28-30 September 2022

15th AOGEO SYMPOSIUM

Himalayan IPS Session of the 5th AOGEO Workshop & Research and Cooperation Progresses

Dr. Shanlong Lu

Aerospace Information Research Institute, CAS

International Research Center of Big Data for SDGs (CBAS)

Part I: Himalayan IPS Session of the 5th AOGEO Workshop

Session I: Himalayan Regions Click here to join us — **Thursday, June 16, 2022**

Description

Affected by global climate change and human activities, the Hindu Kush Himalayan region is facing sustainable development challenges such as high poverty rate, insufficient food and nutrition, overexploitation of natural resources, disordered economic development, and increased risks of natural disasters (floods, ice avalanches, landslides, etc.). It is urgent to reduce disaster risks, mitigate and adapt to climate change through cooperation among countries, countries and regions or organizations in the region. Earth observation technologies such as satellite and aerial remote sensing, and floating in situ observations play a unique role in monitoring regional natural resources and ecological environment, and tracking the progress of the sustainable development goals.

In this session, representatives from different countries in the region will share the progress, problems and trends of monitoring and assessment of water resources, agriculture, ecological environment, and disasters etc. by using earth observation technologies, and form a framework and mechanism for closer cooperation in the future through exchange and discussion.

Moderator(s)

Speaker(s)

Shanlong LU
Aerospace Information Research Institute, Chinese Academy of Sciences.

Birendra Bajracharya
International Centre for Integrated Mountain Development (ICIMOD)

Jianchen SHI
National Space Science Center, CAS

AKM Saiful Islam
Institute of Water and Flood Management (IWFM), Bangladesh University of Engineering and Technology (BUET)

Jinghui FAN
China Aero Geophysical Survey and Remote Sensing Center for Natural Resources (AGRS), China Geological Survey

China
Nepal
Bangladesh
Pakistan

8 speakers

20+ participants

Agenda

- Brief opening remarks by **Xiang Zhou**(AIRCAS)
- EO applications for risk reduction and resilience in the HKH, **Birendra Bajracharya** (ICIMOD). PDF video
- Satellite Observations for Energy and Water Cycle over Tibet, **Jiancheng Shi** (NSSC, CAS). PDF video
- Flood Hazard Mapping of the North-central Bangladesh using Sentinel Satellite Images, **AKM Saiful Islam** (BUET). PDF video
- Progress on the cooperation research of monitoring technologies for the snow, glaciers and geohazards in High Mountain Asia and Arctic. **Jinghui Fan** (AGRS). PDF video
- EO for SDGs monitoring and assessment in HKH, **Shanlong Lu** (AIRCAS). PDF video
- Statements and comments from the session participants (China, Nepal, Pakistan, Bangladesh, etc.)

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EO applications for risk reduction and resilience in the HKH

Birendra Bajracharya
ICIMOD

Content

- Brief background on the Himalaya region
- Examples of EO applications relevant to risk reduction
- Key issues/challenges and way forward for IPS

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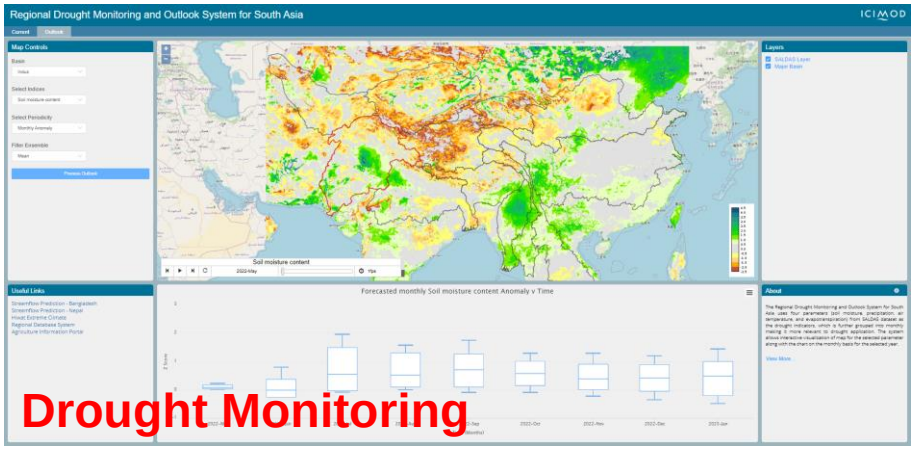

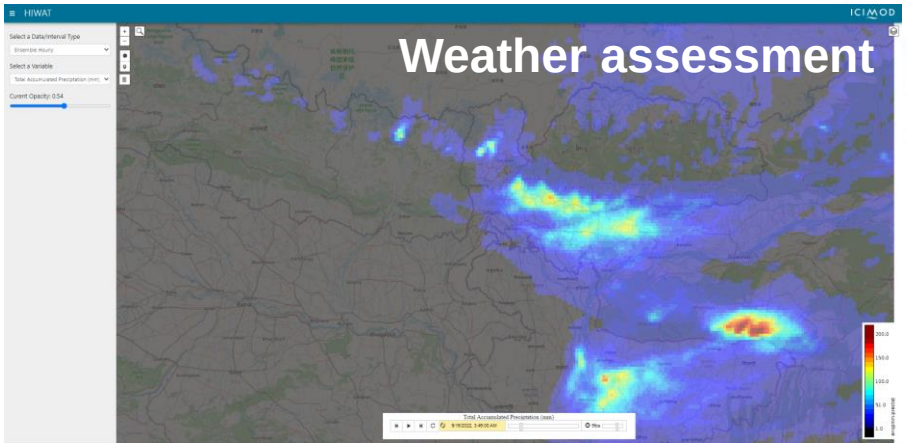

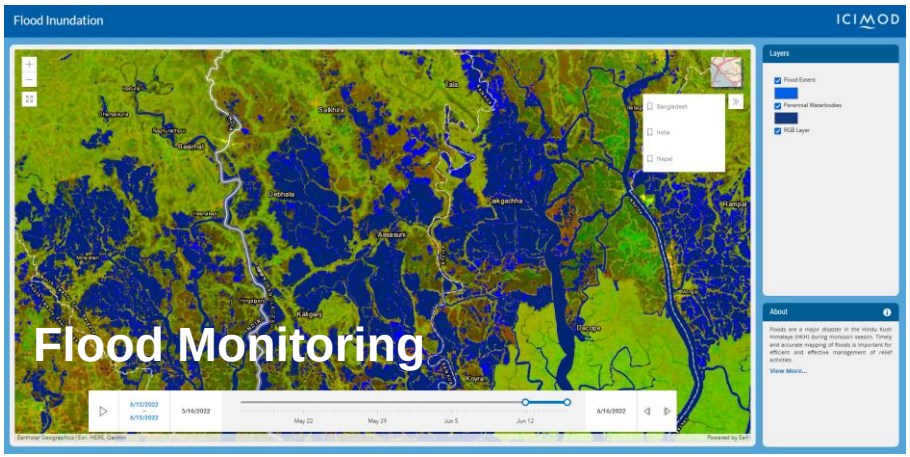

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Issues and challenges

- EO data and models are getting better, risk communication is still a big challenge
- Limited capacity of key agencies to uptake the emerging information systems
- Need for improving coordination within the countries at different levels and regional collaboration
- AOGEO IPS should have a clear framework and pathway

