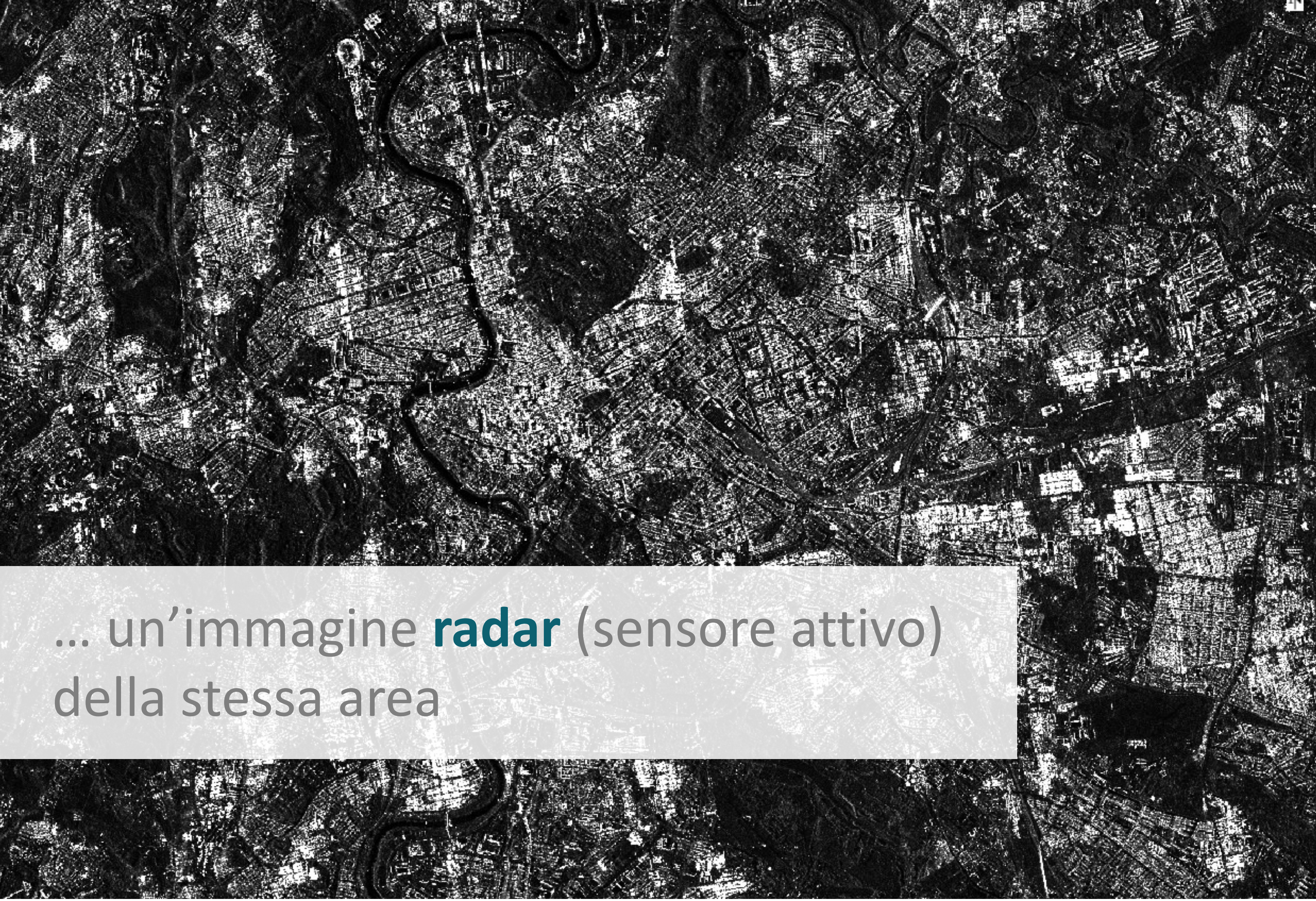
I SENSORI RADAR





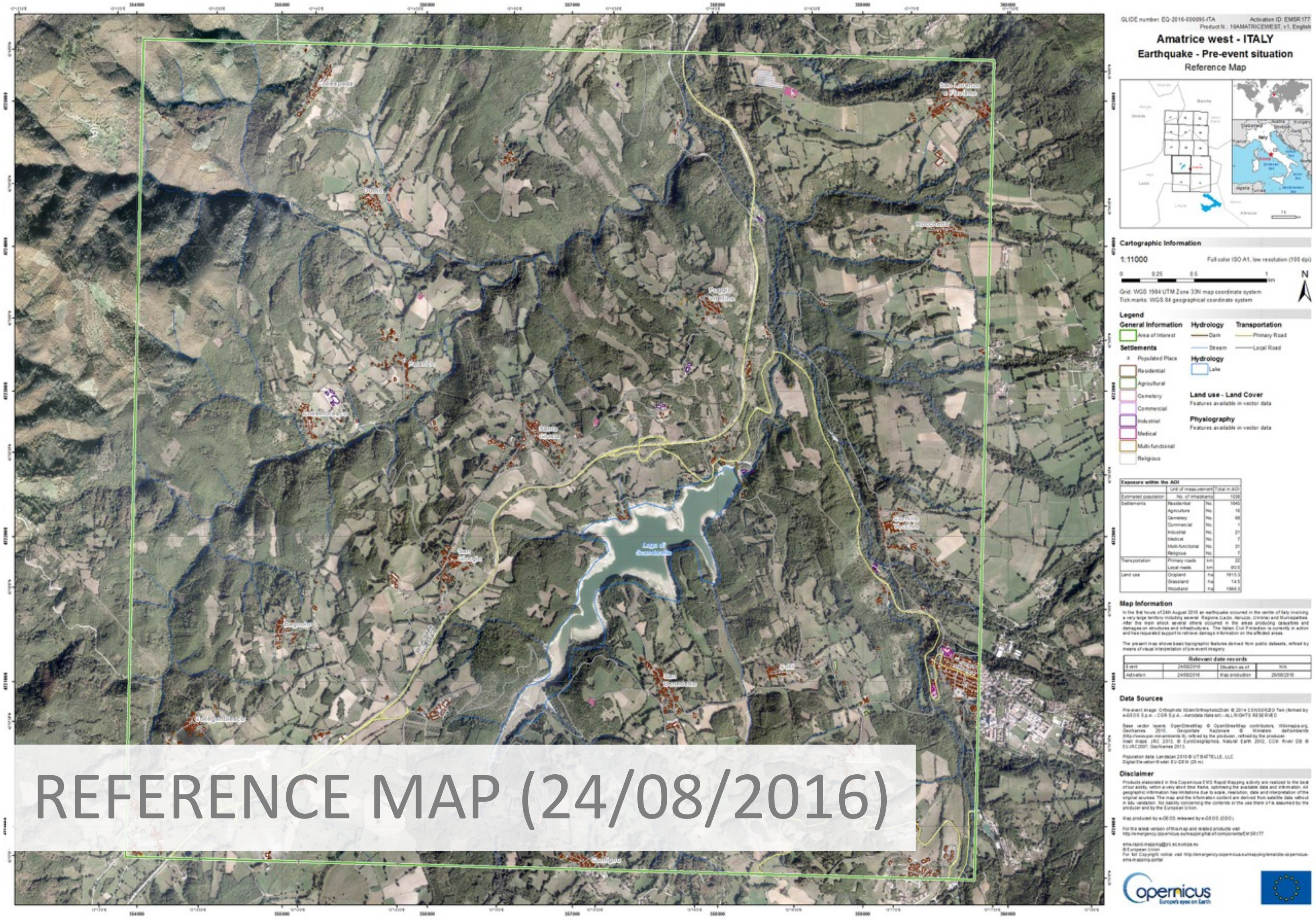
Copyright 2012 CNES. Distribution Astrium Services / Spot Image

