



# **Building Post-Flood Resilience in Pakistan** **Through Integrated Flood Risk Management** **(Virtual Event)**



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## **“Climate Change and Challenges of Flood Management in Pakistan”**

**By: Ahmed Kamal, Chairman Federal Flood  
Commission, Ministry of Water Resources**

**UN Water Conference 2023, New York, USA**  
**23 March, 2023**



# Sequence



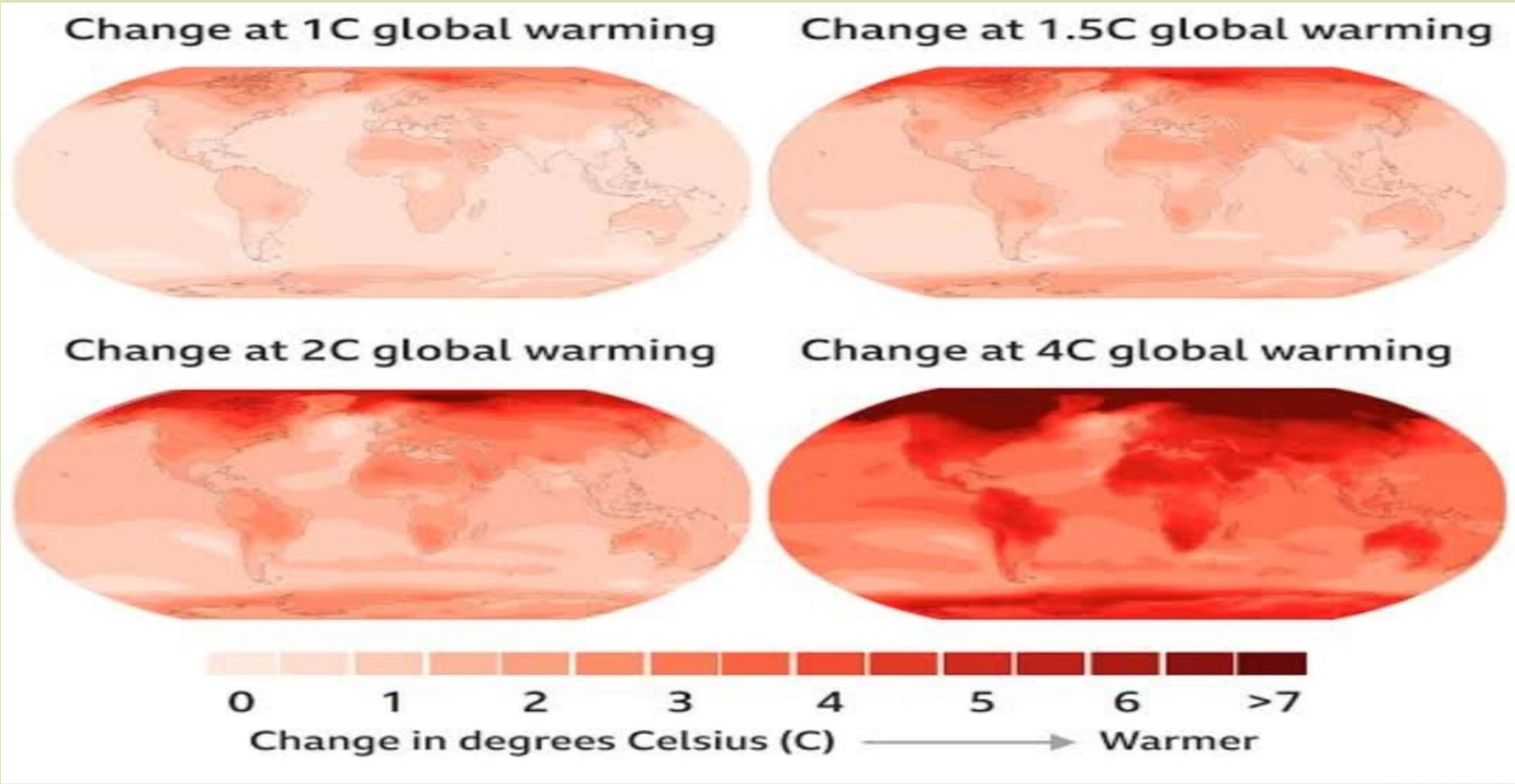
- **Global Climate Risks**
- **Climate Impacts on Pakistan**
- **Pakistan Floods - Economic Impact**
- **Floods - 2022**
- **Challenges in Flood Management**
- **Resilient Flood Management – Road Map**



# How the World could get Warmer?



## Projected Annual Average Temperature Change Relative to 1850 -1900 at Different levels of Global Warming

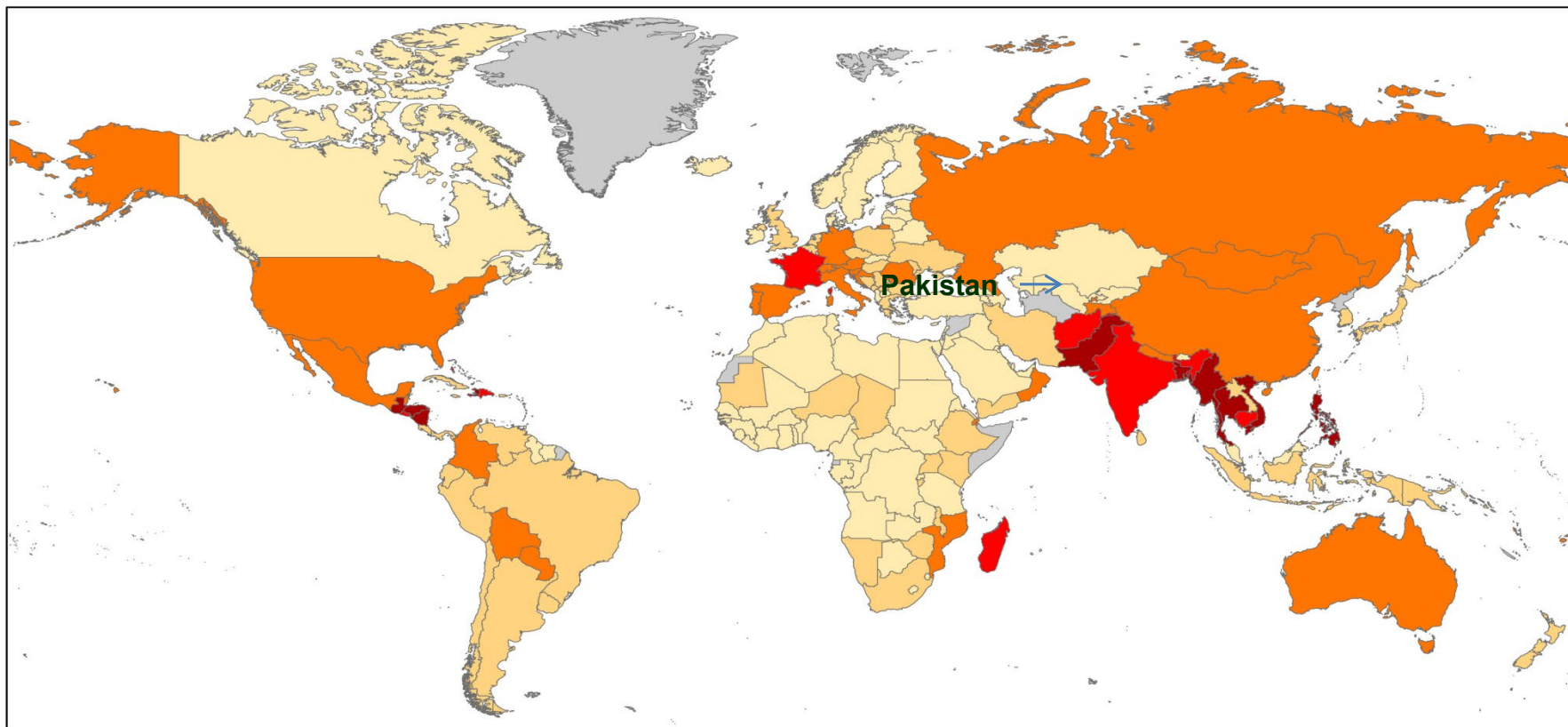




# Global Climate Risk Index



The Long-Term Climate Risk Index (CRI): The 10 countries most affected from 1996 to 2015  
(Annual Averages)



Climate Risk Index: Ranking 1996–2015

1–10	11–20	21–50	51–100	>100	No data
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# Global Climate Change and Its Implications

(Based on IPCC's Assessment Reports)