Way forward

- AOGEO IPS to find ways for better promotion of regional EO resources
- Resource mobilization strategy to facilitate IPS project grants and attract institutions from the region
- Visioning the future of digital innovations and EO applications
- Collaborate with other GEO/AOGEO efforts on capacity building and application development
- Reaching out beyond the GEO member community

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Satellite Observations for Water Cycle Parameters over Tibet

Jiancheng Shi
NSSC/CAS

Content

- MOST funded the Second Expedition Project in Tibet
- Examples of the project results
- Summary

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Objective

To Improve observational and modelling abilities of the spatio-temporal distributions of energy & water cycle for our understanding the system characteristics and rules in the Asian Water Tower changes

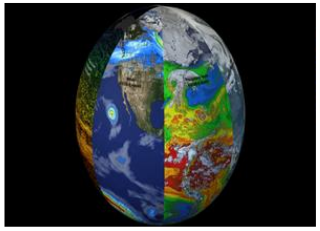
Joint Satellite Observation System

Model Improvement

System for Regional High-resolution Atmospheric forcing

Task-1

Task-3



Task-2

Combined Surface&ground water Hydrological Modeling and Assimilation System

Outcomes

15 datasets of remotely-sensed energy & water cycle key components over 20 years to study and support the objectives and model improvement & validation

Regional high-resolution atmospheric and near-surface reanalysis datasets (30 years, 9 km&3km, per hour) to support hydrological modeling at watershed scales.

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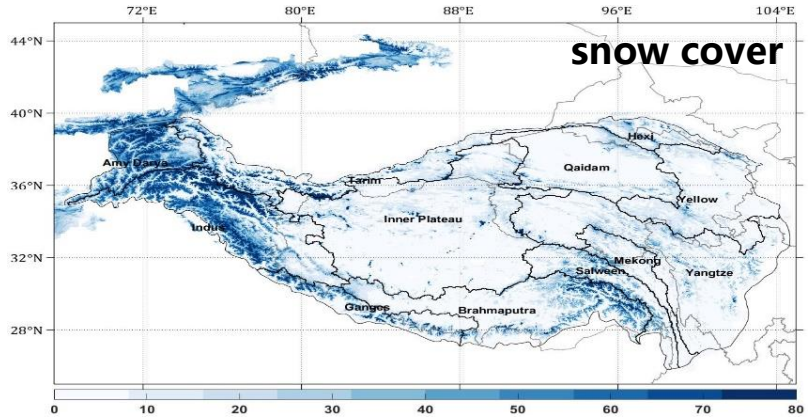

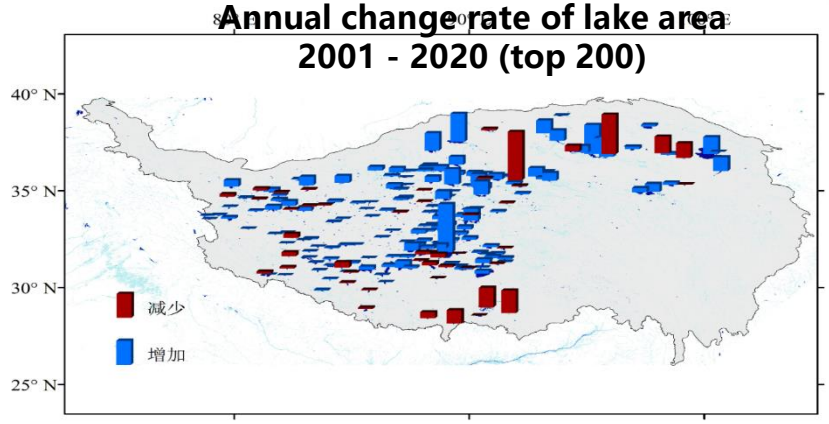

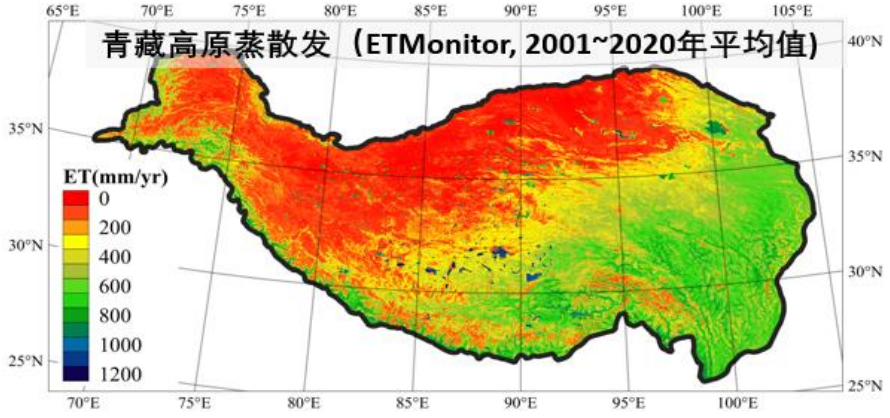

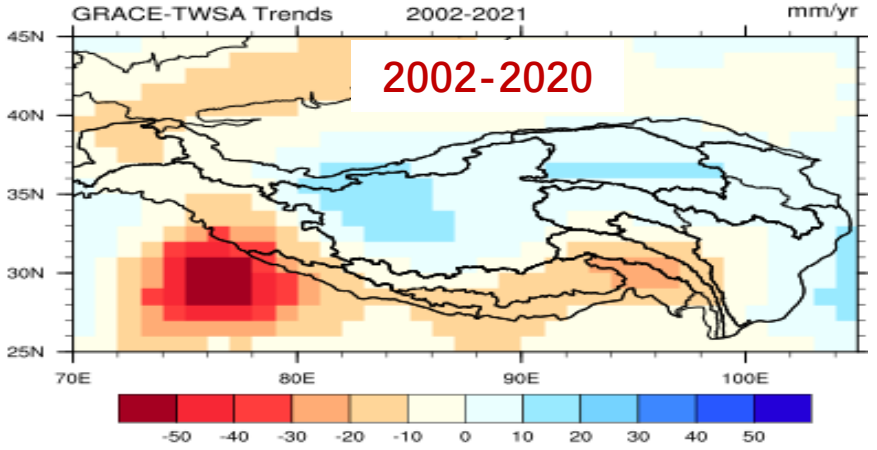

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Parameters	Outcome
Cloud and micro-structure	Spatial & temporal distribution of clouds
Land surface downwelling longwave & shortwave radiation	Spatial & temporal distribution of radiation budget
LST/emissivity	Fine-resolution LST and emissivity
Albedo	Daily, monthly and yearly albedo change
Water vapor	Long-term WV change trend and sources
Soil moisture	Long-term SM change trend
Soil freeze-thaw	Long-term FT and climate relation
Snow cover fraction	Distributions and long-term trend of SCF
SD/SWE	Distribution and long-term trend of SD/SWE
Water dynamic changes	TP lake change trend
Evapotranspiration	ET long-term trend
Land water storage	Long-term LWS trend

Summary

(1) We have generated these 15 energy & water cycle key components to support high resolution models and validations and improvements, from which 8 datasets are already available at https://data.tpdc.ac.cn/zh-hans;

(2) The initial analyses have shown the satellite observations play an important role in studies of the effects of climatic change on the surface water cycle properties over Tibet;

(3) The synergies of satellite observations and Earth system models will provide a new opportunity to increase our understanding on the impacts of Global change over Tibet and the applications in water resource management, ecosystems, and hydrological extreme predictions.

