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**EMERGING ISSUES AND DEVELOPMENTS AT THE REGIONAL LEVEL:
ENVIRONMENT AND NATURAL RESOURCES DEVELOPMENT**

(Item 6 (b) of the provisional agenda)

**EMERGING ISSUES AND DEVELOPMENTS RELATED TO
NATURAL AND MAN-MADE DISASTERS**

Note by the secretariat

SUMMARY

A regional survey jointly conducted in 1998 by the secretariat of the International Decade for Natural Disaster Reduction and ESCAP showed that significant progress has been achieved by vulnerable countries in planning and institutional strengthening for disaster preparedness and reduction in the region over the past decade. Nevertheless, the most recent water-related disasters, particularly floods and events connected with El Niño, have caused heavy losses and a large number of fatalities in several countries. The related national experiences called for the development of strategic approaches towards flood control and management to mitigate the social and economic impact of floods on national economies, particularly in the rapidly growing urban areas. The ESCAP region is also very vulnerable to geology-related disasters such as earthquakes, which are generally destructive, especially in the rapidly expanding urban areas. Mapping of geology-related hazard areas and the integration of pertinent geological information into decision-making for urban development and land-use planning are increasingly recognized as the most cost-effective measures to reduce these types of disaster. In the region, some disasters also resulted from severely faulty practices and mismanagement in land use, making Asia the region of the world most gravely affected by land desertification in terms of loss in land productivity and agricultural output. The occurrence of forest and bush fires in the region has recently reached catastrophic dimensions, such as those affecting South-East Asia in 1997-1998. The increasing intensity of other man-made disasters calls for more vigorous application of environmental impact assessment practices and the enforcement of related norms and regulations. Monitoring of natural hazards and assessment of potential disasters are increasingly accepted as important steps in disaster management, in which the application of space technology is becoming increasingly useful. Many countries are making use of space technology applications, together with high-speed communication technologies, in the mitigation and assessment of water-related, geologic and other disasters. Achievements in the transfer of disaster management know-how and the increasing need for the application of advanced technologies have enhanced the importance of regional cooperation. Several important benefits have resulted from regional cooperation such as network strengthening for better information exchange, as illustrated by the achievements of the three subregional networks supported by ESCAP: the Mekong River Commission, the Typhoon Committee and the Panel on Tropical Cyclones. The increasing severity of the economic and social impact of natural disasters in the region calls for continued efforts towards further development and implementation of strategies and programmes in the five priority areas of disaster reduction identified in the document. Stronger regional cooperation needs the more active participation of the developing countries and stronger support of the donor community, as well as prioritization of regional activities as part of the development and implementation of a regional strategy on mitigation of natural disasters in the twenty-first century.

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INTRODUCTION

1. Over the past two years, the Asian and Pacific region has suffered exceptionally heavy losses from natural disasters. In 1997, the total damage caused by floods alone was estimated at about US\$ 7,230 million in seven countries, according to the annual ESCAP survey on water-related disasters.¹ In 1998, the most extreme floods in several decades devastated several countries in the region, particularly Bangladesh, China and Viet Nam, while droughts related to the El Niño Southern Oscillation (ENSO) caused water shortages and forest fires in Indonesia and the Philippines and affected neighbouring countries as well. In July 1998, the 10-metre tsunami that hit Papua New Guinea took more than 2,000 lives in several coastal villages. The Kobe earthquake of January 1995, which killed over 5,000 people and caused tremendous damage, is still fresh in people's memories. The region is among the areas of the world worst affected by desertification, with 35 per cent of the region's productive land considered to be desertified, including 70 million hectares in rainfed areas and 16 million hectares in irrigated croplands. The impact of natural disasters in the region may reach catastrophic levels; for example, in Bangladesh the damage from recent floods was estimated at more than 5 per cent of the gross domestic product. According to some estimates, the Kobe earthquake in Japan requires rehabilitation costs of over US\$ 100 billion.

