

Impact-Based Forecasting for the Seasonal Outlook for October to December 2023

26th South Asian Climate Outlook Forum (SASCOF-26)
Climate Services User Forum (CSUF)

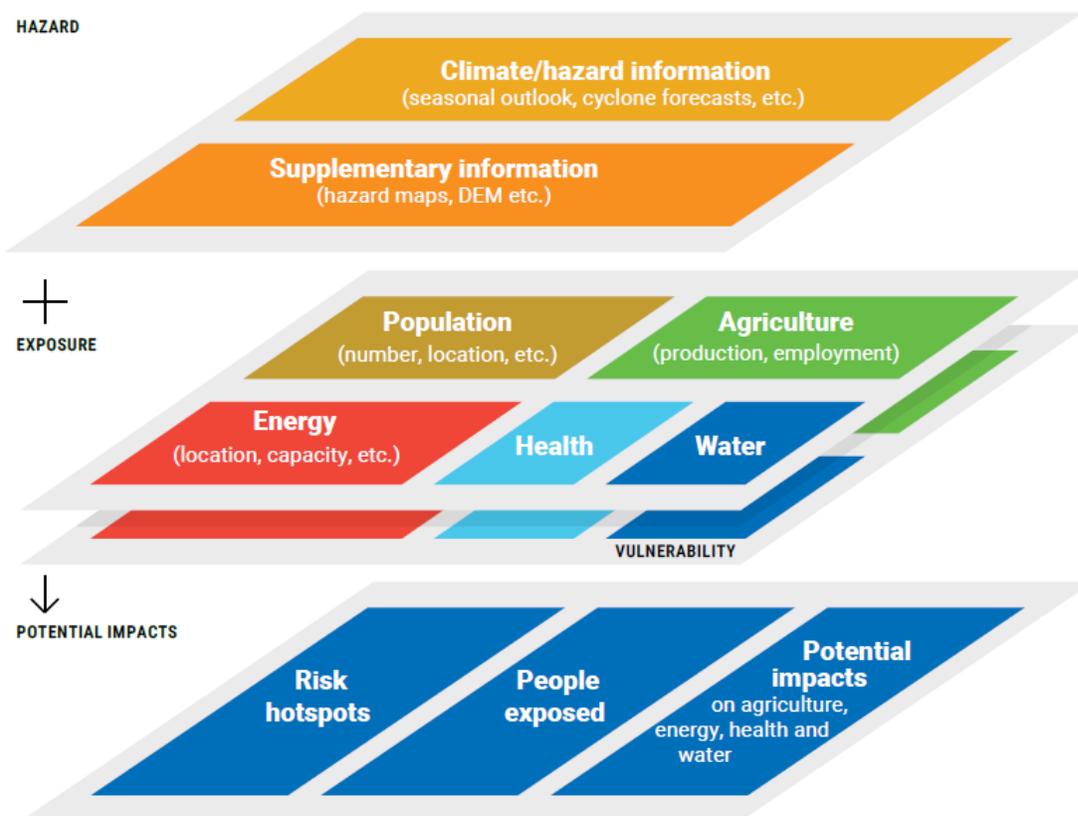
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3 October 2023

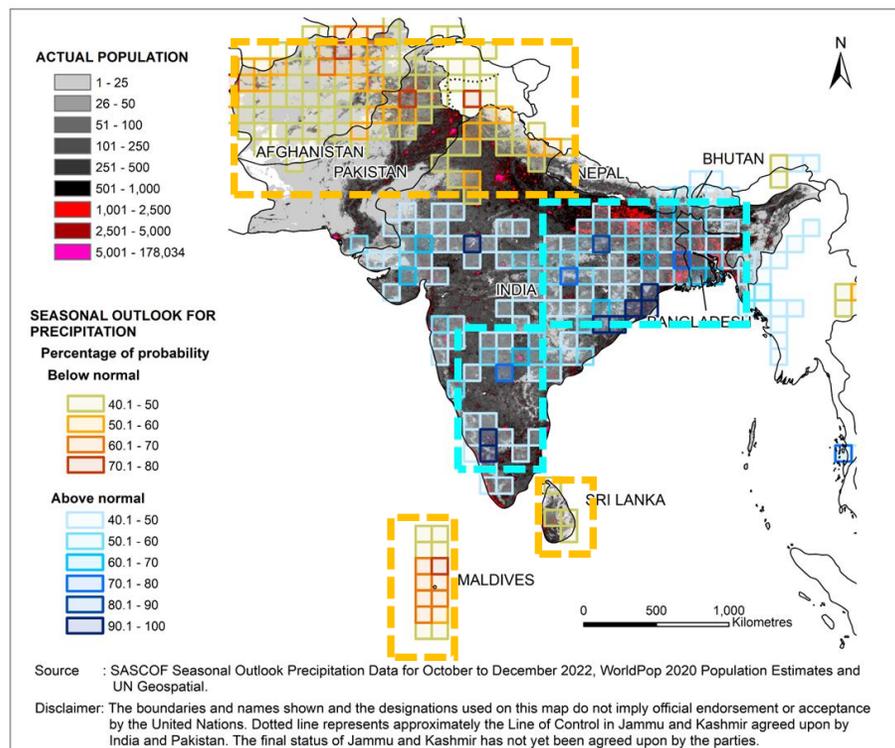
ESCAP's impact-based forecasting approach follows WMO Global Framework for Climate Services



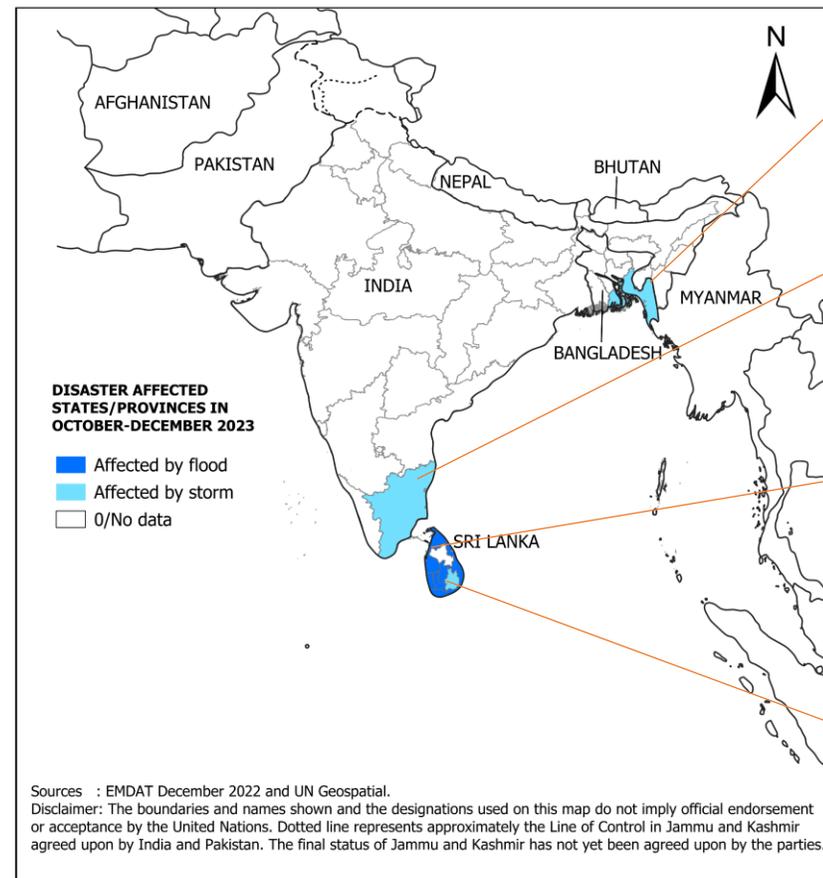
- **IBF based on seasonal forecast products** - Concept and cases were presented to SASCOF, ASEANCOF, EASCOF and FOCRAII.
- **IBF based on observed and forecast tracks of tropical cyclones (quadrant wind)** - Concept and a case were presented to and discussed at TC and PTC.

