

27th Session of South Asian Climate Outlook Forum (SASCOF-27)

**29th November 2023
(Online)**

Consensus Statement on the Forecast for December 2023 to February 2024 (DJF 2023/24) Season Rainfall and Temperatures over South Asia

Summary

Above-normal precipitation is likely during the winter season (December 2023 to February 2024) over many regions of South Asia especially over parts of the north, northwest, along the foothills of the Himalayas, and the northeastern part of South Asia. Below normal precipitation is likely over the parts of the western region and some regions of the northeast and southern part of South Asia

During the season, above normal minimum temperatures are likely over most areas of South Asia. Normal to Above normal maximum temperatures are most likely over many area of South Asia especially over north, northwest, south, northeast regions and along the Himalayas. Below normal maximum temperatures are likely over central part of the region and foothills of Himalaya.

This consensus climate outlook for December 2023 to February 2024 (DJF 2023/24) season over South Asia has been developed through an expert assessment of the prevailing global climate conditions influencing the South Asian climate and seasonal forecasts from different climate models around the world. Currently, strong El Niño conditions are prevailing in the tropical Pacific Ocean, and positive Indian Ocean Dipole (IOD) conditions are prevailing over the Indian Ocean. These parameters are known to influence the climate variability over South Asia. The El Niño is likely to continue during the DJF 2023/24 season but the positive IOD is likely to weaken and turn to neutral by the DJF 2023/24 season. Careful consideration is also given to other regional and global factors as well as the intraseasonal variability of the region that can affect the rainfall and temperature patterns over the region.

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

Introduction

During the winter season (December to January), northern parts of South Asia receive a good amount of precipitation in the form of both snow and rain. The southern part of the region consisting of the southeastern part of India, Sri Lanka, and the Maldives also receive a good amount of rainfall during the season. Most of the remaining areas of the region generally receive very little precipitation during the season. It is recognized that the seasonal predictability of the region during the season is limited to some extent by the strong day-to-day atmospheric variability. The day-to-day atmospheric variability over the northern (southern) part of the region is caused by the passage of disturbances in the mid-latitude westerlies (tropical easterlies). The seasonal predictability over the southern part of the region is also limited by the eastward-moving Madden Julian Oscillation (MJO), which represents the major global scale intra-seasonal variability pattern.

The climate outlook for December 2023 to February 2024 (DJF 2023/24) season was finalized during the 27th session of the South Asian Climate Outlook Forum (SASCOF-27) held on 29th November 2023 via video conferencing. The session was attended by experts representing the National Meteorological and Hydrological Services (NMHSs) of all the nine South Asian countries as well as those representing several global and regional climate agencies including WMO Regional Climate Centre (RCC) Pune and Regional Integrated Multi-hazard Early-warning System (RIMES). The online forum deliberated on various observed and emerging climate forcing that are known to influence the climate variability of the region such as the El Niño/Southern Oscillation (ENSO) conditions over the equatorial Pacific, Indian Ocean Dipole (IOD) conditions over the Indian Ocean, etc. The key features of these climate forcing are briefly discussed below.

ENSO conditions over the Pacific Ocean

The El Niño/Southern Oscillation (ENSO) is one of the global scale climate phenomena having a significant influence on the year-to-year variability of the winter precipitation as well as the surface temperatures over South Asia. The Nino3.4 Sea Surface Temperature anomaly for the last 12 months indicates the La Niña conditions were prevailing till early this year. Thereafter ENSO neutral conditions were observed over the Pacific Ocean from February to May 2023 and Weak El Niño conditions developed during June and July 2023. However, the El Niño conditions strengthened

during August & September 2023. At present strong El Niño conditions are prevailing over equatorial Pacific Ocean. The latest forecasts from global climate models indicate a strong probability for El Niño conditions likely to continue during the winter season (DJF).

IOD Conditions over the Indian Ocean

In addition to ENSO conditions over the Pacific, other factors such as Indian Ocean sea surface temperatures have some influence on the climate variability of the region. The Dipole Mode Index (DMI) for the last 12 months indicates that the negative DMI value weakened from November 2022 to December 2022 and then the neutral IOD conditions were observed between January and July 2023. However, positive IOD conditions developed during August 2023 and continued in October 2023. Forecasts from global climate models indicate a strong probability for weakening positive IOD and turn to neutral conditions during the winter season (DJF).

Consensus Outlook for December 2023 to February 2024 (DJF 2023/24) Season Rainfall and Temperature (Minimum & Maximum) over South Asia

A consensus outlook for December 2023 to February 2024 season rainfall over South Asia has been prepared based on the expert assessment of prevailing large-scale global climate indicators mentioned above and experimental as well as operational long-range forecasts based on statistical and dynamical models generated by various operational and research centers of the world.

