**Sixteenth Session of
South Asian Climate Outlook Forum (SASCOF-16) &
Climate Services Users Forum**
Online Session, 20-22 April 2020
(originally scheduled to be held in Dhaka, Bangladesh)

Consensus Statement on the Forecast for the 2020 Southwest Monsoon Season (June – September) Rainfall over South Asia

Summary

Normal rainfall is most likely during the 2020 southwest monsoon season (June – September) as a whole over most parts of South Asia. Geographically, above-normal rainfall is most likely over the southern part and some areas of north-western parts of the region. However, below-normal rainfall is most likely over land areas around north Bay of Bengal and northern most parts of the region. Normal rainfall is most likely over the remaining areas.

This regional climate outlook for the 2020 southwest monsoon season rainfall over South Asia has been collaboratively developed by the National Meteorological and Hydrological Services (NMHSs) of South Asian countries with support from international experts at the sixteenth session of the South Asian Climate Outlook Forum (SASCOF-16). The process involves an expert assessment of the prevailing global climate conditions and forecasts from different climate models from around the world. The El Niño/Southern Oscillation (ENSO), which is known to be a major influencing factor on South Asian summer monsoon variability, is currently marked by warm neutral conditions prevailing in the tropical Pacific Ocean. Based on the global climate model forecasts, there is strong consensus among the experts that sea surface temperatures (SSTs) in the equatorial Pacific are cooling and likely to reach neutral ENSO level during the southwest monsoon season. However, few climate models indicate slight possibility of development of weak La Niña conditions in the later part of the season or thereafter. It is recognized that the global climate model predictions prior to and during the spring season generally have noticeable uncertainty due to spring barrier in the seasonal predictability. It is also recognized that other regional and global factors as well as the intra-seasonal features of the region can also affect the rainfall patterns over the region.

For more information and further updates on the southwest monsoon outlook on national scale, the respective National Meteorological and Hydrological Services (NMHSs) may be consulted.

Introduction:

The climate outlook for the 2020 southwest monsoon season (June to September) was finalized during the sixteenth session of the South Asian Climate Outlook Forum (SASCOF-16) held during 20-22 April 2020 via video conferencing in the backdrop of the current extraordinary circumstances of Covid-19 pandemic prevailing in the world. The session was attended by experts representing the National Meteorological and Hydrological Services (NMHSs) of nine South Asian countries as well as those representing several global and regional climate agencies including World Meteorological Organization (WMO), WMO Regional Climate Centre Pune, Indian Institute of Tropical Meteorology (IITM), Met Office (UKMO), International Research Institute for Climate and Society (IRI), Regional Integrated Multi-hazard Early-warning System (RIMES), Japan Meteorological Agency (JMA) etc. The online forum deliberated on various observed and emerging climatic features that influence the performance of the southwest monsoon, such as the El Niño-Southern Oscillation (ENSO) conditions over the equatorial Pacific, Indian Ocean Dipole (IOD), winter and spring Northern Hemisphere (NH) snow cover and land surface temperature anomalies. The key features of these conditions are as follows:

ENSO Conditions over the Pacific Ocean

The ENSO is one of the global scale climate phenomena that have significant influence on the year-to-year variability of the monsoon over South Asia. Weak El Niño conditions had prevailed over the equatorial Pacific from the first quarter of the 2019, which turned in to ENSO neutral conditions in the later part of the 2019 southwest monsoon season. Subsequent warming of sea surface temperatures (SSTs) over the equatorial Pacific, resulted in warm ENSO neutral conditions from October 2019 onwards, which continued till date. The current atmospheric conditions over the Pacific reflect ENSO neutral conditions. The latest forecasts from most of the coupled global models indicate cooling of SSTs over equatorial Pacific leading to ENSO neutral conditions during the upcoming southwest monsoon season. However, a few climate models indicate weak La Niña conditions to develop during the latter part of the season or thereafter. La Niña (El Niño) conditions are generally associated with stronger (weaker) than normal southwest monsoon over the region.

