

2022 AOGEO SYMPOSIUM: TG Activity Report



TG7 : Environmental Monitoring and Protection

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September 29, 2022



1. Overview of AOGEO TG-7

2. Achievements in 2020-2022

3. Way Forward for 2023-2025



Objectives of TG7



Co-leaders of TG7



Prof. Qinhuo Liu AIRCAS, China Prof. Alfredo Huete UTS, Australia

- Advocate Analysis-Ready Data, by integrating multi-source EO data to generate common remote sensing products for regional and global Environmental monitoring
- Promote regional cooperation on analysis and assessment for terrestrial ecosystem status, environmental qualities
- ✓ Enhance the public's concerns to regional or global environmental changes and their stress factors.
- Provide knowledge-based environmental protection decision support for Sustainable



Earth Observations for Asia-Oceania

Tasks of AOGEO TG-7

- (1) Develop algorithms for Land use/Land Cover, Terrestrial Ecosystem Status, Inland Water Quality, Atmospheric Quality parameters using data of the Chinese ZY, HJ and GF series satellites, along with other satellite data such as Landsat TM, SPOT, Sentinel series and so on: GEO MUSYQ
- (2) Establish the remote sensing product validation network, and evaluate the remote sensing products accuracy: GEO In-Situ
- (3) Compose and release the Annual Reports for global ecosystem and environment monitoring: GEOARC
- (4) Data sharing, Demonstration Applications and knowledge propagation for end-users: cross TG10-12
- Land use/cover change: macro-ecosystem structure and the variations
- Ecological environment :NDVI, EVI, LAI, FVC, FPAR, NPP, BIOMASS, and Phenology etc);
- Atmospheric environment: aerosol optical properties, particulate matter, greenhouse gases and other trace gases etc);
- In-land water environment : Chlorophyll, suspended matter, water clarity





AOGEO-TG7 Activities



TG -7: Environmental Monitoring and Protection (EMP)

Outline

1. Overview of AOGEO TG-7

2. Achievements in 2020-2022

3. Way Forward for 2023-2025



Achievements of AOGEO TG-7 in 2020-2022

- 1. The Multi-source Synergized Quantitative Remote Sensing Production System (MUSYQ) have advocated analysis-ready data and common Remote Sensing products for environmental monitoring and protection by integrating multiple EO data: One software system and 41 datasets
- 2. More than 40 field experiment station have been connected as a Validation network
- 3. 9 Annual Reports have been composed and released to support the GEO engagement priorities; Paris agreement, SDGs
- 4. More than 15 activities has been organized for Data sharing, Demonstration Applications and knowledge propagation for end-users: 10,000+ participants from 20+ countries



1. Algorithm developments and Product generation

Multi-source Synergized Quantitative Remote Sensing Products (GEOMUSYQ) for AO Environmental monitoring (TG7)

More than 20 types of satellite data;

More than 20 global quantitative remote sensing products.



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



more than 40 quantitative remote sensing products with the higher temporal and spatial resolutions or higher accuracies.



Quantitative remote sensing products have been applied in many ministries and commissions (natural resources, national disaster reduction, ecological environment, etc.) and national tasks (the 3rd National Land Use Inventory, and the National Ecological Environment Assessment), and supported IPS.9

2. Validation Network construction

Platform for Remote Sensing algorithm evaluation and Product validation(RESVAT)

Algorithm evaluation and product validation are at the two key steps of the common products generation. There are 45 experiment sites in china and 25 common products can be validated.





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



3. GEOARC Annual Report

GEOARC	Year			
The growth of terrestrial vegetation	2012、2013			
Global production of bulk grain and oil crops and food security situation	2013、2014、2015、2016、2018、 2019、2020、2021、2022			
African Land Cover	2014			
Large Wetlands of International Importance	2014			
Ecological Environment of China - ASEAN Region	2014			
"The Belt and Road" Regional Ecological-Environment Status	2015、2017、2018			
Impact of Typical Global Major Disasters on Vegetation	2017			
Spatiotemporal Distribution of Global Carbon Sources and Sinks	2018			
Major Global Natural Disasters and their Impacts	2019			
Antarctic Ice Sheet Changes	2020			
Dynamic Monitoring and Assessment of Global Lakes	2021 29			
Changes of Eurasian Grassland Ecosystem during the Past Decades	2021 reports			
Sustainable Development Trend of Global Terrestrial Ecosystems	2021			
2012 2013 2014 2015 2016 2017 2018 2019	2020 2021			
	Image: Source of the state			
http://www.chinageoss.org/geoarc/; http://www.chinageoss.cn/en/inc	lex.html • ••A ••A ••A ••A ••A ••A ••A ••A ••A			

