Monitoring and Analysis of the Italian Permanent Network RDN of GNSS stations

G. Farolfi

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Outlook

- **Data** and **features** of the **RDN network**
- **Processing**
  Strategy
  Alignment to ITRF2005 and Transformation to ETRF2000
- **Comparison** of **results** at **different epochs**
- **Velocity field estimation**

Rete Dinamica Nazionale

100 permanent stations:

13 IGS (ITRF2005)

28 EPN

Features of the **network:**

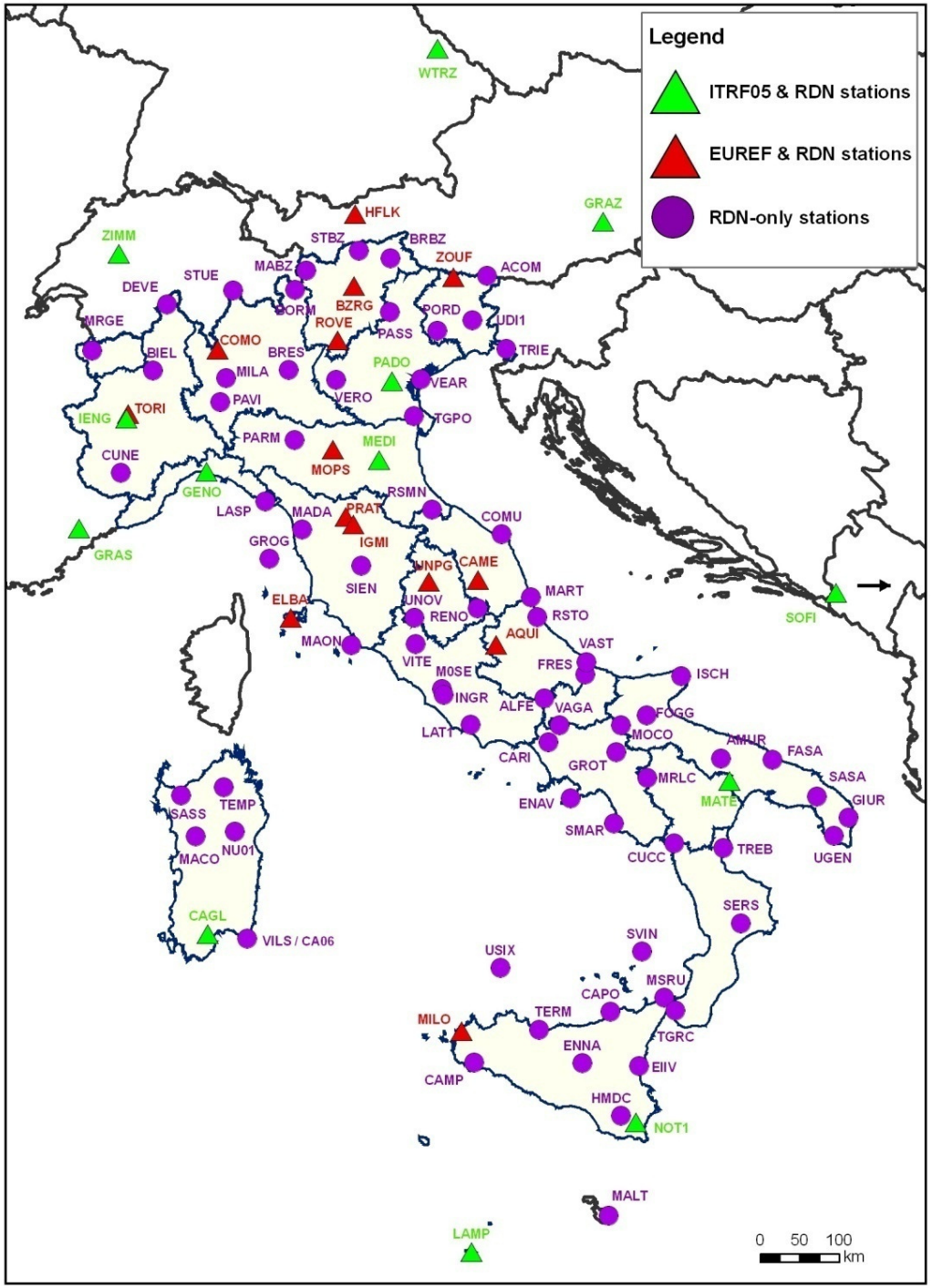
Homogeneous distribution

Good monumentation

Mean interdistance **100 ÷150** km

Stations owned by public institutions (broadcast RTK signal)