- **0.6 °C** increase in average global temperature during the last century (First two decades of 21<sup>st</sup> Century further by about **0.4 °C**);
- 21<sup>st</sup> Century - Increase by **1.5 – 4.6 °C**. Extreme case up to **6 °C**);
- Large changes (**increases/decreases**) of temperature and precipitation in different world regions;
- Considerable increase in Frequency and Intensity of Extreme Climate Events (cyclonic storms, **floods**, droughts etc.);
- Large scale **melting of mountain glaciers** and polar ice caps, particularly the Arctic;
- Sea level rise (**19 cm over 20<sup>th</sup> Century**; further rise by **44-73 cm** projected over **21<sup>st</sup> Century**)



# Impact of Climate Change - Pakistan



## Increased temperatures - Period 2016-2035 (IPCC AR5)

- Global versus Pakistan – **Decadal Mean Temperature Trends**

Period	Global	Pakistan
1901-2000	0.06 °C	0.06°C
1956-2005	0.12 °C	0.16°C
1971-2005	0.15 °C	0.26°C
<b>1981-2005</b>	<b>0.17 °C</b>	<b>0.39°C</b>
1991-2005	0.33 °C	0.74°C
<b>2010-2039</b>	<b>0.7°C</b>	<b>1°C</b>

- The mean temperature rise after **1950s** over Pakistan is **twice as fast** as the global mean change

# Impact of Climate Change - Pakistan



## Effect of Black Carbon On Pakistan Glaciers

Name of Glacier	Length (km)	Aspect	Carbon (ng/m <sup>2</sup> )	Diameter (micron)
Hinarchi	17	S	224	131
Hisper	53	NW	161	212
Minapin	16	N	192	401
Gutumi	14	W	105	203
Bualtar	20	NW	63	116



**Blackening of Glaciers result into heat absorption and hence increase in rate of melting**



# Super Floods 2010



**Human Losses**

-

**1,985**

**Population Affected**

-

**20 M**

**Houses Damaged**

-

**1.61 M**

**Crops Damaged**

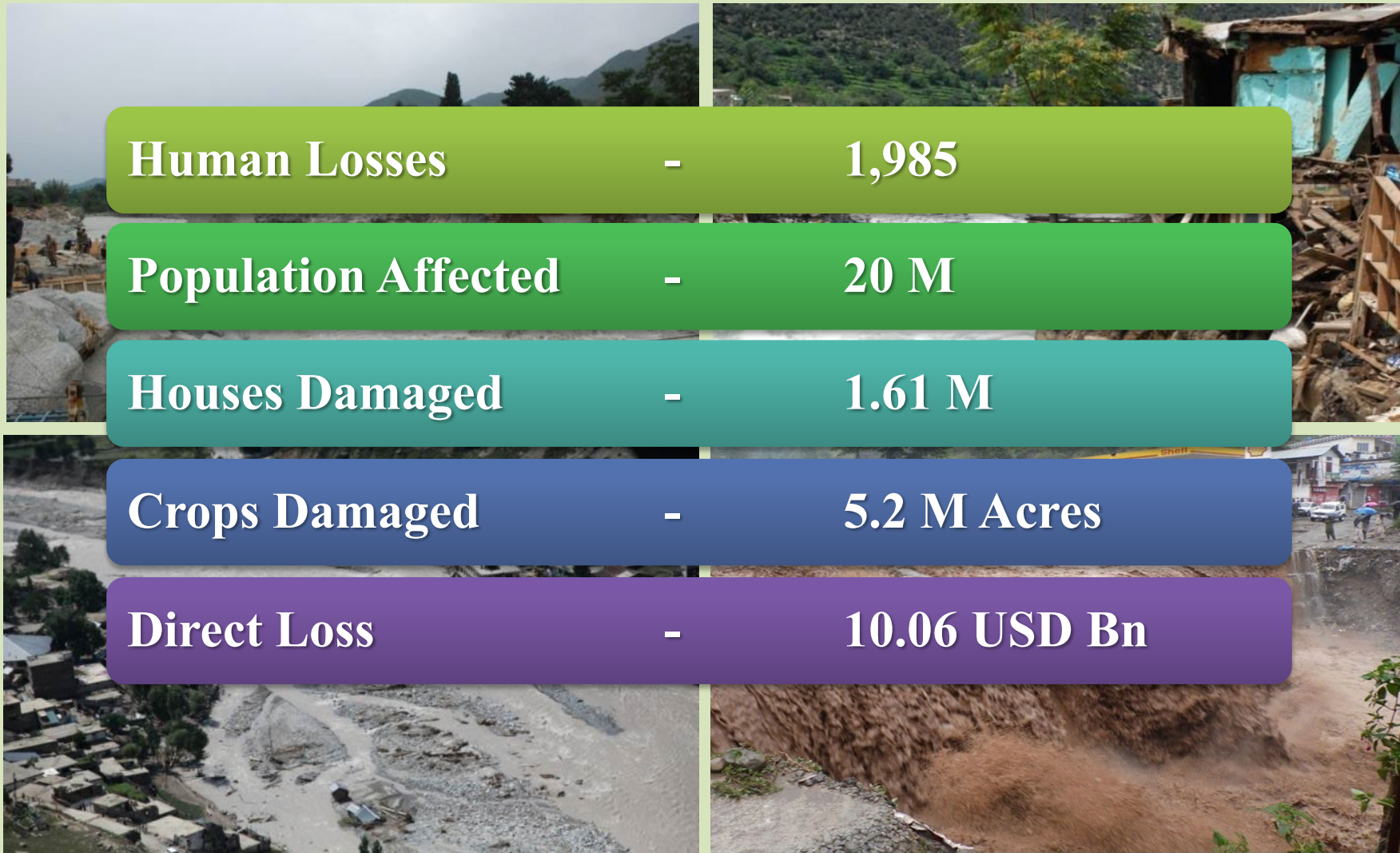
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**5.2 M Acres**

