UNITED NATIONS
ESCAP
Economic and Social Commission for Asia and the Pacific

How space technology applications contributed to combatting COVID-19 pandemic

Virtual meeting on MS Teams, 30 June 2020, 10:30 - 12:00 hrs. (UTC+7, Bangkok time)

SUMMARY

Space technology applications including satellite remote sensing, telecommunication, navigation and positioning provide far-reaching solutions to pressing issues facing humanity, ranging from health – and notably the ongoing COVID-19 pandemic – education, food security, agriculture, energy, to disaster risk reduction and building resilience.

The meeting was attended by 166 participants from 22 countries and 13 organizations. Among them, from 5 LLDCs, 7 LDCs and 4 SIDs, 36.75% of the participants are female.

Participants discussed how space applications can be best utilized to tackle the COVID-19 outbreak and potential future pandemics through enhanced regional cooperation, its role in monitoring and analyzing the impact of COVID-19, as well as supporting the response and recovery efforts. They exchanged good practices and lessons learned from countries in the Asia Pacific region and explored how countries and regional organizations can strengthen collaboration to develop capacity to map health risk hotspots and mitigate potential risks using space applications and geospatial information.

Panelists from Indonesia, Republic of Korea and Thailand, as well as participants from China, India and Sri Lanka introduced their good experiences in integrating geospatial data, existing statistics and ground-based information and exploiting new data sources, analytics, processes and tools that are instrumental to deliver timely, reliable and quality information necessary for governments, businesses, communities and citizens to take accountable actions and make evidenced-based decisions.

The meeting participants reconfirmed that space and geospatial information applications have played an important role in providing essential location-based and temporary data to make an overall data map on COVID-19 pandemic for policy makers and the public.

Participants recognized that regional cooperation will help the governments to operate a comprehensive platform to better integrate various data and information including satellite-derived data and ground georeferenced data in the process of responding COVID-19 pandemic, although the structure of the platform in government were different from country to country.

The participants appreciated the good achievements of featured countries such as China, India, Indonesia, Republic of Korea and Thailand. However, the meeting acknowledged that despite good progress in several Asia-Pacific countries, there are many remaining challenges on data integration such as rapid data collection and integration, link with policy implementation and action, data privacy, and cooperation with the public on data.

The meeting highlighted that it is necessary to continue regional effort to strengthen regional knowledge sharing and cooperation through webinar and other meetings in the future. Some participants requested ESCAP to take further actions including sharing good experiences and operational tools through regional and subregional training, and specific capacity building events to support other countries in using satellite

image to analyze the impact of COVID-19, developing data hub for determining potential risk of COVID-19 across the country focusing on methodology development, and comprehensive COVID-19 situation map focusing on tracking confirmed cases movements and preventing further infections.

This interactive, knowledge sharing session provided a platform to build the capacity of participants looking for inspiration and ideas for using space technology applications to combat the COVID-19 pandemic. Potential next steps to be taken by the secretariat include the development specific training materials and organize online trainings based on the excellent tools and approaches presented. The secretariat will continue to work to enhance regional cooperation so that space technology applications and geospatial data can be best harnessed for achieving the SDGs, which is a priority of the Asia-Pacific Plan of Action on Space Applications for Sustainable Development (2018–2030).

Finally, the meeting participants expressed thanks to ESCAP for organizing this knowledge sharing webinar and asked the secretariat to continue to organize this kind of cooperation event.

Proceedings

Mr. Sanath Panawennage, Co-Chair of ICC-23 on RESAP and Chief Executive Officer of Arthur C. Clarke Institute for Modern Technologies (ACCIMT), Sri Lanka welcomed all participants and highlighted that this webinar is important considering the need for stronger collaboration among governments in combatting COVID-19 pandemic as well as potential future pandemics, to map health risk hot spots and help with mitigation efforts.

