

# PAK-RSO ACTIVITIES

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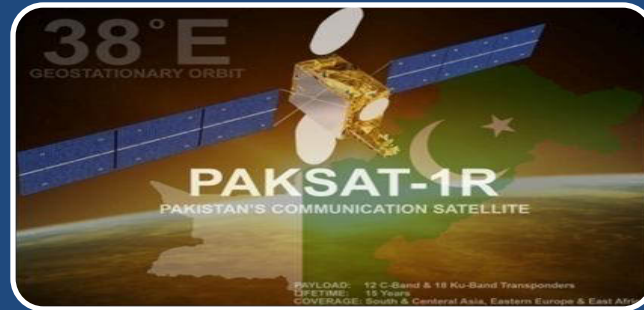
# Sequence of Presentation

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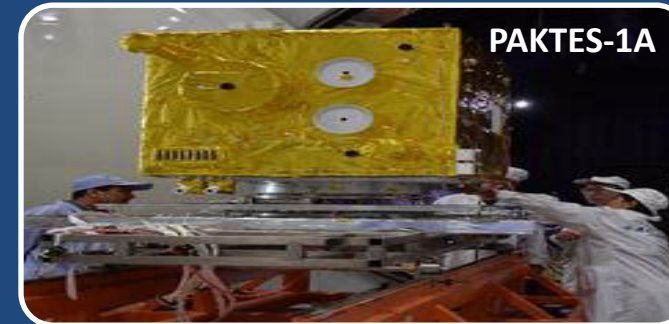
- About SUPARCO
- Space Technology for Disaster Management
- Flood 2022
- NatCat Model Project
- Way Forward

# Assets in Space

COMMUNICATION



REMOTE SENSING



SATELLITE

GROUND

STATIONS

- **DIRECT RECEIVING STATION - PRSS-I , PAK-TES-1A, SPOT CONSTELLATION**
- **SPATIAL RESOLUTION VARIES FROM 0.3 TO 20 METER**
- **LEGACY ARCHIVE SINCE 1989**





# Background – Major Disasters in Recent History



Kashmir Earthquake - 2005



Pakistan Flood - 2010



Awaran Earthquake – 2013

# Space Applications Center for Response in Emergency and Disasters



- The centre provides space based information to Federal & Provincial disaster management agencies to rapidly assess the extent of natural disasters and damages
- Center is also host to **UN-SPIDER** Regional Support office in Pakistan and provides assistance to **regional countries** in case of natural disasters

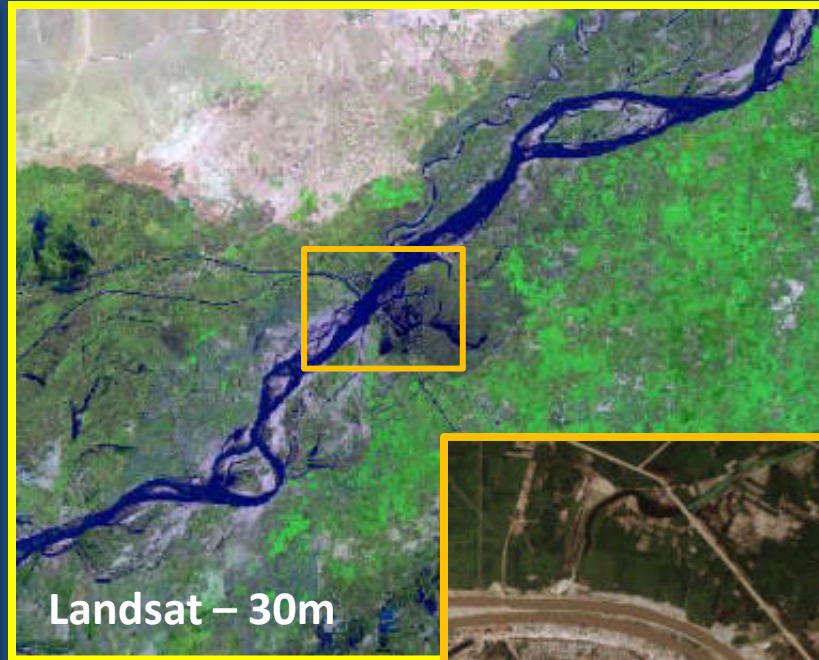
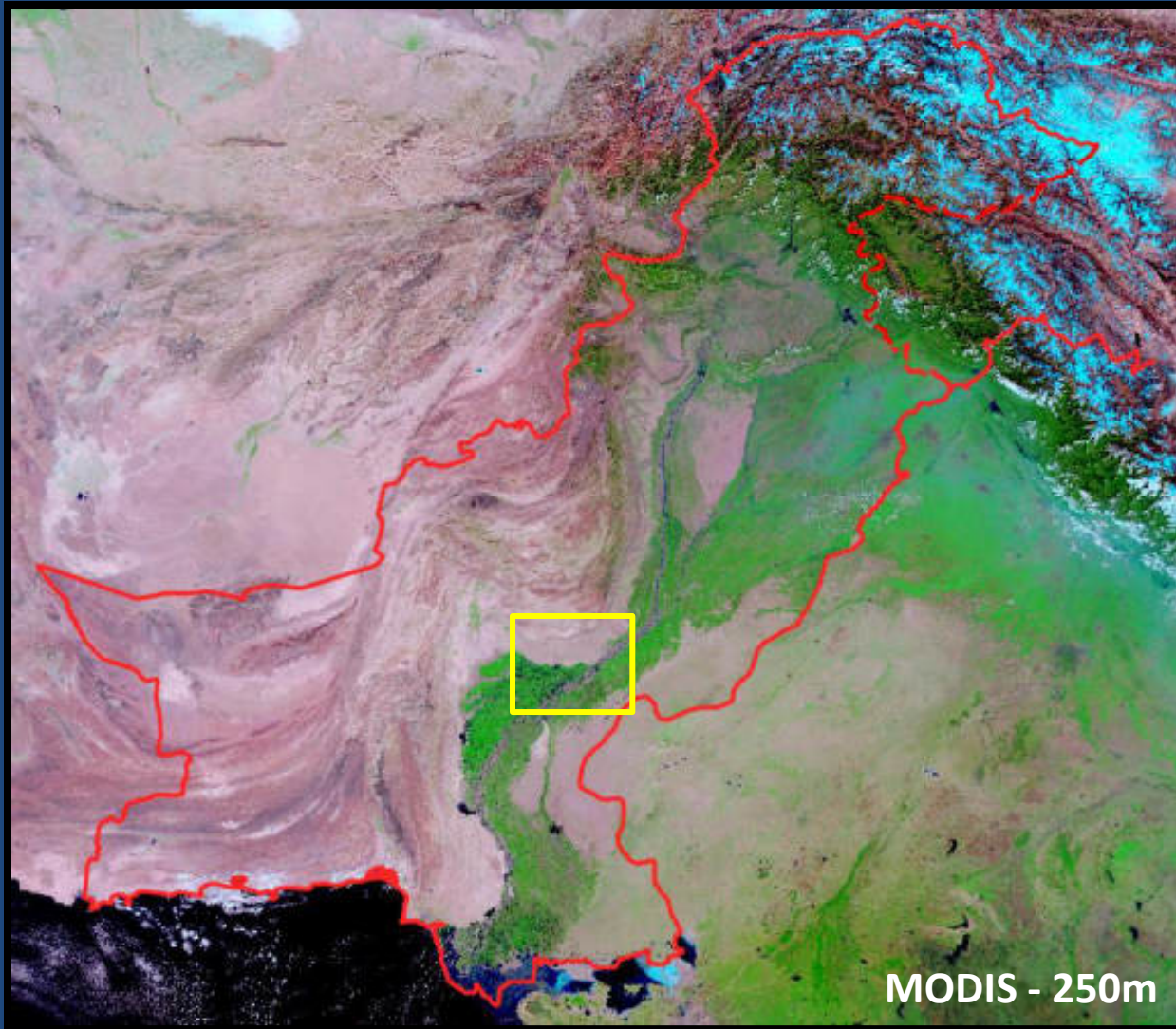


# Space Technology for Disaster Management

Satellite due to the synoptic view and repeated coverage can play pivotal role in the monitoring of following:

- ✓ River basins including trans-boundary which are otherwise inaccessible
- ✓ Dams on Eastern Rivers during monsoon
- ✓ Long-term changes in Glaciers
- ✓ Drought assessment
- ✓ Active Landslide and faults
- ✓ Environmental profile at national and regional level

# Space in Aid



Satellites can provide information at Regional, National and Local level

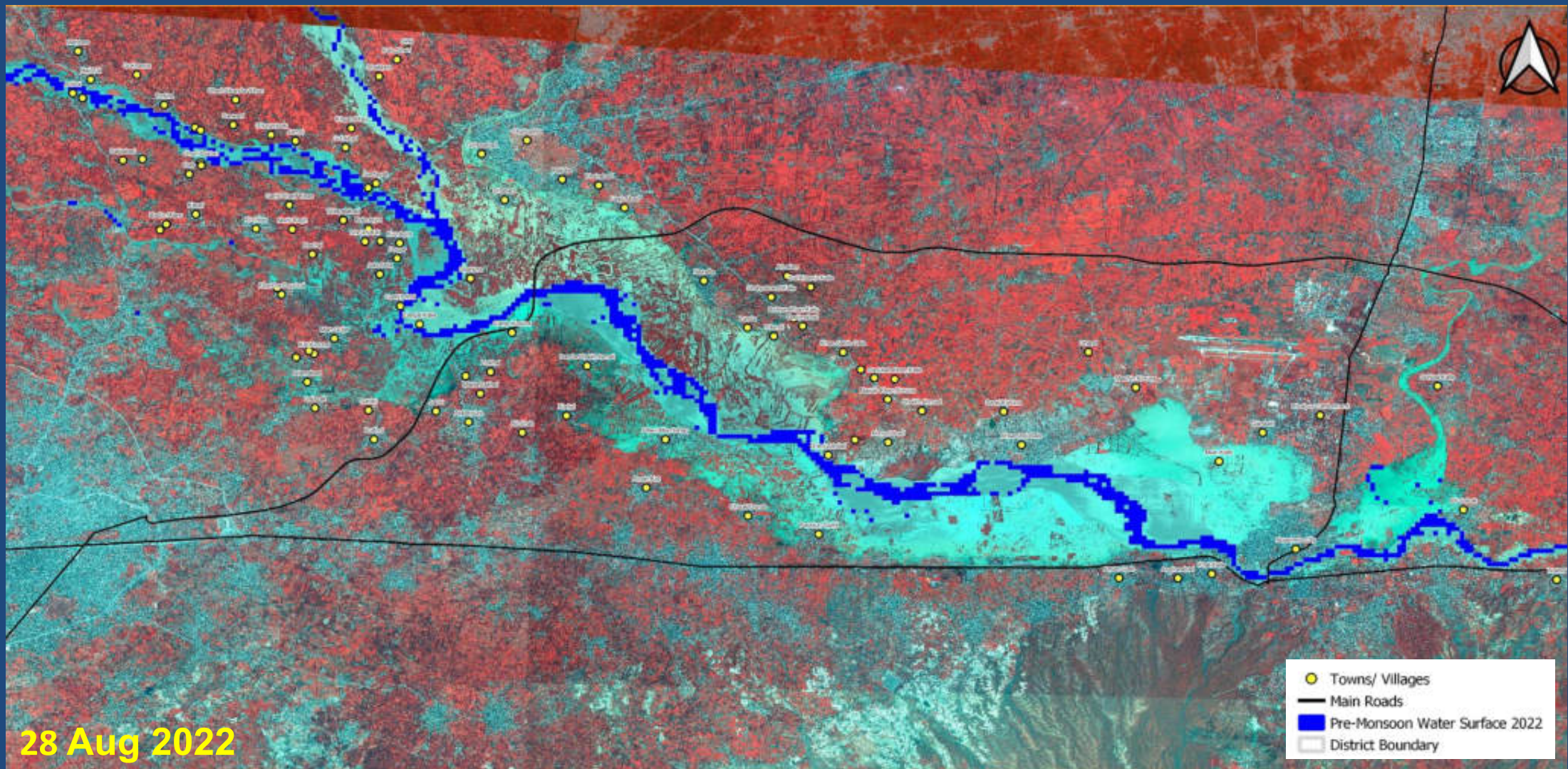
# Space based support to NDMA/PDMAs during Monsoon