**Direct Loss**

-

**10.06 USD Bn**

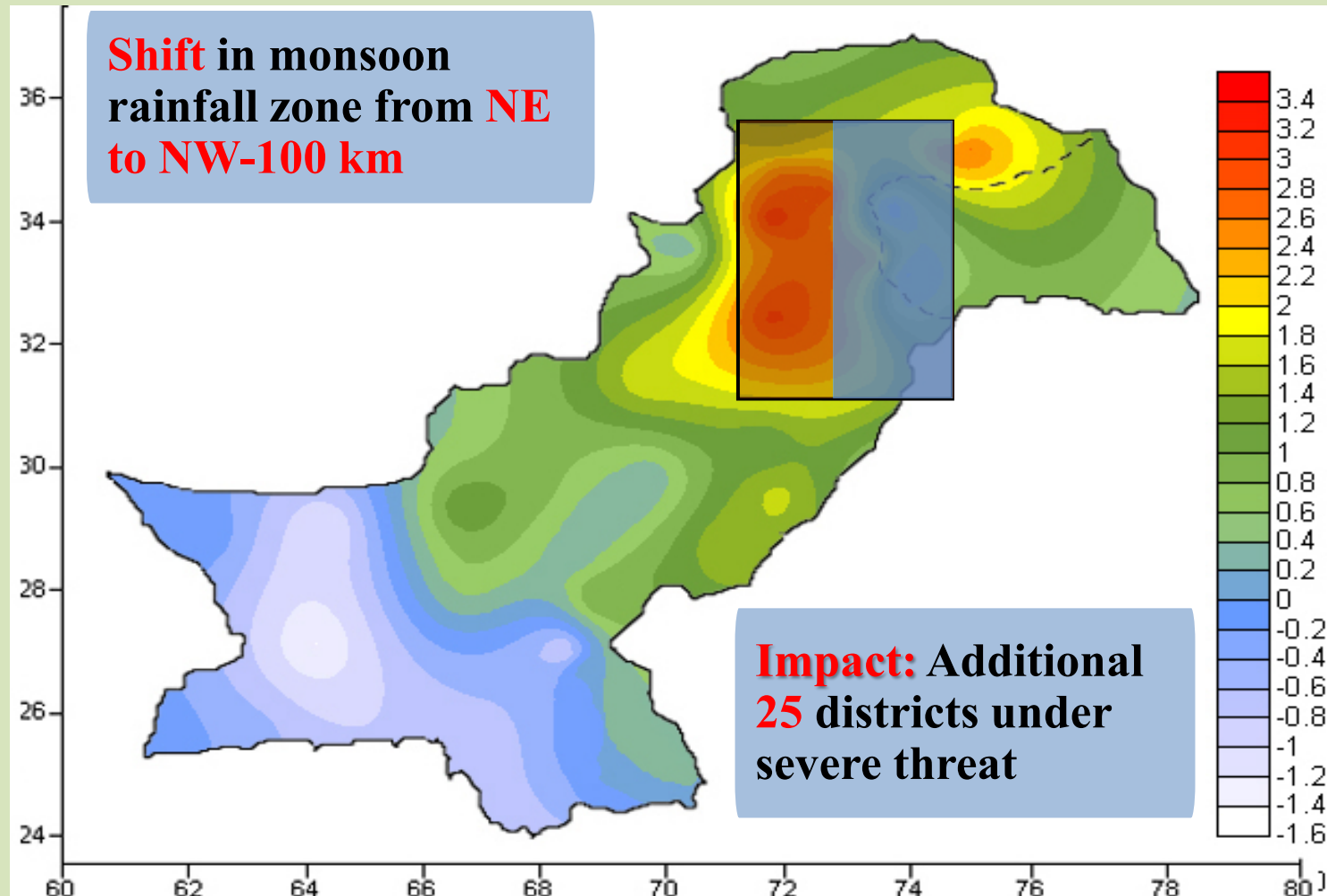






# Impact of Climate Change - Pakistan

## Post 2010 - Floods

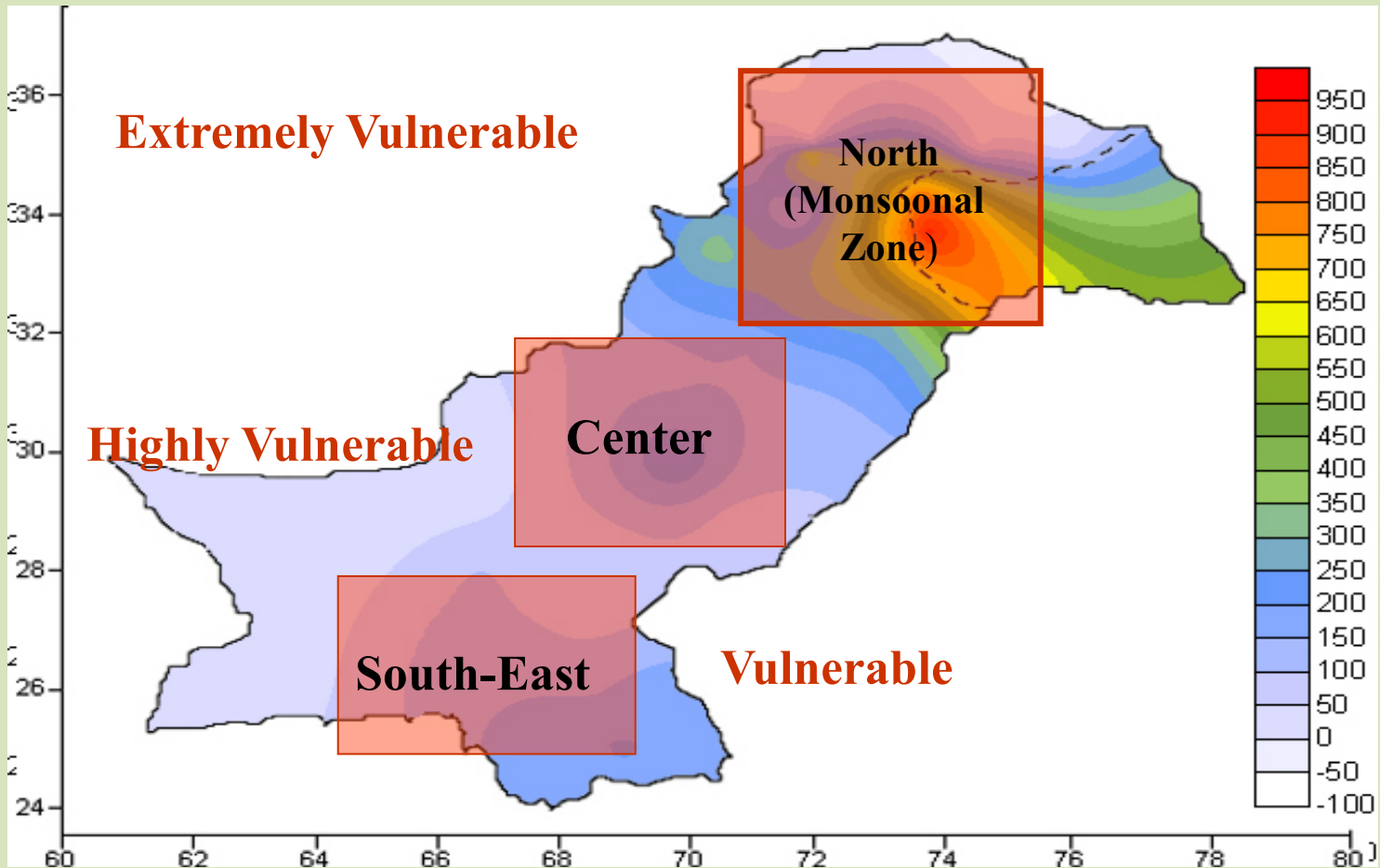




# Post 2010 – Floods Analysis



## Challenges - Monsoon Prediction

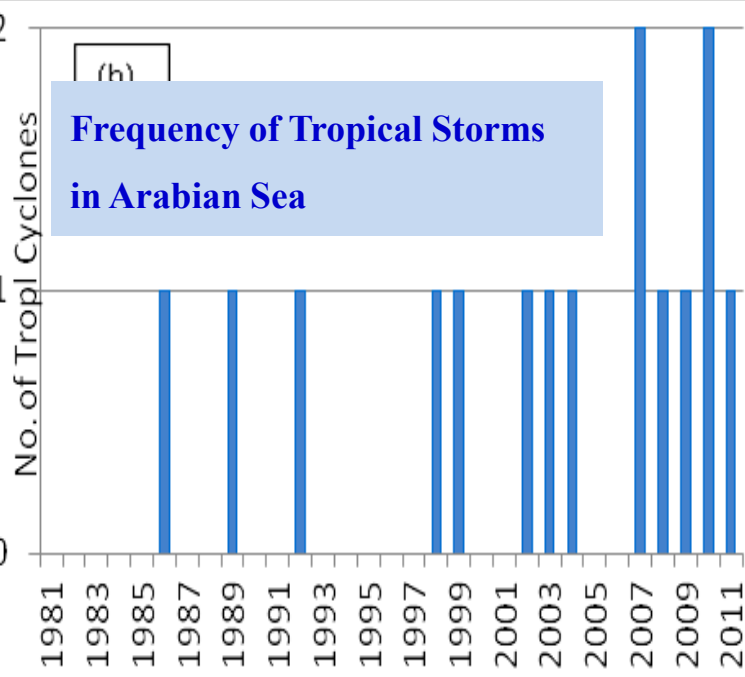
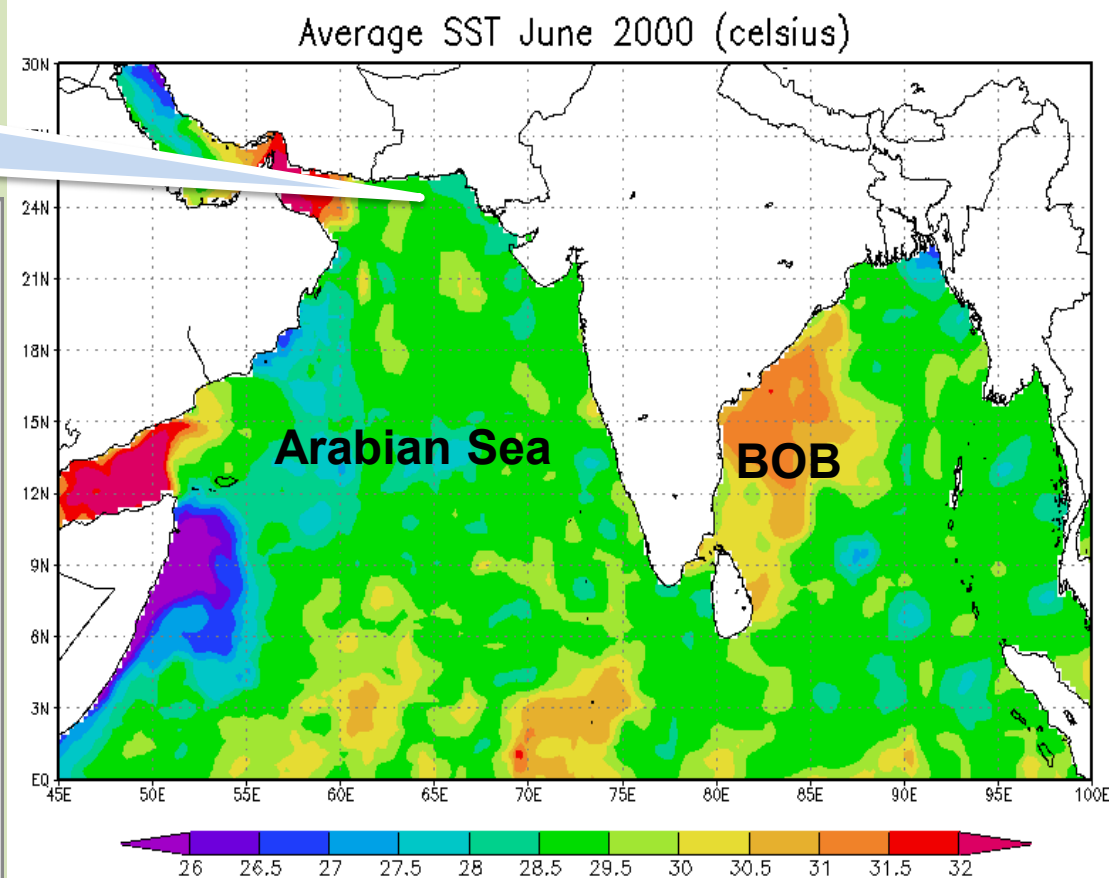


