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

Expert Group Meeting on Space-derived Data for Air Pollution Monitoring

Virtual meeting on MS Teams
7 August 2020, 9:00 - 12:30 hrs. (UTC+7, Bangkok time)

Background

The UNEP study indicates that air pollution is the fifth leading risk factor for mortality. Air pollution was estimated to be responsible for around 3.4 million deaths in Asia-Pacific in 2017[1]. Though countries and cities have implemented various air pollution management policies, these will only offset the additional pollution produced by a growing population and urbanization[2]. Between 1990 and 2015, the population-weighted PM 2.5 concentrations grew by 19 per cent in Asia-Pacific[3], exceeding the global average increase of 10 per cent. In 2018, Asia-Pacific was home to 96 of the 100 cities most polluted with fine particles (PM2.5)[4]. Exposure to particulate matter pollution tends to be greater in least developed countries, whereas tropospheric ozone concentrations grew faster in more developed or rapidly developing countries and regions, such as South Asia, where O3 pollution grew at a much faster rate than the global growth rate.[5]

Air quality monitoring has been mainly based upon in-situ measurements by governments using ground-based air quality monitoring networks within their territories. However, ground-based monitoring has limitations since monitoring stations are mostly concentrated in densely populated cities with rigid installation requirements and very narrow spatial coverage. Satellite observations complement the ground-based networks by providing data over wider areas, which is particularly useful for regions where no ground-based monitors are installed, such as rural areas or countries with limited air pollution monitoring equipment or capacity. This satellite information helps evaluate and improve air quality and chemical transportation models, emissions inventories in a wider perspective and allow the better production of hourly air pollution forecasts, which are accessible to public through a broad range of platforms and applications. Over the long term, the effectiveness of policy interventions can be monitored. For the short-term, pollution hotspots missed by emission inventories or ground monitoring stations can be identified and addressed. This data can fill in information gaps left by ground-data collected through monitoring stations to help evidence-based policy making to address not only national and local air quality, but transboundary pollution issues.

[1] https://www.healtheffects.org/announcements/state-global-air-2019-air-pollution-significant-risk-factor-worldwide
[2] UN Environment (2019) Air pollution in Asia and the Pacific: Science-based solutions
[3] HEI 2018
[4] https://www.airvisual.com/world-most-polluted-cities
[5] State of Global Air, 2019

Member States of Asia-Pacific recognized the urgency of this issue by adopting resolution 75/4 in 2019 on "Strengthening regional cooperation to tackle air pollution challenges in Asia and the Pacific" in 2019. This resolution encourages the sharing of experiences and information relating to air pollution and the means to tackle this problem and is in line with priority actions under the Regional Roadmap for implementing the 2030 Agenda for Sustainable Development in Asia and the Pacific. In addition, the UN General Assembly adopted resolution A/RES/74/212 on "International Day of Clean Air for Blue Skies" in 2019 to strengthen international cooperation at the global, regional and subregional levels in various areas related to improving air quality, including the collection and utilization of data, joint research and development, and the sharing of best practices.

The Asia-Pacific Plan of Action on Space Applications for Sustainable Development (2018 – 2030)[6], which was adopted by ESCAP resolution 75/67, requests ESCAP and member States to develop the capacity to use space applications to monitor air pollution including dust, smog and other pollutants from hazardous chemicals, pollutants and contaminants, which will also contribute the thematic area on "Sustainable Management of Natural Resources" in the UN-ASEAN Plan of Action on Complementarities Roadmap (2020-2025), specifically on "Promoting policy dialogue and enhancing capacity for monitoring air pollution (PM2.5 and PM10) and air quality management".

In this regard, opportunities exist for countries in this region, particularly in Asia, to fill the data and information gap in the nation-wide monitoring of air quality by better utilizing space applications. By integrating satellite data calibrated to monitor air pollution, with reliable ground monitoring information, policy makers will have a better understanding of air pollution and be able to improve model simulations of air quality, including its forecasting and warning service. This may require governments to enhance their capacity to undertake the comprehensive analysis of data derived from space and ground networks which can be achieved through regional cooperation, and to promote policy dialogue, partnership and enhance the capacity for monitoring and managing air pollution at the regional level.

The Expert Group Meeting (EGM) on 7 August 2020 introduced the opportunities and experiences of better utilizing space applications for monitoring air pollution and discussed the needs and challenges of participating countries. In this regard, the results of the EGM included a better understanding of the country's capacity, need assessments and contribution to use of geospatial information for air pollution; knowledge sharing on the experiences of using satellite-derived data for air pollution monitoring; improved understanding on the integration of space information with ground data for air pollution monitoring; and greater regional cooperation relating to air pollution and contributing to the Plan of Action on Space Applications (2018-2030).

