





Activities and plans contribution to AOGEOSS Task 7: Environment Monitoring and Assessment (GI-22 –TG7)

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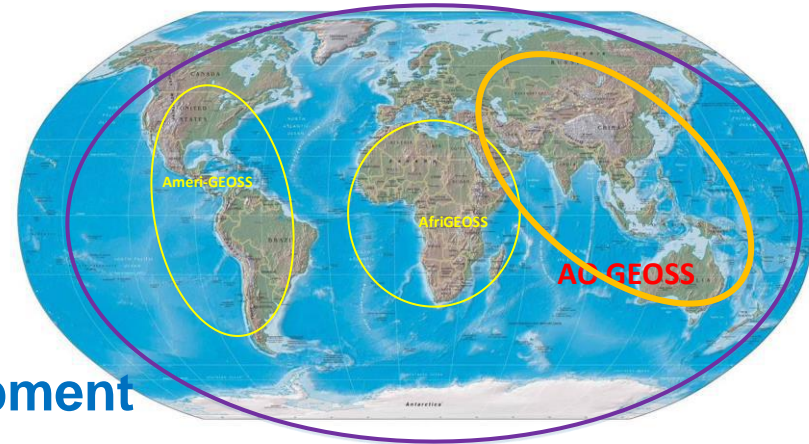
**19 September, 2017
Hanoi, Vietnam**

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-  **Working Contents**.....●
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Background

- **Asia-Oceania region**
 - Complex geographic
 - Large population (70% of world's)
 - Climate change drastically
 - Natural disasters occur frequently
 - Unbalanced socioeconomic development
 - Deteriorating ecological environment
- **Asia-Oceania GEOSS**---a regional cooperation program on Earth observation with broad involvement
- Strengthen comprehensive ability of Earth observation and applications for sustainable development at regional level.



Background

In June 2015, the United Nations released a report entitled *"Transforming our world by 2030: A new agenda for global action"*.

Three dimensions: economy, society, environment

17 total goals and 169 sub-goals

Task 7 focus on the the regional ecological and environmental problems

- 1) Ensure sustainable management of water and sanitation ;
- 2) Ensure the sustainable development of clean energy
- 3) Make cities inclusive, safe, resilient and sustainable
- 4) Take urgent action to combat climate change and its impacts
- 5) Conserve and sustainably use the marine resources
- 6) Protect terrestrial ecosystems, combat desertification and land degradation, and protect biodiversity
- 7) Strengthen cooperation on sustainable development and build a global partnership



Global Ecosystem and Environment Observation: Annual Report from China (GEOARC)

- To support global change studies in the framework of Earth Observation System of Systems (GEOSS)
- Released 13 reports since 2012, on World Environment Day
- Community Activity of GEO Work Programme 2017-2019
- Reports and data can download from China GEOSS Data Sharing Net (<http://www.chinageoss.org/geoarc/>).
- 2017 the 6th annual report will be released in October.



Report on 2012



Report on 2013



Report on 2014



Report on 2015

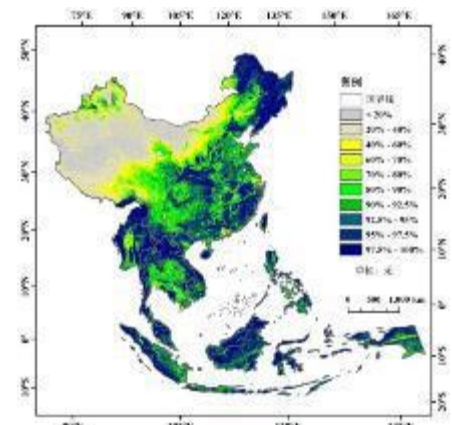
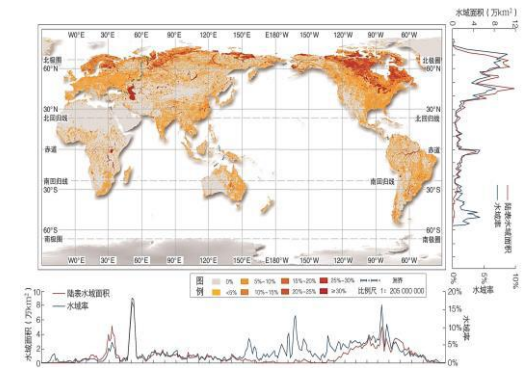
Report on 2016

