

**FIG**

Kathmandu, Nepal 14–16 November

**REGIONAL CONFERENCE 2024**

*Climate Responsive Land Governance and Disaster Resilience: Safeguarding Land Rights*



*Presented at the FIG Regional Conference 2024,  
14-16 November 2024 in Kathmandu, Nepal*

# Earth Observation Applications for Enhanced Resilience to Climate-induced Disasters

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# What we saw this year..



Afghanistan 10-11 May 2024  
300+ dead, 8975 homes damaged



Bangladesh 21-23 August 2024  
23 dead, 5.7 million affected



Bhutan July - August 2024  
5+ extreme events, 7+ villages affected



India 27 June – 16 August 2024  
211 dead, 51 extreme events



# Climate change-induced flood in Thame - Everest Region

16 August 2024





# Unprecedented floods in Kathmandu

## 2024 September Floods and Landslides

Situation Report #2 as of 1 October 2024

(First SitRep published on 29 September 2024)



Government of Nepal  
Ministry of Home Affairs  
National Disaster Risk Reduction and  
Management Authority

This report is produced by National Disaster Risk Reduction and Management Authority (NDRRMA) in collaboration with sectoral ministries, departments, provincial and local governments. It covers the situation of floods and landslides due to the heavy rainfall across the country from 26-28 September.

### Summary of Loss and Damage

#### Human Casualties

 **224**  
Deaths

 **158**  
Injury

 **24**  
Missing

#### Emergency Rescue

  
**30,731**  
Security Personnel Deployed

  
**713 Heli Rescued**  
Stranded Passengers

  
**12,586**  
Rescued

#### Private Housing and Critical Infrastructure


 **700+**  
Fully Damaged

 **500+**  
Partially Damaged

 **43**  
Schools

 **41**  
Health Center


#### Infrastructure

  
**11 Hydropower**  
625.96 MW  
NPR 3 Billion Loss

  
**6 Irrigation Projects**  
NPR 1.35 Billion  
Loss

  
**27 Highway Blocked**  
NPR 1.5 Billion  
Loss

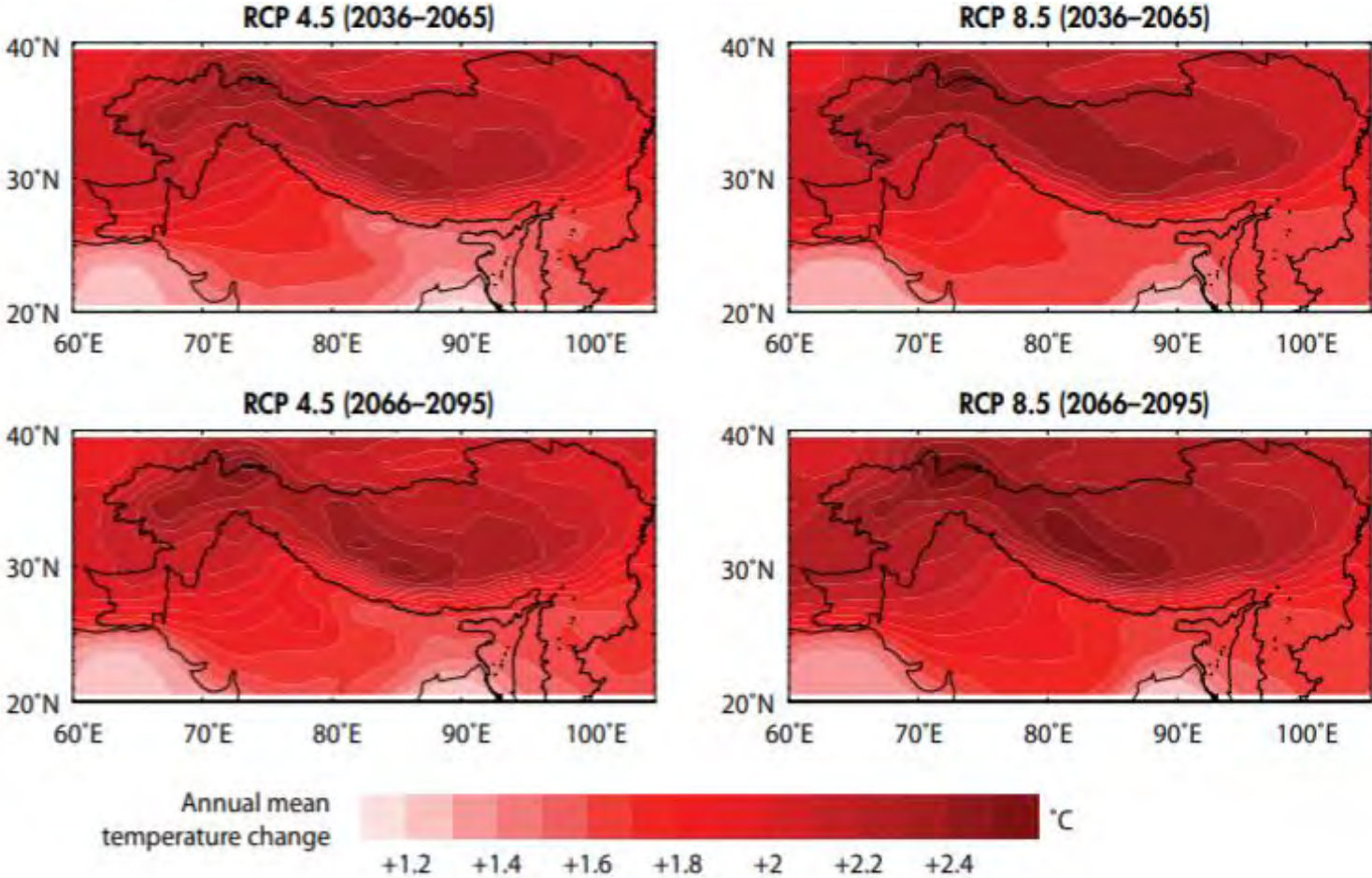
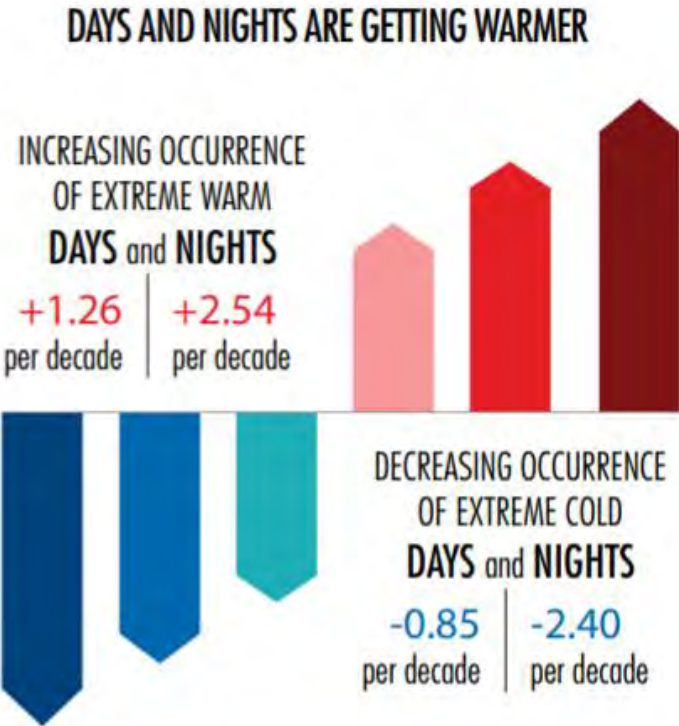
  
