



Session Report of the AOGEO TG 7 Environmental Monitoring and Protection

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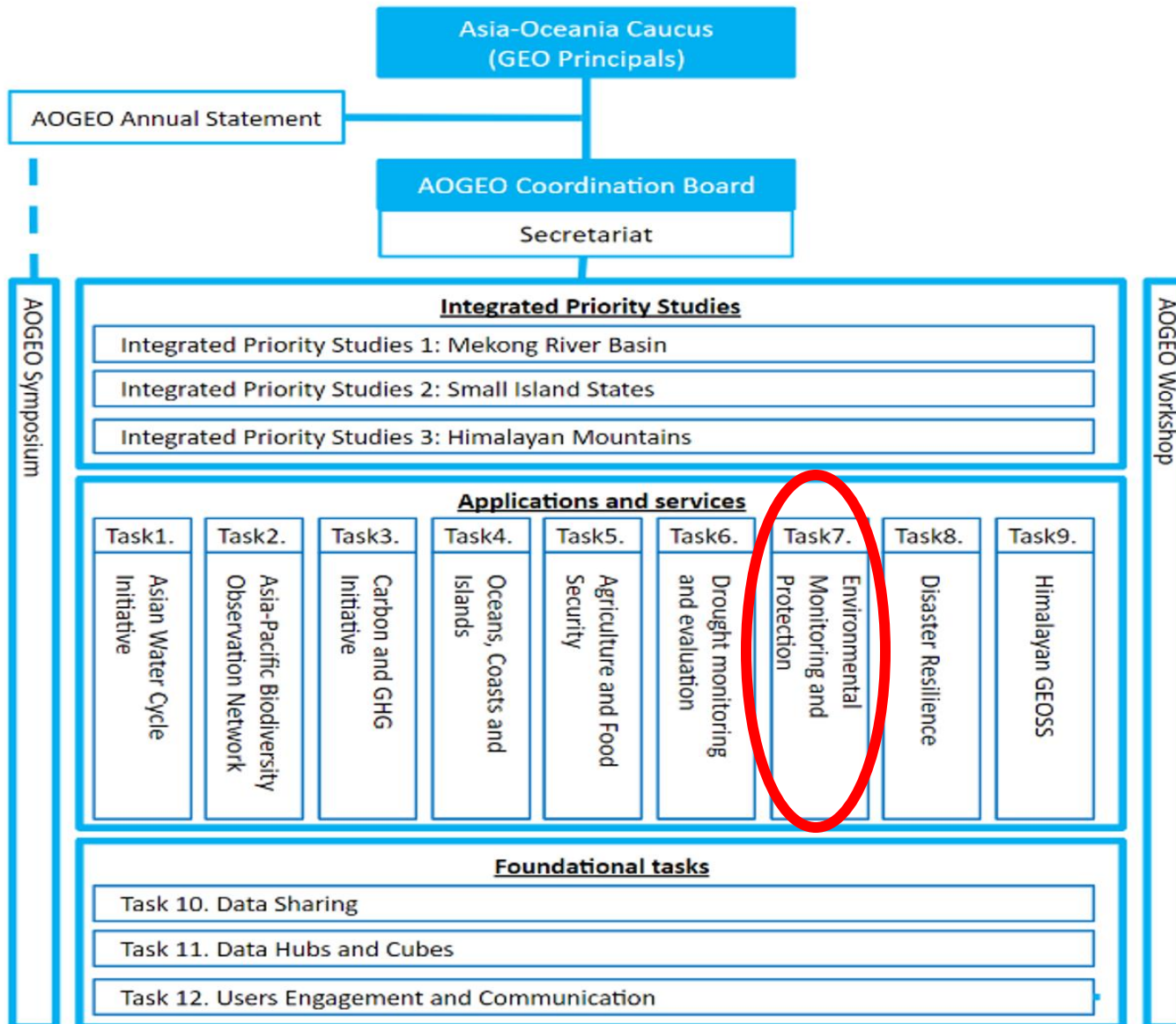
**September 5, 2024
Tokyo, Japan**

TG -7: Environmental Monitoring and Protection (EMP)

Outline

- 1. Overview of AOGEO TG-7**
- 2. Achievements**
- 3. Ongoing Issues**
- 4. Way forward for post-2025**

Task group 7—Environmental Monitoring and Protection



- ✓ Advocate Analysis-Ready **Open Data**, by integrating multiple EO data to generate common products for EMP
- ✓ Promote **cooperation** for regional monitoring and assessment of ecosystem status and **environmental quality**
- ✓ Provide knowledge-based decision support for human well-being and environmental protection
- ✓ Release **Annual Reports** for ecosystem and environmental monitoring to support the **GEO priorities**
- ✓ Facilitate **capacity building** for the Integrated Priority Studies

TG7 EMP Contributes to GEO's Engagement Priorities

SDGs

Sustainable Development Goals 2030: EMP directly addresses the issues of SDG 3, 6, 7, 11, 13, 14, 15 and 17 to support evidence-based decision making for environmental protection.

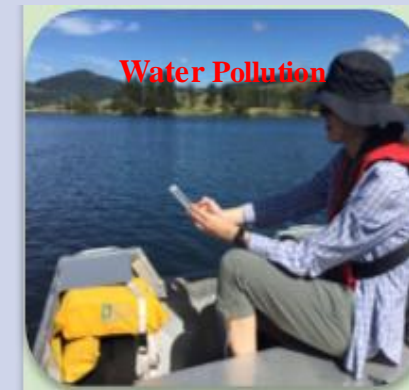


- 1) SDG3: Good Health and Well-being
- 2) SDG6: Clean Water and Sanitation
- 3) SDG7: Affordable and Clean Energy
- 4) SDG9: Industry, Innovation and Infrastructure
- 5) SDG11: Sustainable Cities and Communities
- 6) SDG13: Climate Action
- 7) SDG14: Life below Water
- 8) **SDG15: Life on land**
- 9) SDG17: Partnership for the Goals

.....

Climate Change:

The Paris Agreement within UNFCCC: EMP analyzes the variability of terrestrial ecosystem status, atmospheric and inland water qualities, and evaluate the environmental impacts and feedbacks to climate changes.