Ms. Tiziana Bonapace, Director, Information and Communications Technology and Disaster Risk Reduction Division, United Nations Economic and Social Commission for Asia and the Pacific (ESCAP) provided welcome remarks from ESCAP, the Secretariats of RESAP and UN-GGIM-AP. This is the second in a series of webinars on how geospatial information helps in the COVID-19 response and in building back better. COVID-19 has caused adverse impacts to our pace in implementing 2030 Sustainable Development Goals in the region. In response to the COVID-19 outbreak and the economic and development crisis surrounding it, ESCAP secretariat developed a Framework which sets out ESCAP's offer and value addition to support member States socio-economic response to COVID19, around three main streams of work. Two are particularly relevant to space technology applications, namely "protecting people and enhancing resilience" and another is "building back better with resilience" The Asia-Pacific Plan of Action on Space Applications for Sustainable Development (2018–2030) adopted at the Third Ministerial Conference in October 2018 long before the pandemic hit, had great foresight in requesting the secretariat and its member States to a) research on how GNSS, data, big data analytics and mapping of health risk hotspots, can contain present and future spread of disease and pandemics. The Space Plan of Action also identifies the need for research on tele-health solutions using space technology to improve emergency health capacities.

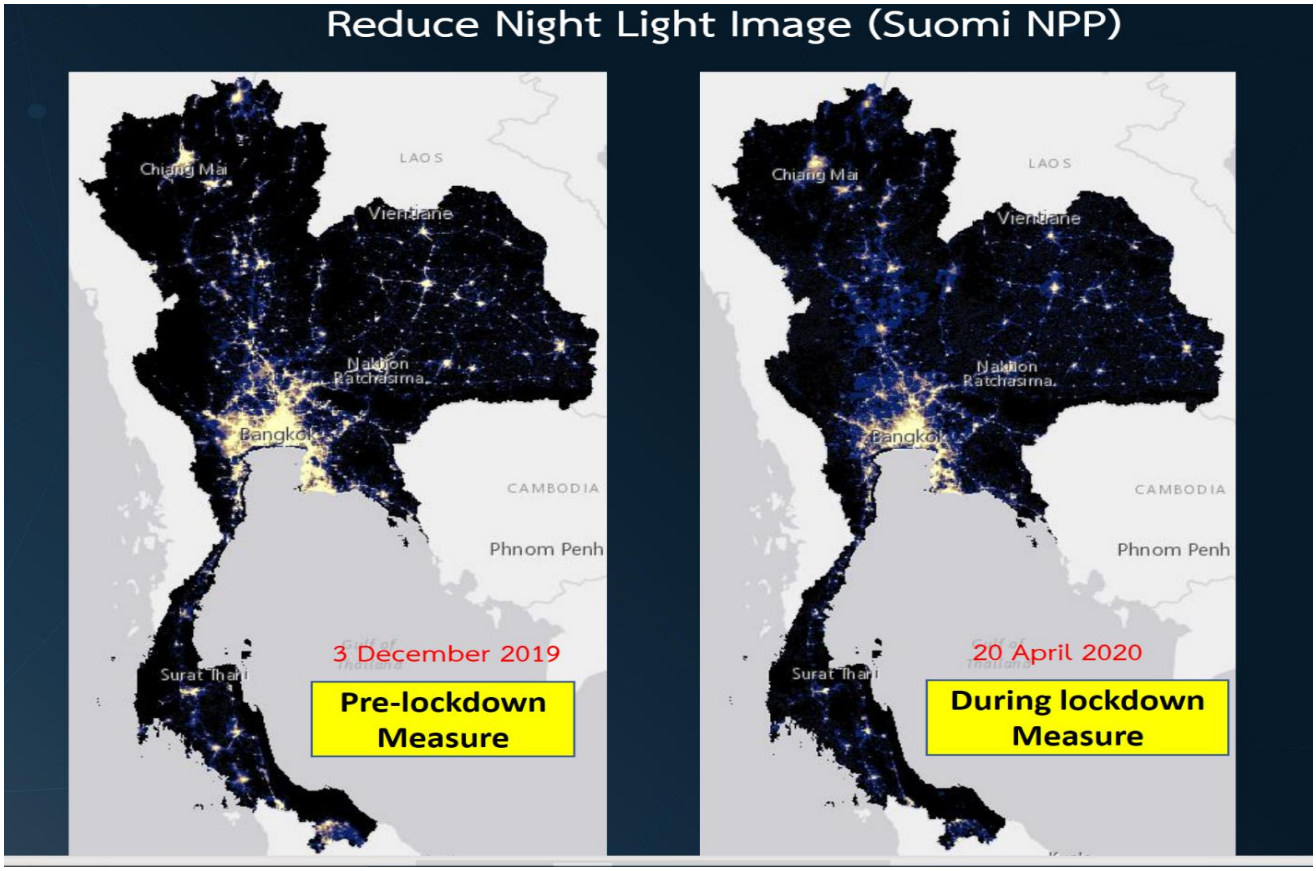
Three key points were highlighted:

