

United Nations International Meeting on the Applications
of Global Navigation Satellite Systems
Vienna, 12 – 16 December 2011



GOMED project : objectives, impacts and accomplishments

Ferdaous CHAABANE (presenter), Alexis
Rigo (Project Coordinator), Martinez-Diaz
José, Dr. Tahayt Abdelilah, Briole Pierre,
Mourabit Taoufik, Bezzeghoud Mourad.



UNIVERSIDADE DE ÉVORA



Universidad
Complutense
Madrid

GOMED project

GOMED (**G**ÉODÉSIE SPATIALE EN **MÉD**ITERRANÉE OCCIDENTALE : RISQUE SISMIQUE ET GÉODYNAMIQUE)

- Project topic: SCIENCES DE LA TERRE – EARTH SCIENCE
- Project start: December 1st, 2011
- Project duration: 24 months
- AUF funding

Project consortium

1	Université de Paul Sabatier, Toulouse	UPS	France	
2	Observatoire Midi-Pyrénées	OMP	France	
3	Ecole Supérieure des Communications	SUPCOM	Tunisia	
4	Ecole Normale Supérieure	ENS	France	
5	Universidade de Évora	UÉ	Portugal	
6	Université Abdelmalek Essaadi	UAE	Morocco	
7	Institut National de Géophysique	CNRST	Morocco	
8	Universidad Complutense de Madrid	UCM	Spain	



ENS

UPS, OMP

UCM

UÉ

UAE

CNRST

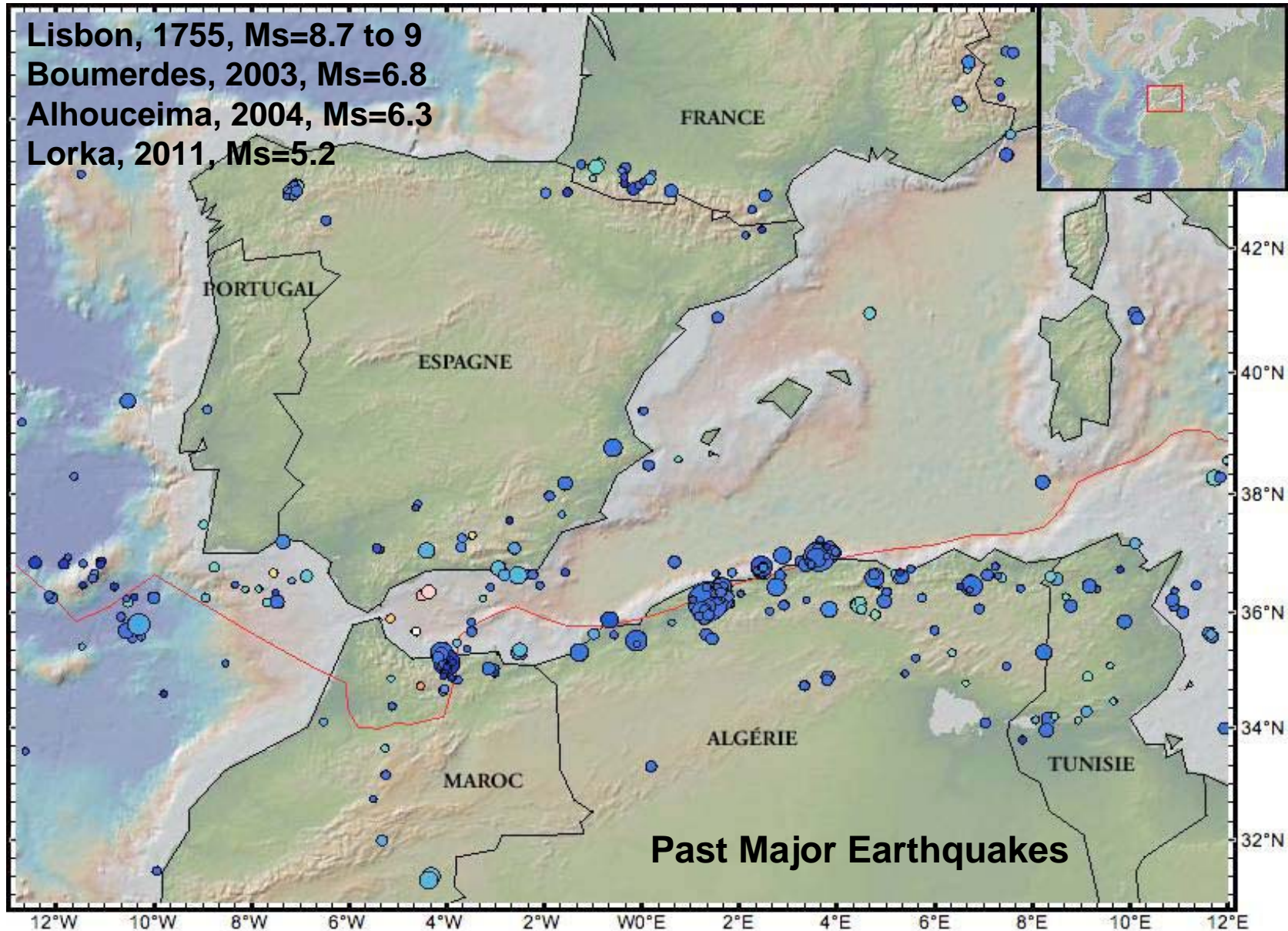
Sup'Com

Why GOMED?