# Impact of Climate Change - Pakistan



## Comparison of Sea Surface Temperature (Bay of Bengal & Arabian Sea)

Arabian sea is showing higher SST values compared to Bay of Bengal since 2000





# Floods 2011 to 2015



**Human Losses**

- 1,787

**Population Affected**

- 18.12 M

**Houses Damaged**

- 1.85 M

**Crops Damaged**

- 5.46 M Acres

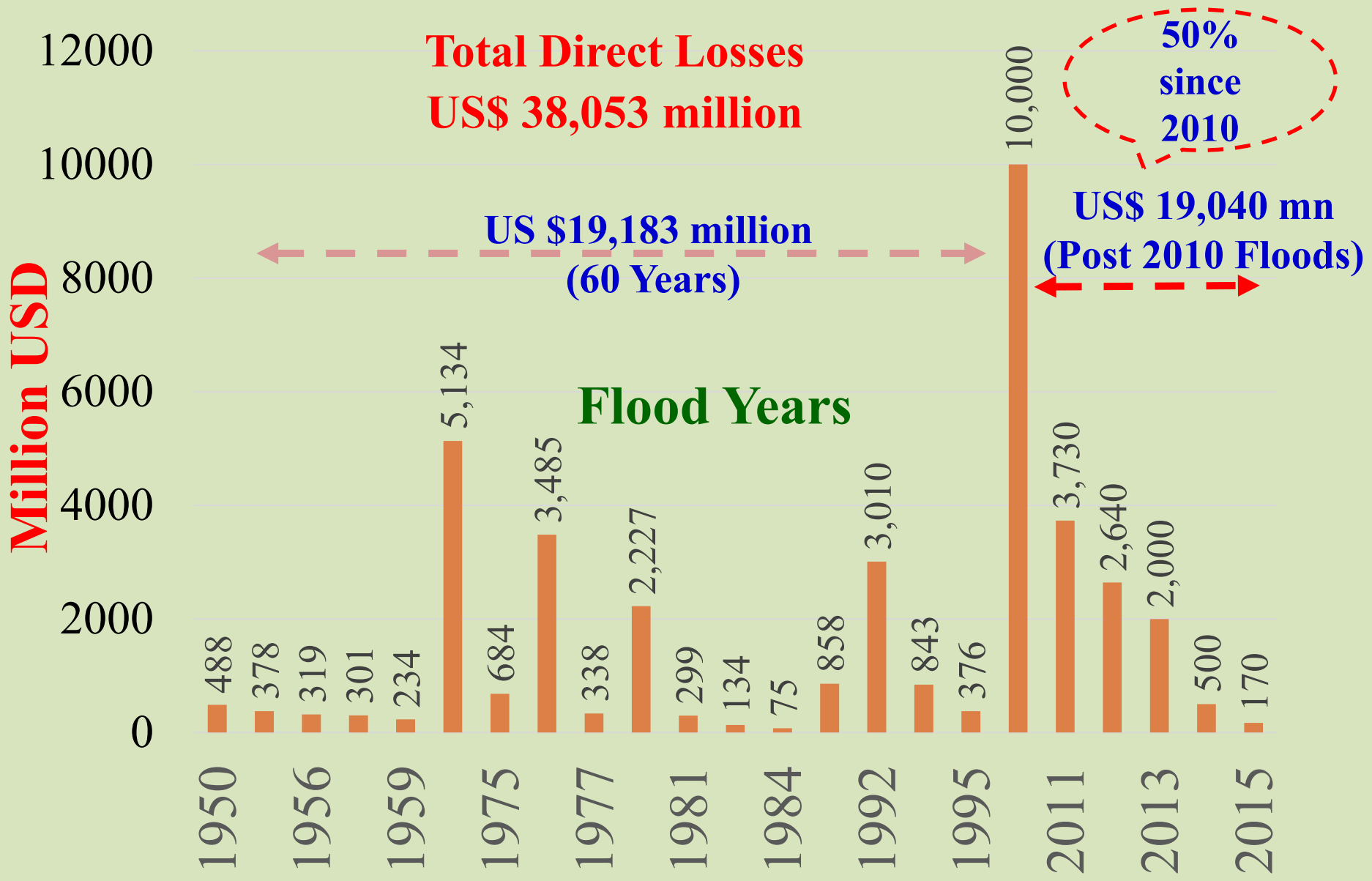
**Direct Loss**

- 9.04 USD Bn



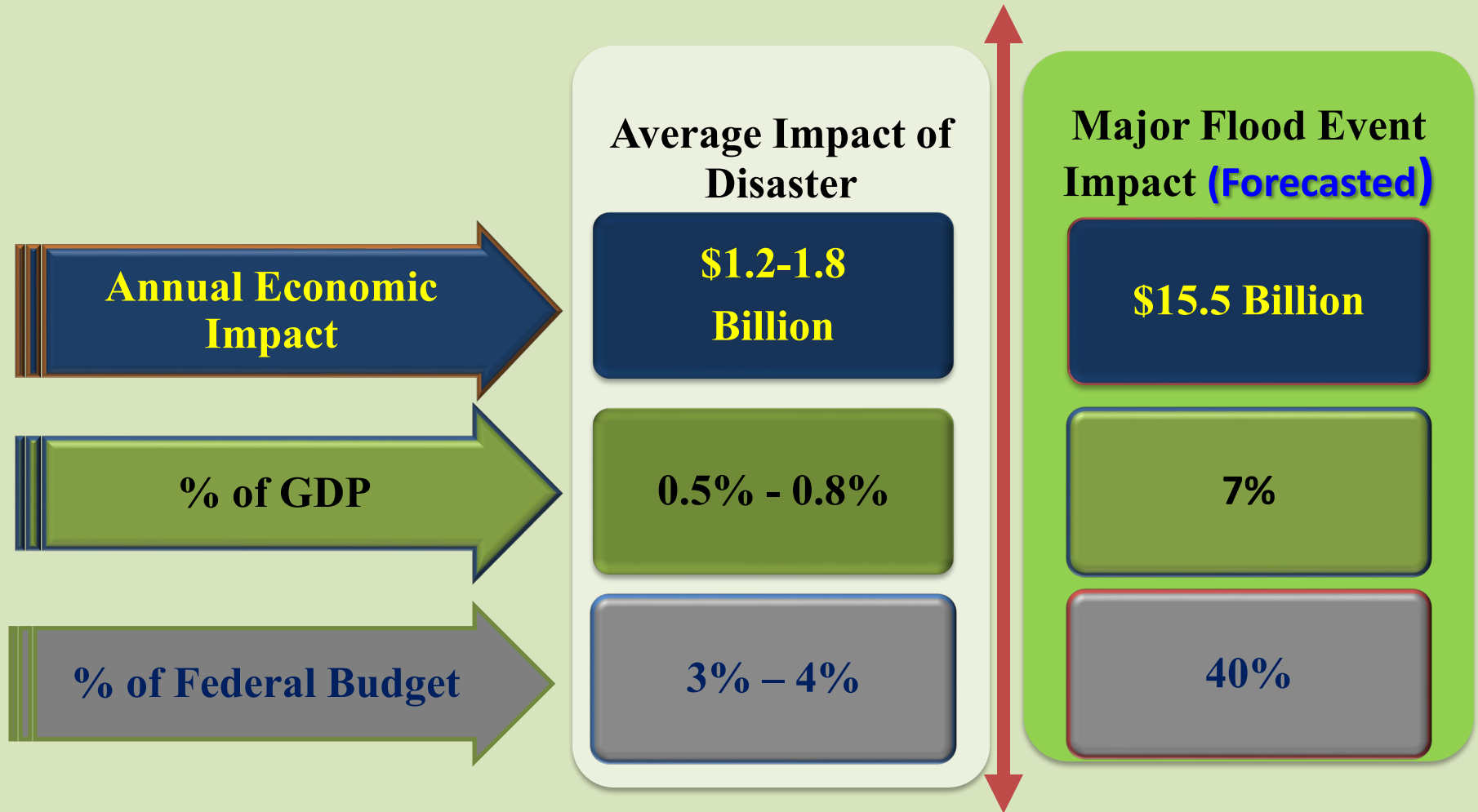


# Losses by Floods





# Pakistan Floods - Economic Impact



**Source:** Fiscal Risk Assessment Options for Consideration, A Study by World Bank and GFDRR, 2015 (Based on 2015 USD)

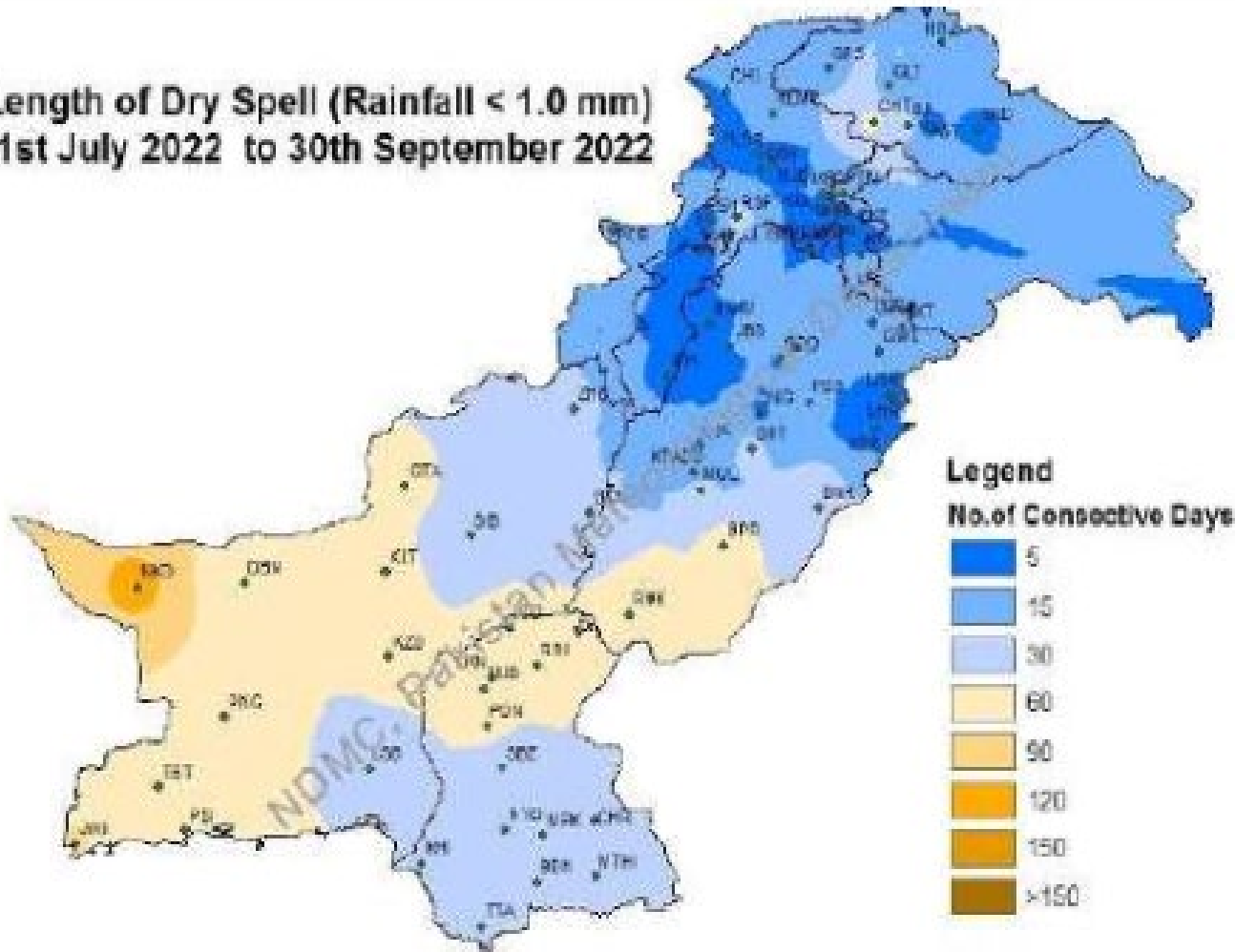


