Centre Sismologique Euro-Méditerranéen
European-Mediterranean Seismological Centre

Newsletter

N° 7 SEPTEMBER 1995

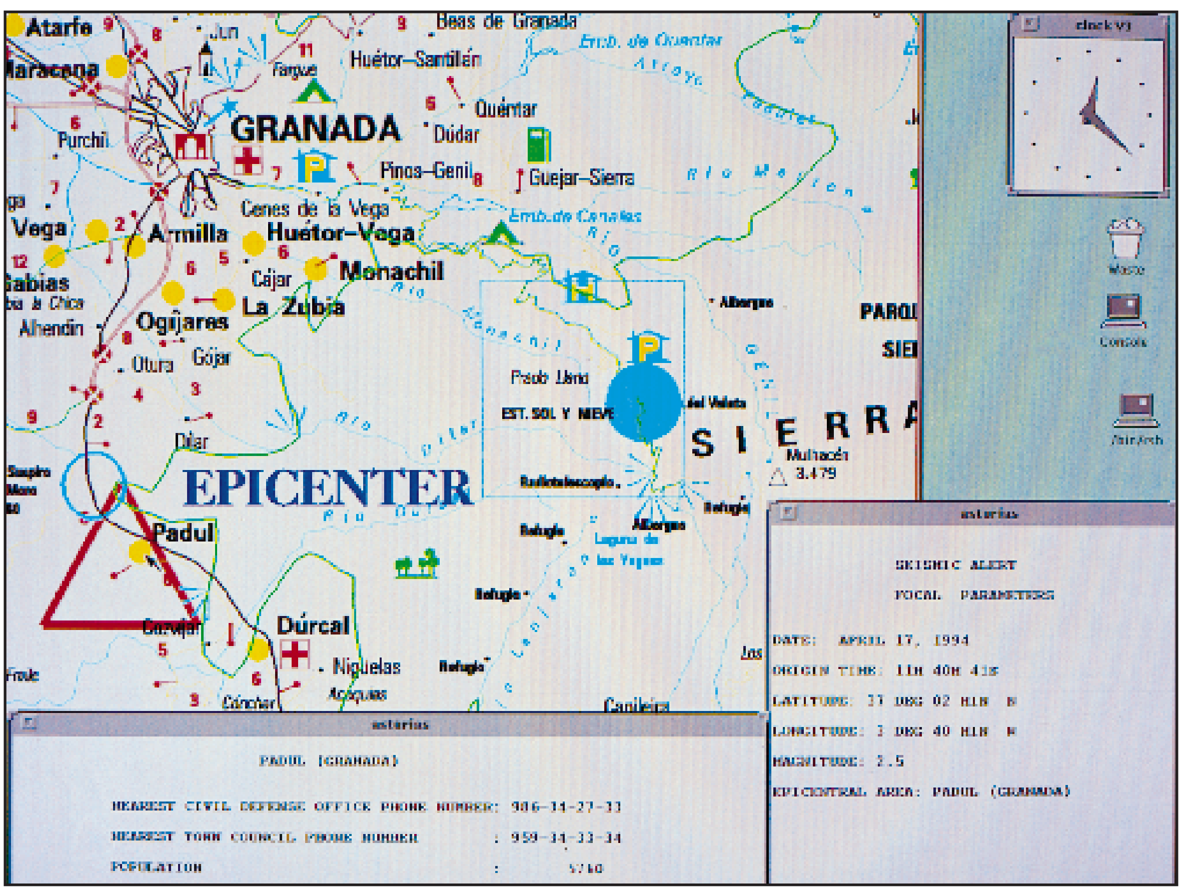
EDITORIAL

In May, I had the pleasure of attending, for the first time, one of the regular meetings of the three key nodal members of EMSC providing our rapid determinations of epicentres : on this occasion, hosted by Julio Mezcua at IGN in Madrid. We know that this distributed system works and that back-up is always available to ensure members receive timely information even at times of computer or communications failure at one of the centres. During our meeting, ideas were pursued for improving the reliability and speed of the service further and I was struck by the harmony among the participants in the pursuit of this goal.

Harmony and collaboration throughout the EMSC community is generally on the increase with the ESMC coordinating office being one catalyst (but by no means the only one) in this process. Membership is going up with 4 new institutions anticipated during the next Assembly on 12 Octobre 1995 at Bruyères-le-Châtel ; namely NRIAG in Egypt, LCPC in France, DIAS in Ireland, and GRC in Lebanon. In his paper on the proposed European parametric database (this issue), Bruno Feignier emphasises the use of ETH's AutoDRM system for the purpose. It can be used not only for parametric data exchange, as in this case, but also for waveforms. Its adoption by EMSC, the nuclear test scientists of GSE, the European braod-band community through ORFEUS and the Transfontier Group of 10 low-to-medium scismicity EU Members States, represents a widespread convergence of our methodologies throughout the EMSC region and throughout the range of magnitudes and events of interest to different parties. Further benefits accrue from this common philosophy in the joint development and exchange of conversion and manipulation software which will help newcomers to the "club" in getting rapidly up-to-speed. If you wish to join in please contact your EMSC Secretary General by one of the means listed on the back page of this Newsletter.

