

Sudip Pradhan  
3 June 2025

# Bridging data gaps for addressing climate and environmental risks in the HKH





10 major Asian  
river systems

THE THIRD POLE

Third largest  
ice mass



4 of 36 global biodiversity  
hotspots and 330  
Important Bird and  
Biodiversity Areas

# The Hindu Kush Himalaya



# International Centre for Integrated Mountain Development (ICIMOD)

Established in 1983 under UNESCO Charter, a regional mountain knowledge, learning, and enabling centre devoted to sustainable mountain development for mountains and people in the Hindu Kush Himalaya



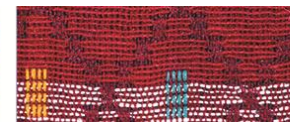
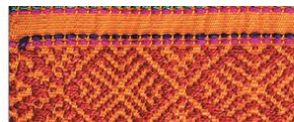


# Strategy 2030: Moving Mountains

Reducing  
Climate and  
Environment  
Risks

Shaping  
Green  
Mountain  
Economies

Enabling Regional and  
Global Mechanisms for  
Sustainable Mountain  
Development





# RS/GIS applications in the HKH region

ICIMOD has been the pioneer institution on GIS and RS applications focusing on mountain environments

## Pathways to promote evidence-based decision making:

- Capacity building
- Data access and customized solutions
- Regional/Global collaboration for innovations

1990–2000

Introduction of GIS/RS to  
RMC institutions

2000–2010

Transition to Internet-based  
Applications and DSS,  
Mountain GeoPortal

2010–2020

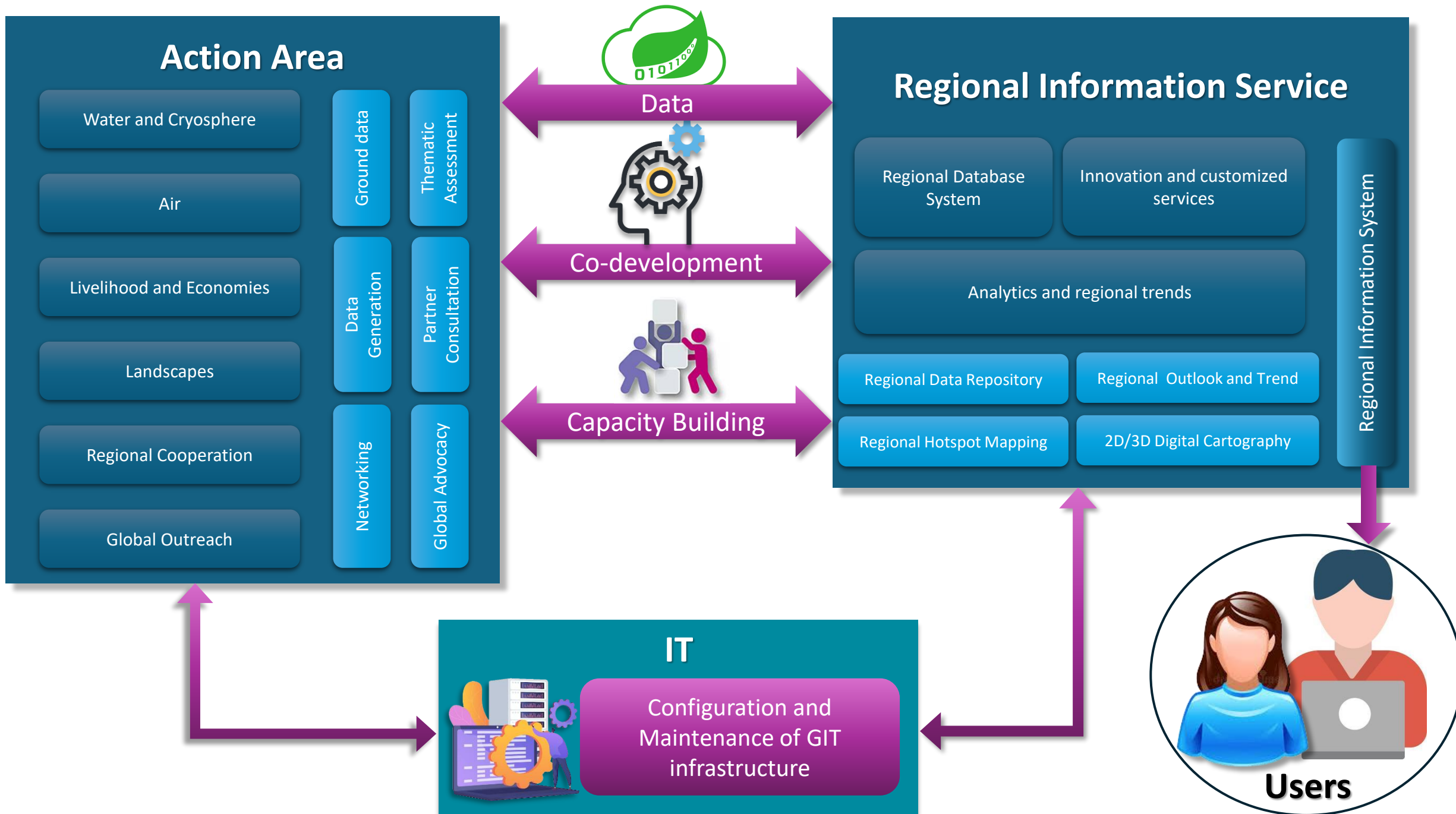
Transformation from  
Applications to Services,  
SERVIR as the main driver  
of GIT

2020–2030

Converging digital  
innovations,  
institutionalization of GIT

ICIMOD is a Participating Member of GEO and collaborated  
with AIRCAS on AOGE0 Regional Centre for Capacity  
Development







# Regional Database System

promoting data access and sharing in the HKH

ICI<sup>MOD</sup>

HomeData ExplorerInundation DataAboutFAQsLogin

Regional Database System

A one-stop data portal for the Hindu Kush Himalaya

SearchAdvanced Search

Latest Datasets

STATUS OF SPRINGS IN SEVEN MUNICIPALITIES OF KAVLE, NEPAL

IMPROVED 8-DAY VERSION 6.1 TERRA-AQUA MODIS CLOUD-FREE SNOW COVER AND BRASSHUP GLACIER INVENTORY 6.0 PRODUCT FOR HIGH-MOUNTAIN ASIA BETWEEN 2002 AND 2022

INVENTORY OF VISUALIZED HYDROPOWER PLANTS IN THE UPPER INDUS BASIN

Data from the Region

ET-PODC

National Tibetan Plateau Data Center  
World Pole Environment Data Center  
TIBETAN PLATEAU DATA CENTER

Inundation Data Download Tool

LAUNCH

Useful Link

APNODS/ET-PODC Water Resources

DATA EXPLORER

CORRECTOR

GEOSPATIAL

ICI<sup>MOD</sup>

HomeData ExplorerClimate DataAboutFAQsLogin

Regional Database System

SearchAdvanced Search

Filters

Keywords

Nepal (32)

Environment (28)

Land Cover (26)

Land use (24)

Geoscientific Information (22)

servircat (22)

Icimod-servir (22)

Land cover (20)

Pakistan (18)

Bhutan (13)

Central Karakoram National Park (12)

CKNP (12)

Land Cover Classification (11)

India (10)

Biodiversity (8)

72 Record(s) found

Land cover of HKH region

Land cover change is a significant contributor to environmental change. The degradation of forests and conversion of natural areas, forests, and farmlands to other land use Impact ecosystem services

DOWNLOAD

Land cover of Afghanistan

The annual land cover data of Afghanistan (2000-2018) have been created through the National Land Cover Monitoring System (NLCMS) for Afghanistan. The system uses freely available remote-sensing data.

DOWNLOAD

Land cover of Nepal

The annual land cover data of Nepal (2000-2019) have been created through the National Land Cover Monitoring System (NLCMS) for Nepal. The system uses freely available remote-sensing data (Landsat) a..

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Land Cover of Pakistan 1990

Land cover data of Hindu Kush Himalayan region of Pakistan for 1990. This dataset is created using the Landsat 30 meter spatial resolution satellite image of 1990.