Redundancy and temporal continuity



First Processing of the Network

Official coordinates computed independently by:

- University of Padova (prof. Caporali, EPN LAC)
- G3 Group in Milano (prof. Sansò)
- University of Bologna (prof. Barbarella)

Common procedures:

- Input data
- Reference system (ETRF2000 epoch 2008.0)

Different procedures:

- Processing Strategy
- Data cleaning
- Datum alignment

Different softwares:

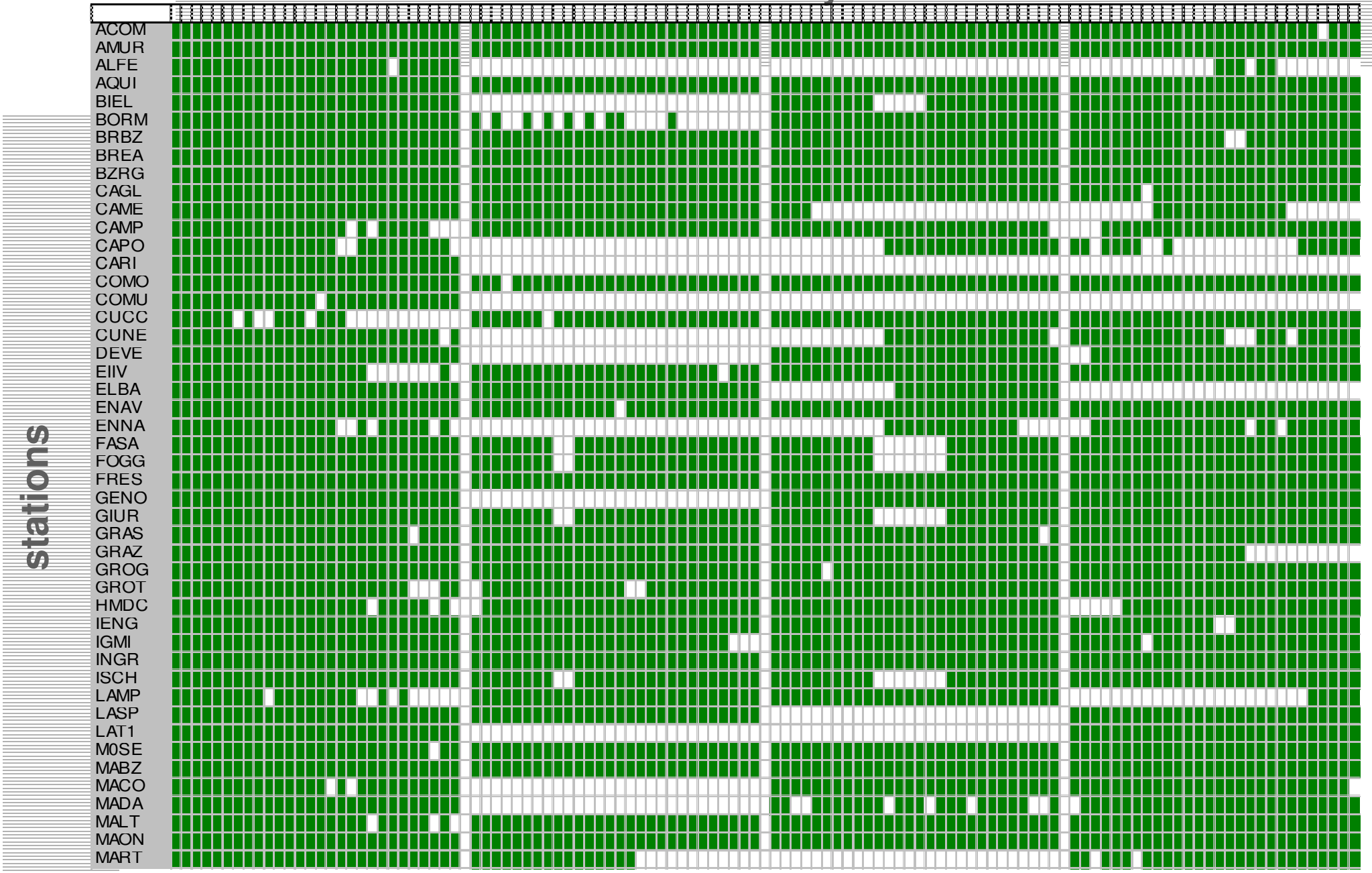
- Bernese
- GIPSY
- Gamit

Monitoring Campaigns

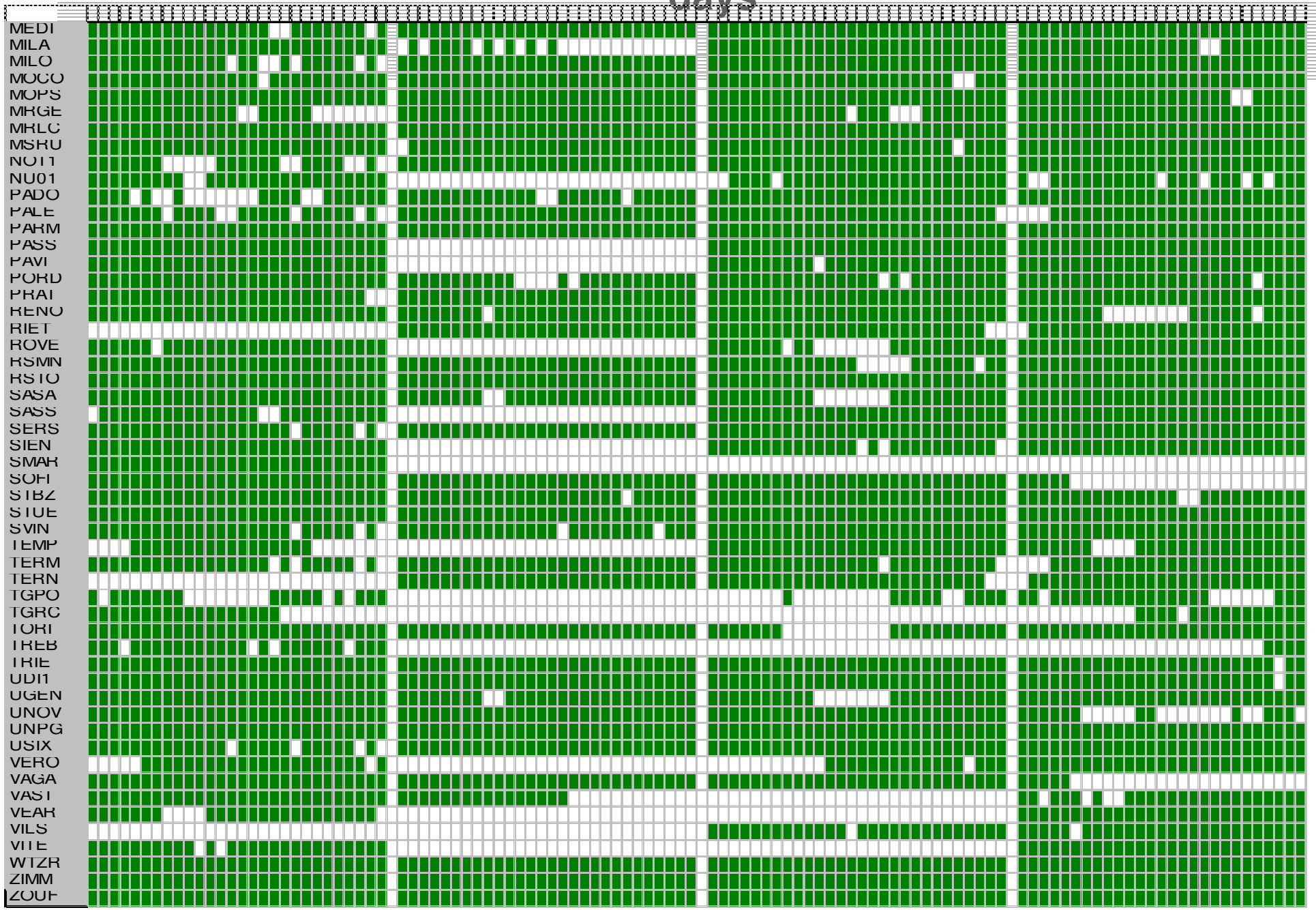
- Daily RINEX 30 s
- 4 campaigns of 28 days each
- Time-spaced by a gap of six months
- Covering a period of two years

