



Eighth Session of

## **South Asian Climate Outlook Forum (SASCOF-8)**

*Colombo, Sri Lanka, 25-26 April 2016*

### **Consensus Statement**

#### **Summary**

Above-normal rainfall is most likely during the 2016 southwest monsoon season (June – September) over much of South Asia. More specifically:

- Above-normal rainfall is most likely over broad areas of central and western South Asia.
- Below-normal rainfall is most likely over eastern parts of the region and the southeastern part of the peninsula.
- Normal rainfall is most likely over the remaining areas.

This consensus outlook for the 2016 southwest monsoon rainfall over South Asia has been developed through an expert assessment of the prevailing global climate conditions and forecasts from different climate models from the participating National Meteorological Services (NMSs) and from around the world. The strong El Niño conditions that prevailed over the Pacific since July, 2015 have now weakened to moderate level. There is strong consensus among experts that El Niño conditions will continue to weaken and reach neutral level by the middle of the southwest monsoon season. There is a possibility of La Niña conditions developing in the later part of the season, but it is recognized that there is uncertainty about its development and timing. There is also consensus that the declining El Niño conditions will not have any major impacts on the southwest monsoon rainfall over the region. Other regional and global factors that can affect the region were also considered in arriving at this consensus outlook.

For more information and further updates on the southwest monsoon outlook on national scale, the respective NMSs may be consulted.

## **Introduction:**

The climate outlook for the 2016 southwest monsoon season (June to September) was finalized during the eighth session of the South Asian Climate Outlook Forum (SASCOF-8), held at Colombo, Sri Lanka during 25–26 April 2016 attended by experts from the South Asian countries. It was preceded by a capacity building training workshop on seasonal prediction for the participants during 19–23 April 2016. The 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) conditions over the Indian Ocean, winter and spring Northern Hemisphere snow cover and land-surface temperature anomalies. The key features of these conditions are as follows:

### **ENSO Conditions over the Pacific Ocean**

The El Niño/Southern Oscillation is one of the global scale climate phenomena that have a significant influence on the year-to-year variability of the monsoon over South Asia. The El Niño conditions over the equatorial Pacific prevailing since April, 2015 reached a strong level in July and peaked in December 2015. The strong El Niño conditions started weakening thereafter and became moderate in early April. Recent changes in atmospheric conditions over the Pacific also reflect the weakening El Niño conditions. Latest forecasts indicate El Niño conditions are likely to continue to weaken and reach neutral level by the middle of the southwest monsoon season. Most models also suggest development of La Niña conditions during the later part of the monsoon season or during the post monsoon season.

### **Conditions over the Indian Ocean**

In addition to ENSO conditions over the Pacific, other factors such as Indian Ocean surface temperatures have some influence on the South Asian southwest monsoon. At present, basin-wide warming is observed in the Indian Ocean, with strongest warming in the near-equatorial south Indian Ocean. Currently neutral Indian Ocean Dipole (IOD) conditions are prevailing. The recent forecasts from coupled models suggest the development of weak positive IOD conditions in the early part of the monsoon season. Subsequently, the positive IOD conditions are likely to weaken to neutral conditions and then turn to negative by the end of the monsoon season.

## **Snow Cover over the Northern Hemisphere**

The snow-covered area over both Northern Hemisphere and Eurasia was below normal during three of the four months since December 2015 (except January, 2016). The February and March snow-covered area over the Northern Hemisphere was 3<sup>rd</sup> and 2<sup>nd</sup> lowest respectively and that over Eurasia was 4<sup>th</sup> and 5<sup>th</sup> lowest during the last 50 years<sup>#</sup>. Below-normal Northern Hemisphere snow cover during winter and spring generally leads to a stronger than normal south Asian summer monsoon.

## **Consensus Outlook for the 2016 Southwest Monsoon Rainfall over South Asia:**

A consensus outlook for the 2016 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.