DOWNLOAD

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Regional Database System

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Land cover of HKH region

UPDATED DATE: 4/19/2025 4:24:56 PM

DOWNLOAD

Land cover change is a significant contributor to environmental change. The degradation of forests and conversion of natural areas, forests, and farmlands to other land use Impact ecosystem services and biodiversity significantly. Using multiple methodologies and input data sources, national agencies in different countries of the Hindu Kush Himalayan region have conducted land cover mapping at various times. Due to the differences in classification schema, methodologies, and input data sources used, currently available land cover data is not suitable for analysis of land cover changes over time. ICIMOD collaborated with SERVIR-Himalaya, Asian Disaster Preparedness Center (ADPC), Afghanistan's Ministry of Agriculture, Irrigation and Livestock, Bangladesh's Forest Department, Nepal's Forest Research and Training Centre, Myanmar's Forest Department, Shauarben, the Global Land Analysis and Discovery (GLAD) laboratory at the University of Maryland, and the United States Forest Service to develop the Regional Land Cover Monitoring System (RLCMS) for the HKH region. The system uses state-of-the-art remote sensing science and technology on the Google Earth Engine, and a standard set of input data sources to regularly generate high-quality land cover data at the regional level for the HKH, and at national levels for Afghanistan, Bangladesh, Myanmar, and Nepal. In developing the RLCMS, ICIMOD focused on collaboration and co-development with partner organizations to define different land cover typologies/classes, collect reference data samples, and validate results. Land cover maps for the HKH region spanning 2000-2022 have been produced under its SERVIR-HKH initiative.

Schema

16/03/19

Purpose

Consolidated and standardized land cover maps for the Hindu Kush-Himalayan region (2000-2022) will support users' needs for environmental management at the regional level.

Descriptive Keyword

Land Cover, Land use, GIS, spatial data, Landsat, GEE, Google Earth Engine, Earth Observation (theme) SERVIR-HKH, ICIMOD, HKH, Hindu Kush Himalayas, Afghanistan, Bangladesh, Bhutan, China, India, Myanmar, Nepal, Pakistan (place)

