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Scaling up the use of space applications to deliver on the Sustainable Development Goals

Enhancing geospatial information applications for implementation of the Sustainable Development Goals

Note by the secretariat

Summary

In the Asia-Pacific Plan of Action on Space Applications for Sustainable Development (2018–2030), it was recognized that rapid digital innovation continues to augment the availability of geospatial information and that this provides the countries of Asia and the Pacific, particularly those with special needs, with an expanded choice of tools to implement the 2030 Agenda for Sustainable Development. Further, the need for exploiting new data sources and analytics associated with enabling and integrative technologies, processes and tools, so that timely, reliable and quality information is delivered to citizens, businesses, organizations and governments was underlined. This is key for evidence-based decision-making and enhanced accountability of actions.

The present document contains an overview of the regional status of the implementation of the Plan of Action and a selection of good practices and lessons learned. It also contains an assessment of future trends and recommendations for areas where regional cooperation can be strengthened. In alignment with the intergovernmental modality contained in the Plan, the Committee on Information and Communications Technology, Science, Technology and Innovation may wish to discuss these issues and endorse the recommendations with a view to strengthening regional cooperation in space applications and guiding the present and future work of the secretariat.

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I. Regional needs with regard to enabling and integrative technologies, data and tools for achieving the Sustainable Development Goals

1. Geospatial information provides far-reaching solutions to pressing issues facing humanity including those related to health, in particular the ongoing coronavirus disease (COVID-19) pandemic; education; food security; agriculture; energy; disaster risk reduction; and resilience-building. Interest in the space sector and its applications has never been greater, with more than 4,500 satellites in orbit registered in more than 80 countries and with increasing public and private investments.[1] Integrating geospatial data with existing statistics and ground-based information and exploiting new data sources, analytics, processes and tools will be instrumental to the delivery of timely, reliable and quality information necessary for governments, businesses, communities and citizens to take accountable actions and make evidence-based decisions. The space economy is projected to grow, as new start-ups disrupt the market, capitalizing on digitalization and the Internet of things and adding to the spillover benefits of space investments in research and development.

2. Rapid digital innovation continues to augment the availability of geospatial information, providing Asia-Pacific countries, particularly those with special needs, with an expanded choice of tools to implement the 2030 Agenda for Sustainable Development. Despite advances in the availability and quality of geospatial information, several gaps and challenges remain with regard to the effective use of integrated geospatial information at the regional and national levels, including a lack of capacity, financial resources, space-derived data, knowledge, expertise, specific tools and well-trained human resources.

3. To address the remaining gaps and challenges, the Asia-Pacific Plan of Action on Space Applications for Sustainable Development (2018–2030)[2] was adopted by the Third Ministerial Conference on Space Applications for Sustainable Development in Asia and the Pacific in 2018.[3] Since then, States members of the Economic and Social Commission for Asia and the Pacific (ESCAP) have made remarkable progress to actively support the implementation of the Plan of Action.

4. In late 2019, the secretariat conducted a detailed survey and analysis of the needs and contributions of various countries in the context of the implementation of the Plan of Action. Approximately 17 member States responded, detailing their needs with regard to the 188 actions included in the Plan and their proposed contributions to support other countries. Of the thematic areas identified in the Plan, natural resource management and disaster risk management are the two in which space applications are most commonly utilized. Accordingly, country responses included 1,532 requests for assistance to meet specific priority needs related to natural resource management and 1,328 requests to meet priority needs related to disaster risk management. In addition, country responses included 1,267 requests for assistance in the other thematic areas identified in the Plan, namely connectivity, social development, energy and climate change. The Asia-Pacific region is fortunate to include some of the world's most advanced spacefaring nations, which have offered various forms of support to meet these needs, such as sharing knowledge and experience

[1] United Nations, Office for Outer Space Affairs, Online Index of Objects Launched into Outer Space. Available at www.unoosa.org/oosa/osoindex/index.jspx?lf_id (accessed on 5 May 2020).

[2] ESCAP/75/10/Add.2.

[3] See ESCAP/75/10.

and providing data, expertise and tools. In this regard, the secretariat has begun to facilitate efforts to bring these countries together to address their gaps and needs.

