Pre-3rd
Mission Idea Contest
Workshop

Monitoring Natural Disasters with Small Satellites – Smart Satellite Based Geospatial System for Environmental Protection

Krištof Oštir, Space-SI, Slovenia

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Operation Part Financed By The European Union
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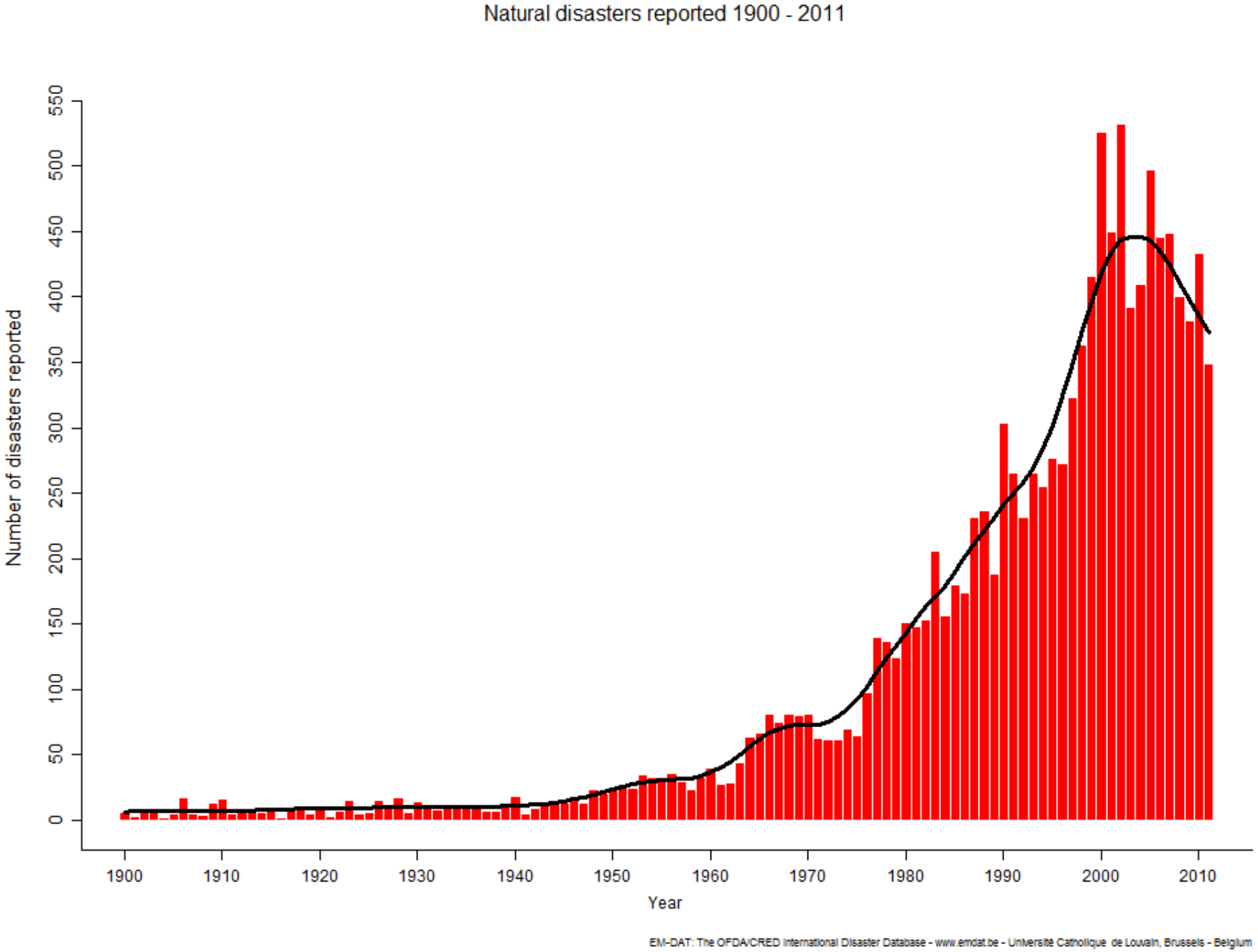
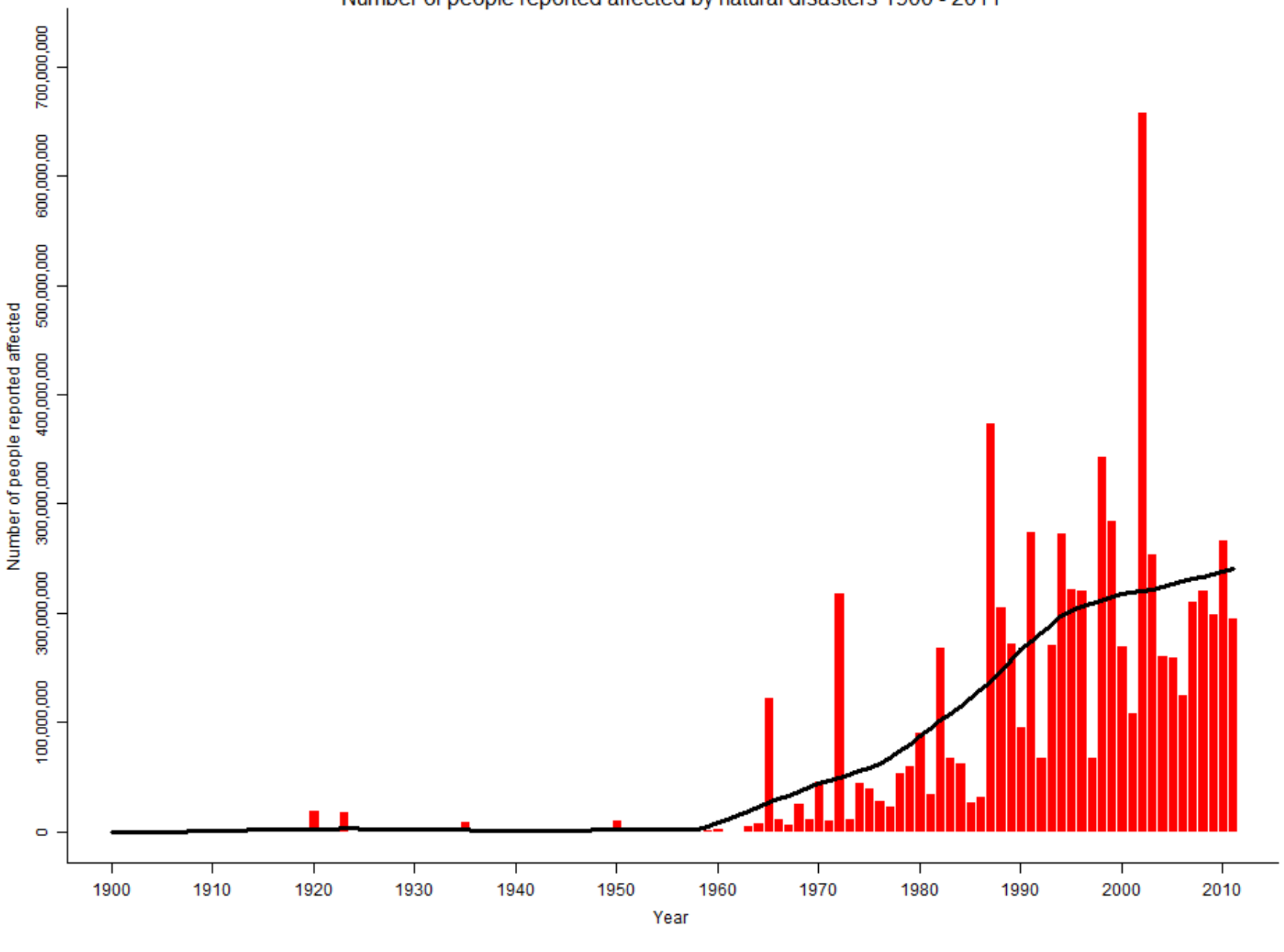
Contents

