



IREA Unit

PRIN PROJECT: *URBAN GEOmatics for Bulk Information Generation, Data Assessment and Technology Awareness*

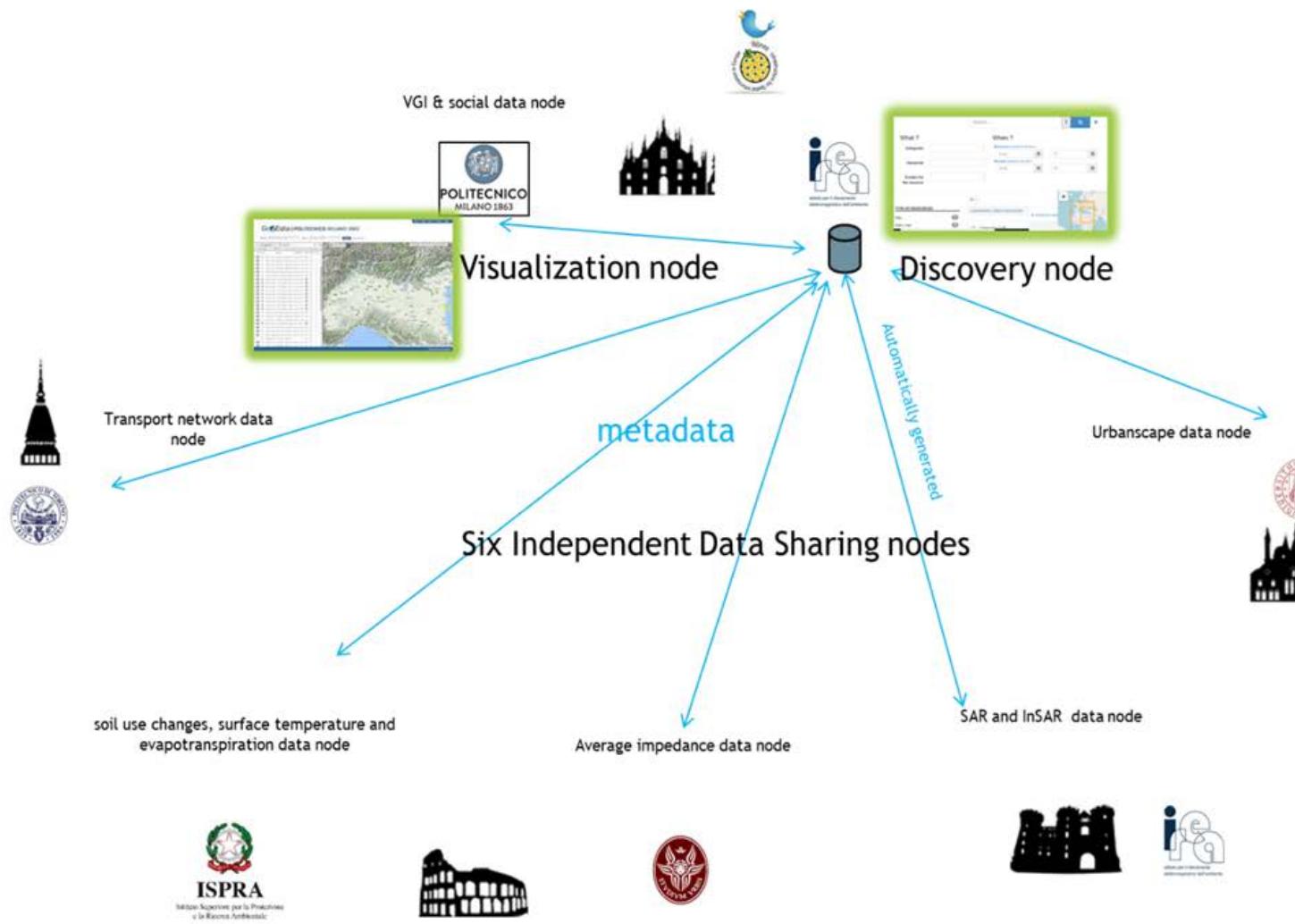


MINISTERO DELL'ISTRUZIONE DELL'UNIVERSITÀ E DELLA RICERCA

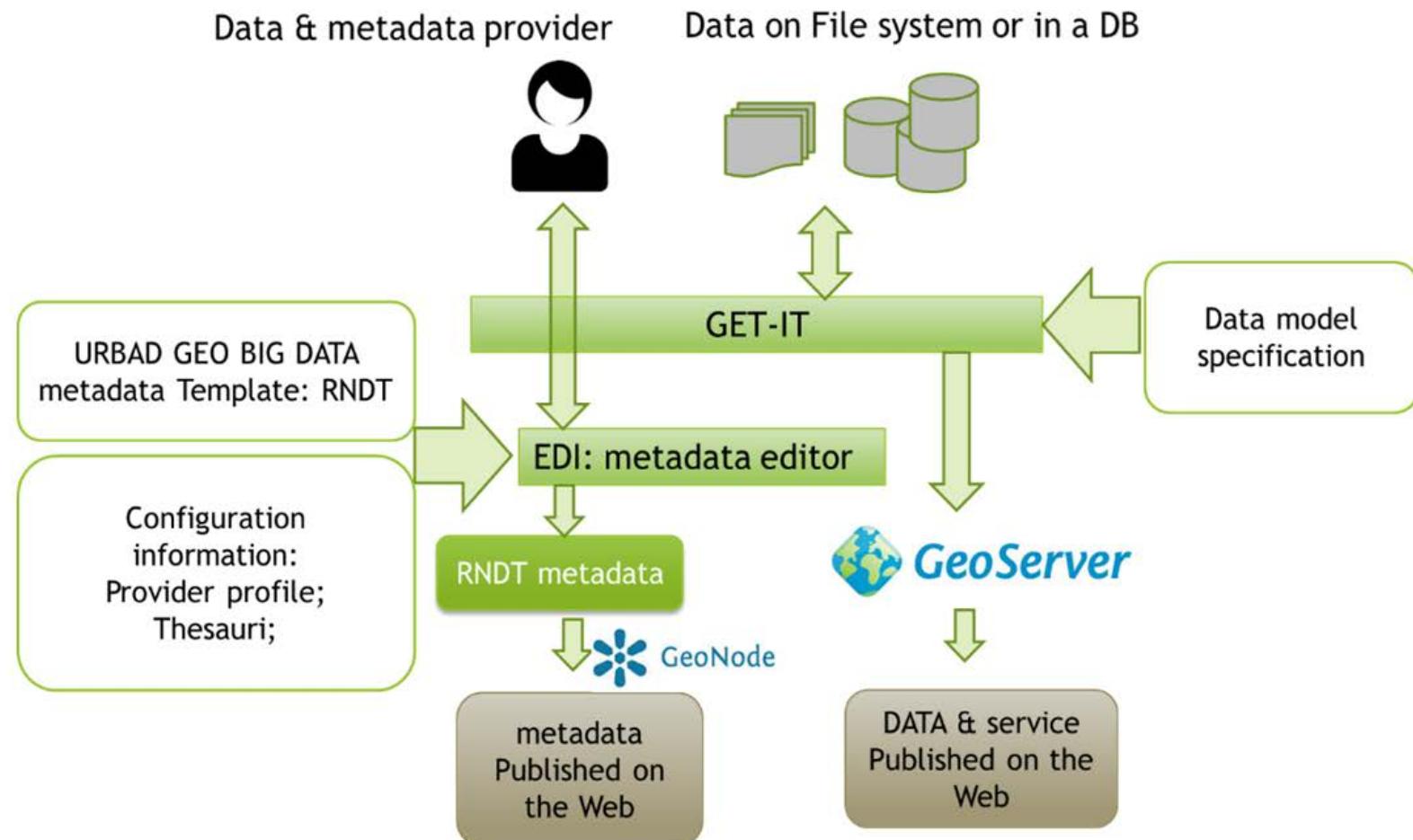
Gantt

- ▶ WP3 architecture design and implementation : server side due month 30
 - ▶ Completed
- ▶ Wp4.4: SAR and InSAR Data - due month 24 : (delayed) March 2019 Padua, Turin and Roma T30.
 - ▶ Completed for all cities
- ▶ Wp4.8: Data selection through quality evaluation due montyh 20 (delayed)
 - ▶ Automatic generation of metadata for the correct ingestion, within the IREA-MI catalogue service (GET-IT), of the SBAS-DInSAR deformation time-series relevant to the Turin, Rome and Padua urban areas
 - ▶ In progress, to be completed the development of the new geocatalogue of the project for discovery based on quality (by 30 09 2019)

SDI acentric distributed Architecture



Manual creation and Automatic publication of metadata



Semiautomatic metadata generation and data and metadata automatic publication

- ▶ Automatic generation of metadata from SAR and InSar data
- ▶ Automatic publication of metadata
- ▶ Automatic generation of WMS WFS and WMTS services from SAR and InSAr data on the IREA urban geo big data node
- ▶ Catalogue service implementation

Pilot experiment of AUTOMATIC RNDT METADATA CREATION from Data Header of Deformation maps

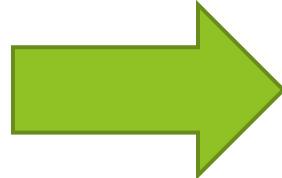
This is a small “sample” of the input data from which we generate RNDT metadata

10.55 cm/year											
1992.31 1992.41 1992.60 1992.69 1992.79 1993.17 1993.36 1993.56 1993.74 1993.94 1993.35 1995.44 1995.54 1995.54 1995.63 1995.73 1995.82 1995.83											
1995.92 1995.92 1996.01 1996.11 1996.11 1996.49 1996.59 1996.68 1997.45 1998.03 1998.60 2000.42 2000.71 2000.81 2000.90 2001.00 2001.58 2001.67 2001.96											
2002.05 2002.25 2002.72 2002.91 2003.10 2003.30 2003.59 2003.68 2003.87 2003.97 2004.64 2004.73 2004.93 2005.22 2005.41 2005.60 2005.79											
385847 79 315635 31 0.837672 -0.110132 161 144 18 123491 18 106645 2.22876 -0.00000 0.726865 1.53615 0.273120 -1.31764 -0.329221 1.58779 3.43777 0.620958											
