FP7-DIGISOIL

An integrated system of data collection technologies for mapping soil properties

G.Grandjean & DIGISOIL Team

Context of EC research on Environment

> Framed by international commitments:

- **UN Framework Convention on** Climate Change, Biological Diversity, Desertification and on International Strategy for Natural Disaster Reduction**;**

- **Kyoto and Montreal protocols**

- **World Summit on** Sustainable Development, Global Earth Observation System of System **initiative (GEOSS)**

> Needs for Environmental technologies

- **Supported by the EC** Environmental Technology Action Plan (2004)

➔ joint initiative between DG ENV / DG RTD to develop European capacities for innovative data acquisition systems that could serve future research activities

Introducing DIGISOIL

> ## The Environmental call

- FP7-ENV-2007-1 work-programme
- Area 6.3.1.2 Soil
- Call: "Development and improvement of technologies for data collection in (digital) soil mapping "
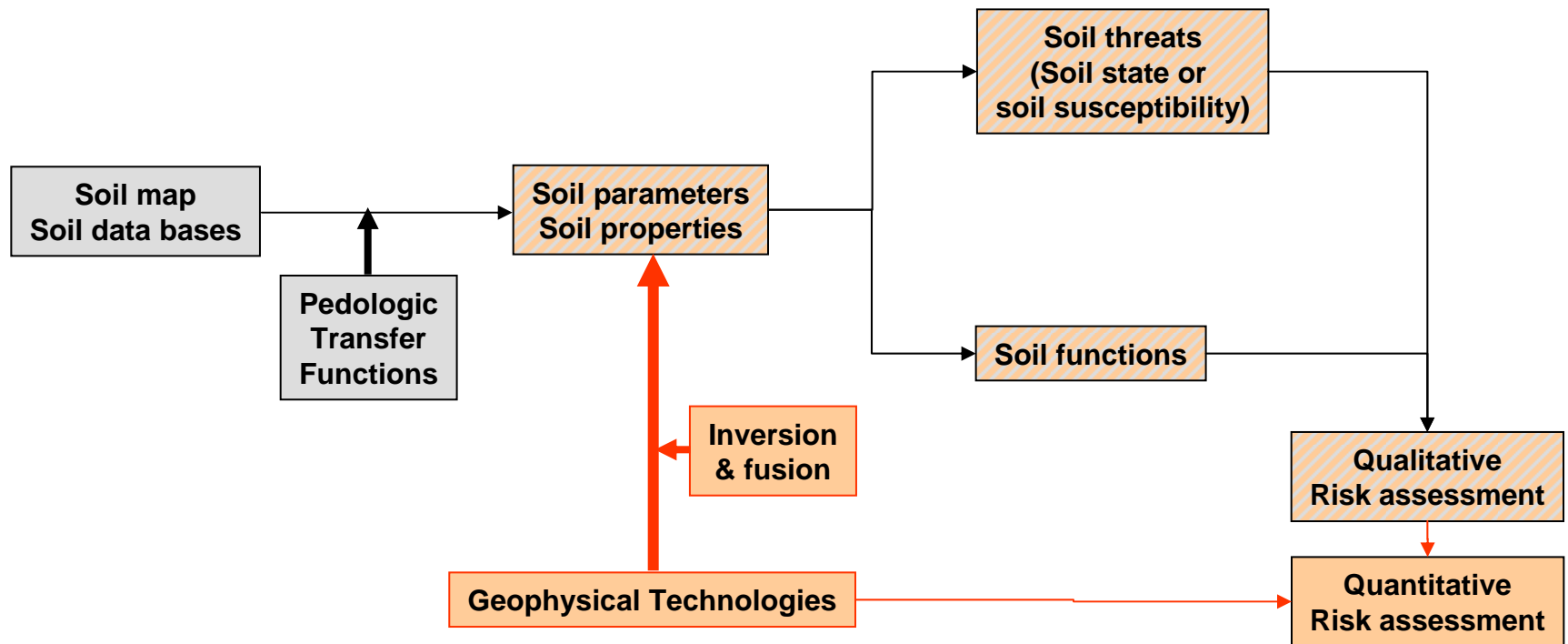- Duration: 36 months