- Natural and technological disasters
- Current state in mapping
- System that connects all stakeholders
- Crowd sourcing
- Small satellite system
- Space and ground segment
- Data processing
- Data delivery

Disasters

- Natural and technological disasters are causing huge damage and loss of lives
- They are more and more frequent


Natural disasters reported 1900 - 2011
Number of disasters reported
0
50
100
150
200
250
300
350
400
450
500
550
1900
1910
1920
1930
1940
1950
1960
1970
1980
1990
2000
2010
Year
EM-DAT: The OFDA/CRED International Disaster Database - www.emdat.be - Université Catholique de Louvain, Brussels - Belgium


Number of people reported affected by natural disasters 1900 - 2011
Number of people reported affected
0
100,000,000
300,000,000
400,000,000
500,000,000
600,000,000
700,000,000
1900
1910
1920
1930
1940
1950
1960
1970
1980
1990
2000
2010
Year
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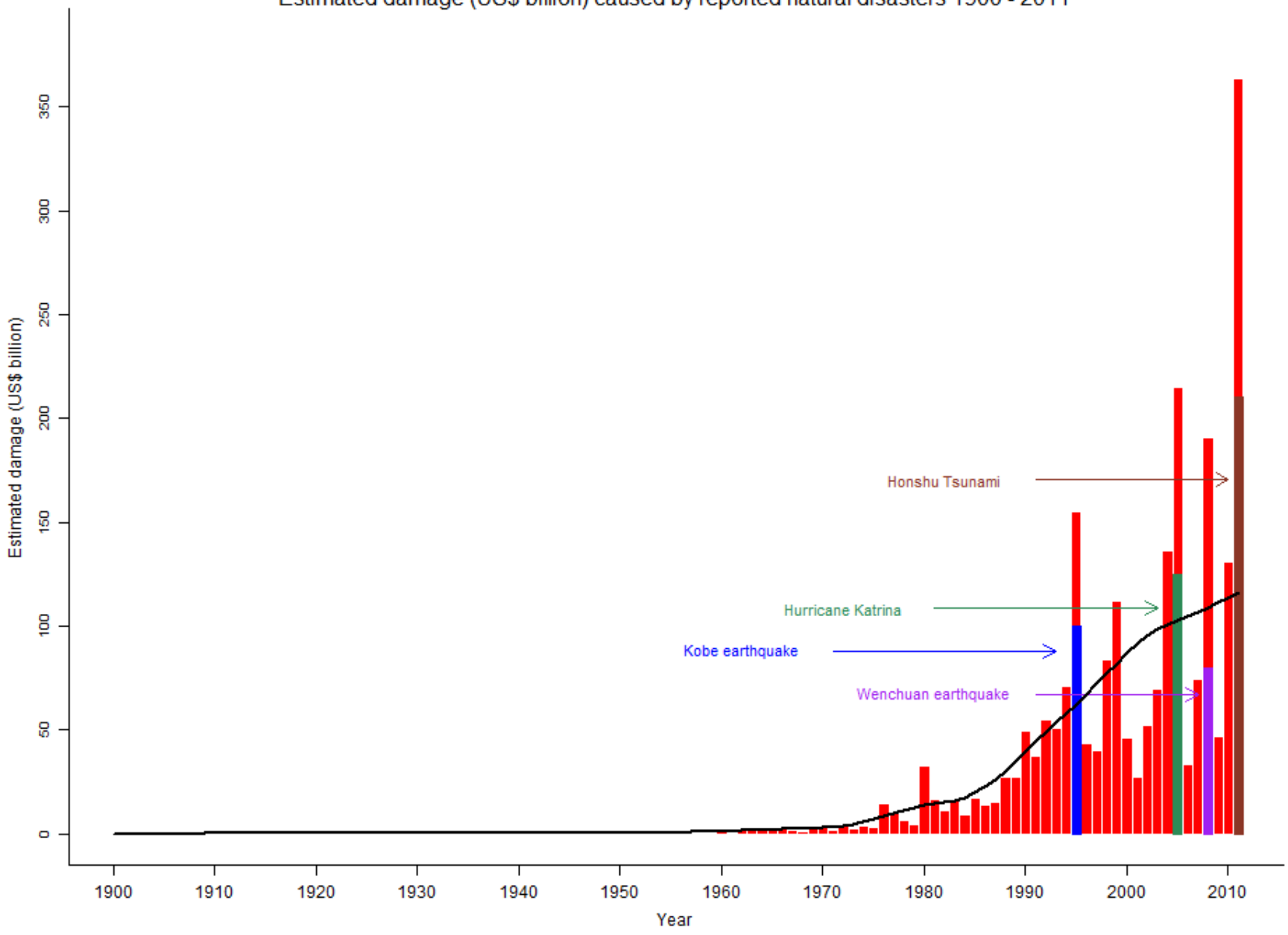
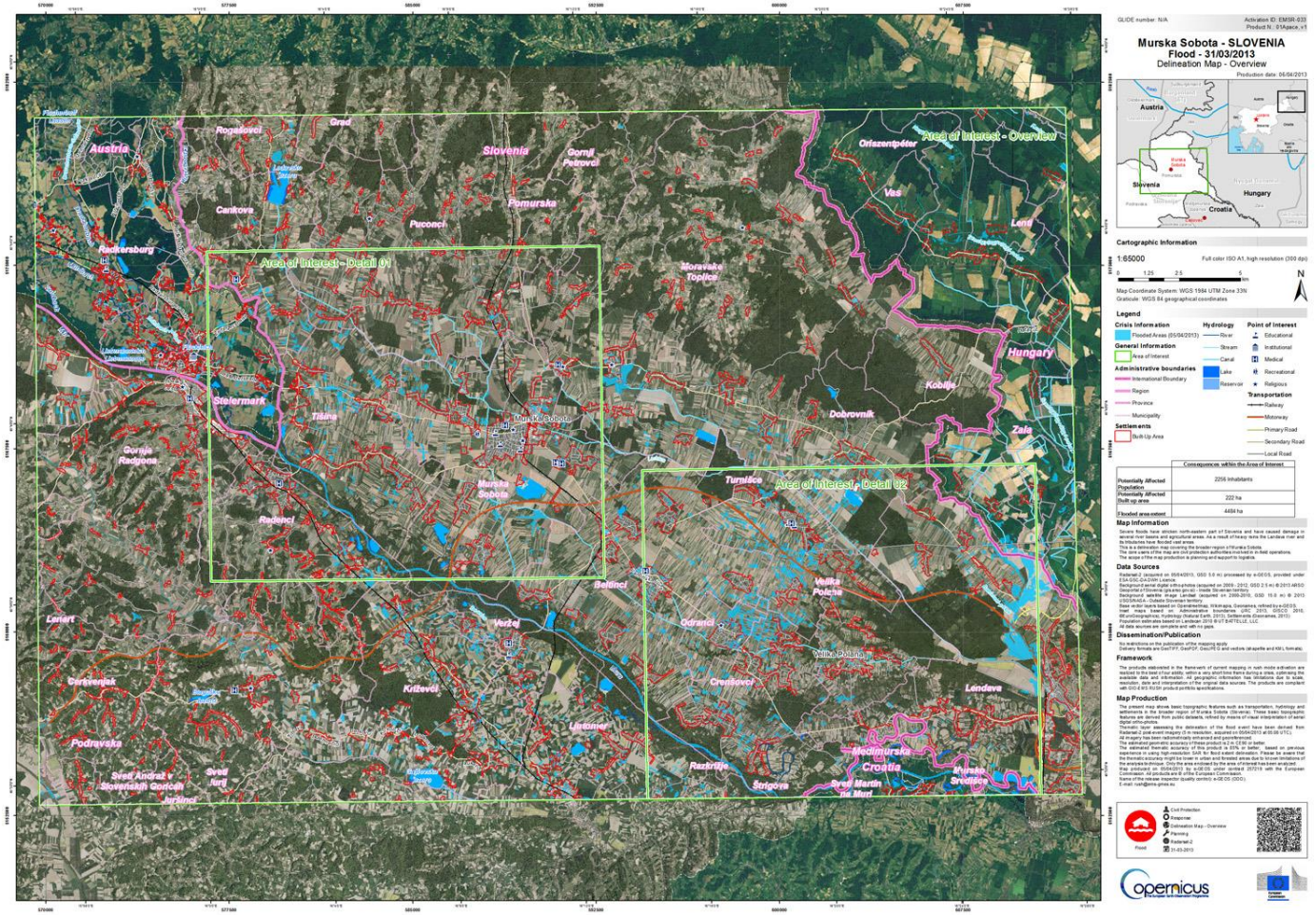