GEOARC

Multi-Scale: Global, AO Region, ASEAN Region

Topic	Data and Contents
Vegetation	Changes of Vegetation Leaf Area Index Dynamics
	Growth Conditions of Global Terrestrial Vegetation.
Land Cover	Africa Land Cover
	Urban & Rural Resident Land Cover Distribution
	International Importance Large Area Wetlands
Agriculture	Supply Situation of Maize, Rice, Wheat & Soybean
Water	Large Terrestrial Surface Water Areas
	Global Land Surface Water & Lakes
Integrated	Ecosystem and Environmental Condition of AO Region
	Ecosystem and Environmental Condition of ASEAN





- Data Sharing to national and global users
Dataset Download: over 10000 times, 60TB.
Report Download: 9000+ times
- Contribute Globe Land 30 Data to U.N.



Objectives of TG 7:

- Establish a framework to integrate multiple EO data acquired by different Countries to monitoring AO Ecosystem and Environmental condition.
- Develop a comprehensive, inclusive and robust Synergized Multi-source Quantitative Remote Sensing Production System for operation.
- Create and maintain a cooperative mechanism to provide Quantitative Remote Sensing products for sharing and validation in AO region
- Release the Annual Report based on the cooperation networks;
- To Support SDGs: Generate policy-relevant advices to support governments to make evidence-based decisions on how to protect the Ecosystem and Environment.

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Main tasks:

- **Ecological Environment (LIU Qinhua (RADI, CAS), Alfredo Huete (UTS, Australia);.....);**
- **Land use/cover change (GONG Peng, Tsinghua University, CHEN Jun, ISPRS,.....);**
- **Atmospheric Environment Quality(Gu Xingfa, RADI, LIU Yi, CSIRO, Australia,.....).**

User: Mario Hernandez (Future Earth); LIU Jian (UNEP-IEMP),

.....



desertification



Ecosystem deterioration



Air Pollution

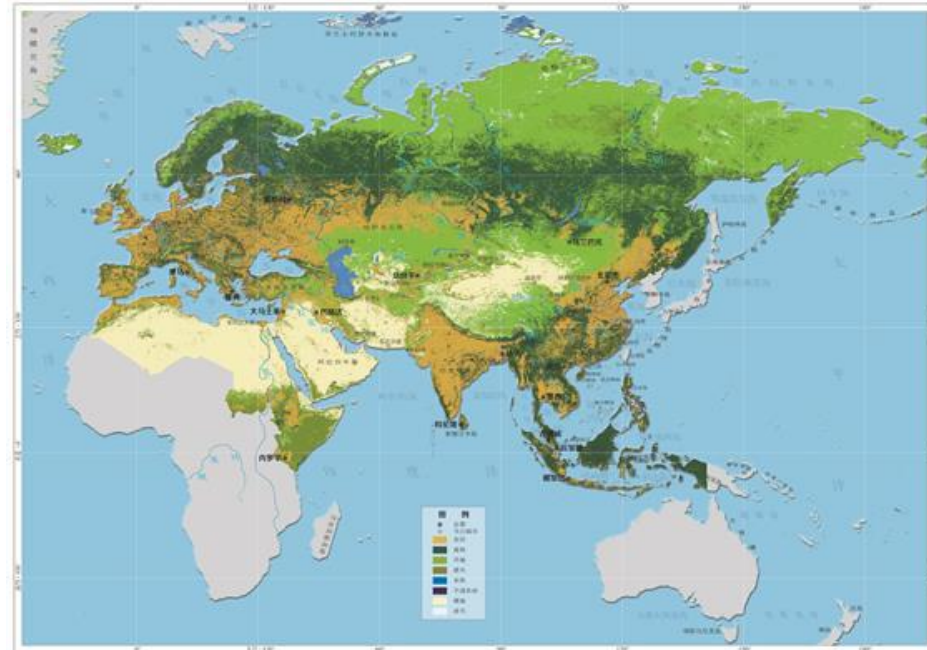
Subtask 7.1 Land use/cover change monitoring for AO : The Land use/cover change, such as urban expansion, desertification, etc., have significant influence to and get obvious feedback from the climate change.

This task will monitor the regional Land use/cover by using the Chinese ZY, HJ and GF series satellites, along with other satellite such as Landsat TM, Spot, Sentinel series and others.

A7.1.1 Construct the AO regional land use/cover remote sensing **product validation network**, and evaluate the existing global and regional land use/cover product's accuracy and quality.

