2020-2022 GEO Work Programme Activities

(Community Activities)

Global Ecosystem and Environment Observation Analysis Research Cooperation (GEOARC)

Contents

1. Executive Summary

- Full title of the Community Activity: **Global Ecosystems and Environment Observation Analysis Research Cooperation**
- Short title or acronym: **GEOARC**
- Proposed or existing category: **Community Activity**

Overview (summary of section 2 below)

This activity mainly focuses on ecological and environmental monitoring at the global or regional scales, to provide information and knowledge services to support the GEO priorities, including Sustainable Development Goals (SDGs), Paris Agreement, and Sendai Framework for Disaster Risk Reduction. This activity promotes a cooperation network to release Annual Reports and share related datasets and technique method through training courses or workshops.

Planned Activities (summary of section 4 below).

1) Integrate multi-source data and products from GEO MUSYQ, GLASS, GlobalLand30, FROM-GLC30, and so on, to monitor global or regional terrestrial ecology and environment condition, and to provide analysis ready data for sharing.

2) Analyze and evaluate the global, regional ecosystem and environment status and provide the policy-making based information for the public human health and environment protection.

3) Compose and release the Annual Report to the public. The Annual Report, ~~and the~~ R~~r~~elated ~~Data~~ Products and Methodology/A~~a~~lgorithms ~~rithmetics~~ will be shared by the GEOSS portal (http://www.geoportal.org/; http://www.geodoi.ac.cn/WebCn/) and ChinaGOESS DSNet (http://www.chinageoss.org/geoarc/).

4) Organize side events ~~at the GEO Plenary and~~ or special sessions in different international conferences; hold or attend training workshops for the Annual Report, ~~and~~ Data Product, Methodology/Algorithm and Demonstration A

Comment [1]: What is the relationship between this activity and GEO MUSYQ? Should these be combined?

Re: GEO MUSYQ provide partial data and products for GEOARC. GLASS, GlobalLand30, FROM-GLC30, and other projects also provide partial data and products for GEOARC.

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~~a~~pplications~~.~~

2. Purpose

In recent decades, there has been rapid economic and scientific/technical progress, which has created huge wealth for humanity. However, this progress has also accelerated the consumption of resources on the earth and the destruction of the common environment. Global warming, resource depletion, ~~-~~ecosystem degradation and environmental pollution, and Natural ~~human induced d~~Disasters not only threaten global and regional ecological security, but also influence ~~social stability and~~ the sustainable development goals of global or regional environment~~of the global economy~~. Remote sensing can play a significant role in global and regional ecosystem and ~~logical~~ environment monitoring.

This activity aims to:

• Improve the standard methodology/algorithm for ecological and environmental monitoring at a global or regional scope;

• Promote the international cooperation network for all participants to support data sharing, product validation, information communication and public decision-making;

• Provide information and knowledge service to support the GEO priority fields of Sustainable Development Goals (SDGs), Paris Agreement, and Sendai Framework for Disaster Risk Reduction; and

• Release annual reports, publish the ~~and share~~ related datasets, discuss the ~~and its~~methodology/algorithm, present demonstration applications~~technique method~~ through training courses, ~~or~~ workshops, ~~and deliver and exchange information among t~~or ~~he~~ the current GEOSS programme activities.

3. Background and Previous Achievements

Ecological and environmental monitoring and analysis has been partially

conducted in previous GEO activities, such as AOGEO, AfriGEO, GEOGLAM. For public decision-maker support, a user-oriented easy-reading and comprehensive report is required. Following the launch of the Global Ecosystem and Environment Observation and Analysis Annual Reports by the Ministry of Science and Technology of the People's Republic of China in 2012, GEOARC has been accepted as a Community Activity in the 2017 - 2019 GEO Work Programme. A series of reports have been released from 2012 to 2018, such as:

2012

- Dynamics of Global Vegetation Leaf Area Index (LAI) from 1982 to 2011
- Global Land Surface Water 2010 and Dynamic Changes of Sample Lakes 2001-2011