1. 09819 1. 03266 1. 62859 3. 16386 2. 60920 1. 06164 2. 11563 2. 26032 2. 94830 3. 37892 2. 13966 1. 01388 3. 71340 3. 63465 2. 20264 2. 67435 3. 26372 2. 45828 1. 99037	1. 37857 3. 99820 1. 38920 1. 089401 0. 898401 1. 28424 2. 69096 -0. 509746 0. 291974 0. 123933 0. 703781 -0. 05103 -0. 04274 -0. 776650 2. 88467 1. 67740	1. 13315 0. 755935 1. 755606 2. 77567 2. 26870 1. 09393 2. 26063 2. 82193 2. 7751 2. 11683 0. 869572 3. 65337 3. 44932 2. 14698 2. 82138 3. 21488 2. 32727 1. 88338	1. 39297 4. 25847 1. 92369 1. 53176 -0. 565357 1. 12916 0. 266027 1. 59169 2. 02387 -0. 673227 -0. 142085 0. 644791 0. 711379 -1. 41418 -0. 719609 -0. 348141 2. 81019	1. 06803 1. 50044 0. 535337 1. 45087 0. 424295 -0. 313013 0. 686014 1. 32579 1. 41940 -1. 54576	1. 50858 -0. 00000 0. 408083 3. 35433 0. 684314 -0. 979364 -0. 0618577 1. 13595 3. 21453	0. 993964 1. 917288 2. 00139 2. 97380 2) 24436 1. 04883 2. 29010 2. 5958612 87980 3. 27706 2. 20167 1. 08337 3. 79747 3. 58637 2. 13109 3. 25455 3. 10238 2. 55705	2. 43309 1. 64585 4. 60834 1. 85294 1. 61110 -0. 375208 -0. 570013 0. 108892 1. 64812 2. 36208 -0. 359409 0. 626673 -0. 281547 0. 960229 -1. 11907 -0. 103198 -0. 679806	3. 09593 1. 58237 2. 11461 1. 25159 1. 42188 0. 328586 1. 09010 1. 18793 1. 36367 1. 63628 -1. 28043	1. 10119 0. 344736 -1. 52335 -0. 318635 1. 25365 3. 12865 0. 655781	1. 30598 -0. 00000 0. 408083 3. 35433 0. 684314 -0. 979364 -0. 0618577 1. 13595 3. 21453	1. 39297 4. 25847 1. 92369 1. 53176 -0. 565357 1. 12916 0. 266027 1. 59169 2. 02387 -0. 673227 -0. 142085 0. 644791 0. 711379 -1. 41418 -0. 719609 -0. 348141 2. 81019

1st record
Number of the column relevant to the start of the time series
Number of employed dates
Deformation measurement unit

2 nd record
Date: [year+(month-1)/12+(day/365)]
The deformation time series of the analyzed points start from the 3 rd record

Column
1 East Coord. - UTM -WGS84
2 North Coord. -UTM -WGS84
3 Temporal interferometric coherence
4 Deformation velocity (cm/year)
5 Azimuth Coord.
6 Range Coord.
7 Latitude Coord.
8 Longitude Coord.
9 Residual topography



```
<?xml version="1.0"?>
<quiz>
<qanda seq="1">
<question>
```

