National Research Council of Italy

Global data-base of co-seismic interferograms generated via unsupervised Sentinel-1 DInSAR processing

Fernando Monterroso (1,2), Manuela Bonano (2,3), Claudio de Luca (2), De Novellis Vincenzo (2), Riccardo Lanari (2), Michelle Manunta (2), Mariarosaria Manzo (2), Giovanni Onorato (2), Emanuela Valerio (2), Ivana Zinno (2), and Francesco Casu (2)

1. University of Naples «Parthenope», Naples, Italy.
2. Institute for Electromagnetic Sensing of Environment (IREA) - National Research Council (CNR), Naples, Italy.
3. Institute of Methodologies for Environmental Analysis (IMAA) - National Research Council (CNR),Potenza, Italy.

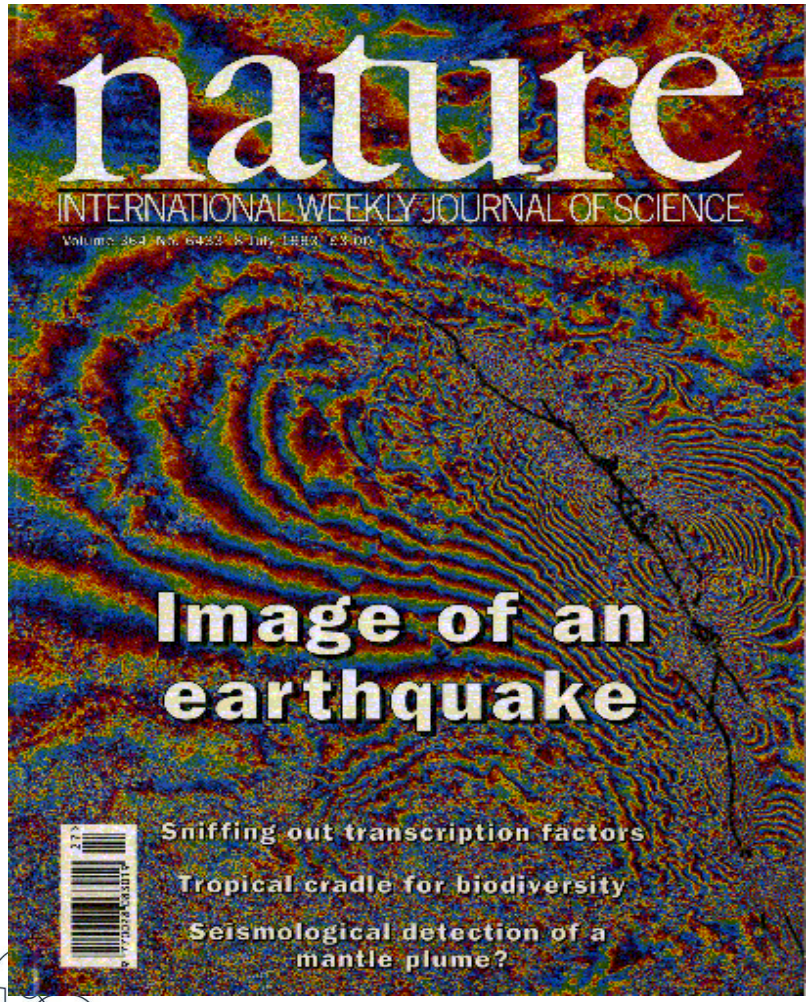
European Geosciences Union

UNIVERSITA' DEGLI STUDI DI NAPOLI PARTHENOPE

Outline

- Studying Earthquakes with DInSAR
- Sentinel-1 Constellation
- Parallel Sentinel-1 DInSAR Workflow
- Automatic generation of co-seismic displacement maps by using Sentinel-1 interferometric SAR data
- Tool implementation and achieved results
- Further Developments

Studying Earthquakes with DInSAR



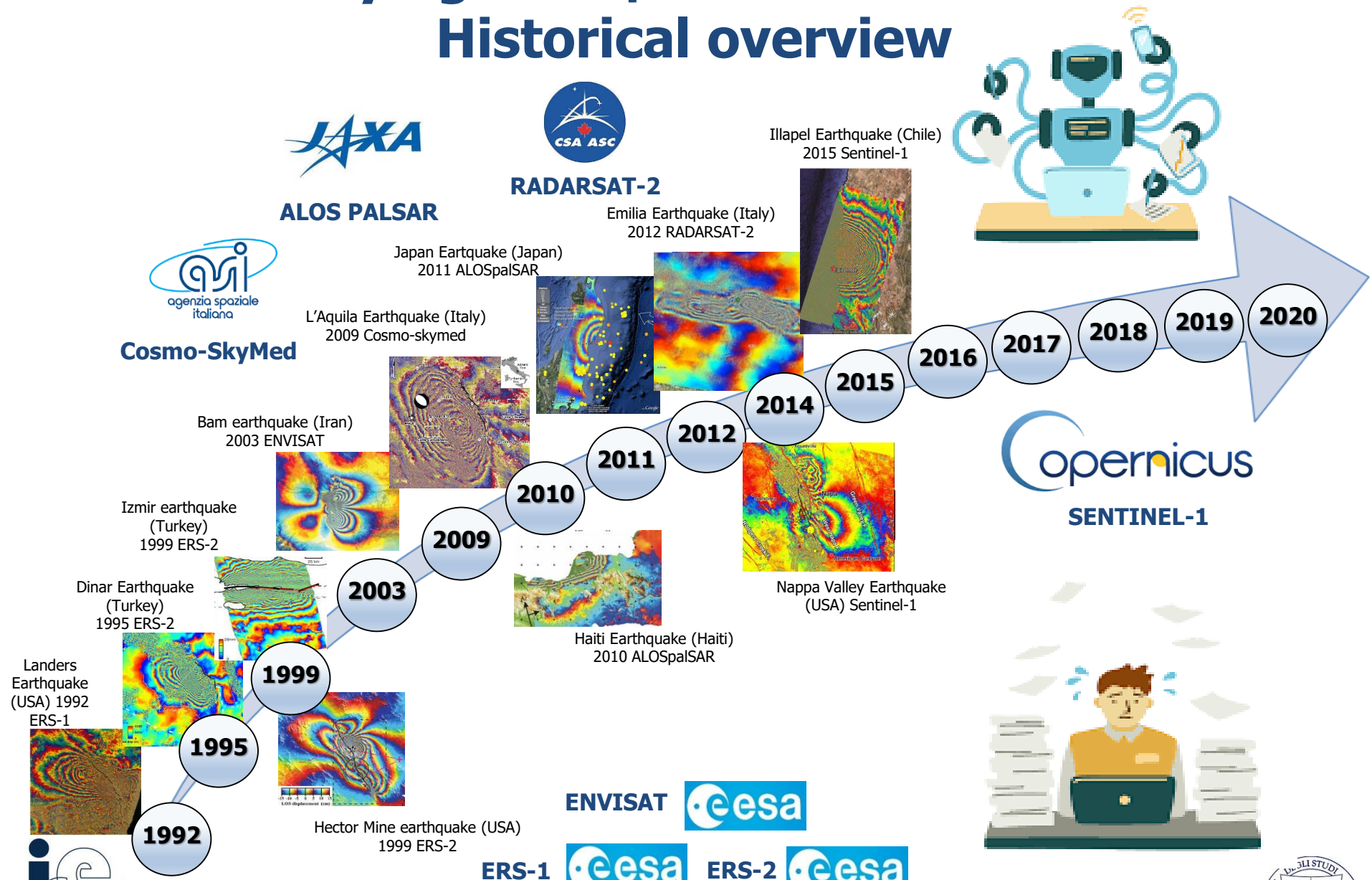
Landers earthquake, 1992 was the first interferogram of an earthquake using ERS images.

Co-seismic interferogram using ERS data (92/4/24-93/6/18).

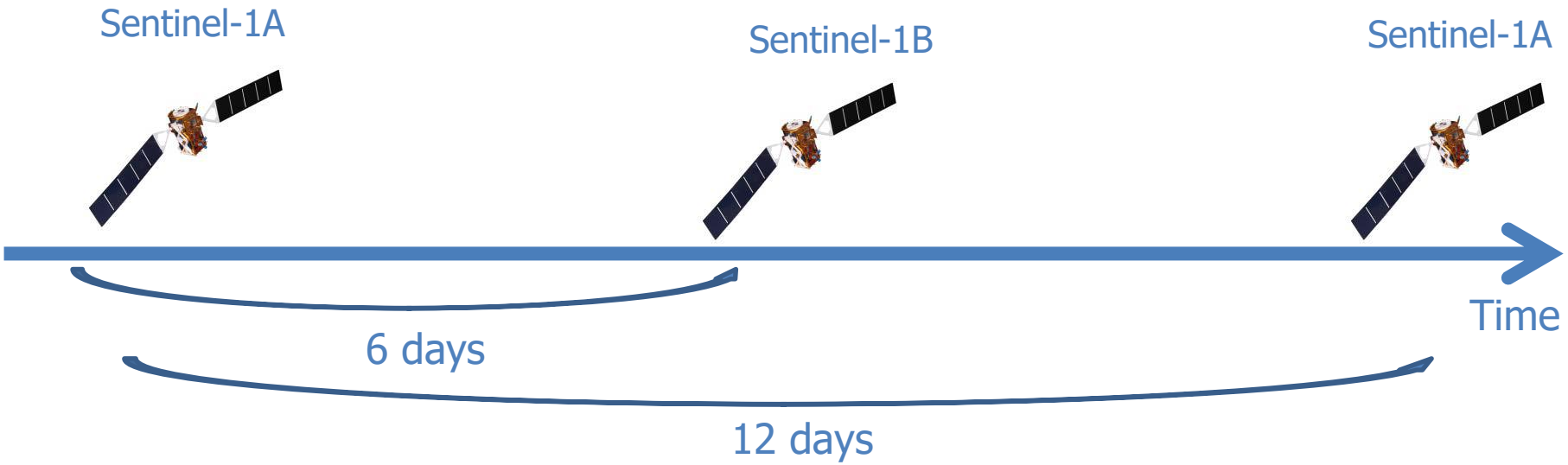
The first application of DInSAR technique are the earthquakes.