AOGEO-TG7 Activities

Organize or participant **25 activities**, Participants 10000+ , The participating countries 20+



AOGEO 2024

- 2024.9 TG7 sectorial meeting, 16th AOGEO Symposium, Tokyo, Japan, onsite/online

2023

- 2023.6 6th AOGEO workshop, Macao, China, onsite/online

AOGEO 2022

- 2022.6 5th AOGEO workshop, Beijing, China, online
- 2022.9 TG7 sectorial meeting, 15th AOGEO Symposium, online

AOGEO 2021

2021.2 13th AOGEO Symposium, TG7 sectorial meeting, online
 2021.6 GEO virtual symposium, online
 2021.7 4th AOGEO workshop, Beijing, China
 2021.11 14th AOGEO Symposium, GEO week, GEOARC side event, online

AOGEO 2020

2020.6 GEO virtual symposium, online
 2020.10 3rd AOGEO workshop, Changzhou, China

AOGEO 2019

2019.11 12th AOGEO Symposium, Canberra, Australia
 2019.11 GEO week, AOGEO-EuroGEO side event, Idea stage, Canberra, Australia

AOGEO 2018

- 2018.5 AO GEOSS workshop, Deqing, China
- 2018.10 AOGEO symposium, GEO-XV and GEO week, GEOARC side event, Kyoto, Japan

AOGEOSS 2017

2017.10 GEO week, GEOARC side event released Belt & Road, AOGEOSS progress, Washington D.C. USA

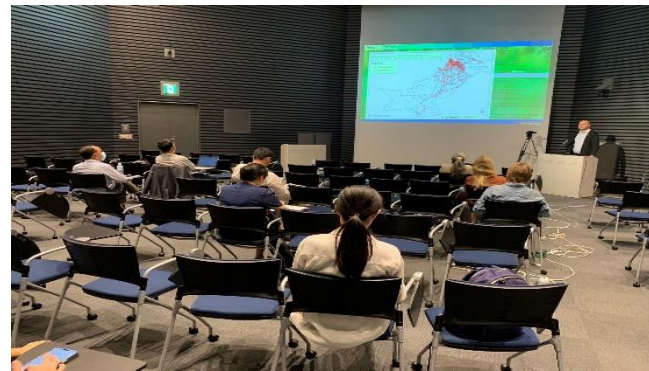
AOGEOSS 2016

2016.4 AOGEOSS initiative work group
 2016.11 AOGEOSS TG-7 established, St. Petersburg, Russia

TG7 session on Sep. 4

- **9 Speakers** from **China, Australia, Pakistan, Thailand, Bangladesh and Cambodia.**
- **50+ Participants** on site and online together.

- **Asia-Oceania Environmental Monitoring Platform (AOEM)** with **advanced monitoring** and **analysis techniques.**
- **Developed 16 thematic Products** and **several advanced algorithms**
- **16m LULC (Global)** produced by **Chinese satellites (1,6)** with an overall accuracy of 89% based on MuSyQ system



- **A wide range of topics were covered, including Global LULC Change, AOEM platform, Climate policies in Pakistan, Air Quality monitoring over Malaysia, Use of Geostationary data, Mangrove Forest Change in Thailand, Cambodia National Forest Monitoring, Environmental monitoring over Bangladesh, and Global environmental changes in major deserts**

TG -7: Environmental Monitoring and Protection (EMP)

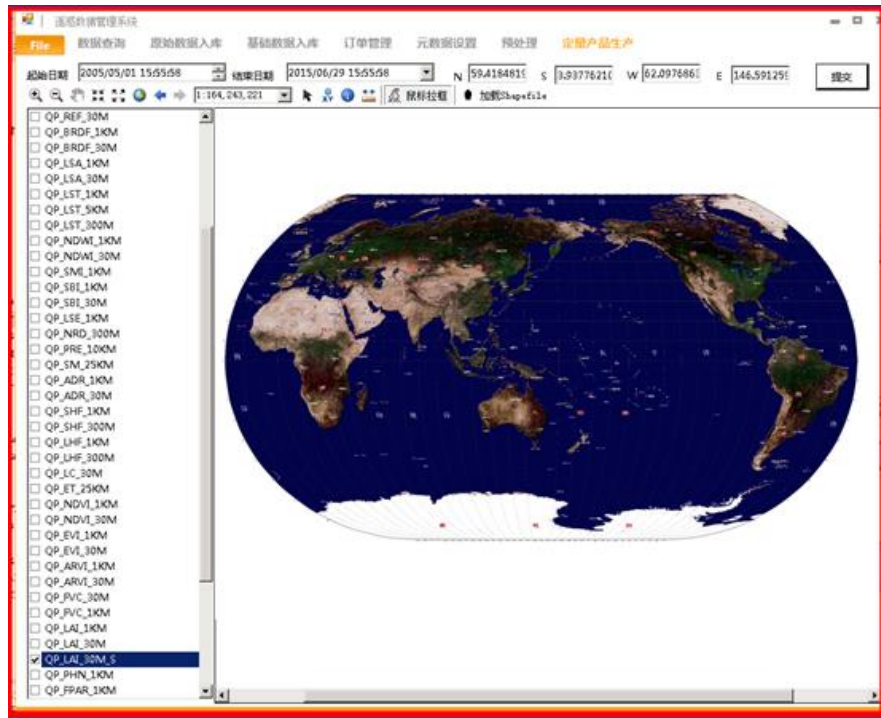
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Achievements— Multi-source Synergized Quantitative Remote Sensing Products (GEOMUSYQ) System

More than 20 types of Chinese and foreign satellite remote sensing data;