Campaign	First GPS Week	Last GPS Week	From	Until
0	1459	1462	23 dec 2007	19 jan 2008
1	1484	1487	15 jun 2008	12 jul 2008
2	1511	1514	21 dec 2008	17 jan 2009
3	1536	1539	14 jun 2009	11 jul 2009
4	1563	1566	20 dec 2009	16 jan 2010

Data availability



Data availability



Processing of single campaign

Input data:

- Daily Rinex (sample rate 30 s)
- IGS05 Orbits and Earth Rotation Parameters
- Absolute Antenna Phase Center Model (IGS05.atx)
- Ocean Tide Loading corrections with model GOT00.2
- Rigorous control of match Rinex header / logsheet

Strategy:

- EUREF guidelines

Main processing parameters:

- Software Bernese 5.0
- Cut off ≤ 3°
- Baselines built up with OBS MAX strategy (max length of 200 km)
- Troposphere delays estimated every 1 hour with Neill Mapping function

Result:

- 28 Daily Normal Equations for each campaign (4)

Combination of the campaigns

Input data:

- 20 Weekly Normal Equation Solution (4 for each campaign)

Processing Module:

- ADDNEQ2 (Bernese Software 5.0)

Estimation of Coordinate

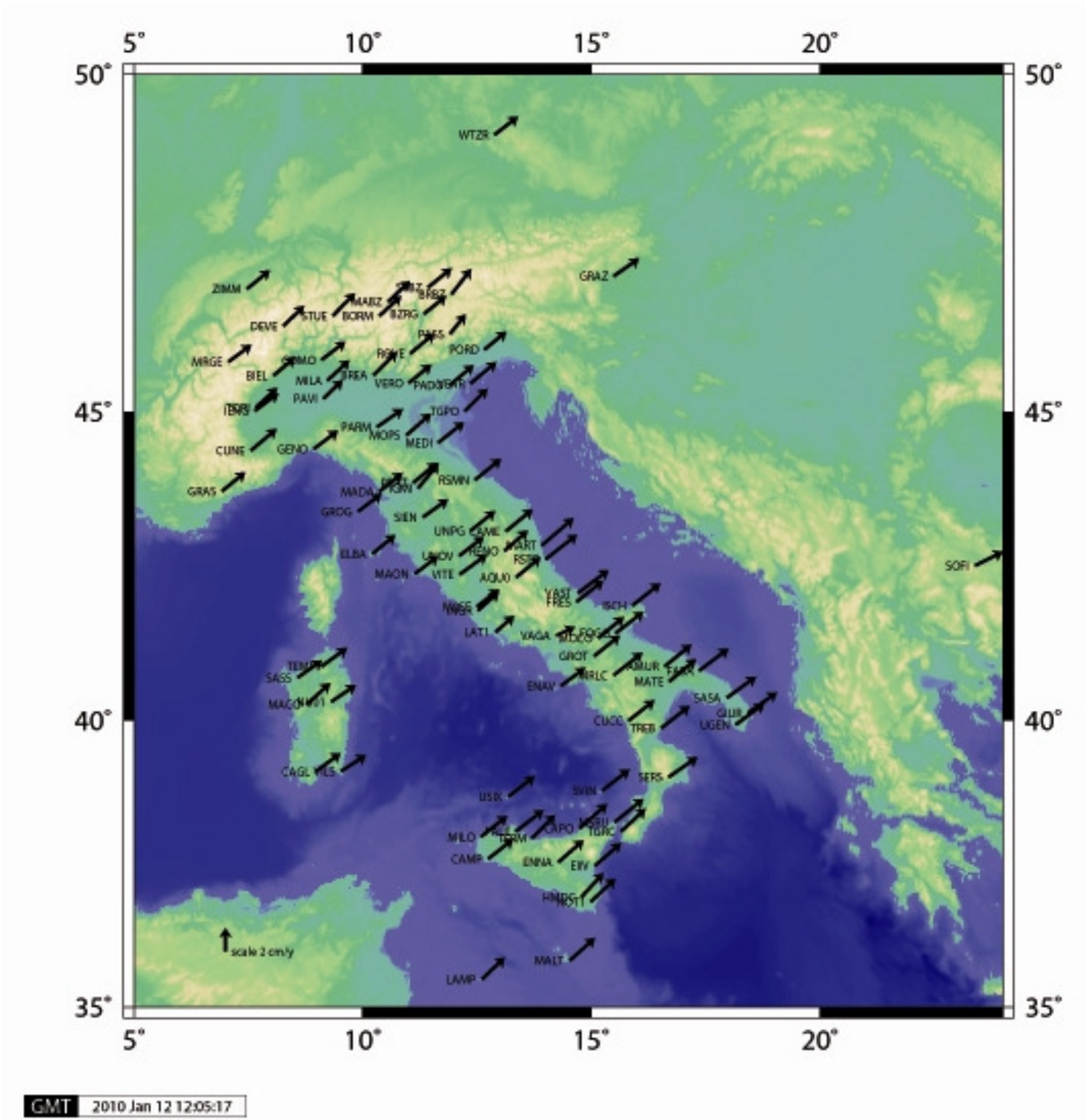
- Minimal constraint condition on 13 IGS fiducial stations