Our 32 members from 21 countries now span the region Morocco to Finland and Saudi Arabia to Portugal. We look forward to meeting most of their representatives at the first Assembly to be held in our new premises on 12 October when more details of progress will be presented and further proposals discussed and steered by all.

Chris Browitt
President



Example of information provided by a Geographical Information System for earthquake alerts.

A GEOGRAPHICAL INFORMATION SYSTEM FOR SEISMIC APPLICATIONS

J. Mezcua, G. Pascual and J. Rueda

Instituto Geográfico Nacional, Madrid (Spain)

Introduction

Since the Instituto Geográfico Nacional of Spain (IGN) was designated key nodal member for rapid earthquake determination in the EMSC, several developments have been taking place in order to improve the service provided by the IGN to its own national authorities. The real-time location of any event in the area of Spain is carried out as soon as the detection of the signals triggers the appropriate location program. As a consequence, epicentral coordinates and origin time plus an estimation of the local magnitude are calculated automatically and validated by the operator on duty. Usually, this information is passed to the Civil Defence Organization and any other official or newspaper interested in these data. However, as experience has shown us, additional information is also of interest, such as the name of the closest most important village, the population of the area, the telephone number of the nearest police station to the epicentral area and so on. In order to be able to give such additional data, a Geographical Information System (GIS) has been developed at the IGN which, besides these answers, is also capable of assisting with several other seismic studies not performed in real-time. The purpose of this note is to present such real-time GIS and show some examples of other seismological applications already performed at the IGN.

Description of the real-time geographical information system for seismic alerts

In Figure 1 a flow diagram of the GIS organization is presented, both for the real- time location of seismic events applications (left of the figure) and for other seismological purposes. In relation to the real-time procedures we represent the seismic stations with real-time connection to a central recording station of the National Spanish Seismic Network which could be supplemented with the information from other stations by a dial-up system in almost real-time. Once the location estimate, origin time and magnitude calculations are performed, these data are captured by the GIS management computer. As soon as this information is validated by the operator, the GIS relates it with a Cartographic Database in which the main attributes are already stored (roads, villages, province and autonomous region limits, etc.). After selecting the area in which the epicenter is located, an alert map and message with literal and numerical information is created and displayed on the