Massonnet, D. et al., 1993

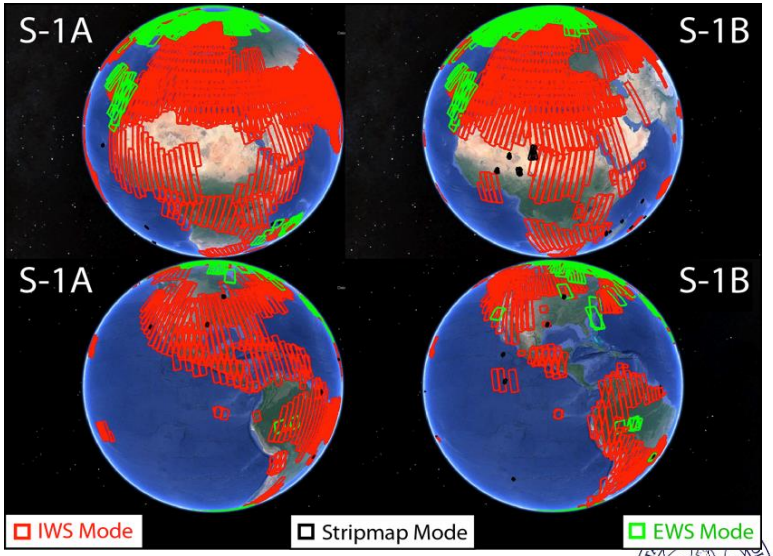
Studying Earthquakes with DInSAR: Historical overview



Sentinel-1 constellation

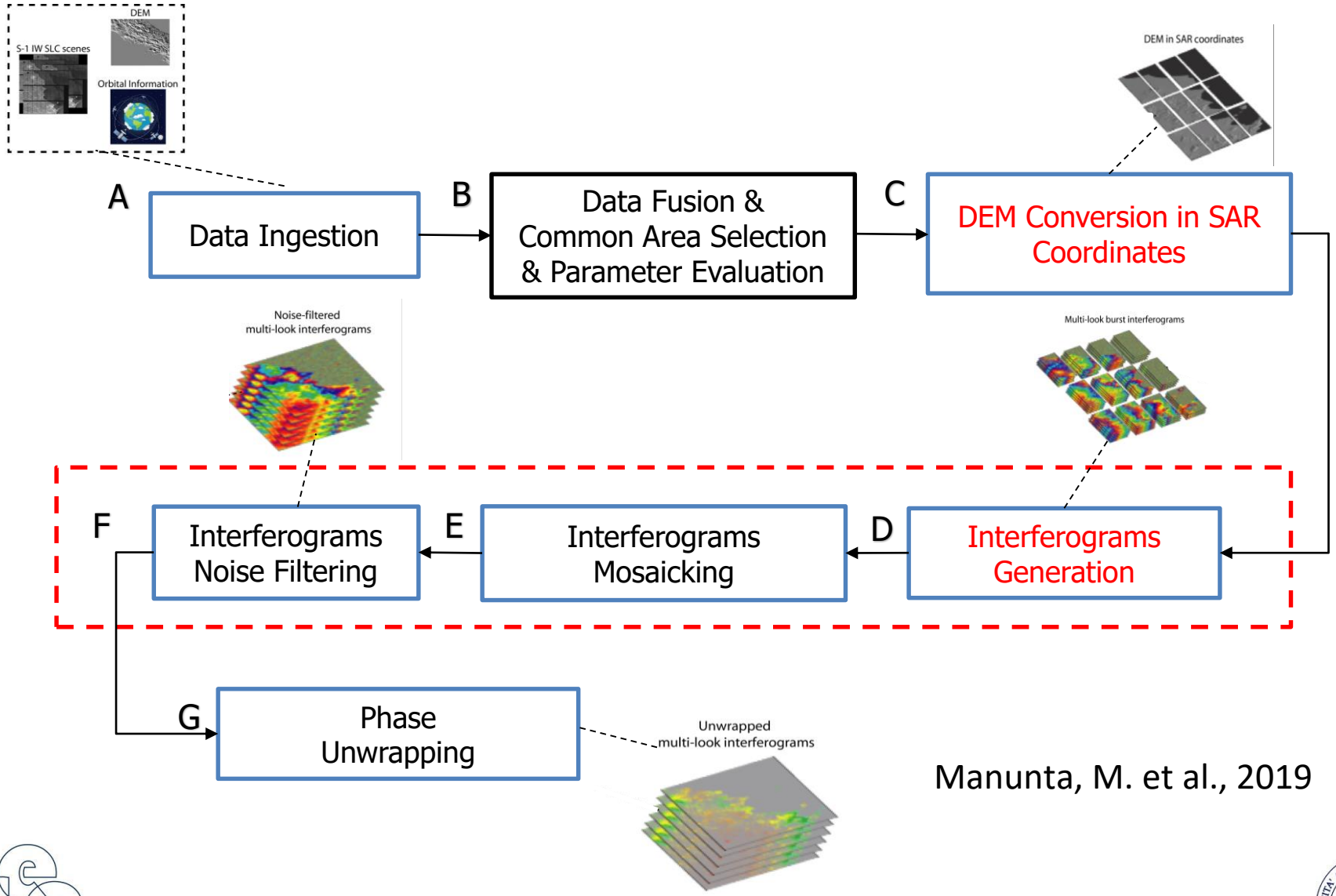


- Sensor spatial resolution:**15x4m**
- Spatial coverage:~**250x250km** (IW)
- **C-band**
- **Free and open data access**
- **Global coverage**
- **Designed DInSAR application**
- **High level operational Service**



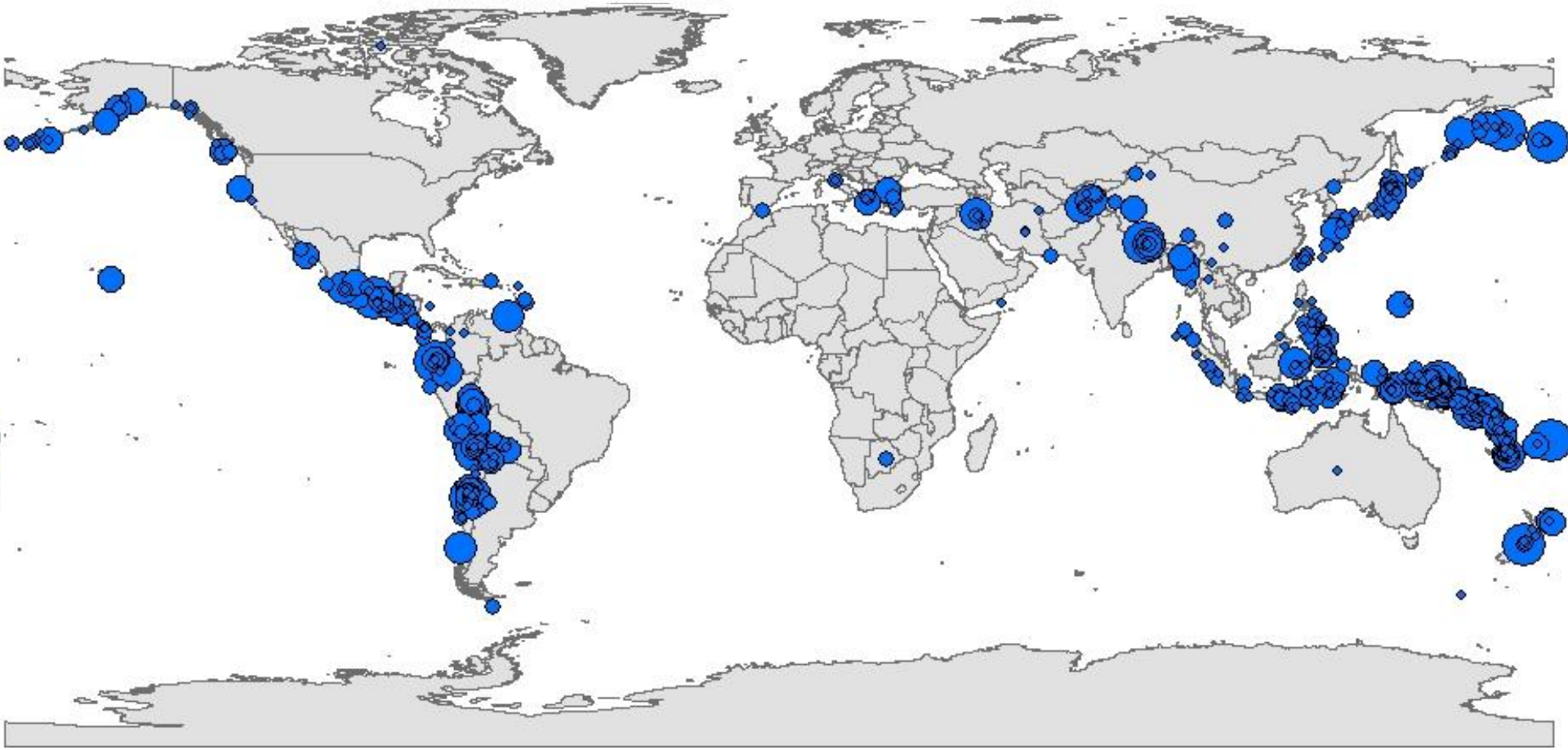
istituto per il rilevamento elettromagnetico dell'ambiente

Parallel Sentinel-1 DInSAR Workflow



Manunta, M. et al., 2019

Significant (> Mw 5.5) Earthquakes Global Map (2014 - 2019)



