Task 3: Test site Irpinia

An advanced, real-time, seismic monitoring infrastructure for the
detailed imaging and characterization of a complex normal fault system
in the southern Apennines

WP3.3: Reflection seismology applied to micro-earthquake data

Nils Maercklin

*RISSC, Universitá degli Studi di Napoli Federico II, Napoli, Italy*

WP3.3 Reflection seismology – Objectives

Image of seismic velocities and discontinuities (e.g. basement, faults) within the crust beneath the Irpinia region using local micro-earthquake data.

Development of a seismic reflection processing scheme for (multi-component) local earthquake data, including mode-converted waves.

Final product is a 3-D structural model, developed in cooperation with WP3.2.
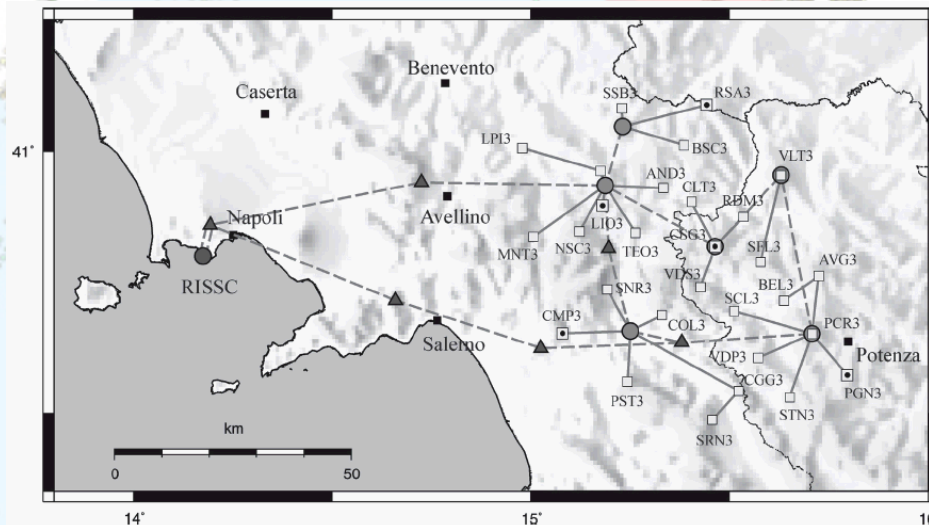
ISNet seismic network
(Weber et al., 2007, SRL)

WP3.3 Reflection seismology – Methods

Development of a seismic velocity model from first arrivals (WP3.2).

Standard seismic reflection processing (filtering, amplitude equalization, etc.).

Seismic depth migration of reflection events using a Kirchhoff-style approach, similar to studies in California (Chávez-Pérez & Louie, 1998, TP) and of the 2002 Molise aftershock sequence (Latorre et al., 2008, GP).

Application of beamforming techniques to spatially clustered earthquakes to image steeply-dipping reflectors (faults, see e.g. Rietbrock & Scherbaum, 1998, GJI, and Maercklin et al., 2004, GJI).

Identification and picking of reflection/conversion events for reflection tomography, possibly guided by synthetic modelling.

