



Fourteenth Session of

## **South Asian Climate Outlook Forum (SASCOF-14)**

**Kathmandu, Nepal, 18-23 April 2019**

### **Consensus Statement**

#### **Summary**

Normal rainfall is most likely during the 2019 southwest monsoon season (June – September) over most parts of South Asia. However, above normal rainfall is likely over some northern parts of the region, eastern coastal areas of Peninsular India, Sri Lanka, southern parts of Myanmar, and most parts of Andaman Nicobar Islands. Below-normal rainfall is likely over some areas of southern Pakistan, some areas along the west coast of Peninsular India, northern parts of central India and some areas of northeastern part of the region. Remaining areas are likely to experience normal rainfall.

This consensus outlook has been developed through an expert assessment of the prevailing global climate conditions and forecasts from different climate models from around the world. Currently weak El Niño conditions are prevailing over the Pacific Ocean and there is a strong consensus among the experts about the possibility of further weakening of these conditions during the latter part of the monsoon season. Some global models are also indicating a possibility of El Niño conditions turning to ENSO neutral conditions during the season. However, it is recognized that there is large uncertainty in the forecasts done at this time of the year particularly regarding the further evolution of the El Niño conditions. Other regional and global factors can also influence the monsoon rainfall patterns over the region.

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



## **Introduction:**

The climate outlook for the 2019 southwest monsoon season (June to September) was prepared during the fourteenth session of the South Asian Climate Outlook Forum (SASCOF-14), held at Kathmandu, Nepal from 22-23 April 2019 attended by experts from South Asian countries. It was preceded by a Pre-COF training workshop on seasonal prediction for the participants during 18-21 April 2019. The Forum deliberated on various observed and emerging climatic features that are known to influence the performance of the southwest monsoon, such as the El Niño-Southern Oscillation (ENSO) conditions over the equatorial Pacific, Indian Ocean Dipole (IOD) conditions over the Indian Ocean, winter and spring snow cover area over Eurasia and land surface temperature anomalies. The key features of these conditions are as follows:

## **El Niño Conditions over the Pacific Ocean**

The El Niño/Southern Oscillation (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. Since October 2018, warmer than normal Sea Surface Temperatures (SSTs) were prevailing across the equatorial Pacific. Subsequently SSTs in the tropical Pacific warmed within the weak El Niño category during February and early March, while subsurface waters became more strongly warmer than average. Associated atmospheric Patterns also changed reflecting El Niño conditions. Currently weak El Niño conditions are prevailing in the equatorial Pacific Ocean. Latest forecasts from global models indicate that these conditions are likely to continue through the monsoon season but with decreased intensity as the time progress. However, few global models are also indicating a possibility of weak El Niño conditions turning to ENSO neutral conditions in the later part of the monsoon season. It is recognized that though El Niño conditions are known typically to weaken the South Asian southwest monsoon circulation and influence the rainfall over the region, there is large uncertainty in their impact on the regional rainfall distribution during one year to another.



## Conditions over the Indian Ocean

In addition to ENSO conditions over the Pacific, other factors such as Indian Ocean SSTs have some influence on the South Asian southwest monsoon. At present, neutral Indian Ocean Dipole (IOD) conditions prevail in the equatorial Indian Ocean. The recent climate model forecasts indicate a possibility of development of weak positive IOD conditions during the middle of the monsoon season. In general negative (positive) IOD is associated with the weaker (stronger) than normal monsoon over south Asia. However, it is recognized that the IOD – monsoon association is relatively much weaker compared to that of the ENSO-Monsoon association.

## Snow Cover over the Eurasia

The snow-covered area averaged over the Eurasia was slightly above normal during December 2018 and was 16<sup>th</sup> highest among December months of last 53 years. The snow-covered area averaged over the Eurasia was normal in January (25<sup>th</sup> highest) and below normal during February to March 2019 (12<sup>th</sup> & 7<sup>th</sup> lowest among the respective months of last 53 years). The Eurasian snow cover area during winter and spring has an inverse relationship in general with the subsequent south Asian summer monsoon rainfall. (data source: <https://climate.rutgers.edu/snowcover/> )

## Consensus Outlook for the 2019 Southwest Monsoon Rainfall over South Asia:

A consensus outlook for the 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 and the current SASCOF sessions, and experimental as well as operational long-range forecasts based on statistical and dynamical models generated by various operational and research centres of the world.