[6] https://www.unescap.org/resources/asia-pacific-plan-action-space-applications-sustainable-development-2018-2030
[7] https://www.unescap.org/commission/75/document/E75_Res6E.pdf

Conclusions and recommendations

Participants of the Expert Group Meeting (EGM) on Space-derived Data for Air Pollution Monitoring deliberated various presentations and discussions from experts, partners, international organizations, and member and associate member States recommended the following:

1. The meeting participants had better understanding on country's capacity, needs and contribution to use of geospatial information for air pollution.
2. The meeting participants had enhanced knowledge of countries in Asia-Pacific region on use of satellite-derived data for air pollution monitoring, through integrated innovative geostationary satellite observation and georeferenced ground monitoring data.
3. The participants requested ESCAP secretariat to enhance regional cooperation on implementation of the Asia Pacific Plan of Action on Space Applications and environment protection.
4. The meeting participants noted greater support from participating countries on building the Pan-Asia Partnership for Geospatial Air Pollution Information.
5. The meeting participants requested the ESCAP secretariat to conduct more in-depth discussions with individual countries on enhancing their capacity on use of space-derived data for air pollution monitoring.
6. The meeting participants urged the ESCAP secretariat to improve engagement with other relevant stakeholders relating to the use of space applications for air pollution monitoring and management.
7. The meeting realized the necessity on establishment of an expert advisory team and an online help desk for technical support and information sharing, and
8. The meeting encouraged strong participation in the event of International Day of Clean Air for Blue Skies, which will be held on 8 September 2020.

Participants from several countries including Cambodia, India, Indonesia, Mongolia, Myanmar, Pakistan, Philippines, and Thailand expressed their interest in gaining access to, or extending the coverage of, the geostationary environment monitoring satellite data for air pollution monitoring.

Many participants also expressed interest in presenting their activities and the situation of their countries, specifically from Pakistan, India and Malaysia.

There were several questions from participants, which are summarized in Annex A, including specific technical questions relating to the Pandora network. Answers for these questions, where possible, are also summarized in Annex A. A summary of the evaluation is also attached as Annex B.

The total of 75 participants from 15 countries attended the EGM. Among them, 59% are female and 87% are from developing countries in the region. List of participants is attached as Annex C. The concept note and programme of the meeting is in Annex D.

Proceedings

Opening session

During the opening session, statements welcoming participants were made by Mr. Young Woo Kim, Director General of the National Institute of Environmental Research (NIER), Republic of Korea, and Mr. Keran Wang, Chief of Space Applications Section, Information and Communications Technology and Disaster Risk Reduction Division (IDD), on behalf of Ms. Tiziana Bonapace, Director, IDD, United Nations Economic and Social Commission for Asia and the Pacific (ESCAP).

Mr. Kim highlighted that this meeting introduced opportunities for air pollution monitoring using the Geostationary Environment Monitoring Spectrometer (GEMS) with the Pandora network, and proposed the enhancement of regional cooperation to build the capacity of countries to undertake the comprehensive analysis of data derived from space and ground networks.

Mr. Wang outlined the challenges facing Asia with respect to increasing levels air pollution despite all the work already done by governments. The health impacts and how pollution can be transboundary, emphasizing the importance of the EGM in building a community of scientists and practitioners for air pollution monitoring, through the Pandora Asia Network, while laying the groundwork for regional cooperation on air pollution in Asia-Pacific. Mr. Wang outlined the initiatives already being undertaken by ESCAP to tackle this issue, in line with the needs identified under the Asia-Pacific Plan of Action on Space Applications for Sustainable Development (2018 – 2030).

Introductory session

The ESCAP secretariat delivered the presentation entitled "The Asia-Pacific Plan of Action on Space Applications and Building Pan-Asia Partnership for Geospatial Air Pollution Information". "Building Pan-Asia Partnership for Geospatial Air Pollution Information" aims to enhance the national and regional capacity to undertake the comprehensive analysis of data derived from space and ground networks, and improve the capacity of governments to better utilize monitoring data and air quality models for analysis, forecasting and warning services. In addition, a regional partnership involving relevant environment, meteorological and space agencies of participating countries to promote policy dialogue for monitoring and management of air pollution at the regional level will be developed.

The representative from the Environment and Development Division of ESCAP delivered a presentation entitled "Air pollution monitoring in Asia-Pacific: Innovative Solutions with Remote Sensing" which outlined a project on air pollution and discussed the example in Chiang Mai. It shows a high Air Quality Index (AQI) for PM2.5. The PM2.5 level has a seasonal pattern with the value often exceeding moderate between December-April, and unhealthy in March. Other pollutants, such as PM10 and O3, also exhibited similar seasonal patterns though are still within the moderate range of the AQI. The study determined agricultural burning as the major

source, with a number of burning hotspots seen from the MODIS satellite, showing the same seasonal pattern as that of the PM2.5 level. Moreover, years with abnormally low burning activities corresponded to lower pollution levels. He concluded that remote sensing empowers science-driven policy, but innovative uses of integrated data sources is needed along with international cooperation, to provide clean air for all.