**14 Damaged**  
Suspension Bridge

  
**11 Damaged**  
Bailey, RCC, ARC Bridge  
1.02 Billion Loss



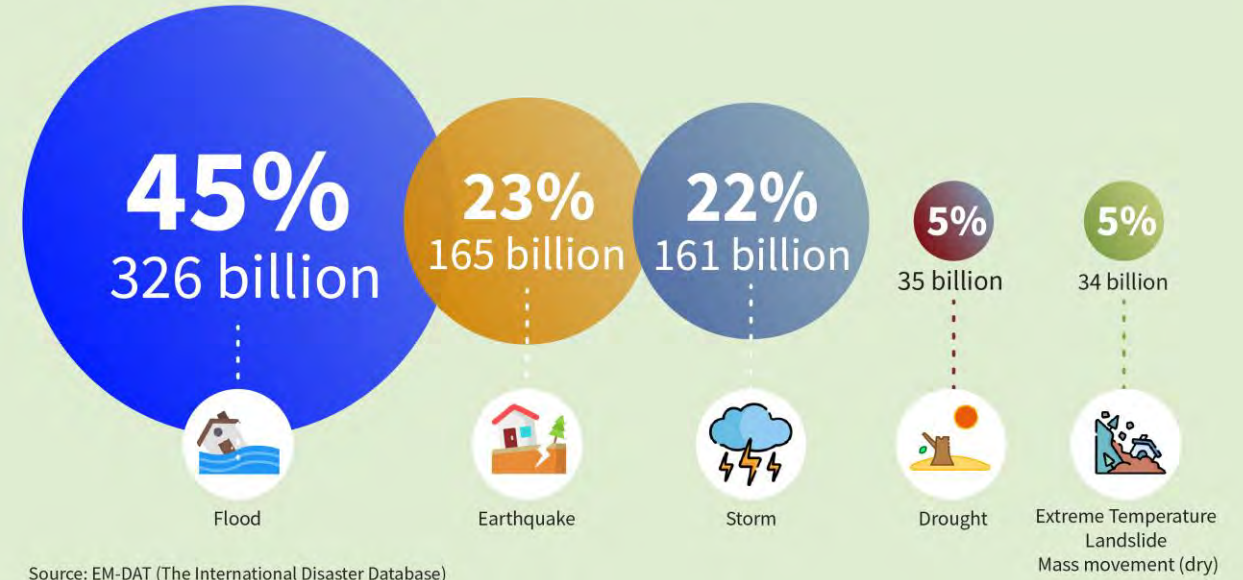


# The HKH will warm more than the global mean and more rapidly at higher elevations



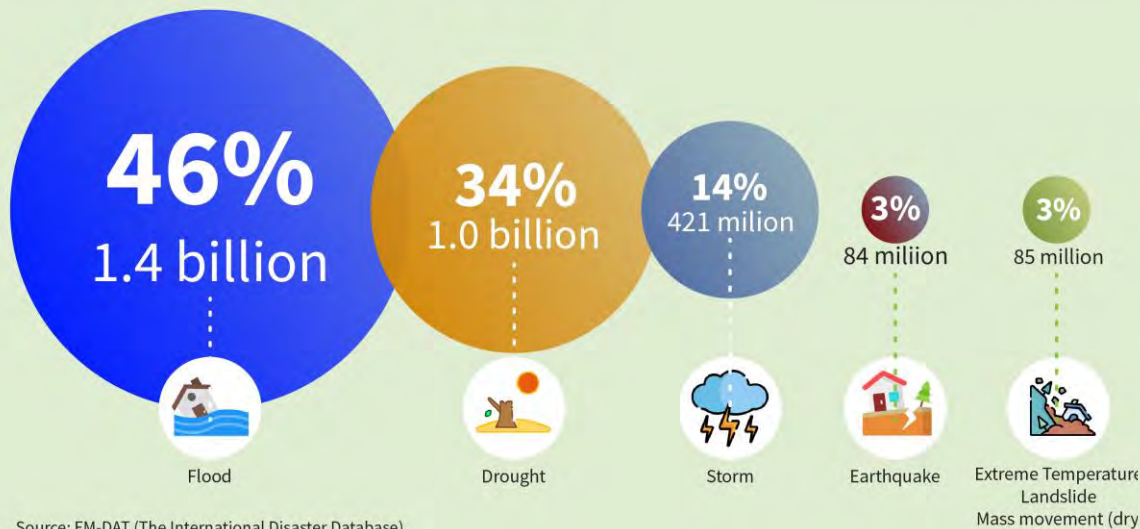
# Disasters in figures in the HKH

## Breakdown recorded economic losses (US\$) per disaster type (2000-2019)



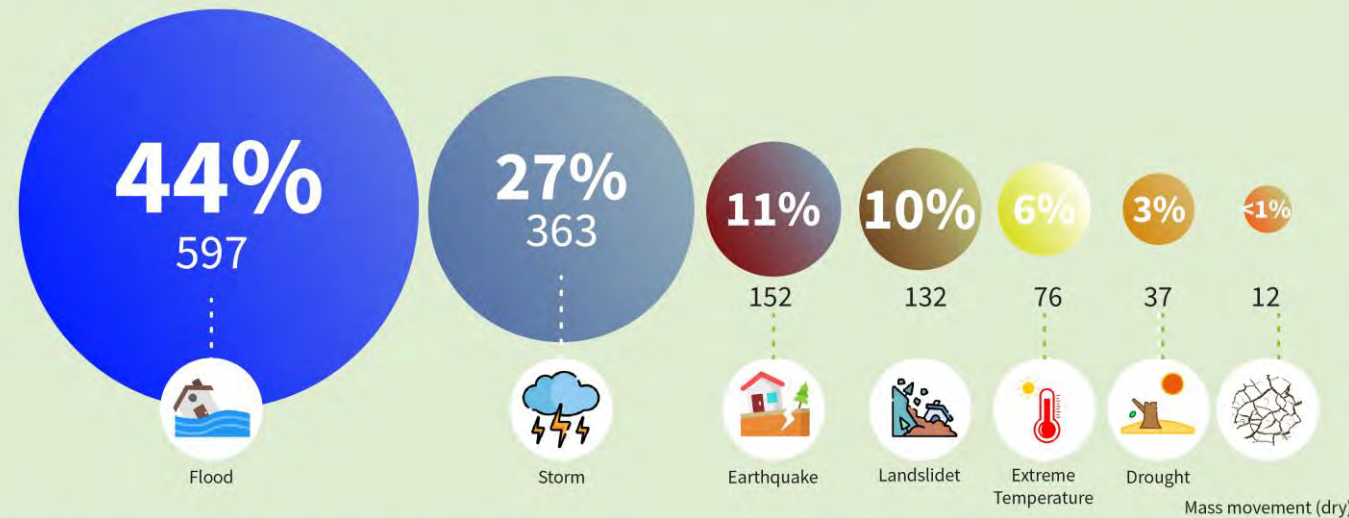
Source: EM-DAT (The International Disaster Database)

## People affected by disaster type in the HKH countries (2000-2019)



Source: EM-DAT (The International Disaster Database)

## Percentage of occurrences of disasters by disaster type in the HKH countries (2000-2019)



Source: EM-DAT (The International Disaster Database)

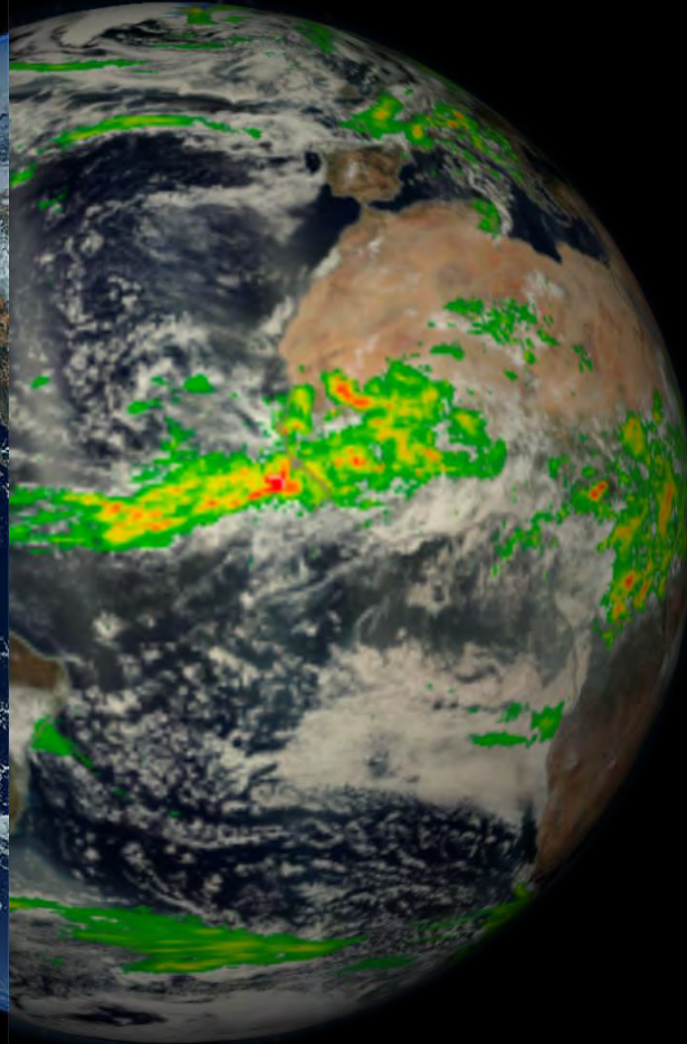




**Information on key trends, events and risks to build resilience**



# Earth observation to understand our planet as a system



**EARTH NOW**

**Air Temperature**  
August 16, 2024 - August 18, 2024

SELECT A DATAMAP:

- Air Temperature
- Carbon Dioxide
- Carbon Monoxide
- Water Storage
- Ozone
- Sea Level
- Soil Moisture & Salinity
- Visible Earth
- Water Vapor
- Precipitation

