United Nations A/AC.105/844

General Assembly

Distr.: General
13 December 2005

Original: English

Committee on the Peaceful
Uses of Outer Space

Report on the United Nations/Austria/European Space Agency series of symposiums on space applications to support the Plan of Implementation of the World Summit on Sustainable Development, held in Graz, Austria, in 2003, 2004 and 2005

Contents

V.05-91105 (E) 030206 060206

I. Introduction

A. Background and objectives

1. At the World Summit on Sustainable Development, held in Johannesburg, South Africa, from 26 August to 4 September 2002, Heads of State and Government reaffirmed their strong commitment to the full implementation of Agenda 21,[1] which had been adopted at the United Nations Conference on Environment and Development, held in Rio de Janeiro, Brazil, from 3 to 4 June 1992. They also committed themselves to achieving the internationally agreed development goals, including those contained in the United Nations Millennium Declaration (General Assembly resolution 55/2). The Summit adopted the Johannesburg Declaration on Sustainable Development[2] and the Plan of Implementation of the World Summit on Sustainable Development.[3]

2. In its resolution 54/68 of 6 December 1999, the General Assembly endorsed the resolution entitled “The Space Millennium: Vienna Declaration on Space and Human Development”,[4] which had been adopted by the Third United Nations Conference on the Exploration and Peaceful Uses of Outer Space (UNISPACE III), held in Vienna from 19 to 30 July 1999. UNISPACE III had formulated the Vienna Declaration as a nucleus of a strategy to address global challenges with the use of space applications in the future. In particular, the implementation of the recommendations contained in the Vienna Declaration could support the actions called for in the Johannesburg Plan of Implementation to enhance the management of water resources as well as in other areas of sustainable development. Details of the synergy between the recommendations of UNISPACE III and actions called for in the Plan of Implementation are provided in the report of the Committee on the Peaceful Uses of Outer Space to the General Assembly for its five-year review of the progress made in the implementation of the recommendations of UNISPACE III (A/59/174, paras. 146-157).

3. At its forty-seventh and forty-eighth sessions, the Committee on the Peaceful Uses of Outer Space considered an agenda item entitled “Space and water”. Among other things, the Committee noted that the General Assembly, in its resolution 58/217 of 23 December 2003, had proclaimed the period 2005-2015 the International Decade for Action, “Water for Life”. The Committee also noted that, in response to the deepening water crisis, space technology could contribute to improving water resource management by providing data and information on the availability of water resources and water use. In that regard, the Committee also noted that space-based data were an important element in the promotion of international cooperation in water resource development and management.[5]

4. In that context, the United Nations, in cooperation with the Government of Austria and the European Space Agency (ESA), organized a series of three symposiums in Graz, Austria in 2003, 2004 and 2005, to examine how space applications could contribute to implementing the actions recommended in the Johannesburg Plan of Implementation. The first in the series of symposiums, held from 8 to 11 September 2003, identified management of water resources as a theme for its 2004 symposium. The second symposium, held from 13 to 16 September 2004, reviewed the needs of water management authorities that could be met by space-based information and discussed ways in which space technology could be

incorporated into national and international water resource management programmes. The third symposium, held from 13 to 16 September 2005, discussed the latest developments in the application of space technology in water resource management and reviewed the follow-up activities undertaken as a result of the previous two symposiums.

5. Specific objectives of the series of symposiums were: (a) to review the needs of end-users engaged in public health, water resource management, marine and coastal ecosystems, disaster prevention and management, food security and forest management and to identify the support that could be provided by space technology; (b) to identify functional partnerships that could be established to introduce space applications into activities aimed at reaching the development goals and to initiate demonstration pilot projects in water resource management; (c) to make recommendations on how such partnerships could be established through voluntary actions that could involve Governments, international organizations and other relevant stakeholders; (d) to examine what type and level of training was required for which target groups in using space technologies for water resource management and water-related challenges; (e) to examine what low-cost space-related technologies and informational resources were available for addressing water-related challenges in developing countries; (f) to review progress made in the development and implementation of pilot projects that used space technologies to enhance management, protection and restoration of water resources, to provide drinking water, to mitigate water-related emergencies and to combat desertification; and (g) to enhance the participation of women in decision-making concerning water resource management.

6. The symposiums were organized as part of the 2003, 2004 and 2005 United Nations Programme on Space Applications and were co-sponsored by the Federal Ministry for Foreign Affairs of Austria, the State of Styria, the City of Graz, the Federal Ministry for Transport, Innovation and Technology of Austria and ESA. The present report has been prepared for submission to the Scientific and Technical Subcommittee of the Committee on the Peaceful Uses of Outer Space at its forty-third session, in 2006, and contains a summary of the conclusions and recommendations of the symposiums.

B. Organization and programme

7. The first Symposium had as its theme "Space applications for sustainable development: supporting the Plan of Implementation of the World Summit on Sustainable Development" and its work was divided into seven sessions, on "strategy for the follow-up to the World Summit on Sustainable Development: role of space science and technology", "remote sensing and geographical information system applications in natural resources surveys and the environment", "enhancement of food security", "management of adverse impacts of extreme weather and natural disasters", "management of water resources", "enhancement of health and medical services" and "funding of projects to promote sustainable development". Details of the Symposium, including the programme and background materials, can be found on the website of the Office for Outer Space Affairs of the Secretariat (www.oosa.unvienna.org/SAP/act2003/austria/index.html).

8. The theme of the second Symposium was “Water for the world: space solutions for water management”, with five sessions, on “providing critical information in a timely manner to decision makers”, “transboundary water management: remote sensing in diplomacy”, “water resource management in Africa”, “protecting and optimizing water resources” and “water, sanitation and health”. A working group, consisting of 15 representatives of international organizations, water resource management authorities and space agencies, was established during the Symposium to identify the essential elements to be included in a pilot project to strengthen capacity in water resource management using space technology. Details of the second Symposium, including the programme and background materials, can be found at www.oosa.unvienna.org/SAP/act2004/graz/index.html.

9. The third Symposium had as its theme “Space systems: protecting and restoring water resources”. Its programme was divided into eight sessions, on “protecting and restoring water resources”, “low-cost space-based technology, data and information for addressing water challenges in developing countries”, “developing and funding projects”, “managing the humanitarian consequences of water-related disasters by using space technologies”, “improving water sanitation and health through space systems”, “follow-up pilot project development”, “building capacity for the application of space technologies for water-related challenges” and “enhancing the participation of women in decision-making on water resource management”. Details, including the programme and background materials, can be found at www.oosa.unvienna.org/SAP/act2005/graz/index.html.

10. Sessions during the meetings featured technical presentations of successful applications of space technology that provided cost-effective solutions or essential information for planning and implementing programmes and projects to enhance water resource management and environmental protection, ensure food security, combat natural disasters and support health and medical services. A number of presentations raised issues related to planning and implementing projects that could include the use of space technology, as well as on the needs of end-users engaged in water resource management that could be met or facilitated through the use of space technology. On the last day of each symposium, session chairpersons presented their reports based on the presentations made and the discussions that followed.