5. Further details on specific good practices in the use of space applications at the national level were requested by the secretariat in early 2020. More than 20 member States responded, with many ministries providing an array of more than 90 examples of practical uses of geospatial information to support sustainable development. The areas covered by these examples, including disaster risk management and resilient agriculture; management of water, land and coastal resources; social protection and urban planning; mapping renewable energy resources; and studying the potential impacts of climate change, correlate closely with the thematic areas identified in the Plan of Action. The present document contains a selection of those examples and information on the progress already made by member States, the secretariat and international organizations.

II. Progress and highlights: emerging good practices and lessons learned in the implementation of the Asia-Pacific Plan of Action on Space Applications for Sustainable Development (2018–2030)

6. The Plan of Action includes 188 actions relating to research and knowledge-sharing, capacity-building and technical support, and intergovernmental discussions and regional practices. These actions are grouped into six thematic areas: disaster risk management, natural resource management, connectivity, social development, energy and climate change. Several cross-cutting issues are also identified in the Plan.

A. Implementation of the Asia-Pacific Plan of Action on Space Applications for Sustainable Development (2018–2030): progress by the secretariat

7. The long-standing Regional Space Applications Programme for Sustainable Development in Asia and the Pacific has enabled the rapid delivery of ongoing work and new programmes that support the implementation of the Plan of Action. Highlights of these efforts are provided below.

1. Cross-cutting activities

8. Member States requested that capacity-building with regard to space applications across all sectors be prioritized in the implementation of the Plan of Action. Through enhanced regional cooperation, the secretariat has been facilitating member States' access to timely satellite-derived geospatial data, expertise and resources by promoting the sharing of knowledge and good practices. With the support of the Governments of India and Thailand, the secretariat has facilitated the participation of six young officials from Bangladesh, Indonesia, Kazakhstan, Mongolia, Myanmar and Sri Lanka in a nine-month postgraduate course on remote sensing and the Global Navigation Satellite System at the Centre for Space Science and Technology Education in Asia and the Pacific in Dehradun, India, beginning on 1 July 2019. In addition, in mid-2019, the secretariat sponsored three young professionals from Cambodia, the Lao People's Democratic Republic and Myanmar to participate in a one-year master's degree programme jointly organized with the Association of Southeast Asian Nations (ASEAN) Research and Training Centre for Space Technology and Applications. The training had a positive impact on participants, who acquired knowledge about the innovative applications of technologies

which they can apply in designing specific space technology applications that support their countries' needs in achieving the Sustainable Development Goals.

9. Another cross-cutting issue identified in the Plan of Action is the provision of technical support for the integration of space applications with digital innovations, other sources of data and existing geospatial data platforms to facilitate evidence-based decision-making. The need for multi-stakeholder partnerships has also been underlined.

10. To that end, in line with the strategic focus of the ESCAP Multi-Donor Trust Fund for Tsunami, Disaster and Climate Preparedness in Indian Ocean and Southeast Asian Countries to harness innovation, science and technology, the ESCAP Sustainable Business Network held discussions in 2019 on complementary strategies to augment observation capabilities for effective tsunami early warning. Representatives of the maritime private sector, academia, participating governments and international agencies agreed to pursue three strategies to augment tsunami monitoring: (a) the use of precise Global Navigation Satellite System position readings from commercial ships to detect and report anomalies in sea surface elevation; (b) the use of stationary oil and gas platforms as passive markers for vertical sea surface observation and Global Navigation Satellite System communications; and (c) the integration of submarine telecommunications cables into ocean-spanning observation networks equipped with sensors to provide real-time data on seismicity and sea level movements. Each of these strategies offers co-benefits; in addition to augmenting early warning for tsunamis, they generate a wealth of geospatial data that can help to monitor ocean health and climate change impacts to support the achievement of Sustainable Development Goal 14 (Life below water).

11. In November 2018, at the request of member States, ESCAP assumed the secretariat functions of the Regional Committee of United Nations Global Geospatial Information Management for Asia and the Pacific, which had previously rotated among member States. Since then, the ESCAP secretariat has been coordinating with all Regional Committee members to strengthen the implementation of the Integrated Geospatial Information Framework of the Committee of Experts on Global Geospatial Information Management in the region, with support from Australia, China, Fiji, India, Indonesia, Japan, Mongolia, the Republic of Korea and Tonga. In late 2019, the Government of the Republic of Korea provided funding support to the secretariat to initiate the process of building an Asia-Pacific geospatial data platform by 2030. This one-data-one-map-one-platform initiative is aimed at connecting spacefaring data-supply countries and data-user countries so that geospatial data can be shared across the region in a more open, compatible and systematic manner in support of global initiatives such as the Group on Earth Observations.

