



South Asian Climate Outlook Forum (SASCOF)

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**भारत मौसम विज्ञान विभाग
INDIA METEOROLOGICAL DEPARTMENT**

Introduction

- Enhanced adaptive capacities are required as the impacts of climate variability and change on natural, social and economic systems are becoming increasingly evident.
- Rapid advances have been made in the understanding and predicting the climate system
- Therefore, now it is possible to provide climate products and services through optimized use of existing climate related data and monitoring products, sector specific climate products and the production of reliable predictions for time scales ranging from seasons to decades and longer time scales.
- Regional Climate Outlook Forums are one of the vehicles for developing user-driven products and services and communicating those to users at regional and national scale.



Regional Climate Outlook Forum?

- A Regional Climate Outlook Forum is a platform that brings together climate experts and sector representatives from countries in a climatologically homogenous region to provide consensus based climate prediction and information, with input from global and regional producing centres and National Meteorological and Hydrological Services, with the aim of gaining substantial socio-economic benefits in climate sensitive sectors.
- RCOFs strengthen regional networking of the climate service providers and user-sector representatives. Participating countries recognize the potential of climate prediction and seasonal forecasting as a powerful development tool to help populations and decision-makers face the challenges posed by climatic variability and change. One of the important components of RCOFs is development of existing capacities of NMHSs in seasonal forecasting and communication of climate information to user community.



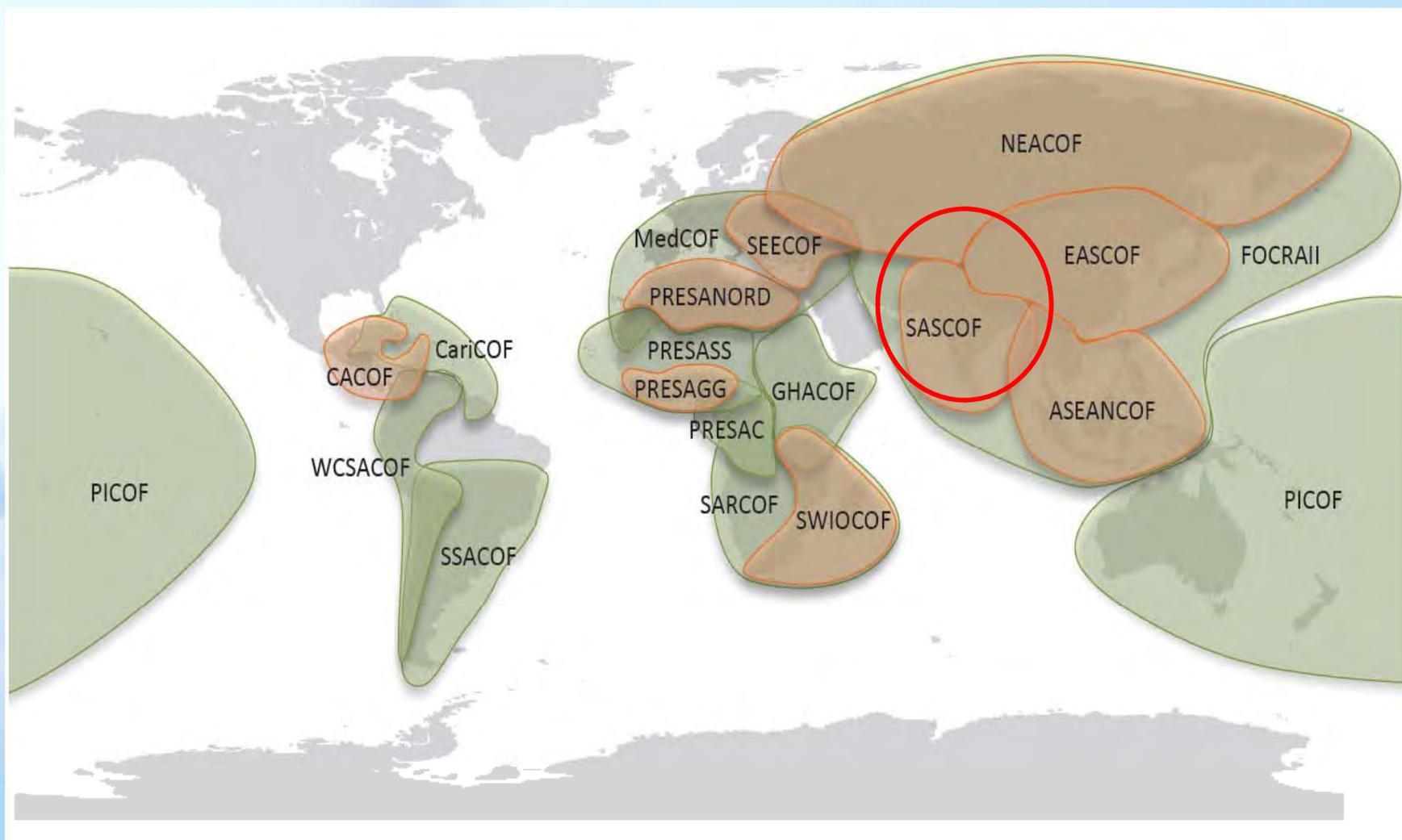
Background

- The World Meteorological Organization (WMO), a specialized agency of the United Nations for weather, climate, and water, enables scientific understanding of climate variability and change through dedicated observations of the climate system; improvements in the analysis, monitoring and prediction and the development of climate applications and services; capacity building in the application of meteorological and hydrological data, dissemination of information in support of climate risk management and scientific research and assessments.
- Regional Climate Outlook Forum (RCOF) was initiated In late 1990s under the WMO Climate Information and Prediction Services (CLIPS) project in collaboration with National Meteorological and Hydrological Services (NMHSs), regional institutions and other international organizations. RCOF was first established in 1996 at a Meeting in Victoria Falls, Zimbabwe. It gained momentum as a regional response to the major 1997–1998 El Niño event, since then RCOF concept was spread worldwide.
- Currently there are 19 forums operational around the world, as of 2016.



Regional Climate Outlook Forums All Over the World

In different regions of the world, the RCOFs have evolved in different ways, based on specific needs and capabilities and tailored to meet the local conditions. Meanwhile, in all regions they constitute reliable and authentic sources of high-quality climate information, developed through a cooperative endeavour and on a sustainable basis.



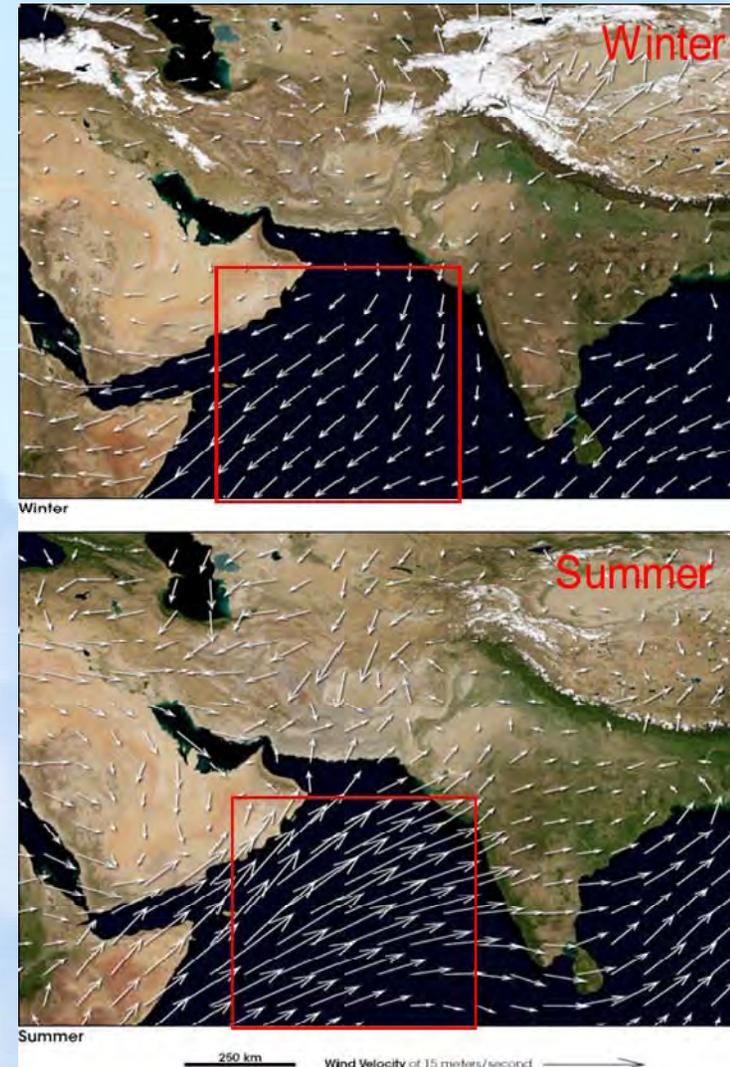
Establishment of SASCOF

- ❖ In Asia, China has been coordinating a RCOF called '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 a sub-regional scale. 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 RCOF for south Asia known as 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 summer monsoon climate.

