THE RISKSCAPE OF THE EAST ASIA AND METHODOLOGICAL FRAMEWORK OF IMPACT FORECASTING
: A CASE FROM SOUTH ASIA

Mr SungEun Kim
Disaster Risk Reduction Section, IDD
ESCAP

UNITED NATIONS ESCAP
Economic and Social Commission for Asia and the Pacific

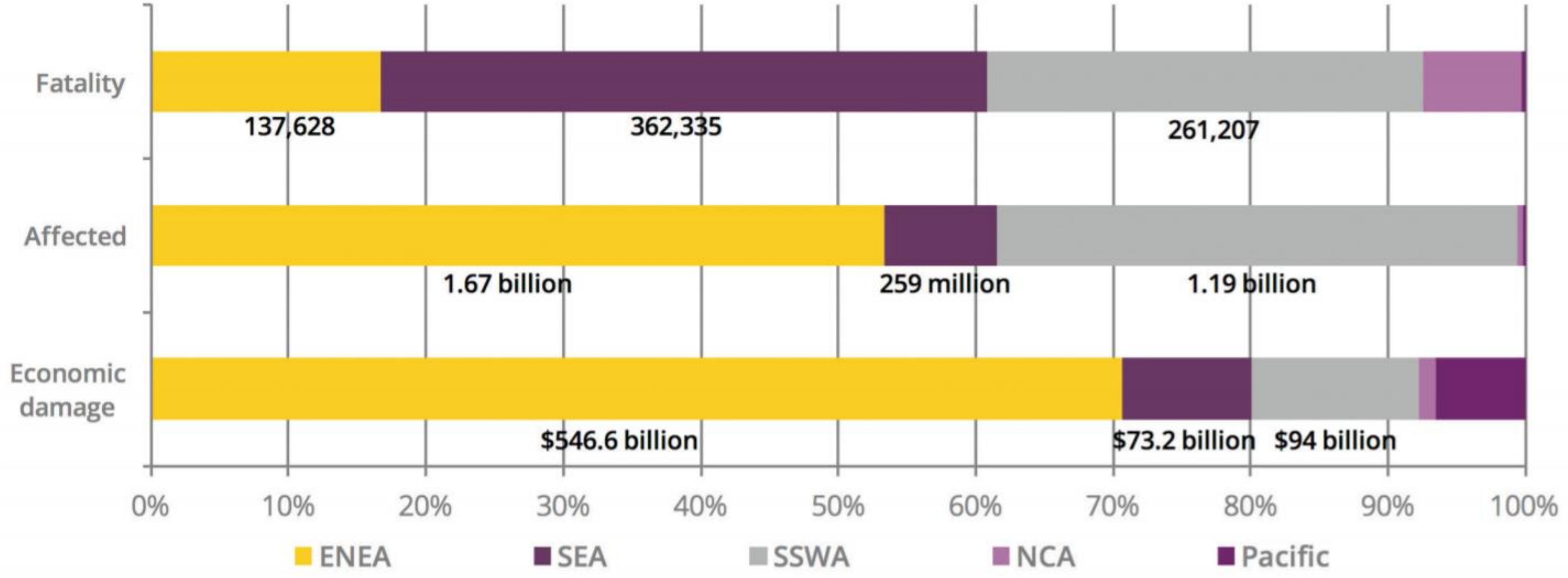
5 November 2020

East Asia Riskscape

United Nations ESCAP
Economic and Social Commission for Asia and the Pacific

East and North Asia is one of the most disaster prone subregions in the disaster prone Asia and the Pacific.

Disaster impacts by subregion, 2000–2016

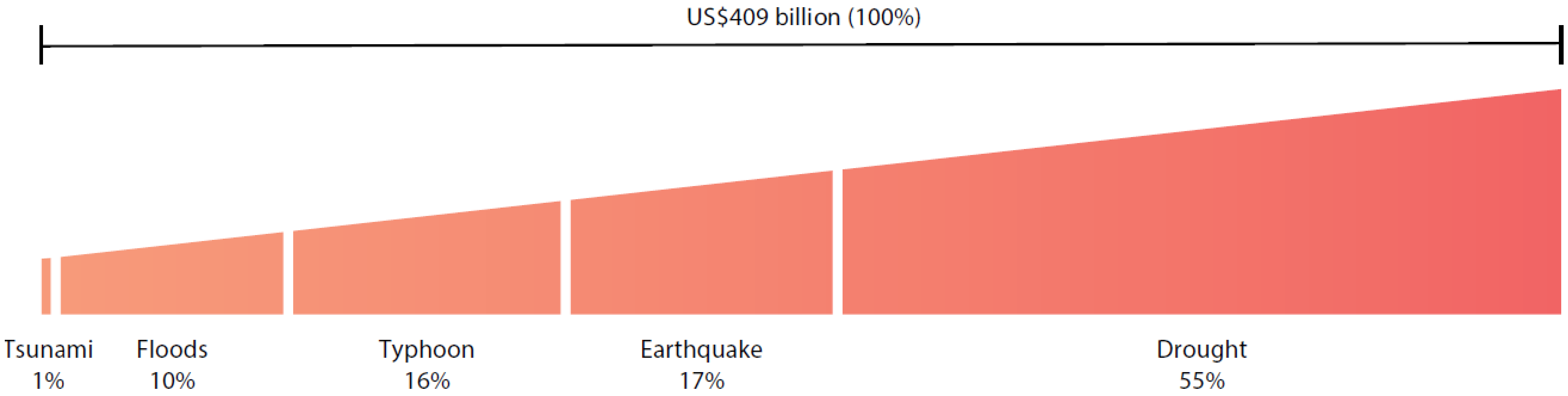


ESCAP (2017) Asia-Pacific Disaster Report 2017, Figure 1-8

East Asia Riskscape

Among others, climate related hazards (drought, typhoon, floods, etc.) account for **more than four-fifths of average annual losses** from natural disasters.

East and North-East Asia disaster riskscape (average annual losses)



Source: ESCAP, based on probabilistic risk assessment.
Note 1: Volumetric analysis is a measurement by volume (impacted population, geographical area and economic losses).
Note 2: Drought average annual losses data of Democratic People's Republic of Korea is not available.

ESCAP (2019) Asia-Pacific Disaster Report 2019

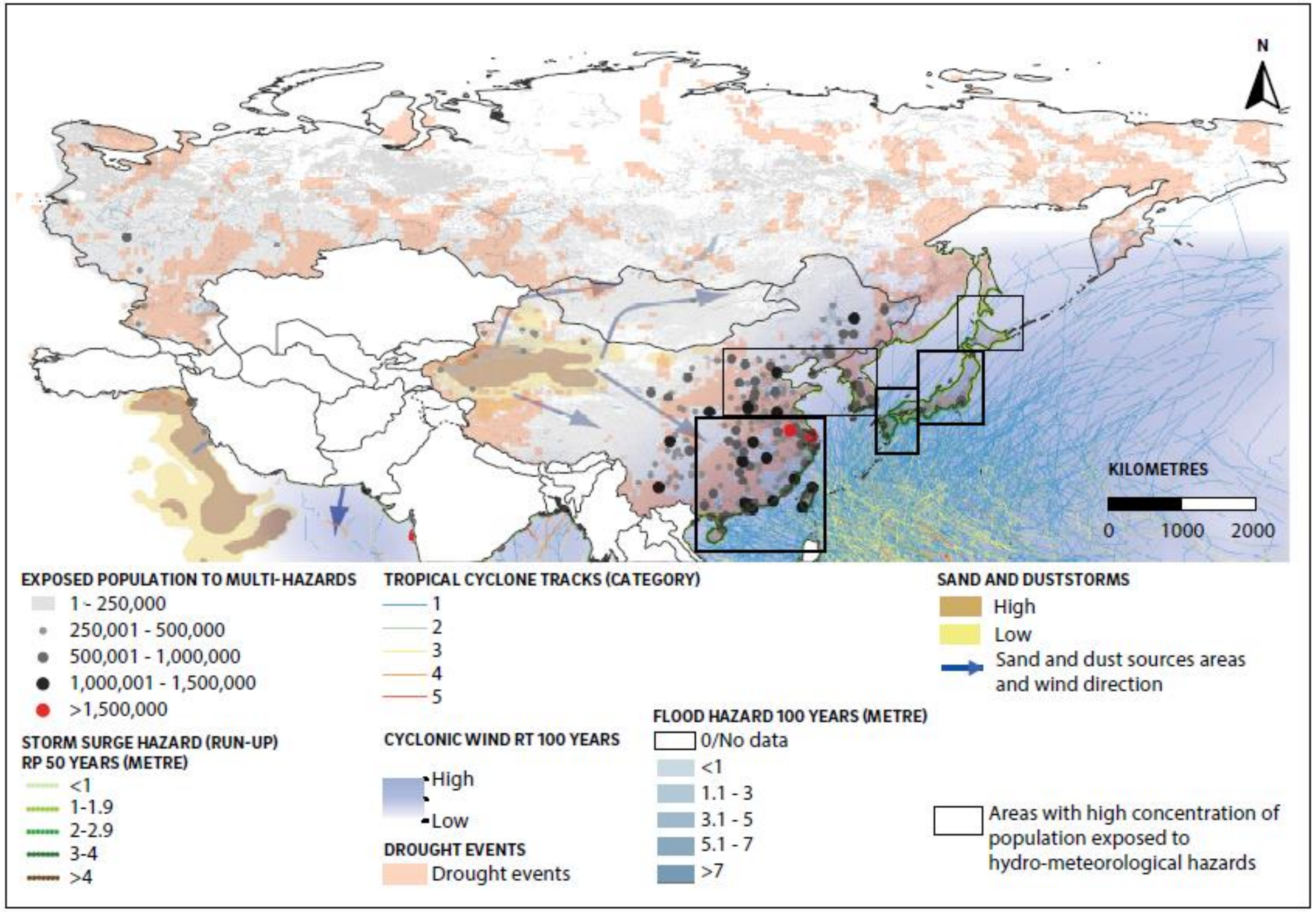
UNITED NATIONS ESCAP
Economic and Social Commission for Asia and the Pacific

East Asia Riskscape

In coastal areas, residents are prone to climate-related disasters.

About **45%** of the population in the subregion is exposed to **typhoons**, while **20%** is exposed to **floods**.