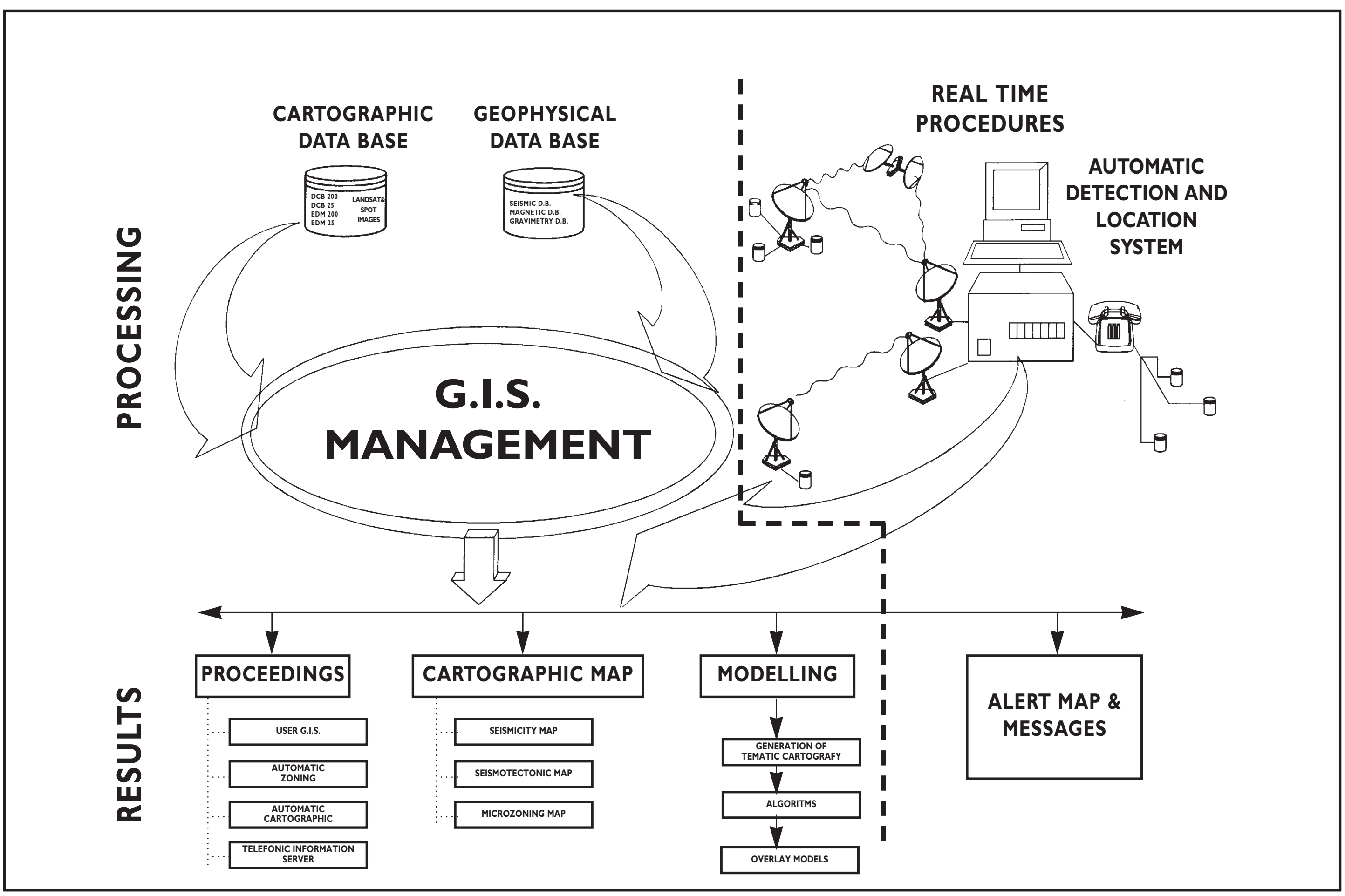


Figure 1. Schematic diagram of the GIS for seismic studies at the IGN.

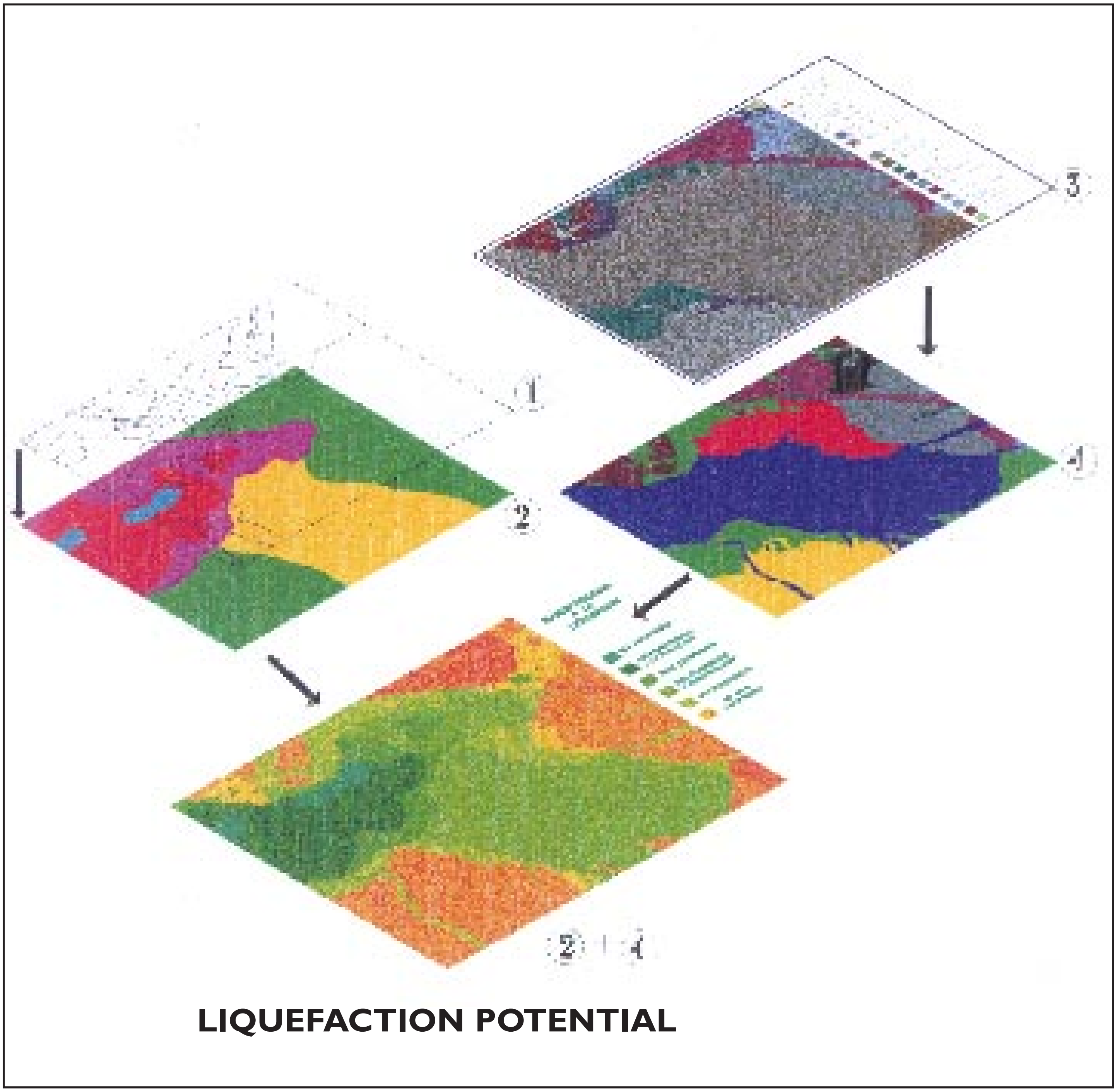


Figure 2. Different layers of information to obtain the liquefaction potential in case of a strong earthquake in the region of Granada (Spain).