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Flood Hazard Mapping of the North-central Bangladesh using Sentinel Satellite Images

A.K.M. Saiful Islam
BUET

Content

- Background of Floods in Brahmaputra River
- Flood mapping method with SAR images
- Mapping platform and results

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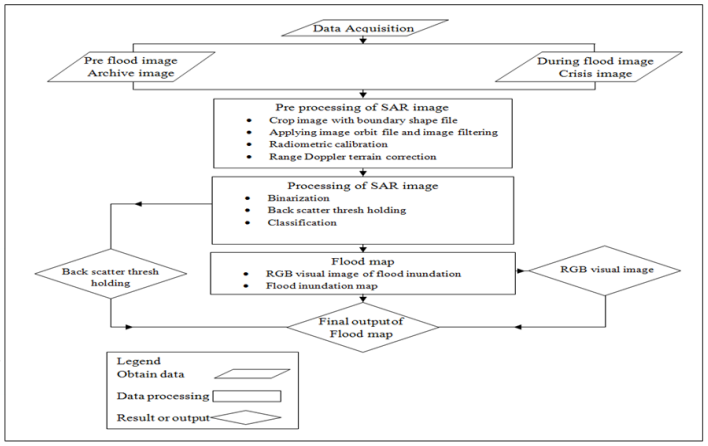
Methodology

Data Acquisition
- Achieve Image
- Crisis Image

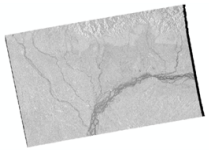
Pre-processing SAR Image
- Crop image with boundary shape file
- Applying image orbit file and image filtering
- Radiometric calibration
- Range-Doppler terrain correction

Processing of SAR Image
- Binarization
- Backscatter thresholding
- Classification (Unsupervised)

Final output
- Visualization of RGB flood image
- Final flood inventory map

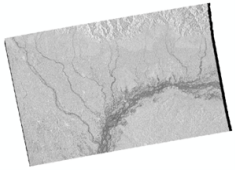


Archive Image – In Dry Image



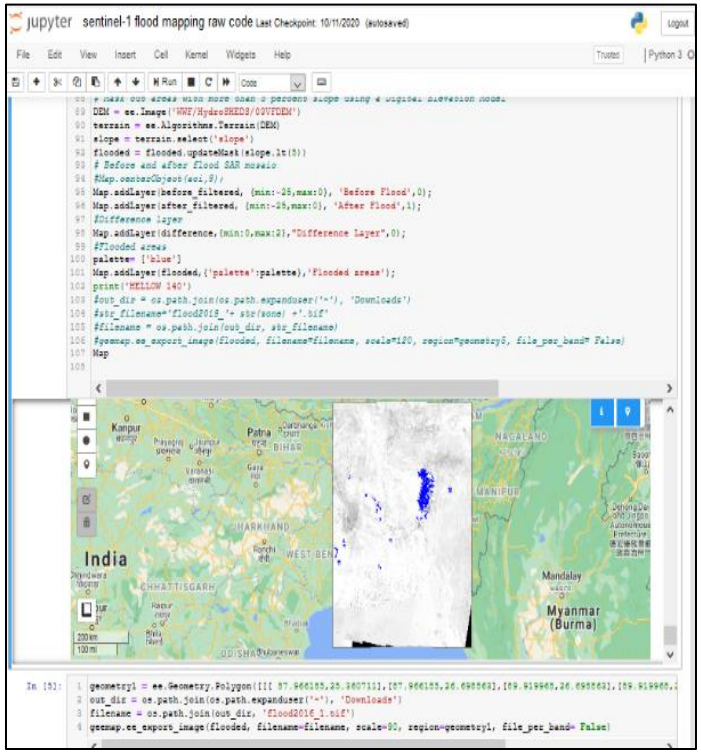
31 March 2017

Crisis Image – During Flood



22 August 2017

GEE platform



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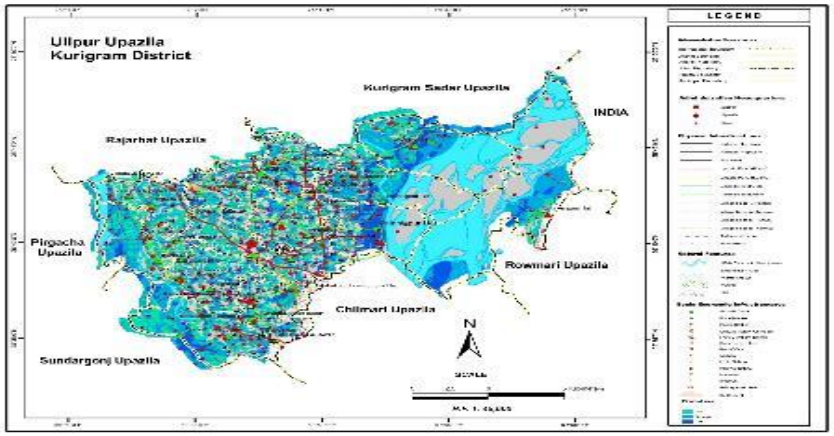