Representative of the National Institute of Environmental Research (NIER), Republic of Korea, introduced the Geospatial Environmental Monitoring Spectrometer (GEMS) data and Pandora Asia Network (PAN). Pandora is a compact, modestly priced sun/sky/lunar passive UV/VIS grating spectrometer, which can be integrated in the PAN as a new network of ground-based remote sensing instruments dedicated to validating the GEMS data. Pandora monitors air quality and atmospheric composition in the region where it is installed and serves to monitor satellite data quality for the whole of the GEMS and LEO mission durations. NIER informed participant that NIER will share GEMS and PAN data with Asian countries in collaboration with NASA, ESA and PGN. In addition, a representative from NIER provided an overview of the ground station of GEMS and its work in receiving, processing and analyzing, validating, monitoring, and providing a back-up and archive service for the GEMS data. GEMS standard products will be applied to research areas such as air quality and climate change, and the validated GEMS data will also enable air quality forecasting for better air quality predictions. The estimation of ground-level particulate matter (PM) is being conducted based on statistics and AI techniques, while data fusion between various satellites aims to increase the quality and accuracy of data. It is also expected that international campaigns such as Pandora Asia Network (PAN) and Satellite Integrated Joint Monitoring of Air Quality (SIJAQ) will help to validate GEMS data.

Experts from the Japan Agency for Marine-Earth Science & Technology (JAMSTEC) introduced their experience of using Pandora #146 at Yokosuka, Japan. JAMSTEC has been using the MAX-DOAS with Pandora direct-sun observations to provide a firmer basis for satellite validation for NO2. Following suggestions were given to the participants: instruments would become more robust if adapted to "humid" conditions in Asia; the attendance of a local operator at least once per week is recommended; and hiring network manager with hardware skills in the Asian time zone would be very helpful.

Expert from the Atmospheric Chemistry and Dynamics NASA Goddard Space Flight Center, introduced PGN status and future plans. He outlined the difference between the satellite and Pandora measurements and the importance of validation and calibration, and presented the current network of instruments worldwide and plans to expand the Pandora locations and the PGN network, which provides support to the instruments, coordinating the operation of the network with the local operators. In the future, the PGN is expected to add instruments, improve retrievals beginning, assist in the development of the PAN, and hold a 2021 PGN meeting in the Washington D.C.

Country reports

Representative of the Geo-Informatics and Space Technology Development Agency (GISTDA), Thailand, presented "Application on Forest Fire (PM 2.5) using satellite image and GIS data", where the Aerosol Optical Depth data from MODIS was converted to PM 2.5 and PM 10 data. Using that data, GISTDA was able to analyze the degree of air pollution in Thailand in real time.

Representative of the National Institute of Aeronautics and Space (LAPAN), Indonesia, introduced their work on atmospheric environment monitoring and research, including in greenhouse gases, ozone, aerosols, air quality, acid deposition, environmental health, forest fires, volcanic ash, etc. LAPAN requested to participate in the project on "Building Partnership for Geospatial Air Pollution Information". They indicated that the project was very relevant to their activities at the Centre of Atmospheric Science and Technology of LAPAN and aligned with their vision to contribute to national wellbeing through monitoring and prediction of air quality.

Representative of the Information and Research Institute of Meteorology Hydrology and Environment (IRIMHE), Mongolia, briefed the meeting on air quality monitoring in Mongolia. She indicated that Ulaanbaatar was the most polluted city in Mongolia because it has the highest population in the country. About 850,000 people live in Ulaanbaatar's ger areas and have poor access to urban services. A heavy reliance in these ger areas on coal for heating and energy generates large carbon dioxide emissions and air pollution, especially during winter. In Mongolia, air quality monitoring data is quite limited due to monitoring stations are mostly concentrated in densely populated Ulaanbaatar city and having a very narrow spatial coverage. Furthermore, air pollution is also increasing in 21 provinces during the wintertime, which also need coverage by their air quality monitoring network. Satellite data can fill in information gaps left by ground-data collected through monitoring stations. They expressed a need for more capacity building on air pollution monitoring using remote sensing.

Representative of the Institute of Environmental Science and Meteorology (IESM), University of the Philippines (UP) Diliman, Philippine Space Agency (PhilSA)/ IESM UP Diliman introduced the current air quality monitoring network/system in the country, which is mostly ground-based. Multi-element analytical technique is in operation using the KevexED–771 and Panalytical Epsilon 5 Energy Dispersive X–ray Fluorescence spectrometer. Black carbon is analyzed using the M34D Smoke Stain Reflectometer. Total Carbon Column Observing Network (TCCON) is in operation from 2017 until present. She also indicated that the PhilSA has prepared to undertake the Pan-Asia Partnership for Geospatial Air Pollution Information project in the Philippines.