2. Apart from the need to take stock of the impact of the increasing intensity of disasters in the region, 1999 is also a special year for disaster reduction. It marks the end of the International Decade for Natural Disaster Reduction² and also the fiftieth year of establishment of the Bureau of Flood Control (now the Water and Mineral Resources Section) by the then Economic Commission for Asia and the Far East in 1949 to advise and assist member governments on matters relating to flood control and related river problems. Since the mandate of ESCAP in this respect is concerned mainly with providing assistance in disaster preparedness and prevention, rather than on disaster relief, this document deals with these aspects. The secretariat has undertaken considerable work in the past on structural and non-structural measures applied to disaster mitigation and made presentations in past sessions of the Commission and the Committee on Environment and Sustainable Development. This document focuses on space technology applications, as one of the most recent techniques adopted for warning, monitoring and assessing natural disasters. A review of the latest developments in space technology applications for natural disaster prevention and mitigation would provide a useful input for the Second Ministerial Conference on Space Applications for Sustainable Development in Asia and the Pacific, scheduled to be held in India in December 1999. The specific impacts of any global climate change such as possible sea level rise are not discussed here as these have been well covered by other international studies on this subject.

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¹ See *Water Resources Journal* (ST/ESCAP/SER.C/197), June 1998.

² The General Assembly decided in 1997 that the closing event would also be a platform for the future to project the ideas and fundamental concepts of disaster reduction into the twenty-first century.

I. SUMMARY FINDINGS OF THE REGIONAL SURVEY

3. In preparation for the closing of the International Decade, ESCAP in cooperation with the Decade secretariat conducted a regional survey in July 1998, based on a questionnaire prepared by the Decade secretariat in consultation with ESCAP for a global assessment. The survey aimed to collect information on (a) recent natural disasters affecting the region and related experience in disaster reduction; (b) the progress which had been made since the inception of the Decade in the field of disaster reduction as a component of development planning and risk management; (c) institutional and legal structures and the relative position of the Decade national committees or focal points; and (d) future requirements foreseen to formulate and implement disaster reduction policies effectively. The results of the survey were to be presented at the Regional Meeting for Asia: Risk Reduction and Society in the Twenty-first Century to be held in Bangkok from 23 to 26 February 1999. The questionnaire was sent to all members and associate members of ESCAP and responses were received from 17 national government agencies in countries vulnerable to natural hazards and two non-governmental organizations working on disaster reduction. These responses covered disasters related to water, geology and the environment which resulted in a large number of fatalities, severe damage and heavy economic losses, and discussed activities in the three phases of natural disaster management: (a) pre-disaster planning, consisting of steps leading to disaster prevention and preparedness, (b) disaster response, consisting of warning and emergency relief aspects, and (c) the rehabilitation and reconstruction phase.

4. Most of the responses noted a significant increase in awareness of the importance of disaster preparedness and in the commitment by governments to disaster reduction. In several countries, these commitments had been translated into institutional infrastructure to ensure effective mobilization of resources and sustained public participation in national efforts, such as creating national disaster reduction coordinating committees, establishing disaster management systems, formulating national strategies and action plans, and preparing disaster management programmes. Apart from national achievements, the responses also noted achievements in regional efforts to share information and experiences, as well as in coordinating activities. Examples included the sharing of meteorological data for better flood warning by Bangladesh, India and Pakistan realized through the Panel on Tropical Cyclones, the achievements of the members of the Typhoon Committee in typhoon tracking and flood forecasting, and the establishment of a regional haze action plan by countries of the Association of South East Asian Nations (ASEAN). In this context, space technology applications were highlighted as an important tool for monitoring natural hazards and related communications. With respect to future requirements, most of the responses endorsed the need to integrate disaster preparedness and mitigation activities into the economic and social development process, to increase public awareness and participation, and to strengthen regional networking and transfer of technologies.

5. In view of the length limitation of this document, the results of the regional survey are presented in a separate report which is available for interested delegations upon request. Based on the conclusions of this survey, and the findings and recommendations for follow-up action from recent ESCAP studies

on relevant emerging issues, this document presents information on the current practices and experiences in the region, and particularly on phase I of the study on regional cooperation on flood control and management for improvement of the urban environment in the Asian and Pacific region. It is expected that the Commission will deliberate on these issues and guide the secretariat and countries on possible courses of action towards strategic approaches in disaster reduction and risk management in the region.