C. Attendance

11. On behalf of the sponsors, the United Nations invited to the three symposiums individuals from developing countries and countries with economies in transition to apply to participate in the first Symposium. The participants selected held decision-making positions within governmental or research institutions carrying out activities in water resource management as well as other areas covered during the first Symposium. Other participants came from space-related institutions or companies carrying out activities that could support programmes or projects in water resource management.

12. Funds allocated by the Government of Austria, the State of Styria, the City of Graz, the Federal Ministry for Transport, Innovation and Technology of Austria, ESA and the Office for Outer Space Affairs were used to cover travel and living expenses of selected participants. In total, 217 participants from 65 countries and

representatives of 12 international organizations, including five river and lake basin commissions and authorities, attended.

13. Participants came from Afghanistan, Algeria, Austria, Azerbaijan, Belarus, Bhutan, Brazil, Bulgaria, Cambodia, Cameroon, Canada, Chile, China, Colombia, Côte d'Ivoire, Croatia, Ecuador, Ethiopia, France, Germany, Georgia, Guatemala, Haiti, Honduras, India, Indonesia, Iran (Islamic Republic of), Jamaica, Jordan, Kazakhstan, Lesotho, the Libyan Arab Jamahiriya, Madagascar, Mali, Mauritania, Morocco, Myanmar, Namibia, Nepal, the Niger, Nigeria, Pakistan, Panama, the Philippines, Poland, the Republic of Moldova, Romania, Samoa, Saudi Arabia, Senegal, South Africa, Sri Lanka, the Syrian Arab Republic, Tajikistan, Thailand, Trinidad and Tobago, Tunisia, Uganda, the United Arab Emirates, the United Kingdom of Great Britain and Northern Ireland, the United Republic of Tanzania, the United States of America, Uzbekistan, Venezuela (Bolivarian Republic of) and Viet Nam. Participants from the following bodies of the United Nations system were represented at the Symposium: Office for Outer Space Affairs, Economic Commission for Africa, United Nations Environment Programme, United Nations Organization Satellite (UNOSAT), the United Nations Educational, Scientific and Cultural Organization, the World Health Organization (WHO), the World Bank and the International Atomic Energy Agency. Other international organizations represented were ESA, the European Organization for the Exploitation of Meteorological Satellites (EUMETSAT), the Committee on Earth Observation Satellites, the International Space University, Comisión Administradora del Río de la Plata, the Lake Chad Basin Commission, the Niger Basin Authority, the Nile Basin Initiative secretariat and the Organization for the Development of the Senegal River.

II. Summary of discussions and recommendations

A. Space applications for sustainable development: supporting the Plan of Implementation of the World Summit on Sustainable Development

1. Remote sensing and geographical information system applications in natural resource surveys and the environment

14. During this session of the 2003 Symposium, the participants identified the near-term priority areas where efforts should be strengthened to make space tools available to developing countries in particular. In order to strengthen the use of remote sensing and geographical information systems (GIS) in natural resource surveys and environmental monitoring, the participants agreed that it was important: (a) to promote and develop cooperation in the use of remote sensing technologies to share experience and develop common policies in those areas; (b) to develop a common policy for receiving and acquiring satellite data for developing countries, in particular among those within the same region, aimed at developing their own capacity using available human and material resources; (c) to define a common policy for developing, disseminating and transferring technologies for processing remote sensing and GIS data; and (d) to increase awareness of the use of those technologies among decision makers and the general public.

15. Participants made the following recommendations concerning a strategy to integrate space tools in developing and implementing policies to protect the environment and manage natural resources, in particular in developing countries: (a) access to available data resources by institutions engaged in the protection of environment and management of natural resources should be promoted; (b) short- and long-term goals for policies on the protection of environment and natural resource management should be set; (c) a common policy should be developed for the development and distribution of technological tools based on remote sensing and GIS data for use in environment protection; (d) there should be exchange of experience with other countries and cooperation with them; and (e) a list should be prepared of projects, technologies and tools needed for countries to solve their priority problems in natural resource management and environmental protection.

16. Participants noted that the priority areas and strategies identified for the enhancement of food security, management of adverse impacts of extreme weather and natural disasters, as well as management of water resources, were similar to those identified for the protection of the environment and management of natural resources. Thus the capacity built and tools acquired could be used to support strategies in all those areas.

2. Enhancement of food security

17. Participants defined food security as the state in which all people, at all times, had physical and economic access to sufficient, safe and nutritious food to meet their dietary needs and preferences in order to achieve an active and healthy life. In that regard, participants noted the need to focus not only on how to make rural areas, especially in low-income food-deficit countries, survive, but also on how to provide opportunities to learn about ways to improve their quality of life and to reduce poverty. The measures to achieve those objectives would include rapid increases in food production and productivity, reduction of year-to-year variability in food production to an economically and environmentally sustainable basis by improving people’s access to food, which could be done with the use of technologies such as space imaging and GIS applications.

18. The following priority areas were identified: (a) providing farmers and fishermen with training and equipment so as to enhance food production by the following four complementary means: water control, intensification of the crop production system, diversification of production systems and constraint analysis and resolution; (b) developing and strengthening partnerships at all levels to enhance sharing of information, especially data on weather patterns and marketing; (c) developing and disseminating technologies on irrigation; (d) establishing regional centres of excellence for food security monitoring (i.e. early identification of problems); and (e) building capacity by providing better access to information and international exchange of experience and by organizing workshops and training courses on the use of space technologies to enhance food security and disaster preparedness.

19. Participants noted that remote sensing and GIS served as powerful applications and tools to increase the production by classifying types of cultivated crop, conducting analyses of cropping systems to make possible the intensification and diversification of crops, and by contributing to the development of land and water resources. Satellite-obtained data and derived information could support fishermen

by providing valuable information on the coastal environment and coastal and ocean resources. High-resolution satellite data could be effective in crop planning, forecasting and monitoring. The participants recommended that capacity-building such as that carried out in Africa under the Preparation for Use of Meteosat Second Generation (MSG) in Africa (PUMA) and African Monitoring of the Environment for Sustainable Development projects of EUMETSAT, which include the provision of equipment to receive satellite meteorological data and training activities, should be replicated in other regions.

3. Management of adverse impacts of extreme weather and natural disasters

20. Participants considered the following as short-term priority areas where efforts should be strengthened to manage adverse impacts of extreme weather and natural disasters: (a) ensuring the availability of high-quality remote sensing data in a timely manner during pre- and post-disaster periods; (b) ensuring timely flow of data and information to disaster managers; (c) defining standards for the preparation of geospatial data and its utilization; (d) establishing a legal framework for intellectual property of geospatial data; (e) increasing the availability of trained local personnel to facilitate the timely and efficient integration of ground information and remote sensing products into GIS at the local, national or regional levels; and (f) establishing and strengthening the infrastructure to support the use of space technologies for disaster management.