Conditions over the Indian Ocean

In addition to ENSO conditions over the Pacific, other factors such as Indian Ocean SSTs also have influence on the South Asian southwest monsoon. At present, basin-wide warming is observed in the Indian Ocean, with strongest warming in the south Indian Ocean and neutral Indian Ocean Dipole (IOD) conditions are prevailing. A positive (negative) IOD is associated with a stronger (weaker) than normal monsoon. The recent forecasts from coupled global models suggest that these neutral IOD conditions are likely to continue during the monsoon season. However, few climate models indicate development of weak negative IOD conditions in the later part of the monsoon season.

Snow Cover over the Northern Hemisphere

The snow-covered areas over both Northern Hemisphere (NH) and Eurasia were below normal during last four months (December 2019 to March 2020) with record below normal snow cover area during the recent two months. The NH snow cover areas during February and March 2020 were fifth and third lowest ever during the respective months in the last 54 years. On the other hand, the Eurasian snow cover area was fourth and third lowest ever during the respective months in the last 54 years. Winter and spring snow cover extent has a generally inverse relationship with the subsequent Asian summer monsoon rainfall.

Regional Outlook for the 2020 Southwest Monsoon Rainfall over South Asia:

A regional climate outlook for the 2020 Southwest monsoon season rainfall over South Asia was prepared based on the expert assessment of prevailing large-scale global climate indicators mentioned above, experimental models developed during capacity-building workshops conducted for the South Asian countries in association with the previous SASCOF sessions, and experimental as well as operational long-range forecasts based on statistical and dynamical models generated by the NMHSs in the region and various other operational and research climate centres of the world.

There is a strong consensus among the experts about the weakening of the prevailing warm ENSO neutral conditions in the equatorial Pacific leading to neutral ENSO conditions, which are likely to continue during the southwest monsoon season. Though few global models are suggesting slight possibility of the development of weak La Niña

