REPORT

Evaluation of Drought Prediction in South Asia Drought Management System (SADMS): Assessment over India in Kharif 2025

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Front cover photo: Cracked farmland in the Indian state of Gujurat (photo credit: Hamish John Appleby/IWMI)
Back cover photo: Women farmers planting millet, a climate-resilient and water-efficient crop, in Keonjhar, Odisha (photo credit: Tanmoy Bhaduri/IWMI)

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Contents

Evaluation of Drought Prediction in South Asia Drought Management System (SADMS): Assessment over India in Kharif 2025

Summary

The Kharif 2025 season was marked by strong spatial and temporal variability in monsoon rainfall across India, leading to moderate to severe meteorological drought conditions in several regions. Despite India Meteorological Department (IMD) seasonal forecasts indicating an above-normal monsoon under neutral El Niño-Southern Oscillation (ENSO) and Indian Ocean Dipole conditions, the realized rainfall deviated significantly, with erratic monsoon behavior causing sustained rainfall deficits and prolonged dry spells. Satellite-based monitoring through the South Asia Drought Management System (SADMS) confirmed widespread seasonal stress, with drought indicator assessments and fortnightly outlooks indicating progressive drought propagation. Extended dry spells during July–August 2025 coincided with critical crop growth stages, increasing agricultural vulnerability across Northern Bihar, Eastern Uttar Pradesh, Assam, and parts of Northeastern India.

District and state level assessments demonstrated the operational value of the SADMS for drought early warning. In Uttar Pradesh, the 14-day lead forecasts captured broad spatial variability in rainfall deficits with moderate skill, with about one-third of districts experiencing seasonal shortfalls. Bihar recorded a seasonal rainfall deficit of approximately 31%, with SADMS achieving a categorical accuracy of about 75% in identifying drought-affected districts, while Assam experienced severe early-season deficits exceeding 40% with moderate forecast performance. The Normalized difference vegetation index (NDVI) analysis from the National Aeronautics and Space Administration (NASA's) Moderate Resolution Imaging Spectroradiometer (MODIS) satellite sensor data made available by SADMS platform revealed widespread negative vegetation anomalies during July–September 2025, particularly in Bihar and Assam, indicating sustained crop stress, while contrasting drought and excess rainfall impacts were evident in eastern and western Uttar Pradesh. Overall, Kharif season in 2025 highlighted increasing climate vulnerability of rainfed agriculture and underscored the importance of integrating forecast-based monitoring, satellite indicators, and ground observations to strengthen drought preparedness and inform timely mitigation and planning for the Rabi 2025–26 season.

Introduction

The Kharif 2025 season was marked by uneven but concentrated rainfall distribution across India, with several regions experiencing moderate to severe drought conditions. Multiple forecasts suggested early onset and excess rainfall across India at the beginning of the season. However, erratic monsoons and satellite-based monitoring have confirmed rainfall deficits, vegetation stress, and soil moisture anomalies across multiple districts in Northern Bihar, Eastern Uttar Pradesh, and the Northeastern belt of India (Assam, Meghalaya, and parts of Nagaland and Arunachal Pradesh). Figure1 shows the status of three-monthly Standardized Precipitation Index indicator [1] (SPI-3) issued on 19 September 2025 by the South Asia Drought Management System (SADMS), representing seasonal meteorological conditions across India.

The IMD issued seasonal forecasts for June – September 2025 in advance in stage-1 (15 April 2025). The stage-1 forecast anticipated above-normal rainfall (>104 %) for the entire country. The Stage-2 forecast for the same period (issued on 27 May 2025) anticipated a similar excess (>106 %) for the entire country. The El Niño-Southern Oscillation (ENSO) and Indian Ocean Dipole conditions were observed to be neutral in both forecasts by the India Meteorological Department (IMD), indicating no significant influence from global weather patterns.

The Drought Prediction Module in SADMS is designed to capture weekly forecasts from National Oceanic and Atmospheric Administration - Global Ensemble Forecast System (NOAA–GEFS) at a 16-day lead time. This capability allows for the monitoring of drought propagation on a fortnightly basis, providing insights that extend beyond the current conditions. The anticipated drought hotspots, derived from fortnightly forecast images for the entire season, are shown in Figure 1. These hotspots indicate the spatial extent of meteorological drought categories, enabling the early identification and proactive management of affected areas. The countrywide propagation of areal meteorological droughts is presented in Figure A1 in Annexure.

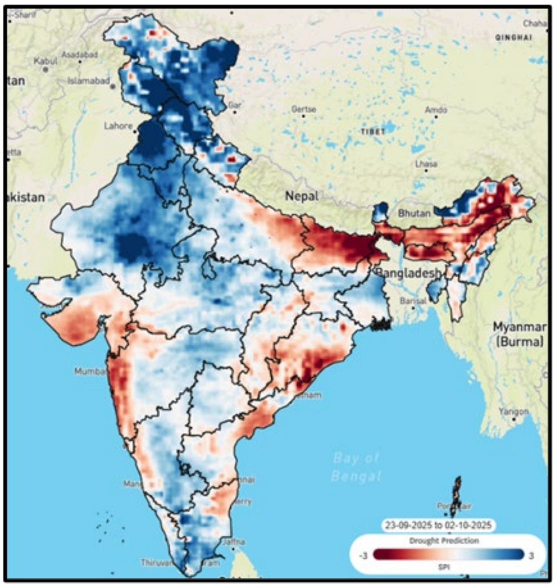

Figure 1: Status of SPI-3 issued on 19 September 2025. (Source: SADMS Drought Prediction).