WP3.3 Reflection seismology – Data

Currently more than 400 well-located local earthquakes recorded at ISNet and some INGV stations (M_w < 3) in the years 2006–2008.
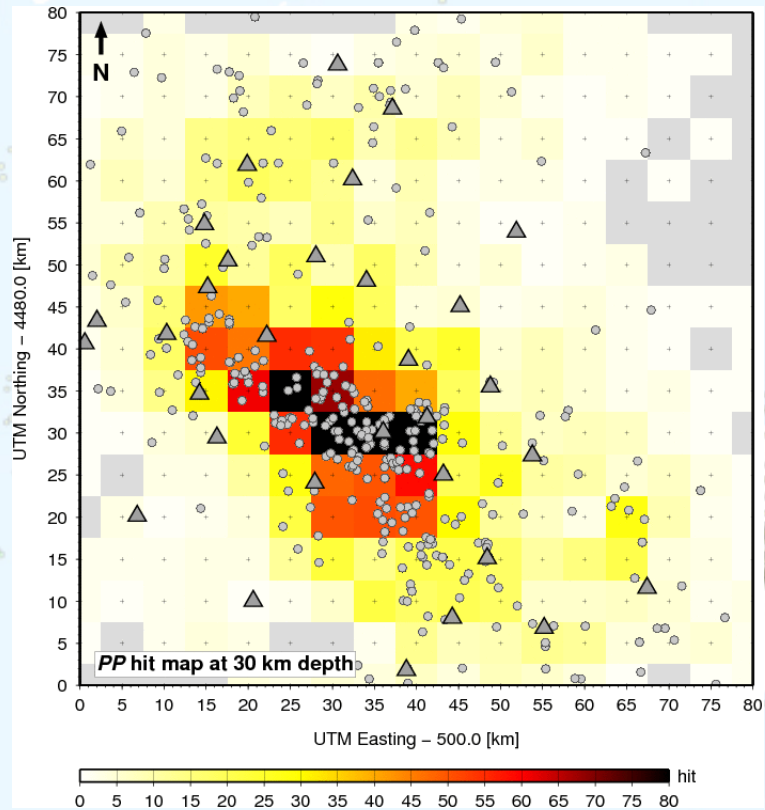
PP and SS reflection point coverage for a hypothetical reflector at 30 km depth (events 2006–2007)
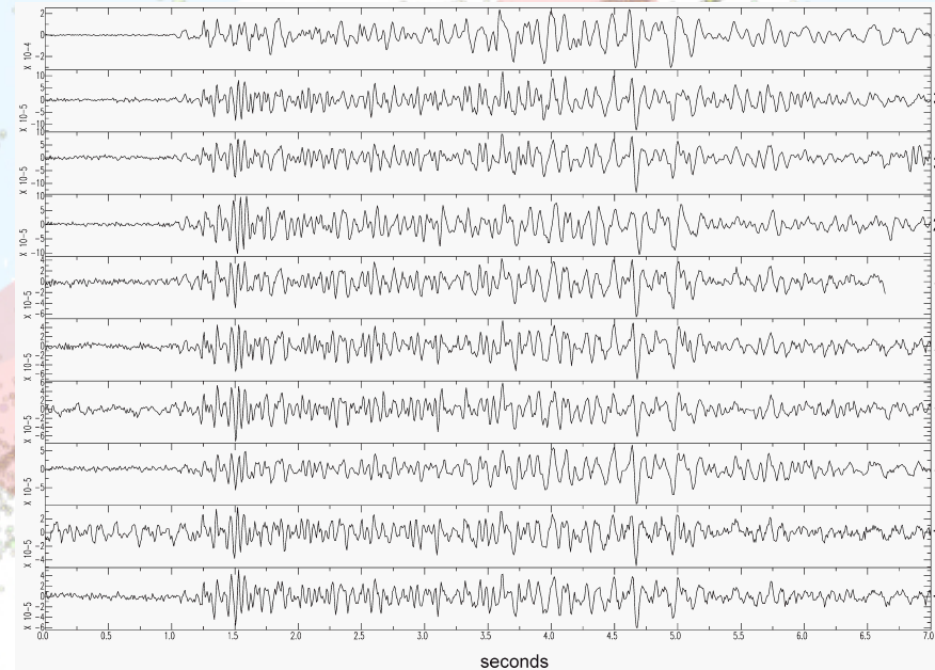
N-component seismograms of an earthquake sequence recorded at station VDS3 (Weber et al., 2007, SRL)

WP3.3 Reflection seismology – First-year activity

Definition of a smooth reference velocity model for migration/beamforming, event relocation, and static corrections (related to WP3.2).

Software development (modifications of already available codes).

Data gathering and processing: bandpass filtering, amplitude normalization, polarity equalization or signal deconvolution, move-out analyses for phase identification, test of multi-component processing.

Identification and collection of event clusters (similar waveforms) suitable for source-array beamforming techniques.

Initial migration and beamforming for reflected/scattered arrivals, including energy-focusing analyses.