RNDT METADATA

```
</question>
<answer>
```

OUTPUT

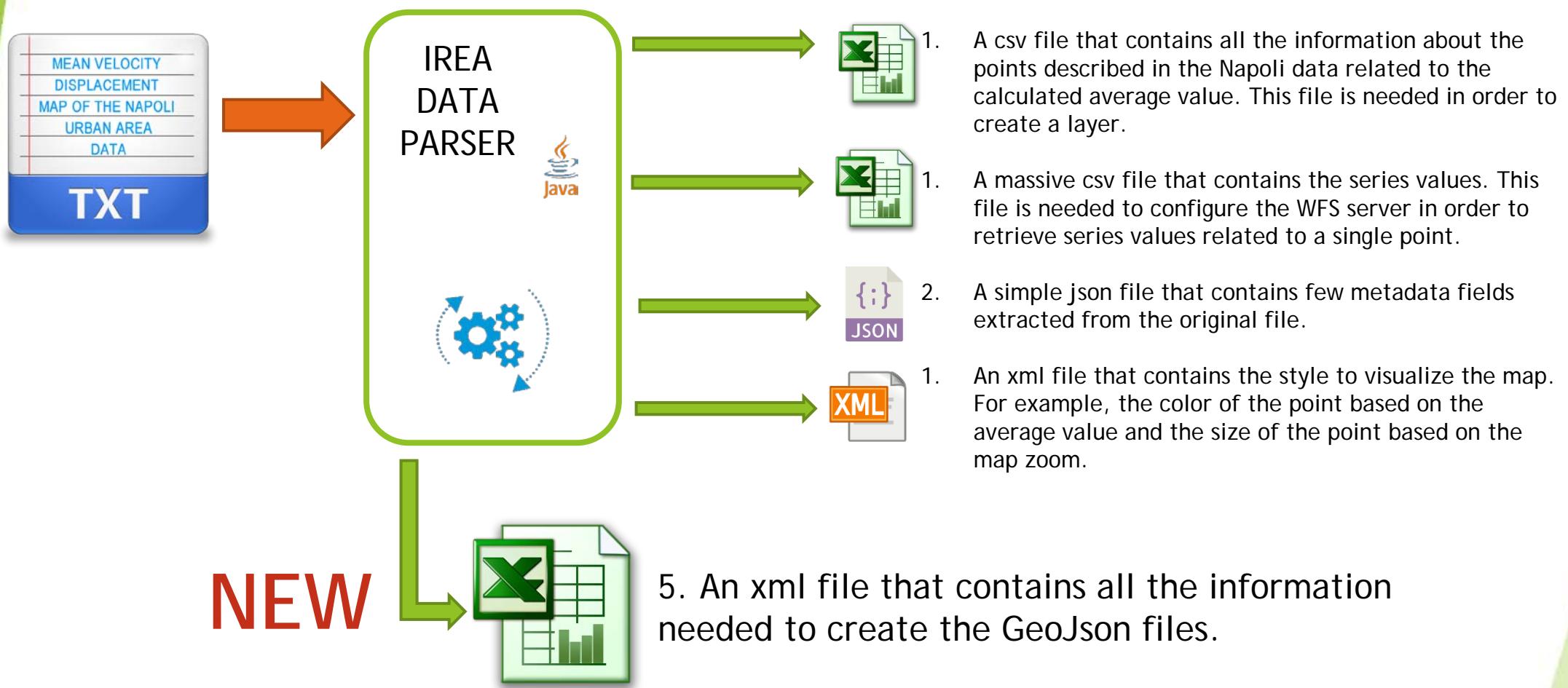
```
</answer>
</qanda>
```

```
<!-- Note: We need to add more questions later.-->
</quiz>
```

XML

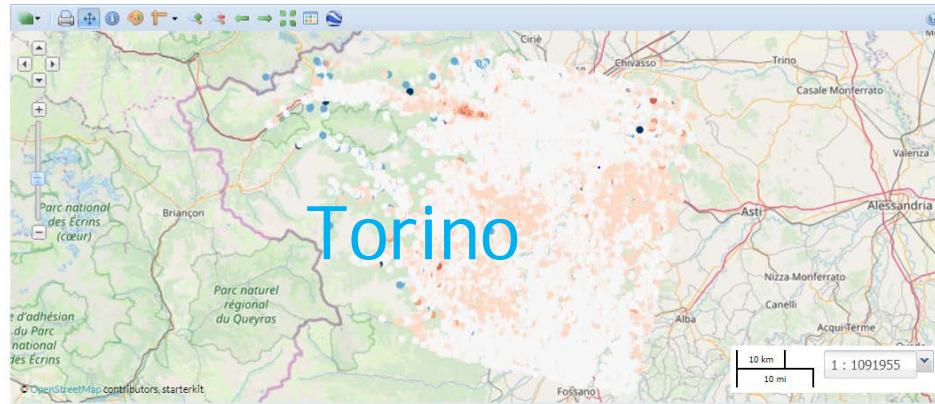
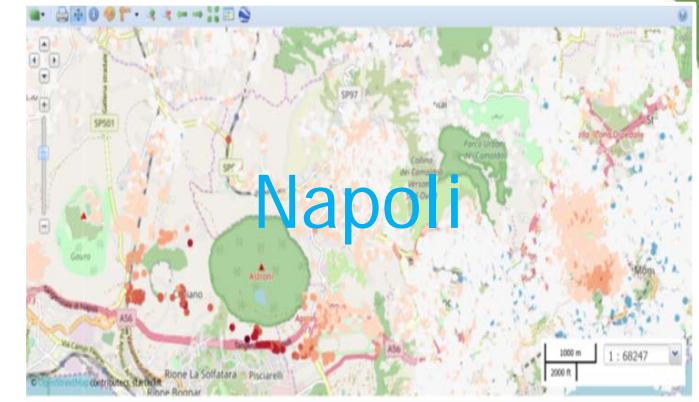
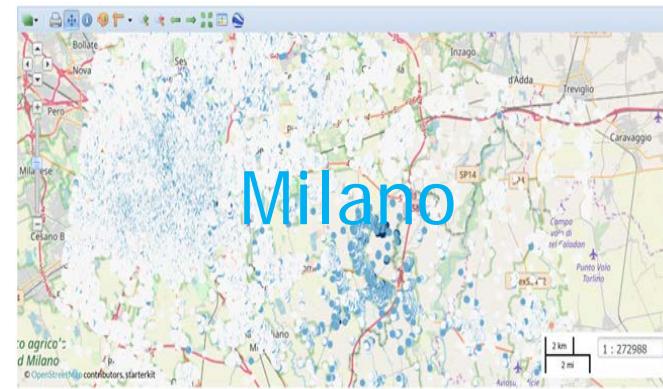
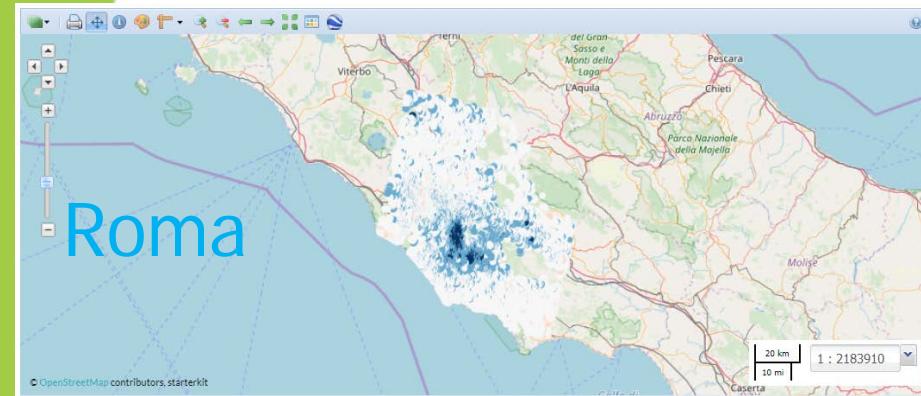
Static metadata fields for deformation maps:
Description, abstract, keywords, creator, etc.,.