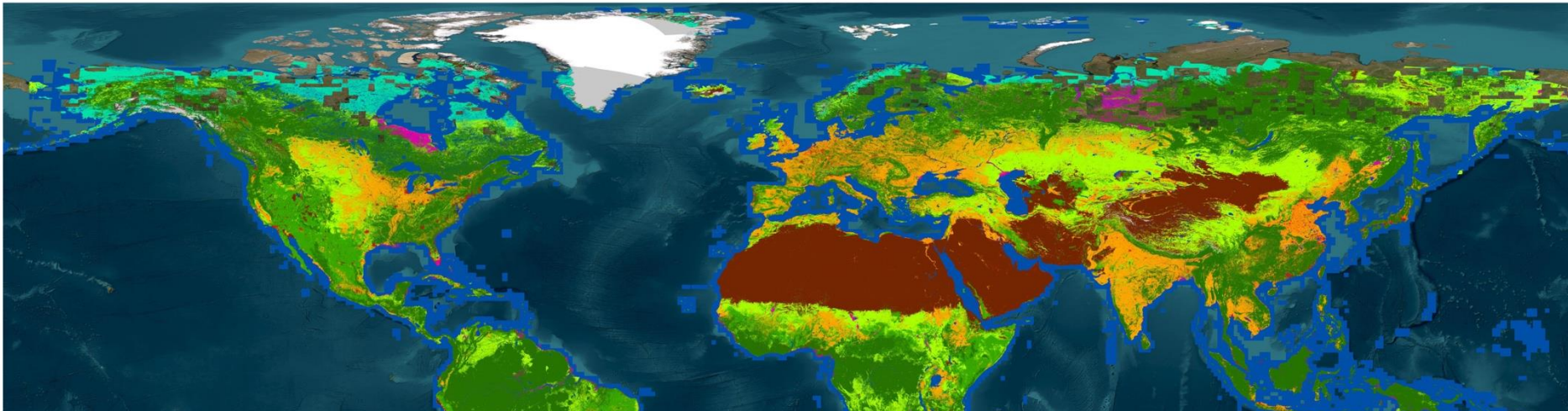
More than 20 global quantitative remote sensing products.



- Multi-source data Synergized Quantitative remote sensing production system (MuSyQ) independently developed by AIRCAS.

Achievements—Global LULC

- Developed a global LULC product at 16m resolution using Chinese satellite data (GF1/6) based on **MuSyQ system**.



- ARD does help to improve the landcover mapping accuracy
- Longer time series of ARD are better for temporal consistency
- Yearly landcover can captures the subtle variations for knowledge discovering
- Complementary validation required
- Samples and validation for easy confused land covers from end users are encouraged and better to be collected by a public platform.

□ 16 m spatial resolution

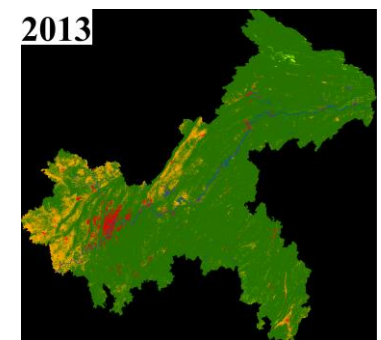
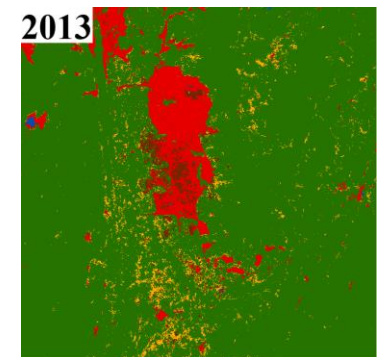
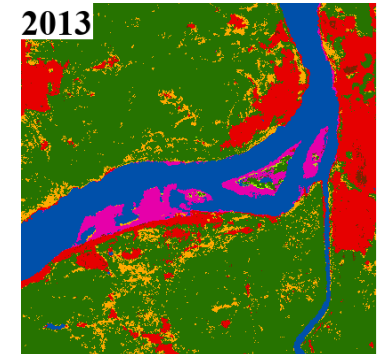
□ Higher frequency for updating: once a year

□ Only the Chinese GF data are used

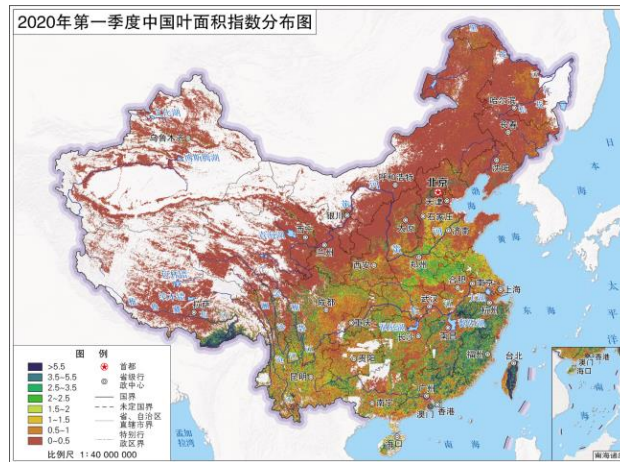
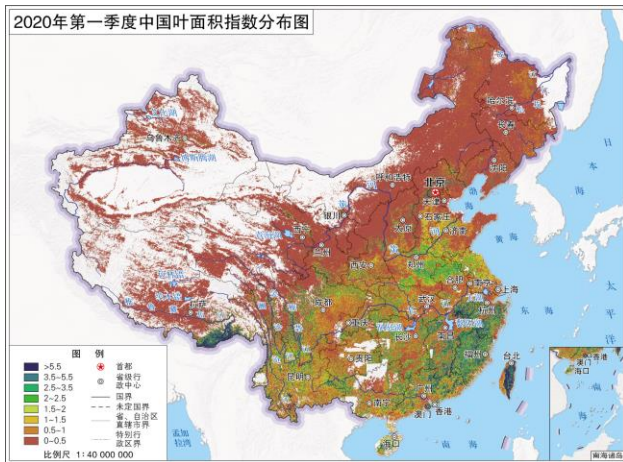
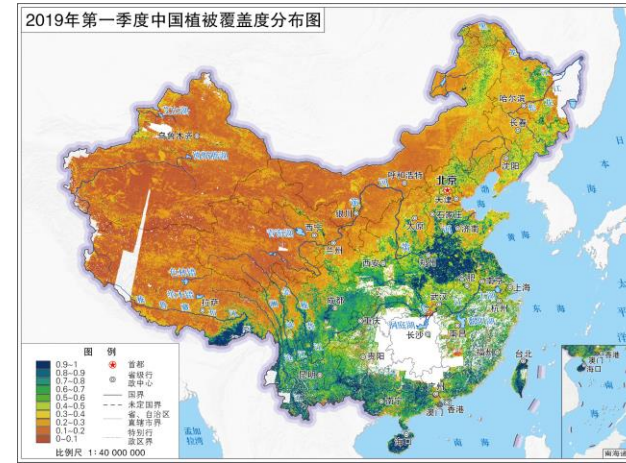
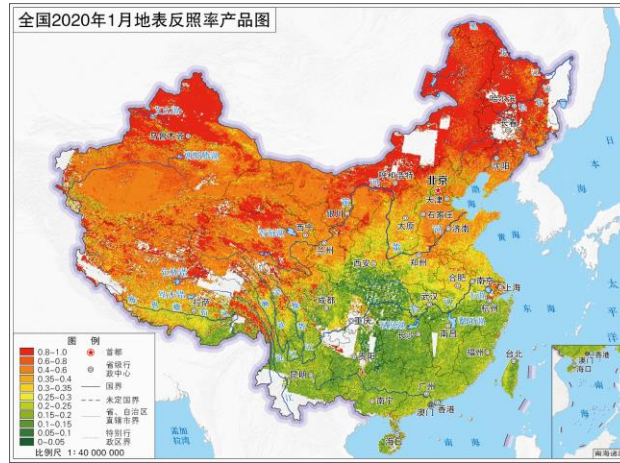
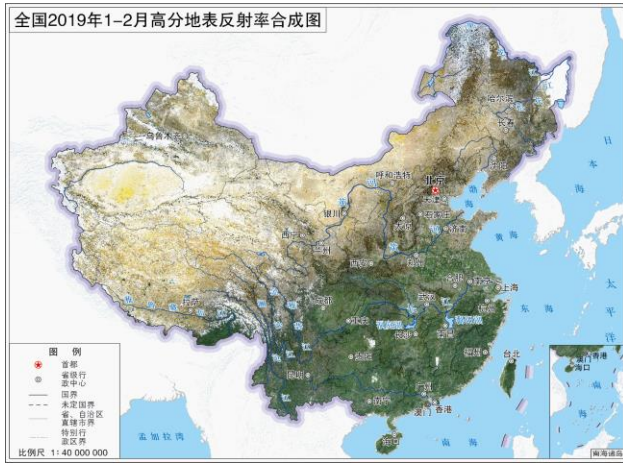
□ Better temporal consistency

