TEST SITE IRPINIA: WORKPACKAGE 3.4

High Frequency GPS: a potential contribution for monitoring a active faults

Main goals of the project:

1) A first dense local CGPS network acquiring at 1Hz in Italy for GPS seismology studies on a single active fault.

2) Processing of HRGPS data using a geodetic-quality software

3) Development of a procedure for quick detection of co-seismic mean displacement after the earthquake

State of the art

- Larson et al. (2003) showed that high-rate GPS (HRGPS, 1 Hz or greater) can resolve displacement changes that vary on time scales of seconds.

- Ge et al. (2000) described in situ experiments and comparative studies indicating that HRGPS can resolve large displacements in a short-baseline environment.

- More recently, Elosegui et al. (2006), Wang et al. (2007) & Emore et al. (2007) have shown good agreement between seismic and 1-Hz HRGPS measurements.

- Larson et al. (2003) and Bock et al. (2004) used 1-Hz GPS to observe large ground motions over continental scales in the case of the Denali earthquake.

- Following the Denali event, HRGPS data began to be used in seismic rupture studies (Ji et al., 2004, Miyazaki et al., 2004, Langbein et al., 2005) for earthquakes ranging in magnitude from M6 to 8.

- Blewitt et al. (2006) showed, for the case of Sumatra Mw=9.2-9.3 event, that the earthquake's true size and tsunami potential could have been determined by using GPS data to only 15 minutes after the earthquake initiation

- High-rate GPS data represent also an important contribution to volcanic monitoring purposes, such as for the case of Mt.Etna (Mattia et al., 2004).

Data and data processing

RETE INTEGRATA NAZIONALE GPS
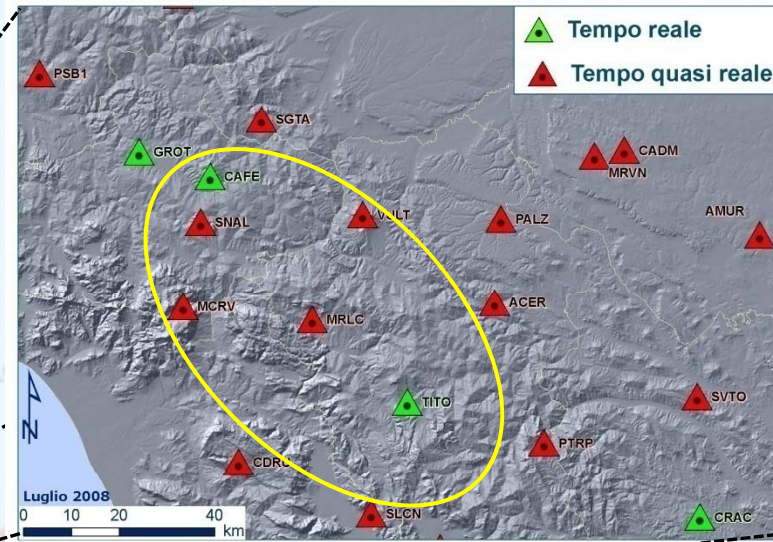
Present:
- Data are acquired at 30s and are transmitted in quasi-real time by satellite telemetry.
- Data processing provides daily solutions for active tectonics studies

Future DPC-S5 products:
- Data will be acquired at 1Hz and transmitted in real time by GPRS/UMTS (already done for CAFE) and/or by WiFi technologies.
- Data processing will provide epoch by epoch solutions for alert systems with respect to other farer CGPS stations

Methodology

Blewitt et al. (2006):

Mean displacement detection after post-processing of some IGS GPS sites, available at 30s, in a 20min time window including the Sumatra earthquake.
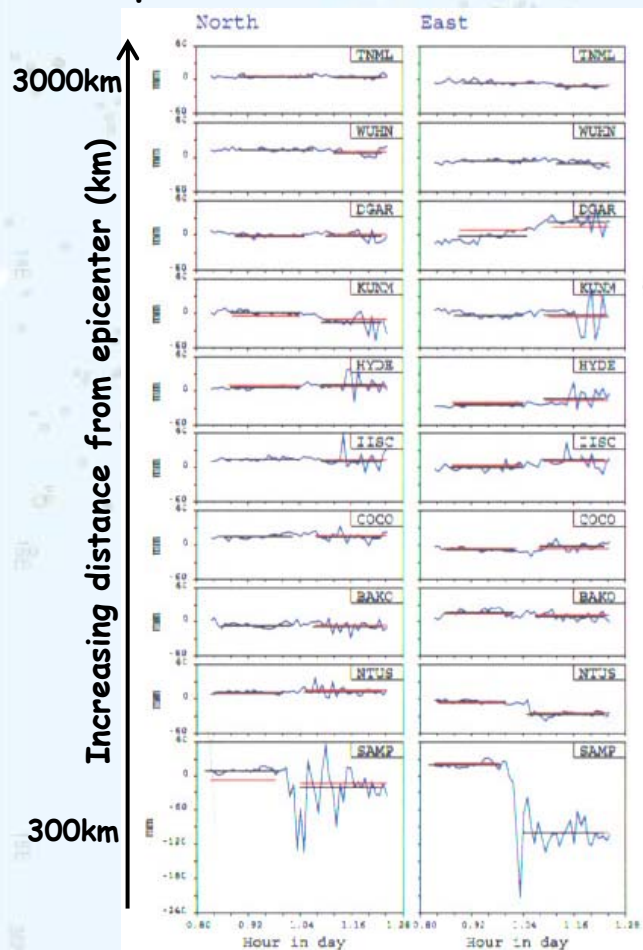
This study:

Implement the Blewitt et al. (2006) method as an operational real-time system (for ex., using moving time windows) for quasi-real time mean displacement detection at the Irpinia area CGPS sites (acquiring at 1Hz).

The possible occurrence of significative displacements will provide rapid model of the earthquake and quick estimation of the related magnitudes

By modeling several earthquakes with different magnitudes values, some scenarios will be investigated to determine the potential and the capability for such a local dense GPS network to detect low to moderate earthquakes waveforms.

Planned activities for the 1st year...

High-rate GPS acquisition:

- Acquisition at 1Hz sampling interval for the RING sites in the Iprinia area

- Data transmission by means of UMTS technology for the RING sites in the Irpinia area

- Siting and densification of the CGPS 1Hz network in the Irpinia area (for ex. co-location in the ISNET sites with WIFI transmission)

High-rate GPS processing:

- Epoch by epoch processing of HRGPS data by using a geodetic-quality software (Gipsy/Oasis v.5)

...After the 1st year

Development of the alert system procedure & scenarios analysis