Source: ESCAP (2022) APDR – Pathways to Adaptation and Resilience in South and South-West Asia Overview of the work of secretariat and the UN system at the regional level.
ESCAP/CDR/2021/INF/1

In September 2022, potential above-normal and below-normal precipitation hotspots were identified



States or provinces affected by disasters from October to December 2022



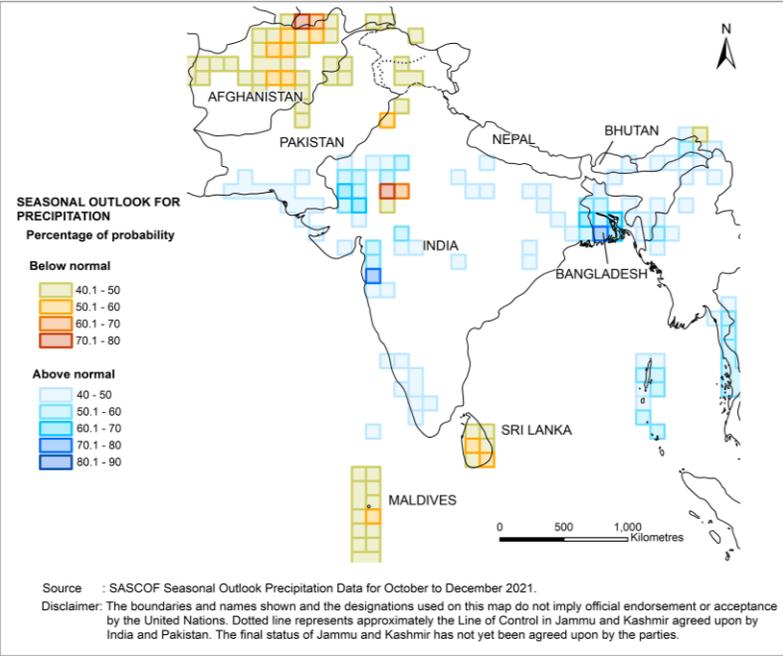
October 2022
Tropical Cyclone, BANGLADESH
 Total deaths: 35
 Affected: 1,000,000
 Chittagong, Barisal

December 2022
Tropical Cyclone, INDIA
 Tamil Nadu

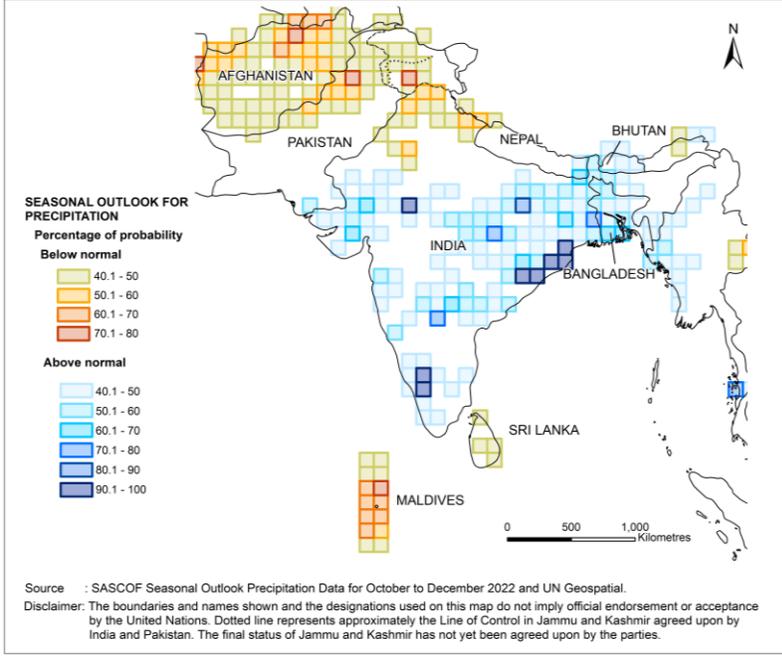
October 2022
Flood, SRI LANKA
 Total deaths: 30
 Affected: 61,469
 Eastern Province, Western Province, Southern Province, North Western Province, Central Province and Sabaragamuwa

December 2022
Tropical Cyclone, SRI LANKA
 Total deaths: 2
 Affected: 6,500
 Uva Province

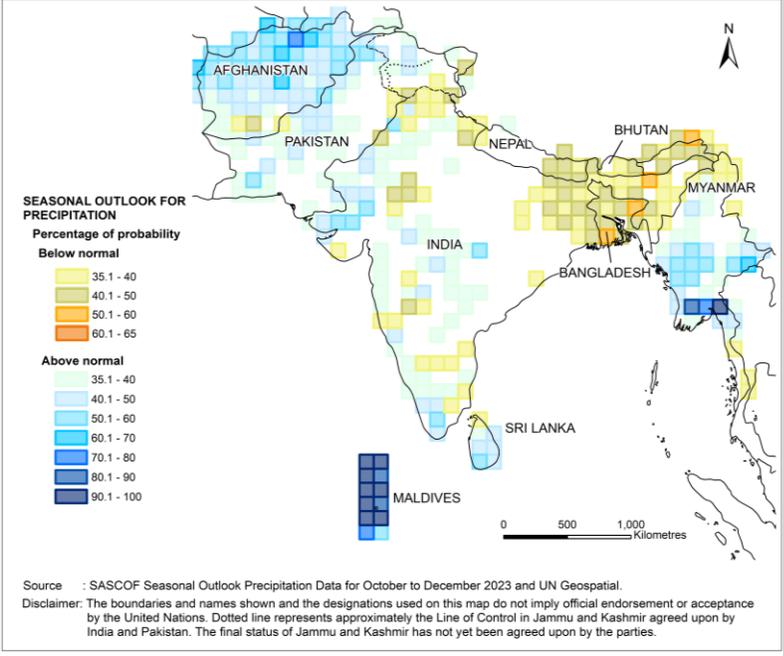
Seasonal outlook for precipitation OND 2021



Seasonal outlook for precipitation OND 2022



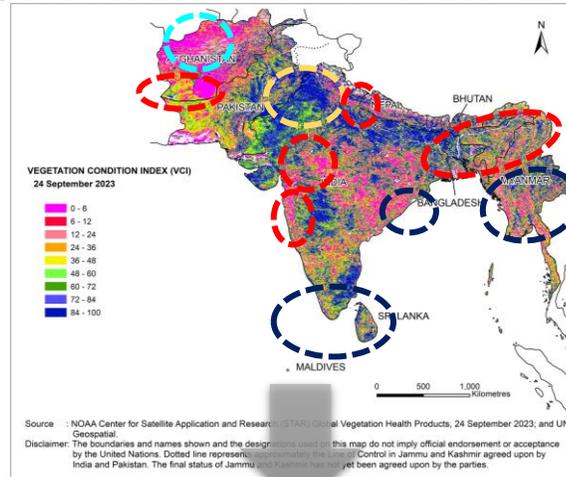
Seasonal outlook for precipitation OND 2023



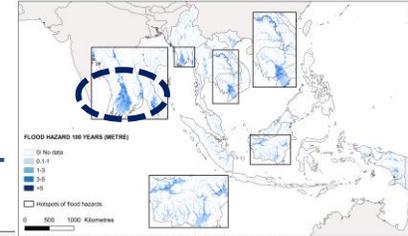
Seasonal Outlook October – December 2023

Vegetation health during the most recent week, historical flood and drought hazard maps were used to find out the areas of attention for **above-normal** and **below-normal** precipitation.

