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CIVIL PROTECTION PLANNING AND ACTIONS: THE ROLE OF THE SCIENTIFIC COMMUNITY IN ITALY

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Abstract. In recent years the Italian scientific community has been giving increased attention under the auspices of the National Research Council (CNR) to the question of natural hazards. The 1994 extraordinary flood event of the Upper Po basin in the Piedmont region showed, that the Mediterranean environment, and for that matter Italy, is highly vulnerable to frequent occurrences of natural disasters such as floods and landslides, which are often triggered by large scale atmospheric perturbations. This growing awareness of the vagaries of natural hazards has been confined not only within the walls of research institutions, but a concerted effort has been created to coordinate the activities of prediction, mitigation, and monitoring of many institutions dealing with flood hazards. At the governmental level the Department for Civil Protection, groups together scientific and professional leaders in the various aspects of natural and man-made hazards such as hydrogeological, seismic, volcanic, and nuclear. The research activities are coordinated under competent National Groups for the Prevention of Disasters. This paper deals with the organization and major research activities and accomplishments of the National Group for the Prevention of Hydrogeological Disasters (GNDCI).

1. INTRODUCTION

The main activities of the Italian scientific community involved in hydrogeological disasters are coordinated under various groups for the prevention of disasters. These groups in turn administrate a number of operational units within university research institutions, and also some relevant agencies at regional and local levels. The main source of their funding comes from the Department for Civil Protection, which aims at creating a national scientific network, useful for the promotion and realization of scientific initiatives and for providing consultancy in emergency situations, such as, prompt interventions during extreme atmospheric and geologic perturbations such as floods, landslides, earthquakes, and volcanic explosions.

This arrangement offers the opportunity to establish both horizontal and vertical interactions between research needs and demands of operation and viceversa. The Group was instituted under the auspices of the National Research Council by a governmental decree of 12/12/1984 sponsored by the Ministry of Scientific Research and Technology in concert with the Ministry for Civil Protection, and the Ministry for Public Works. As stated above, the Ministry of Civil Protection provides the financial support for the activities of the Group. The Group

coordinates the activity of more than one hundred operational units mainly at University Departments and Research Institutions.

The statute establishing the GNDCI assigned the following seven objectives under the competence of the group:

1) to promote and develop coordinated interdisciplinary research directed towards the acquisition and improvement of scientific knowledge necessary for the containment of floods and landslides;
2) to provide scientific and technical consultancy in the area of hydrogeological hazards to interested ministries, regional authorities, and other local departments, with particular attention to civil protection problems and the education of populations exposed to the dangers of inundations and landslides;
3) to coordinate scientific assistance and activities in the event of inundations and landslides;
4) to formulate proposals with reference to specific research programs:
5) to formulate proposals with regarding to guides and provisions appropriate for forecasting and prevention;
6) to maintain a liaison with public organizations in charge with territorial development and, in particular, to coordinate scientific expertise regarding the planning of river basins;
7) to maintain connections with similar research initiatives of other countries, promoting an interchange of experience on the subject.

2. GNDCI RESEARCH ACTIVITIES

The scientific activities of GNDCI have been directed towards two complementary actions:

1) to build a framework of knowledge, homogeneous within the national territory, and compatible with the available resources, for the planning of structural interventions (measures) so as to optimize the benefits to be obtained while reducing damages;
2) to organize and establish procedures for determining and inventorying vulnerable areas, a forecasting system of extreme events, which would enable the adoption of non-structural interventions (measures), and a communication and warning systems, which would permit an efficient transmission of information to the public as hazardous events develop and evolve.

The research activities of the group are subdivided according to four lines of research. They are described in the following subsections.

2.1 FORECASTING, PREVENTION, AND CONTROL OF HYDROLOGICAL EXTREMES

The accurate evaluation of flood risk is the key point for a national program designed to reducing flood damages. Considering the fact that absolute protection from flooding is not possible, a scale of intervention priorities is needed based on appropriate criteria, homogeneous choice of flood risk, and accurate methods of evaluation. In this regard, risks due to hydrological extremes may be subdivided with respect to three general objectives:

(a) Evaluation of the maximum instantaneous flood of given duration and exceedance probability or return period, i.e. evaluation of flood quantiles for given durations.
(b) Evaluation of the effect of floods caused by structural interventions.
(c) Evaluation of the accuracy of flood forecasts.

