

INTEGRATED SEED DATA ARCHIVE FOR TEMPORARY SEISMIC EXPERIMENTS

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ABSTRACT

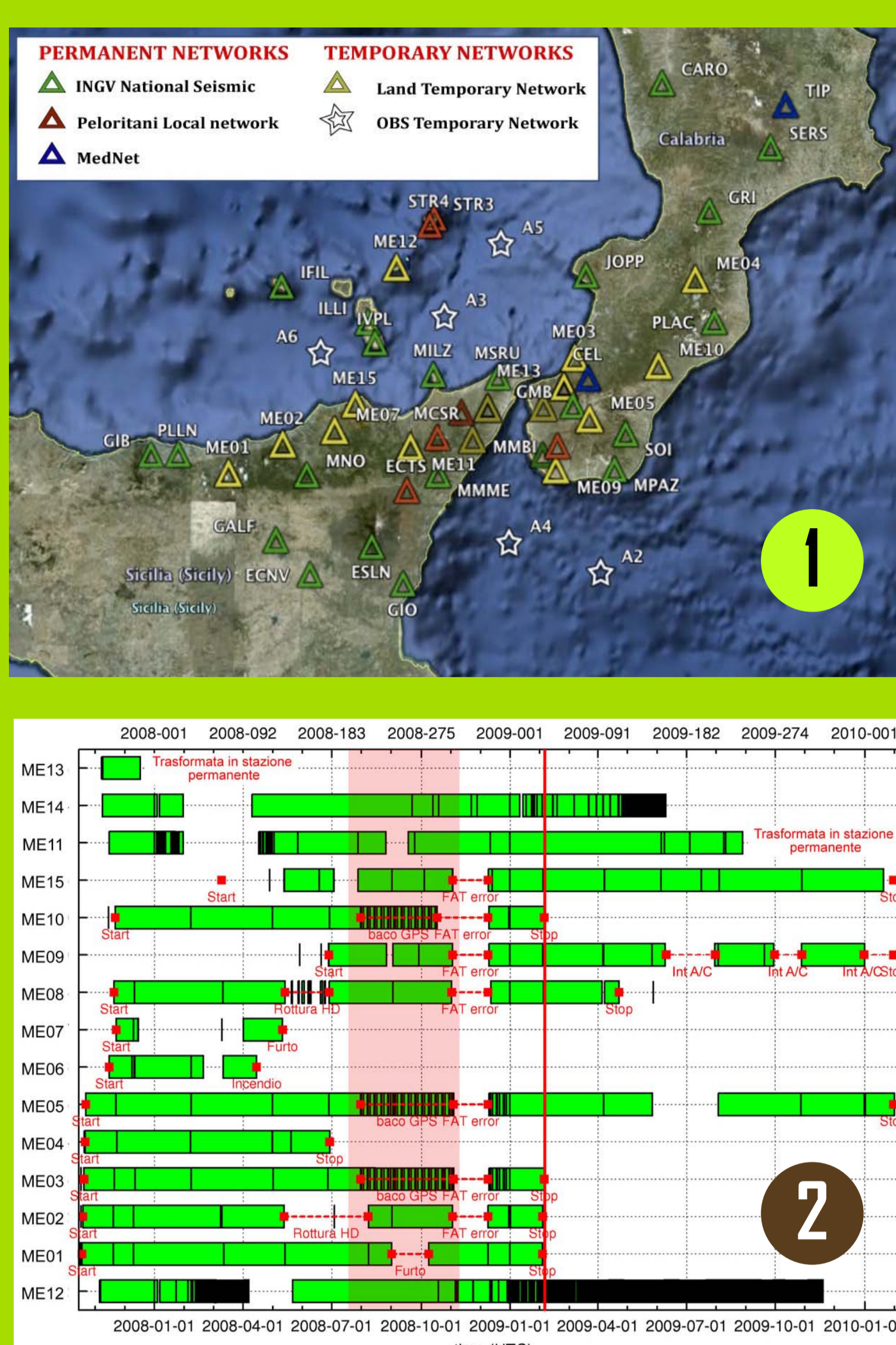
One of the most valuable results achieved during the work on S5 project is the implementation of a new temporary network data management that allows the integration in the National Data Center together with all other seismological data produced by INGV. This makes all data gathered during temporary experiments immediately available from the same source and in the same data format (SEED) increasing the availability for processing and analysis. Moreover the data are distributed to the scientific community using the EIDA (European Integrated Data Archive) (http://eida.rm.ingv.it/). The first application has been carried out for the Messina 1908-2008 experiment (WP2.2) http://dpc-s5.rm.ingv.it/en/Database-MessinaFault.html where has been achieved the complete integration of permanent networks (INGV-CNT and INGV-MedNet and Peloritani Local Network), temporary deployments (INGV-CNT and INGV-CT mobile networks) and OBS data. All the procedures were used and further improved during the L'Aquila sequence (Task 4) where data was available from the field giving to the scientific community the opportunity to study the evolution of the seismic sequence with higher density of stations (WP4.2) (http://dpc-s5.rm.ingv.it/en/Database-AquilaFaultSystem.html).