519 Earthquakes with Mw more than 5.5 occurred on land

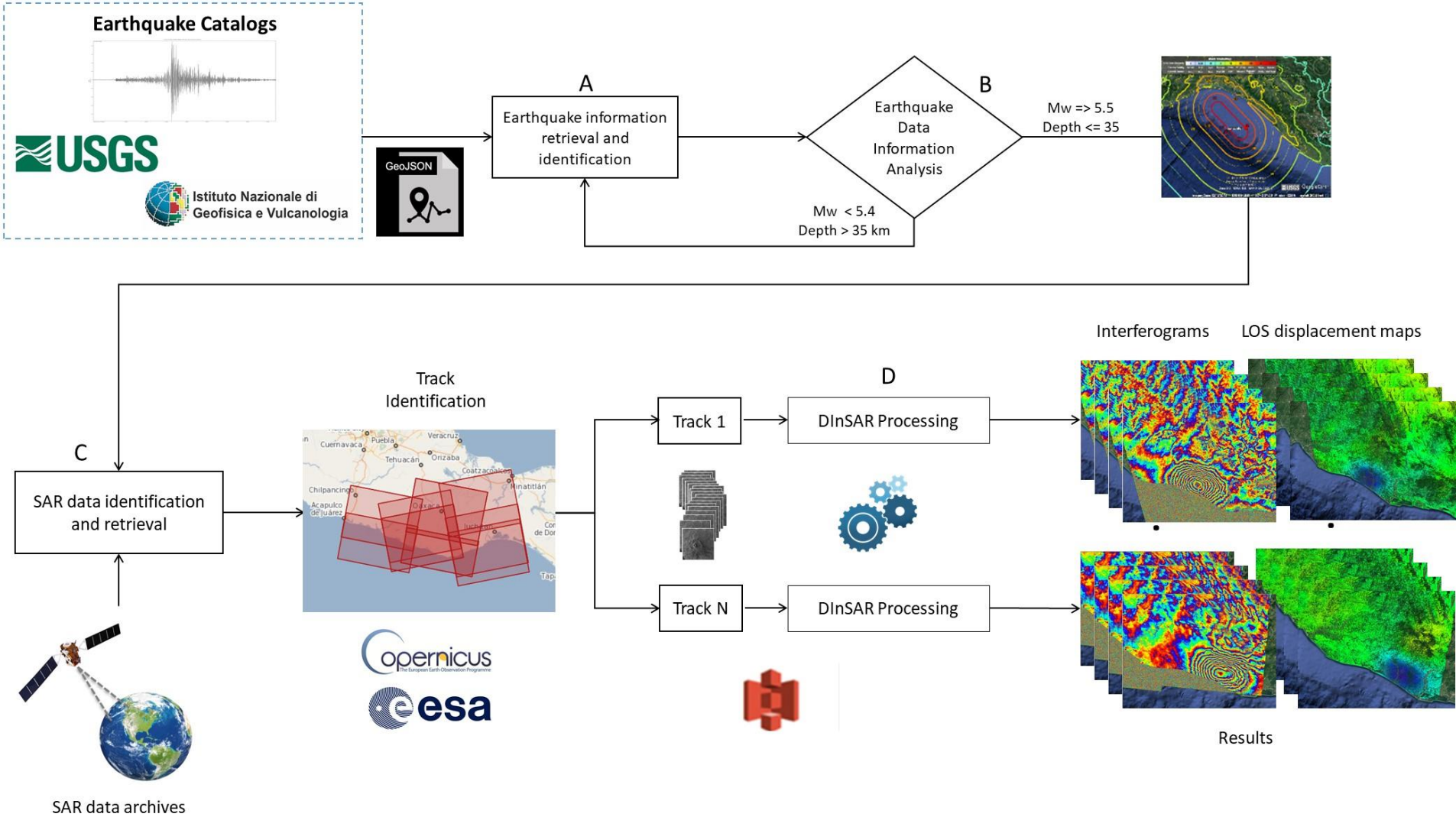
USGS science for a changing world

ISTITUTO NAZIONALE DI GEOFISICA E VULCANOLOGIA

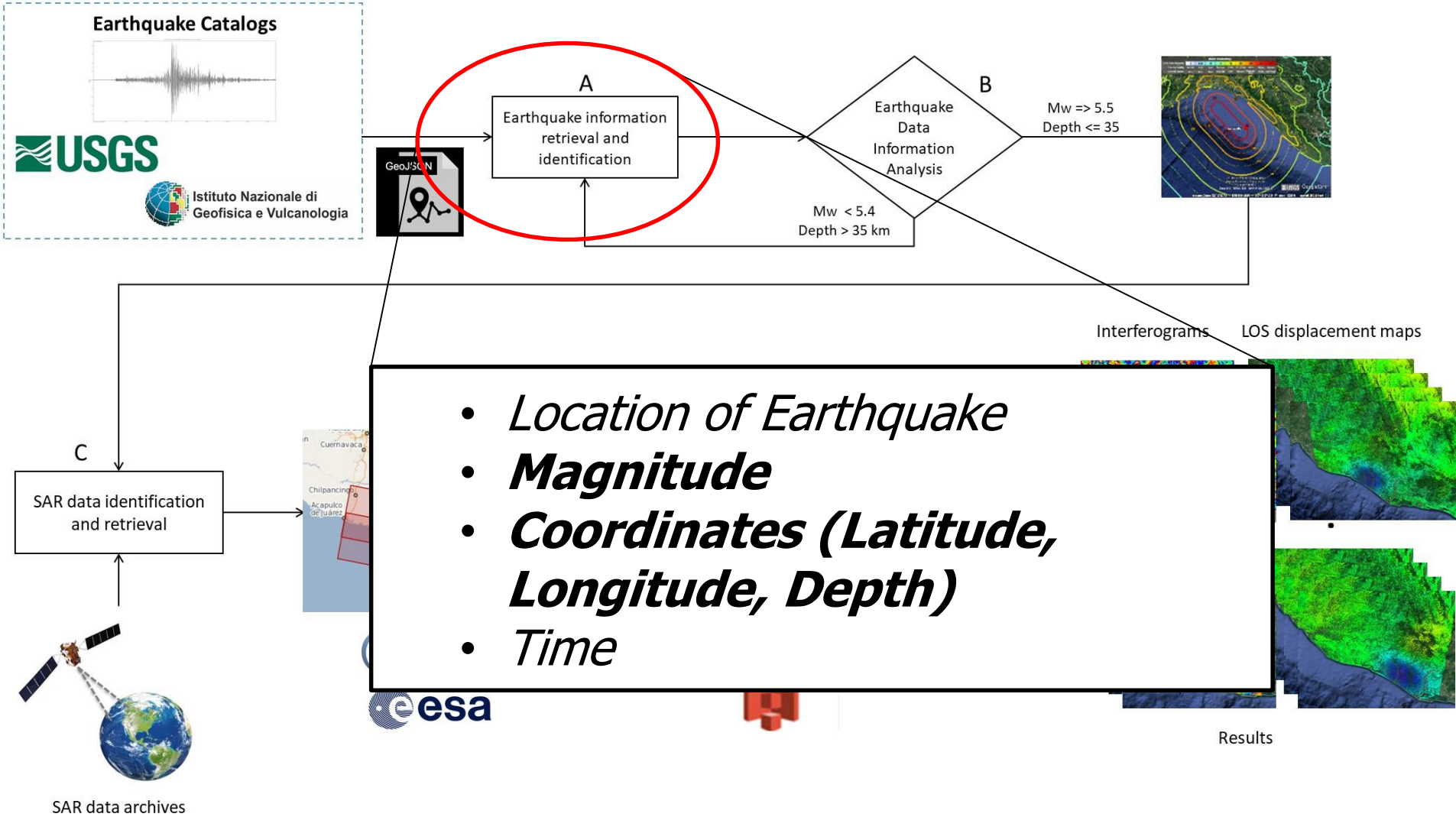
irea istituto per il rilevamento elettromagnetico dell'ambiente

UNIVERSITÀ DI NAPOLI PARTHENOPE

Automatic generation of co-seismic displacement maps workflow



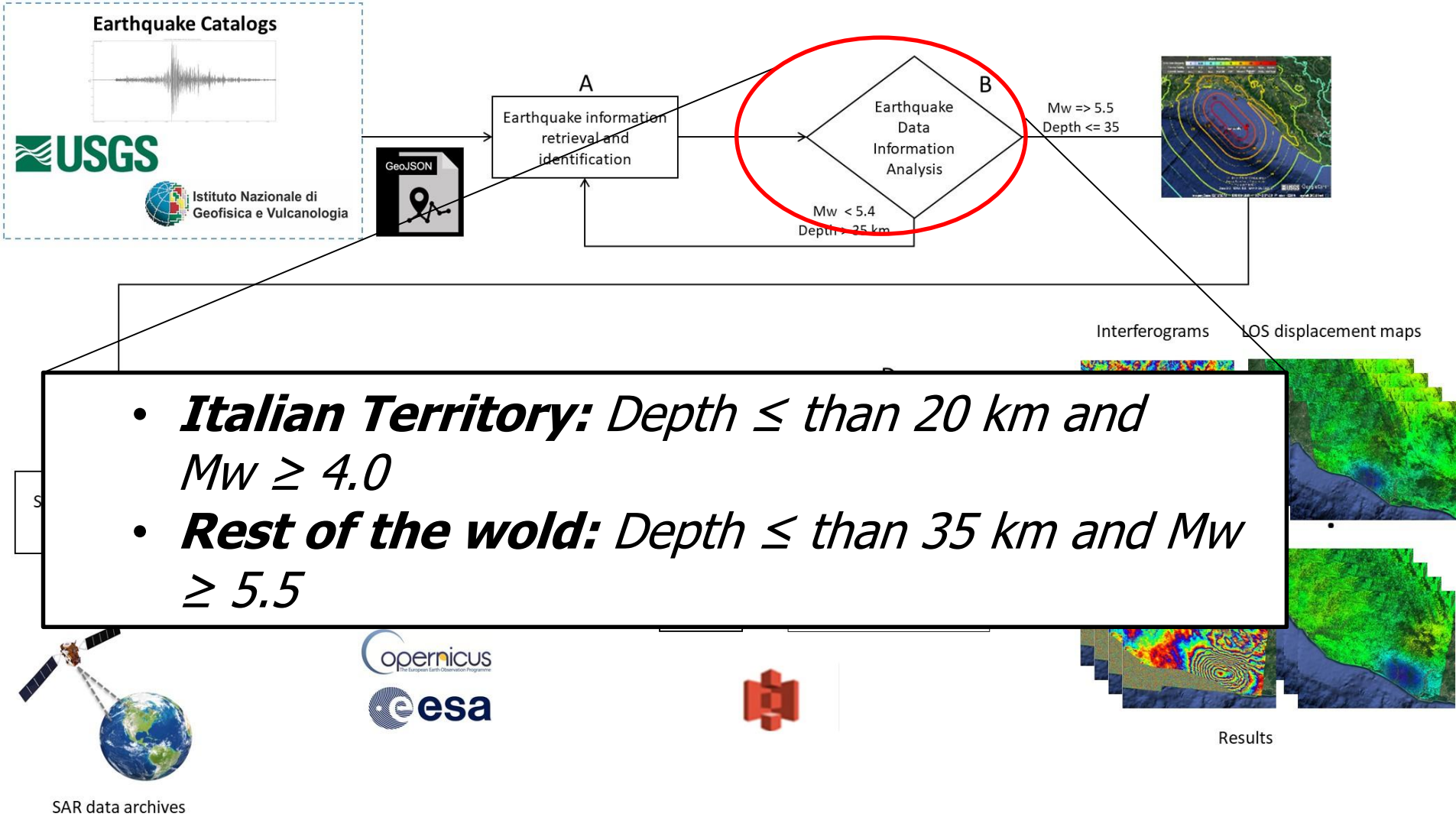
Automatic generation of co-seismic displacement maps workflow



- *Location of Earthquake*
- ***Magnitude***
- ***Coordinates (Latitude, Longitude, Depth)***
- *Time*