1) A growing recognition of the role of ICT and space applications for tackling regional and global challenges such as COVID-19;
2) There is a growing number of good practices in using space applications for COVID-19; and
3) Regional cooperation is an imperative.

The pandemic calls for borderless solidarity and regional cooperation is the key tool to strengthen our capacity, overcome unexpected challenges, and find useful solutions together.

Mr. Tatiya Chuentragun (acting Deputy Director) and representative of **Mr. Pakorn Apaphant**, Executive Director of the Geo-Informatics and Space Technology Development Agency (GISTDA), Thailand, delivered the presentation entitled "Space technology applications for combatting COVID-19 pandemic in Thailand".

GISTDA found that there is a wide variety of COVID-19 related data, information and numbers from many government agencies, however, it is difficult for the policymakers to access those data in one place to be able to utilize them most effectively. GISTDA recognized how space applications could help address this challenge and the COVID-19 situation to monitor and visualize the impact of the policies employed in the country. For example, GISTDA analyzed reduced night light images to monitor what the impact has been from lock-down measures. A significant change can be seen between the images from 3 December 2019 (pre-lockdown measure) and 20 April post-lockdown measures. Furthermore, GISTDA used satellite data to monitor nitrogen dioxide emissions and found that since the beginning of the year most provinces in Thailand have less activities that cause emissions. These are examples of some of the many sources of data for monitoring that were reported to the government.



The bounty of available information needs to be integrated to support the government and for this reason, the Working Group on Data Integration and Analysis for COVID-19 Situation was initiated under the Centre for COVID-19 Situation Administration. To support this working group, GISTDA identified the need for a platform to help at the operational level, especially the inspection teams in each province. The newly developed platform integrates data so it can be summarized, linked to maps and visualized on a dashboard for specific users: the policymaker, and those in the field. For this system, the target user is the government agencies, to enable them to monitor the pandemic situation, medical capacity and supplies, consumer goods, and to design preventive and precautionary measures.

The key challenges and lessons learned include: it is difficult to drive the policy to action, cooperation and authority are essential, completeness of data and data privacy and ethics. The next steps for GISTDA are to try to project from the current situation to see what would happen and the potential social and economic impacts from easing of lockdown measures and restrictions.