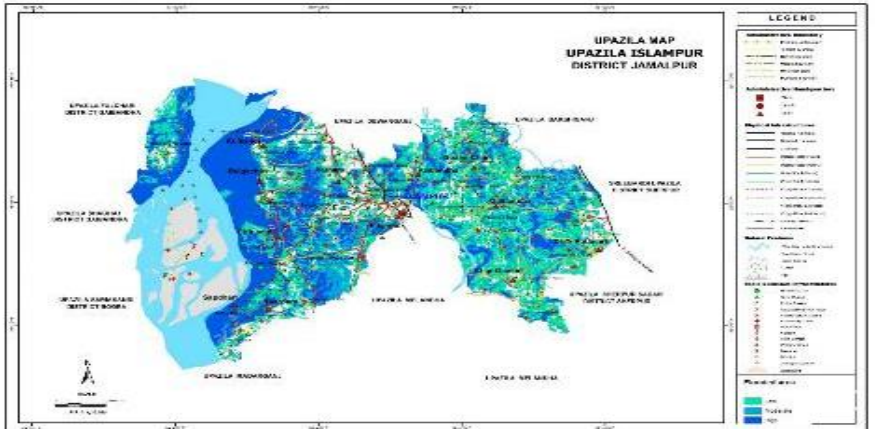

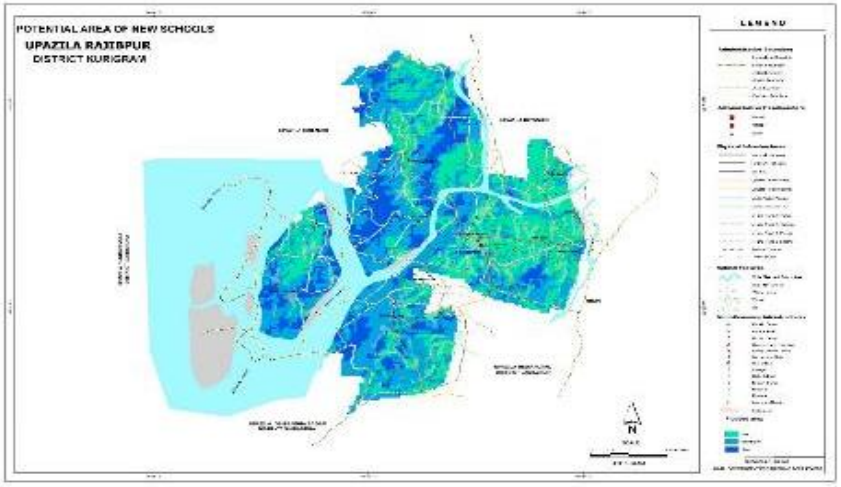

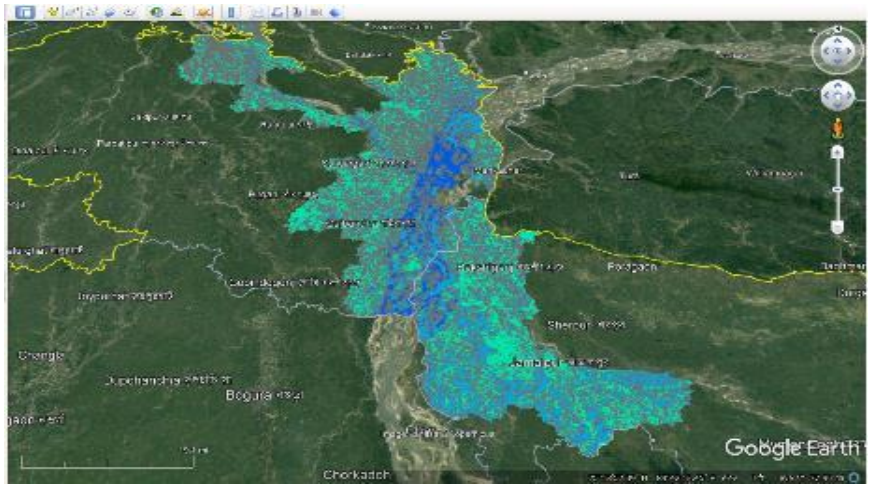

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Monitoring the snow, glaciers and geohazards in High Mountain Asia (HMA) and Arctic

Jinghui Fan
AGRS

Content

- MOST funded project introduction
- Research progresses
- Participating in GEO activities

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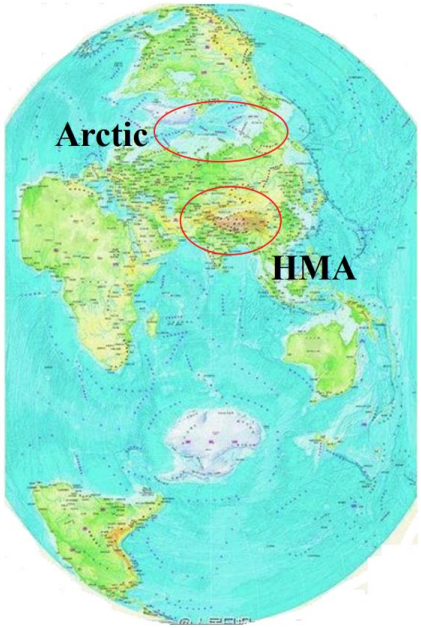
Research region, content, and goals



Snow:
- snow cover
- snow water equivalent

Glaciers:
- boundary
- surface flow
- elevation change
- thickness

Geohazards:
- ground deformation
- boundary

SDGs 2030
SDG6, 13, 9, 15, 11

P1 P2
UN World Conference on Disaster Risk Reduction
14-18 March 2015, Sendai, Japan

Water Resources Management
GEO水资源管理SBA

Biodiversity and Ecosystem Sustainability
GEO生物多样性和生态系统可持续SBA

Infrastructure and Transport Management
GEO基础设施与交通管理SBA

It is supported by National Key R&D Program of China

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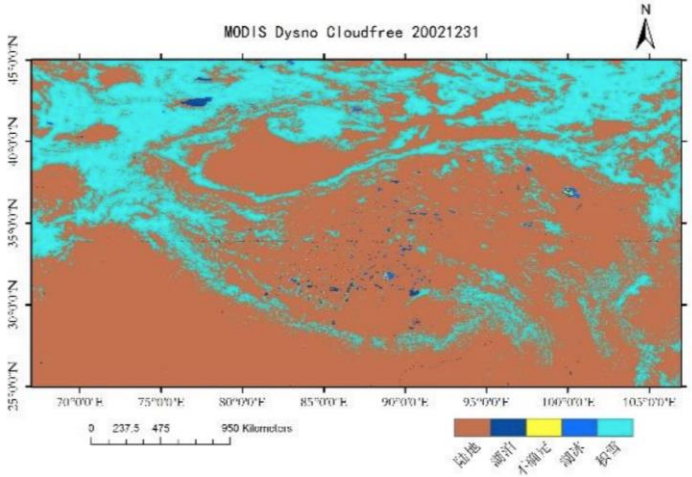