During the season, the climate of the region is also generally get influenced by the strong day-to-day atmospheric variability. Therefore, it is recognized that there is large uncertainty in the prediction of winter precipitation over the region. It was also recognized that SSTs over the Pacific (such as ENSO) are not the only factor that decides the performance of the winter season climate over the region. Other relevant climate drivers such as the state of the Indian Ocean Dipole (IOD), the Tropical Atlantic SST, etc. are also important. The relative impact of all these parameters needs to be considered to determine the expected state of the climate over the region during the season. There is unanimity among the experts that the prevailing El Niño conditions in the equatorial Pacific Ocean are likely to continue during the winter season but the positive Indian Ocean Dipole conditions over the Indian Ocean are likely to weaken and turn to neutral during the winter season. However, the impact of El Niño on the

winter season precipitation over northern parts of South Asia is not very clear particularly due to strong day-to-day atmospheric variability over the region.

The outlook for the 2023/24 winter season precipitation and Temperature (Minimum & Maximum) over South Asia is shown in **Fig.1a-c**. The figures illustrate the most likely tercile category¹ 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 using an objective approach from an initial set of gridded forecasts from multiple GCMs and consolidated through a consensus-building discussion among climate experts.

The outlook suggests that during the winter season December 2023 to February 2024 (DJF 2023/24) season, above normal precipitation is likely during the winter season (December 2023 to February 2024) over many regions of South Asia especially over parts of the north, northwest, along the foothills of the Himalayas, and the northeastern part of South Asia (**Fig.1a**). Below normal precipitation is likely over the parts of the western region and some regions of the northeast and southern part of South Asia. The rest of the region is likely to experience normal rainfall or have climatological probabilities.

The consensus outlook on minimum temperatures for December 2023 to February 2024 season indicates that above normal minimum temperatures are likely over most areas of South Asia (**Fig.1b**).

The consensus outlook on maximum temperatures for December 2023 to February 2024 season suggests that above normal maximum temperatures are most likely over many area of South Asia especially over north, northwest, south, northeast regions and along the Himalayas (**Fig.1c**). Below normal maximum temperatures are likely over parts of the central and foothills of Himalaya.

As the rainfall and temperature during the winter season depict strong intra-seasonal variability, it is advised to watch the extended-range forecasts along with updated seasonal forecasts for better decision-making. The extended range forecasts for rainfall, temperature, cyclone genesis, MJO, etc. over the region can be obtained from RCC, Pune website (<http://rcc.imdpune.gov.in/exrange.html>). These forecasts are updated every week.

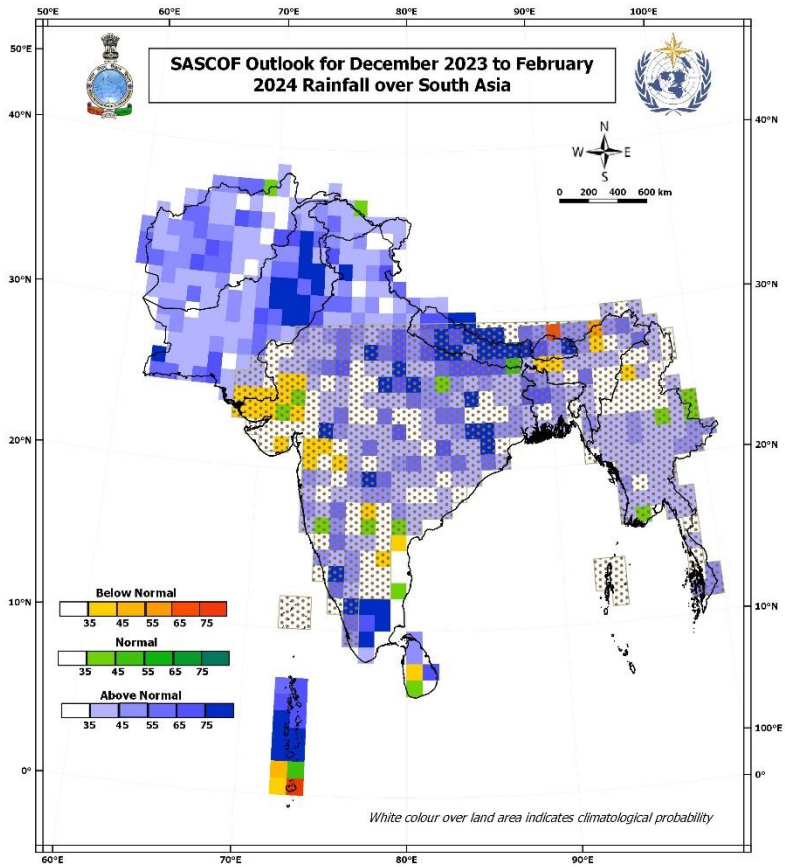


Fig.1a. Consensus outlook for the winter season (December 2023 to February 2024) precipitation over South Asia. The dotted area shown in the map climatologically receives very low rainfall and experiences dry weather during the DJF season.