12. To that end, over the course of the decade beginning in 2020, the secretariat will set up a gateway to facilitate the sharing of geospatial data in support of the implementation of the Plan of Action. These efforts will help to deepen understanding in developing countries of cross-cutting and complex sustainable development issues and identify evidence-based solutions for achieving the Sustainable Development Goals, including by sharing environmental, urban, health and disaster-related information. In the first phase of the process, funded by the Government of the Republic of Korea and scheduled to last from 2020 to 2022, preparatory work to establish the regional gateway will consist of developing a set of principles for sharing geospatial data and a set of operational modalities. Work in this phase will also be focused on developing a basic design for the geospatial data integration algorithm. The design of the website of the Regional Committee of United Nations Global Geospatial Information Management for Asia and the Pacific will also be

improved. In addition, this work will contribute to global initiatives such as the Integrated Geospatial Information Framework of the Regional Committee of United Nations Global Geospatial Information Management for Asia and the Pacific.

2. Disaster risk management

13. To directly support the emergency response and disaster assessment sub-themes of the Plan of Action, the secretariat has facilitated intergovernmental cooperation to conduct the following capacity-building and knowledge-sharing activities.

14. Since 2018, the secretariat has collaborated with member States participating in the Regional Space Applications Programme for Sustainable Development in Asia and the Pacific and other partners such as the United Nations Institute for Training and Research (UNITAR) Operational Satellite Applications Programme, the International Charter Space and Major Disasters, Sentinel Asia, the Multi-Global Navigation Satellite System Asia, the Centre for Space Science and Technology Education in Asia and the Pacific and the ASEAN Research and Training Centre for Space Technology and Applications, to provide timely assistance on satellite-derived remote sensing data for damage assessment of natural disasters. For example, more than 120 GB of remote sensing data as well as products and relevant services have been provided free of charge to countries that have been severely affected by disasters for use in analysing the damage and impact of floods, cyclones, earthquakes, tsunamis, volcanic eruptions, droughts and saltwater intrusions. When Cyclone Harold hit Vanuatu and Fiji in early April 2020, the secretariat worked with partners from the UNITAR Operational Satellite Applications Programme and India to provide 15 analytical reports on infrastructure damage and 3.8 GB of satellite-derived data, in addition to two Sentinel Asia reports, to the Subregional Office for the Pacific and to the Pacific Community.

15. As part of the project on improving institutional responsiveness to coastal hazards through multi-agency situational awareness, the ESCAP Multi-Donor Trust Fund for Tsunami, Disaster and Climate Preparedness in Indian Ocean and Southeast Asian Countries assisted the Governments of Maldives, Myanmar and the Philippines in implementing a Common Alerting Protocol in combination with the Geographic Information System (GIS). The Common Alerting Protocol is a digital format for exchanging emergency alerts for a wide range of hazards. It allows a consistent alert message to be disseminated simultaneously through a variety of communications systems and channels. The Common Alerting Protocol used the Sahana Alerting and Messaging Broker in this project, allowing for not only the dissemination of alerts and warnings but also map-based visualization.[4]

16. Since 2019, the secretariat has supported the Governments of Central Asian countries to develop a platform, methodologies and indicators to be used as analytical tools for the assessment of disaster risks in the overall context of the Sustainable Development Goal indicators related to disasters. The project, which was focused on identifying potential risks before disasters strike and highlighting the role of space applications and geospatial data for achieving this purpose, contributed to addressing priorities of the Plan of Action and the Integrated Geospatial Information Framework of the Committee of Experts on

[4] Asian Institute of Technology, “CAP on a MAP: improving institutional responsiveness to coastal hazards through multi-agency situational awareness”, terminal report, December 2016. Available at www.unescap.org/sites/default/files/TTF25-AIT-Terminal-Report-certified.pdf.

Global Geospatial Information Management. Specifically, the project involved cooperation between the secretariat and experts from China, Japan, Kazakhstan, the Republic of Korea and the Russian Federation to test the validity of the proposed disaster-related statistical geospatial indicators for analysing drought, floods, air pollution and sandstorms in Kazakhstan, which served as a pilot country.