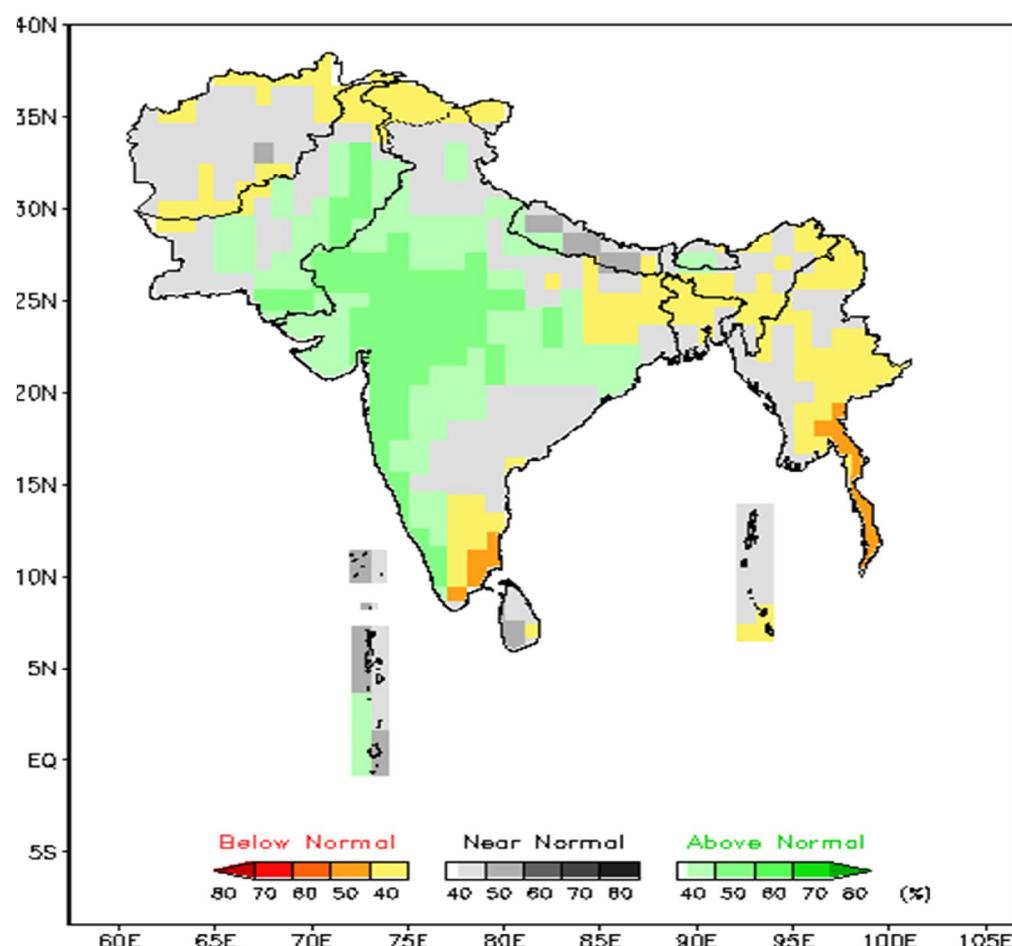
There is strong consensus among the experts that the prevailing moderate El Niño conditions in the equatorial Pacific will weaken to a neutral level by the middle of the southwest monsoon season. Although there is a possibility of La Niña conditions developing in the later part of the season, uncertainty in its development and timing was recognized. It was also recognized that the declining El Niño conditions should not have significant impacts on the southwest monsoon rainfall over the region. Analyses of historical observations indicate that normal to above-normal rainfall occurs in most of South Asia, except in the northeastern part, during the southwest monsoon season after El Niño events, and especially when La Niña develops immediately following El Niño. Furthermore, this impact is stronger over northwestern and central parts of the region. However, it is important to note that declining El Niño or developing La Niña conditions are not the only factors that determine the performance of the Southwest monsoon over the region. Other relevant climate drivers such as the state of the Indian Ocean Dipole, the Tropical Atlantic temperatures, Eurasian land heating, are also important. The net impact of all these parameters determines the state of the monsoon over the region.

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<sup>#</sup>Data source: Rutgers University global snow cover (link: <http://climate.rutgers.edu/snowcover/>)

The outlook for southwest monsoon rainfall over South Asia is shown in Fig. 1. The figure illustrates the most likely tercile category<sup>1</sup> as well as its probability for each of the  $1^{\circ}$  latitude x  $1^{\circ}$  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.