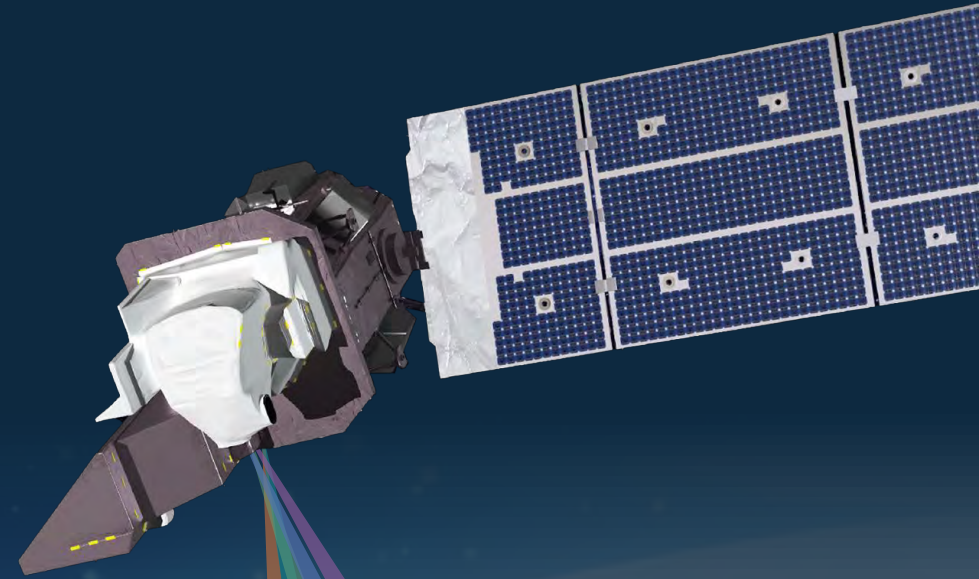
CANCEL



# CONNECTING SPACE TO VILLAGE



**SERVIR** is a joint initiative of NASA, USAID, and leading geospatial organizations in Asia, Africa, and Latin America that partners with countries and organizations to address challenges in climate change, food security, water and related disasters, forest and carbon management, and air quality.





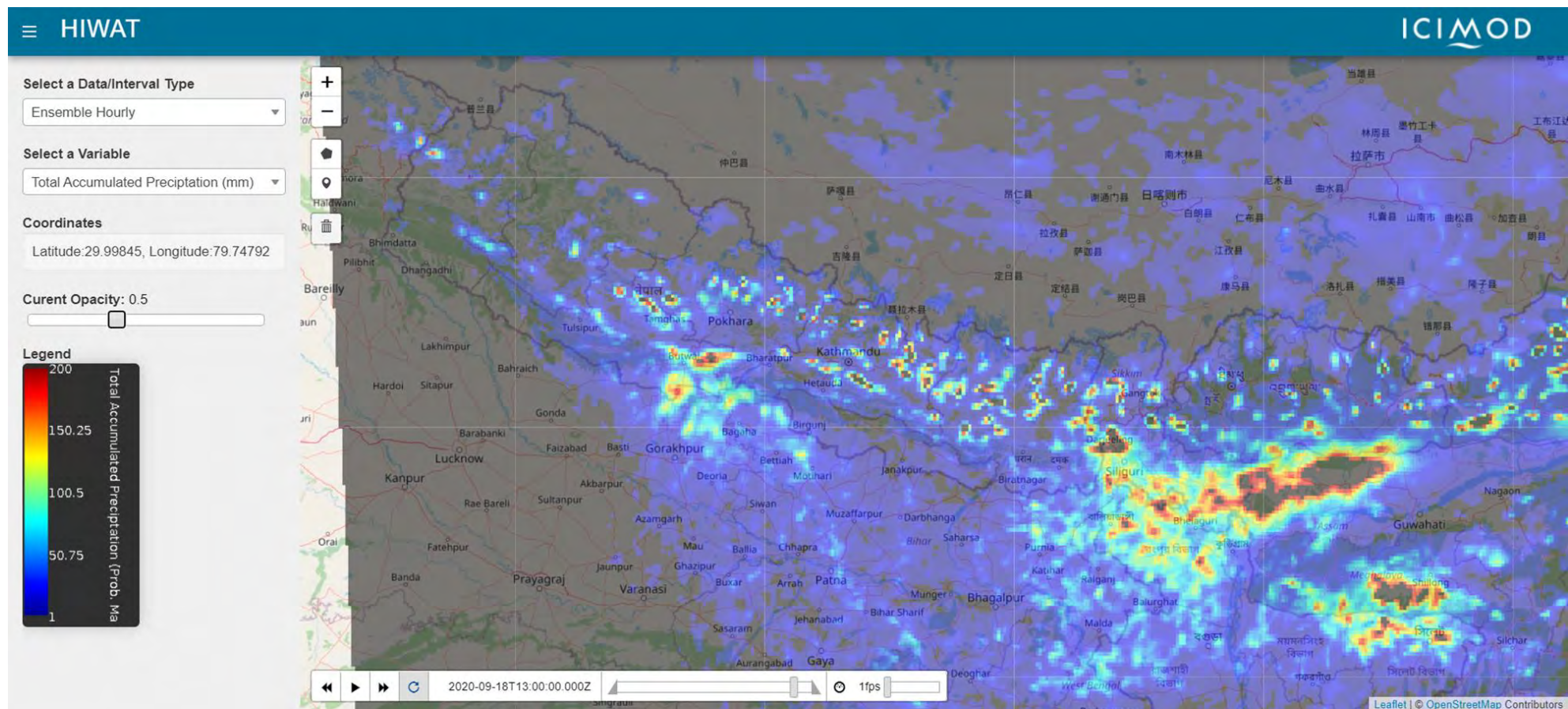
# Improving predictions for better preparedness

## High Impact Weather Assessment Tool (HIWAT)

### 54-hr forecast

- Rainfall
- Lightning
- Hail
- Wind
- Supercell storms

Key partner:  
NASA-MSFC





# Improving flood forecasting and early warning

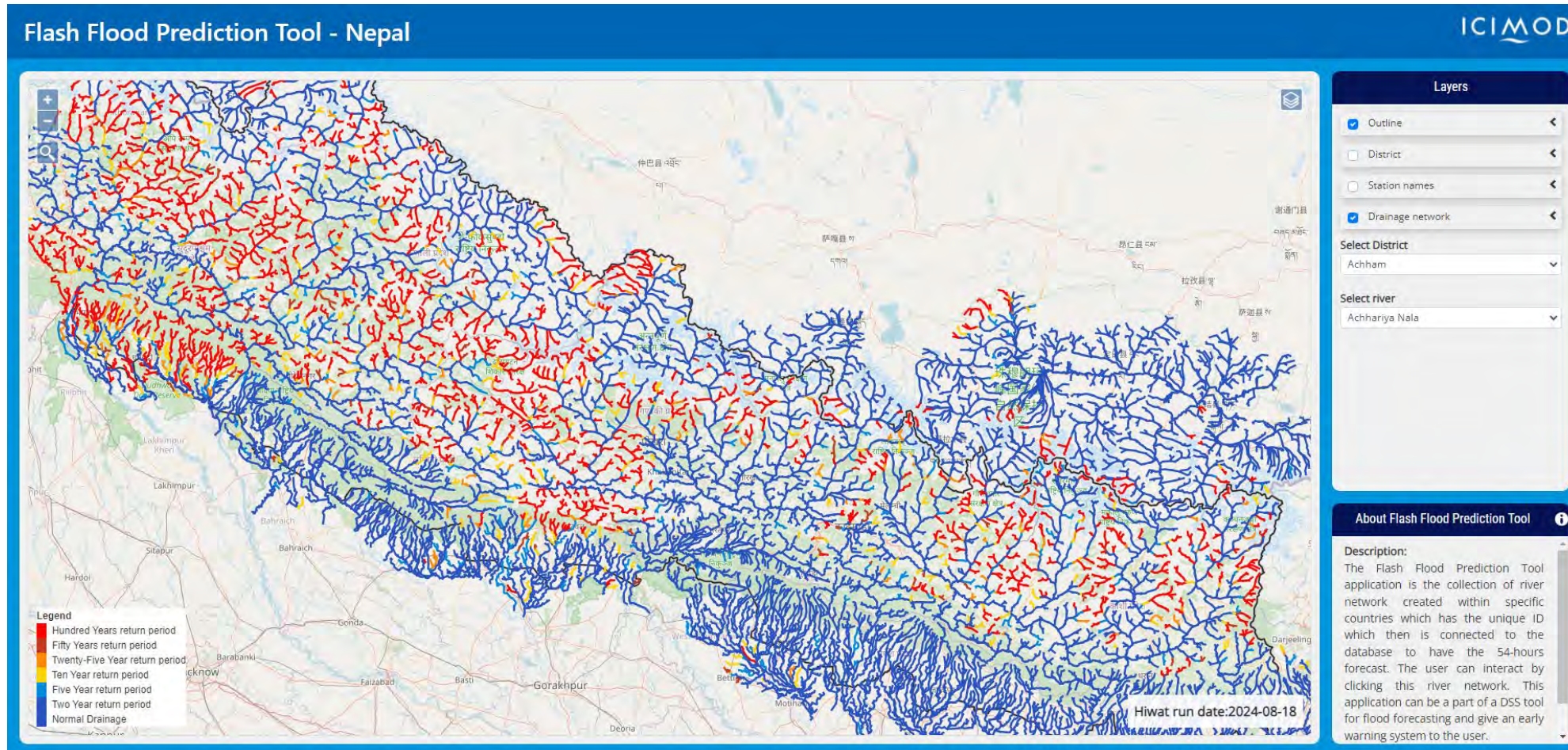
- Flash flood prediction tool (54 hr lead time using HIWAT forecast)
- Streamflow Prediction (10 days lead time using ECMWF forecast)