screen to the operator and then sent by a dedicated telephone line.
However, any additional information required on the different attributes can be retrieved by the operator and plotted on the map, such as population of the city requested, telephone number of the police station and any other information included in the different databases. A screen of the typical data presented is shown on the cover page of this Newsletter. We see a map of the region near Granada in which, besides the representation of the epicenter location, are displayed the main villages, roads, hospitals, gas stations, etc. In this form a general view of the possible affected area is presented. In the upper left, a window is included with the earthquake focal parameters such as date, origin time, epicentral coordinates, magnitude and geographical name of the most affected area. In the lower right, a window with the telephone numbers from the local authorities, police station and other relevant interested organizations are shown beside the estimated population possibly affected by the earthquake.

The system also generates automatically a short note, with all the relevant information selected, to be sent by fax or E-mail.

Other GIS applications for seismic studies

The classical GIS for seismic studies is also presented in figure 1 on the right side. The main cartographic databases are those officially created for the scales 1:200000 and 1:25000 together with their corresponding Elevation Data Models (EDM). For some thematic uses, images of Landsat and Spot satellites are also included. The geophysical databases include the earthquake, gravity and magnetic data banks. We developed methodologies to

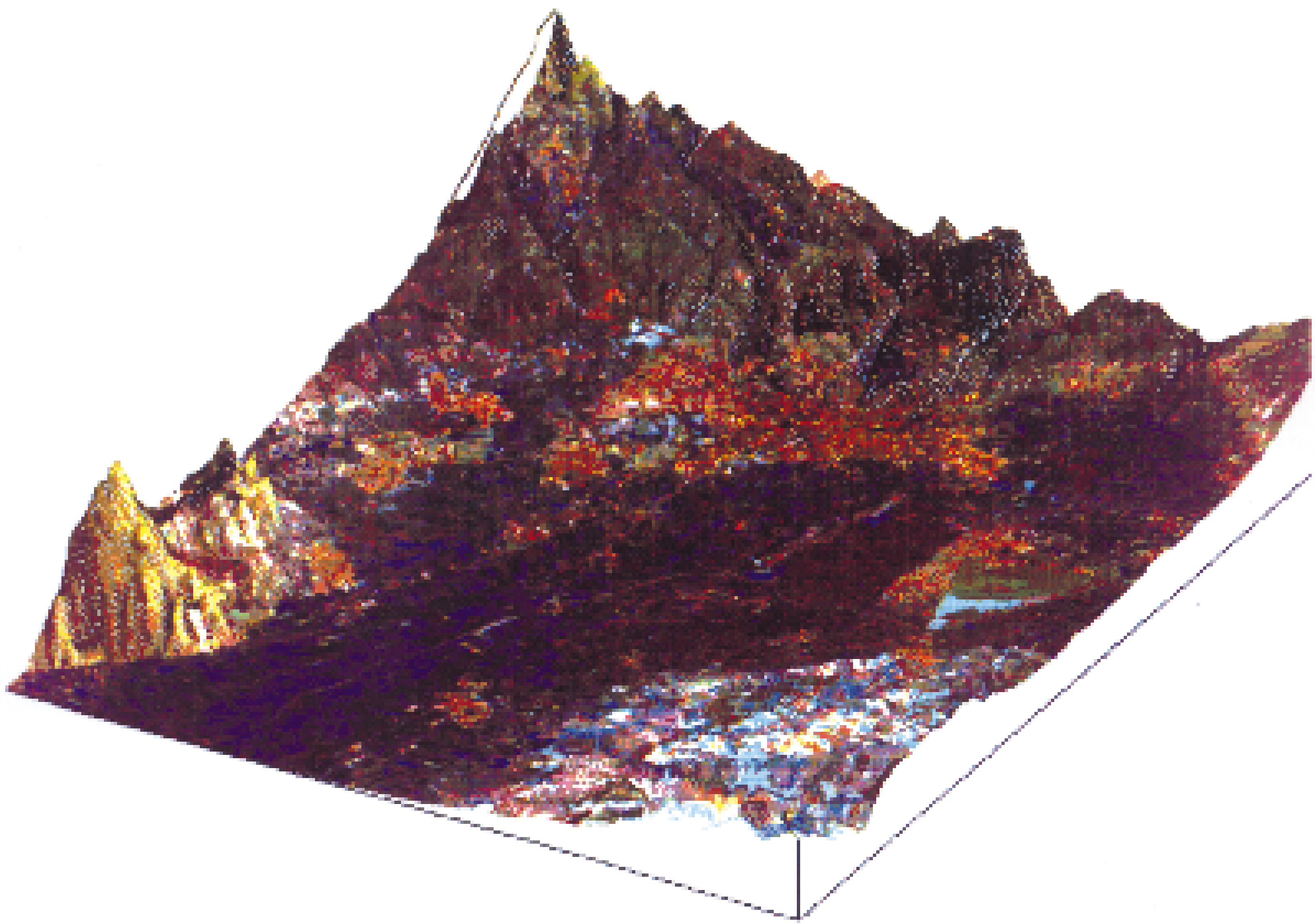


Figure 3. Digital terrain model for the area of Granada (Spain) with the information provided by Landsat (TM).

transform the vectorial databases with curving functions into a raster classification. For specific studies, such as the one presented here, additional databases of geological data are also included. In this case the geological database is formed by capturing the information from digitizing or by raster application of the published maps of the selected area.