Differenze: un’immagine **ottica** (sensore passivo) e…



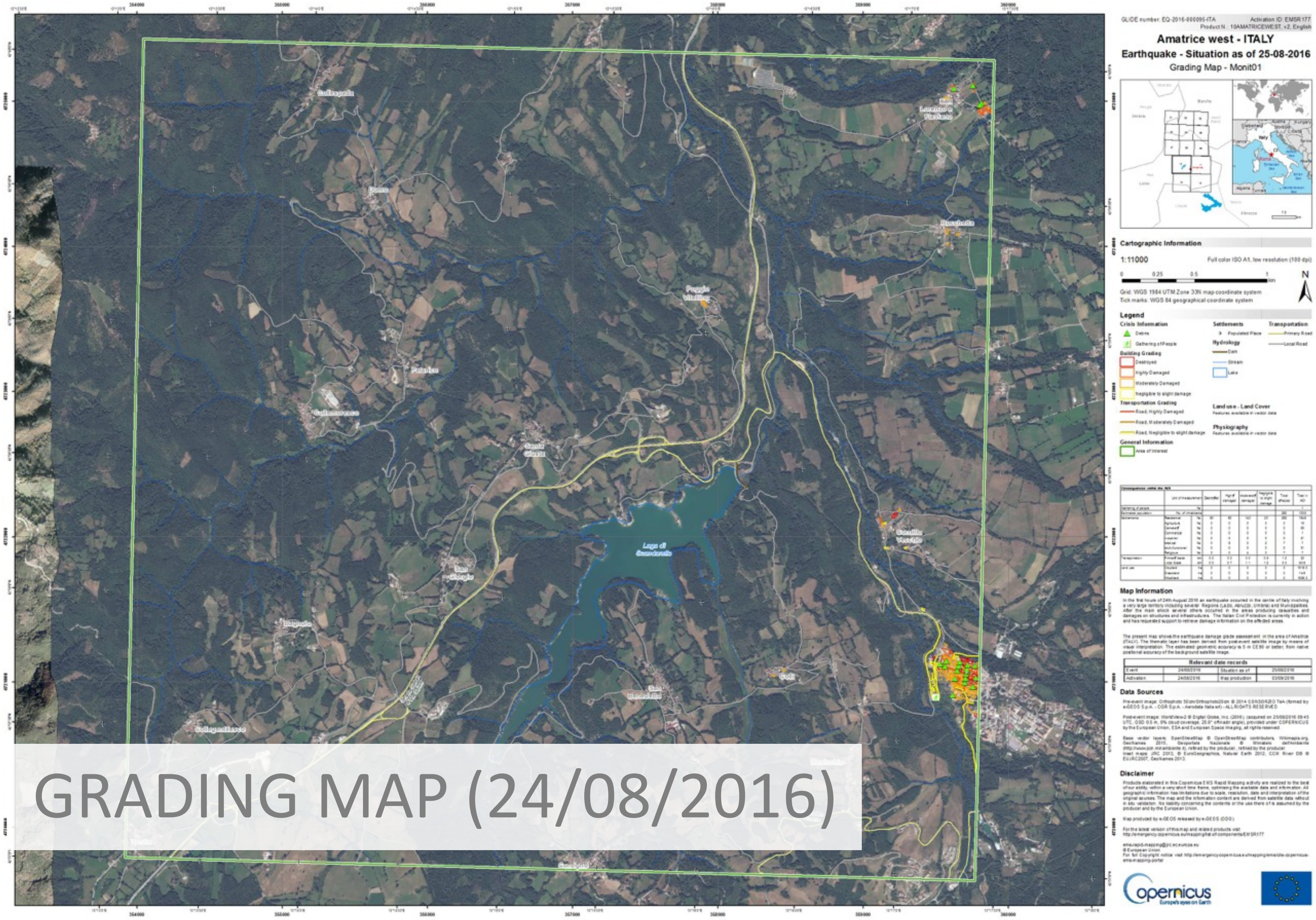
… un’immagine **radar** (sensore attivo) della stessa area