21. Participants identified a strategy to integrate space-tools in developing and implementing disaster management policies, in particular in developing countries, that could include: (a) increasing the awareness of decision makers and policymakers of the benefits of remote sensing applications; (b) providing funding to institutions, either academic or research centres, to be the sources of basic satellite-derived products and services for sustainable use of early warning and disaster management systems; (c) providing opportunities for education and training to build capacity in the use of remote sensing for disaster management; (d) improving access to and sharing low-cost remote sensing data; (e) establishing networks among countries that have space capabilities and global initiatives to strengthen partnerships in disaster management; (f) developing and making available national and regional products and services relating to risk and vulnerability assessments that cover specific geographical areas; and (g) establishing a link between national legislation and international agreements relating to disaster management at the global level.

4. Management of water resources

22. Participants noted that Earth observation from space provided a continuing, systematic and comprehensive overview to address many issues relating to water, such as the relationship between climate and the abundance of water, transboundary water problems, as well as flood risk assessment and management. They also noted that, in promoting the use of space technologies in water resource management, it was necessary to bear in mind that space technology would be relevant only if it could find applications that responded to the real needs of people.

23. Participants agreed that it was necessary to enhance the use of space technologies in water resource management and efforts should be strengthened to increase cooperation at the regional level. Such cooperation could be established

between the intergovernmental bodies responsible for water management and space-related institutions.

24. With regard to the use of satellite images for flood risk management, participants agreed that measures for risk should be considered. Such measures could include the obligation to acquire flood insurance. The creation of legislative norms to prevent housing construction in the flood-prone areas, in particular if the owners of houses could not afford insurance, should also be considered.

25. Participants agreed that efforts should be made to change the unsustainable use of water resources, especially in irrigation practices. Information derived from satellite data could provide evidence of the pattern of use of water resources, which could be used to suggest courses of action that should be followed.

26. To raise awareness about the use of space-based information in water resource management, participants agreed that regional workshops on the use of space technologies for water resource management should be organized for policymakers. Efforts should also be strengthened to provide school children with opportunities to learn about the usefulness of satellite images to address water issues.

27. Participants agreed that action should be taken to establish the following links in relation to water resource management: (a) space and water; (b) water and other natural resources; (c) water resources and water use; (d) space-based knowledge and people; and (e) space-based knowledge and the political process, including regional cooperation.

5. Enhancement of health and medical services

28. Participants noted that telemedicine and space technologies to support life were promising areas to support sustainable development. For instance, technologies that were being developed to sustain life in an orbital station, such as the International Space Station, had potential applications for terrestrial needs. Of those technologies, the technologies used for water recycling systems and waste management were considered the most valuable.

29. Participants noted that communication satellite systems had the advantage of wide area coverage, high capacity for transmitting information and rapid deployment of end-user equipment. They were, therefore, indispensable to provide communication infrastructure in case of natural disaster or in areas where adequate telecommunication infrastructure was not available. Satellite-based communication systems provided fast transfer of patient data and radiology images in broadcast television quality and made it possible to consult medical experts by videoconference. As an example, the participants were shown a satellite communications system for use in the event of disasters, which had been developed by the Joanneum Research of Graz, Austria, as a collaborative effort of the Institute of Applied Systems Technology, the Institute of Digital Image Processing and the Technical University of Graz.

30. In the area of enhancement of health and medical services with the use of space technologies, participants identified the following priorities: (a) reducing the cost of the technology involved in telemedicine; (b) creating awareness of the benefits of telemedicine, in particular in the context of medical and pharmaceutical sciences; (c) reviewing legislation in order to allow for the use of telemedicine, especially

with respect to pharmaceuticals; (d) developing infrastructure to support telemedicine; (e) developing human resources and capacity in that field; and (f) providing quality maintenance services.

31. In order to expand the use of space technology in enhancing health and medical services, participants identified a strategy that consisted of the following components: (a) establish regional partnerships in collaboration with the WHO; (b) develop capacity for telemedicine at district hospitals; (c) integrate the use of telemedicine into curricula for medical students; (d) integrate telemedicine into disaster management; and (e) strengthen health information systems by the use of remote sensing products and GIS databases. Participants also noted that telemedicine and tele-education could be supported by the same system in a cost-efficient manner.

6. Funding of projects to promote sustainable development

32. Participants identified the following elements as important in the successful implementation of projects, including securing funds for implementation: (a) involving users in defining projects; (b) meeting the requirements of prospective donors for project funding; (c) increasing awareness among decision makers of the importance of the project; and (d) developing and sustaining capacity in the use of the space technologies that were part of proposed projects.

33. Participants noted that there was a need to improve skills in applying for funding and articulating specific needs that were addressed in the proposed projects. It was noted that, in some cases, such as funding provided by the African Development Bank, less than half of the funds that would have been available for projects had been used in the past because most of the project proposals did not meet project requirements.

34. Participants agreed that it would be beneficial to organize training courses to prepare project proposals to apply for funding and that the Office for Outer Space Affairs could consider organizing such courses. The participants noted that partnerships between the United Nations Office for Project Services and satellite data providers should be encouraged. Participants also noted that some satellite data providers, such as Spot Image, made data available free of charge or at low cost for educational purposes.

B. Water for the world: space solutions for water management

1. Providing critical information in a timely manner to decision makers

35. Participants at the second Symposium noted that water resource management could benefit from the use of spatial information on existing water resources and catchment hydrology. Topography, vegetation and soil moisture were identified as key parameters for water resource management. Timely and accurate information on such parameters could help decision makers manage water resources efficiently.

36. Accurate knowledge of soil moisture and land cover were useful in the prediction and early warning of floods. Participants noted that microwave remote sensing was effectively used in monitoring soil moisture and vegetation land cover, which influenced the storage of water in the ground. They were also informed of the

opportunities offered by Landsat and Earth observation satellite (SPOT) data for determining water use for irrigation.

37. The Symposium took note of the opportunities offered by the Global Monitoring for Environment and Security (GMES), a programme aimed at assessing environmental and security situations on the basis of the integration of Earth observations with ground measures and socio-economic data.

38. Participants agreed that it was important to move from experimental and pilot uses of Earth observation data in projects on water resource management to operational and sustainable use of such data. At the same time, they recognized the importance of standardizing methodologies for the use of Earth observation data and equipment, for data collection as well as for data transfer and analyses.

39. Participants also agreed that it was also important to provide customized and understandable information to decision makers and end-users involved in the management of water resources. At the same time, they concluded that remote sensing data and data products needed to be distributed to all levels of society to allow each person to understand the conditions and limitations of water resources. Involvement of local communities in the management of water resources could lead to a "bottom-to-top" approach in making decisions related to water resource management. Participants agreed that it was important to bring projects to the grass-roots level.

40. Participants further agreed that international organizations should strengthen the capacity of developing countries to utilize remotely sensed data to enable them to benefit from space technology. At the same time, capacity-building should be seen as a process that was initiated through projects and sustained beyond the period of project implementation. Participants noted that it was important to upgrade the equipment and capacity of remote sensing users in developing countries.