Under the auspices of the project, a special operational program for Italian rivers (called the VAPI program) for the evaluation of floods of specified return periods has been developed. The program involves the frequency analysis of annual maximum rainfall of given duration and annual maximum discharges, as documented by the Italian Hydrographic Services.

2.2 FORECASTING AND PREVENTION OF HIGH RISK LAND SLIDES

The research program and activities focuses on:

(a) Thorough investigations and systematic data collection program regarding the phenomena of landslides and other centers of land mass movements geared to detecting the localization and estimating the magnitude, the extent, and the recurrence of such events, as well as evaluating and estimating the damages produced.
(b) Study of the phenomena of landslides, the integration and interpretation of available data, the identification and delineation of unstable zones, geographical and topographic definition of the movements, spatial trends in geologic-structural grouping and geotechnical characterization of soils.

2.3 EVALUATION AND MAPPING OF HYDROGEOLOGICAL RISK AND INTERVENTION STRATEGIES FOR THE MITIGATION OF THE EFFECTS OF EXTREME EVENTS

The research program here is dedicated to the evaluation and use of structural and non-structural interventions (based on national standards and procedures) and the identification, mapping and zoning of areas subject to the risk of inundation. The expected outcome of the research program includes the preparation of a scientific and technical report on areas vulnerable to flood risk. Specifically, they will include the following:

(a) Cartographic, topographic, hydrographic, hydrological, hydraulic, meteorological, geologic, and geotechnical data, in relation to flood plain delineation and mapping including obstacles to flow channels. In addition, the study will include flood plain occupancy and socio-economic data of urban and other uses of floodplains needed for the evaluation of risk.
(b) Description of the hydrological and hydraulic procedures adopted in the evaluation of flood risk mapping.
(c) Presentation of the following results in a standard format: hydrological and hydraulic evaluations with associated return periods and confidence intervals.

2.4 EVALUATION OF THE VULNERABILITY OF AQUIFERS

This line of research is dedicated to the study of the temporal and spatial variability of contamination of aquifers. Specific objectives are:

1) To acquire a good understanding of the groundwater contamination problem in selected priority areas of the country.
2) To develop guidelines for the rapid evaluation of the likelihood of contamination of any effective and potential agent.
3) To evaluate the possibility of installing monitoring systems for a rapid and efficient assessment of interventions directed to protecting and warning (short and medium term) the population at risk.

The studies, to be conducted on selected representative pilot-areas, will serve for developing standard methodologies and preparing base documents (e.g. vulnerability maps for aquifers) and for providing the central and peripheral state agencies, specific proposals for the protection and defense of the national territory.

3. ACCOMPLISHMENTS AND PRODUCTS

From its inception, GNDCI recognized that the complexity of atmospheric and geologic extreme perturbations underlying hydrogeological hazards called for an active collaboration and exchange of experiences at the international level. Towards this end, it convened a series of seminars and workshops with an enhanced participation of scientists and engineers from all over the world. As a consequence, GNDCI developed an active network of collaboration with institutions and agencies abroad, such as the U.S. Geological Survey, the French Delegation on High Risks, the Massachusetts Institute of Technology (MIT), Pennsylvania State University, and the Institute of Hydrology of Wallinford.

In the last ten years, several international scientific meetings were sponsored by GNDCI. In 1988 and 1991, the Italian National Research Council and the U.S. National Science Foundation co-sponsored two multidisciplinary international workshops. The first entitled “Natural Disasters in European Mediterranean Countries” was convened jointly by GNDCI and MIT. The second one entitled "Prediction and Perception of Natural Disasters" was organized in collaboration with the Disaster Research Center of the University of Delaware. This was the first international meeting held after the United Nations proclamation of the International Decade for Natural Disaster Reduction (IDNDR). The meeting had an active participation of the Secretary of IDNDR. The novelty of this workshop was to bring together both physical and social scientists, which gave rise to an active dialog and exchange of ideas on the state of the art on prediction, monitoring, and mitigation techniques including the role of uncertainties related to natural disasters.

In addition to these seminars, GNDCI has been organizing since 1988, a one-month Summer School on "Hydrogeological Hazards Studies" under an agreement between the Italian National Research Council and the U.S. Geological Survey. Furthermore, the Hungarian professors Istvan Ijjas (past V. President of ICID) and Istvan Zuffa, under the agreement between the Hungarian and Italian committees of ICID, lectured on flood management decision making systems and modeling hydrological extremes for water resources management during the 6^{th} and 7^{th} summer courses held in 1993 and 1994, respectively.