Representative of the Department of Meteorology and Hydrology (DMH), Ministry of Transport and Communications, Myanmar, indicated that Myanmar has started acid deposition monitoring in rainwater since 2003 with 9 stations which increased to 25 stations by March 2019. Near the Myanmar-Thailand boarder, PM2.5 and PM10 is worsening, so the Government has implemented various actions to reduce haze pollution. A project for Improving the of Capability of Air Quality Monitoring in Myanmar has been proposed to the Japanese Government. In Myanmar, real time

monitoring stations are limited. Public awareness and long-term plans to combat air pollution is limited. The technology and capacity to monitor forest fires and other fire hot spots using satellite images is also limited. Due to the limitation of ground monitoring stations nation-wide, utilizing satellite information could be the best option for air quality monitoring.

Representative of the Ministry of Environment (MOE), Cambodia, introduced that from 2017 to 2020, the government has installed air quality monitors in 41 locations for monitoring PM2.5, PM10, CO, NO2, SO2 and O3. The data on air quality is transferred from a sever of the company who procured the air monitoring equipment. Cambodia is facing many challenges including no data platform for monitoring and storing the data of air quality; insufficient laboratory facilities to monitor and control environmental quality; limited capacity and experience of staff, mainly those are in charge of monitoring and controlling air quality; insufficient legal and technical guidelines and action plans on air pollution management; lack of technical assistance and air quality management experts; and lack of cooperation between ministries in promoting information and data sharing.

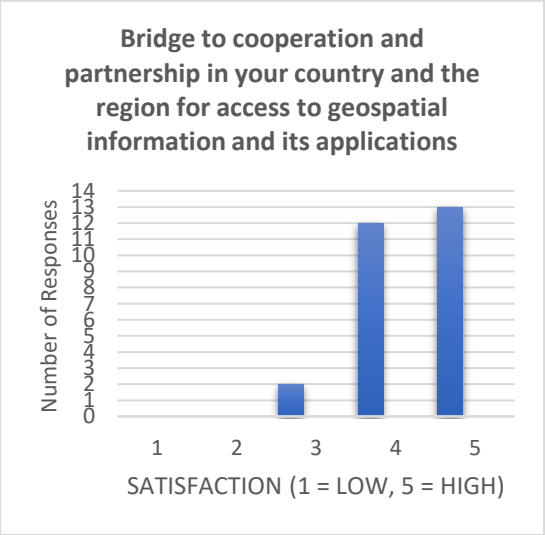
Annex A: Questions from the floor and answers

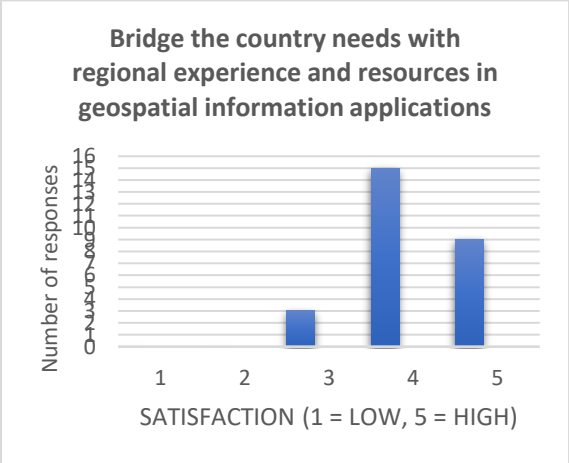
#	Questions	To	From	Response
1.	Have you monitored NMHCs by satellite or ground level as it is also one of the important species to assess the formation of ground level ozone?	Mr. Chang	Pallavi Saxena, India	Ministry of environment is operating PAMS network and GEM and Pandora will provide HCHO concentrations, an indicator of NMHCs.
2.	There have been various smog episodes in south Asia since 2016 and mainly caused by trans-regional crop-residue burning. Although, there have been a male declaration but due to geo-political situation the regional states are reluctant to cooperate with each other and consequently the problem is growing bigger and bigger. I would like to have your take on this emerged environmental and regional security threat in South Asia. Pandemic of COVID-19 has caused severe health concerns and economic disruptions worldwide. The socio-economic lockdown had a positive change in severely polluted cities across the world. It poses a serious question; Do We Need Socio-Economic Lock-down On Regular Basis To Breath Clean Air?	Ms. Lee	Md. Faheem Khokhar	Thank you for your comments. NIER will keep eyes on what you told to us!
3.	Would it be possible for GEMS to cover also the southern part of Indonesia region (Java Island) since it is the most active region in Indonesia?		Didi Satiadi, LAPAN	GEMS can observe area above 5 degrees south latitude.
4.	I was just wondering if GEMS could also include the northwestern parts up to Pakistan. as here we are working on both satellite and ground-based MAX-DOAS observations.		Md. Faheem Khokhar	
5.	I was wondering, is there any opportunity to install the PANDORA instruments in Northern India? As we are also monitoring PM, O3 and other trace gases in	Mr. Yugo Kanaya	Prof. Saurabh Sonwani	Thank you. Currently we do not have capacity to operate Pandora in Northern India. Under the framework of