Concentration of exposed population to climate-related hazards

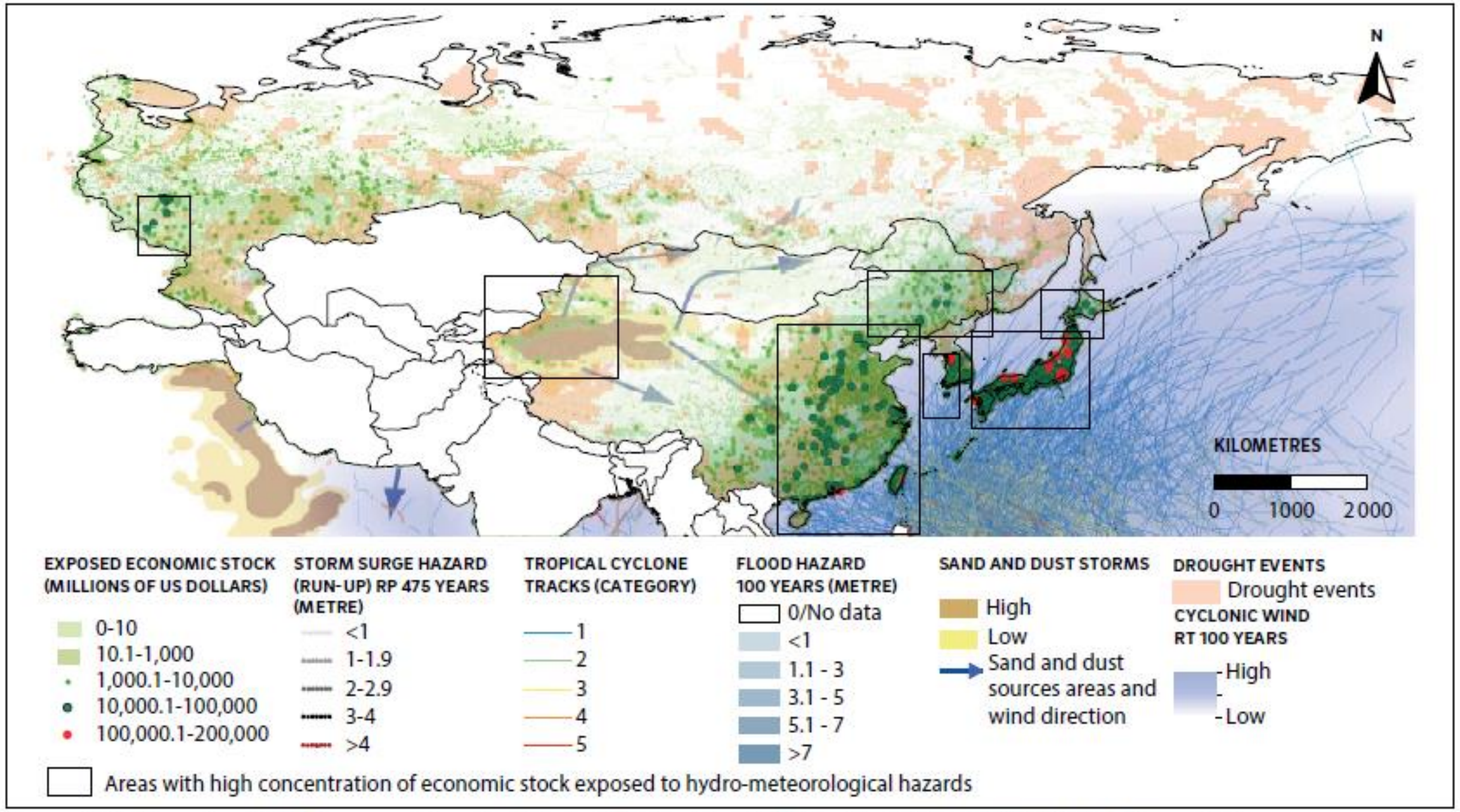


Sources: ESCAP, based on Global Assessment Report on Disaster Risk Reduction (GAR) Risk Atlas, 2015; Global Risk Data Platform, 2013.
Disclaimer: The boundaries and names shown and the designations used on this map do not imply official endorsement or acceptance by the United Nations. Dotted line represents approximately the Line of Control in Jammu and Kashmir agreed upon by India and Pakistan. The final status of Jammu and Kashmir has not yet been agreed upon by the parties.
Note: Cyclone data consist of all cyclone wind categories with a return period of 100 years and an intensity of 119 km/h to more than 252 km/h.

ESCAP (2019) Asia-Pacific Disaster Report 2019 – East and North-East Asia

UNITED NATIONS ESCAP
Economic and Social Commission for Asia and the Pacific

Exposure of economic stock to hydro-meteorological hazards



Sources: ESCAP, based on Global Assessment Report on Disaster Risk Reduction (GAR) Risk Atlas, 2015; Global Risk Data Platform, 2013.
Disclaimer: The boundaries and names shown and the designations used on this map do not imply official endorsement or acceptance by the United Nations. Dotted line represents approximately the Line of Control in Jammu and Kashmir agreed upon by India and Pakistan. The final status of Jammu and Kashmir has not yet been agreed upon by the parties.
Note: Cyclone data consist of all cyclone wind categories with a return period of 100 years and an intensity of 119 km/h to more than 252 km/h.

ESCAP (2019) Asia-Pacific Disaster Report 2019 – East and North-East Asia

East Asia Riskscape

Many economically developed areas, such as Japan, ROK and the coastal areas of China are exposed to hydro-meteorological hazards.

Thus, seasonal forecast products can be extremely useful information in disaster risk management and other key sectors.

UNITED NATIONS ESCAP
Economic and Social Commission for Asia and the Pacific

Member States requested ESCAP to address…

ESCAP Resolution 73/7 (2017) – Request "continue to support and facilitate **multi-hazard early warning systems, impact-based forecasting and disaster risk assessment** to strengthen regional cooperation mechanisms"

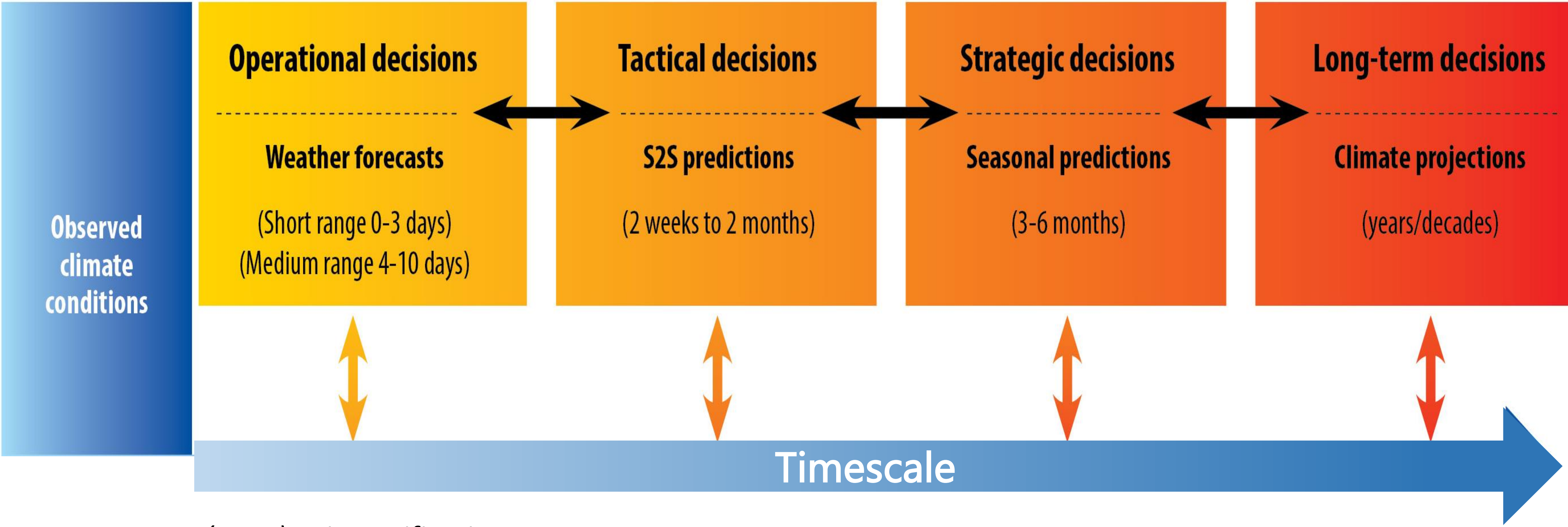
ESCAP Committee on Disaster Risk Reduction (2019)

- **Decision 1:** The Committee notes the operationalization of the Asia-Pacific Disaster Resilience Network, with **priority given to the regional platform for multi-hazard early warning systems for floods and droughts**.
- **Decision 2:** The Committee underlines the importance of the findings of The Disaster Riskscape across Asia-Pacific: Pathways for Resilience, Inclusion and Empowerment – Asia-Pacific Disaster Report 2019 with regard to **supporting risk-informed policy decisions of member States** and requests the secretariat to further deepen its analytical research to respond to the changing geography and intensification of disaster risks.

ESCAP and WMO collaboration – MoU (2019)

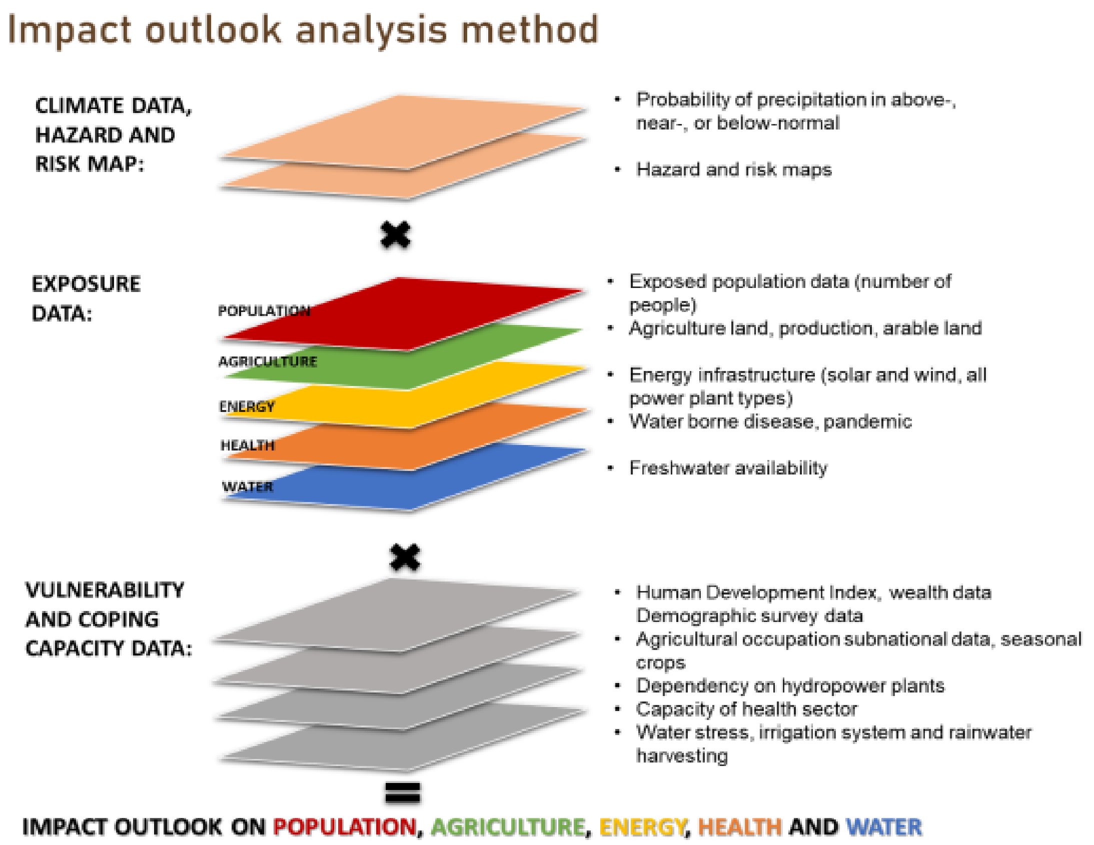
Challenges lie in customization of climate services

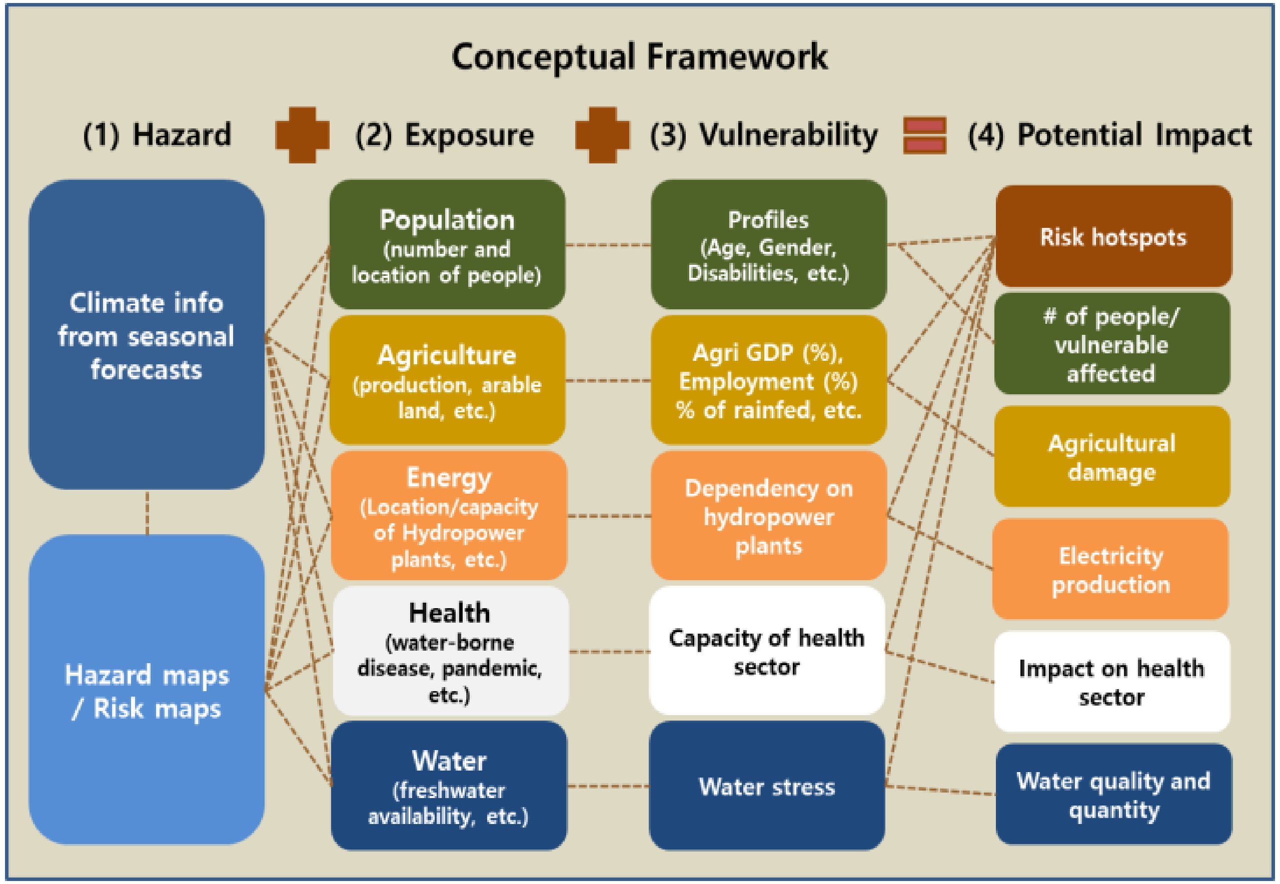
- Seamless integration of services across multiple time scales