- The majority of the western Mediterranean regions are located on a seismic line which exposes them to an increased risk of earthquakes (Africa/Eurasia plates convergence).
- Many geodynamic models were proposed ?!
- Poor GPS stations cover
- Many archive data to analyze, how?

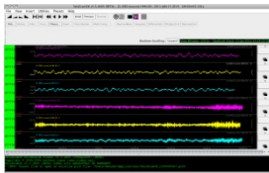


Why GOMED?

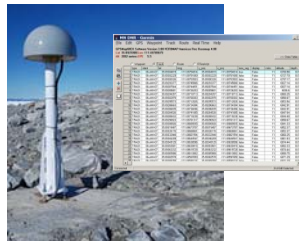


Why GOMED?

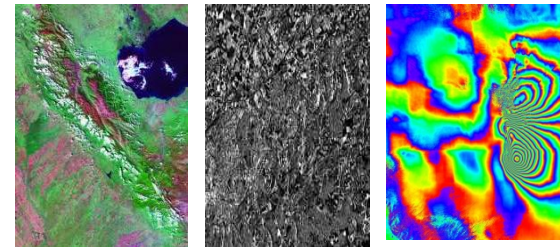
- to focalize on ground surface tectonic deformation related to the seismic activity
- Geodynamic deformation understanding \Rightarrow Early warning is the way to avoid or minimize damages and help concerned countries to evaluate the risks
- Need to combine different type of data.