Estimated damage (US$ billion) caused by reported natural disasters 1900 - 2011
Estimated damage (US$ billion)
0
50
100
150
200
250
300
350
1900
1910
1920
1930
1940
1950
1960
1970
1980
1990
2000
2010
Year
Honshu Tsunami
Hurricane Katrina
Kobe earthquake
Wenchuan earthquake
EM-DAT: The OFDA/CRED International Disaster Database - www.emdat.be - Université Catholique de Louvain, Brussels - Belgium

Current state

- **There is a huge and diverse number of end users that need mapping data**
  - public authorities
  - civil protection
  - fire fighters
  - **public**
- **They are not getting the information needed**
  - Not frequent enough
  - Too complex
  - Not delivered in the form (way) needed

Copernicus EMS Product



Copernicus

- Global Monitoring for Environment and Security – GMES
- European information services based on satellite Earth Observation and in situ data
- Overall funding by the EU and ESA has reached over 3.200 million €
- Large part – 738 Mio € – dedicated to the development of satellites (Sentinels)
- EU Multiannual financial framework for 2014–20 includes 3.786 million € for the Copernicus
- Emergency Management Service - natural or man-made disasters

Satellite data is available

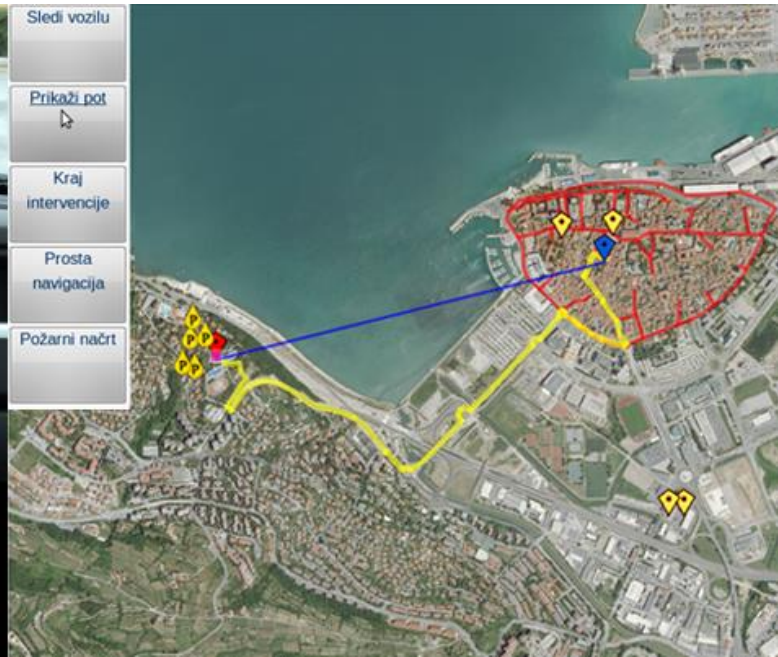
There are several sources of satellite data