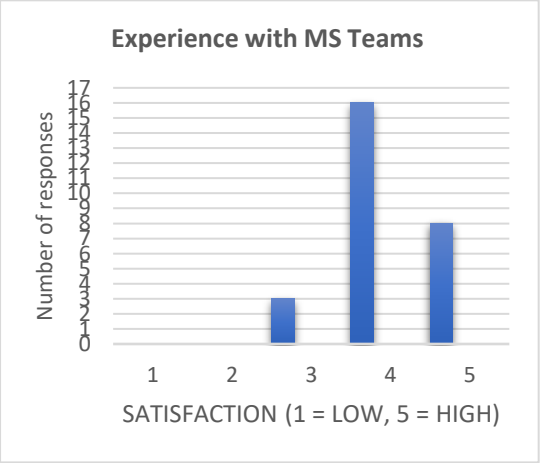
	various parts of India through ground level measurement.			PAN, Limseok might consider this if not currently?
6.	Excellent presentations, I have question for Mr. Mathew Perkin regarding the integration of congestion modelling, urban air quality monitoring in cities, how it can be integrated with satellite monitoring and is it possible to get city level hotspots using this program and use it for policy development. Thanks a lot. We are monitoring and correlating pollution due to traffic at ground level. Looking forward to collaborating on this issue.	Matthew	Ms. Anuradha Shukla	Verbal response from Matthew
7.	What are the requirements/criteria for site selection to install the pandora? How the process for the installation (pre-, during) and duration needed to be ready to operate? As I have seen from the slide mentioning installation in 2020, could you give us an idea of what things/activities need to be prepared in advance before the installation process? Is it possible to install the equipment be the end of October 2020 in Thailand? How the cost/expenses to be divided between donor (ROK) and beneficiary countries? For importation process, do we need any legal binding to receive & install this system? Will this be between NIER and beneficiary country? After installation, any maintenance support will be provided by donor and how will be? How long the duration of the support?	Mr. Chang	Thailand/GISTDA	• The requirements for Pandora sites are 1) 220/120VAC power 2) Ethernet or WiFi 3) Firm, fixed base for mounting (a tripod can be provided) 4) Clear horizon (i.e. minimal obstructions) to view the Sun The pandora installation will take four steps. 1) Roles and responsibilities of donor and beneficiary organizations are negotiated through bilateral meetings. 2) A written document (e.g. MOU) is signed between two organizations. 3) NIER purchases and transport Pandora to the site, while beneficiary organization handles customs clearance. It is expected to take about 1-3 months but can be prolonged due to customs clearance in each country. 4) Pandora is installed by manufacturer, NIER and local operators and can be put into regular operation after six-week test (this

				period can be shortened depending on the site situation) •After installation, two organizations share the responsibility of pandora operation. 1) NIER provides consumables (i.e. cable, motor, etc.) for Pandora and repairs Pandora if it breaks down during PAPGAPI project. NIER would like to maintain PAN for GEMS lifetime (i.e. 10 years) and will try to secure the budget for it.
8.	Thanks for interesting presentation from each country. Next time Malaysian representative also can present to show our network and research related to air pollutants using satellite and remote sensing.	Keran		Welcome Malaysia to share their good experience in next meeting.
9.	Hi Prof. Perez. Thanks for your great presentation. I want to know about crop yield impact studies in your area. We, in Northern India, also working on crop yield impact and ozone. [11:50 AM] Pallavi Saxena (Guest) Thanks Prof. Perez. Yes sure, I am happy to discuss. My email address: pallavienvironment@gmail.com	Prof. Perez	Pallavi Saxena	Thank you Prof. Pallavi, it's my pleasure to meet you. I'd be happy to discuss our common interest in these two application fields. I will send you an email if you can share with me your contact details. Thanks.
10.	We in Pakistan are also working on atmospheric composition monitoring by using both satellite and ground-based measurements in Pakistan. I can present a brief overview right now or in the next meeting.	Kelly	Md. Faheem Khokhar	Thank you. If there is sufficient time perhaps you can say something after the presentations, otherwise we will organize further meetings and we can have some discussions later. There won't be time today for you to present, but we will invite you to do so next time.

Annex B: Evaluation







Specific comments:

What are your suggestions to improve the webinar in terms of the technical perspective?	
1.	I wish I could save the chat.
2.	The webinar is good for us.
3.	The webinar was perfect!
4.	Although some difficulty was faced while connecting the MS Teams (for the first time), overall, the experience was good.
5.	Send in advance some links to participants
6.	The committee / MS team has a backup file of presentations from country representatives, so that it makes it easier when there is trouble during the presentation.
7.	I think the use of the MS platform is good enough, so far I have had no difficulties using this platform.

