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Work Package 2: Identification of Risk scenarios

Activity 2.1: Evaluation of hazard, exposure and vulnerability

Deliverable D2.1.3: Report on the setting up of an improved real-time seismic network in the Central Mediterranean, and updated earthquake catalogue for the Sicily Channel

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Earthquake catalogue for the Sicily Channel, 1995–2013

1.1 Geo-tectonic background

The Sicily Channel is characterised by a relatively stable plateau of the African foreland, the Pelagian Platform, that connects Sicily with Tunisia (Figure 1.1). This platform forms a shallow shelf separating the deep Ionian basin from the Western Mediterranean. The sea-bed topography is characterised mainly by the north-west trending Sicily Channel Rift Zone (SCRZ) — a system that features 3 grabens of Miocene–Pliocene age (Pantelleria graben, Malta graben and Linosa graben) [Reuther and Eisbacher, 1985]. The Central Mediterranean is a region of active tectonics characterised by the interaction of a number of varied and sometimes poorly understood processes. Superimposed on the convergent scenario of the African plate pushing north-westward, giving rise to the Maghrebides thrust belt, a NE–SW directed extensional regime is presently active in the Sicily Channel, expressed in the form of a seismically active east-west trending system of strike-slip lineaments and a series of pull-apart grabens, the SCRZ. The offshore seismicity of the Sicily Channel, generally limited to magnitudes below 5, is normally difficult to quantify precisely, due to poor station coverage, yet it is believed that its analysis will considerably improve our understanding of the processes affecting the region. Figure 1.1 shows the main tectonic structures of the region together with the focal mechanisms of recent significant earthquakes.

1.2 Complete data archive of seismic station WDD

Seismic station WDD was installed in 1995 as part of the MedNet program [Boschi and Morelli, 1994]. Until recently, the station was the only seismograph on the Maltese Islands. From 1995 to 2004, data was archived on magnetic tapes at the MedNet Data Centre, Istituto Nazionale di Geofisica e Vulcanologia (INGV) in Rome. Only some event data was stored at the Seismic Monitoring and Research Unit (SMRU). In 2002, through the EU project MEREDIAN, WDD was upgraded to an online station as part of the Virtual European Broadband Seismic Network (VEBSN) managed by the Observatories and Research Facilities for European Seismology (ORFEUS) Data Centre in the Netherlands [van Eck et al., 2004]. In 2004 continuous seismic data started to be transmitted in near real time from WDD to ORFEUS, MedNet, and the Incorporated Research Institutions for Seismology (IRIS) data centres.

Within Work Package 2, the whole data set from WDD from 1995 till the present has been retrieved and merged to create the most complete continuous data archive for WDD (Figure 1.2). The entire data set has been re analysed to produce a seismicity catalogue of the region.

1.3 Analysis of seismic events using single-station location algorithm for WDD station on Malta.

All the seismic day files were processed with LESSLA [Local Earthquake Single-Station Location Analyser, Agius and Galea, 2011], an algorithm which locates local earthquakes. The system detects earthquakes by applying an amplitude-based triggering algorithm on three channel streams: HH (80 samples per seconds (sps)), BH (20 sps), and LH (1 sps). LESSLA then performs automated phase picking, epicentral location, and magnitude estimation for each triggered event.

Major tectonic features in the Sicily Channel Rift Zone

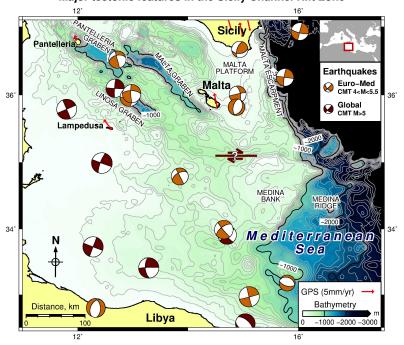


Figure 1.1: Map showing the system of grabens and the solutions of recent significant earthquakes within the SCRZ. Red and orange beach balls are double couple Centroid Moment Tensor (CMT) solutions from the global catalogue [http://www.globalcmt.org/, Dziewonski et al., 1981, Ekström et al., 2012] and the from the European-Mediterranean CMT Catalogue [http://www.bo.ingv.it/RCMT/, Pondrelli et al., 2002, 2004, 2007, 2011], respectively. Red arrows are Global Positioning System (GPS) horizontal velocity vectors with respect to fixed Eurasia [Devoti et al., 2011]. Note the GPS directional shift between Lampedusa and Malta.

Data availability and analysed seismic activity

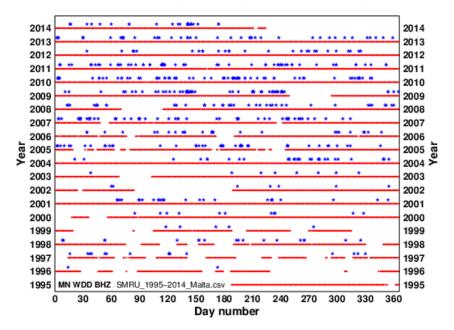


Figure 1.2: Seismic data availability and catalogued local earthquakes recorded on seismic station WDD. Red diamonds indicate data availability on each day from 1995 till 2014. Blue stars represents earthquakes listed in the preliminary earthquake catalogue using single-station analysis.

All events identified by LESSLA were manually re analysed for validation. By looking at the seismogram, the event was first classified as being either an earthquake or a blast. In the case of an earthquake, the accuracy of the automated picks of the Primary (P) and the Secondary (S) wave was checked, and, in some cases, these had to be manually re picked. From the S-P time (the time difference between the arrival of the P and S wave), the epicentral distance from WDD is computed by the system. The actual location of the epicentre (distance and back azimuth) is then computed by the system from polarisation analysis. In most cases, the back azimuth was also manually revised. The accuracy of the back azimuth depends mostly on the P-wave pick and the signal-to-noise ratio of the traces. The following criteria were used to choose the back azimuth:

- Coherence between the signals,
- Channel triggers, and
- Stability of the back azimuth.

A quality grade was assigned to each event as follows:

- Quality grade A indicates a very confident location with an agreement between BH and HH azimuth
 approximations or has a good LH solution in the case of a strong local or regional earthquake. For
 Quality A earthquakes, the P- and S-wave picks are clearly identified.
- Quality grade B means that there is little or no confidence in the epicentre location usually because of different BH and HH back-azimuth approximations.
- Quality grade C is set to unreliable earthquake locations with poor or no P pick identification. Quality C earthquakes were left out of the catalogue.

Other earthquake catalogues, the Italian Seismic Instrumental and parametric Data-basE (ISIDE) catalogue of INGV (http://iside.rm.ingv.it/iside) and the European-Mediterranean Seismological Centre (EMSC) catalogue (http://www.emsc-csem.org), were browsed to check if an earthquake was listed and located by other regional networks. If so, this location was also entered in the database. When there was a disagreement between the locations of the same earthquake, the preferred solution was chosen on the basis of other criteria. In some cases the earthquake location from the other catalogues was inconsistent with the measured S-P time recorded at station WDD, therefore the LESSLA location was preferred. In the case of earthquakes originating in the Pantelleria region, the data quality at WDD was usually poor, and INGV locations were preferred. In general, for earthquakes occurring closer to the Maltese islands, and especially to the south of the islands, the LESSLA location was preferred. When the earthquake was not reported by any other network, no comparisons could be made, and the LESSLA location was taken as the final one. The earthquakes that were judged to have a reliable location were marked as 'verified' and automatically listed in the bulletin.

In order to have a complete catalogue for this period, the INGV catalogue was merged with the SMRU catalogue, making sure that no 'double' events were listed. Figure 1.3 shows all seismic events in the merged catalogue between 2002–2013, also listed in the Appendix.

Seismicity in the Sicily Channel

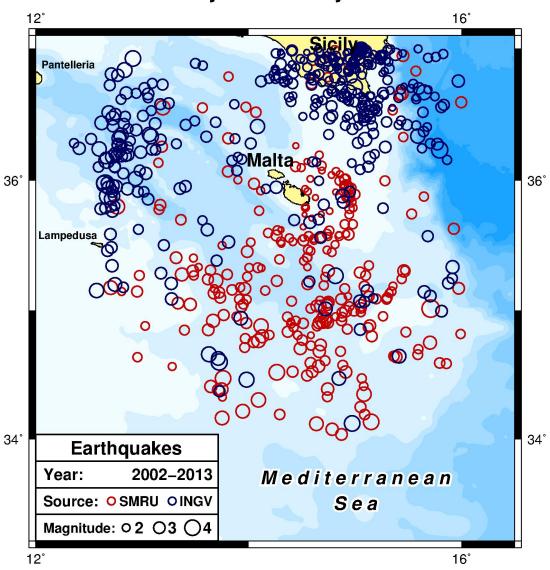


Figure 1.3: Preliminary seismcity map of the Sicily Channel from 2002-2013. Blue open circles are earthquake locations determined from single-station analysis using seismic data of WDD. Red open circles are earthquake locations from INGV. Each circle represents a unique event as listed in the Appendix.

An improved real-time seismic network in the Central Mediterranean

2.1 Introduction

Part of the remit of Work Package 2 within SIMIT was the setting up of an enhanced real-time broadband seismic network in the Central Mediterranean. The aim of this network was to improve the monitoring, reporting and alert of seismic activity in this region, and particularly the Sicily Channel which impinges on the cross-boundary area to which the project is dedicated. This particular seismic region has always suffered from inadequate station coverage and consequently poorer epicentral location and rapid alert capability than, for example, mainland Italy. Besides its scientific value, the system is to provide timely and accurate reporting of such seismic activity to the Civil Protection Departments (CPD) of Sicily and Malta. In particular the CPD of Malta was lacking such a direct system of communication with the seismological community. Another advantage of such a network was to improve the earthquake location and analysis for events in the Central Mediterranean. Better knowledge of this seismic activity will help to identify and understand tectonically active structures in the region and thus contribute to a better evaluation of the seismic hazard for Malta and Sicily.

2.2 Rationale for the new seismic network

Before the start of SIMIT, the seismic monitoring facilities for this region of the Mediterranean consisted of:

- The National Seismic Network of Italy, maintained by the INGV, Rome, in particular, around 45 stations on Sicily and Calabria;
- One broadband station (WDD) on Malta, belonging to the University of Malta and managed by the SMRU;
- The National Network of Tunisia, of which 3 stations were made publicly available in real time.

Although the data from Tunisia and Sicily could be received in real time at the SMRU, no system was in place to use this data to obtain rapid locations. Moreover the earthquakes that occurred in the Sicily Channel, especially to the south of the Maltese islands, were not well covered azimuthally by the INGV network, and many of the earthquakes were too weak to be detected by enough stations to give a reliable epicentral location. Earthquakes detected only at WDD (SMRU) were located by a single-station polarization analysis technique (LESSLA), however this is not a real-time method, and is subject to a certain amount of error. Despite LESSLA's limitation the method is still useful for weak events recorded only on one station.

There was therefore the need to set up a monitoring seismic network that acquired real-time data from a number of well-distributed stations and provided better locations and faster dissemination. These requirements were met by the installation of SeisComP3.

Malta seismic network (ML)

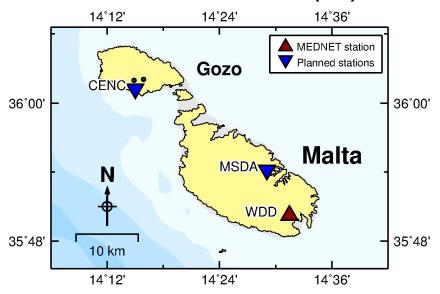


Figure 2.1: Map showing the location of existing and planned seismic stations for the Malta Seismic Network (ML).