GEOARC in 2020-2022



2020 Released	 Antarctic Ice Sheet Changes Global Urban Land Composite and Expansion in 2000-2020 Grain Production Outlook and the State of Food Security
2021 Released	 Sustainable Development Trend of Global Terrestrial Ecosystems Crop Production Outlook and the State of Food Security Ecological and Environmental Status of Global Typical Lakes

4. Eurasia Grassland Ecological Status

2022 Due

- 1. Arctic Ice and Snow and Ecological Environment Changes
- 2. Production Situation of Global Bulk Grain and Oil Crops and the Utilization of Arable Land



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13 CLIMATE ACTION



BIRGEC

Highlights of EMP Output in 2020: Links to GEOARC





Global Ecosystem and Environment Observation Analysis Research Cooperation(GEOARC) **Changes in Antarctic Ice Sheet**

Satellite data and long-term time series calving dataset have been used to identify the iceberg calving of the Antarctic ice shelves at the continental scale. Antarctic ice sheet

change and the impact on penguin colony



HY1C 2018/12/3

HY1C 2019/2/20

Stable melt zone _____ Intermittent melt zone

LEGEND

HY1C 2018/12/31

0 720 1 440 km



Explore the latest news and perspectives from the GEO community. all news / observations blog

GEOARC Releases Three Reports and Thematic Datasets on Climate Change, Food Security and Sustainable City Biog / Qinhuo UU / November 19, 2020



What's New







GEOARC Releases Three Reports and Thematic Datasets on Climate Change, Food Security and Sustainable City

COMMUNITY ACTIVITY: GLOBAL ECOSYSTEM & ENVIRONMENT OBSERVATION ANALYSIS RESEARCH COOPERATION

Who are not think on the

Understanding the Antarctic Ice Sheet change and the impact on the penguin colony

The GEO community activity GEOARC Penguins are known as an eco-indical tem and Environment species of the Southern Ocean marine Analysis Research ecosystem Their distribution of great operation), works to produce knowledge significance to understand the evolution on the status and trends across different the Antarctic ice sheet, ice shelves and rrestrial and marine ecosystems. One of Antarctic ecosystem, and to provid ts activities is the monitoring of the Antarctic scientific support for policy makers to con ice sheet, a sensitive element of global with climate change and participate in global climate change



Satellite data have been used to identify the iceberg calving of the Antarctic ic shelves at the continental scale. Based on multi-source satellite imagery, we detected 1786 annual calving events, whose areas were larger than 1 km2, to precisely evaluate the loss of ice shelves and processed the long-time series calving dataset. Satellite data and aerial images were used to identify the location of the penguin colony and population size. Pan-Antarctic emperor penguin colonie: vere identified in 2000, 2014, and 2018. Variations in the penguin population and colony spatial extent were investigated in 1983, 2012, and 2018

GEO Highlights reports

v f h D m -



Highlights of EMP Output in 2020: Links to GEOARC



SC

Earth Observations



GEOARC

SUSTAINABLE CITIES AND COMMUNITIES

Global Ecosystem and Environment Observation Analysis Research Cooperation(GEOARC) Global Urban Land Composite and Expansion in 2000–2020

- Global urban land composite and expansion in 2000–2020 were analyzed in this report, to reflect the intensities of human activities, habitat environments and severe impact on the Earth system.
- Provided accurate geospatial information for improving global living environments and support SDG11 'sustainable cities and communities'.



A summary of global urban land composites and their changes in 2000–2020



Highlights of EMP Output in 2021: Links to GEOARC



Earth Observation for Asia-Oceania



15 LIFE ON LAND

alvsis Research Cooperation(GEOARC Sustainable Development Trend of Global Terrestrial Ecosysten

Monthly global average VAI during La Niña events from 2010 to 2020

SDG15: "Protect, restore and promote sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification, halt and reverse land degradation and halt biodiversity loss"





El Niño

Climate change is still the main factor affecting vegetation growth, and regional vegetation

improvement coexist



Global forest area continues to decrease, and achieving the SDG15. 2.1 target for sustainable forest management remains a major challenge

Continuous decrease of global forest areas represents a major obstacle in achieving the SDG of ending deforestation (total forest area decreased by 0.6% from 2015 to 2020) Significant regional differences exist in the effectiveness of forest management, the achievement of sustainable forest management requires an enhanced cooperation. Continuous conservation efforts on mountain ecosystems have improved the growth status of vegetation