Source: ESCAP(2018) Asia-Pacific Disaster Report 2017

Concept and framework

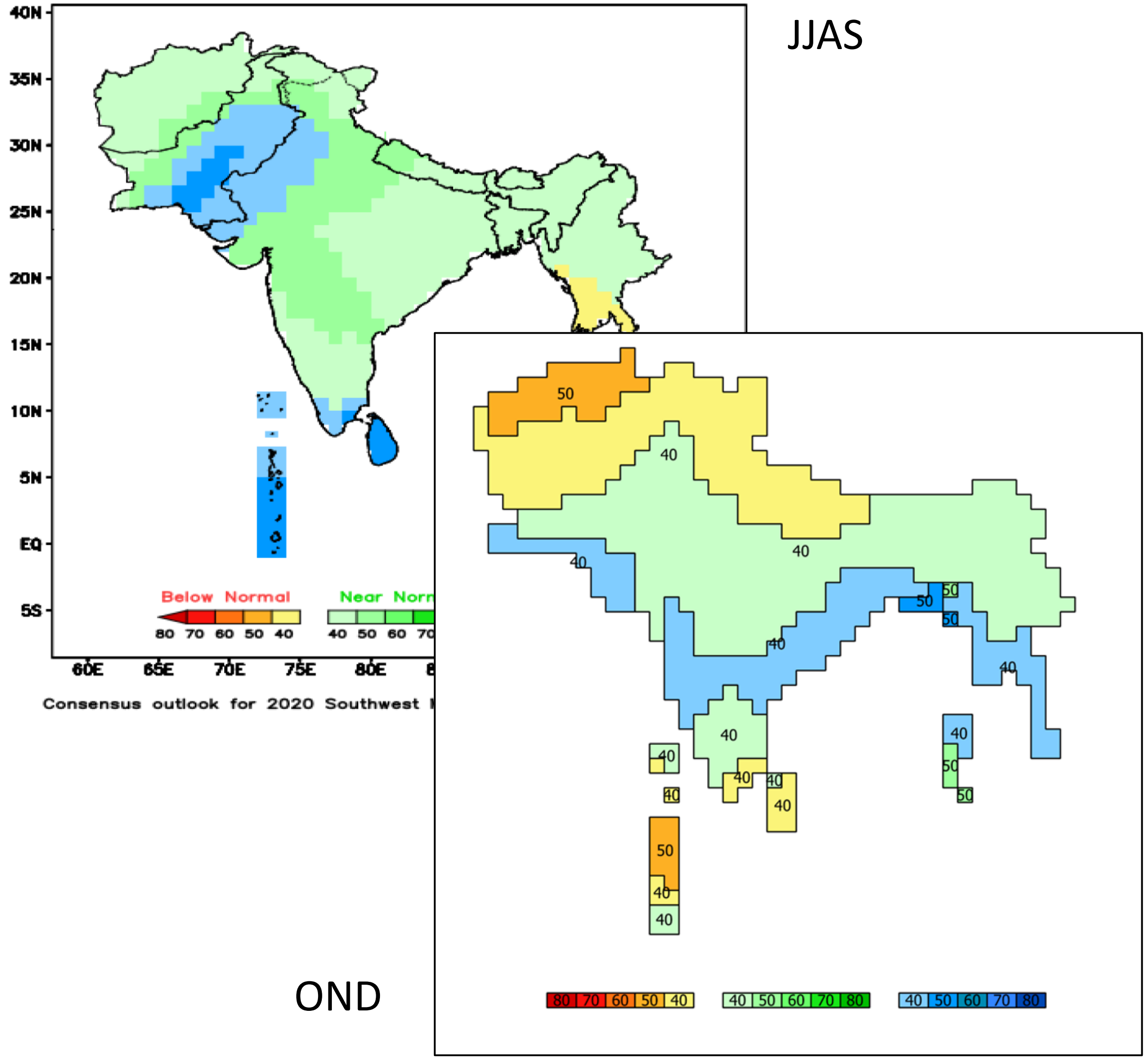




UNITED NATIONS ESCAP
Economic and Social Commission for Asia and the Pacific

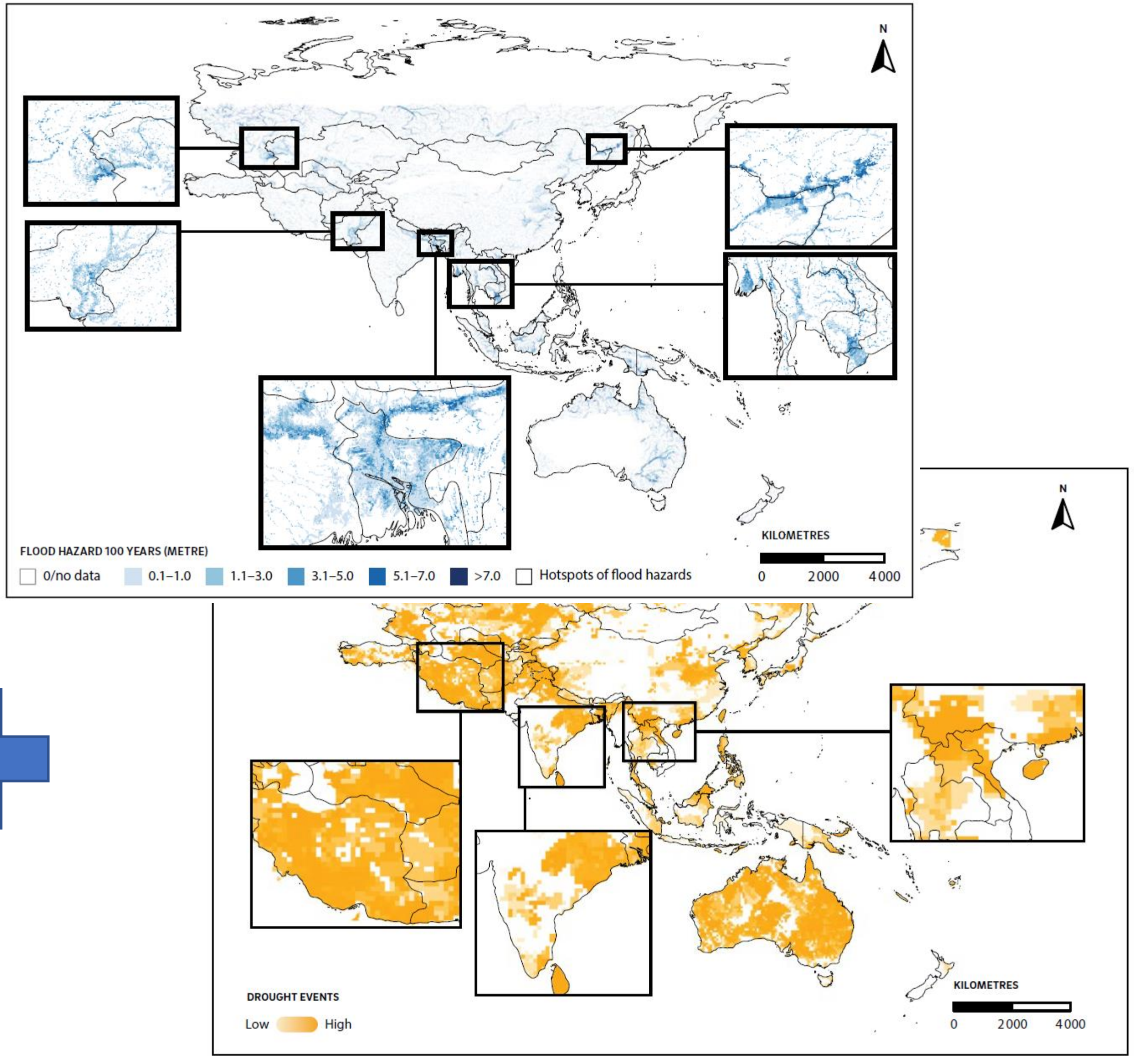
Hazard

JJAS



OND

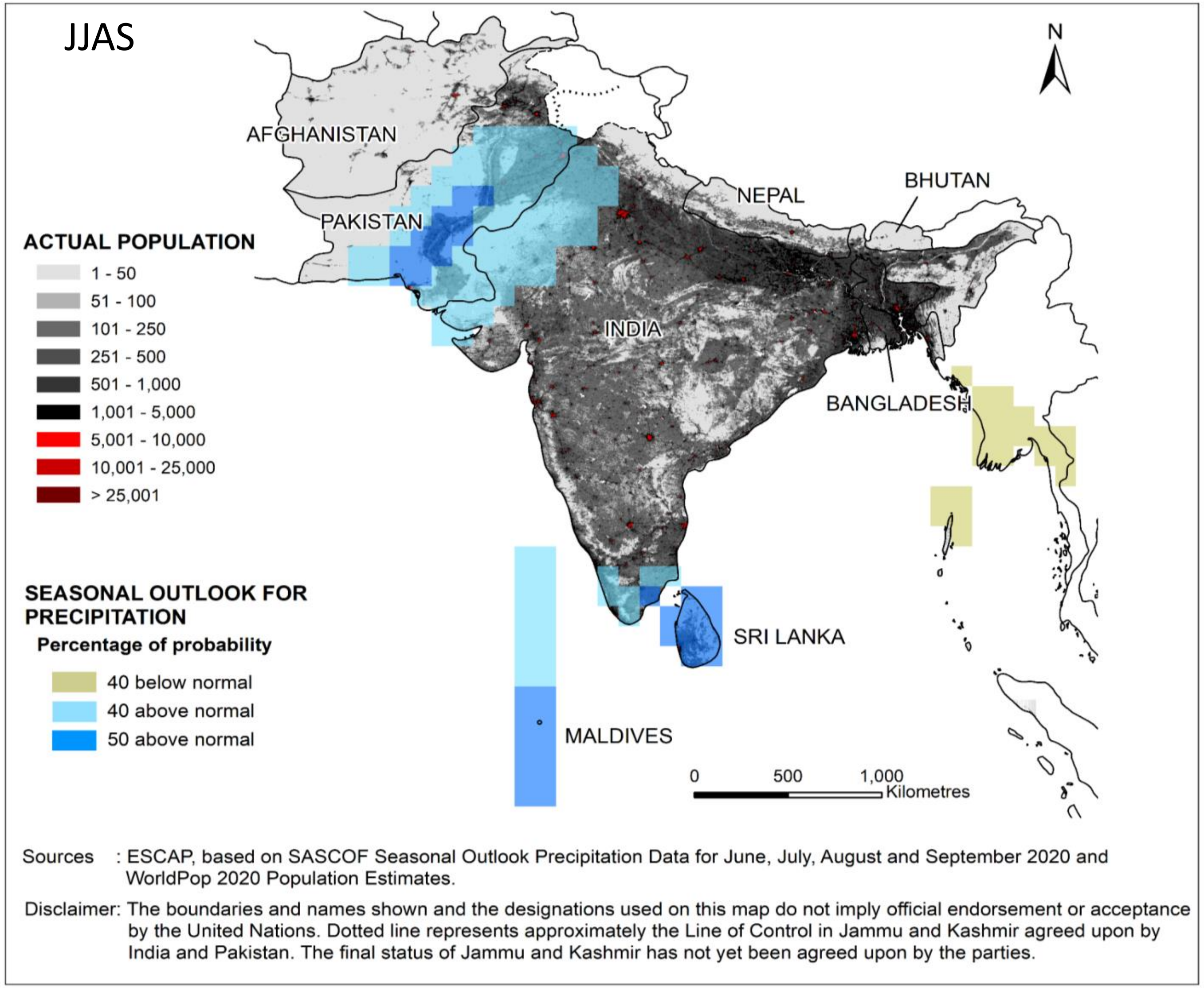
SASCOF-17/18 seasonal forecast product



Hotspots of flood hazard(up) and drought hazard (down)