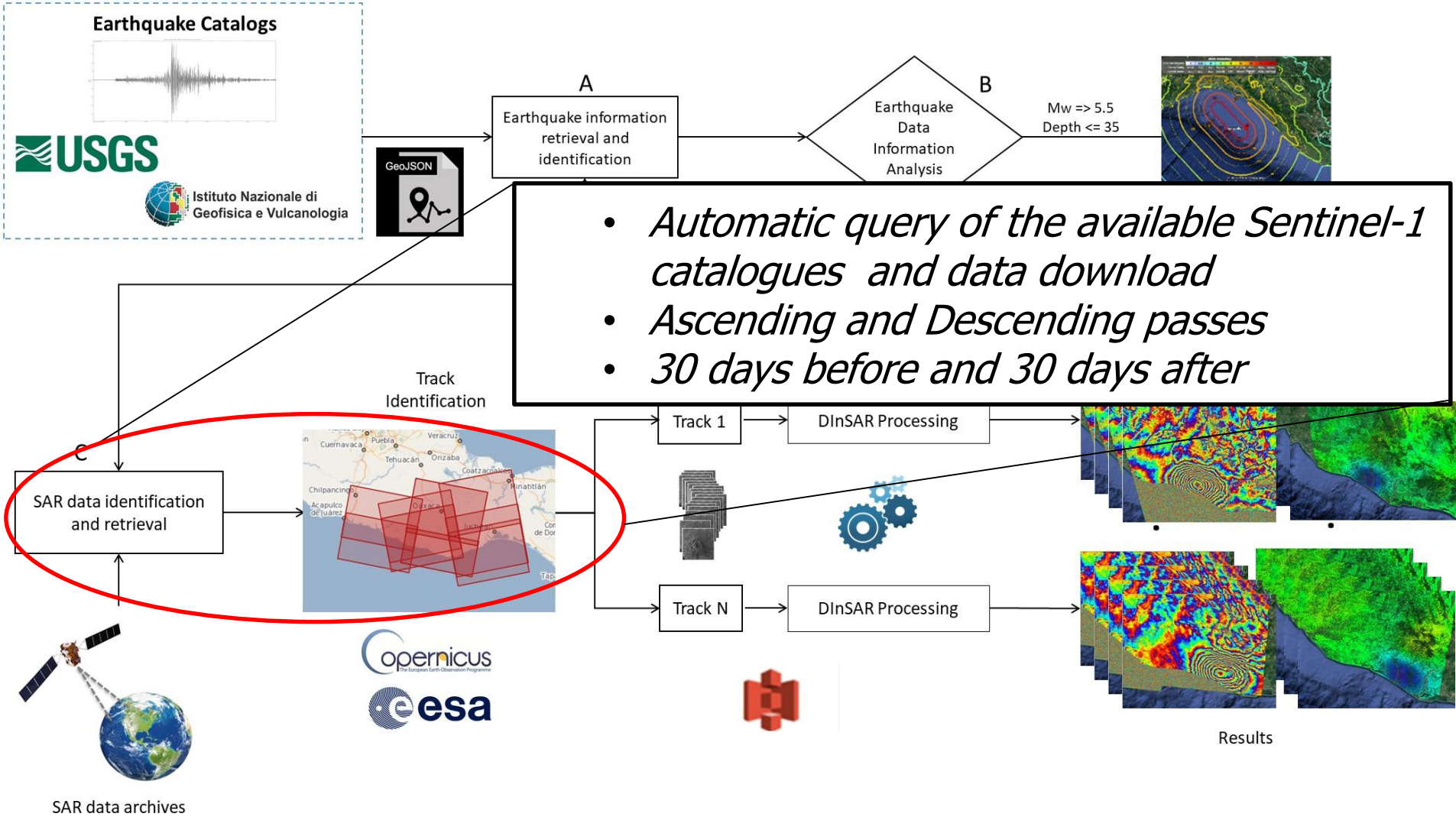
istituto per il rilevamento elettromagnetico dell'ambiente

Automatic generation of co-seismic displacement maps workflow



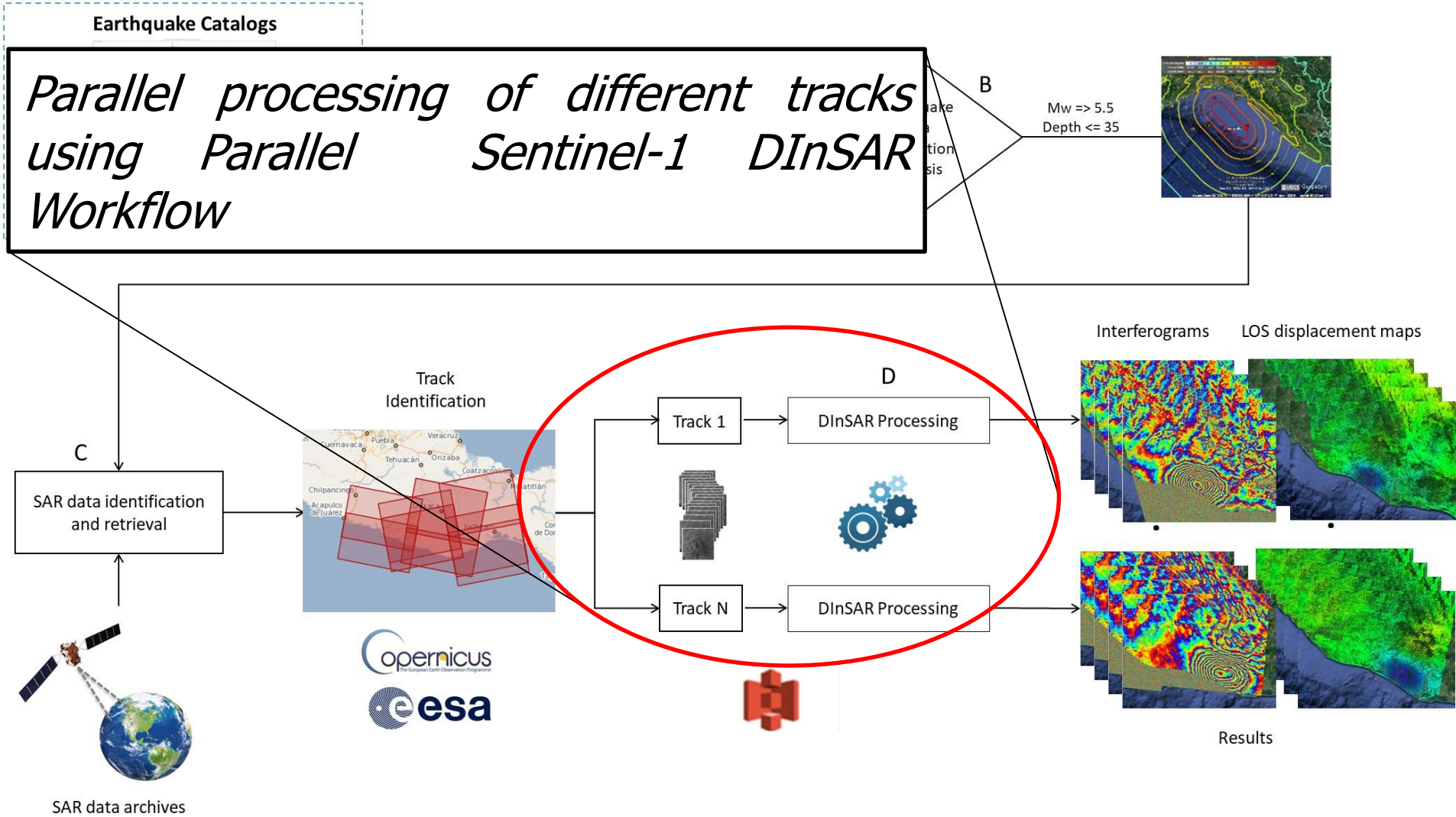
- ***Italian Territory:*** *Depth ≤ than 20 km and Mw ≥ 4.0*
- ***Rest of the wold:*** *Depth ≤ than 35 km and Mw ≥ 5.5*

Automatic generation of co-seismic displacement maps workflow



- *Automatic query of the available Sentinel-1 catalogues and data download*
- *Ascending and Descending passes*
- *30 days before and 30 days after*

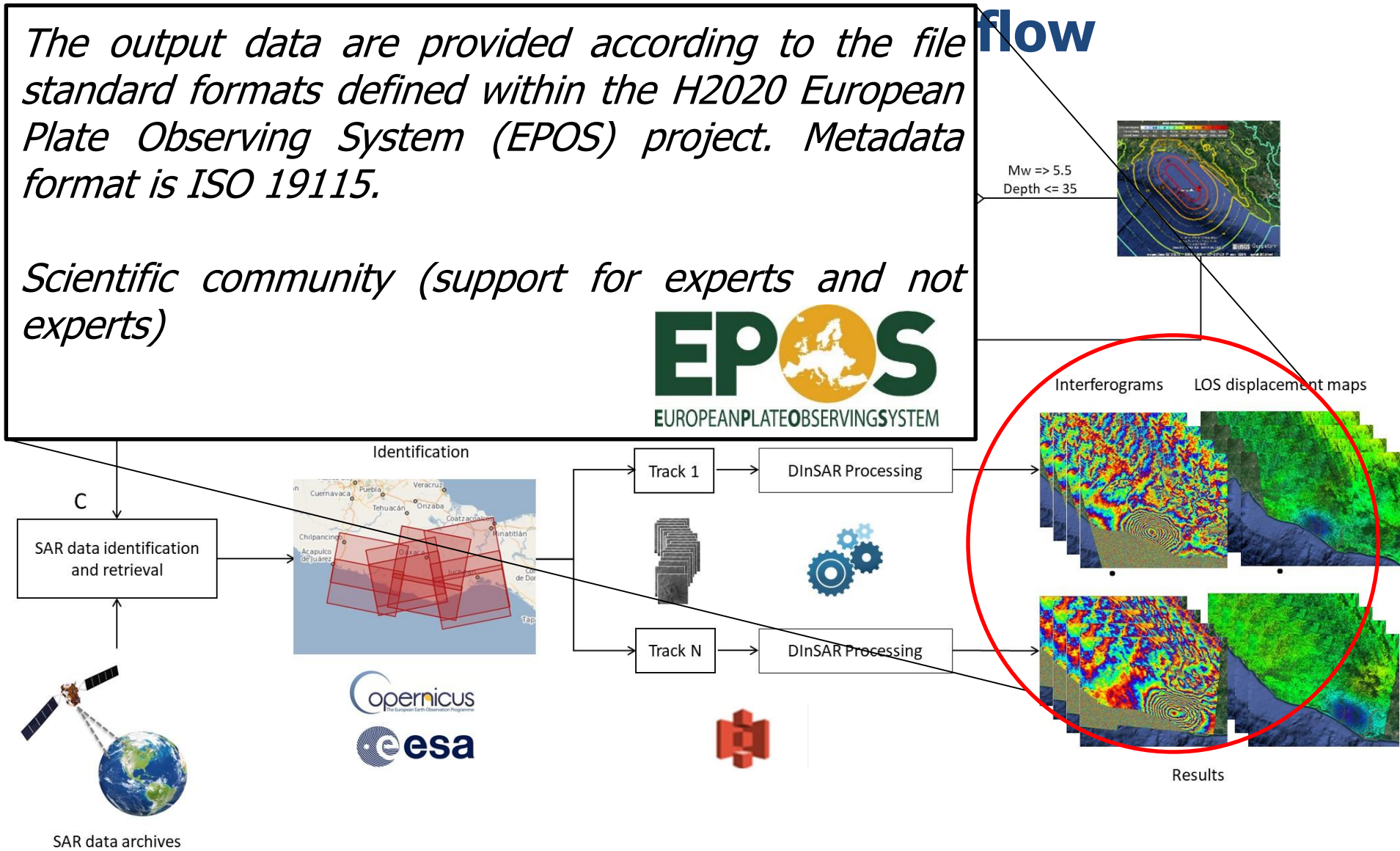
Automatic generation of co-seismic displacement maps workflow



Automatic generation of co-seismic flow

The output data are provided according to the file standard formats defined within the H2020 European Plate Observing System (EPOS) project. Metadata format is ISO 19115.