> ## The DIGISOIL Project

- Based on new technologies for *in situ* soil data collection
- Budget: 4.4M€ (3.4M€ funded)
- Starting date: June 2008
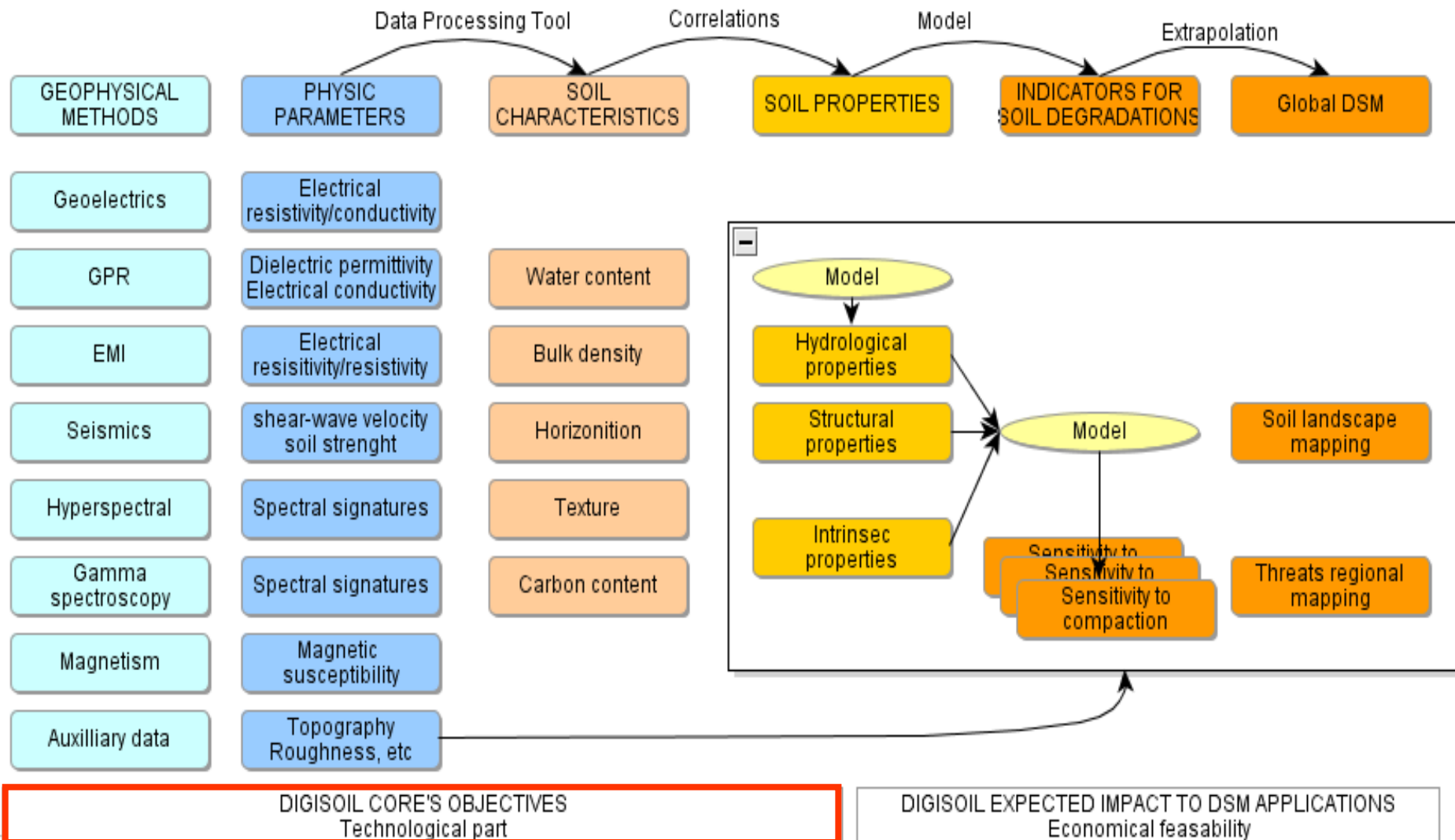- 10 scientific partners (universities, research centers, SMEs)