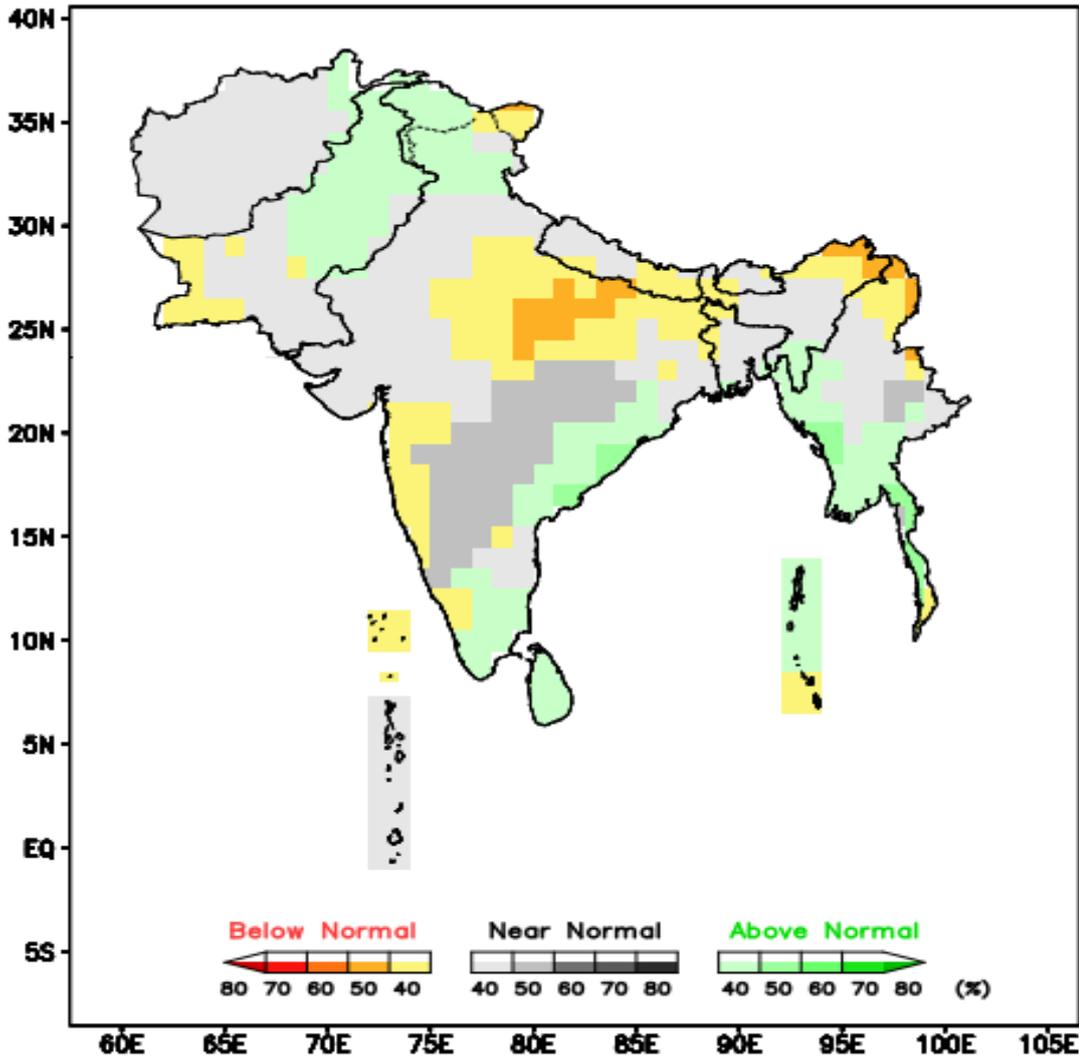
There is a strong consensus among the experts about the possibility of further weakening of prevailing weak El Niño conditions in the equatorial Pacific during the latter part of the southwest monsoon season and thereafter. Other relevant climate drivers such as the state of the Indian Ocean Dipole, the Tropical Atlantic SST, 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.

The outlook for the southwest monsoon rainfall over South Asia is shown in Fig. 1. The figure illustrates grid wise most likely tercile category<sup>1</sup> 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 synthesis of the available information and expert assessment. It was derived from an initial set of gridded objective forecasts and modified through a consensus building discussion of climate experts.