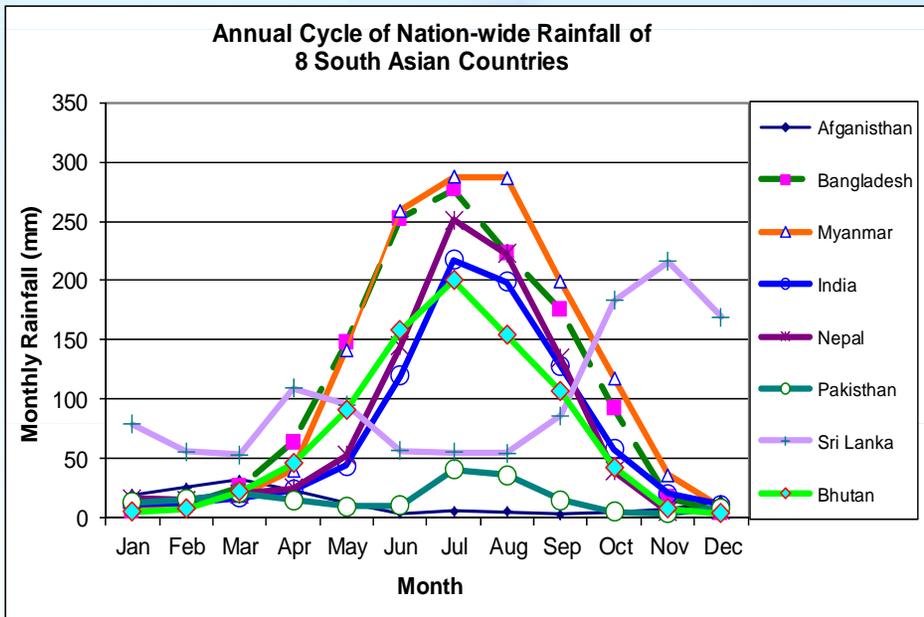


Some Climatic Features of South Asia

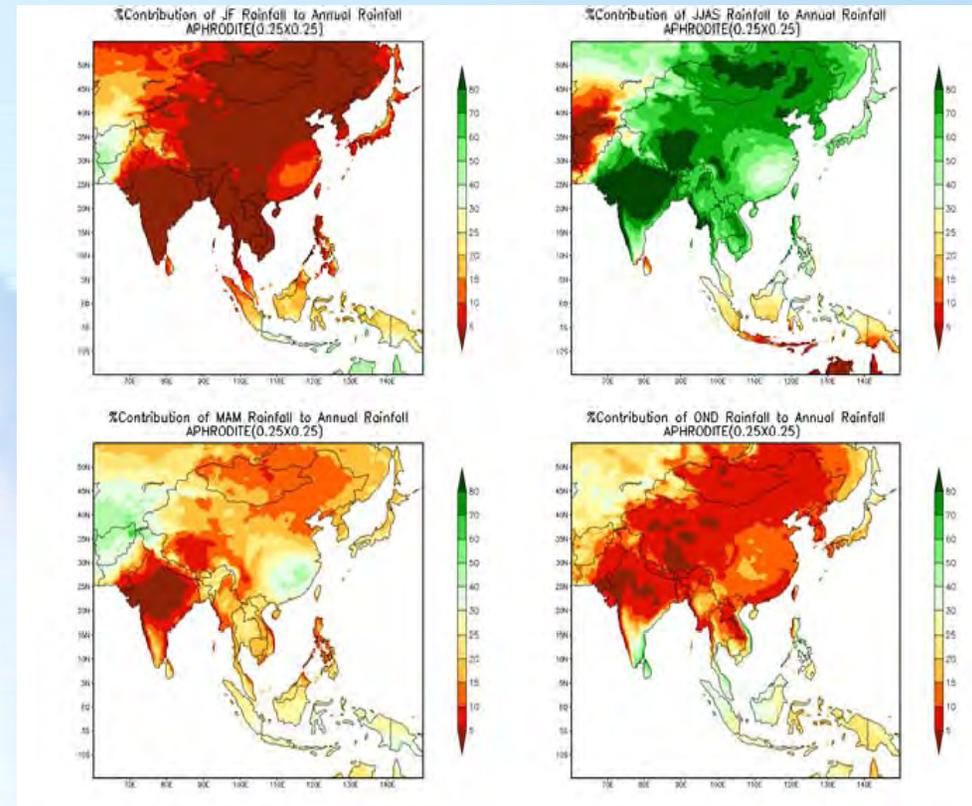
- ❖ The annual Climate of the south Asia is dominated by two monsoons: SW and NE monsoons.
- ❖ The summer monsoon plays a crucial role in the entire socio-economic fabric of South Asia, highly influencing all walks of life. The summer monsoon (June–September) rainfall accounts for 75–90% of the annual rainfall of the most of the countries of the region.
- ❖ During SW monsoon season, most intense rainfall activity is seen over the North Eastern parts of the region over Bangladesh, India and adjoining Myanmar. West coast of India also experiences high rainfall amounts owing to the steep topography of the “Western Ghats”.
- ❖ During NE monsoon and early winter months, substantial rainfall results over the region covering the Southern tip of India and Sri Lanka as the prevailing northeasterly trade winds over the region gain strength.



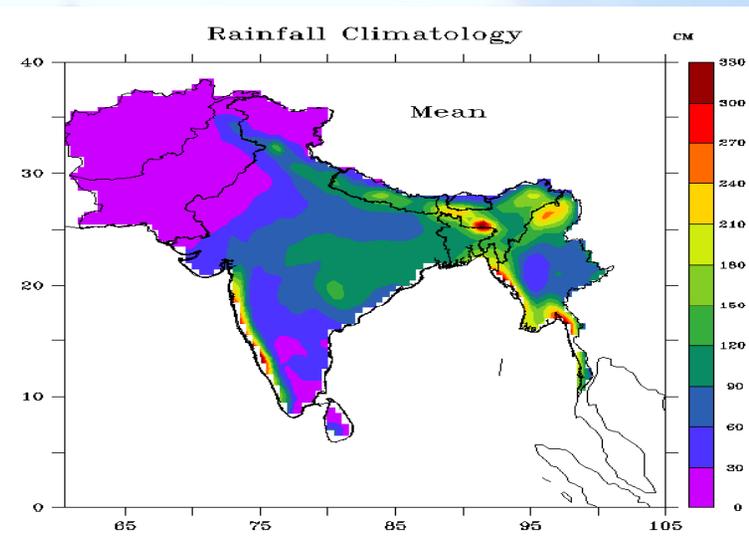
Rainfall Features of South Asia



Contribution of Seasonal Rainfall to the Annual Rainfall



JJAS Climatology: 1951-2000

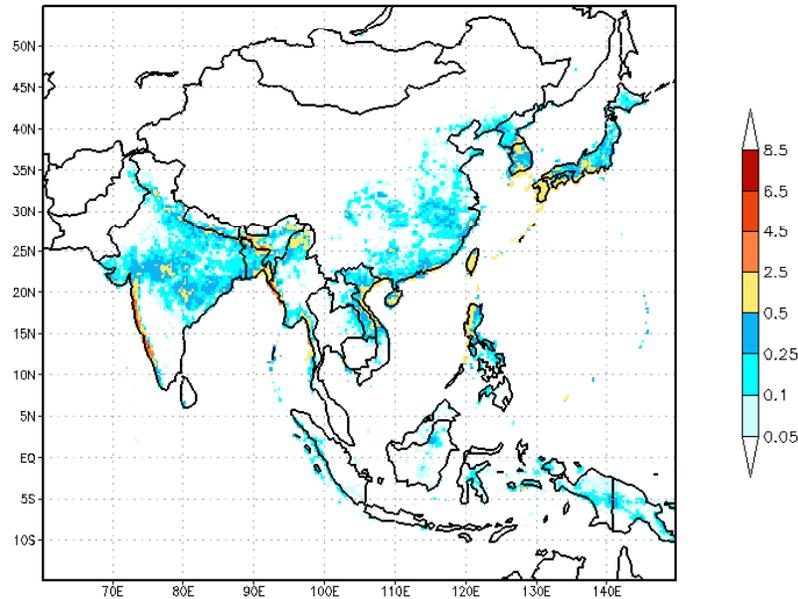


Data source: APHRODITE's daily grided rainfall data <http://www.chikyu.ac.jp/precip/>

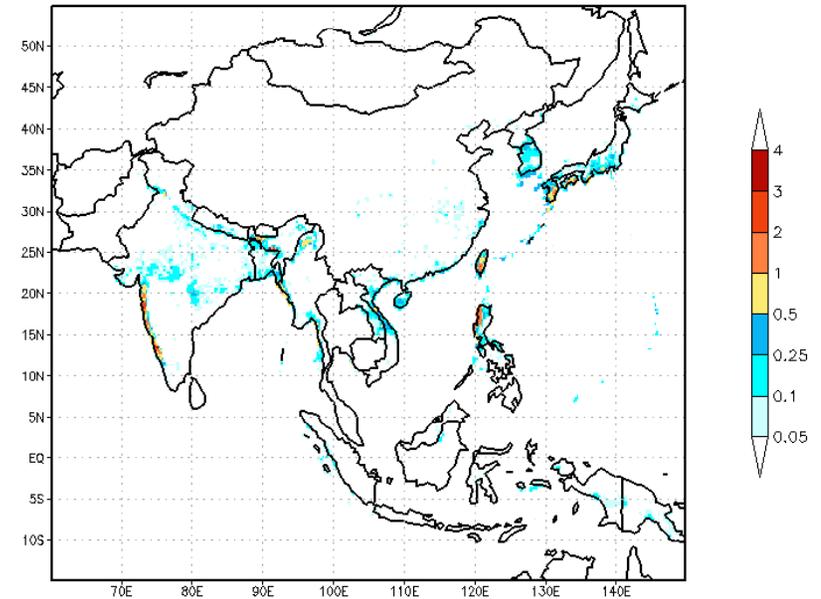


Frequency of Extreme Rainfall Events over South Asia: JJAS

FREQUENCY OF HEAVY RAINFALL EVENTS (100mm to 150mm)
JUN-SEP(1901-2010)



FREQUENCY OF VERY HEAVY RAINFALL EVENTS (≥ 150 mm)
JUN-SEP(1901-2010)



Floods are common disasters in monsoon Asia.



11/14/2019

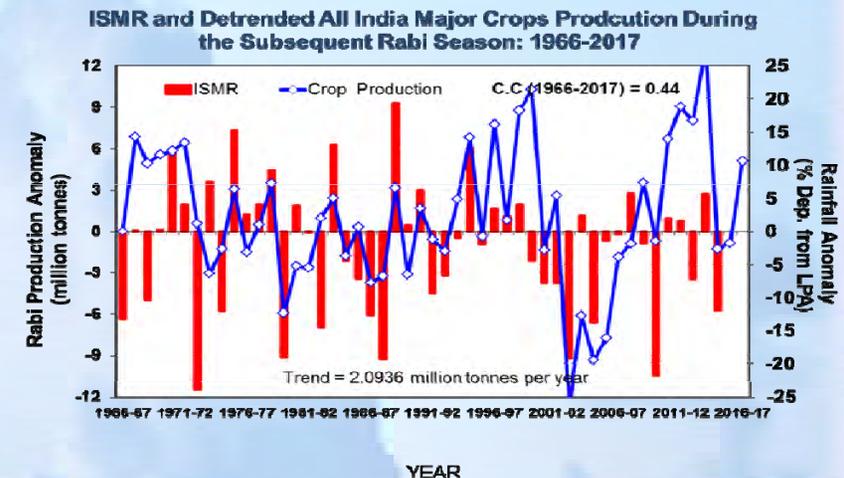
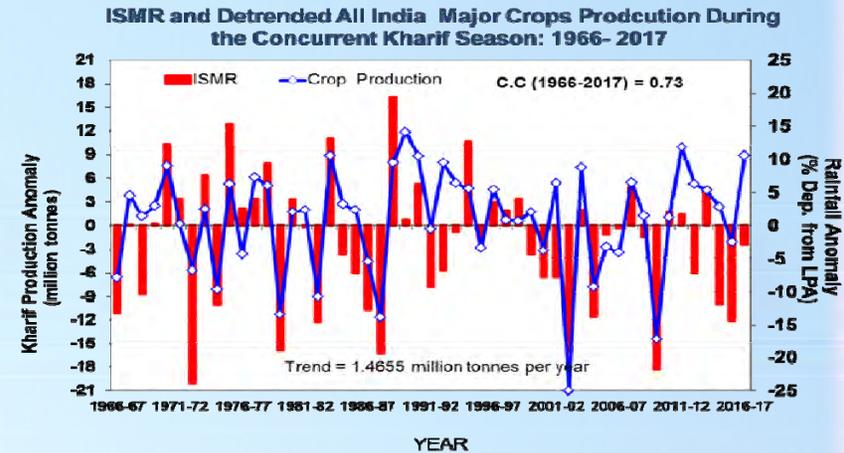
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Monsoon and Agriculture

- ❖ Several studies have highlighted the critical dependence of crop production on summer monsoon rainfall. The summer monsoon rainfall is also important for hydroelectric power generation and meeting drinking water requirements. Thus, being essentially driven by agricultural growth, the economies of all South Asian countries are inextricably tied to the performance of the summer monsoon.
- ❖ Therefore, prior information about the performance of the monsoon over South Asia will always be helpful for the society in planning risk management strategies.
- ❖ Although substantial progress has been made in its understanding, prediction in respect of different aspects of the monsoon, particularly rainfall during the season with sufficient lead time, has remained a challenge for meteorologists/researchers across the globe even today.
- ❖ Monsoon knowledge and its prediction stand for a shared challenge for South Asian nations which led to the development of a consensus focused on the outlook for the ensuing summer monsoon



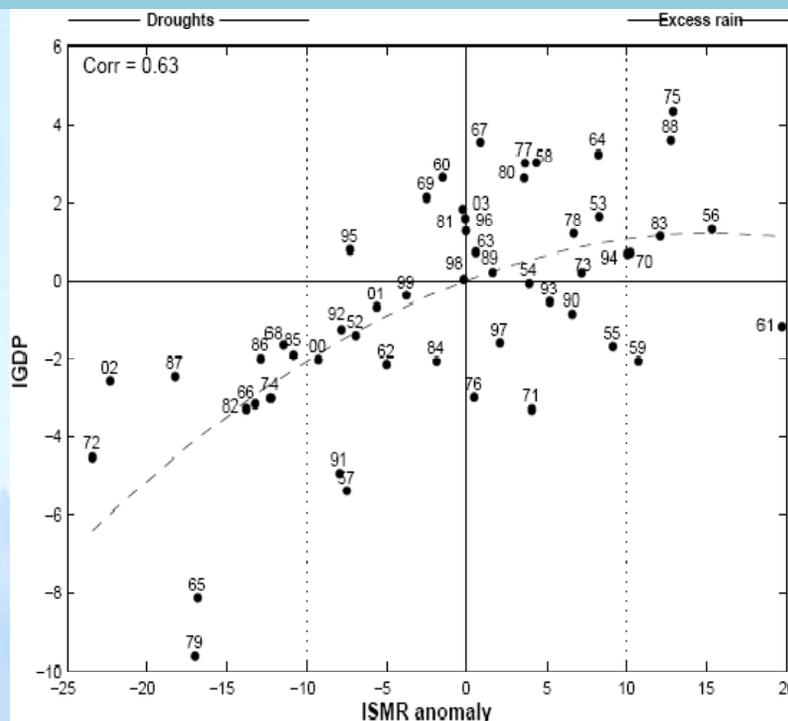
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Monsoon & Economics

Impact of a severe drought on GDP remains 2 to 5% throughout, despite the substantial decrease in the contribution of agriculture to GDP over the five decades (Gadgil and Gadgil 2006)



IGDP by sector (2012-13)
 agriculture: 13.7%,
 industry: 21.5%,
 services: 64.8%

Labour force by occupation
 agriculture: 49%,
 industry: 20%,
 services: 31%
 (2012 est.)