Source: ESCAP(2019) APDR 2019, Figure 1-14 & 1-15

Population

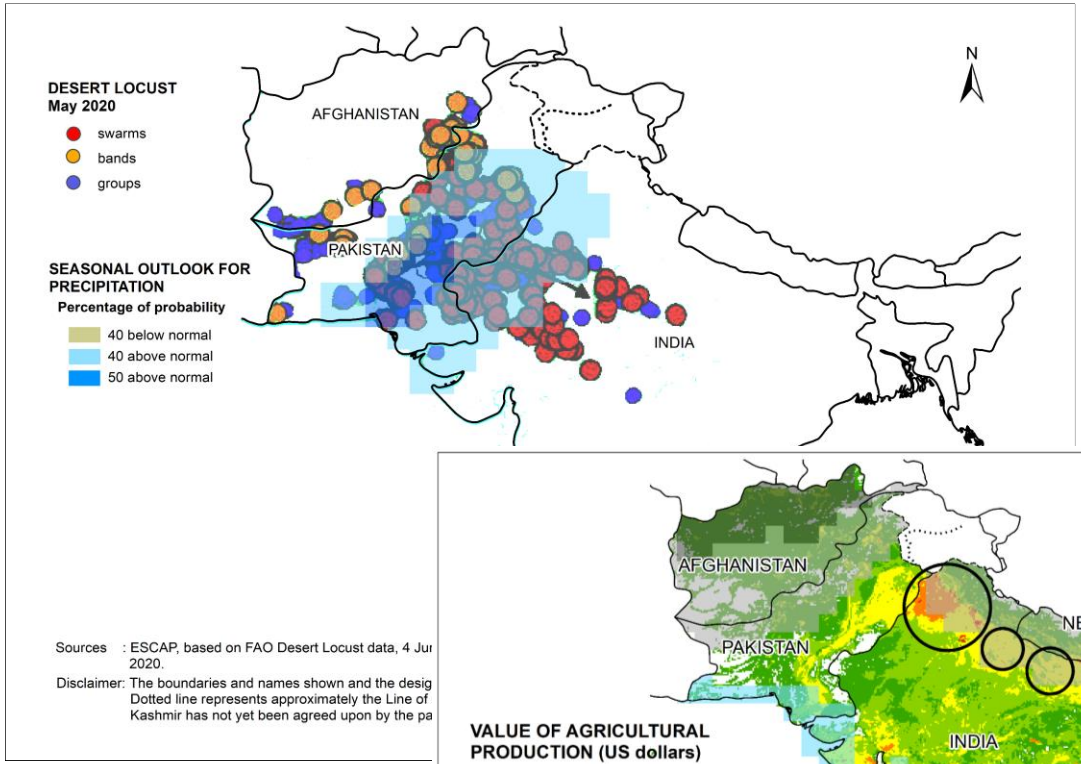


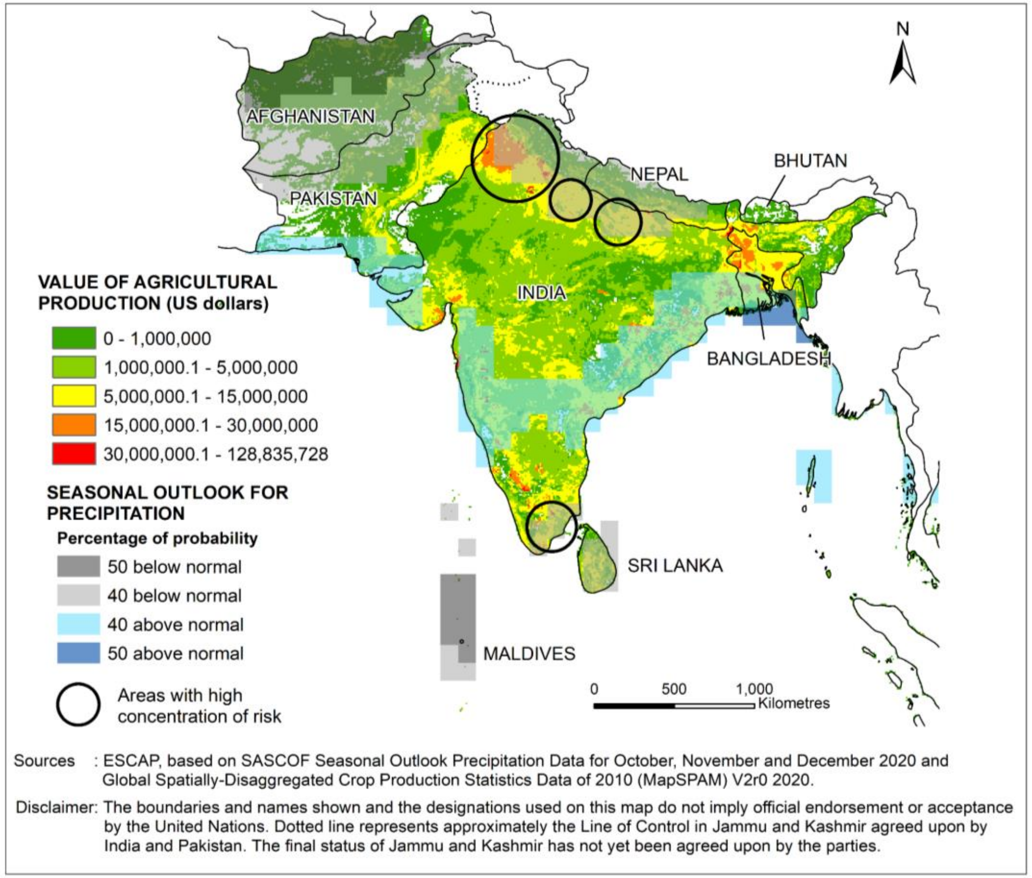
- Actual population data can be overlaid to get the percentage of population having more chance to receive above or below normal rainfall.
- For the 2020 monsoon season, around 18% of region’s total population were located in the areas having more change to receive above normal precipitation.
- Vulnerability of population, such as HDI, can be also added for more information on the population in the areas.

Agriculture

- Global Framework for Climate Services identifies 5 priority areas of climate services: (1) agriculture and food security, (2) DRR, (3) energy, (4) health, and (5) water.
- Data on agricultural production value, production quantity, irrigation facilities and agricultural system can be overlaid to get potential implications on agriculture.
- This year, the unprecedented desert locust poses threats, and this is added to see the implications of climate.