WP3.2 GET IT node for IREA data node

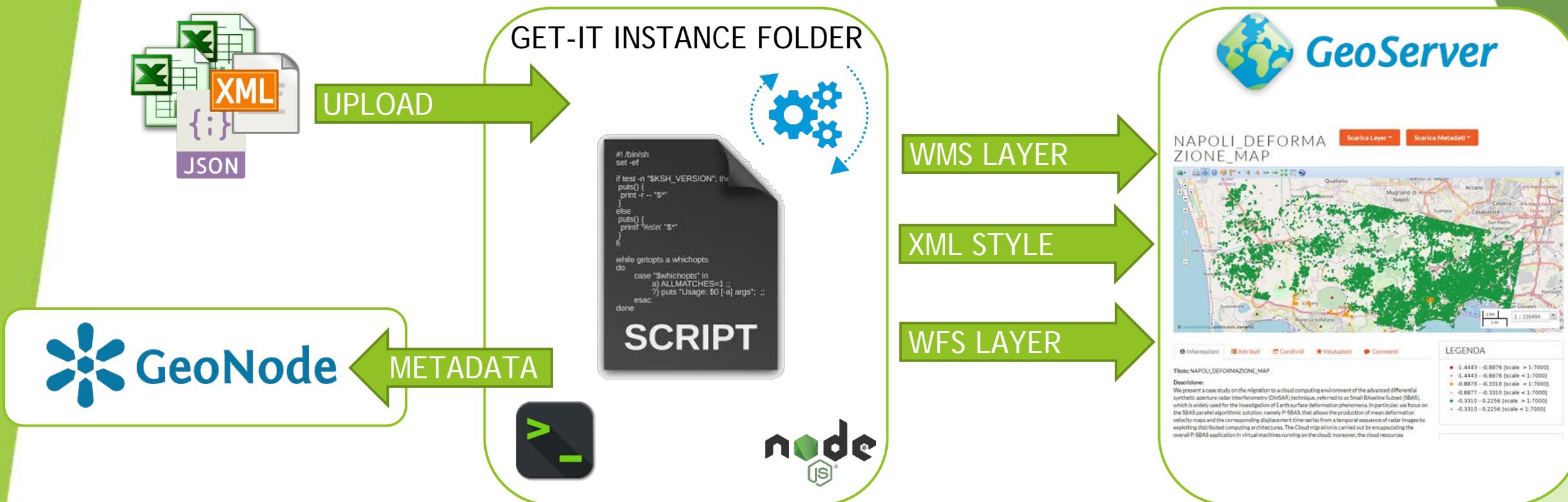


Average Displacement maps of all 5 cities now available

All the layers <https://ugbd.get-it.it/>

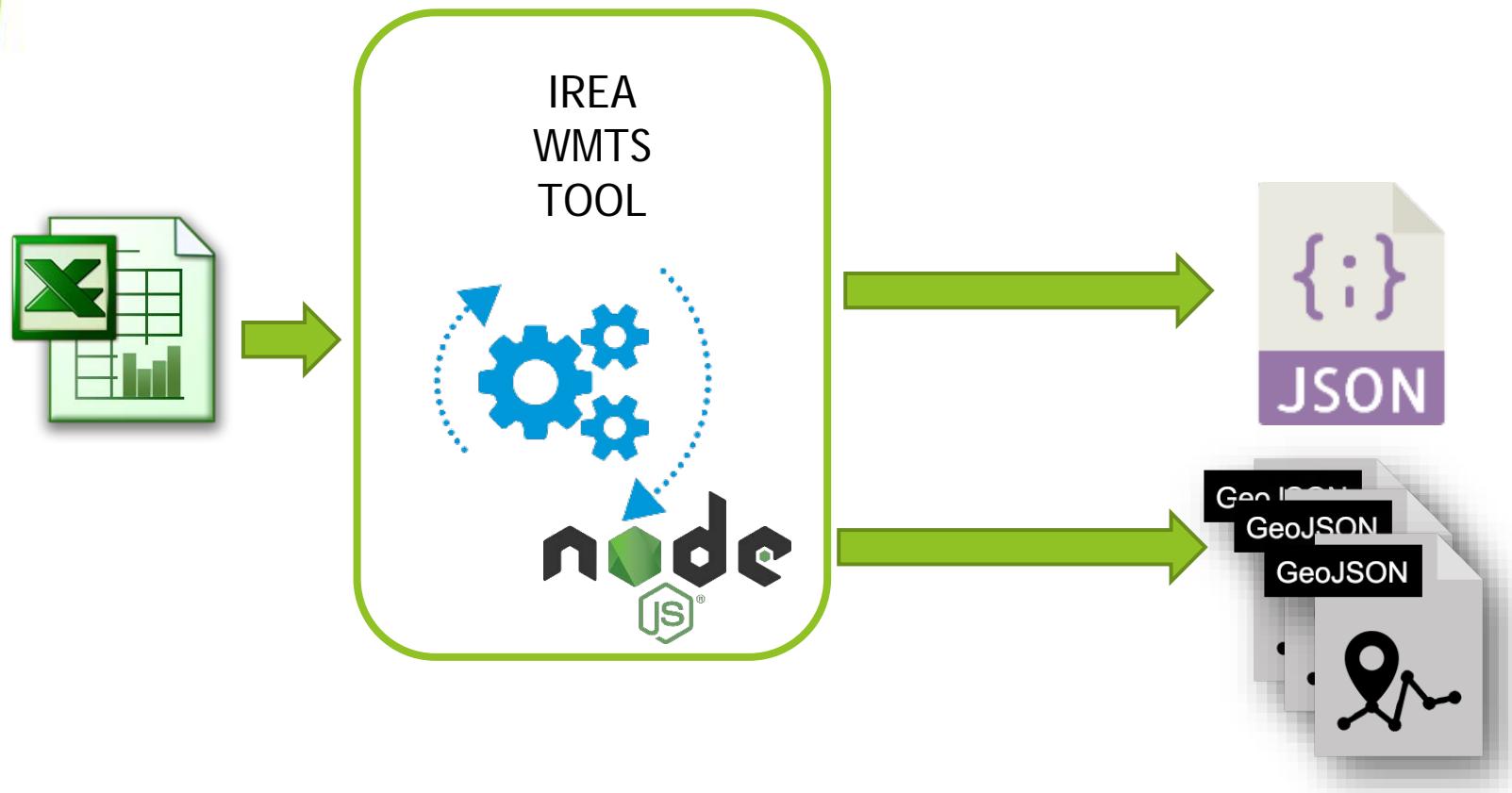


WP3.2 GET IT node for IREA data node



All the layers <https://ugbd.get-it.it/>

WMTS multidimensional : first step

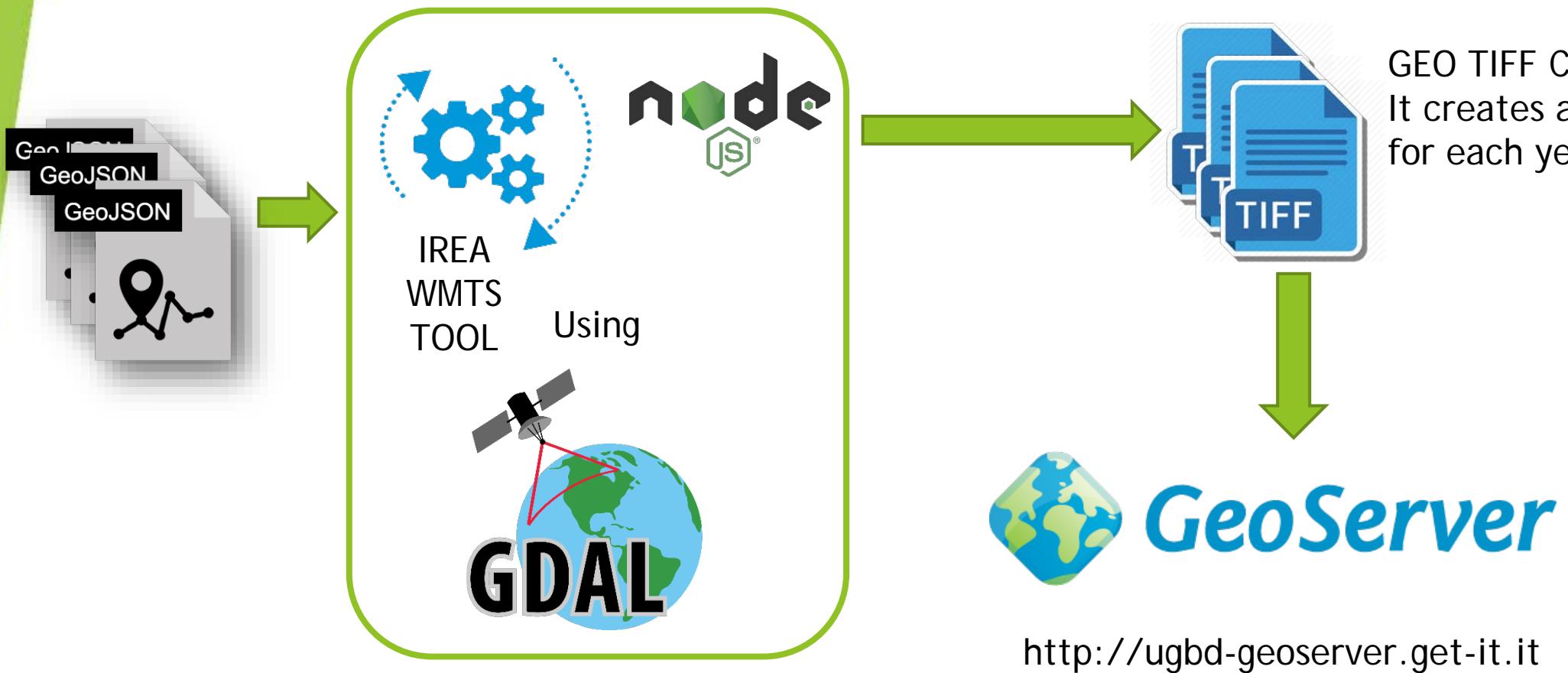


DATA ANALYSIS