- Regular monitoring of Rivers, Trans-boundary dams, Glaciers
- Torrents / Flash floods
- House / settlements damage assessment
- Road / bridges damage assessment on major highways
- Crops damage assessment
- Dams breach assessment / identification



# ***Flood 2022***

# Flooding in Kabul and Swat Rivers at Nowshera





# Damages caused by Floods/Rains 2022 - Buildings



Pre - 01 Jun 2022



Post - 28 Aug 2022



Pre - 01 Jun 2022



Post - 28 Aug 2022



# Damages caused by Floods/Rains 2022 – Road/Bridges



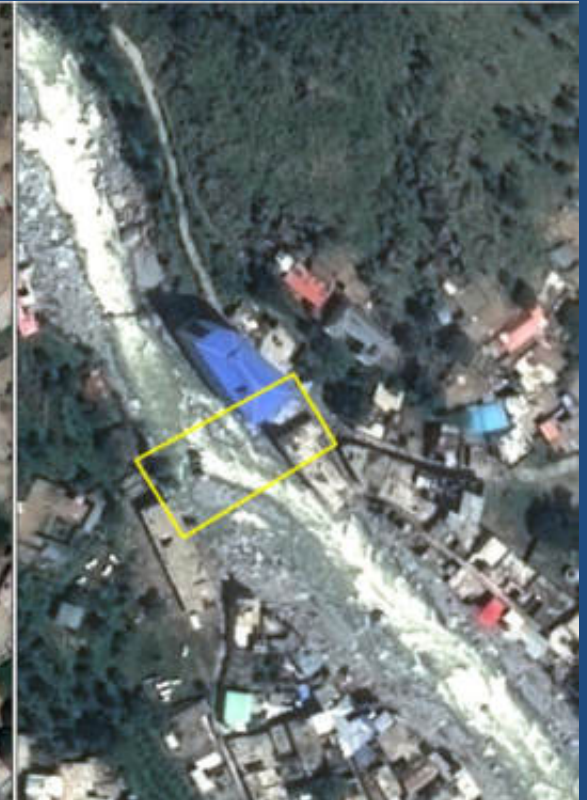
Pre - 01 Jun 2022



Post - 28 Aug 2022



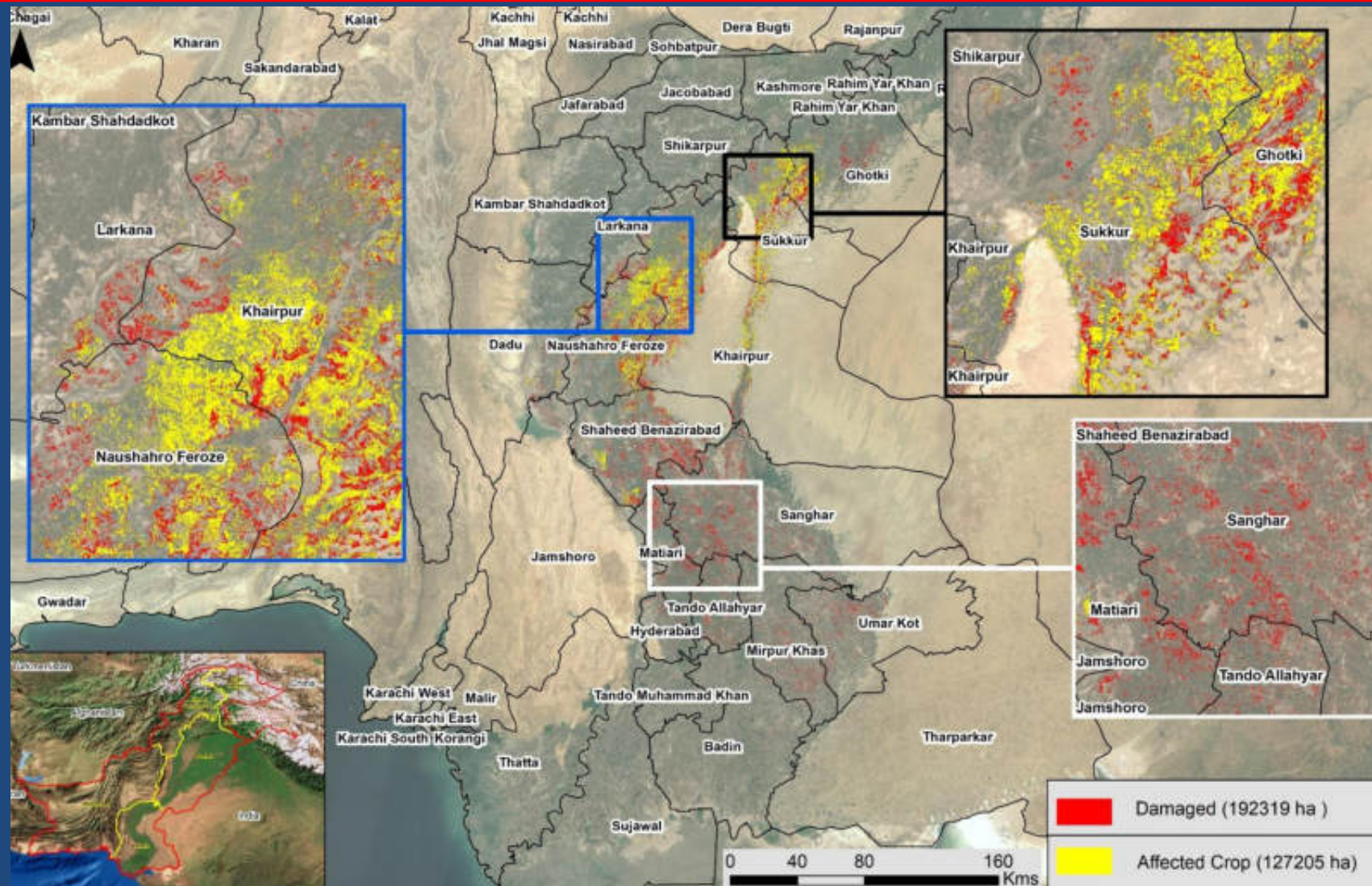
Pre - 01 Jun 2022



Post - 28 Aug 2022



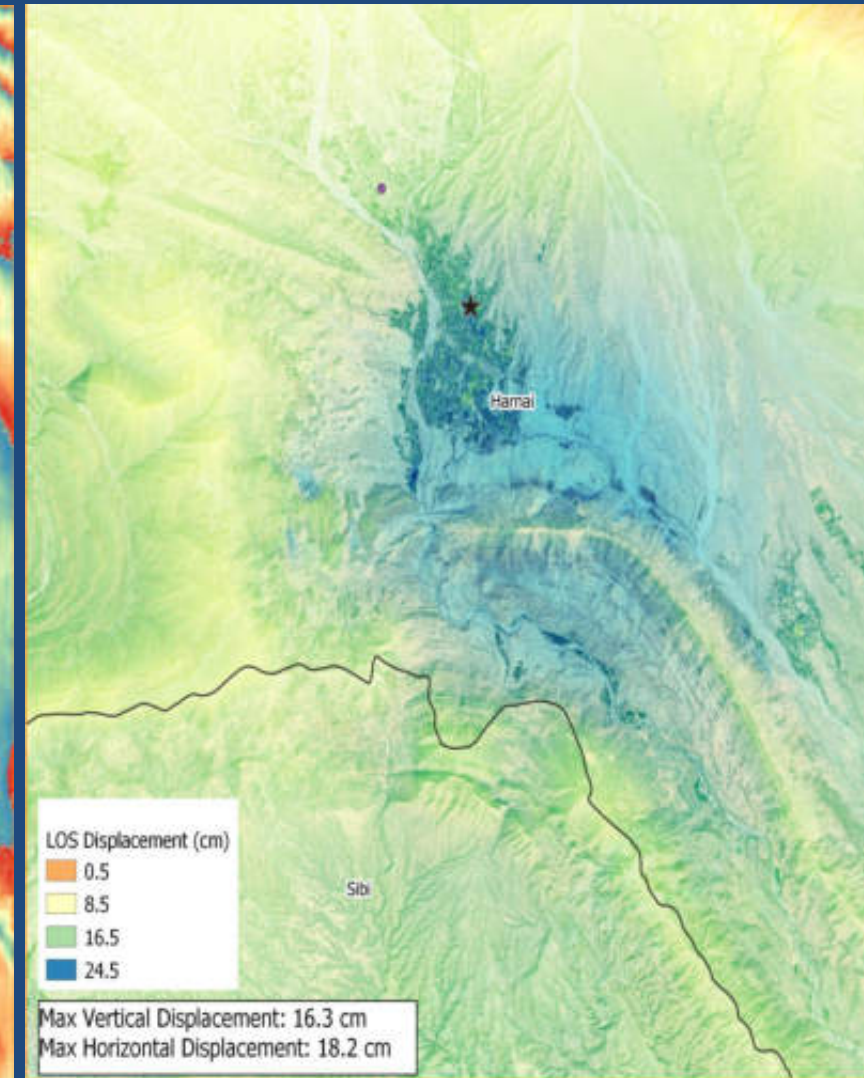
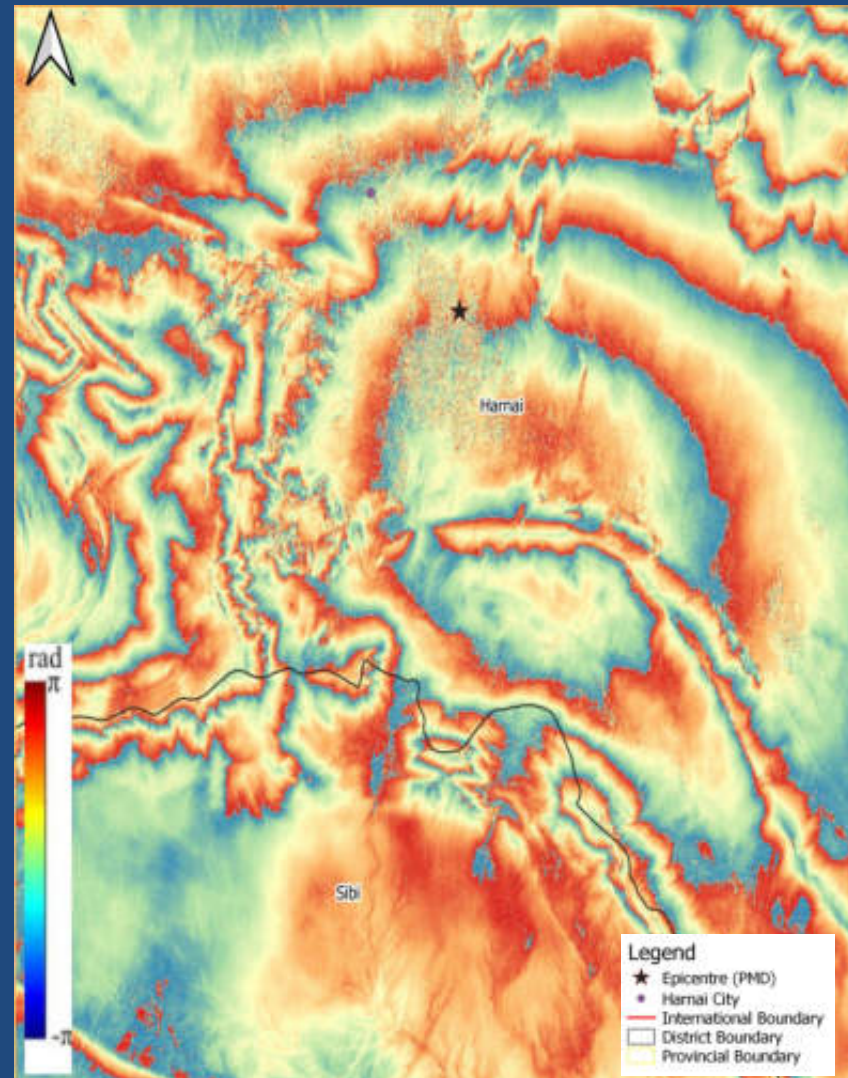
# Damages caused by Floods/Rains 2022 – Crops