¹Tercile categories have equal climatological probabilities, of 33.33% each

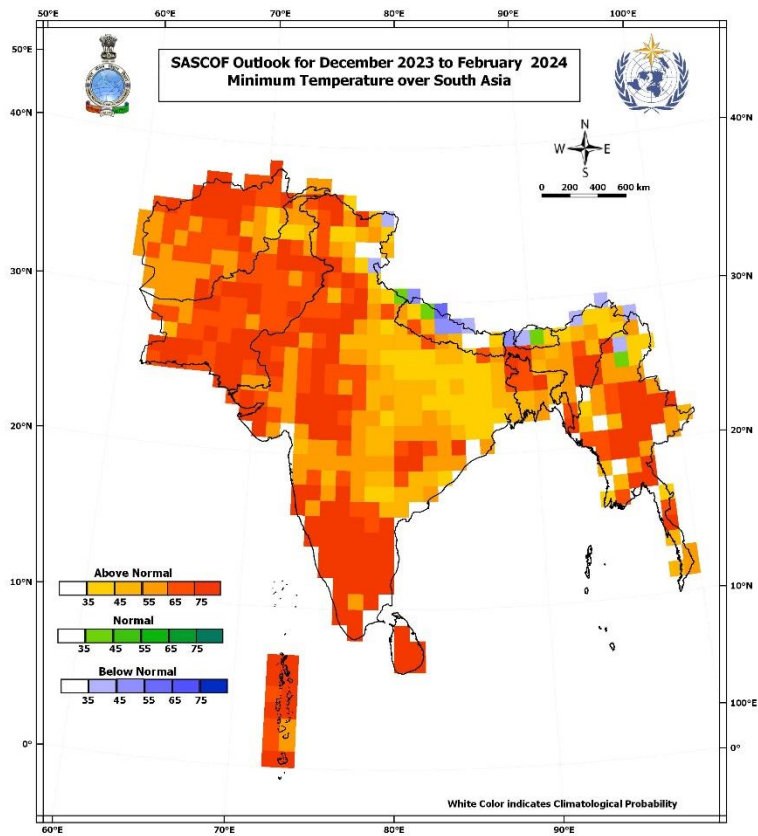


Fig.1b. Consensus outlook for the winter season (December 2023 to February 2024) Minimum Temperature over South Asia.

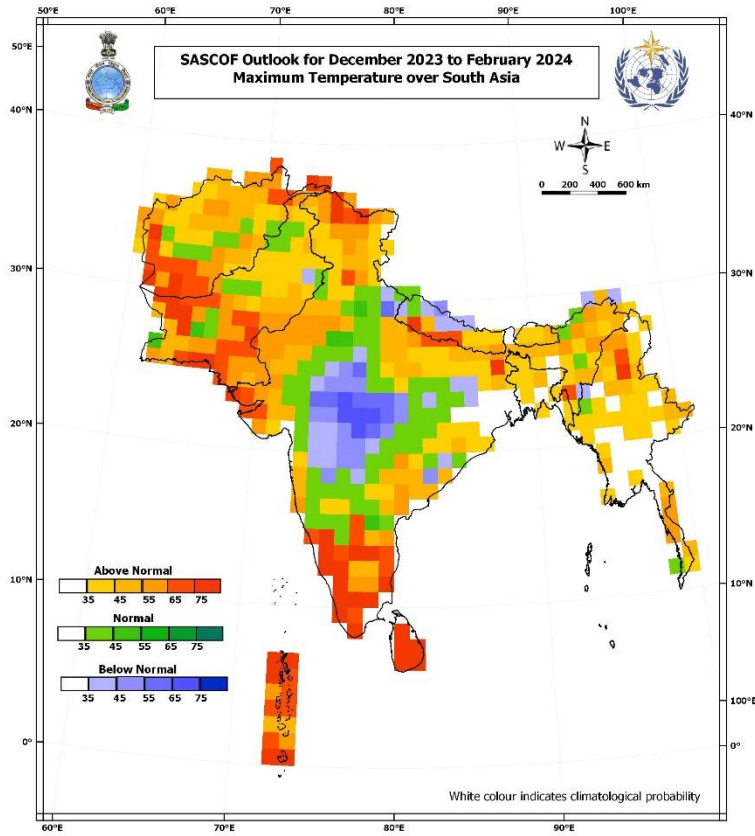


Fig.1c. Consensus outlook for the winter season (December 2023 to February 2024) Maximum Temperature over South Asia.