Metadata Record Info

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Character

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dataset

Date

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ICIMOD

Position name

GIS and Remote Sensing Specialist

Role

author

Identification Info

Title

Land cover of HKH region

Date

2022-11-09

Date Type

publication

Abstract

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Status

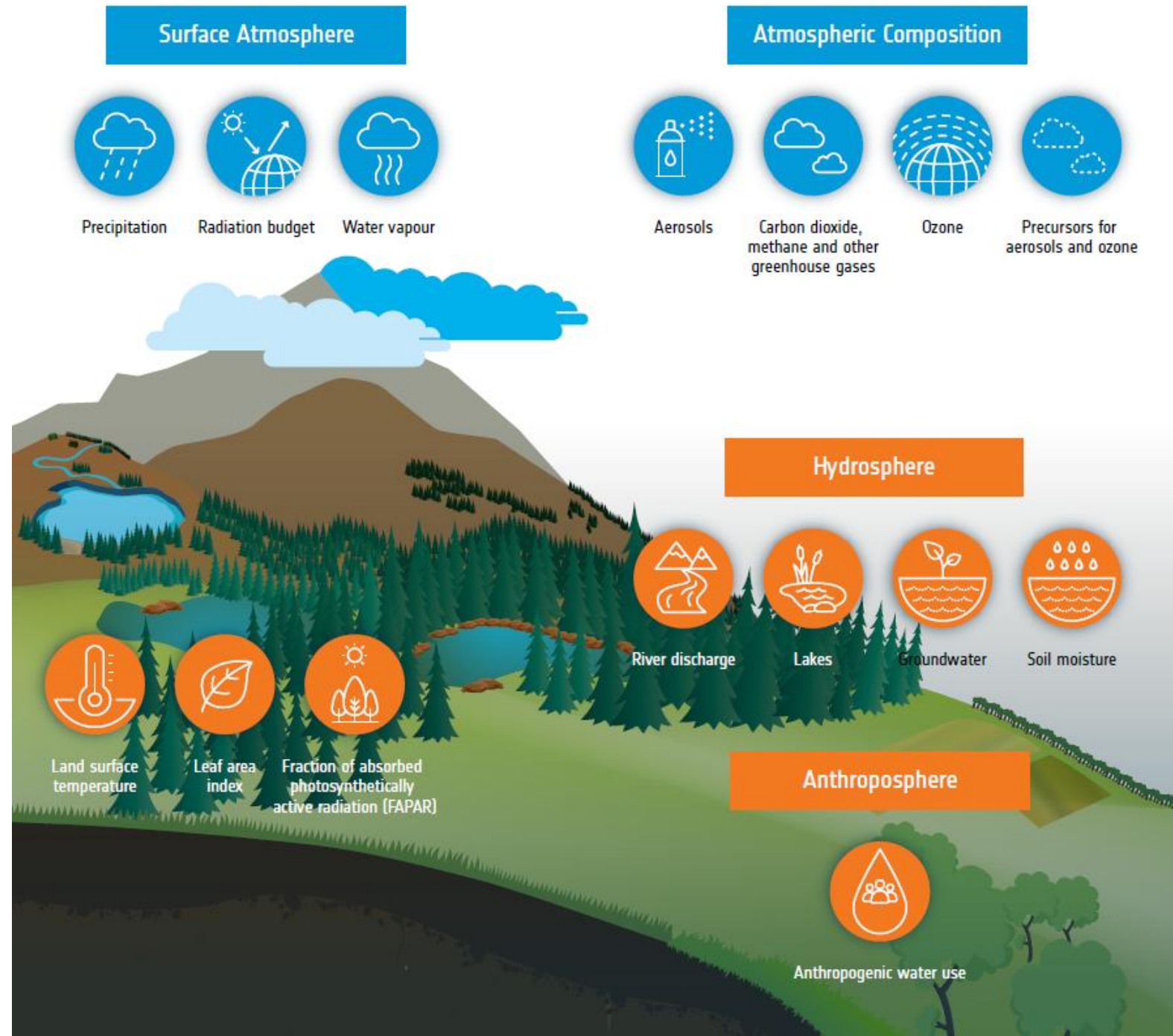
onGoing

<https://rds.icimod.org>



# GCOS Essential Climate Variables supported by Earth Observation

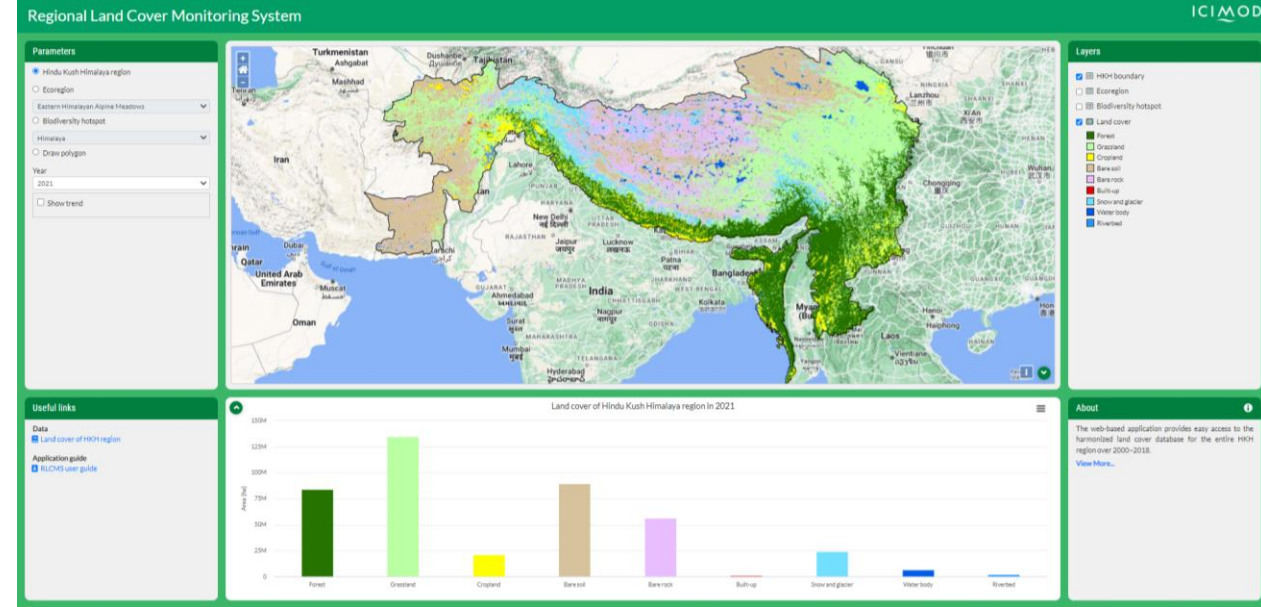
Atmosphere	Land	Ocean
<b>Surface</b> <ul style="list-style-type: none"> <li>Precipitation</li> <li>Surface Pressure</li> <li>Surface Radiation Budget</li> <li>Surface Temperature</li> <li>Surface Water Vapour</li> <li>Surface Wind Speed and Direction</li> <li>Upper-air Temperature</li> </ul>	<b>Hydrology</b> <ul style="list-style-type: none"> <li>Groundwater</li> <li>Lakes</li> <li>River Discharge</li> <li>Terrestrial Water Storage (TWS)</li> <li>Evaporation from Land</li> <li>Soil Moisture</li> </ul>	<b>Physical</b> <ul style="list-style-type: none"> <li>Ocean Surface Heat Flux</li> <li>Sea Ice</li> <li>Sea Level</li> <li>Sea State</li> <li>Surface Currents</li> <li>Sea Surface Salinity</li> <li>Surface Stress</li> <li>Sea Surface Temperature</li> <li>Subsurface Currents</li> <li>Subsurface Salinity</li> <li>Subsurface Temperature</li> </ul>
<b>Upper Atmosphere</b> <ul style="list-style-type: none"> <li>Earth Radiation Budget</li> <li>Lightning</li> <li>Upper-air Water Vapour</li> <li>Upper-air Wind Speed and Direction</li> </ul>	<b>Cryosphere</b> <ul style="list-style-type: none"> <li>Glaciers</li> <li>Ice Sheets and Ice Shelves</li> <li>Permafrost</li> <li>Snow</li> </ul>	<b>Biogeochemical</b> <ul style="list-style-type: none"> <li>Inorganic Carbon</li> <li>Nitrous Oxide</li> <li>Nutrients</li> <li>Ocean Colour</li> <li>Oxygen</li> <li>Transient Tracers</li> </ul>
<b>Atmospheric Composition</b> <ul style="list-style-type: none"> <li>Clouds</li> <li>Aerosols</li> <li>Carbon Dioxide, Methane &amp; Other Greenhouse Gases</li> <li>Ozone</li> <li>Precursors for Aerosols and Ozone</li> </ul>	<b>Biology</b> <ul style="list-style-type: none"> <li>Above-ground Biomass</li> <li>Albedo</li> <li>Fire</li> <li>Fraction of Absorbed Photosynthetically Active...</li> <li>Land Cover</li> <li>Land Surface Temperature</li> <li>Leaf Area Index</li> <li>Soil Carbon</li> </ul>	<b>Biological/Ecosystems</b> <ul style="list-style-type: none"> <li>Marine Habitats</li> <li>Plankton</li> </ul>
	<b>Human Use of Natural Resources</b> <ul style="list-style-type: none"> <li>Anthropogenic Greenhouse Gas Emissions</li> <li>Anthropogenic Water Use</li> </ul>	





# Land Cover Monitoring

- Partnership between SERVIR hubs (Mekong) and global network (USFS, UMD, FAO)
- Uses cloud computing and ML technologies



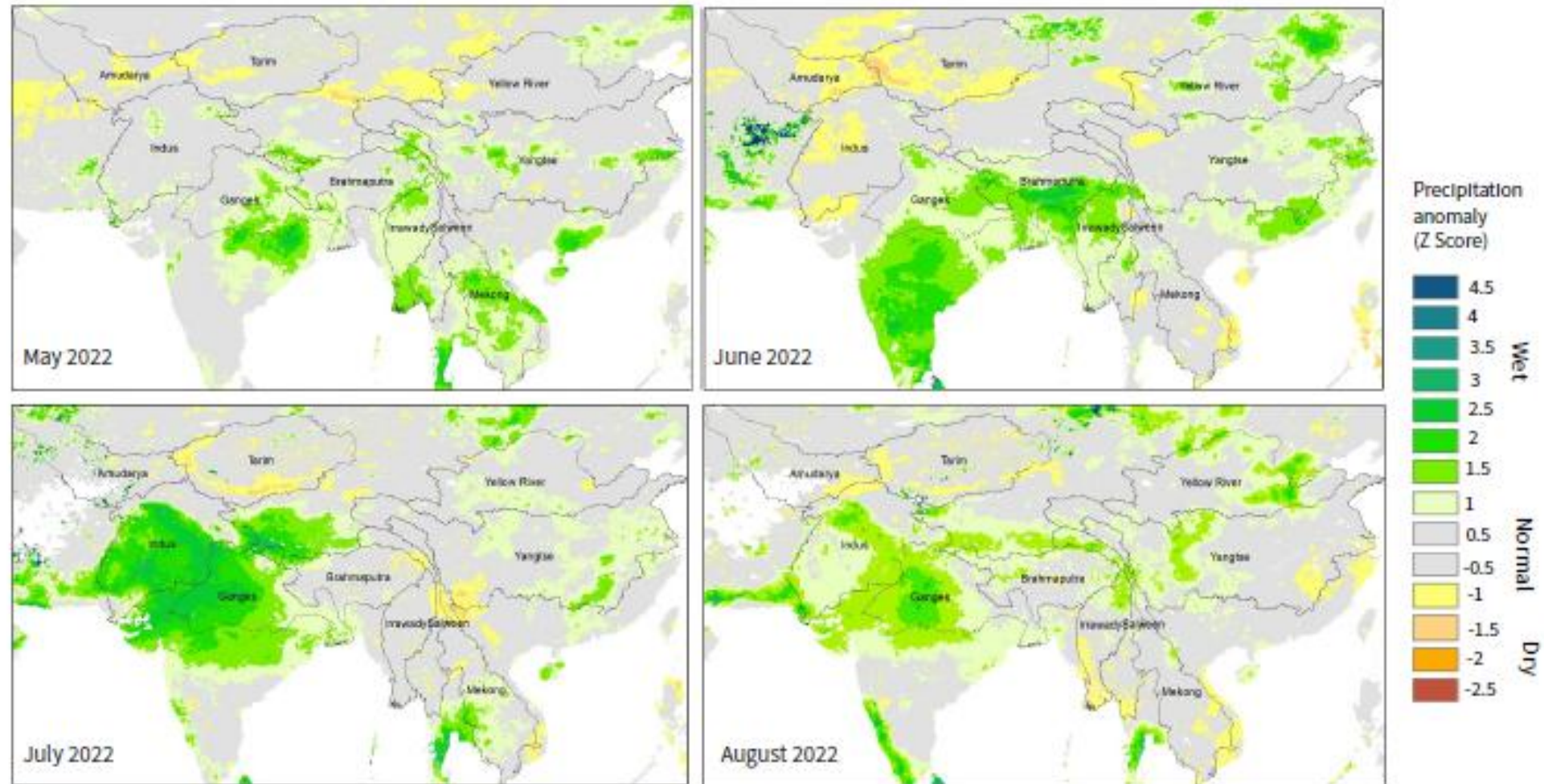
NLCMS formally  
launched as national  
system for Nepal





# Seasonal/sub-seasonal (3-9 month) drought outlooks

**South Asia Land Data Assimilation System (SALDAS)** provides outlooks on weather parameters e.g. rainfall, temperature, soil moisture, and evapotranspiration which are useful for early anticipation of drought conditions