The outlook suggests that most parts of South Asia are likely to experience normal rainfall during the 2019 southwest monsoon season (June – September). Some northern parts of the region, eastern coastal areas of Peninsular India, Sri Lanka, southern parts of Myanmar, and most parts of Andaman Nicobar Islands are likely to experience above normal rainfall. Below-normal rainfall is likely over some areas of southern Pakistan, some areas along the west coast of Peninsular India, northern parts of central India and some areas of northeastern part of the region. Normal rainfall is likely over remaining areas.

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<sup>1</sup>Tercile categories have equal climatological probabilities, of 33.33% each.

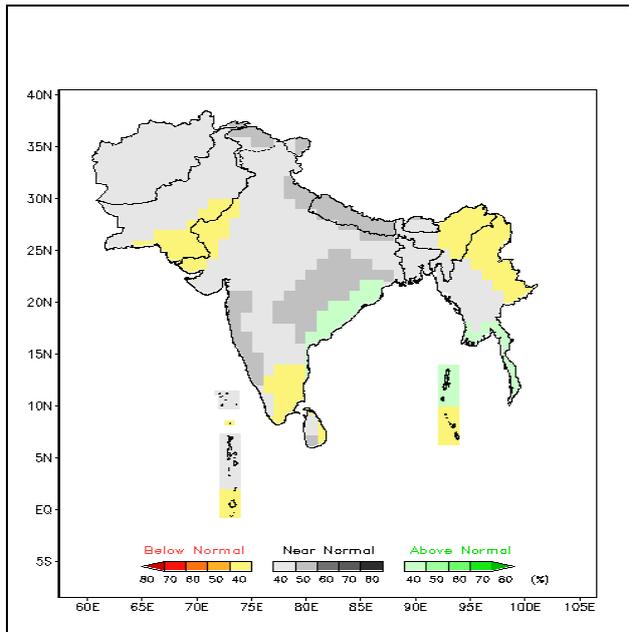


Consensus outlook for 2019 Southwest Monsoon Rainfall over South Asia

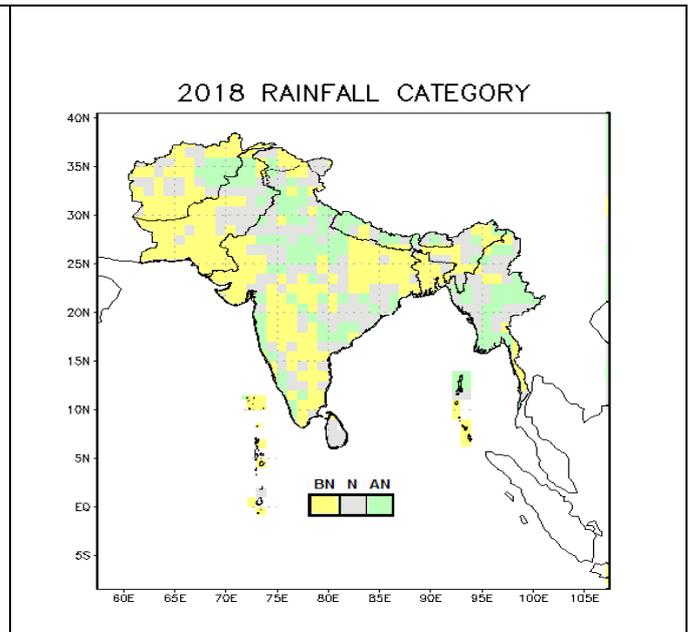
Fig.1. Probability of the most likely category for the 2019 Southwest Monsoon Rainfall over South Asia based on this consensus statement. The consensus-based probability forecast map was prepared based on model forecasts at global as well as national levels synthesized through subjective expert assessment.



### Verification of consensus outlook statement of 2018:



**Fig.2 Consensus outlook map of SASCOF-12 for 2018 Southwest Monsoon Rainfall over South Asia.**



**Fig.3\* Observed rainfall distribution during 2018 Southwest Monsoon season over South Asia expressed as the grid point rainfall tercile categories. (\*Data source: [iridl.ldeo.columbia.edu/SOURCES/UCSB/CHIRPS/v2p0/monthly/global/deg1p0/precipitation](http://iridl.ldeo.columbia.edu/SOURCES/UCSB/CHIRPS/v2p0/monthly/global/deg1p0/precipitation))**

The outlook for the 2018 southwest monsoon season (June to September) suggested normal rainfall over most parts of South Asia. Above normal rainfall was forecasted in some areas of east central India and southeastern parts of the region and below-normal rainfall was forecasted in some areas of southern, northwestern and northeastern parts of South Asia.