## Key partners:

NASA-MSFC

NASA-JPL

Brigham young  
University

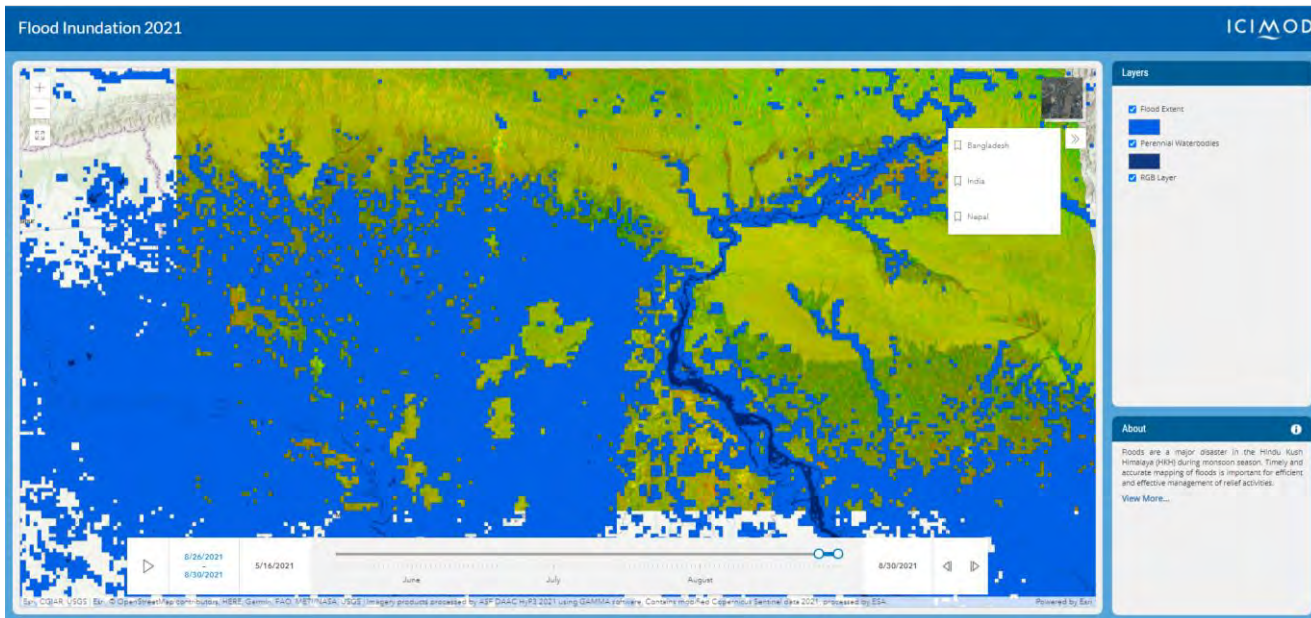




# Flood inundation monitoring

## Identifying the extent of affected areas

- 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



### Key partners:

NASA-MSFC

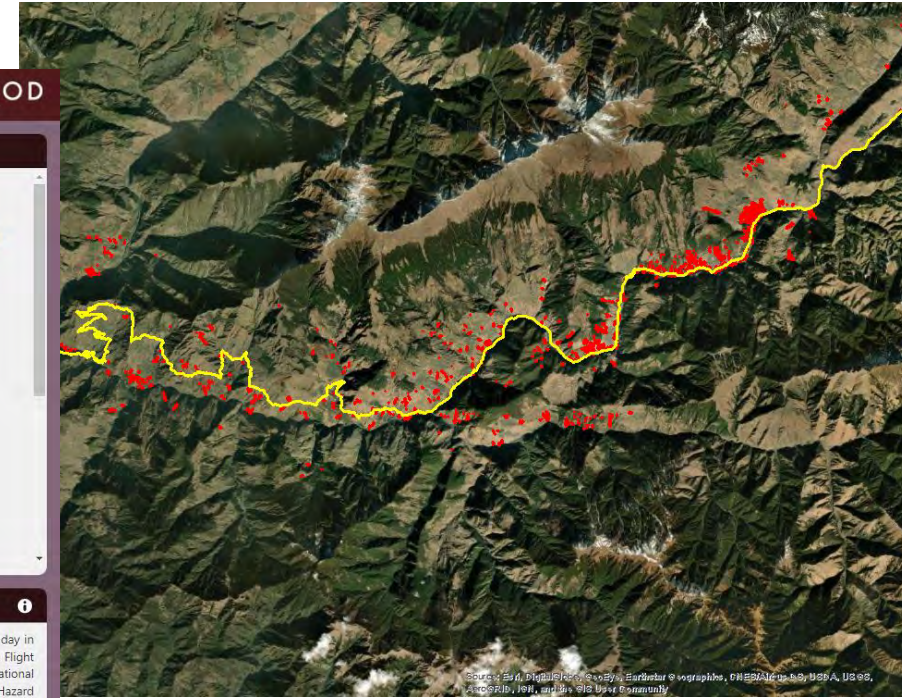
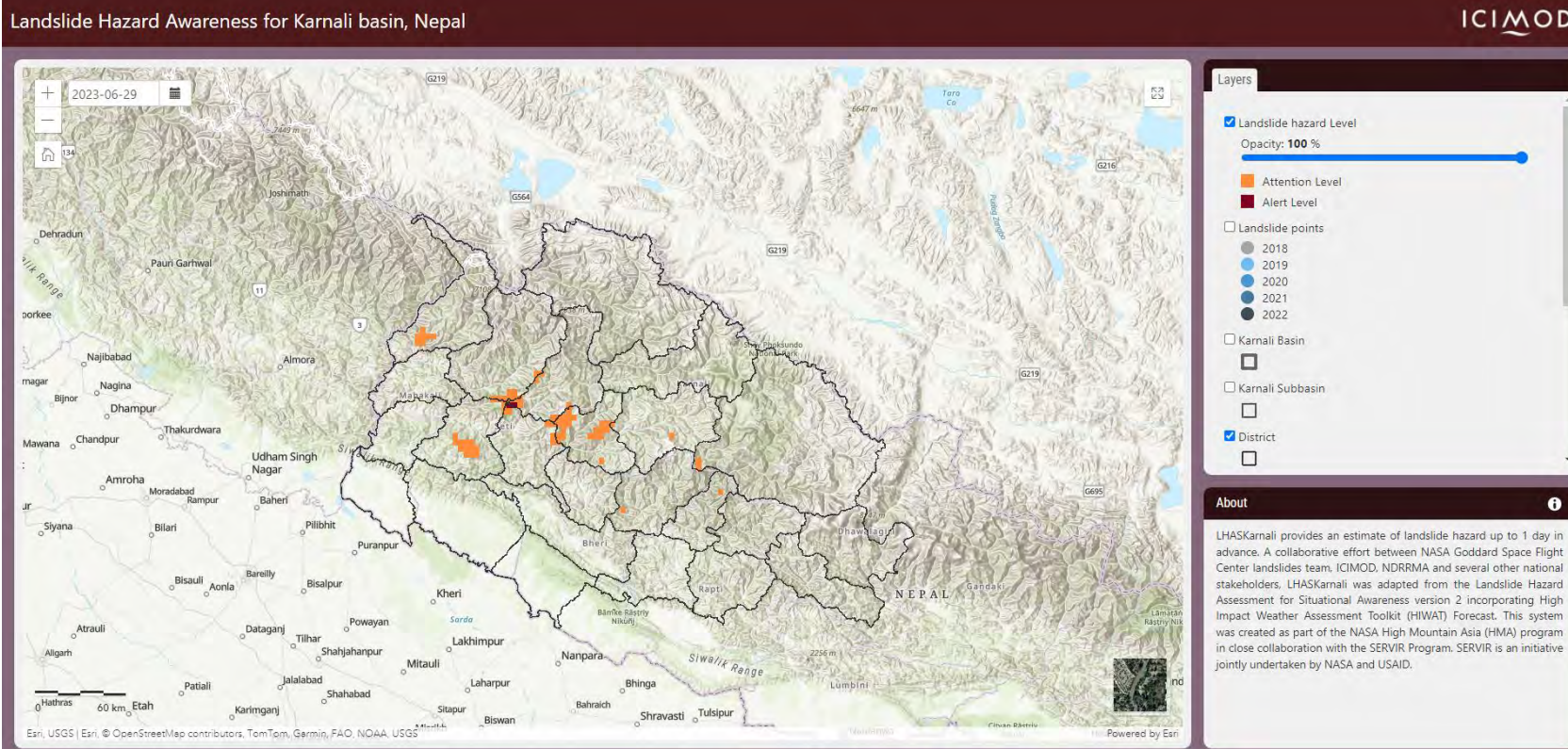
University of Alaska Fairbanks