2013

- Growth Conditions of Global Terrestrial Vegetataion
- Large Terrestrial Surface Water Areas
- Supply Situation of Maize, Rice, Wheat and Soybean
- Urban and Rural Resident Land Cover Distribution between 2000-2010

2014

- Africa Land Cover
- China-ASEAN Ecological and Environment Conditions
- Large Area Wetlands of International Importance
- Supply Situation of Maize, Rice, Wheat and Soybean

2015

- 'The Belt and Road Initiative' Ecological and Environmental Conditions
- Supply Situation of Maize, Rice, Wheat and Soybean

2016

- Supply Situation of Maize, Rice, Wheat and Soybean

2017

- The Belt and Road Initiative Ecological and Environment Conditions
- The impacts of global natural disaster on vegetation

2018

- Regional Ecosystem Trends along the Belt and Road
- Supply Situation of Maize, Rice, Wheat and Soybean
- Temporal Dynamics and Spatial Distribution of Global Carbon Source and Sink

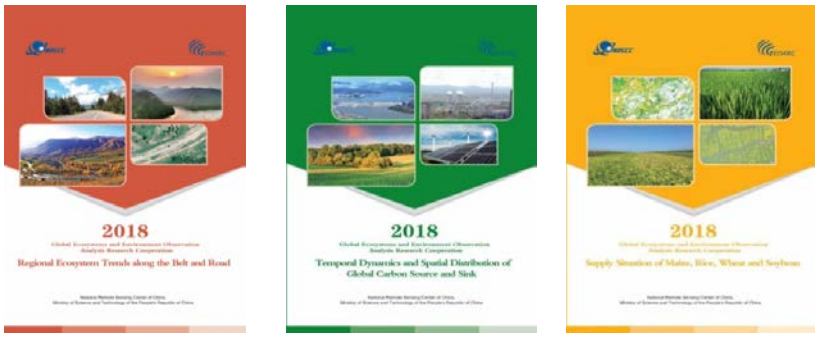

Fig.1 GEOARC 2018

The Annual Reports in 2018 mainly focus on the typical ecological environment elements and hot environment issues, the dynamic monitoring and comprehensive analysis was conducted using the advantage of the earth observation technology. As part of GEOARC-2018 reports, based on the full coverage of the previous series of the" Belt and Road" ecological environment, Regional Ecosystem Trends Along the Belt and Road report focuses on monitoring the ecologically fragile areas along the farming-pastoral ecotone, along the coast and the coastal zones, natural protected areas such as national parks, as well as key traffic construction projects which aim to enhance infrastructure interconnectivity. Global Spatiotemporal Distribution of Carbon Source and Sink report focuses on monitoring the CO_2 spatiotemporal change

Comment [w2]: More detail here would be helpful.

at the globle scale, and monitoring the distribution of globle carbon source and sequestration, and analyze the reason of the carbon change, some typical regions were taken as examples to been analyzed detailed. Supply Situation of Maize, Rice, Wheat and Soybean report presents an overview of global agro-climatic conditions, as well as cropping patterns and stresses over major production areas. The report also specifically presents agronomic conditions in China and a global and national outlook for 2018 food production and supply. The Annual Reports were published, and the related datasets have been released on the website (http://chinageoss.org/dsp/home/index.jsp) and published by the Global change scientific research data publishing system (http://www.geodoi.ac.cn/WebCn/), all of which are open to the public for free. Until June 17, 2018, according to incomplete statistics for 2012-2017 Annual Reports, more than 1000 reports have been made by major news media, the downloads of Annual Report were 11107, and the downloads of related products were 12,136, and the downloaded datasets reached 124.95TB.

The Annual Reports have made a positive impact in China and abroad, and have attracted extensive attention from industry, the public and the media. The Annual Report has been widely publicized through international cooperation, and its international influence has been increasingly enhanced, highly recognized by international peer experts and closely watched by international organizations. In order to keep good continuity and cooperation, Annual Reports are planned for 2020 to 2022.