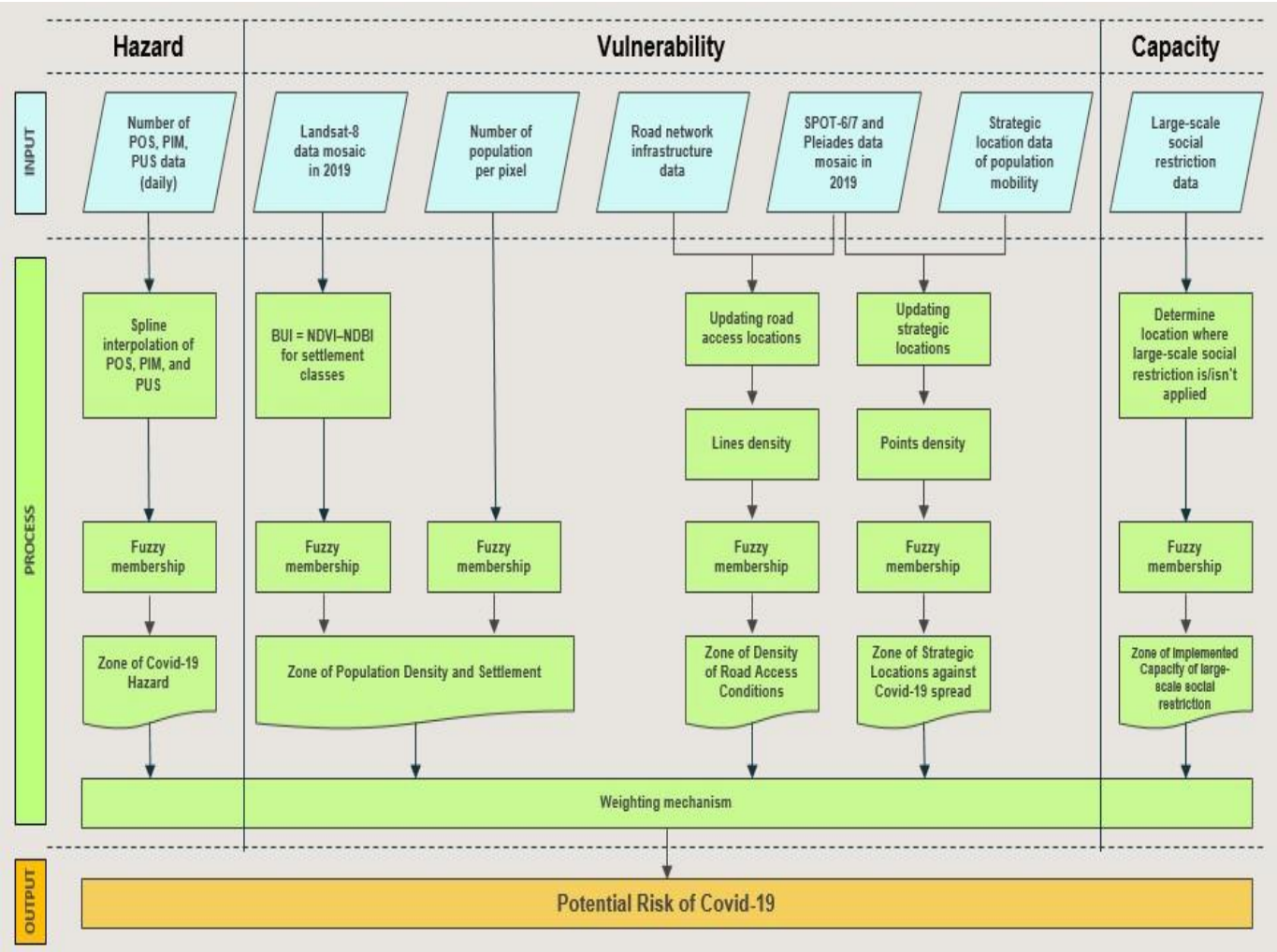
Ms. Orbita Roswintiarti, Co-Chair of ICC-23 on RESAP, and Deputy Chairman for Remote Sensing Affairs of the National Institute of Aeronautics and Space of Indonesia (LAPAN), Indonesia delivered the presentation entitled "**How space technology applications contributed to combatting COVID-19 pandemic: Development of LAPAN Hub COVID-19**"

The first case of COVID-19 in Indonesia was announced on 2 March, and by mid-March, Indonesia's Ministry of Health's Circular Letter No. 02/2020 of Self Isolation Protocol was released. After data collection and brainstorming for the methods in April, the LAPAN data Hub of COVID-19 was developed by the end of the month.