# Landslide mapping and forecasting

## Landslide Hazard Assessment for Situational Awareness



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

### Key partners:

NASA-GFSC

University of Alaska Fairbanks

Key parameters used: Geology/lithology, Faults, Drainage, Morphology  
HIWAT, IMERG, GPM, SMAP

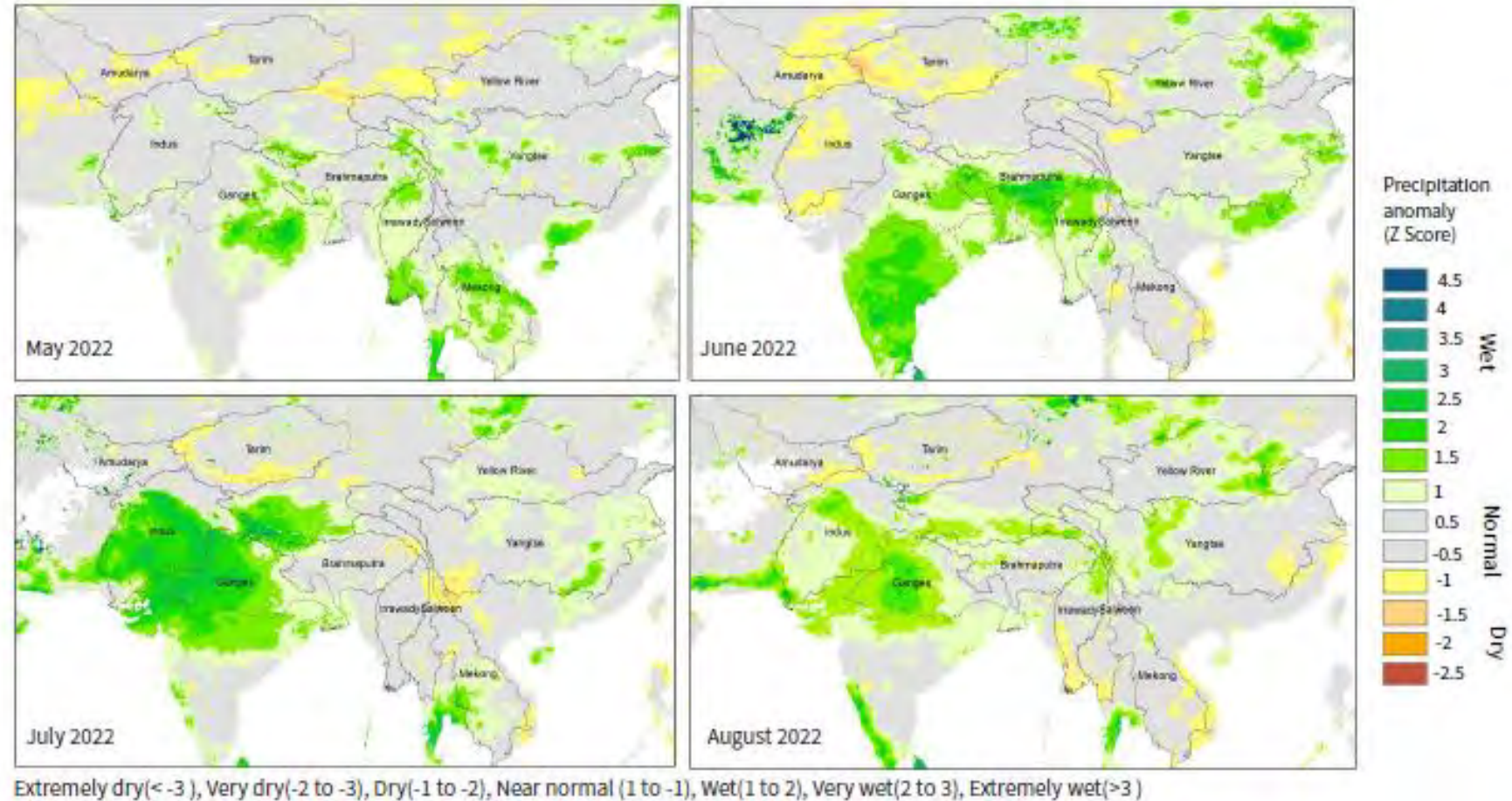


# Drought as slow-onset disaster

**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

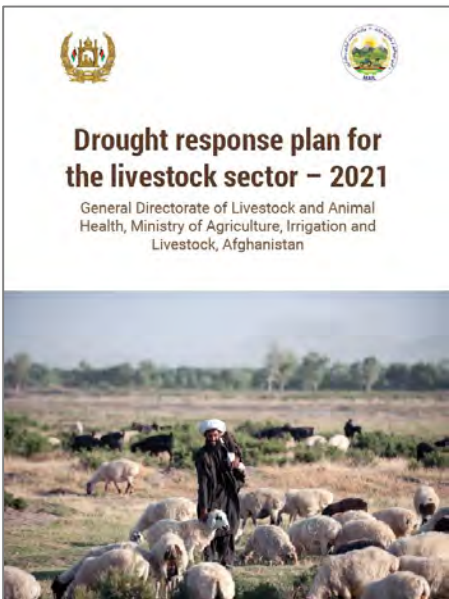
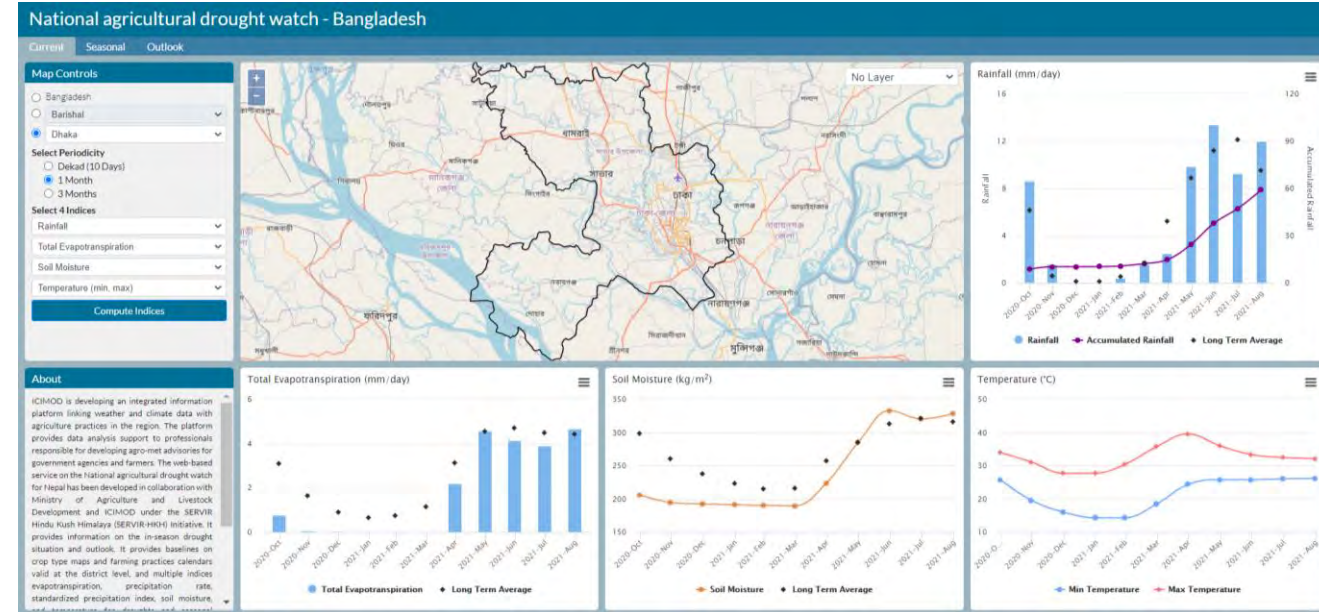
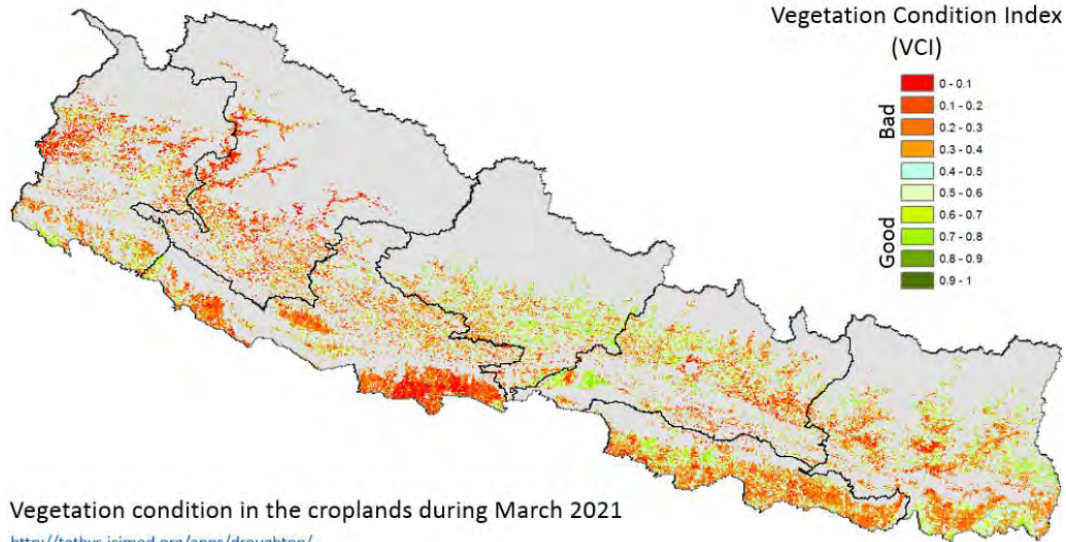
Key partners:

Johns Hopkins University

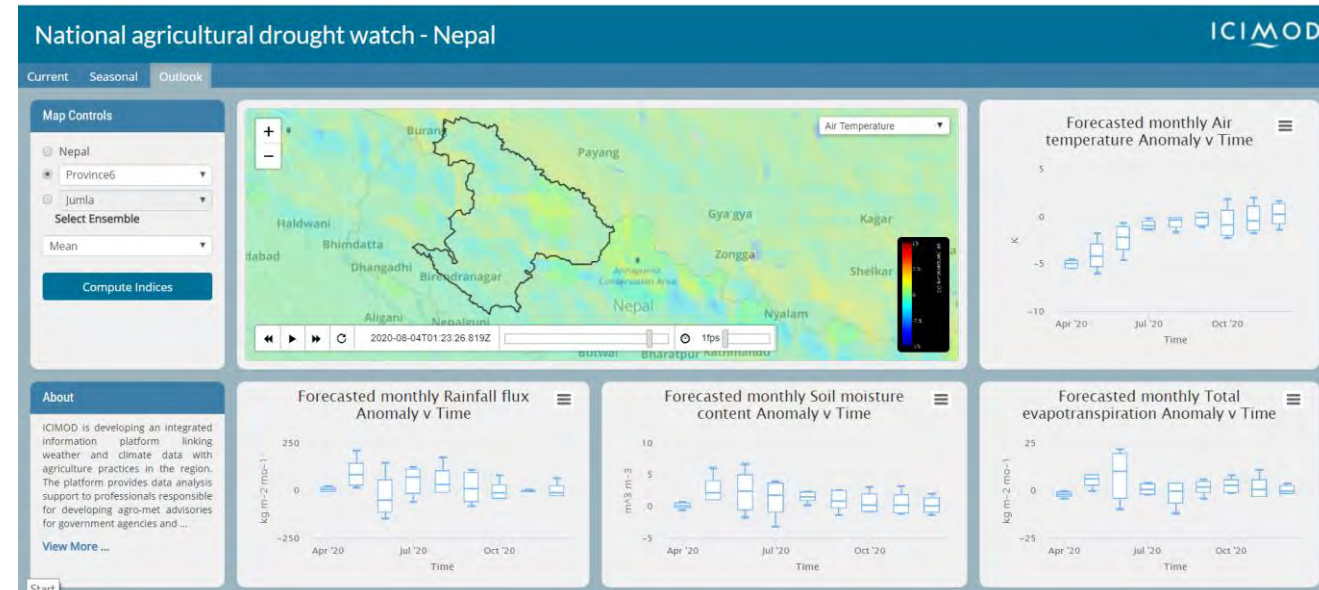




# Drought monitoring and early warning



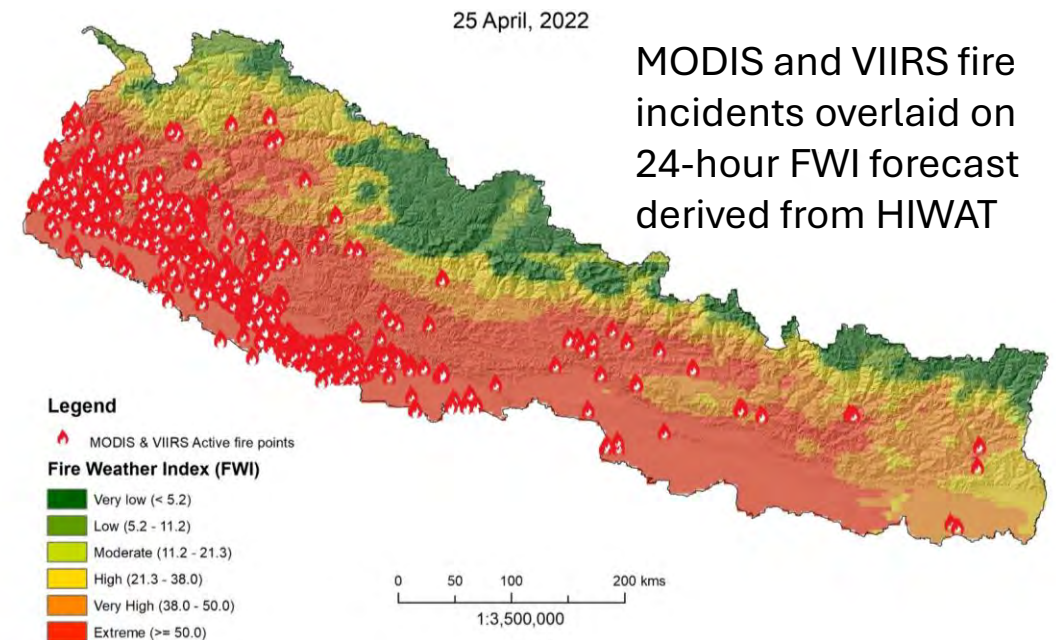
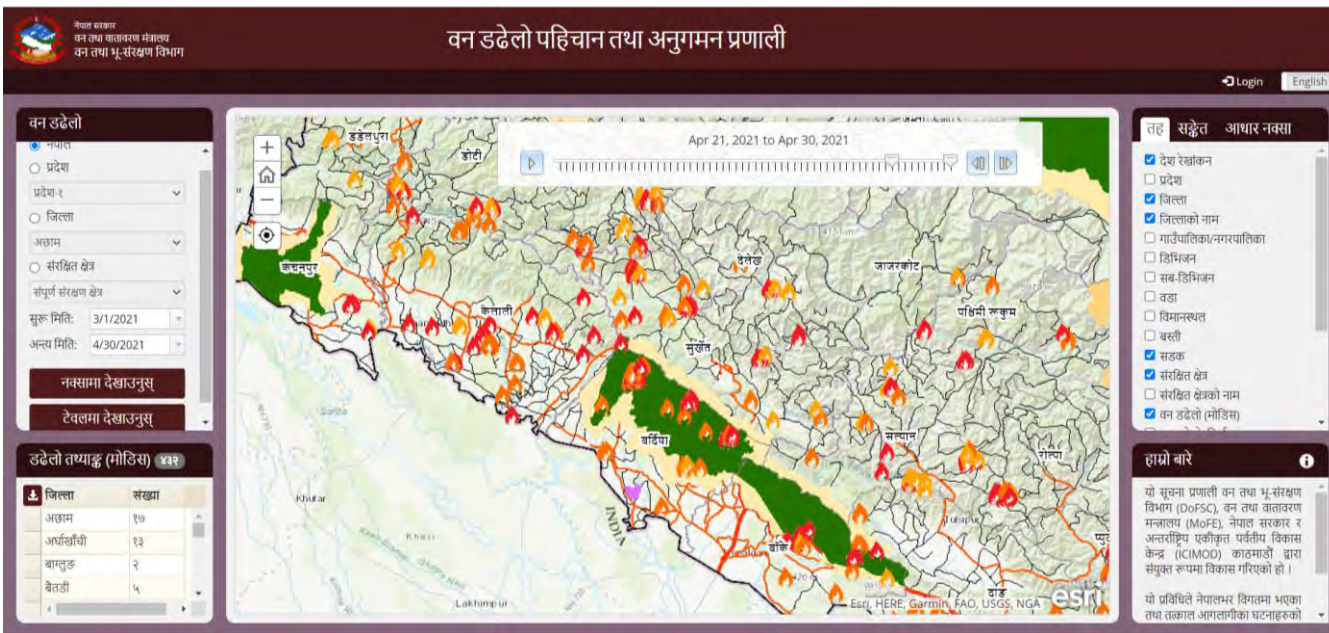
Declaration of national drought emergency Presidential office; Rangelands Directorate used for farmer aid assistance planning