JJAS

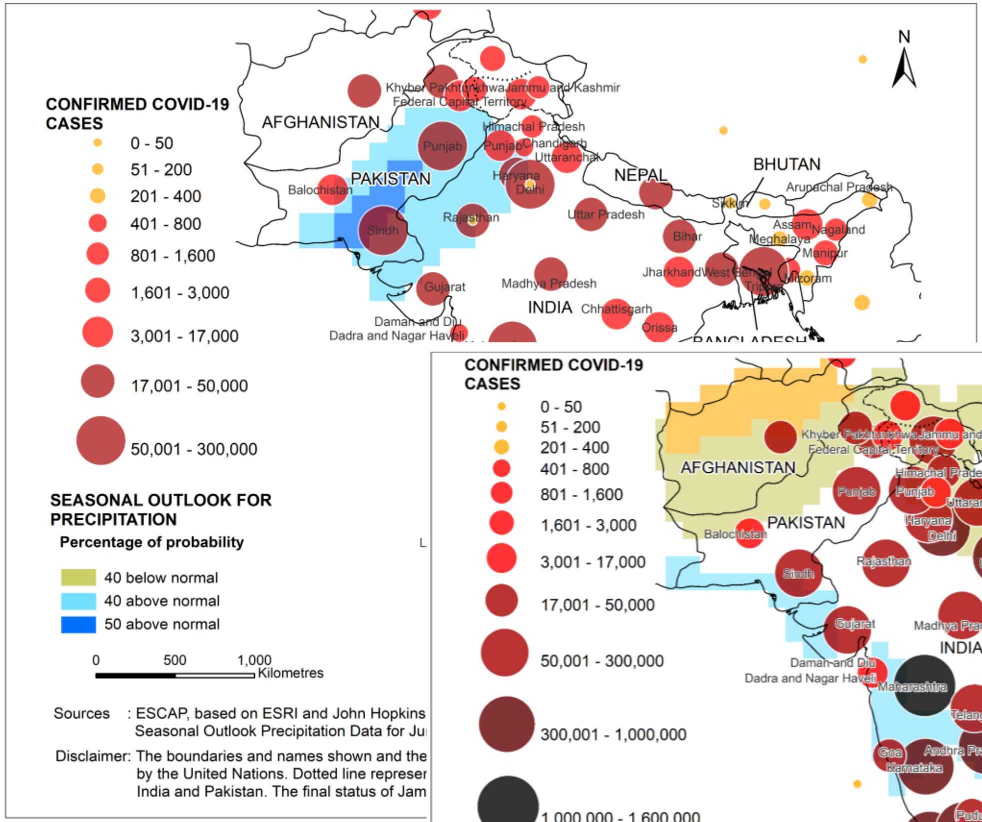


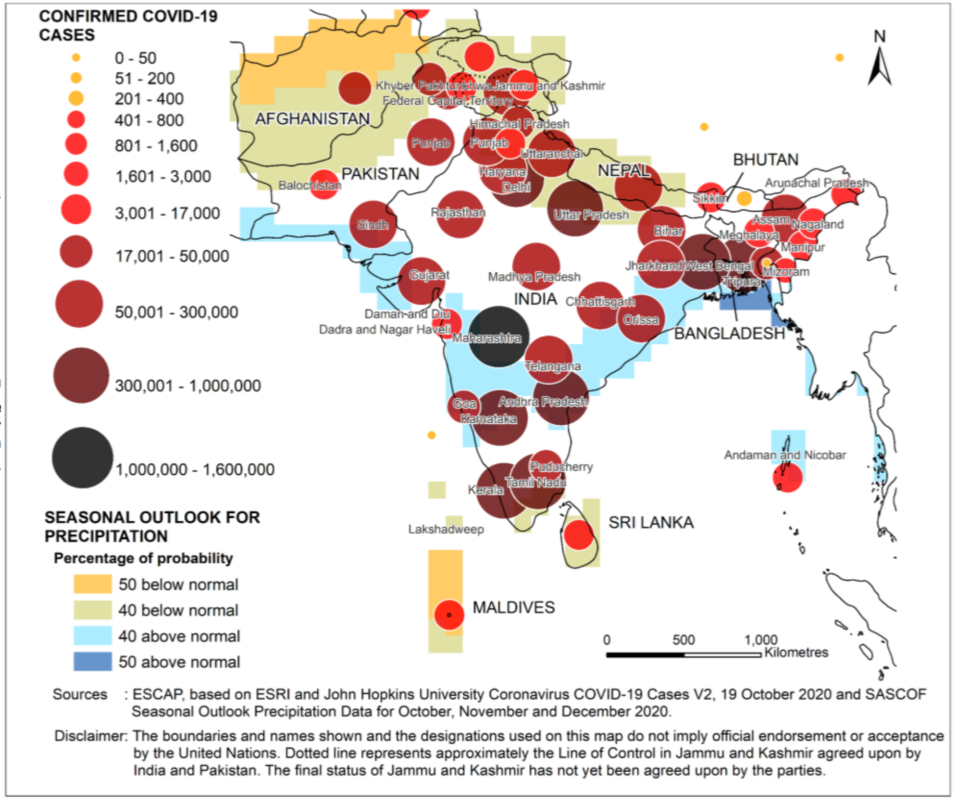


OND

Disaster Risk Reduction

JJAS

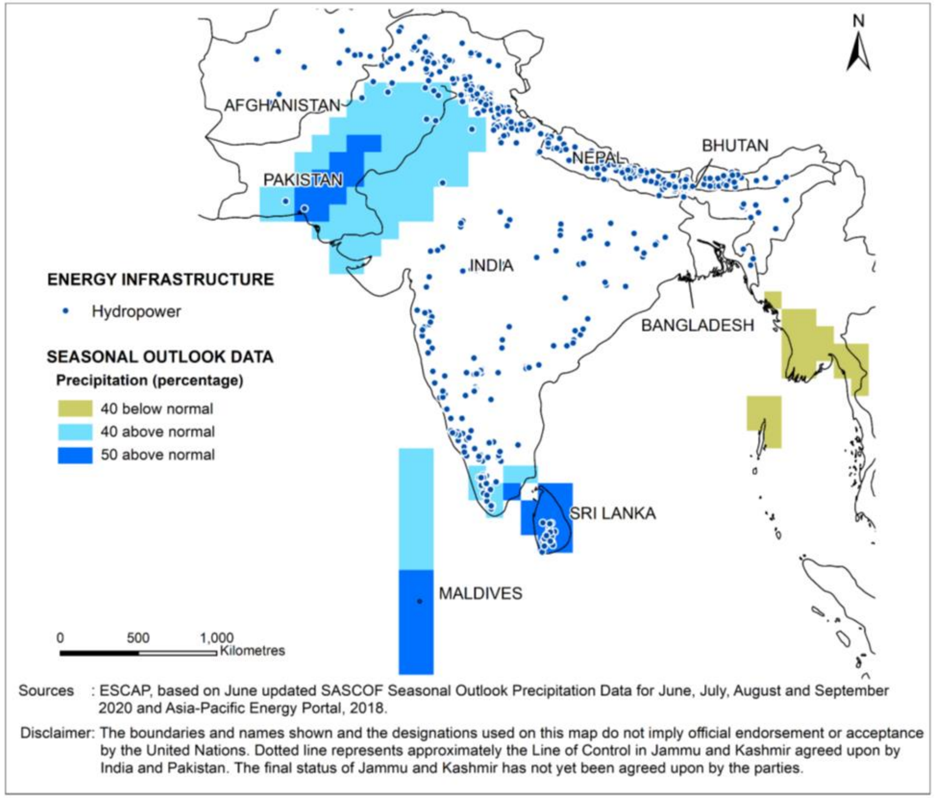




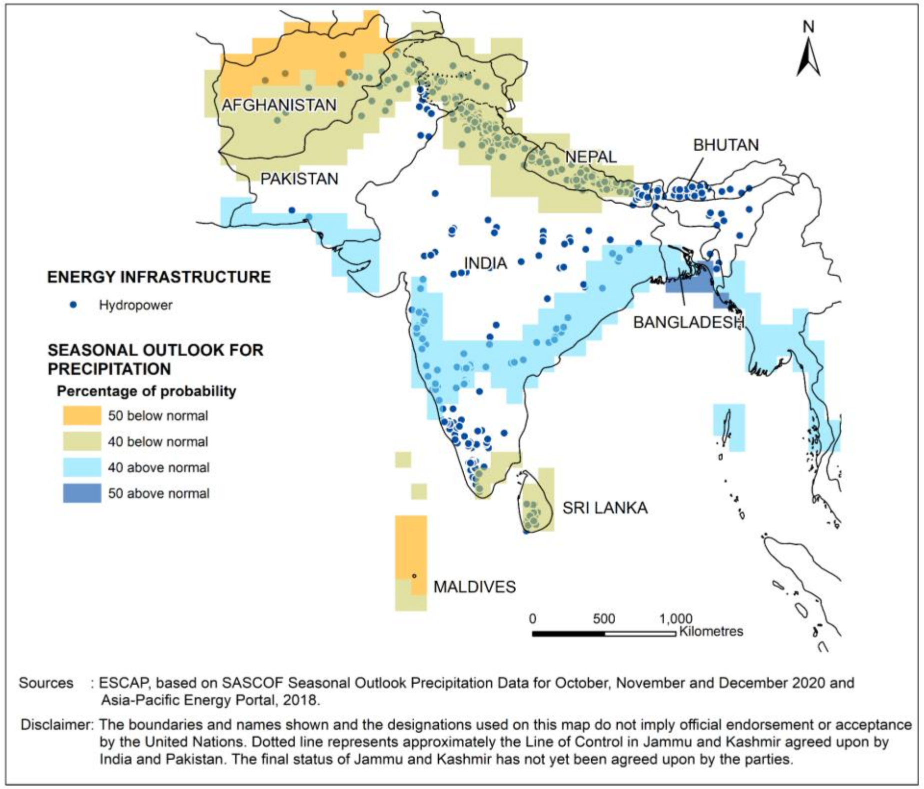
OND

- In South Asia, floods were most frequent during the monsoon season (EM-DAT).
- As this year, COVID-19 was quickly spreading throughout the region, when the region was entering into the monsoon season, there was possible convergence of health and disaster risk.
- COVID-19 data can be also overlaid to identify hotspots that requires careful monitoring of COVID-19 and possible climate hazards.

Energy



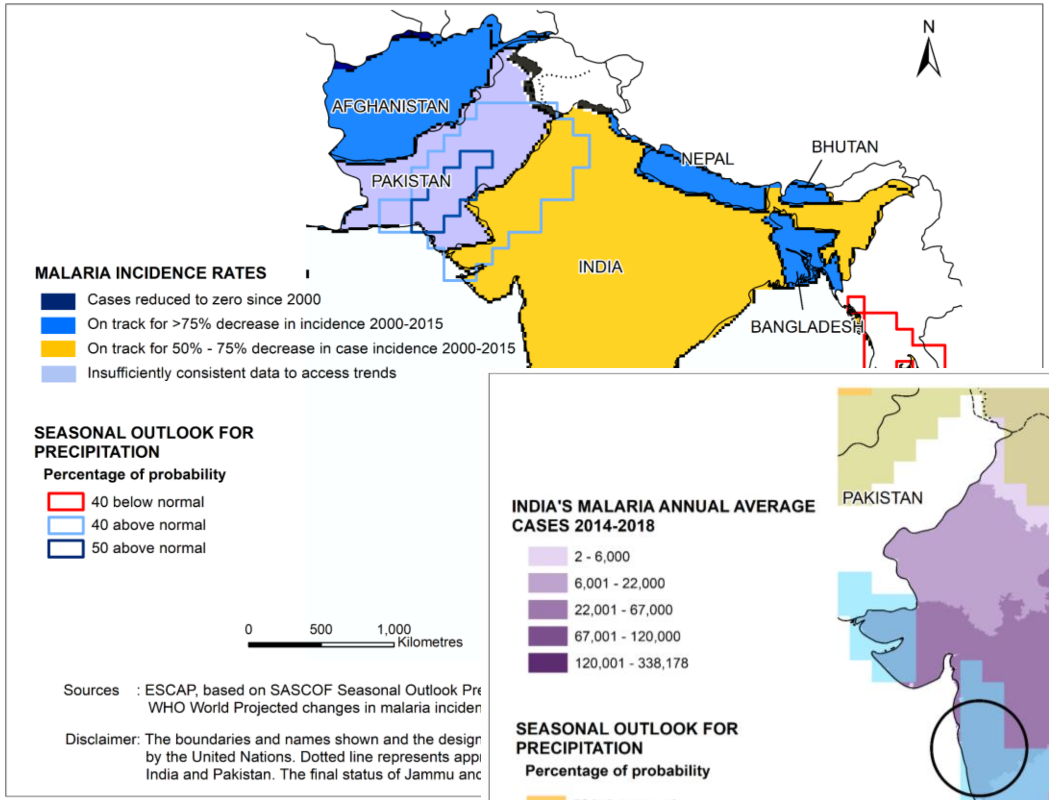
JJAS



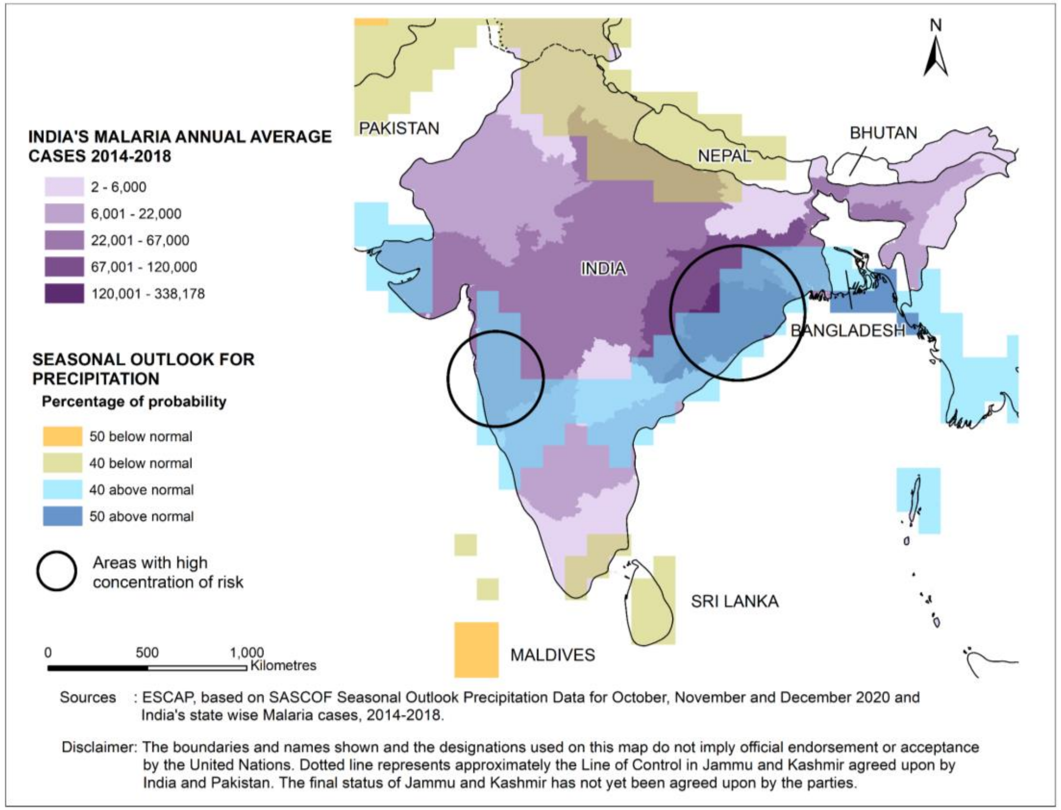
OND

- If overlaid with energy infrastructure that requires huge amount of water resources, it can also give useful information for energy management.
- During this summer, the region had more chance to receive near- or above-normal precipitation, so the pressure to region’s hydropower plants were not very high, but during the winter, many of region’s hydropower plants in norther areas are located in the areas having more chance to receive below normal precipitation (especially, Nepal).