II. REGIONAL EXPERIENCES AND EMERGING ISSUES ON WATER-RELATED DISASTERS

A. Main features of water-related hazards and recent disasters in the region

6. The occurrence of water-related natural hazards is common in the ESCAP region. The impact of these disasters is becoming more devastating as increasing populations and denser occupation of hazard-prone areas contribute to the growing costs of damage and disruption of activities. Despite national efforts to reduce their impact, the extreme floods of 1998 caused nearly 7,000 deaths, more than 6 million houses were damaged and nearly 25 million hectares of crops were destroyed in the four countries of Bangladesh, China, India and Viet Nam. Elsewhere, the drought events associated with the El Niño phenomenon, which occurred from May 1997 to June 1998, were reported to be the strongest experienced in this century, resulting in severe shortages of water in several countries, including Malaysia and the Philippines. El Niño continues to adversely affect some parts of the region, such as Fiji, and is expected to be followed by La Niña phenomena, with opposite effects from those of El Niño, in some parts of the region. These extreme events have generated awareness of the need to create a new dimension in water resources planning and management.

7. Tropical cyclones occur more frequently in the Asian and Pacific region than in any other part of the world, and are usually accompanied by severe flooding. While riverine flooding in the region continues to be a common occurrence causing substantial annual damage, the impact of flash floods is also becoming increasingly important. Urban flooding has become a major potential hazard in terms of its economic and social impact, as a result of the rapid urbanization process and uncoordinated infrastructure development. With respect to coastal flooding, storm surges have the potential to cause substantial loss of life and property damage in large and heavily populated deltaic areas, such as those of Bangladesh and Viet Nam, and tsunamis generated by submarine earthquakes can also become very destructive as experienced in Papua New Guinea in July 1998.

8. In this context, it may be useful to reconsider the concepts of hazard, risk and disaster. Hazards are phenomena that happen naturally whereas both risks and disasters are brought on by human factors. Risks result from locating people and property in hazard zones, ultimately leading to natural disasters.

B. National experience and emerging issues in water-related disaster reduction

9. Significant progress has been achieved in the region on water-related disaster reduction, as indicated in recent studies by ESCAP and the latest survey mentioned above. Improvements can be noted in planning, management, prevention and preparedness. Experience indicates that success depends on how effectively disaster reduction activities are integrated into the national development processes. Progress on such integration has been achieved in three aspects: (a) as an integral part of the national development process, (b) as a social component, and (c) as a major requirement for sustainable development.

10. On the first aspect, a review of recent experiences revealed successful cases in several countries in the region: for example, in Australia (the upper Parramatta river catchment), Indonesia (Brantas and Citarum river basins), Malaysia (Klang river basin) and Thailand (Chao Phraya river basin). These experiences pointed to the fact that national targets for natural disaster reduction need to be established in the context of the overall goals of the national development process and that community participation is conceived as a key factor for success.

11. Disaster reduction is now considered a social component of national development in developing countries, where the cost of flood control measures is too high for annual government budgets or allocations for public sector investment. Prioritization of disaster reduction activities is a difficult task in the context of the national socio-economic development process. A case in point is the complex flood control and management system in Bangladesh, for which a water and flood management strategy had to be drawn up in 1995, with assistance from the donor community, to identify feasible structural and non-structural measures for mitigating flood disasters and to provide an overall framework to prioritize disaster reduction activities for national development.

12. In several countries, activities on water-related disaster reduction have been conceived as an important part of an environmental management strategy for sustainable development when they account for a major share of resources allocated to the national water resources management programme. Experiences of such strategies include the conceptual approach for flood control and management for the Chao Phraya river basin in Thailand, the amendment of the River Law of Japan in 1997 to incorporate environmental dimensions into flood control programmes, and the Klang river basin environmental improvement and flood mitigation project in 1998 in Malaysia.

13. With respect to management practices, the integrated basin approach to water-related disaster reduction is being increasingly accepted. Related experiences include the comprehensive flood loss prevention and management approach adopted recently in China and Japan, the Chao Phraya basin water management strategy in Thailand (1997), and the enactment of the Law of Water Resources of Viet Nam in 1998. In overall water-related disaster reduction management, the current emphasis is on the importance of storm water management to provide a better response to the rapid urbanization process. Improvements in the legal framework for better storm water management have recently been introduced in Indonesia, Japan and Malaysia.

