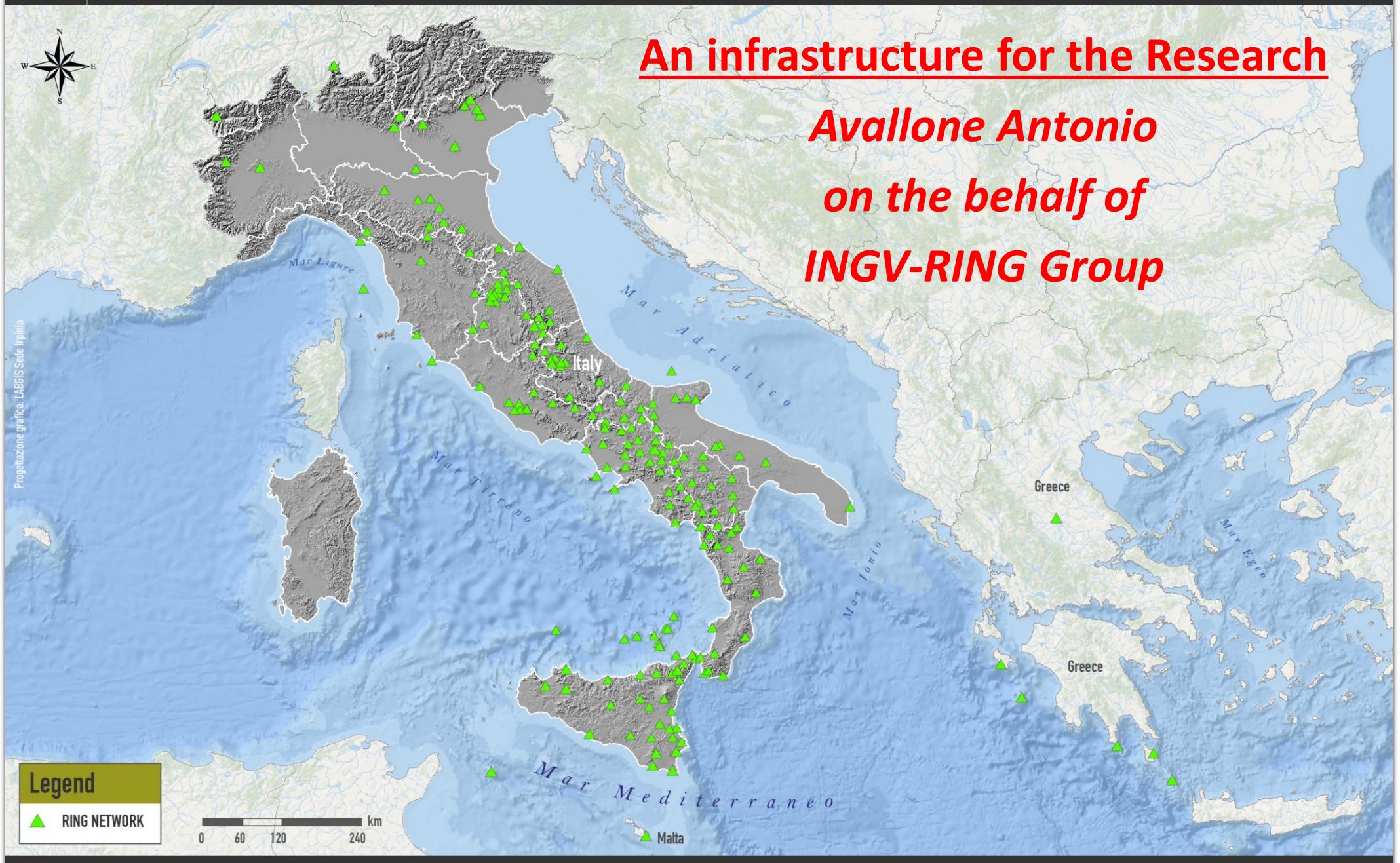
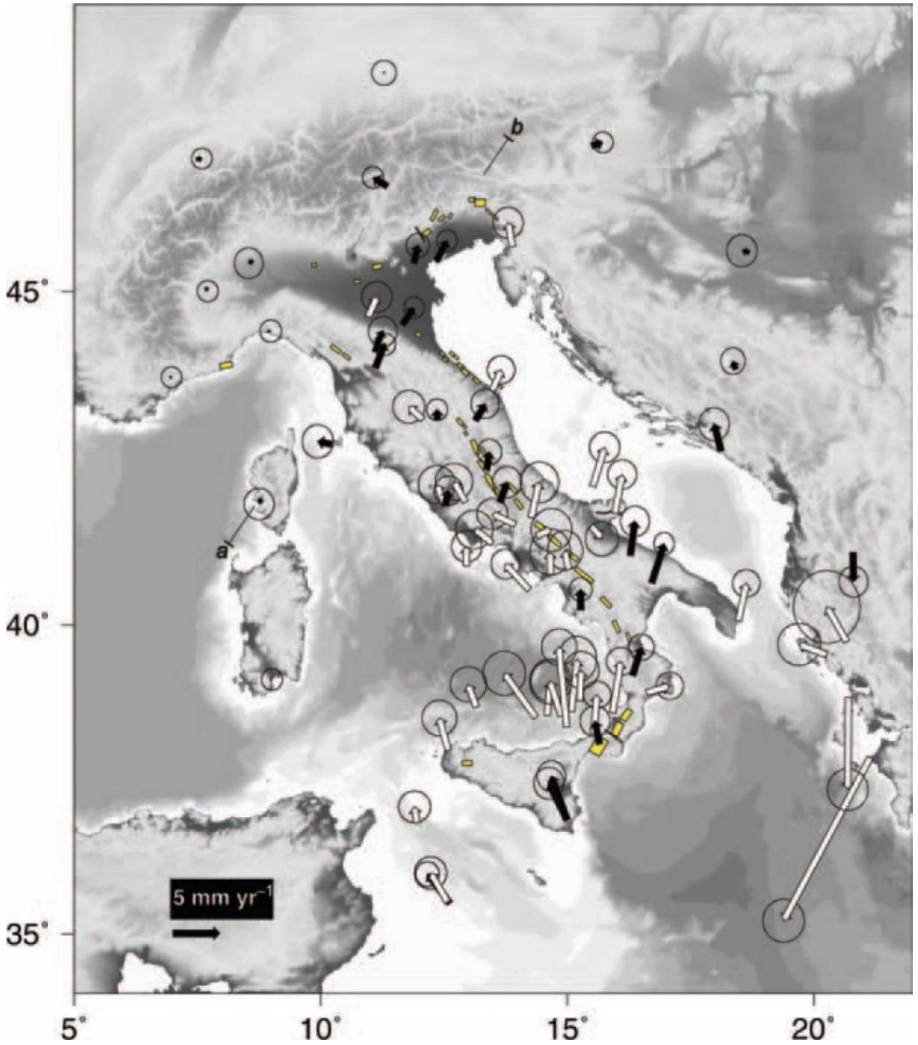
RETE INTEGRATA NAZIONALE GPS (RING)

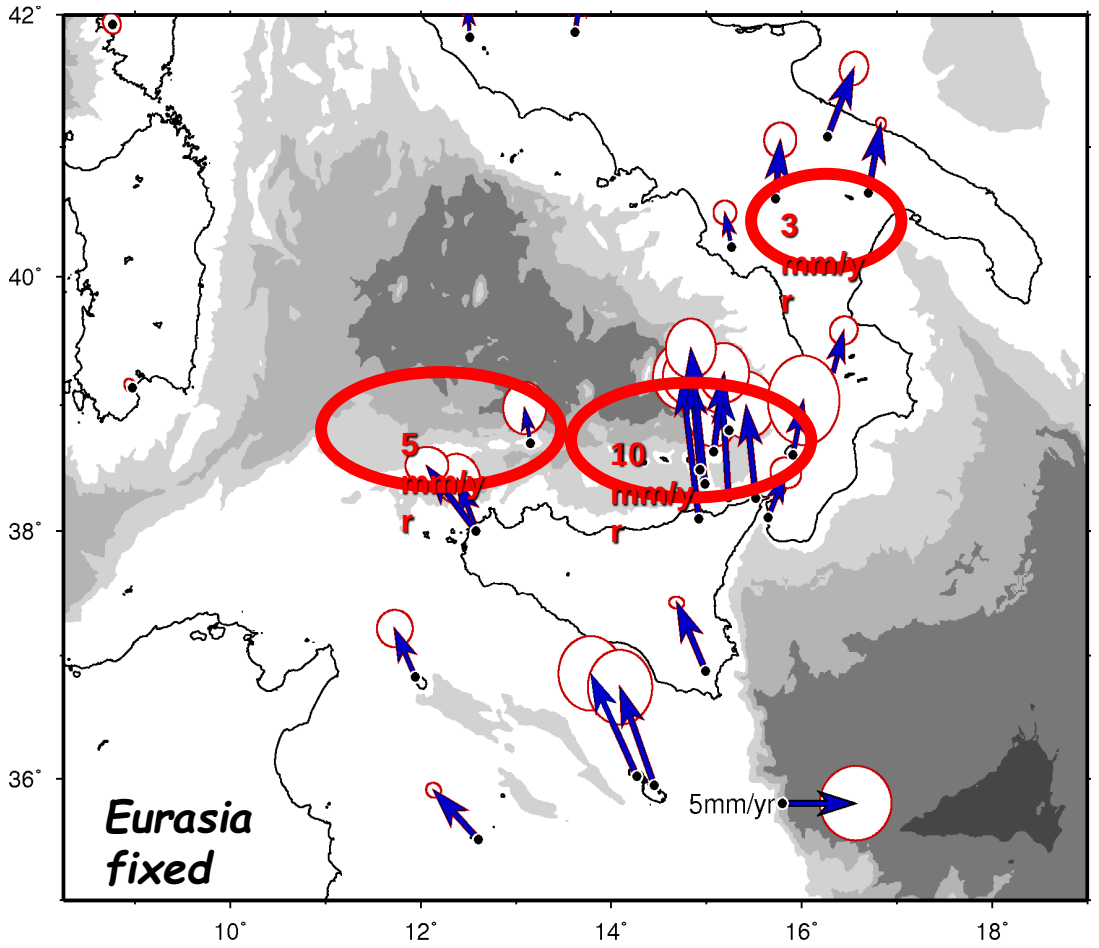


Pre-2004: knowledge from discrete & (a few) continuous GPS measurements

(Serpelloni et al., 2005)