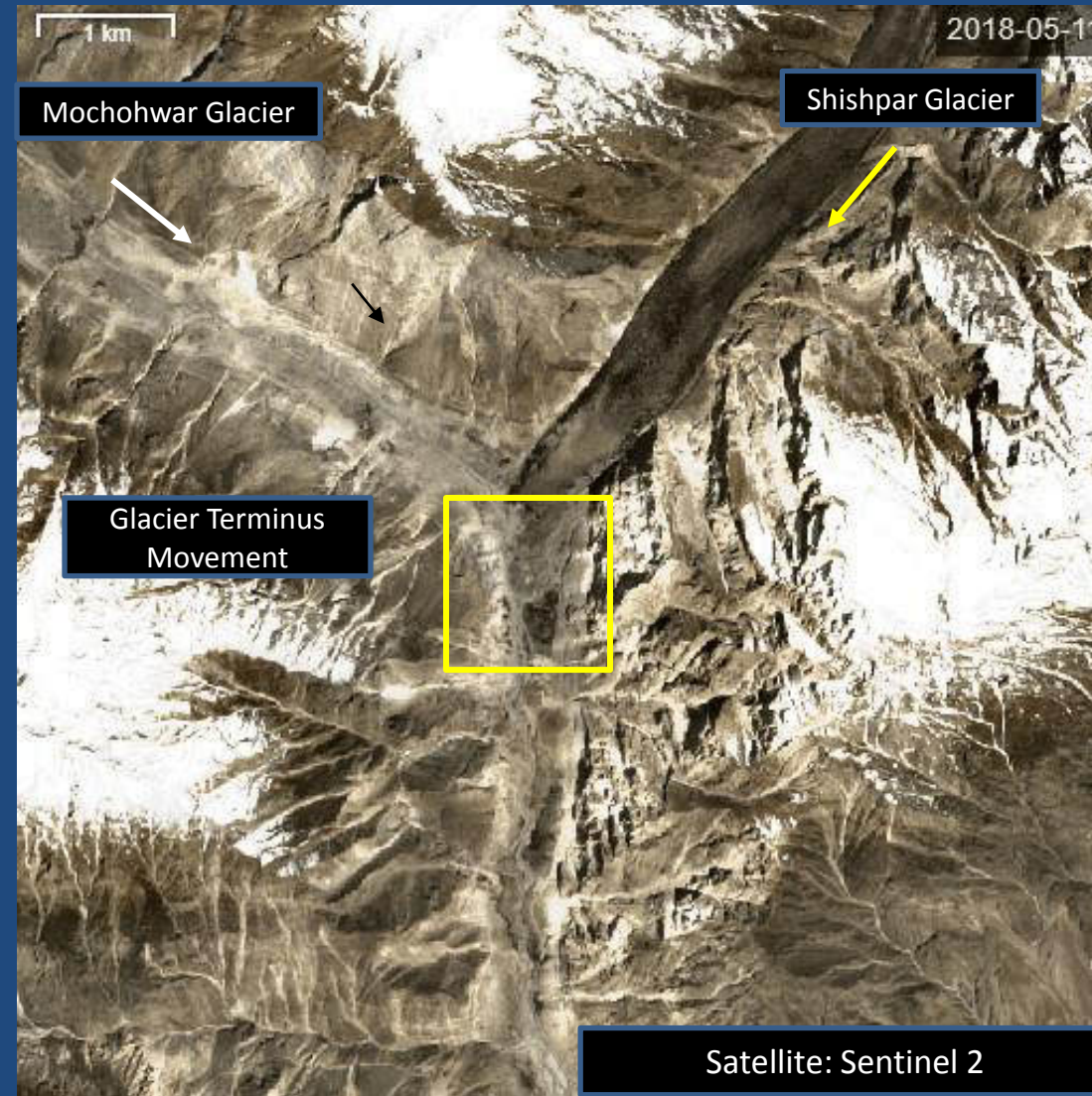
# Harnai Earthquake, Co-Seismic Displacement Map

- **Background:** Line of Sight (LoS) Displacement extracted from SAR Interferogram
- **Image Date:** 28 Sep & 10 Oct 2021
- **Location:** Harnai, Balochistan
- **Data Sources:** Sentinel-1





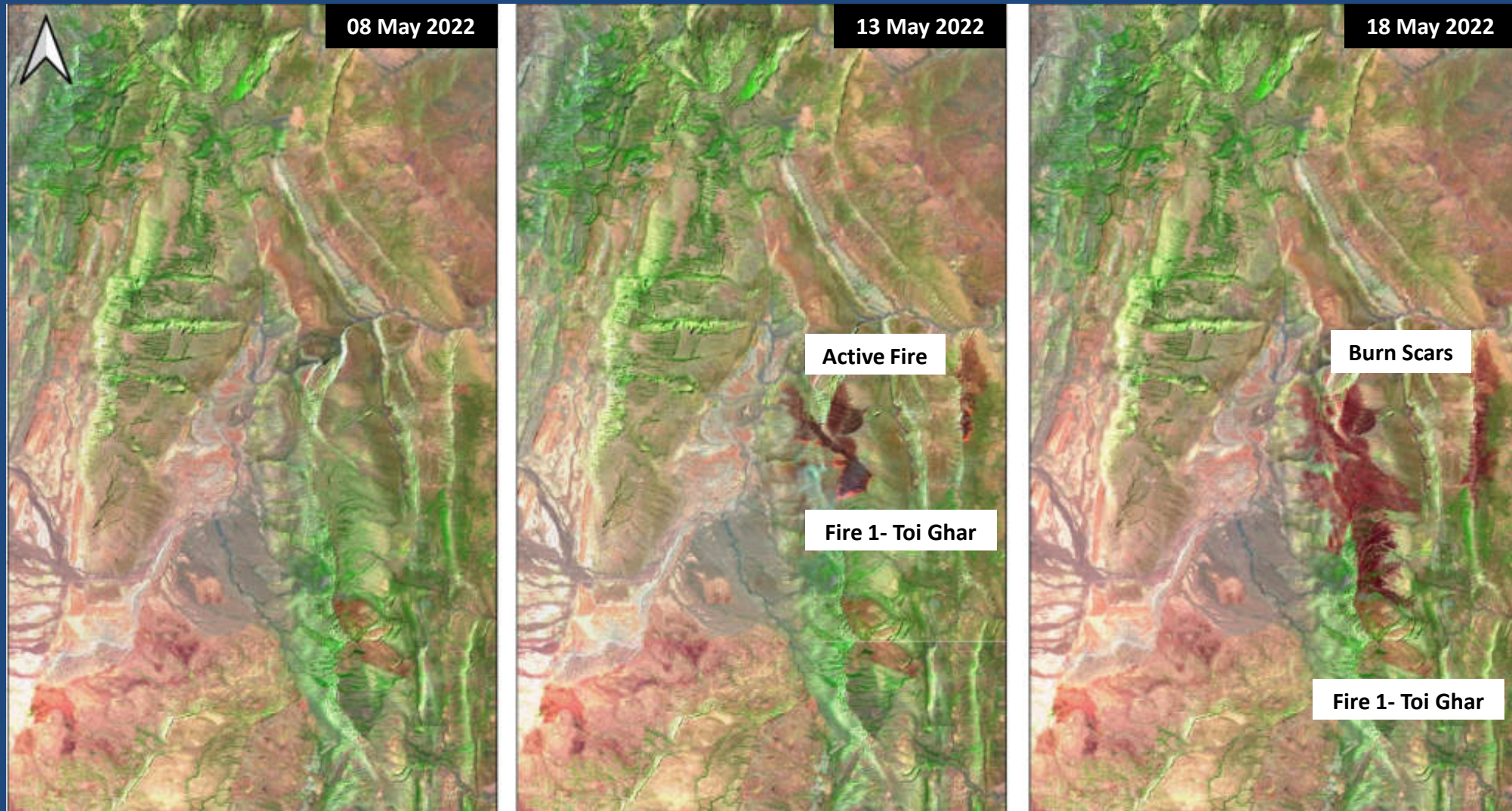
# Monitoring of Shishper Glacier Surging