4. Key Activities

GEOARC~~The activity~~ would like to ~~generate~~release data ~~and~~ products, methodology/algorithms ~~and techniques,~~ information and knowledge ~~in the Annual Report~~ to support decision-making as annual reports. ~~, and the~~The users of different countries ~~published algorithms and remote sensing products will be able to~~may not only obtain the information or knowledge directly from the annual report, but also do deepen analysis using the data products and the technical methodology/algorithms to support decision making~~for free for other countries~~. To summarize, it's a synergic activity of collection, integration, interpretation and knowledge-generation in the global or regional scope of ~~ecology and~~ ecosystem and environment issues that are

Comment [3]: To what extent will the methods, algorithms and other knowledge developed through this activity be openly shared with other GEO Members and POs? For example, would other countries be able to replicate similar reports for their own national decision making?

RE: Yes, this work can provide data, methods, algorithms, products and report service, based on which other countries are able to replicate similar reports for their own national decision making. We also provide some international training for data, algorithm and report serves and utilization.

related with SDGs. ~~On the basis~~ Based on ~~of~~ the past work and experiences, ~~existing Annual Reports, global ecological environment monitoring by remote sensing with multi-frequency, multi-topic and multi-hot regions will be carried out in the future. T~~the topics of GEOARC ~~global ecological environment monitoring reports~~ from 2020 to 2022 will~~are mainly planned for continuous monitoring, hot regions and hot issues monitoring,~~ focus~~ing~~ on sustainable agriculture and water resources, sustainable clean energy, sustainable ecosystem and its serving function, land degradation/desertification, global carbon source and sink, global glacier variation and its climate change responses, global natural disasters~~ monitoring, atmospheric environment monitoring and climate change response~~, ~~global carbon source and sink, sustainable ecological environment and service, marine/coastal resources monitoring, water resources management, land degradation/desertification monitoring and evaluation, glacier monitoring and dynamic change, sustainable development of clean energy,~~ etc. ~~which are highly related with SDGs.~~

The main activities include:

• Remote Sensing Product Generation ~~Remote sensing data integration and normalization,~~ based on the Multi-source Synergized remote sensing data~~Remote Sensing Common Product Generation platform for Products including:~~. The products include:

Land Cover (LC), Solar Radiation (SR), Photosynthetically Active Radiation (PAR), Photosynthetic Thermal Productivity (PTP), Precipitation, Evapotranspiration (ET), Fraction of Vegetation Cover (FVC), Leaf Area Index(LAI), Vegetation Index(VI), Biomass, Phenology, Fraction of Absorbed Photosynthetically Active Radiation(FAPAR), Albedo, Net Primary Productivity (NPP), Gross Primary Productivity(GPP), Urban Heat Island, Arable Land use Intensity, Cropping Index, Farmland Planting Proportion, Arthropod-borne, etc..

• Annual Report composing by experts~~, invite~~ from different ~~industries~~ organizations or different countries ~~to work together and employ experts of different fields~~ to analyze the~~ condition of~~ ecosystem~~s~~ and environment conditions,~~and monitoring the global change,~~ to evaluate the realizability of SDGs, to propose suggestions for policy making based on the remote sensing products and

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comprehensive analysis;

~~even make suggestions for the local development, to protect the health of human and environment and form the Annual Reports;~~

- Data~~,~~ products, ~~,~~ algorithms and ~~Annual~~ Annual Reports, Methodology/algorithm and demonstration applications ~~and product~~ releasing to the public ~~at the GEO Plenary, and conduct Annual Report and products publication~~ on the GEOSS portal (http://www.geoportal.org/; http://www.geodoi.ac.cn/WebCn/).

- Organizing side events ~~or ,~~ joining in ~~the~~ international conferences, hosting ~~communities or~~ training workshops to propagate the annual reports and data products, to discuss the methodology/algorithm, and to present demonstration applications, ~~publicity the data, algorithms reports and data reports sharing, such as GEO mi~~ at ~~nisterial summit meeting, GEO plenary session,~~ GEO Week, AOGEO symposium, etc.

