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The FDSN: history and objectives

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The origins of the Federation of Digital Seismograph Networks (FDSN) can be traced to the summer of 1984. At that time, GEOSCOPE – the French global network of broadband instruments – was already well under way, and in the United States, the Incorporated Research Institutions for Seismology (IRIS) had just published its Science Plan for Global Seismographic Network (GSN). There was clearly an opportunity and the need to involve scientists from other countries in planning for the future of global seismology. An ad hoc meeting of some ten West European seismologists had been arranged in August during the annual meeting of the European Geophysical Society in Louvain. This may be considered to signify the beginning of widescale international cooperation, even though this particular group eventually became the nucleus of ORFEUS (Observatories and Research Facilities for EUropean Seismology). Rather than taking an active role in deployment of new stations, it chose to focus on the issue of providing the service for data collection and exchange, with an important mission of developing the requisite software.

The concept of a very-broadband seismograph system (Wielandt and Steim, 1986), capable of recording in a single channel all signals of interest to seismology, save for a strong motion channel, removed the distinction between instrumentation needed for registration of teleseismic signals of particular interest in global studies and regional networks deployed for national needs. Thus, there was an opportunity to combine together these different objectives on the basis of an agreement on data exchange and some common characteristics of data formats.

Therefore, a need arose to have an organization which would bring together the «global» networks and those national networks that were using broadband instrumentation compatible with the specifications outlined by GEOSCOPE and IRIS, for example. In the fall of 1985, Karl Fuchs, then the president of the International Lithosphere Commission, proposed that a group of interested scientists should assemble in Karlsruhe in April 1986, during the annual meeting of the German Geophysical Society, with the goal of forming an international organization affiliated with the ILC. Barbara Romanowicz of GEOSCOPE and Adam Dziewonski of IRIS/GSN were asked to convene the meeting.

Invitations were mailed to some 20 scientists from 10 countries. Most of those invited attended the meeting, whose main point was to determine whether there was a broad enough support for creating a new international body and, if so, what its terms of reference should be. The support for the formation of the new organization was unanimous, and its purpose was defined as follows.

> The international seismological community recognizes new opportunities within its field for improved understanding of the internal structure and dynamical properties of the earth provided by recent developments in seismographic network technology. The developments include greatly improved broadband seismographic systems that capture the entire seismic wave field with high fidelity, efficient and economical data communications and storage, and widely available, powerful computing facilities. It also recognizes that rapid access to seismic data from arrays of modern broadband digital instruments, wherever they might be, is now possible. In view of the above, and to take advantage of existing

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and developing global and regional networks it is considered that a Federation should be formed to provide a forum for:

– developing common minimum standards in seismographs (*e.g.* bandwidth) and recording characteristics (*e.g.* resolution and dynamic range);

– developing standards for quality control and procedures for achieving and exchange of data among component networks;

– coordinating the siting of additional stations in locations that will provide optimum global coverage.

The Federation will welcome the participation of all institutions committed to the development of broadband seismographs and willing to contribute to establishment of an optimum Global system with timely data exchange.

In August of 1986, the Federation held its founding meeting in Kiel, during the annual meeting of SEG (Society of Exploration Geophysics), when it adopted the principles presented above and elected its officers, with Michael J. Berry of the Geological Survey of Canada as its first chairman. It also set up several working groups to consider, among others:

– specifications of digital broadband seismograph systems;
– siting plans;
– data exchange formats;
– mechanism for data exchange and data centers;

Some of these working groups still carry out their functions today, some have fulfilled their objectives and have been dissolved. The siting group continues to play a critical role in coordination of deployment of new stations and the questions of data exchange remain at the forefront of the activity of the FDSN. All these issues are discussed and described at some length in this collection of network reports.

Progress was initially slow; this is understandable considering the economic and personnel challenges. Only now, are some of the products, such as the Federation CD-ROM, first discussed at the meeting in Vancouver in 1987, about to be released. The same is true with respect to the «Station Book» agreed upon in 1989: a collection of data on individual stations of the Federation Member Networks, which will contain information on the response and even the noise levels. But, as with the two examples above, many other early goals are near completion.

One of those has been the total number of broadband stations with «optimal characteristics» and good global distribution, which was set in 1989 to approximately 100. It is clear that this numerical target will be met or overtaken within the next year or so. Yet, this will be primarily accomplished by the deployment of stations on continents, with some 3:1 advantage in the northern hemisphere.

To meet the objective of understanding the dynamic behavior of our Planet, much better coverage is needed in the oceans and in the southern hemisphere, in particular. Because of the significantly higher noise level, the stations located on oceanic islands are qualitatively different from the low noise continental stations and their installation has to be justified on purely scientific merits. It is hoped that the member networks and their sponsoring institutions will not withdraw further support for station deployment, simply because the *total* number of stations reached a certain figure.

From the standpoint of global coverage, it is difficult to underestimate the importance of permanent observatories on the ocean bottom. The Federation has supported the objectives of the Ocean Seismic Network (OSN) from the very beginning. Because of the very high cost of deployment and operation of such observatories, it is easier to obtain the support if such observatories fulfill multidisciplinary functions. For this purpose, a new organization has been formed: International Ocean Network (ION); clearly, the OSN will be a very important part of the objectives of ION, and the Federation might consider establishing a link with this group.

Even though further deployment of stations and continuing improvement of their performance remain the essential priorities of the member networks, the question of data exchange and retrieval are likely to become the greatest challenges in the next few years. The archiving procedures at IRIS Data Management Center in Seattle – IRIS has undertaken to serve as the first Federation archive – have now been streamlined, and the development of the worldwide web of INTERNET and related computer communications systems make this archive accessible to seismologists in nearly every part of the world. It is time now for scientists to begin taking full advantage of the efforts of the member networks to demonstrate that the scientific objectives formulated nearly ten years ago can not only be met but substantially exceeded.

REFERENCES

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