- Copernicus
- Space and Major Disasters Charter
- Disaster Monitoring Constellation

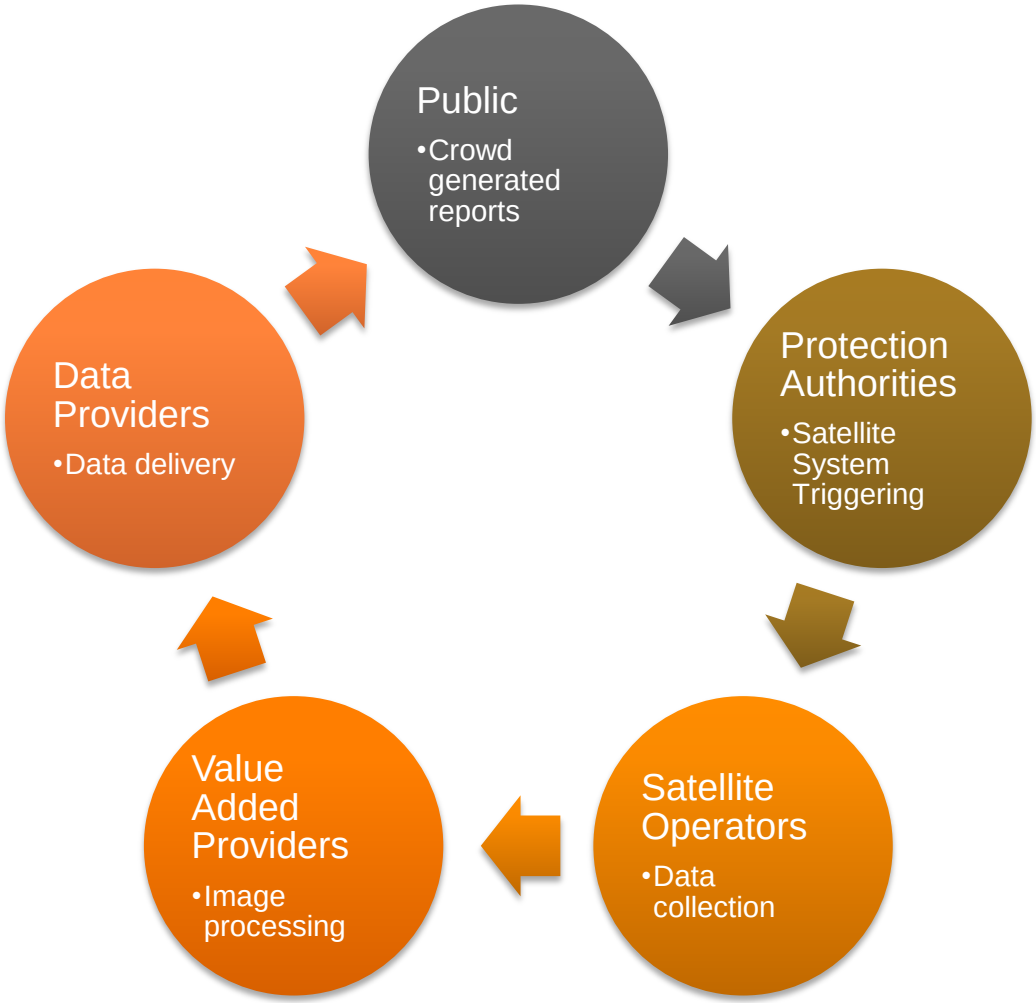
However

- Triggering is difficult
- Only authorized users can start mapping
- The users do not need data ➔ they need information
- Data is not easy to get
- Processing is not provided or not optimal