# Impact of Climate Change – Pakistan

## Simultaneous Flood & Drought in 2022



Max Length of Dry Spell (Rainfall < 1.0 mm)  
from 1st July 2022 to 30th September 2022



Mild to Moderate **drought in Sindh, Balochistan & Southern Punjab**  
**With** subsequent Flooding

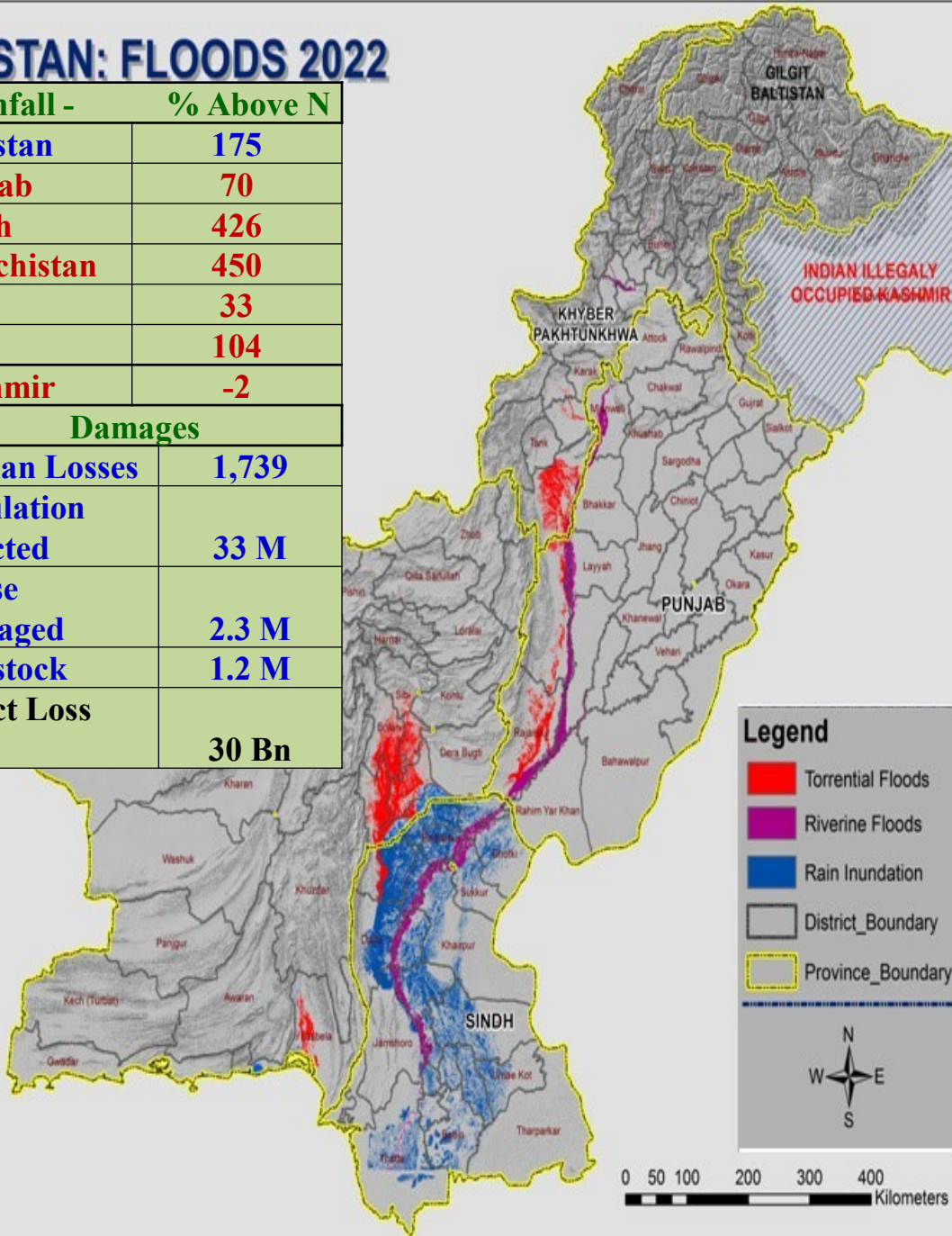
# PAKISTAN: FLOODS 2022

## Rainfall - % Above N

<b>Pakistan</b>	<b>175</b>
<b>Punjab</b>	<b>70</b>
<b>Sindh</b>	<b>426</b>
<b>Balochistan</b>	<b>450</b>
<b>KP</b>	<b>33</b>
<b>GB</b>	<b>104</b>
<b>Kashmir</b>	<b>-2</b>