In Figure 2, a schematic view of the process to obtain the liquefaction potential for the area of Granada is presented. The different levels of information are: 1. map of water table level expressed in their depth and given in vectorial form; 2. depth of the dried layer in raster form, in four levels (0,3, 3-6, 6-9, 9-12 and > 12 m); 3. map of main geological features, including different types of terrains, trends, faults, etc.; 4. map showing the classification of geology as a function of the terrain's lithology in order to present four types of the cohesionless coefficient. Finally by overlay and reduction to six levels, the liquefaction potential map is presented for the area.

Another important application of the GIS for seismic studies is the analysis of the geomorphology of an area. In Figure 3, the MDT 25000 of the region of Granada is formed and we added up the bands 4, 5 and 7 of the image from Landsat (Thematic Mapper). With this three dimensional view, which of course could be rotated and presented under different points of view, it is possible to analyze some geomorphic characteristics such as the determination of river basin limits.

Conclusions

The GIS is a powerful tool that can process georeferenced data to provide the answers to different questions involved in seismic studies. In particular in case of an earthquake alert, all pertinent information related with the earthquake parameters and the affected area, including alphanumeric information of interest is presented in almost real-time. This information is sent by a dedicated telephone line to the different users.

Other GIS applications to seismic studies performed by the IGN are those in which the relationship between different types of geophysical and geological information are required. Those relationships between georeferenced data are performed in a very rapid way producing the corresponding cartography in an automatic form.

THE EUROPEAN SEISMOLOGICAL PARAMETRIC DATABASE: A PROGRESS REPORT

B. Feignier

European-Mediterranean Seismological Centre

Introduction

As defined in its statutes, one of the important tasks of the European-Mediterranean Seismological Centre is the operation and maintenance of a seismological parametric database for the European-Mediterranean region. This database should provide the scientific community with an easy access to the wealth of parametric data available in the whole European-Mediterranean area and should also allow the EMSC to compute and release a European-Mediterranean seismological bulletin.

It was decided, in early 1994, to investigate various schemes for implementing such a database, taking into consideration the recent developments of electronic mail in most of the European-Mediterranean countries. An ad-hoc working group, chaired by M. Baer from ETH Zürich, reported on this matter at the Assembly in Athens, in October 1994. In order to structure the project further, and to allow the direct input from EMSC members, a seminar was held in Nice in December 1994. During this seminar, it was unanimously decided to develop a decentralized database, each participating member being in charge of maintaining its own local database and giving free access to the data. The EMSC itself being in charge of coordinating the data exchange and developing a software to provide a transparent access to the local databases.

This new concept of a decentralized database offers a unique opportunity to develop a truly European database and will greatly facilitate the exchange of seismological data for the whole seismological community. Furthermore, it will also help the EMSC to answer specific requests for data in a more efficient manner.

Organization of the database

The structure of a decentralized database implies the definition of standards for the data exchange, especially considering that most institutes in Europe have already created their own database structure in their own specific format, on various database management systems. One software is currently becoming a standard for such data exchanges, it is the Automatic Data Request Manager (AutoDRM) developed by U. Kradolfer in ETH Zürich (cf. EOS Transactions, 1993, Vol. 74, No. 39, p 442, 444-445) This software provides an efficient way of exchanging data stored in different formats, using e-mail to request data from local databases. Electronic messages sent to the AutoDRM are automatically decoded and analyzed by the AutoDRM, which will then request the data from the local database. Once extracted, the data are automatically sent back to the requester, through e-mail. Because it is fully automated, the AutoDRM is very simple to maintain locally. Furthermore, it has recently been chosen as a standard by various seismolo-