5. Relationship to GEO Engagement Priorities and to other Work Programme Activities

5.1 Relationship to GEO Engagement Priorities

GEOARC pay more attention to the three priorities of the GEOSS, which focus on eight social benefit areas ~~key fields~~(SBAs), such as disaster prevention and reduction, food security and sustainable agriculture, water management, energy and natural resource management, human health monitoring, environmental impact of biodiversity and ecosystem protection, urban development, infrastructure and traffic management, to provide three categories of products and technical services, including data and products, algorithms and techniques, information and knowledge~~data, information and knowledge~~.

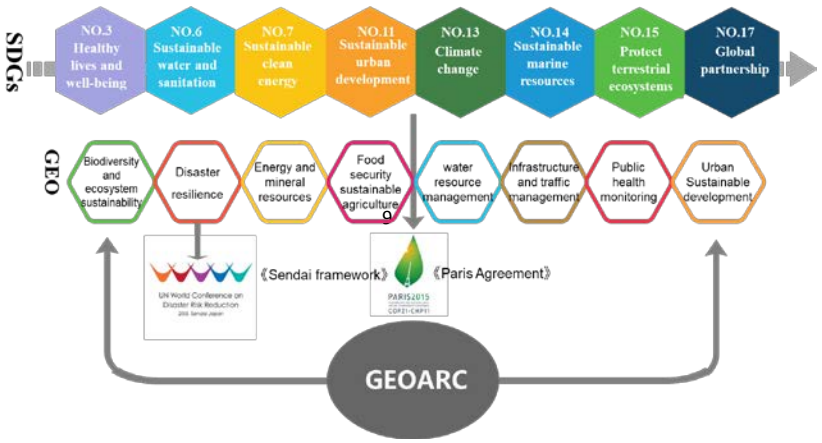

Fig.2 The relationship between GEOARC and SDGs & GEO

The planned contents of GEOARC for 2020-2022 are highly related with Paris Agreement, Sendai Framework for Disaster Risk Reduction, and SDGs, i.e.~~such as~~ SDG ~~s~~3, 6, 7, 11, 13, 14, 15, 17.

- SDG~~s~~3 ensure healthy lives and promote well-being for all at all ages;
- SDG~~s~~6 Ensure availability and sustainable management of water and sanitation;
- SDG~~s~~7 ensure access to affordable, reliable, sustainable and modern energy;
- SDG~~s~~11 Make cities and human settlements inclusive, safe, resilient and sustainable;
- SDG~~s~~13 Take urgent action to combat climate change and its impacts;
- SDG~~s~~14 Conserve and sustainably use the oceans, seas and marine resources for sustainable development;
- SDG~~s~~15 Protect, restore and promote sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification, and halt and reverse land degradation and halt biodiversity loss;
- SDG~~s~~17 Strengthen the means of implementation and revitalize the Global Partnership for Sustainable Development.

5.2 Relationship to other Work Programme Activities

GEOARC will keep close connection with other related~~ other~~ Activities, Initiative or Flagship programs such as GEOMUSYQ, GEOGLAM, and AOGEO in the Work Programme 2020-2022.~~Activities~~

• GEOMUSYQ data product have~~ve~~ ~~supported the monitoring and analyzing the typical ecological environment elements and hot environment issues. MuSyQ products have~~ been directly used and will be continuously used to support the GEOARC ~~(Global Ecosystems and Environment Observation Analysis Report Cooperation)~~ report~~ and these products played the great role. The products of GEOMUSYQ will support the GEOARC continually~~ during 2020-2022~~ as the main data source~~.

The reports and methods of GEOARC and GEOGLAM are consistent while they focus on different aspects. The GEOGLAM forms seasonal reports about the agricultural meteorology and crop growth condition continually, while GEOARC report (the Supply Situation of Maize, Rice, Wheat and Soybean) focus on the synthesize analysis about the supply situation of grain and oil crops annually.