2.3 The Malta Seismic Network (ML)

A unique seismic network code ML was first registered with the international Federation of Digital Seismograph Networks (FDSN) (http://www.fdsn.org/networks). The number of stations on the Maltese islands has been increased to three, covering the archipelago more uniformly and allowing better location resolution for nearby earthquakes. The location of the three stations in the Malta Seismic Network is shown in Figure 2.1. The network consists of:

- The present station WDD in Wied Dalam, in the south of the island of Malta;
- New station MSDA at the University of Malta, near the centre of the island;
- New station CENC on the island of Gozo, in the north of the archipelago.

The new instruments were acquired from Nanometrics Inc. of Canada, in March 2014, after a call for tenders (UM1782). They consist of a Trillium 120PA broadband sensor and a Centaur digitizer, with Global Positioning System (GPS) antenna receiver, and Internet enabled communication protocol for real-time data transmission (Figure 2.2). The stations were tested at the Department of Physics laboratory for a period of 2 weeks, during which their performance was considered satisfactory.

2.3.1 Data format

Data from the new seismic stations will be stored in 2 sampling streams: HH at 100 sps, and BH at 20 sps. Each data stream includes three components: North (N), East (E) and Vertical (Z). The two sampling frequencies are broad enough to record local, regional and teleseismic earthquakes, in line with international practise. The time-series data is stored in the Standard for the Exchange of Earthquake Data (SEED) format intended primarily for the archival and exchange of seismological data.

2.3.2 Laboratory analysis

The performance of a seismic station is best established by analysing its spectral content. The various frequency-dependent signals recorded in a seismogram reveal the sensitivity of an instrument to ambient, cultural, and seismic activity.

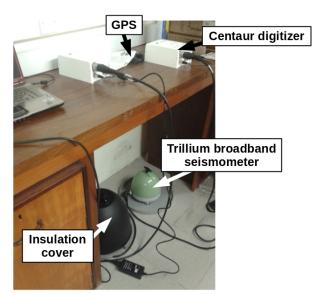


Figure 2.2: The broadband seismometers undergoing testing in the laboratory. The equipment consists of 2 Triliuam 120PA sesimometer with corresponding Centaur digitizer, GPS receiver antenna, insulating cover, power supplies, and waterproof electrical and communication cables.

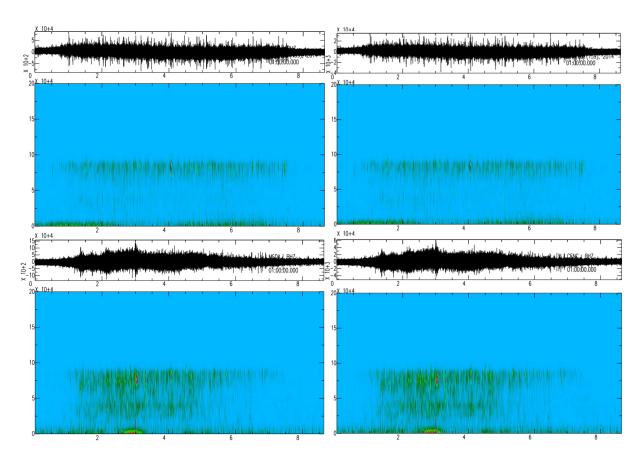


Figure 2.3: Test analysis: Seismic spectral variations throughout the day recorded by the new stations inside the laboratory. The normalised spectrograms show a 24-hour seismic trace and the corresponding spectral energy (0–20 Hz) of stations MSDA (left) and CENC (right) recorded on the 8th (top) and 10th (bottom) of June 2014. The data is the BHZ component (20 sample per seconds) for all plots. Green and red shade indicate high energy frequencies.

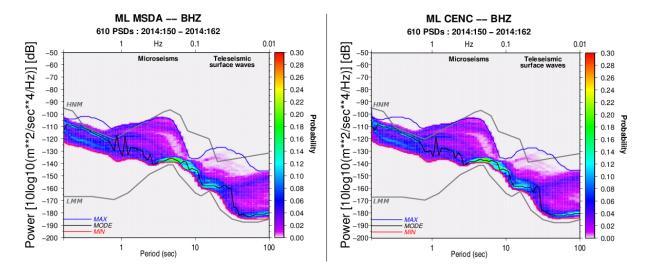


Figure 2.4: Test analysis: Seismic spectral analysis based on the calculation of Power Spectral Density (PSD) distribution using a Probability Density Function (PDF) [McNamara and Boaz, 2006] for 13 days of data recorded by the new stations inside the laboratory. The graphs show the analysis for stations MSDA (left) and CENC (right) during day numbers 150–162 of year 2014. Grey curves: low noise model (LNM) and high noise model (HNM) [Peterson, 1993]. Blue and red curves: maximum and minimum PSD for the data, respectively. Black curve: the highest probability mode. Each curve represents 30 minutes of data.

Figure 2.3 shows a 24-hour seismic trace and its corresponding spectrogram recorded at the laboratory by test stations MSDA and CENC on Sunday 8th of June 2014 and on a weekday 10th of June 2014. No earthquake were recorded by the stations on both dates, and hence, the data contains only 'ambient' noise – vibrations generated from cultural activity such as nearby passing cars and also from natural forces such as wind. Note that the spectral energy shown in the figure has a constant, high-energy frequency range (7.5–8.5 Hz) that has a varying amplitude; high during daytime and low during night time, suggesting that the source is weather related. A stark contrast in the frequency content can be clearly seen between the spectrograms recorded on the weekday with those recorded on Sunday. The increased noise in the first half of the day is a result of the bustling student activity in the adjacent room next door.

Figure 2.4 shows the power spectral density over 2 weeks, confirming that the noise is below the high noise model (HNM) [Peterson, 1993] for a broad frequency range even though the test site was rather noisy. Both stations, which where placed next to each other during testing, show similar analysis to one another, as expected and clearly seen in the 'identical' plots in Figures 2.3 and 2.4.

2.3.3 Station site selection

The selection of the preferred sites was based on the geographical location and geological setting. Station MSDA will be sited on the Lower Globigerina Limestone whereas station CENC (Figure 2.5) will be sited on Lower Coralline Limestone. At both sites the horizontal-vertical ratio (H/V) response is flat (Figure 2.6) showing no horizontal amplification at any particular frequency.

At present, both stations are running on site for their second testing phase. Following months-long data acquisition the data will be analysed once more to establish the station-site characteristics. Figure 2.7 shows an example of a Greek earthquake and the PSD-PDF of ambient seismic noise recorded at CENC. The analysis indicate that the station is performing good, well within the international standard of seismic noise models. We note that the data only covers the summer period, when the ambient noise generated from weather storms is at its lowest. More time is needed to analysis the data during the winter, stormy season. Construction work will then be required to make the underlain foundation, install electrical and internet connections, and secure the site.



Figure 2.5: Selected station site in Ta' Cenc, at the Water Services Corporation plant. Left: The room housing the seismic station during testing. Right: The temporary set up inside the room: seismometer, digitizer, GPS receiver and an UPS for consistent power supply.

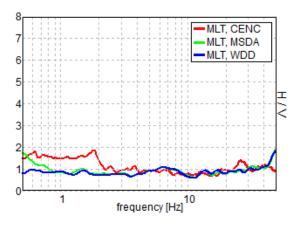


Figure 2.6: HVSR site response analysis of the seismic stations test sites CENC and MSDA in comparison with station WDD.

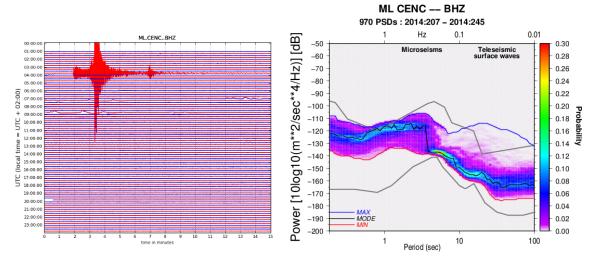


Figure 2.7: Data and analysis for seismic station test site CENC. Left: A Greek earthquake of magnitude 5.8 recorded on Friday 29th of August 2014. Right: PSD-PDF seismic spectral analysis using 1 month of seismic ambient noise data.

2.4 New virtual seismic network for the Central Mediterranean

A new virtual seismic network for the Central Mediterranean is set up, composed of a backbone network of seismic stations in Tunisia, Malta and Sicily. In total 15 stations encompass the circumference of the Sicily Channel. Figure 2.8 shows the main stations that are presently configured to receive real-time data to a SeisComP3 server at the SMRU.

SeisComP3 is the current state-of-the-art real-time earthquake monitoring software. It has simple, automatic event detection, location, and magnitude determination capabilities. It offers a comprehensive graphical user interface (GUI) for visualisation, rapid event review and quality control [Hanka et al., 2010]. Figures 2.8 and 2.9 show different GUI's of SeisComP3. The latter has an example of a local earthquake that took place on 21st of May 2014 close to Malta. The seismogram recorded at different stations can be viewed and studied. The analyst can manually re pick the P- and S-wave arrivals and reassess the earthquake location. SeisComP allows for multiple users logging in at the same time. This gives the possibility for several users such as Civil Protection Department or international partners to connect to the system. A SeisComP licence was obtained for SMRU from Gempa GmbH, for free, on research grounds, and was installed in June 2013.

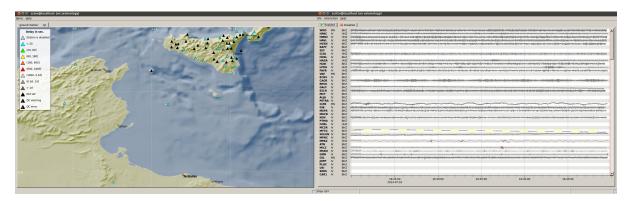


Figure 2.8: SeisComP3 station map and real-time trace view. Left: Light triangles on map show the online stations transmitting data in real time. Dark triangles are off-line stations at the time of the screen shot. Right: Real-time trace view that aids the operator note communication problems such as the data gaps of station MTTG, or make a visual confirmation of an earthquake that has just occurred.

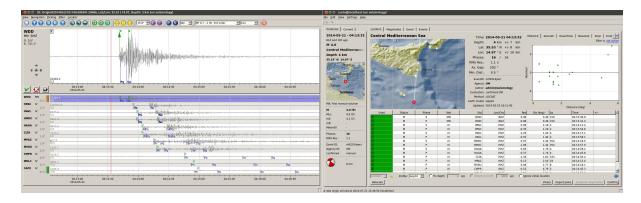


Figure 2.9: SeisComP3 picker mode and earthquake solution view. Example of a relocated local earthquake on 21st of May 2014. Left: The manually picked P- and S-wave phases. Right: The recomputed final solution from the selected stations.

2.5 Earthquake alerts

Since August 2013 SeisComP3 has been configured to issue e-mail and SMS earthquake alerts to the SMRU personnel in real time. The alerts are sent automatically for all earthquakes of magnitude greater or equal to 7 around the globe or for earthquakes that are within a magnitude-distance threshold in relation to the Sicily Channel. E-mail alerts have a lower threshold and contain more technical information including a map (Figure 2.10). SMS alerts are more concise, limited to a single sentence.

The rapidness of an early earthquake alert depends on one major factor: the station coverage close to the earthquake source. Unfortunately the seismic data availability in the Mediterranean is mostly from stations across southern Europe, with very few open stations available from North Africa, a region that is also prone to strong earthquakes. On the other hand the effective alert time to issue an earthquake warning is related to the epicentral distance. For example in Figure 2.10 the earthquake was over a thousand kilometres away from the Sicily Channel; the alert was issued within 2 minutes — well within the time it takes for seismic surface waves to propagate through the Sicily Channel (estimated to traverse through it after 4 minutes). But, for an earthquake that occurs within the Sicily Channel, an early warning alert for the region will be ineffective because the seismic waves will arrive 'instantly'.