2. Transboundary water management: remote sensing in diplomacy

41. Participants noted that anthropogenic activities had had an impact on the quantity and quality of water resources and that environmentally friendly management of water resources was not practised in many parts of the world. They also noted that sustainable water resource management should incorporate the principles of the integrated water resource management.

42. Participants noted that many water basins were shared by several countries and that most aspects of water management required international cooperation as well as sound scientific knowledge about water resources. Participants agreed that space technology could provide objective information that could provide better understanding of water systems.

43. Presentations illustrated how some projects on water resource management in the Danube basin would be implemented with the use of space applications. From other presentations, participants saw that the use of space applications could substantially improve the management of water resources in Central Asia, the Lake Chad basin and other regions, but that agreements among co-basin countries on sharing water-related information and on taking coordinated action was necessary.

3. Water resource management in Africa

44. Remote sensing data has been used in a number of initiatives throughout Africa aimed at identifying, mapping and monitoring water resources, forecasting and monitoring floods, implementing integrated land and shared water resource management, exploring groundwater reserves and detecting global vegetation change.

45. Participants noted that, in the absence of a legal framework, sharing information on available water resources and assessing them could present challenges. Other challenges related to water resource management included the absence of effective monitoring systems, technical problems related to the use of ground-based equipment and a weak economic situation in countries that needed improved water resource management. Participants noted that a large portion of economic activity in Africa depended on access to water.

46. Participants noted with appreciation the Earth Observation for Integrated Water Resource Management in Africa (TIGER) initiative of ESA aimed at developing sustainable Earth observation services for integrated water resource management in developing countries with a particular focus on Africa. They also noted that, in the context of the TIGER initiative of ESA to support the follow-up programme to the World Summit on Sustainable Development of the Committee on Earth Observation Satellites, the Symposium was an example of successful international cooperation.

4. Protecting and optimizing water resources

47. Participants noted that gaps in understanding water resource management existed among researchers, end-users and local communities. While some countries sharing the same water basins had various capacities for managing those resources, some countries did not have up-to-date water management policies. Participants also noted that conflict of interests existed among social, political, economic and environmental aspects of water resource management.

48. Participants agreed that in order to better protect and optimize the use of water resources, local communities should be involved in their management by providing them with proper information so that they could convince policymakers and decision makers to change the existing policies, if they were found detrimental to local water resources. Participants agreed that the gap between research and application should be narrowed and that the capacity of scientific and technological communities in different countries should be improved by means of knowledge-sharing. In that respect, the experience of the TIGER initiative of ESA should be expanded to the regions of Latin America and Caribbean and Asia and the Pacific.

5. Water, sanitation and health

49. Participants noted that remotely sensed data were used for monitoring, surveillance and risk mapping of water-related diseases. The applications were based on water resource variables, such as topography, vegetation cover, humidity, standing water and soil moisture, and the success of using remote sensing for monitoring and prediction of disease depended on observation of breeding conditions of disease vectors. There was no spatial, temporal or spectral resolution that was ideal for understanding the transmission risk for all diseases. At the same

time, new satellite systems already in orbit, or to be launched, offered additional capabilities for the prediction and monitoring of disease.

50. Participants took note of various water cycle management strategies. One of the clusters of such strategies concerned water demand management, which included technical, policy, legislative and financial interventions as well as awareness and education.

51. Participants agreed that the public health community needed to be aware of and use the data from the newer satellites for prediction, detection and monitoring of disease. They needed to be aware of the potential products from multidimensional data assimilation, which had the potential for vastly improved spatial and temporal data related to water resources and the conditions controlling outbreaks and transmission of disease.

6. Working group on development of a pilot project to strengthen capacity in water resource management using space technologies

52. During the 2004 Symposium, a working group was established to discuss elements to be included in pilot project proposals in order to increase the possibility of their financing and implementation. The group consisted of 15 experts from water management authorities and commissions, space agencies and international organizations. It held three meetings in parallel to the Symposium's main sessions. At the end of the Symposium, the working group presented to participants the results of its discussions, including a plan and a strategy for developing, financing and implementing pilot projects aimed at strengthening capacity in water resource management by using space technologies.

53. During 2004 and 2005, the plan and the strategy proposed by the working group were further refined and incorporated into a document entitled "Elements to be considered for developing and implementing pilot projects for water resource management with the use of space applications", intended as a guide for experts in water resource management and space applications in their efforts to incorporate space applications into water resource management. The document was distributed among all the Symposium participants and presented during the Symposium in 2005 (annex I).

54. Furthermore, based on the recommendations of the working group, the Office for Outer Space Affairs established a group of experts consisting of experts from water resource management authorities and space agencies (annex II). The group provides, on a voluntary basis and by electronic means of communication, advice to interested parties from developing countries that plan to initiate projects in water resource management with the use of space applications. The group has so far considered pilot project proposals from Viet Nam and the Lake Chad Basin Commission.

C. Space systems: protecting and restoring water resources

1. Protecting and restoring water resources

55. Participants at the symposium held in 2005 agreed that many national activities in water resource management could be improved with the use of space applications

by increasing the availability of information for decision makers. In particular, remote sensing images and data on water levels obtained using space-borne data collection platforms could be used to map and monitor water resources in the Lake Chad basin. Space-based data could provide critical information on soil moisture and weather. Those data could then be used to determine the vulnerabilities of water resource systems, map areas with water quantity and quality problems arising as a result of agriculture and industrialization, explore groundwater as well as monitor the recharge of aquifers. Participants agreed that remotely sensed data could be used to develop global maps of baseline water resource availability and vulnerability, which could be used to determine the need for restoration programmes and, in combination with forecast information, could trigger warning systems.

56. Satellite data could provide effective imagery for communicating with policymakers and the skill of communicating such information should be developed. In that regard, participants called for broader exchange among countries of information on the successful uses of space applications in water resource management.

57. Participants agreed that in order for space-based information to be useful for decision makers it should meet the following criteria: (a) data and information should match the needs of water resource managers; (b) data should be made available in real time for operational support; and (c) data should be packaged in a way convenient to end-users.

58. Space technology also offered the possibility of communicating field data to central offices and of communicating between remote sites. They agreed that satellite data could be used to supplement gaps in existing networks due to lack of observing stations or their malfunctioning. For instance, satellite data could provide inputs to hydrological models during critical periods, such as low flows and other extremes.

59. Participants agreed that GIS and other multilayer platforms were needed to make full use of satellite data and that software packages should be developed to allow for the use of remote sensing data from desktop computer analysis systems.

60. Participants agreed that metrics should be established to ensure the success of rehabilitation projects that used space-based data and that monitoring programmes using satellite data should be put in place. Techniques should be developed to identify groundwater resources by means of geological mineral remote sensing exploration. To that end, pilot projects were needed to show the use of remote sensing and isotope data to determine the age of groundwater reservoirs, in an integrated system, in planning the restoration of degraded aquatic habitats.