Health



JJAS



OND

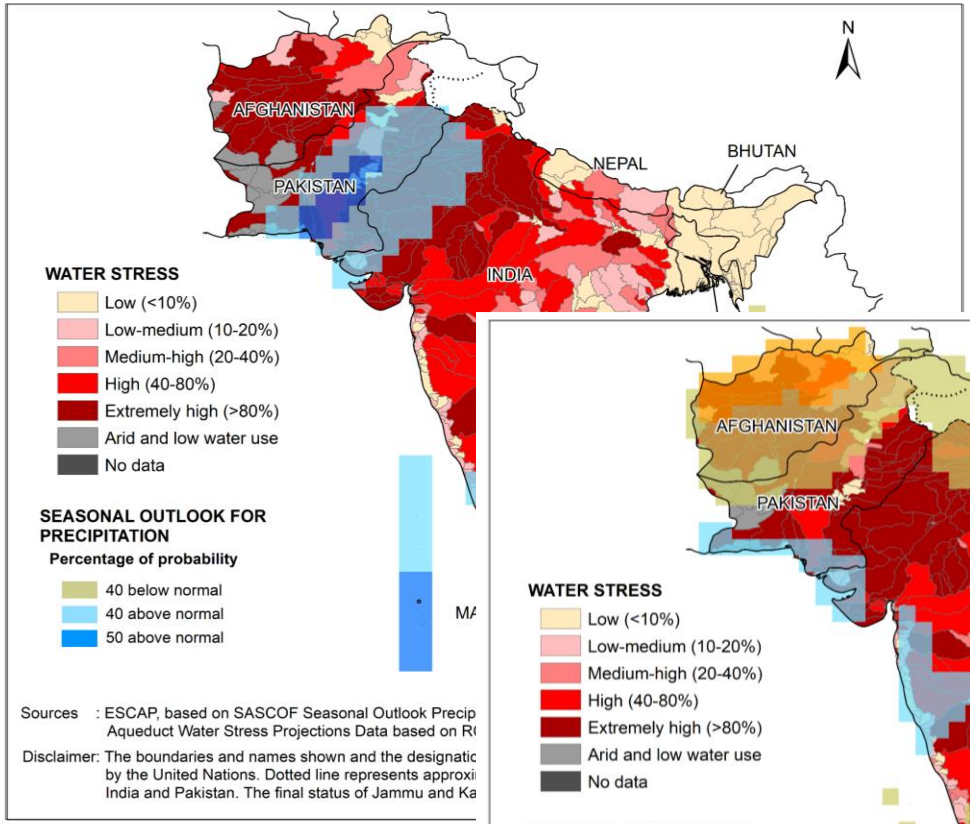
- Health related data can be also overlaid to better understand potential impacts of climate.
- Malaria and dengue developments are linked with climate conditions, and this can be assessed with seasonal forecast products.
- If seasonal forecast for temperature is available, then this will be also useful to assess potential impact.

Water resources management

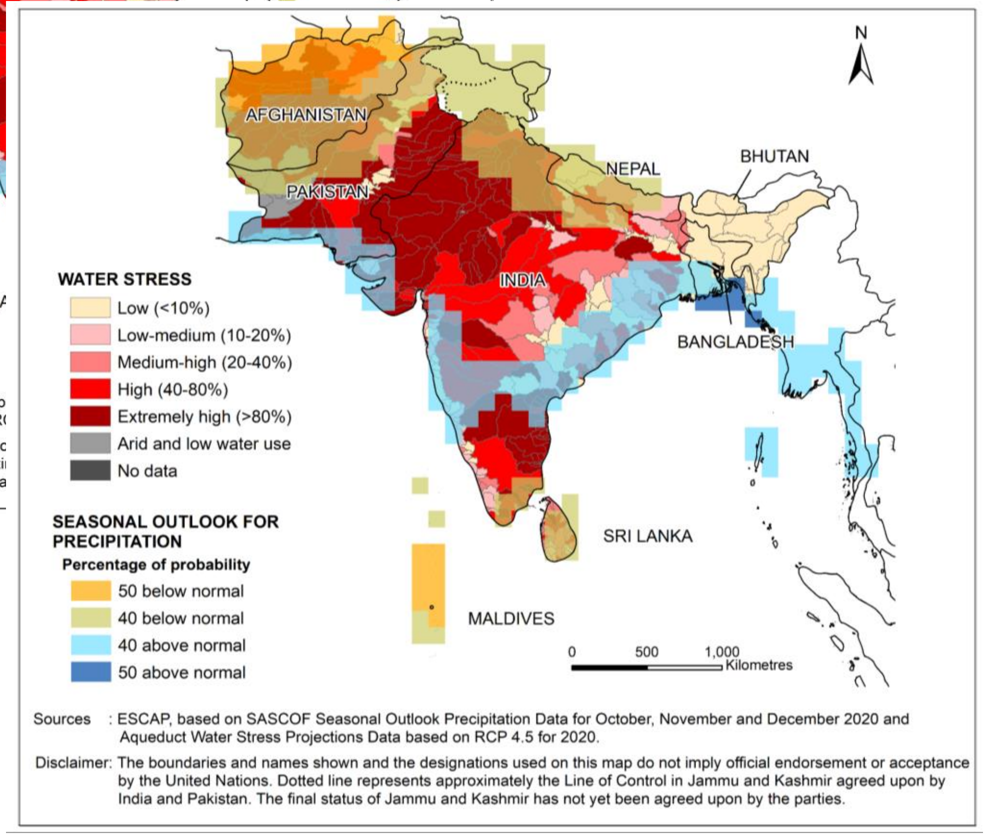
- Last sector is water resources management.

- Water stress can be a useful information to understand in this regard. For example, below normal rainfall in high water stress areas can have significant implications on water resources management.

- As suggested, if this is considered together with observed rainfall data over the past year, this can further improve the assessment.

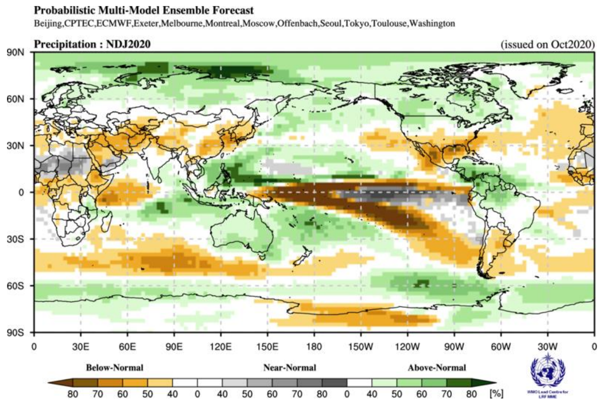


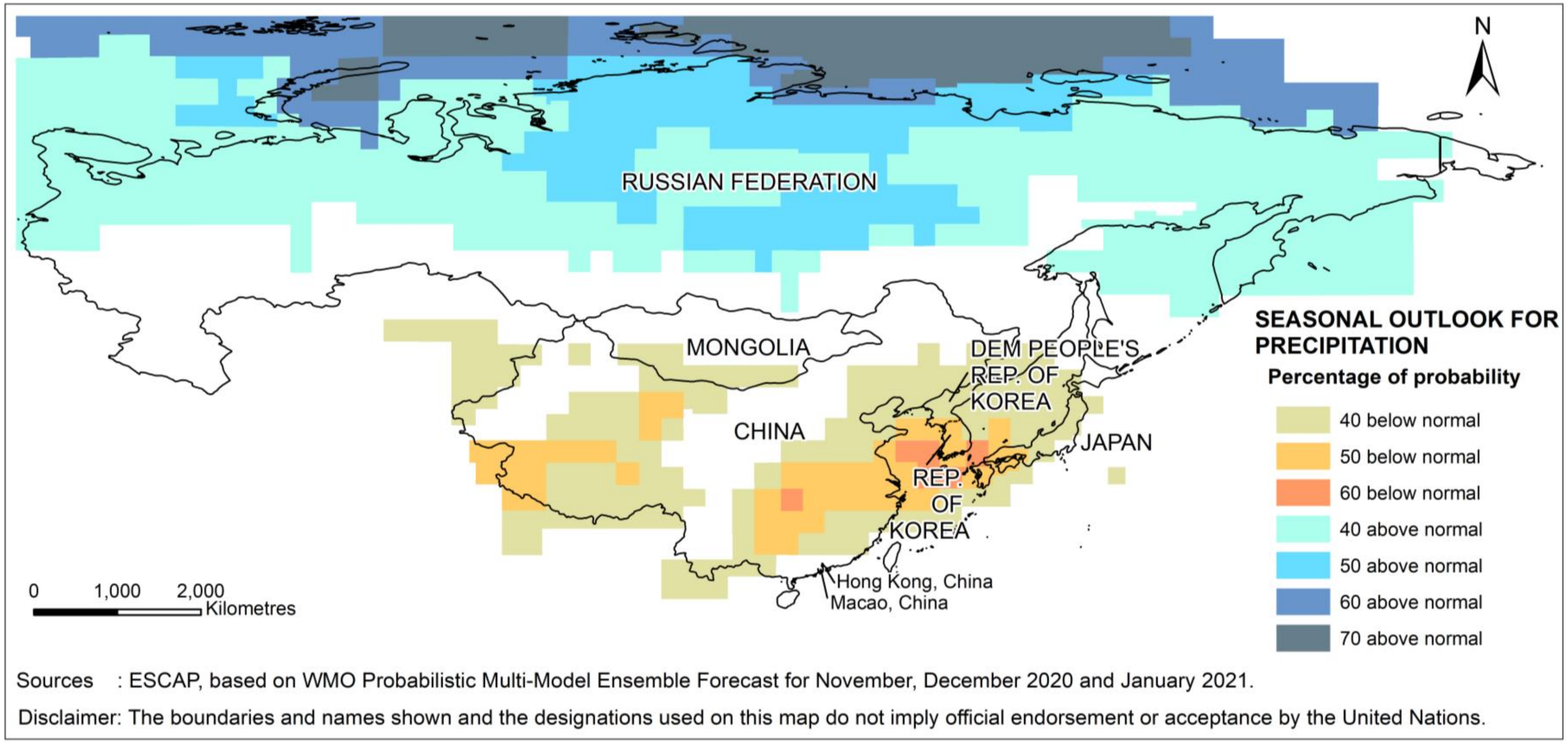
JJAS



OND

East and North-East Asia Example (NDJ2020)