RAPID MAPPING


GLIDE number: EQ-2016-000095-ITA
Activation ID: EMSR177
Product N.: 10AMATRICEWEST, v1, English
Amatrice west - ITALY
Earthquake - Pre-event situation
Reference Map
Cartographic Information
1:11000
Full color ISO A1, low resolution (100 dpi)
0
0.25
0.5
1
km
N
Grid: WGS 1984 UTM Zone 33N map coordinate system
Tick marks: WGS 84 geographical coordinate system
Legend
General Information
Area of Interest
Settlements
Populated Place
Residential
Agricultural
Cemetery
Commercial
Industrial
Medical
Multi-functional
Religious
Hydrology
Dam
Stream
Hydrology
Lake
Transportation
Primary Road
Local Road
Land use - Land Cover
Features available in vector data
Physiography
Features available in vector data
Exposure within the AOI
Map Information
Relevant date records
Data Sources
Disclaimer
Lago di Scandarello
opernicus
Europe's eyes on Earth

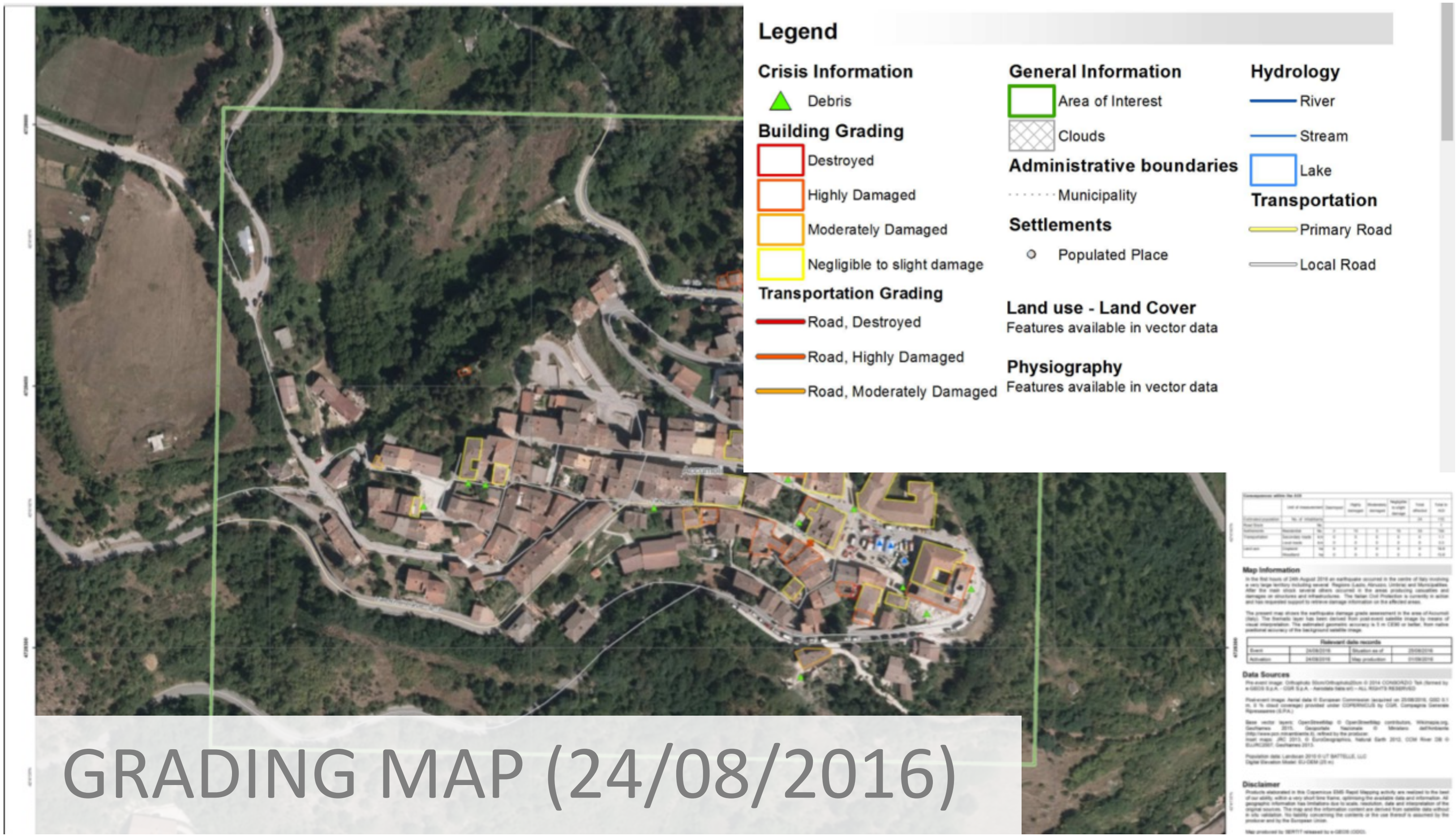
REFERENCE MAP (24/08/2016)

RAPID MAPPING


GLIDE number: EQ-2016-000095-ITA
Activation ID: EMSR177
Product N.: 10AMATRICEWEST, v2, English
Amatrice west - ITALY
Earthquake - Situation as of 25-08-2016
Grading Map - Monit01
Cartographic Information
1:11000
Full color ISO A1, low resolution (100 dpi)
0
0.25
0.5
1
km
N
Grid: WGS 1984 UTM Zone 33N map coordinate system
Tick marks: WGS 84 geographical coordinate system
Legend
Crisis Information
Debris
Gathering of People
Building Grading
Destroyed
Highly Damaged
Moderately Damaged
Negligible to slight damage
Transportation Grading
Road, Highly Damaged
Road, Moderately Damaged
Road, Negligible to slight damage
General Information
Area of Interest
Settlements
Populated Place
Hydrology
Dam
Stream
Lake
Transportation
Primary Road
Local Road
Land use - Land Cover
Features available in vector data
Physiography
Features available in vector data
Map Information
Data Sources
Disclaimer
Lago di Scandarello
opernicus