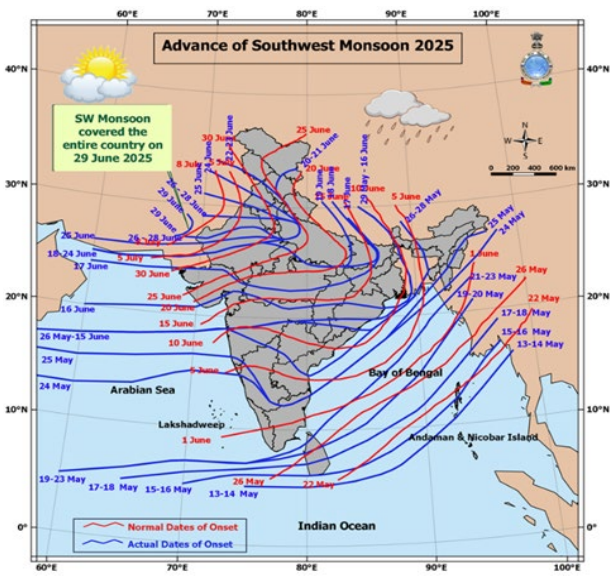

Figure 2: SW monsoon forecast issued on 15 April 2025. (Source: IMD).

Dry spell monitoring insights

The dry spell indicator represents periods of low or no rainfall that can substantially affect agricultural productivity [2]. Unlike long-term droughts, dry spells can occur within the rainy season and disrupt the soil moisture balance essential for crop growth. A comparative analysis of monthly dry spells between June and September for 2024 and 2025 was conducted using the SADMS monitoring tool, as illustrated in Figure 3. The results indicate that Bihar experienced more frequent dry spells in June 2024 than in June 2025. However, July and August 2025 showed notably longer dry spells, lasting 7–10 days, than the same period in 2024. Consequently, kharif crops in Bihar will be exposed to higher stress during the flowering and development stages in 2025. Similar patterns of increased dry spell frequency were observed in Assam and several other northeastern states during June and July 2025, in contrast to 2024. Additionally, the southern states (Tamil Nadu, Andhra Pradesh, Karnataka, and Telangana) experienced higher dry spell occurrences in July 2025 compared to July 2024. Furthermore, Maharashtra and Gujarat experienced prolonged dry spells during the latter half of the kharif season, indicating a wider regional impact of rainfall irregularity in 2025. Overall, the erratic rainfall distribution observed across Bihar, Maharashtra, Gujarat, Northeastern, and Southern India in 2025 deviated from the rainfall trends anticipated in the IMD forecasts.

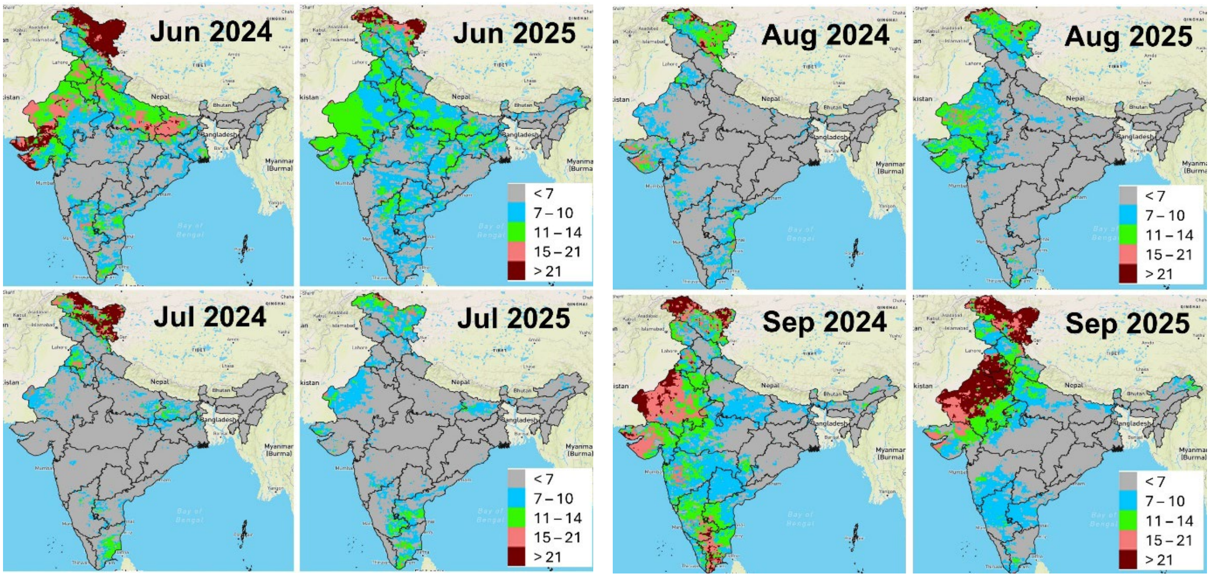

Figure 3: Monthly comparison of dry spell in Kharif (Jun – September) 2024 and 2025.

District-level validation in Uttar Pradesh

Validation of seasonal accumulation

The district-level zonal statistics (spatial averages) were derived in Uttar Pradesh using the monthly accumulated rainfall data of the SADMS 14-day lead forecast and the corresponding observed rainfall records. These datasets were analyzed and compared for June and July 2025 to evaluate the predictive performance of the model. The comparative analysis, illustrated in Figure 4, highlights the accuracy of the forecasted and observed rainfall across different districts. In June 2025, the forecasted rainfall accumulation achieved a coefficient of determination (R^2) of 0.5, whereas in July 2025, the R^2 value slightly decreased to 0.4. These correlation values suggest that the forecast reasonably captured the spatial variability of rainfall at the district level. Although the performance was not exceptional, the results were considered satisfactory for operational early warning applications.