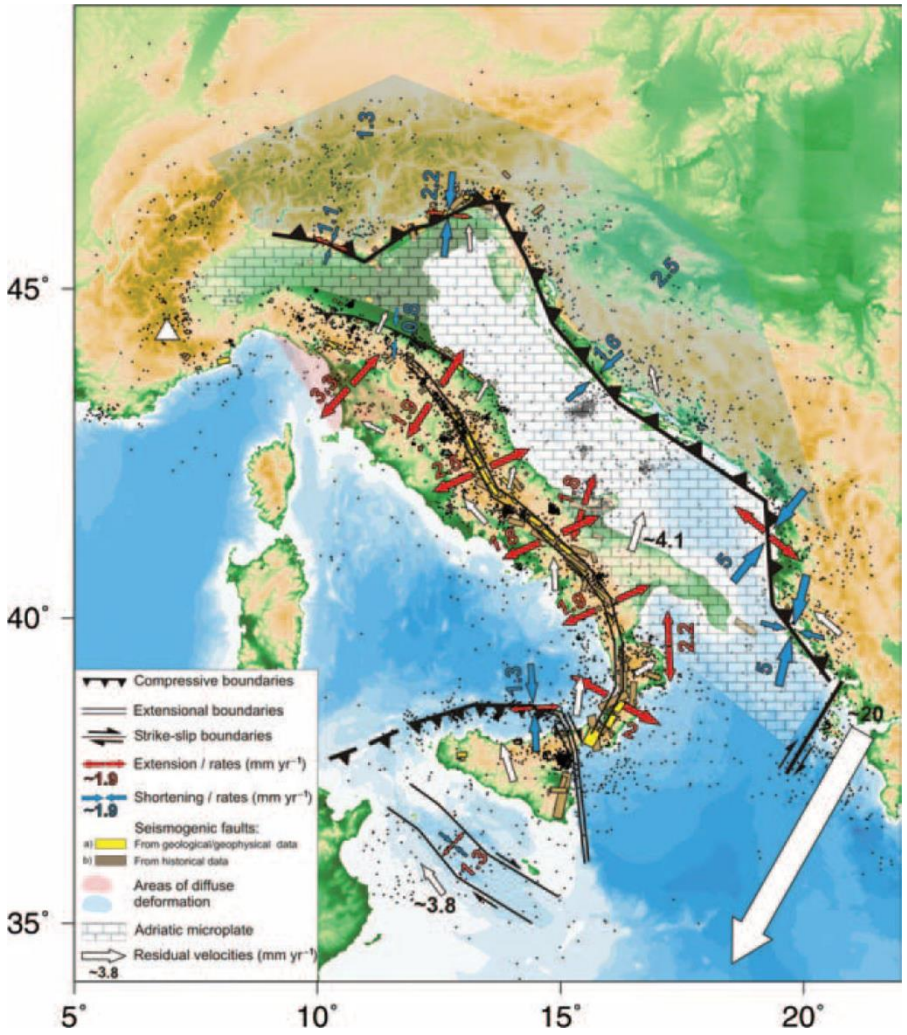
(Hollenstein et al., 2003; D'Agostino & Selvaggi, 2004)



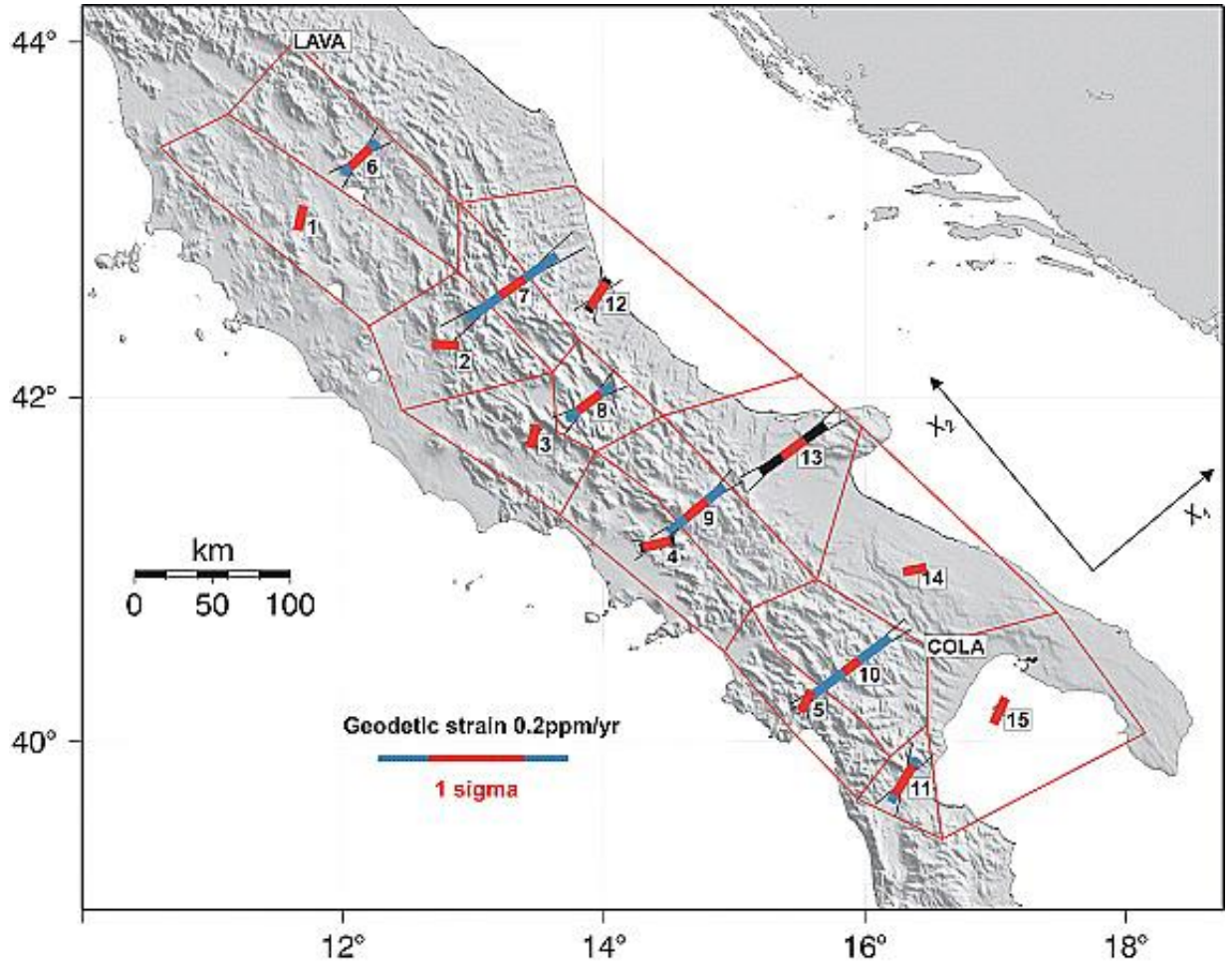
1st order knowledge with large uncertainties

Pre-2004: knowledge of the strain rates (from discrete GPS measurements, a few cGPS & seismic data)

(Serpelloni et al., 2005)



(Hunstad et al., 2003)