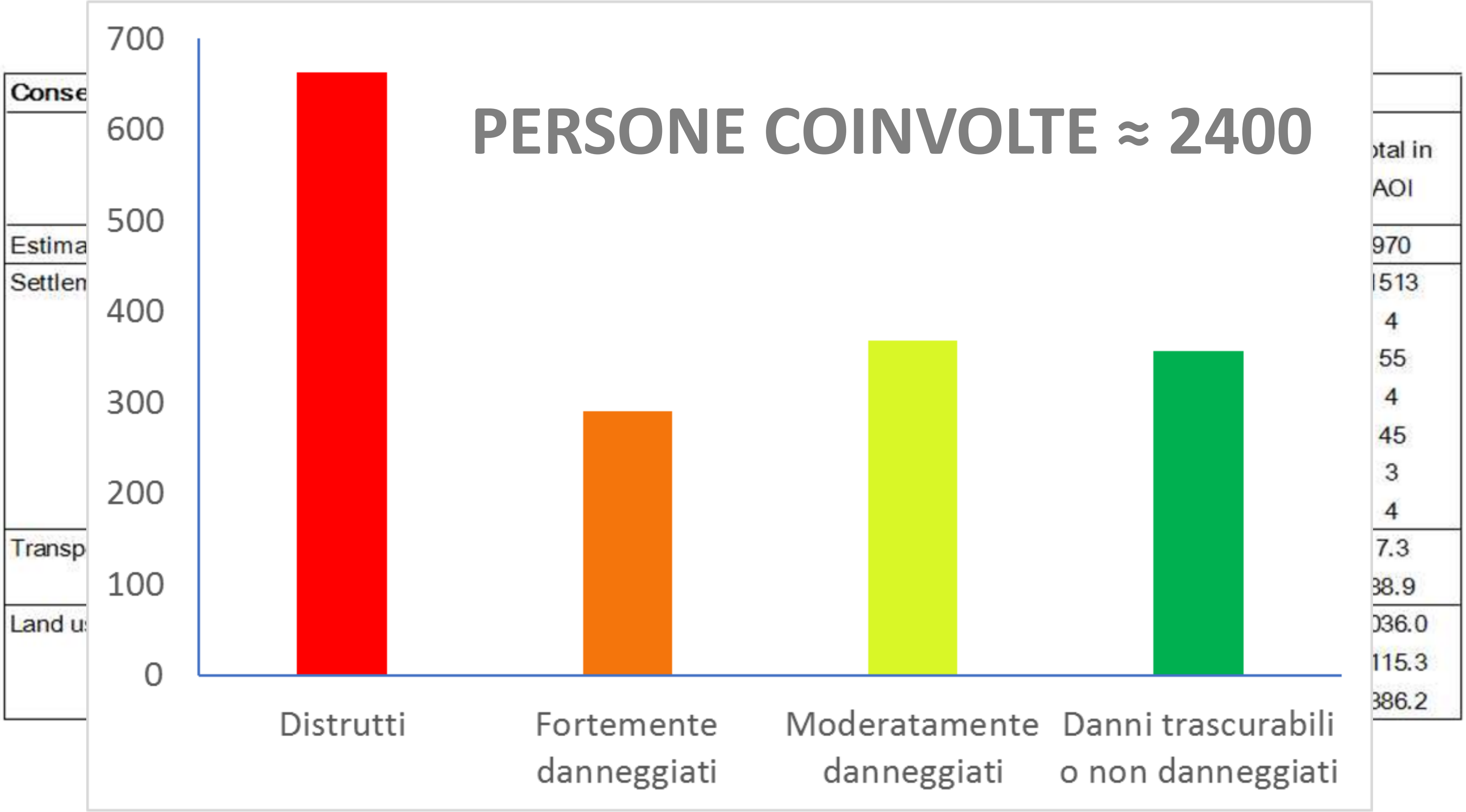
GRADING MAP (24/08/2016)

RAPID MAPPING


Legend
Crisis Information
Debris
Building Grading
Destroyed
Highly Damaged
Moderately Damaged
Negligible to slight damage
Transportation Grading
Road, Destroyed
Road, Highly Damaged
Road, Moderately Damaged
General Information
Area of Interest
Clouds
Administrative boundaries
Municipality
Settlements
Populated Place
Land use - Land Cover
Features available in vector data
Physiography
Features available in vector data
Hydrology
River
Stream
Lake
Transportation
Primary Road
Local Road
Map Information
Data Sources
Disclaimer