2018-21



# Balochistan Forest Fire 2022 - Toi Ghar



Sentinel-2 10m satellite imagery acquired on 08, 13 and 18 May 2022



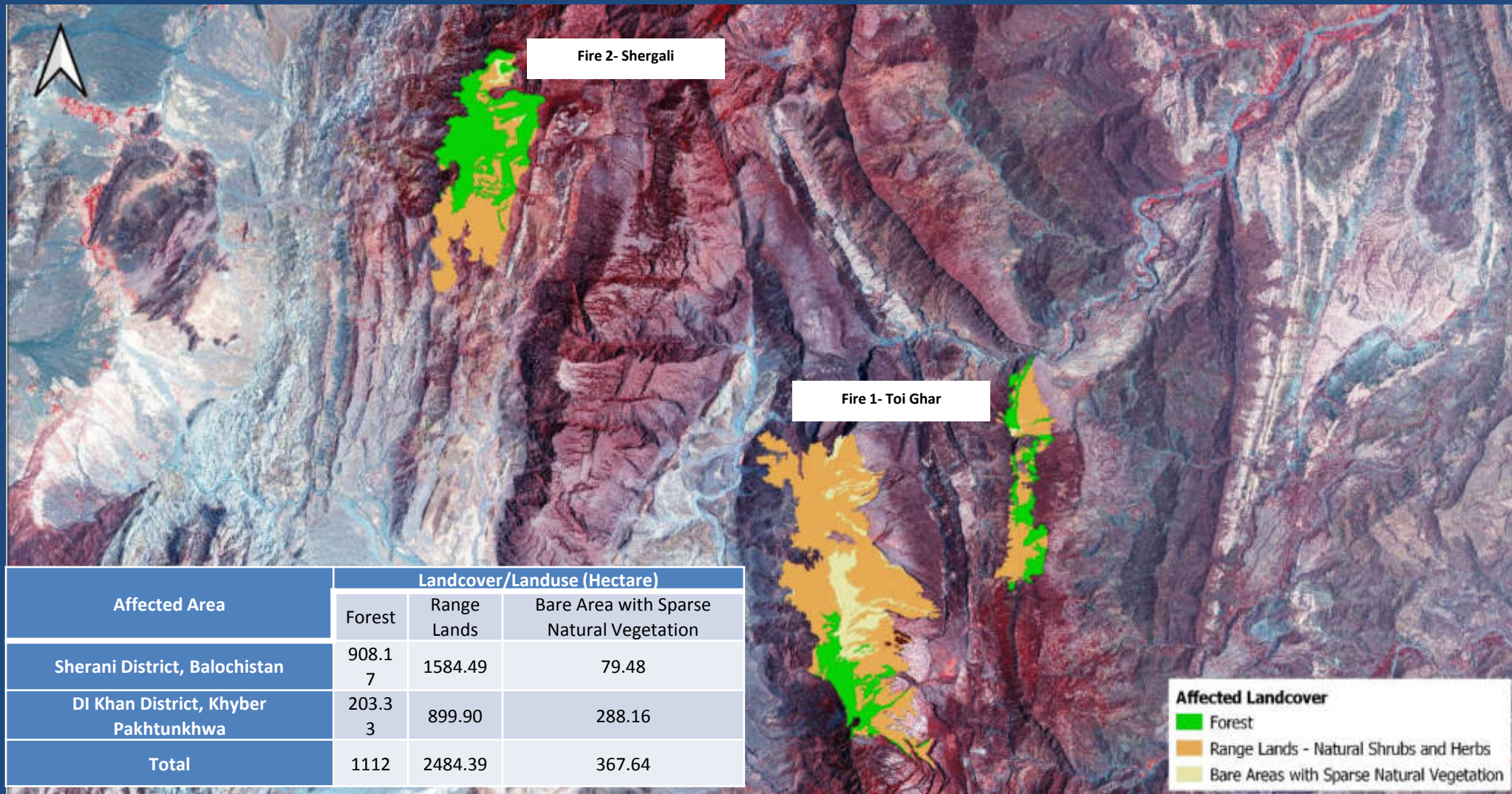
# Balochistan Forest Fire 2022 - Toi Ghar and Shergali Forest



SPOT 1.5m satellite imagery acquired on 19, 20 and 22 May 2022

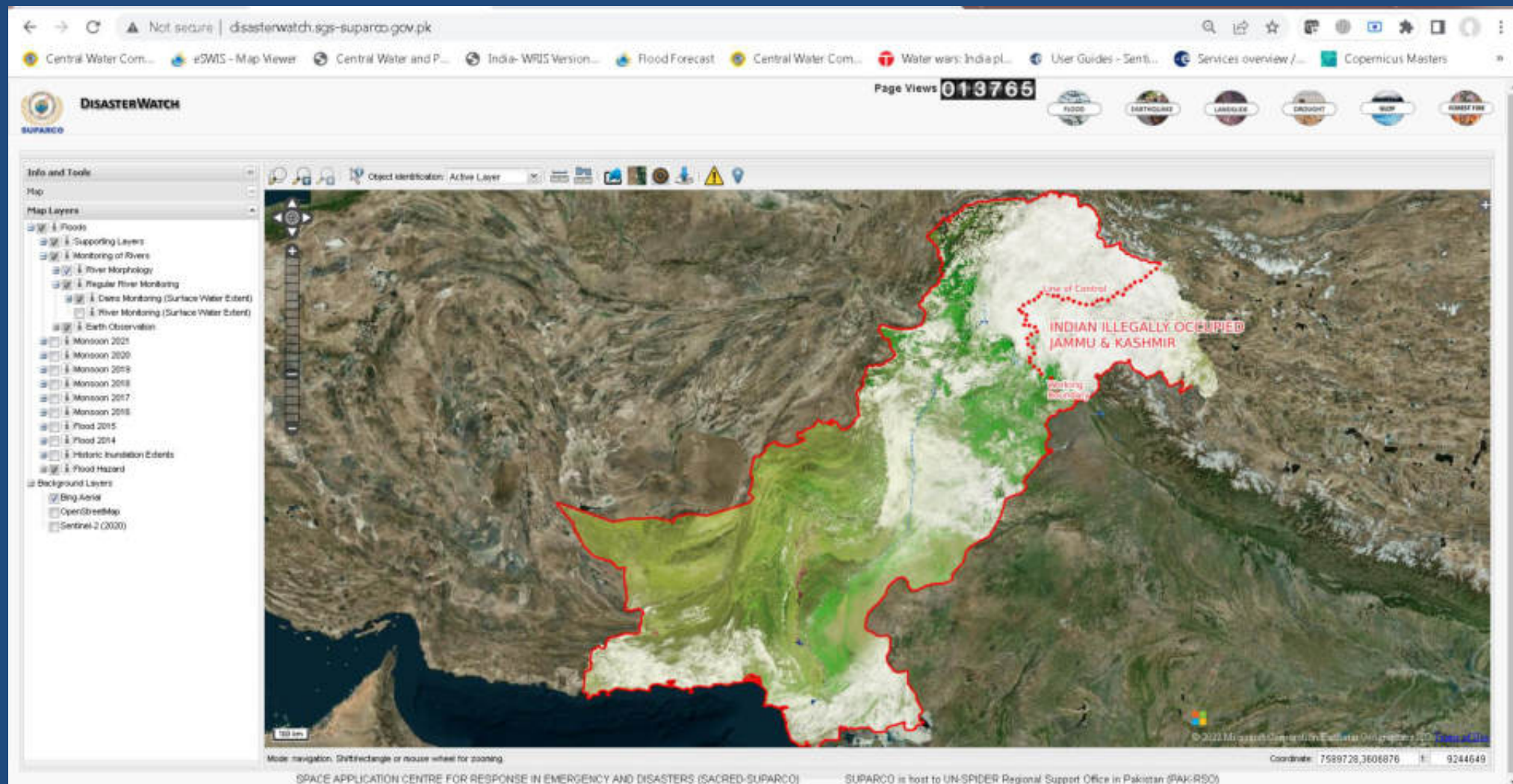


# Balochistan Forest Fire 2022 – Affected Landcover





# Near Real Time Support via DisasterWatch



# Near Real Time Support via DisasterWatch

Not secure | disasterwatch.sgs-suparco.gov.pk/?map=floods/downloadMaps

Central Water Com... eSWIS - Map Viewer Central Water and P... India- WRS Version... Flood Forecast Central Water Com... Water wars: India pL... User Guides - Senti... Services overview /... Copernicus Masters

Page Views **013766**

DISASTERWATCH  
SUPARCO

FLOOD EARTHQUAKE LANDSLIDE DROUGHT SLUR ROCKET FIRE

Inundation Maps Hazard Maps

River Ravi Situation Analysis – 02 August 2022

Flooding Situation Analysis SPOT-6 – Kachhi, Balochistan 02 August 2022

Flooding Situation Analysis SPOT-6 – Loralai, Balochistan 02 August 2022

Flooding Situation Analysis – Kalat, Balochistan 30 July 2022

Flooding Situation Analysis – Khuzdar, Balochistan 30 July 2022

Flooding Situation Analysis SPOT-6 – Jhal Magsi, Balochistan 30 July 2022

Flooding Situation Analysis Sentinel-2 – Jhal Magsi, Balochistan 30 July 2022

River Chenab Situation Analysis – 30 July 2022

Flooding Situation Analysis – Lasbela, Balochistan 30 July 2022

Flooding Situation Analysis – Balochistan 30 July 2022

Flooding Situation Analysis – Jhang,

Flooding Situation Analysis – Fazipur, District Rajanpur,

Flooding Situation

Flooding Situation

Flooding Situation

SPACE APPLICATION CENTRE FOR RESPONSE IN EMERGENCY AND DISASTERS (SACRED-SUPARCO) SUPARCO is host to UN-SPIDER Regional Support Office in Pakistan (PAK-RSO)



# Global Agenda's

## *Shifting of focus from Reactive to Proactive Approach*

- ❖ Sendai Framework for Disaster Risk Reduction 2015-2030 Priorities for action

### **1. Understanding disaster risk;**

2. Strengthening disaster risk governance to manage disaster risk;

3. Investing in disaster risk reduction for resilience;

**4. Enhancing disaster preparedness for effective response, and to “Build Back Better” in recovery, rehabilitation and reconstruction.**

- ❖ Climate Change Agreement (COP21) – **Article 8**

- ❖ Sustainable Development Goals (SDGs) 2015-30 – **SDGs 6, 13, and 15**

### **SDG13: TAKE URGENT ACTION TO COMBAT CLIMATE CHANGE AND ITS IMPACTS**

- ❖ National Disaster Management Plan (NDMP) Implementation Roadmap 2015-30

# Disaster Risk Assessment – NatCat Model Project



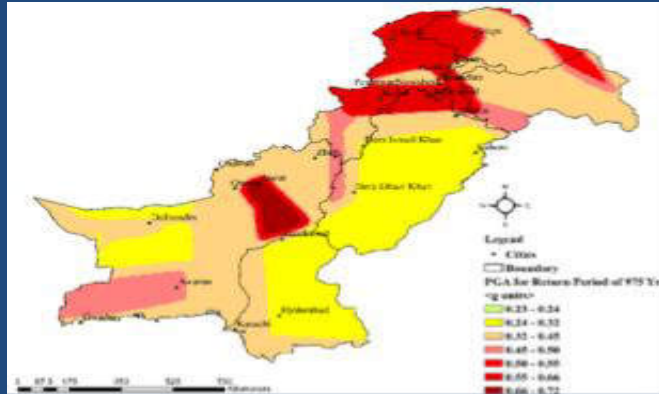
# National Catastrophic Model (NatCat) for NDRMF

- Development of Database and Web Application (Risk Calculator)
- Hydro-meteorological Hazard Assessment (Flood, Drought, Cyclone)
- Geo-physical Hazard Assessment (Seismic)
- Exposure of Landcover, Crops and Infrastructure to Hydro-meteorological and Geo-physical Hazards
- Loss and Risk Assessment Model for Hydro-meteorological and Geo -physical Hazards
- Integrated Risk Assessment

# NatCat Model Project

SUPARCO is currently undertaking Development of geo-referenced database for natural catastrophe (NatCat Model) Project for National Disaster Risk Management Fund (NDRMF).