conditions in the later part of the season or thereafter, uncertainty in its development and timing is recognized. Further, it is well-known that ENSO predictions at this time of the year generally have substantial uncertainty due to the so-called spring barrier in seasonal predictability. It is also recognized that in general neutral ENSO conditions are associated with normal southwest monsoon rainfall over South Asia. However, it is important to note that ENSO status is not the only factor that determines the performance of Southwest monsoon over the region. Other relevant climate drivers such as the state of the Indian Ocean Dipole, tropical Atlantic sea surface temperatures, Eurasian land heating etc. are also important. The relative impact of all these parameters needs to be considered to determine the expected state of the monsoon over the region which are implicitly considered by the dynamical climate models that underpin the present outlook.
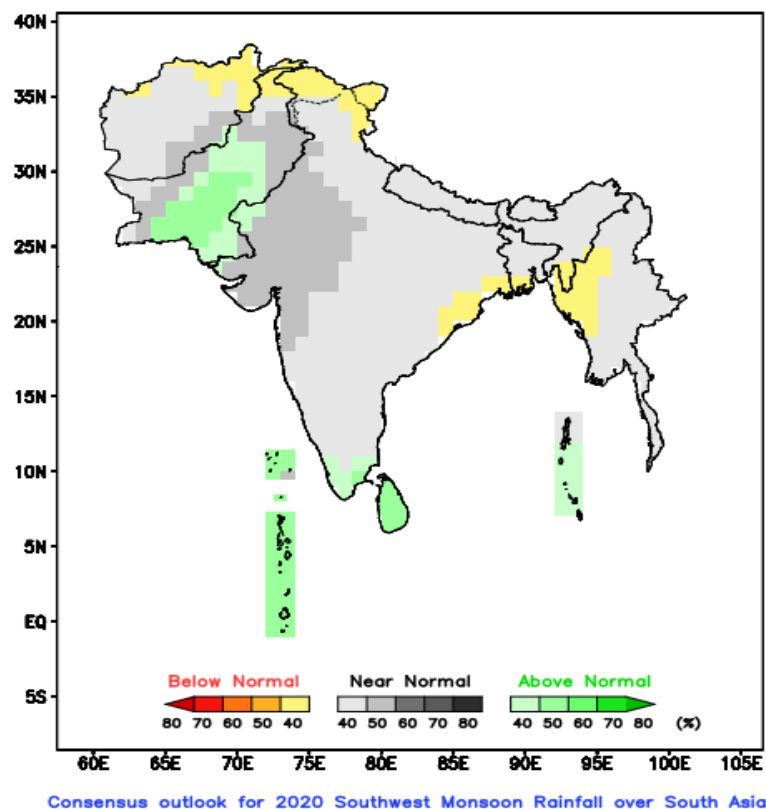
Fig.1. Probability of the most likely category for the 2020 southwest monsoon rainfall over South Asia.
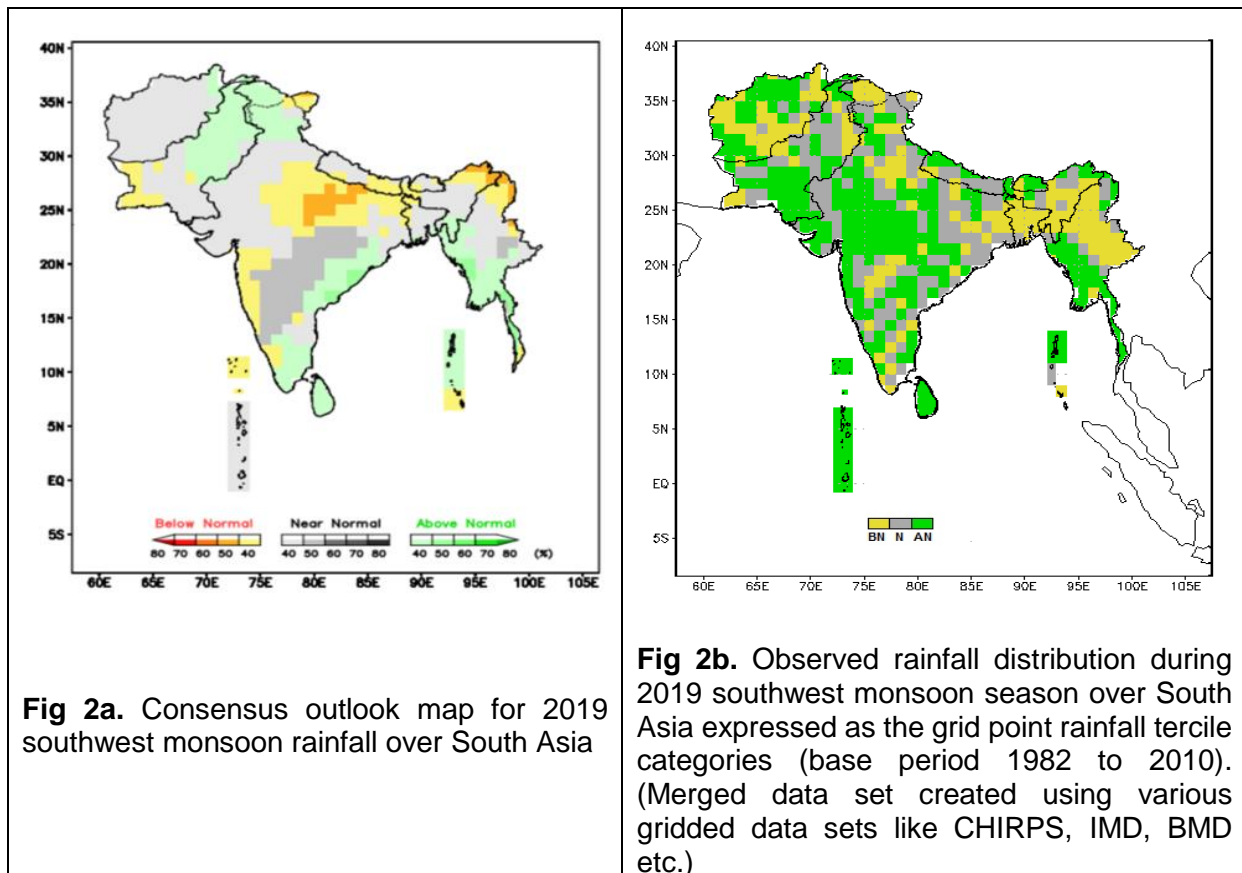
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[1]Tercile categories have equal climatological probabilities, of 33.33% each.

The outlook for the southwest monsoon rainfall for the season (June to September) as a whole over South Asia is shown in Fig. 1. The Figure illustrates grid wise most likely tercile category[1] as well as its probability for each of the 1° latitude x 1° longitude spatial grid boxes over the region. The box-wise tercile probabilities were derived by a synthesis of the available information and expert assessment. It was derived from an initial set of gridded objective forecasts and was iterated through collaborative assessment to synthesize predictive signals coming from reliable multiple sources.