Estimation of Velocities

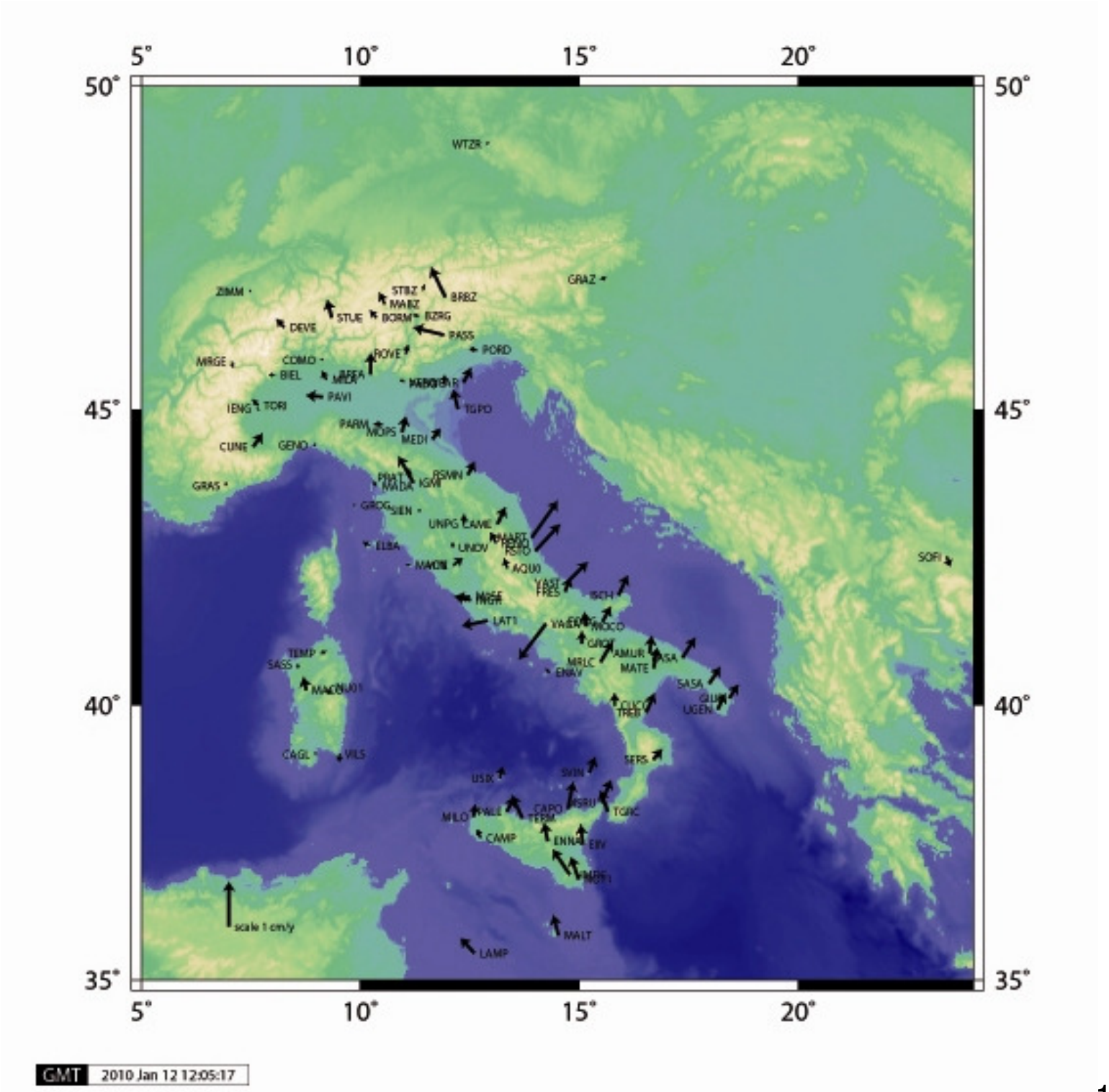
- Strong constraint on the 13 IGS fiducial site velocities (ITRF 2005 solutions)