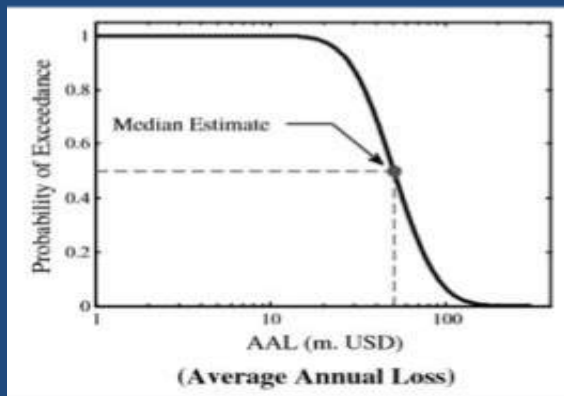
and magnitude.



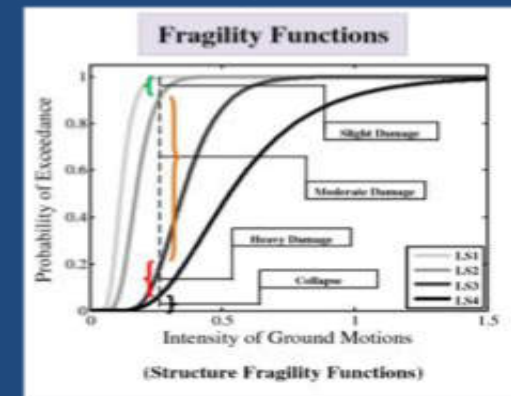
Hazard



Exposure



Loss/Risk



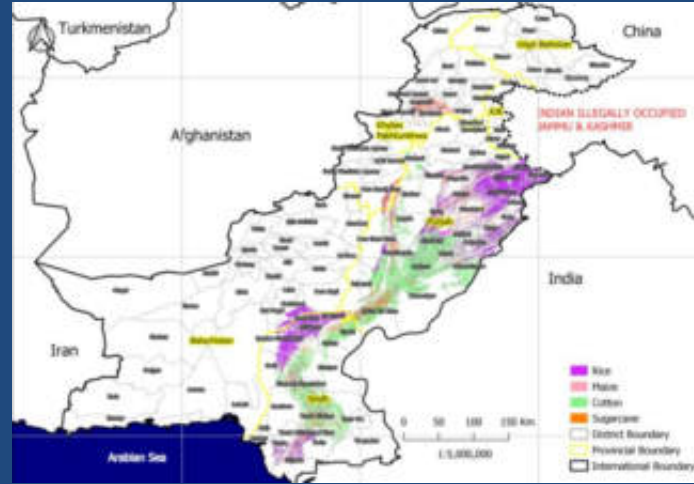
Vulnerability



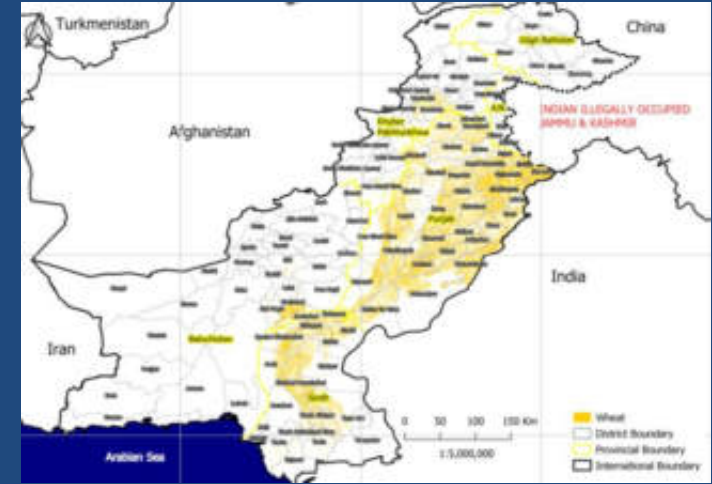
# Exposure Datasets



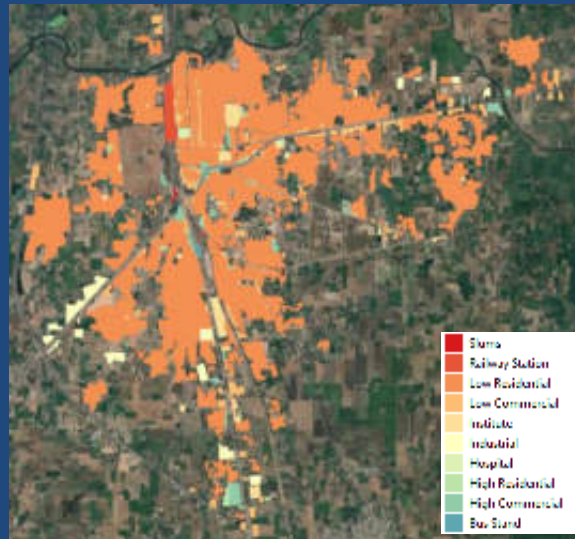
Landcover



Kharif CropMask



Rabi CropMask

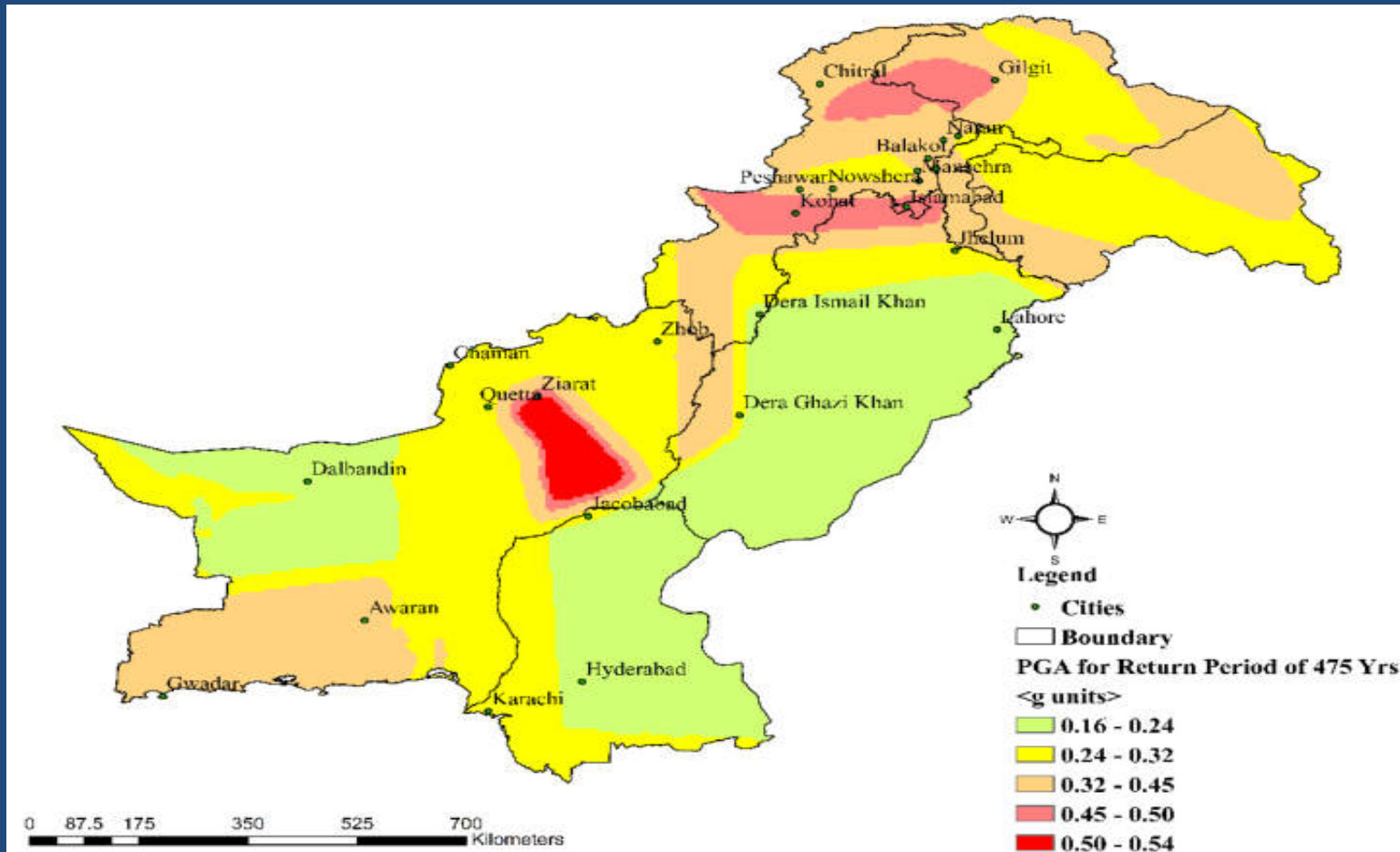


Low Rise Residential



High Rise Residential

# NatCat Project - Seismic Hazard Assessment



Probabilistic Seismic Hazard Assessment against 95, 475, 975, and 2475 years return periods