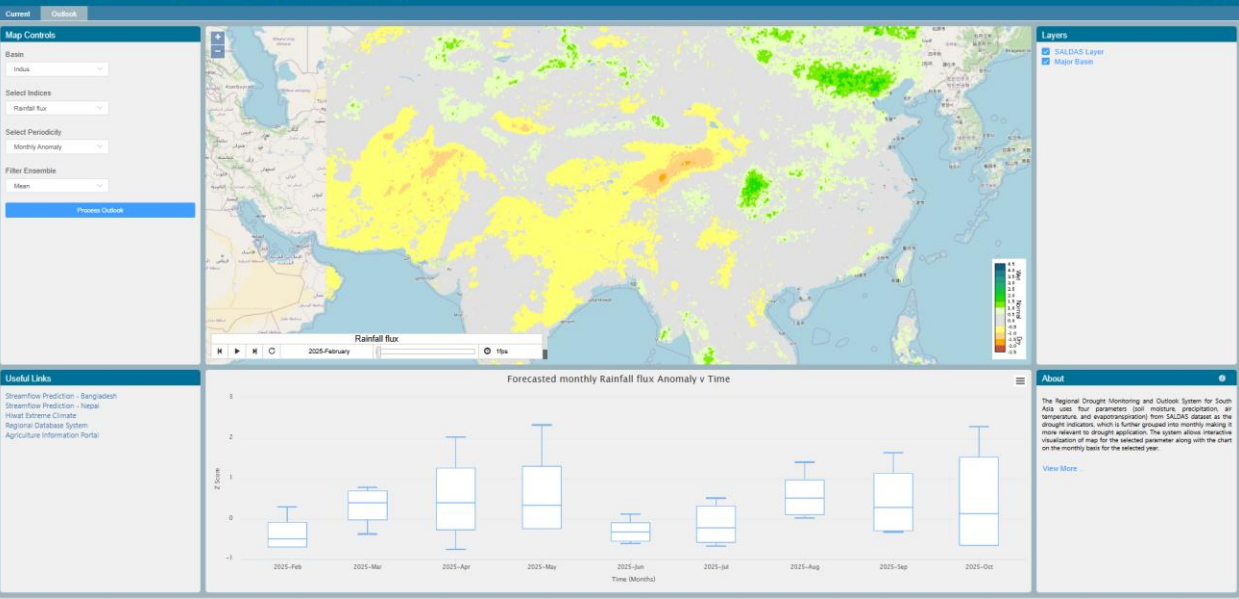


PRECIPITATION OUTLOOK FOR MAY-AUGUST 2022

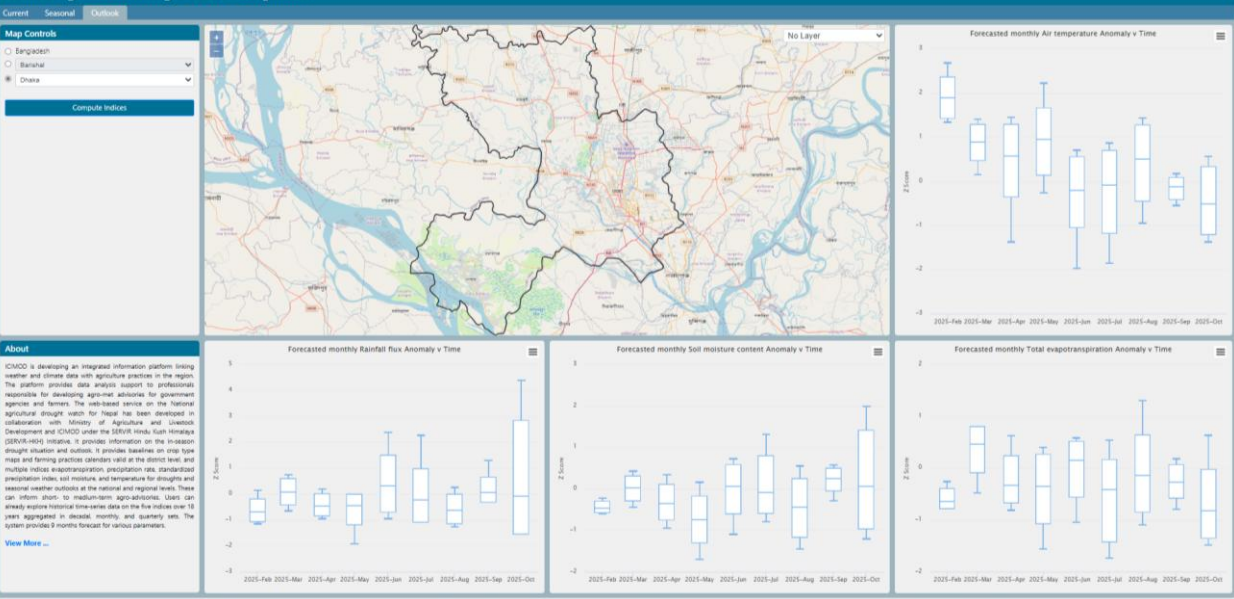


## Regional Drought Monitoring and Outlook System for South Asia

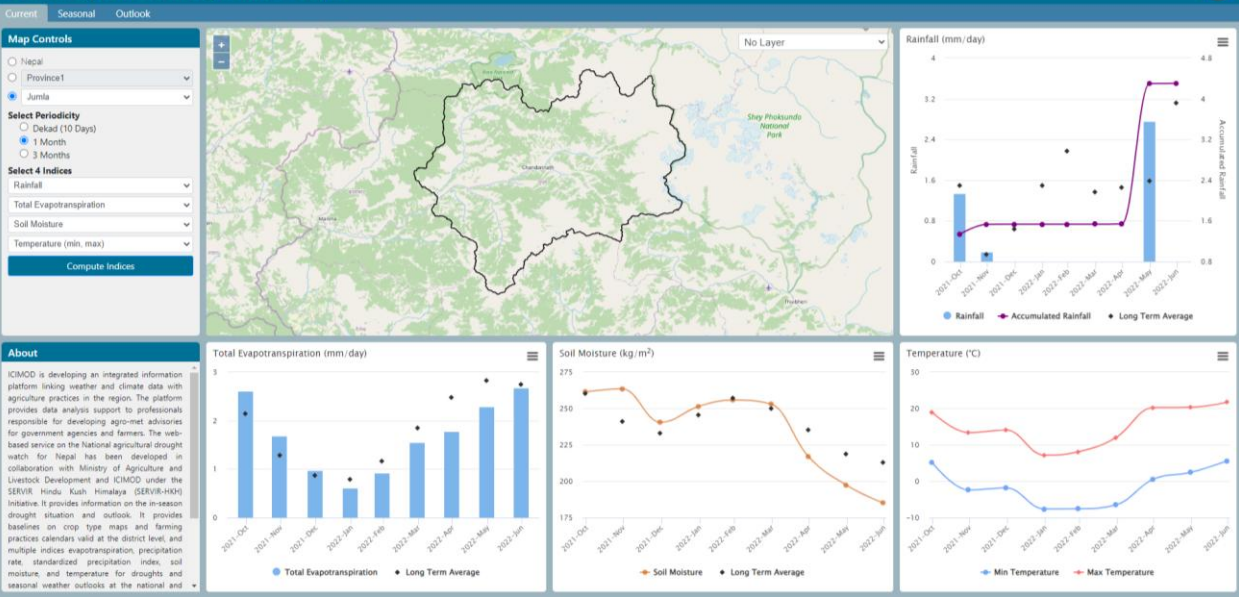
ICIMOD



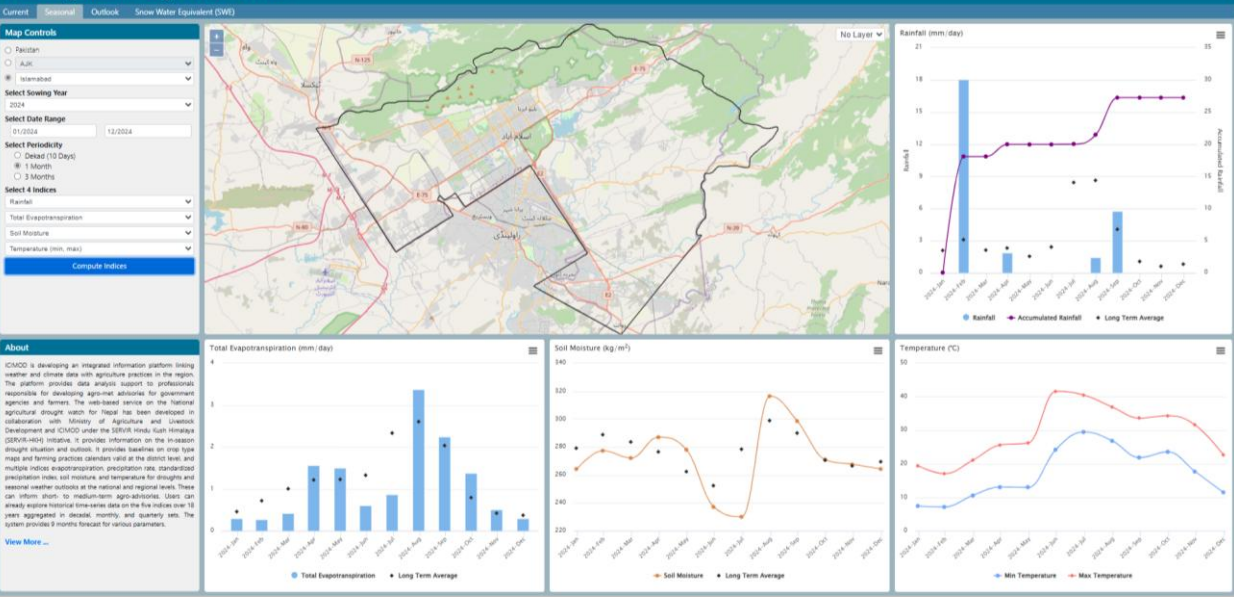
## National agricultural drought watch - Bangladesh