The outlook suggests that the rainfall for the season as a whole is most likely to be normal during the 2020 southwest monsoon season (June – September) over most parts of South Asia. Above-normal rainfall is most likely over the southern parts and some areas of north-western parts of the region. However, the seasonal rainfall over land areas around the north Bay of Bengal and some northern most areas of the region is most likely to be below normal. The seasonal rainfall is most likely to be normal over the remaining areas.

Verification of rainfall outlook for JJAS 2019 issued by SASCOF-14

Fig 2a. Consensus outlook map for 2019 southwest monsoon rainfall over South Asia

Fig 2b. Observed rainfall distribution during 2019 southwest monsoon season over South Asia expressed as the grid point rainfall tercile categories (base period 1982 to 2010). (Merged data set created using various gridded data sets like CHIRPS, IMD, BMD etc.)

The outlook for the 2019 southwest monsoon season (June to September) showed in Fig.**2a** suggested normal rainfall over most parts of South Asia. However, above normal rainfall was forecasted for some parts of northern, east and south east parts of South Asia. Below-normal rainfall was forecasted for extreme northwest parts, some parts from west, central and adjoining east and northeast parts of South Asia. Normal rainfall was forecasted for the remaining areas of the region.

Fig.**2b** shows the observed rainfall distribution during the 2019 southwest monsoon season expressed in terms of tercile categories. It is seen that normal to above normal rainfall was experienced over most parts of the region. The below normal rainfall observed over some areas along the Himalayas and northeast parts of the region some what matched with the forecast. The above normal rainfall over Sri Lanka, southern parts of the Myanmar, some coastal areas of Indian Peninsula also matched with the forecasts. However, there were differences between the observed and forecasted rainfall patterns over central part of the region where above normal rainfall was experienced over many areas.

Background of SASCOF

Climate predictions are of substantial benefit to many parts of the world in risk management and adaptation to the impacts of climate variability and change, and it is considered useful for countries having common climatological characteristics to come together and collaboratively assess the available prediction information to develop consensus outlooks. Recognizing this, regional climate outlook forums (RCOFs) were conceived with an overarching responsibility to produce and disseminate a joint assessment of the state of the regional climate for the upcoming season. Built into the RCOF process is a regional networking of the climate service providers and user sector representatives. In Asia, China has been coordinating the 'Forum on Regional Climate Monitoring, Assessment and Prediction for Regional Association II' (FOCRA II) since 2005, covering the entire Asian continent.

Asia is a large continent with large differences in the climatological settings on sub regional scales. Therefore, WMO's Regional Association II (Asia) recommended sub-regional RCOFs devoted to specific needs of groups of countries having similar climatic characteristics. Implementation of the South Asian Climate Outlook Forum (SASCOF) in 2010 is a step in that direction with specific focus on the climate information needs of nations affected by the Asian southwest monsoon climate. The first three sessions of the SASCOF were held at Pune, India (during April) and its 4th session was held in April, 2013 at Kathmandu, Nepal. SASCOF-5 (April, 2014) was again held in Pune, India.

SASCOF-6 (April, 2015) was held in Dhaka, Bangladesh along with Climate Service User Forum (CSUF) for water sector. SASCOF-7 (October, 2015), which was the first forum that focused on the winter season, was held in Chennai, India in conjunction with the first CSUF-Agriculture. SASCOF-8 (April, 2016) was held in Colombo, Sri Lanka along with CSUF Water and CSUF-Health in parallel sessions. SASCOF-8 was also preceded by a capacity building training workshop on seasonal prediction for the operational climate experts of the South Asian countries. SASCOF-9 (September, 2016) was held in Nay Pyi Taw, Myanmar in September 2016, in conjunction with the second CSUF-Agriculture.SASCOF-10 was held in Thimphu, Bhutan (April 2017) and SASCOF-11 was held in Male, Maldives (September 2017). The SASCOF-12 (April 2018) and associated training workshop on Climate Data base Management and seasonal prediction were held in Pune, 2018. SASCOF-13 (September 2018) was held in Colombo, Sri Lanka. The SASCOF-14 and associated Pre-COF training workshop on seasonal prediction and CSUF was held in Katmandu, Nepal and hosted by Department of Hydrology and Meteorology (DHM). India Meteorological Department (IMD), World Meteorological Organization (WMO), Met Office, UK and Regional Integrated Multi-hazard Early-warning System (RIMES) co-sponsored the event held during 18-23 April, 2019.