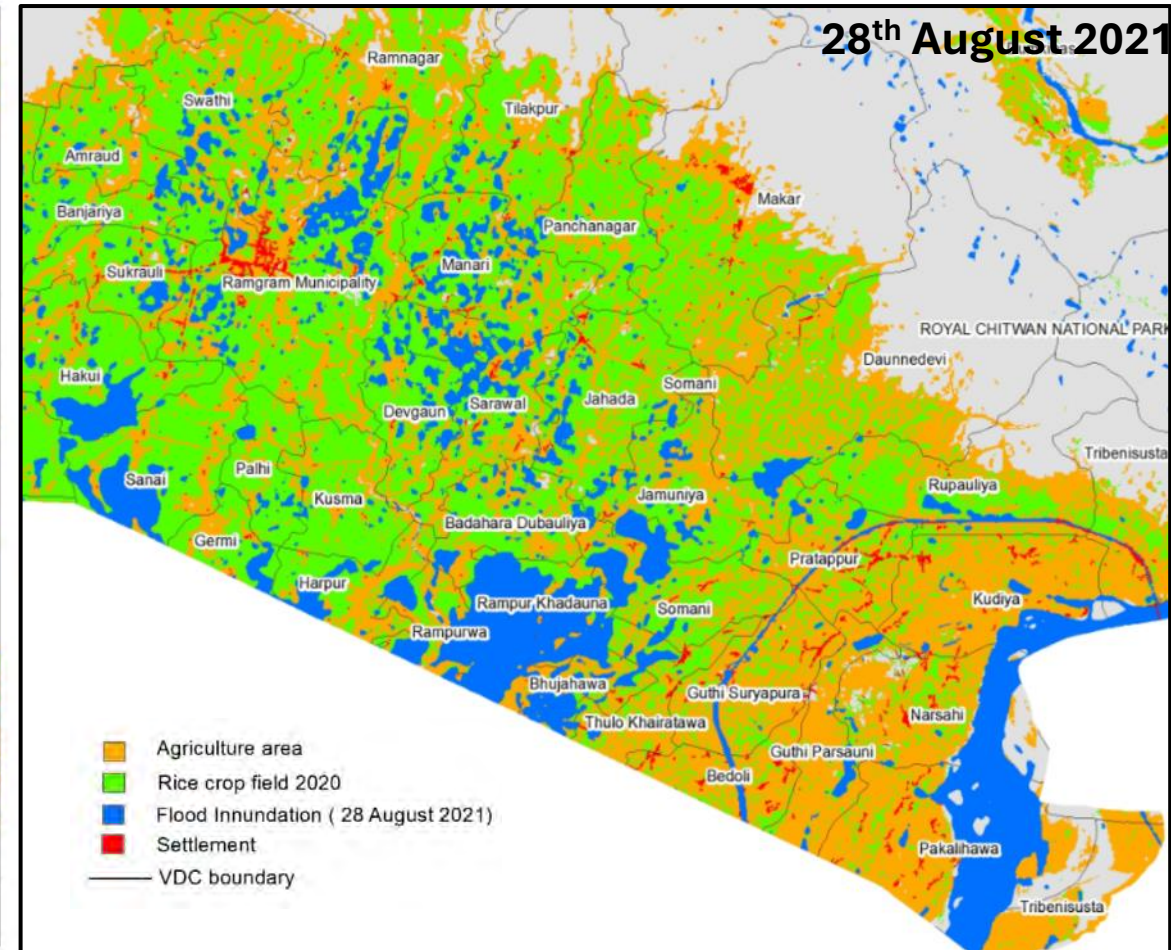
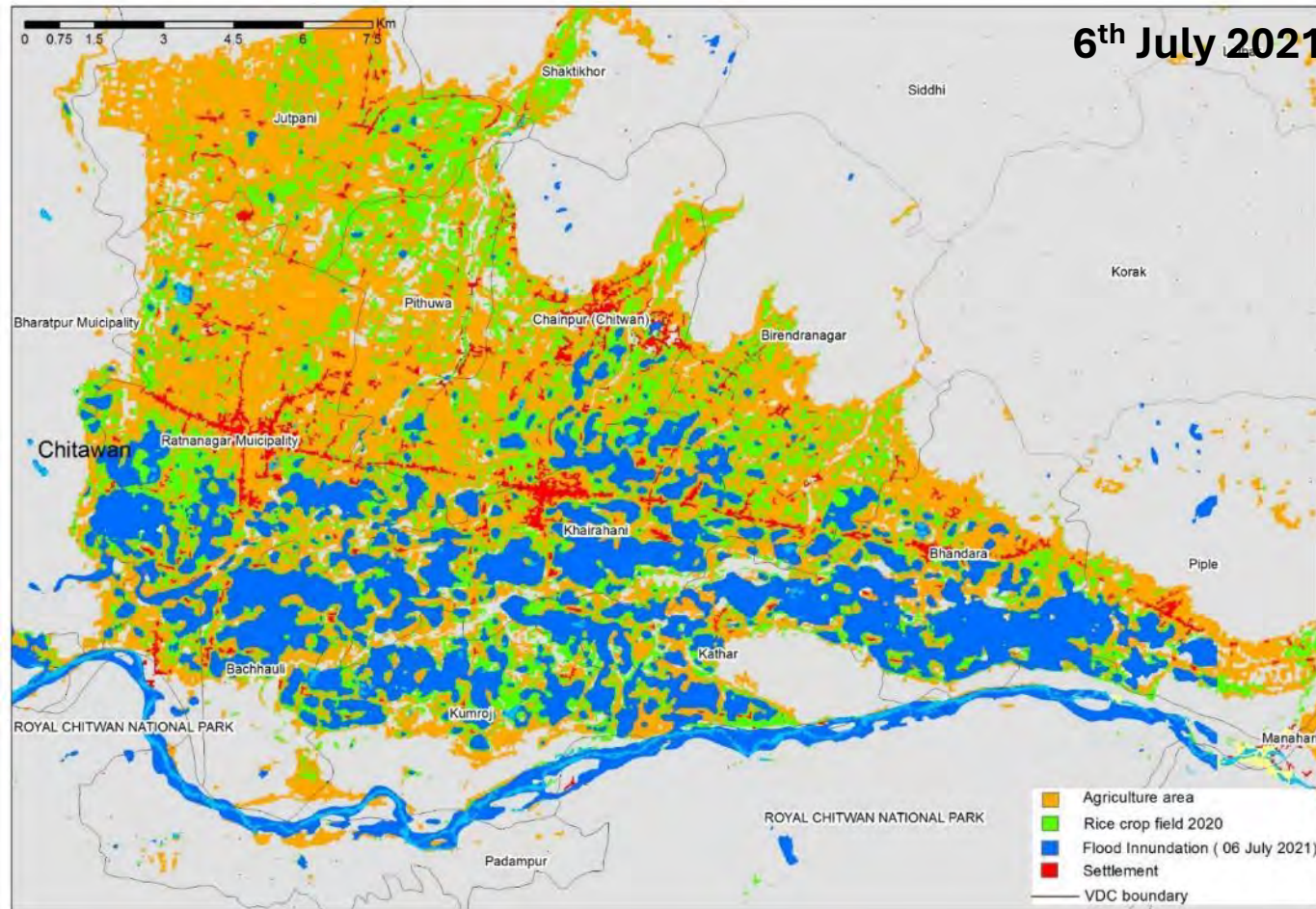
# Forest fire monitoring system

- Monitoring forest fires using MODIS and VIIRS satellite data for analysis of trends
- Fire risk outlook for two days using HIWAT model forecasts to identify potential risk areas