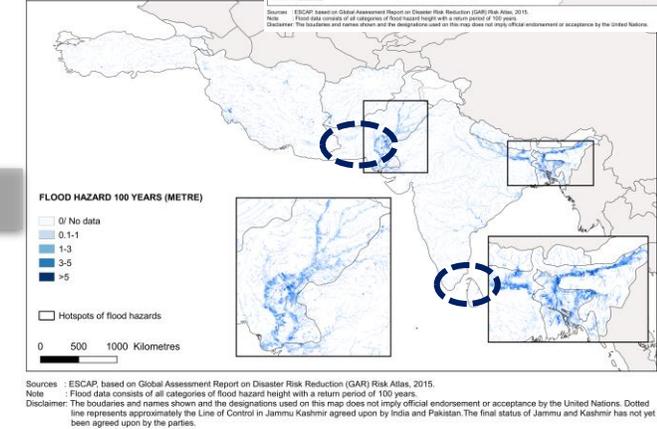
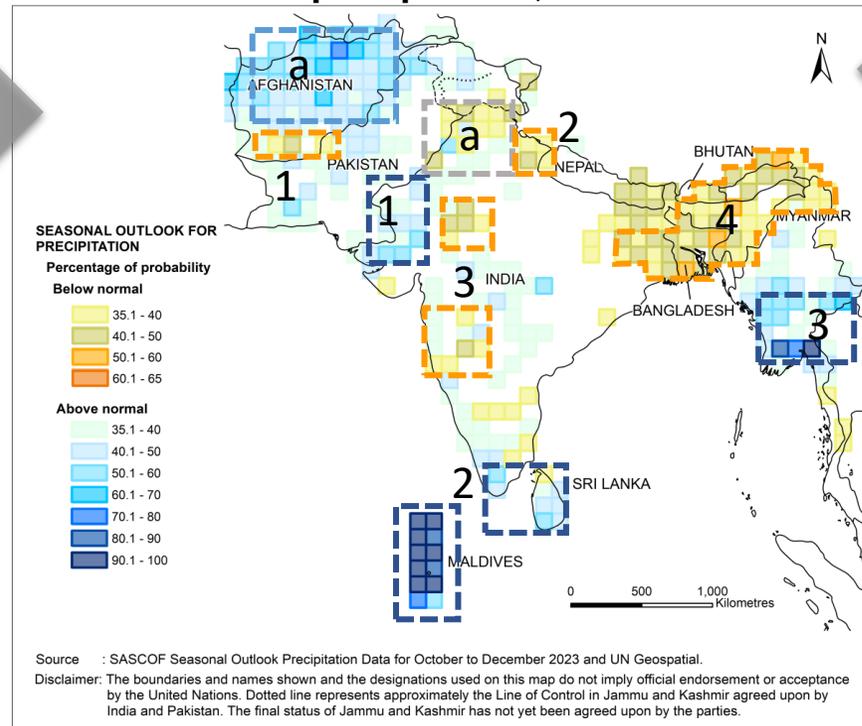
Vegetation condition index as of 23 April 2023



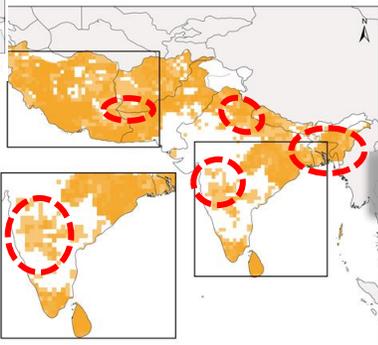
Flood hazard in 100-year return period



Areas of attention for above-normal and below-normal precipitation, OND 2023



Drought events from 1980-2001



Areas of attention for below-normal precipitation

1. North-west part
2. North part
3. Central part
4. East part

Areas with advantage - Below-normal precipitation
a. North part

Areas of attention for above-normal precipitation

1. North part
2. South part
3. East part

Areas with advantage - Above-normal precipitation
a. North-west part

Seasonal Outlook for precipitation October-December 2023

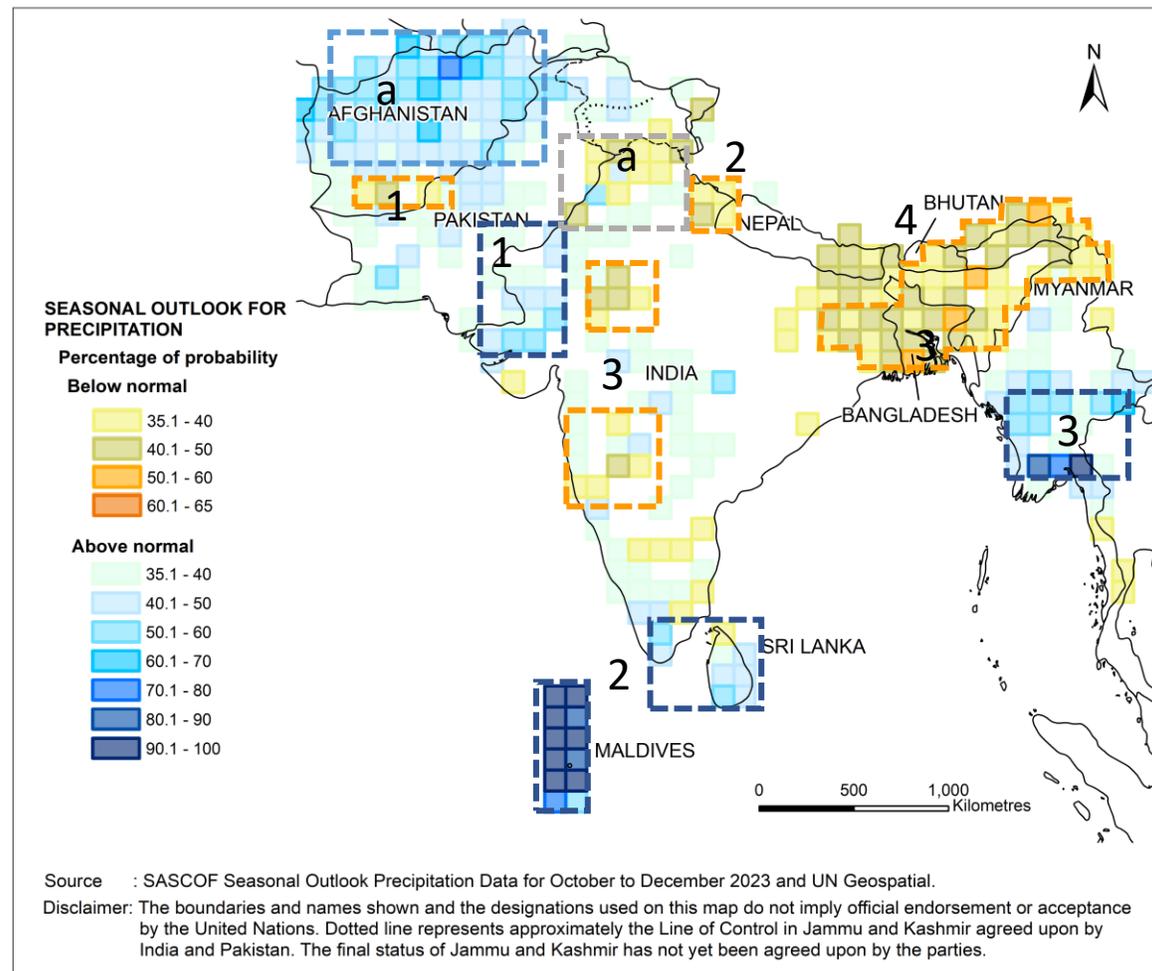
Areas of attention for precipitation

Areas of attention for below-normal precipitation

- 1. North-west part:** south-west part of Afghanistan neighboring with north-west part of Pakistan (up to **44%** probability of below-normal precipitation).
- 2. North part:** north part of India neighboring with Nepal (up to **44%** probability of below-normal precipitation).
- 3. Central part:** central part of India (up to **50%** probability of below-normal precipitation).
- 4. East parts:** east and north-east parts of India (up to **52%** probability of below-normal precipitation), Bangladesh (up to **57%** probability of below-normal precipitation), Bhutan (up to **40%** probability of below-normal precipitation), and north part of Myanmar (up to **44%** probability).