C. Emerging issues in regional cooperation in water-related natural disaster reduction

14. A review was conducted recently by the secretariat for the Workshop on Regional Cooperation in Flood Control and Management for Improvement of the Urban Environment in Asia and the Pacific, phase I, held in October 1998 to study developments in the regional approach for cooperation in flood control and management over the past decades. The review highlighted the effectiveness of a two-pronged regional approach: (a) regional network-building with adequate subregional elements, and (b) promotion of technical cooperation. In terms of network-building, important achievements have been made through the three subregional networks in whose establishment ESCAP played an active role. ESCAP has continued this active role by promoting cooperation in these subregional networks (through the Mekong River Commission, the Typhoon Committee and the Panel on Tropical Cyclones) over the past decades. The following conclusions have so far been reached in subregional networking: (a) success in cooperation for flood mitigation depends on how the related measures are integrated into subregional development and annual disaster preparedness plans; (b) in addition to the firm commitment of governments, external assistance is essential to build up national capacities gradually into an effective and sustainable system of cooperation; and (c) effective cooperation can create a conducive environment for foreign investment in the respective subregions.

15. With respect to technical aspects of regional cooperation in flood control and management, the experiences of ESCAP indicated that (a) flood control cooperation has evolved from being mainly a single subject into a multidisciplinary area; (b) cooperation has become more sophisticated, involving the latest technologies; (c) cooperation has expanded from limited activities to projects, programmes and institutions; (d) while the modality adopted by ESCAP continues to be relevant, its limited resources available for promoting regional cooperation call for the more active participation of members and stronger support from the donor community; and (e) prioritization of the activities of ESCAP is required to meet the increasing needs of its members.

III. EXPERIENCES AND EMERGING ISSUES ON GEOLOGY-RELATED DISASTERS

A. Recent experiences

16. Geology-related disasters are generally one of the most destructive in terms of human lives lost. In a global survey covering the period 1970-1997 prepared by the Swiss Reinsurance Company, published in 1998, of the 40 worst catastrophes in terms of fatalities listed (with over a million deaths), 48 per cent were caused by earthquakes. The fact that 30 of the 40 catastrophes had occurred in the ESCAP region (and 87 per cent of the casualties) highlights the importance of this issue for the countries of the Asian and Pacific region. However, most of the efforts of central and local governments have been aimed either at disaster mitigation or at post-disaster relief operations, and thus were more reactive rather than proactive in nature. Moreover, the continued population growth in the already heavily populated parts of the region will increase the number and size of large cities, placing more and more people and assets at risk in potential natural disasters. In this context, effective measures are available, particularly to prevent geology-related hazards, such as earthquakes, volcanic eruptions and landslides, from developing into natural disasters.

B. Emerging issues and future policy direction

17. Seismic, volcanic or other geology-related hazards, being natural attributes of a particular piece of land, can actually be mapped. The resulting natural hazard maps, depicting high-, medium- and low-level hazard zones, would be among the most valuable tools in overall attempts for natural disaster reduction. In the decades to come, many millions of people will have to be housed and employed in urban areas that have yet to be planned and constructed. The availability of pertinent geological information, such as geology-related hazard maps, could enable planners and decision makers to make the right choices and locate new urban areas away from hazard zones. This would be one of the most cost-effective measures for natural disaster reduction. By comparison, existing cities require far more expensive measures that may at best have a limited mitigating effect. Adequate urban geological information will be essential in both situations. Accordingly, national geological survey departments should be requested and funded to collect relevant information and present this to planners, disaster managers and other decision makers in central governments and local authorities on a regular basis and in a format that is readily understandable to non-geologists. To this end, the ESCAP secretariat continues to promote the integration of geological information into urban planning and decision-making.

18. To date, a number of member countries have established their own geology for planning programmes, supported either by national funding or from bilateral sources. Notable examples are the initiatives taken by the Ministry of Land and Resources of China and the Geological Survey of India. However, the availability of relevant information is still not adequate.