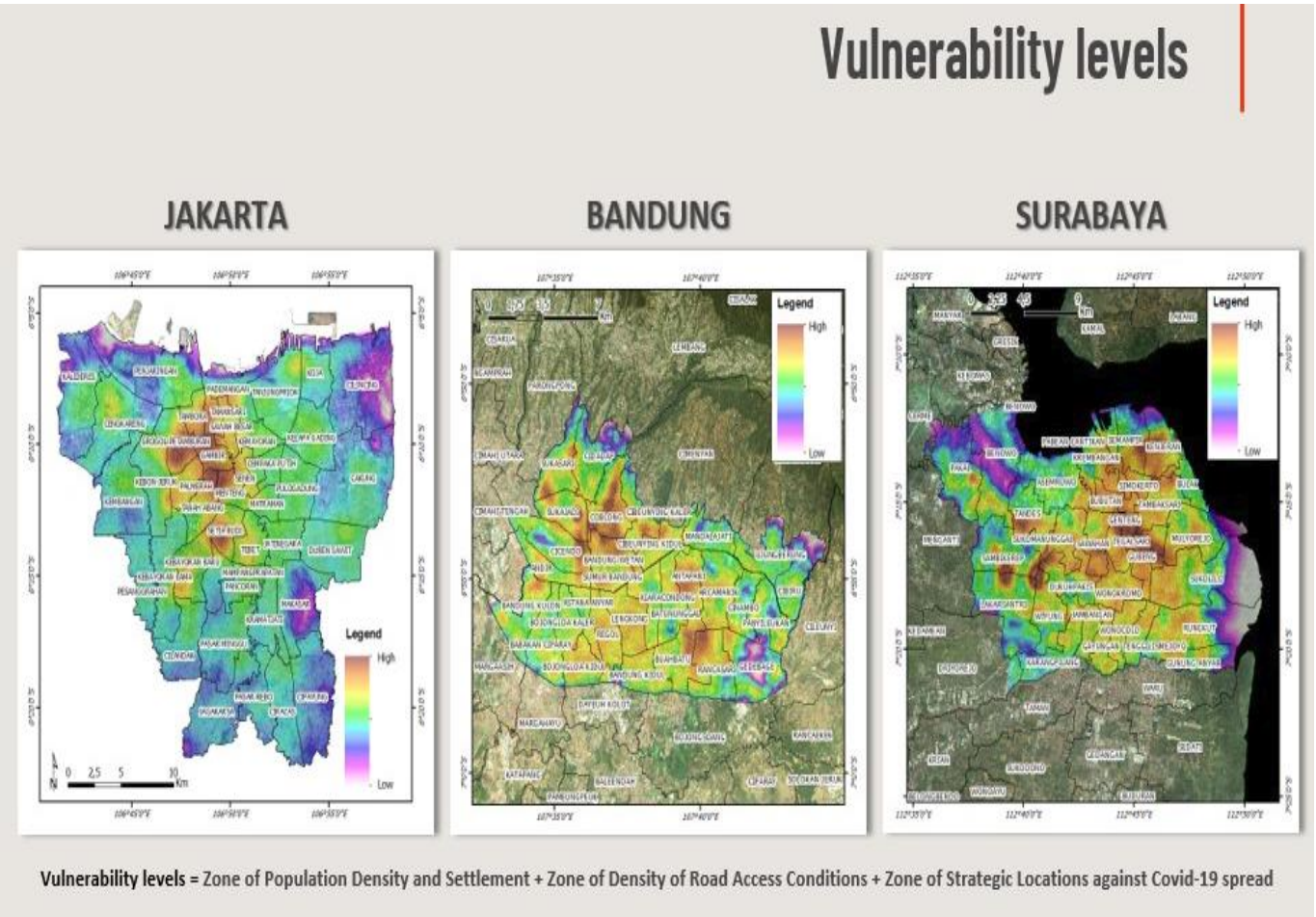
The applied risk assessment methodology adapted the idea of risk=Hazard * (vulnerability/capacity). The indicator of COVID-19 hazard was comprised of the daily positive case (POS), patient in monitoring (PIM) and people under surveillance (PUS), which varies from place to place. Vulnerability was measured by the latest Landsat-8, SPOT-6/7, and Pleiades data mosaic and related statistical/ground-based data to

update distribution of settlement (BUI=NDVI-NDBI) to update distribution of settlements, density, road access and strategic location (near markets, malls, health facilities and other public areas). Capacity was measured by government policy of large-scale social restriction (not implementing lock-down).