17. Furthermore, in support of the implementation of the Integrated Geospatial Information Framework and the integrated use of statistical and geospatial land data in countries in Central Asia, the secretariat is working with its partners in the region on strengthening institutional capacity with regard to land accounts, including the application of the System of Environmental-Economic Accounting in the formulation and collation of national statistics. In addition, combined statistical geospatial data can potentially be used to assess changes and find solutions in development patterns, urbanization, infrastructure, societies and environmental resources. The data can also support efforts to build disaster resilience by mapping hazards and the vulnerable populations and infrastructure they might affect. These efforts are particularly important for monitoring slow-onset disasters with long-term implications such as desertification and land degradation. This work supports activities under a number of the thematic areas of the Plan of Action, including disaster risk management, natural resource management and social development.

18. Considerable work has also been carried out to support the food production sub-theme of the Plan of Action. This work has been accomplished using the Regional Cooperative Mechanism for Drought Monitoring and Early Warning, through which member States provide a menu of tailored tools, products and services in the spirit of regional cooperation.

19. With support from the Governments of China, the Republic of Korea and the Russian Federation, the secretariat is collaborating with members of the Regional Space Applications Programme for Sustainable Development in Asia and the Pacific to enhance the capacity of government officials and develop tailored tools to improve the use of geospatial information for resilient agriculture in the Lower Mekong River Basin[5] and Central Asia.

20. Through a project on enhancing capacity in the developing countries in Central Asia to effectively use space applications for drought monitoring and early warning, the Governments of countries such as Kazakhstan, Kyrgyzstan and Uzbekistan are receiving support to develop high-quality, user-tailored tools and applications to support decision-making for drought monitoring and early warning as well as capacity-building assistance with regard to their use. Experts from China, Kazakhstan, the Republic of Korea and the Russian Federation share their knowledge and provide technical assistance to develop tools and applications for assessing drought and other issues such as fire risk, agricultural productivity, ecosystem protection and management, land degradation and desertification, and land use change. In addition, under the coordination of the Subregional Office for North and Central Asia, an advisory working group consisting of subregional and regional research institutes and experts is developing models, guidelines and practices suited to the weather and topographical conditions of Central Asia.

[5] See the meeting report of the inception workshop on integrating cutting-edge geospatial information for agricultural crop monitoring in the Lower Mekong Basin. Available at www.unescap.org/events/inception-workshop-integrating-cutting-edge-geospatial-information-agricultural-crop.

21. In Mongolia, the secretariat is facilitating work to develop tools and models to better monitor and prepare for dzud conditions. With the support of the Subregional Office for East and North-East Asia and the Institute of Remote Sensing and Digital Earth in China, the National Remote Sensing Centre of Mongolia is developing tailored seasonal forecast models, which will enable people to better prepare for possible dzud conditions, for example by stocking up on additional food or moving their livestock to less vulnerable areas. The DroughtWatch Mongolia system makes real-time drought monitoring information available through an internal network that is accessible to the Ministry of Environment and Tourism and the Ministry of Food, Agriculture and Light Industry, as well as to local meteorological departments.

3. Natural resource management

22. To support the urban planning sub-theme of the Plan of Action under the thematic area of natural resource management, the secretariat has been working on integrating cross-sectoral space and ground data to support local government decision-making by ensuring access to the right information at critical times. Specifically, the secretariat is cooperating with regional partners to develop a common data format and platform to capture, store, display, query and analyse geospatial information and cross-sectoral statistical data simultaneously to support decision-making.

23. In addition, to support activities identified under the marine and ocean pollution sub-theme of the Plan of Action, the secretariat is addressing coastal plastic pollution by developing a digital tool to visualize plastic waste leakage and its temporal dynamic, integrating georeferenced data including ground, air, space and crowdsourced data.