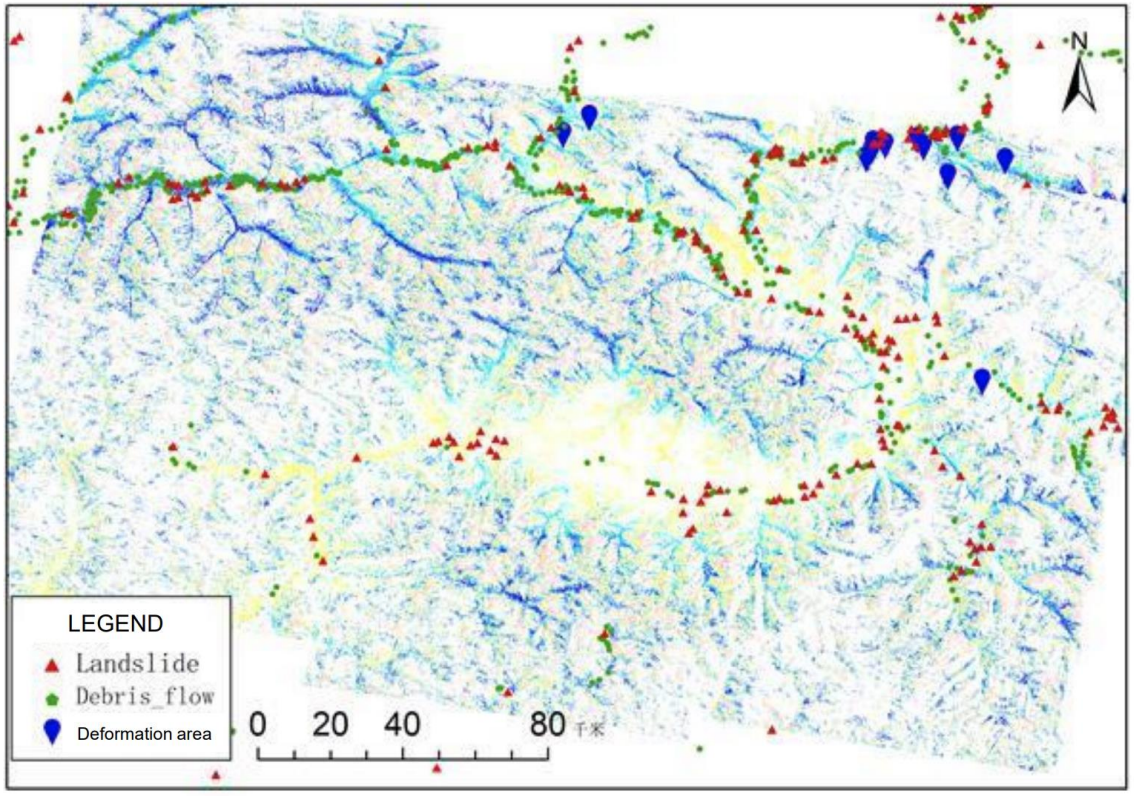

the preliminary ground deformation monitoring result in in Gilgit, Pakistan

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- **Launched** a new GEO pilot initiative "WP23_25: Global Mining Deformation Observation Initiative" (submitted, under review)

  Ground deformation monitoring and application in mining areas

- Participated in new GEO pilot initiative "WP23_25: GEO Cold Regions Initiative"

  Glaciers monitoring and application in cold regions

  Geohazards monitoring and application in cold regions

Part I: Himalayan IPS Session of the 5th AOGEO Workshop

EO for SDGs monitoring and assessment in HKH

Shanlong Lu
AIRCAS/CBAS

Content

- MOST funded SDG Project in HKH region
- Joint field observation plan
- Future cooperations

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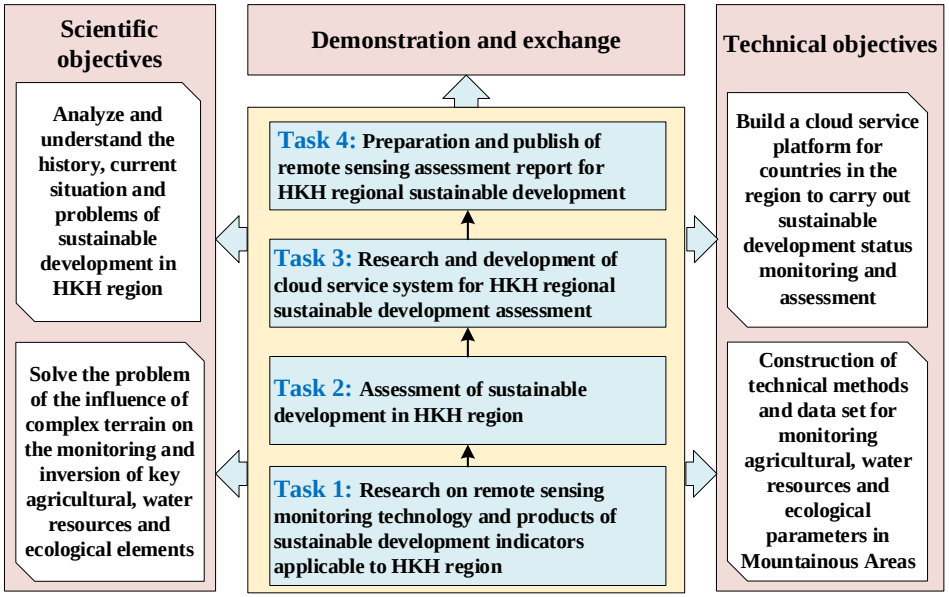
Remote sensing assessment and capacity building of sustainable development in Hindu Kush Himalaya region

Main contents



Expect outcomes

(1) Date sets

The crop distribution and yield data set, surface distribution and water quality data set, forest and grass distribution and coverage data set in Hindu Kush Himalayan region (2000, 2010, and 2020, 30m).

(2) System platform

National scale sustainable development monitoring and evaluation cloud service system.

(3) Scientific report

Remote sensing assessment report on sustainable development of agriculture, water resources and ecological environment in Hindu Kush Himalayan region（2000-2020）

(4) Academic seminar

Organize 2 symposiums on earth observation technology for regional sustainable development.

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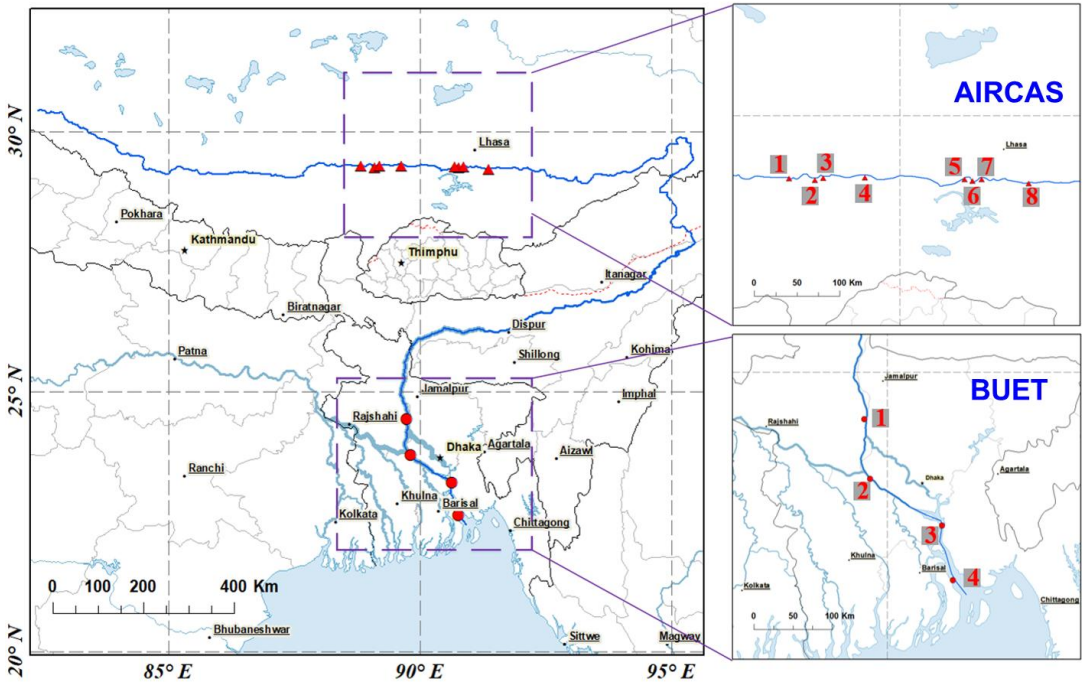
Joint observation

The water clarity and river topography observation on Brahmaputra/Jamuna River.