Highlights of EMP Output in 2021: Links to GEOARC



Impacts of climate change and human activities on lake quality deterioration

Earth Observation for Asia-Oceania

- United Nations Sustainable Development Goals (SDGs) clean water and sanitation
 - Call for global observations and sharing of data and experience



CLEAN WATER AND SANITATION

Global Ecosystem and Environment Observatio Analysis Research Cooperation Ecological and Environmental Status of Global Typical Lakes



algal blooms from 2000 to 2020



Fig. 3-8 Overview of the Aral Sea and Lake Urmia. (a) is the Landsat satellite image and (b) is a Tehran Times reporter's photograph³



Global Actions to Protect Lakes for Clean Water



Fig. 3-7 Elephant death events in Botswana (a) area where elephants died and (b) aerial photos of the dead elephants²





Fig. 3-6 The algal bloom events in Lake Taihu. (a) Time series of algal blooms area of Lake Taihu, (b-f) MODIS images when a large algal blooms area occurred in Lake Taihu

The seasonal classification distribution of global lakes with



GEOARC Products Lists

Year	Dataset	Dataset size(GB)		Downloads	Total(GB)			
	The Antarctic ice sheet freeze-thaw dataset with multi-source	data fusion (1999	9-2019)		0.03	64	2.01	
	Antarctic Ice Shelf Monthly Calving Dataset (2010-2019)			0.002 23		23	0.04	
2020	Dataset of emperor penguin babitat around the Antarctic (2000	201/ 2018)		0 0001 77		77	0.01	
	Dataset of emperor penguin nabitat around the Antarctic (2000,2014,2016)				1.10	11	51 50	
	Global urban sprawl and land cover change				1.12	45	51.52	
	Global 30m Land Cover Dataset (2015)	15.4 26	400.40	(http://www	uu obinogoooo o	ralannal	· .	
	Global 30m Land Cover Dataset (2020)	15.6 49	764.40	(http://www.chinageoss.org/geoarc/;				
	Global 1km Land Cover Change Dataset (2015-2020)	0.33 40	13.20	http://www	w chinagooss on	/on/indov	html	
	Global 1km/5-day Normalized Difference Vegetation Index Dataset (2010-2020)	920 29	26.05	πτιμ.// ٧٧٧	w.ciiiiageuss.cii			
	Global 500m/4-day Vegetation Leaf Area Index Dataset (2010-2020)	5, 806. 08 51	289.17					
	Global 500m/4-day Fractional Vegetation Cover Dataset (2010-2020)	1280 62	77.50					
	Global 500m/4-day Vegetation Net Primary Productivity Dataset (2010-2020)	811 66	52.27	Datacat	to and range	to Eroc	Downla	
	Global 500m Vegetation Growth Index Dataset (2010-2020)	12.4 21	260.40	Datasel	ls and repor	IS - FIEE	;レロヘベ゙	
	Global 0.05° Vegetation Anomaly Index Dataset during ENSO Events (2010-2020)	0.004 13	0.05		•			
	Global 1km Anthropogenic Stressor Index Change Dataset (2010-2020)	0. 03 33	0.99	stran-	-60		Register Login	
	Global 1km/ 3-hour Photosynthetically Active Radiation Dataset (2015-2020)	108 42	4.42	୍କ <u>ଜ୍</u> ୟୋତ୍କ		Home News Data Public	hing Search Data Orders	
	Global 1km Light-temperature Potential Productivity Dataset (2015-2020)	2. 41 72	173.52			Home News Data Publis	ang search bata orders	
2021	Long-term water area-level dataset of global lakes (2000-2020)	0.15 148	22.20		Welcome to visit ChinaGE	OSS Data Sharing Network		
	Long-term water storage dataset of global lakes (2000-2020)	0.02 152	3.04	Latest Datasets	News Updates		[15 satellites 2378776 items]	
	Time series of maximum algal blooms area in global eutrophic lakes (2000-2020)	0.00002 216	0.0043	2018 Indonesia Earthquake Data	Chies CEO will held two side meetings and sublitizes during CEO. YU Blocks	FY3A(99305)		
	Time series of algal blooms frequency in global eutrophic lakes (2000-2020)	0.00002 264	0.01		ChinaGEOSS will update international datasets dur	actional datasets during GEO-XV Plenary 2018-10-30	FY3B(133883)	
	Basic data list of global eutrophic lakes (2000-2020)	0.00002 196	0.0039	2017 Irag-Iran Earthquake Dataset			FY3C(34572)	
	Long-term water area-level dataset of Chinese lakes (2000-2020)	0.15 164	24.60	2016 Kaikoura Earthquake Dataset 8 Indonesia Lombok Earthquake		2018-09-15	CBERS-01(10)	