DIGISOIL strategy
Improvement of the classical DSM approach

DIGISOIL's Concept: from Geophysical methods to soil properties

DIGISOIL's thematic context: from soil threats to soil parameters

SOIL THREATS				
Soil erosion	**OM decline**	**Compaction**	**Salinisation**	**Landslide**
SOIL PROPERTIES				
Soil texture	Soil texture/clay content	Soil texture	Soil texture	
Soil density		Soil density		
Soil hydraulic properties		Soil hydraulic properties	Soil hydraulic properties	
	Soil organic Carbon	Soil organic matter		
SOIL-RELATED PARAMETERS				
Topography	Topography	Topography		Topography
Land cover	Land cover	Land cover		Land cover
Land use	Land use	Land use	Irrigation areas	Land use
Climate	Climate	Climate	Climate	Climate
Hydrological conditions				
Agro-ecological zone				
				Occurrence/density of existing landslides
			Groundwater information	
				Bedrock
				Seismic risk

DIGISOIL's technological state of the art

> Established technologies:

- electrical resistivity tomography
- GPR/Electromagnetic induction
- Hyperspectral / Spectrometry

> Innovative technologies:

- Seismics
- Magnetics

> Rejected technologies:

- Airborne thermic
- Gravity
- Airborne gammametry

| Geophysical methods	Physical parameters
Ground-penetrating radar (GPR):	Dielectric permittivity, electric conductivity, magnetic permeability, frequency dependence of these electromagnetic properties
Seismic reflection and refraction:	Volume and shear-wave velocities
Electromagnetic induction (EMI):	Electrical resistivity (electric conductivity and frequency dependence)
Electrical resistivity (geoelectric):	Electrical resistivity (almost zero-frequency)
Gravity:	*Density*
Magnetics:	Magnetic susceptibility and viscosity
Airborne thermic:	*Surface temperature*
Airborne hyperspectral:	Spectral reflectance
Gammametry:	*Gamma spectrum (U, K, Th)*

DIGISOIL's objectives

> **To develop, test and validate** the most relevant geophysical technologies for mapping soil properties (geoelectric, seismic, GPR/EMI, magnetic and airborne hyperspectral);

> **To establish correlations** between the measured geophysical measurements and the soil properties involved in soil functions / threats (erosion, compaction, organic matter decline, salinisation and shallow landslides) **by using innovative data processing and correlation protocols;**

> **To evaluate the societal impact** of the developed techniques by investigating their relevance relative to the end-user needs, the technical feasibility and the cost effectiveness;

> **To produce an exploitation plan** including the standardization of the processes and the technical specifications of the developed methodologies describing the system components in terms of equipment (sensors, acquisition system, mobile vector), **techniques** (signal processing, inversion or fusion processes, specialization) **and operational protocols.**