4. Connectivity

24. The Plan of Action includes several elements that are very relevant to the COVID-19 pandemic. For example, in the Plan, the secretariat and member States were requested to take the following actions: (a) research how global, navigation and communications satellite systems can be used to minimize the spread of epidemics; (b) promote regional cooperation by leveraging existing mechanisms to share data and exchange expertise on big data analytics to contain the present and future spread of disease and pandemics; (c) develop capacity to map health risk hotspots using geospatial information and big data; and (d) research tele-health solutions using space technology applications to improve the capacity in vulnerable countries to prepare for, mitigate and respond to emergency health situations. In line with these actions and in response to the COVID-19 outbreak and the economic and development crisis surrounding it, the secretariat published a paper on the regional impact of and policy responses to COVID-19.[6]

25. In addition to supporting medical and health-care solutions, the integration of geospatial information and digital technologies can help governments to monitor infection trajectories and empower people with information during pandemics such as COVID-19. In support of these efforts, the secretariat is enhancing regional sharing of georeferenced big data, analysis of geospatial and temporal interlinkages and understanding of risk correlations between COVID-19 and socioeconomic sectors such as health, finance, connectivity, education, energy and safety. There is scope in the Plan of Action to leverage existing regional cooperation mechanisms to promote the sharing of

[6] ESCAP, “The impact and policy responses for COVID-19 in Asia and the Pacific”, 26 March 2020.

geospatial data and technical expertise with a view to improving global health and mitigating pandemics, including by mapping risk hotspots and integrating space technology applications for evidence-based decision-making.

26. In the Plan of Action, the secretariat and member States were requested to use space applications to monitor air pollution and raise awareness about various sources of data on pollutants and contaminants. In this regard, the secretariat is initiating a programme to establish an open platform and build capacity to effectively utilize scientific data generated by the Geostationary Environment Monitoring Spectrometer and ground sensors to address air pollution in the region.

5. Social development

27. Outlined below are initiatives that directly support the sub-theme of utilizing space applications to develop efficient and resilient transport and information and communications technology (ICT) systems.

28. The secretariat utilizes geospatial data to maintain information on the regional infrastructure network, formalized by the Intergovernmental Agreements on the Asian Highway Network, the Trans-Asian Railway Network and Dry Ports as well as the Asia-Pacific Information Superhighway initiative. This information covers the composition of the Asian Highway network in 32 countries, the Trans-Asian Railway network in 28 countries and the network of dry ports in 27 countries. The secretariat is currently considering the possibility of using GIS and other solutions to offer interactive maps of the regional transport network as well as of the e-resilience of the telecommunications networks and infrastructure.

6. Energy

29. In the Ministerial Declaration on Regional Cooperation for Energy Transition towards Sustainable and Resilient Societies in Asia and the Pacific, adopted at the Second Asian and Pacific Energy Forum, the secretariat was requested to develop the Asia Pacific Energy Portal[7] to provide a detailed, up-to-date and interactive energy infrastructure database for the region, including power plants and high-voltage transmission lines. Space-based data can play a large role in augmenting and improving spatial data which will provide member States with decision-making support to better achieve their domestic energy access targets. The Portal specifically supports the request in the Plan of Action to develop capacity to use space applications for mapping and planning energy infrastructure and services.

7. Climate change

30. In the Plan of Action, the use of space applications was recognized as important in monitoring of and adapting to the effects of climate change. In that regard, the secretariat has been working on activities relating to building national capacities to establish resilient agricultural systems through crop and drought monitoring.

31. Member States in South-East Asia, namely Cambodia, the Lao People's Democratic Republic, Myanmar and Viet Nam, are receiving capacity development and technical support from the Governments of China, India and Thailand to integrate geospatial information into crop and drought monitoring for building resilient agriculture. An operational cloud-based crop monitoring

[7] Available at https://asiapacificenergy.org/.

system tailored to each country has been developed for monitoring crop conditions, production, disease and pest infestations as well as drought impacts, and each Government is receiving capacity-building to effectively utilize the system.

32. A joint publication on drought research by the secretariat and ASEAN, entitled *Ready for the Dry Years: Building Resilience to Drought in South-East Asia – With a Focus on Cambodia, Lao People's Democratic Republic, Myanmar and Viet Nam: 2020 Update*,[8] features a space-based data analysis of drought trends and impacts. The analysis shows that drought accounts for approximately 60 per cent of average annual losses due to disasters in South-East Asia. In addition, the publication serves to encourage policymakers to consider how space-based products and services can enable drought resilience-building in the subregion. Ongoing ESCAP-supported efforts to operationalize space-based drought monitoring and early warning systems in several countries are also showcased in the publication.