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South Asian Climate Outlook Forum (SASCOF): Beginning & Objectives

- ❖ In a meeting convened by WMO, the Directors General of the National Meteorological and Hydrological Services (NMHSs) in South Asia and Permanent Representatives (PRs) of the respective countries with WMO, at the Abdus Salam International Centre for Theoretical Physics (ICTP), Trieste, Italy, on 6 August 2009, the PRs of south Asian nations with the WMO had unanimously agreed to establish a South Asian Climate Outlook Forum (SASCOF), to be implemented from 2010 onwards. The main objectives of SASCOF are the following.
- ❖ *To review the progress made in understanding and long range prediction of summer monsoon both regionally and globally;*
- ❖ *To make available detailed information on climate variability in South Asia for dissemination along with the seasonal outlook;*
- ❖ *To provide a platform for the stakeholders of SASCOF to share and exchange experience and knowledge on summer monsoon and its prediction;*
- ❖ *To initiate capacity building/human resource development activities for the South Asian region, particularly in seasonal prediction;*
- ❖ *To build collaboration and partnerships among the members of SASCOF for mutual benefit;*
- ❖ *To identify needs of user sectors through a dialog among different groups.*



SASCOF Process

- ❖ SASCOF, co-sponsored by WMO is coordinated by India Meteorological Department (IMD). The Climate Research & Services Division of IMD, Pune is currently working as the WMO Regional Climate Centre (RCC) for South Asia (RCC, Pune). RCC, Pune also takes lead role in the preparation of consensus forecast. The main participants in the forum are representatives/ experts from the National Meteorological and Hydrological Services (NMHSs) of the South Asian countries (Afghanistan, Bangladesh, Bhutan, India, Maldives, Myanmar, Nepal, Pakistan and Sri Lanka).
- ❖ Other participants are climate experts from global and regional climate research/service institutions like Indian Institute of Tropical Meteorology (IITM), Pune, Regional Integrated Multi-Hazard Early Warning System for Africa and Asia (RIMES), Bangkok, Japan Meteorological Agency (JMA), Korean Meteorological Administration (KMA), China Meteorological Administration (CMA), International Research Institute for Climate and Society (IRI), National Centers for Environmental Prediction (NCEP), Meteo-France, Met Office, UK, Asia-Pacific Economic Cooperation Climate Centre (APCC) etc



SASCOF Process

- ❖ During the first 5 years (2010 to 2014), SASCOF sessions were held only for southwest monsoon season (June to September).
- ❖ From 2015 onwards, SASCOF session dedicated to northeast monsoon season (October to December) was started in addition to the existing session for southwest monsoon season.
- ❖ Each year, the session for southwest monsoon season is held in April and that for northeast monsoon season is held in September.
- ❖ In addition to these physical sessions for the preparation of consensus forecasts for southwest and northeast monsoon seasons, online session for preparing consensus forecast for winter season (December to February) was started from 2015 onwards. The online session for preparing consensus forecast for winter season is generally held in November.
- ❖ The main forum meetings of SASCOF are generally conducted for a period of 2-3 days. In these meetings, experts from south Asian countries join other regional and international climate experts to assess the skills of available seasonal forecasting systems over south Asia and develop a consensus climate outlook statement for south Asia.



SASCOF Process

- ❖ The consensus outlook is reached based on the prevailing large scale global climatic patterns (like ENSO, IOD, Snow Cover etc.) and seasonal forecasts for the relevant season from both statistical and dynamical models. These forecast information are derived from the participating National Meteorological Services (NMSs) of the region, WMO GPCLRFs and RCCs, and other climate research centers like IRI, IITM, APEC Climate Center etc. At least 50% of the forecast information is derived from various dynamical models.
- ❖ The main forum meeting is followed by a joint meeting of climate experts, and experts from various user sectors and stake holders from the region. These sectors include Agriculture and food security, health, energy, water resources, disaster risk reduction and response etc. Joint meetings review various issues related to the use of climate information to sector specific applications, sharing the experiences and lessons learned from the applications of previous SASCOF products etc.



SASCOF Process

- ❖ The joint meeting also encourage sector experts to develop detailed sector specific risk information including warnings based on the SASCOF products, and communicate to decision-makers and the public. Special outreach sessions involving media experts are also conducted to develop effective communication strategies.
- ❖ In addition to the above, capacity building training workshops are also conducted. Currently training workshops are conducted only during the April SASCOF sessions. The workshop is generally conducted as a pre-COF session for the experts from NMHSs to improve understanding of the regional climate processes, access and interpret global and regional climate prediction products, and gain skills in long range forecasting and communication of the climate information to user community. The capacity building training workshops are generally designed to impart theoretical and practical knowledge on the seasonal prediction and its applications to the participants.



Contents of the SASCOF consensus statement

- ❖ Summary providing highlights of the consensus forecast outlook in a brief.
- ❖ Introduction about the concerned SASCOF like venue, participation, inputs used for preparing the forecast outlook, the current methodology/approach adopted for preparing the seasonal predictions and consensus outlook, including the global/regional/national technical inputs for the process, contents of the consensus forecast outlook statement etc.
- ❖ Current status of the large global climate anomalies like ENSO, IOD, snow cover over Northern Hemisphere that have some influence on the monsoon rainfall over the region. The forecast outlook for ENSO and IOD during the concerned season is also presented.
- ❖ Consensus forecast outlook over south Asia for the relevant season along with a probability forecast map for rainfall over the region. Though a brief statement on the temperature forecast outlook for temperature is included for OND and DJF seasons, probability forecast map for temperature is not presented.
- ❖ Verification of consensus forecast issued for the relevant season of previous year. The practice of including the verification part in the consensus forecast was started from 7th session of the SASCOF held in Colombo, Sri Lanka.



NCOFs and RCC, Pune

- ❖ Once the regional consensus forecast is issued, most of the NMHSs of the region conduct National Climate Outlook Forums (NCOFs) in the country as well as sub-country scales in local languages.
- ❖ As the SASCOF consensus forecast process does not cover all the seasons, Regional Climate Center (RCC), Pune issues forecast outlook for the rainfall and temperature for the next two three month moving seasons (i.e.,for next four months period) over the region, The outlook is updated every month. The forecast outlook is prepared based on the high resolution climate forecasting system (CFS) model. RCC, Pune also provides forecast anomaly maps of rainfall and temperature over the region for the next 9 months and the anomaly maps are for monthly and 3 month moving seasons. RCC, Pune also provides latest status of the ENSO and IOD and its forecasts for next 9 months and issues ENSO and IOD bulletin updated every month. These products and other climate information relevant to the region are available through a dedicated website (http://www.imdpune.gov.in/Clim_RCC_LRF/Index.html).



Long Range Forecast Products Available from RCC, Pune Website Based on Monsoon Mission CFS

(http://www.imdpune.gov.in/Clim_RCC_LRF/Index.html).

Regional Climate Centre (RA II Region)
India Meteorological Department, Pune
(In Demonstration Phase)

Home | Climate Monitoring | Climate Prediction | Climate of South Asia | Regional Products | Training | SASCOF

What are WMO RCCs
WMO Regional Climate Centers (RCCs) are centres of excellence that create regional products including long-range forecasts that support regional and national climate activities, and thereby strengthen the capacity of WMO Members in a given region to deliver better climate services to national users.

Forecast
CFS Forecasts
Climate Forecast System for India and South Asia Region ...

SASCOF
IMD has taken responsibility for the preparation of annual regional forecast outlook for the SW Monsoon Season rainfall under the regional forum known as the ... (read more)

Mandatory RCC Functions
WMO RCCs perform the following set of mandatory functions covering the domains of long-range forecasting (LRF), climate monitoring, data services and training.

- Operational Activities for Long-range Forecasting
- Operational Activities for Climate Monitoring
- Operational Data Services, to support operational LRF and climate monitoring
- Training in the use of operational RCC products and services

Hindcast Verification
CFS Hindcast
CFS Hindcast Verification for India and South Asia Region ...

ABOUT NCC
National Climate Centre (NCC), Pune which was established in 1995 by India Meteorological Department (IMD) with an objective to provide various climate related ... (read more)

Regional Products

- ENSO Bulletin
- Climate Diagnostic Bulletin
- Annual Climate Summary
- SASCOF Forecast Outlook

Important Links : IMD New Delhi | MoES | NCMRWF | NIOT | CLMRE | NOAA | IITM | Incois | WMO

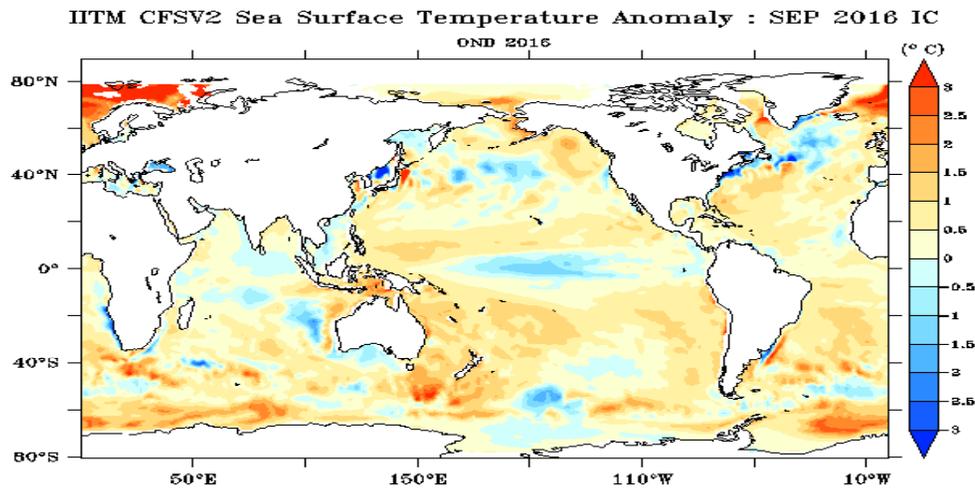
Developed and maintained by Climate Prediction and Monitoring Group, India Meteorological Department, Pune

- **Global monthly and seasonal forecast anomaly maps of rainfall and Temperature for next 8 months (Every month)**
- **ENSO & IOD Forecast Bulletins (Every month)**
- **Seasonal Forecast Outlook of Rainfall and Temperatures over South Asia (updated every month)**
- **Consensus forecast of SW Monsoon Rainfall over South Asia (issued in April every year)**