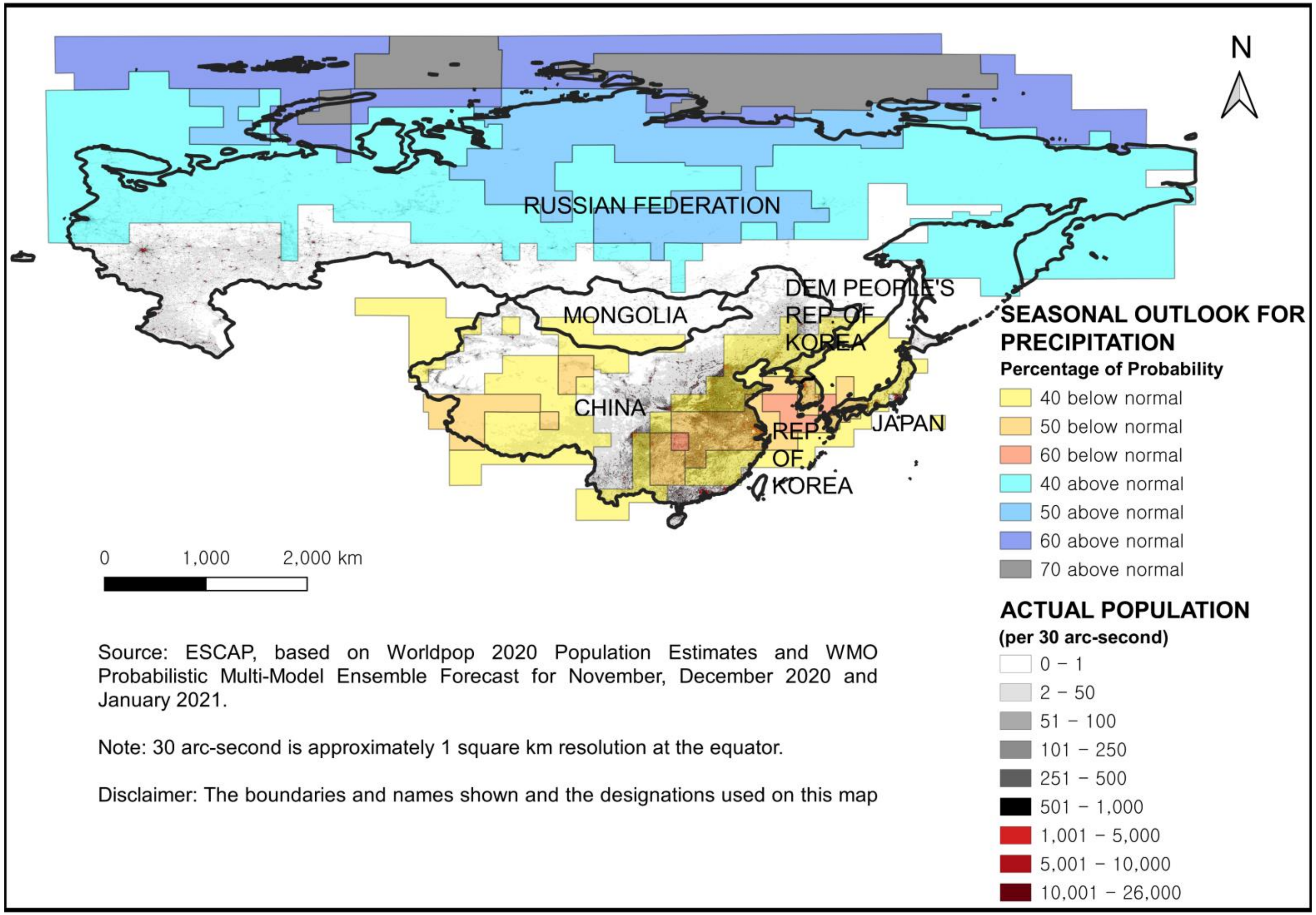




Probabilistic Multi-Model Ensemble Forecast – NDJ 2020

Source: https://www.wmolc.org/seasonPmmeUI/plot_PMME#. (Accessed in October 2020)

East and North-East Asia Example - Population



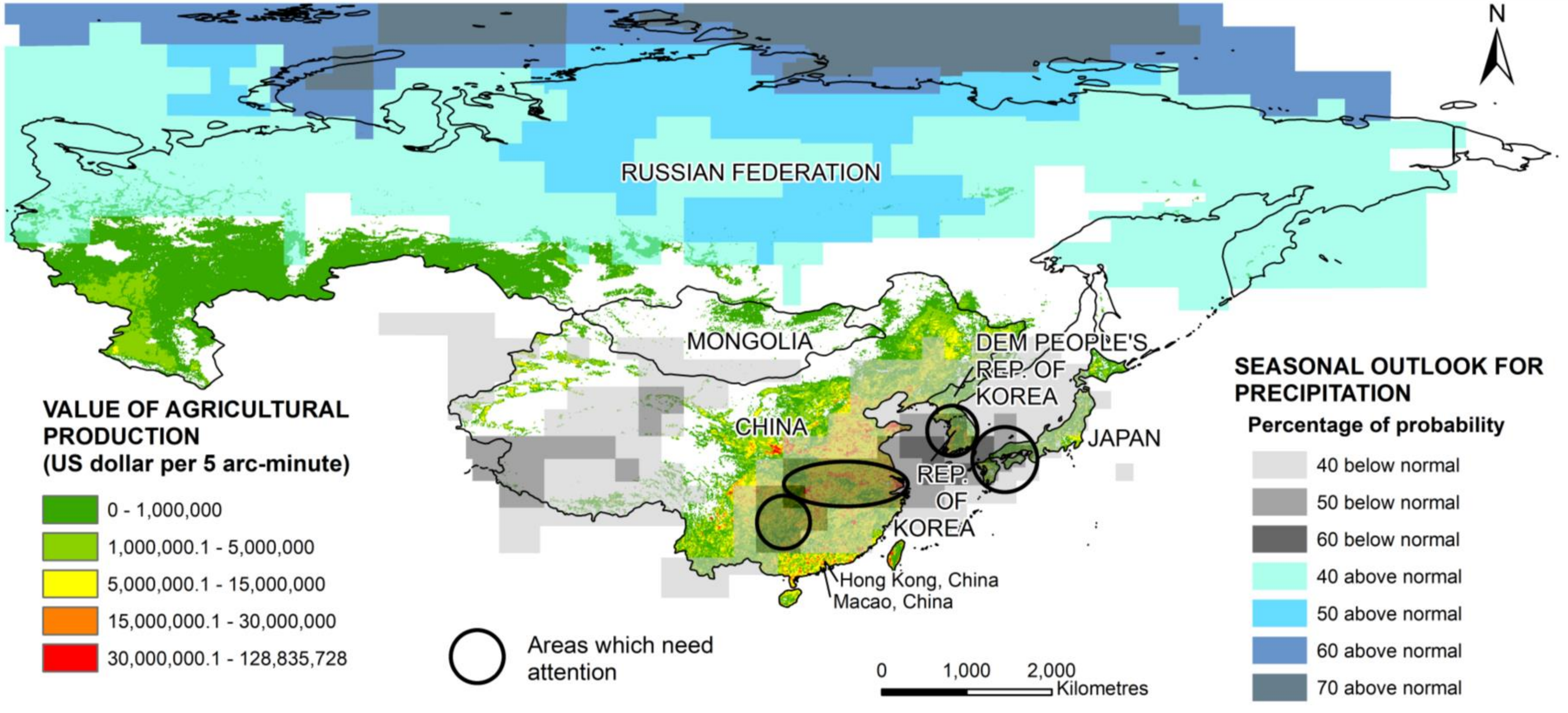
Source: ESCAP, based on Worldpop 2020 Population Estimates and WMO Probabilistic Multi-Model Ensemble Forecast for November, December 2020 and January 2021.

Note: 30 arc-second is approximately 1 square km resolution at the equator.

Disclaimer: The boundaries and names shown and the designations used on this map

Country	Total population (thousand) (ESCAP 2020)	Percentage of population		
		40% prob. below normal	50% prob. below normal	60% prob. below normal
China	1,439,324	41.2%	**30.6%**	0.6%
DPRK	25,779	81.8%	**18.4%**	0.0%
Japan	126,476	33.7%	**25.7%**	4.0%
Mongolia	3,278	4.3%	0.0%	0.0%
Rep of Korea	51,269	1.7%	**88.6%**	**9.8%**
Russian Federation	145,934	0.0%	0.0%	0.0%
Total	**1,792,060**	**36.8%**	**29.3%**	**1.1%**

East and North-East Asia Example - Agriculture

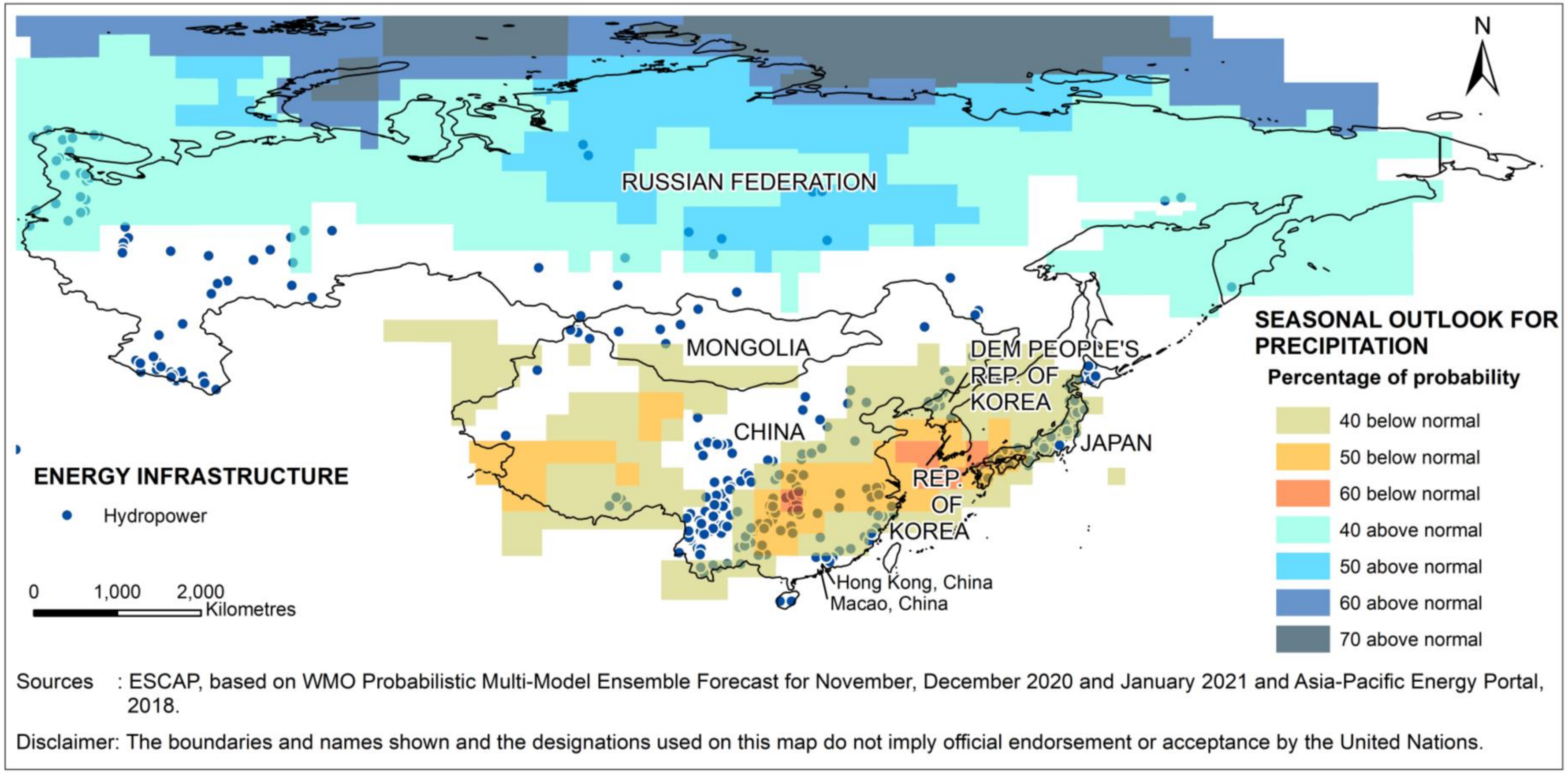


Sources : ESCAP, based on Global Spatially-Disaggregated Crop Production Statistics Data of 2010 (MapSPAM) V2r0 2020 and WMO Probabilistic Multi-Model Ensemble Forecast for November, December 2020 and January 2021.
Note : 5 arc-minute is approximately 100 square km at the equator.
Disclaimer: The boundaries and names shown and the designations used on this map do not imply official endorsement or acceptance by the United Nations.

- In the subregion, approximately **29% of value of agriculture production** is likely to receive below normal precipitation (50 probability or more), including:

- 30% of China's agri. value,
- 28% of DPRK's agri. value,
- 24% of Japan's agri. value, and
- 95% of ROK’s agri value.