The presentation took Jakarta as an example. In the beginning of March, it was very difficult to find the relevant data. To solve this, LAPAN developed a formula of data mining that incorporated mid, high and very high-resolution satellite data combined with statistics for determining the potential risk of COVID-19 spread.



Vulnerability levels visualization results showed high risk levels in central Jakarta, North West and North East of Bandung, and it spread throughout Surabaya. Increased risk in Jakarta areas was visualized from May to June 2020 based on daily POS, PIM and PUS. With these analyses one can see shifts over time, such as worsening in some parts and improving in others, allowing better targeting, as overall statistics do not reflect the spatial differences seen on the ground.



The major challenge is to obtain daily COVID-19 statistical data automatically in digital format, as some statistics are available only for district and village levels. Tools available included the ESRI's ArcGIS Hub coronavirus response template, linked with the COVID-19 National Task Force managed by the National Disaster Management. LAPAN used multiple innovative data applications in using the tools to address the challenges. Remote sensing data have been used mainly for updating settlement distribution, density of road access, and strategic locations of COVID-19 spreading. Some indices derived from remote sensing data have been used to determined zone of settlement. Air pollution information derived from remote sensing data have been used among others to investigate the impact of large-scale social restriction.

Issues that need to be further addressed included adding locations to be analyzed and conducting the accuracy assessment: Increases (POS, PIM, PUS) data have been resulted from more massive (rapid and PCR) tests. LAPAN also had the following recommendation for the regional cooperation: focus Group Discussion and capacity building on sharing experience on good practice in the Asia-Pacific region; use more data or information in the analysis; exchange methods, particularly those which could be derived from remote sensing data.

Mr. In Hyun KIM, CEO, Korea Spatial Information & Community (KSIC), Republic of Korea presented "**Korea's experience on using space applications and geospatial information to address the COVID-19**".

There are 150 corona virus map services in Korea. The reason for this is that the Korean National Geographic Information Service openly shares map data, so that anyone can easily create services. Following COVID-19 spread in Korea in late January 2020, Korea Information and Communication implemented a location-based mapping service for public notification. KSIC started to provide spatial data on the movements of confirmed patients because they believed that tracking the movements of confirmed patients would help prevent further spread of infection.

Comprehensive COVID-19 Situation Map, one of the best examples of mapping services in Korea, is a collaborative project between the government, the private sector and volunteers. Technologically, Kaoni provided cloud services and technical support, LX covered the cloud service costs, and NGIS provided their e-map, and others offered AI chat bot service, volunteer focused update service, EBS special service containing 3 types of status maps, and real time mask service. Soon after, they began offering real-time mask information, English version of the map, pre-voting station information, and other various analytics.

Comprehensive COVID-19 Situation Map provides more information and faster updates than any map service involved. Specifically, the biggest difference between this map and others is that while other maps are limited to providing location information, this can quickly and comprehensively provide spatial data relating to coronavirus. While other map services only provide a straight-line patient route, Comprehensive COVID-19 Situation Map provides a much more exact Network based Route using our specialized GIS engines that can create a tracking simulation by analyzing the road network.

Questions and Answers

Question: "We know Indian Space Research Organization has a very powerful and useful geospatial data portal Bhuvan, can ISRO introduce have how you integrate Bhuvan geoportal and other satellite navigation systems to support combating COVID-19? Can these tools be used by other countries in the future?"

Answer (from Mr. Goru Srinivasa Rao):
It is a gigantic task to control COVID-19 spread in India with about 1.3 billion population. Indian government and state governments have taken several steps to contain the steps, and the ISRO assisted in this by providing geo-spatial tools, in particular BHUVAN – the Indian Geo-Platform of ISRO. The GI platform provided service in six aspects: tracking, hotspots, vegetable markets, food for need, home isolation and pollution.