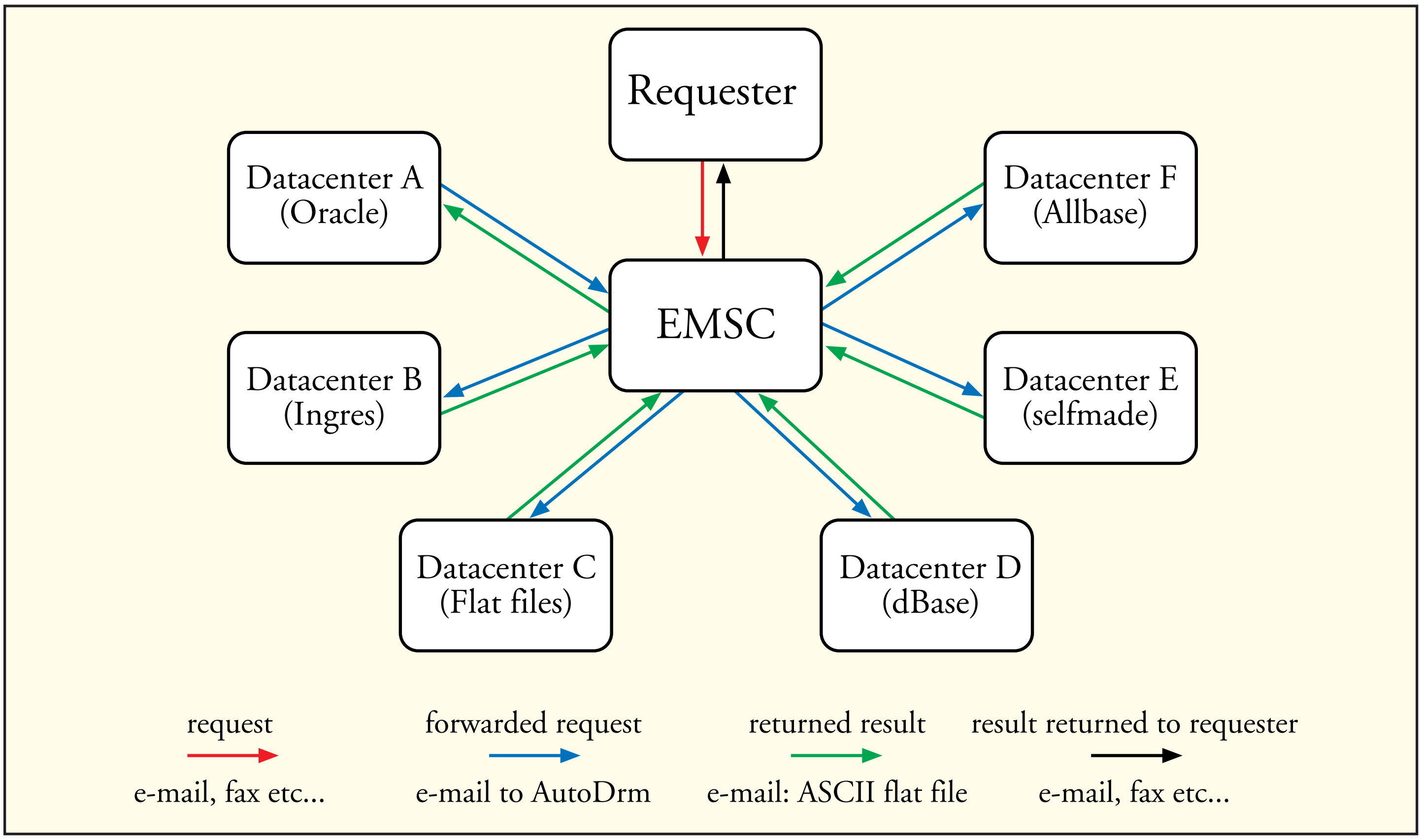


Figure 1. : Schematic organisation of the decentalized database.