Seismic data



GPS data

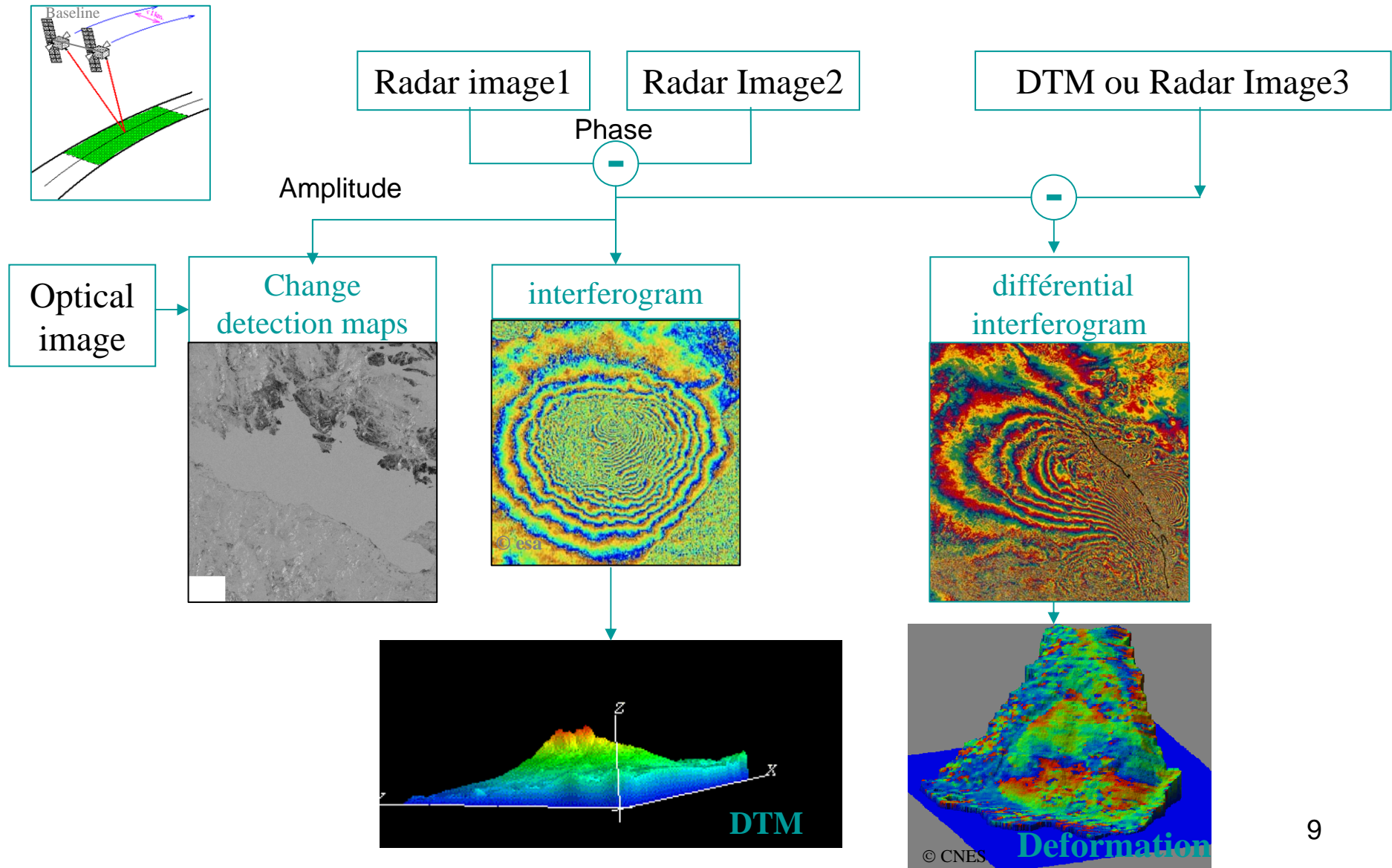


Satellite images

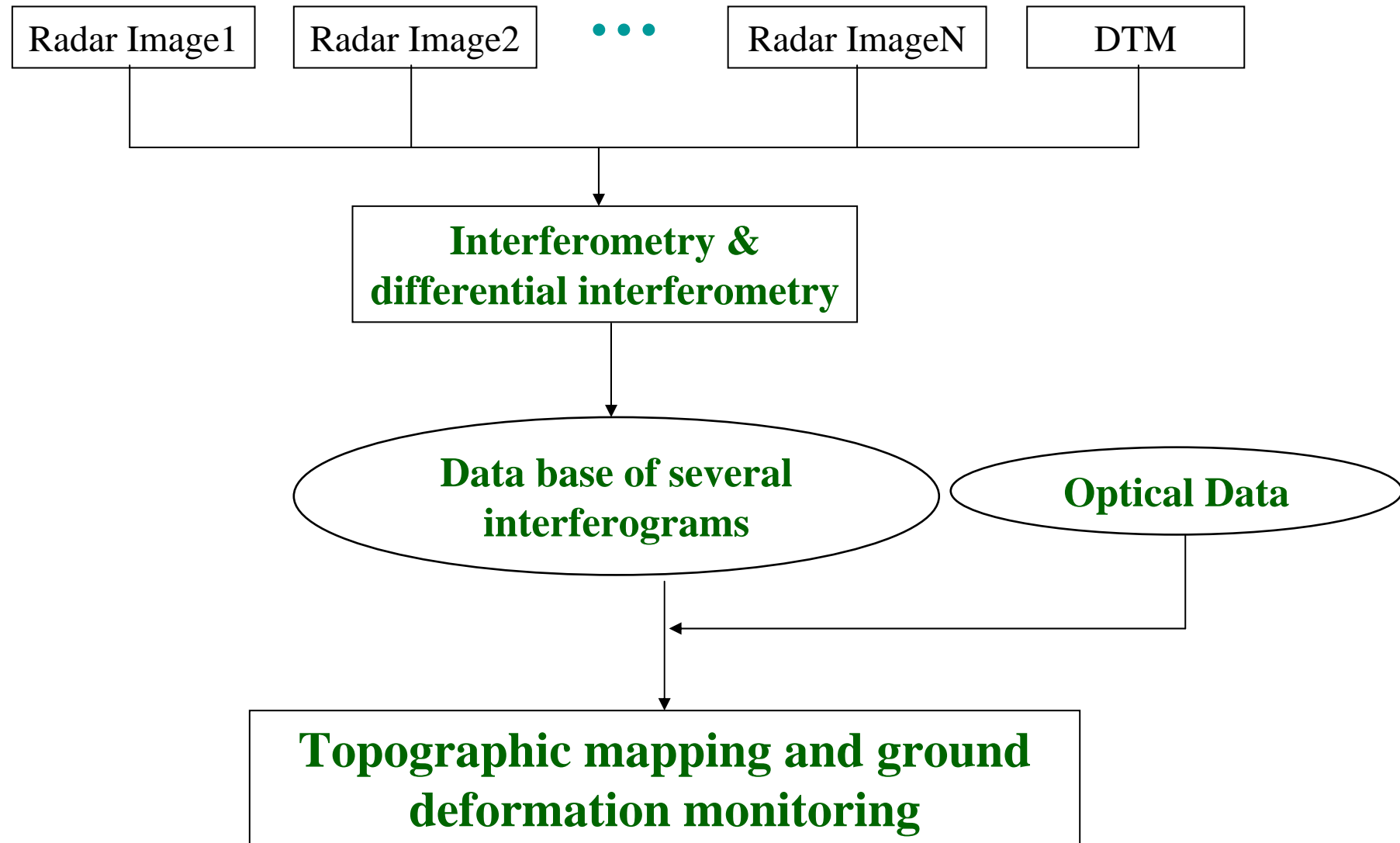
Outline

- GOMED main objectives
 - Satellite images
 - GPS processing
 - Seismic data exploitation
 - Students formation
- GOMED main steps and accomplishments
 - Satellite images: common data base and processing for all the partners.
 - GPS processing
 - Seismic data exploitation

GOMED main objectives: InSAR



GOMED main objectives: InSAR



GOMED main objectives: Satellite images

⇒ To progress the access of the space techniques for all the partners, (bilateral Collaborations already exist)