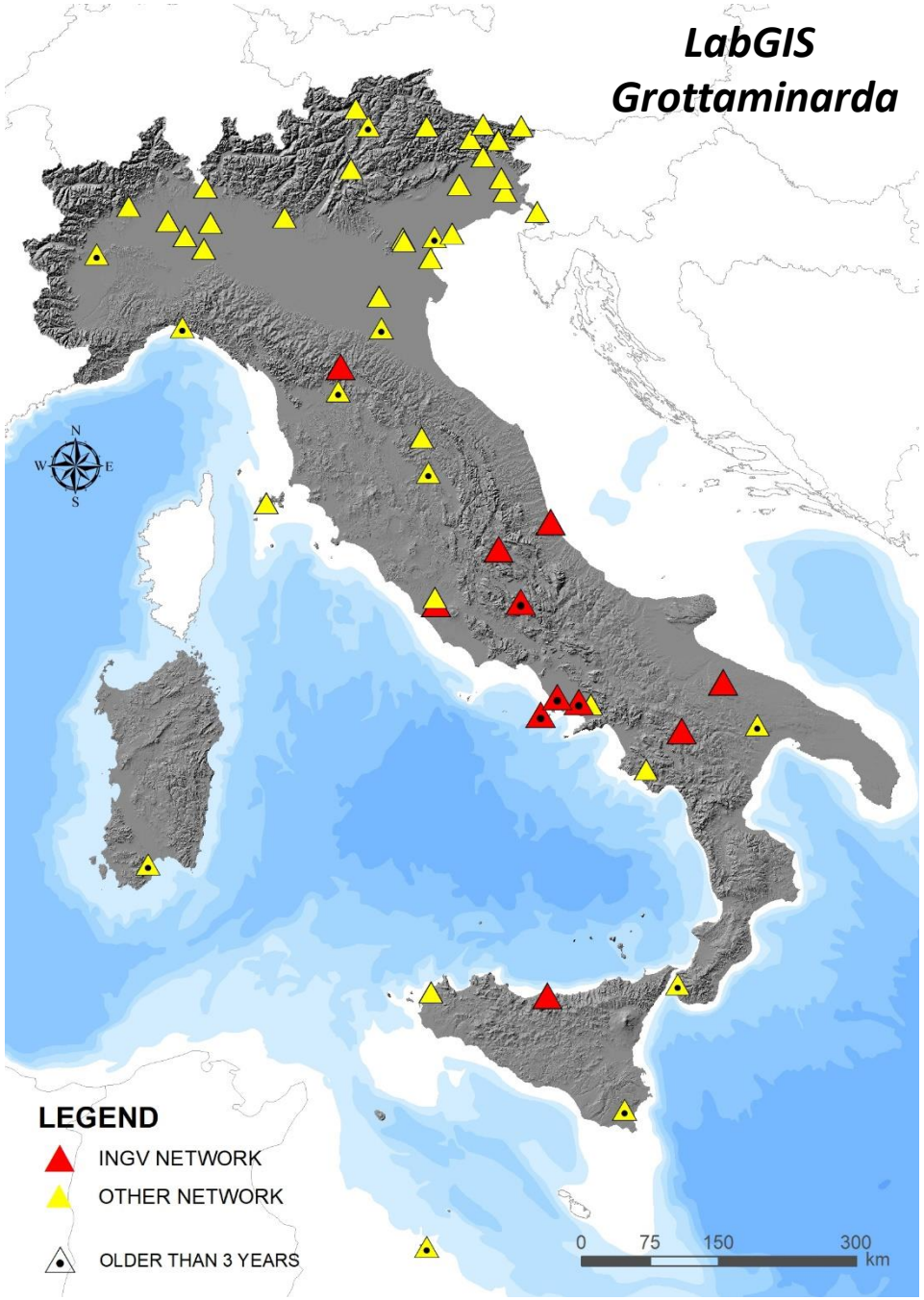


GPS network pre-2004

50 stations not honogeneously distributed in Italy

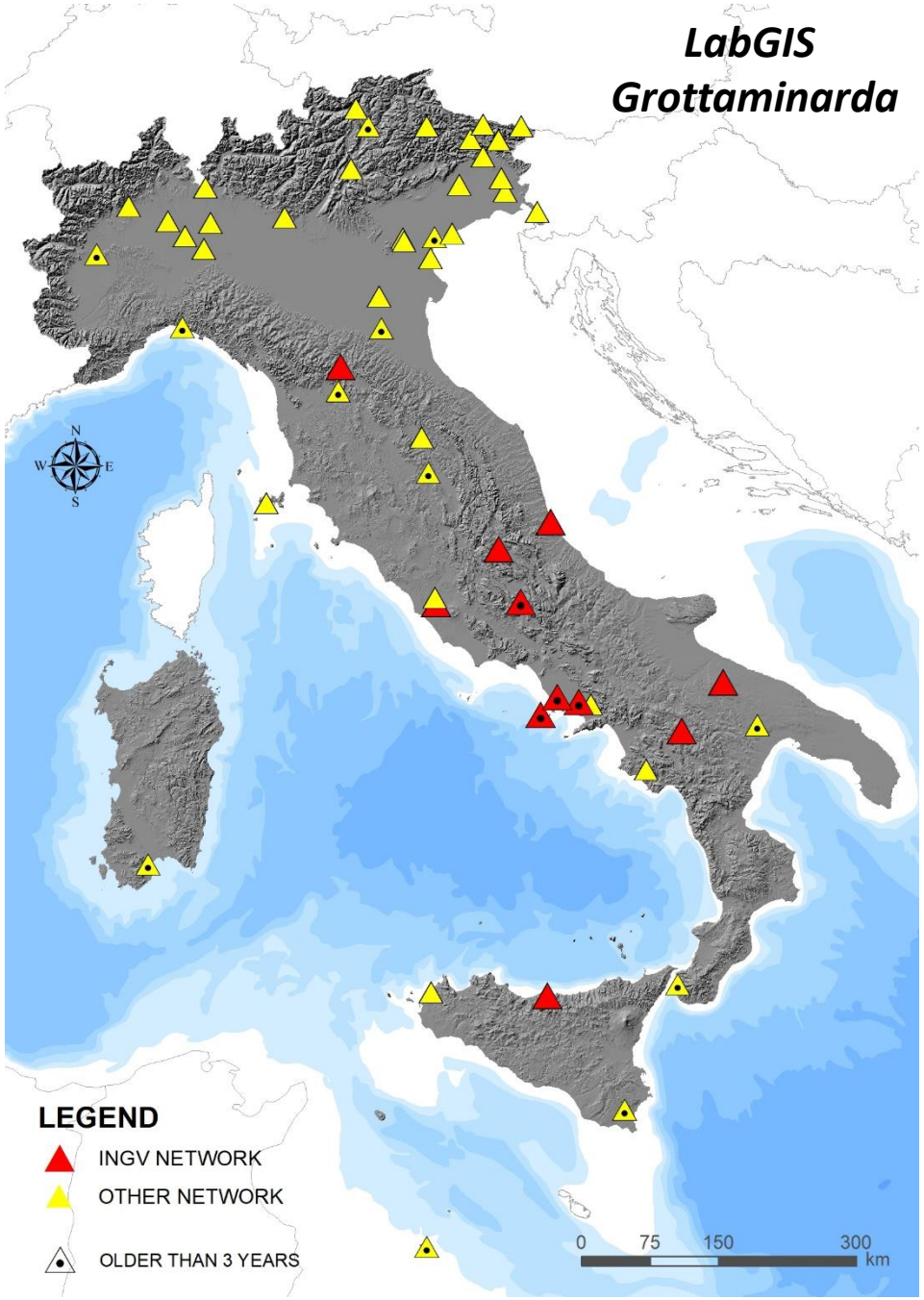
1/3 of existing cGPS had time series > 3 ans

Southern Italy was scarsely sampled



Debated topics:

- Slab retreat still active?
- How does the Calabrian arc move?
- Where is the S boundary of Adria microplate
- Are the seismogenic structures well constrained?
- Where the deformation is localized and where it is distributed?
- Deformation is released only seismically?
- Which temporal and spatial scale is useful to sample the different deformation processes?



RING

Started in 2004 as project from integration of different experiences in INGV

Developed by means of several projects funded by the Italian Ministry of Research and Civil Protection Department

Instrumentation:
Receivers -> Leica GRX 1200, GRX1200 PRO, GR10, GR25;
now some Trimble Alloy
Antennas -> Leica AT504, AT504GG, AR10, AR25;
now Trimble Choke-ring
Radome (SCIGN, Leica, Trimble)

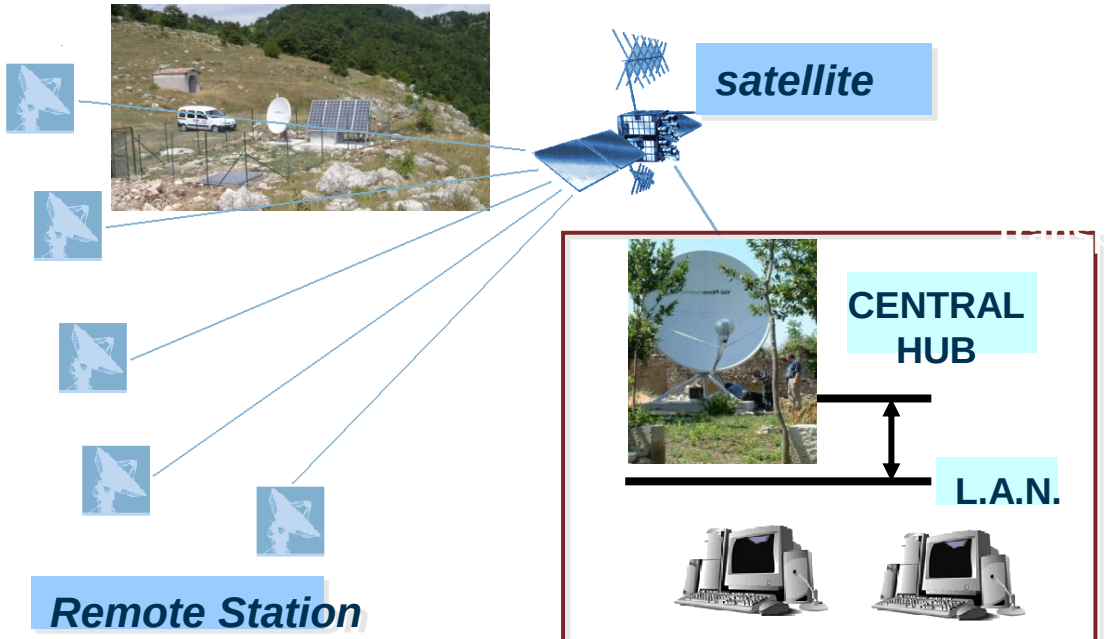
We paid attention to the GPS monumentation