Areas with advantage - Below-normal precipitation

- a. North part:** north parts of India neighboring with Pakistan (up to **44%** probability).



Areas of attention for above-normal precipitation

- 1. North part:** south part of Pakistan neighboring with north-west part of India (up to **57%** probability of above-normal precipitation).
- 2. South part:** south part of India (up to **55%** probability of above-normal precipitation), Sri Lanka (up to **51%** probability of above-normal precipitation), and Maldives (up to **97%** probability of above-normal precipitation).
- 3. East part:** central to south parts of Myanmar (up to **100%** of probability of above-normal precipitation).

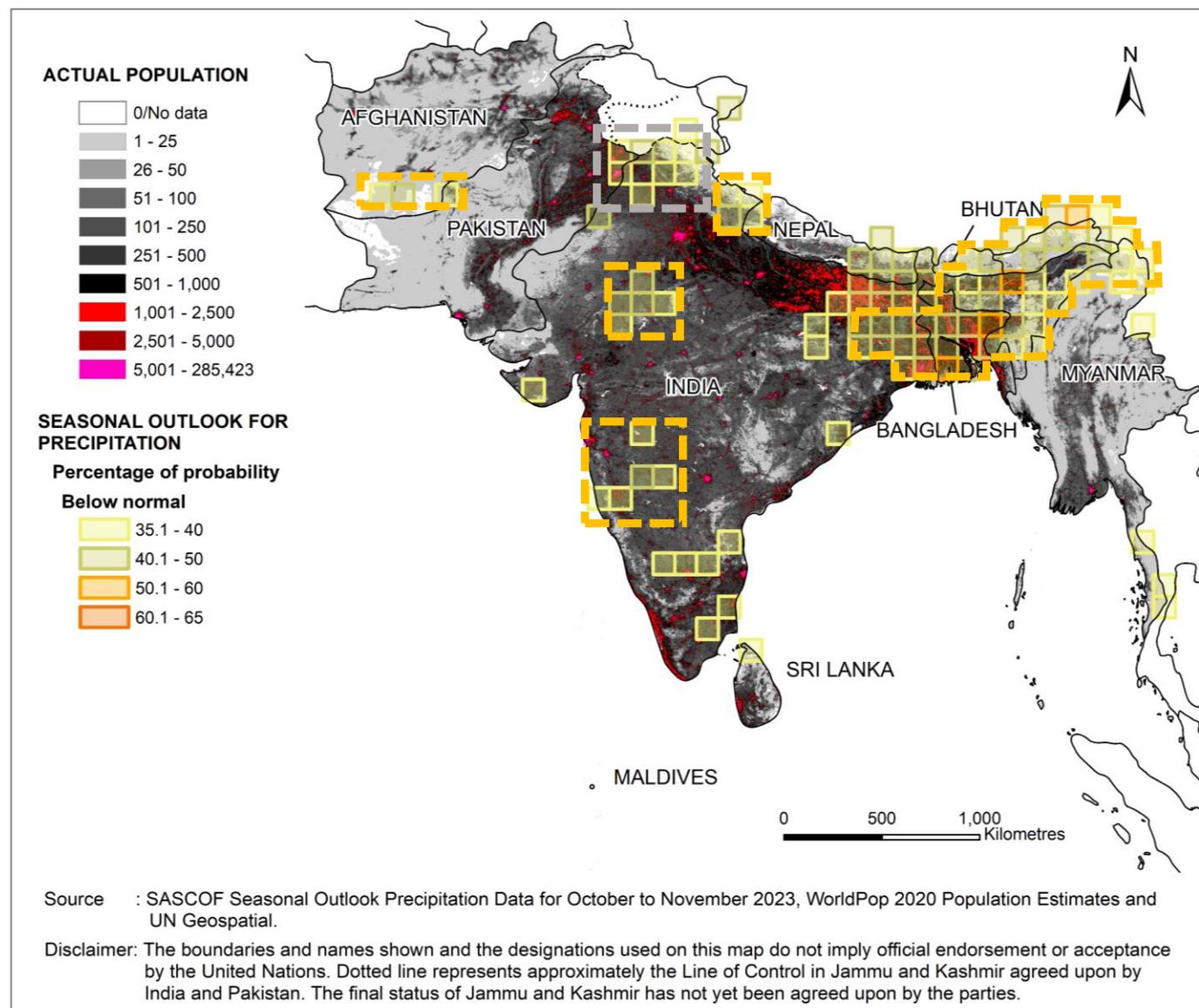
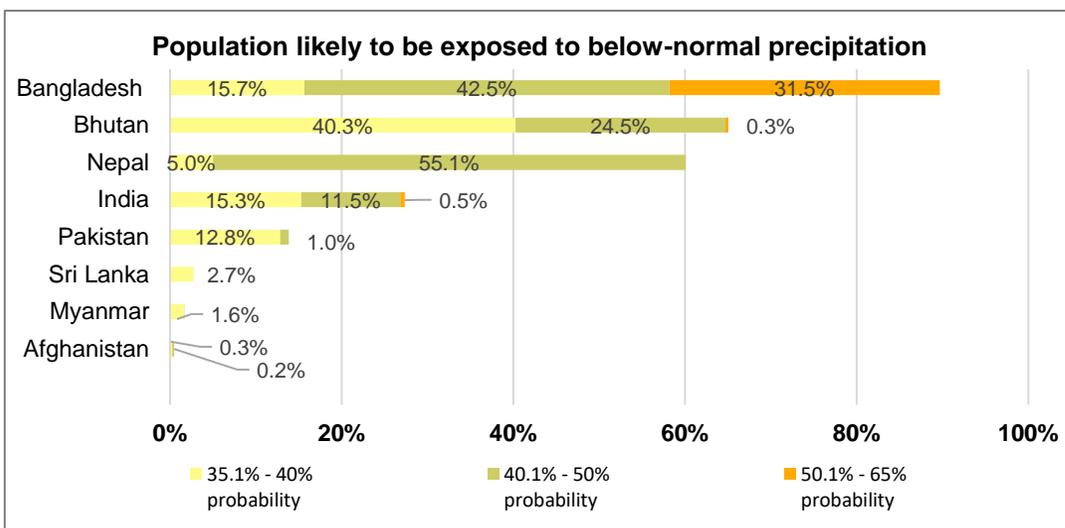
Areas with advantage - Above-normal precipitation

- a. North-west part:** Afghanistan and north-west part of Pakistan (up to **78%** probability of above-normal precipitation).