- Choice of the priority targets

- Acquisition of the images and formation of a data base

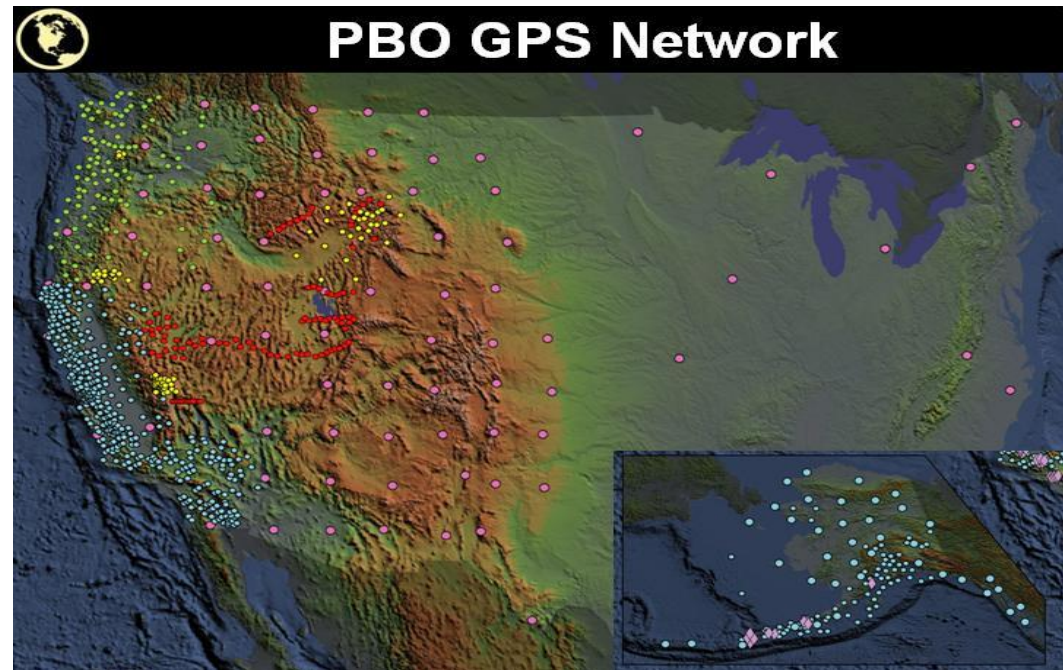
- Development of new techniques for ground deformation measurements

- Starting of geological interpretations and numerical modelling.

GOMED main objectives: GPS

GPS Networks exist in each country partner of GOMED project.

2 network types:
permanent GPS networks
and Re-measurements
GPS networks.



The permanent observations \Rightarrow covering all the studied area (North/South): estimation of motion velocity.

The Re-measurements networks \Rightarrow detect deformation related to particular tectonic structures.

GOMED main objectives: GPS

- These networks data will be shared as far as their temporal compatibilities between all the partners \Rightarrow initiate a coordination of measurements of these networks in a joint way.
- GPS network densification
 - Installation of a Wide-Band GPS network in the Pyrenees French/Spanish frontiers (ANR – resp. : S. Chevrot, participant : A. Rigo)
 - Installation of permanent GPS stations in Morroco (ANR – resp. : H. Hébert, participants : P. Briole, A. Rigo, A. Tahayt)
- Processing and monitoring of permanent GPS stations covering all the region of study.