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earthquake, 2 minutes ago, Aegean Sea, magnitude 6.5, depth 10 kilometers
MLT scalert-event <smru-weh@um edu mt>
                                                                                                                                                                                                                                                                                        24 May 2014 11:27
 To: "matthew.agius@um.edu.mt" <matthew.agius@um.edu.mt> , "pauline.galea@um.edu.mt" <pauline.galea@um.edu.mt"
'sebastiano.damico@um.edu.mt" <sebastiano.damico@um.edu.mt> , "daniela.farrugia.09@um.edu.mt" <daniela.farrugia.09
                                                                                                                                                                                                                                 ela.farrugia.09@um.edu.mt>
   Message string: earthquake, 2 minutes ago, Aegean Sea, magnitude 6.5, depth 10 kilometers Flag (1=new event, 0=update event): 1
   EventID: mlt2014kbzp
   Arrival count: 0
Origin time: 2014-05-24T09:25.01
Latitude: 40.2587
Longitude: 25.5136
Magnitude: 6.5
   Magnitude: 6.5 Tell string: earthquake, 2 minutes ago. Aegean Sea, magnitude 6.5, depth 10 kilometers 1 mlt2014kbzp 0 2014-05-24T09:25.01 40.2587 25.5136 6.5 Server time: Sat May 24 11:27:30 CEST 2014 Distance: 1078 km Magnitude-distance trigger SMS (M*100): 0 Magnitude-distance trigger EML (M*200): 1
  Event:
Public ID mlt2014kb:
Description
region name: Aegean Sea
                                            mlt2014kbzp
                                           2014-05-24
09:25:01.7 +/- 0.4 s
                                             09:25:01.7 +/- 0.4 $
40.26 deg +/- 4 km
25.51 deg +/- 5 km
10 km
UM
automatic
         Latitude
         Longitude
Depth
Agency
Mode
Status
                                                     0.69 s
138 deg
          Residual RMS
         Azimuthal gap
        mb 6.54
M 6.54
                                               3 preferred
   11 Phase arrivals
       1 Phase arrivals: sta net dist azi phase VTS M 2.9 325 P APE GE 3.2 180 P SANT GE 3.9 181 P ITM HL 4.2 223 P ITR MN 4.4 286 P ITR GE 4.7 26 P KARP GE 4.9 164 P DI MN 5.0 186 P PDG MN 5.2 297 P MATE GE 6.7 276 P TIP MN 6.8 264 P
                                                          time res wt sta
09:25:47.7 0.4 A 1.0 VTS
09:25:51.2 -0.6 A 1.0 APE
09:26:01.9 0.5 A 1.0 SAM
09:26:02.9 0.5 A 1.0 SAM
09:26:09.9 1.1 A 1.0 TIR
09:26:16.0 0.9 A 1.0 KARP
09:26:12.0 -0.3 A 1.0 TIR
09:26:20.0 0.8 A 1.0 PDG
09:26:39.4 -1.1 A 1.0 MATE
09:26:41.7 -0.3 A 1.0 TIP
   3 Station magnitudes:

sta net dist azi type value res amp per

PDG MN 5.2 297 mb 6.78 0.24 7506.89 0.74

MATE GE 6.7 276 mb 6.45 -0.10 4100.94 1.23

TIP MN 6.8 264 mb 6.40 -0.14 2003.95 0.68
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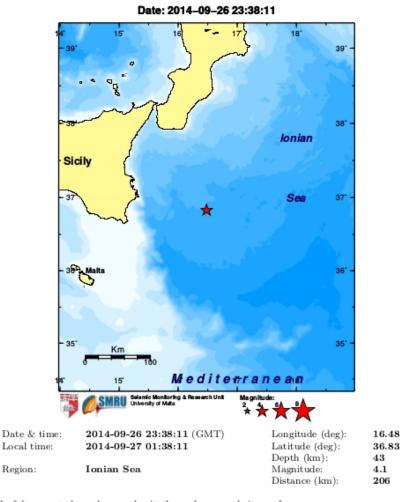
scalert_map.png 57K

Figure 2.10: An automatic earthquake e-mail alert issued by SeisComP. The e-mail was sent 2 minutes after an earthquake struck in the Aegean Sea with an initial estimated magnitude of 6.5.

2.6 Earthquake reports to the Civil Protection Department (Malta)

Following a meeting between the SMRU and the Malta CPD on the 13th of March 2014 it was agreed that the SMRU will start to issue specific reports about earthquakes that would have likely been felt on the Maltese Islands. These reports are aimed to give general information on the earthquake location and magnitude, as well as other comments that the SMRU deem fit. Figure 2.11 is an example of a report issued to the CPD for an earthquake on the night of the 26–27th September, 2014.

Seismic Monitoring & Research Unit University of Malta EARTHQUAKE REPORT



No felt reports have been submit through our website so far.

Disclaimer: This is a preliminary analysis. Although SMRU has taken all possible care to ensure the quality of the enclosed information, further analysis may be needed to verify or improve this report.

 $http://seismic.research.um.edu.mt.\ Earthquake\ solution:\ EMSC.\ Report\ date:\ Sat\ Sep\ 27\ 03:18:35\ CEST\ 2014$

Figure 2.11: An earthquake report issued by the SMRU to the CPD.

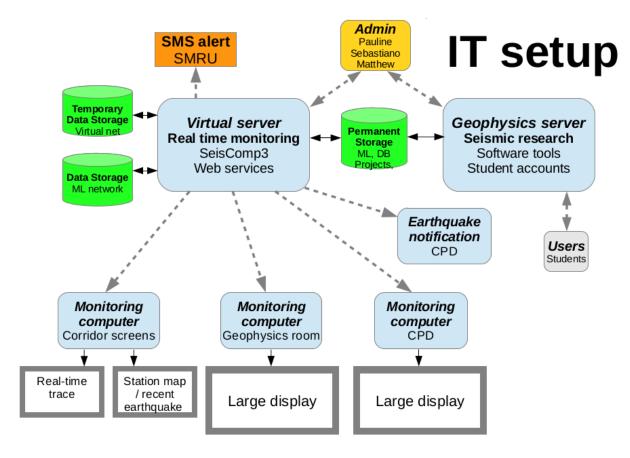


Figure 2.12: The IT system infrastructure.

2.7 IT facilities

The SMRU has engaged the IT Services (ITS) department of the University of Malta for the running of the IT systems required for the seismic real-time network monitoring. ITS runs a 24-hour operational facility that includes: backup electric generator, cloud computing servers, high-speed Internet, and a second off-campus site running in parallel to the main site in the case of a major failure.

SeisComP3 and the SMRU web services (http://seismic.research.um.edu.mt/) are running on a dedicated Linux virtual machine hosted on the cloud computing system. The advantage of a virtual machine is its ability to switch between different physical servers, hence being independent of a single machine failure. So far ITS has provided SMRU with two data repositories: one for the temporary storage of incoming data from the entire seismic network, and one for storing only the local seismic data (Figure 2.12). ITS also provides communication to mobile phone users via Short Message Service (SMS), needed for earthquake alerts. Recently a request for supplier quotes has been issued for the purchase of a permanent data storage server to be incorporated in the IT infrastructure as in Figure 2.12. In the next phase various display terminals (used for monitoring) are to be connected to the central virtual machine.

Courses

Matthew Agius has attended a SeisComP3 hands-on training course at Gempa GmbH in Potsdam, Germany, between the 7th and 11th of October 2013. Gempa are the developers of SeisComP3. They run an annual course in order to ensure that SeisComP users make the best use of the software, particularly due to its detailed and specific configuration. These courses are typically limited to a few participants to make it possible to discuss specific case studies. The attended course dealt with the installation, configuration and usage of SeisComP3.

The course was beneficial to the SMRU in various aspects, especially in the context of SIMIT Work Package 2: Seismic monitoring in the Central Mediterranean. The different configurations of seismic stations and networks for automatic earthquake location was thoroughly discussed because of its importance to the monitoring of local, regional and teleseismic earthquakes. Another part of the course was on how to manually analyse an earthquake to determine the accurate epicentre, exact magnitude, and earthquake mechanism. A special session was dedicated to the offline playback of events on the entire system. This helps with fine tuning the system because one can follow all the communication messages sent by SeisComP to the different internal modules. Participants were also shown how to make their own modules such as one for event alerts. Finally, the latest modules for SeisComP currently underdevelopment were unveiled and demonstrated. These included a fully-operation web interface and TOAST (Tsunami Observation And Simulation Terminal).



Figure 3.1: Photos during the Gempa Course, October 2013. Left: Demonstration of the new SeisComP web interface still underdevelopment. Centre: Bernd Weber explaining how to configure stations for better local and regional earthquake detection. Right: Participants of the SeisComP hands-on training course.

Presentations

The progress on technical and research work related with SIMIT Work Package 2 has been regularly reported to the scientific community at major international conferences. The following is a list of presented work:

- Agius, M. R., Galea, P., D'Amico S. (2013, October). In the process of a major upgrade at the Seismic Monitoring and Research Unit, University of Malta. XXXV UNESCO-RELEMR International Workshop on Seismicity and Earthquake Engineering in the Extended Mediterranean Region, Malaga, Spain. (Oral).
- Agius, M. R., Galea, P., D'Amico S. (2014, January). In the process of a major upgrade at the Seismic Monitoring and Research Unit, University of Malta. SIMIT 2nd Partners Meeting Valletta, Malta. (Oral)
- Agius, M. R., Galea, P., D'Amico S. (2014, April). An improved real-time seismic network in the Central Mediterranean. In EGU General Assembly Conference Abstracts (Vol. 16, p. 4793). (Figure 4.1)
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- Agius, M. R., Galea, P., D'Amico S. (2014, August). An improved real-time seismic network in the Central Mediterranean. ESC 34th General Assembly, Istanbul, Turkey. (Figure 4.2).

4.1 Publications

• Agius, M. R., D'Amico, S., Galea, P., Panzera, F. (2014), Performance evaluation of Wied Dalam (WDD) seismic station in Malta, *Xjenza*, 04/2014; 2(1):78-86. DOI: 10.7423/XJENZA.2014.1.11.

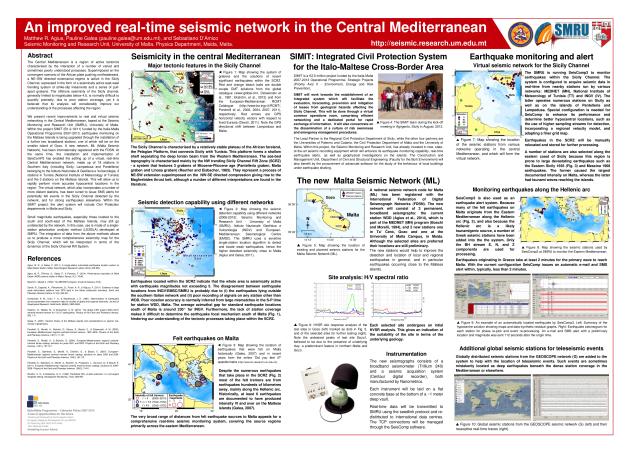
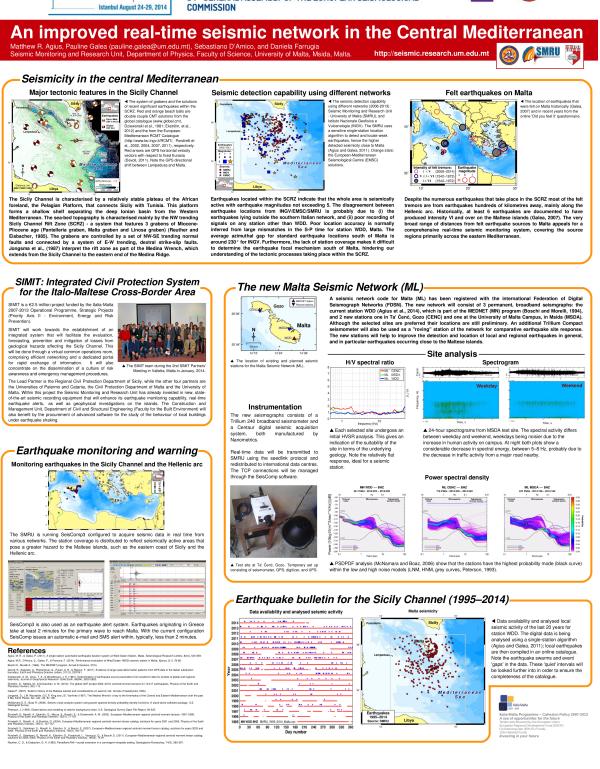


Figure 4.1: Poster reporting the initial work done on the new seismic network. The poster was displayed at the European Geosciences Union General Assembly 2014 held in Vienna, Austria, May 2014.