## Damages

<b>Human Losses</b>	<b>1,739</b>
<b>Population Affected</b>	<b>33 M</b>
<b>House Damaged</b>	<b>2.3 M</b>
<b>Livestock</b>	<b>1.2 M</b>
<b>Direct Loss USD</b>	<b>30 Bn</b>





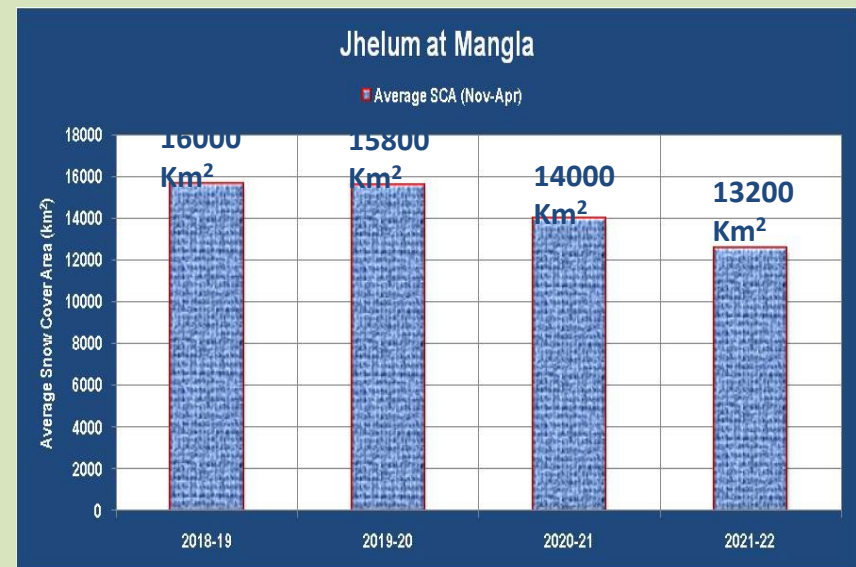
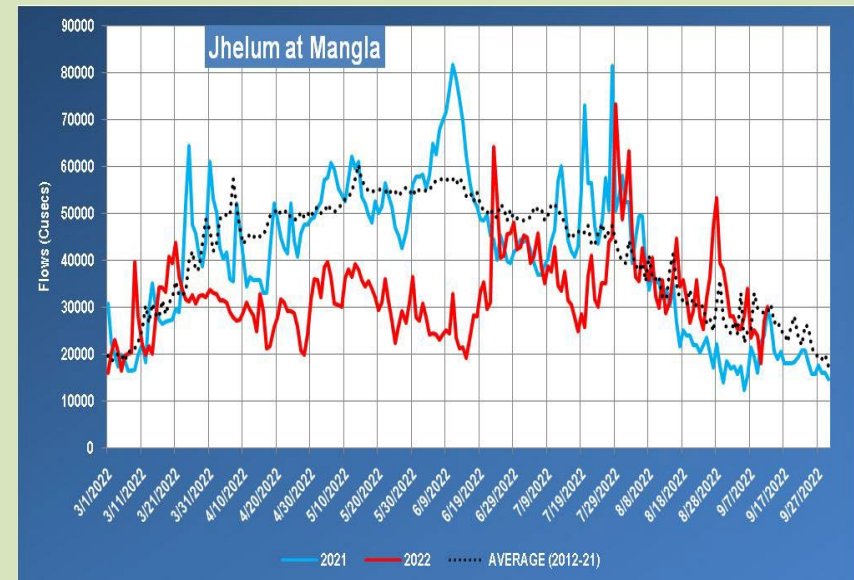


# Impact of Climate Change Mangla Catchment



## Generally

- **Snowmelt** contribution from **Apr-Jun**
- **Rainfall** contribution from **July-Sep Year 2022**
- **Lesser** snowfall
- **High** temperatures observed from **March to May**
- Early **snow depletion** from **March to May**
- **Deficient rainfall** from **March to August**