8.	MS Teams is perfect.
9.	Video conferencing is quiet good platform in case of COVID-19, however, its need good internet connection especially in presentation time.
10.	Time of webinar shall be coordinated.
11.	The current platform is working properly.
12.	Send links before the webinar
13.	I believe that there was already rehearsal before the meetings although there were still some technical problems such as problems in sharing the presentation documents. But still technical problems can be solved if quickly the corresponding presenter let the committee do the sharing instead. The 10 minutes allocation for each presenter was badly violated so making the duration longer and exhausting for the audiences.
14.	No comment. It is perfect.
15.	Google meet or zoom is the most popular videoconference platform right now, so it is not a problem to use both of that.
16.	MS Teams is quite good, however depend on the internet connection of country, it would be having some difficulties.

Any other follow-up actions and recommendations?	
1.	Some of the satellite data and application sharing all participant countries.
2.	Look forward to future related webinars.
3.	Regular meetings and coordination is anticipated through research collaboration.
4.	We would like to seek your kind cooperation to email the slides to all participants. Thank you.
5.	Yes, it may include presenters from other interested countries.
6.	We recommend that the day for meetings Monday to Thursday at 09:00 AM to 12:00 AM.
7.	Is it possible OC provides a list of attendance?
8.	It would be great if there will be some session dedicated to Early Career Researchers (in the field of Air Pollution Monitoring) in the Developing Nations.
9.	Continue with good work
10.	In terms of PANDORA and GEMS, I believe that there was already further discussion with the high-level personnel in LAPAN and other institutions as to implement this collaboration. Please also consider our request to further extend the coverage of GEMS to also include Java and other southern part of Indonesia. Thank you.
11.	Supporting data and technical assistance.
12.	It will be another interesting thing if there is a webinar about the technical detail of the mission, further collaborations, possible application for this mission, etc.

Annex C: List of Participants

CAMBODIA

Mr. Chea Nara, Director, Department of Air Quality and Noise Management, General Directorate of Environmental Protection, Ministry of Environment, Phnom Penh

Mr. Chandath Him, Deputy Director, Air Quality and Noise Management, Ministry of Environment, Phnom Penh

Mr. Bunnavuth Ku, Deputy Secretary General, Secretariat General, National Committee for ESCAP, Phnom Penh

Mr. Kok Sothea, Head of Department, Environmental Science, Royal University of Phnom Penh, Phnom Penh

HONG KONG, CHINA

Mr. Hongsheng Zhang, Assistant Professor, Department of Geography, University of Hong Kong, Hong Kong, China

Prof. Bo Huang, Professor, Geography and Resource Management, Chinese University of Hong Kong (CUHK), Hong Kong, China

Mr. Luoma Wan, Phd. Student, ISEIS, CUHK, Hong Kong, China

Ms. Yinyi Lin, Phd. Student, CUHK, Institute of Space and Earth Information Science, Hong Kong, China

INDIA

Prof. Bomidi Lakshmi Madhavan, Scientist, Aerosols, Radiation and Trace Gases (ARTG), National Atmospheric Research Laboratory (NARL), Gadanki, Tirupati

Ms. Anuradha Shukla, Chief Scientist, Transport Planning and Environment Division, Central Road Research Institute (CSIR), New Delhi

Prof. Madineni Venkat Ratnam, Scientist, National Atmospheric Research Laboratory (NARL), Indian Space Research Organisation (ISRO), Bangalore

Prof. Manish Naja, Scientist, Atmospheric Sciences Division, Aryabhatta Research Institute of Observational Sciences (ARIES), Nainital

Prof. Pallavi Saxena, Assistant Professor, Department of Environmental Sciences, Hindu College, University of Delhi, Delhi

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Mr. Halimurrahman Mukri, Deputy Chairman, Space and Atmospheric Science Affairs, National Institute of Aeronautics of Space (LAPAN), Bandung

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Prof. Ir. Puji Lestari, Faculty of Civil and Environmental Engineering, Institut Teknologi Nasional Bandung, Bandung

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Mrs. Ohnmar May Tin Hlaing, Environmental Health Consultant, Environmental Health Impact Assessment, Environmental Quality Management Co., Ltd., Yangon

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Prof. Gay Jane Perez, Associate Professor, Institute of Environmental Science and Meteorology (IESM), University of the Philippines (UP) Diliman, PhilSA / IESM UP Diliman, Quezon City

Prof. James Bernard Simpas, Head, Air Quality Dynamics and Instrumentation and Technology Development Laboratories, Manila Observatory, Quezon City

Prof. Roland Emerito Otadoy, Professor of Physics, Department of Physics, University of San Carlos, Cebu City

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REPUBLIC OF KOREA

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Ms. Sihyun Nam, English Editor, Environmental Satellite Center, NIER, Seoul