The present and sixteenth session of the SASCOF (SASCOF-16) was held during 20-22 April 2020 via video conferencing in the backdrop of the current extraordinary circumstances of Covid-19 pandemic prevailing in the world. The session was jointly conducted by Bangladesh Meteorological Department (BMD), India Meteorological Department (IMD), World Meteorological Organization (WMO), Met Office, UK and Regional Integrated Multi-hazard Early-warning System (RIMES).

For preparing the consensus forecasts, the forecast products from various centers such as RCC, Pune, JMA, CMA, WMO's Lead Centre for Long Range Forecasting – MultiModel Ensemble (WMO LC-LRFMME), National Centres for Environmental Prediction (NCEP), USA, Météo France, Met Office UK, European Centre for Medium Weather Forecasting (ECMWF), Canadian Meteorological Centre (CMC), Bureau of Meteorology, Australia, International Research Institute for Climate and Society (IRI), USA, Japan Agency for Marine-Earth Science and Technology (JAMSTEC), APCC, and CPTEC, Brazil etc. were also considered.

The long-term historical patterns of the southwest monsoon rainfall over South Asia (Fig.3), characterized by remarkable spatial variability, provide the general reference points at the respective locations for the rainfall anomalies indicated in the outlook.
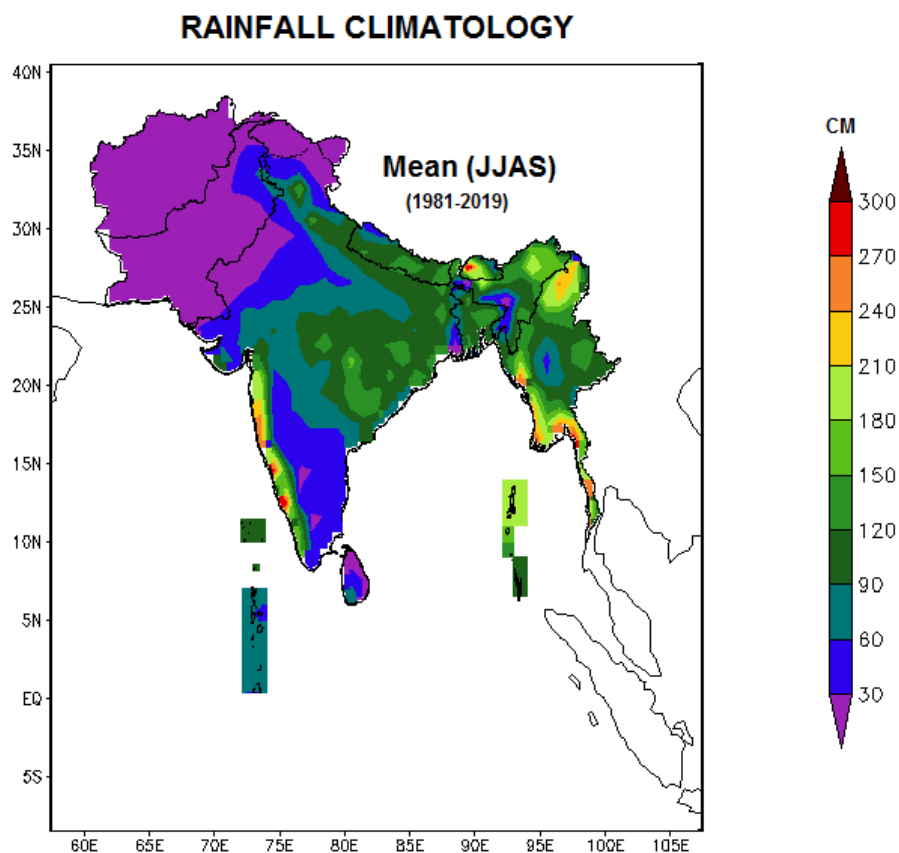
Fig.3 Rainfall climatology for the period 1981-2019 over South Asia Source: Merged rainfall data over south Asia of RCC, Pune)