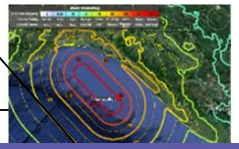
Scientific community (support for experts and not experts)

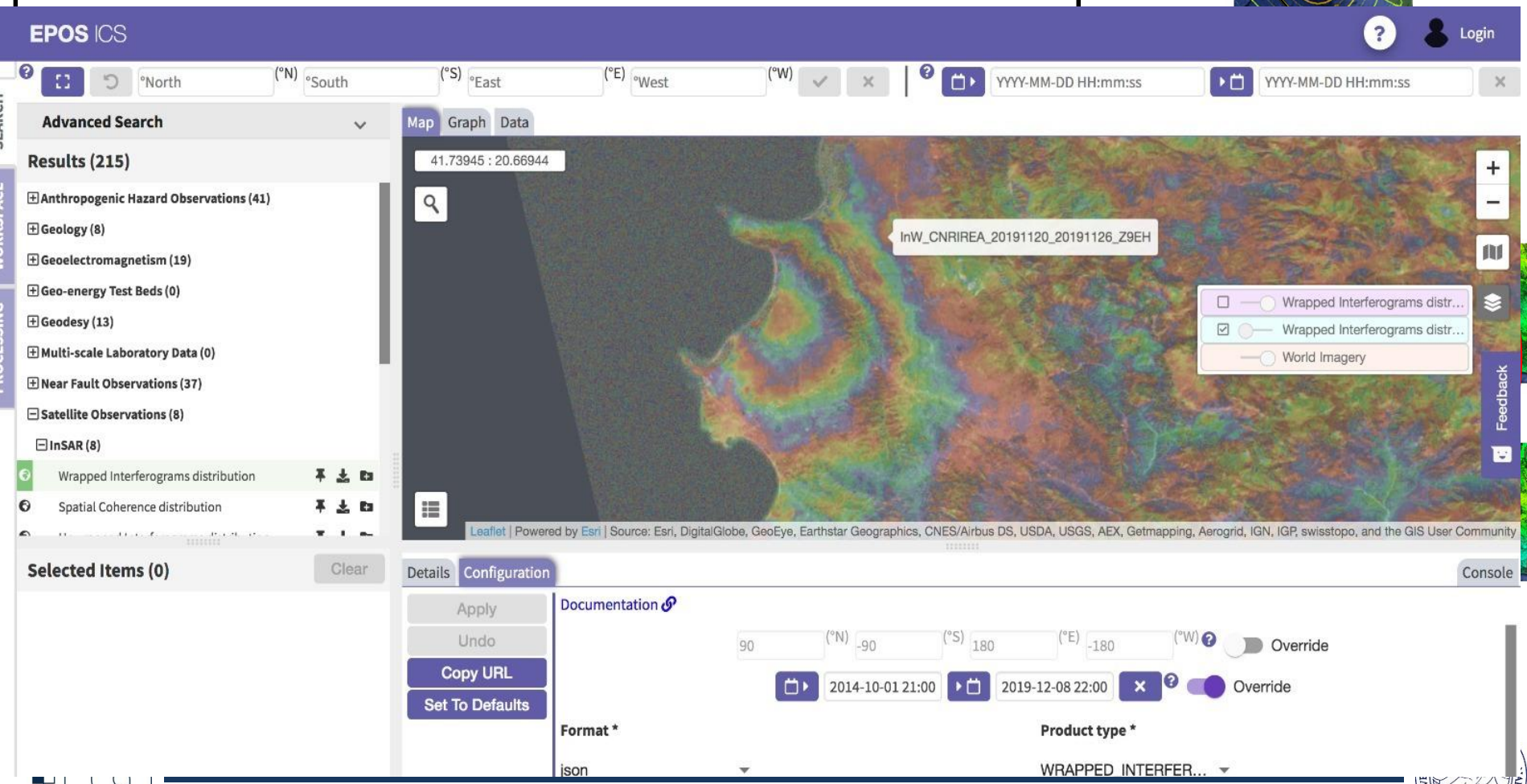


Automatic generation of co-seismic flow

The output data are provided according to the file standard formats defined within the H2020 European Plate Observing System (EPOS) project. Metadata format is ISO 19115.