Velocity is only the common scale to compare the spatial variations at different epochs
Not possible apply a statistical approach (only 5 series)

ITRF 2005 horizontal velocities



ETRF 2000 horizontal (intra plate) velocities



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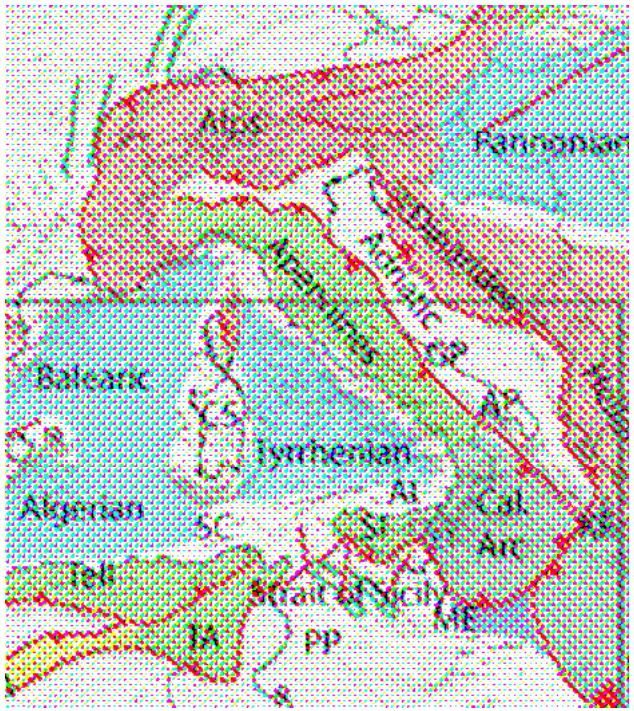