Firefighters and GIS technology

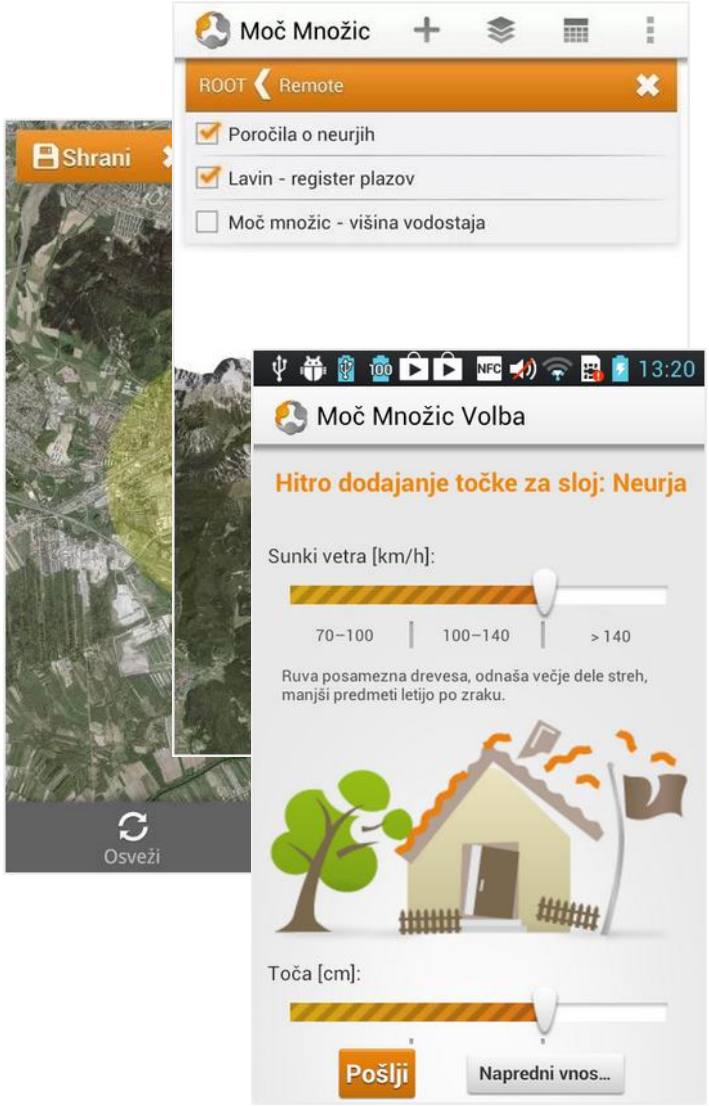


System that connects all stakeholders



Crowd generated disaster reports

- Use of crowd-sourcing to get information about the disasters
- Simple smart phone or web apps
- Used for detecting location and extend of disaster



Triggering of a small satellite system

- **Collaborative network**
- **Semi automatic operation**
  - reports are aggregated and delivered to the expert
  - Expert notifies the satellite operator(s)
- **Space and ground segment**
  - Optical
  - Radar
  - Network of GS
- **Different nation and different operators**