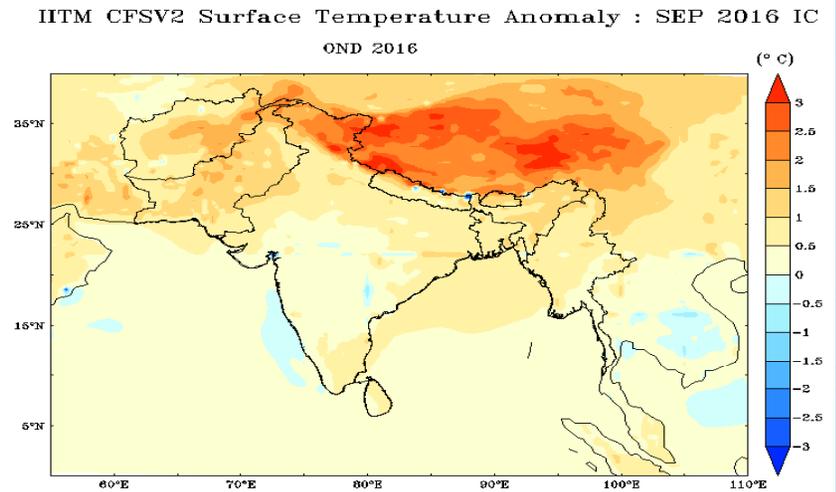


Products based on CFS: LRF Maps

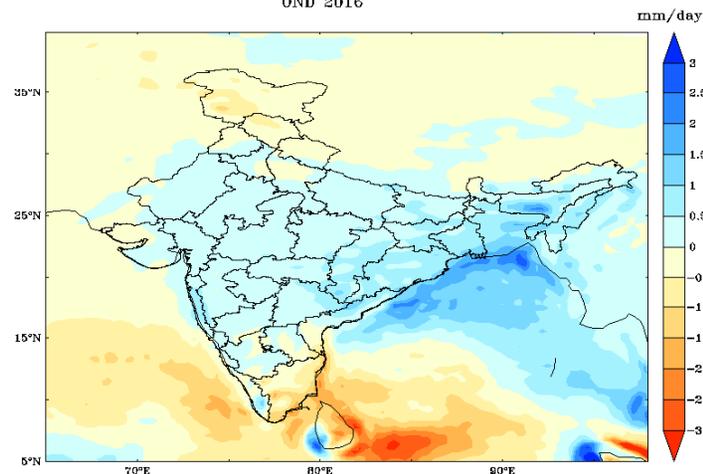
Global SST Ano. Forecast



South Asia 2m Temp. Ano. Forecast



IITM CFSV2 Rainfall Anomaly : SEP 2016 IC OND 2016



India Rainfall Ano. Forecast



ENSO & IOD Forecast Bulletin (Every month)



Ministry of Earth Sciences
Government of India

El Niño/La Niña
Indian Ocean Dipole
Update (15th October 2016)

1. Current Sea Surface Temperature (SST) Conditions over Pacific & Indian Oceans

During September 2016, cool SSTs anomalies persisted along much of the equator in the eastern and central Pacific crossing the date line, while positive SST anomalies were observed over north and south of this band. Cool SST anomalies (since August 2016) were observed over North Pacific Ocean off the west coast of North America, which was warmer as observed in July month. Cool SST anomalies persisted in the subtropical north and south Pacific. SST anomaly difference from August to September (Fig.1b) shows there was SST cooling of up to -1°C over the small patches along the equator in the eastern and central Pacific and a smaller region in east Pacific showing warming of SSTs. Slight increase in SST positive anomaly over some pockets of east Pacific Ocean was observed as compared to August month, where cooling was observed over the entire equatorial Pacific Ocean.

During September 2016, cool SST anomalies were observed over most parts of Arabian Sea, equatorial Indian Ocean and south subtropical Indian Ocean (Fig.1a) and warm anomalies is observed over Bay of Bengal and over maritime continents in the east equatorial Indian Ocean. The positive anomalies which were observed over the maritime continents in August continue to exist. During September, cooling of SST was observed over the entire Indian Ocean while warm SSTs persisted over maritime continents in east equatorial India Ocean (Fig.1b).

1.1. El Niño Southern Oscillation (ENSO) conditions over the Pacific Ocean

The monthly time series of Niño3.4 SST anomalies for the last 12 months (Fig.2a) suggest that the El Niño conditions which started since April 2015 after peaking during December 2015 have continued to weaken to neutral conditions in summer 2016. In association with the decay, cool subsurface anomalies were observed in the western Pacific crossing the date line towards east (Fig.2 b).

1.2. Indian Ocean Dipole (IOD) Conditions over Indian Ocean

Warm subsurface (Fig. 2d) anomalies were observed in the eastern Equatorial Indian Ocean. Cool subsurface anomalies which were seen over a region centred at 50°E at thermocline level (approximately about 100m depth) in September. The subsurface dipole strength is stronger in September compared to August. The September Dipole Mode index (DMI) suggests negative IOD conditions currently present in the Indian Ocean (Fig. 2c).

2. ENSO & IOD Forecast

The SST forecast was prepared using the ESSO-IMD-IITM high resolution Coupled Forecast System (AGCM T382L64; 38 km and OGCM 25km in tropics) based on 2016 September initial conditions. The initial conditions for the model runs were obtained from ESSO-INCOIS and ESSO-NCMRWF analysis. Probability density function (PDF) correction, based on hindcasts for the period 1982-2008 was applied over the forecasts of Niño3.4 index (Fig.4a) and DMI (Fig.4b).

The forecasted 3-month season averaged SST anomalies (Fig.3) indicate cooler SST anomalies in the central equatorial Pacific Ocean in OND season, which persisted till DJF with reduced intensity. Warming of SST conditions is observed in either side of this narrow band till JFM season. There is neutral El Niño condition currently prevailing in Pacific Ocean which is likely to remain the same for the forecasted seasons (Fig.4a). In the central Indian Ocean, cool SST anomalies are observed in OND season and are likely to remain near normal in the later forecasted seasons (Fig.3). The IOD conditions over Indian Ocean are likely to remain negative in OND season (Fig.4b) and remain neutral in the later forecasted seasons.

IITM CFSv2 SST Anomaly Forecast : September 2016 IC

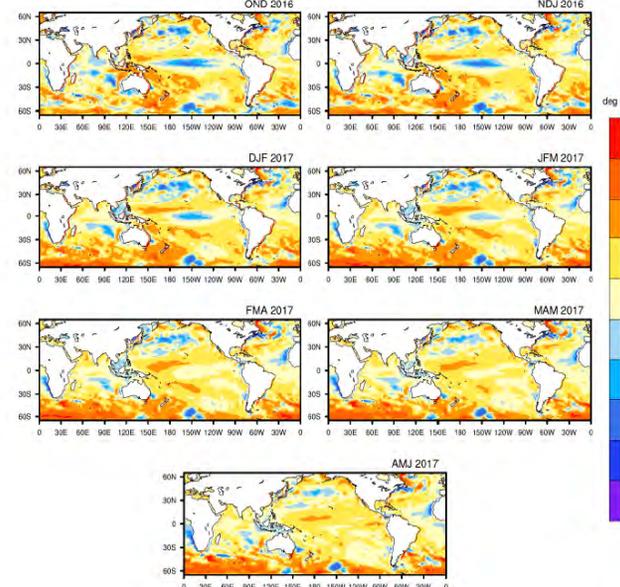


Fig.3: Forecasted Seasonal mean SST anomalies for 3 monthly seasons. (a) October through December (OND), (b) November through January (NDJ), (c) December through February (DJF) (d) January through March (JFM), (e) February through April (FMA), (f) March through May (MAM) and (g) April through June (AMJ).

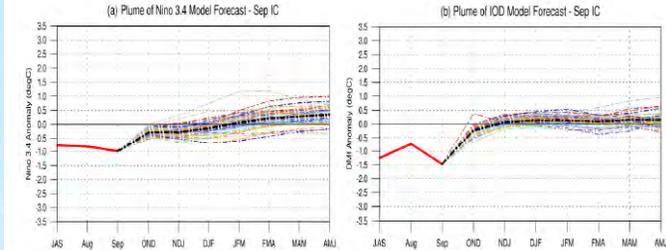


Fig.4: Plume of (a) Niño 3.4 SST anomalies, (b) Indian Ocean Dipole Mode Index forecasted by high resolution CFSv2. The forecasts were PDF corrected for bias and variance. The solid red line is the observed SST anomaly (INCOIS-GODAS) and dashed black line is the ensemble SST anomaly forecast mean of 47 members (CFSv2). The individual ensemble member forecasts are shown in light dotted lines of different colours.

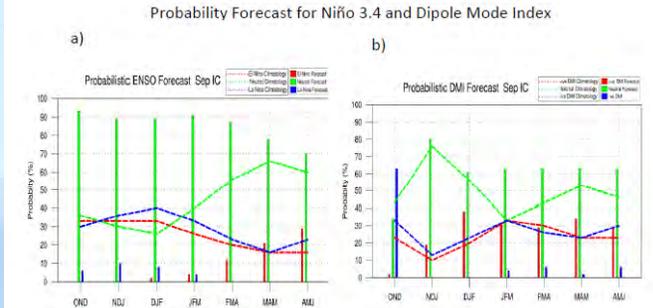


Fig.5: Probability forecast along with climatological probability of (a) Niño 3.4 and (b) Indian Ocean Dipole Mode Index from high resolution CFSv2. Data source for Climatology probabilities: NOAA Extended Reconstructed SST V3b. Criteria used for Probabilistic ENSO Forecast: ≤ -0.5 La Niña, -0.5 to <-0.5 neutral, ≥ 0.5 El Niño. Criteria used for Probabilistic DMI Forecast: ≤ -0.2 negative DMI, >0.2 to <-0.2 neutral, ≥ 0.2 positive DMI.

The probability forecast suggests that there is highest probability for ENSO neutral conditions for the season OND and later seasons, which gradually reduces to about 70% in the AMJ forecasted seasons. The probability for neutral ENSO condition remain significantly above the climatological probability throughout the forecast range, which indicate high confidence for the forecast of neutral ENSO condition. The probability for a La-Niña condition is very small and not at all significant, while there is a slight probability for the revival of another episode of El-Niño in the coming pre-monsoon season (AMJ), which is further subjected to the limitations of the spring barrier of ENSO predictability.

The DMI probability forecast for OND season indicates high probability (63%) for negative IOD mode conditions but reduces sharply during NDJ and remain not significant based on climatological probability. Neutral DMI forecast probability indicates increase from OND season to NDJ season and thereafter a slight decrease from DJF season and continue to remain constant and significant till AMJ season.



Seasonal Climate Outlook for South Asia



Ministry of Earth Sciences
Earth System Science Organization

India Meteorological Department
WMO Regional Climate Centre
(Demonstration Phase)

Pune, India

SEASONAL CLIMATE OUTLOOK FOR SOUTH ASIA

(September to December 2016)

Issued in September 2016

- During August 2016, neutral El Niño conditions prevailed over equatorial Pacific Ocean with sea surface temperatures along the equatorial Pacific being cool. The latest coupled model forecast suggests moderate warming will start from January 2017.
- The 2016 spatial pattern of the SON precipitation forecast indicates above normal precipitation over most parts of Central India, whole of Bangladesh, Bhutan, eastern Nepal and Myanmar. The OND precipitation is likely to be similar as that of SON season but with less intensity.
- The country averaged monthly precipitation is likely to be below normal for Afghanistan and Pakistan and normal to above normal for rest of the South Asian countries for the month September, October, November and December.
- The 2016 SON mean temperatures are likely to be normal over all the South Asian countries except for extreme northern parts of India. The OND mean temperatures shows similar pattern as that of SON with increase in the intensity of the anomalies.
- The country averaged monthly mean temperature is likely to be above normal for all South Asian countries for all months (September, October, November and December)

DISCLAIMER:

- (1) The long range forecasts presented here are currently experimental and are produced using techniques that have not been validated.
- (2) The content is only for general information and its use is not intended to address particular requirements.
- (3) The geographical boundaries shown in this report do not necessarily correspond to the political boundaries.