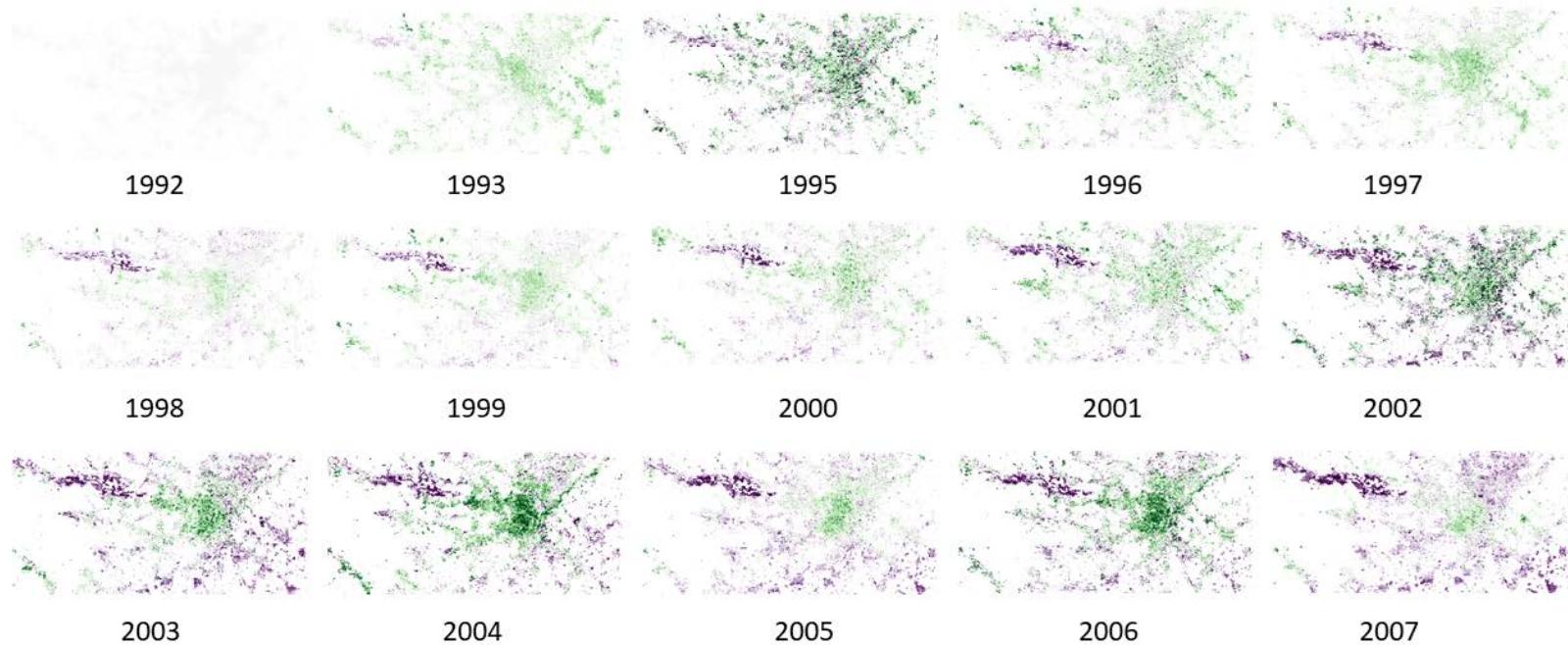
- Max, Min values
- Distribution

GEO JSON CREATOR
It creates a GeoJson
for each interval of values
for each year

WMST multidimensional : step two



WMTS service for all 5 cities



Torino:
Annual Time series
of dispacement
accumulation

Milano : <http://ugbd-geoserver.get-it.it/geoserver/gwc/demo/DeformationTS:milanowmts?gridSet=EPSG:900913&format=image/png>