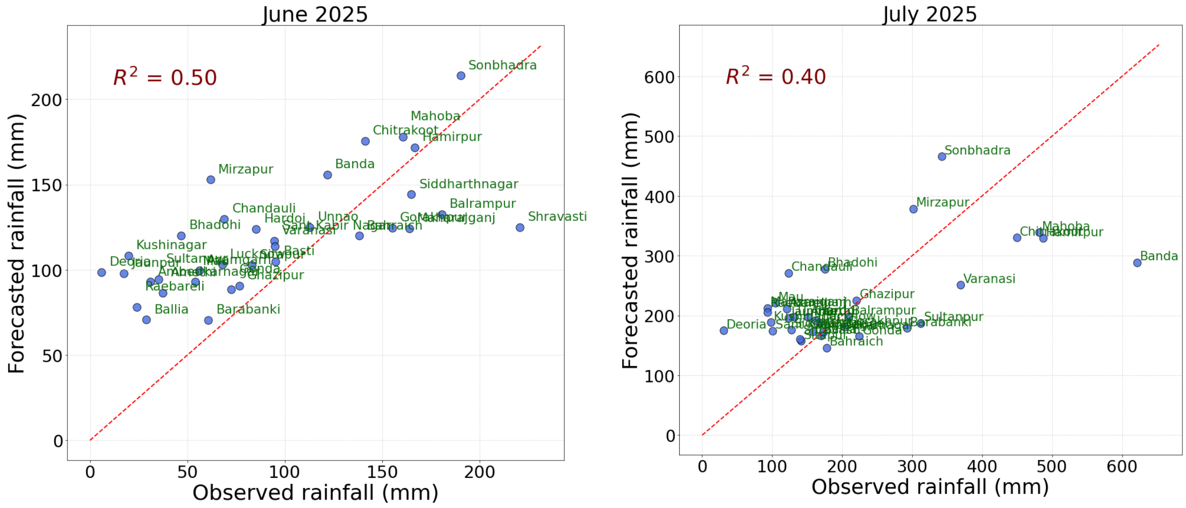

Figure 4: Spatial accuracy of forecasted and observed rainfall across different districts in Uttar Pradesh in early Kharif 2025

Table 1 provides a comprehensive list of the districts in Uttar Pradesh that experienced rainfall deficits during the current Kharif season. Out of the total 77 districts in the state, 25 (approximately 33%) were identified as deficit-hit based on the seasonal rainfall analysis. This highlights the considerable spatial extent of rainfall deficiency across the region. The districts of Deoria, Kushinagar, and Raebareli recorded a large rainfall deficiency, ranging between 60% and 100%, and were marked as being affected by a large deficit. The remaining districts listed in Table 1 experienced deficits with rainfall shortfalls ranging from 20%–60%. These findings indicate a concerning pattern of uneven rainfall distributions. The observed deficit is expected to have significant implications for agricultural productivity during the June-August 2025 period.

Building upon the identification of districts affected by rainfall deficits during June-August 2025 from observed sources, Figure 5 presents the forecasted weekly accumulated rainfall from the SADMS for six representative districts during the Kharif 2025 season (1st June – 30th September 2025). The figure illustrates that the SADMS 14-day lead forecast indicates a persistent deficit trend across most of these districts, validating the actual conditions, except for Raebareli. The exception in Raebareli may be attributed to the system's inability to adequately capture the sharp spatial contrast between the wetter western and drier eastern parts of Uttar Pradesh, with Raebareli positioned near the transitional zone between these two regions. This spatial heterogeneity poses challenges for regional-scale rainfall forecasting. Although the deficit categories predicted by the SADMS may not precisely match the observed data, their consistent indication of deficit conditions is significant. This demonstrates the potential value of the system as an early warning tool, providing actionable insights for seasonal drought preparedness and decision-making.

Table 1: Districts in Uttar Pradesh reported seasonal rainfall deficit in June-August 2025.

District	Accumulated rainfall (June-August long-term mean)	Observed accumulated rainfall (June-August 2025)	Percentage deficit	category
Ambedkarnagar	694.60	419.20	-39.65	deficient
Amethi	666.50	373.20	-44.01	deficient
Azamgarh	701.20	403.80	-42.41	deficient
Bahraich	773.70	525.80	-32.04	deficient
Ballia	684.40	414.40	-39.45	deficient
Basti	868.40	496.60	-42.81	deficient
Bhadohi	721.20	533.20	-26.07	deficient
Chandauli	721.20	372.00	-48.42	deficient
Deoria	766.50	62.90	-91.79	large deficient
Ghazipur	725.90	478.20	-34.12	deficient
Gonda	791.80	547.50	-30.85	deficient
Gorakhpur	930.60	527.30	-43.34	deficient
Hardoi	600.90	439.10	-26.93	deficient
Jaunpur	679.50	435.70	-35.88	deficient
Kushinagar	766.50	188.60	-75.39	large deficient
Lucknow	653.90	491.90	-24.77	deficient
Maharajganj	930.60	506.70	-45.55	deficient
Mau	701.20	316.00	-54.93	deficient
Mirzapur	798.50	621.90	-22.12	deficient
Raebareli	649.00	223.60	-65.55	large deficient
Sant Kabir Nagar	868.40	352.20	-59.44	deficient
Shravasti	773.70	531.00	-31.37	deficient
Siddharthnagar	868.40	491.40	-43.41	deficient
Sitapur	661.30	425.90	-35.60	deficient
Unnao	577.20	417.70	-27.63	deficient

Validation of categorical indication of deficit

Categorical identification of rainfall deficits is an important element in drought early warning systems, particularly when the quantitative precision of rainfall estimates is limited. By concentrating on the occurrence of key hydrometeorological events, such as deficit or excess rainfall, it facilitates the early recognition of potential drought situations. This event-based approach enhances communication clarity among stakeholders, supporting timely preparedness and response measures. Furthermore, the consistent identification of deficit events, even with moderate numerical inaccuracies, contributes to monitoring seasonal rainfall patterns and strengthening contingency planning frameworks.