Climatological Information of Rainfall and Temperature (Maximum & Minimum) over South Asia during the December to February Season.

The long-term historical patterns of the rainfall over South Asia during the December to February Season (Fig.2 a & b), characterized by remarkable spatial variability, provide the general reference points at the respective locations for the rainfall anomalies indicated in the outlook. The long-term historical patterns of the Temperature (Minimum and Maximum) over South Asia during the December to February Season (Fig.3 a & b), characterized by large spatial variability, provide the general reference points at the respective locations for the temperature anomalies indicated in the outlook.

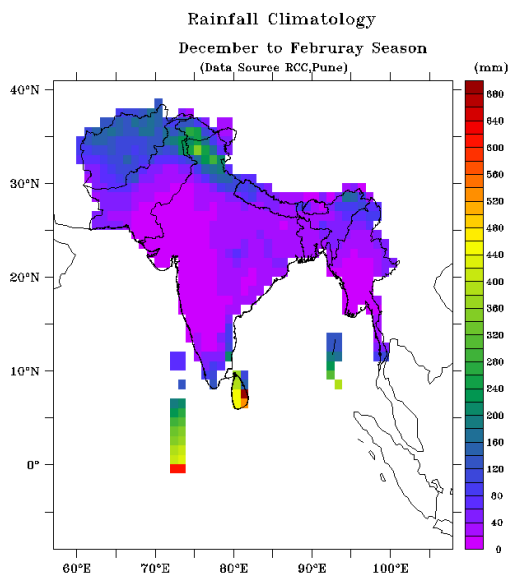


Fig.2 (a) Rainfall climatology for the period 1982-2019 for December to February Season over South Asia

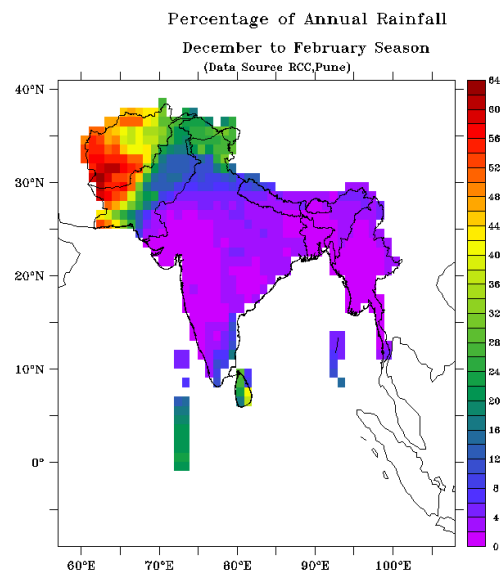


Fig.2 (b) Percentage of annual rainfall for December to February Season over South Asia.

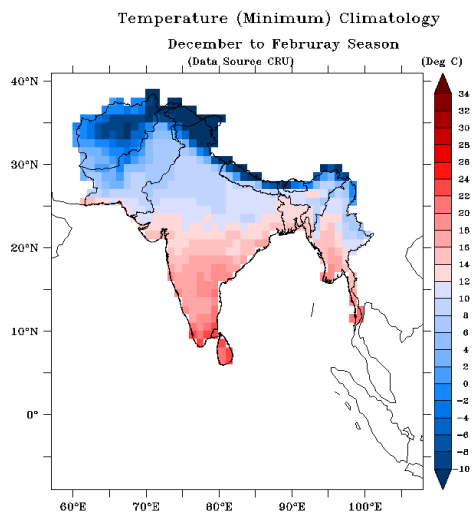


Fig.3 (a) Minimum Temperature climatology for the period 1982-2019 for December to February Season over South Asia

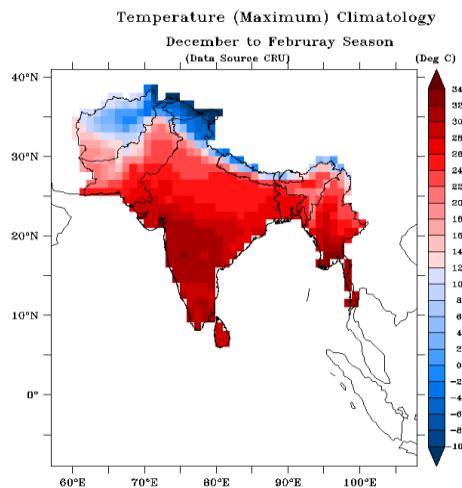


Fig.3 (b) Maximum Temperature climatology for the period 1982-2019 for December to February Season over South Asia