As India needed a dashboard to know about what happened in the country, ISRO customized Geo-portal and developed 'Bhuvan-COVID-19' at national level to track the pandemic and update the common public on current situation. The data was from the Ministry of Health and Family Welfare, and included daily pandemic growth status, day wise spread, pan-India scenario etc.

To help the field level functionality in Bihar State, ISRO has enabled the health officials to map the hotspots for containment with buffer zones to manage the pandemic. This is an automated tool, updates it layer automatically based on the hotspot information from the State and is helping various districts in the Bihar State to easily identify the villages, their population, etc. in the containment zones. With very high resolution satellite images, the tool is able to provide household level information for management teams to draw strategies at local level.

In lockdown getting basic food goods is very difficult, so ISRO has developed mobile applications for helping people find essentials such as vegetable markets and free food provided by the government. Location based services are enabled using mobile Apps linked to Geo-portal 'BhuvanCOVID-19' that helps in services of mobile vegetable market at different places in Hyderabad. It helped in geotagging all the home quarantine cases and enabling in monitoring them from a simple-to-use dashboard, provision of the essential services and medical facilities. Similarly, a geospatial tool was also available for "Anna Unavagam" (free food for the needy) with easy navigation functionality to reach food to the needy at various locations in Chennai.

Because of the difficulties to accommodate all patients, some patients needed to be hospitalized at home. Monal 2020 (Electronic Device) enabled round-the-clock monitoring, geotagging and home isolation of

COVID-19 patients uses Bhuvan Services to geolocation of Patients, different zones (like Red/Orange/Green) of a specified area (like city/district/State). Medical equipment at home also identify patients in critical situations.

Geospatial information was also used to monitor changes in air and water pollution. In monitoring nationwide air pollution situations, spatial distribution of NO2 shows significant decrease in NO2, as compared to the previous years, due to reduction in the anthropogenic activities. Satellite based observations are made from INSAT-3D and MODIS to measure the AOD and also the Particulate Matter PM2.5 & PM10, which could have adverse effect on human health, particularly respiratory infections, apart from climatic effects. The observations show a decrease of about 20 to 36% in AOD levels across the country. As for water pollution, Satellite images are used to observe turbidity levels of river Ganga flowing across Kanpur & Prayagraj cities for two different dates. Images depicted Pre-lockdown period of March 19, 2020 showing high turbidity levels, while the post-lockdown period images of April 4, 2020 shows reduced turbidity levels in the river Ganga. This is mostly attributed to reduction of outflow of industrial waste, due to lockdown and natural flushing caused by river flow.

Question: How does GISTDA share space-derived data with other countries including ASEAN countries to address the COVID-19? Are there any recommendations to enhance our regional cooperation?

Answer (Mr. Pakorn Apaphant):
We are willing to share information via our system. Regarding enhancing regional cooperation, I think we can have workshops like this, they may be a good beginning to start for the regional cooperation, for example through ESCAP. We can also integrate assistance from each country, so that we can learn from each other, and promote further applications and extend to bigger audience.

Question: "China has paid a lot of efforts in COVID-19 response and recovery. Can Chinese expert introduce some good examples to help us learn what innovative space technologies have been used in the past few months? If there is request, can these applications be shared with other countries?"

Answer (Prof. Guoqing Li):
On behalf of Satellite Data Technology Division, Aerospace Information Research Institute, Chinese Academy of Sciences (AIR-CAS), we would briefly introduce Chinese activities concerning combating COVID-19. In general, space technology applications can response and contribute to pandemic control in the following aspects.

First, monitoring the policies. In China, institutions like the Wuhan University and private sectors all use Chinese satellites to track the lockdown policy's impact to the crowd and activities around China and in major cities around the world. For example, in the more than two months of lockdown in Wuhan, more than 30 Chinese satellites were used to capture information from more than 120 observing stations over the Wuhan area, which gave a lot of information to the users.