Estimation of population likely to be exposed to below-normal precipitation

Country	Total population 2022 (thousands) ESCAP statistics	Percent of population exposure			
		35.1% - 40% probability of below normal precipitation	40.1% - 50% probability of below normal precipitation	50.1% - 65% probability of below normal precipitation	Below normal precipitation
Afghanistan	41,129	0.3%	0.2%	0.0%	0.5%
Bangladesh	171,186	15.7%	42.5%	31.5%	89.7%
Bhutan	783	40.3%	24.5%	0.3%	65.1%
India	1,417,173	15.3%	11.5%	0.5%	27.3%
Maldives	524	0.0%	0.0%	0.0%	0.0%
Myanmar	54,179	1.6%	0.0%	0.0%	1.7%
Nepal	30,548	5.0%	55.1%	0.0%	60.1%
Pakistan	235,825	12.8%	1.0%	0.0%	13.9%
Sri Lanka	21,832	2.7%	0.0%	0.0%	2.7%
Total	1,973,178	14.0%	13.0%	3.1%	30.2%

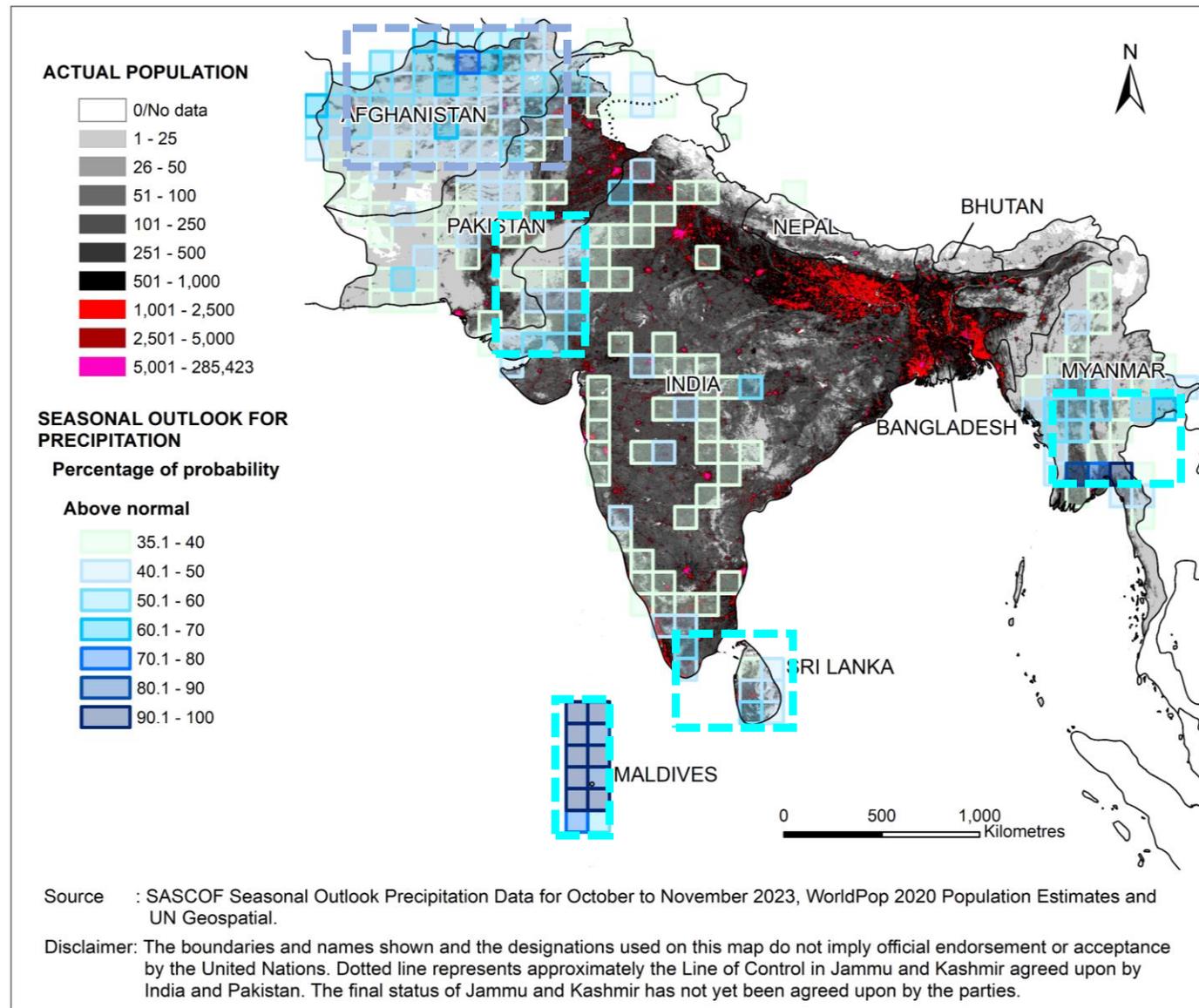
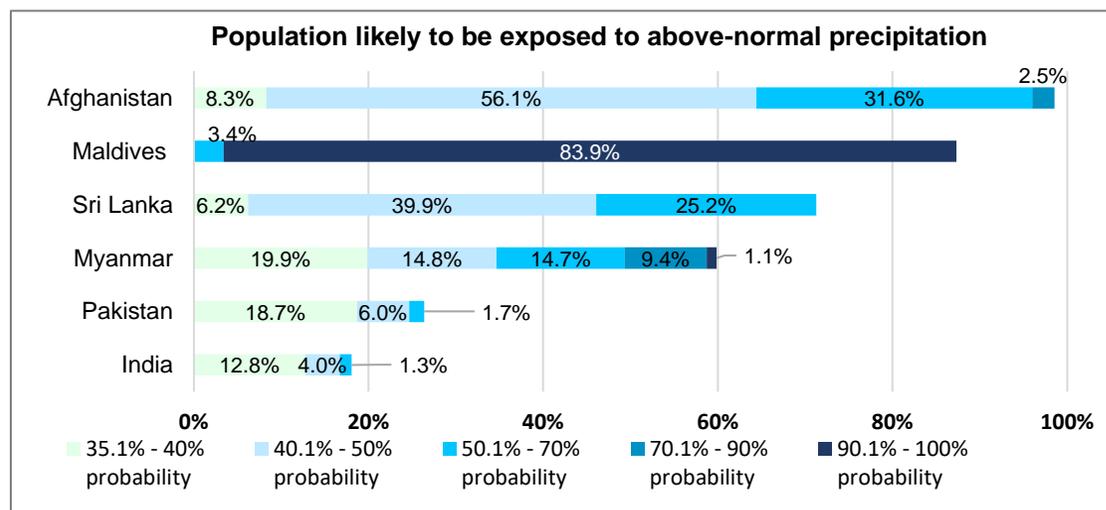
In total, **30.2%** population of this region are likely to be exposed to **more than 35%** probability of below-normal precipitation.



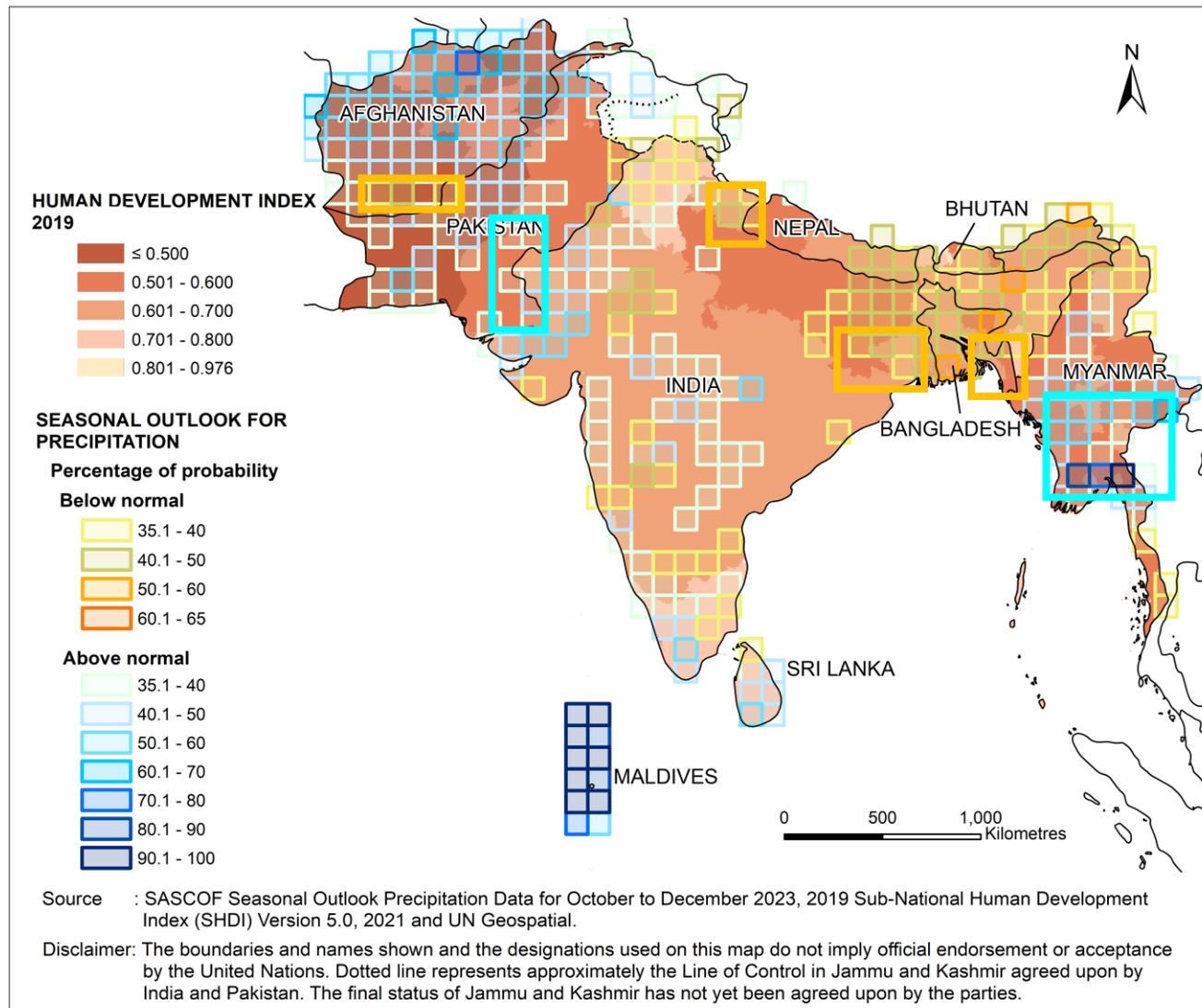
Estimation of population likely to be exposed to above-normal precipitation