## National agricultural drought watch - Nepal



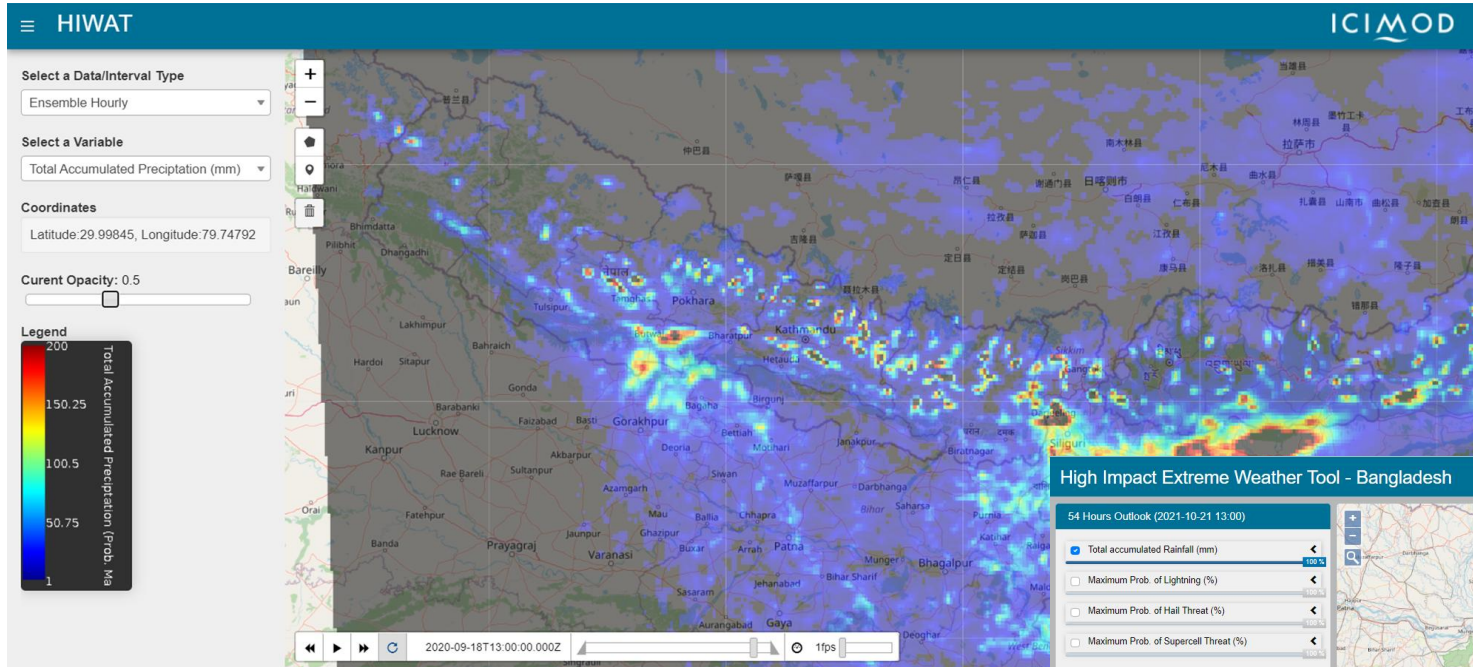
## National agricultural drought watch - Pakistan