Test sites

> **Sites for developments**
> **Sites for validation**
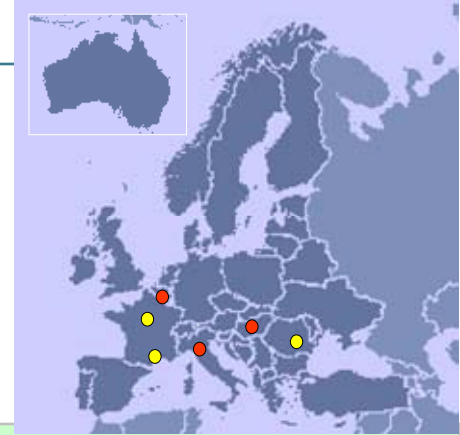
| Localization *Site coordinator*	Soil properties	Tested techniques	Site characteristics
Beauce-FR *INRA*	C content Bulk density Hydro. Prop.	Geoelectric Seismic Magnetism	Center France: atlantic area Intensive agriculture Existing database of soil properties
Roujan-FR *INRA*	Soil depth	Geolectric	Southern France: mediterranean area Traditional agriculture Soil depths & erosion measurements maps & models available
Telega-RO *GIR*	Soil mechanics	Seismic	Southern Carpaths: alpine area Peri-alpine context Forest and grassland
Luxembourg *UCL*	C content Bulk density Hydro. Prop. Soil depth	Hyperspectral Magnetism Geoelectric/EM Seismic GPR	Southern Belgium/Luxembourg: atlantic area Intensive agriculture Airborne & field data available
Chianti-IT *UNIFI*	C content Soil depth	Hyperspectral Seismic GPR/EM	Centre Italy: mediterranean area Traditional agriculture Soil database availlable (OM, erosion model)
Zala-HU *UPA*	Bulk density Soil depth	Geoelectric GPR	Western Hungary: continental area Intensive & traditional agriculture

Exemple of applications: ERT > %W monitoring

> **Objective: monitor the water saturation in time for spatially characterize the soil capacity to store water**

Oct. 2005   Apr. 2006   Jun. 2006
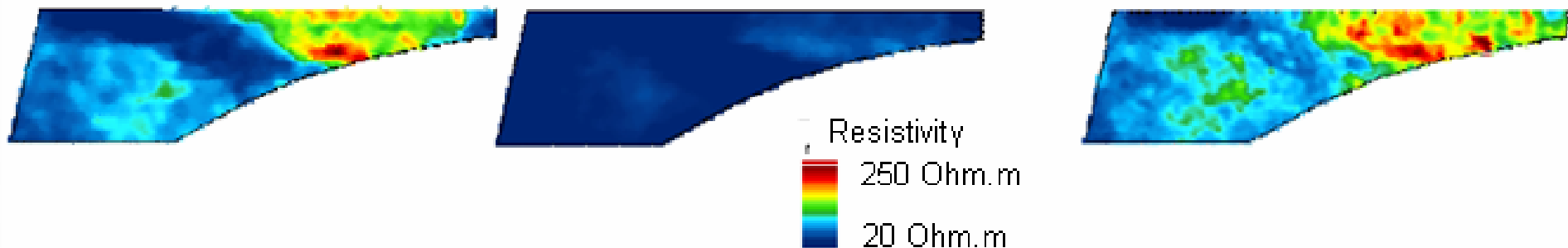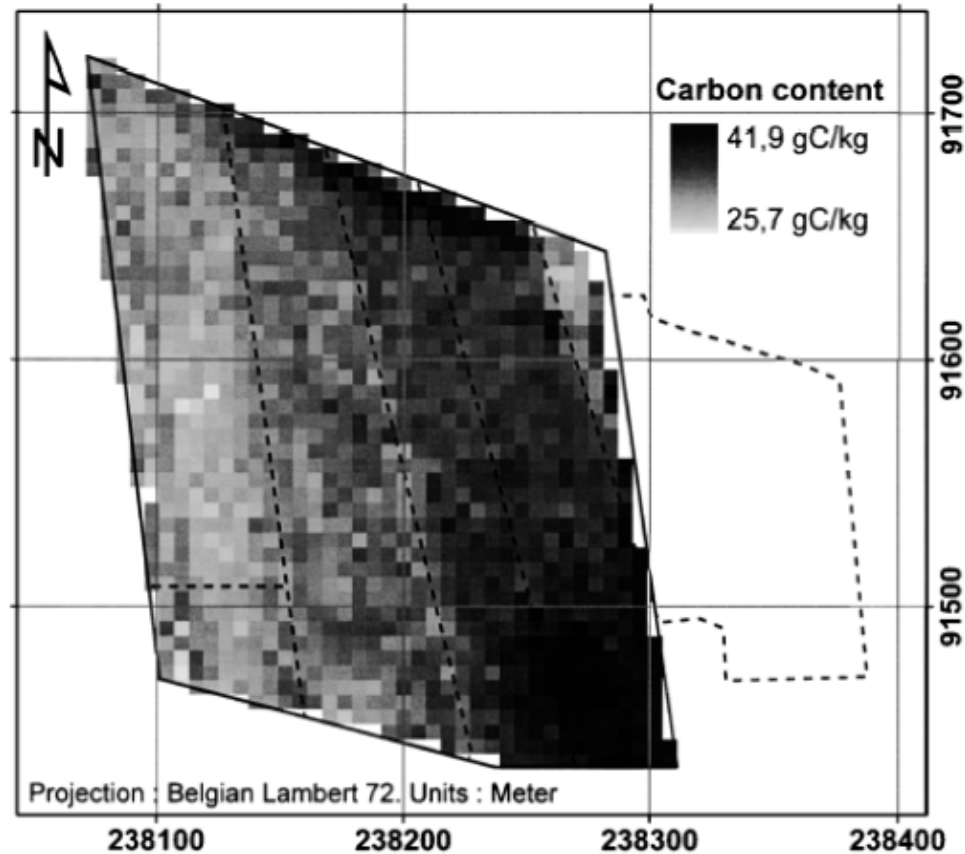
Resistivity
250 Ohm.m
20 Ohm.m