Fig. 3 shows the observed rainfall distribution during the 2018 southwest monsoon season expressed in terms of tercile categories. It is seen that major areas of above normal and below normal categories in the forecasted map matched with that in the observed map. However, the observed above normal rainfall areas along the west coast, northern parts of the region and over north Myanmar were forecasted as normal. Similarly observed areas of below normal over southern Myanmar, east India and southern Pakistan was also forecasted as normal.



## 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.

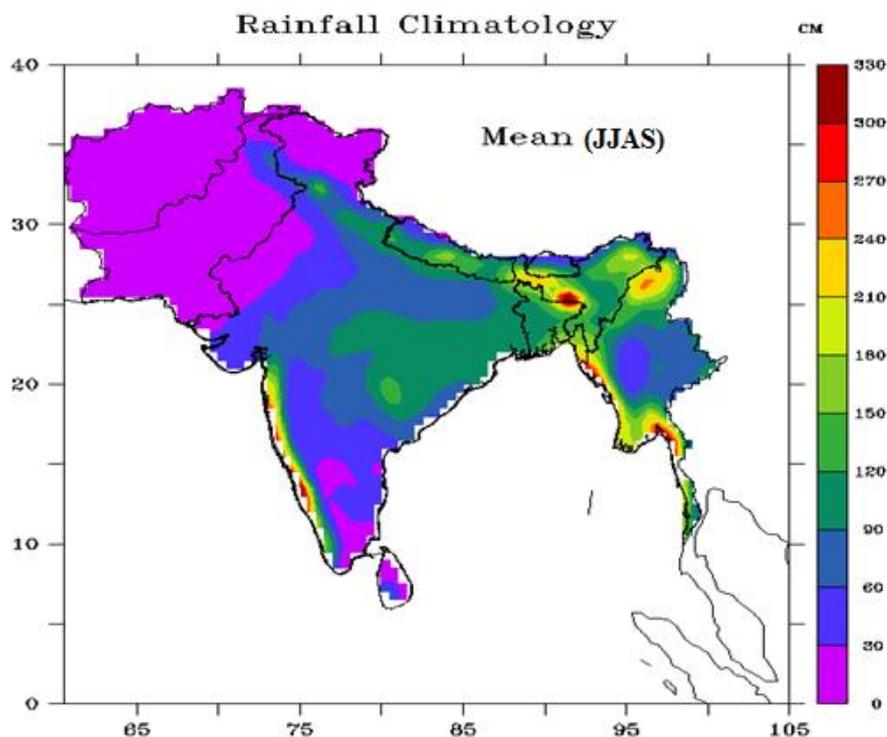
Asia is a large continent with large differences in the climatological settings on sub-regional scales. Therefore, WMO's Regional Association II (Asia) recommended sub-regional RCOFs devoted to specific needs of groups of countries having similar climatic characteristics. Implementation of the South 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 4<sup>th</sup> 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 present and fourteenth session of the SASCOF (SASCOF-14) and associated Pre-COF training workshop on seasonal prediction, and CSUF were 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 SASCOF-14 (22-23 April 2019) session was attended by participants from 8 South Asian countries, namely, Bangladesh, Bhutan, India, Maldives, Myanmar, Nepal, Pakistan and Sri Lanka. In addition, experts from Indian Institute of Tropical Meteorology (IITM), Japan Meteorological Agency (JMA), WMO, Met Office, UK, Regional Integrated Multi-hazard Early-warning System (RIMES) and from various user sectors such as government, health, media, agriculture, water resources etc. also took active part in the event. The long-term historical patterns of the southwest monsoon rainfall over South Asia (Fig.4), characterized by remarkable spatial variability, provide the general reference points at the respective locations for the rainfall anomalies indicated in the outlook.



**Fig.4 Rainfall Climatology for the period 1951-2007 over South Asia**  
(Source: APHRODITE's Water Resources Home page,  
<http://www.chiku.ac.jp/precip/english/index.html>)

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 - Multi-Model 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.