# Weather and climate

## High Impact Weather Assessment Tool (HIWAT)

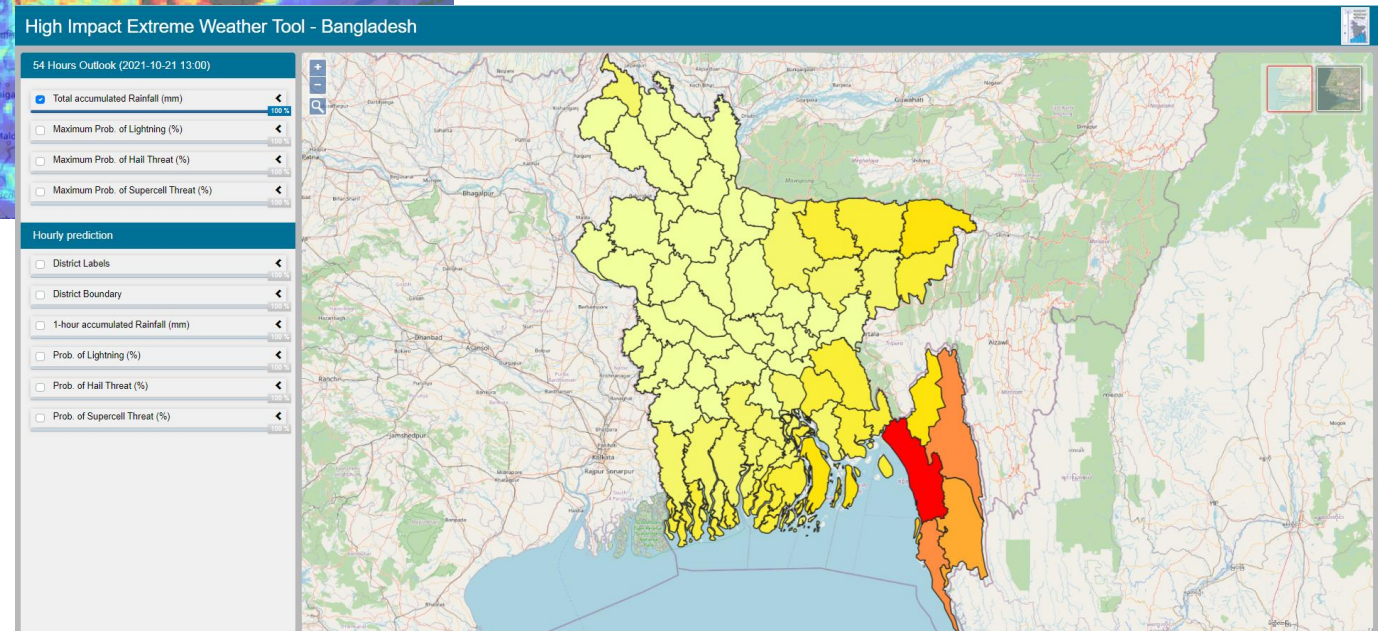


### 54-hr forecast

- Rainfall
- Lightening
- Hail
- Wind
- Supercell storms



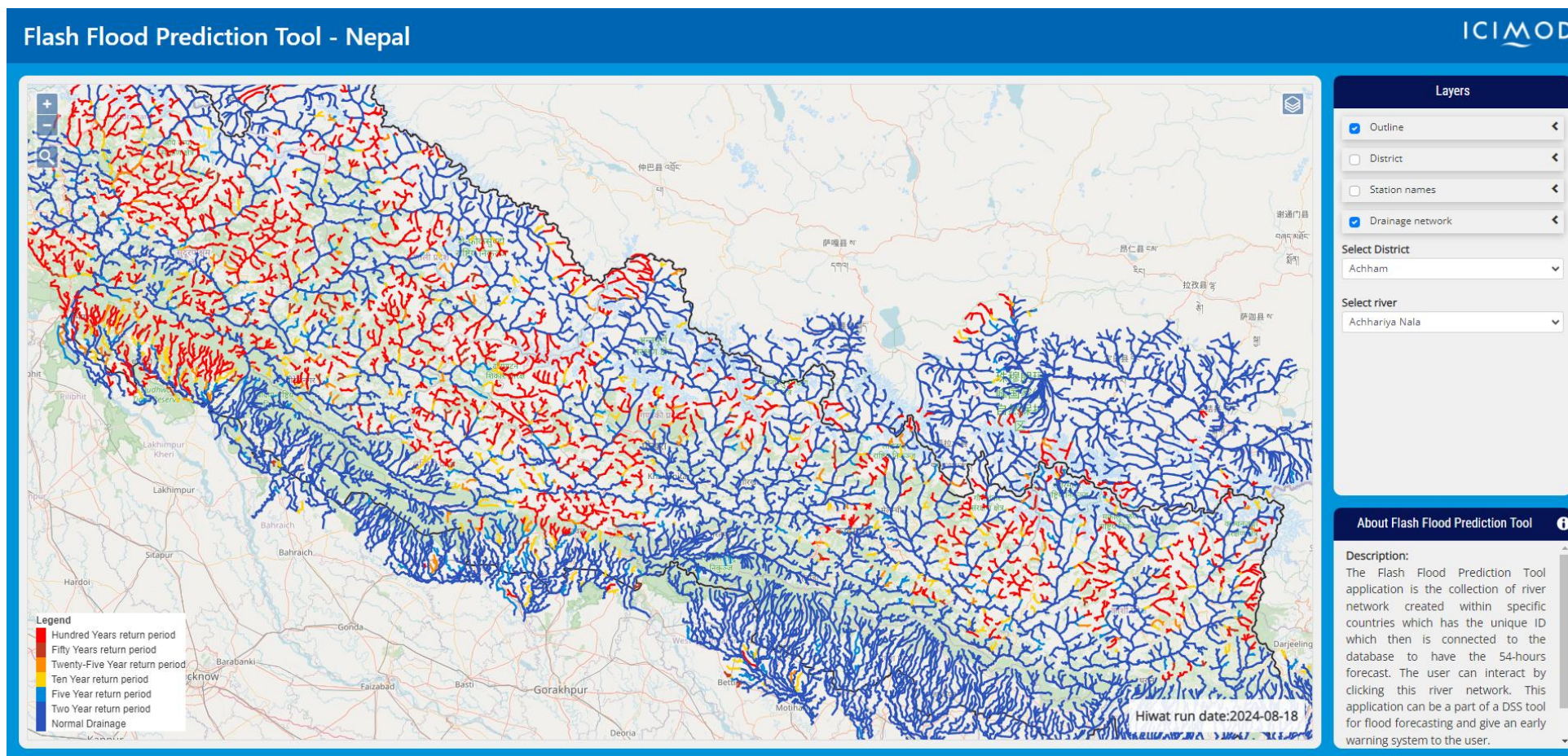
*Launching of HIWAT at Bangladesh Meteorological Department*





# Improving flood forecasting and early warning

- Flash flood prediction tool (54 hr lead time using HIWAT forecast)
- Streamflow Prediction (10 days lead time using ECMWF forecast)





CIMOD

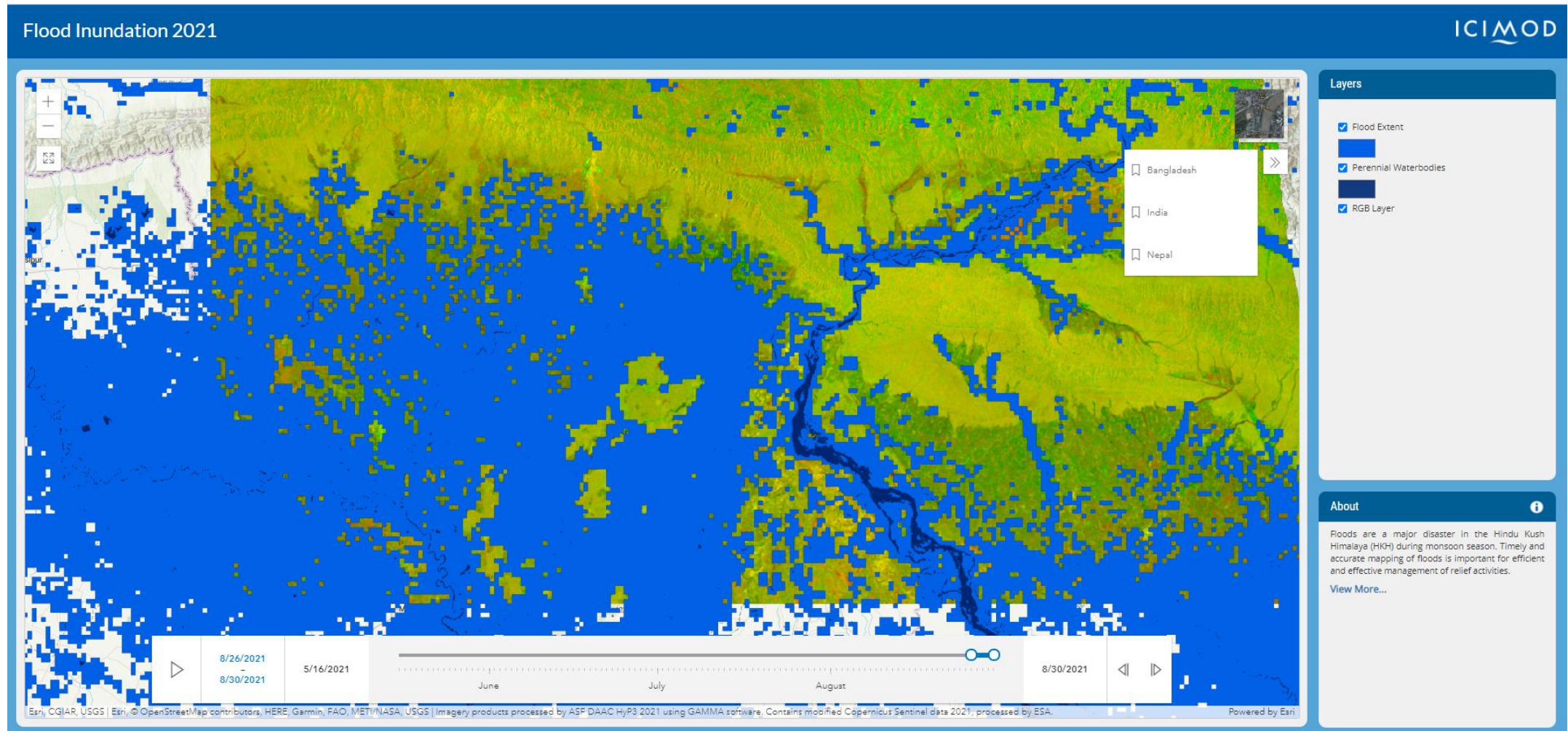


- ## About Flash Flood Prediction Tool
- Description:**
- The Flash Flood Prediction Tool application is the collection of river network created within specific countries which has the unique ID which then is connected to the database to have the 54-hours forecast. The user can interact by clicking this river network. This application can be a part of a DSS tool for flood forecasting and give an early warning system to the user.
- [View More...](#)



# Flood inundation monitoring

- Use of SAR data during cloudy season
- Regularly updated as soon as new images are available
- Web based platform for interactive visualization of inundated area