TASK 2: TEST SITE "MESSINA STRAIT"

The main goal of the Task 2 is the creation of a waveform archive that will collect in a uniform format, in a SEED (Standard for the Exchange of Earthquake Data - IRIS), the continuous recordings of all the available seismic stations present the Calabro - Peloritana area across the Messina Strait affected by the 1908 earthquake.

A passive seismic experiment, "Messina 1908-2008 Experiment", was carried in the area across the Messina Strait to integrate the national network (Margheriti et al., 2008; Moretti et al., 2008; 2010). In Figure 1 is shown the seismic networks operating during the experiment. In addition, during the summer of 2008, the ocean bottom seismometers (OBS) were deployed to better monitor the area largely covered by the sea (D'Anna et al., 2008; 2009).

It will be the first example of complete integration of permanent networks (National Seismic Network; Peloritani Local network), temporary deployments (both mobile network from INGV CNT and INGV CT) and OBS data, that hopefully will become a standard for INGV seismic experiment.



EXPERIMENT

Period: October 18, 2007 - January 31, 2010

Station: 15 temporary seismic stations (yellow triangles in Figure 1) and 5 OBS (white stars in Figure 1).

Data: In Figure 2 are shown the "Start", the "Stop" and all data gaps:
 - "FAT error" caused by a wrong CF formatting;
 - "rottura HD" caused by an Hard Disk failure;
 - "baco GPS" caused by a bug in some GPS units firmware;
 - "Int. A/C" caused by the switch off of the mains;
 - "Furto" the station was stolen;
 - "Incendio" the station was destroyed by a large fire.

The light red box indicates the period of deposition of the OBS (July 15 - November 8, 2008).

The red line shows the date of the reduction of the RSM station number (February 2009).

TASK 4: TEST SITE "L'AQUILA FAULT SYSTEM"

On April 6th 2009 (1:32 UTC, 3:32 local time) a Mw6.3 earthquake struck central Italy, devastating the L'Aquila town and surrounding villages of the Abruzzo region, causing 300 deaths and leaving sixty thousand homeless.

A few hours after the mainshock, the staff of the Re.Mo. have installed in the epicentral area, a temporary seismic network consisting of 8 seismic stations stand alone. In the days after the network was completed by adding 14 more stations.

The LGIT Institute from Grenoble has installed additional 20 stations (http://www.fosfore.igpp.fr/en/).