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Prof. Myoung-Hwan Ahn, Professor, Climate and Energy Systems Engineering, Ewha Womans University, Seoul

Ms. Minjeong Cho, Graduate Student, Climate and Energy Systems Engineering, Ewha Womans University, Seoul

Ms. Gyuyeon Kim, Student, Climate System Engineering, Ewha Womans University, Ewha, Seoul

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SINGAPORE

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THAILAND

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Mr. Thudchai Sansena, Chief of Environmental and Disaster Division, Environmental and Disaster Division, Geo-Informatics Applications Office, GISTDA, Bangkok

Mr. Poramet Thuwakham, Geo-Informatics Scientist, CEO Team, GISTDA, Bangkok

Ms. Surassawadee Phoompanich, Geo-Informatic Officer, Environmental and Disaster Division, GISTDA, Bangkok

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VIETNAM

Prof. To Thi Hien, Associate Professor, Faculty of Environment, University of Science, Vietnam National University, Ho Chi Minh

Prof. Thuy Ly, Lecturer, School Environmental Science and Technology, Hanoi University of Science and Technology, Hanoi

UNITED STATES OF AMERICA

Mr. Thomas Hanisco, Research Scientist, Atmospheric Chemistry and Dynamics, NASA Goddard Space Flight Center, Maryland

Prof. Yunsoo Choi, Associate Professor, Dept. of Earth and Atmospheric Sciences, University of Houston, Houston

Mr. Ali Mousavinezhad, Research Assistant, Earth and Atmospheric Science, University of Houston, Houston

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Mr. Sangmin Nam, Deputy Head, East and North-East Asia Office, ESCAP, Incheon, Republic of Korea

Annex D: Concept note and Programme

1. Background

According to a recent study by UNEP, air pollution is the fifth leading risk factor for mortality and was estimated to be responsible for around 3.4 million deaths in Asia-Pacific in 2017[1]. Though countries and cities have implemented various air pollution management policies, these will only offset the additional pollution produced by a growing population and urbanization[2]. Between 1990 and 2015, the population-weighted PM 2.5 concentrations grew by 19 per cent in Asia-Pacific[3], exceeding the global increase of 10 per cent. In 2018, Asia-Pacific was home to 96 of the 100 cities most polluted with fine particles (PM2.5)[4]. Exposure to particulate matter pollution tends to be greater in least developed countries, whereas tropospheric ozone concentrations grew faster in more developed or rapidly developing countries and regions, such as South Asia, where O3 pollution grew at a much faster rate than the global growth rate.[5]

Air quality monitoring has been mainly based upon in-situ measurements by Governments using ground-based air quality monitoring networks within their territories. However, ground-based monitoring has limitations since monitoring stations are mostly concentrated in densely populated cities with rigid installation requirements and very narrow spatial coverage. Furthermore, air pollution monitoring stations are often based in urban areas, and yet pollutants can be generated or travel great distances and affect not only rural areas but other countries. Satellite observations complement the ground-based networks by providing data over wider areas, which is particularly useful for regions where no surface monitors are installed, such as rural areas or countries with limited air pollution monitoring equipment or capacity. This satellite information will help evaluate and improve air quality and chemical transportation models, emissions inventories and allow the better production of hourly air pollution forecasts which are accessible to public through a broad range of platforms and applications. Over the long term, the effectiveness of policy interventions can be monitored. For the short-term, pollution hotspots missed by emission inventories or ground monitoring stations can be identified and addressed. This data can fill in information gaps left by ground-data collected through monitoring stations to help evidence-based policy making to address not only national and local air quality, but transboundary pollution issues.

Member States of Asia-Pacific recognized the urgency of this issue by adopting resolution 75/4 in 2019 on "Strengthening regional cooperation to tackle air pollution challenges in Asia and the Pacific" in 2019. This resolution encourages the sharing of experiences and information relating to air pollution and the means to tackle this problem and is in line with priority actions under the Regional Roadmap for implementing the 2030 Agenda for Sustainable Development in Asia and the Pacific.

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[1] https://www.healtheffects.org/announcements/state-global-air-2019-air-pollution-significant-risk-factor-worldwide

[2] UN Environment (2019) Air pollution in Asia and the Pacific: Science-based solutions

[3] HEI 2018

[4] https://www.airvisual.com/world-most-polluted-cities

[5] State of Global Air, 2019

In addition, the UN General Assembly adopted resolution A/RES/74/212 on "International Day of Clean Air for blue skies" in 2019 to strengthen international cooperation at the global, regional and subregional levels in various areas related to improving air quality, including the collection and utilization of data, joint research and development, and the sharing of best practices.