B. Progress in national implementation of the Asia-Pacific Plan of Action on Space Applications for Sustainable Development (2018–2030)

33. Since the adoption of the Plan of Action, member States have provided the secretariat with a large range of examples of how they already use space applications to support the thematic areas identified in the Plan and of future work, or they have requested support. Some of these examples are provided below.

1. Disaster risk management

34. Disaster risk management is one of the thematic areas of the Plan of Action in which space applications are used extensively in many countries. Even in those countries without national space or geoinformatics programmes, space information is readily used for risk reduction, response and reconstruction.

35. In Thailand, space applications are utilized for many purposes and have been integrated into the work of a range of ministries. The Geo-Informatics and Space Technology Development Agency and the Department of Disaster Prevention and Mitigation are using space applications to determine the risk of subsidence and flooding near the coast. They are also using these applications to map fault risk using digital elevation model data and considering the rate of motion of the fault energy. The Department of Marine and Coastal Resources, working with the Geo-Informatics and Space Technology Development Agency, has established an ocean forecasting and marine disaster mitigation system for South-East Asia, while the Office of the National Water Resources uses space applications to manage water during floods and drought.

36. In the Philippines, the use of light detection and ranging data and maps has accelerated the rehabilitation of the areas affected by the eruption of the Taal Volcano. The University of the Philippines Training Centre for Applied Geodesy and Photogrammetry is making its map data on the Taal Volcano and surrounding areas freely available to the public, providing light detection and ranging technology maps with a resolution of up to 1x1 metre that can be used for planning and reconstruction in areas damaged by the eruption.

37. In addition, the Remote Sensing and Data Science Help Desk in the Philippines combines GIS, remote sensing, artificial intelligence and other data

[8] United Nations publication, Sales No. E.19.II.F.7.

science techniques to produce and communicate relevant disaster information to agencies and key end-users to complement the current efforts of existing government agencies and initiatives.

38. In India, the Central Water Commission and Google signed an agreement to share expertise on flood forecasting to improve disaster risk reduction through artificial intelligence and spatial mapping.[9] The Government of India has also been an important partner of the Regional Cooperative Mechanism for Drought Monitoring and Early Warning.

39. In countries such as Australia and Armenia, space information has been used for monitoring forest fires. During the Australian bush fires in 2019 and 2020, space applications and telecommunications were used extensively in emergency response and preparedness efforts. The Digital Earth Australia Hotspots monitoring system provided daily information on the location of bush fires, and the Fires Near Me and Spark applications combined that location information with geospatial data on vegetation, topography, weather and infrastructure to model bush fire behaviour.[10]

2. Natural resource management

40. As the human population and its impacts on ecosystems and natural resource use grow, natural resource management is increasingly important from the community level to the global level. Space applications offer valuable information to support sustainable resource management and conservation.

41. Many countries in the region already have experience developing and implementing tools, approaches and systems to leverage space applications for enhanced food security. In addition to previously mentioned examples involving the secretariat and partners in China, India and the Russian Federation, many other member States and international organizations have been developing their own applications. The Bangladesh Space Research and Remote Sensing Organization regularly uses satellite images and data to support the national agricultural sector. Remote sensing time series data from satellites, covering a period of January to December, are acquired at the country scale to estimate the area coverage of major agricultural crops. The methodological approach consists of remote sensing radiometric analysis of temporal and spatial dynamics of crop responses, supported by GIS.

42. Remote sensing and other space applications are used for a range of other environmental management purposes in addition to crop monitoring. The Thailand Department of Marine and Coastal Resources monitors near-real-time sea surface temperatures from space to assess the risk to coral reefs, as heat is a major factor triggering coral bleaching. In addition to being important ecosystems for fisheries, coral reefs provide tourism benefits and protect coastal areas against some disasters such as storm surges. Monitoring sea surface temperatures provides an early warning about when and where action may be needed to protect fragile coral ecosystems from additional pressures, such as tourism, in order to reduce the impact of warming periods to prevent the permanent loss of coral reefs and support faster recovery.

[9] Express News Service, “Central Water Commission, Google tie up to better flood forecasting”, New Indian Express, 18 June 2018.

[10] Kate Crawford, Paul Reed and Roshni Sharma, “Spatial solutions for agile real-time bushfire responses for communities, nations and the whole world”, Utility Magazine, 24 January 2020. Available at https://utilitymagazine.com.au/spatial-solutions-for-agile-real-time-bushfire-responses-for-communities-nations-and-the-whole-world/.