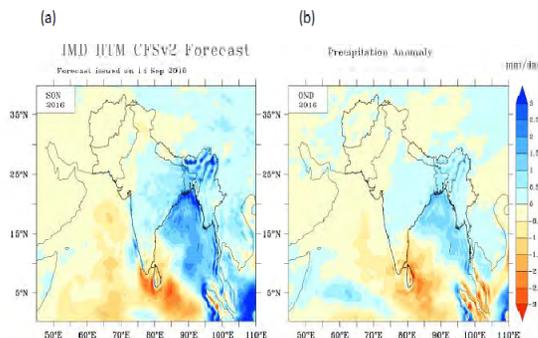


Fig. 5: Seasonal forecasts of precipitation anomalies (mm/day) for (a) SON and (b) OND (right) based on Initial conditions of August 2016.

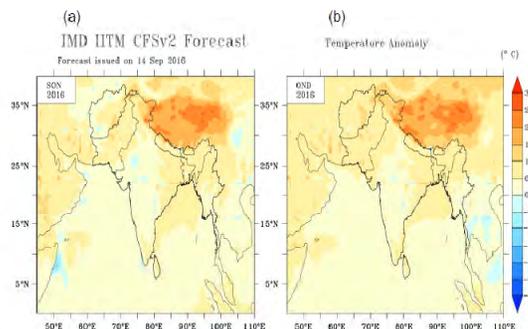


Fig. 6: Seasonal mean temperature anomalies (°C) for (a) SON and (b) OND (right) based on Initial conditions of August 2016.

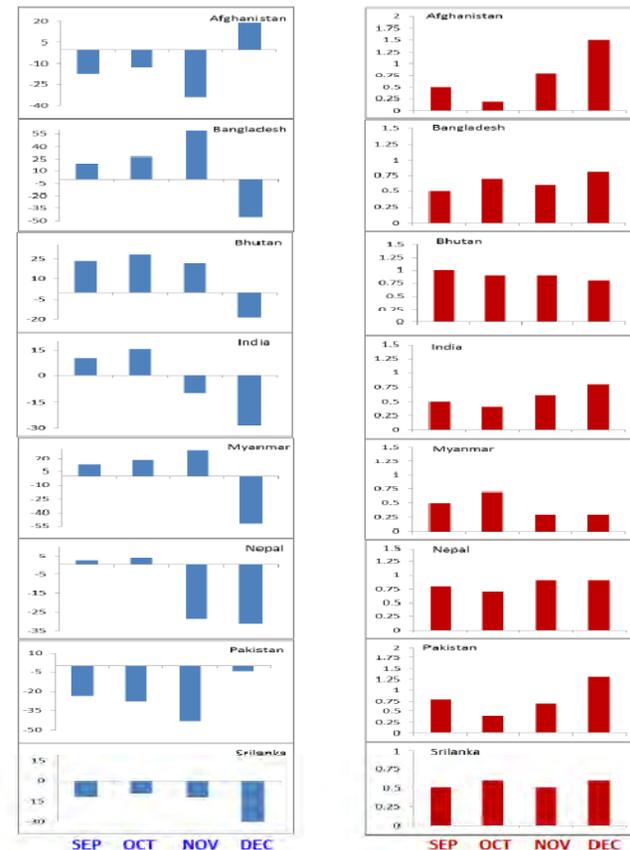


Fig. 7: Monthly country averaged rainfall forecast expressed as percentage departures (%) during September to December, 2016 (Normal % departure range $10 \geq 0 > -10$).

Fig. 8: Monthly country averaged temperature anomaly (°C) forecast during September to December, 2016 (Normal anomaly range $0.25 \geq 0 > -0.25$).



Verification of the Consensus Forecasts

- ❖ Since the first SASCOF session in 2010 to till date, there have been some changes in the content, methodology and presentation of the consensus forecast outlook for the south Asia.
- ❖ In the first year (2010), the consensus forecast outlook did not present probability forecast map and the forecast consisted of only rainfall forecast for the south Asia as a whole and no mention about the spatial distribution of season rainfall was made.
- ❖ From 2011 onwards probability forecast map and statement indicating probability forecast for regional rainfall distribution. During 2011-2015, the probability forecast map depicted areas of most likely rainfall categories (below normal, normal and above normal using yellow, green and blue colour shades) over the region, as well as the probabilities for each tercile categories over broad areas of same colour shade.
- ❖ From 2016 onwards the probability forecast map depicted grid wise most likely tercile category 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.



Verification of the Consensus Forecasts

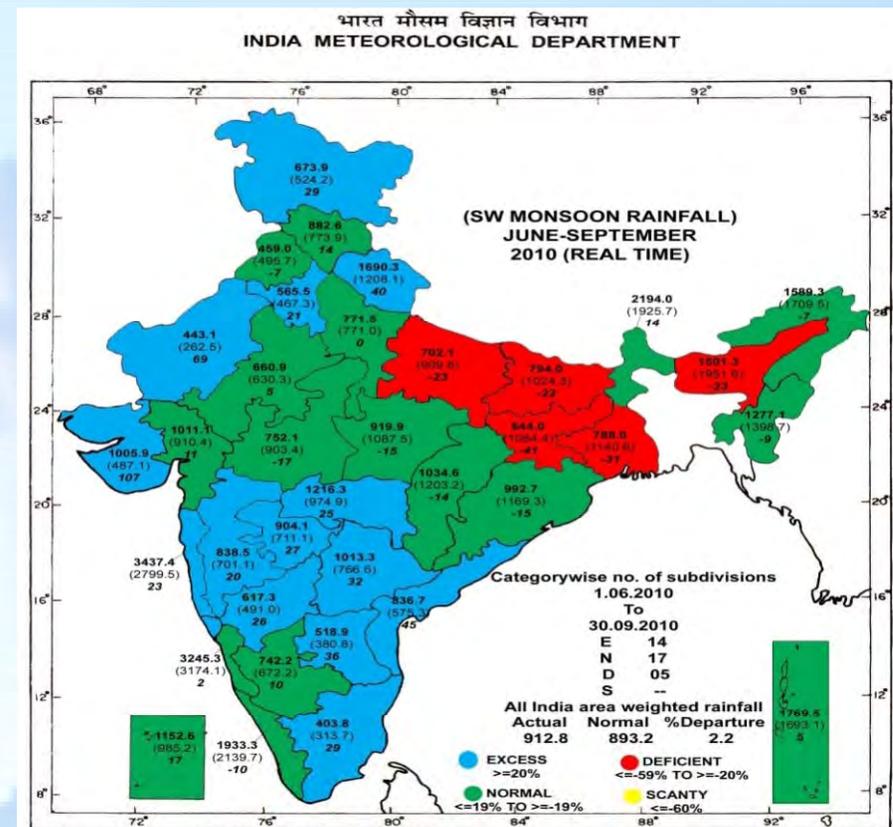
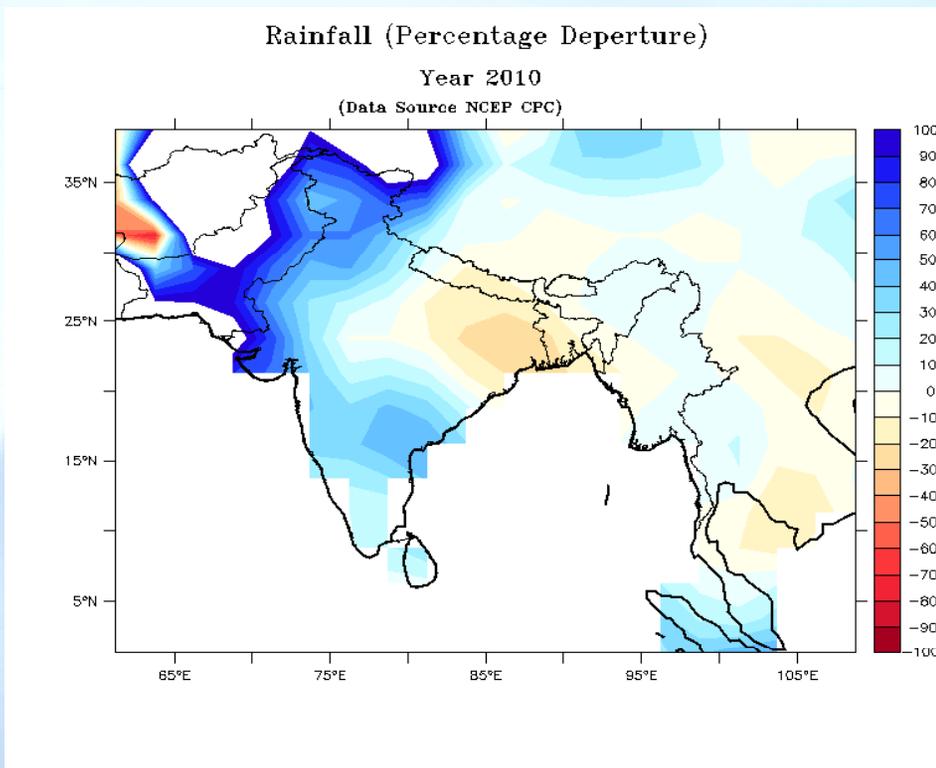
- ❖ The verification of the consensus forecast maps for seasonal rainfall issued during the last six years (2011-2016) is given in the next few slides. It can be seen that in most of the cases, the performance of the large scale rainfall anomaly over the region during the season was correctly indicated by the consensus forecasts. However, some differences were noticed in the forecast for the regional rainfall distribution. It may be mentioned that consensus forecasts were able to correctly indicate the below normal southwest monsoon season (June to September) rainfall over the region during the years 2014 & 2015 as well as the above normal northeast monsoon season (October to December) rainfall over the southern part of the region.



Verification of Forecast for South Asia - 2010

- ❖ Forecast: Based on the prevailing global climate indicators and forecasts from statistical and global dynamical models, rainfall over South Asia, in general, is likely to be within the normal range (No forecast map were produced).

GPCP PRECIPITATION ANOMALY: JJAS 2010



Arrived based on both Statistical and Dynamical Model Forecasts



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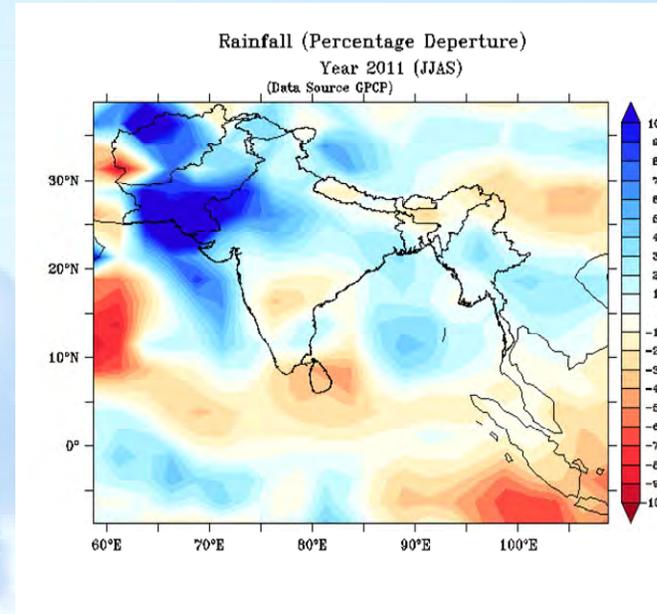
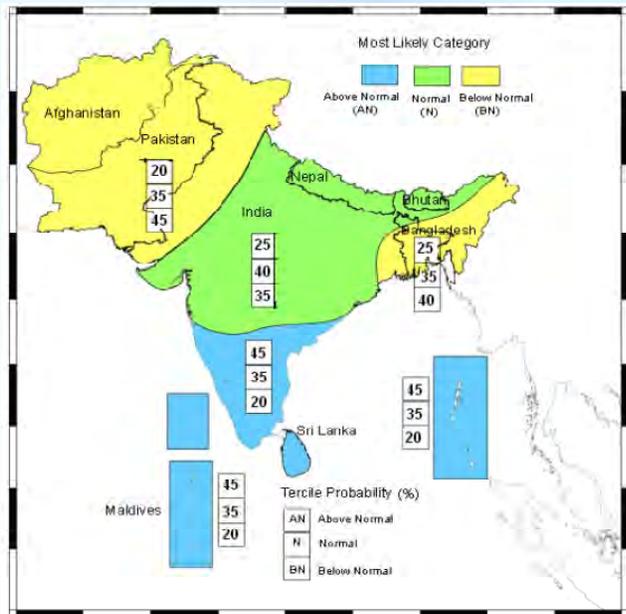


Verification of Forecast for South Asia - 2011

FCST

OBS

a) JJAS 2011



Forecast: Over South Asia, for the season as a whole, the large-scale summer monsoon rainfall would most likely be within the normal range. There is slightly enhanced likelihood for below normal rainfall conditions over the northwestern parts and some northeastern parts of South Asia. On the other hand, there is slightly enhanced likelihood of above normal rainfall over the southern parts of South Asia including the islands. Rainfall conditions close to the normal are more likely over the remaining parts of South Asia.