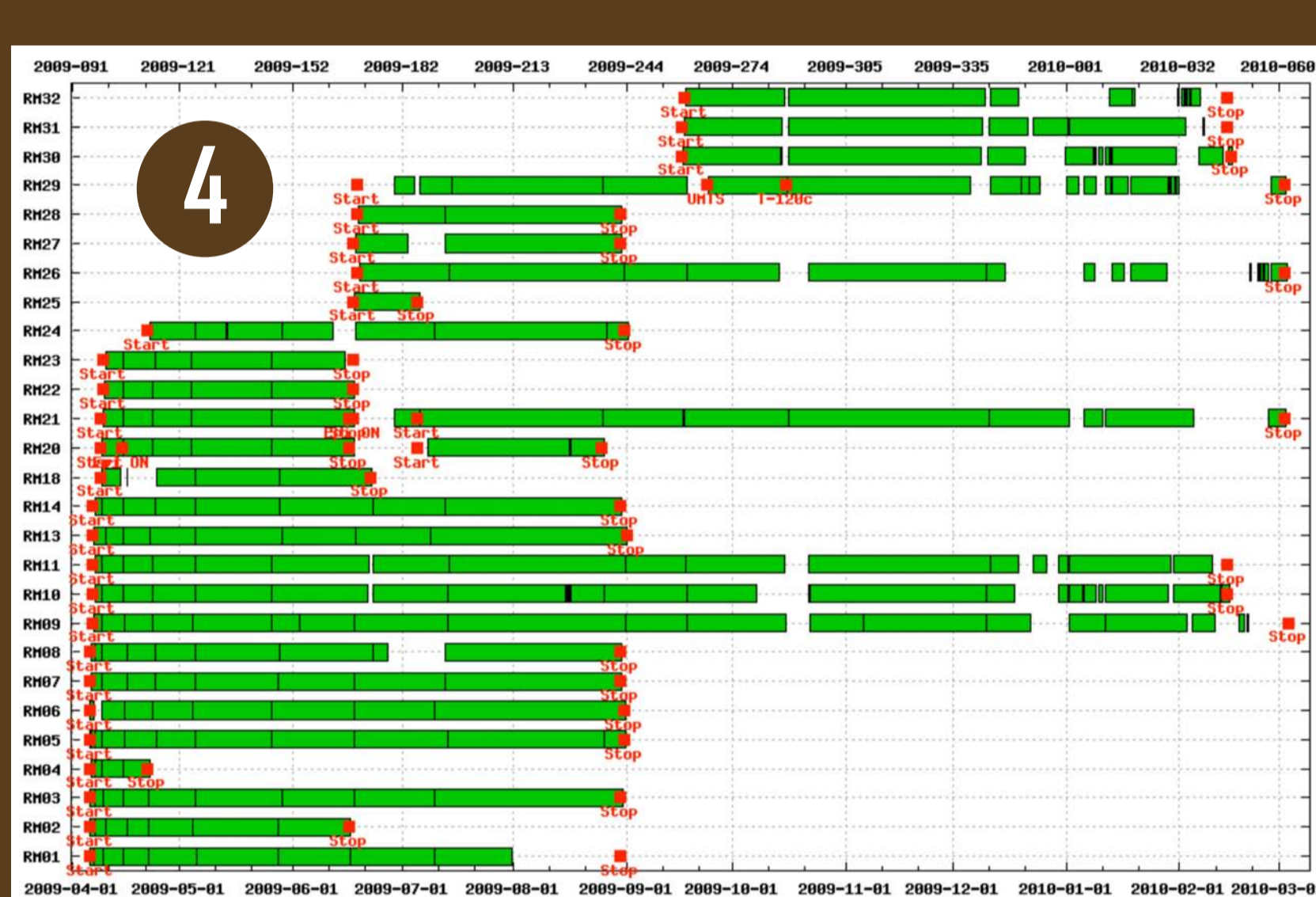
Purpose of the Re.Mo.: getting a better and more detailed location of low magnitude seismic activity and provide near real-time information on all the space-time evolution of the earthquake in progress.

The network has undergone changes to better follow the evolution of seismic activity.

STRUMENTATION

N	Datalogger	Sensors
25	REF TEK 130	LE-30lite and Episensor FBA ES-T
2	REF TEK 130	LE-30lite
3	TAURUS	LE-30/20s

RM29 station from September has been setup in real time telemetry with a UMTS router and from October the sensor was changed with a Trillium I2Qs sensor.



EMERGENCY

Period: April 06, 2009 - March 23, 2010

Station: 27 temporary seismic stations (yellow triangles in Figure 3).

Data: In Figure 4 are shown the "Start", the "Stop" and all data gaps.

Timing of the operation and evolution of the network:

- from April 06, 2009 to June 20 | 22 stations
 - April 06: 8 stations (RM01-RM08) installed between 06:30 and 14:30 (local time);
 - April 07: 6 stations (RM09-RM14) installed within the 16:30 (local time);
 - April 08: 1 station (RM16);
 - April 09: 4 stations (RM15, RM18, RM20, RM21);
 - April 10: 2 stations (RM22, RM23).
- from June 21 to August 31 | 19 stations
- from September 01 to March 23, 2010 | 9 stations