15th EUROPEAN CONFERENCE ON EARTHQUAKE ENGINEERING &

34th GENERAL ASSEMBLY OF THE EUROPEAN SEISMOLOGICAL

Second European Conference on

Earthquake Engineering and Seismology

WWW.minn.Whym

A joint event of the

Figure 4.2: Poster reporting the latest progress on the new seismic network. The poster was displayed at the 34th General Assembly of the European Seismological Commission held in Istanbul, Turkey, August 2014.

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Appendix

Seismic catalogue of the Sicily Channel

Preliminary earthquake catalogue for the Sicily Channel for the years 2002–2013.

the years 2002–2013.				
Date	Lon.	Lat.	Mag.	Source
2002/03/01 17:50:38	35.23	14.27	2.8	LESSLA
2002/06/03 07:36:50	36.49	12.84	2.7	INGV
2002/06/15 12:32:30	35.94	14.16	2.3	INGV
2002/06/20 01:26:28	36.31	15.09	3.6	INGV
2002/08/17 04:04:50	36.32	13.81	2.8	LESSLA
2002/08/26 04:35:17	35.74	14.52	1.2	LESSLA
2002/10/26 14:51:08	34.12	14.64	3.5	LESSLA
2002/12/21 07:55:49	35.06	14.74	2.7	LESSLA
2003/02/07 23:16:57	34.82	15.99	2.3	LESSLA
2003/03/19 07:34:40	36.63	15.41	2.3	INGV
2003/04/20 17:33:14	36.60	14.94	2.2	INGV
2003/05/04 08:04:09	36.87	13.57	2.3	INGV
2003/07/07 15:08:05	35.27	14.81	$\frac{2.3}{4.1}$	INGV
2003/08/24 01:09:59	36.16	13.94	2.5	INGV
2003/09/08 14:32:43	36.37	15.64	$\frac{2.5}{2.7}$	INGV
	34.75		3.4	LESSLA
2003/09/14 02:22:12		15.71		
2003/10/26 19:05:03	34.98	14.88	$\frac{2.7}{2.7}$	LESSLA LESSLA
2003/11/19 03:10:01	35.11	15.13		
2003/12/29 20:12:20	36.27	12.78	3.4	INGV
2004/01/21 17:43:19	34.88	14.12	3.8	LESSLA
2004/01/31 04:09:43	35.28	13.37	3.4	LESSLA
2004/02/02 15:26:34	36.76	15.97	3.2	INGV
2004/02/26 01:07:06	36.48	15.08	2.5	INGV
2004/04/11 00:37:28	35.15	15.12	3.2	INGV
2004/06/10 05:44:09	36.73	12.69	2.8	INGV
2004/06/10 06:05:23	35.98	12.67	3.1	INGV
2004/06/20 16:32:31	36.59	16.00	2.9	LESSLA
2004/07/03 01:47:26	36.75	14.12	2.9	INGV
2004/07/14 23:10:35	35.06	13.34	3.1	LESSLA
2004/07/19 10:12:31	35.19	15.09	2.7	LESSLA
2004/07/25 20:59:55	36.60	14.40	2.6	INGV
2004/07/30 05:45:33	36.56	14.62	1.9	INGV
2004/07/30 06:54:07	36.81	14.42	2.6	INGV
2004/07/30 06:54:07	36.98	15.04	3.0	LESSLA
2004/07/30 11:16:55	36.86	14.37	1.7	INGV
2004/08/18 02:13:34	36.52	15.64	2.7	INGV
2004/09/04 01:59:42	34.41	15.08	2.2	LESSLA
2004/09/10 00:54:24	34.48	14.85	3.6	INGV
2004/09/10 16:13:34	34.88	15.14	3.0	LESSLA
2004/09/11 01:24:28	34.80	15.16	2.8	LESSLA
2004/09/15 17:32:09	34.68	14.67	3.2	LESSLA
2004/09/27 23:37:44	35.57	14.57	2.3	LESSLA
2004/10/24 13:08:07	35.50	13.20	2.8	INGV
2004/11/09 09:07:10	36.53	15.35	2.3	LESSLA
2004/11/26 19:25:17	35.18	12.82	2.7	INGV
2004/12/15 06:59:21	36.34	15.59	3.8	INGV
2004/12/20 21:39:19	34.71	14.48	3.3	LESSLA
2004/12/30 04:04:49	36.91	14.95	3.5	LESSLA
2005/01/02 02:05:57	35.86	13.05	3.0	INGV
2005/01/06 16:25:32	34.53	14.60	3.1	LESSLA
2005/01/08 16:59:15	36.74	14.59	2.9	LESSLA

Continued on next column

Continued	from p	revious	column	
Date	Lon.	Lat.	Mag.	Source
2005/01/09 02:46:16	36.78	14.74	2.3	LESSLA
2005/01/15 01:08:52	35.70	14.43	2.8	INGV
2005/01/17 04:30:00	34.91	14.67	3.3	LESSLA
2005/02/01 14:47:27	34.77	14.09	3.5	LESSLA
2005/02/22 22:12:15	35.31	13.48	3.0	LESSLA
2005/02/23 14:40:42	34.84	14.37	2.8	LESSLA
2005/03/03 08:56:05	35.03	13.93	2.8	LESSLA
2005/03/20 02:18:17	36.63	14.38	2.3	INGV
2005/04/22 15:40:38	35.02	15.71	4.6	LESSLA
2005/05/09 10:55:46	35.27	15.10	2.6	LESSLA
2005/05/29 22:50:46	36.61	14.70	2.2	INGV
2005/05/30 21:09:13	34.95	14.36	2.6	LESSLA
2005/05/30 21:19:38	36.26	15.28	3.0	INGV
2005/05/30 22:06:09	34.92	14.44	2.3	LESSLA
2005/06/02 18:33:36	35.91	13.02	2.7	INGV
2005/06/06 04:22:50	36.56	15.81	2.8	INGV
2005/06/09 02:12:14	35.13	13.68	3.0	LESSLA
2005/06/26 03:12:03	35.60	14.18	2.4	LESSLA
2005/07/16 05:35:13	35.16	13.84	2.7	LESSLA
2005/07/16 23:45:16	34.52	14.91	3.2	LESSLA
2005/07/16 23:47:35	34.57	14.66	3.2	LESSLA
2005/07/17 01:27:00	34.58	14.89	2.6	LESSLA
2005/07/17 01:50:55	34.39	14.74	3.2	LESSLA
2005/07/17 02:48:32	34.47	15.06	2.4	LESSLA
2005/07/17 03:10:35	34.66	15.59	2.6	LESSLA
2005/07/18 11:45:42	34.64	15.39	3.1	LESSLA
2005/07/25 22:06:02	35.09	13.91	2.5	LESSLA
2005/09/04 18:07:32	34.78	13.97	2.5	LESSLA
2005/09/04 18:59:34	35.63	15.93	2.8	LESSLA
2005/09/05 08:14:10	35.33	14.00	2.2	LESSLA
2005/09/27 10:24:32	34.91	14.70	2.9	LESSLA
2005/10/01 08:35:21	36.92	14.60	3.1	LESSLA
2005/10/01 08:41:44	36.79	14.30	3.6	INGV
2005/10/02 08:04:01	36.79	14.33	2.1	INGV
2005/10/02 13:52:09	36.88	14.41	2.1	INGV
2005/10/12 19:55:55	36.90	14.83	2.8	INGV
2005/10/15 01:30:33	36.75	14.33	2.4	INGV
2005/10/16 16:10:00	36.65	15.27	2.3	INGV
2005/11/08 09:54:26	36.98	15.03	2.2	INGV
2005/12/09 09:22:04	36.91	15.29	2.0	INGV
2006/01/04 09:57:19	36.95	15.26	$\frac{2.4}{2.7}$	INGV INGV
2006/01/09 21:13:16 2006/02/05 18:34:32	$36.89 \\ 36.80$	14.98 12.77	$\frac{2.7}{3.2}$	INGV
2006/02/05 18:34:32 2006/02/05 21:15:59	36.84	12.77	3.9	INGV
	36.75	14.34	$\frac{3.9}{2.6}$	INGV
2006/02/12 20:42:06 2006/02/20 03:18:33	36.76	14.34 14.37	2.0	INGV
2006/03/13 15:38:55	36.22	12.99	$\frac{2.3}{3.2}$	INGV
2006/03/13 13:38:35 2006/03/13 18:04:55	35.15	12.59 12.57	$\frac{3.2}{3.8}$	INGV
2006/03/14 08:57:03	36.88	15.16	2.1	INGV
2006/03/14 11:28:26	36.80	15.16	2.1	INGV
2006/03/14 11:28:20 2006/03/15 20:33:12	36.05	13.04	3.3	INGV
2006/03/13 20:33:12 2006/04/16 05:17:53	35.25	15.04 15.91	$\frac{3.3}{2.7}$	INGV
2006/04/17 05:35:09	36.47	14.91	1.9	INGV
2006/05/01 19:10:00	36.58	15.83	2.9	INGV
2006/05/07 15:47:48	36.33	12.79	3.3	INGV
2006/05/08 04:05:12	36.32	12.78	3.5	INGV
2006/05/08 20:43:00	36.19	12.81	3.0	INGV
2006/05/10 01:44:06	36.42	14.91	2.5	INGV