61. Participants agreed that an inventory of satellite data and products, including resolution, accuracy, frequency and data sources, available for water resource management should be developed. They also agreed that a broad capacity-building initiative based on the general structure of the ESA TIGER projects was needed for all developing countries and that it could be developed within the framework of the Global Earth Observation System of Systems (GEOSS) being established by the Group on Earth Observations.

62. Participants agreed that further research was needed to develop analysis and modelling systems that utilized remote sensing data in integrated water resource

management. More research was needed on the practical application of light detection and ranging (Lidar) systems, for example, for urban water management, as well as to overcome the limitations of satellite data in determining soil moisture when vegetation was present.

2. Low-cost space-based technology, data and information for addressing water challenges in developing countries

63. Participants noted that low-cost data were available from various sources, such as the Moderate Resolution Imaging Spectroradiometer (MODIS) or Landsat sensors. Archived data were also considered a solution, as the cost of such data would be low. Participants noted that a number of software tools had been developed by the Canadian Space Agency, the National Aeronautics and Space Administration of the United States and ESA and were available at low cost. They also noted that in space-based telecommunications the major obstacle was usually local postal authorities, which would either require that a user utilize their own services or charge very high fees for operating independent networks.

64. Participants agreed that low-cost space-based technology should be made available not only to scientists and technicians but also to end-users in order to ensure the sustainability of their programmes. The participants noted that a number of free software applications had been developed by the scientific community and were available on the Internet. In particular, information on free and low-cost web resources were available on the dedicated web portal on Earth observation education, training and capacity-building developed by CEOS (wgedu.ceos.org). The portal contained some space-based data, GIS and digital analysis software and a wide range of educational materials.

65. Participants suggested that, in order to increase capacity-building and the operational use of space-based technology, major space agencies could make available their older imagery and software tools free-of-charge.

66. Participants noted that there was a need for continuous discussion of the opportunities that low-cost space-based technology could offer the international scientific and technological communities, especially in developing countries. For that reason, they suggested that, if possible and if compatible with the themes of future symposiums and workshops, a session on low-cost space-based technologies should be included as a regular session in all similar activities of the Office for Outer Space Affairs.

3. Developing and funding projects

67. Participants noted that it was important to consider the question of budgeting and funding of pilot projects at the very beginning of the process of conceptualization of a project. It was important to establish cost-sharing schemes to ensure that not all expenses were covered by the central Government or a development agency. Local financial participation was considered essential to ensure that the product was “owned” at the local level. It was noted that, in developing projects, it was important to ensure local participation, as there was much knowledge about local problems and possible solutions at the communal level. Participants agreed that it was important to keep in mind the cost recovery at a realistic pace.

68. Participants agreed that any project proposal involving the use of space technologies for water resource management needed to be interdisciplinary in nature. Private and public partnerships as well as counterpart funding by the host Governments of projects should be considered for implementation of such projects.

69. Participants noted that, based on the recommendations of the Symposium held in 2004, the Office for Outer Space Affairs had established an informal group of experts from water resource management institutions and space agencies. That group, working on a voluntary basis and by means of electronic mail, was available to provide expertise on the development of pilot project proposals initiated by experts from developing countries.

4. Managing the humanitarian consequences of water-related disasters by using space technologies

70. Participants noted that space-based data and information had been widely used for prediction, prevention and mitigation of disaster. In particular, they discussed the uses of space technologies in such disasters as hurricane Mitch (1998), the Indian Ocean tsunami (2004), hurricane Katrina (2005), as well as various other floods in Ecuador, Guyana and South East Asia, river floods in Canada, China and Honduras, and landslides in the coastal areas of the Bolivarian Republic of Venezuela. In that regard, participants noted that many water-related disasters were transboundary in nature, which called for close cooperation among stakeholders to minimize the damage of such disasters and even prevent or mitigate them.

71. Participants took note of the Charter on Cooperation to Achieve the Coordinated Use of Space Facilities in the Event of Natural or Technological Disasters (International Charter "Space and Major Disasters"), as well as the activities of the Office for Outer Space Affairs in triggering the Charter on behalf of entities of the United Nations system for major natural and technological disasters in developing countries. The participants also noted with appreciation the work of UNOSAT in processing and disseminating data received through the Charter. In that connection participants agreed that the role of UNOSAT and the Charter should be made more broadly known and utilized by developing countries.

72. Participants agreed that the use of space-based information should be introduced to local end-users before a major disaster in order to familiarize them with the capacity to cope with various emergencies when disasters occurred. Not only remote sensing data, but also information and communication technology should be in place to facilitate the monitoring of disasters and the rehabilitation after them. Participants further agreed that guidelines and best practices for using space technology to cope with water-related disasters should be developed and made available so that remote sensing data and GIS could be used efficiently.

5. Improving water sanitation and health through space systems

73. Participants noted that space-based imagery could be used efficiently to plan and implement optimal water management and sanitation in a given area. They also noted that, in the case of the Indian Ocean tsunami of 2004, the inundation mapping at the parcel level in some of the coastal townships demonstrated the possibilities of using space-based information for water and sanitation management using GIS modelling. In particular, considering low-lying areas along the coast, the type of

land use, coastal geomorphology and other infrastructure, spatial modelling and a query tool connected to GIS could show areas requiring improvements in sanitation. Participants noted that the correlation of waste disposal sites with either groundwater aquifers or water lines would provide answers on overall management and pollution scenarios. They noted that space technology could effectively assist public health services to monitor specific natural resource parameters and man-made utility services through GIS.

74. Participants noted that the benefits of space technologies for improving sanitation had not been sufficiently highlighted. They agreed that it was important to maximize the use of space-based information in detecting health-related problems related to the environment, such as malaria zones, sea pollution and groundwater pollution.

6. Building capacity for the application of space technologies for water-related challenges

75. Participants noted the available capacity-building opportunities supported by national and international institutions. In particular, the regional centres for space science and technology education, affiliated to the United Nations, offered in-depth training in space-based meteorology, communications and remote sensing as well as in space sciences. They noted too that various workshops and symposiums organized as part of the United Nations Programme on Space Applications had provided a multidisciplinary review of questions related to the use of space technologies in various fields of sustainable development.

76. Participants noted the positive experience of the Indian Institute of Technology in Mumbai in developing GIS and remote sensing tutorials adapted to local needs. They also noted possibilities provided by various software vendors that provided sample data on their websites.

7. Development of a pilot follow-up project

77. During the course of the Symposium, two side meetings were held with interested parties to review the progress achieved in the development of a pilot project proposal to use space-based data for water resource management in the Lake Chad basin and to discuss possible further strategies for carrying out follow-up activities to the Graz symposiums. In that regard, a special session was organized for participants to present the outcome of those meetings.

78. With regard to the development of a pilot project proposal for water resource management in the Lake Chad basin, participants reviewed the proposal presented by the Lake Chad Basin Commission. They were also briefed about a pilot project proposal on the use of satellite imagery for flood mitigation in the Mekong river delta in Viet Nam by a participant from that country.