□ Accuracy over 85%

□ high efficiency for producing



Achievements—Essential Environmental Variables products



The first set of Gaofen series generic products was released on April 24, 2021, National Space Day

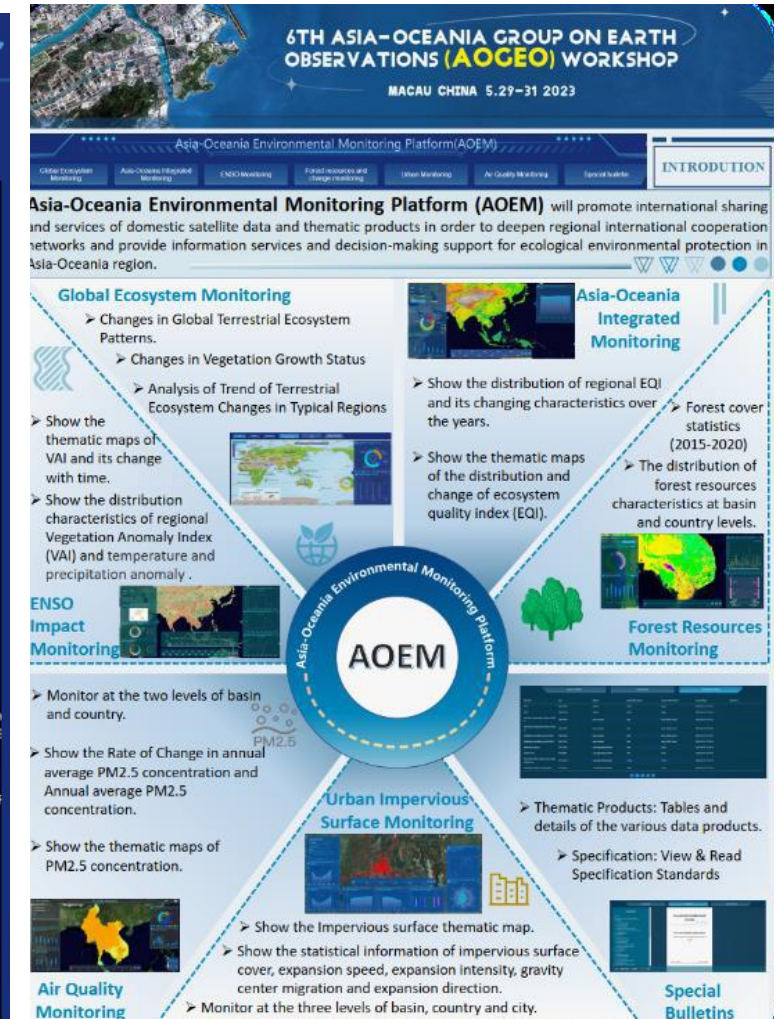
- Quantitative remote sensing products have been applied in many ministries and commissions (natural resources, national disaster reduction, ecological environment, etc.) and national tasks (three adjustment, national ecological environment assessment), and supported IPS.

Achievements—Environmental Monitoring platform

Please visit:

<http://121.36.229.60:6060/>

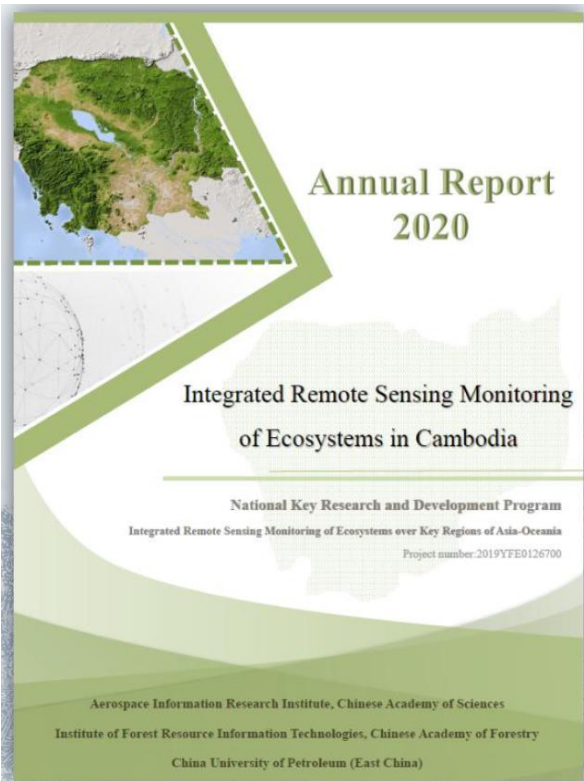
- Developed Asia-Oceania Environmental Monitoring platform (AOEM), to promote the international sharing and provide convenient information services in Asia-Oceania.