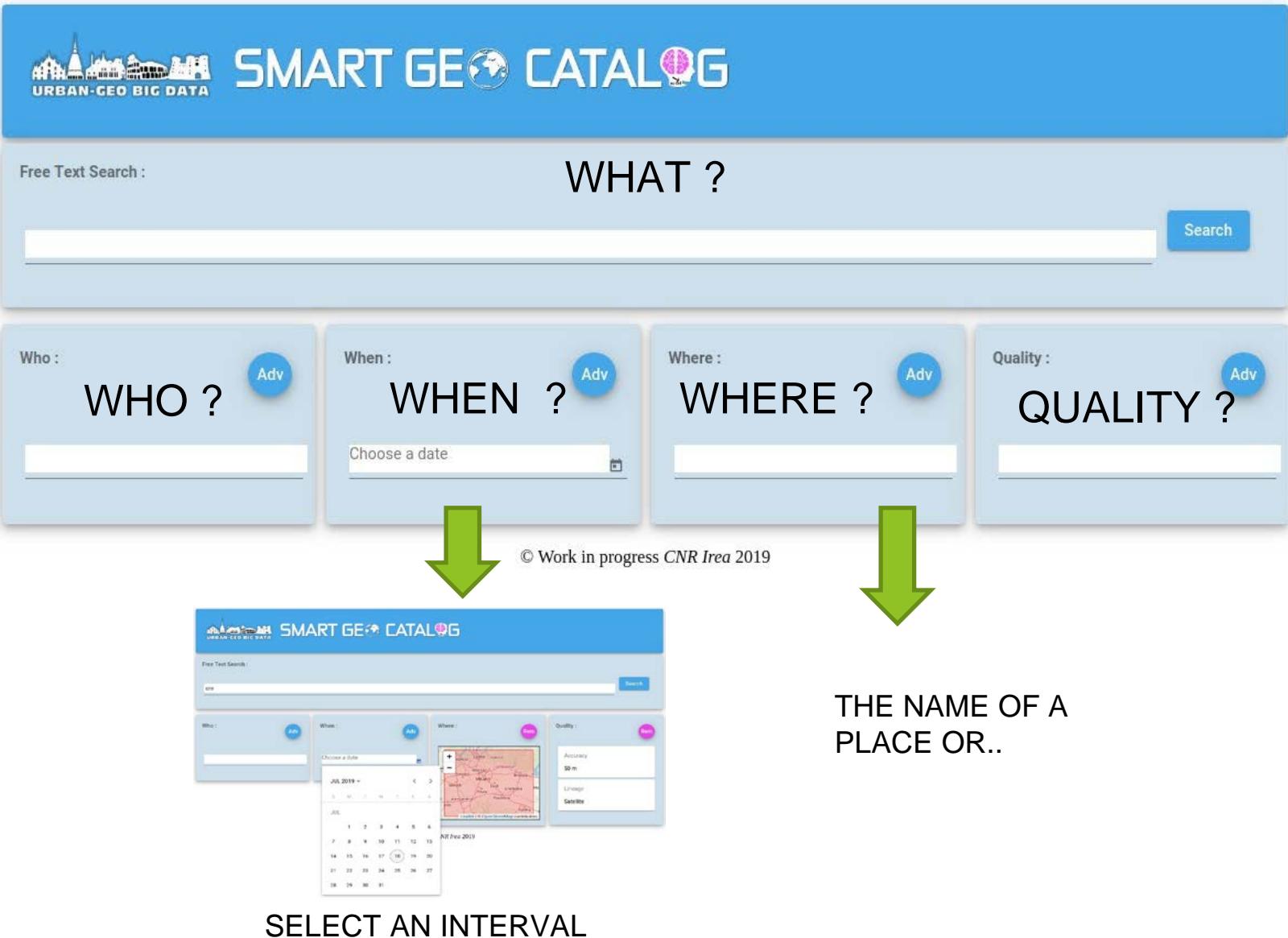
Roma : <http://ugbd-geoserver.get-it.it/geoserver/gwc/demo/DeformationTS:imageroma?gridSet=EPSG:900913&format=image/png>

Torino : <http://ugbd-geoserver.get-it.it/geoserver/gwc/demo/DeformationTS:torinowmts?gridSet=EPSG:900913&format=image/png>

Padova : <http://ugbd-geoserver.get-it.it/geoserver/gwc/demo/DeformationTS:padovawmts?gridSet=EPSG:900913&format=image/png>

Napoli : <http://ugbd-geoserver.get-it.it/geoserver/gwc/demo/DeformationTS:imagenapolirealcolors?gridSet=EPSG:900913&format=image/png>

New Geo Catalog



The diagram illustrates the Smart Geo Catalog search interface. At the top, there is a logo for "URBAN-GEO BIG DATA" featuring a city skyline icon and the text "SMART GEO CATALOG" with a globe icon.

The search interface includes a "Free Text Search:" input field with a "Search" button, and four main query fields:

- Who :** WHO ? (with an "Adv" button)
- When :** WHEN ? (with an "Adv" button, accompanied by a "Choose a date" input field)
- Where :** WHERE ? (with an "Adv" button)
- Quality :** QUALITY ? (with an "Adv" button)

Below these fields, two green arrows point downwards to a smaller screenshot of the catalog interface. The screenshot shows the search bar with "one" entered, the "When" field set to "JUL 2019", and a map view. The text "© Work in progress CNR Irea 2019" is centered between the two arrows.

At the bottom, the text "SELECT AN INTERVAL" is displayed above the map.

On the right side of the diagram, there is a large green triangular shape with several blue location pins connected by lines, suggesting a network or spatial data visualization.

Select a region drawing on a map

Who : Adv

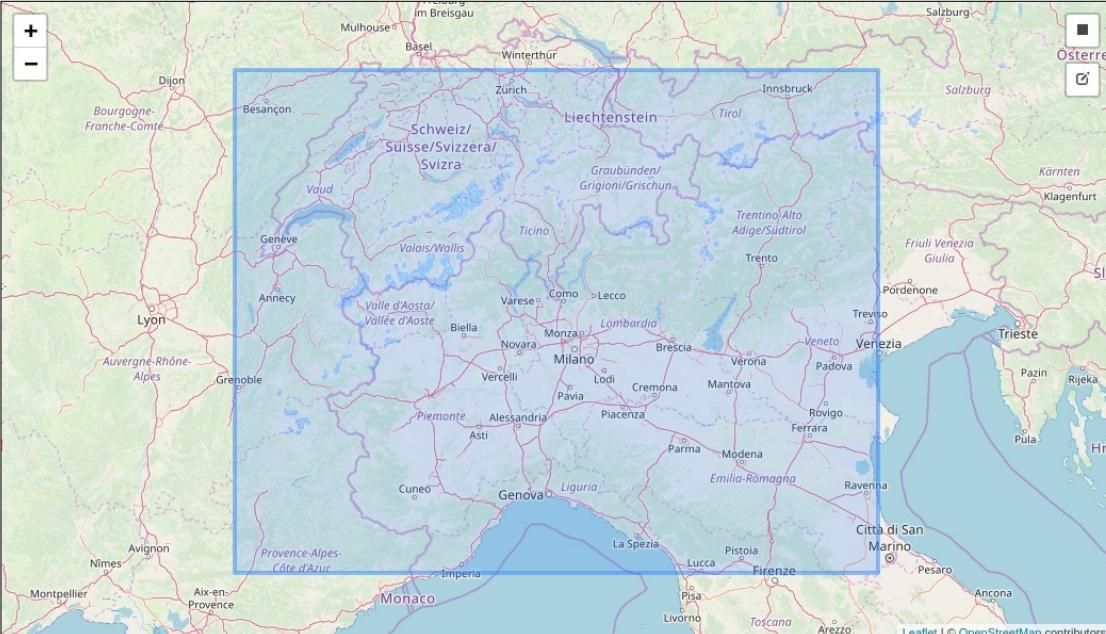
When : Choose a date Adv

Where : Adv

Quality : Adv

Select an area using the top right menu

Save Bounds!