79. Participants were briefed about the follow-up activities that had been coordinated by the Office for Outer Space Affairs based on the recommendations of the Symposium held in 2004. In particular, participants were presented with the document entitled “Elements to be considered for developing and implementing pilot projects for water resource management with the use of space applications” (see para. 53 above). They were also briefed about the voluntary group of experts from various water resource management and space agencies that was available to

provide expertise on pilot project proposals by means of electronic mail (see para. 54 above). Participants were encouraged to develop pilot project proposals that would include the use of space technologies for water resource management.

8. Enhancing the participation of women in decision-making on water resource management

80. Participants reviewed the question of the marginalization of women in decision-making in relation to water resource management. They noted that the reasons for lower participation by women in the decision-making process, especially in developing countries, lay in cultural perceptions of the roles of women. Women in developing countries, on average, had a lower level of formal education, resulting in less access to information, jobs and resources. Moreover, some participants noted that the distribution of household responsibilities in some countries also contributed to lower participation of women in decision-making at the communal and national levels. At the same time, participants noted that women's participation in decision-making in water resource management was important, as in many countries they were the primary users of household water supply. Participants also noted the need to gender mainstream projects in water resource management in developing countries.

81. Participants noted that equal access to formal education for boys and girls should be encouraged and backed up with the necessary legislation. Families should be informed about the importance of education for women. The traditional skills and experience of women in resource management should be harnessed and integrated into water resource management. Information on gender mainstreaming should be collected to reflect existing inequities and to identify differences in needs, interests and priorities in water resource management between women and men. Gender advocacy should be promoted to remove all sources of insecurity, as equal treatment might not necessarily produce equal outcome and decision-making capability, but could rather have an added value on outcome. Participants noted that appropriate means, including indigenous means, of dissemination of information on water resources should be used. Finally, they noted that various Governments had made a number of commitments to encourage women to participate in water resource management and to provide the necessary financial resources for the practical implementation of such commitments.

III. Conclusions

82. Based on the discussions, findings and recommendations of the Symposium in 2004, participants drew up a document that stated the major conclusions and recommendations of the Symposium, entitled "Graz vision: water for all through the application of space technology" (annex III).

83. Participants agreed that the series of United Nations/Austria/ESA symposiums on space applications to support the Plan of Implementation of the World Summit on Sustainable Development had been very valuable in generating ideas and establishing partnerships, especially for experts from developing countries. They expressed their satisfaction at the fact that the symposiums had produced real results from which they could continue to benefit in the future. Participants expressed their

appreciation to all the sponsors and organizers for the financial support, which had made their participation possible, and for the hospitality, substance and organization of the Symposium.

Notes

[1] *Report of the United Nations Conference on Environment and Development, Rio de Janeiro, 3-14 June 1992* (United Nations publication, Sales No. E.93.I.8 and corrigenda), vol. I: *Resolutions adopted by the Conference*, resolution 1, annex II.

[2] *Report of the World Summit on Sustainable Development, Johannesburg, South Africa, 26 August-4 September 2002* (United Nations publication, Sales No. E.03.II.A.1 and corrigendum), chap. I, resolution 1, annex.

[3] Ibid., resolution 2, annex.

[4] See *Report of the Third United Nations Conference on the Exploration and Peaceful Uses of Outer Space, Vienna, 19-30 July 1999* (United Nations publication, Sales No. E.00.I.3), chap. I, resolution 1.

[5] See *Official Records of the General Assembly, Fifty-ninth Session, Supplement No. 20* and corrigenda (A/59/20 and Corr.1 and 2), para. 232.

Annex I

Elements to be considered for developing and implementing pilot projects for water resource management with the use of space applications[a]

1. Title and objectives

(a) **Title**: "Space technology in support to water resource management for poverty alleviation"

(b) **Objectives**

(i) Capacity-building

(ii) Protection of the environment

(iii) Sustainable development of water resources

(iv) Sustainable development (economic, social, education etc.)

2. Time frame

Following the preparatory phase, the following time frame is suggested for a pilot project:

(i) Three years

a. Operation (development and implementation, including monitoring and evaluation as well as sharing of experience)

b. Baseline review

c. Mid-term review

d. Impact assessment review

(ii) One year:

Preparation for sustainable operations (starting after the mid-term review)

3. Donor partners

Donor partners can include, but need not be limited to, the following:

(i) Members and affiliates of the Committee on Earth Observation Satellites

(ii) Entities of the United Nations system

(iii) World Bank

(iv) Professional associations and scientific associations, such as International Council for Science

---

[a] National, regional and international entities initiating proposals for pilot projects should take the lead in developing, finalizing, fund-raising and implementing pilot project proposals with the help of the advisory group to be composed of volunteer experts.

(v) Regional development banks

(vi) Private sector

(vii) Official development assistance

(viii) Regional commissions other than United Nations regional economic commissions

(ix) Water-related organizations

4. Partnership

(a) It is critical to promote the broad participation of non-governmental organizations, universities and research institutions with data-processing capability and grass-roots partners:

Examples can be drawn from the Indian Space Research Organization project that involves personnel from the field. Grass-roots partners could make commitment by providing in-kind support, such as manpower, data collection and so on;

(b) For Africa, it is desirable to build upon existing regional partner networks, such as the African Network of Basin Organizations, and regional commissions, such as the Economic Community of West African States;

(c) The involvement of women's organizations is important in view of the essential role that women play in development;

(d) It is important to involve the donor/funding community to ensure funding of projects;

(e) The space community should be involved to ensure the sharing of best practices and up-to-date information about available space technologies that can be used for water resource management.

5. Recipients

(a) Relevant government institutions (on a cost-sharing basis):

(i) National/federal Governments;

(ii) Regional/local authorities;

(b) National and multinational water management authorities;

(c) Intergovernmental organizations;

(d) Non-governmental organizations;

(e) Community-based organizations;

(f) Academia.

A precondition should include agreement by the recipient institution to consider the results of the project in order to make decisions on the possible operational use of space technology (project output).

Experience of the Indian Space Research Organization

A multi-level partnership should be established between national/governmental agencies and local authorities and users. Governmental agencies should contribute grants, matched to local contributions, for the implementation of projects and involve local groups in the implementation process. There could be two categories of groups: self-help groups representing landless people; and area groups representing farmers in the microcatchment areas. These groups could form an executive committee from among the people who would administer projects and make various contributions (cash, in-kind contributions or labour). Such contributions would be made against the total estimated costs of projects aimed at developing private and common lands. This approach could ensure sustainability of such projects implemented at the grass-roots level.