Achievements—Environmental Monitoring platform

Please visit:
<http://121.36.229.60:6060/>

- AOEM offers monitoring results including ENSO impact, Forest resources, Urban expansion, Air quality and Ecosystem quality, release the monitoring reports and products.



Ecosystem Quality

2020 Annual Report
Integrated Remote Sensing Monitoring of Ecosystems in Cambodia

2. Distribution and Change Characteristics of Vegetation Ecosystem Quality in Cambodia

In this chapter, the assessment of ecosystem quality in Cambodia is conducted using the Ecological Quality Index (EQI), which is based on indicators such as Leaf Area Index (LAI), Fractional Vegetation Cover (FVC), and Net Primary Productivity (NPP). These indicators reflect the service capacity of ecosystems and are measurable through remote sensing techniques. The EQI is used to evaluate the quality status of vegetation ecosystems in Cambodia in 2020 and analyze its change trends from 2010 to 2020. The chapter also examines the characteristics of ecosystem quality in provinces where significant improvements and degradation have occurred. The findings aim to provide scientific data and decision-making support for ecological conservation and sustainable development in Cambodia.

2.1 Characteristics of Ecosystem Quality Distribution

The distribution of LAI, FVC, NPP, and EQI in Cambodia in 2020 reveals that the overall ecosystem quality is relatively good (Figure 2). The average EQI for vegetation in Cambodia is 62.12. Regions with excellent and good ecosystem quality ratings account for 27.5% and 30.0% of the total vegetation area in Cambodia respectively, while regions with poor and critical ecosystem quality ratings only make up respectively 4.0% and 0.2% of the total vegetation area in Cambodia.

Figure 17: EQI events occurrence timeline from 1982 to 2020.

ENSO Influence

2020 Annual Report
Integrated Remote Sensing Monitoring of Ecosystems in Cambodia

3. Monitoring the Impact of ENSO Events on Ecosystems in Cambodia

In the context of global changes, frequent occurrences of extreme climate events have led to a growing interest in accurately understanding and assessing their impacts on vegetation growth. The El Niño-Southern Oscillation (ENSO) phenomenon refers to the sustained anomalous warming or cooling of sea surface temperatures in the central and eastern Equatorial Pacific region, coupled with interaction between the atmosphere and ocean circulation. It is a significant influencing factor driving global extreme climate events. Specifically, El Niño and La Niña events represent warm and cold phases of the ENSO cycle, respectively, reflected in sea surface temperature anomalies. ENSO events alter the atmospheric conditions in certain regions globally, such as reducing rainfall in tropical oceanic rainy areas due to changes in atmospheric pressure gradients and affecting monsoon rain areas. Therefore, the frequent occurrences of El Niño/La Niña events in recent decades have directly resulted in disastrous extreme weather phenomena, including droughts and heavy rainfall, in the tropical Pacific and its adjacent regions, while indirectly influencing global climate and triggering meteorological disasters elsewhere. Between 1982 and 2020, a total of 20 ENSO events were recorded, including 11 El Niño events and 9 La Niña events (Figure 17). Based on decadal global LAI products, a Vegetation Anomaly Index (VAI) was constructed as an indicator of vegetation anomalies to assess the impacts of ENSO events on vegetation growth conditions.

Figure 17: ENSO events occurrence timeline from 1982 to 2020.

3.1 ENSO-correlated Regions

The correlation analysis between the VAI and ENSO (Niño4 index) in Cambodia reveals spatial variations in the regions correlated with ENSO. Overall, during the period from 1982 to 2020,

Forest Resources

2020 Annual Report
Integrated Remote Sensing Monitoring of Ecosystems in Cambodia

Figure 30: Forest Cover Maps of Cambodia in 2015 and 2020.

Urban Imperious

2020 Annual Report
Integrated Remote Sensing Monitoring of Ecosystems in Cambodia

5. Monitoring Urban Impervious Surface and Its Changes in Cambodia

5.1 Characteristics of Urban and Rural Construction Land Distribution

The distribution of urban and rural construction land in Cambodia from 2015 to 2020 is shown in Figure 37. Large, contiguous areas of construction land are centered around the capital city, Phnom Penh, and mainly concentrated in the southeast. The flat terrain and the presence of the Aeklong River provide favorable conditions for urban development in this region. Additionally, in central and northwest Cambodia, construction land is distributed around the Tonle Sap Lake in a circifiable linear pattern. Major cities such as Battambang, Siem Reap, and Sihanoukville are located in this area. The southwestern coastal region, separated by the Cardamom Mountains, has limited accessibility, with only small-scale port cities like Sihanoukville and Kampot appearing. In the northeastern mountainous and plateau regions, dense forests dominate the landscape, and construction land is specifically distributed along rivers.

Figure 37: Distribution of urban and rural construction land in Cambodia from 2015 to 2020.

Air Quality

2020 Annual Report
Integrated Remote Sensing Monitoring of Ecosystems in Cambodia

Figure 47: Distribution of annual average PM2.5 concentration in Cambodia in 2020.

Figure 48: Percentage of annual average PM2.5 concentrations in different levels in Cambodia in 2020.