Country	Total population 2022 (thousands) ESCAP statistics	Percent of population exposure					Above normal precipitation
		35.1% - 40% probability of above normal precipitation	40.1% - 50% probability of above normal precipitation	50.1% - 70% probability of above normal precipitation	70.1% - 90% probability of above-normal precipitation	90.1% - 100% probability of above normal precipitation	
Afghanistan	41,129	8.3%	56.1%	31.6%	2.5%	0.0%	98.5%
Bangladesh	171,186	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Bhutan	783	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
India	1,417,173	12.8%	4.0%	1.3%	0.0%	0.0%	18.1%
Maldives	524	0.0%	0.0%	3.4%	0.0%	83.9%	87.3%
Myanmar	54,179	19.9%	14.8%	14.7%	9.4%	1.1%	59.9%
Nepal	30,548	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Pakistan	235,825	18.7%	6.0%	1.7%	0.0%	0.0%	26.4%
Sri Lanka	21,832	6.2%	39.9%	25.2%	0.0%	0.0%	71.3%
Total	1,973,178	12.2%	5.6%	2.5%	0.3%	0.04%	20.6%

In total, **20.6%** of South Asia population are likely to be exposed to above-normal precipitation.

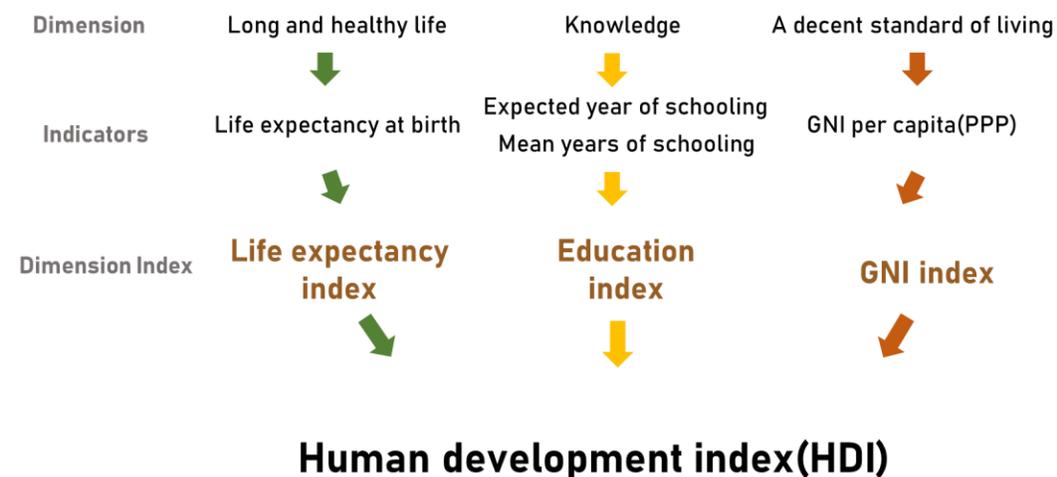


Vulnerability indicators can be added to understand the vulnerability of people likely to be affected.



HDI is overlaid to understand the vulnerability of people exposed.

Sub-national Human Development Index (SHDI)



Source: UNDP, 2019.

Other indicators (poverty, income, education, literacy, or other vulnerability indicators) can be used as appropriate.