43. The Government of China, in association with the Group on Earth Observations, used remote sensing data to analyse land degradation between 2000 and 2018. The Amazon and Congo tropical rainforests have experienced large-scale forest degradation since 2000, indicating that these important ecosystems may be heading for recession. However, land degradation in China and South Asia has been reversed, indicating that policy guidance and scientific governance can be effective in that regard.

3. Connectivity

44. In India, long-established telemedicine, tele-education and village resource centres providing social services in remote areas are all supported by communications satellites and applications.[11]

45. Several Governments are designing systems to support road safety using space applications. In the Philippines, research is being conducted into the integration of artificial intelligence, closed-circuit television and other data sources to detect traffic conditions, hazardous areas and driver behaviour. Traffic violations are being monitored, detected and reported through a system that uses artificial intelligence and closed-circuit television. A traffic simulation software has also been designed to support local government road and traffic engineers in decision-making for traffic management.

46. In Sri Lanka, work is under way to develop intelligent transport systems focused on the remote monitoring of railways using the Global Navigation Satellite System and a passenger information system based on the Global Positioning System (GPS). The GPS-based Global Navigation Satellite System is also used by the Telecommunications Regulatory Commission of Sri Lanka in the context of its spectrum monitoring system to investigate interference with official and licensed radio frequencies. In addition, telecommunications infrastructure is being mapped using GIS.

4. Social development

47. Space and ICT applications have been important tools in tracking and tackling the COVID-19 pandemic, with applications being launched in several countries to track the movement of infected people and the transmission of the virus. The Government of the Republic of Korea, like the Government of China, was among the earliest to begin operating a system that utilizes smart city technologies to support the automation of the public health surveillance process for COVID-19. The system enables real-time analysis of big data to automatically identify the travel history of infected people and their location during the period of infection, as well as various statistical analyses including of large-scale outbreak areas to identify sources of infection. The use of the system ensured the availability and rapid acquisition of accurate information.

48. The smart city system utilized in the Republic of Korea in the context of the COVID-19 outbreak was originally launched in the early 2000s under the Ubiquitous City initiative. It is now focused on efficiently building and managing existing and new cities. Similar applications for urban planning have been developed in several other countries such as the Philippines, Sri Lanka and Thailand.

49. In India, the Government has been supporting a telemedicine programme since 2001 to provide health services in remote areas of the country. The

[11] Indian Space Research Organization, “Communication and navigation applications”. Available at www.sac.gov.in/sacsite/communication%20&%20navigation.pdf.

programme uses satellites to link remote hospitals and mobile telemedicine units to larger specialty hospitals, enabling specialist doctors to provide medical diagnosis and consultation services to patients in remote areas.[12]

5. Energy

50. Remote sensing and space applications, which have long been used in the mining industry to locate fossil fuel sources, are increasingly being applied in mapping renewable energy potential. The Philippines Department of Energy uses light detection and ranging surveys and other satellite images to map potential sites and capacity for renewable sources of energy such as wind, solar, hydroelectric and biomass energy. Utilizing new geospatial technologies such as light detection and ranging coupled with updated data sets allows for more detailed and localized resource assessments which can complement or improve upon previous work.

51. Daily insolation data derived from several geostationary satellites are used in India to analyse the minimum and maximum temperatures in specific locations in order to map suitable areas for solar power plants. A digital elevation model was used to identify suitable slopes, and a GIS application has been developed to provide monthly and yearly information on solar energy. An Android app has also been developed for users to compute the solar energy potential at their location, taking into account such factors as the slope of the terrain, distance to power lines, distance to roads, land use and the solar insolation.

52. Similarly, in Sri Lanka, an island-wide hydroelectric and solar energy atlas has been completed using GIS, and plans are in place to produce similar tools for wind, geothermal and ocean energy resources.