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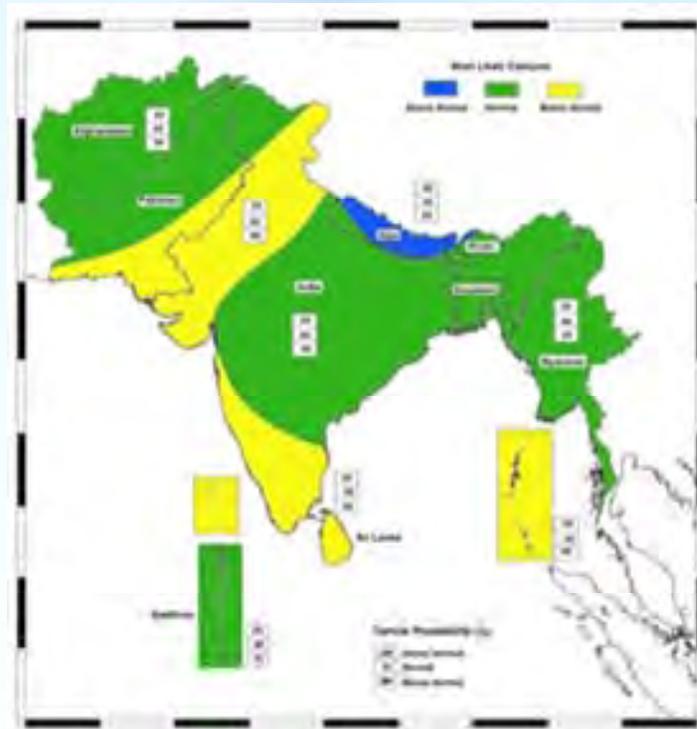
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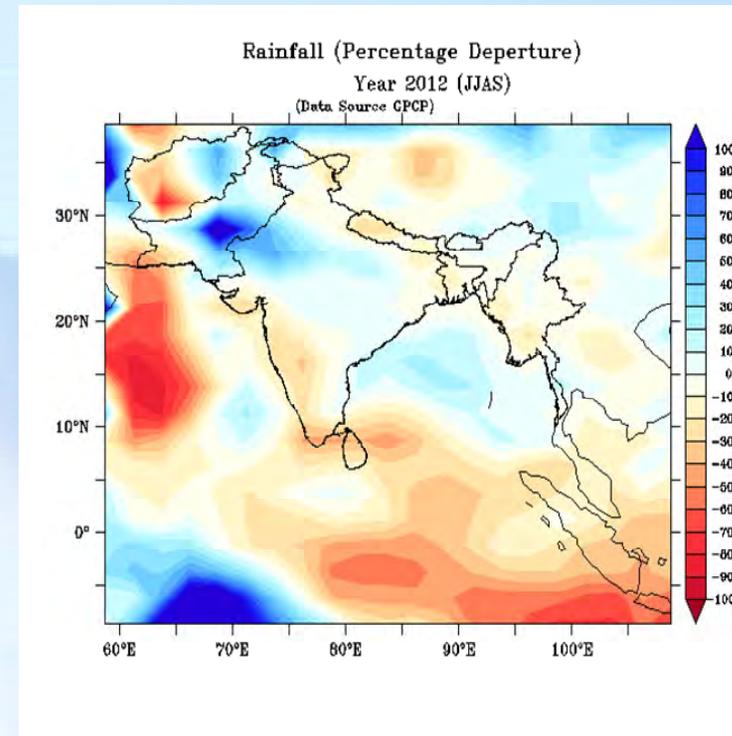
Verification of Forecast for South Asia - 2012

FCST

a) JJAS 2012



OBS



Forecast: Over South Asia and for the season as a whole, the large-scale summer monsoon (June to September) rainfall would most likely be normal. However, the expert assessment also noted a slight tendency for the South Asian summer monsoon rainfall to be below normal. There is slightly enhanced likelihood for below normal rainfall conditions over some broad areas of northwestern and southern parts of South Asia. Rainfall conditions close to the normal are more likely over the remaining parts of South Asia



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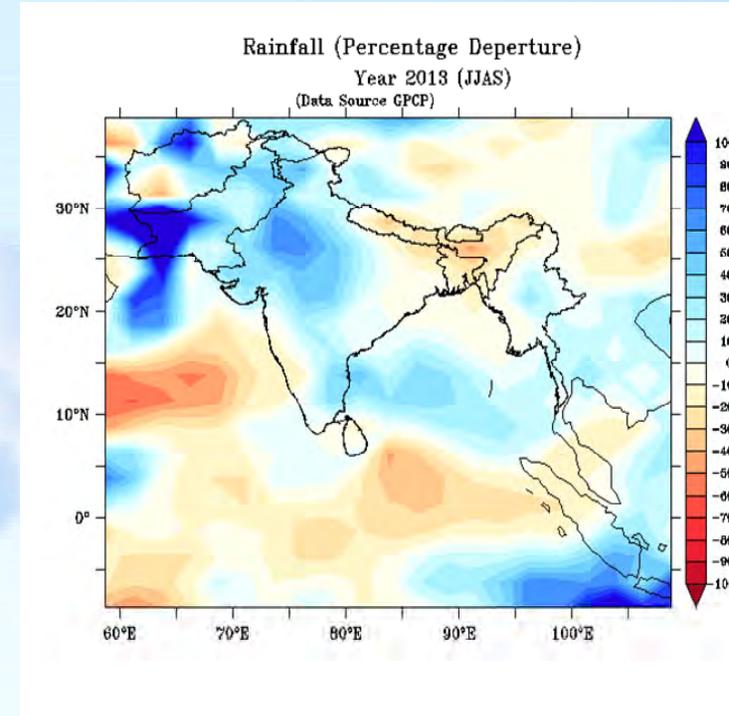
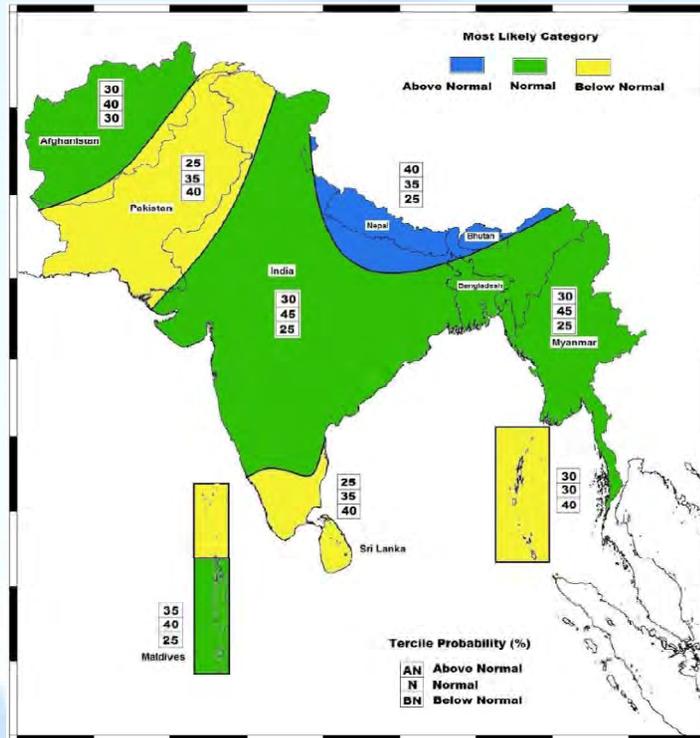


Verification of Forecast for South Asia – JJAS 2013

FCST

OBS

a) JJAS 2013



Forecast: The large-scale summer monsoon rainfall for South Asia and the season (June – September) as a whole will most likely be within the normal range with a slight tendency towards the higher side of the normal range.

In terms of spatial distribution of rainfall, the more likely scenario is for below normal rainfall over some areas of northwestern and southern parts of South Asia and for above normal rainfall over some areas along the Himalayan region. Rainfall conditions close to the long-period average are more likely over the remaining parts.

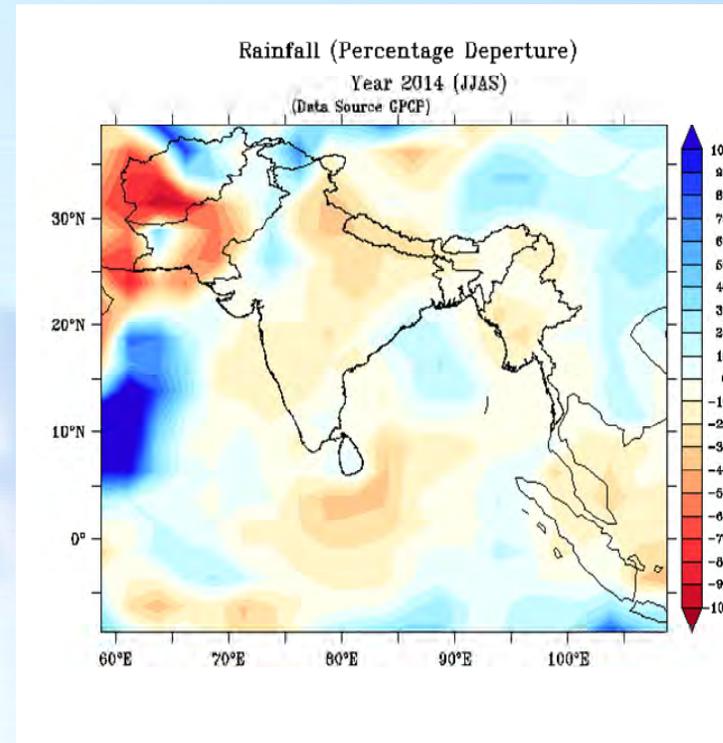
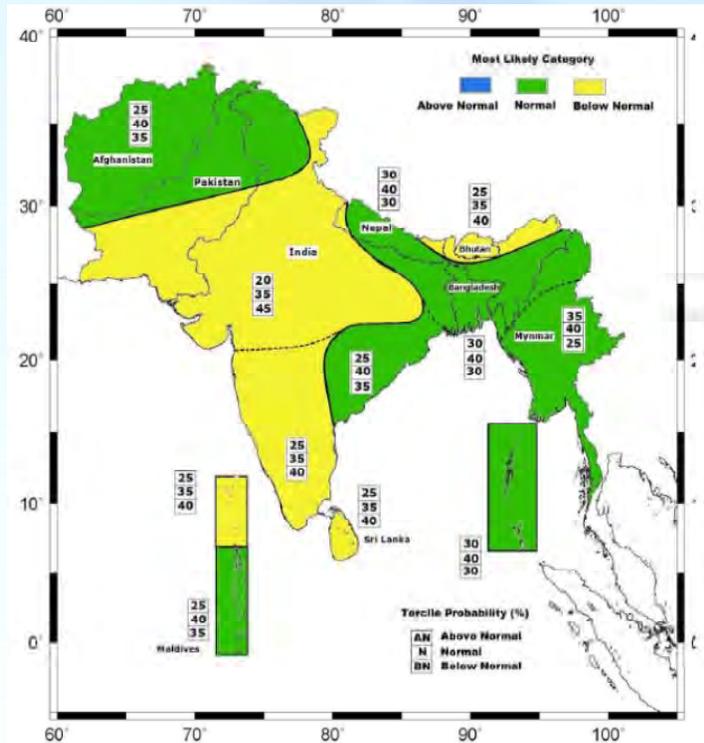
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Verification of Forecast for South Asia – JJAS 2014