Of the numerous projects and products prepared by GNDCI researchers, one notable project was the AVI Project, which collected and analyzed hydrogeological hazard information in Italy. In the late 1980's, the Italian Minister for Civil Protection asked GNDCI to complete, within 18 months, a bibliographical and archive inventory of landslides and floods in Italy.

Seventeen research groups active at the regional and national levels, involving more than 300 people, and including university professors, researchers, and government and private experts, completed the AVI Project. Figure 1 summarizes AVI's project coordination and organizational scheme.

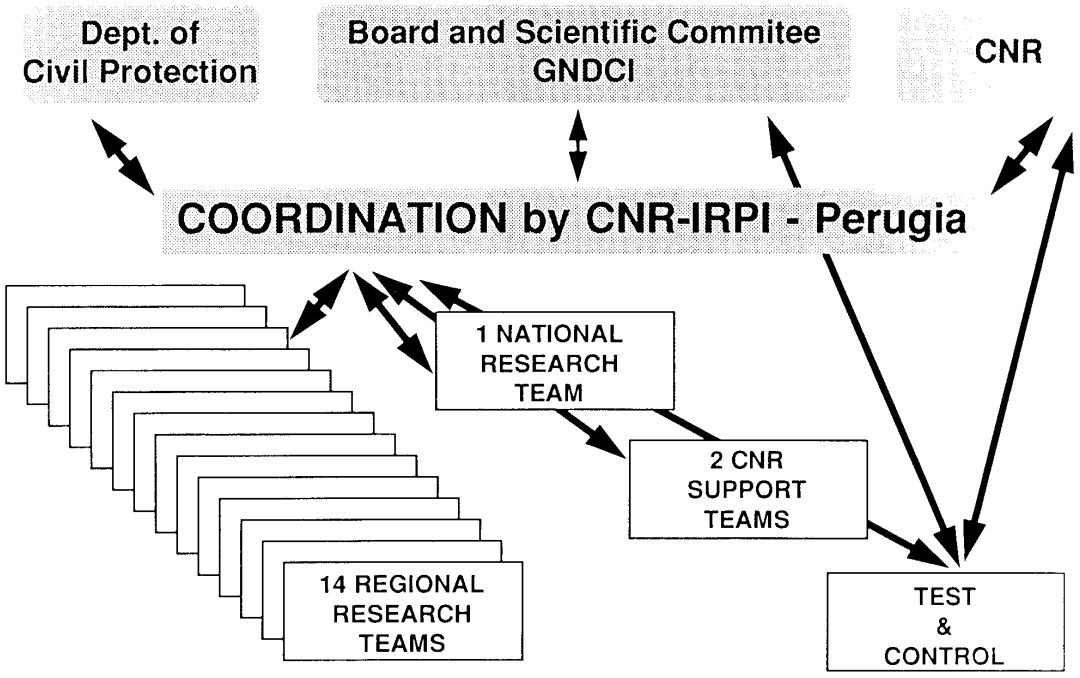

Figure 1. Organization and Coordination Chart of the AVI Project

Each research group collected information on landslides and floods from different sources (newspaper, books, reports, and interviews) and summarized them into special formats. More that 300,000 issues published by 22 different newspapers in the period 1918-1990 were reviewed, about 150 interviews were completed, and 1,595 technical and scientific documents were reviewed. This effort resulted in documenting nearly 17,000 episodes of landslides and floods that have occurred in the country. Figure 2 is a map that indicates the locations of such events. In addition, the referred inventory and analysis yield an archive of more than 30,000 articles from 22 different journals and a digital archive with information on 11,455 landslides and 5,358 floods. A set of reports including the list of sites affected by landslides and floods were submitted and distributed to local and regional authorities. Furthermore, most of the information gathered during the referred nation-wide project, as well as additional supporting data on hydrogeological catastrophes is now available through the internet. GNDCI developed and maintains a data-server that automatically distributes data, information, and maps.

In spite of the difficulties associated with the complexity of the Italian territory, the different perceptions and awareness of the impacts and consequences of landslides and floods on the Italian territory, and the limited time available to complete the project, the results of the inventory represent the most comprehensive archiving of landslide and flood information ever prepared in Italy.