REFERENCES

- D'Anna, R., Mangano, G., D'Alessandro, A., D'Anna, R., Passafiume, G., Speciale, S., Selvaggi, G., Margheriti, L., Patane, D., Luzzo, D., and Calò, M. (2008). "MESSINA 1908-2008" - Progetto di ricerca integrato sull'area Calabro - Peloritana. La campagna OBS. Convegno: "1908 - 2008. Scienza e Società a 100 anni dal grande Terremoto". Reggio Calabria (Italy) | December 10-12, 2008.
- D'Anna, G., G. Mangano, A., D'Alessandro, R., D'Anna, G., Passafiume, S., Speciale, S., Passarello (2009), Progetto "Messina 1908 - 2008", Rapporto della campagna OBS nell'area Eoliana e dello Stretto di Messina. Rapporto Tecnico INGV, N. 98.
- Lauciani V., Mandiello A.G., Marocco C., Pintore S., Mazza S. (2009) - INGV Seismic Waveform Distribution and Archive Integration. FIRST ANNUAL MEETING. Rome, 19-21 October 2009 DPC-INGV, Seismological Projects.
- Mandiello A.G., Govoni A., Di Stefano R., Moretti M., Chiaraluce L., Lauciani V., Pintore S., Baccheschi P., Margheriti L., Mazza S., and Selvaggi G. (2009). Complete Uniform and Available Data archive at INGV. First Annual Meeting, October 19-21, 2009.
- Margheriti, L. and Messina 1908-2008 team (2008). Understanding crust dynamics and subduction in southern Italy. Eos Trans. AGU, 89(25), 225-226.
- Moretti M., A. Govoni, L. Abruzzese, G. Aiesi, P. Baccheschi, F. Criscuolo, G. D'Anna, R. D'Anna, G. De Luca, D. Franceschi, L. Giovanni, F.P. Lucente, L. Zuccarello, A.G. Mandiello, A. Basili, A. Bono, C. Castellano, F. Criscuolo, S. Mazza, D. Torrioni (2008). "Messina 1908-2008" - Progetto Di Ricerca Integrato Sull'area Calabro - Peloritana: La Campagna Sismica. Convegno: "1908 - 2008. Scienza e Società a 100 anni dal grande Terremoto". Reggio Calabria (Italy) | December 10-12, 2008.
- Moretti M., A. Govoni, L. Margheriti, L. Zuccarello, S. Speciale, A.G. Mandiello, A. Basili, A. Bono, C. Castellano, F. Criscuolo, S. Rapisarda, L. Abruzzese, G. Aiesi, P. Baccheschi, R. D'Anna, G. De Luca, D. Franceschi, L. Giovanni, F.P. Lucente, G. Mangano, M. Manni, C. Marocco, C. Passafiume, P.R. Platania, L. Scuderi, D. Torrioni, G. D'Anna, S. Mazza, D. Patané and G. Selvaggi (2010). "Messina 1908-2008" Progetto di ricerca integrato sull'area Calabro - Peloritana: L'esperimento di sismica passiva". Quaderno di Geofisica INGV, in press.

WAVEFORM ARCHIVE

THE GOAL

Integrating the temporary stations to INGV acquisition system to include these stations in INGV monitoring system.

MESSINA 1908-2008 PROJECT | WP 2.1-2.2

The waveform archive of the "Messina 1908-2008" Project is the first example of complete integration of data provided by permanent networks (INGV National Seismic Network, Peloritani Seismic Network and MedNet) and temporary deployments (CNT and CNT). In Figure 5 the sketch of the data sources and the role of the data servers in the process of archive building.

All the continuous data recorded by the mobile stations operated by INGV have been completely qualified, converted to SEED data format (Standard for the Exchange of Earthquake Data) and made available to the scientific community using the EIDA platform (European Integrated Data Archive, Figure 6). Also all metadata available have been checked and converted to SEED format. The EIDA archive gives access also to the National Network data.