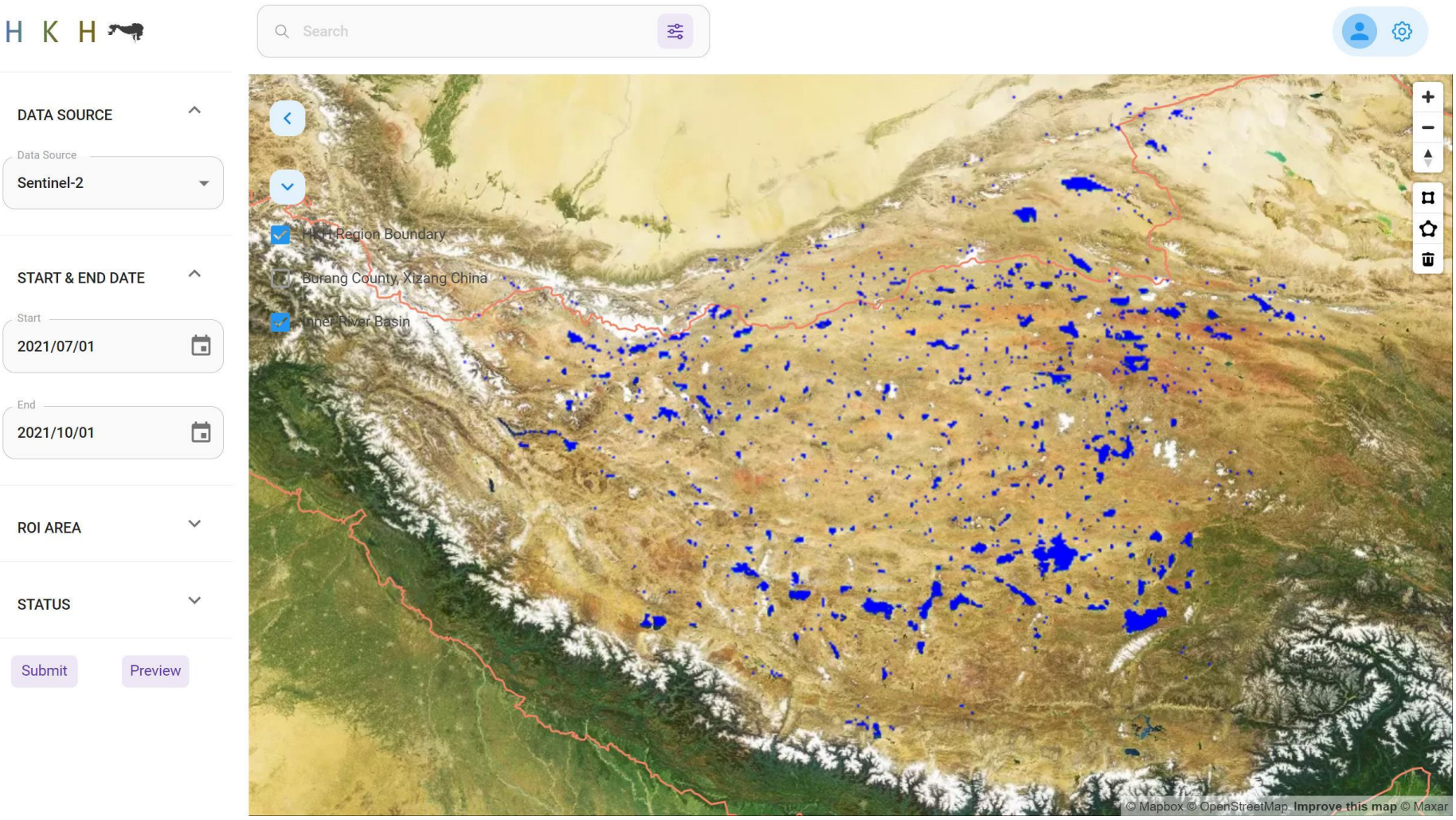


Future cooperation

- Joint field observation **(Indus River).**
- Joint project application (UNEP, MOST, NSFC, ANSO, CBAS, etc.).
- Jointly host regional academic exchange seminar.

Part II: Research and Cooperation Progresses

Automatic lake extraction in HKH Cloud Computing Service Platform

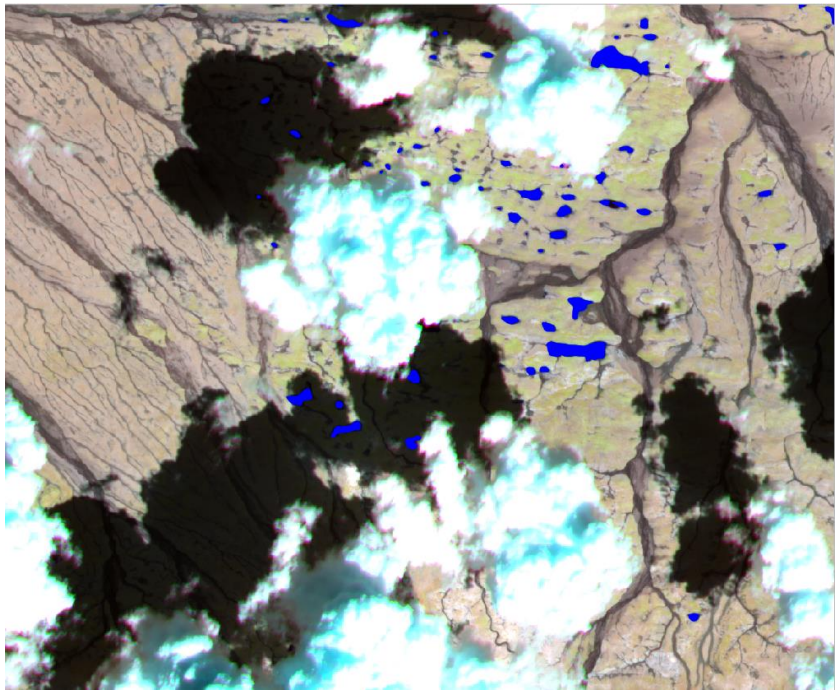


Part II: Research and Cooperation Progresses

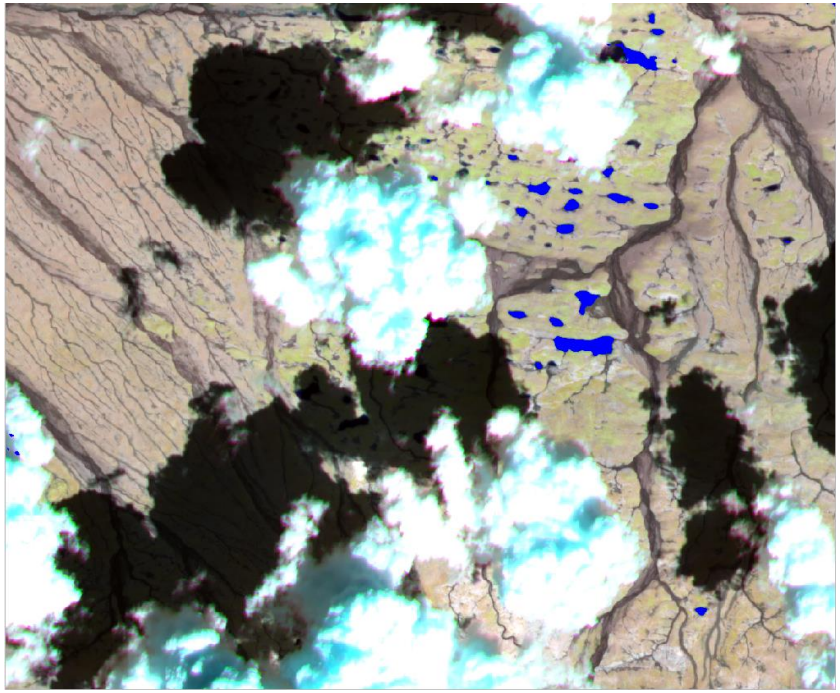
The result of lake extraction

The experimental results over the validation set can achieve an Accuracy of 0.9970, Precision of 0.9878, Recall of 0.9784, IoU of 0.9667, and Kappa of 0.9814. When the proportion of cloud shadows reaches 4%, the model can **fully learn the difference between cloud shadows and lakes.**