ENSO Influence

Forest resource

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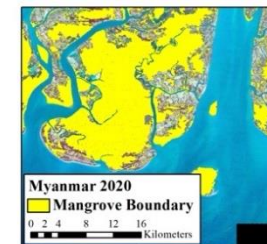
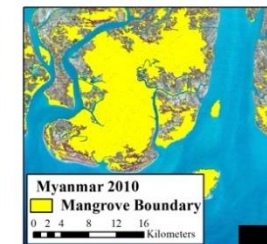
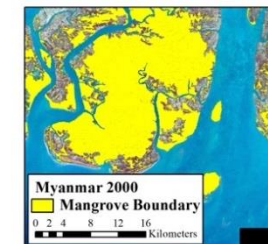
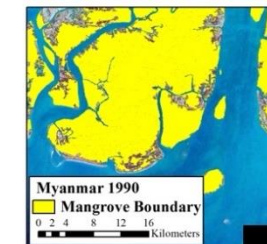
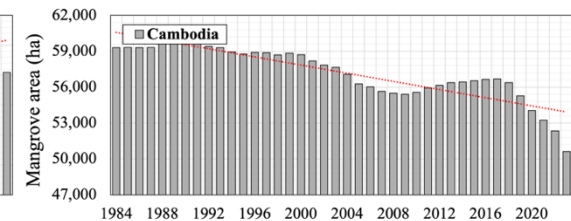
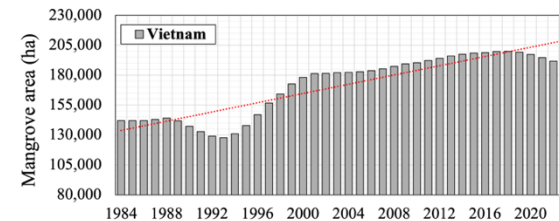
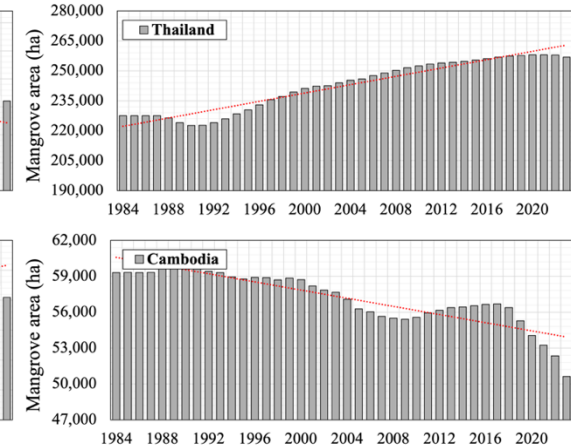
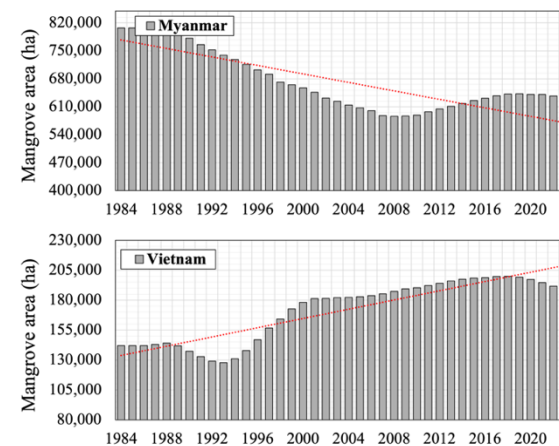
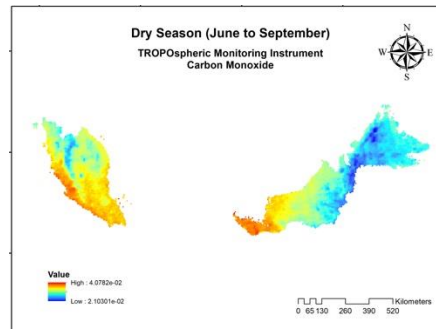
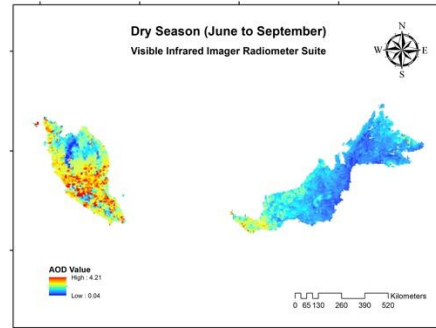
Application and cooperation

A great deal of ecosystem researches have been done under TG7, such as the air quality in Malaysia, heat wave, climate change and deforestation monitoring in Pakistan, the mangrove mapping in Thailand, flood and city monitoring in Bangladesh, forest change and detection in Cambodia, Global environmental changes and human activity in major deserts, and so on.

- Multi Sensor Satellite Observation for Particulate Matters Monitoring in Malaysia

32,000 avoidable deaths in Malaysia annually due to air pollution (Centre for Research on Energy and Clean Air and Greenpeace Malaysia, 2023)

- Spatial and Temporal Patterns of Mangrove Forest Change in the Mekong Region Over Four Decades Based on Remote Sensing Data-Driven Approach



AIR POLLUTION – THE SILENT KILLER

Air pollution is a major environmental risk to health. By reducing air pollution levels, countries can reduce:

Every year, around **7 MILLION DEATHS** are due to exposure from both outdoor and household air pollution.



REGIONAL ESTIMATES ACCORDING TO WHO REGIONAL GROUPINGS:



WHO Air Quality Guidelines set goals to protect millions of lives from air pollution.

Application and cooperation

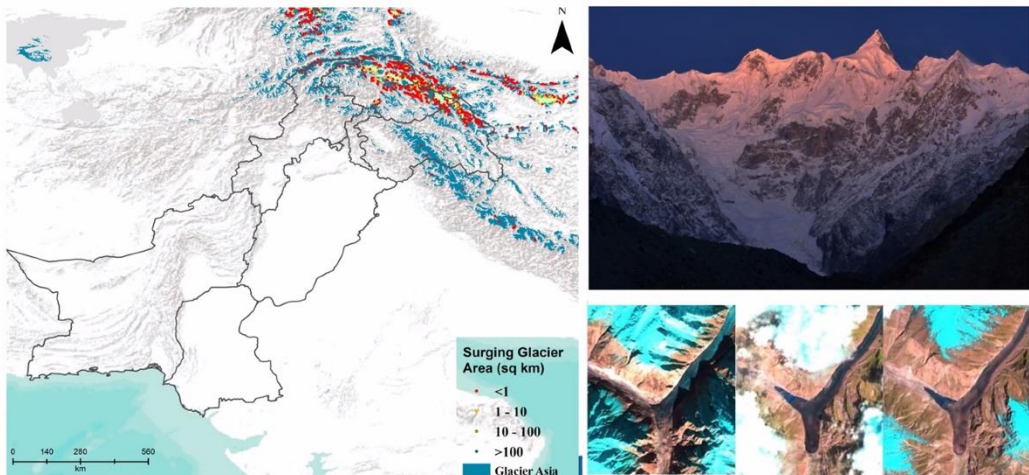
Climate change heat wave, and deforestation monitoring in Pakistan