GOMED main objectives: Seismic data

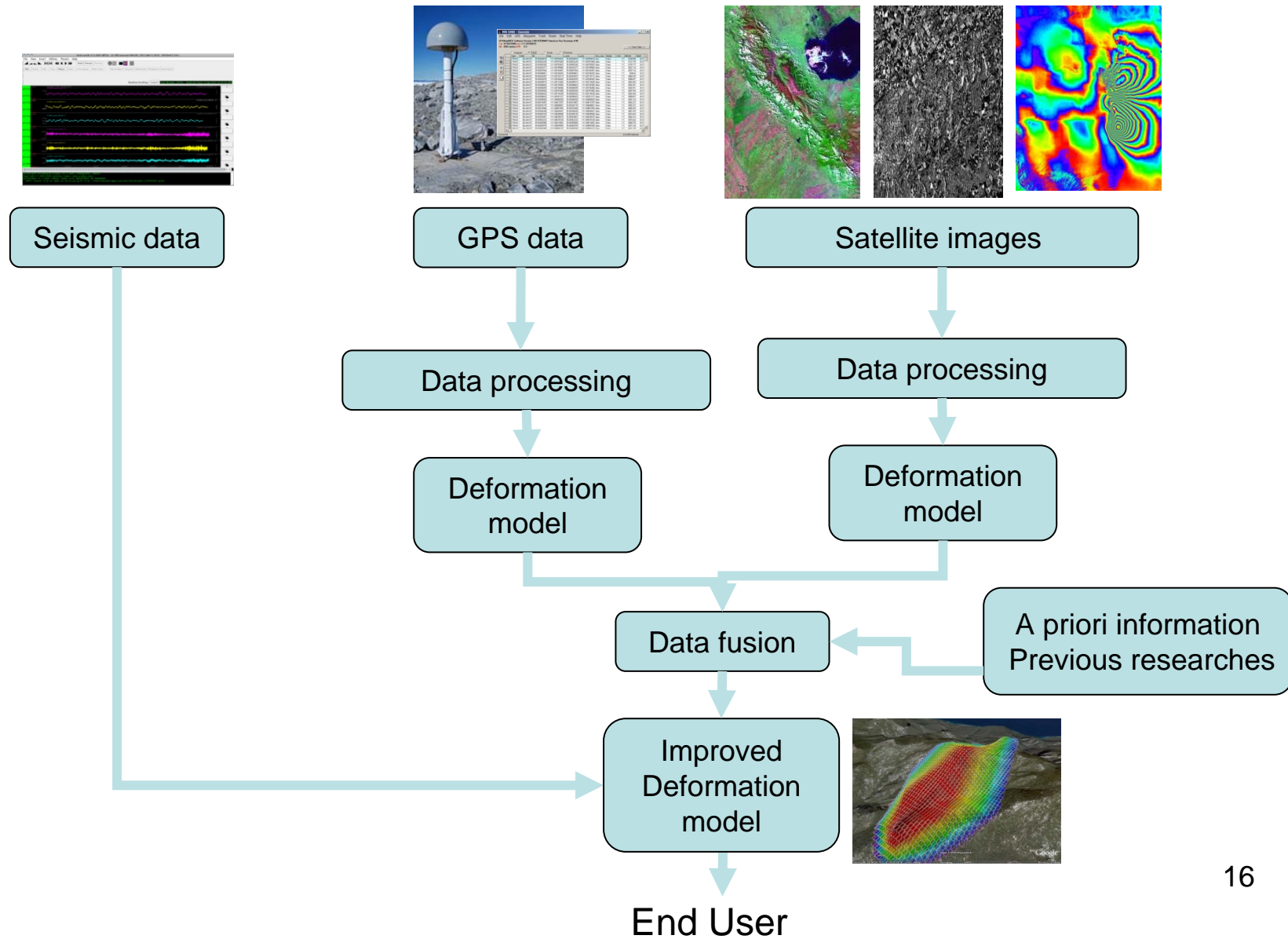
- Seismic data shared between all the partners.
- Seismic data analyzed in order to improve :
 - Precise details of locations,
 - Focal mechanisms,
 - Fault characterization,
 - The crustal structure, etc.
- In particular, with the experiments of broad-band seismology in progress on the Iberian peninsula and the south of France.
- Analyze seismicity of the zone of study according to the results obtained in geodesy.

GOMED main objectives: students formation

Exchanges of students between north and south for research and training.

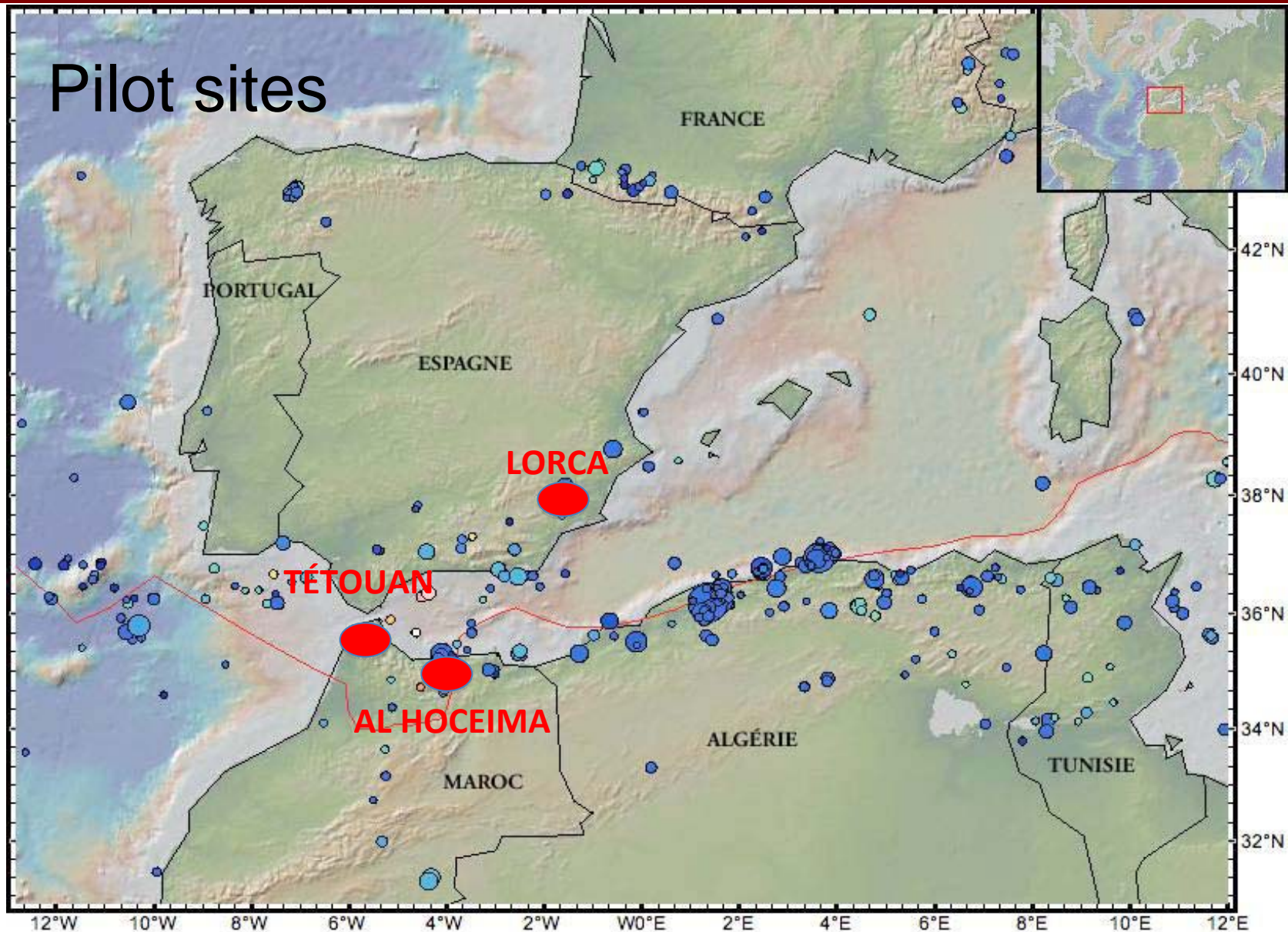
- Meetings of all the partners to summarize the activity carried out during the project
- Response to national and/or international project proposals \Rightarrow allowing the continuation of collaboration
- Participation to workshops and conferences.