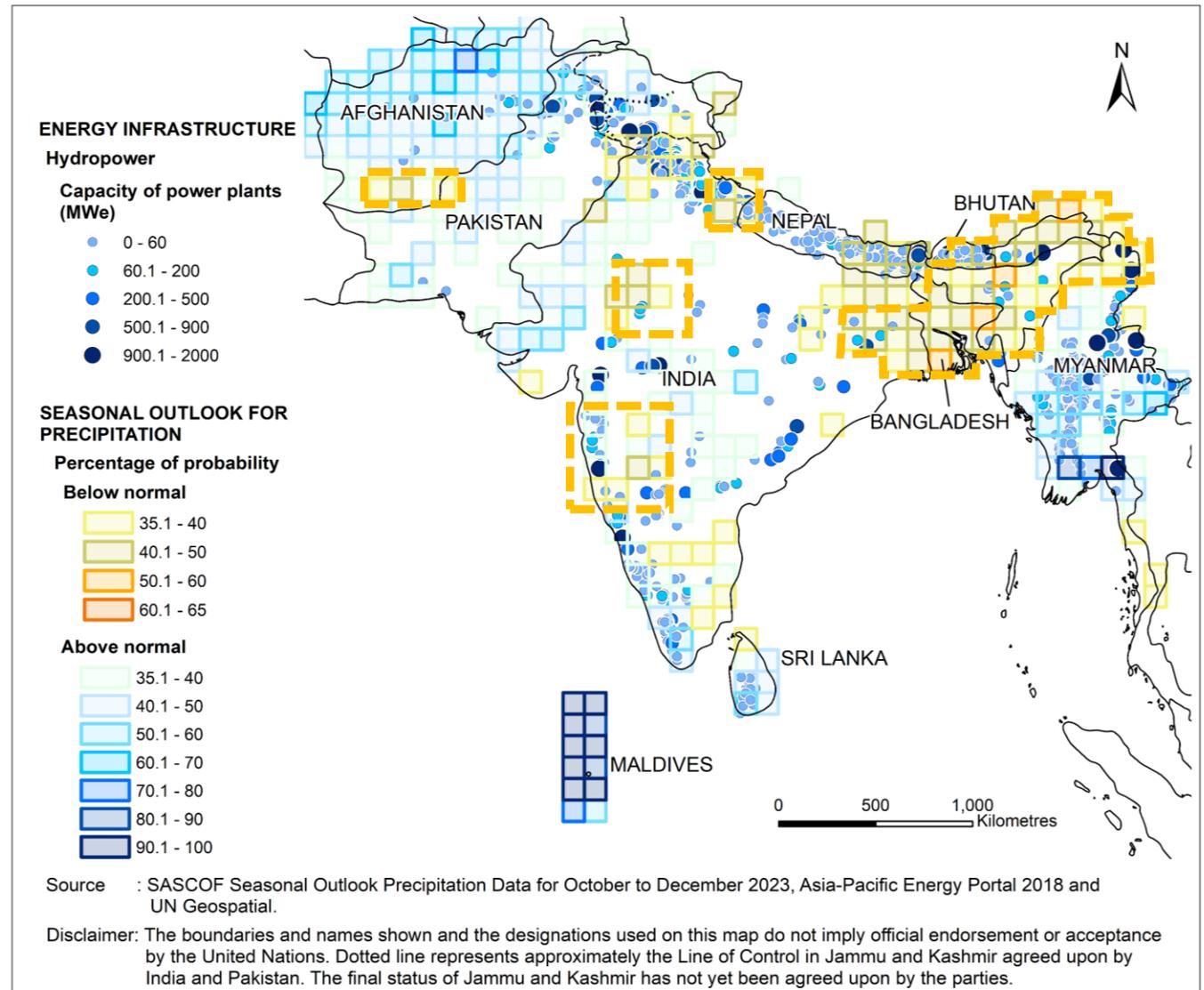
Potential exposure to hydropower plants

Areas of attention for below normal precipitation

- **25.2%** of total hydropower plants' capacity in South Asia will be exposed to 35.1% - 65% probability of **below-normal precipitation**.
- Those are particularly located in Bhutan, India, Myanmar, Nepal and Pakistan.

Hydropower plants in areas with potential exposure to above-normal precipitation

- **36.5%** of total hydropower plants' capacity in South Asia will be exposed to 35.1% – 100% probability of **above-normal precipitation**.
- Those are located in Afghanistan, India, Myanmar, Pakistan and Sri Lanka.



Verification of the OND 2023 IBF percent exposure from automation tool with the manual calculations on QGIS

- Percent difference from automation and manual calculations, for population exposure ranges from **0.1% to 0.3%** in each country for **below-normal precipitation**.
- Percent difference from automation and manual calculation in each country, for population exposure ranges from **0% to 4% and -4.8%** in each country for **above-normal precipitation**.

Country	Method	BELOW-NORMAL				ABOVE-NORMAL					
		Exposed to 35.1% - 40% probability of below normal precipitation	Exposed to 40.1% - 50% probability of below normal precipitation	Exposed to 50.1% - 65% probability of below normal precipitation	Percent of exposure to below normal precipitation	Exposed to 35.1% - 40% probability of above normal precipitation	Exposed to 40.1% - 50% probability of above normal precipitation	Exposed to 50.1% - 70% of above normal precipitation	Exposed to 70.1% - 90% of above normal precipitation	Exposed to 90.1% - 100% of above normal precipitation	Percent of exposure to above normal precipitation
Afghanistan	Manual	0.3%	0.2%	0.0%	0.5%	8.3%	56.1%	31.6%	2.5%	0.0%	98.5%
	Script	0.3%	0.2%	0.0%	0.5%	8.4%	56.4%	31.9%	2.5%	0.0%	99.2%
	% difference	0.1%	0.3%	0.3%	0.3%	0.1%	0.3%	0.3%	0.0%	0.0%	0.7%
Bangladesh	Manual	15.7%	42.5%	31.5%	89.7%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	Script	15.9%	43.2%	31.7%	90.7%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	% difference	0.1%	0.3%	0.3%	0.3%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Bhutan	Manual	40.3%	24.5%	0.3%	65.1%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	Script	40.5%	24.4%	0.5%	65.3%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	% difference	0.1%	0.3%	0.3%	0.3%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
India	Manual	15.3%	11.5%	0.5%	27.3%	12.8%	4.0%	1.3%	0.0%	0.0%	18.1%
	Script	15.5%	11.6%	0.5%	27.7%	12.9%	4.0%	1.4%	0.0%	0.0%	18.3%
	% difference	0.1%	0.3%	0.3%	0.3%	0.1%	0.1%	0.0%	0.0%	0.0%	0.2%
Maldives	Manual	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	3.4%	0.0%	83.9%	87.3%
	Script	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	3.9%	0.0%	79.1%	83.0%
	% difference	0.1%	0.3%	0.3%	0.3%	0.0%	0.0%	0.5%	0.0%	-4.8%	-4.3%
Myanmar	Manual	1.6%	0.0%	0.0%	1.7%	19.9%	14.8%	14.7%	9.4%	1.1%	59.9%
	Script	1.6%	0.0%	0.0%	1.7%	20.1%	14.9%	14.8%	9.5%	5.2%	60.5%
	% difference	0.1%	0.3%	0.3%	0.3%	0.3%	0.1%	0.1%	0.1%	4.0%	0.6%
Nepal	Manual	5.0%	55.1%	0.0%	60.1%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	Script	5.2%	55.0%	0.0%	60.2%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	% difference	0.1%	0.3%	0.3%	0.3%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Pakistan	Manual	12.8%	1.0%	0.0%	13.9%	18.7%	6.0%	1.7%	0.0%	0.0%	26.4%
	Script	12.9%	1.0%	0.0%	13.9%	19.1%	6.1%	1.7%	0.0%	0.0%	26.9%
	% difference	0.1%	0.3%	0.3%	0.3%	0.4%	0.1%	0.0%	0.0%	0.0%	0.5%
Sri Lanka	Manual	2.7%	0.0%	0.0%	2.7%	6.2%	39.9%	25.2%	0.0%	0.0%	71.3%
	Script	2.7%	0.0%	0.0%	2.7%	6.3%	40.0%	25.5%	0.0%	0.0%	71.8%
	% difference	0.1%	0.3%	0.3%	0.3%	0.1%	0.1%	0.3%	0.0%	0.0%	0.5%
TOTAL	Manual	14.0%	13.0%	3.1%	30.2%	12.2%	5.6%	2.5%	0.3%	0.0%	20.6%
	Script	14.2%	13.1%	3.1%	30.5%	12.3%	5.6%	2.5%	0.3%	0.1%	20.9%
	% difference	0.1%	0.3%	0.3%	0.3%	0.1%	0.1%	0.0%	0.0%	0.1%	0.2%

The Automation Tool for Impact-Based Forecasting - Seasonal Outlook for October to December 2023

26th South Asian Climate Outlook Forum (SASCOF-26)
Climate Services User Forum (CSUF)

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Consultant

Disaster Risk Reduction Section, IDD, UN ESCAP

3 October 2023

Automated Seasonal Impact-Based Forecasting Methodology

INPUT*



- Population data
- Infrastructure data
- Hazard data
- Boundary data

OUTPUT



- Exposure and intensity zone of hazards
- Map & exportable table



GEOSPATIAL PYTHON AUTOMATION SCRIPT

GEOSPATIAL PRE-PROCESSING



- Setting Coordinate Reference Systems
- Setting resolution
- Classifying hazard (based on intensities, create different hazard intensity zones)