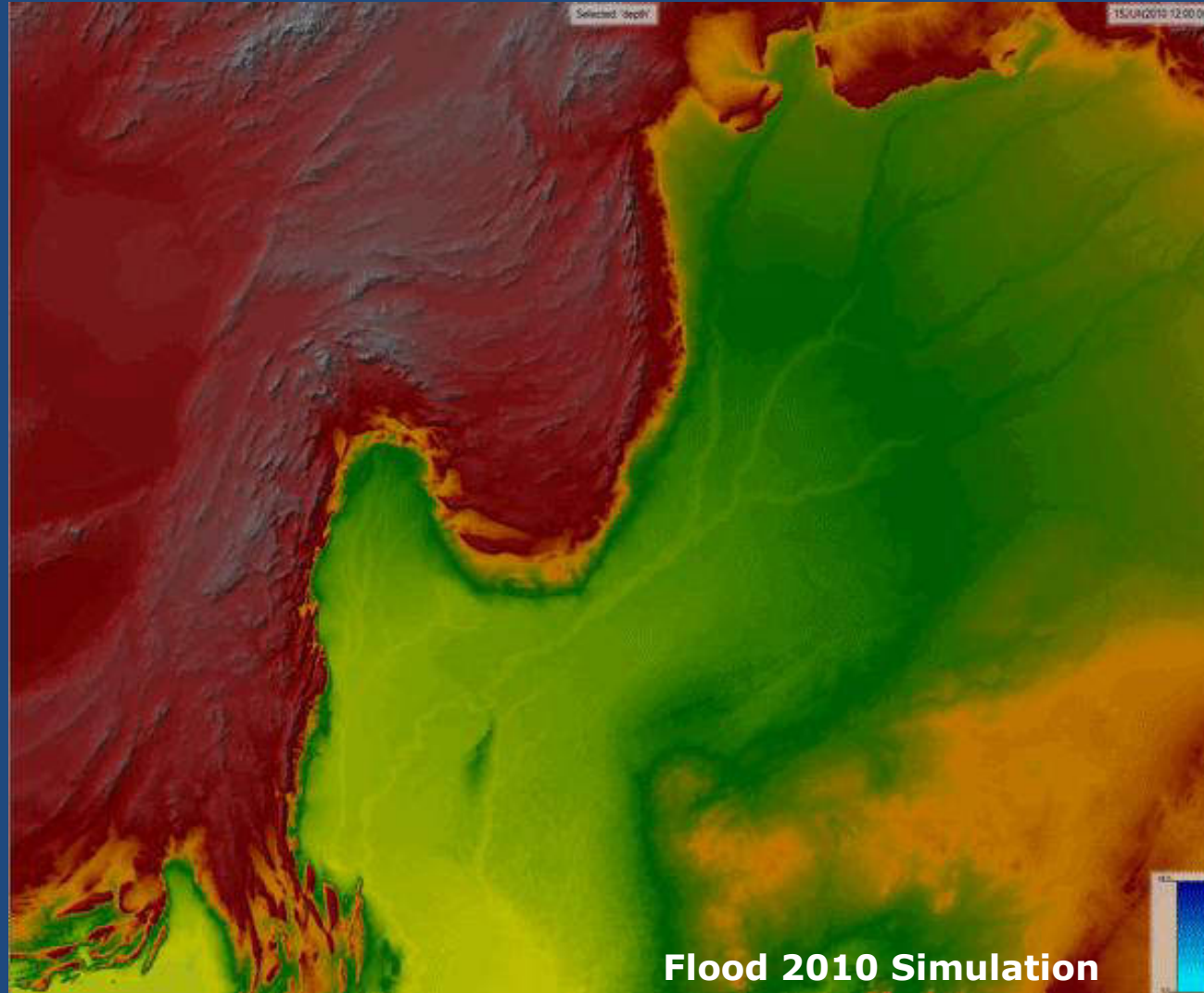
# FLOOD HAZARD ASSESSMENT

Forecast Models are used as tool for building Early Warning Systems

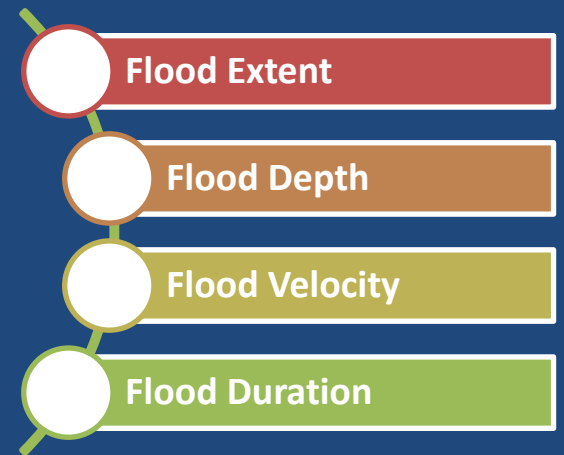
## Key Inputs

Satellite derived data:

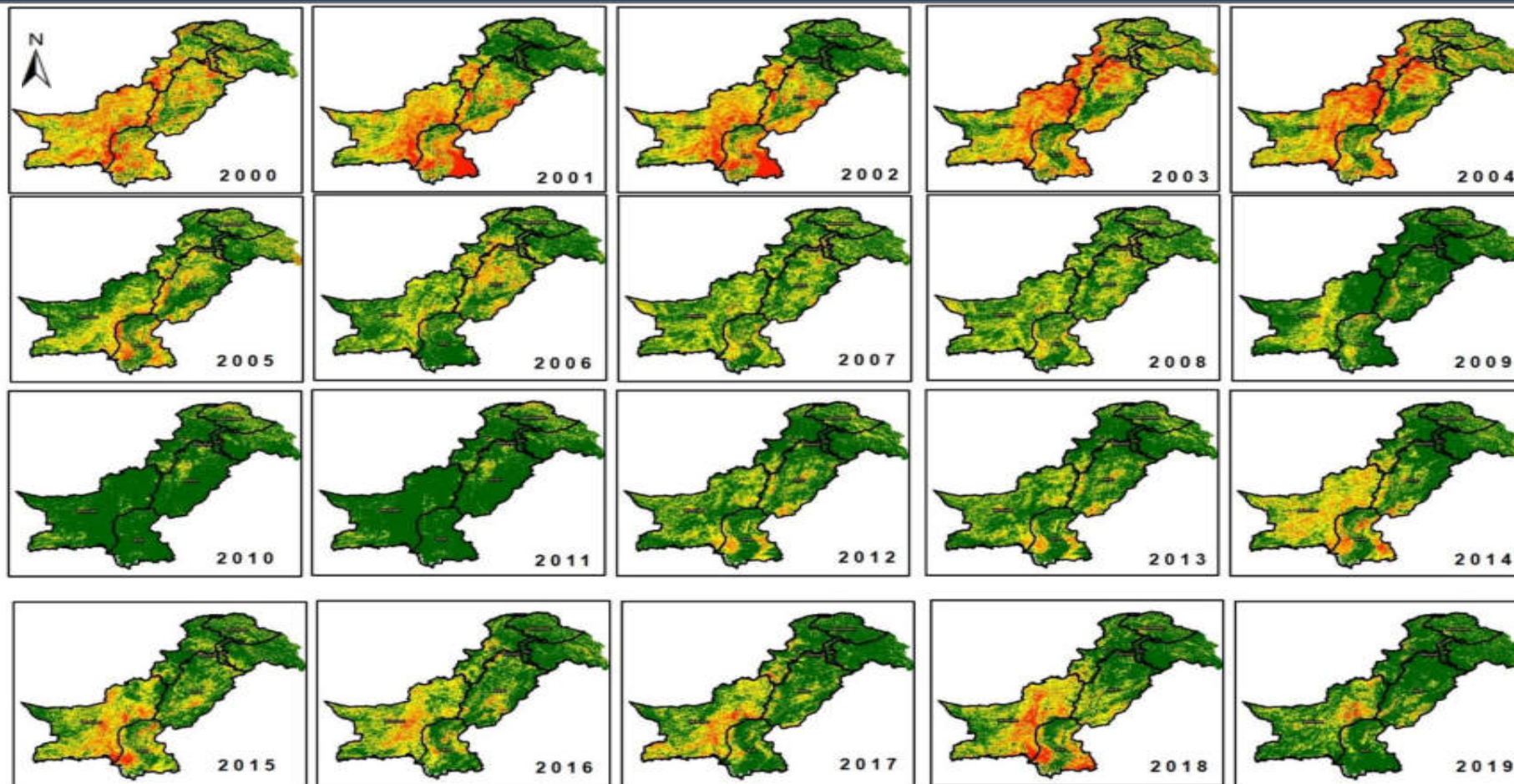
- DEM
- Landcover
- Historical Events
- Hydrographs