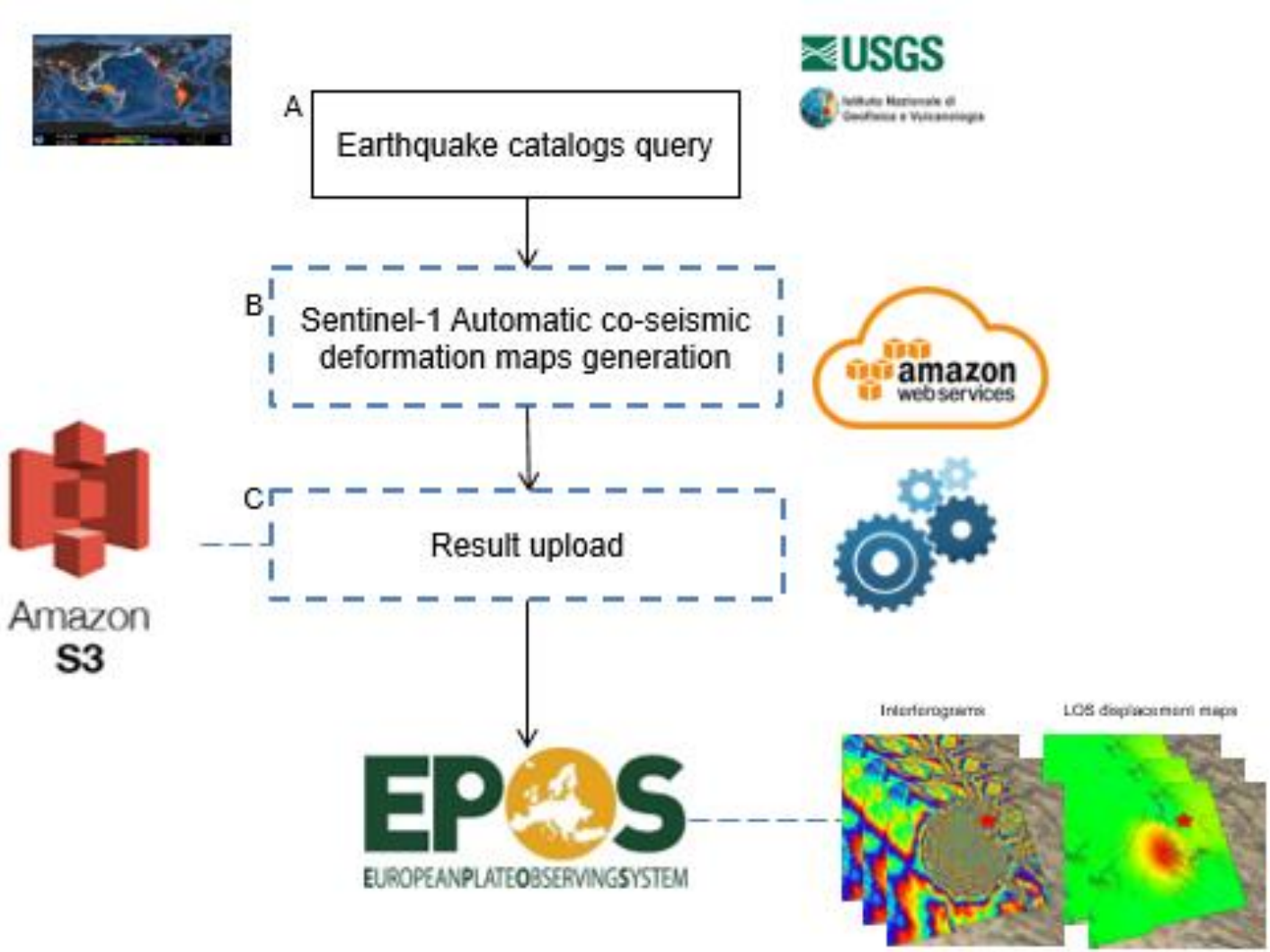
Mw => 5.5
Depth <= 35





istituto per il rilevamento elettromagnetico dell'ambiente

Automatic tool implementation

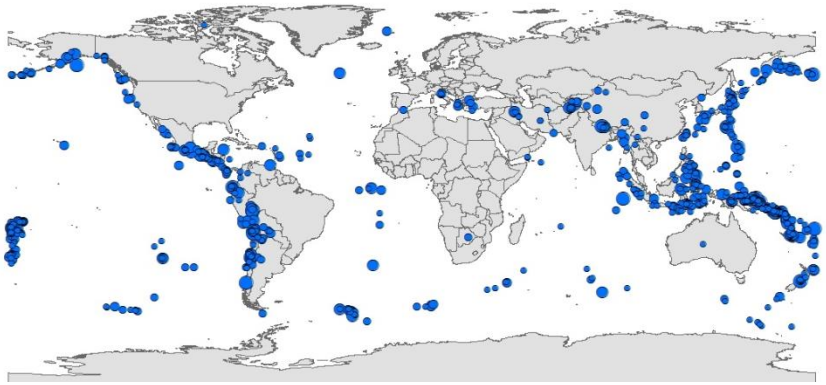


Automatic tool implementation

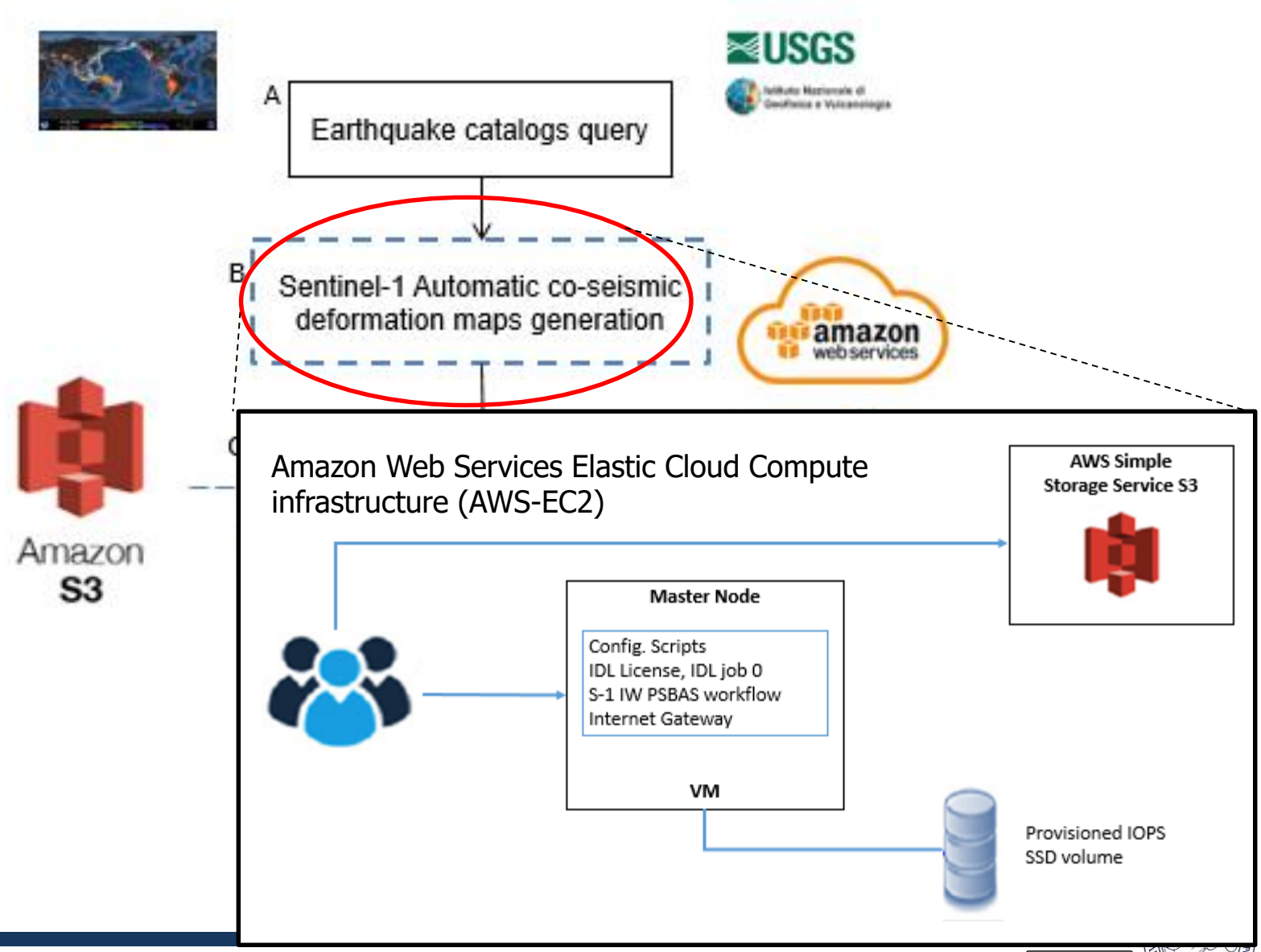
A Earthquake catalogs query

B Sentinel-1 Automatic co-seismic deformation maps generation

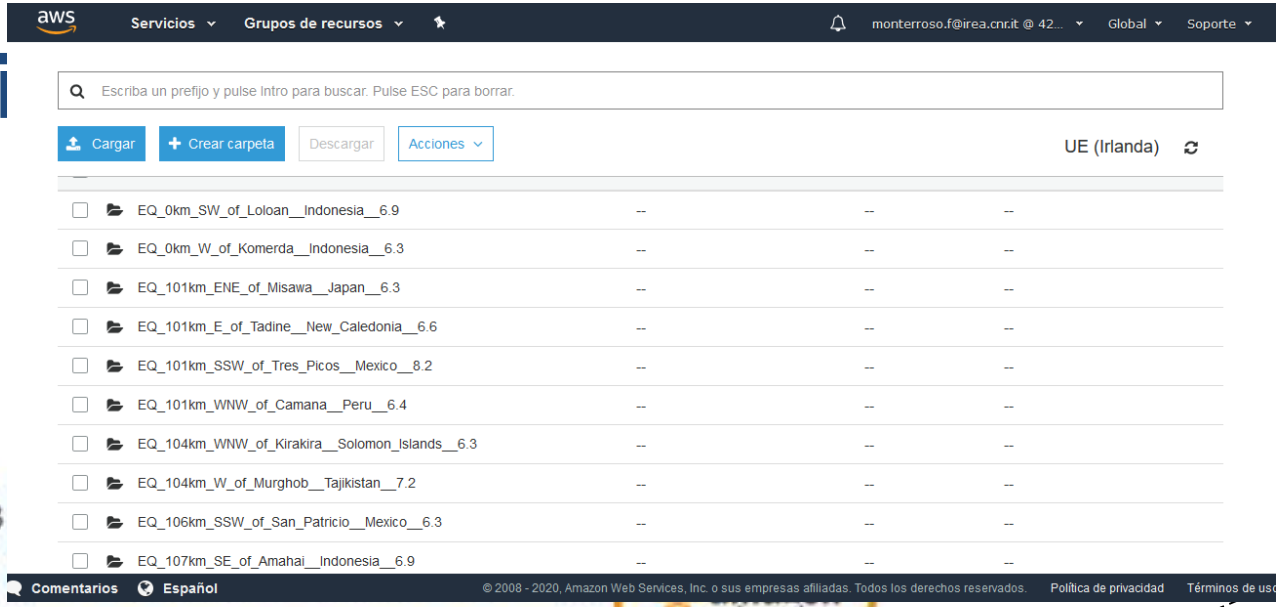
Earthquakes catalog records from January 2015.

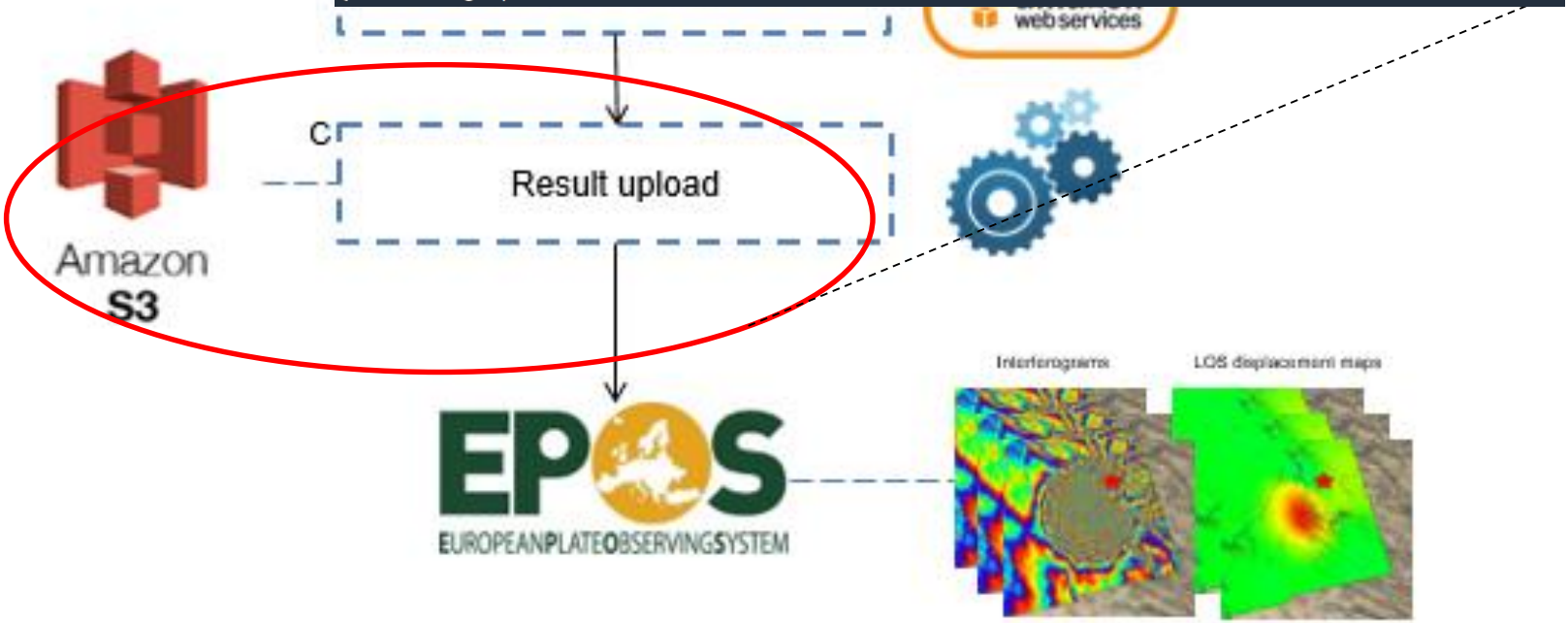


Automatic tool implementation

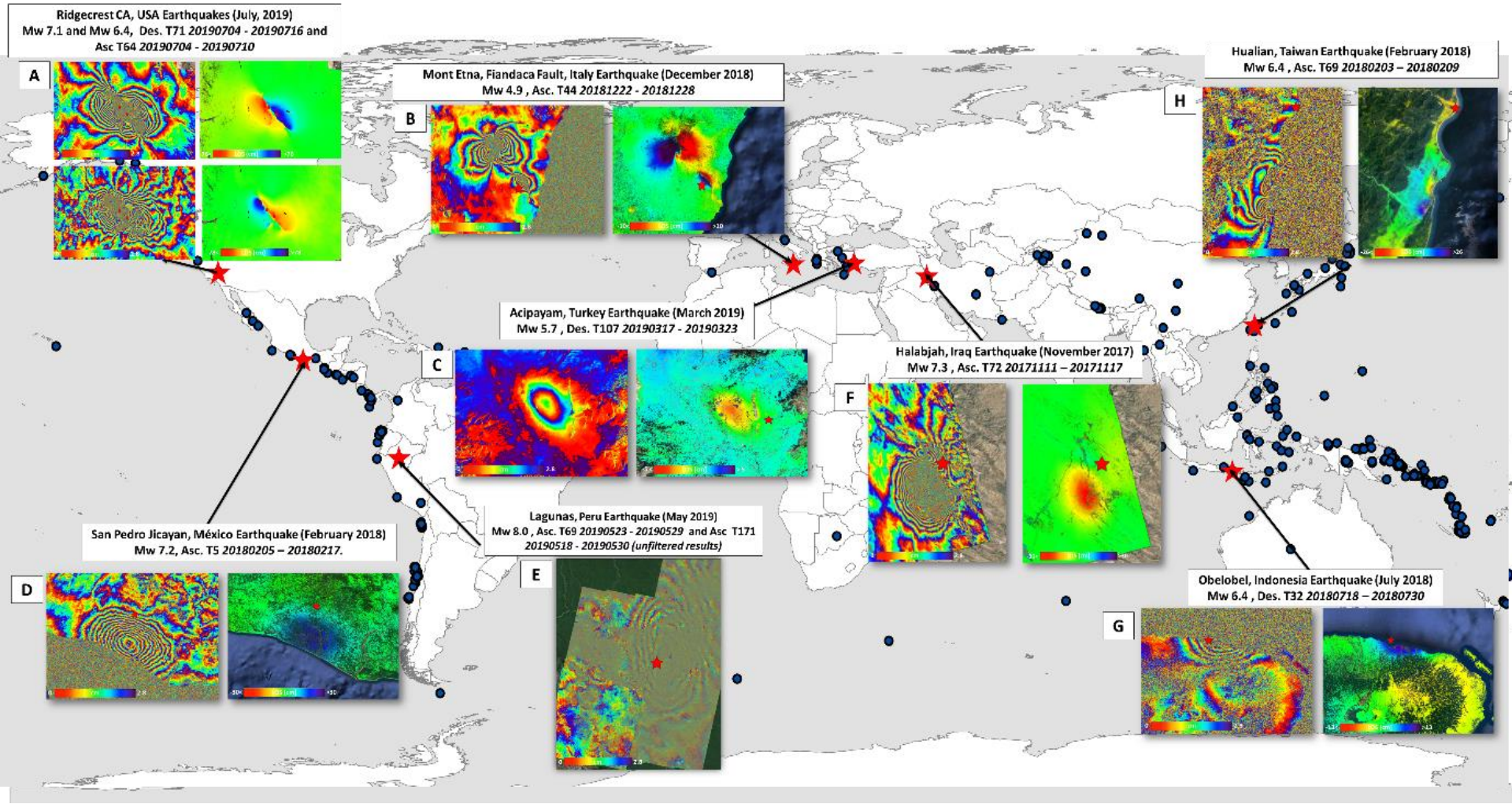


Automati


aws
Servicios
Grupos de recursos
monterroso.f@irea.cnr.it @ 42...
Global
Soporte
Escriba un prefijo y pulse Intro para buscar. Pulse ESC para borrar.
Cargar
Crear carpeta
Descargar
Acciones
UE (Irlanda)
EQ_0km_SW_of_Loloan__Indonesia__6.9
EQ_0km_W_of_Komerda__Indonesia__6.3
EQ_101km_ENE_of_Misawa__Japan__6.3
EQ_101km_E_of_Tadine__New_Caledonia__6.6
EQ_101km_SSW_of_Tres_Picos__Mexico__8.2
EQ_101km_WNW_of_Camana__Peru__6.4
EQ_104km_WNW_of_Kirakira__Solomon_Islands__6.3
EQ_104km_W_of_Murghob__Tajikistan__7.2
EQ_106km_SSW_of_San_Patricio__Mexico__6.3
EQ_107km_SE_of_Amahai__Indonesia__6.9
Comentarios
Español
© 2008 - 2020, Amazon Web Services, Inc. o sus empresas afiliadas. Todos los derechos reservados.
Política de privacidad
Términos de uso