a) JJAS 2014

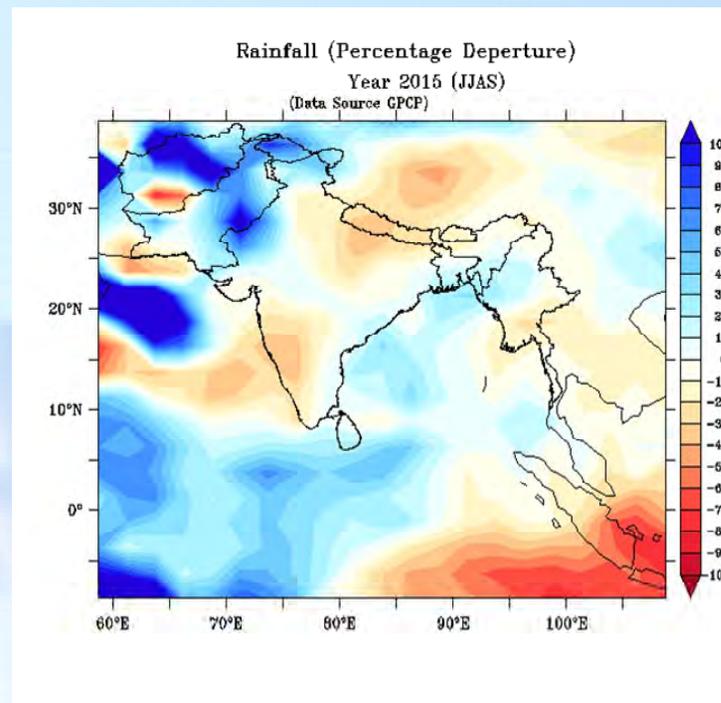
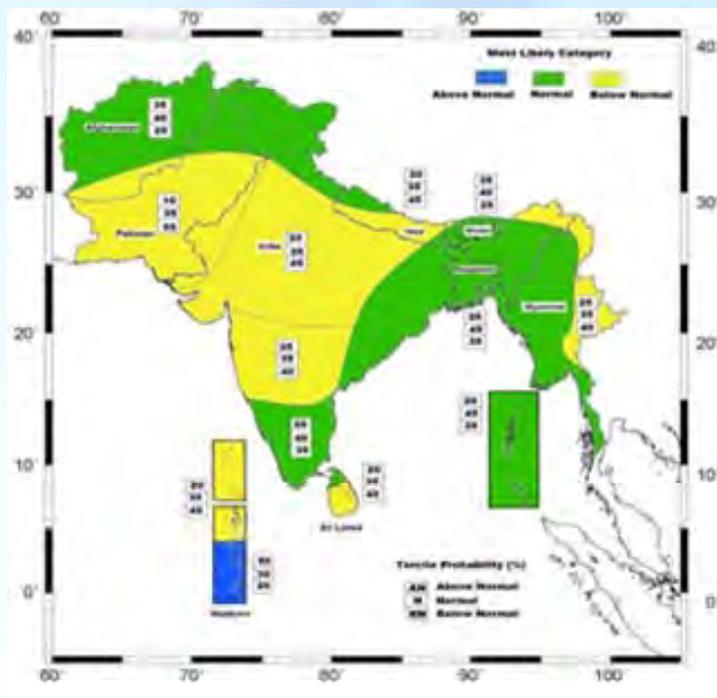


Below-normal to normal rainfall is most likely during the 2014 summer monsoon season (June – September) over south Asia as a whole. Below-normal rainfall is likely over broad areas of western, central and southwestern parts of South Asia and some areas in the northeastern-most parts of the region. Normal rainfall is likely over broad areas of northwestern and eastern parts and some island areas in the southernmost parts of the region.



Verification of 2015 SW monsoon consensus Forecast

a) JJAS 2015



The observed rainfall for the 2015 southwest monsoon season was below normal over most parts of the south Asia except over some northeastern parts of 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.



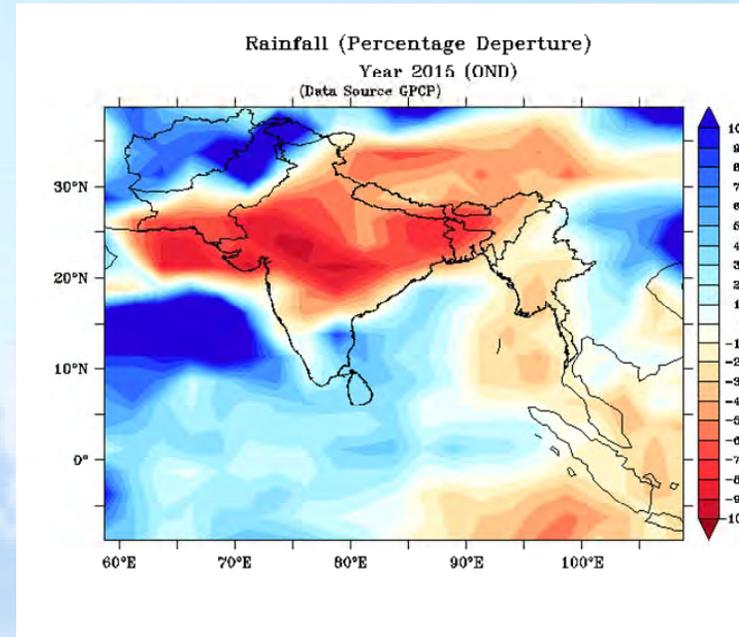
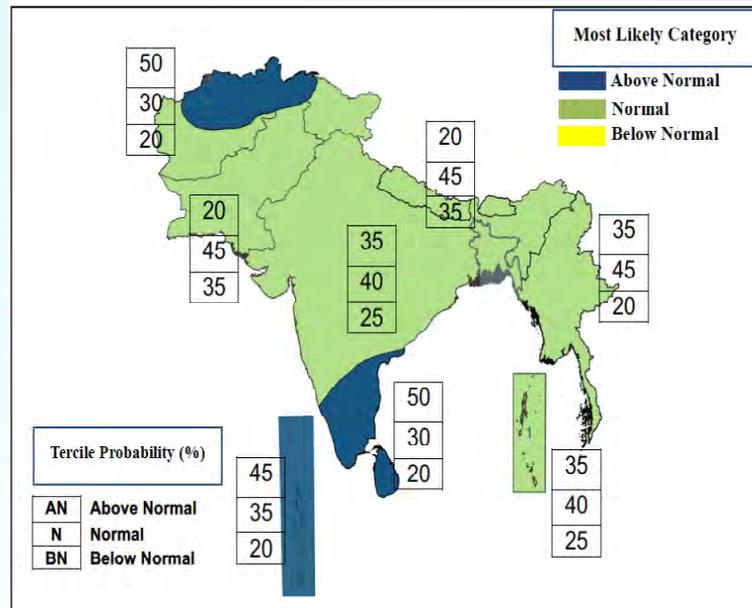
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Verification of 2015 NE monsoon consensus Forecast

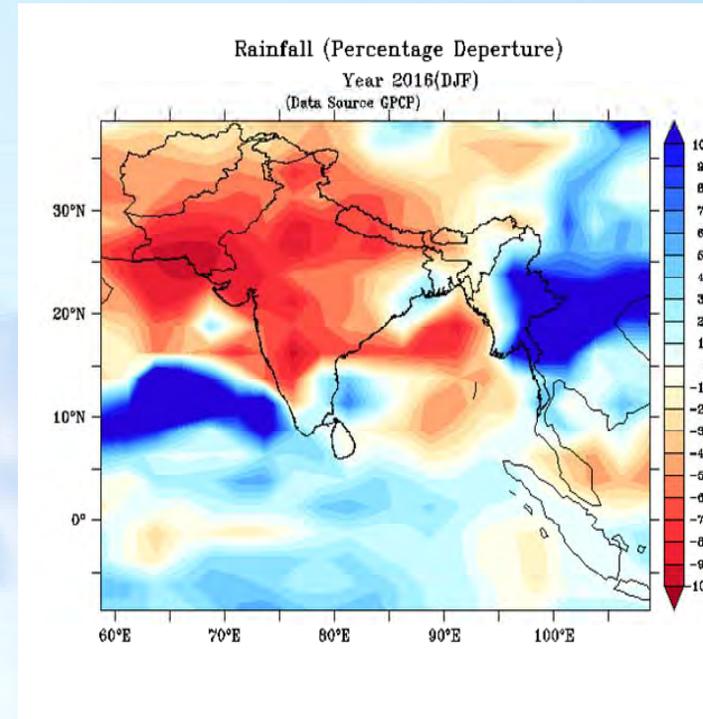
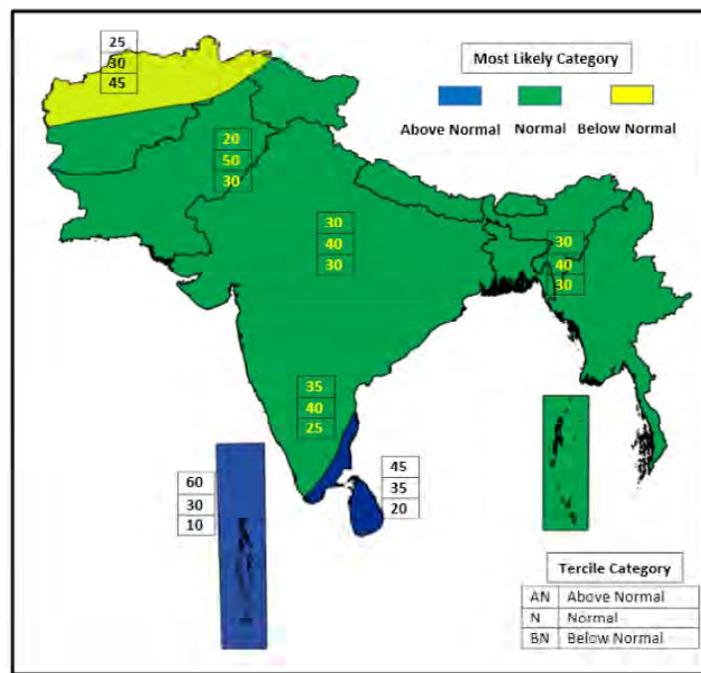
a) OND 2015



Normal to above normal rainfall is likely during the 2015 Northeast monsoon season (October–December) over southern parts of South Asia including southeast peninsular India, Sri Lanka and Maldives. Above normal rainfall is likely over northern most parts of the region. Other areas of the region that generally receive very little rain during the season are likely to receive normal rainfall. During the season, normal to above normal temperatures are likely, over most parts of the region.