	Long-term water storage dataset of Chinese lakes (2000-2020)	0.02 124	2.48	2017 Mexico Earthquake Dataset III Laos Government thanks ChinaGEOSS and AOGEOSS for their h m Collapse disaster III The ChinaGEOSS data portal released for emergency response t e at early of Nov 14	ISS for their help following 2018 Da	CBERS-02(2603)		
	Edible forage yield of Eurasia grassland (2000-2020)	0.89 602	535.78		2018-08-10	CBERS-02B(69)		
	Theoretical carrying capacity of Eurasia grassland (2000-2020)	0.72 161	115.92		The ChinaGEOSS data portal released for emergency response to Iraq-Iran	cy response to Iraq-Iran Earthquak	GF1(725)	
	Aboveground standing biomass of the main grazing grasslands in Eurasia (2000-2020)	0.62 431	267.22		e at early of Nov 14	2017-11-15	Linke	
	Utilization intensity index of the main grazing grasslands in Eurasia (2000-2020)	0.55 218	119.90	. op bata bownloads	China to treely share data from weather, carbon sa ChinaGEOCS will delivery its international postal delivery	relines: official 2017-10-26	Lina .	
	The Belt and Road 1km/5-day Fractional Vegetation Cover Dataset (2016-2019)	111 111	12.03	2018 GEOARC Report ChinaGeDas will derivery its international portal duit 2017 GEOARC Report China's Plan for Implementing GEOSS (2016-2025) 2016 GEOARC Report China launches satellite to monitor global carbon er 2015 GEOARC Report New Zealand Government thanks China GEOSS, CO 2016 GEOARC Report owing 2016 Kalkoura Earthquake	2017-10-19 2017-10-19	China's Plan for Implementing		
	The Belt and Road 1km/5-day Normalized Difference Vegetation Index Dataset (2016-2019)	447 321	140.12		China launches satellite to monitor global carbon	al carbon emissions 2017-10-19	GEOSS (2016-2025)	
	The Belt and Road 500m/4-day Vegetation Net Primary Productivity Dataset (2016-2019)	185 553	99.91		New Zealand Government thanks China GEOSS, CODATA and IRDR for their help fol	DDATA and IRDR for their help foll		
	The Belt and Road 1km/5-day Light-temperature Potential Productivity Dataset (2016-2019)	704 481	330.69		2017-10-19	Tan(Sat		
	The Belt and Road 0.05° Solar Power Potential Dataset (2016-2019)	0.31 681	211.11	2013 GEOARC Report				
	The Belt and Road 0.05° Solar Resource Dataset (2016-2019)	0.31 782	242.42	2012 GEOARC Report				
	China-ASEAN 1km/5-day Fractional Vegetation Cover Dataset (2016-2019)	30.6 361	10.79					
	China-ASEAN 1km/5-day Normalized Difference Vegetation Index Dataset (2016-2019)	122 481	458.45		Copyright © 2017 by the Institute of Remote	e Sensing and Digital Earth		
	China-ASEAN 500m/4-day Vegetation Net Primary Productivity Dataset (2016-2019)	54.5 551	234.61					
	China-ASEAN 1km/5-day Light-temperature Potential Productivity Dataset (2016-2019)	47.4 108	39.99					
	China-ASEAN 0.05° Solar Power Potential Dataset (2016-2019)	0.03 116	3.48					
	China-ASEAN 0.05° Solar Resource Dataset (2016-2019)	0.03 251	7.53					
	Global Large Terrestrial Surface Water Areas Spatially Distributed Update Dataset (2018-2019)	0.05 354	17.70				17	
	Global 1km/8-day Vegetation Leaf Area Index Dataset (2018-2019)	7.63 121	923.23					

4. Training and Propogation



China

the Hindu Kush

Himalayan region",







2021.7 The first Asia and Oceania Regional **Integrated Earth Observation Program** (AOGEO) International Training Course, Beijing, China, online

2022.7 The second Asia and Oceania **Regional Integrated Earth Observation Program (AOGEO)** International Training Course, Beijing, China, online

2020.10 International Training Course on Earth Observation Services for Sustainable **Development in Developing Countries**, Beijing, China

The annual report received wide attention from domestic media, with more than 50 media outlets reporting the release and republishing the report. Reports downloaded 17196 times; Data downloaded 8755 times, 5950.43GB 中國新闻編