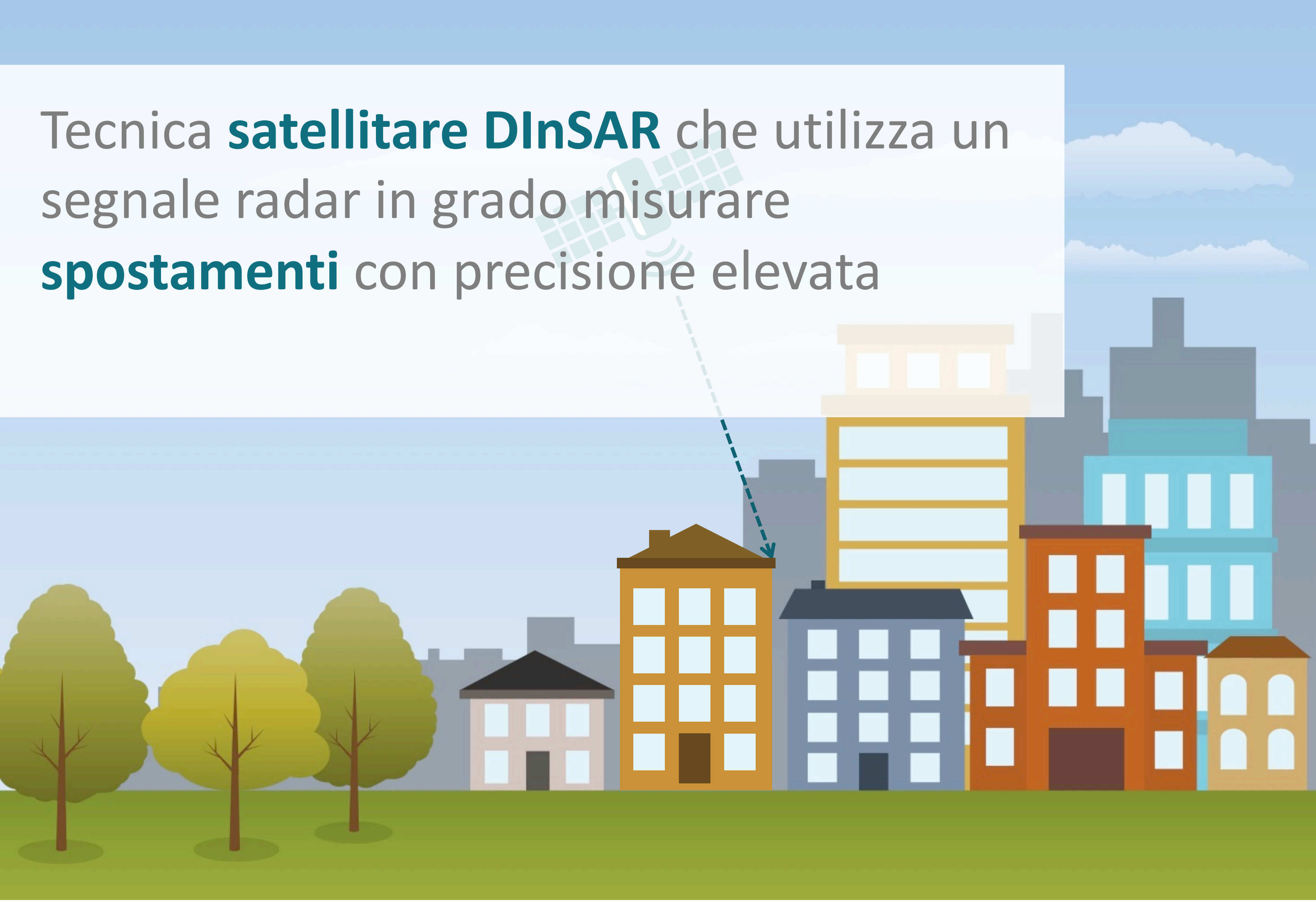
GRADING MAP (24/08/2016)