19. In order to be effective, the authorities who are the intended end-users of the geodata must be aware of the crucial nature of that information, and they must be able to understand it readily. With this in mind, the ESCAP secretariat periodically convenes the Forum on Urban Geology in Asia and the Pacific, where such aspects of interdisciplinary communication are discussed among members of the geoscience community (the suppliers) with some input from the planners and local authorities (the clients). As more and more experience is accumulated by members, the Forum becomes increasingly important as an effective means of sharing this experience with other members. For this important activity to be carried on, its ongoing extrabudgetary funding must continue, together with a growing willingness by member governments to establish national budgets for the purpose.

IV. OVERVIEW OF REGIONAL EXPERIENCES AND EMERGING ISSUES ON OTHER DISASTERS

A. Important regional experiences and emerging issues

20. Land degradation and desertification are other major disasters which pose a serious threat in the region in the wake of growing populations and enhanced food demand. The countries most affected by desertification are Afghanistan, China, India, the Islamic Republic of Iran, Mongolia, Pakistan and the Central Asian republics. A comparison of desertification among the continents indicates that Asia is most severely affected in terms of loss of land productivity and agricultural output, whereas Africa has the highest percentage of desertified dry land.

21. Although the desertification process can be seen as a complex interaction of natural and socio-economic forces, in fact human-induced factors such as deforestation, faulty land-use practices, mismanagement of irrigation systems and overgrazing are responsible for accelerating the process. One of the main factors responsible for desertification in the Aral Sea basin in Central Asia has been overuse of water resources, particularly owing to the excessive diversion of the two major rivers Syrdarya and Amudarya for irrigation purposes, which eventually contributed to salinization of irrigated land and severe environmental effects. In order to assist countries in combating desertification, a desertification control network in Asia and the Pacific was established by the ESCAP secretariat to promote exchange of experiences, provide training on desertification control methodologies and assist in the development of an Asian annex to the United Nations Convention to Combat Desertification in Those Countries Experiencing Serious Drought and/or Desertification, Particularly in Africa. In close collaboration with the Convention secretariat, ESCAP assists countries in region to implement the Convention.

22. Forest and bush fires have always been a hazard in the region but recently these have reached catastrophic dimensions. In 1997 and 1998, massive fires in South-East Asia destroyed millions of hectares of forest, caused more than \$4.5 billion in damage and, according to some estimates, generated greenhouse gas emissions greater than the annual output of cars and power stations in Western Europe. The fires were caused by a combination of drought, slash and burn agriculture, and exploitation of forests and created a thick, choking haze that covered the subregion, creating serious health problems,

causing accidents on land, at sea, and in the air, disrupting transportation systems, and resulting in a steep drop in tourism in parts of the region where declining economies could hardly afford it. In order to prevent or deal effectively with future forest and bush fires, the ASEAN secretariat developed a fire prevention and suppression strategy in the form of a regional haze action plan to provide training in fire fighting and haze management, improve meteorological services, launch air and ground surveillance, strengthen early-warning systems and provide technical assistance for coal and peat fire suppression. This action plan was endorsed by ASEAN Ministers in December 1997. A number of United Nations agencies, donors and others assisted in this ASEAN endeavour. In this regard, ESCAP has initiated a project, funded by the Government of Australia, to create awareness on prevention and promote monitoring of forest fires, which is being implemented in close collaboration with the ASEAN secretariat and other organizations involved in the implementation of the action plan.

B. Other disasters

23. Apart from natural disasters, some major man-made environmental disasters resulting from chemicals, hazardous wastes, industrial accidents and transport of inflammable materials have had devastating effects on human health in some areas, often killing many people and resulting in great economic losses. If the effect of small accidents is also considered, the total sum of the impact is high. According to some reports, the total number of accidents causing pollution that occurred in China in 1994 alone was 3,000. A few years ago, a fire in a chemical storage depot at Klong Toey port in Bangkok emitted toxic fumes which killed five people, destroyed five warehouses and hundreds of shanties nearby, injured 500 people and left 6,000 homeless. In 1995, in the Republic of Korea, an underground gas explosion at Taegu killed 101 people and caused the collapse of a department store, resulting in a further 160 people reported dead, 260 missing and 900 injured. Such disasters can be avoided by undertaking an environmental impact assessment of various economic activities, on which numerous guidelines have been published by ESCAP for countries to use for the prevention of such disasters, and by applying safety norms and regulations.