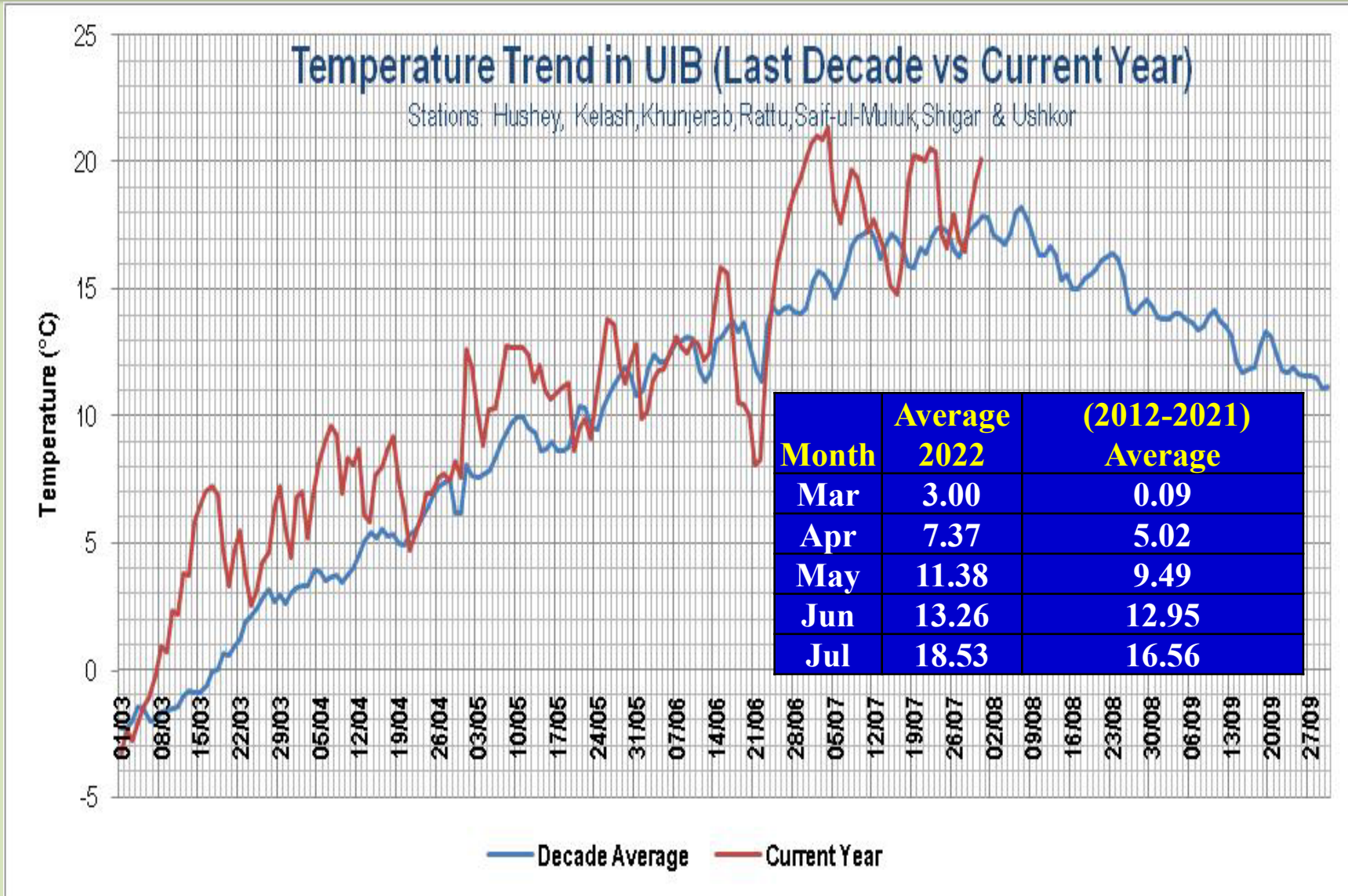




# Challenges in Flood Management



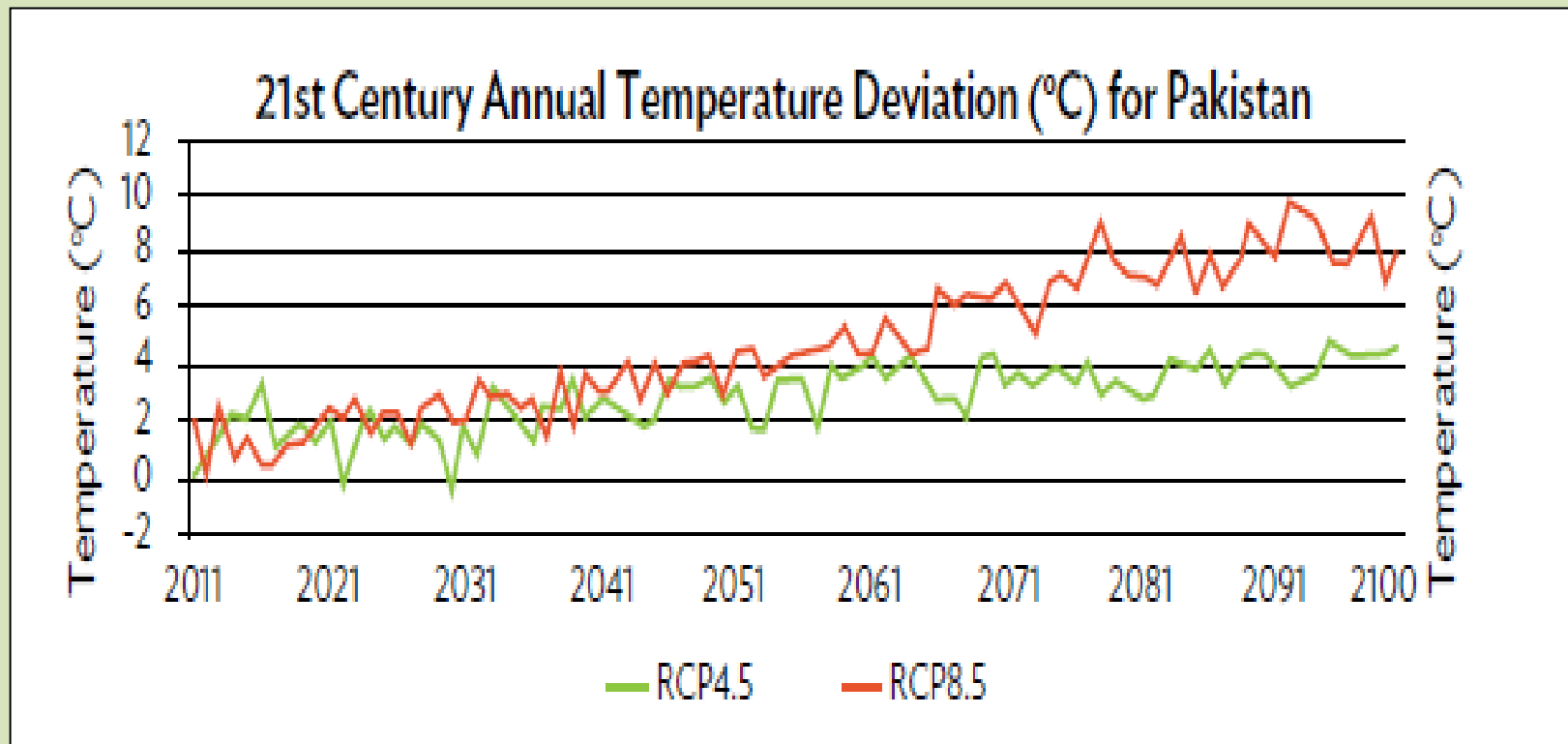
# Temperature Trends - Upper Indus Basin