Air Quality: Challenges and Issues

Three Waves of Lahore: Heat Wave - Water Wave - Smog Wave



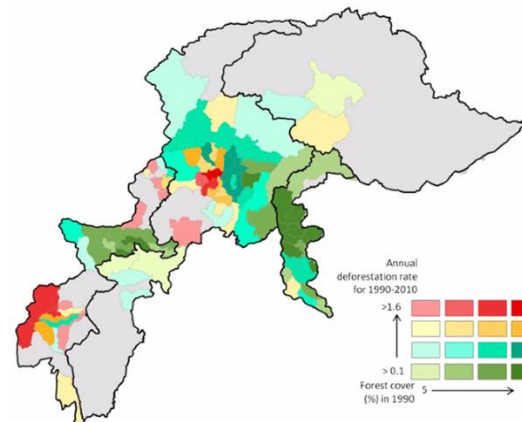
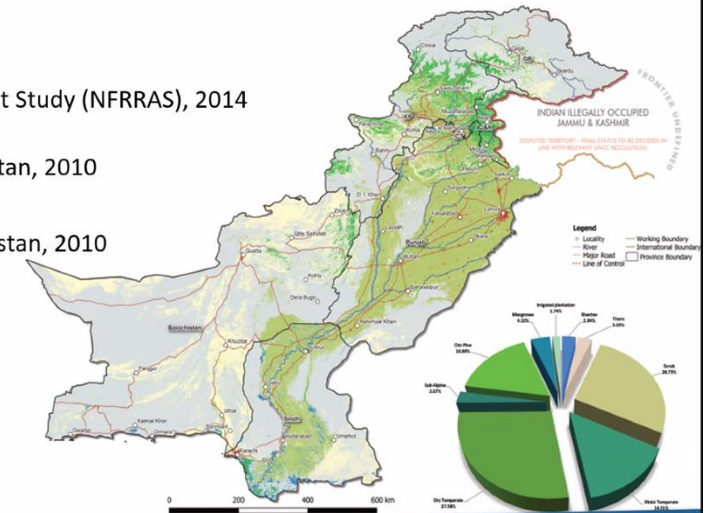
Surging Glaciers in the Mountains of Pakistan



Forest: Challenges and Issues

National-level Forest Cover Assessments

- Forestry Sector Master Plan (FSMP), 1992
- National Forest & Range Resources Assessment Study (NFRRAS), 2014
- District-wise Forest Cover Assessment of Pakistan, 2010
- National Mangroves Cover Assessment of Pakistan, 2010
- Forest Cover Change Assessment, 2013
- National Level Forest Cover Assessment, 2020



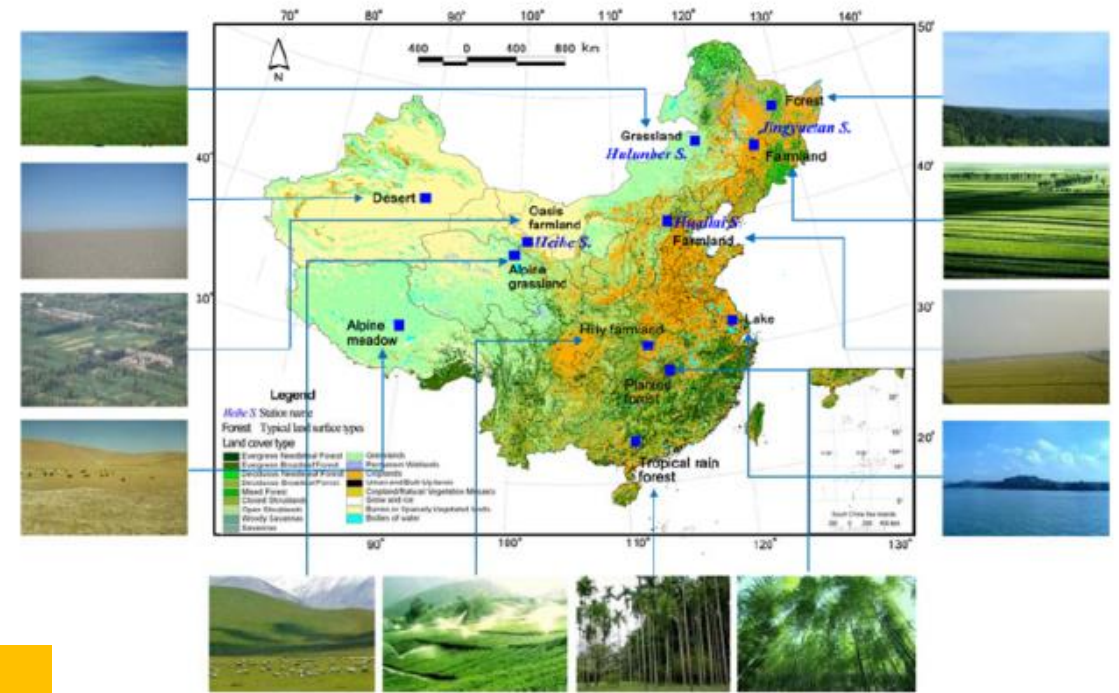
Bivariate choropleth map showing forest cover and degradation patterns for Tehsils (sub-districts) having more than 5% forest cover in 1990



Validation network

Platform of Algorithm Test of Remote Sensing Products(RESVAT)

Algorithm test and product validation are at the two ends of the common products generating process. Its service platform are of great importance for quality controlling in the generating of remote sensing common products, which have 45 algorithms test and 25 common products validation capabilities under a unified environment.



International validation network needs more efforts to build.

The *in situ* data is global-coverage, including China Validation Network (CVN) data.

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Way forward for post-2025

TG7-1 Land Cover/Use
Zhong Bo , Yule, Ping Tang,
Thomas Corpetti, Jean-Louis,
Roujean...

TG7-2 Ecosystem Environment
Jing LI and Alfredo HUETE,
Xiaoping Xin, Jiaguo Qi...