• AOGEO is a regional GEO for ASIA-OCEANIA region, with Task Group 7 "~~,~~ ~~Eco~~Environment Monitoring and Protection" ~~system and Environment Monitoring is a main task of AOGEO. This activity~~ aims to monitor and evaluate~~ and monitor~~ the terrestrial ecological ~~and ee~~nvironment~~al~~ status ~~situations~~ in Asia and Oceania,~~n area,~~ while ~~ich made a solid basis for~~ GEOARC~~ to~~ conduct the ecological and environmental monitoring at global or regional scale.

~~• The "Belt and Road" initiative puts into practice the new concept of green development in the process of construction, investment and trade, advocate a green, low-carbon, circular and sustainable way of life and production, strengthen cooperation in ecological and environmental protection, avoid possible risks, and jointly build the green Silk Road. The monitored contents about ecology and environment in 2020-2022 GEOARC respond to the initiative, which will provide a basis to formulate environmental policies, and deepens the public's understanding of the global ecological environment.~~

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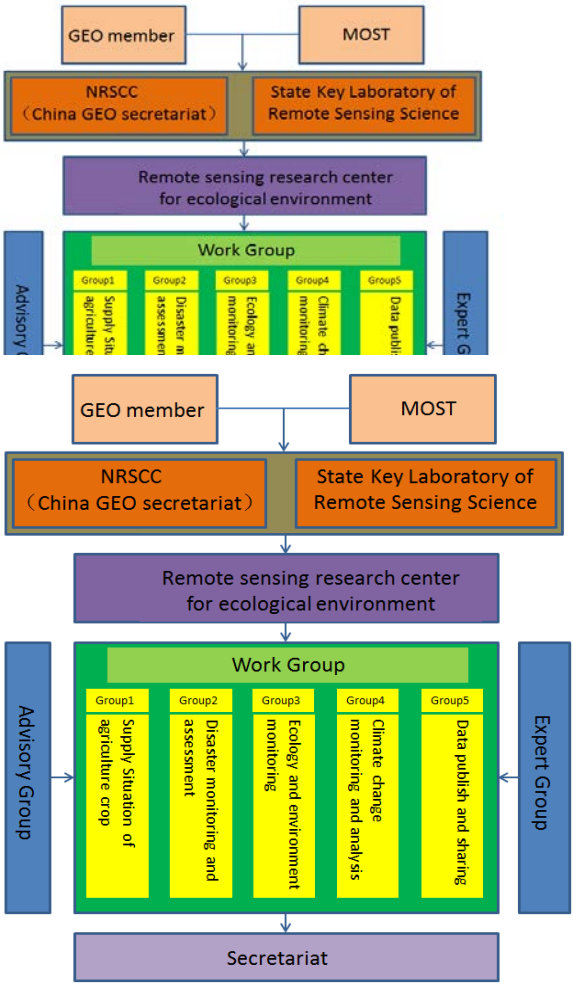
6. Governance

- **Leadership**

Under the leadership of the Ministry of Science and Technology (MOST) of the People's Republic of China, the Annual Report is organized by the National Remote Sensing Center of China (China GEO Secretariat), assisted by the State Key Laboratory of Remote Sensing Science in operation and management. The ecological environment remote sensing research center was jointly established by the two sides, which is responsible for the daily operation of the Annual Report. The foreign organizations like EAS and other GEO members are welcome to participant in the GEOARC.



- **Workgroups**

The top research teams at home and aboard ~~were~~ are organized interdepartmentally, giving full play to the advantages of remote sensing technology, the ecological environment of long-term dynamic change monitoring by remote sensing were conducted at the global, regional and national scales, to analyze the ecological environment change rule and driving factor, to release the Annual Report and datasets. The work group contains five parts: Supply Situation of Maize, Rice, Wheat and Soybean, disaster monitoring and assessment, ecological ~~y and en~~environment monitoring, climate change monitoring and analysis, data publishing and sharing. The advisory and expert groups give suggestions during the process of Annual Report writing and the secretariat group provides services to guarantee the successful release of the Annual Report. In a word, the Annual Report was governed from organization, manpower and technology to ensure the orderly and smooth work.