Building on these considerations, Figure 6 presents a categorical validation for the identification of deficit and excess rainfall accumulation across all districts of Uttar Pradesh during the Kharif season (1st June – 31st August 2025). In the figure, each grid cell represents a district, where deficit or excess rainfall categories are marked based on both the SADMS 14-day lead forecast and observed rainfall data. District grids appear in grey where observed data are unavailable, and white grids indicate districts with valid comparisons. It was observed that nearly 52% of the districts lacked observed data, leaving 48% available for validation. Among the compared districts, the categorical accuracy of the SADMS was correct for 29%, incorrect for 19%, and unverified for the remaining 52% due to data gaps. These findings underscore that, despite data limitations and forecast uncertainties, categorical rainfall classification provides a practical and operationally relevant tool for early warnings and seasonal monitoring.

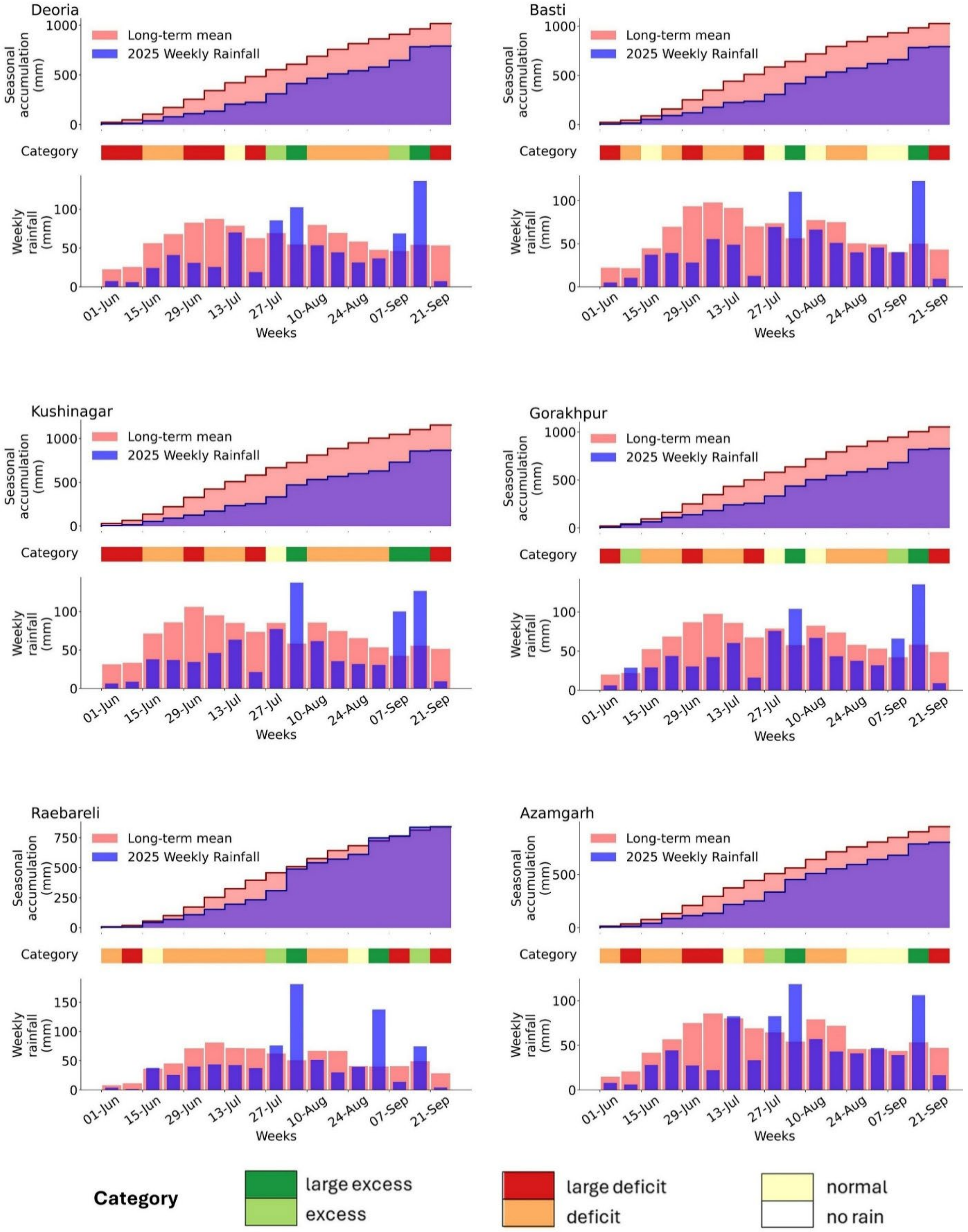

Figure 5: Forecasted weekly accumulated rainfall from the SADMS during the Kharif 2025 season (beginning of June to end of September in 2025).