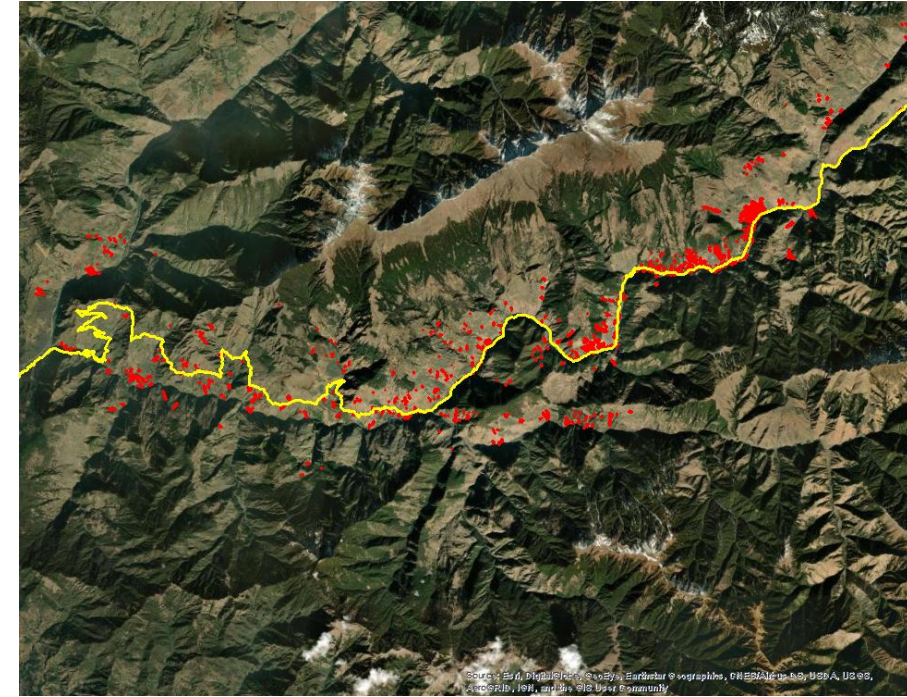
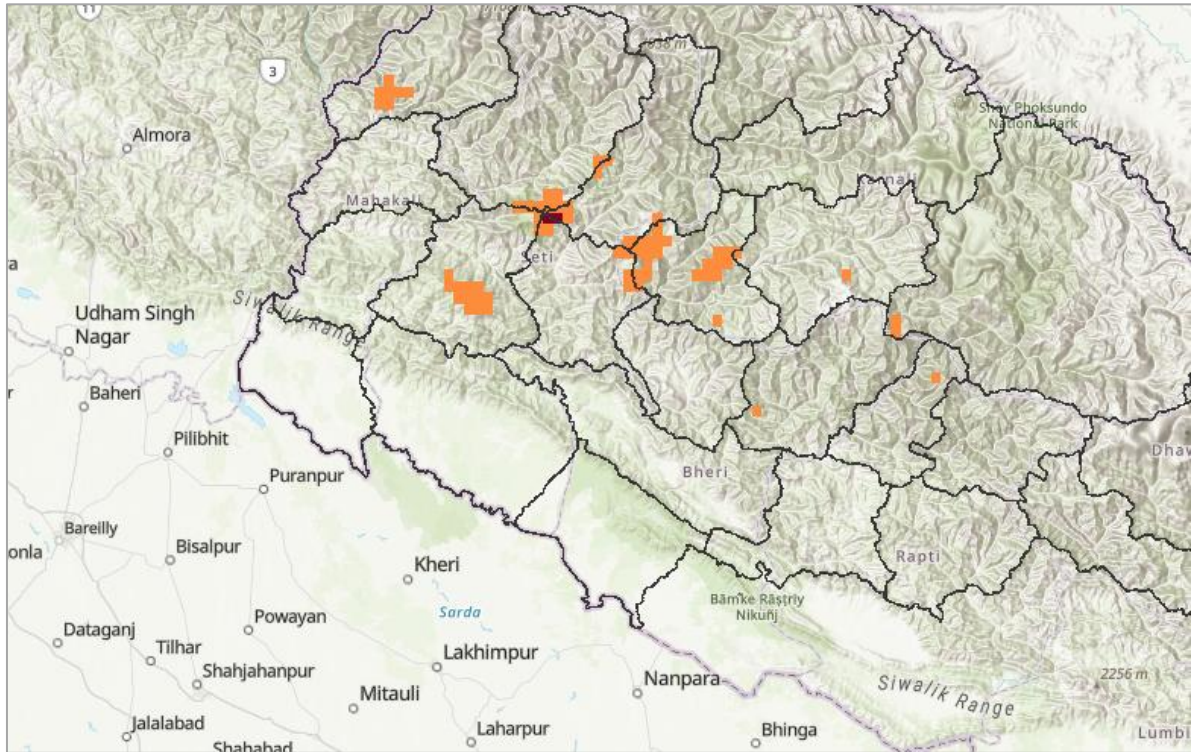


# Landslide mapping and forecasting

## Landslide Forecast System

Geology/lithology, Faults, Drainage, Morphology

HIWAT, IMERG, GPM, SMAP

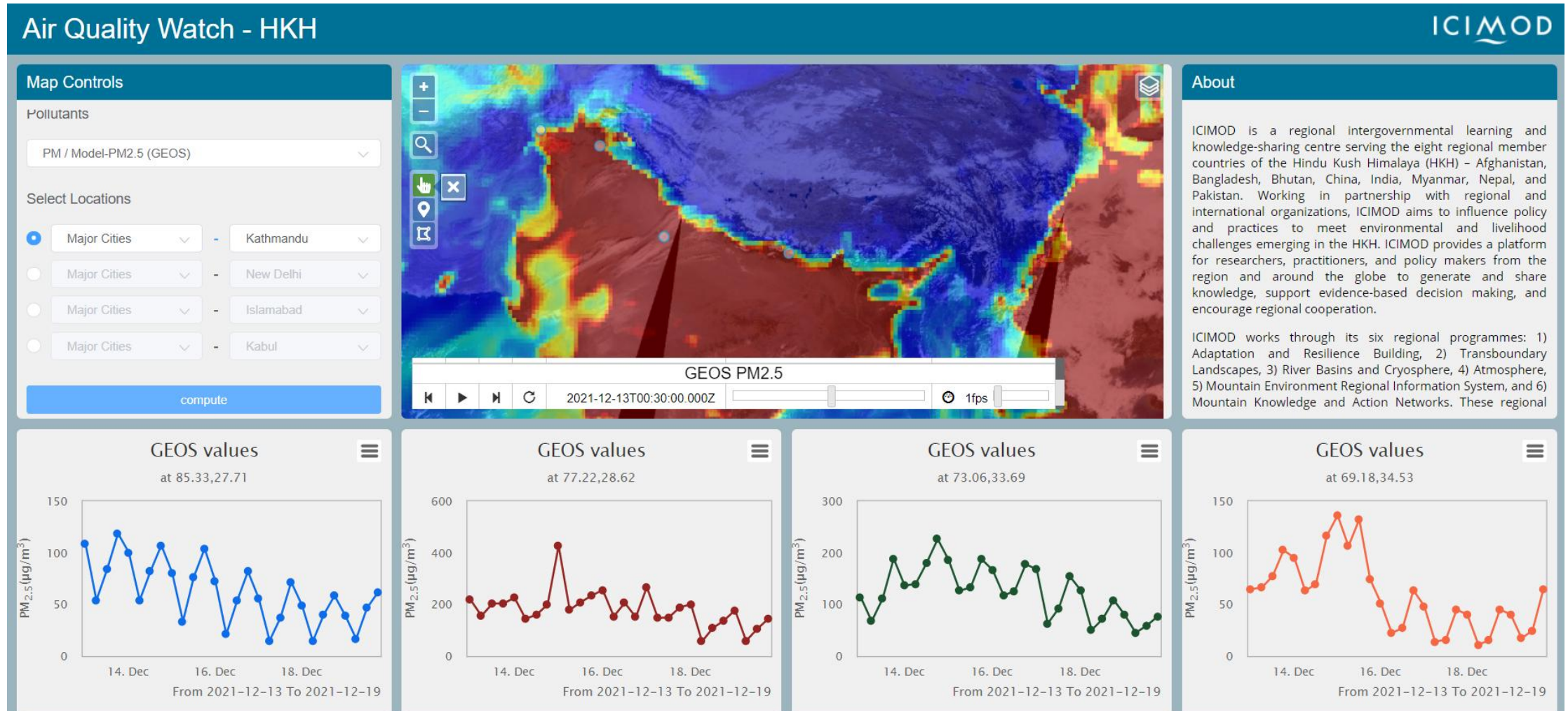


Landslides between Manma and Jumla section directly impacting the Karnali highway – mapped using Planet imagery and SALaD-CD



# Air quality monitoring

Innovative air quality products using models, satellite data, and monitoring stations for dust, AOD and trace gases