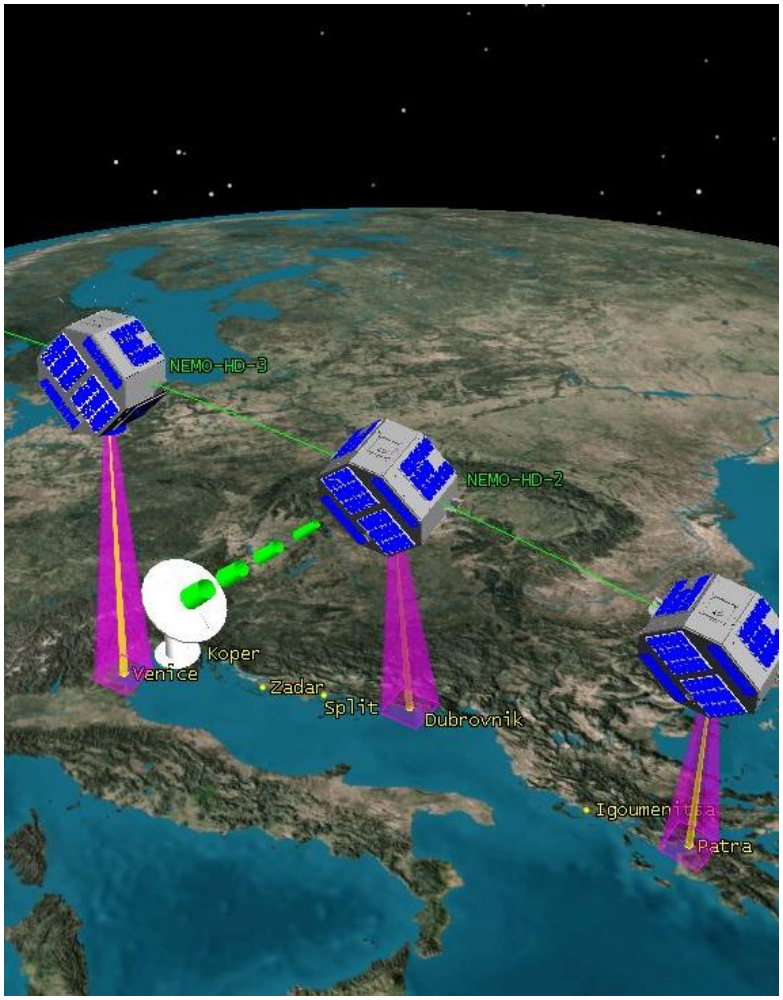
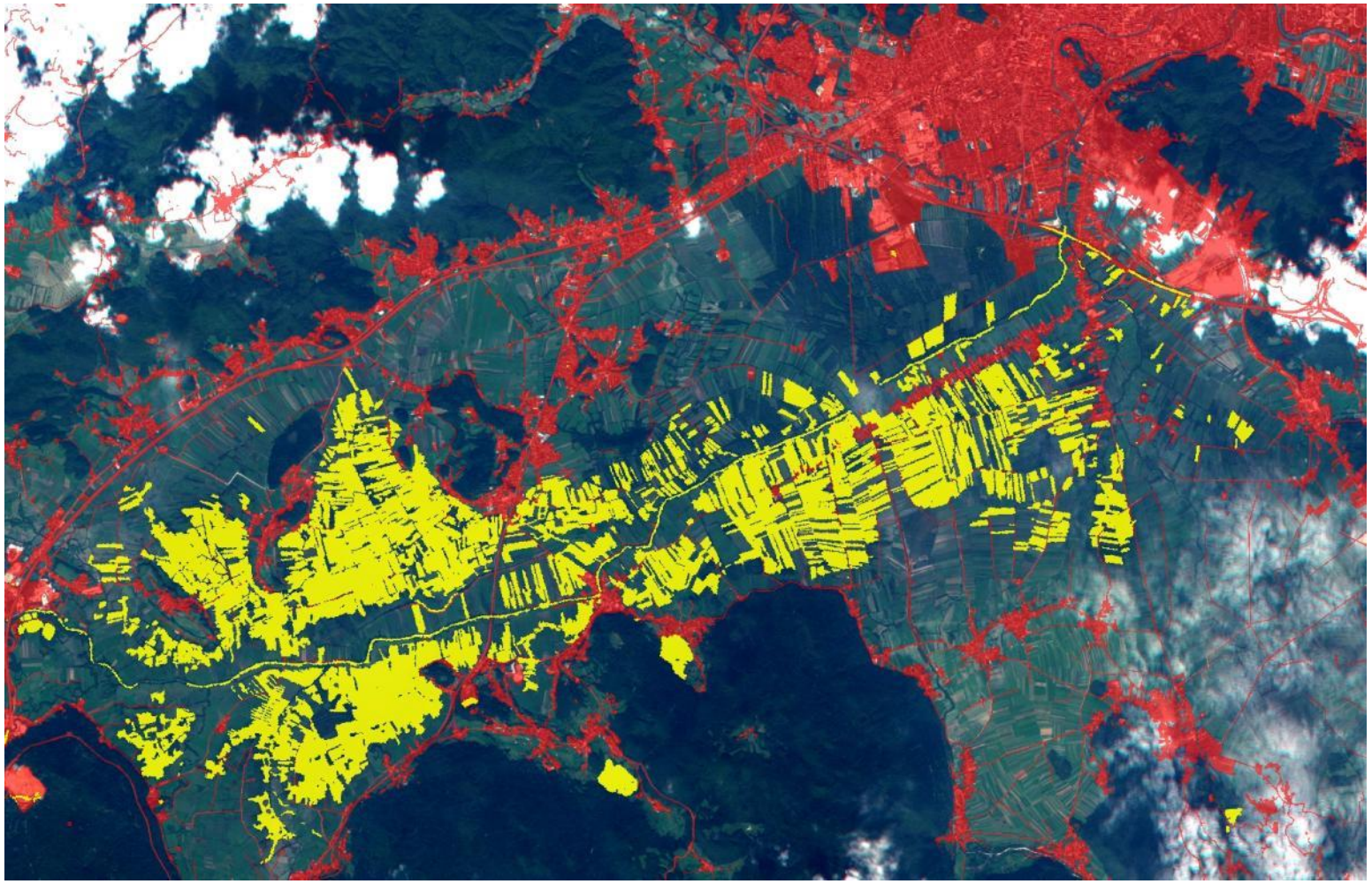


Image collection and processing

- Images have to be acquired automatically and simultaneously
- Received in the ground station
- Delivered to the value added providers
- Data has to be in a standard format
- Available to value added application providers
- Simple well defined processing steps
- Products defined by disaster type and end user (e.g. flood map, fire map, …)
- Cloud computing should be used

Flood detection, modeling and mapping



Data delivery

- **Maps**
  - Image – informative
  - Interpretation – experts
- **Textual information**
  - Warning system
- **Use internet technologies**
  - Web mapping
  - Web GIS
- **Crowd delivered maps and products**

Mission requirements

Characteristics	Value		
Imaging mode	High resolution	←	Low resolution
Image size (swath)	20 by 20 km		100+ by 100+ km
Imaging area per day	10.000+ km^2		100.000+ km^2
Spectral resolution	0.45-0.90+ µm Multispectral R, G, B, NIR Panchromatic if used for pan sharpening Radar sometime in the future		
Spatial resolution	<= 5 m MS 1-2 m PAN		10-20 m MS
Temporal resolution	Daily coverage of selected (smaller) area Weekly coverage of larger area Less than daily for selected (smaller) area		
Spatial coverage	-60 deg S to +60 deg N		