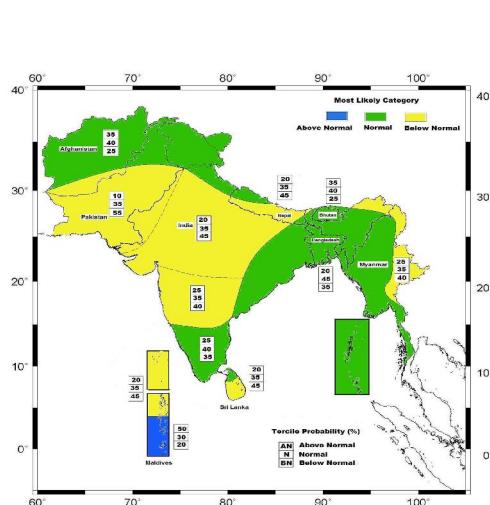
The outlook suggests that during the 2016 southwest monsoon season (June – September), above-normal rainfall is most likely over much of South Asia. More specifically, above-normal rainfall is most likely over broad areas of central and western South Asia. Below-normal rainfall is most likely over eastern parts of the region and the southeastern part of the peninsula. Normal rainfall is most likely over the remaining areas.



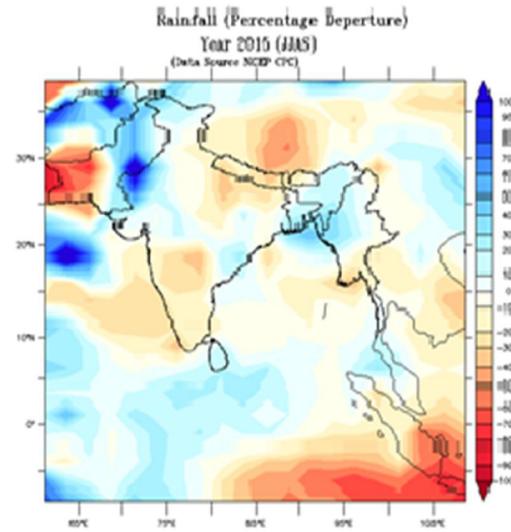
**Fig.1. Probability of the most likely category for the 2016 Southwest Monsoon Rainfall over South Asia based on this consensus statement.**

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

## Verification of consensus outlook statement of 2015:



**Fig.2 Consensus outlook map of SASCOF-6 for 2015 Southwest Monsoon Rainfall over South Asia.**



**Fig.3 The observed rainfall anomaly (percentage departure) during the 2015 Southwest Monsoon Season over South Asia.**

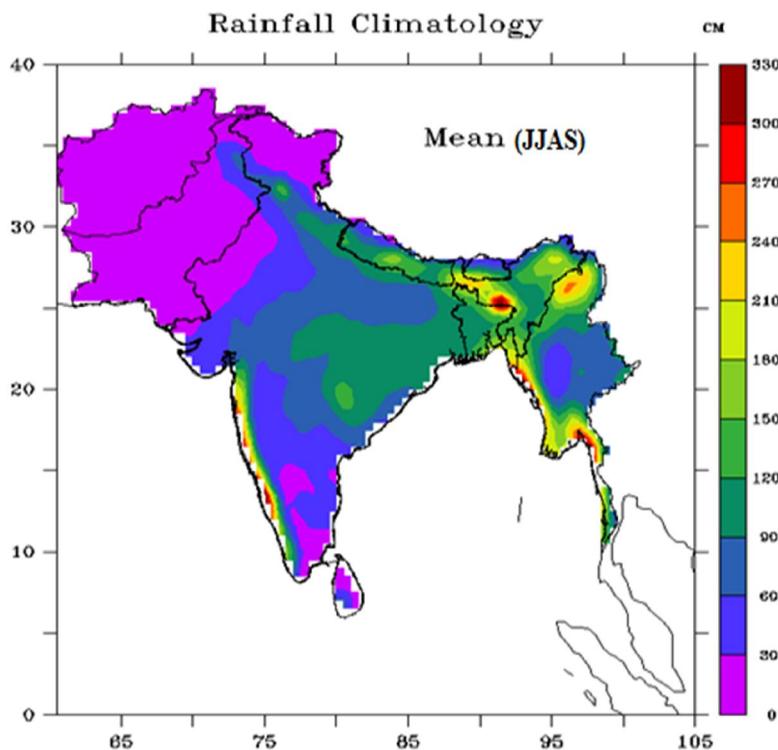
The consensus outlook map (Fig.2) for the southwest monsoon season (June to September) of 2015, developed in the sixth session of the South Asian Climate Outlook Forum (SASCOF-6) had indicated below-normal rainfall over South Asia as a whole during the 2015 southwest monsoon season (June – September). Region-wise, the forecast had indicated below-normal rainfall over broad areas of western, central and southwestern parts of South Asia and some areas in the northeastern-most parts of the region. Above-normal rainfall was forecasted over the southern Maldives islands region.