RING sites were initially installed with seismic instrumentation

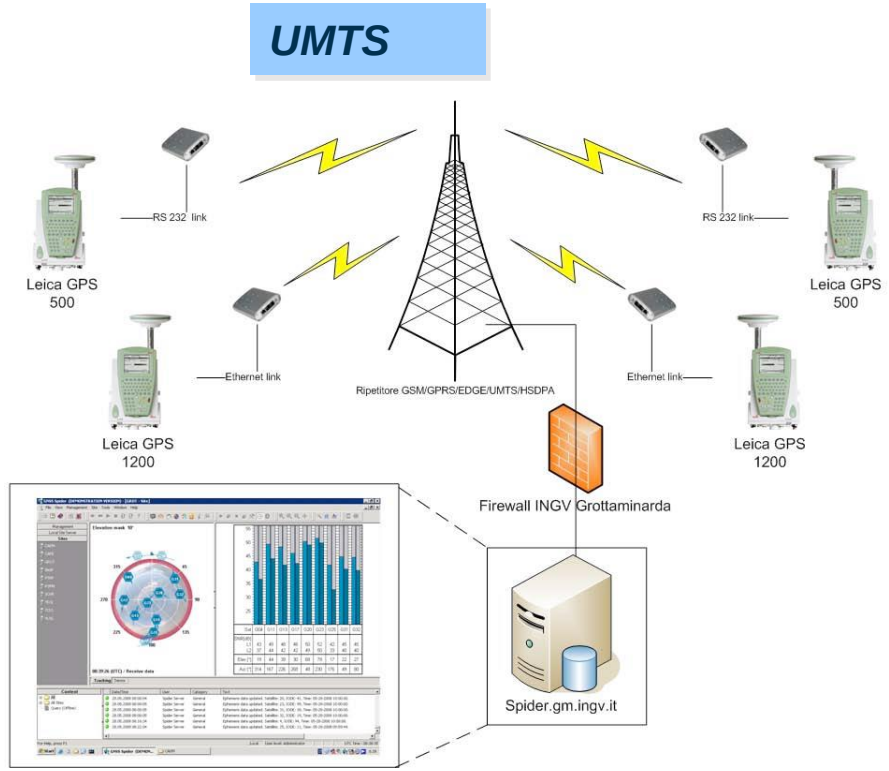
RING sites are also installed alone

… and deeper

RING was in real-time since the beginning

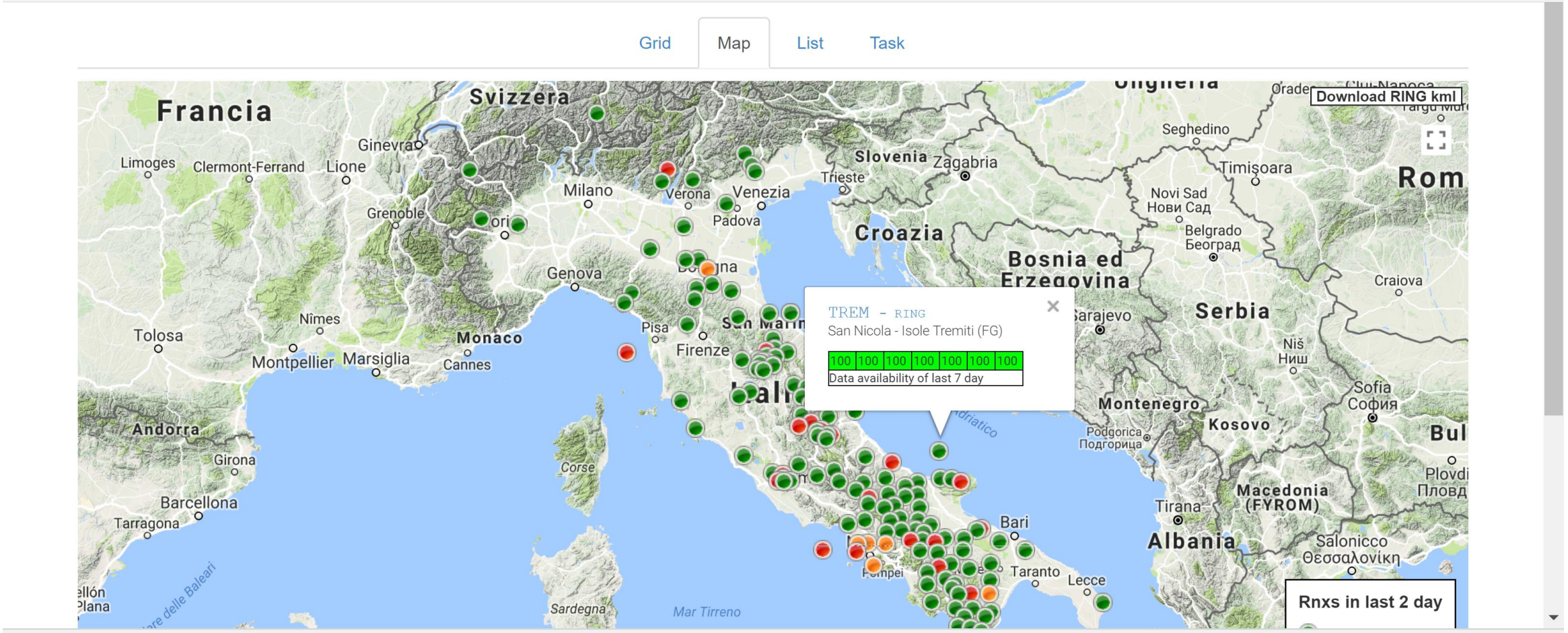


3 Acquisition sites: Rome, Grottaminarda and Catania



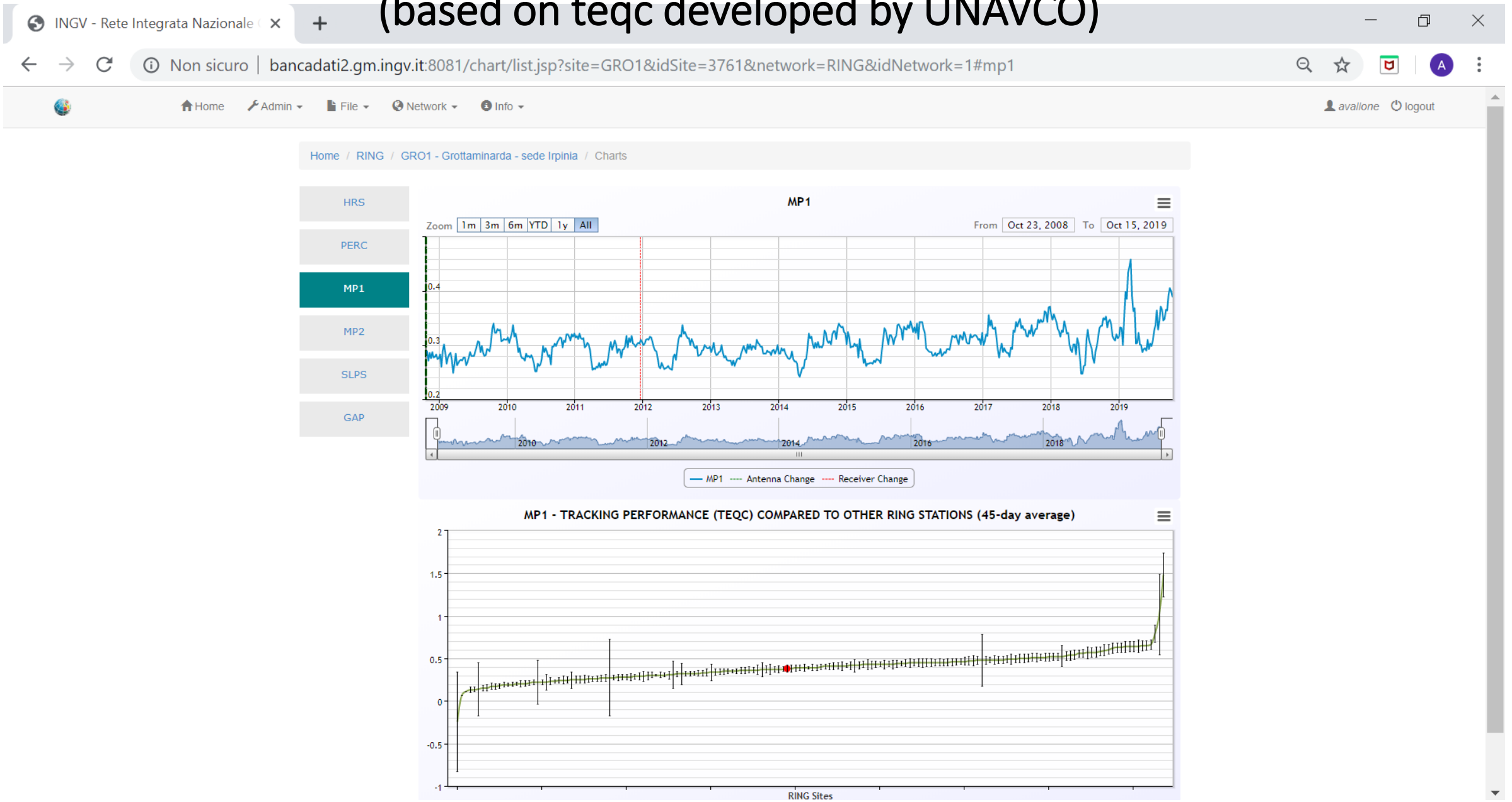
2 Acquisition sites: Rome & Grottaminarda

A database was created for archiving RING GPS data and metadata (BANCADATI)

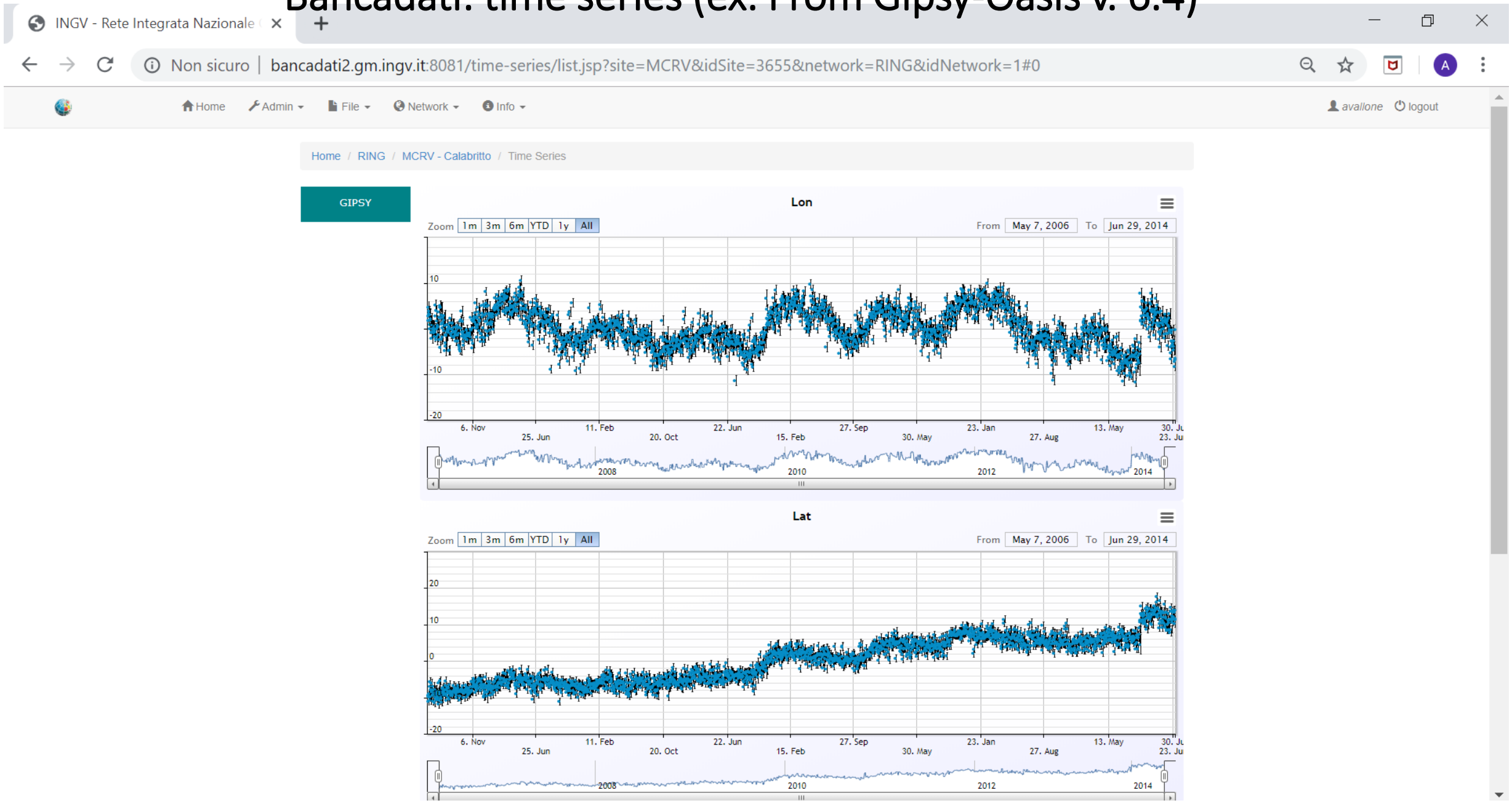


Presently is mainly used for internal maintenance staff

Bancadati: charts to monitor the site and data quality (based on teqc developed by UNAVCO)