A7.1.2 **Algorithm development for the Classification or change detection based on the DATA CUBE. Produce new time series of 30m AO regional land use/cover product.**

A7.1.3 Annual report on the land use/cover change to **evaluate the urban expansion and desertification of the AO region.**



Land Cover

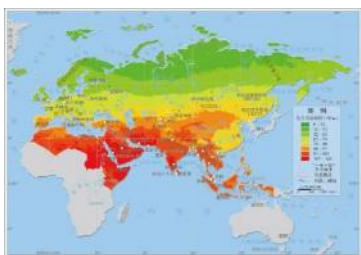
Subtask 7.2 Ecological Environment Monitoring for AO region: The ecosystem environmental change is one of the main restriction factors for the development of human society in the 21 century, to the sustainable. The forestry, agricultural and grass ecosystem have sensitive response and feedback to the climate change.

A7.2.1 Construct the AO regional ecosystem parameter remote sensing product validation network, and evaluate the existing product's accuracy and quality.

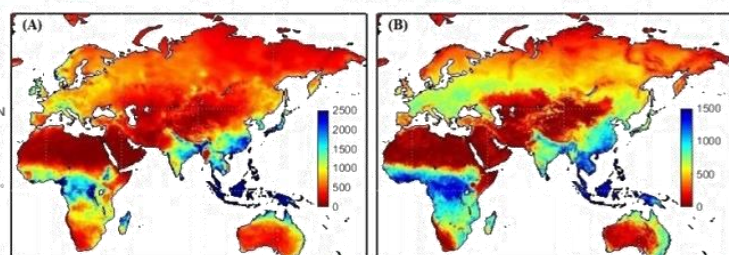
A7.2.2 Develop the ecosystem parameter retrieval algorithm (NDVI, EVI, LAI, FVC, FPAR, NPP, BIOMASS, and Phenology et al.,) for AO regional scale, based on the DATA CUBE.

A7.2.3 Building the ecosystem monitoring System, produce the 30m to 1km ecosystem environmental product integrating the USA, Chinese, Japanese and European satellites.

A7.2.4 Annual report on the ecosystem environmental condition and the ecosystem evaluation related with climate change for the AO region.

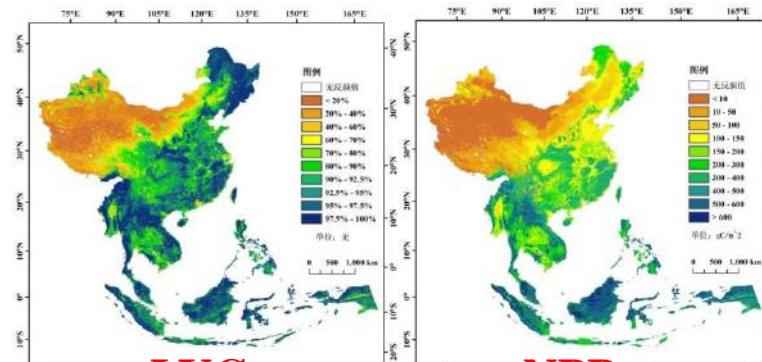


PAR



Precipitation

ET



LVC

NPP

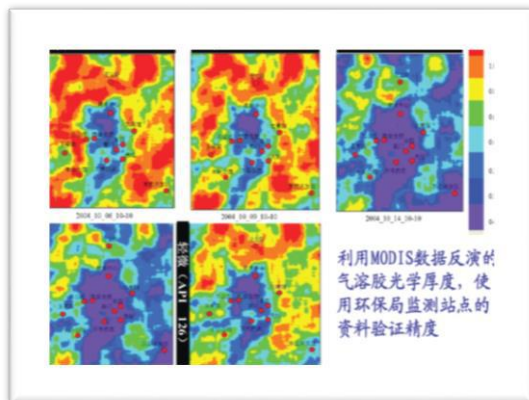
Subtask 7.3 Atmospheric Environment Monitoring for AO region: the Asian area faces serious Atmospheric environment problem: particulate matter (PM2.5, PM10), greenhouse gases and **noxious** gases (NO, SO). This task will monitor and evaluate Atmospheric environment quality and providing technology and data for the regional air quality monitoring and regional coordinated control, improving the prediction of air quality.

A7.3.1 Construct the AO regional **atmospheric parameter remote sensing product validation network**, and evaluate the existing global atmospheric product's accuracy and quality.