PROCESS IDENTIFICATION

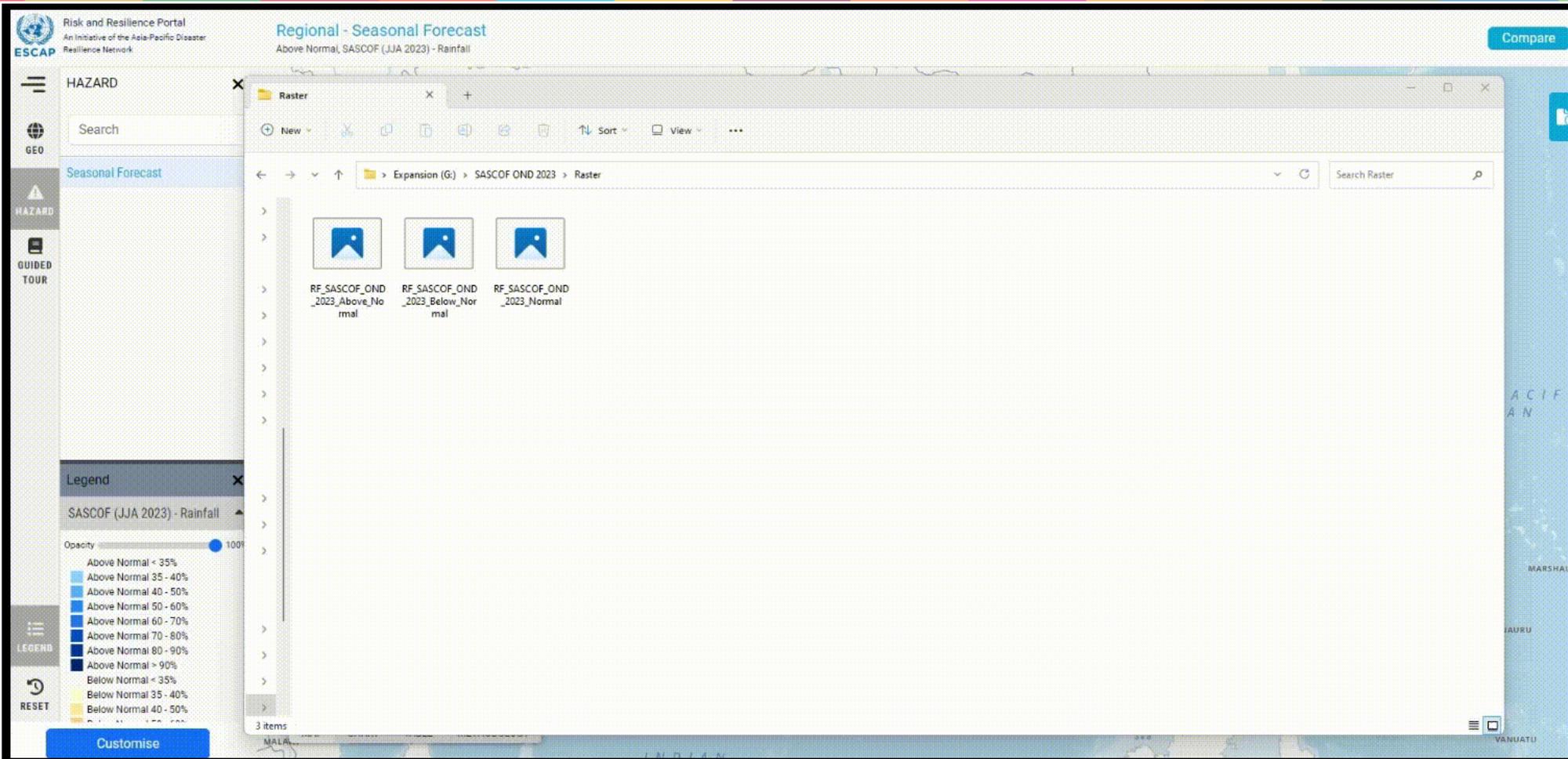


- Auto recognize type of infrastructure / population data

GEOSPATIAL EXPOSURE ANALYSIS



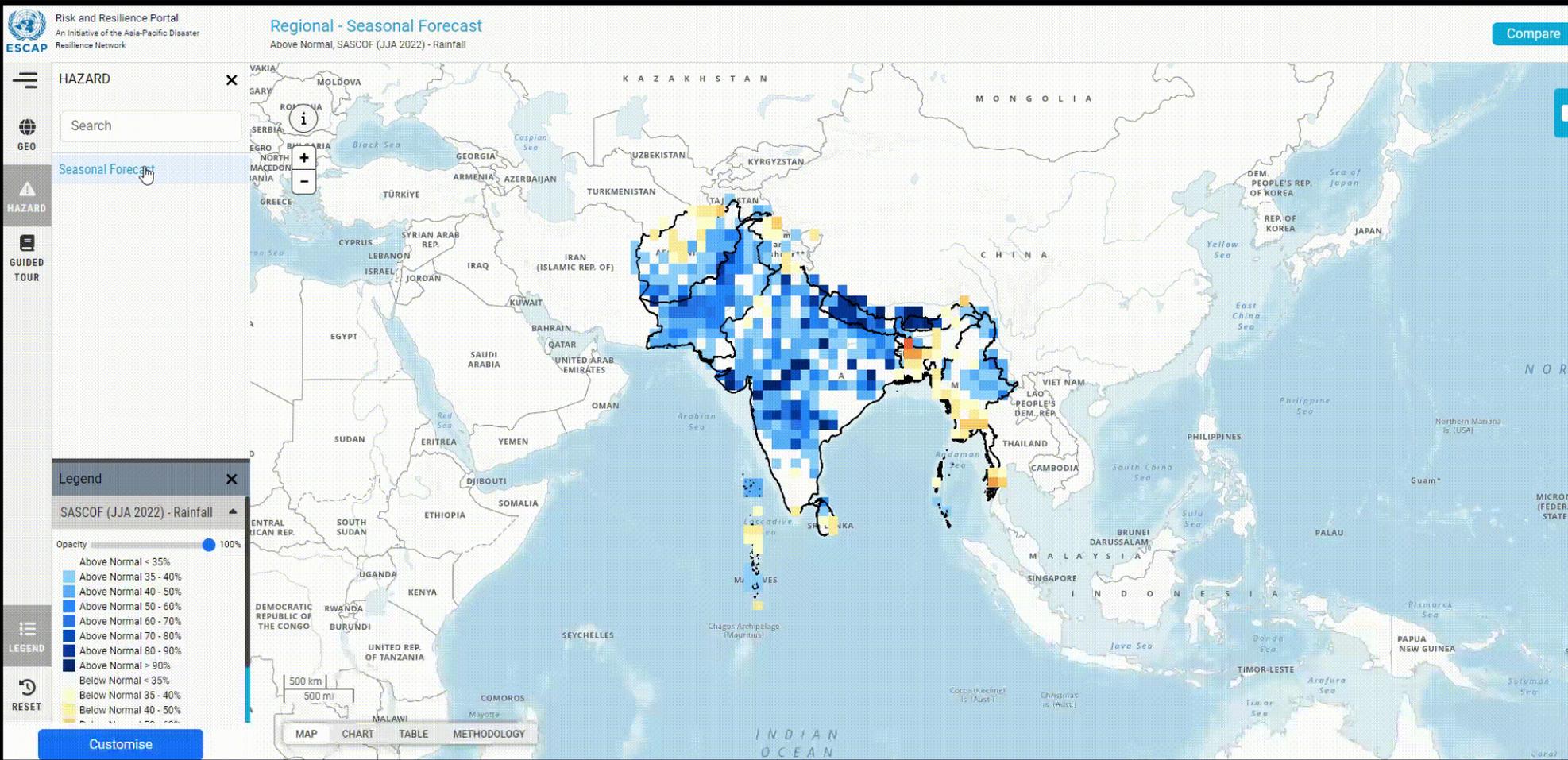
- Calculate exposure to all infrastructure and population
- Overlay & count exposure



Upload your own data

Upload your own hazard data, and the tool will automatically generate tiles to display on a map and calculate exposure to population or infrastructure. It is easy to compare this visually on the map or compare the exposure numbers with other seasonal forecast data from different organizations or time periods





Identify hotspot areas

Choose from seasonal forecast hazard data from different organizations and identify hotspot areas on a map



Visualize exposure

Choose from available infrastructure or population data and visualize the exposure to it in charts or look at the absolute numbers or percentage intensity in a table at different intensity of above normal or below normal hazard



Compare hazards and exposure

Compare seasonal forecast hazard data from different organizations or from different years on a map. Compare the exposure numbers for different years or for different organizations on charts or tables



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An Initiative of the Asia-Pacific Disaster Resilience Network

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