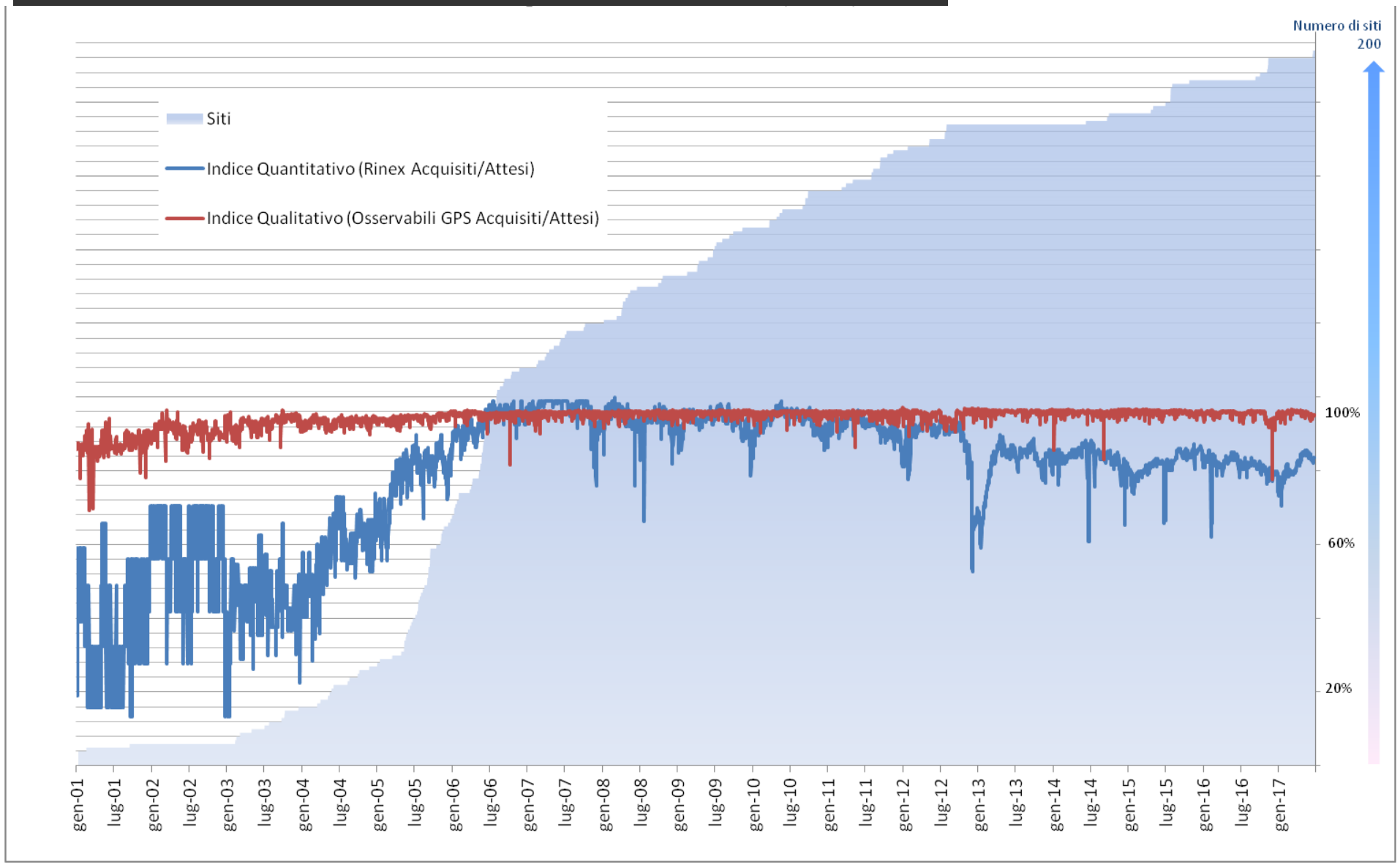


Bancadati: time series (ex. From Gipsy-Oasis v. 6.4)

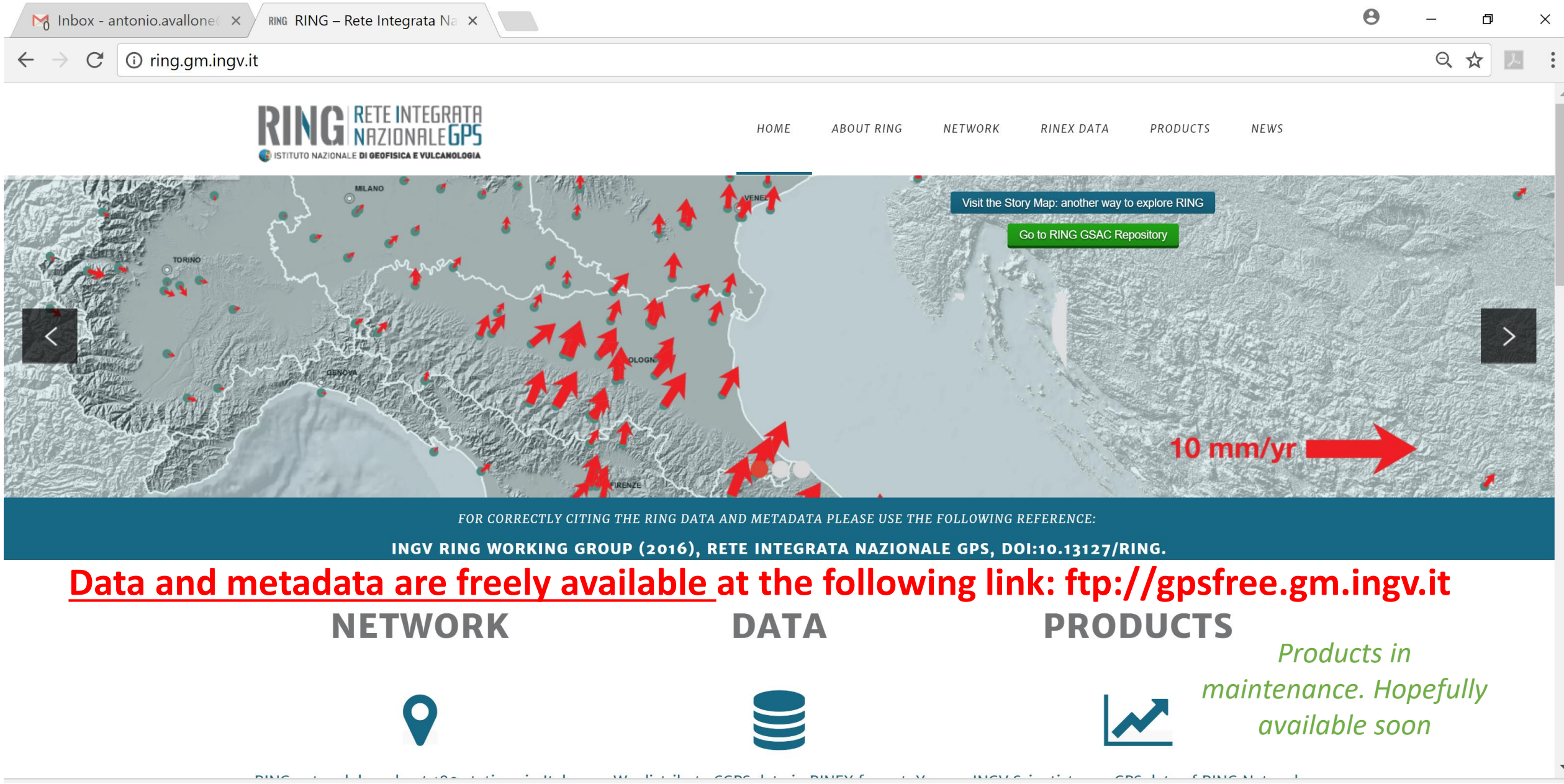


Bancadati: time series (ex. MCRV, southern Italy)