6. Climate change

53. According to research conducted by the secretariat, measures for disaster risk reduction should take account of the shifting risks associated with climate change, especially in risk hotspots, where a greater likelihood of change coincides with a higher concentration of poor, vulnerable or marginalized people.[13]

54. In India, the programme on climate change research in the terrestrial environment consists of studies on climate change and climate-based modelling and characterization of diverse habitats ranging from coral reefs and mangrove swamps to high altitude Himalayan alpine ecosystems. The studies are carried out with synergistic use of ground measurements, space inputs and climate projection data. The work will use space applications to review potential long-term impacts of climate change including on the alpine zone, sea surface temperatures and coral bleaching, as well as on photosynthesis estimation of mangrove forests and hydrological modelling of national water resources.[14]

[12] Indian Space Research Organization, “Tele-education”. Available at www.sac.gov.in/SACSITE/TELE-MEDICINE%20&%20TELE-EDUCATION.pdf (accessed on 15 April 2020).

[13] *Asia Pacific Disaster Report 2019: The Disaster Riskscape across Asia-Pacific – Pathways for Resilience, Inclusion and Empowerment* (United Nations publication, Sales No. E.19.II.F.12).

[14] Space Applications Centre, “Environment and climate change”. Available at www.sac.gov.in/Vyom/envandclimate.jsp (accessed on 6 May 2020).

55. In the Philippines, several studies and projects have also been initiated to anticipate the effects of climate change. These include analysing the influence of changes in sea surface temperatures, testing models to determine climate variability and extremes, improving the detection of tropical cyclones, and developing high resolution climate change projections for various scenarios.

III. Future trends and recommendations

56. Considerable progress has been made by member States and international organizations on the effective use of space applications to support development and the achievement of the Sustainable Development Goals. With the rapid emergence of more sophisticated sensors comes a greater opportunity to harness innovative technologies for development efforts.

57. Remote sensing is mostly carried out by Earth observation satellites employing traditional sensing instruments such as spectrometers, radars, light detection and ranging sensors and other passive or active hardware. However, several telecommunications satellite constellations have also been deployed for the purpose of Earth surface monitoring. These solutions are increasingly being used on the ground to facilitate data-intensive operations, such as pipeline monitoring and remote control of machinery. The implementation of several machine-to-machine automatic control systems has increased equipment safety and efficiency, primarily in the energy sector and transportation, including freight.[15]

58. Other innovative applications include the use of the GPS radio occultation technique[16] to allow for more accurate and enhanced weather forecasting in combination with other atmospheric data. The emergence of the Internet of things will continue to blur the lines between satellite applications, as any device will theoretically be able to feed into the broad monitoring ecosystem.[17]

59. A state-of-the-art trend for integrating geospatial information is the inclusion of novel data sources and technologies, such as big data, the Internet of things, crowdsourcing and cloud computing. Geospatial analysis for a wide range of development priorities may benefit from the use of big data. Because of the massive amount of data available, big data can be used to produce real-time, in-depth analysis that is more precise or on a larger scale than would have been possible using traditional geospatial data. Such analysis benefits end users and stakeholders alike by guiding decision-making and helping to tailor development strategies. As a result, in multiple countries in the Asia-Pacific region, such as Australia, China and the Republic of Korea, research was initiated on big data usage and the development of big data platforms at the national or subnational level as a means of advancing geospatial applications.

IV. Issues for consideration by the Committee

60. Considering the growing use of space applications in the region and the potential development of new and innovative applications, the Committee may wish to deliberate on how to better leverage innovative technologies, data and

[15] Daniel Alsen, Mark Patel and Jason Shangkuan, “The future of connectivity: enabling the Internet of things”, McKinsey and Company, 29 November 2017.

[16] Elizabeth Howell, “Shipping companies have a new weather forecast tool using space tech”, Forbes, 11 September 2019.

[17] Nicolas Hunke and others, “Winning in IoT: it’s all about the business processes”, Boston Consulting Group, 5 January 2017.

tools to strengthen the contribution of space applications to the achievement of the Sustainable Development Goals.

61. In line with the intergovernmental modality contained in the Plan of Action and recognizing the need to develop norms and commonly shared principles, the Committee may wish to deliberate on how to scale up good practices and strengthen regional cooperation in space applications to guide the present and future work of the secretariat.

62. In particular, given the increased need and demand for connecting and integrating diverse but scattered data sources for evidence-based decision-making, the Committee may wish to support the secretariat's preparatory work for building a regional gateway to promote the sharing of integrated geospatial data, tools and good practices in an open and systematic manner, in line with global initiatives such as the Integrated Geospatial Information Framework of the Committee of Experts on Global Geospatial Information Management.