Leaflet | ©OpenStreetMap contributors



Who : Adv

When : Choose a date Adv

Where : Adv

Quality : Adv

Select an area using the top right menu

Save Results!



REFINE YOUR SELECTION



SMART GEO CATALOG

URBAN-GEO BIG DATA

Free Text Search : **Search**

Who : Adv

When : Choose a date Adv

Where : **Refine**

Quality : Adv



SAVE BOUNDS

© Work in progress CNR Irea 2019



Advanced quality search form

SMART GEO CATALOG

Free Text Search :

Who : Adv

When : Choose a date

Where : Adv

Quality : Adv

Qualità

Positional Accuracy (default meter)

Unit of measure * m

Lineage

© Work in progress CNR Irea 2019



SMART GEO CATALOG

Free Text Search :

Who : Adv

When : Choose a date

Where : Adv

Quality : Adv

Accuracy 12 km

Lineage Satellite Crn

© Work in progress CNR Irea 2019

Complex search form

SMART GEO CATALOG

Free Text Search: cnr

Who: Adv

When: Adv

Where: Rem

Quality: Rem

Choose a date: JUL 2019

Accuracy: 50 m

Lineage: Satellite

JUL 2019

NR Irea 2019



-
- SMART GEO CATALOG
- Back
- Mean Velocity Displacement Map of the Torino urban area
2019-05-13T00:00:00.000Z
We present a case study on the migration to a cloud computing environment of the results produced by the multi-temporal differential synthetic aperture radar interferometry (DInSAR) technique, referred to as Small Baseline Subset (SBAS). The technique, which was proposed in 2002, is widely used for the investigation of Earth surface deformation phenomena, and allows ...
- CNR_MILANO_DEFORMAZIONE_MAP_WMTS_SERVICE_DEMO
2019-01-22T00:00:00.000Z
Web Map Tile Service Demo created analyzing the displacement time-series map of Milano. The displacement maps have a given accuracy that is in the order of some millimeters (1mm-3mm). It has been selected only one deformation value per year to expect that the relative deformation in one-year is considerably higher than the accuracy of the measurement. ...
- Mean Velocity Displacement Map of the Napoli urban area WFS SERVICE
2018-12-26T00:00:00.000Z
We present a case study on the migration to a cloud computing environment of the results produced by the multi-temporal differential synthetic aperture radar interferometry (DInSAR) technique, referred to as Small Baseline Subset (SBAS). The technique, which was proposed in 2002, is widely used for the investigation of Earth surface deformation phenomena, and allows ...
- CNR_NAPOLI_DEFORMAZIONE_MAP_WMTS_SERVICE_DEMO
2019-01-22T00:00:00.000Z
Web Map Tile Service Demo created analyzing the displacement time-series map of Napoli. The displacement maps have a given accuracy that is in the order of some millimeters (1mm-3mm). It has been selected only one deformation value per year to expect that the relative deformation in one-year is considerably higher than the accuracy of the measurement. ...