RAPID MAPPING

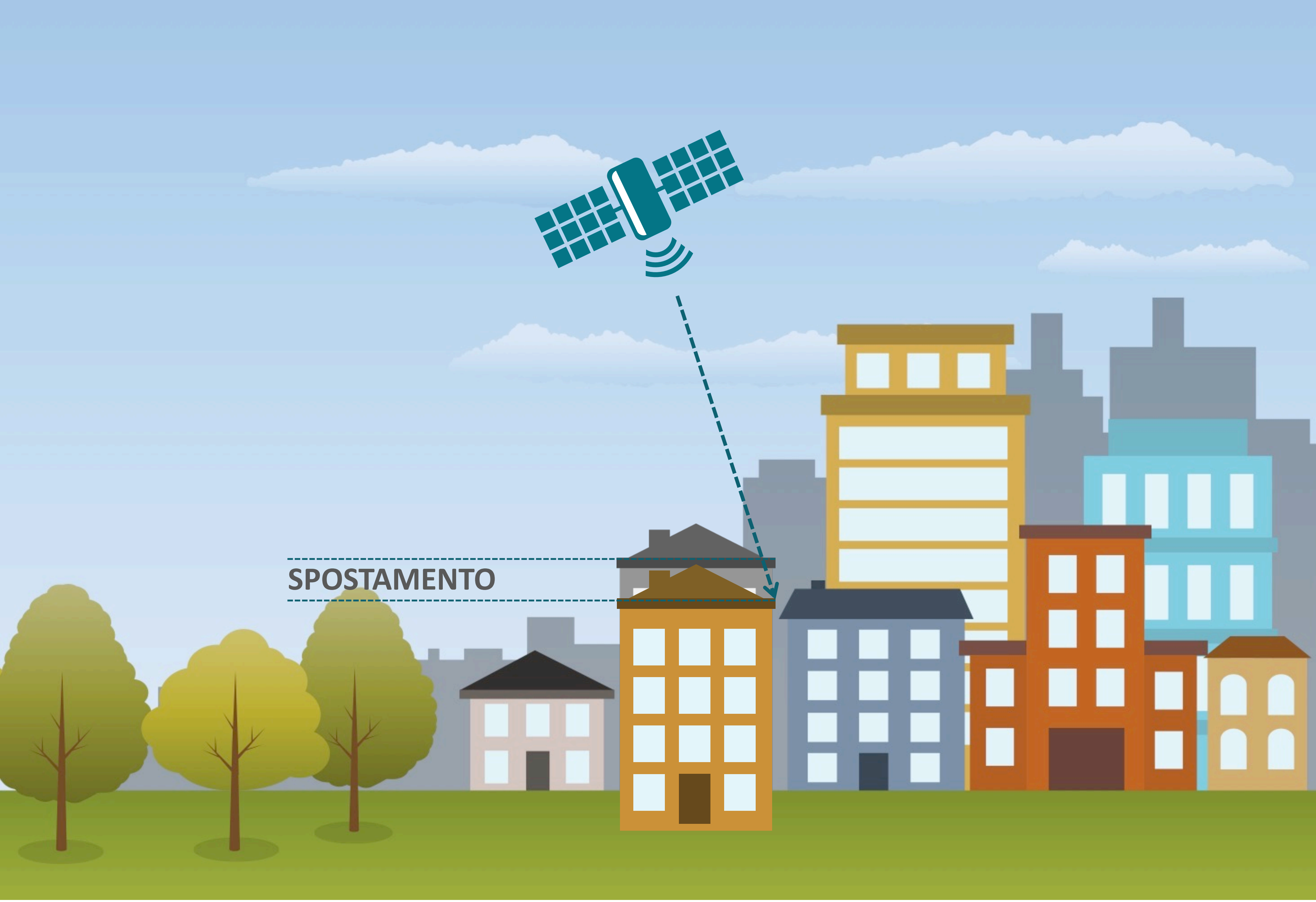


PERSONE COINVOLTE ≈ 2400

DATI STIMATI PER L’EVENTO DEL 24/08/2016

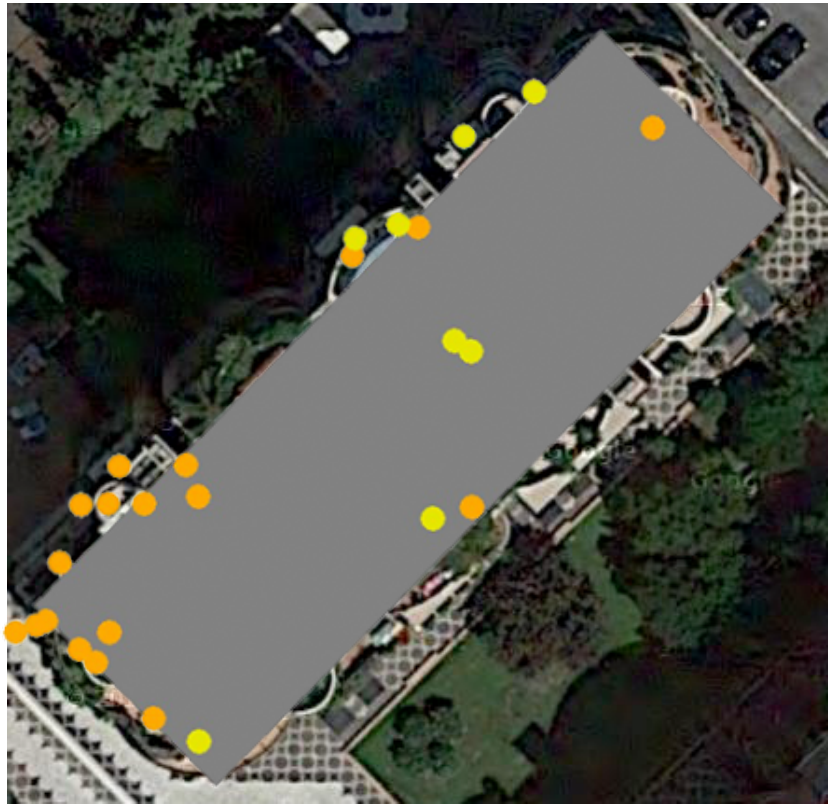


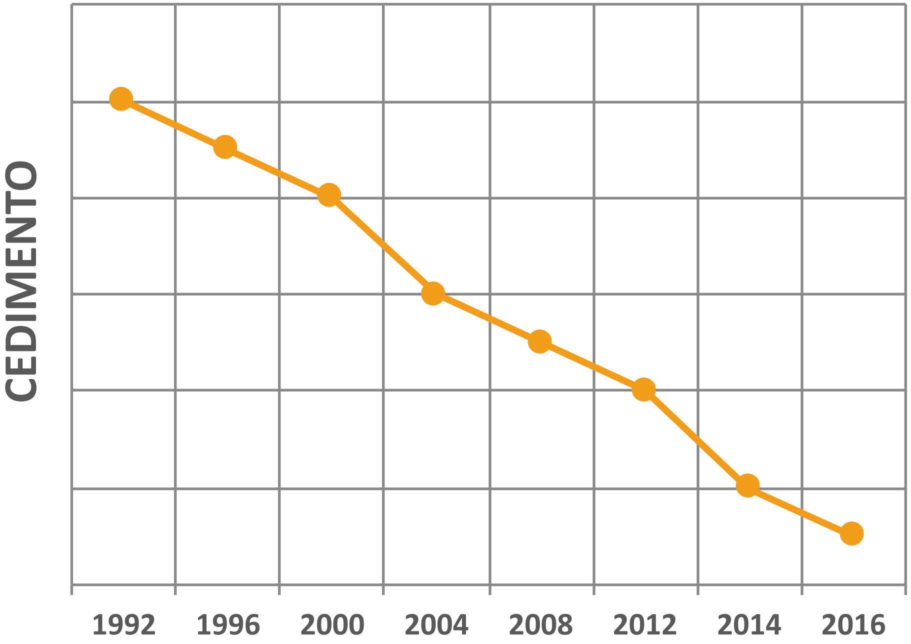
Tecnica **satellitare DInSAR** che utilizza un segnale radar in grado misurare **spostamenti** con precisione elevata


SPOSTAMENTO

LA TECNICA DInSAR

Confrontando i dati satellitari nel tempo può essere misurato lo **spostamento di singoli edifici**