East and North-East Asia Example - Energy

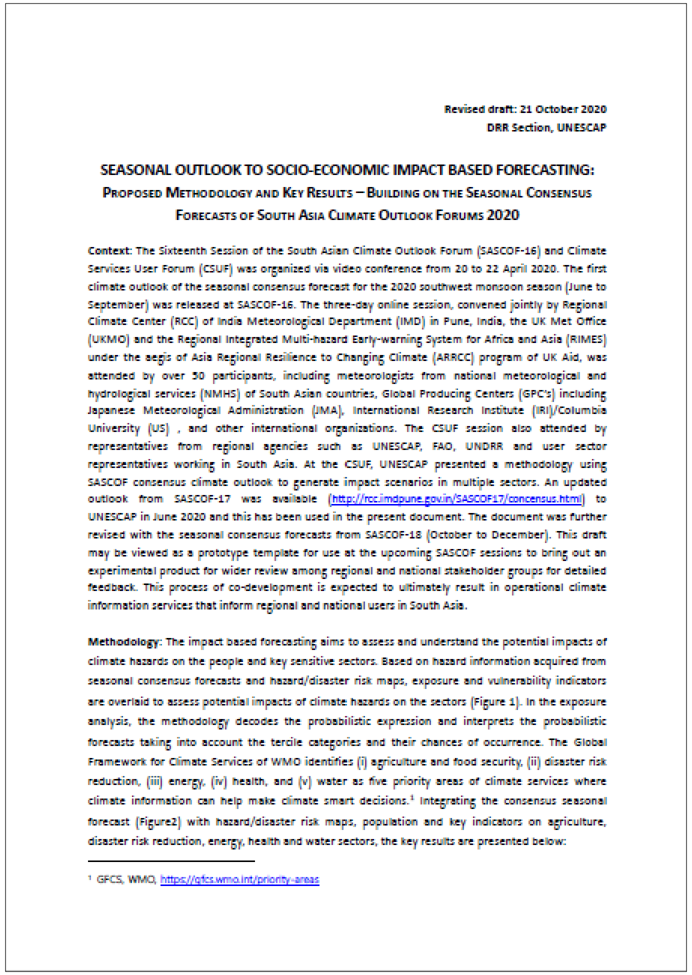


	Hydro % of Electricity Production, 2018
DPRK	78.5 (2017)
China	17.4
Japan	8.18
Mongolia	1.00 (2017)
ROK	0.58

There are more than 650 hydropower plants with total capacity of approximately 306 thousands MWe in East and North-East Asia.

- In China and Japan, respectively around 28% and 34% of hydro power plants (capacity) are in the areas having more chance to receive below normal precipitation (50% probability or more).

Draft Document for Comments



Revised draft: 21 October 2020
DRR Section, UNESCAP

SEASONAL OUTLOOK TO SOCIO-ECONOMIC IMPACT BASED FORECASTING:
PROPOSED METHODOLOGY AND KEY RESULTS – BUILDING ON THE SEASONAL CONSENSUS FORECASTS OF SOUTH ASIA CLIMATE OUTLOOK FORUMS 2020

Context: The Sixteenth Session of the South Asian Climate Outlook Forum (SASCOF-16) and Climate Services User Forum (CSUF) was organized via video conference from 20 to 22 April 2020. The first climate outlook of the seasonal consensus forecast for the 2020 southwest monsoon season (June to September) was released at SASCOF-16. The three-day online session, convened jointly by Regional Climate Center (RCC) of India Meteorological Department (IMD) in Pune, India, the UK Met Office (UKMO) and the Regional Integrated Multi-hazard Early-warning System for Africa and Asia (RIMES) under the aegis of Asia Regional Resilience to Changing Climate (ARRCC) program of UK Aid, was attended by over 50 participants, including meteorologists from national meteorological and hydrological services (NMHS) of South Asian countries, Global Producing Centers (GPC's) including Japanese Meteorological Administration (JMA), International Research Institute (IRI)/Columbia University (US) , and other international organizations. The CSUF session also attended by representatives from regional agencies such as UNESCAP, FAO, UNDRR and user sector representatives working in South Asia. At the CSUF, UNESCAP presented a methodology using SASCOF consensus climate outlook to generate impact scenarios in multiple sectors. An updated outlook from SASCOF-17 was available (http://rcc.imdpune.gov.in/SASCOF17/concensus.html) to UNESCAP in June 2020 and this has been used in the present document. The document was further revised with the seasonal consensus forecasts from SASCOF-18 (October to December). This draft may be viewed as a prototype template for use at the upcoming SASCOF sessions to bring out an experimental product for wider review among regional and national stakeholder groups for detailed feedback. This process of co-development is expected to ultimately result in operational climate information services that inform regional and national users in South Asia.

Methodology: The impact based forecasting aims to assess and understand the potential impacts of climate hazards on the people and key sensitive sectors. Based on hazard information acquired from seasonal consensus forecasts and hazard/disaster risk maps, exposure and vulnerability indicators are overlaid to assess potential impacts of climate hazards on the sectors (Figure 1). In the exposure analysis, the methodology decodes the probabilistic expression and interprets the probabilistic forecasts taking into account the tercile categories and their chances of occurrence. The Global Framework for Climate Services of WMO identifies (i) agriculture and food security, (ii) disaster risk reduction, (iii) energy, (iv) health, and (v) water as five priority areas of climate services where climate information can help make climate smart decisions.[1] Integrating the consensus seasonal forecast (Figure2) with hazard/disaster risk maps, population and key indicators on agriculture, disaster risk reduction, energy, health and water sectors, the key results are presented below:

[1] GFCS, WMO, https://gfcs.wmo.int/priority-areas

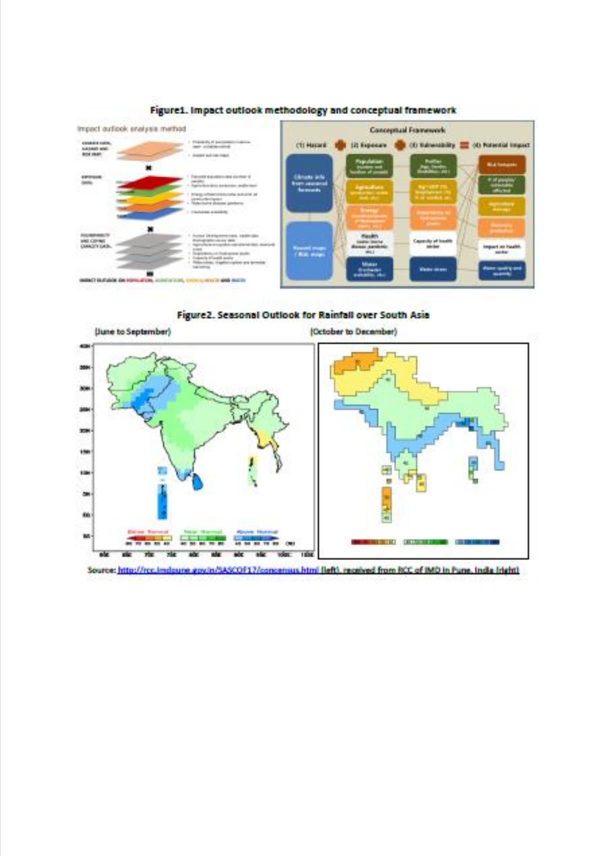
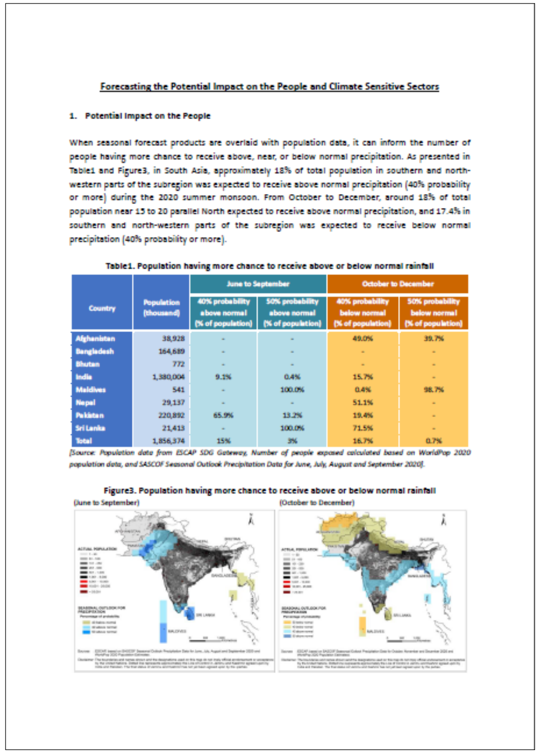


Figure1. Impact outlook methodology and conceptual framework

Figure2. Seasonal Outlook for Rainfall over South Asia

(June to September) (October to December)

Source: http://rcc.imdpune.gov.in/SASCOF17/concensus.html (left), received from RCC of IMD in Pune, India (right)



Forecasting the Potential Impact on the People and Climate Sensitive Sectors

1. Potential Impact on the People

When seasonal forecast products are overlaid with population data, it can inform the number of people having more chance to receive above, near, or below normal precipitation. As presented in Table1 and Figure3, in South Asia, approximately 18% of total population in southern and north-western parts of the subregion was expected to receive above normal precipitation (40% probability or more) during the 2020 summer monsoon. From October to December, around 18% of total population near 15 to 20 parallel North expected to receive above normal precipitation, and 17.4% in southern and north-western parts of the subregion was expected to receive below normal precipitation (40% probability or more).

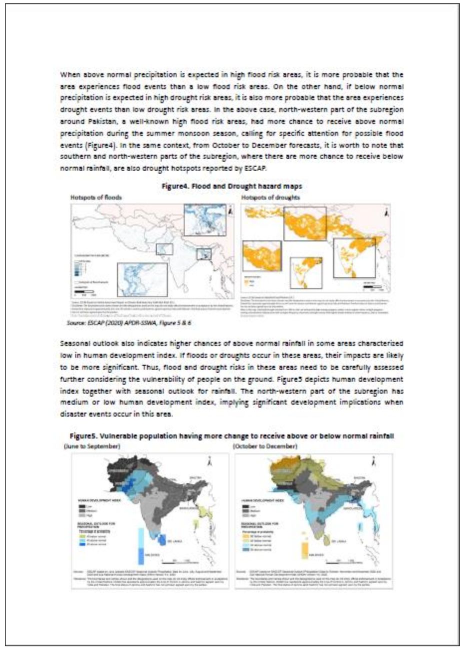
Table1. Population having more chance to receive above or below normal rainfall

Country	Population (thousand)	June to September		October to December	
		40% probability above normal (% of population)	50% probability above normal (% of population)	40% probability below normal (% of population)	50% probability below normal (% of population)
Afghanistan	38,928	-	-	49.0%	39.7%
Bangladesh	164,689	-	-	-	-
Bhutan	772	-	-	-	-
India	1,380,004	9.1%	0.4%	15.7%	-
Maldives	541	-	100.0%	0.4%	98.7%
Nepal	29,137	-	-	51.1%	-
Pakistan	220,892	65.9%	13.2%	19.4%	-
Sri Lanka	21,413	-	100.0%	71.5%	-
Total	1,856,374	15%	3%	16.7%	0.7%

[Source: Population data from ESCAP SDG Gateway, Number of people exposed calculated based on WorldPop 2020 population data, and SASCOF Seasonal Outlook Precipitation Data for June, July, August and September 2020].

Figure3. Population having more chance to receive above or below normal rainfall

(June to September) (October to December)



When above normal precipitation is expected in high flood risk areas, it is more probable that the area experiences flood events than a low flood risk areas. On the other hand, if below normal precipitation is expected in high drought risk areas, it is also more probable that the area experiences drought events than low drought risk areas. In the above case, north-western part of the subregion around Pakistan, a well-known high flood risk areas, had more chance to receive above normal precipitation during the summer monsoon season, calling for specific attention for possible flood events (Figure4). In the same context, from October to December forecasts, it is worth to note that southern and north-western parts of the subregion, where there are more chance to receive below normal rainfall, are also drought hotspots reported by ESCAP.

Figure4. Flood and Drought hazard maps

Hotspots of floods Hotspots of droughts

Source: ESCAP (2020) APDR-SSWA, Figure 5 & 6

Seasonal outlook also indicates higher chances of above normal rainfall in some areas characterized low in human development index. If floods or droughts occur in these areas, their impacts are likely to be more significant. Thus, flood and drought risks in these areas need to be carefully assessed further considering the vulnerability of people on the ground. Figure5 depicts human development index together with seasonal outlook for rainfall. The north-western part of the subregion has medium or low human development index, implying significant development implications when disaster events occur in this area.

Figure5. Vulnerable population having more change to receive above or below normal rainfall

(June to September) (October to December)

UNITED NATIONS
ESCAP
Economic and Social Commission for Asia and the Pacific

Comments Received

Terminology:
Using less deterministic languages

Interpretation:
Careful interpretation of seasonal forecast products

Consultation:
Consultation with sectoral experts, especially FAO for agriculture

Scale:
Subregional focus, leaving subnational analysis to national institutions

Thank you for kind attention !

SungEun Kim (kim54@un.org)

Disaster Risk Reduction Section
Information and Communications Technology and Disaster Risk Reduction Division
United Nations Economic and Social Commission for Asia and the Pacific