Ground Truth



The result of the model trained by training dataset with 4% cloud shadows

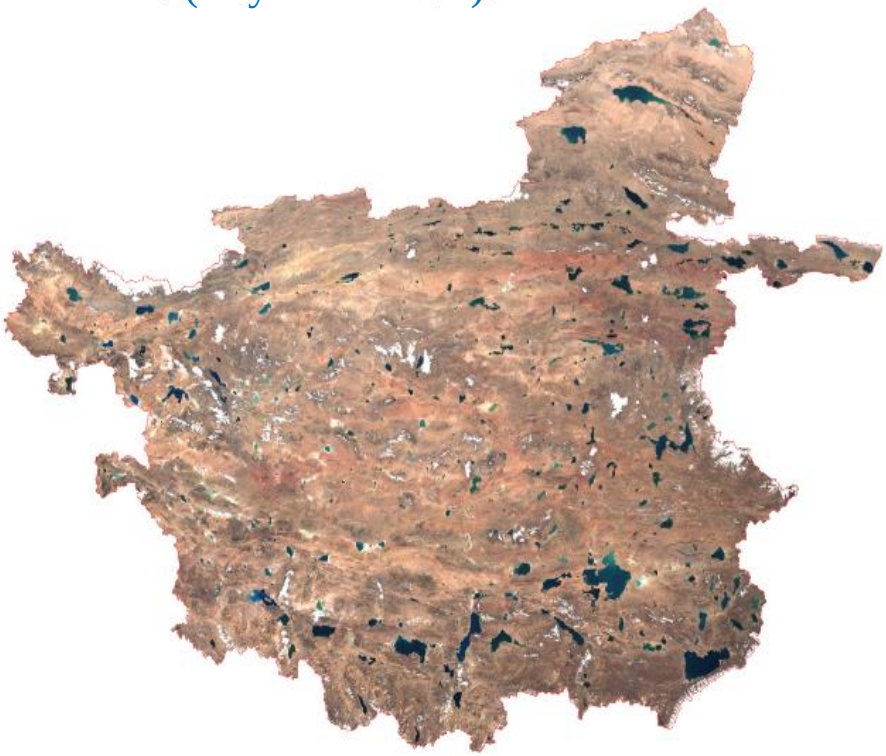


Part II: Research and Cooperation Progresses

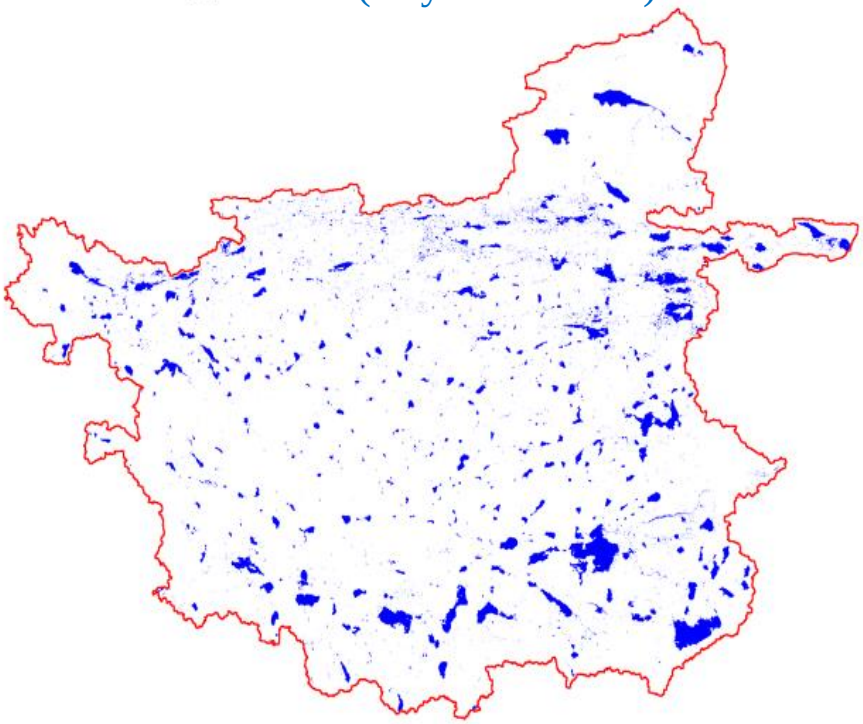
Application in the Inner River Basin of Tibetan Plateau

The model is applied to the Inner River Basin of the Tibetan Plateau. The result shows that the model can automatically extract lakes for a large region. It indicates that the model have strong generalization ability.

Sentinel-2 images of the Inner River Basin (July – Oct 2021)

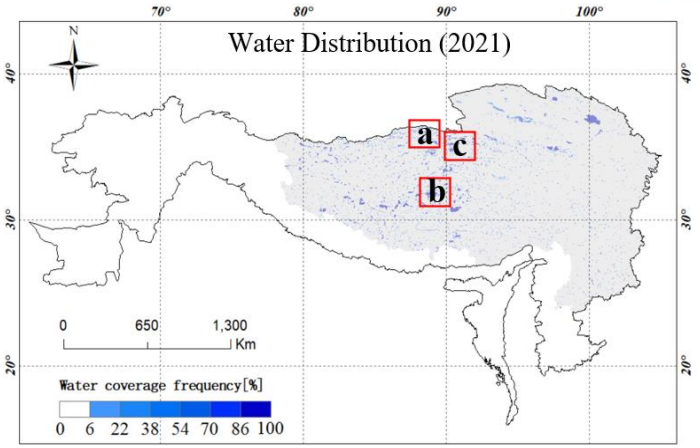


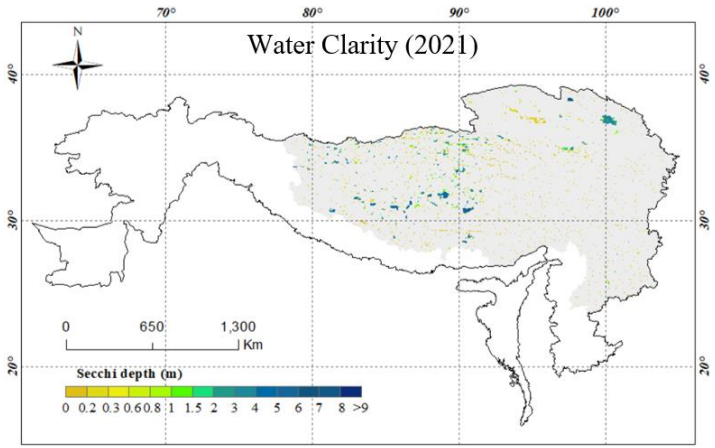
The result of lake extraction in the Inner River Basin Basin (July – Oct 2021)