STABILITÀ

SICUREZZA

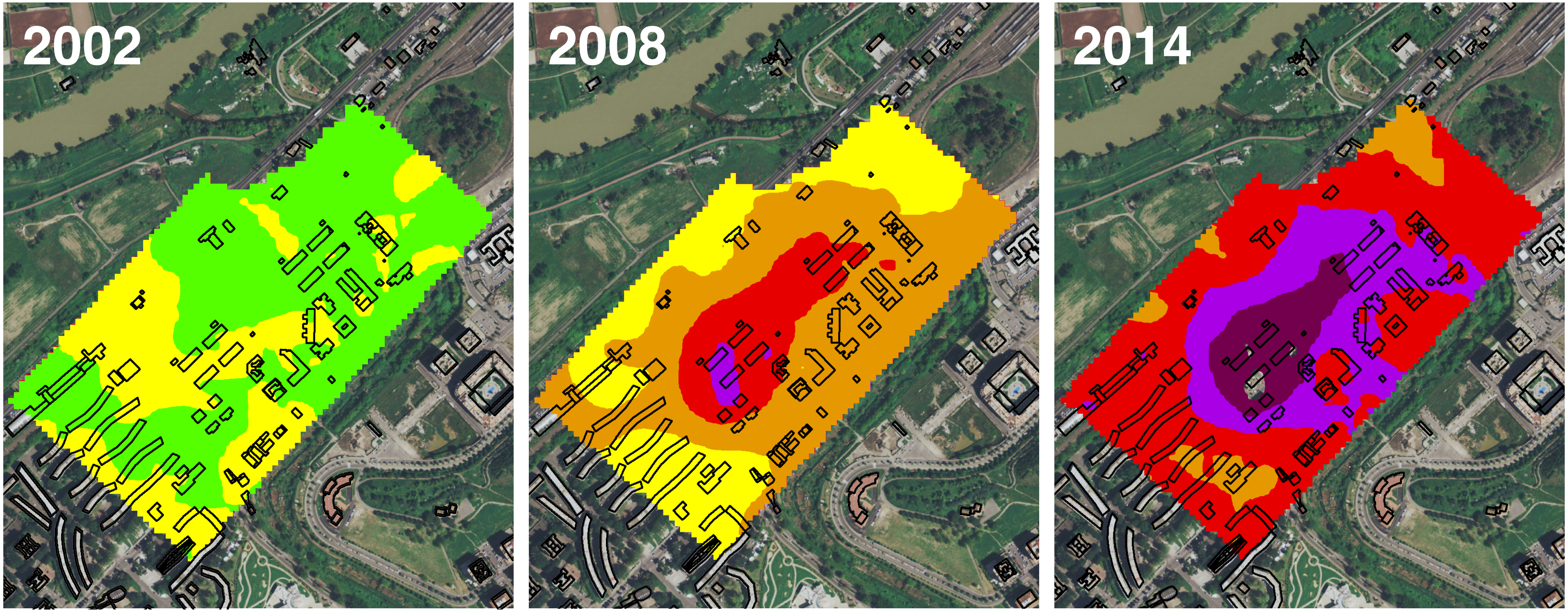
La **stabilità degli edifici**
è strettamente collegata alla
sicurezza della popolazione

POSTO DI COMANDO AVANZATO
AF CL

MONITORAGGIO

MANUTENZIONE

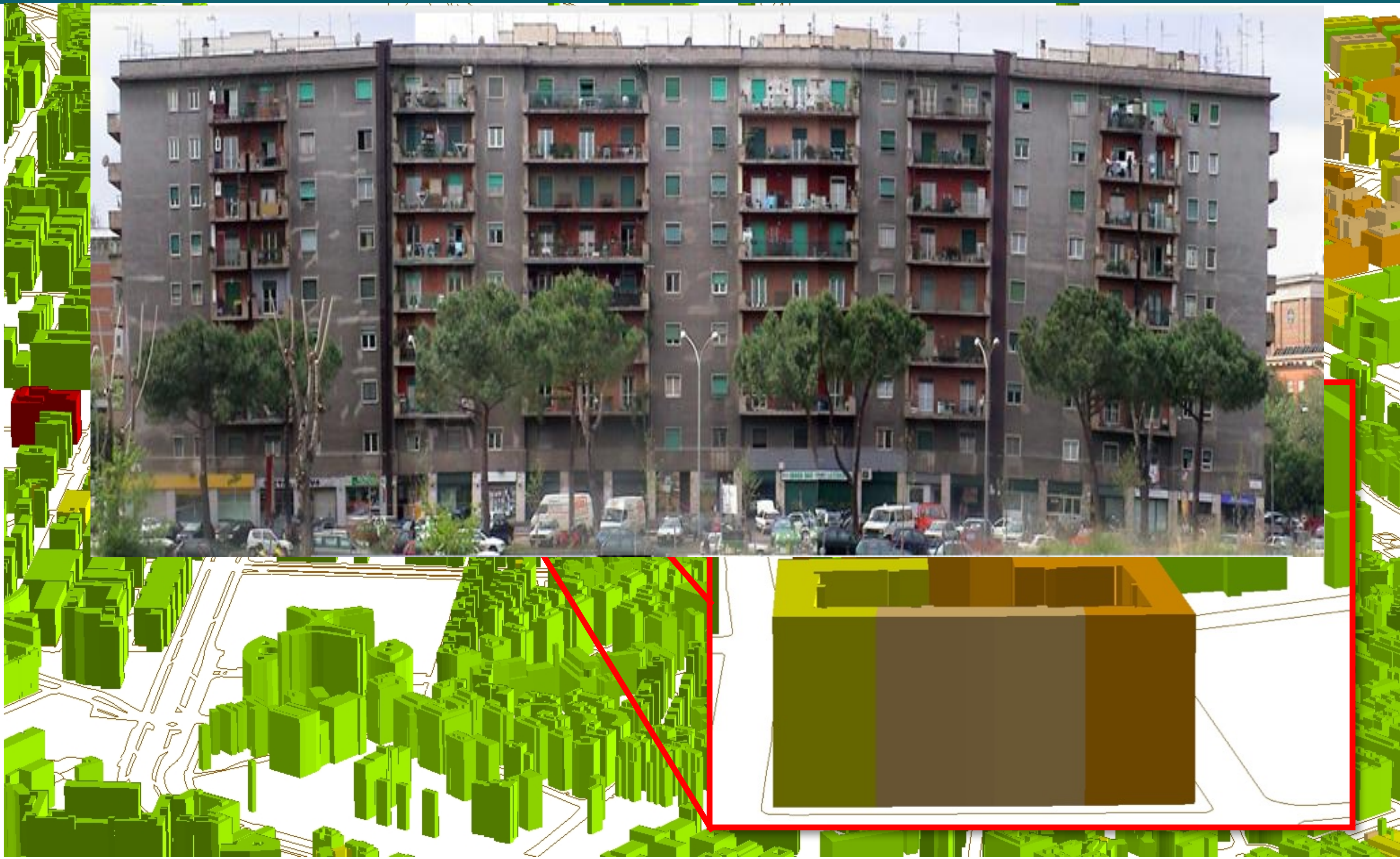
Il **monitoraggio** è fondamentale per programmare interventi di **manutenzione** e **messa in sicurezza**