TG7 Contributions

China•€€⊃











Priority fields

6 CLEAN WATER AND SANITATION	7 AFFORDABLE AND CLEAN ENERGY	13 CLIMATE	15 LIFE ON LAND						
 ▶ SDG 6.3 ▶ SDG 6.4 ▶ SDG 6.6 	➡ SDG7.2	➡ SDG 13.1	 ◆ SDG15.1 ◆ SDG 15.2 ◆ SDG 15.3 						
 Water usage Water capacity Profit and loss 	 Solar energy potential PAR FPAR 	• CO_2 • $PM2.5$ • O_3 • Glacier •	 Forest coverage Degradation Land cover NPP Biomass 						
TG7 contribution									
		CO2							
Water resource management	Energy and mineral resources management	Public Health Surveillance	Biodiversity and sustainable development of ecosystems						

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.



SDG3: Good Health and Well-being
 SDG6: Clean Water and Sanitation
 SDG7: Affordable and Clean Energy
 SDG9: Industry, Innovation and Infrastructure
 SDG11: Sustainable Cities and Communities
 SDG13: Climate Action
 SDG14: Life below Water
 SDG15: Life on land
 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.



Achievements Propagation



for Asia-Oceania





• June 5, 2022, "Annual Report and datasets of remote sensing monitoring of global ecological environment" was selected as one of the "Top Ten Research Progresses in **China's Geographic Sciences 2021**" by the Geographical Society of China.





• Sep. 9, 2022, "The Belt and Road Ecological Environment Remote Sensing Monitoring Special Products Supporting Regional Ecological Sustainable Development" research report was selected as one of the "Top 100 Earth Observation Application Cases" by China GEO.



• Aug. 10,2022, The application case of "Assessment of Sustainable Development Situation in Southeast Asia Based on Human Activity Pressure" has been submitted to UNESCAP as one of the three selected, due to be released at the 4th UNESCAP Ministerial Conference on Space **Applications for Sustainable Development in Asia and the Pacific by the United Nations.**

Outline

1. Overview of AOGEO TG-7

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3. Way Forward for 2023-2025



Way Forward Toward 2023- 2025 and Beyond

TG7 will promote the construction of international cooperation network;

Establish an international validation network for Earth observation products;

Strengthen cooperation with other working groups and support the Integrated Priority Studies(IPS);

Enhance the data sharing to endusers (AIIB, EXIM Bank, UNEP...) for environmental protection decisionmaking. Cooperate with TG2 Asia-Pacific Biodiversity Observation Network and TG3 GEO Carbon and GHG Initiative and other task groups



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

Cooperate with other GEO activities: GEOARC, EO4SDG,



Earth Observations for Asia-Oceania



On-going projects and expected Outputs in 2023-2025

- Global 1km and 16m land cover and terrestrial ecosystem parameter products.
- Asia-Oceania Environment Monitoring platform for urban expansion, air quality, vegetation 2) change monitoring, and provide real-time update of monitoring results, and build the capacity for remote sensing monitoring of environmental changes in developing countries.
- **Develop artificial intelligence framework for agricultural infrastructure identification**, 3) practical intelligent grazing products, risk assessment model for ships in polar regions.











Annual Reports in 2023-2025

for Asia-Oceania

• 2022: "Arctic ice and snow and ecological environment changes", "Production situation of global bulk grain and oil crops and the utilization of arable land";

• 2023: "Impact of changes in global terrestrial ecosystem types on carbon emissions and carbon absorption", "Environmental changes in the North and South Pole and the Qinghai-Tibet Plateau", "Global bulk grain and oil crop production and food security";

• 2024-2025: "Global Land Surface Ecological Environment Change", "Global Ecologically Vulnerable Areas", "Global Bulk Grain and Oil Crops", "Global Terrestrial Important Waterbodies and Wetlands", "Global Carbon Neutralization Process", "Ocean and Atmospheric Environment" ...





Users' Connection

- United Nations Environment Programme (UNEP)
- United Nations Convention to Combat Desertification (UNCCD)
- International Centre for Integrated Mountain Development (ICIMOD)
- Asia-Pacific Space Cooperation Organization (APSCO)
- Governments of China and Southeast Asian Countries
- Earth Observations for the Sustainable Development Goals (EO4SDG)
- Asian Infrastructure Investment Bank (AIIB)

Cross TG Activities: IPS: Integrated Research in Mekong River Basin for Environment monitoring Joint Workshop with TG2, 3, 6?

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,



AOGEO-TG7