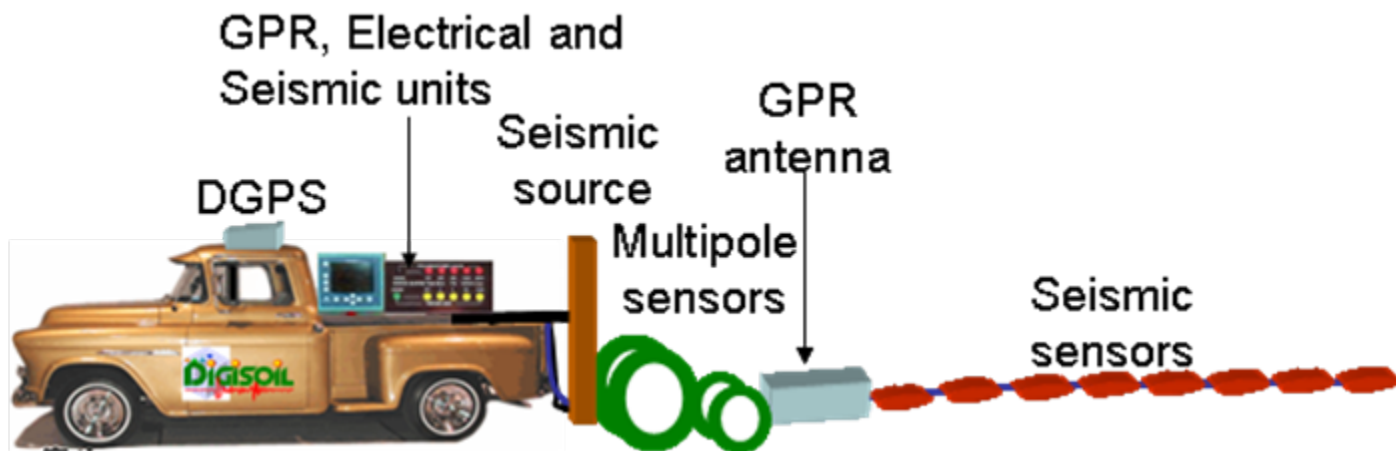> **Objectives: to analyze relationship between Hs image and OMC**