2002
2008
2014

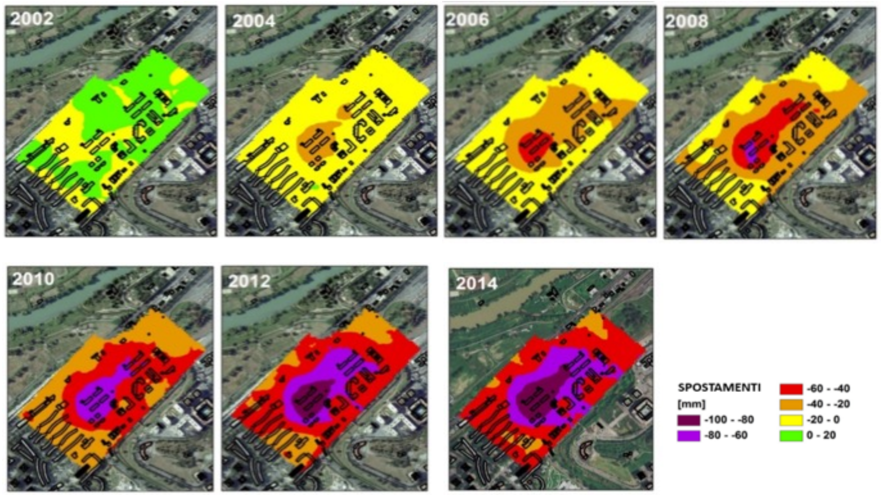
Analisi a ritroso 2002-2014

MAPPE INTERPOLATE

MAPPA DI CLASSIFICAZIONE DEGLI EDIFICI

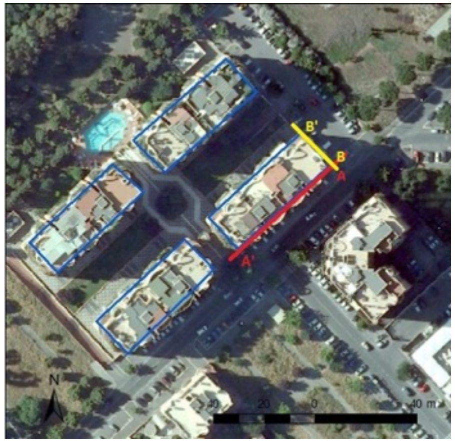


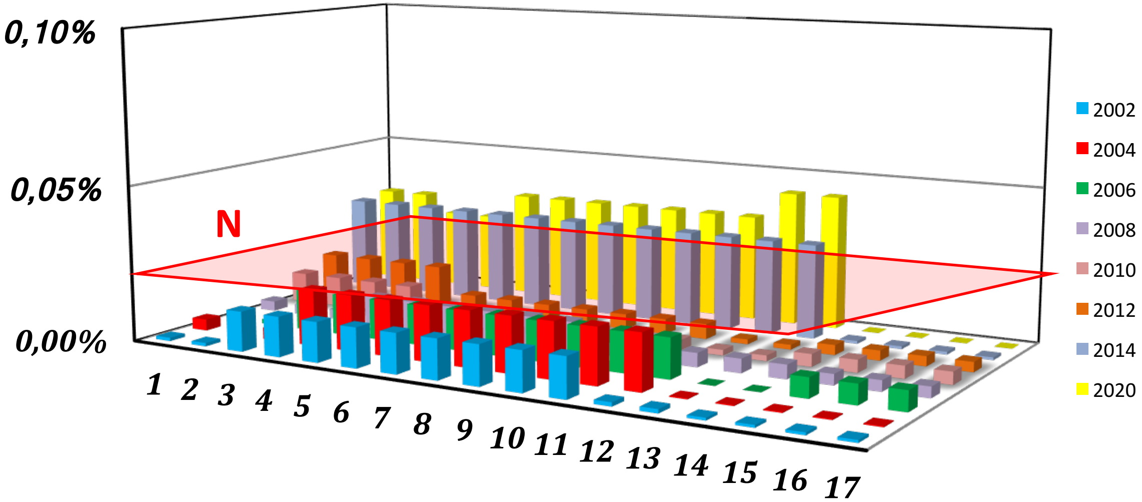
ANALISI SINGOLE STRUTTURE ATTRAVERSO MODELLI SEMI-QUANTITATIVO DELLO STATO DI DANNEGGIAMENTO


2002
2004
2006
2008
2010
2012
2014
SPOSTAMENTI [mm]
-100 - -80
-80 - -60
-60 - -40
-40 - -20
-20 - 0
0 - 20

Classificazione del danno strutturale
Estensione delle fratture e deformazione a trazione associati alle varie categorie di danno (Burland, 1977; 1995).

Categoria di Danno	Grado di Danneggiamento	Limite deformazione a trazione ε%
0	Trascurabile - N	0.000 – 0.025
1	Molto leggero- VS	0.025 – 0.0375
2	Leggero - S	0.0375 – 0.075
3	Moderate - M	0.075 – 0.15
4 a 5	Grave - Molto Grave - SE	>0.015





Evidenzia **comportamenti anomali** rispetto al contorno

Permette di andare **indietro** (**e avanti**) **nel tempo**

Permette una **analisi a grande scala** tenendo conto del **contesto geologico** e **infrastrutturale**

PICCADILLY CIRCUS
PICCADILLY CIRCUS
PICCADILLY CIRCUS

H2020 - SME Instrument Phase 2

This project has received funding from
the European Union’s Horizon 2020
research and innovation programme
under grant agreement No 720121

> “The innovation aims new market opportunities addressing EU/global challenges”

Grazie per l'Attenzione!

esa
0 days 00 hours 00 minutes
Sentinel-2 constellation:
summer solstice