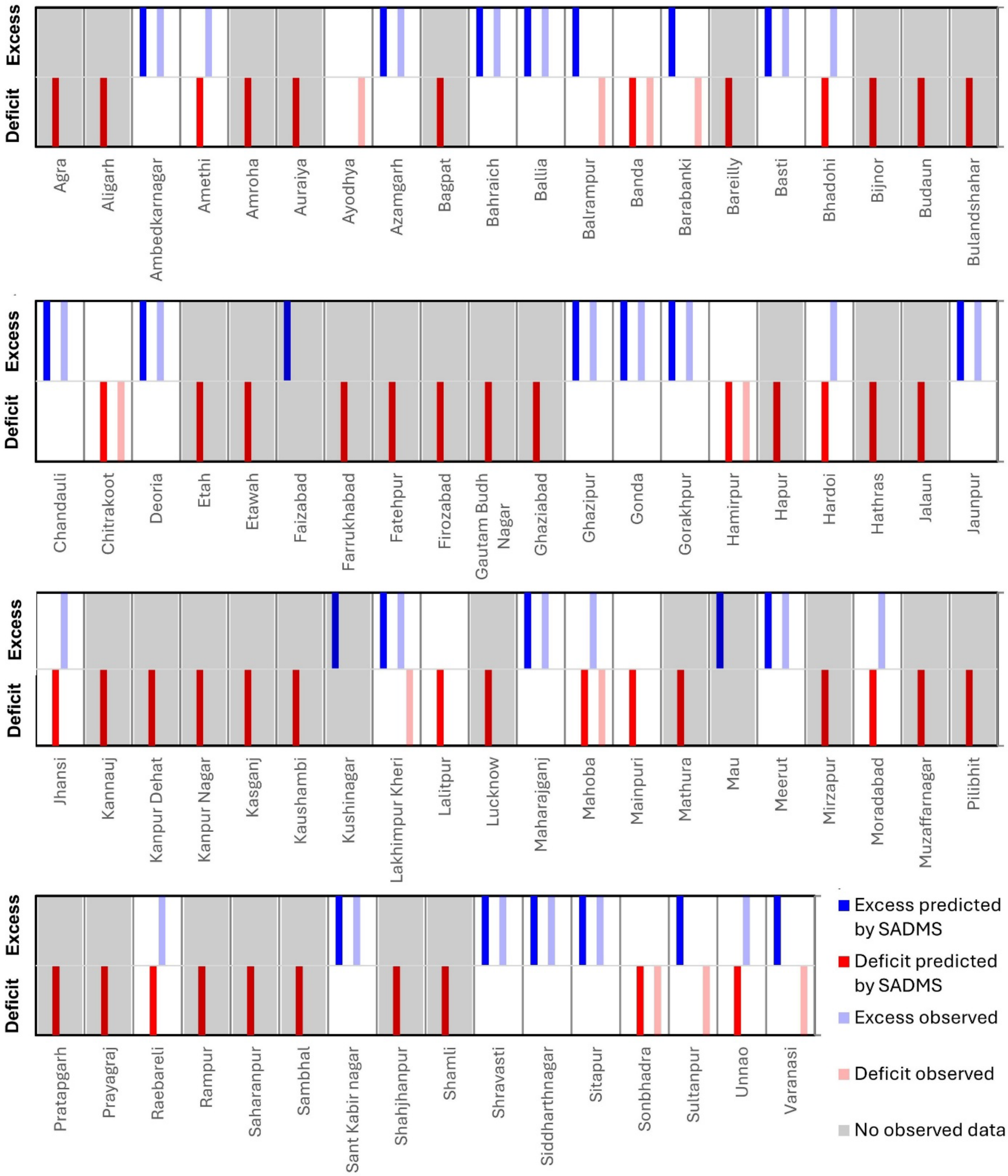

Figure 6: Categorical accuracy of SADMS for identification of drought by seasonal rainfall deficit across districts of Uttar Pradesh (June – August 2025).

Drought affected states in Kharif 2025

Bihar

Bihar experienced a severe and widespread drought during the Kharif 2025 season, with cumulative rainfall registering 31% below the long-term normal, resulting in substantial agricultural and socioeconomic impacts across the state. The drought event was among the most intense in recent years and reflected a continuing pattern of weakening monsoon activity observed over the past four years. The temporal progression of the 2025 monsoon season revealed a highly erratic rainfall distribution. June began with a 36% deficit, followed by July, which experienced the most severe shortfall of 41%, significantly affecting crop establishment and soil moisture availability. By late July 2025, Bihar had already accumulated nearly a 50% rainfall deficit, severely constraining the cropping systems, and August brought a short-lived improvement in rainfall conditions with a marginal deficit of approximately 9%. However, this recovery was not sustained, as September again recorded a steep decline in rainfall with a 38% deficit, aggravating seasonal water stress.

Figure 7 presents a graphical summary comparing the meteorological drought conditions forecasted by the SADMS with the observed conditions reported by the IMD Patna in Bihar. Figure 7a illustrates the district-wise seasonal rainfall accumulation (June–September 2025) forecasted by SADMS in comparison to the long-term mean (2001–2024). The results indicate that no district experienced rainfall exceeding its normal seasonal accumulation level. Figure 7b depicts the spatial distribution of districts classified according to the IMD's drought categories, based on the SADMS forecasts for 2025. The analysis revealed that the northern districts of Bihar were predominantly classified under the deficient category (–20% to –59%), while the southern districts were largely categorized as normal (+19% to –19%). A categorical comparison between the SADMS forecasts (Figure 7b) and the official IMD drought assessment released in October 2025 (Figure 7c) is shown. A total of 24 districts were reported to fall under the "deficient" category by the IMD. The districts which were impacted includes Sitamarhi, East Champaran, West Champaran, Muzaffarpur, Purnea, Gopalganj, Saran, Madhubani, Katihar, Bhagalpur, Bhojpur, Kishanganj, Munger, Samastipur, Darbhanga, Jehanabad, Begusarai, Araria, Aurangabad, Gaya, Nalanda, Vaishali, Khagaria, Supaul, and Lakhisarai. The drought prediction system under the SADMS predicted that 29 districts were likely to experience rainfall deficits. It forecasted false positives for three districts (Bhabua, Bhojpur, and Jahanabad) and false negatives for six districts (Lakhisarai, Shekhpura, Patna, Banka, Khagaria, and Vaishali), while true positives and negatives were observed for the remaining 28 districts in Bihar. Figure 7c demonstrates that SADMS correctly identified meteorological droughts in approximately 57% of the districts and accurately recognized the absence of droughts in 18% of the districts. However, drought conditions were missed in 10% of the districts, and false alarms were issued in 15%. Overall, the categorical accuracy of the SADMS for forecasting meteorological droughts in Bihar during the Kharif 2025 season was determined to be 75%. This performance underscores the reliability of the SADMS in providing early season drought forecasts that closely align with the observed conditions.