Second, geospatial information can monitor hospital, health and emergency facilities. Companies and universities used satellites and analysis to monitor water quality and surface information of Huoshenshan and Leishenshan, the emergency hospitals, during their construction.

Third, the epidemic's development can be simulated based on geographic and environment factor. Several companies used the satellite data, such as Beidou navigation system data and cellphone data, in risk mapping and transmission simulating of COVID-19. The Beidou navigation system was also widely used for disinfection and logistics assistance.

Fourth, geospatial information was used to guide and help socio-economic recovery. Companies and universities used satellites to trace the recovery process, such as resumption of Wuhan city, Shanghai and Chengdu. They also assessed the impact factors to the spring crop in China.

Last, they also did some cross disciplinary decision-making work. The decision makers need not only the spatial information but also some of the medical and other information. Therefore, cross disciplinary knowledge supporting is very important. For example, a geographical COVID-19 knowledge data hub when COVID-19 was announced as a world-wide disease. This hub has become a very important knowledge base for UN, WHO, UNESCO and GEO. More than 20 papers were published about the geospatial communities' response to COVID-19 are on the portal. If you are interested, you can join the group of observation and find some showcased examples from China.

Question: For ESCAP as an institution, is there any effort in terms of technical actions and policies to contain the spread of the COVID-19 that can be implemented by other countries? In other words, are there any policy frameworks that are developed and can be used?

Answer (ESCAP secretariat):
As mentioned in the beginning, there is a framework that ESCAP has been putting forward for addressing the response to COVID-19. Additionally, as the secretariat for RESAP, ESCAP is helping countries share their best practices in space technologies to inspire and inform planning and practices in other countries. There is more to come as we are all learning from each other. We share those information and act as a connector to help facilitate and connect, to contribute to those countries that have identified their needs and facilitate regional cooperation.

In Addition, we are guided by the Asia-Pacific Plan of Action on Space Applications for Sustainable Development (2018–2030), with several important actions formulated and requested by Member States for this pandemic, public health and how to use space applications to combat pandemic. We are presenting this OneData – OneMap – OnePlatform initiative. For example, for the case of hotspot of pandemics and vulnerable communities, we are cooperating with LAPAN and Indonesia in the pilot city Makassar to geo-reference relevant data for health, economy, transport, urban and disaster into one map.

Annex: List of Participants

Moderator

Mr. Sanath Panawennage
Co-Chair of ICC-23 on RESAP
Chief Executive Officer
Arthur C. Clarke Institute for Modern Technologies (ACCIMT), Sri Lanka

Opening remarks

Ms. Tiziana Bonapace
Director, ICT and Disaster Risk Reduction Division
United Nations Economic and Social Commission for Asia and the Pacific (ESCAP)

Panelists

1. Thailand: Mr. Pakorn Apaphant
   Executive Director
   Geo-Informatics and Space Technology Development Agency (GISTDA), Thailand

2. Indonesia: Ms. Orbita Roswintiarti
   Co-Chair of ICC-23 on RESAP
   Deputy Chairman for Remote Sensing Affairs, National Institute of Aeronautics and Space (LAPAN), Indonesia

3. Korea: Mr. In Hyun KIM
   Chief Executive Officer
   Korea Spatial Information & Community (KSIC), Republic of Korea

AUSTRALIA

Mr. Chris Body, Consultant, Geospatial Standards, Australia

Mr. Graeme Kernich, Chief Executive Officer, FrontierSI, Melbourne

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Mr. Md. Ilias Miah, Chief Executive, Science & Technology, Centre for Environment, Human Rights & Development Forum (CEHRDF), Dhaka

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Mr. Goru Srinivasa Rao, Associate Director, Earth Observation & Disaster Management (EDPO), Indian Space Research Organization (ISRO), Bangaluru

Mr. Sunil S. Fatehpur, Government Civil Servant, GIS & RS DTE, Survey of India

Prof. Virender Kaul, Professor (retd.), Department of Plant Pathology, Punjab Agricultural University, Ludhiana

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