Comment [4]: What is the connection between this information and that produced in GEOGLAM? Are the reports and methods consistent?

Re: The reports and methods of GEOARC and GEOGLAM are consistent while they focus on different aspects. The GEOGLAM forms seasonal reports about the agricultural meteorology and crop growth condition continually, while GEOARC report (the Supply Situation of Maize, Rice, Wheat and Soybean) focus on the synthesize analysis about the supply situation of grain and oil crops annually.

~~Fig.3 Organizational structure of GEOARC~~

7. Data Policy

GEO promote and encourage to implement GEOSS Data Sharing Principles: Data, metadata and products will be shared as Open Data by default, by making them

available as part of the GEOSS Data Collection of Open Resources for Everyone (Data-CORE) without charge or restrictions on reuse, subject to the conditions of registration and attribution when the data are reused; Where international instruments, national policies or legislation preclude the sharing of data as Open Data, data should be made available with minimal restrictions on use and at no more than the cost of reproduction and distribution; All shared data, products and metadata will be made available with minimum time delay. GEO also promote the use of Data Management Principles which are based on discoverability, accessibility, usability, preservation and curation. GEOARC will strictly abide by GEOSS Data Management Principles to share the published remote sensing data, algorithms, products and reports. China GEOSS Data Sharing Network has been proposed as a part of China's Plan for Implementing GEOSS (2016-2025) to address the restrictions in distributed resource management and tightly coupled service interoperability and facilitating cross-disciplinary exploration and application. China GEOSS Data Sharing Network develops a national GEOSS data sharing framework, including resource integration mechanism, sharing-oriented metadata standards, and lightweight interoperability service to coordinate various Earth observation resources and enhances international cooperation. The related datasets and technique methods of Global Ecosystems and Environment Observation: Annual Report from China (GEOARC) can also be queried and downloaded for free at the website (http://www.nrscc.gov.cn/) of National Remote Sensing Center of China and ChinaGOESS DSNet (http://www.chinageoss.org/geoarc/).

Tables

Comment [5]: Tables are required to provide in spreadsheets.

RE: it has been mended

A. Individual Participants

Name	Organization	Email	Nationality	contributions
Leader				
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Name	Organization	Email	Nationality	contributions
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Gong Adu	BNU	gad@bnu.edu.cn	China	Vegetation and Disaster
Shukla Acharjee	DU	sacharjee@dibru.ac.in	India	Vegetation Index, Urban heat Island and Disaster (flood)
Md. Nurul Islam	JU	nislamju@gmail.com	Bangladesh	Flood Monitoring and Mitigation
Data publish and sharing				
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Li Xin	NIER	lixin@lzb.ac.cn	China	Validation Data
Xiao Qing	NIER	xiaoqing@lzb.ac.cn	China	Validation Network
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Secretariat				
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Guo Jiahuan	NRSCC	guojiahuan@nrscc.gov.cn	China	Secretariat Group