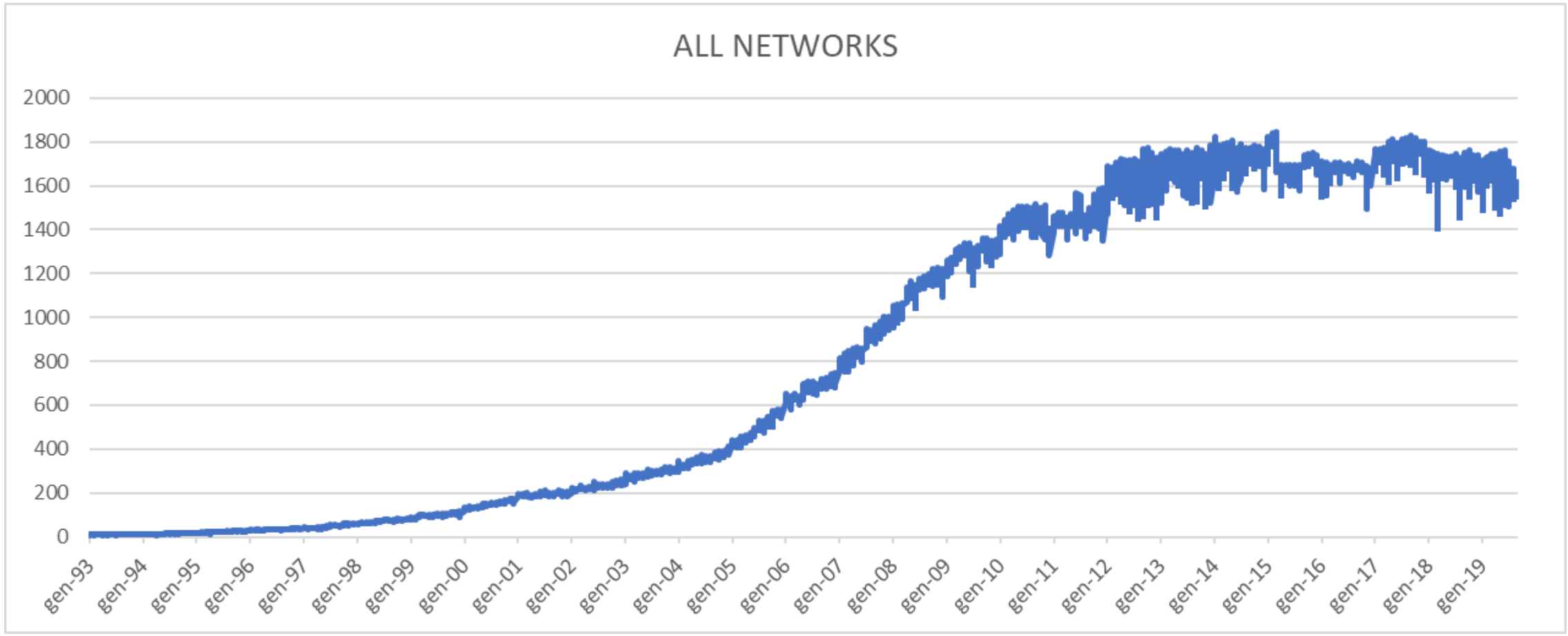
La Rete Integrata Nazionale GPS



Data dissemination (doi:10.13127/RING)



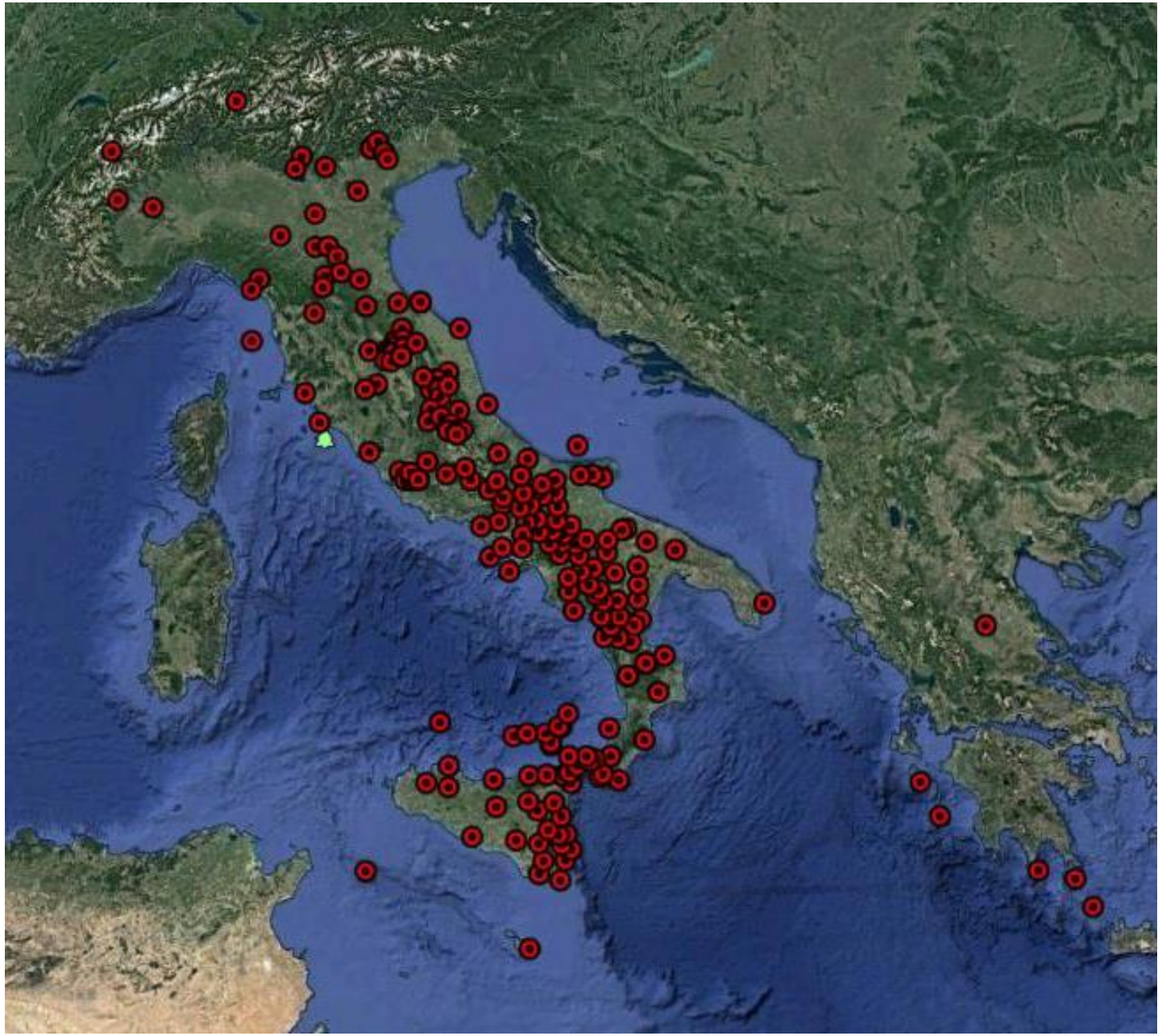
For scientific interests we started in retrieving data from other continuous networks (municipalities, regions, private)



The data and metadata (& products) distribution from other networks is also planned (within agreements) in the future

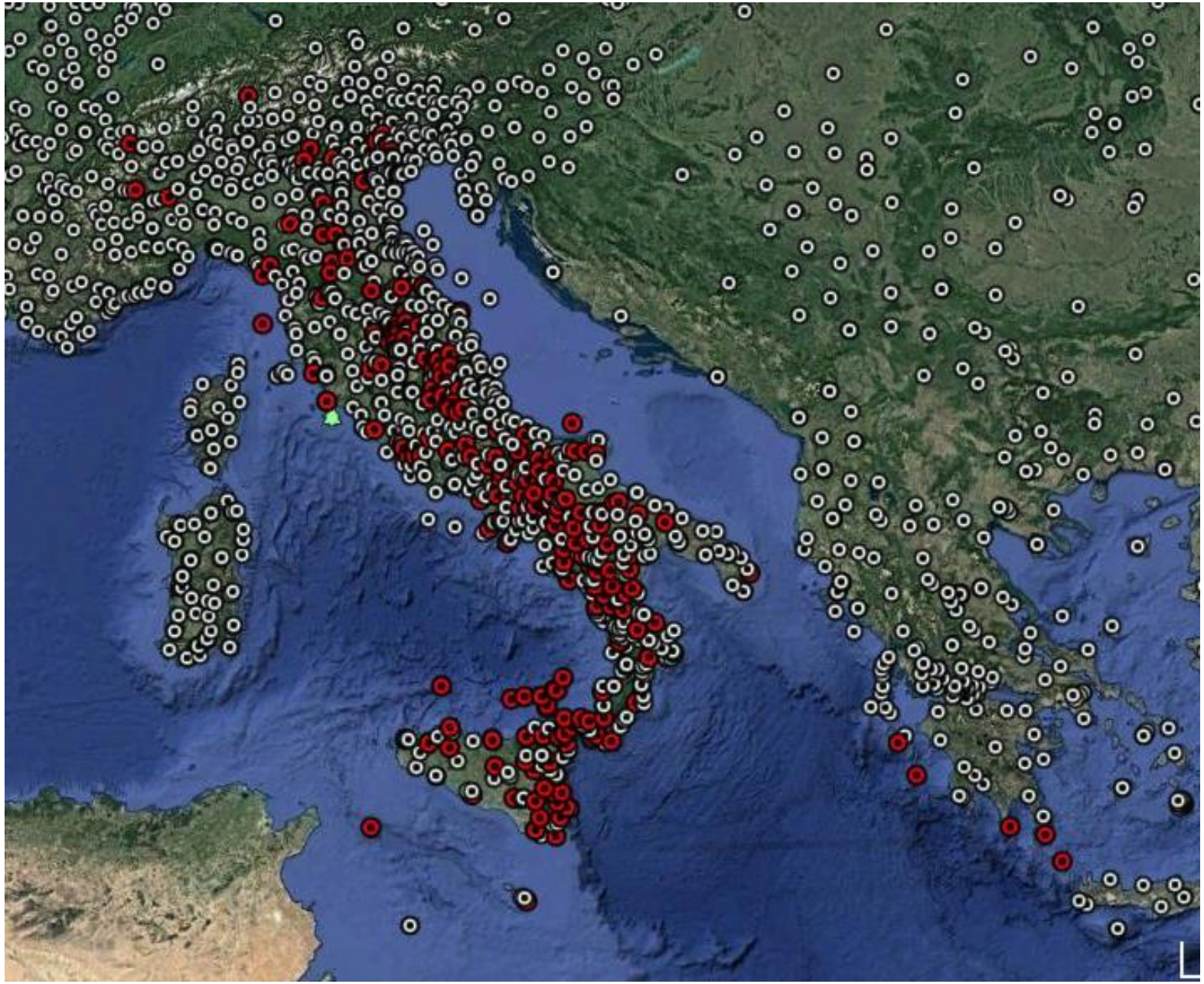
RING today

- 204 sites
- Real-time data trasmission
- Up to 10Hz-20Hz recording frequency at remote sites