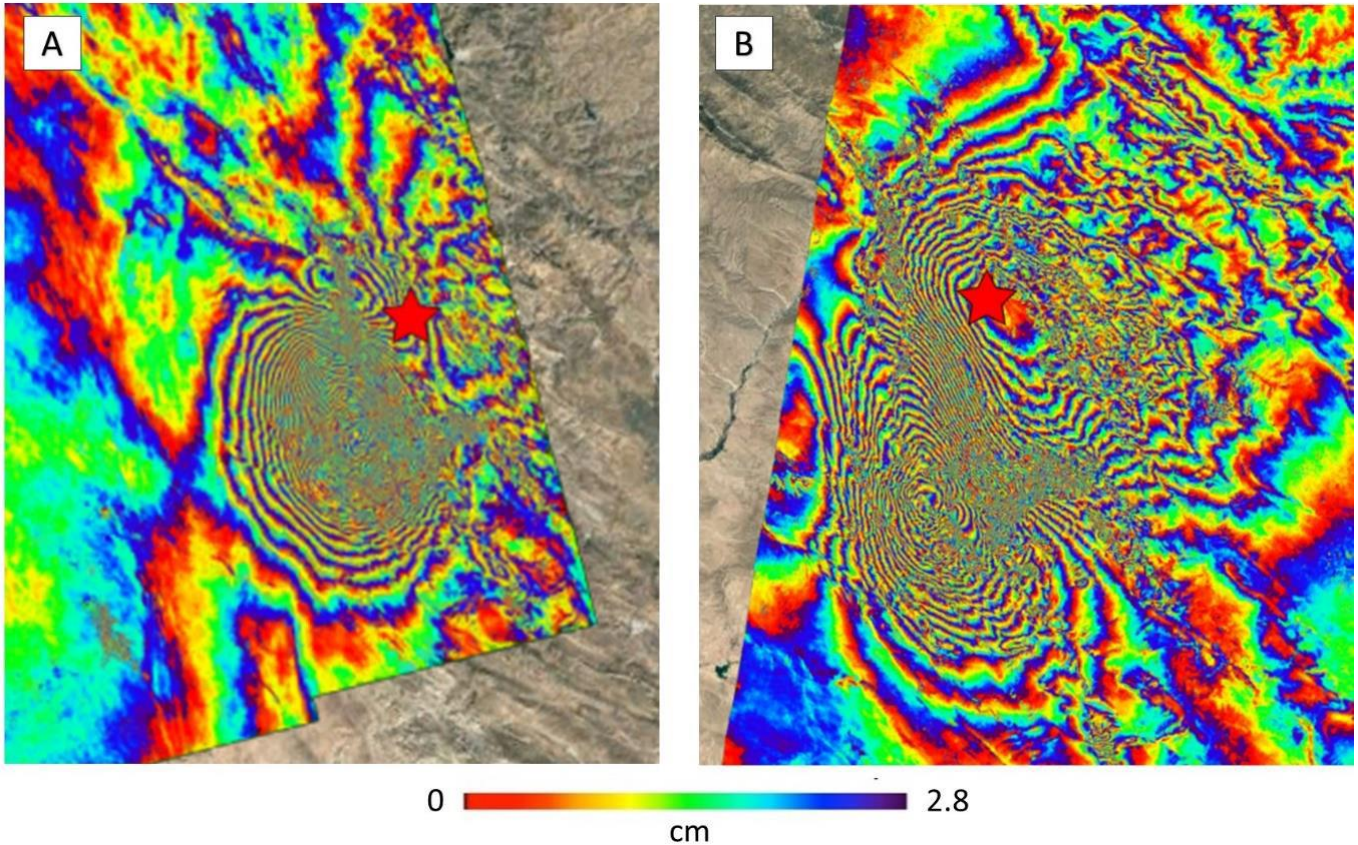

B
web services
C
Result upload
Amazon
S3
EPOS
EUROPEANPLATEOBSERVINGSYSTEM
Interferograms
LOS displacement maps

Experimental Results



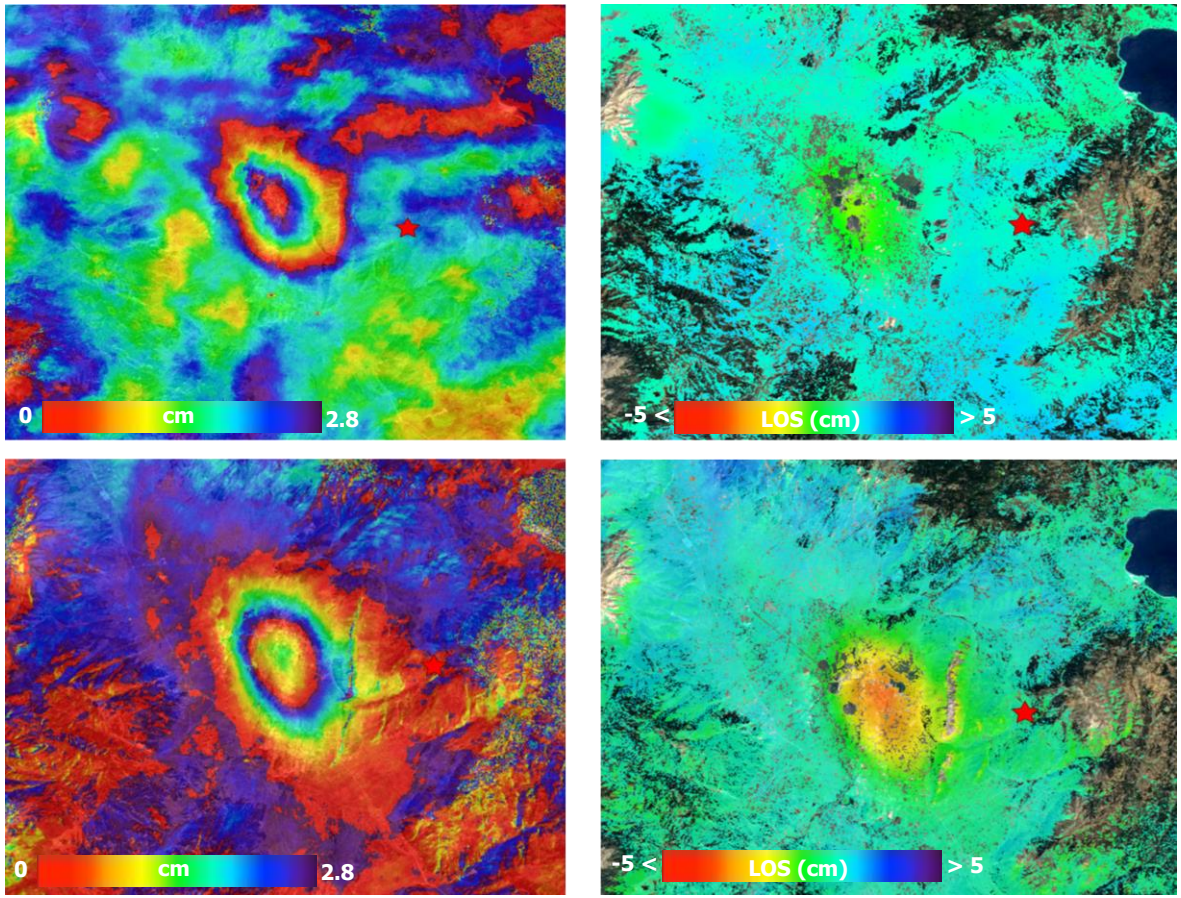
Significant seismic events with large deformation

Co-seismic interferograms spanning the Mw. 7.3 for Halabjah earthquake in Iran seismic event, occurred on 2017-11-12 (A) Ascending Track 72 acquired on 20171111 and 20171117. (B) Descending Track 6 20171107 and 20171119.



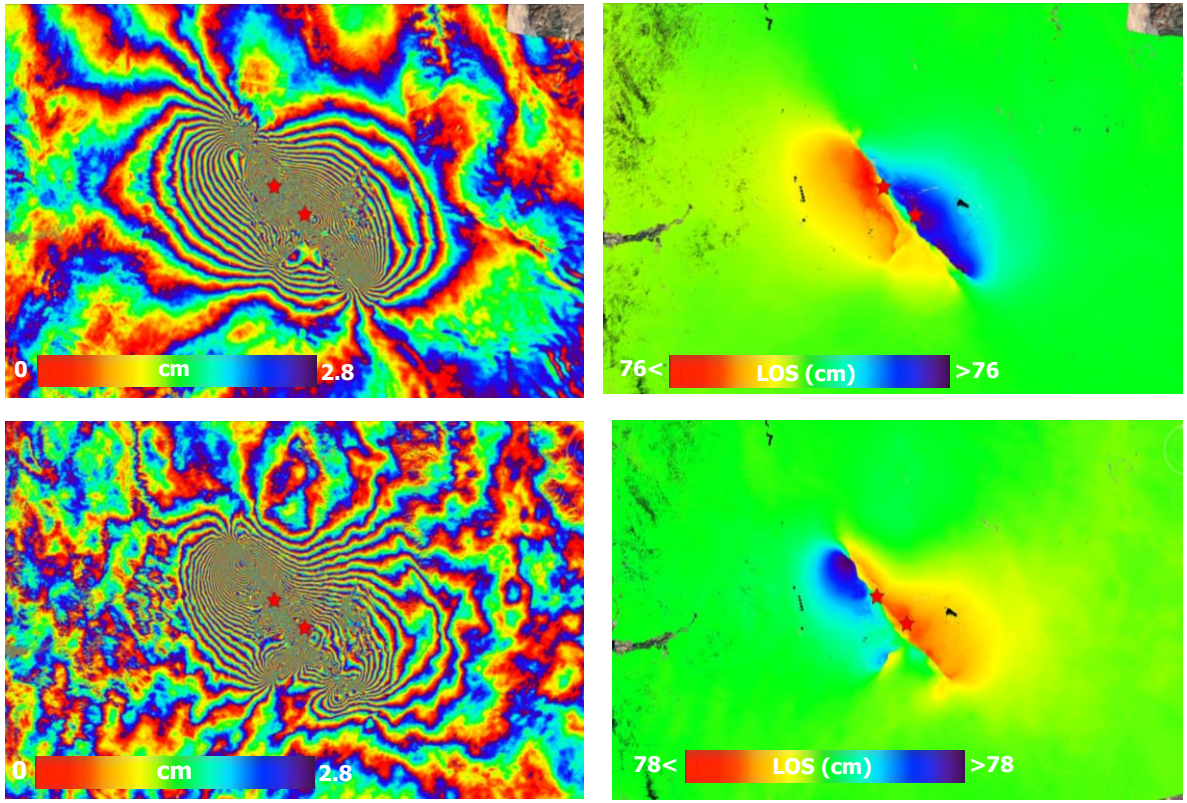
Earthquakes of small magnitude

The co seismic interferogram and LOS displacement maps for The Mw 5.7 16 km E of Acipayam, Turkey seismic event, occurred on 2019-03-20. Track 58 20190317 – 20190323 and Track 138 20190317-20190323