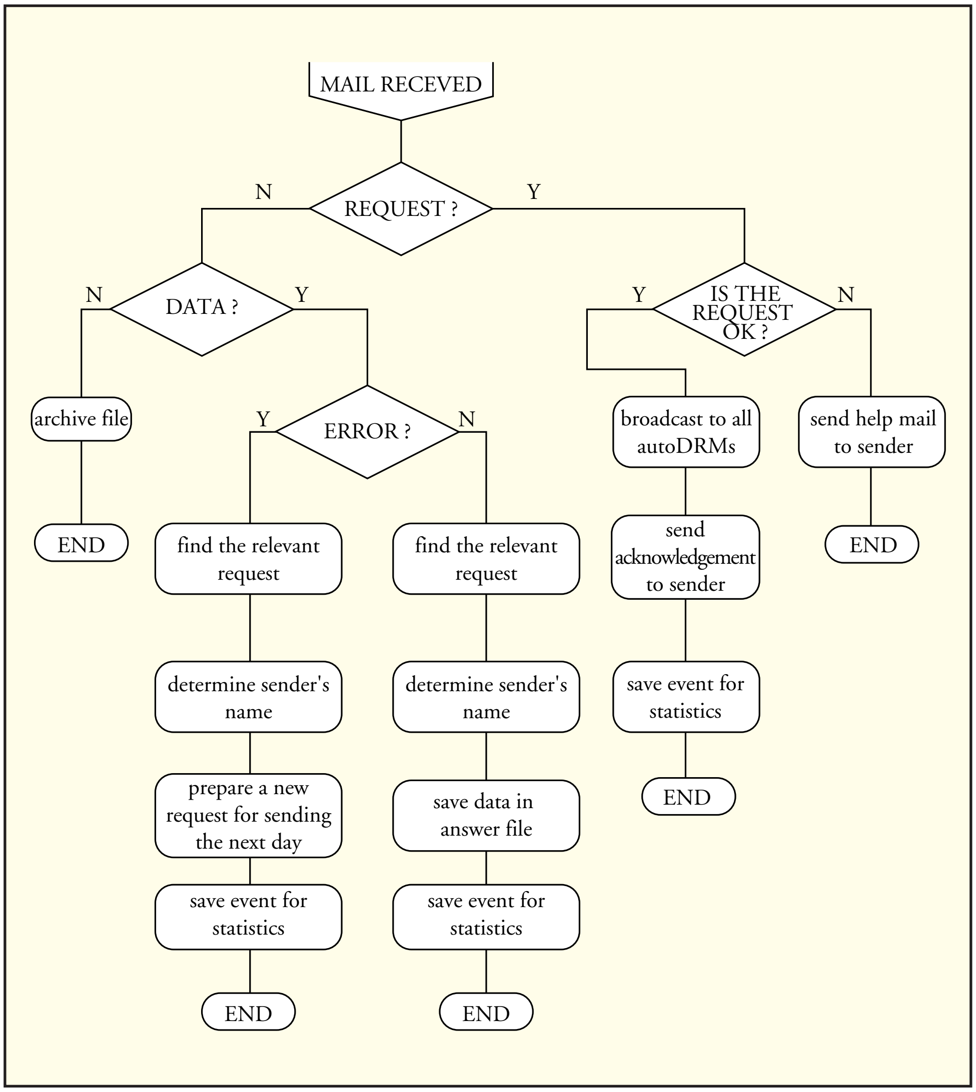


Figure 2. EMSC AutoDRM Flow chart

gical groups in Europe and throughout the world (European project 'Transfrontier', GSETT-3, ...) and also by many individual observatories. Therefore, it was the logical choice as a data exchange procedure for the European database. To homogenize also the format of the data being exchanged, it was decided to adopt the format of the GSETT-3 experiment (GSE2.0 format). The AutoDRM source codes and the specifications of the GSE2.0 format are freely available, through the Internet, at the ETH Zürich (anonymous ftp at seismo.ethz.ch or 129.132.53.1, directory pub/gse). Both the AutoDRM and the GSE2.0 format were explained and discussed during a two-day technical seminar organized jointly by the EMSC and ETH Zürich in June 1995, which was attended by 18 participants from 12 countries.

In order to access easily data that are in fact distributed over the whole European-Mediterranean region, it was recognized that the best solution would be for the user to address only one request to a central site: the EMSC. The EMSC would then automatically forward the request to all participating databases. By doing so, requests sent to the EMSC by other means than electronic mail (i.e., fax, post or telex) can also be processed manually by the EMSC personnel, making the contents of the database accessible to all EMSC members. The scheme adopted is presented in Figure 1.

The software necessary to forward the requests received by the EMSC computer to all the participating AutoDRMs, as displayed in Figure 1, has been implemented and is currently being tested. The software has been developed thanks to the financial support of the LDG, France. As shown in Figure 2, it analyzes the mail received to determine whether it is a new request, or data coming back from an AutoDRM as an answer to a request. After checking its format, a new request is broadcasted to all participating AutoDRMs. In a same way, answers from various AutoDRMS are identified, stored, grouped together and sent back to the requester. The software has been designed to send the answers back to the requester in two separate data sets. The first one containing data which have come back very rapidly (e.g., one hour), the second one containing data which have been received later on (e.g., twelve hours or one day). Naturally, the delays for sending the two data sets back to the requester are parametrized and will be optimized during the tests.

Description of the data

This network of databases will provide an easy access to a large amount of seismological data. The EMSC will maintain its own database, which will contain only data that could not otherwise be retrieved at local sites.

The data to be accessed can be separated into several categories:
- weekly/monthly seismological bulletins (stored at local sites and at the EMSC);
- catalogues of instrumental seismicity (stored at local sites);
- automatic data used for the Rapid Determination of Epicentres (stored at the EMSC local database);
- strong motion data (stored at CGDS Moscow, Russia)
- other data sets collected by the EMSC.

Additional data sets that should be added to the network in the future include:
- historical and macroseismic data (in particular, in collaboration with the current European project coordinated by M. Stucchi, CNR Milan, Italy);
- catalogue of existing historical records;
- catalogue of known blasts in the European-Mediterranean region.

This list is only preliminary and suggestions for additional data sets to be put on-line are encouraged.

Currently operationnal AutoDRMS	IPE Brno, Czech Republic GI Prague, Czech Republic IS Helsinki, Finland LDG Bruyères-le-Châtel, France IPGS Strasbourg, France Israel Atomic Energy Commission KNMI De Bilt, the Netherlands IGN Madrid, Spain ETH Zurich, Switzerland AWE Blacknest, UK BGS Edinburgh, UK
AutoDRMs available at the end of 1995	ORB Brussels, Belgium BGR Hannover, Germany BGR Erlingen, Germany GI Karlsruhe, Germany HAS Budapest, Hungary DIAS Dublin, Ireland NORSAR Kjeller, Norway GSSC Obninsk, Russian Fed.
AutoDRMs available by mid-1996	CIMG Vienna, Austria KMS Copenhagen, Denmark UEES Tehran, Iran ING Roma, Italy NIEP Bucharest, Romania

List of available or planned AutoDRMs in the European-Mediterranean area.