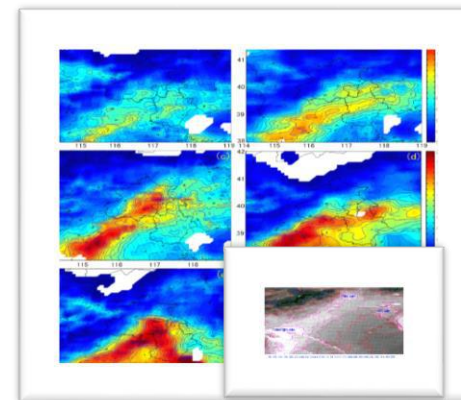
A7.3.2 Develop the atmospheric parameter (aerosol optical properties, particulate matter, greenhouse gases and trace gases et al.,) **remote sensing retrieval model**.

A7.3.3 **Building the Atmospheric environmental monitoring System** for Asia-Oceania region and produce the Atmospheric environmental product based on the multi-source remote sensing data.

A7.3.4 **Annual report** on the atmospheric environmental condition and the major air pollution event evaluation for the AO region.







PM



nitrogen oxides

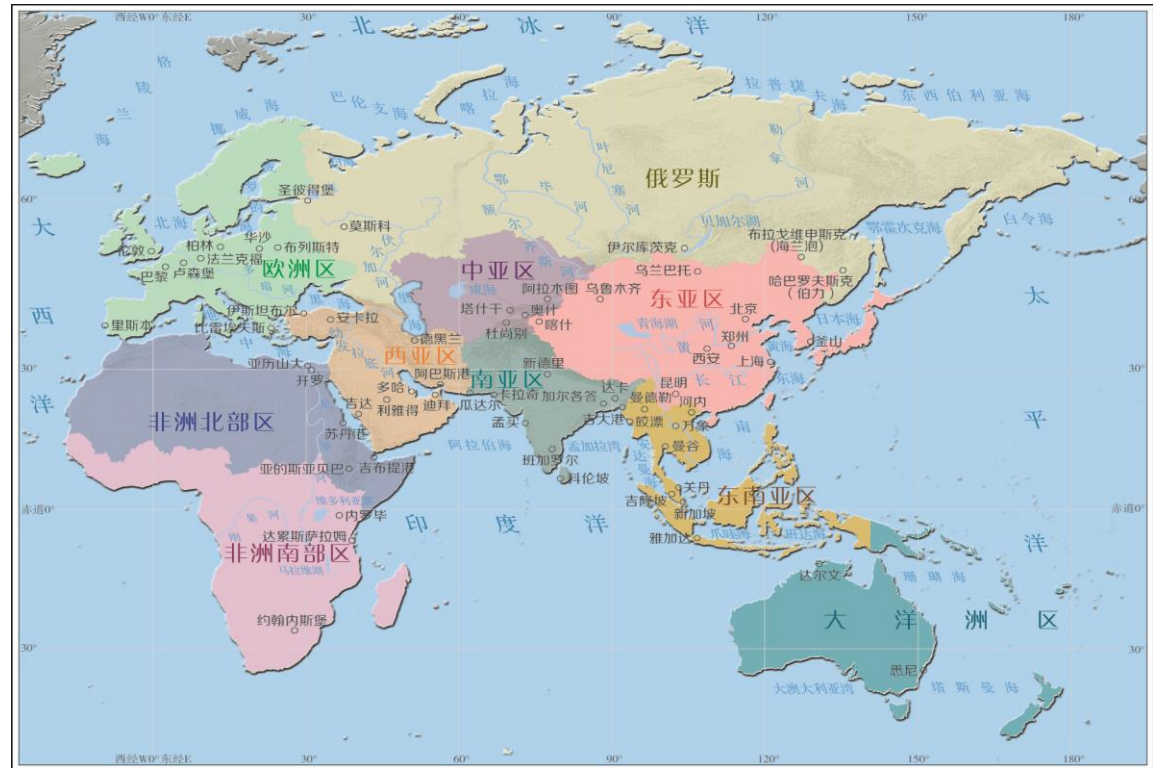
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2015, the base year of the ecological environment monitoring and evaluation to implement the UN sustainable development (SDG 2030), the condition of ecological environment must be make a comprehensive monitoring and evaluation.