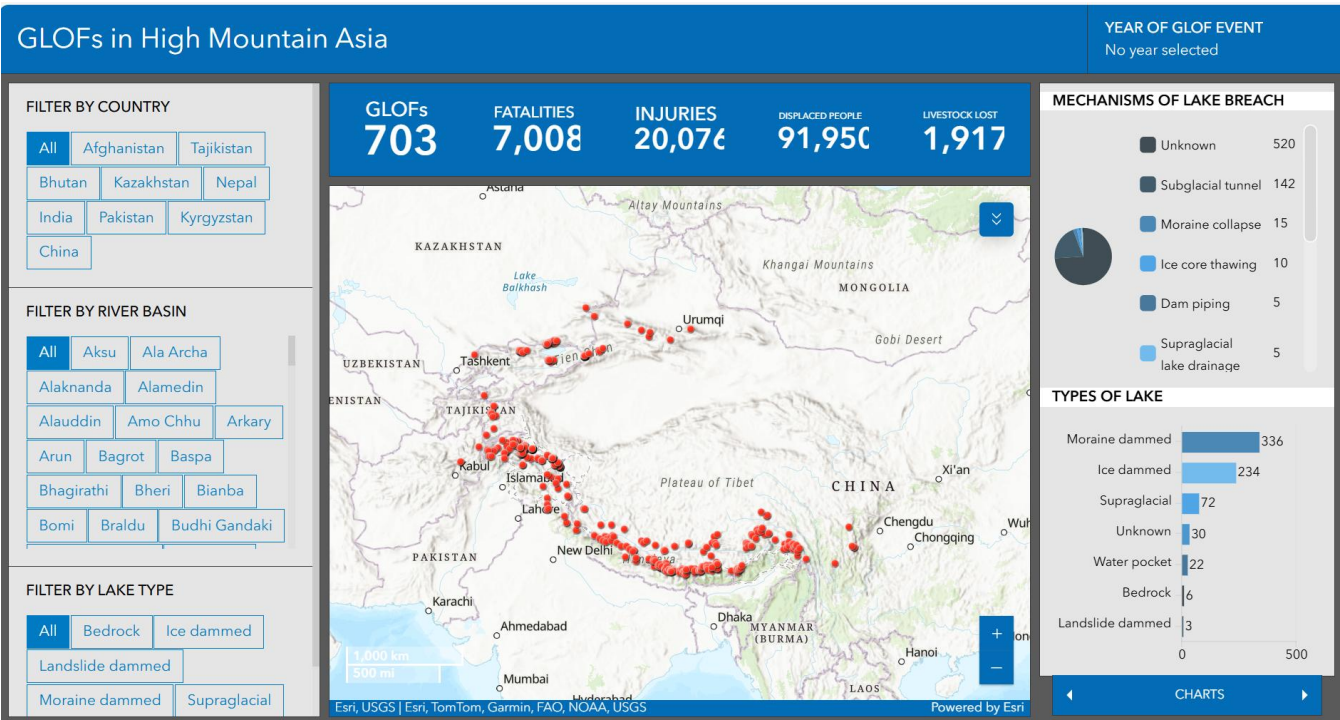
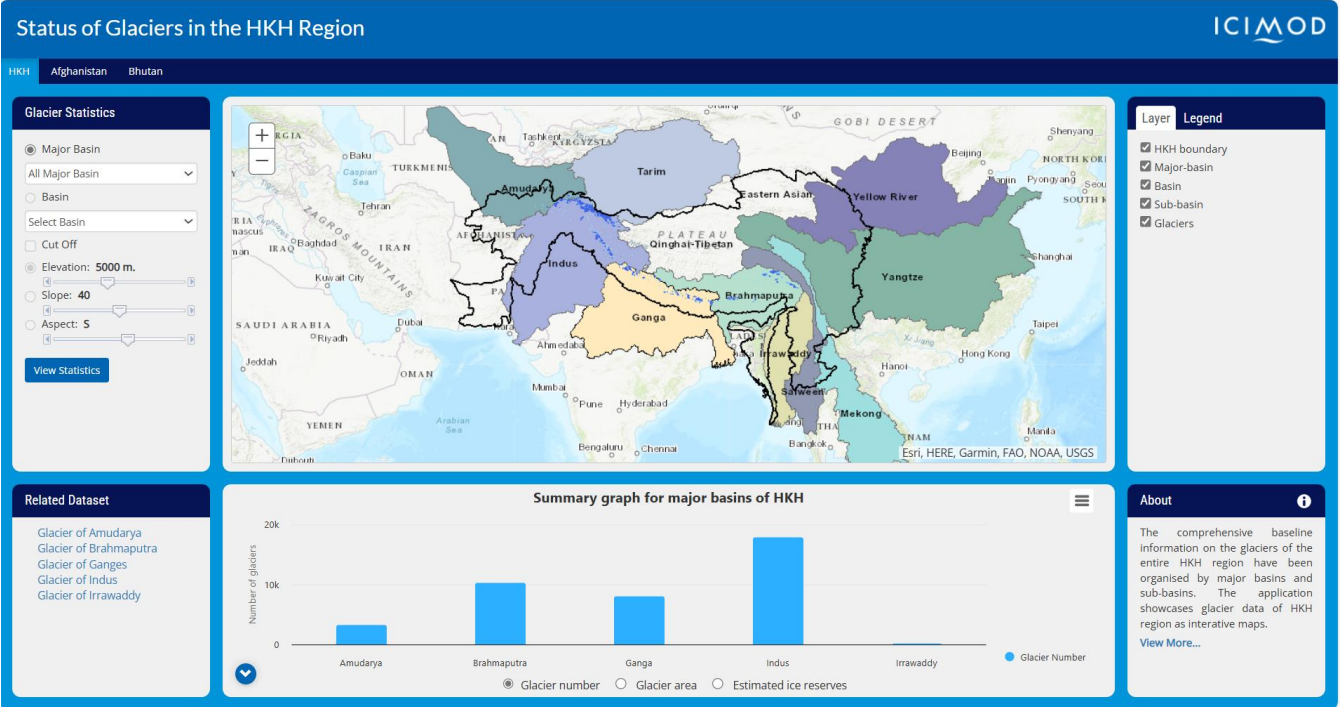


# Cryosphere

- Decadal glacier mapping of the entire HKH region for 1990, 2000, 2010, 2020
- GLOFs database in the High Mountain Asia
- Annual mass balance measurements in Yala and Rikha Samba glaciers in Nepal

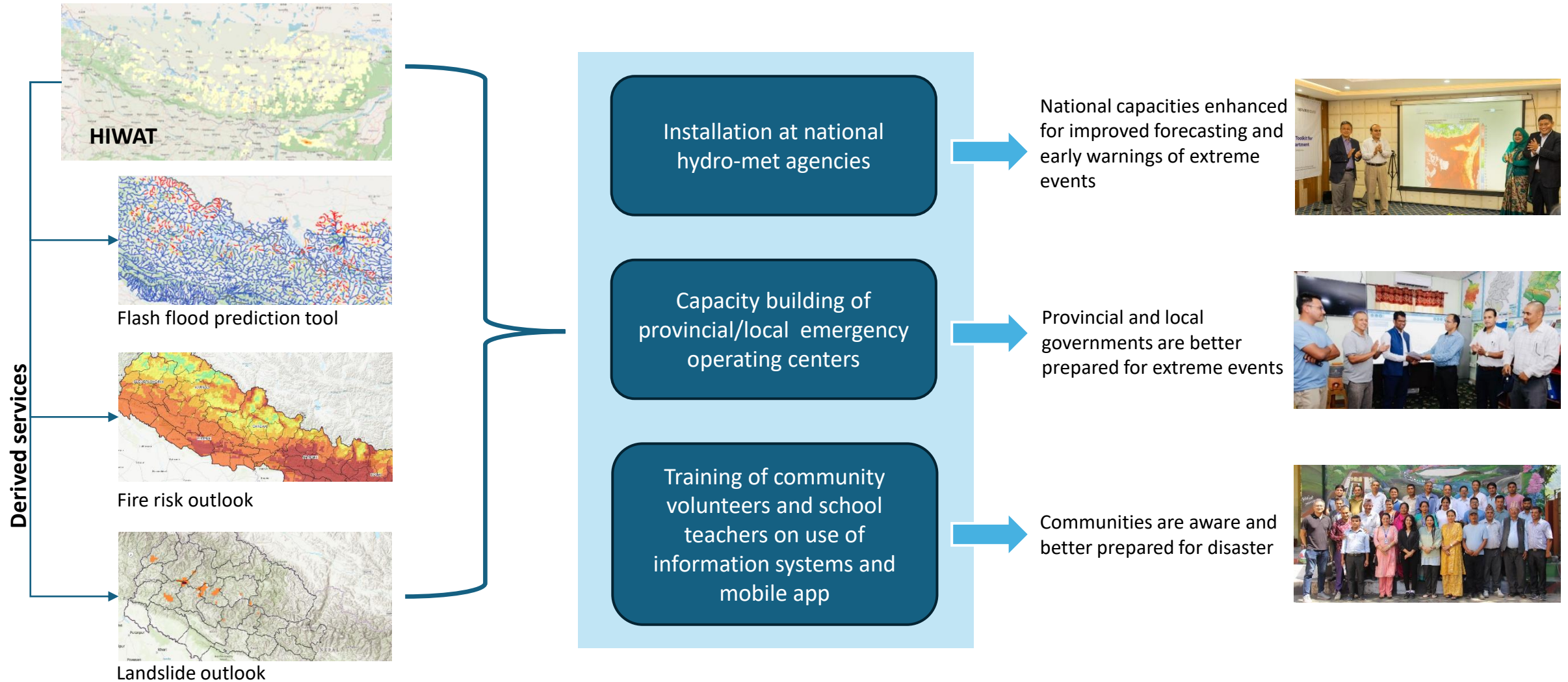


Rikhasamba Glacier





# Pathways to Achieve Impacts





Thank  
You