Example of application: S-wave velocity > compaction

> **Objectives: to image the soil stiffness to identify the bedrock / compacted layers**
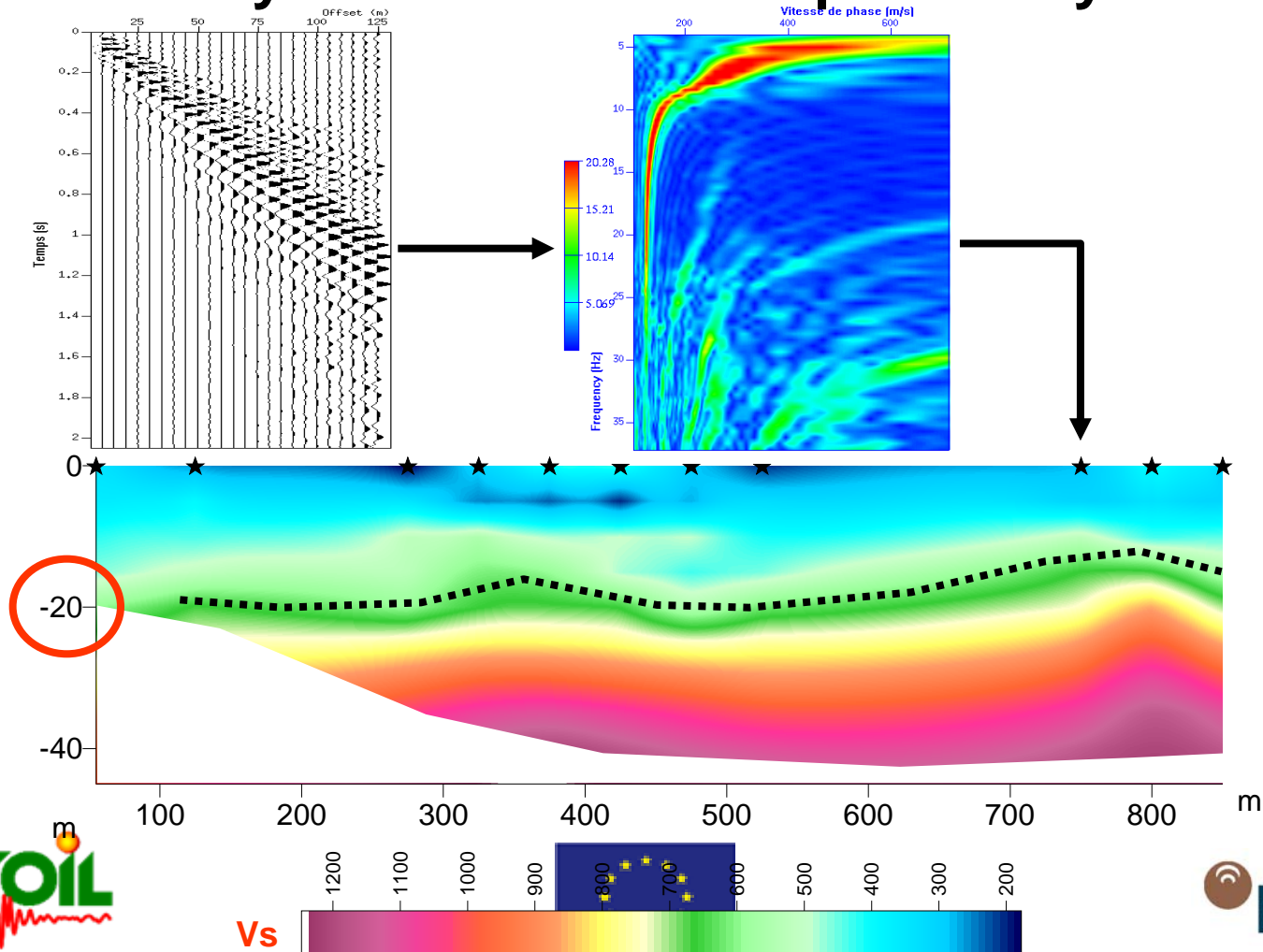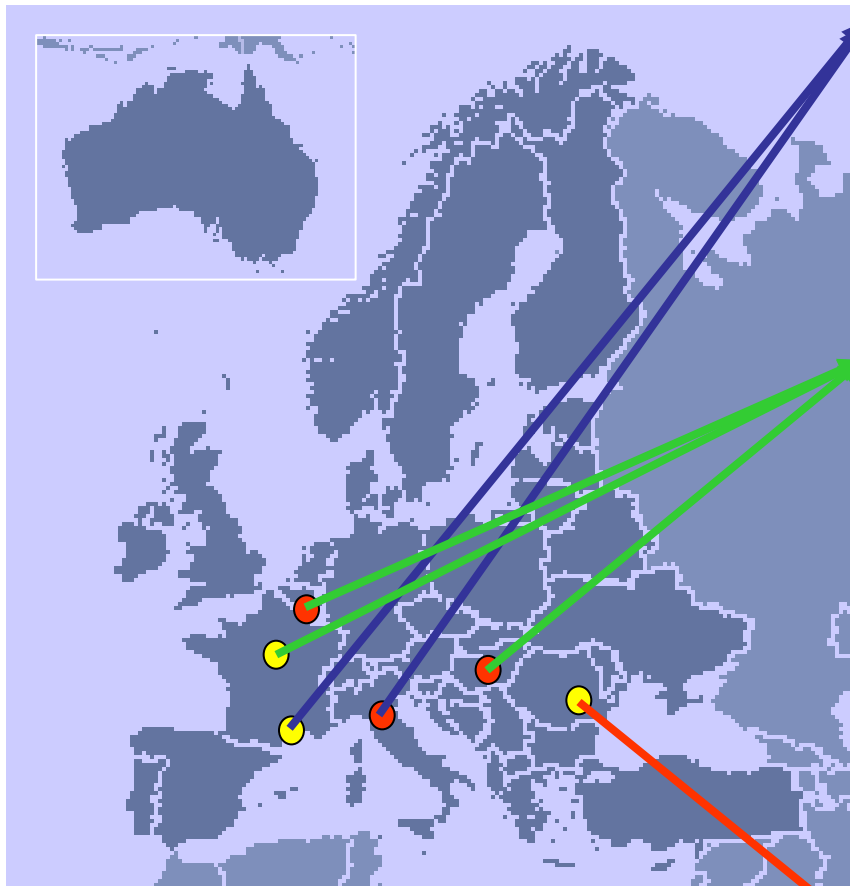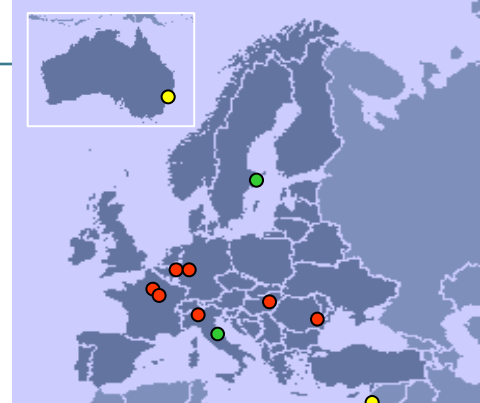
The integrated system

> **The main deliverable: an integrated system for soil properties mapping in a quasi-continuous mode**

GPR, Electrical and Seismic units

DGPS

Seismic source

GPR antenna

Multipole sensors

Seismic sensors

Sites to be studied

EROSION

C DECLINE / COMPACTION

SHALOW LANDSLIDES

DIGISOIL

The partnership

BRGM, *Orléans, France*

INRA, *Orléans/Montpellier, France*

Université catholique de Louvain, *Louvain-la-Neuve, Belgium*

Forschungszentrum Jülich GmbH, *Jülich, Germany*

JRC, *Ispra, Italy*

GIR, *Buccarest, Romania*

University of Pannonia, *Pannonia, Hungary*

ABEM, *Sundbyberg, Sweden*

Gallileo Avionica, *Firenze, Italy*

University of Firenze, *Firenze, Italy*

University of Sidney, *Sydney, Australia*

University of Tel Aviv, *Tel Aviv, Israel*

Steering Comittee

Important dates

> ## Project's schedule

- Starting date: june 2008
- First results june 2009 (technologies development)

> ## Project synergies

- Digisoil will interact with the iSoil project successful as well in the same call

> ## Next Scientific events

- EGU'09
- CONSOIL'10

Thank you for your attention