Assam

Assam also experienced a severe drought crisis during the Kharif 2025 season, marked by significant rainfall deficiency that severely impacted agricultural production and farmer livelihoods across the state. The severity of droughts has been unprecedented in recent years. Between 1st June and 30th September 2025, Assam recorded a 33% rainfall deficiency over the entire monsoon season, with even more critical shortages during the early months. Specifically, from 1st June to 31st July 2025, Assam experienced a 42-44% rainfall deficit, with the normal monsoon rainfall expected to be around 850.4 mm but the actual rainfall received being only 506.6 mm. Nine districts reported large rainfall deficits (–60% to –99% below normal): Bajali (71%), Barpeta (72%), Bongaigaon (63%), Chirang (64%), Darrang (80%), Dhemaji (63%), Dhubri (66%), Nalbari (65%), and Tamulpur (68%). Another 16 districts showed deficient rainfall (–20% to –59% below normal): Baksa, Dibrugarh, Goalpara, Golaghat, Kamrup, Kamrup Metro, Kokrajhar, Lakhimpur, Majuli, Nagaon, Sivasagar, Sonitpur, Sribhumi, Tinsukia, Udalguri, and West Karbi Anglong [3,4].

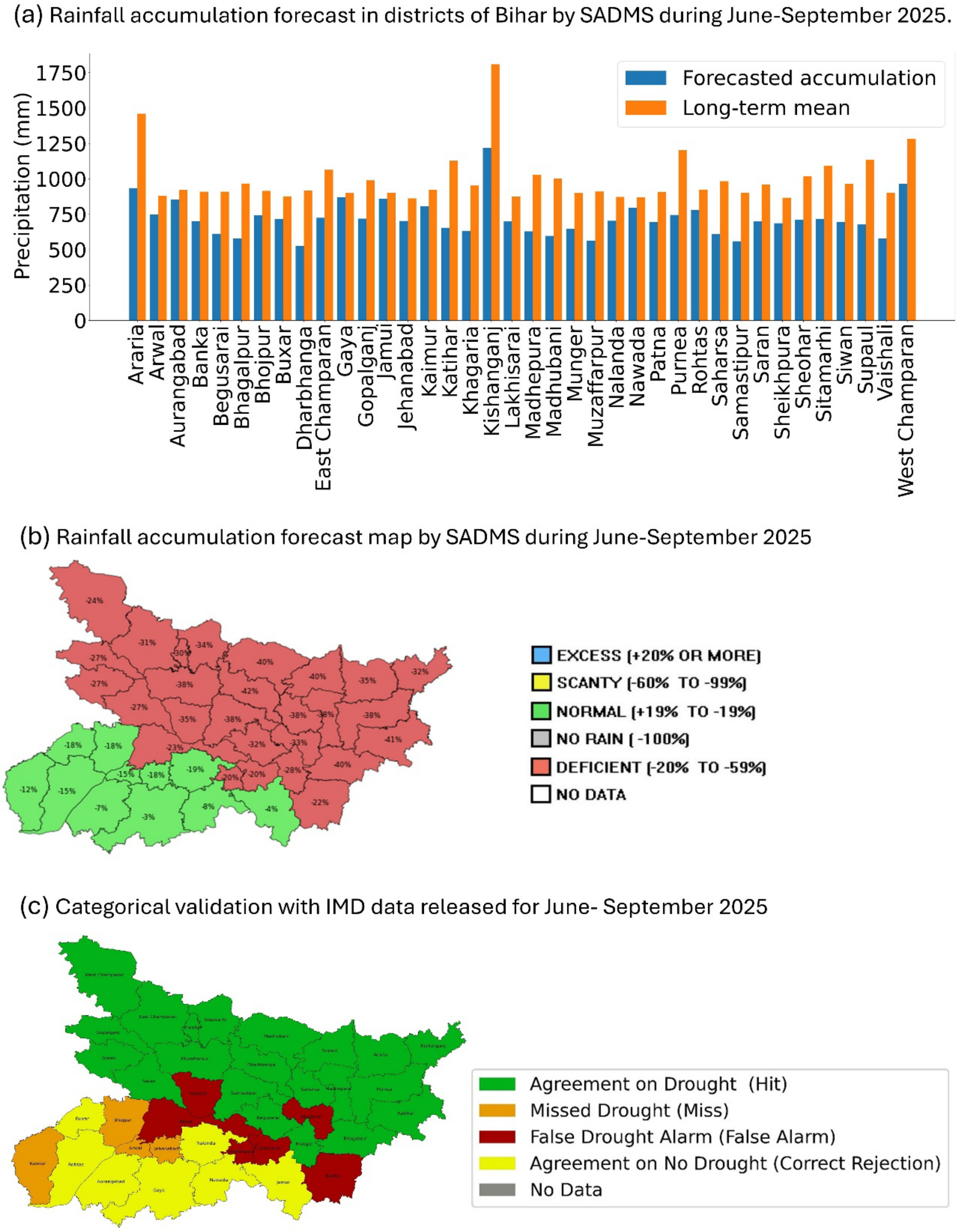

Figure 7: Graphical summary comparing the forecasted meteorological drought conditions in Bihar for June–September 2025 generated by the SADMS with the observed conditions reported by the IMD Patna [5].

Figure 8 presents a comparative analysis of the meteorological drought conditions predicted by the SADMS and the observed conditions reported in Assam by the IMD Guwahati. Figure 8a illustrates the district-wise early seasonal rainfall accumulation (June–July 2025) forecasted by SADMS relative to the long-term mean (2001–2024) for the state. The analysis indicates that, except for Hailakandi, no district received rainfall exceeding its normal early season accumulation. Figure 8b shows the spatial classification of districts according to the IMD's drought categories based on the SADMS forecasts for June–July 2025. The results showed that most districts in Assam were categorized as deficient (–20% to –59%), while a few southern districts were classified as normal (+19% to –19%). A categorical comparison between the SADMS forecasts (Figure 8b) and the IMD's official assessment released in July 2025 (Figure 8c) revealed that SADMS correctly identified meteorological deficiencies in 55% of the districts. Stress conditions were missed in 35% of the districts, and false alarms were issued in 10% of the districts. Consequently, the overall categorical accuracy of the SADMS for forecasting meteorological droughts in Assam during the early Kharif 2025 season was 55%. This outcome indicates moderate forecasting performance with scope for improvement.