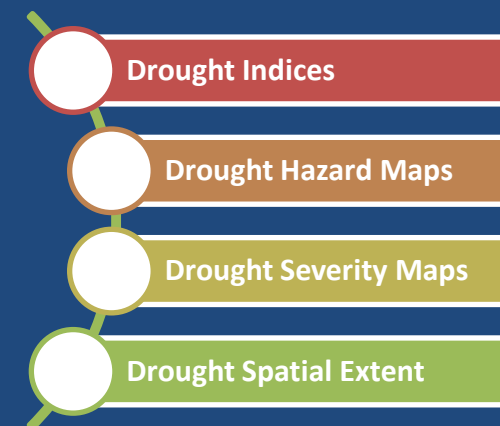
## Model Outputs



# Drought Hazard Assessment

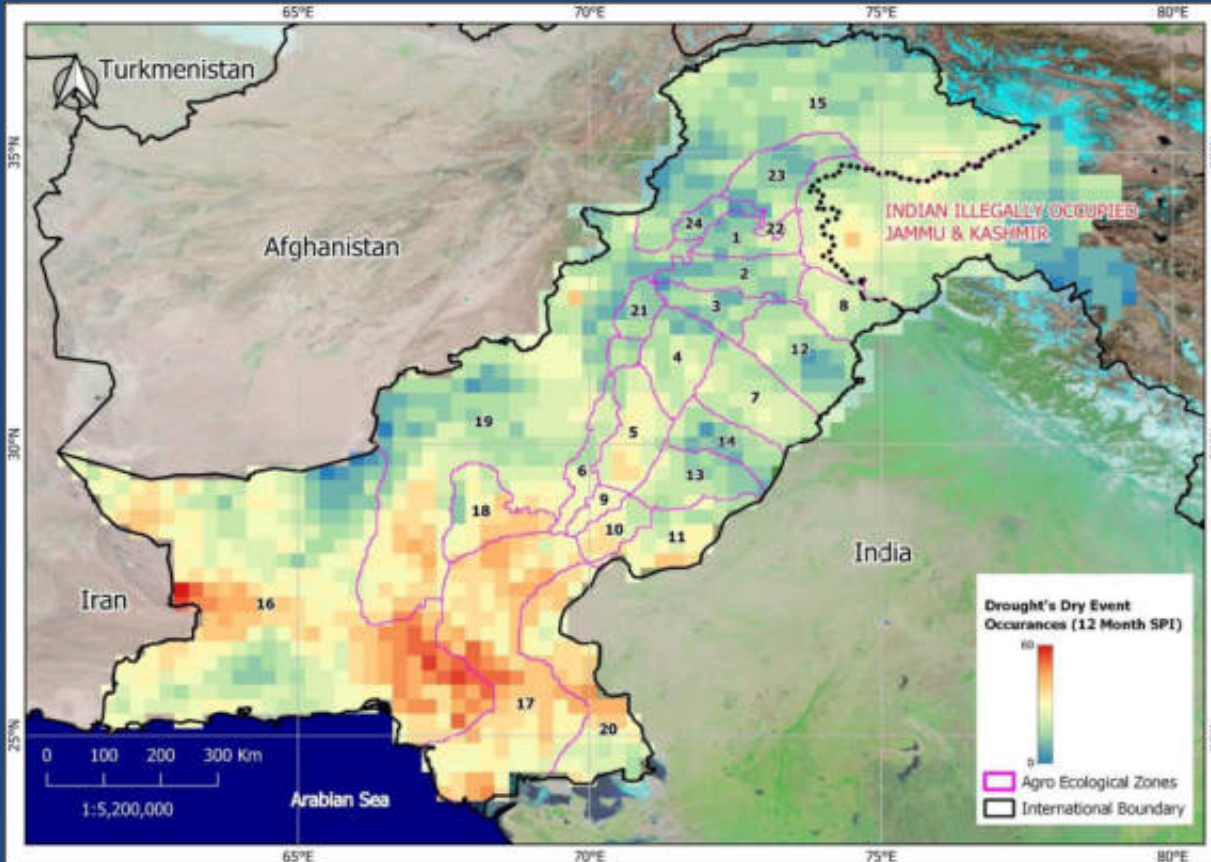


## Agriculture Drought Model Outputs

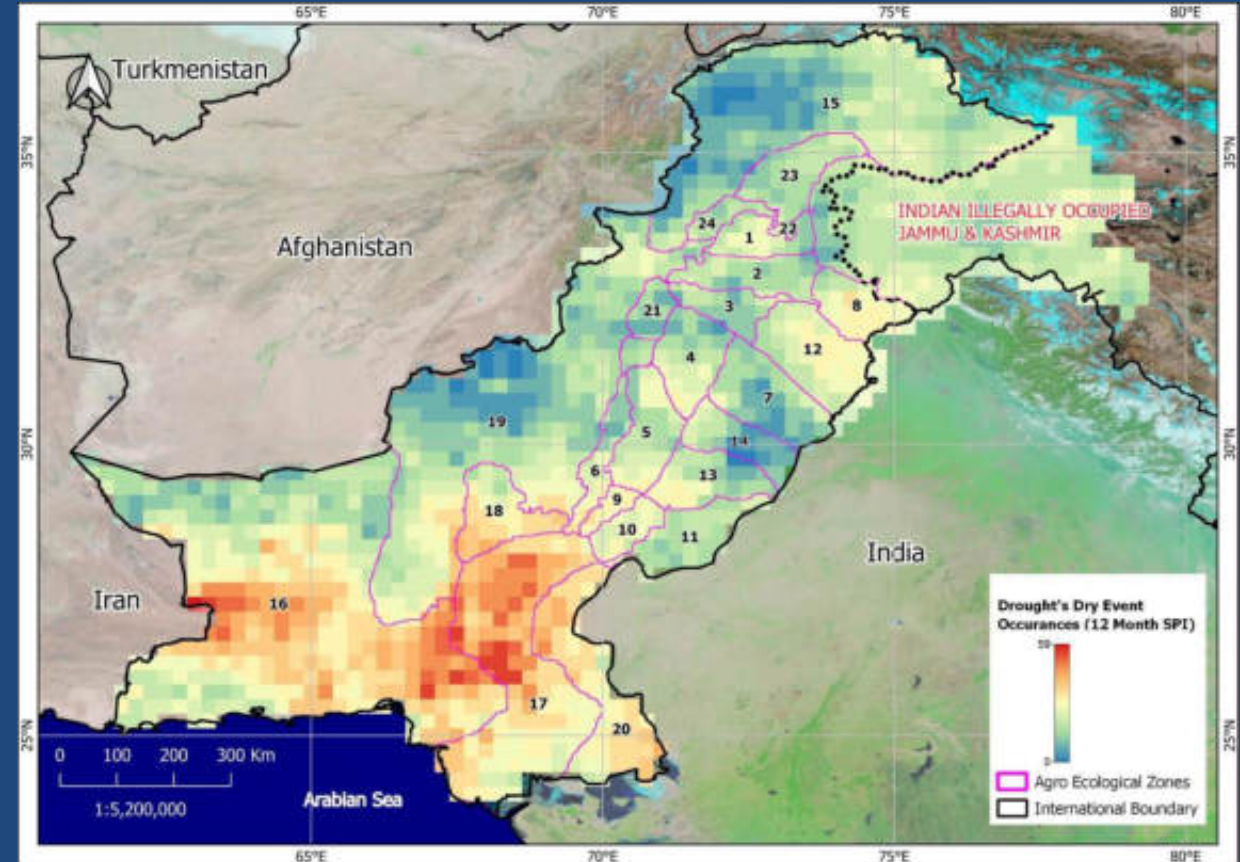




# Spatial distribution of Drought's Dry events occurrence (%) for 12-SPI

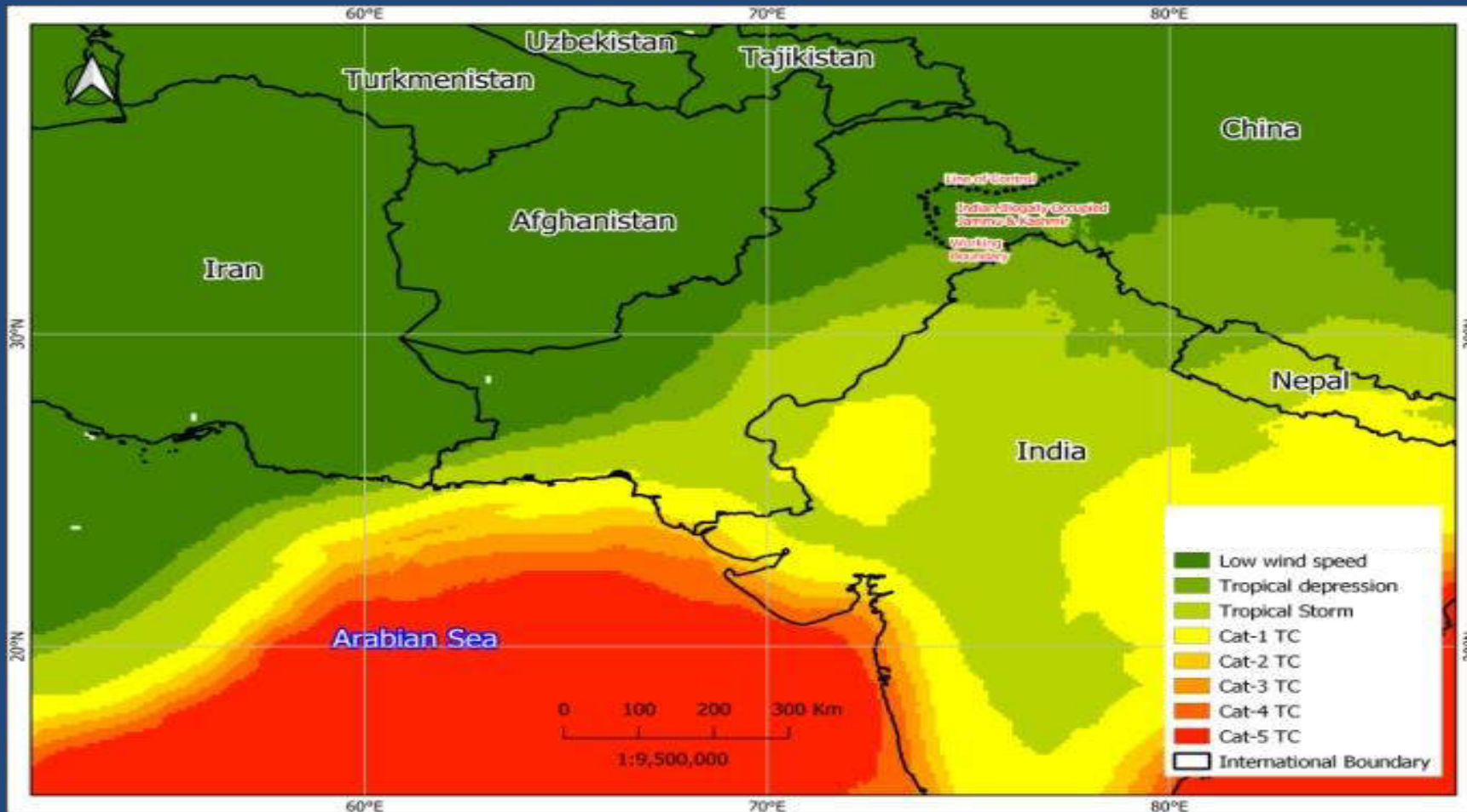


SSP245



SSP585

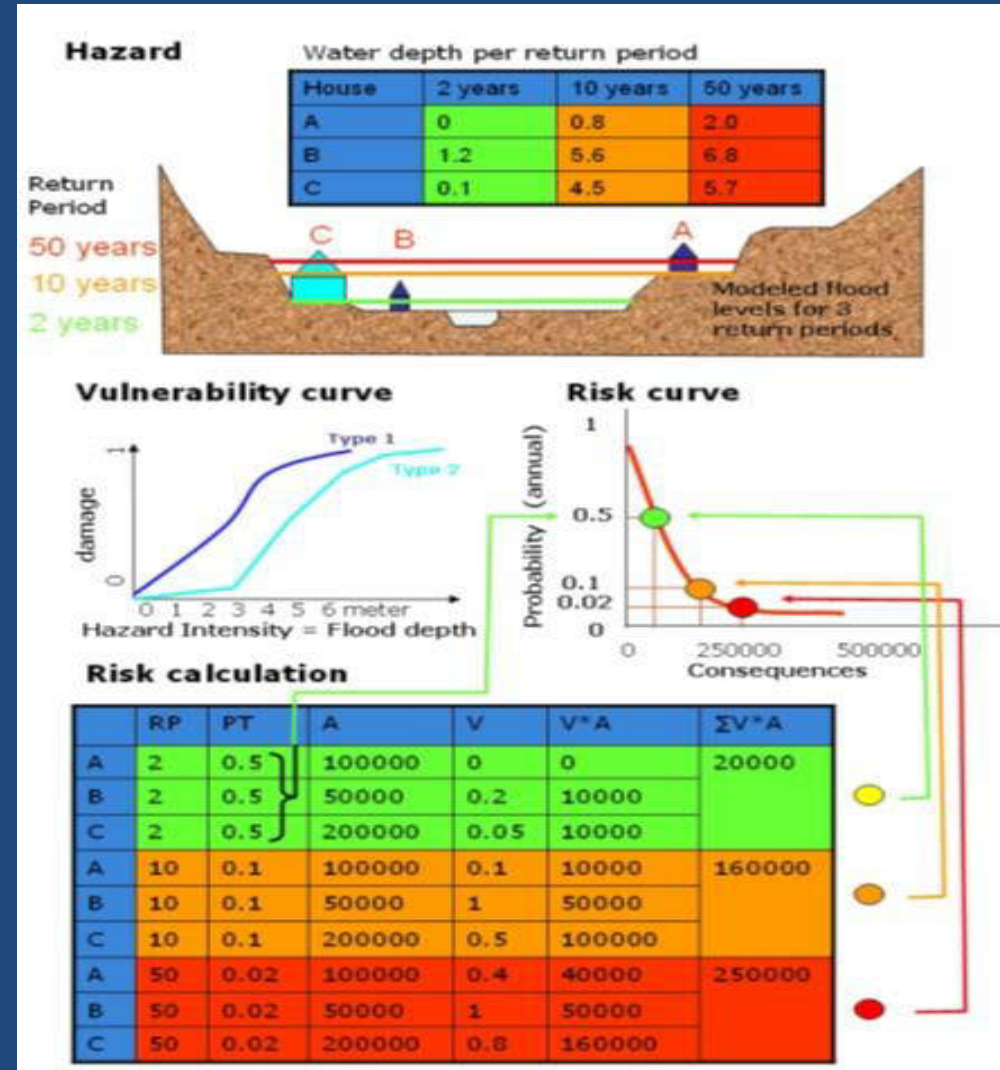
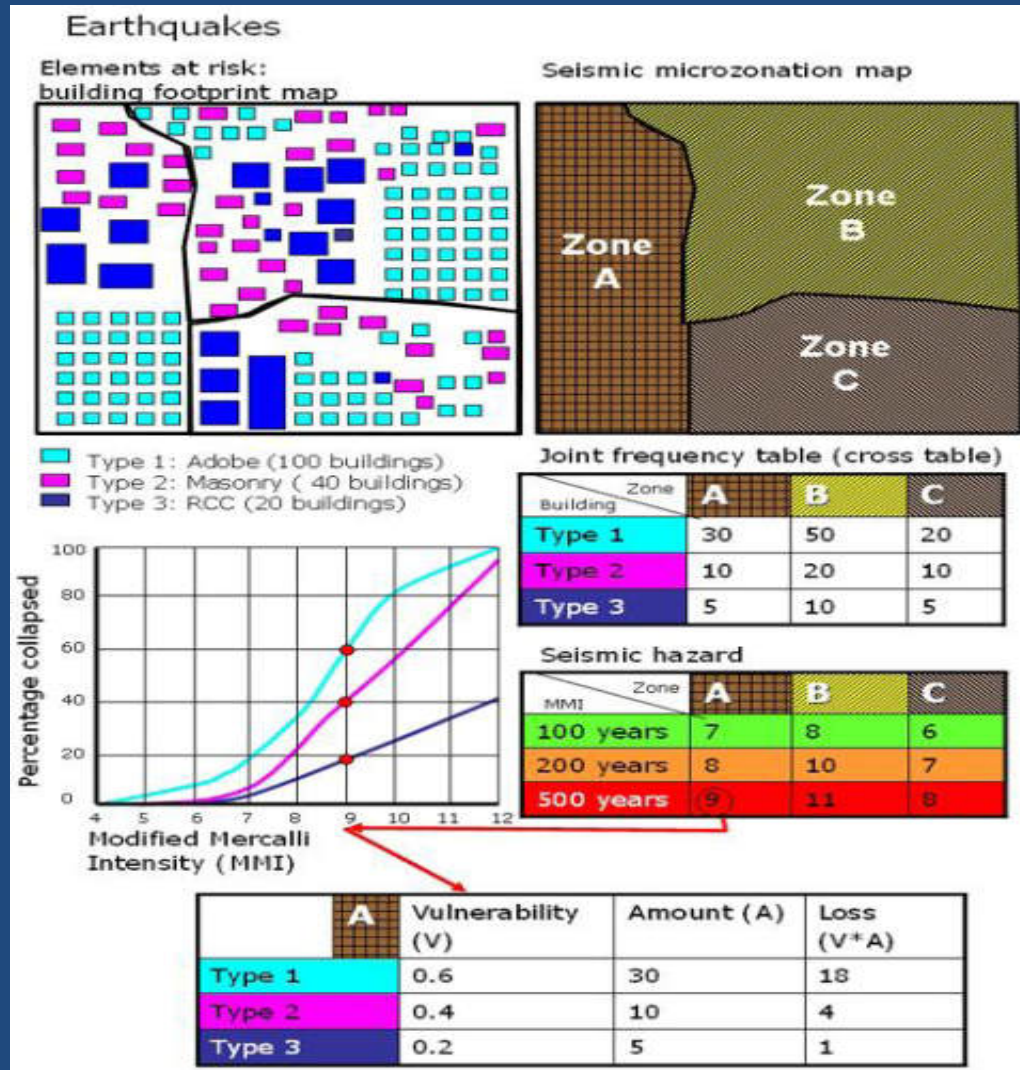
# Cyclone Hazard Assessment – Wind Component




Probabilistic Cyclone Hazard Assessment against 5, 25, 50, 100, 500, 1000, 2000 and 2500 years return periods



# Complete Spatial Picture





# RISK CALCULATOR

×

AOI | LEIAH TEHSIL -> LEIAH TEHSIL

Hazard Module

Element at Risk Module

☐ Schools

Charts

☒ High

☐ Primary

☐ Middle

☐ MPS

☐ sMosque

☐ H.Sec

☒ Health Facility

Charts

☒ BHU

☐ THQ

☐ Clinic

☐ DHQ

☐ Hospital

☐ Maternity Home

☐ RHC

☐ Store

☐ Zacha Bacha Center

Return Period(s)	Selected Return Period (Loss in Million(s))	All Return Period(s) (Loss in Million(s))
10y	~1600	~100
25y	~7800	~200
100y	~9800	~300
250y	~15000	~400

32



# Recommended Practices for UN-SPIDER Knowledge Portal

The screenshot shows the UN-SPIDER Knowledge Portal interface. The header includes the UN-SPIDER logo and navigation links. The main content area is titled 'Recommended Practice: Flood Hazard Assessment'. It features a 'Flowchart' on the left with steps like 'Data', 'Risk Assessment', 'Data Integration', 'Model Validation', 'Model Calibration', 'Model Execution', and 'Result Mapping'. The main text describes the objective of the practice, which is to carry out a flood hazard assessment, identify potential flood-prone areas, and potentially affected infrastructure. It also lists related practices, data, and software. A 'Share this page' section is at the bottom.

FLOOD HAZARD ASSESSMENT

The screenshot shows the UN-SPIDER Knowledge Portal interface for 'Flood Mapping and Damage Assessment using S2 Data'. It features a 'Flowchart' on the left with steps like 'Data', 'Risk Assessment', 'Data Integration', 'Model Validation', 'Model Calibration', 'Model Execution', and 'Result Mapping'. The main text describes the objective of the practice, which is to identify the extent of a flood as well as the affected infrastructure. It also lists related practices, data, and software. A 'Share this page' section is at the bottom.

FLOOD MAPPING AND DAMAGE ASSESSMENT

DROUGHT HAZARD ASSESSMENT UNDER PUBLICATION

The image shows the cover of a booklet titled 'Lessons Learnt from Floods in Pakistan'. The cover features a satellite image of a flooded area in Pakistan. The text on the cover includes 'UN-SPIDER REGIONAL SUPPORT OFFICES', 'SUPARCO', and 'Effective use of Space-based information to monitor disasters and its impacts'. The booklet is prepared by SUPARCO, Pakistan.

BOOKLET