Current status and timetable

The project is currently well under way. The software to be used at the EMSC has been completed and is currently being tested with a few AutoDRMs. We expect to have an operational system this fall, at which point it will be open for public use. Results from the preliminary tests have shown that the answers from the various AutoDRMs come very fast (from 15 minutes to 1h 30 on average). On the other hand, the messages issued by the various AutoDRMs have proven to be quite heterogeneous in their format and error handling. This makes it virtually impossible at this point in time to read the messages and extract the necessary information, i.e. the data. Therefore, the response currently provided by the EMSC is simply a file containing all the responses relevant to the request, without interpretation. This whole procedure will be undergoing a review during the EMSC Assembly on October 12, 1995.

The European bulletin

The EMSC used to publish a bulletin of seismic events for the European-Mediterranean region, which resulted from the manual merging of all the bulletins received at the EMSC. Its publication was suspended in July 1993 due to budgetary constraints. This project brings a new opportunity to resume the publication of the bulletin. We propose to use the network of databases and the software developed at the EMSC to automatically retrieve bulletins computed locally and merge them together. This bulletin, generated automatically, will then be reviewed by an analyst prior to publication. This new approach is expected to allow us to issue the bulletin approximately 2 to 3 weeks behind real-time. The Working Group on Evaluation (WGE) of the GSETT-3 experiment is very interested by this project and collaboration between the WGE and the EMSC has been initiated. Since the WGE is already developing a similar product (i.e., an automatic merging of seismological bulletins) for its own evaluation purpose, it was agreed that the EMSC should be part of the project and would eventually use the software for computing the European bulletin.

Concerning this European Bulletin, initial work with a limited number of seismological bulletins will start in late 1995. An operational version of the software for automatically merging the bulletins is expected to be ready by early 1996. After testing the software with all the bulletins available at the EMSC in digital format (to date, seismological bulletins from 35 observatories of the European-Mediterranean area could be integrated in the procedure), one could expect the first issues of the bulletin by mid-1996.

Conclusion

As shown in the table above, 10 AutoDRMs are currently operational in 8 different countries in Europe. Another 6 are expected to be operational by the end of this year, and at least another 5 by mid-1996. Therefore, this project has a very high potential and should be able to provide the scientific community with a standardized access to an unprecedented number of local databases. We would like to strongly encourage you to give us some feedback on this project, as it is still in an early stage. Finally, if you or your institute are planning to install an AutoDRM, please make sure to let us know, so that we can include your centre to the network and make your data accessible to the whole scientific community.

FORUM

EMSC ASSEMBLY

The EMSC Assembly will take place on October 12, 1995 at 2 p.m in EMSC's new offices in Bruyères-le-Châtel. On the occasion of the Assembly, 4 institutes will join the EMSC as active members: the National Research Institute of Astronomy and Geophysics, Egypt; the Laboratoire Central des Ponts et Chaussées, France; the Dublin Institute for Advanced Studies, Ireland and the Geophysics Centre at Bhannes, Lebanon.

RAPID DETERMINATION OF EPICENTRES

As you will have noticed earlier this year, the EMSC now disseminates, as a complement to the Rapid Determinations of Epicentres, additional reports within 24 hours of any destructive earthquake in the European-Mediterranean area. These reports include refined epicentre determination, MS magnitude estimates, aftershock information and, when available, damage reports. This last information can be provided by various sources, including seismological laboratories. Therefore, in case of a large earthquake in the European-Mediterranean area, we invite you to report ANY ADDITIONAL INFORMATION YOU MAY HAVE to the EMSC as soon as possible. You can either phone (+33-1-69267814, leave a message if no response), fax (+33-1-64903218) or e-mail (alert@ldg.bruyeres.cea.fr) your reports. Do not forget to give your own contact numbers.

AUTOMATIC DATA REQUEST MANAGERS (AUTODRM)

Let us know if you are installing an autoDRM at your institute! The EMSC is keeping an up-to-date record of all available autoDRMs in the European-Mediterranean area. This list includes: e-mail address of the autoDRM, name and address of the administrator, functionalities of the AutoDRM (upgrades, etc...). The list will soon be made available on the EMSC DRM.

EMSC DRM

Check out the new options! By logging on the EMSC Data Request Manager (DRM), you can now get the data from the last alert processed by EMSC, along with its moment tensor solution for European-Mediterranean events. You can also get new information on all the codes used for the seismological networks sending their data to the EMSC. Finally, you can send your comments/suggestions for improvements directly to the EMSC from the DRM. To log on, type:

telnet ldg.bruyeres.cea.fr
login: emscdrm
password: emscguest

EMSC NEW PHONE/FAX NUMBERS !

The EMSC has moved into its new offices in Bruyères-le-Châtel. Consequently, some of our phone and fax numbers have changed:

Phone:	Bruno Feignier:	+33-1-69267814	(Secretary General)
	Frédéric Ramon:	+33-1-69267813	(Data exchange / requests)
Fax:	Administrative matters:	+33-1-69267000	
	Seismological data:	+33-1-64903218	(unchanged)
E-mail:	Data for Rapid Determination:	alert@ldg.bruyeres.cea.fr (unchanged)	
	Seismological bulletins and administrative matters:	csem@ldg.bruyeres.cea.fr (unchanged)	
Address:	CSEM/EMSC, c/o LDG, BP 12, 91680 Bruyeres-le-Chatel, FRANCE		

Synop6 Nancy