RING and other network archive

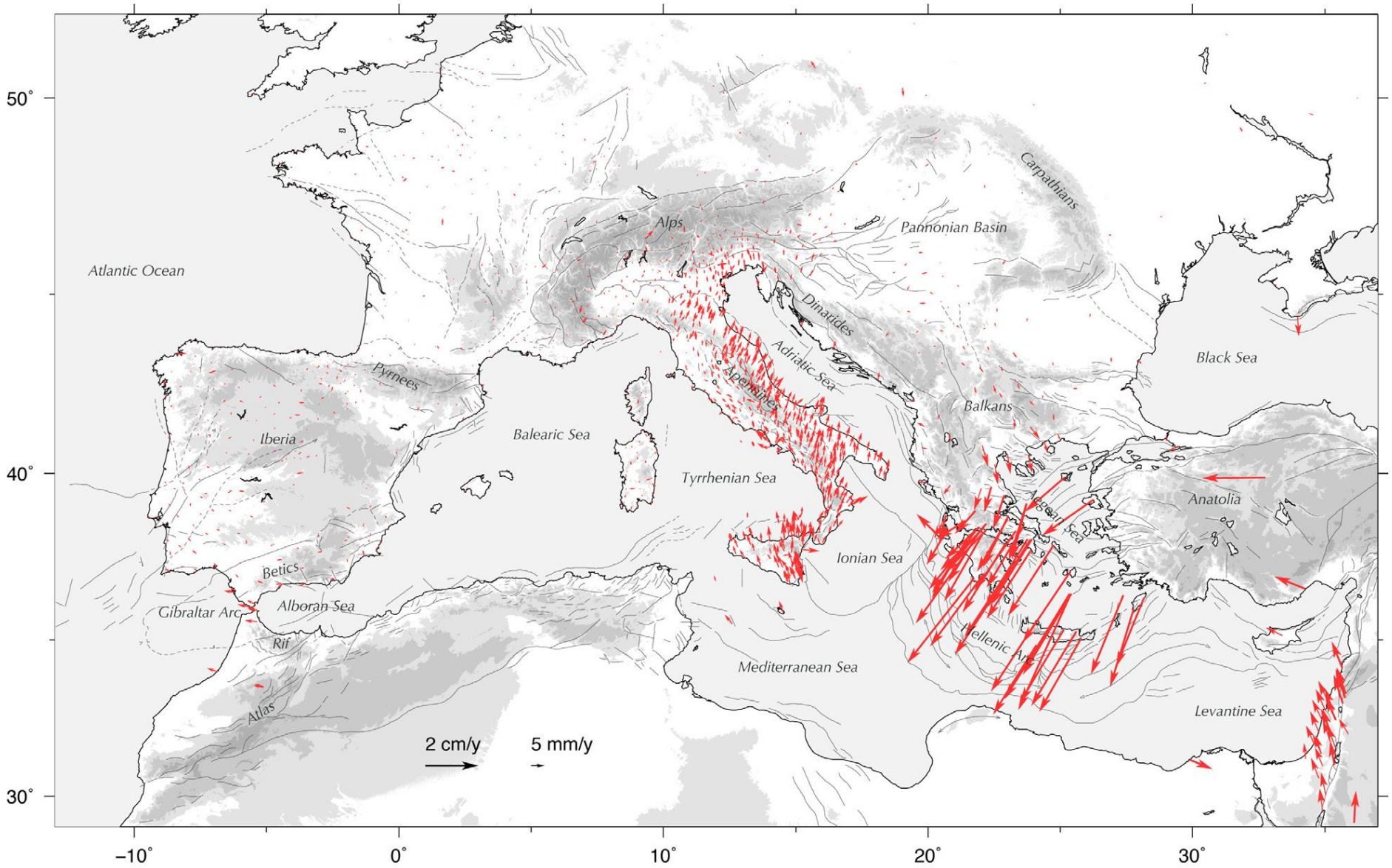
- **~1000 sites in Italy**
- **daily download**
- **30s sampling rate (also 1s in case of earthquakes)**



RING
(Rete Integrata Nazionale GPS):

Impact to the Research after 15 years

Detailed velocity field in the Mediterranean Sea



3 Analysis centres (Bernese, Gamit e Gipsy)

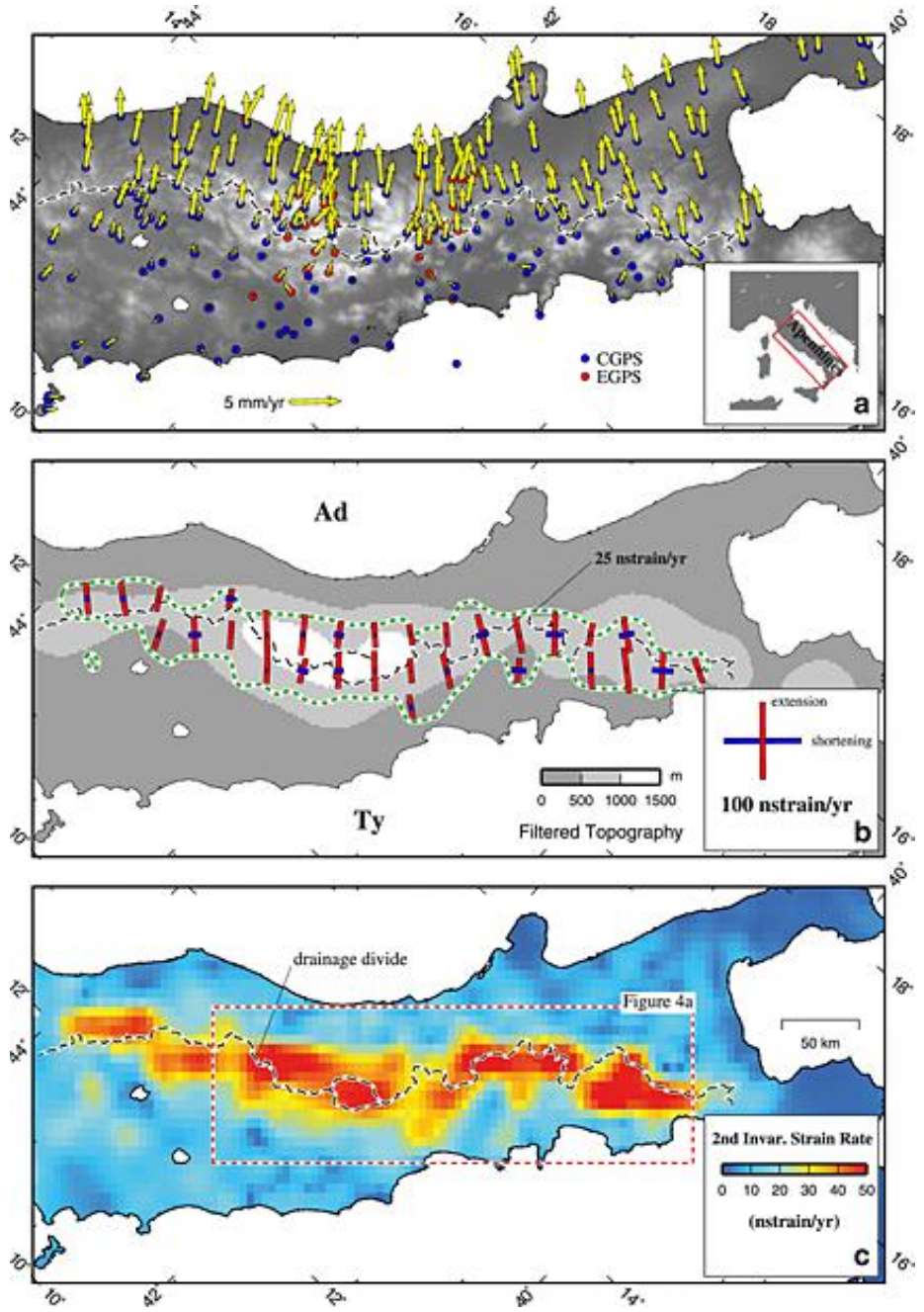
Combination at the velocity level

(Avallone et al., 2010; Devoti et al., 2017)

Detailed velocity field and strain rate maps in the Apennines

(D'Agostino, 2014)

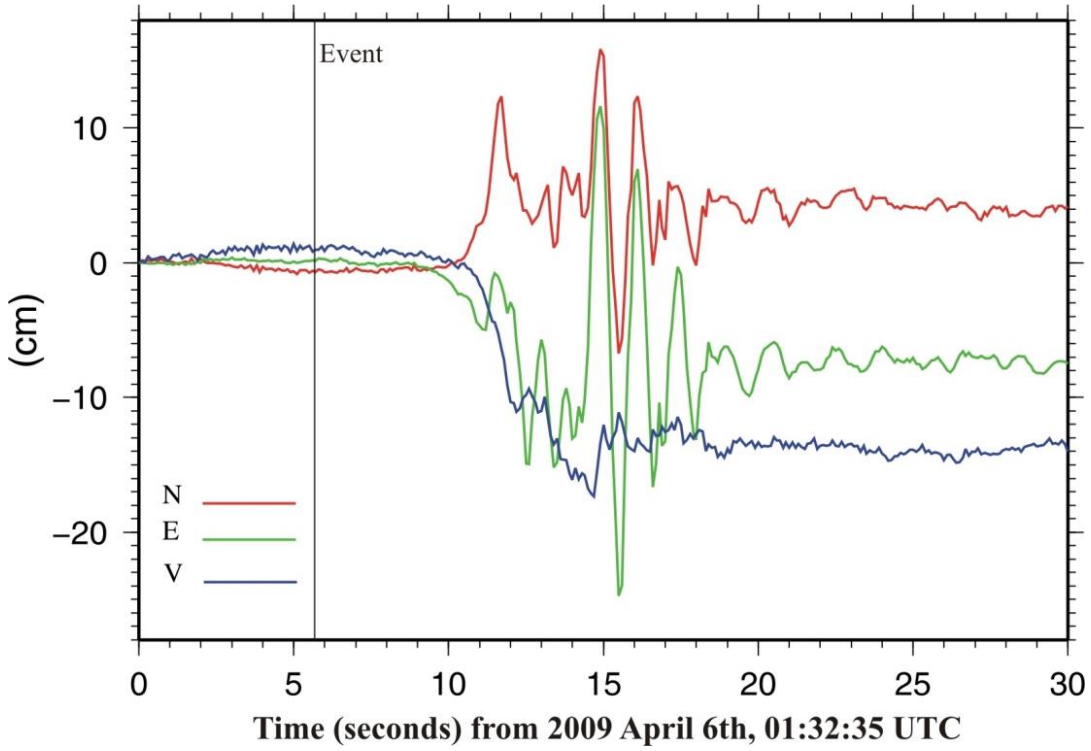
The integration among scientific, cadastrial and commercial GNSS networks allow higher detail in the observation of the strain accumulation



Coseismic dynamic displacements (HRGPS)