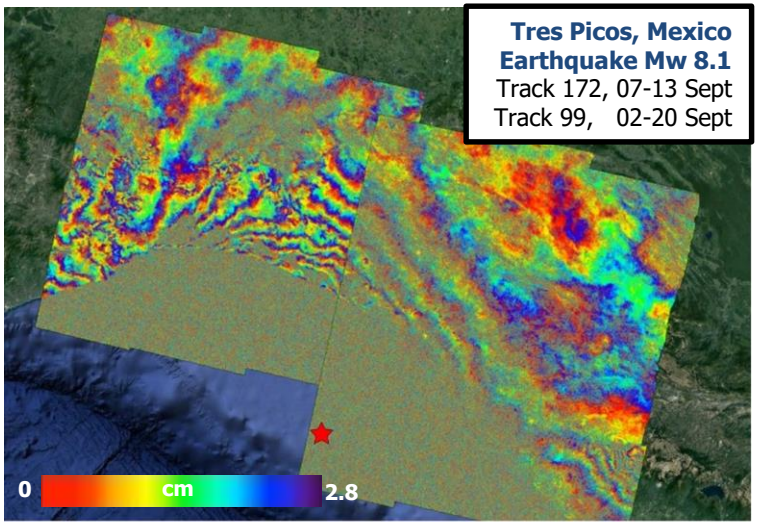
Processing optimization: Several earthquakes in the same time interval

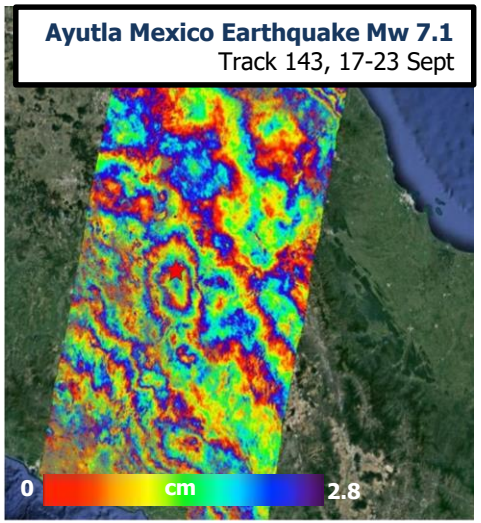
Ridgecrest CA, USA Earthquakes (July, 2019)
Mw 7.1 and Mw 6.4, Des. T71 20190704 - 20190716 and
Asc T64 20190704 - 20190710

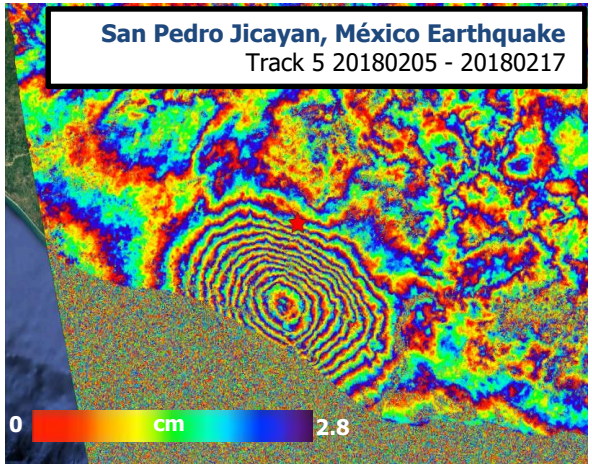


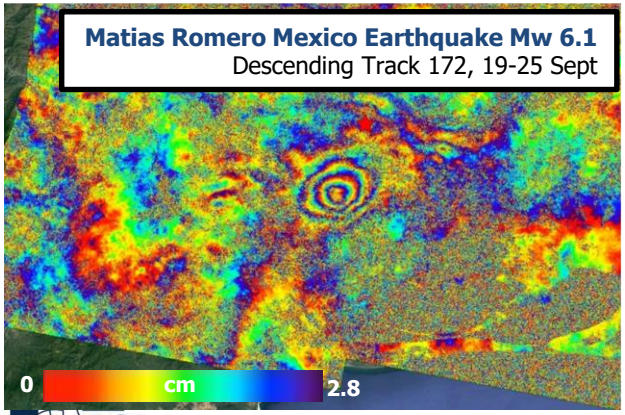
Processing optimization: Earthquakes that occurred in the same area but in different periods

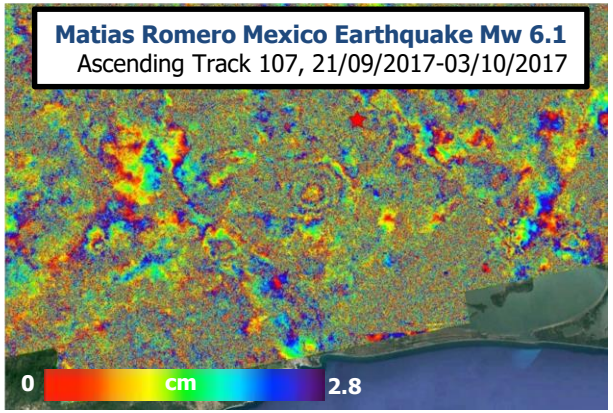
Seismic crisis in Mexico (September 2017 – February 2018)

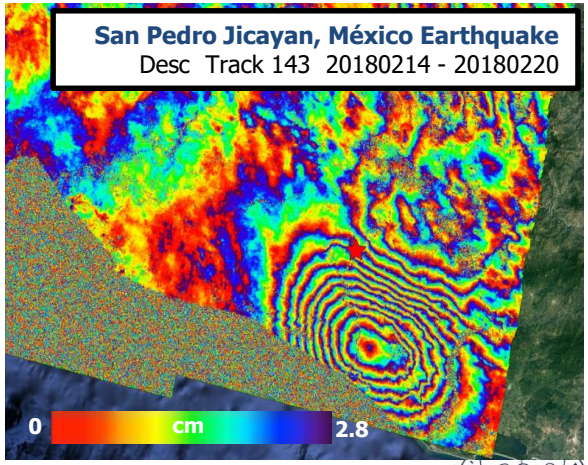






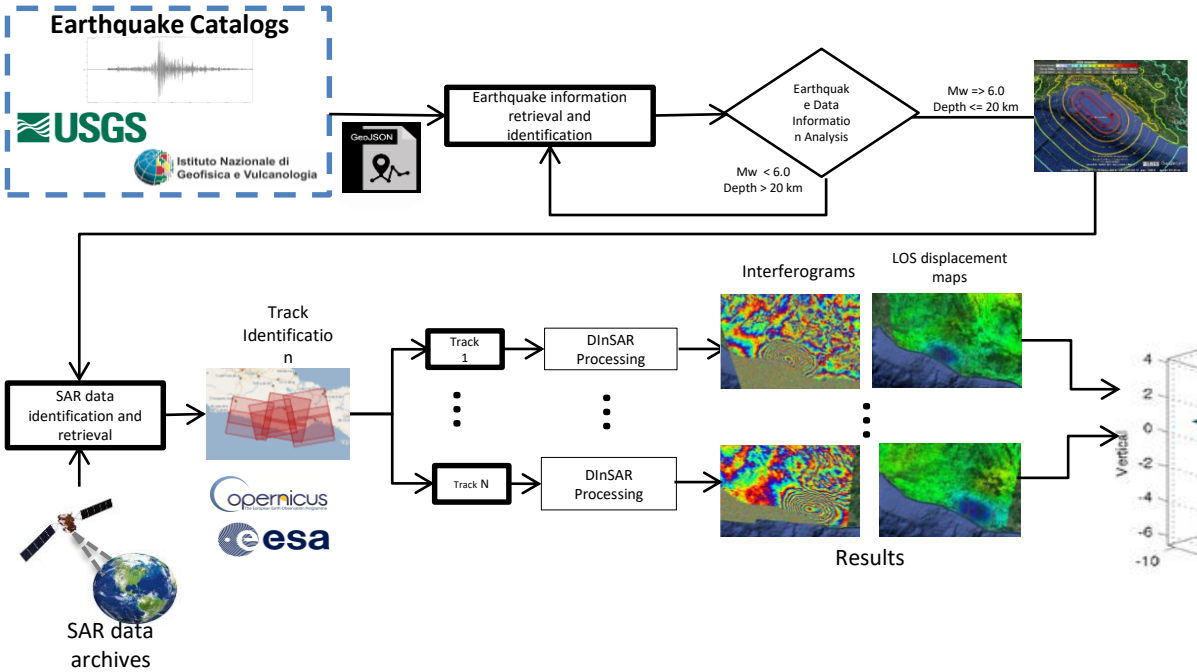


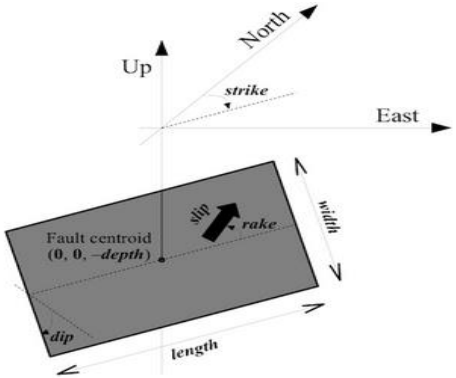


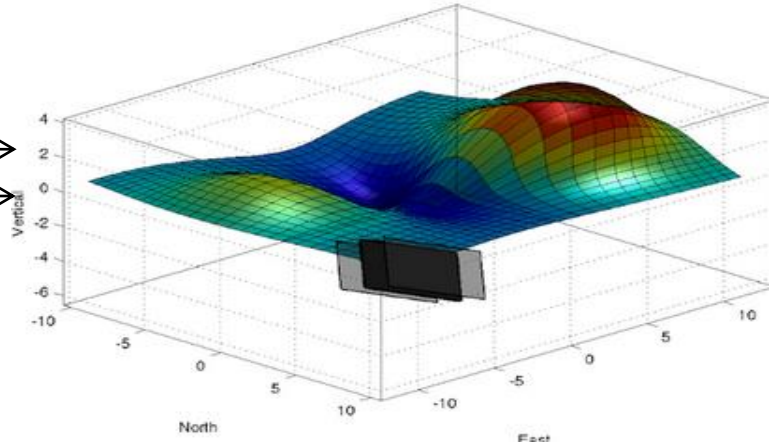


Further Developments

Earthquake Automatic Analytical Modeling







Okada Model

Analytical solution for surface deformation due to shear and/or tensile dislocations faults in an elastic and homogeneous half-space.

Further Developments

- Big data co-seismic interferograms and displacement maps generated on automatic way.

- Statistical analysis of the coherent deformation signal in co-sismic interferograms, product of the relationship between the Magnitude and Depth.