The observed rainfall (Fig.3) for the 2015 southwest monsoon season was below-normal over most parts of South Asia except over some northeastern parts of the region suggesting below-normal rainfall over the region as whole in general agreement with the consensus forecast. However, there were some differences in the spatial distributions of the observed and forecasted rainfall over the region.

## Background of SASCOF

Climate predictions are of substantial benefit in many parts of the world in risk management and adaptation to the impacts of climate variability and change. It is 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 climatology 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 and its 4<sup>th</sup> session was held in 2013 at Kathmandu, Nepal. The fifth session of SASCOF was held in 2014 again at Pune, India. SASCOF-6 was held during 21–22 April last year (2015) in Dhaka, Bangladesh along with Climate Service User Forum (CSUF) for water sector. SASCOF-7, which was the first Forum that focused on the winter season, was held in Chennai, India during 14–15 Oct 2015, in conjunction with the first CSUF-Agriculture.



**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/>)

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.

The SASCOF-8 and associated training workshop on seasonal prediction were hosted by the Department of Meteorology (DoM), Sri Lanka with the technical co-ordination by India Meteorological Department (IMD). World Meteorological Organization (WMO) co-sponsored the events under a project funded by the Department of the Environment, Government of Canada, for the implementation of the Global Framework for Climate Services (GFCS). These events also form part of the demonstration phase for a WMO Regional Climate Centre (RCC) for South Asia, currently under implementation by IMD.

The training workshop was attended by participants from eight South Asian countries, namely, Bangladesh, Bhutan, India, Maldives, Myanmar, Nepal, Pakistan, and Sri Lanka. Experts from IMD, Indian Institute of Tropical Meteorology (IITM), International Research Institute for Climate and Society (IRI), USA, and Met Office, UK contributed to the training workshop as resource persons.

The SASCOF-8 (25–26 April 2016) session was attended by the above experts as well as experts from WMO, Japan Meteorological Agency (JMA), China Meteorological Administration (CMA), Korea Meteorological Administration (KMA), International Commission on Irrigation and Drainage (ICID), Global Water Partnership (GWP), Bureau of Meteorology, Australia, Regional Integrated Multi-hazard Early-warning System (RIMES), and water resource and health sectors of various South Asian countries. In addition, experts from various user sectors of Sri Lanka such as government, health, media, agriculture, and water resources took active part in the deliberations for assessing the available forecast information and for finalizing the consensus outlook for the southwest monsoon rainfall over South Asia. For preparing the consensus forecasts, the forecast products from various centers such as IMD, IITM, National Centers for Environmental Prediction (NCEP), USA, Météo France, Met Office, European Centre for Medium Weather Forecasting (ECMWF), Canadian Meteorological Centre (CMC), Bureau of Meteorology, Australia, IRI, WMO's Lead Centre for Long Range Forecasting - Multi-Model Ensemble (WMO LC-LRFMME), Japan Agency for Marine-Earth Science and Technology (JAMSTEC), APEC Climate CenterAPCC,) JMA, CMA and Centro de Previsão de Tempo e Estudos Climáticos (CPTEC), Brazil were also considered.