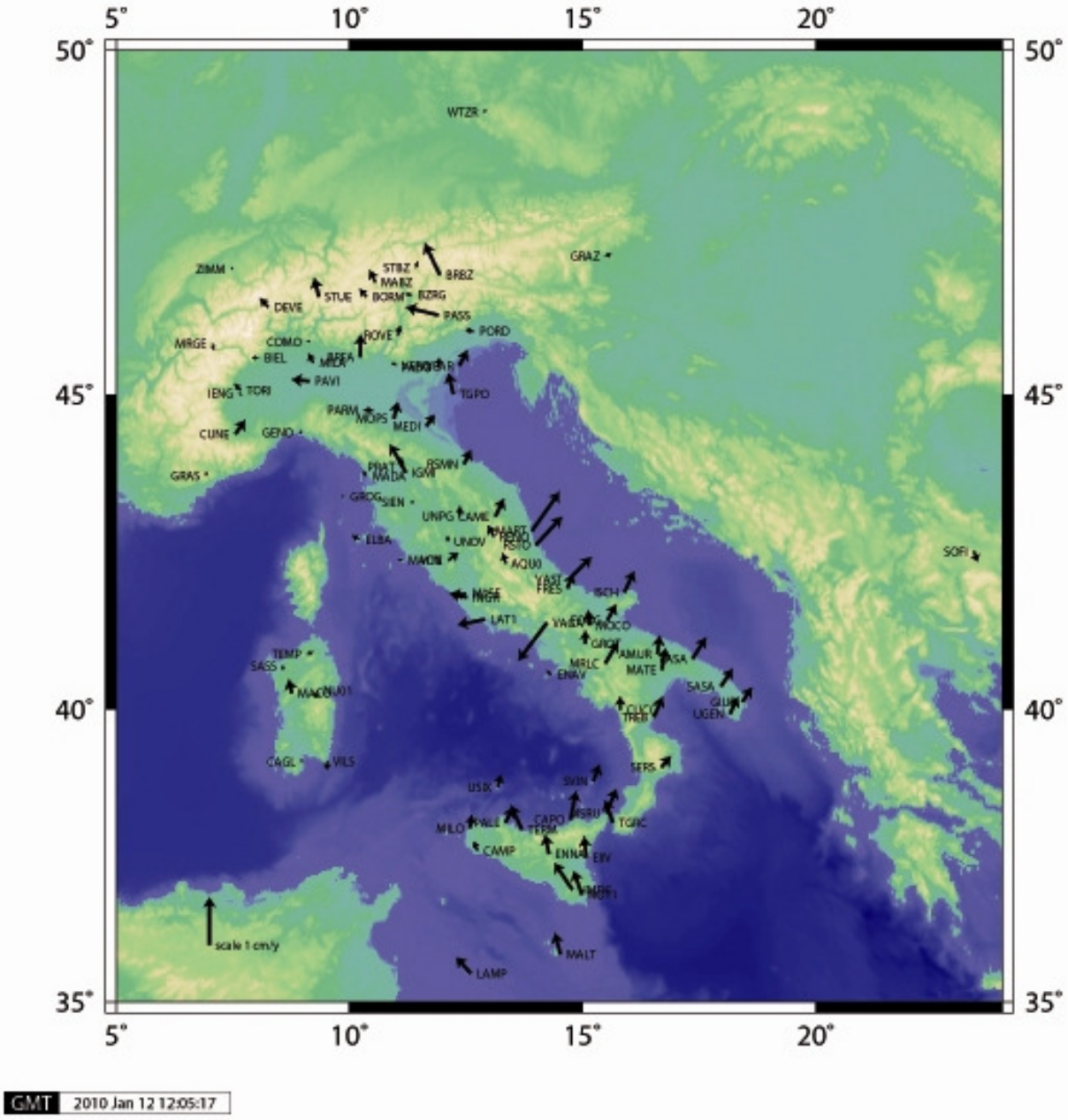

Estimation of Errors

Repeatability of coordinates

	N	E	h
mean **rms**. **[mm]**	1.4	1.0	4.1

Errors in velocity field

Velocity	Planimetry	Altimetry
mean **rms**. **[mm / y]**	2.5	6.0

Comparison of results with EPN densification of solution ITRF 2005

	Velocity (mm/y)		Velocity (mm/y)				
	ETRF2000-RDN 2009		RDN2008.0-RDN 2009.5			Difference (mm/y)	
Site ID	East	North	East	North		East	North
BZRG	-1,8	-0,9	-3,2	6,5		1,4	-7,4
CAGL	-0,3	0,1	0,1	0,5		-0,4	-0,4
CAME	1,0	3,4	1,7	3,7		-0,7	-0,3
COMO	-0,1	-1,3	0,5	0,1		-0,6	-1,4
ELBA	-0,7	0,7	-1,3	0,7		0,6	0,0
GENO	0,0	0,2	0,6	0,2		-0,6	0,0
GRAS	-0,6	0,1	0,2	0,7		-0,8	-0,6
GRAZ	0,4	0,8	1,1	0,5		-0,7	0,3
IENG	-0,6	-0,4	0,5	-0,4		-1,1	0,0
LAMP	-3,4	3,1	-3,1	3,4		-0,3	-0,3
MATE	-0,2	4,3	0,8	4,5		-1,0	-0,2
MEDI	1,5	2,2	1,6	2,3		-0,1	-0,1
MILO	-3,8	6,0	0,4	2,6		-4,2	3,4
NOT1	-1,9	4,6	-0,3	-1,5		-1,6	6,1
PADO	1,1	0,0	0,3	2,0		0,8	-2,0
PRAT	0,1	1,9	0,1	1,8		0,0	0,1
SOFI	0,2	-2,1	0,7	-2,2		-0,5	0,1
TORI	-0,3	0,3	-1,2	1,2		0,9	-0,9
UNPG	-1,3	2,6	0,1	1,9		-1,4	0,7
WTZR	-0,3	0,4	0,4	0,5		-0,7	-0,1
ZIMM	-0,3	0,4	0,4	0,4		-0,7	0,0

Conclusions

The main purpose: to study the stability of coordinates

Despite the limitation due to the short interval of observation:

- Stable solutions
- The behaviour of velocities fields are in agreement with the geodynamics

In the future:

To continue to monitor the network for:

- Monitoring the national reference frame
- More comprehensive description of the structural and kinematic complexity of the region
- Analysis of the dynamic processes governing crustal deformation

Tectonic Sketch of Mediterranean Region