GOMED main steps



GOMED first accomplishments Satellite Images

GOMED first accomplishments



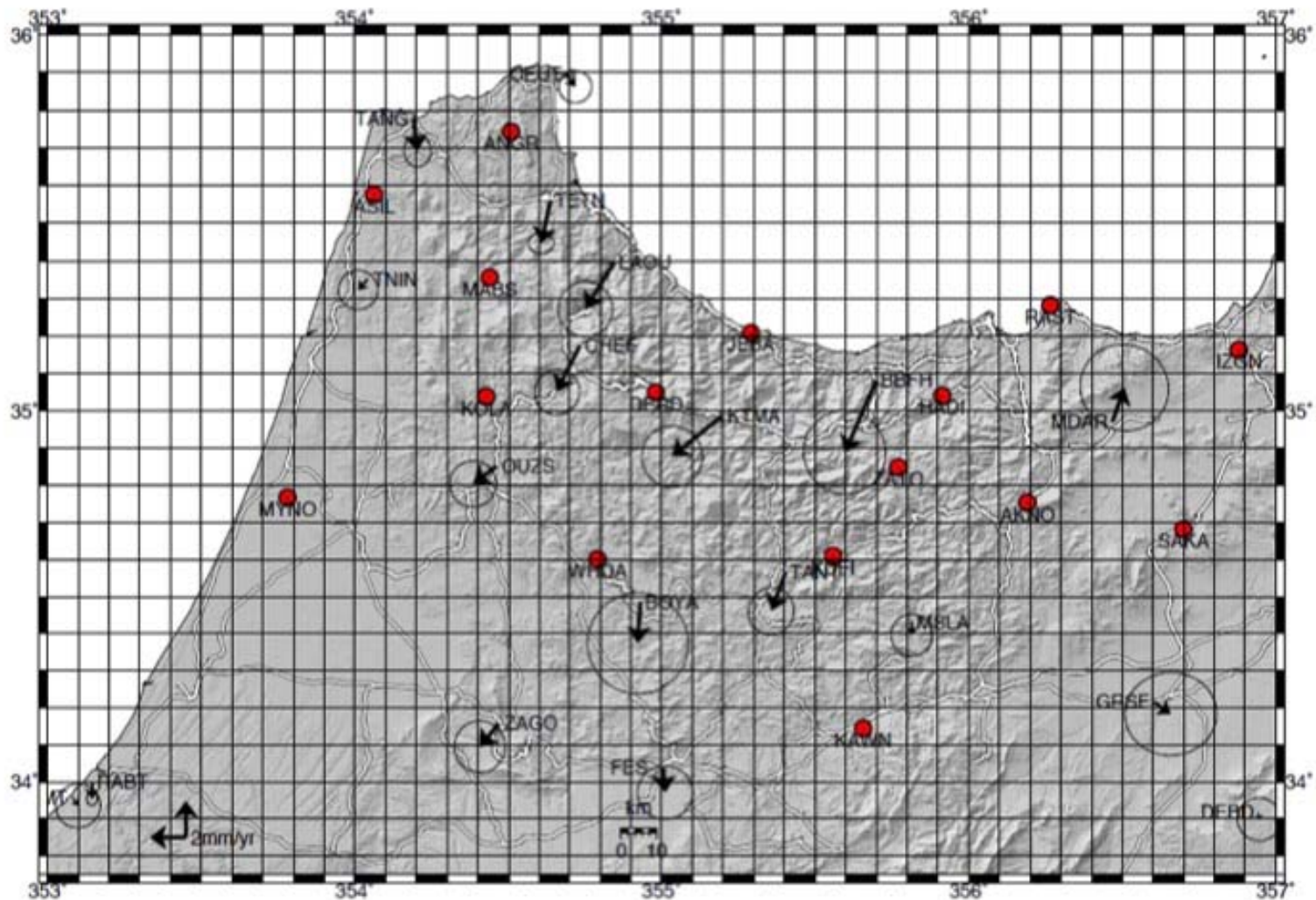
GOMED first accomplishments

- Satellite images data base : ESA Category 1 project (accepted)
- All the archive data (ERS1-2, ENVISAT): \pm 200 images for the 3 regions of study
- Exchange of interferometric Tools between partners by a virtual machine