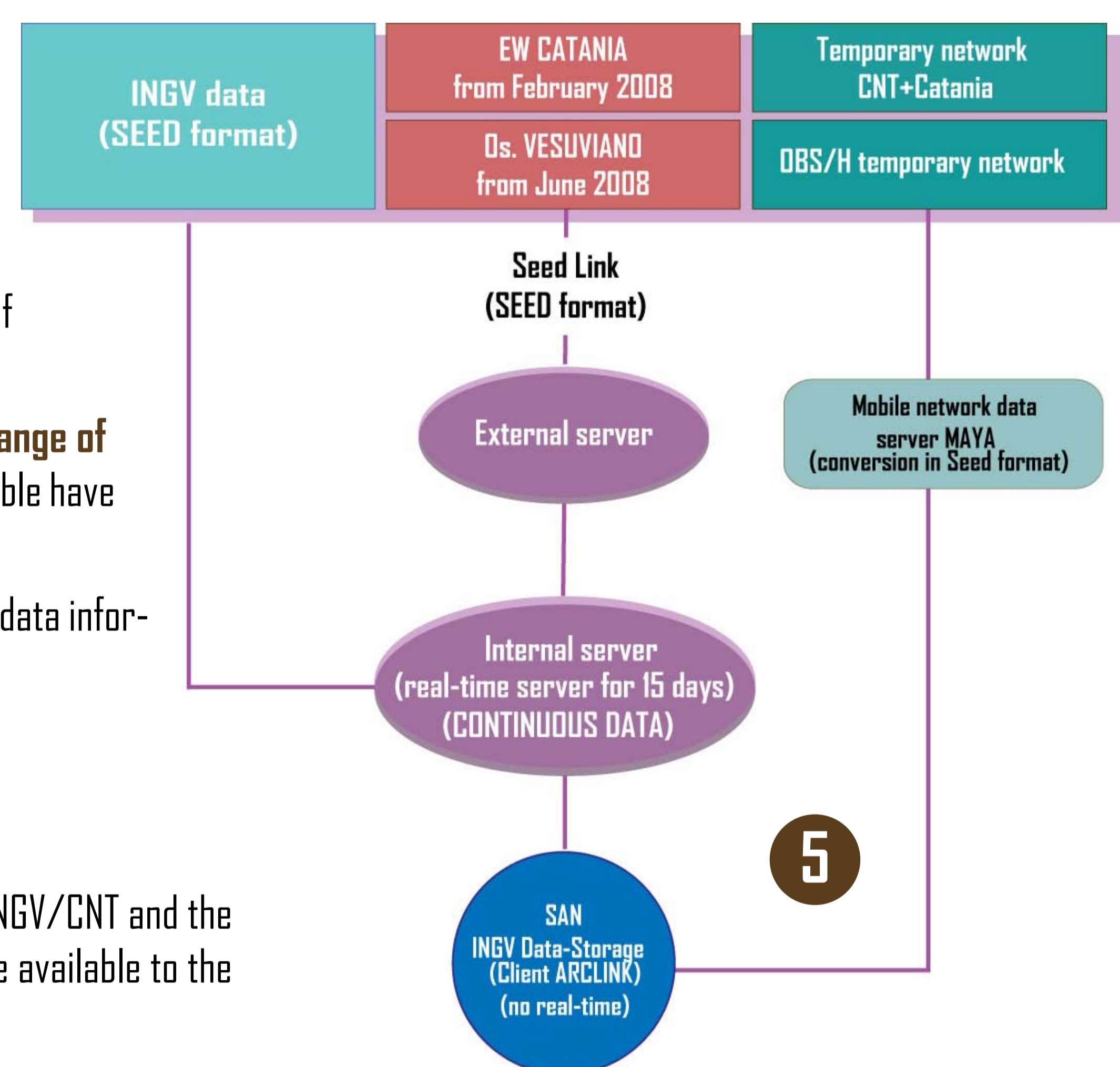
The continuous OBS waveform data is temporarily available at <ftp://ftp.ingv.it/pro/s5-data/>. Data will be merged in the integrated archive as soon as the meta data information is converted to SEED data format (dataless).

AQUILA 2009 EMERGENCY | WP 4.2

The experience gained in the Task 2, was used in Task 4 to create the waveform archive. All the continuous data recorded by the 18 mobile stations operated by INGV/CNT and the 3 mobile stations operated by INGV/CT deployed during the L'Aquila sequence (Figure 3) have been completely qualified, converted to SEED data format and made available to the scientific community using the EIDA platform.

This data set spans from a few hours after the the April 6, 2009 mainshock (first data recorded at 04:43:08 UTC) to March 23, 2010 when the last 9 stations were disinstalled and consist of about 270 GB.

All the data recorded by the seismic stations installed by LGIT (Grenoble, France) are distributed in the same format at <http://www.fosfore.igpp.fr/en/> (in "Fosfore Portal" under "Stations", network XJ) together with metadata.



	WHEN	WHERE
MESSINA 1908-2008	October 18, 2007 - January 31, 2010	37.5-39.4 ---> 14.2-16.6
AQUILA EMERGENCY	April 6, 2009 - March 3, 2010	41.9-42.7 ---> 12.9-14.1

INGV SEISMIC WAVEFORM DISTRIBUTION

Data are collected and archived in a Storage Area Network with a SEED Data Structure, while station information is organized in a MySQL database (Mandiello et al., 2009). The ArcLink protocol (by the Geofon Group, GF2) provides to access to archive data and station database. The ArcLink protocol is similar to SeedLink: it is based on TCP and uses simple commands in ASCII coding. The client requests data based on time windows. An ArcLink request is associated with a request ID that can be used by the client to get status of the request, download data, and delete the request.

Waveform output is in SEED or MiniSEED format, meta data output in XML or dataless SEED (response information only).

HOW



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