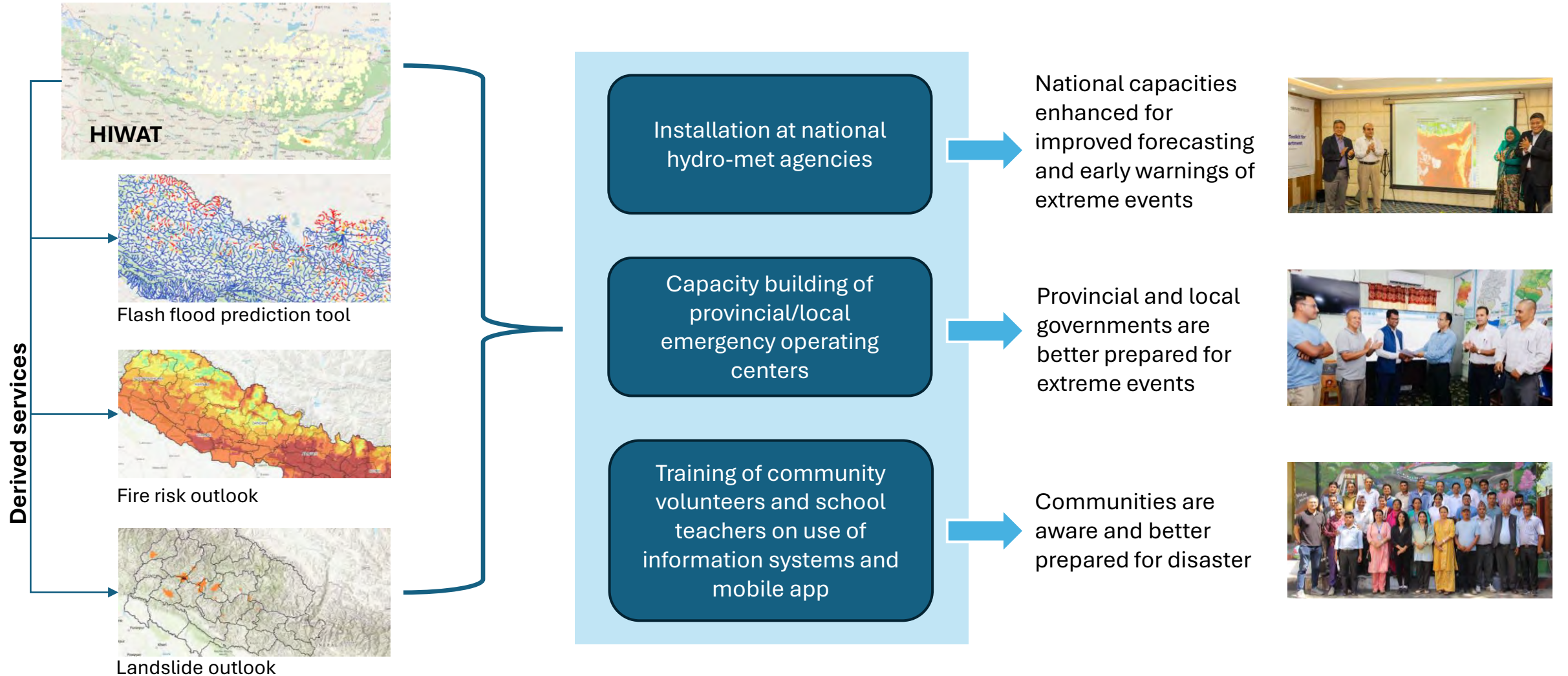


# Rapid response mapping for flood inundation in croplands





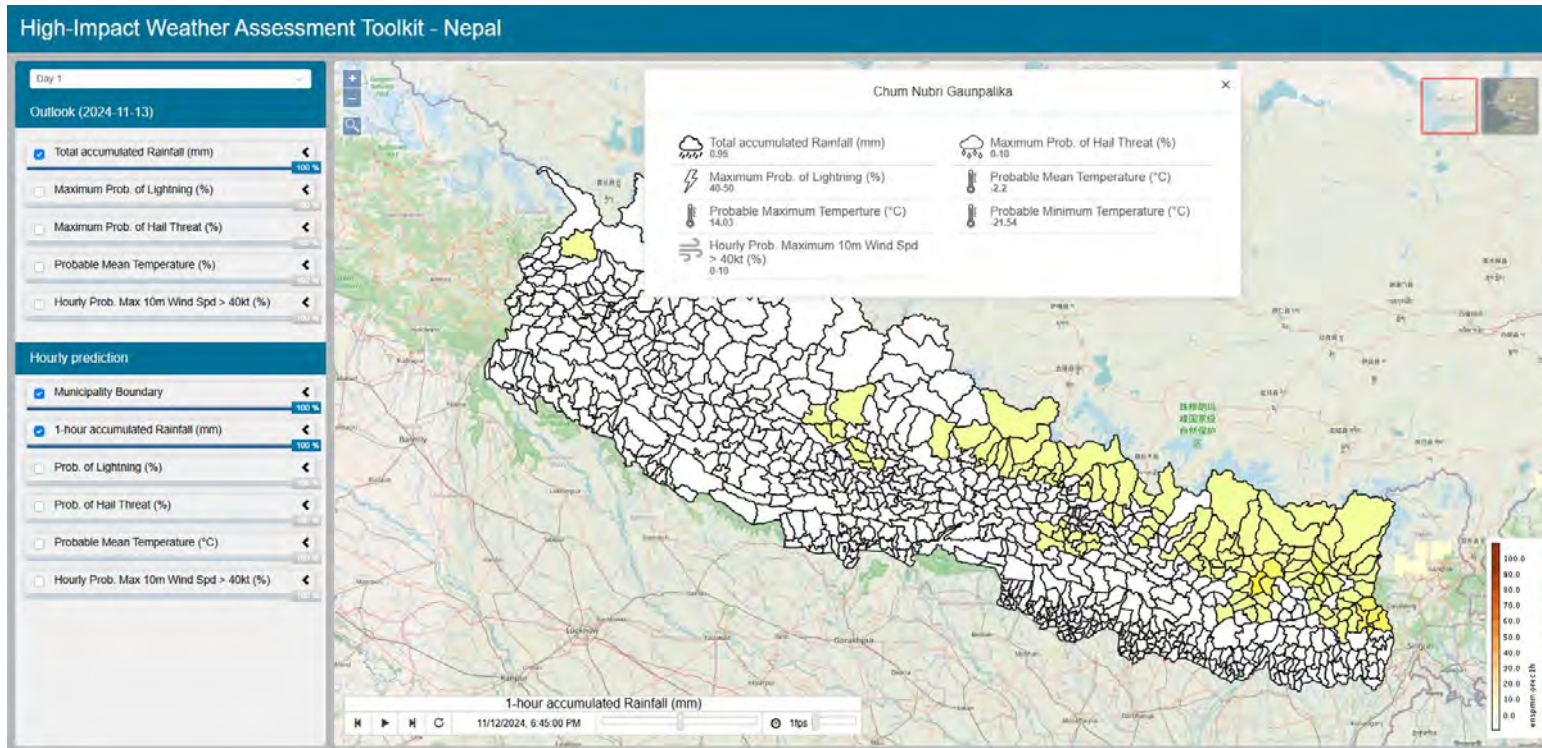
# Pathways to achieve impacts





# Customized applications for reaching out to communities

**Web applications** with simple user interfaces for easy understanding of information – HIWAT in Nepal and Bangladesh



ICIMOD

**DOWNLOAD  
OUR NEW APP**

GET IT ON  
**Google Play**

PRAKOPALERT PRAKOPALERT

**Prako Alert** mobile app specially developed on user demand to provide weather and flood forecast information generated from HIWAT System in Nepal



# Promoting data access and sharing

The screenshot shows the homepage of the ICIMOD Regional Database System. At the top, there is a navigation bar with links for Home, Data Explorer, Climate Data, About, FAQs, and Login. Below the navigation bar is a search bar and a 'Advanced Search' button. The main content area features a large globe graphic with satellite icons, followed by a 'Latest Datasets' section with three thumbnail images and their descriptions: 'GLACIAL LAKES IN THE KOSHI, GANDAKI, AND KARNALI RIVER BASINS OF NEPAL, THE TIBET AUTONOMOUS REGION OF CHINA, AND INDIA', 'POTENTIALLY DANGEROUS GLACIAL LAKES IN THE KOSHI, GANDAKI, AND KARNALI RIVER BASINS OF NEPAL, THE TIBET AUTONOMOUS REGION OF CHINA, AND INDIA', and 'FLOOD EXTENT IN NEPAL, INDIA AND BANGLADESH FOR JULY 2019'. Below this is a 'Programmes and Initiatives' section with several small images and text, and a 'Data Explorer' section with a map and several data visualization charts.

The screenshot shows the search results page for 'land cover' in the ICIMOD Regional Database System. The search bar at the top contains 'land cover' and the results show '72 Record(s) found'. The results are listed in a grid format, each with a title, a brief description, and a 'DOWNLOAD' button. The records include: 'Land cover of HKH region' (Land cover change is a significant contributor to environmental change...), '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...), '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...), and 'Land Cover of Pakistan 1990' (Land cover data of Hindu Kush Himalayan region of Pakistan for 1990...).

The screenshot shows the 'Climate Data Download Tool' interface. It features a map of the region with a red box highlighting a specific area. The tool includes several input fields: 'Data Source' (set to 'ICIMOD'), 'Select or draw AOI' (with 'Major Basin' and 'Sub Basin' dropdowns), 'Draw' (with 'REC', 'POLY', 'KML', and 'RESET' buttons), 'Measurement' (set to 'Interpolation Chart'), 'Future Climate Model' (set to 'Reference (RCP 2019)'), and 'Time Period' (with 'From Year' set to '2013' and 'To Year' set to '1985'). A 'DOWNLOAD' button is located at the bottom left of the tool panel.

Climate Data Download Tool

The screenshot shows the 'Flood Inundation Data Download Tool' interface. It features a map of the region with several green boxes highlighting specific areas. The tool includes input fields for 'From Date' (set to '01/01/2010') and 'To Date' (set to '01/01/2020'), a 'Region' dropdown (set to 'Nepal'), and a 'Data' dropdown (set to 'Flood'). There are 'RESET' and 'FILTER' buttons, and a 'DOWNLOAD' button at the bottom.

Flood Inundation Data Download Tool

<https://rds.icimod.org>





# Key takeaways

- Earth observation provides critical data needed to understand and monitor changes in our environment
- Emerging technologies offer new opportunities for Climate Modeling and Predictions to generate more accurate and timely information
- We need more openness on sharing Data and Science to promote collaborative research, capacity building, and policy and decision support
- Community Engagement for meaningful use of available information resources to empower local populations
- Incorporating Earth observation into climate resilience strategies can significantly enhance our ability to adapt to and mitigate the effects of climate change



Thank You