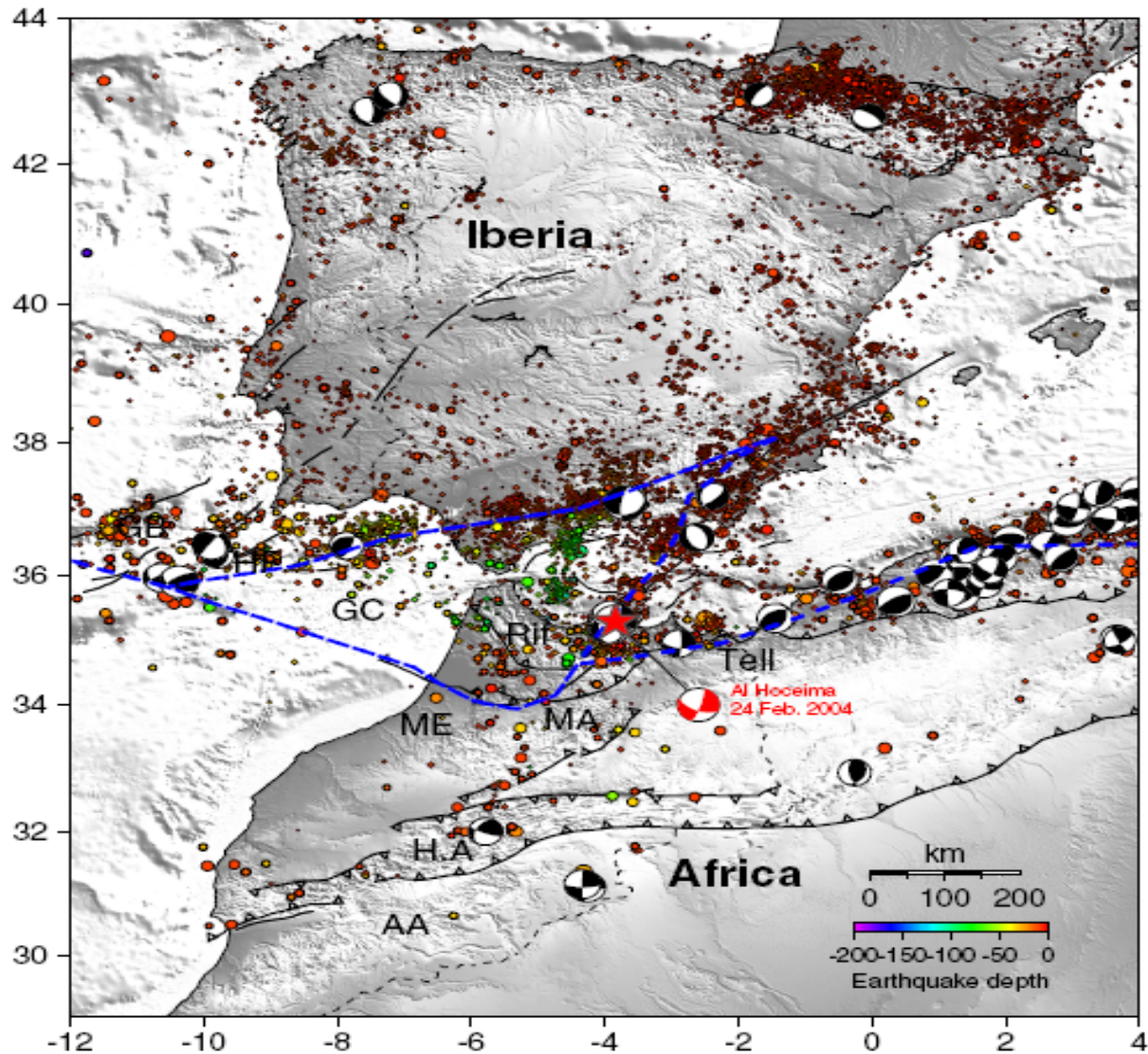
GOMED first accomplishments GPS data

GOMED first accomplishments

GPS Network densification
New GPS sites in the Rif: better resolution



GOMED : general information for the Iberia-Africa region



GOMED: New GPS constraints along Africa-Iberia boundary

Objectives

- To investigate present day deformation along the Africa-Iberia plate boundary.
- To estimate the geometry and rates of strain accumulation on Africa-Iberia plate boundary
- To determine a new velocity field across the most western part of the Africa-Iberia plate boundary,

⇒ **Rigorous GPS Modeling Combined with Kinematic block modeling**

Data

- GPS observations : 65 permanent stations, 31 survey-mode GPS sites, new continuous stations in Morocco and southern Spain.