6. Pre-conditions for institutional development/conditionality

(a) Institutional development is the key for success of any project, which involves large numbers of people. It is advised to involve non-governmental organizations as facilitators at grass-roots levels. Such organizations may be best equipped for social mobilization and capacity-building activities;

(b) There should be a coordinated mechanism to ensure the collection of, access to and distribution at all levels (i.e. local to national) of appropriate information, building upon existing partner networks:

The Earth Observation for Integrated Water Resource Management in Africa (TIGER) initiative could provide an important framework for such a coordination mechanism at least for its initial phase thanks to its flexibility in information-sharing;

(c) “Transparency” is a key to solving water resource management issues and space-derived information provides such transparency (no administrative boundaries can be viewed from space);

(d) A possible approach could be to have one institution to manage the information required at the international level:

(i) River basin authorities could be a model for such an institution;

(ii) Efforts should be made to build confidence through shared information management;

(e) The information to be managed should encompass policy, social and technical aspects, initially. Information to be shared internationally should be of a general nature;

(f) There is a need to determine the recipients of information (both internal and external to the project);

(g) Project output should contain recommendations on policy issues related to utilizing space technology.

Experience of the Indian Space Research Organization

(a) A management information system for internal use should be developed and a web-based module should be hosted on a website in the public domain so that the relevant information could be shared internationally (see http://kar.nic.in/watershed/sujala/). Such packages have been developed by the organization and are being used in the World Bank-assisted Karnataka watershed development project;

(b) A study should be conducted on environmental and social impact of projects. The study should be carried out by an outside agency before the implementation of projects;

(c) There should be procedures to be followed upon the completion of projects. Non-governmental organizations, project implementation teams from local authorities or national Governments and other stakeholders should smoothly withdraw from projects in order to ensure their sustainability. The resources used and created by projects should preferably be transferred to local communities. To ensure successful withdrawal from and sustainability of projects, local capacity should be developed to an adequate level;

(d) When developing a project, it is important to properly budget operational and maintenance costs to ensure the smooth transfer of the project to local authorities and communities. It is important to ensure that the right people are involved.

7. Infrastructure, technical facilities and equipment

(a) Validation and calibration of space-based data is essential when dealing with a wide variety of satellite and sensor data to meet specific needs of project execution;

(b) An in situ measurement network is fundamental, to include spectroradiometers, differential global positioning system (DGPS), mobile mapping units and so on. Consideration should also be given to using data products from multidimensional data assimilation techniques to fill in where in situ data are lacking;

(c) Use of existing ground facilities and receiving stations should be optimized and their upgrading ensured;

(d) The entire processing chain needs to be considered ensured with a view to upgrading, augmentation or replacement;

(e) Acquisition of hardware/software and equipment and its maintenance have to be considered with respect to the project, its scope and requirements. Maintenance of hardware and application software is crucial to the success of the project and should be clearly addressed at the outset;

(f) Consideration should be given to a proper trade-off between built-in, customized processing systems and commercially available systems, bearing in mind the goal of sustainable operations (the maintenance costs for commercial systems should be taken into account). There are many tools in existence that could be used through certain simple developments using an Open Source development environment. This could be explored for such projects based on the experience of the Indian Space Research Organization, which developed such tools for the World Bank project;

(g) Maintenance of equipment is a critical issue: development of local capability in this area should be emphasized;

(h) Local environmental conditions should be considered by manufacturers;

(i) Data summaries from existing hydro-meteorological networks should be required;

(j) There is now affordable technology for operating automatic weather stations using satellite linkages for data collection and download. This should be one of the technologies to be introduced in such projects from the beginning;

(k) The following supporting data are important:

(i) Base maps (topographic, land use, hydrology, channel cross sections etc.);

(ii) Digital elevation models (DEM) (high-resolution DEM);

(iii) Derivation of slope and aspect database from DEM;

(iv) Watershed documentation and maps (highlighting ridge to valley);

(v) Soil and its characteristics;

(vi) Land use studies using multi-temporal satellite data;

(vii) Hydrogeological and hydrological data and information;

(viii) Geomorphological and structural maps of the terrain;

(ix) Diversions and impoundments;

(x) Water use at various points in a basin;

(xi) Simulation models, in particular with reference to disasters to be addressed;

(l) Flood and drought forecasting methods need to be developed;

(m) Approaches to land use management need to be developed. This would amount to processing the satellite data by using multi-season data in a year as the base and designing the monitoring and management practice on a temporal basis. A detailed methodology document on this aspect could be prepared and provided as the Indian Space Research Organization has executed such projects earlier.

8. Functional scope

(a) The minimum level of technical functionality (processing, measurement and evaluation) among all participants in the projects (e.g. all participating institutions) should be guaranteed. This should be ensured by proper design of the project, which should clearly address the organizational structure at all levels. Roles and responsibilities should be clearly defined among all the stakeholders/institutions involved in implementation of the project;

(b) The project should be implemented at the basin level. This would be useful to generate a technically sound action plan for water resource development in the region using an integrated approach;

(c) Different information levels for decision makers should be addressed. This could be efficiently done by implementing the right kind of MIS/global information system (GIS) solution using customized software solutions. A client-server approach needs to be adapted over a local area network/wide area network for smooth information flow at all levels. This is especially important for the decision maker and project directorate on a day-to-day basis;

(d) A “bottom-up” approach should be pursued, ensuring the participation of all stakeholders at the local level, by involving the communities in the capacity-building, planning, implementation and monitoring processes.

9. Capacity-building

(a) Capacity-building is essential to ensuring the sustainability and autonomy of the project;

(b) It is necessary to conduct a survey on what kind of education, training and capacity-building is required for which type of audience (e.g. decision makers, programme managers, technicians, local communities (e.g. farmers’ associations), women and the younger generation etc.);

(c) Some areas of capacity-building include:

(i) Social mobilization and simple bookkeeping;

(ii) Environment and technical training;

(iii) Preparation of communities for a participatory approach;

(iv) Equipment management and maintenance;

(v) Data collection and analysis;

(vi) Infrastructure management;

(vii) Increasing awareness of decision makers;

(d) Training for trainers is important;

(e) Institutional capacity-building (as opposed to individual capacity-building) is important;

(f) There is a need for capacity-building of river basin authorities in modelling and remote sensing;

(g) Promotion and strengthening of partner networks is important.

10. Resources

(a) Proper budgeting is a key for the success of the project and should cover such elements as cost of procurement of space data and equipment, training and capacity-building, identification of key project professionals, participation of non-governmental organizations at the grass-roots level, baseline surveys of the area, identification of beneficiaries and social mobilization. Cost-sharing at the project and community levels, as well as operational and management costs, should be taken into consideration;

(b) Contributions from donor organizations, such as development agencies, regional commissions, regional development banks and the private sector, are essential. It is important for the local authorities/communities to provide grants matching the contributions of donors. This will ensure the sustainability of projects at the local level;

(c) Counterpart contribution and commitment are prerequisites for project sustainability. A degree of local involvement would be beneficial to ensure long-term commitment to the project.

11. Criteria for selection of the area for study

(a) Transboundary basins should be given priority;

(b) A basin authority should exist;

(c) A well-documented needs assessment should be available;

(d) An in situ measurement network should exist. (Such networks may be not too comprehensive and may lack automatic recording or reporting instruments);

(e) Capacity in space technologies should exist;

(f) Non-governmental organizations should exist;

(g) Socio-economic and environmental impact should be considered;

(h) Existing related initiatives should be considered;

(i) Review of water laws, protection of ecosystems, water quality criteria and so on should be undertaken;

(j) Existing bilateral transboundary water and emergency cooperation agreements should be considered.