Continued on next column

Continued	from p	revious	column	ı		Continued	from p	revious	column	
Date	Lon.	Lat.	Mag.	Source	_	Date	Lon.	Lat.	Mag.	Source
2006/05/14 15:17:52	36.77	14.19	2.3	INGV		2007/03/31 13:08:01	34.52	14.26	4.0	LESSLA
2006/05/18 16:10:05	36.14	14.60	2.5	INGV		2007/04/06 16:20:51	34.64	12.95	2.4	LESSLA
2006/05/19 13:27:01	36.20	15.18	2.4	INGV		2007/04/10 19:17:32	36.93	12.91	4.1	INGV
2006/06/06 02:52:41	35.09	13.28	3.2	INGV		2007/04/11 12:02:36	36.70	13.02	2.9	INGV
2006/06/06 15:57:16	36.61	14.93	2.1	INGV		2007/04/19 00:35:10	36.33	15.45	2.3	LESSLA
2006/06/16 18:17:55	35.96	12.72	3.4	INGV		2007/04/19 07:19:16	36.94	15.26	2.3	INGV
2006/06/16 18:33:58	35.88	12.73	3.0	INGV		2007/04/22 05:17:21	36.88	15.01	1.7	INGV
2006/06/16 18:36:13	35.79	12.65	2.8	INGV		2007/04/23 21:59:18	36.00	14.66	2.3	INGV
2006/06/16 23:28:45	35.78	12.61	3.1	INGV		2007/05/01 02:09:07	35.27	13.48	2.4	LESSLA
2006/06/17 00:56:01	35.86	12.70	3.1	INGV INGV		2007/05/08 01:05:44	35.66	14.98	2.3	LESSLA
2006/06/17 01:43:53	35.49	12.71	3.0			2007/05/11 03:29:58	35.59	14.91	1.9	LESSLA
2006/06/17 02:13:19 2006/06/17 04:12:19	$35.92 \\ 35.80$	12.72 12.71	$\frac{3.1}{2.8}$	INGV INGV		2007/05/11 12:56:28 2007/06/04 03:32:18	$34.38 \\ 36.98$	13.73 14.41	$\frac{2.9}{2.3}$	INGV INGV
2006/06/28 19:39:44	35.23	12.71 14.57	2.9	INGV		2007/06/15 22:56:00	36.96	15.38	3.3	INGV
2006/06/29 07:54:16	35.56	14.68	3.1	INGV		2007/06/16 17:31:55	36.99	15.36 15.31	2.6	INGV
2006/07/04 06:17:12	36.98	14.93	1.7	INGV		2007/06/24 16:13:04	35.47	14.74	2.0	LESSLA
2006/07/20 06:05:22	35.59	12.70	3.1	INGV		2007/06/30 10:03:03	36.58	13.17	2.9	INGV
2006/08/01 07:00:19	36.95	15.23	2.2	INGV		2007/07/04 14:51:47	36.77	14.25	2.3	INGV
2006/08/09 10:38:50	36.08	13.89	2.7	INGV		2007/07/05 23:43:35	36.88	14.30	2.8	INGV
2006/08/16 02:47:45	35.81	14.71	2.9	INGV		2007/07/07 16:08:41	36.63	13.06	2.5	INGV
2006/09/22 10:10:41	36.62	14.62	2.1	INGV		2007/07/07 16:59:25	36.53	13.09	2.6	INGV
2006/09/23 10:04:16	36.96	14.31	1.9	INGV		2007/07/10 06:13:26	36.87	15.12	1.7	INGV
2006/10/27 20:27:40	35.14	15.65	3.2	INGV		2007/07/11 14:10:13	36.80	14.24	2.9	INGV
2006/11/04 01:53:25	36.59	13.25	2.9	INGV		2007/07/13 06:12:47	35.41	14.55	2.3	LESSLA
2006/11/10 13:34:19	36.66	14.92	2.1	INGV		2007/07/22 10:56:03	36.84	14.25	2.1	INGV
2006/11/20 01:49:26	34.63	13.71	3.5	INGV		2007/08/02 03:24:11	36.89	15.12	1.9	INGV
2006/11/21 21:11:39	36.89	13.50	2.6	INGV		2007/08/11 02:19:05	35.58	14.26	2.8	LESSLA
2006/11/23 13:31:54	35.88	12.68	4.6	INGV		2007/08/16 01:51:28	35.91	14.82	1.6	LESSLA
2006/11/23 13:55:43	35.94	12.69	3.6	INGV		2007/08/16 08:36:26	36.63	14.90	2.8	INGV
2006/11/24 04:37:40	36.23	15.80	4.2	INGV		2007/08/18 16:43:01	36.99	14.41	2.9	INGV
2006/11/24 08:35:22	36.19	12.84	3.0	INGV		2007/08/23 20:38:52	35.70	14.66	2.8	INGV
2006/11/25 18:56:53	36.28	15.78	3.1	INGV		2007/08/30 22:18:22	36.08	14.69	1.7	LESSLA
2006/11/25 19:04:52	36.28	15.71	2.6	INGV		2007/09/03 01:08:37	34.85	13.40	2.6	LESSLA
2006/11/29 12:05:27	35.95	12.75	3.4	INGV		2007/09/05 06:36:03	35.56	14.68	2.3	LESSLA
2006/12/05 08:07:03	36.91	15.25	1.2	INGV		2007/09/05 06:59:25	35.56	14.51	1.7	LESSLA
2006/12/13 13:28:57	34.65	15.41	3.5	INGV		2007/09/05 07:58:12	35.56	14.38	2.2	LESSLA
2006/12/16 07:16:45	35.94	12.86	3.2	INGV		2007/09/05 08:02:48	35.62	14.27	2.3	LESSLA
2006/12/16 19:46:41 2007/01/04 10:07:39	$36.11 \\ 35.46$	12.74 14.58	$\frac{3.1}{2.2}$	$\frac{INGV}{LESSLA}$		2007/09/05 09:21:53 2007/09/16 18:21:02	$35.62 \\ 35.07$	14.30 14.40	$\frac{1.5}{2.6}$	LESSLA LESSLA
2007/01/04 10:07:39	34.59	14.58	2.9	LESSLA		2007/09/18 06:11:03	35.21	13.27	3.3	INGV
2007/01/04 13:08:21 2007/01/07 12:04:15	34.85	15.05	3.1	INGV		2007/09/20 03:01:31	35.21 35.17	15.27 15.97	3.0	LESSLA
2007/01/10 08:01:55	36.88	15.12	2.4	INGV		2007/09/30 03:20:29	36.92	14.96	2.9	INGV
2007/01/14 23:23:36	36.91	14.98	2.0	INGV		2007/10/03 02:15:08	35.54	14.62	2.0	LESSLA
2007/01/25 08:28:35	34.88	14.64	2.6	LESSLA		2007/10/12 05:40:52	36.81	14.64	1.9	INGV
2007/01/26 15:15:35	35.31	15.46	3.2	LESSLA		2007/10/15 17:36:44	35.29	15.04	2.9	LESSLA
2007/01/26 23:35:46	34.91	14.74	3.1	LESSLA		2007/10/26 12:49:21	36.66	14.90	2.5	INGV
2007/01/27 00:52:50	34.90	14.51	2.7	LESSLA		2007/11/02 04:47:06	36.19	14.66	2.1	LESSLA
2007/01/27 01:21:56	34.90	14.40	2.2	LESSLA		2008/01/13 20:28:11	35.81	13.17	2.8	LESSLA
2007/01/27 02:08:37	34.87	14.42	2.4	LESSLA		2008/01/14 11:10:07	35.02	15.06	2.7	LESSLA
2007/01/27 02:23:34	34.95	14.88	2.4	LESSLA		2008/01/16 05:04:16	35.94	14.53	1.7	LESSLA
2007/01/27 23:03:16	34.94	14.73	2.9	LESSLA		2008/02/11 08:05:41	36.00	13.90	2.0	LESSLA
2007/01/31 01:57:39	35.80	12.75	2.3	INGV		2008/02/13 11:34:52	35.15	12.95	2.9	LESSLA
2007/01/31 16:37:18	35.91	12.96	2.8	INGV		2008/02/24 10:58:24	35.62	13.61	3.3	INGV
2007/02/03 11:38:39	35.00	14.99	2.8	LESSLA		2008/02/24 19:03:29	35.65	14.51	1.6	LESSLA
2007/02/06 04:23:59	35.09	13.98	2.4	LESSLA		2008/03/06 14:29:32	36.28	14.02	2.9	INGV
2007/02/06 10:52:00	36.20	12.87	3.2	INGV		2008/03/12 18:48:31	36.89	14.98	2.3	INGV
2007/02/06 12:16:52	35.15	15.34	2.4	LESSLA		2008/03/23 02:06:54	36.69	15.43	2.3	INGV INGV
2007/02/06 17:40:14 2007/02/11 20:30:59	34.96	14.70	2.8	LESSLA		2008/04/05 05:10:20 2008/04/07 16:59:11	36.42	15.49 14.94	$\frac{2.9}{2.2}$	INGV
2007/02/11 20:30:59 2007/02/15 04:26:22	$36.84 \\ 35.59$	$14.90 \\ 14.94$	$\frac{3.4}{2.8}$	$\frac{INGV}{LESSLA}$		2008/04/07 16:59:11 2008/05/06 05:19:10	$36.49 \\ 34.81$	14.94 14.46	$\frac{2.2}{2.2}$	LESSLA
2007/02/18 04:20:22 2007/02/18 07:32:07	36.36	14.94 15.17	$\frac{2.8}{2.7}$	INGV		2008/05/08 19:52:29	36.01	12.94	3.7	INGV
2007/02/18 07:32:07	36.86	14.83	2.0	INGV		2008/05/08 19:32:29	36.01	12.94	2.9	INGV
2007/02/28 09:24:29 2007/03/03 00:56:19	36.86	14.83	1.6	INGV		2008/05/08 20:19:08	35.78	13.16	2.6	LESSLA
2007/03/03 00:30:19	36.66	14.75	2.3	INGV		2008/05/08 20:13:14	35.00	14.91	3.0	LESSLA
2007/03/06 06:19:21	35.56	14.61	2.1	LESSLA		2008/05/29 23:52:01	36.38	12.94	3.1	INGV
2007/03/06 00:13:21	36.93	15.25	$\frac{2.1}{2.5}$	INGV		2008/06/07 00:18:46	36.18	12.72	3.4	INGV
2007/03/10 20:49:59	36.98	14.66	2.3	INGV		2008/06/07 01:40:16	36.26	12.80	2.8	INGV
2007/03/13 01:26:00	36.56	13.98	2.5	LESSLA		2008/06/07 01:42:58	36.20	12.76	2.8	INGV
2007/03/22 12:18:57	35.98	14.05	2.9	LESSLA		2008/06/07 03:25:02	36.22	12.78	2.8	INGV
2007/03/30 13:59:47	35.74	14.94	2.2	LESSLA		2008/06/07 13:54:51	35.77	12.72	3.3	INGV
2007/03/31 12:22:32	34.60	13.72	4.3	INGV		2008/06/12 07:46:33	36.20	12.75	3.4	INGV
		Comition	od :	ext column	-			Contin	od :	rt och
		Continu	ed on ne	xt column						