TG7-3 Inland Water Quality
Qi Zhang, John Melack, Jeffrey
Walker, Biswas...

TG7-4 Atmospheric Quality
Guohong, Li Wang, Martin Rudbeck
Jepsen, Rachhpal Jassal...

Cooperate with **TG2** Asia-Pacific
Biodiversity Observation Network
and **TG3** GEO Carbon and GHG
Initiative or other task groups

High Quality EEVs
Products and integrated
Analyses based EI

Cooperate with other
GEO activities: GEOARC,
GEO4SDG,

Support GEO
engagement priorities:
SDGs, Climate Change,
Disaster Risk Reduction,
Resilient Cities

Global Ecosystems Atlas

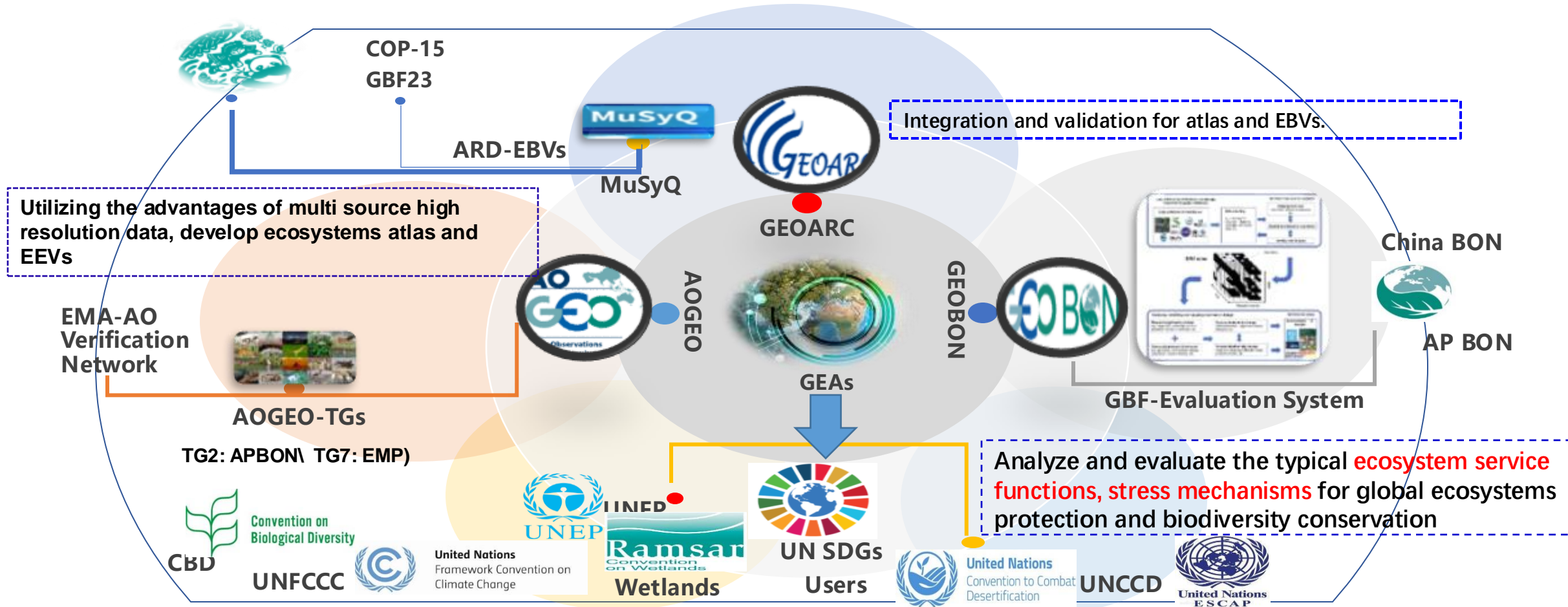
How contribute to GEA or AOEA?

AOGEO TG 7 have continuously carried out global ecosystems and environment monitoring, which will undoubtedly provide **robust methodologies, open datasets, public knowledge, useful tools and collaboration network** for the Global Ecosystems Atlas.

The challenge issues for GE Atlas or AOE Atlas include:

- **user orientation:** How to fill **the gap between the GEO society and the users**
- **integration and collaboration:** different LULC **classification systems; the gap between RS and In situ observation; the inconsistent scales and accuracy of EBV products.....**
- **open knowledge:** How to fill the gap among **data-information-knowledge**
- **Operationalization:** Fund, manpower, platform, **mechanism...**

Cooperation and collaboration Mechanism



Call for Participation

AOGEO-TG7 welcomes all participants:

➤ **GEO Members** and countries in AO region

Australia, Bangladesh, China, India, Japan, Korea, Laos, Mongolia, Myanmar, Nepal, Pakistan, Vietnam, Cambodia, Bangladesh, Uzbekistan, Kazakhstan, Thailand, North Korea, South Korea, Philippines, Malaysia, Brunei, Singapore, Indonesia, Timor-Leste, Nepal, Bhutan, Sri Lanka, Maldives, Afghanistan, Iraq, Iran, Syria, Jordan, Lebanon, Israel, Palestine, Saudi Arabia, Bahrain, Qatar, Kuwait, United Arab Emirates, Oman, Yemen, Georgia, Armenia, Azerbaijan, Turkey, Cyprus, Palau, Nauru, Fiji, Tonga, Tuvalu, Samoa, New Zealand, Vanuatu, Kiribati, Solomon Islands, Marshall Islands, Papua New Guinea, Federated States of Micronesia.....

➤ **POs and other Societies:**

UNEP-IEMP, UNESCO-HIST, WMO, UNESCAP, CEOS, ICSU/Future Earth, ICSU/IRDR, ICIMOD, POGO, ISDE, ISPRS, GRSS, APSCO, **UUCCD, FAO, IPCC, AIIB**,



**16th
AO GEO
SYMPOSIUM**

**3-5 September, 2024
Tokyo, Japan**

**# Creating Earth Intelligence
with the Asia Oceania Society**

The banner features a stylized globe with a grid of latitude and longitude lines, set against a light blue background with a subtle geometric pattern. The text is in a bold, sans-serif font, with the dates and location highlighted in an orange box.

Thanks a lot for your attention !