L'Aquila earthquake (central Italy)
06/04/2009 M_w 6.3

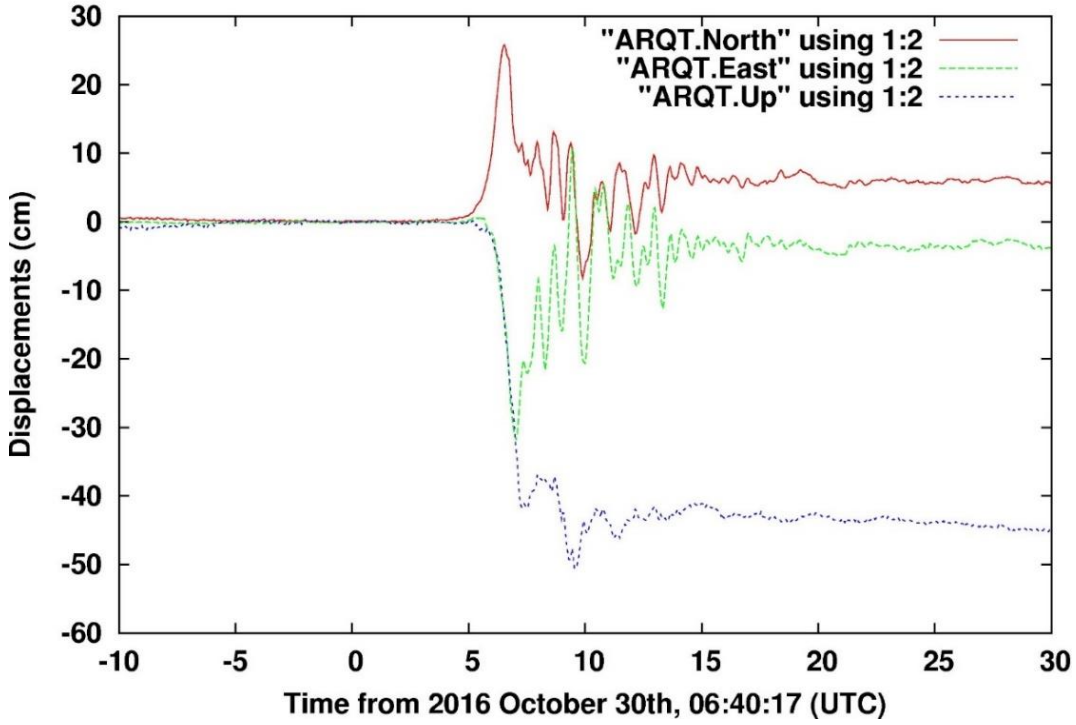
10 Hz, ~10 km above the nucleation



Avallone et al., JGR, 2011

Norcia earthquake (central Italy)
30/10/2016 M_w 6.5

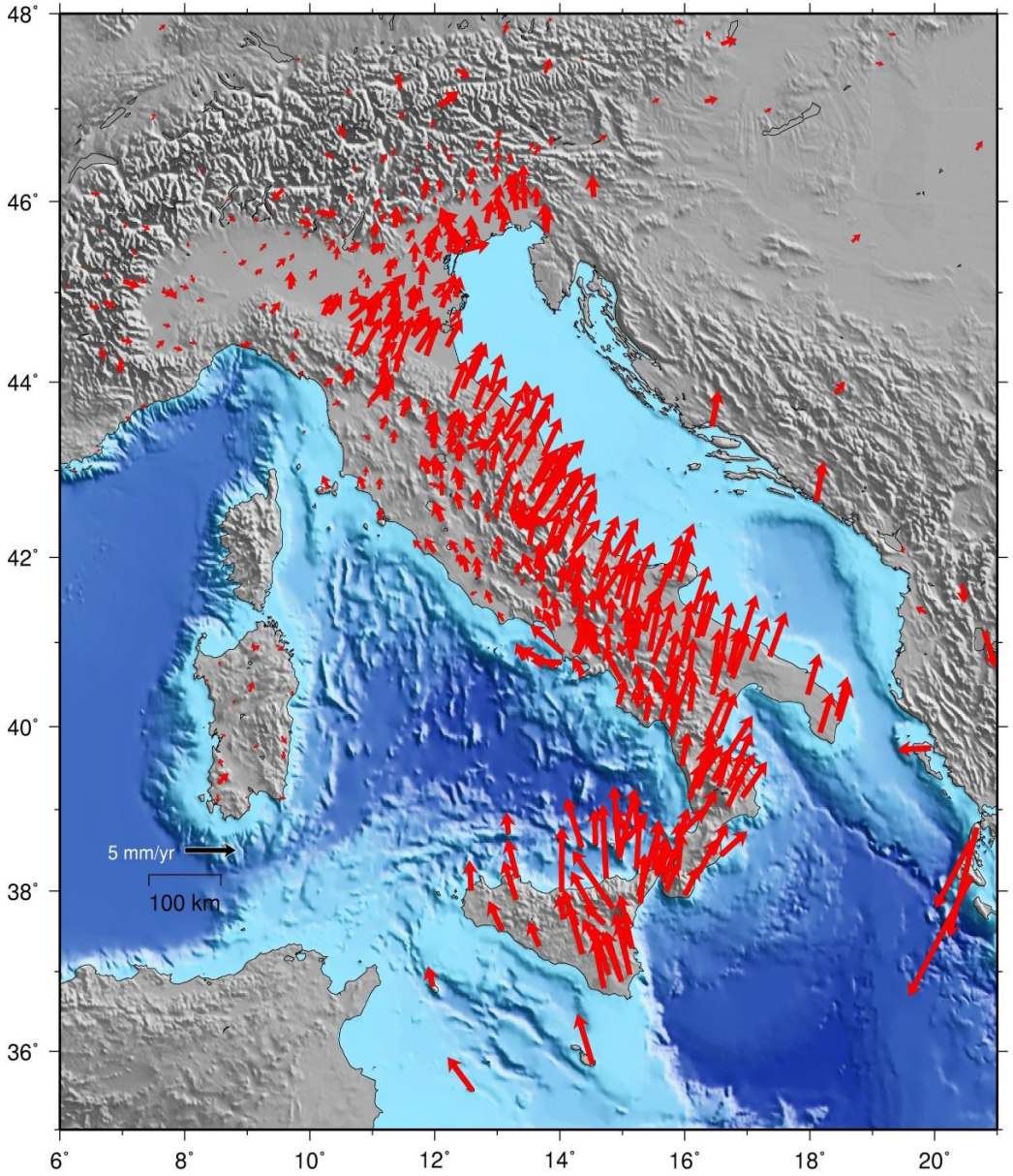
20 Hz, ~9 km above the nucleation



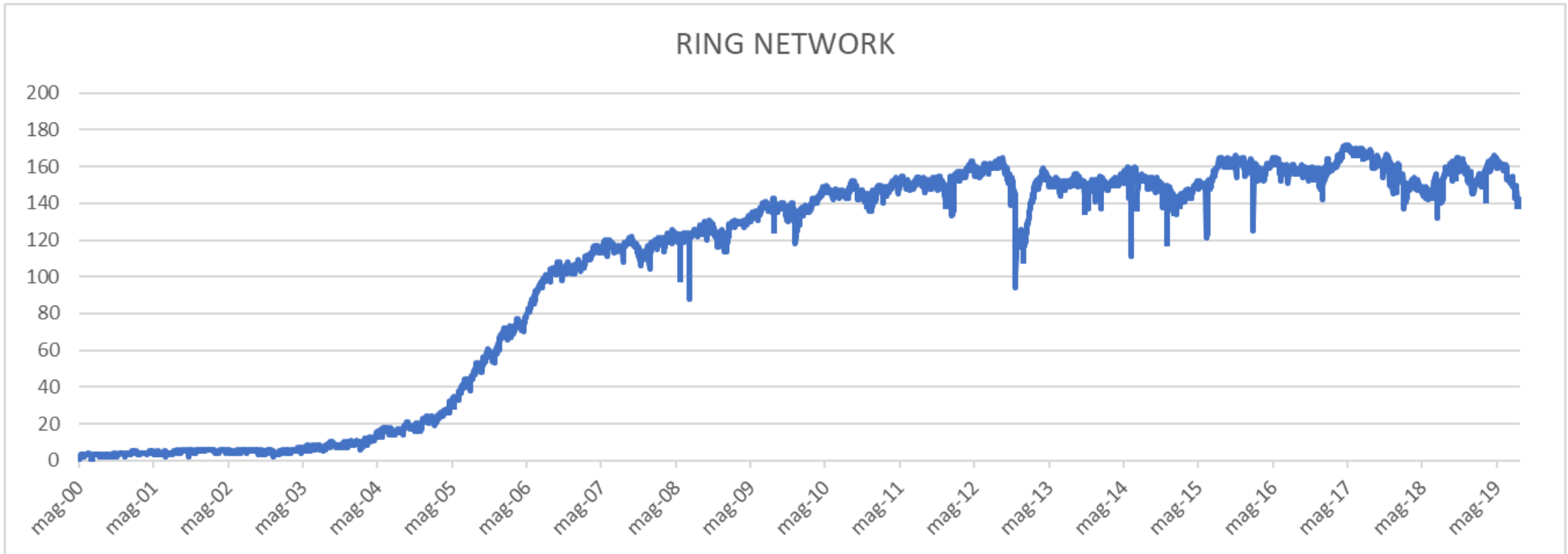
Avallone et al., Ann. Geoph., 2016

and...

- **Coseismic deformation (*Anzidei et al., 2009; Serpelloni et al., 2012; Cheloni et al., 2016, 2017*)**
- **Afterslip (*Cheloni et al., 2010*)**
- **Regional kinematics (*Devoti et al., 2008; D'Agostino et al., 2008; Devoti et al., 2012*)**
- **Transient deformation (Cheloni et al., 2017; Gualandi et al., 2017)**
- **Earthquake source studies (Avallone et al., 2011,2016; Cirella et al., 2018)**
- **Seismic vs aseismic deformation (D'Agostino et al., 2009; D'Agostino et al., 2014)**
- **Ionosphere (*Cesaroni et al., 2017*)**
- **Real-time GNSS in Warning systems (starting)**




MERCI


RING NETWORK
200
180
160
140
120
100
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La Rete Integrata Nazionale GPS