The Asia-Pacific Plan of Action on Space Applications for Sustainable Development (2018 – 2030)[6], which was adopted by ESCAP resolution 75/67, requests ESCAP and member States to "develop the capacity to use space applications to monitor air pollution including dust, smog and other pollutants from hazardous chemicals, pollutants and contaminants". In addition, the project will contribute to the Regional Roadmap for Implementing the 2030 Agenda for Sustainable Development in Asia and the Pacific, and the thematic area on "Sustainable Management of Natural Resources" in the UN-ASEAN Plan of Action on Complementarities Roadmap (2020-2025), specifically paragraph 3.6 on "Promoting policy dialogue and enhancing capacity for monitoring air pollution (PM2.5 and PM10) and air quality management".

In this regard, opportunities exist for countries in this region, particularly in Asia, to fill the data and information gap in the nation-wide monitoring of air quality by better utilizing space applications. By integrating satellite data calibrated to monitor air pollution, with reliable ground monitoring information, policy makers will have a better understanding of air pollution and will be able to improve model simulations of air quality, including its forecasting and warning service. This may require governments to enhance their capacity to undertake the comprehensive analysis of data derived from space and ground networks which can be achieved through regional cooperation. The aim would be to promote policy dialogue, partnership and enhance the capacity for monitoring and managing air pollution at the regional level.

The Expert Group Meeting (EGM) outlined in this concept will introduce the opportunities and experiences of better utilizing space applications for monitoring air pollution and discuss the needs and challenges of participating countries in doing this. The EGM is expected to be an open and informative discussion on the opportunities and next steps in building a longer-term project for air pollution monitoring and management in Asia-Pacific.

2. **Expected outcomes:**

1. Understanding the country's capacity, needs and contribution to use of geospatial information for air pollution
2. Enhance knowledge on use of satellite-derived data for air pollution monitoring
3. Enhance regional cooperation on implementation of the space Plan of Action and environment protection
4. Integration space and ground data for better monitoring air pollution

[6] https://www.unescap.org/resources/asia-pacific-plan-action-space-applications-sustainable-development-2018-2030
[7] https://www.unescap.org/commission/75/document/E75_Res6E.pdf

3. **Programme**

9:00 – 9:10	**Opening session** • Opening by Mr. Young Woo Kim, Director General of the National Institute of Environmental Research (NIER), Republic of Korea • Welcome by Mr. Keran Wang, Chief of Space Applications Section, Information and Communications Technology and Disaster Risk Reduction Division (IDD), on behalf of Ms. Tiziana Bonapace, Director, IDD, ESCAP
9:10 – 10:20	**Introduction to air pollution monitoring using space applications** (10 min each) • Introduction to air pollution under the Asia-Pacific Plan of Action on Space Applications and the partnership project by Ms. Kelly Hayden, Economic Affairs Officer, IDD, ESCAP • Air pollution monitoring in Asia-Pacific, by Mr. Matthew Perkins, Economic Affairs Officer, Environment and Development Division (EDD), ESCAP • Introduction to Geostationary Environment Monitoring Spectrometer (GEMS) and Pandora Asia Network (PAN) by Mr. Limseok Chang, NIER, Republic of Korea • GEMS application plans by Ms. Kyunghwa Lee, NIER • Experience with Pandora by the Japan Agency for Marine-Earth Science and Technology Mr. Yugo Kanaya, JAMSTEC • Pandora Global Network (PGN) status and future plans by Thomas F. Hanisco, NASA Goddard Space Flight Center
10:20 – 10:30	**Break**
10:30 – 12:00	**Country presentations** (10 min + 2 min Q&A. Moderated by Mr. Keran Wang, Chief, Space Applications Section, IDD, ESCAP) • Presentation by Mr. Thudchai Sansena, Chief of Environmental and Disaster Division, Geo-Informatics and Space Technology Development Agency (GISTDA), Thailand • Presentation by Mr. Didi Satiadi, Director, Atmospheric Science and technology Center, LAPAN, Indonesia • Presentation by Ms. Batchuluun Ganaa, Information & Research Institute of Meteorology, Hydrology and Environment (IRIMHE), Mongolia • Presentation by Prof. Gay Jane Perez, Philippine Space Agency • Presentation by Ms. Kyu Kyu Sein, Assistant Director, Department of Meteorology and Hydrology, Myanmar • Presentation by Mr. Chea Nara, Director, Department of Air Quality and Noise Management, General Directorate of Environmental Protection, Ministry of Environment, Cambodia
12:00 – 12:25	• **Discussion on next step** (25 min)
12:25 – 12:30	**Closing**

4. **Guide for country presentations:**

- What satellite-derived data is used for air pollution monitoring and the future plan?
- What ground equipment/system is using for air pollution monitoring? What kind of air quality monitoring networks are in operation by your government? Does data link to space-derived data?
- Capacity of teams in space agency on interpretation of the satellite-data and processing system, ICT capacity (internet, computing, etc.)
- Need assessment for 2020-2025, including policy related to air pollution

5. **Contact:**

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