12. Assessment of water resources

(a) Identification of key watershed and the major water resource problems and issues in each watershed in the basin should be technically assessed, to cover the socio-economic advantages of implementing such a project, the number of people to benefit from the project, as well as the total area to be covered and the types of natural resource to be assessed. Natural resource budgeting needs to be done as a precursor to the project;

(b) Assessment of the relative contributions of surface water and groundwater to seasonal and drought-induced variations in total water resources and water use requirements. This will be a part of the baseline study, which will establish all such facts before the study is started;

(c) Hazard and risk assessment related to flooding and droughts;

(d) Assessment of existing emergency management practices;

(e) Assessment of flood and drought mitigation options.

13. Sharing the experience and outreach

Each project should aim to increase the awareness of the general public and policymakers as regards the importance of water resource management and the usefulness of space-derived data and information for decision-making including by stimulating the awareness of the media.

Annex II

Follow-up to the United Nations/Austria/European Space Agency symposiums held in Graz, Austria, from 13 to 16 September 2004 and from 13 to 16 September 2005): Graz Proposal Evaluation Committee

1. Country representatives

Austria	Lukas Madl Austrian Research Centers Seibersdorf Research GmbH
	Erwin Mondre Forschungsförderungsgesellschaft Agentur für Luft- und Raumfahrt Earth Observation and Space Transportation
	Pierpaolo Saccon Institute of Water Resource Management Joanneum Research
	Klaus Scipal Institute for Photogrammetry and Remote Sensing Technical University of Vienna
Brazil	Carlos A. Vettorazzi University of São Paulo Escola Superior de Agricultura “Luiz de Queiroz”
Canada	Vern Singhroy Canada Centre for Remote Sensing
Croatia	Jure Margeta Faculty of Civil Engineering and Architecture Split University
India	P. G. Diwakar Regional Remote Sensing Service Centres Indian Space Research Organization
Morocco	Ahmed Er Raji Royal Centre for Remote Sensing
Niger	André Nonguierma Regional Training Centre for Agrometeorology and Operational Hydrology and Their Applications
South Africa	Simon Hughes Water Programme Council for Scientific and Industrial Research
United Arab Emirates	Abdul Habib Mahmood Ministry of Agriculture and Fisheries

United States of America	Edwin T. Engman Hydrological Sciences Branch (formerly Code 974) Goddard Space Flight Center National Aeronautics and Space Administration
	Richard Lawford International Global Energy and Water Cycle Experiment Project Office

2. Representatives of related entities

United Nations Environment Programme	Dag Daler Global International Waters Assessment Coordination Office
European Space Agency	Jean-Charles Bigot
Lake Chad Basin Commission	Garba Hassan Sambo
Niger Basin Authority	Ibraheem Alabi Olomoda
Nile Basin Initiative	Tom Waako

Annex III

Graz vision: water for all through the application of space technology

Taking into consideration that:

(a) While some countries have abundant and untapped stores of water to support growth in water consumption, others already use most of their water resources, and some lack water to satisfy their current needs;

(b) Sustainable access to safe and clean drinking water is one of the elements required to ensure the implementation of the Millennium Development Goals and the recommendations of the World Summit on Sustainable Development, held in Johannesburg, South Africa, from 26 August to 4 September 2002[a] related to the improvement of health conditions across countries;

(c) Improved water resource management contributes to the implementation of the Millennium Development Goals and the Plan of Implementation of the World Summit on Sustainable Development[b] related to ensuring environmental sustainability that can help reduce the risk of disaster, inter alia, from floods, droughts and desertification;

(d) Water is an essential resource for human well-being and economic activity and the World Summit on Sustainable Development identified water pollution as a major challenge that needs to be met to provide sustainable development;

(e) Management of natural resources was one of the central themes of the Third United Nations Conference on the Exploration and Peaceful Uses of Outer Space (UNISPACE III),[c]

Recognizing that:

(a) In order to provide access to the safe and clean water needed for improved health, sustainable economic development and the environment, it is essential to develop and implement integrated water resource management at the national and regional levels;

(b) Timely and accurate information is important to develop and implement efficient integrated water resource management, especially in view of the fact that many water basins are shared by several countries;

(c) Sharing timely information and assessing existing issues in water resource management can pose a challenge in some regions that share the same water basin, while space technology could provide objective information that could lead to building trust among countries sharing the same water resources;

---

[a] See *Report of the World Summit on Sustainable Development, Johannesburg, South Africa, 26 August-4 September 2002* (United Nations publication, Sales No. E.03.II.A.1 and corrigendum).

[b] Ibid., chap. I, resolution 2, annex.

[c] See *Report of the Third United Nations Conference on the Exploration and Peaceful Uses of Outer Space, Vienna, 19-30 July 1999* (United Nations publication, Sales No. E.00.I.3).

(d) Space technology can provide the tools necessary to collect various types of real time data that can be used by planners and decision makers in charge of management of water resources in order to understand water systems and manage available water resources effectively;

(e) Space technology can provide critical information on water resources in a timely manner with the use of remote sensing and telecommunication capacity,

Participants at the United Nations/Austria/European Space Agency Symposium on Space Applications for Sustainable Development to Support the Plan of Implementation of the World Summit on Sustainable Development "Water for the world: space solutions for water management", held in Graz, Austria, from 13 to 16 September 2004,

1. *Agreed* that pilot projects on the use of space technologies in water resource management were important tools to develop experience and build capacity in developing countries and to demonstrate the usefulness of space applications to high-level decision makers;

2. *Also agreed* that it was important to move from experimental and pilot uses of Earth observation data in projects on water resource management to operational and sustainable use of such data in those projects, and recognized the importance of standardizing methodologies for the use of Earth observation data and equipment, for data collection as well as for data transfer and analysis;

3. *Further agreed* that it was necessary to provide customized and understandable information to decision makers and end-users involved in management of water resources, and concluded that remote sensing data and data products needed to be distributed to all levels of society to allow each person to understand the conditions and limitations of water resources; involvement of local communities in the management of water resources could provide a "bottom up" approach in taking decisions related to water resource management;

4. *Agreed* that international organizations should strengthen the capacity of developing countries to utilize remotely sensed data to enable developing countries to benefit from space technologies, and that, at the same time, capacity-building should be seen as a process that was initiated through projects and sustained beyond the period of project implementation, and also agreed that it was important to upgrade equipment and capacity of remote sensing users in developing countries and to bring projects to the grass-roots level;

5. *Further agreed* that the public health community should be made aware of the opportunities provided by space technology in detection and monitoring of diseases and should attempt to use data from the newer satellites for monitoring and prediction of disease, since they had the potential to provide vastly improved spatial and temporal data related to water resources and the conditions controlling outbreaks and transmission of disease.