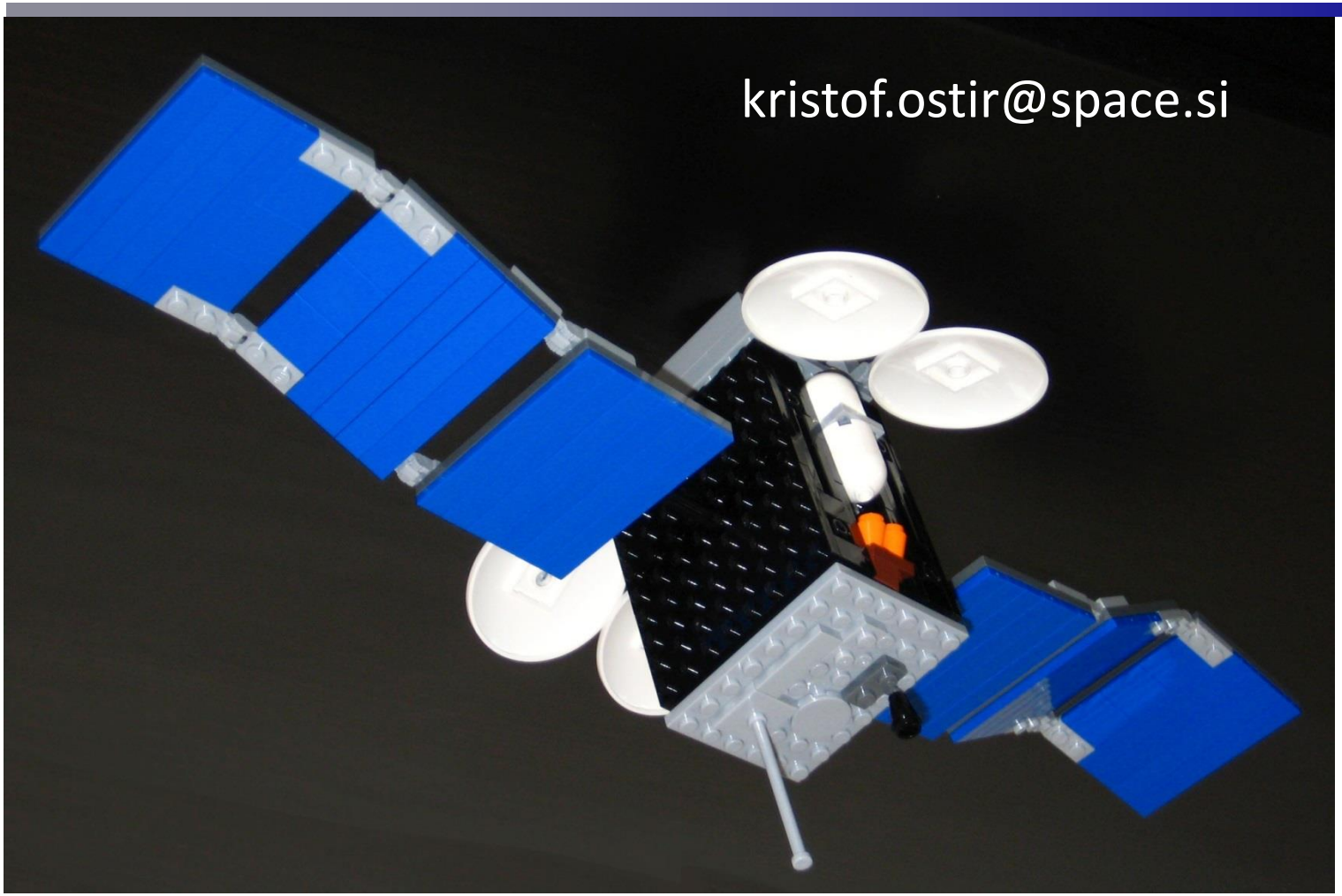
Mission requirements

Characteristics	Value (range)
Orbit	Not necessary Sun synchronous
Pointing accuracy	< 500 m on the ground
Sensor type	Full frame Line scanner
Of-nadir imaging	Up to 30 deg in any direction
Imaging	Agile, sweeping, non-continuous area imaging, orientation during imaging, target following
Image compression	Allowed
Downlink latency	1-2 h Real-time
Time to the end user	< 6 h Near-real-time
Video	Beneficial

Main advantages of the proposed mission

- Collaborative or distributed small satellite system
- Multisensor and multiresolution (spatial and temporal)
- Standard protocols for triggering, data collection, processing and delivery
- End users have an important role in the system
- Available to the end users including public
- Crowd sourcing is used (to collect the need) for triggering

Contact



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