GOMED: GPS observations

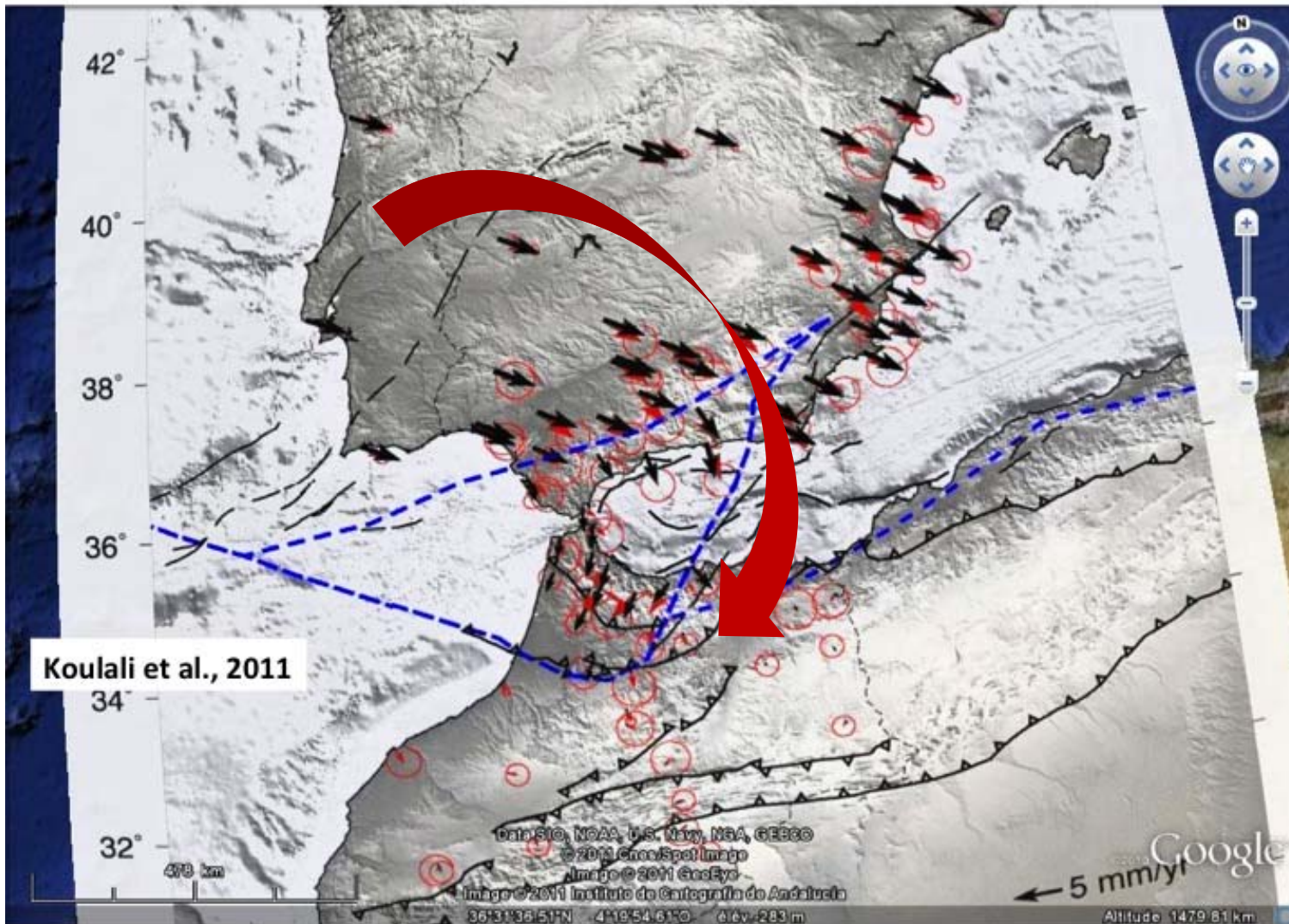
- GPS three steps approach:
 - 1st step: GPS phase observations \Rightarrow to estimate daily positions
 - 2nd step: combine daily positions with similar solutions for over 200 global GPS stations
 - third step: combine all the data in a single solution \Rightarrow estimate positions, velocities, etc.

GOMED: Block modeling

- To relate GPS velocities in the interseismic period to long period geologic deformation, we estimate block motions and strain accumulation on block bounding faults \Rightarrow **Kinematic block modeling**
- Assumption: the active lithosphere deformation zone is composed of a series of finite elastic blocks bounded by faults.
- Kinematic model: using a block model that includes rigid block rotation and elastic strain accumulation on block boundaries.

GOMED first accomplishments

GPS / Kinematic block modeling results



Conclusion and perspectives

- Western Mediterranean = scientific and educational challenge for the next 10 years
- GPS data + satellite imagery + seismic data combination \Rightarrow Geodynamic comprehension and tectonic risk evaluation
- GOMED: Satellite data acquisition and new GPS results
- Establishing a long-term Mediterranean partnership with common scientific objectives and exchanges of students and researchers

Conclusion and perspectives

- Allowing all the countries to benefit of the recent spatial imageries and processing developments
- To the future: enlarge the partnership: relations with Montpellier and Nice (France), Grenada (Spain) Universities, Algeria,...
- A few new ANR projects in preparation on Morocco, Pyrenees...

Thank you for your attention