V. PROGRESS AND LATEST DEVELOPMENTS RELATED TO SPACE TECHNOLOGY APPLICATIONS FOR NATURAL DISASTER MANAGEMENT

24. Since the first Ministerial Conference on Space Applications for Development in Asia and the Pacific, held in Beijing in September 1994, significant achievements in regional cooperation have been made through the secretariat's activities on promotion of space technology applications for sustainable development in the region, including natural disaster reduction and management.

A. Progress in space technology applications for natural disaster management

25. Integrated use of space technology applications such as satellite communications, satellite-based positioning, satellite meteorology and remote sensing (Earth observation) is increasingly being adopted in the region for the establishment of the necessary infrastructure and operational systems for natural disaster mitigation. The most important application of space technology is in detecting and delivering early warnings of impending disasters and in disseminating this information to people likely to be affected. Space-based disaster mitigation systems, integrated with conventional ground-based systems, are increasingly applied to provide inputs for all three phases mentioned earlier of natural disaster management systems. A space-based disaster mitigation system can provide unbiased, synoptic and timely information on the nature and effect of disasters as well as reliable estimates of disaster damage, the location and extent of disaster-affected areas, and an assessment of the post-disaster situation.

1. Typhoons and floods

26. Use of satellite meteorology has been triggered by the need to improve weather and climatological information and to initiate a close weather watch over a region vulnerable to natural disasters. The use of data from geostationary meteorological satellites has been triggered to provide real-time or near real-time information on typhoons and tropical cyclones and to assist in forecasting the movement of tropical cyclones. It has become possible to predict the movement of tropical cyclones 24-48 hours in advance. At present, China, India, Japan and the Russian Federation have operational meteorological satellite systems in polar and geostationary orbits, while more than 30 countries in the region have ground reception facilities. With such infrastructure, much expertise has been built up in many countries in the region in the application of meteorological satellite data.

27. An effective flood control system relies on timely availability of accurate information on rainfall, river level, cloud cover and other data, in many cases over inaccessible areas. Data from satellites have been widely used to improve rainfall estimates for more accurate flood forecasting. Snow melt run-off has also been estimated in China, India, Mongolia and the Central Asian republics using remote sensing data. In several countries, notably Bangladesh, China, India, Japan, Malaysia, Pakistan, Thailand and Viet Nam, and in the Mekong river basin, the application of space technology has improved flood forecasting and disaster warning efforts. Remote sensing data have also been used to identify and map flood risk areas as well as to assess flood damage.

2. Droughts, El Niño and related disasters

28. Efforts have continued by concerned governments and scientists to predict El Niño events in advance, following the severe El Niño episode of 1982-1983. The May 1997-June 1998 El Niño phenomenon was probably one of the most significant weather events observed in recent times and it was monitored by using combined earth observation satellite systems data. Abnormal events that could be related to the effects of El Niño, including drought and fires in Indonesia and other parts of South-East

Asia and floods in China, were all recorded through the use of space technology. The lessons learned from these events have encouraged Malaysia and Singapore to collaborate on a continuous forest fire monitoring system and on a disaster warning system between the two countries. Early detection of the onset of an ENSO event allows governments and individuals to react promptly and to take appropriate measures to minimize any possibly drastic impact, and the next generation of satellites is being designed to facilitate this.

3. Earthquake and volcanoes

29. The use of meteorological satellites for non-meteorological applications has triggered greater interest in these areas, although this is still at the developmental research stage. Scientists in China were able to predict the occurrence of an earthquake by analysing temperature anomaly blocks observed from the National Oceanic and Atmospheric Administration and Feng Yung satellite data. Scientists were also able to determine the date of another earthquake occurrence (between 16 April and 5 May 1995), and its expected location (Samal Island, Philippines).