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Date	Lon.	Lat.	Mag.	Source		Date	Lon.	Lat.	Mag.	Source
2008/06/26 02:31:41	35.50	13.75	2.0	LESSLA		2009/07/05 03:23:13	36.70	15.53	2.0	INGV
2008/06/27 04:06:32	34.25	15.05	2.8	LESSLA		2009/07/05 18:52:14	35.05	13.45	3.2	LESSLA
2008/06/29 07:16:30	36.63	14.87	2.4	INGV		2009/07/16 19:47:11	36.28	12.36	2.3	INGV
2008/06/29 12:29:08	36.85	15.32	2.6	INGV		2009/07/29 19:30:03	35.24	15.44	2.3	LESSLA
2008/07/02 09:17:50	36.15	12.66	4.0	INGV		2009/07/29 21:58:23	34.96	15.26	2.3	LESSLA
2008/07/03 01:32:09	36.10	12.59	2.7	INGV		2009/07/30 02:58:36	35.10	15.30	2.6	LESSLA
2008/07/05 00:59:41	35.77	14.76	1.7	LESSLA		2009/07/30 04:20:07	36.74	14.69	1.9	INGV
2008/07/05 18:48:16	36.45	15.29	2.7	INGV		2009/07/30 05:38:54	34.93	14.73	2.8	LESSLA
2008/07/08 06:12:59 2008/07/08 06:28:55	36.07	13.80	2.8	LESSLA		2009/07/30 06:10:47	35.19	15.36	2.0	LESSLA
2008/07/12 09:02:27	$36.90 \\ 36.93$	$15.24 \\ 15.02$	$\frac{1.2}{1.9}$	INGV INGV		2009/08/07 09:06:22 2009/08/08 19:52:51	$35.89 \\ 36.01$	$15.00 \\ 14.90$	$\frac{2.6}{2.3}$	LESSLA LESSLA
2008/07/23 04:07:14	36.53	15.15	3.3	INGV		2009/08/12 03:54:12	36.49	13.01	2.9	INGV
2008/07/24 00:56:25	36.00	15.28	2.6	LESSLA		2009/08/14 10:12:31	37.00	15.59	2.0	INGV
2008/08/01 15:22:33	35.04	14.74	2.9	LESSLA		2009/08/16 07:49:42	34.92	14.70	4.1	LESSLA
2008/08/05 07:02:36	36.14	14.55	1.6	LESSLA		2009/08/19 01:10:07	35.15	12.81	2.0	LESSLA
2008/08/12 09:23:15	35.35	15.13	2.3	LESSLA		2009/08/19 03:43:18	36.65	15.38	0.1	INGV
2008/08/22 02:54:18	34.33	14.74	2.5	LESSLA		2009/08/20 21:28:41	35.40	13.48	2.1	LESSLA
2008/08/26 04:10:43	36.35	14.75	2.5	INGV		2009/08/23 18:25:37	35.34	13.53	1.8	LESSLA
2008/08/28 05:05:19	34.50	14.55	2.8	LESSLA		2009/08/25 03:21:05	35.88	15.65	2.3	LESSLA
2008/09/02 22:41:46	34.73	14.58	$^{2.4}$	LESSLA		2009/08/25 20:53:12	35.31	13.64	2.7	LESSLA
2008/09/08 05:52:44	36.97	15.12	2.1	INGV		2009/08/29 03:34:07	35.28	13.80	2.7	LESSLA
2008/09/30 05:56:24	36.78	14.81	2.6	INGV		2009/08/29 06:36:27	35.18	13.92	2.4	LESSLA
2008/10/01 13:17:50	36.76	14.76	2.0	INGV		2009/08/29 20:53:45	35.17	13.68	2.0	LESSLA
2008/10/05 05:25:51	36.90	14.67	2.5	INGV		2009/08/29 22:37:57	35.10	13.73	2.8	LESSLA
2008/10/05 05:27:26	36.90	14.71	3.4	INGV		2009/08/30 02:10:57	35.11	14.93	1.8	LESSLA
2008/10/24 06:02:00	35.33	14.12	1.9	LESSLA		2009/09/01 17:45:13	35.24	13.62	2.9	LESSLA
2008/11/03 08:37:12	36.84	15.00	2.0	INGV		2009/09/22 14:40:08	36.28	13.32	2.6	INGV
2008/11/30 16:28:27	35.66	14.90	2.3	LESSLA		2009/09/23 13:01:06	36.24	13.09	3.1	INGV
2008/12/02 18:42:19	35.74	15.53	2.5	LESSLA		2009/10/01 06:04:37	35.39	13.70	2.8	INGV
2008/12/15 18:38:58	36.27	12.78	3.4	INGV		2009/10/02 00:05:34	35.53	13.81	3.2	INGV
2008/12/17 03:02:44	36.01	14.58	1.7	LESSLA		2009/10/03 17:22:10	36.98	15.06	2.0	INGV
2008/12/23 23:47:24	$35.58 \\ 34.53$	14.85 14.41	$\frac{1.7}{2.8}$	LESSLA LESSLA		2009/10/03 21:54:39 2009/10/10 14:55:00	$36.91 \\ 36.50$	$15.05 \\ 12.75$	$\frac{2.1}{3.0}$	INGV INGV
2008/12/25 18:52:53 2009/01/11 02:46:24	34.59	15.80	$\frac{2.6}{2.7}$	LESSLA		2009/10/18 08:06:10	35.01	12.73 14.72	3.6	INGV
2009/02/05 03:55:23	36.66	15.44	3.4	LESSLA		2009/10/30 23:07:32	36.62	12.80	2.6	INGV
2009/02/18 07:38:06	35.51	14.81	2.0	LESSLA		2009/11/07 03:05:42	36.93	14.60	2.2	INGV
2009/02/20 13:45:49	35.57	15.68	2.8	INGV		2009/12/20 04:33:35	34.85	13.62	3.1	LESSLA
2009/03/19 09:29:19	36.25	12.86	3.0	INGV		2010/01/04 01:50:37	34.33	13.75	2.1	LESSLA
2009/03/19 10:25:57	36.44	12.62	3.5	INGV		2010/01/04 06:28:53	34.04	14.87	3.1	LESSLA
2009/03/20 01:15:16	36.47	12.72	3.5	INGV		2010/01/05 11:23:23	34.12	14.97	4.1	INGV
2009/03/23 18:44:35	34.47	13.76	4.0	LESSLA		2010/01/28 13:05:41	36.96	15.03	2.8	INGV
2009/03/27 09:19:08	34.88	13.03	2.2	LESSLA		2010/02/09 02:51:53	36.26	13.19	2.9	LESSLA
2009/04/17 05:44:07	36.59	14.64	2.3	INGV		2010/02/14 00:51:05	36.47	15.14	2.5	INGV
2009/04/17 07:40:11	36.11	14.68	2.3	LESSLA		2010/02/16 06:42:16	35.17	13.96	3.3	LESSLA
2009/04/20 14:19:30	35.92	14.89	2.0	LESSLA		2010/02/17 07:54:27	36.52	14.07	2.7	LESSLA
2009/04/25 01:36:25	$34.31 \\ 35.62$	14.09	$\frac{3.8}{2.3}$	LESSLA		2010/02/24 14:44:20 2010/02/26 16:38:49	35.05	13.95	2.6	LESSLA
2009/04/28 02:56:40 2009/05/02 09:27:26	35.52	$14.76 \\ 14.74$	$\frac{2.3}{2.3}$	LESSLA LESSLA		2010/02/20 10:38:49 2010/03/08 19:11:35	$35.29 \\ 36.25$	13.18 12.41	$\frac{3.0}{3.2}$	INGV INGV
2009/05/07 22:35:53	36.14	14.74	$\frac{2.3}{2.2}$	INGV		2010/03/08 19:11:33	36.86	12.41 14.55	$\frac{3.2}{2.3}$	INGV
2009/05/13 11:04:22	34.70	15.59	2.4	LESSLA		2010/03/21 11:54:15	35.26	13.99	2.4	LESSLA
2009/05/16 13:08:42	35.92	14.56	1.9	LESSLA		2010/04/18 09:38:27	35.47	14.56	2.4	LESSLA
2009/05/20 00:50:03	35.87	14.63	1.5	LESSLA		2010/04/21 03:46:42	35.14	13.72	2.9	LESSLA
2009/05/20 08:24:04	36.55	13.56	2.5	LESSLA		2010/04/27 07:45:06	35.09	14.87	2.9	LESSLA
2009/05/20 14:31:15	34.86	14.93	2.6	LESSLA		2010/04/27 18:48:22	35.03	14.94	2.3	LESSLA
2009/05/20 16:01:49	35.09	15.20	2.5	LESSLA		2010/05/01 05:23:52	36.10	14.44	2.6	LESSLA
2009/05/21 00:52:07	35.27	12.97	2.5	LESSLA		2010/05/08 22:23:26	36.65	15.42	3.0	LESSLA
2009/05/21 01:46:31	35.14	15.32	2.0	LESSLA		2010/05/09 16:09:44	36.57	15.21	2.5	INGV
2009/05/21 01:52:37	34.95	14.82	2.1	LESSLA		2010/05/23 22:03:48	34.08	14.79	3.2	LESSLA
2009/05/21 02:24:58	34.91	14.40	1.9	LESSLA		2010/05/28 13:53:59	36.97	14.26	2.3	INGV
2009/05/21 02:41:14	35.07	15.09	2.8	INGV		2010/05/30 04:59:43	36.39	12.87	2.6	INGV
2009/05/21 02:58:16	34.81	14.58	1.7	LESSLA		2010/06/15 23:29:24	35.52	14.31	1.8	LESSLA
2009/05/21 03:17:45	35.09	15.30	2.3	LESSLA		2010/06/18 01:38:08	35.69	13.57	2.3	INGV
2009/05/21 03:19:44	35.31	15.47	2.2	LESSLA		2010/06/22 23:46:36	35.11	15.71	3.1	INGV
2009/05/24 13:54:50	34.65	15.37	$\frac{2.7}{2.7}$	LESSLA		2010/06/25 13:39:13 2010/06/28 22:26:07	36.92 35.45	14.49	2.2	INGV
2009/05/26 21:17:53 2009/05/26 21:37:21	34.92	14.87	$\frac{2.7}{2.4}$	LESSLA		, ,	35.45	14.78	2.2	LESSLA INGV
2009/05/26 21:37:21 2009/05/26 21:49:04	34.99 35.09	$15.05 \\ 15.17$	$\frac{2.4}{2.4}$	LESSLA INGV		2010/06/29 07:45:03 2010/06/29 08:08:41	$35.94 \\ 35.70$	13.36 13.36	$\frac{3.0}{2.7}$	LESSLA
2009/05/29 10:25:22	34.83	15.17	$\frac{2.4}{2.6}$	LESSLA		2010/06/29 08:08:41 2010/06/29 08:08:41	35.70 35.95	13.40	3.0	INGV
2009/06/26 04:16:51	36.97	13.48 14.91	1.5	INGV		2010/06/30 02:13:40	36.69	15.40 15.69	$\frac{3.0}{2.0}$	INGV
2009/06/26 10:36:43	36.83	14.26	$\frac{1.5}{2.1}$	INGV		2010/00/30 02:13:40	36.13	14.97	2.2	INGV
2009/07/04 01:24:37	36.90	15.32	2.0	INGV		2010/07/03 19:06:05	35.57	14.85	2.2	LESSLA
Continued on next column Continued on next column										