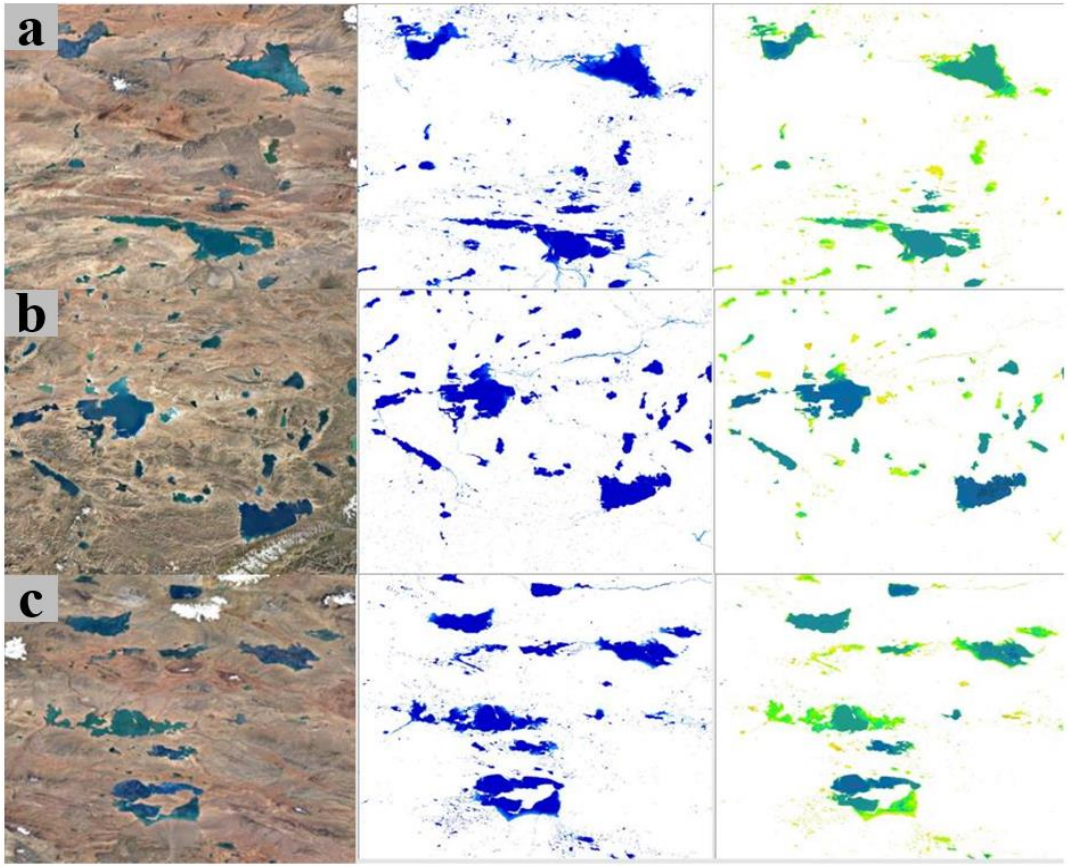
Part II: Research and Cooperation Progresses

■ Water clarity monitoring





RGB water water clarity



Part II: Further Research and Cooperation Progresses

INTERNATIONAL RESEARCH CENTER OF BIG DATA
FOR SUSTAINABLE DEVELOPMENT GOALS
可持续发展大数据国际研究中心

ICIMOD

Call for Global SDG Partnership (2022-2023)

International Centre for integrated Mountain Development (ICIMOD)

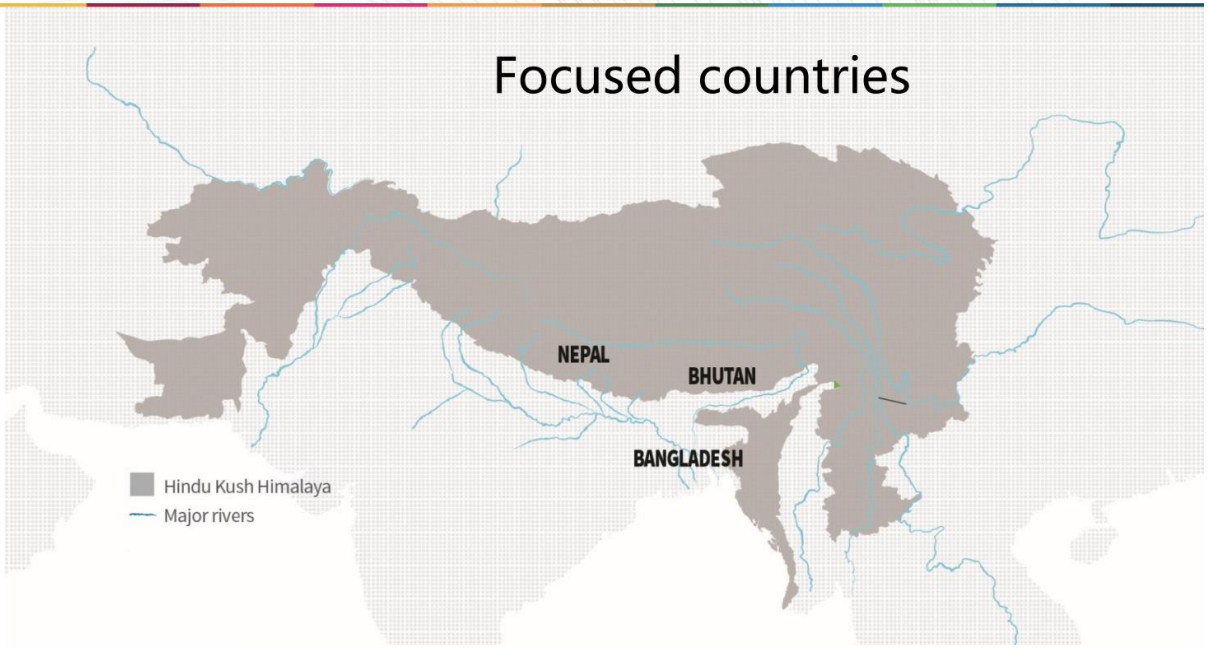
Generating and sharing data on “SDG 15 - Life on Land” in the HKH

Part II: Further Research and Cooperation Progresses

Generating and sharing data on "SDG 15 - Life on Land" in the HKH

The project will consist of four main components

1. User consultations
2. Dataset generation
3. Development of a digital platform
4. Capacity building



Key agencies

- Bangladesh Forest Department, Bangladesh
- Ministry of Agriculture and Forest, Bhutan
- Forest Research and Training Centre, Nepal

Thanks for your attention!

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