Simple localized metadata viewer

SMART GEO CATALOG
URBAN-GEO BIG DATA

MULTI-LANGUAGE

Identificatore del file
CNR_TORINO_DEFORMAZIONE_MAP

Lingua
eng

Set dei caratteri dei metadati
utf8

Livello gerarchico
dataset

Punto di contatto

Nome dell'Ente
CNR-IREA Napoli

Informazioni di contatto

Indirizzo

E-mail
<mailto:pepe.a@irea.cnr.it>

Tipo di rappresentazione spaziale
vector

Risoluzione spaziale
distance

unit
<http://standards.iso.org/ittf/>

value
80

Set dei caratteri dei metadati
utf8

Estensione dei dati



LINKS, IMAGES AND MAP

Qualità dei dati

Accuratezza Posizionale (metri)
5

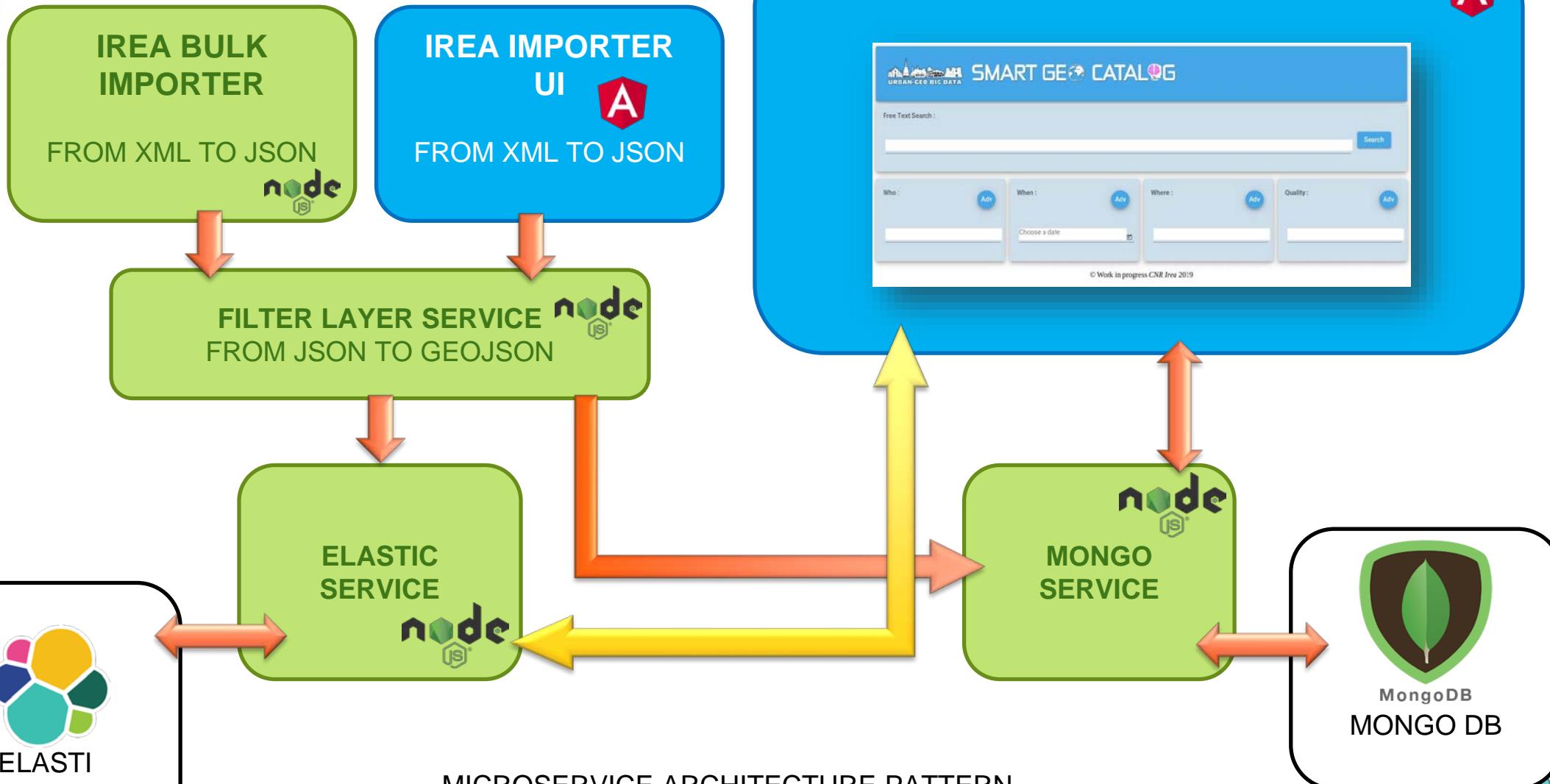
Genealogia

Dichiarazione

The analysis of surface deformations in the urban area of Naples has been carried out using the full-resolution adaptation of the Small Baseline Subset (SBAS) interferometric differential synthetic aperture radar (DInSAR) technique. SAR data were acquired at C band by the ERS and ENVISAT satellite platforms of the European Space Agency. The approach provides detailed information in urban areas, detecting specific local movements, such as subsidence related to single buildings and public infrastructures, highlighting the relative displacements of coherent structures with respect to the average movement of the ground. The process involved 16 InSAR images, corresponding to Track 36 (descending orbits), acquired from June 1992 to September 2010. Starting from these images, 485 InSAR SB data pairs have been selected, with a maximum perpendicular baseline of 400 m. The topographical phase components have been removed using an SRTM digital elevation model (DEM) of the area, with a resolution of about 80 x 80 m². Mean displacement velocity value (cm/year)
Cose : Temporal coherence, which quantifies the goodness of the achieved solution. Only pixels with temporal coherence values larger than 0.7 are considered reliable and visualized
Cosn : North direction cosine
Cose : East direction cosine
Cosu : Up direction cosine
Id : Id number
Topo : height topography of the considered pixel calculated w.r.t. the reference ellipsoid.

QUALITY

How does it works ?

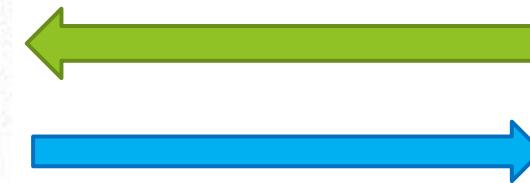




The Proxy



1. ADD C.O.R.S. TO QUERY AND IMAGES REQUESTS
2. HIDE THE SECOND GEOSERVER USED FOR THE WMTS



REDIRECTS HTTPS REQUESTS TO HTTP ONLY SERVER

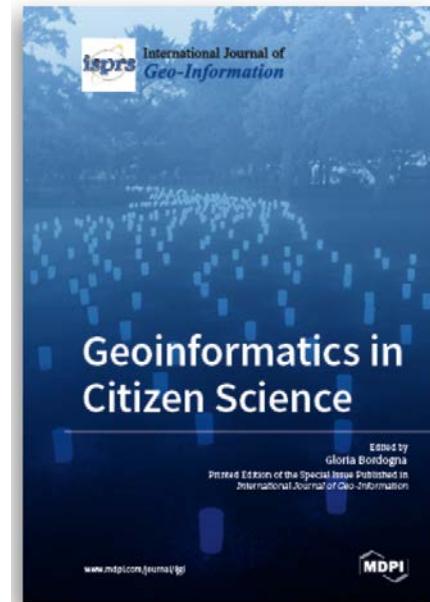
EDI CLIENT

SSL TO NOT SSL
PROBLEM
SPARQL QUERIES

Research products

Published papers

- ▶ A. Pepe, M. Bonano, G.Bordogna, M. Brovelli, F.Calò, P. Carrara, L. Congedo, L. Frigerio, P. Imperatore, R. Lanari, S. Lanucara, M. Manzo, M.Munafò The "Urban Geomatics for Bulk Information Generation, Data Assessment and Technology Awareness" Project: Detection, Representation and Analysis of the Urban Scenario Changes, short paper in proceeding of GARSS 2018 - 2018 IEEE Int. Geoscience and Remote Sensing Symposium, 2902-2905, Valencia, Spain.
- ▶ Antonio Pepe, "Theory and Statistical Description of the Enhanced Multi-Temporal InSAR (E-MTInSAR) Noise-Filtering AlgorithmRemote," Sensors 2019, 11, 363; doi:10.3390/rs11030363
- ▶ Geoinformatics and Citizen Science, Gloria Bordogna, Special issue of the ISPRS Int. J. of Geoinformation, 2018: http://www.mdpi.com/journal/ijgi/special_issues/citizen-science (10 papers included) Prefazione <https://www.mdpi.com/2220-9964/7/12/474>
- ▶ Also printed Book available ISBN 978-3-03921-072-5 (Pbk); ISBN 978-3-03921-073-2 (PDF)
<https://doi.org/10.3390/books978-3-03921-073-2>



Organization activities

- ▶ Workshop on Volunteered Geographic Information: Enabling VGI creation, management and sharing : AREA della Ricerca CNR Via Alfonso Corti 12 , 20133 MILANO April the 16th, 2018.

Ongoing products

papers

- ▶ Candan EYLÜL KILSEDAR , Luca Frigerio , Manuela Bonano , Gloria Bordogna , Paola Carrara , Pasquale Imperatore , Riccardo Lanari , Mariarosaria Manzo , Antonio Pepe2, Maria Antonia Brovelli, Visualization of Big GeoData: an experiment with DInSAR deformation Time series, in Proce. Of FOSS4G, Bucharest, 2019
- ▶ Luca Frigerio , Candan EYLÜL KILSEDAR , Manuela Bonano, Gloria Bordogna, Paola Carrara, Pasquale Imperatore, Riccardo Lanari, Mariarosaria Manzo, Antonio Pepe , Maria Antonia Brovelli, Generazione, Sintesi e Condivisione Interoperabile di Serie Temporali Derivate da DInSAR , accettato per presentazione ad ASITA 2019

Other products planning

papers

- ▶ Common paper for IJGI special issue:
- ▶ ""Spatial Big Data, BIM and advanced GIS for Smart Transformation: City, Infrastructure and Construction"" deadline febbraio 2020.
https://www.mdpi.com/journal/ijgi/special_issues/BIM_GIS
"the main requirement of a successful smart city in the implementation phase depends on the availability of the appropriate digital information systems. This special issue invites all researchers to share their scholarly work concerning the development of advanced technologies which may help the implementation of smart cities."
- ▶ Adele Fusco, Antonio Pepe, Paolo Berardino, Claudio De Luca, Sabatino Buonanno, Riccardo Lanari A Phase Preserving Focusing Technique for TOPS Mode SAR Raw Data Based on Conventional Processing Methods, under revision (minor) MDPI Sensors, open access journal
- ▶ New IJGI special issue «Ai for multisource geoinformation» deadline 31 Marzo 2020
https://www.mdpi.com/journal/ijgi/special_issues/Geospatial_Artificial_Intelligence