The monitoring scope including:

- ✓ Asia
- ✓ Oceania
- ✓ Africa
- ✓ Europe
- ✓ Three oceans:
 - Pacific Ocean
 - Indian Ocean
 - Anlantic Ocean



Monitoring and evaluation content

Monitoring and evaluation content	Monitoring indicators(24 indicators)
Macrostructure and condition of terrestrial ecosystem	ecological system type, annual mean LAI, MFVC, forest biomass on the ground, light-warm-water production potential, light-warm-water stress factor, anomaly value
Important urban development and ecological environment	Night light index, impervious surface, heat island intensity, heat island ratio
Land traffic conditions	density of road network, Road capacity index, Road accessibility index
Solar resource status	total solar radiation and Solar power potential
Water balance	Precipitation, ET, water budget, precipitation anomaly
The situation of marine disasters in key areas	Catastrophic waves, sea level anomalies, typhoons

Data source and data collection

Remote sensing data source have been collected:

China Satellites: HJ-1A/B, GF-1/WFV, GF-1 Panchromatic Multispectral, FY-3/A/B/C- MERSI, FY2-E/F, CBERS-04/ Multispectral, CBERS-04/ Infrared Multispectral, CBERS-04/ Wide Field Imager, ZY-3;

Foreign Satellites: Landsat, MODIS, MTSAT2, MSG2/3, AVHRR, ENVISAT/MERIS;

Other Data Set:

Night lamplight remote sensing data

OpenStreetMap Route Data

DEM, Climate Zoning, Protected Area, Ecological Function Zoning

Meteorological Data:

Temperature Data, Precipitation Data;

Socio-economic data:

Population, Gross National Product

Production For Quantitative Remote Sensing Products

Global quantitative remote sensing products have been generated from 2010 to 2015.

Multi-source data

Synergized Quantitative

remote sensing production

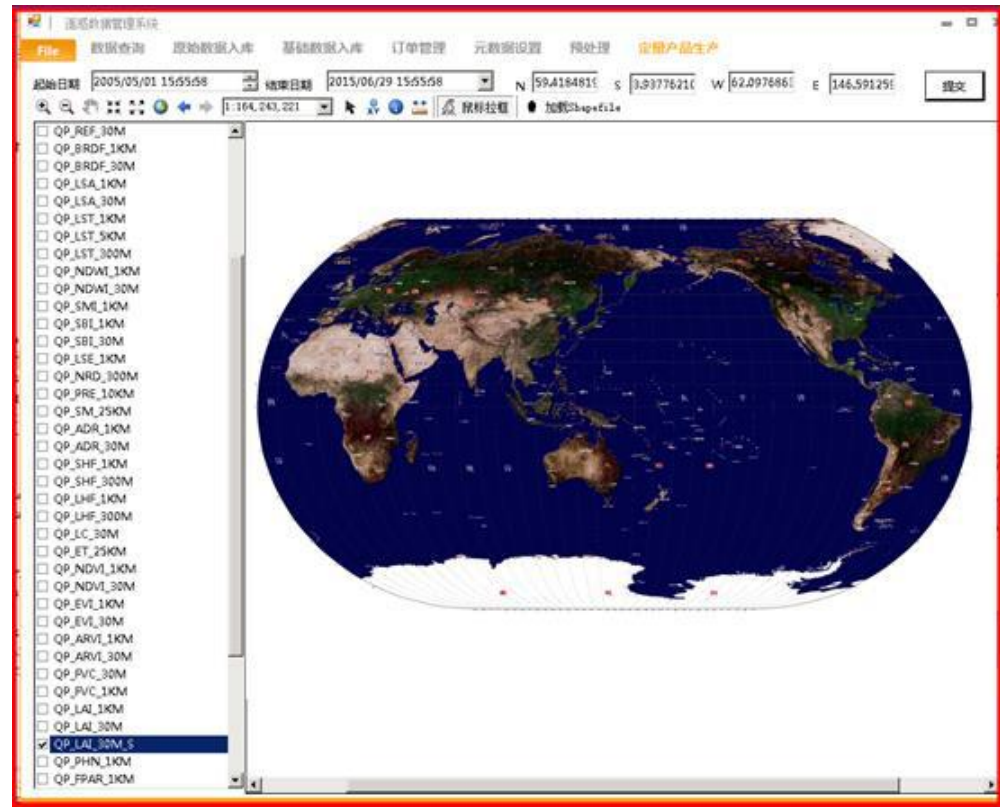
system (MuSyQ), which

has been developed by

RADI, cooperated with

different organization in

China.