30. A combination of radar and optical satellite data was also used in post-eruption monitoring of active volcanoes, including Mount Pinatubo in the Philippines and Barren Island volcano in India. The parameters studied included land-cover change as a result of the deposition of volcanic material and the extent of lahar and lava flows. Remote sensing and geographic information systems have also been used to identify areas susceptible to earthquake-induced liquefaction and landslide hazard mapping.

B. Emerging issues and opportunities for strengthening regional cooperation in the use of space technology applications in disaster mitigation

31. There are several areas of possible cooperation in enhancing the use of space technology for disaster management. Early warning and high-speed communications, together with effective and efficient satellite communications technologies facilitated by regional cooperation, are vital for disaster prevention, preparedness and response operations for floods, earthquakes, droughts and desertification. The presently available wealth of space assets indicates the potential for sharing data among users. However, there is an unfilled component in terms of a terrestrial infrastructure comprising low-cost systems as well as appropriate protocols that will permit the linking of existing space resources in support of disaster prevention, preparedness and response. An initiative called the global observation information network currently exists between the United States and Japan for sharing earth science information through high-speed networks. There are efforts to expand this information networking to include countries in the Asian and Pacific region initially and other regions subsequently. The network could perhaps be expanded in extent to cover hazard advisories and warnings on major hazards such as tropical cyclones or tsunamis.

32. Currently, programmes are being considered to launch a constellation of satellites which would provide continuous coverage of disaster-prone areas and timely monitoring of disasters for early

warning. Such a system could be developed and built on a global scale, with the cost being equitably financed by participating countries. These programmes could be complemented by the design and construction of low-cost terminals that would interface with personal computers.

33. It should be noted that, with developments in space technology, opportunities have become greater for disadvantaged countries to have access to the data and information necessary for disaster mitigation and prevention. Greater regional and international cooperation in using space technology for disaster management could further improve and expand these opportunities.

VI. CONCLUSIONS AND RECOMMENDATIONS

34. Significant progress has been achieved in disaster preparedness and reduction in the region over the past decade in terms of improvements in planning, institutional strengthening and the use of advance technology, including space technology applications. Important benefits have been realized from these disaster reduction and preparedness efforts by various countries in the region. However, the increase in the intensity of natural disasters requires continuing and more intensive efforts at local, national and regional levels. In this respect, pertinent geological and hydrological information, such as thematic hazard maps, has a very high potential for reducing fatality rates and losses resulting from natural disasters.

35. Regional cooperation becomes even more important in view of the rapid urbanization process, increasing rates of economic and social development, and other global factors that will increase the severity of disasters such as El Niño and potential global climate changes. Within this context, prioritization of regional activities for effective planning, management and development of disaster reduction measures, and for the application of space technology to meet urgent needs, requires the wide application of strategic approaches to natural disaster reduction and management. These activities need to be effectively integrated into the national economic and social development process. This regional cooperation needs to be formulated in a well-conceived framework and well-developed regional strategy. A priority emerging issue for cooperation in the twenty-first century is the development and updating of such a framework and regional strategy.

36. On the basis of the above achievements and experiences, the Commission may wish to urge governments to continue their efforts in developing and implementing strategies and programmes in the following five priority areas: (a) realistic integrated planning for disaster prevention and mitigation; (b) enhancement of disaster preparedness, including real-time information exchange; (c) community participation throughout the natural disaster reduction and management process; (d) more effective transfer of disaster reduction and management technology; and (e) exchange of experiences and information on institutional arrangements for disaster reduction and management.

37. In order to focus regional efforts on realistic targets in the development of a regional strategy for better disaster reduction, the following common objectives may be adopted: (a) realistic reduction of

damage, (b) increased disaster awareness, and (c) improvement of forecasting systems. As specific targets of these common objectives depend on the economic and social conditions of the respective countries, the Commission may wish to urge governments to establish details for these targets regarding the timing and goals for selected frequencies of hazards (for example, 100 per cent protection for residential areas against the 100-year flood by 2010).

38. The Commission may wish to assign high priority to the secretariat's activities on natural disaster reduction in the region and on its efforts towards developing a regional strategic approach, paying particular attention to the exchange of information and experience aspect in disaster preparedness and warning and to the increased use of technical cooperation among developing countries resources for these purposes.