Figure 8 presents a comparative analysis of the meteorological drought conditions predicted by the SADMS and the observed conditions reported in Assam by the IMD Guwahati. Figure 8a illustrates the district-wise early seasonal rainfall accumulation (June–July 2025) forecasted by SADMS relative to the long-term mean (2001–2024) for the state. The analysis indicates that, except for Hailakandi, no district received rainfall exceeding its normal early season accumulation. Figure 8b shows the spatial classification of districts according to the IMD's drought categories based on the SADMS forecasts for June–July 2025. The results showed that most districts in Assam were categorized as deficient (–20% to –59%), while a few southern districts were classified as normal (+19% to –19%). A categorical comparison between the SADMS forecasts (Figure 8b) and the IMD's official assessment released in July 2025 (Figure 8c) revealed that SADMS correctly identified meteorological deficiencies in 55% of the districts. Stress conditions were missed in 35% of the districts, and false alarms were issued in 10% of the districts. Consequently, the overall categorical accuracy of the SADMS for forecasting meteorological droughts in Assam during the early Kharif 2025 season was 55%. This outcome indicates moderate forecasting performance with scope for improvement.

In Assam, the rainfall distribution during the Kharif season did not exhibit a clear geographical separation between deficient and normal conditions. Instead, district selection was based on the IMD's early season classification, distinguishing areas identified as stressed or normal. Accordingly, Kamrup, Jorhat, and Dibrugarh were chosen to represent the deficient category (Figure 10m–10o), and Nagaon, Nalbari, and Tinsukia were selected to represent the normal category (Figure 10p–10r). The districts exhibited crop stress in mixed results, irrespective of being declared meteorological stress. However, Jorhat and Nagaon were clearly under stress, while other districts showed some stress towards the end of the season.

Normalized difference vegetation index

The Normalized difference vegetation index (NDVI) is a widely used remote sensing indicator for quantifying the presence and health of vegetation within a given area [6]. It exploits the contrast between the strong absorption of red light by chlorophyll and the high reflectance of near-infrared radiation by the plant cell structures. Consequently, healthy and dense vegetation exhibits higher NDVI values, whereas sparse or stressed vegetation yields lower values. Monitoring changes in NDVI over time can help track the progression of drought conditions and serve as a warning system.

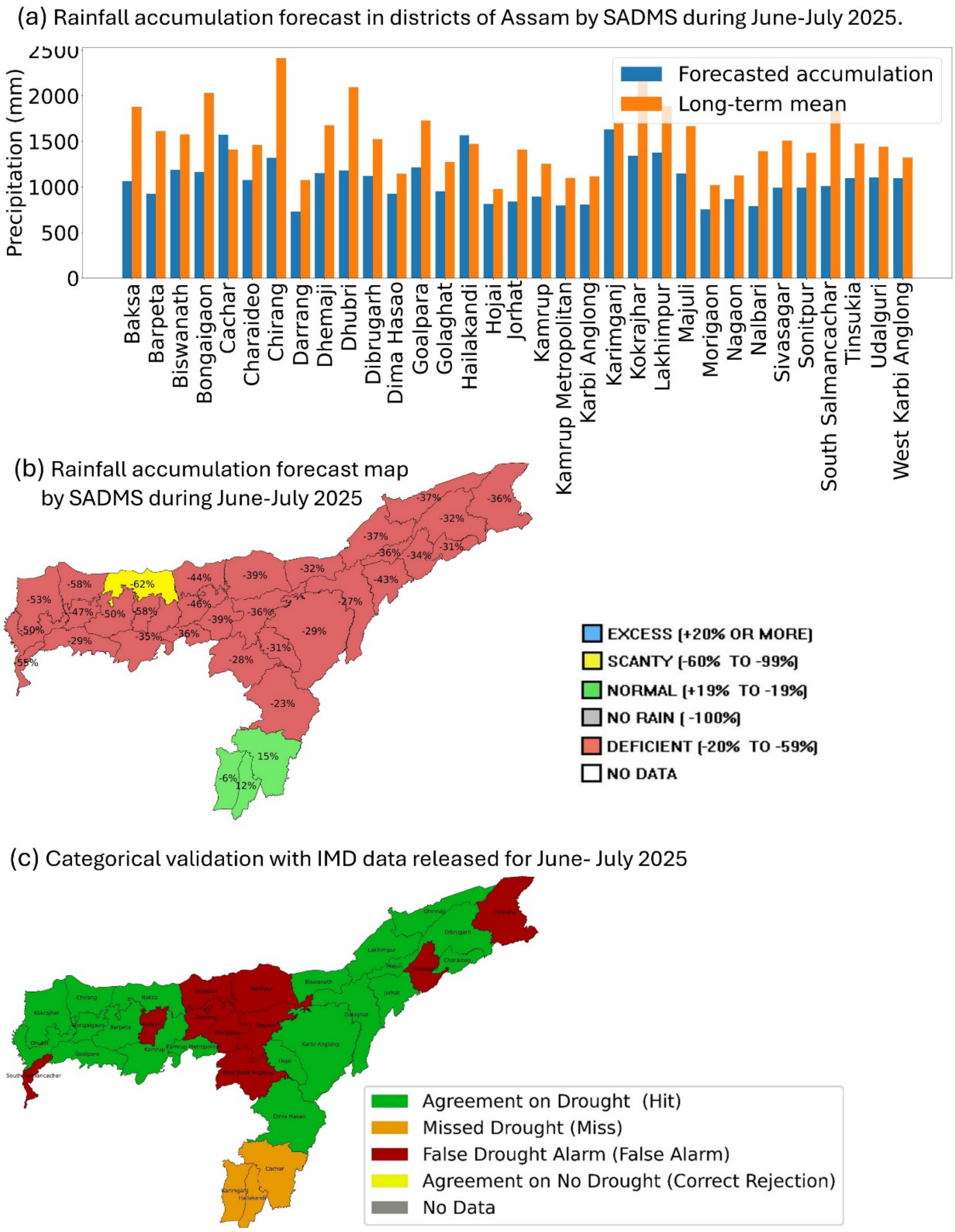

Figure 8: Graphical summary comparing the forecasted meteorological drought conditions in Assam for June – July 2025 generated by the SADMS with the observed conditions reported by the IMD Guwahati [6].