Production For his spatial resolution Land Cover Products

Land Cover Types:

Forest Ecosystem Grassland Ecosystem

Farmland Ecosystem Aquatic Ecosystem

Urban Ecosystem Desert Ecosystem

methods:

Collecting land cover sample

drawing Land cover map

Cartographic data post-processing

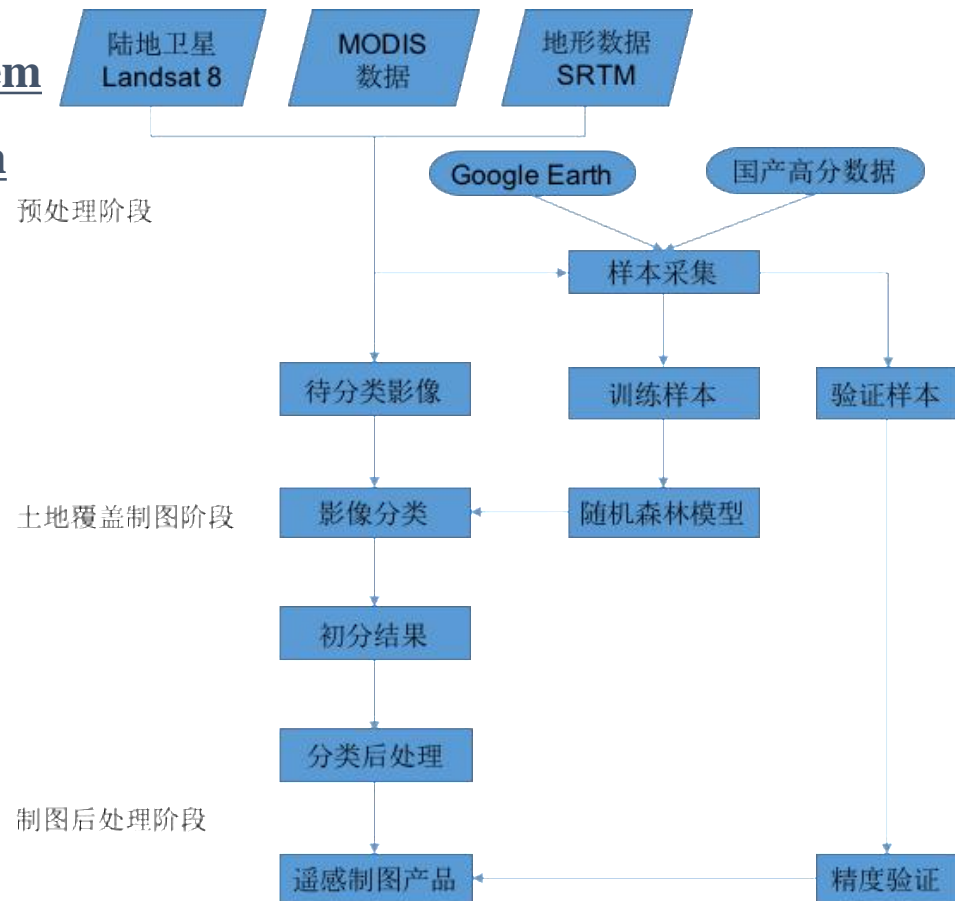
Differences with previous products

Spatial resolution: 30 meters

Time period: 2015

The classification system: UNFCCC vs FROM-GLC

Residential data: JRC GHSL 2014 vs GlobCover30 2010



Quantitative remote sensing product set

The report uses 12 quantitative remote sensing product data sets.

Product name	Spatial resolution	Time resolution	Time range	source	product superiority
LAI	1km	5 day	2010~2015	MuSyQ system RADI, CAS	Spatio-temporal resolution is higher, spatio-temporal continuity is better, space coverage is more complete,
FVC	1km	5 day	2010~2015		
Forest biomass on the ground	1km	1 year	2010,2015		
Total solar radiation	5km	1 year	2010,2015		
ET	1 km	1 day	2010~2015		
Water budget	1 km	1 day	2010~2015		
Road network density	1km		2016	Data calculation based on OpenStreetMap road network	Domestic satellite utilization and precision are higher
Urban heat island	1km	8 day	2010,2015	RADI, CAS	
Land cover	30m	1 year	2015	from the 30m land cover data set of Tsinghua University	
Catastrophic wave	25 km	1 year	2006~2016	The Second Marine Research Institute of the State Oceanic Administration	
typhoon disaster	25 km	1 year	2006~2016		
sea surface height anomaly	25 km	1 year	2006~2016		

Indicator calculation for ecosystem and environmental assesment

Based on the 12 quantitative remote sensing data sets, 24 monitoring indicators for the ecosystem and environmental assessment have been calculated.