Date	Continued	from p	revious	column		Continued	from p	revious	column	
2010 07/08 18:16-41 36:92 15:23 2.0 NGV 2011 07/08 13:5226 36:64 14:93 2.1 NGV 2011 07/08 13:526 36:64 14:93 2.1 NGV 2011 07/18 13:528 36:64 14:93 2.1 NGV 2011 07/18 13:526 36:64 14:93 2.1 NGV 2011 07/18 13:526 36:64 14:93 2.1 NGV 2011 07/18 13:526 36:64 14:93 36:64 16:14 2.0 NGV 2011 07/18 13:65:63 36:64 16:14 2.0 NGV 2011 07/18 13:65:63 36:74 16:15 2.8 LESSILA 2011 07/18 13:65:63 36:75	Date	Lon.	Lat.	Mag.	Source	Date	Lon.	Lat.	Mag.	Source
2010 07/19 06-19-24 35-41 13-32 3.1	2010/07/05 06:06:18	36.72	15.13	0.3	INGV	2011/04/27 05:40:38	35.78	14.95	2.3	LESSLA
2010 07/10 21:46:29 34.97 13.77 2.8 LESSIA 2011 05/11 15:17:11 35.68 14.57 3.3 INGV 2010 07/12 23:195:59 35.51 14.75 2.1 LESSIA 2010 07/12 23:195:50 35.58 14.57 3.1 LESSIA 2010 07/12 23:195:50 35.58 14.58 1.5 2.1 LESSIA 2010 07/12 23:195:50 35.58 14.59 1.5 1.5 2.5 LESSIA 2010 07/12 23:195:50 35.58 14.59 1.5 1.5 2.5 LESSIA 2010 07/13 23:195:50 35.58 14.59 1.5 1.5 2.5 LESSIA 2010 07/13 23:195:50 35.58 14.59 1.5 2.5 LESSIA 2010 07/13 23:195:50 35.58 14.59 2.5 LESSIA 2010 07/14 20:35:38 34.58 13.71 3.0 LESSIA 2011 07/19 18:09:36 36.59 14.52 2.2 INGV 2010 07/19 13:34:34 34.19 14.29 2.7 LESSIA 2011 07/19 13:34:34 34.19 14.29 2.7 LESSIA 2011 07/19 13:34:34 36.70 15.60 3.1 INGV 2010 07/19 13:34:34 36.70 15.60 3.2 INGV 2010 07/19 13:34:34 36.70 15.60 3.3 INGV 2010 07/19 13:34:34 36.70 15.60 3.3 INGV 2010		36.92	15.23	2.0			36.64	14.93	2.1	
2010 07/11 22:56:36 34:17 13:75 3.6 LESSLA 2011 07/12 23:16:50 35.67 14.75 2.1 LESSLA 2010 07/12 23:56:50 35.68 14.53 14.52 2.2 LESSLA 2010 07/12 23:56:50 35.68 14.53 14.52 2.2 LESSLA 2010 07/12 23:56:50 35.68 14.53 14.52 2.2 LESSLA 2010 07/13 23:36:50 35.68 14.59 3.0 LESSLA 2010 07/13 23:36:50 35.68 14.59 2.2 LESSLA 2010 07/14 00:35:38 34.87 31.28 2.1 LESSLA 2010 07/16 16:36:36 36.50 14.62 2.2 INGV 2010 07/12 00:35:38 34.88 31.71 30.0 LESSLA 2011 07/06 00:35:38 34.88 31.71 30.0 LESSLA 2011 07/06 00:35:38 34.88 31.71 30.0 LESSLA 2011 07/16 00:30:36 36.66 15.65 2.9 INGV 2010 07/12 00:35:38 36.88 15.55 1.9 INGV 2011 07/12 00:30:30 36.64 15.98 2.9 INGV 2011 07/12 00:30:30 36.64 15.98 36.98 15.98 2.9 INGV 2011 07/12 00:30:30 36.64 15.98 36.98 15.98 2.9 INGV 2011 07/12 00:30:30 36.64 15.98 36.98 15.98 2.9 INGV 2011 07/12 00:30:30 36.64 15.88 36.98 15.98 2.9 INGV 2011 07/12 00:30:30 36.64 36.68 36.98 3	, ,					, ,				
2010 07/11 23:26:57 36.32 13.87 2.6 INGV 2011 06/12 12:09:51 35.80 14.53 1.6 LESSIA 2010 07/13 23:35:30 34.22 13.94 3.6 LESSIA 2011 06/23 20:50:37 35.53 14.02 2.2 LESSIA 2010 07/13 13:19:31 34.22 13.94 3.6 LESSIA 2011 06/23 20:50:37 35.53 14.02 2.2 LESSIA 2010 07/13 23:35:20 34.57 33.28 2.1 LESSIA 2011 06/30 16:00:36 36.50 14.02 2.2 LESSIA 2010 07/13 23:35:20 34.57 33.28 2.1 LESSIA 2011 06/30 16:00:36 36.50 14.02 2.2 LESSIA 2010 07/19 13:35:35:35 36.50 14.22 2.2 LESSIA 2010 07/19 13:35:35 2.0 LESSIA 2010 07/19 13:35:35 2.4 LESSIA 2010 07/19 20:35:35 3.4 LESSIA 2010 07/19 20:35:35						*. *.				
2010/07/12 22:33:04 36:64 13:14 2.0 INGV 2011/06/21 12:09:51 35:64 13:99 3.0 LESSIA 2010/07/13 13:18:53 34:76 14:05 2.8 LESSIA 2011/06/28 16:36:46 36:97 15:01 2.6 INGV 2010/07/13 23:33:001 34:57 34:76 32:82 21 INGV 2010/07/13 33:18:53 34:76 34:05 22 INGV 2010/07/14 00:35:38 34:38 13:71 3:0 LESSIA 2011/07/02 13:49:43 36:70 15:06 3:1 INGV 2010/07/12 02:21:21 35:23 13:09 3:5 LESSIA 2011/07/02 13:49:43 36:70 15:06 3:1 INGV 2010/07/12 02:21:21 35:23 13:09 3:5 LESSIA 2011/07/02 03:79:49 36:70 15:06 3:1 INGV 2010/07/12 02:21:21 35:23 13:09 3:5 LESSIA 2011/07/12 07:11:08 36:48 15:03 2:4 INGV 2010/07/12 02:21:21 35:23 13:09 3:5 LESSIA 2011/07/12 07:11:08 36:48 15:03 2:4 INGV 2010/08/24 08:06:19 35:54 15:19 2:4 INGV 2011/07/12 07:11:08 36:48 15:03 2:4 INGV 2011/08/24 06:08:23 36:50 15:03 2:9 INGV 2011/07/12 07:11:08 36:48 15:03 2:4 INGV 2011/08/24 06:08:23 36:50 15:03 2:9 INGV 2011/07/12 07:11:08 36:54 15:55 2:4 INGV 2011/08/24 06:08:23 36:60 13:06 3:06	, ,									
2010/07/13 11:19:31 34:22 13:94 3.6 LESSIA 2011/06/23 06:50:37 35.33 14:02 2.2 LESSIA 2010/07/14 23:33:00:1 34:57 13:28 2.1 LESSIA 2011/06/30 16:00:36 36:50 14:62 2.2 INGV 2010/07/14 03:35:38 34:38 34:57 3.2 2.1 LESSIA 2011/06/30 16:00:36 36:50 14:62 2.2 INGV 2010/07/15 17:38:46 34:57 34:58 34:19 14:29 2.7 LESSIA 2011/07/04 07:35:35 36:56 15:66 3.0 INGV 2010/07/19 05:35:35 36:56 15:65 3.0 INGV 2010/07/19 05:35:35 36:56 15:65 3.0 INGV 2010/07/12 12:49:90 36:68 15:33 2.0 INGV 2011/07/12 12:49:90 36:68 15:33 2.0 INGV 2011/07/12 12:49:90 36:58 14:39 2.2 LESSIA 2011/07/12 10:49:30 36:59 36:										
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2011/04/24 13:02:13 35.94 14.92 3.4 LESSLA 2011/10/22 07:31:30 36.58 15.07 2.4 INGV 2011/04/25 06:10:19 35.94 14.96 2.5 LESSLA 2011/10/26 07:15:50 34.80 14.13 3.4 LESSLA 2011/04/26 04:10:29 35.83 14.96 2.6 LESSLA 2011/11/16 06:40:34 35.21 14.55 3.1 LESSLA 2011/04/26 18:00:14 36.00 14.85 2.4 LESSLA 2011/11/16 08:09:06 35.33 14.09 2.6 LESSLA	, ,									
2011/04/25 06:10:19 35.94 14.96 2.5 LESSLA 2011/10/26 07:15:50 34.80 14.13 3.4 LESSLA 2011/04/26 04:10:29 35.83 14.96 2.6 LESSLA 2011/11/16 06:40:34 35.21 14.55 3.1 LESSLA 2011/04/26 18:00:14 36.00 14.85 2.4 LESSLA 2011/11/16 08:09:06 35.33 14.09 2.6 LESSLA										
2011/04/26 04:10:29 35.83 14.96 2.6 LESSLA 2011/04/26 18:00:14 36.00 14.85 2.4 LESSLA 2011/11/16 08:09:06 35.33 14.09 2.6 LESSLA 2011/11/16 08:09:06 35.33 14.09 2.6 LESSLA	, ,					, ,				
	2011/04/26 04:10:29	35.83	14.96	2.6	LESSLA	2011/11/16 06:40:34			3.1	LESSLA
Continued on next column Continued on next column	2011/04/26 18:00:14	36.00	14.85	2.4	LESSLA	2011/11/16 08:09:06	35.33	14.09	2.6	LESSLA
			Continu	ed on ne	ext column			Continu	ed on ne	xt column