Verification of DJF 2015-16 consensus Forecast

a) DJF 2015-16

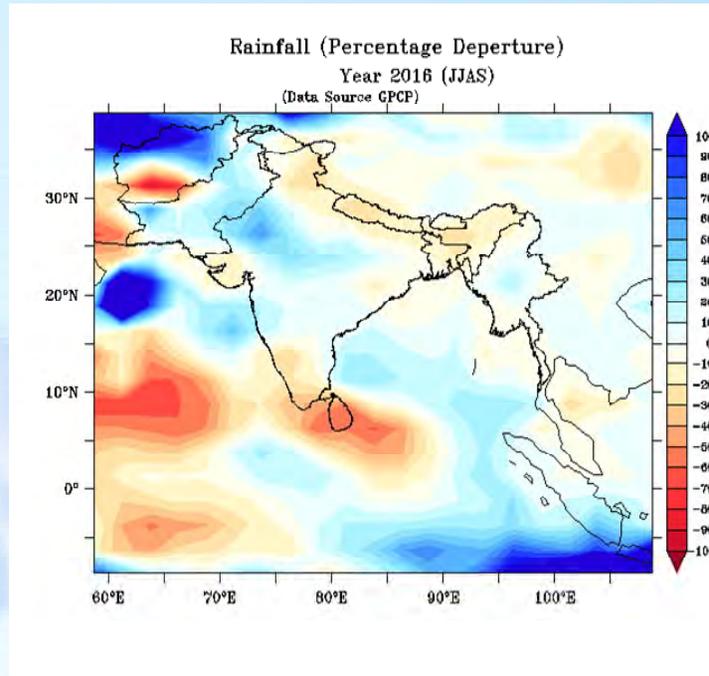
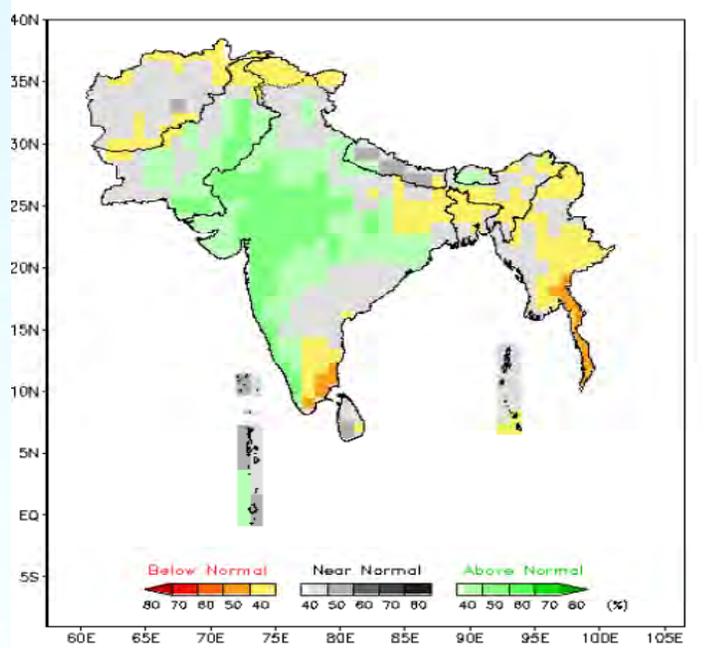


Above normal rainfall is likely during the Winter Season (December 2015 to February 2016) over southern parts of South Asia including Sri Lanka, Maldives and neighboring Lakshadweep Island region. Below normal precipitation is likely over the northernmost part of south Asia. Other areas of the region are likely to receive normal precipitation. During the season, normal to above normal temperatures are likely, over most parts of the region.



Consensus forecast of 2016 SW Monsoon Rainfall

a) JJAS 2016



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.

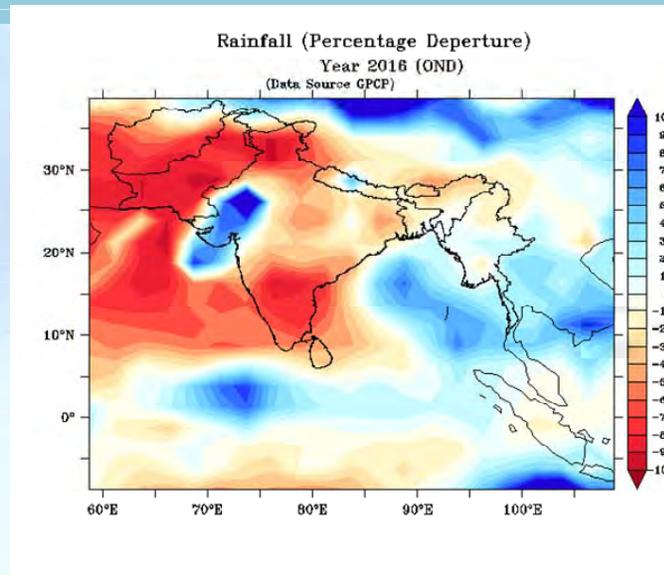
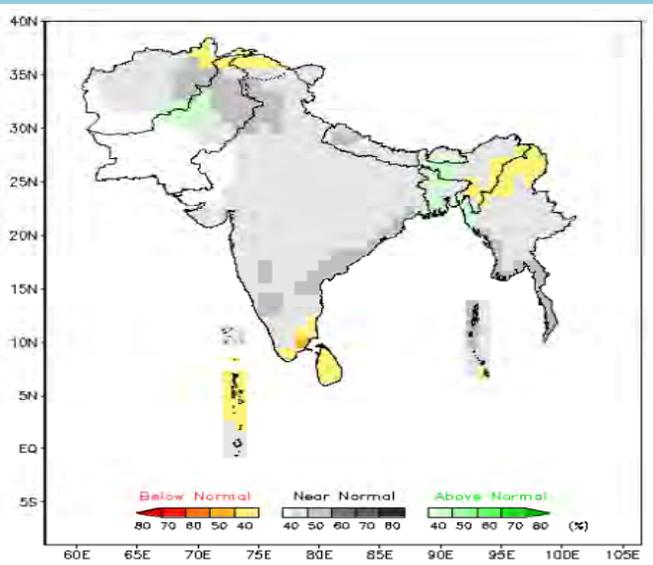
Below-normal rainfall is most likely over eastern parts of the region and the southeastern part of the peninsula.

Normal rainfall is most likely over the remaining areas.



OND 2016 & DJF 2016-17

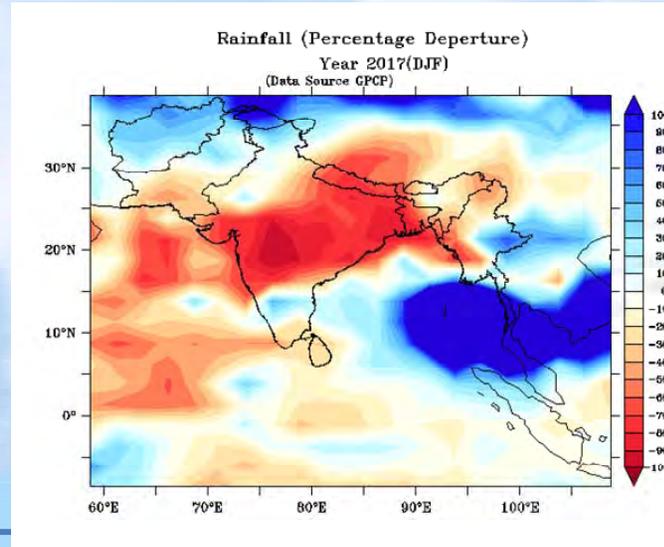
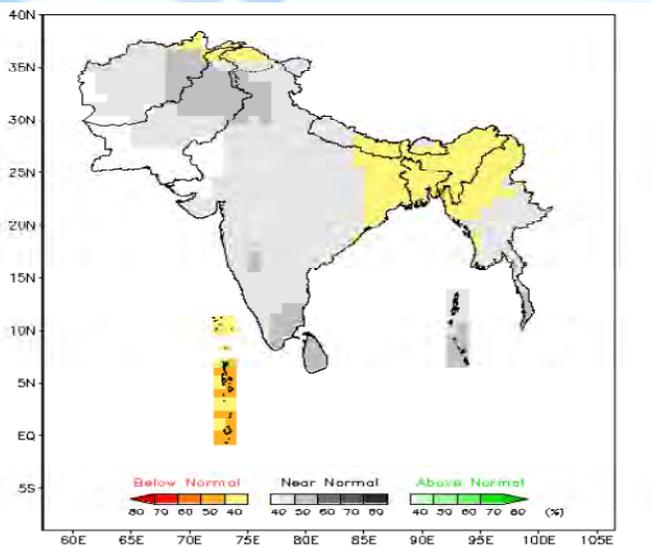
a) OND 2016



Normal rainfall is most likely over most parts of south Asia during the 2016 Northeast monsoon season (October – December). However, below normal rainfall is likely over some areas of southeast peninsular India, Sri Lanka and Maldives. Below normal rainfall is also likely over some areas of north and eastern parts of the region. Above normal rainfall is likely over western and northwestern parts of Pakistan and some northeastern parts of the region.

During the season, normal to slightly above normal temperatures are likely, over most parts of the region.

b) DJF 2016-17

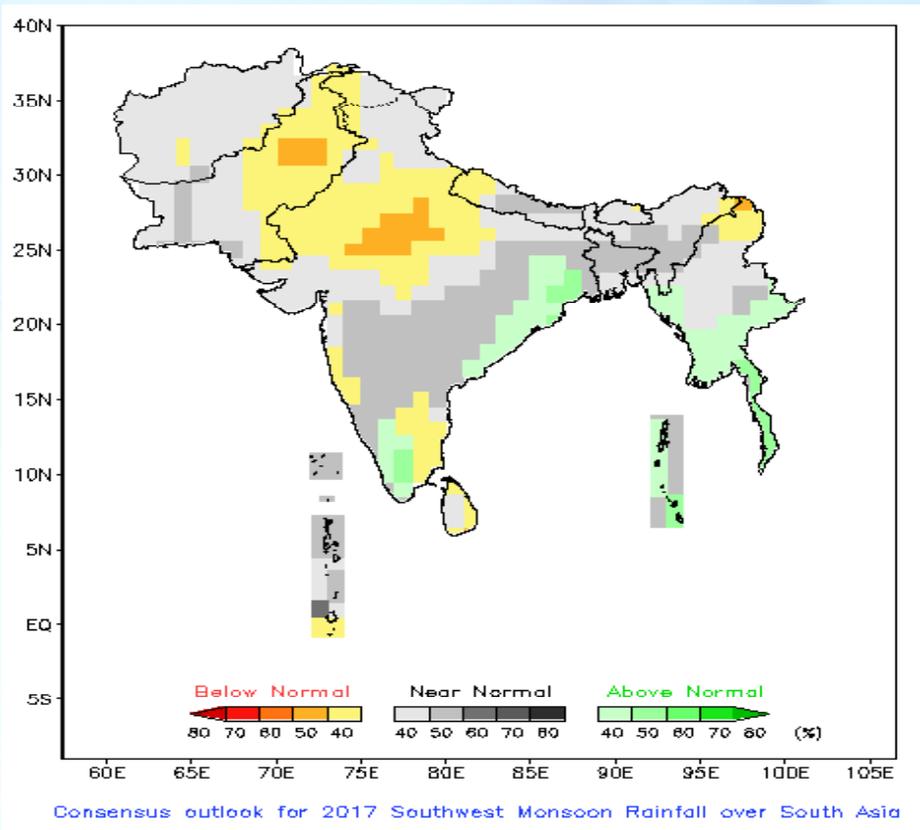


Below normal precipitation is likely during the Winter Season (December 2016 to February 2017) over northern most parts of the south Asia, Maldives & neighboring Lakshadweep, and northeastern parts of South Asia including northeast India, east Nepal, Bhutan, and northern parts of Myanmar. Normal precipitation is likely over the remaining parts of the region.

During the season, normal to above normal temperatures are likely, over most parts of the region.



Consensus Rainfall Probability Forecast



- Normal rainfall is most likely during the 2017 southwest monsoon season (June – September) over much of South Asia.
- More specifically:
 - Below-normal rainfall is most likely over broad areas of north-western, central and south-eastern parts of South Asia.
 - Above-normal rainfall is most likely over broad areas of eastern and the south-western parts of the region.
 - Normal rainfall is most likely over the remaining areas.

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



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Way Forward

- Currently under the SASCOF, a consensus forecast is issued in mid-April for the Southwest monsoon season rainfall over South Asian countries. There is user demand for an update of this forecast in the later months. There is also demand consensus forecast for all the seasons.
- Currently, the training workshops associated with the forum session mainly concentrate on seasonal prediction. In the future, training workshops will also be conducted on other topics such as the construction of long time series of gridded climate data over the region, extended range prediction, climate applications and climate impact assessment.
- Efforts will also be made to have more interaction with the user community and generation of tailored climate products for the users.





Thank you



11/14/2019

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