● Anomaly

Anomaly, the difference between the vegetation characteristic parameters (such as the annual mean leaf area index, annual maximum vegetation coverage, illumination stress factor, temperature stress factor and water stress factor) and the average value of the vegetation characteristics of the years, is used to describe the spatial and temporal variability of vegetation growth. The average value of 2010 to 2015 was reported.

● Solar power potential $Bias = Temp_n - \frac{\sum_{i=1}^n Temp_i}{n}$

- Power generation potential (G_i) estimation model(Wang et al,2010), Considering energy status, road network distribution, distance from town, population and other factors.

$$G_i = I_i h A_i$$

$$A_i = \sum_{j=1}^{L_i} \pi_j A_j^{T_i}$$

I, irradiance; h, Illumination hours; A, area of solar energy available; adaptability factor of land use type; Refe^{ring} to the area of type j and use type in the i grid data; L_i , Number of land use types

Results includes:

- Land cover monitoring and land use analysis for AO region
- Solar energy resources monitoring, give a reasonable **suggestion for the site selection of solar power generation**, provide decision-making basis for government
- Regional water balance analysis and dynamic change monitoring, give an **assessment about drought and flood for different rivers**
- Vegetation ecosystem evaluation, **monitor the interference factors** for its dynamic changes;
- The typical urban environment analysis, urban **heat island effect** evaluation and its development potential;
- Marine disasters monitoring, give suggestions and comments for **the safety of sea routes**;
- **Build up a comprehensive index** for ecological environment monitoring and evaluation based on remote sensing.

Main contents of the report

1.Preface

1.1Background and Significance

1.2Monitor scope and Content

2.The situation of the terrestrial ecosystem of the region

2.1The macro-structure of the ecosystem

2.2Ecosystem vegetation production potential and ecosystem coercion

2.3The status and characteristics of the main vegetation ecosystem

2.4Regional vegetation ecosystem status and change

3. important urban development and ecological environment status

3.1Overview of geographical environment of urban areas

3.2The status and characteristics of land use in urban areas

3.3Urban area development status

3.4The condition of urban heat island

4. land traffic condition of the area

4.1Regional road network density distribution

4.2Regional road capacity

4.3The Highway accessibility of the economic corridor

4.4The effect of road on landscape pattern

Monitor Content and Report Outline

5.Solar energy resources condition of the area

5.1The spatial and temporal distribution of total solar radiation

5.2Solar power generation potential and development status

6.the situation of water budget

6.1 The spatial and temporal distribution of water budget in 2015

6.2The impact of el Niño events on regional water budget in 2015

7.The situation of Marine disasters in key areas

7.1Cooperative construction at sea and Marine disasters

7.2 Spatial distribution and temporal variation of catastrophic waves

7.3 The spatial distribution and temporal variation of sea surface height anomaly





7.4 The spatial and temporal variation of the location of typhoon center

8.Conclusions and Suggestions

8.1 Conclusions

8.2 Suggestions

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Call for Participation

The Global Ecosystems and Environment Observation: Annual Report from China (GEOARC 2017) and the related data set will be officially released in October, during the GEO 2017 annual conference in Washington DC.

There are 3 sub group in WG7:

- **WG7-1 Land Cover/Use**
- **WG7-2 Ecosystem Monitoring**
- **WG7-3 Atmospheric Environment Monitoring**

AOGEOSS WG 7 welcome all participants in AO GEOSS.

Participants(till Dec. 2016) :

➤ **GEO Members and countries in AO region (12)**

Australia, Bangladesh, China, India, Japan, Korea, Laos, Mongolia, Myanmar , Nepal, Pakistan; Vietnam.

➤ **POs and other societies(13):**

UNEP-IEMP, UNESCO-HIST, WMO, UNESCAP, CEOS, ICSU/Future Earth, ICSU/IRDR, ICIMOD, POGO, ISDE, ISPRS, GRSS, APSCO.

AOGEOSS WG 7 will also welcome all countries in AO region

Thank you very much!