Continued	from p	revious	column		Continued from previous column						
Date	Lon.	Lat.	Mag.	Source	Date	Lon.	Lat.	Mag.	Source		
2011/12/02 12:21:12	35.21	15.88	3.0	INGV	2012/06/27 03:19:54	36.99	15.04	1.9	INGV		
2011/12/06 07:03:59	36.83	14.94	2.5	INGV	2012/06/27 03:28:09	36.98	15.02	1.6	INGV		
2011/12/06 07:06:02	36.84	14.94	2.6	INGV	2012/06/27 03:33:10	36.98	15.04	2.0	INGV		
2011/12/14 04:00:57	36.97	15.03	1.8	INGV	2012/06/27 04:06:12	36.98	15.04	1.6	INGV		
2011/12/18 15:01:02	35.80	12.77	3.9	LESSLA	2012/06/27 04:49:04	36.98	15.04	1.7	INGV		
2011/12/18 15:01:02	35.98	12.65	4.5	INGV	2012/06/27 06:54:57	36.98	15.04	1.9	INGV		
2011/12/18 15:30:04	36.17	12.66	3.0	INGV	2012/06/27 07:01:09	36.98	15.03	1.8	INGV		
2011/12/18 15:42:48	36.10	12.74	2.8	INGV	2012/06/27 08:53:50	36.98	15.03	1.8	INGV		
2011/12/18 17:57:48	35.98	12.63	3.5	INGV	2012/06/27 09:58:35	36.98	15.04	2.2	INGV		
2012/01/17 11:22:23	36.50	15.07	$\frac{2.1}{3.9}$	INGV	2012/06/27 10:23:15	36.98	15.04	2.1	INGV INGV		
2012/02/03 08:25:55 2012/02/05 10:45:27	$34.47 \\ 36.92$	13.98 14.79	$\frac{3.9}{2.7}$	INGV INGV	2012/06/27 10:54:15	$36.97 \\ 36.98$	15.03 15.02	$\frac{1.7}{1.6}$	INGV		
2012/02/18 14:42:23	36.41	12.79 12.72	3.1	INGV	2012/06/27 11:41:30 2012/06/27 15:28:36	36.98	15.02 15.04	$\frac{1.0}{2.4}$	INGV		
2012/02/10 14:42:23	36.43	12.72	2.8	INGV	2012/06/27 15:28:30	36.98	15.04 15.03	1.7	INGV		
2012/02/20 08:31:08	36.52	12.69	3.5	INGV	2012/06/27 15:52:57	36.98	15.03	2.0	INGV		
2012/03/23 10:28:13	34.41	13.64	3.2	LESSLA	2012/06/27 17:28:38	36.98	15.04	$\frac{2.0}{2.1}$	INGV		
2012/03/23 10:28:36	35.95	14.26	3.3	INGV	2012/06/27 18:08:49	36.98	15.02	1.6	INGV		
2012/03/24 01:18:58	34.95	13.89	2.4	LESSLA	2012/06/27 19:06:19	36.98	15.03	1.9	INGV		
2012/03/24 05:37:21	36.67	15.26	2.9	INGV	2012/06/27 20:10:03	36.98	15.03	1.4	INGV		
2012/03/24 05:37:21	36.91	14.69	2.3	LESSLA	2012/06/27 23:40:19	36.98	15.03	1.6	INGV		
2012/03/27 02:29:36	35.07	15.04	3.3	INGV	2012/06/28 00:31:04	36.98	15.04	1.7	INGV		
2012/03/27 02:29:36	35.17	14.90	2.6	LESSLA	2012/06/28 05:38:38	36.98	15.04	1.5	INGV		
2012/03/29 20:00:12	36.93	14.78	1.8	INGV	2012/06/28 08:57:28	36.98	15.03	1.7	INGV		
2012/03/29 20:01:24	36.93	14.79	1.8	INGV	2012/06/28 20:08:39	36.97	15.03	1.3	INGV		
2012/03/29 20:18:14	36.99	14.81	2.2	LESSLA	2012/06/28 23:16:04	36.98	15.04	1.8	INGV		
2012/03/29 20:18:15	36.94	14.82	2.6	INGV	2012/06/29 02:20:54	36.98	15.03	1.7	INGV		
2012/03/29 21:09:36	36.42	15.57	2.3	INGV	2012/07/01 05:12:32	36.98	15.05	1.2	INGV		
2012/03/30 19:54:09	34.66	13.63	3.9	INGV	2012/07/02 02:03:34	36.98	15.03	2.3	INGV		
2012/04/05 03:14:34	36.94	14.79	2.3	INGV	2012/07/02 03:05:47	36.79	14.55	1.3	INGV		
2012/04/16 02:33:41	36.81	12.71	3.3	INGV	2012/07/02 13:03:29	36.98	15.04	1.7	INGV		
2012/04/29 06:00:28	36.93	15.69	2.4	INGV	2012/07/03 05:03:42	34.13	15.15	4.0	LESSLA		
2012/05/06 14:14:51	36.26	14.44	1.6	LESSLA	2012/07/03 05:59:42	34.19	15.09	2.7	LESSLA		
2012/05/10 04:22:53	36.95	14.78	1.9	INGV	2012/07/03 23:49:57	36.98	15.04	1.8	INGV		
2012/05/22 16:18:41	36.73	14.59	2.7	INGV	2012/07/05 07:58:24	36.98	15.04	1.7	INGV		
2012/05/25 00:35:10	35.91	14.95	2.9	INGV	2012/07/05 13:59:18	36.81	15.26	1.6	INGV		
2012/05/25 01:29:41	36.94	15.14	2.6	INGV	2012/07/05 19:29:13	36.98	15.04	1.7	INGV		
2012/06/05 12:51:26 2012/06/09 03:01:14	$36.84 \\ 36.76$	14.84 15.31	$\frac{1.8}{2.4}$	INGV INGV	2012/07/08 20:58:54 2012/07/09 06:55:44	$36.98 \\ 36.97$	$15.04 \\ 14.54$	$\frac{1.2}{1.6}$	INGV INGV		
2012/06/16 16:09:47	36.45	13.49	2.4	INGV	2012/07/09 00:33:44 2012/07/09 07:35:41	36.55	15.35	1.7	INGV		
2012/06/16 16:09:47	36.79	13.43	$\frac{2.0}{2.4}$	LESSLA	2012/07/14 07:35:54	36.98	15.03	1.8	INGV		
2012/06/17 02:18:52	36.91	14.52	1.9	INGV	2012/07/14 07:33:34	36.99	15.03 15.04	1.9	INGV		
2012/06/19 15:22:56	36.90	14.99	1.6	INGV	2012/07/20 23:35:01	34.59	15.86	2.6	LESSLA		
2012/06/25 10:57:35	36.98	15.03	2.1	INGV	2012/07/21 13:58:12	36.64	15.75	2.2	INGV		
2012/06/25 11:00:22	36.98	15.02	1.7	INGV	2012/07/24 16:52:40	36.97	15.04	1.8	INGV		
2012/06/25 11:47:04	36.98	15.03	1.8	INGV	2012/07/30 14:27:36	36.98	15.04	1.6	INGV		
2012/06/25 13:22:35	36.98	15.03	1.7	INGV	2012/07/30 15:47:48	36.98	15.05	1.6	INGV		
2012/06/25 14:37:15	36.98	15.03	1.7	INGV	2012/09/06 00:17:54	36.97	15.04	1.7	INGV		
2012/06/25 20:41:25	36.97	15.02	1.8	INGV	2012/09/06 20:54:54	36.91	14.86	1.8	INGV		
2012/06/26 01:14:00	36.98	15.03	1.3	INGV	2012/09/09 04:59:12	34.81	14.19	2.4	LESSLA		
2012/06/26 11:54:26	36.97	15.04	1.4	INGV	2012/09/14 22:19:23	36.35	13.07	3.8	INGV		
2012/06/26 21:27:00	36.97	14.67	1.9	INGV	2012/09/15 01:38:14	36.98	15.04	1.5	INGV		
2012/06/27 01:07:39	36.97	15.06	2.6	INGV	2012/09/15 15:40:59	36.55	13.19	3.7	LESSLA		
2012/06/27 01:09:49	36.98	15.03	1.9	INGV	2012/09/15 15:41:00	36.34	13.08	3.9	INGV		
2012/06/27 01:14:20	37.00	15.06	3.7	INGV	2012/09/15 15:53:12	36.31	13.17	2.8	INGV		
2012/06/27 01:21:00	37.00	15.05	3.0	INGV	2012/09/15 17:31:22	36.43	13.12	3.0	INGV		
2012/06/27 01:31:23	36.98	15.04	1.8	INGV	2012/09/16 00:57:01 2012/09/17 18:46:24	36.57	14.78	2.8	INGV INGV		
2012/06/27 01:33:24 2012/06/27 01:39:05	$36.98 \\ 36.98$	15.03 15.03	$\frac{2.1}{1.8}$	INGV INGV	2012/09/17 18:46:24 2012/09/18 04:17:59	$36.79 \\ 35.53$	$14.58 \\ 14.42$	$\frac{1.8}{2.0}$	LESSLA		
2012/06/27 01:39:05	36.98	15.03 15.04	1.6	INGV	2012/09/18 04:17:39 2012/09/23 01:29:40	36.96	14.42 14.74	1.3	INGV		
2012/06/27 01:53:22	36.98	15.04 15.03	1.8	INGV	2012/09/24 23:35:00	34.73	14.74	3.1	LESSLA		
2012/06/27 01:55:32	36.98	15.03 15.04	2.0	INGV	2012/10/02 03:42:00	35.87	14.92	2.6	LESSLA		
2012/06/27 02:00:30	36.98	15.03	1.6	INGV	2012/10/03 12:44:40	36.47	15.10	2.1	INGV		
2012/06/27 02:06:13	36.98	15.04	2.0	INGV	2012/10/04 07:28:53	34.91	13.98	2.9	LESSLA		
2012/06/27 02:00:10	36.98	15.04	1.9	INGV	2012/10/01 01:20:00	36.62	15.57	2.3	INGV		
2012/06/27 02:21:24	36.98	15.03	1.8	INGV	2012/10/11 06:46:56	36.16	15.87	2.4	INGV		
2012/06/27 02:37:51	36.98	15.04	1.6	INGV	2012/10/12 13:15:36	36.42	15.41	2.3	INGV		
2012/06/27 02:48:00	36.95	15.45	3.1	LESSLA	2012/10/12 16:37:05	36.91	14.99	1.7	INGV		
2012/06/27 02:48:02	36.98	15.09	3.3	INGV	2012/10/16 17:02:07	34.94	13.93	3.6	INGV		
2012/06/27 02:58:50	36.98	15.04	1.8	INGV	2012/10/22 03:34:49	36.66	12.85	3.3	INGV		
2012/06/27 03:11:23	36.98	15.04	2.3	INGV	2012/10/25 16:41:33	34.87	15.12	2.6	LESSLA		
2012/06/27 03:13:25	36.99	15.03	1.6	INGV	2012/10/26 13:21:31	36.83	15.57	2.5	LESSLA		
		Continu	ied on no	ext column	· -		Continu	ied on no	ext column		
	Continued on next column Continued on next column										

Continued	from p	revious	column	
Date	Lon.	Lat.	Mag.	Source
2012/10/31 02:15:27	36.98	15.04	1.8	INGV
2012/10/31 02:38:34	36.98	15.03	1.6	INGV
2012/11/09 02:48:15	36.46	15.43	2.3	INGV
2012/11/09 19:40:39	36.57	15.10	2.7	INGV
2012/11/10 08:12:38	36.81	14.66	2.4	INGV
2012/11/10 15:55:58	36.74	13.10	2.6	INGV
2012/11/18 05:03:07 2012/11/20 05:25:13	$35.79 \\ 35.18$	14.98 12.71	$\frac{2.1}{3.5}$	LESSLA LESSLA
2012/11/20 05:25:13	35.16 35.20	12.71 12.74	$\frac{3.5}{3.5}$	INGV
2012/11/25 21:22:50	36.64	14.41	2.0	INGV
2012/11/26 20:32:16	36.94	15.76	2.3	INGV
2012/12/05 20:05:04	36.77	14.59	2.1	INGV
2012/12/06 20:43:44	36.68	14.78	2.7	INGV
2012/12/07 15:25:45	36.93	14.94	2.0	INGV
2012/12/12 22:49:58	36.15	13.85	2.7	INGV
2012/12/13 11:11:15	36.76	14.89	1.9	INGV
2013/01/03 11:29:56	36.42	13.41	2.9	INGV
2013/01/07 18:24:07	36.69	14.78	2.2	INGV
2013/01/20 06:03:36	36.71	14.87	3.0	INGV
2013/02/15 05:54:48	37.00	14.65	1.8	INGV
2013/03/01 04:17:55	36.05	12.82	2.9	INGV
2013/03/02 04:22:10	36.24	12.60	3.7	INGV
2013/03/03 12:36:41	36.89	14.98	1.9	INGV
2013/03/08 04:59:24	36.96	15.17	2.0	INGV
2013/03/08 15:52:04 2013/03/21 09:45:54	$36.18 \\ 36.47$	13.90 14.76	$\frac{2.4}{3.1}$	INGV INGV
2013/03/21 09.43.34 2013/04/02 06:23:41	35.63	12.96	2.6	INGV
2013/04/04 17:43:09	36.49	14.79	2.8	INGV
2013/04/13 11:15:37	36.86	14.44	2.0	INGV
2013/04/16 21:57:12	35.35	12.72	3.2	INGV
2013/05/02 18:43:08	35.46	12.67	3.0	INGV
2013/05/14 13:51:58	36.17	15.14	3.3	INGV
2013/05/21 16:33:26	36.11	15.12	2.8	INGV
2013/05/24 12:21:19	36.96	15.83	2.4	INGV
2013/06/09 09:43:21	36.85	14.73	1.4	INGV
2013/06/23 12:20:36	36.86	14.82	1.6	INGV
2013/06/26 18:51:27	36.61	15.07	2.2	INGV
2013/07/20 11:54:25	36.91	14.99	1.7	INGV
2013/07/23 16:38:16	36.85	14.77	1.7	INGV
2013/07/27 01:43:57 2013/07/28 11:42:53	$36.84 \\ 36.24$	15.03 15.63	$\frac{1.3}{2.3}$	INGV INGV
2013/07/29 00:41:03	36.62	15.03 15.23	2.0	INGV
2013/07/29 23:24:54	36.98	14.77	1.7	INGV
2013/08/20 14:13:59	36.75	14.87	1.9	INGV
2013/08/24 17:18:19	36.71	15.00	4.0	INGV
2013/08/26 03:45:25	36.41	14.08	3.7	INGV
2013/08/29 21:09:56	36.63	15.57	1.8	INGV
2013/09/07 06:26:23	36.97	15.45	1.9	INGV
2013/09/12 02:53:05	36.66	15.03	2.3	INGV
2013/09/18 18:34:58	36.99	15.09	1.5	INGV
2013/10/14 07:32:20	36.83	15.28	1.8	INGV
2013/10/18 11:05:21	36.78	14.97	3.0	INGV
2013/10/27 06:21:11	36.61	14.67	1.5	INGV
2013/10/29 02:11:29	36.99	15.33	2.2	INGV
2013/10/30 03:04:53 2013/12/03 02:55:05	$36.73 \\ 36.82$	13.19 14.93	$\frac{2.9}{1.7}$	INGV INGV
2013/12/08 16:53:07	36.74	14.93 14.41	$\frac{1.7}{2.7}$	INGV
2013/12/15 03:57:33	36.67	14.41 14.94	3.9	INGV
2013/12/19 21:24:43	36.98	14.30	1.6	INGV
, ,				

Concluded