In conclusion, I would like to stress the necessity of better understanding the causes and effects of hydrometeorological disasters in such a way as to allow us to give a notable and responsible support to the complex mission of the Civil Protection System.

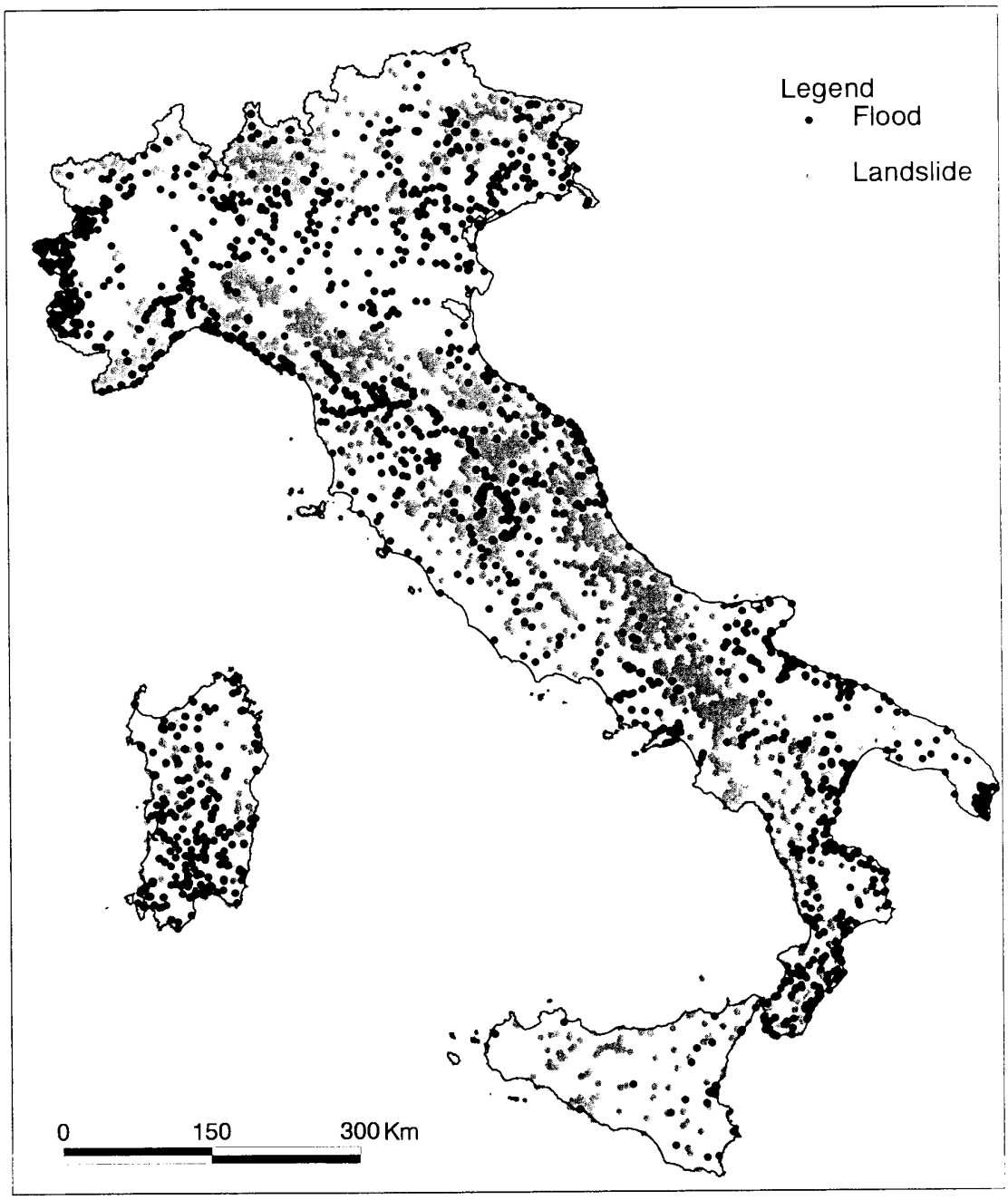

Figure 2. The AVI Project: Map of Sites Affected by Landslides and Floods in Italy during the period 1918-1990.

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