# Recommended Practices for UN-SPIDER Knowledge Portal

The screenshot shows the UN-SPIDER Knowledge Portal interface. The main heading is "Recommended Practice: Flood Hazard Assessment". Below the heading is a satellite image of a river delta. To the right of the image is a brief description of the practice. Below the description are two buttons: "Step by Step" and "In Detail". To the left of the main content is a sidebar with a "Flowchart" section containing a vertical list of buttons: "SRM", "RSC Risk Assessment Data Preparation", "Flow Data Input", "Model Validation", "Model Calibration", "Model Run", and "Result Mapping". To the right of the main content is a "Recommended by:" section featuring the SUPARCO logo. Below this is a "Related Practices" section with a list of links. At the bottom right is a "Share this page" section with social media icons for Facebook, Twitter, YouTube, LinkedIn, and Email.

FLOOD HAZARD ASSESSMENT

The screenshot shows the UN-SPIDER Knowledge Portal interface. The main heading is "Flood Mapping and Damage Assessment using S2 Data". Below the heading is a satellite image of a river delta. To the right of the image is a brief description of the practice. Below the description are two buttons: "Step by Step" and "In Detail". To the left of the main content is a sidebar with a "Flowchart" section containing a vertical list of buttons: "SRM", "RSC Risk Assessment Data Preparation", "Flow Data Input", "Model Validation", "Model Calibration", "Model Run", and "Result Mapping". To the right of the main content is a "Recommended by:" section featuring the SUPARCO logo. Below this is a "Related Practices" section with a list of links. At the bottom right is a "Share this page" section with social media icons for Facebook, Twitter, YouTube, LinkedIn, and Email.

FLOOD MAPPING AND DAMAGE ASSESSMENT

The screenshot shows the UN-SPIDER Knowledge Portal interface. The main heading is "Recommended Practice: Drought Hazard Assessment and Monitoring using Satellite Data". Below the heading is a satellite image of a river delta. To the right of the image is a brief description of the practice. Below the description are two buttons: "Step by Step" and "In Detail". To the left of the main content is a sidebar with a "Flowchart" section containing a vertical list of buttons: "SRM", "RSC Risk Assessment Data Preparation", "Flow Data Input", "Model Validation", "Model Calibration", "Model Run", and "Result Mapping". To the right of the main content is a "Recommended by:" section featuring the SUPARCO logo. Below this is a "Related Practices" section with a list of links. At the bottom right is a "Share this page" section with social media icons for Facebook, Twitter, YouTube, LinkedIn, and Email.

DROUGHT HAZARD ASSESSMENT



# Conclusion

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- SUPARCO can provide Resource persons for Flood Modeling trainings
  - Participation in regional Collaborative projects
  - Participation in TAMs
  - Capacity Building in the field of SAR data processing and analysis for Disaster monitoring, mapping and damage assessment particularly for earthquake and landslide
  - Need for inter RSOs collaborations on regional basis
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# Conclusion

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***“Disaster Management is the shared responsibility”***