B. Confirmed Contributions

Contribution category	Description
Data	China Centre For Resources Satellite Data and Application, Satellite Environment Center, Ministry of Environment Protection of China, National Satellite Meteorological Centre, China Meteorological Administration, ESA and other organizations provide data support of GF-1, GF-2, GF-6, HJ-1A/1B, MODIS, FY4A, MSG3/4, FY3/MERSI & VIRR, AVHRR,etc..
Resources	✔ Multi-source data Synergized Quantitative remote sensing production system (MuSyQ), integrating multi-sensory data as MODIS, FY3/MERSI & VIRR, MSG2/3, GOES13/GOES15, MST2/Himawari-8, AVHRR, HJ-1/CCD, GF-1, ZY-3, CBERS-04, Landsat/TM to produce various vegetation and radiation remote sensing products. ✔ A Chinese validation network in national scale where the core observation sites are the Huailai Station, the Hulunber Station, the Heihe Station, the Jingyuetan Station, Minqin Station, Daxing'anlin Station, Hainan Station, Pu'er Station and Dongting Lake Station. ✔ New software developed for image analysis on the Shenweitaihu Light Super Computer, Ranked the fastest in the world in 2016 and 2017
Projects and financials	✔ "Report on Remote Sensing Monitoring of Global Ecosystem~~s~~ and Environment" supported by Ministry of Science and Technology, China (6 million CNY/yr); ✔ projects supported by the state key laboratory of Remote Sensing Sciences, Institute of Remote Sensing and Digital Earth, Chinese Academy of Sciences (5 million CNY /yr) ; ✔ "High Spatio-temporal Resolution Carbon Emission Monitoring and Application Demonstration of Beijing-Tianjin-Hebei Urban Agglomeration", supported by Chinese Ministry of Science and Technology, China. (8 million CNY /yr) ✔ "Research and Demonstration on Key Technologies of Space-Earth Integrated Cooperative Monitoring Emergency Response to Heavy and Extreme Disasters", supported by Chinese Ministry of Science and Technology, China. (8.5 million CNY /yr) ✔ "Key Parameters Development of Global Change Based on Domestic Satellite Data", supported by Chinese Ministry of Science and Technology, China. (3.2

	million CNY /yr) ✔ Scientific Cognition and Cloud Sharing Platform for Global Change Big Data, supported by Chinese Ministry of Science and Technology, China. (7 million CNY /yr)

Annexes

I. Acronyms and abbreviations

- Ministry of Ecology and Environment of the People's Republic of China(MEE/China)
- Ministry of Science and Technology of the People's Republic of China (MOST/China)
- National Remote Sensing Center of China (NRSCC/China)
- Institute of Remote Sensing and Digital Earth (RADI/CAS/China)
- Institute of Geographic Sciences and Natural Resources Research (IGSNRR/CAS/China)
- Northwest Institute of Eco-Environment and Resources (NIER/CAS/China)
- Research Institute of Forest Resource and Information Techniques (IFRIT/CAF/China)
- Satellite Surveying and Mapping Application Center (SASMAC/NASG/China)
- National Geomatics Center of China(NGCC/NASG/China)
- Second Institute of Oceanography (SIO/SOA/China)
- Institute of Telecommunication Satellite (ITS/CAST/China)
- Space Star Technology Co., Ltd (SSTC/China)
- Tsinghua University (THU/China)
- Beijing Normal University (BNU/China)
- Southwest Jiaotong University (SWJTU/China)
- Jiangsu Normal University(JSNU/China)
- Geosciences Australia (GA/Australia)
- University of Technology Sydney (UTS/Australia)
- International Institute for Applied Systems Analysis (IIASA/Austria)
- University of Chittagong (CU/Bangladesh)

- Jahangirnagar University (JU/Bangladesh)
- Suez canal university (SCU/Egypt)
- Joint Research Center (JRC/EU)
- European Space Agency (ESA/France)
- Dibrugarh University (DU/India)
- Indian Institute of Technology Karagpur (IIT/India)
- Polytechnic University of Milan (PUM/Italy)
- Delft University of Technology (TUD/Netherlands)
- Institute for Water Education (UNESCO-IHE/Netherlands)
- University of Twente (UT/Netherlands)
- Institute of Space Technology (IST/Pakistan)
- COMSATS Institute of Information Technology(COMSATS IIT/Pakistan)
- Estacion Experimental de Zonas Aridas, CSIC (CSIC/Spain)
- University College London (UCL/UK)
- University of Maryland (UMD/USA)
- United States Geological Survey (USGS/USA)
- National Oceanic and Atmospheric Administration (NOAA/USA)
- Massachusetts Institute of Technology (MIT/USA)
- Stanford University(SU/USA)
- Boston University (BU/USA)
- Asia-Pacific Space Cooperation Organization (APSCO)
- Institute of Atmospheric Physics, Chinese Academy of Sciences (IAP/ CAS/China)
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WORK EXPERIENCES

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