**The climate data shows the temperatures are increasing at a drastic rate**



# Future Temperature - Projections

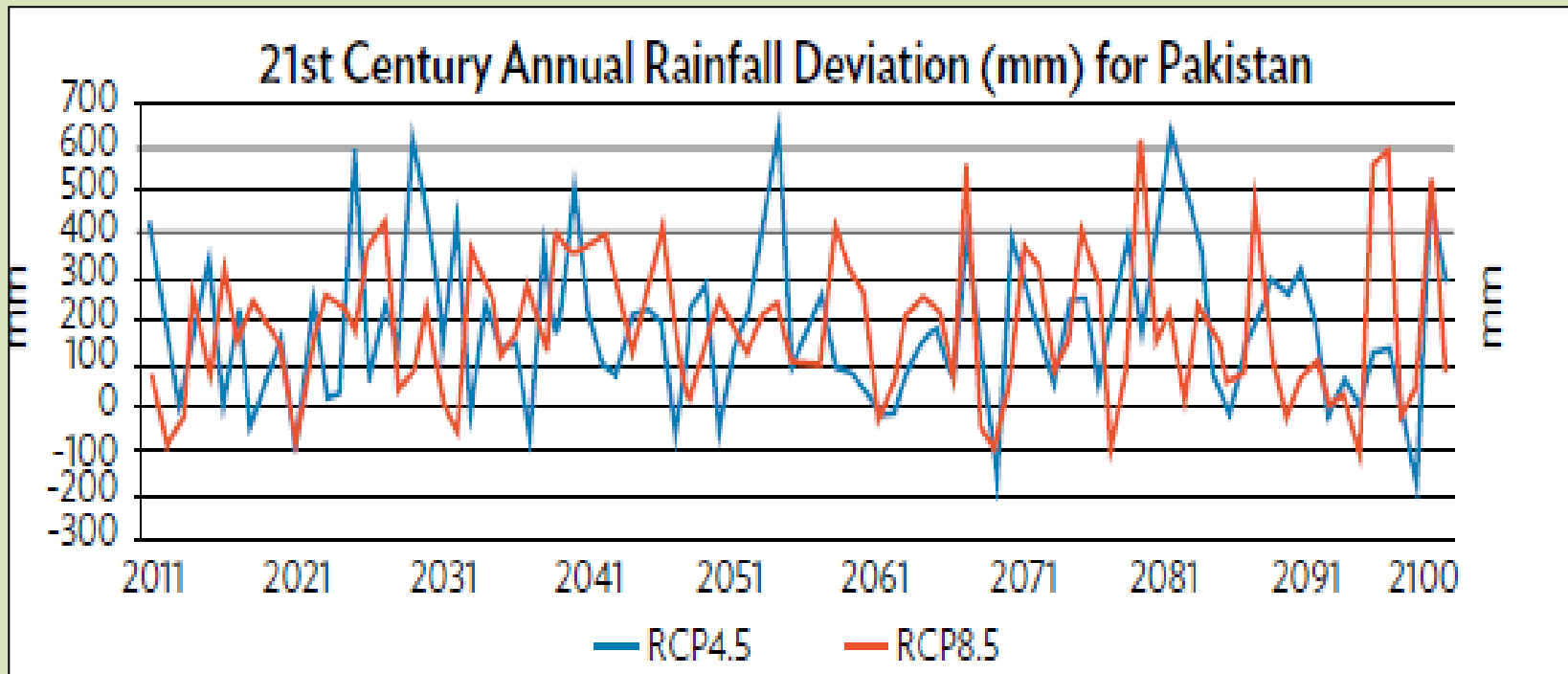


**Average annual temperature may rise upto 3°C–5°C especially in Northern Pakistan at the end of 21st Century**



# Extreme Weather Events

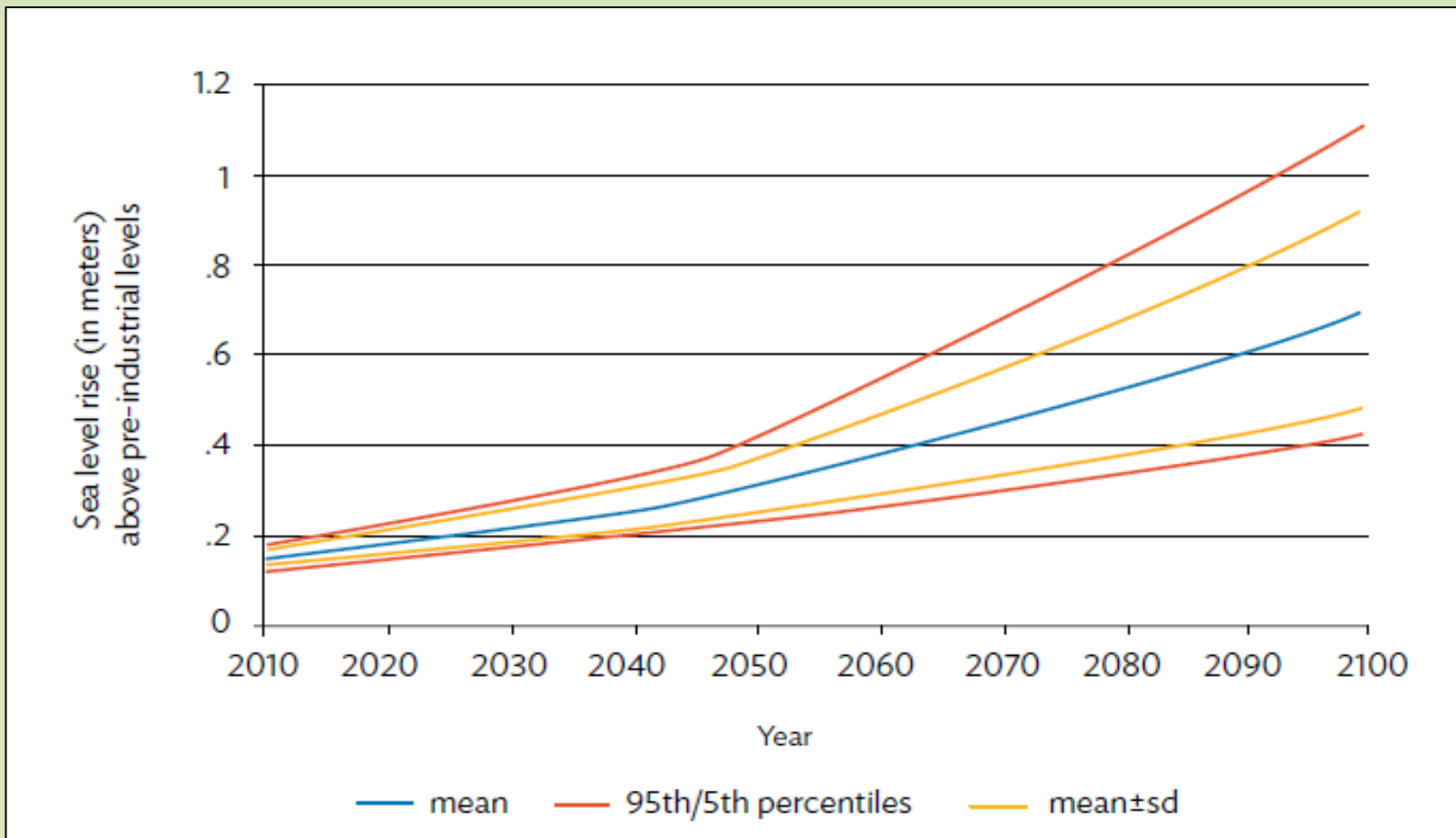
## Increase in Frequency & Intensity



- Area average rainfall over Pakistan shows a large inter-annual variability.
- Sharp rising peaks give indication of extreme precipitation events while negative peaks indicate droughts.

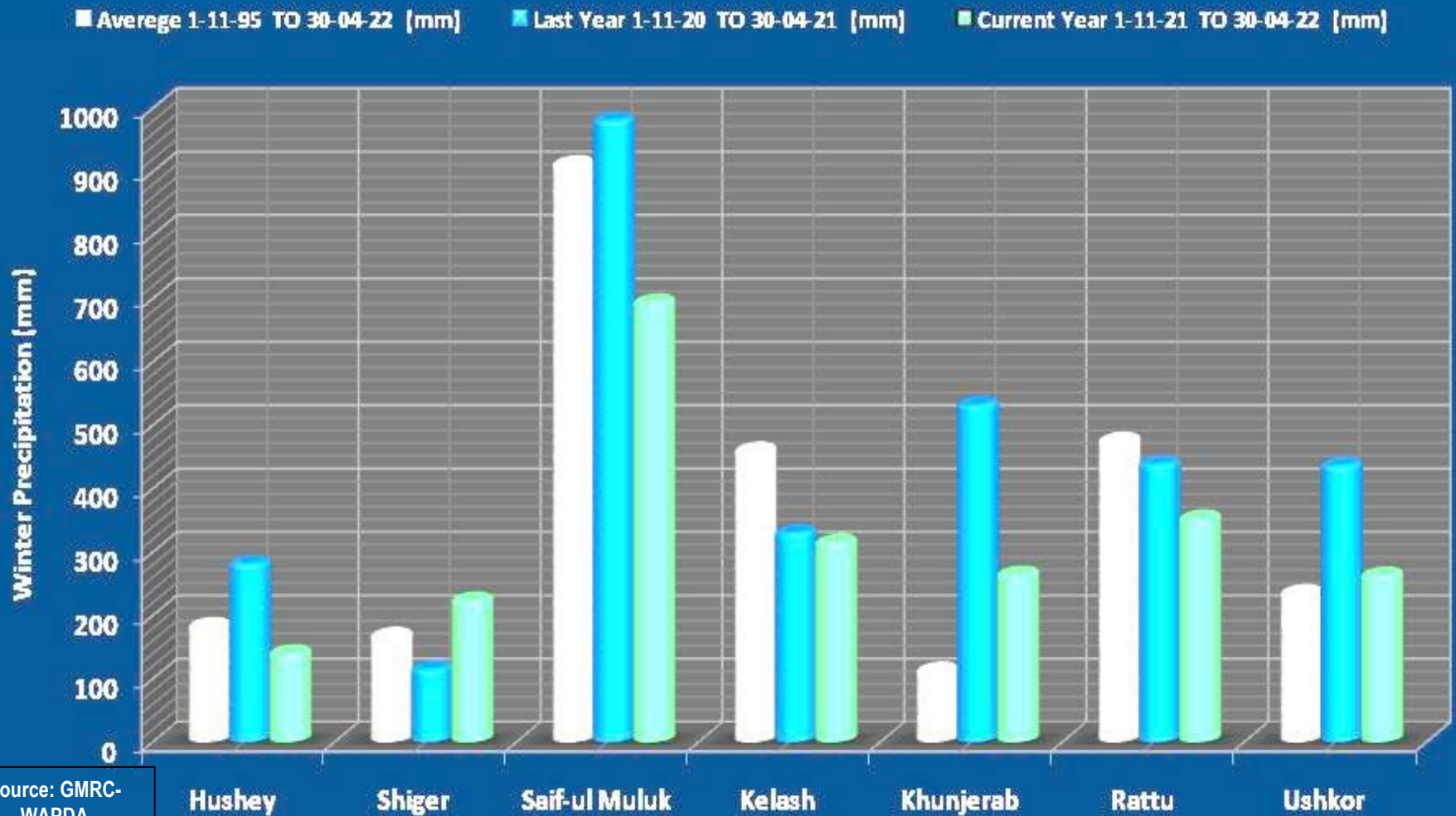


# Future Climate Impacts - Sea Level Rise



**By the end of Century (IPCC Projections)**  
**Global Mean Sea Level may rise from 0.2–0.6 m**  
**Pakistan's coast is part of South Asia may rise 0.7 m**

# Climate Change - Decrease in Snow at UIB



Source: GMRC-WAPDA

Current year **winter precipitation (snow)** at most of the stations shows **decreasing trend** with respect to average of previous years and the last year



# Flood Risk Management Mechanism



- Flood Management **Planning & Execution** - FFC
- National level **Contingency Planning** - NDMA (Member of FFC)
- **Forecast** generation - PMD, FFD (-do-)
- Cross Border **data management** - PCIW (-do-)
- **Regulation** of Dams - WAPDA (-do-)
- Canal water **regulation** - IRSA (-do-)
- Barrage **operation** - PIDs (-do-)
- **Maintenance** of flood infrastructure - PIDs (-do-)
- Flood **fighting** - PIDs & Army (-do-)
- Management of resulting **disasters** - DDMAAs/ PDMAs/NDMA (-do-)





## Implementation of NFPP - IV:

- **Enforcement** of River Flood Plain **Act**;
- Implementation of **National Master Plan** on Flood Telemetry;
- Establishment of **Regional** Flood Forecasting Centres (**RFFCs**);
- Networking of **RFFCs** with PMD/FFD, FFC, WAPDA, IRSA, NDMA, PDMAs;
- Improved computerized **FEWS**, enhanced radar coverage;
- **Urban** flood management (**20 most** vulnerable cities);
- Much **awaited** Capacity Building & Institutional Strengthening



## Implementation of Updated of NFPP - IV:

- **Nature based** solutions to IFRM
- **Hill torrents**, flash floods, coastal area IFRM
- **All Inclusive** Approach – Community participation
- Extended research on weather patterns, impact of climate change etc.
- Country-wide **media awareness**
- Political will, **allocation of adequate** protection and O&M funds
- Activation of **Loss & Damage** Fund

**THANK YOU**