Figures 9 and 10 present a comparison between the monthly NDVI values (June - September for the period 2001–2024) and the monthly NDVI (June - September for the year 2025) across the selected districts in the states of Uttar Pradesh, Bihar, and Assam. The analysis was conducted using the MODIS NDVI product (MOD13Q1), which provides 16-day composite data for regional vegetation monitoring. This comparative assessment highlights the spatial and temporal variability of vegetation health within each district during the Kharif 2025 season relative to the historical normal. By evaluating these variations, the analysis provides insights into the extent to which current seasonal conditions may have affected crop health and helps in identifying whether the district is experiencing agricultural stress to propagate impacts on crop productivity.

Figure 9 shows the spatial variability of NDVI anomaly made by the difference between NDVI in the current season (June - September 2025) and historical mean (June - September 2001 - 2024) in Uttar Pradesh, Bihar, and Assam. Across the presented states, all of them saw highly negative differences in July when compared to the historical mean. However, many districts have these negative differences that persisted through August and September. In Uttar Pradesh, it seems to recover by the end of the season, but the western regions show persistent negative NDVI differences in a few districts in August. This might be due to the damage caused by the extremely high rainfall reported in the late season. In Bihar, the northern districts clearly have negative anomalies in NDVI in clusters and patches from June to August. The same observation was made for Assam. Visually, these differences suggest that Uttar Pradesh experienced a mixed kharif season, whereas Bihar and Assam experienced a moderately stressful kharif season in 2025.

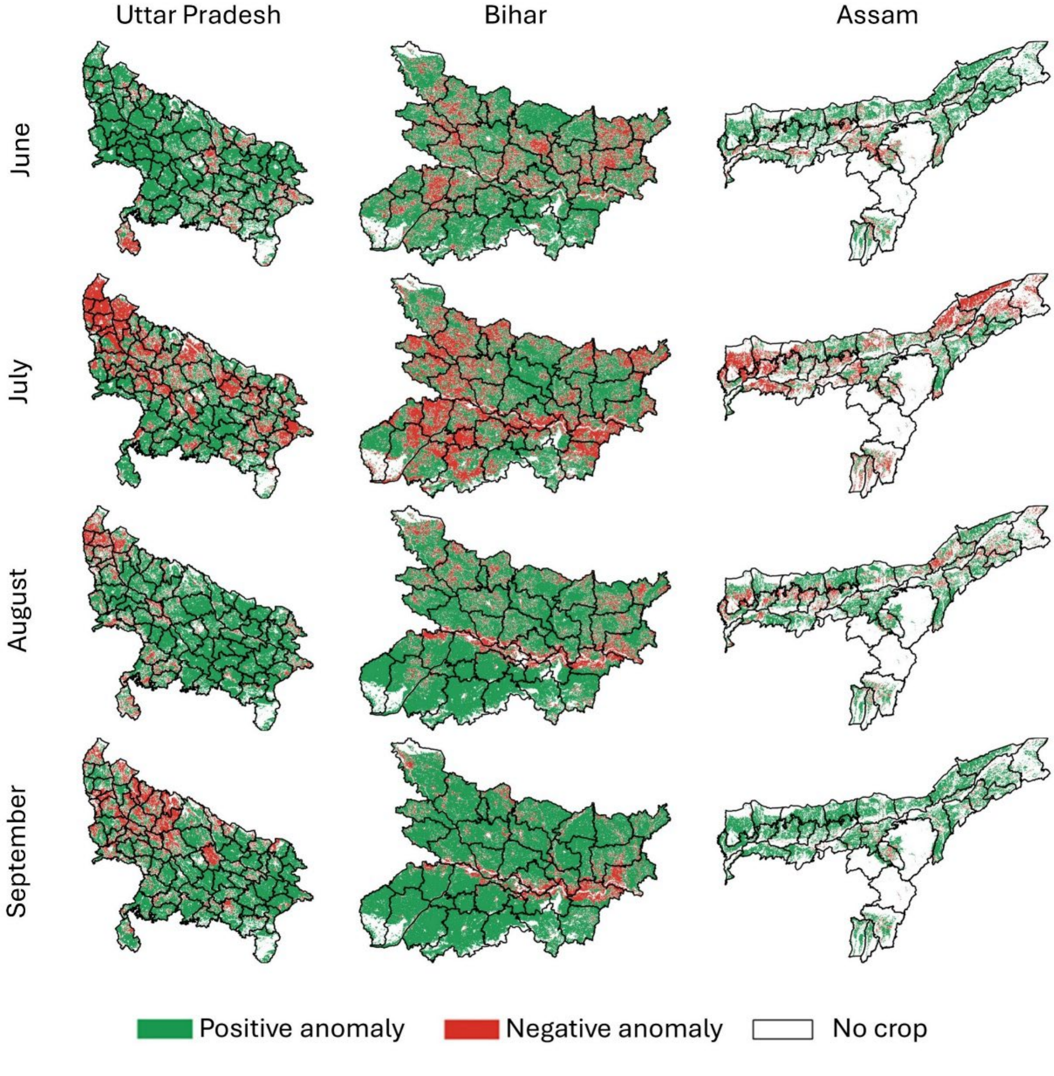

Figure 9: Spatial variability of NDVI anomaly between current season (June - September 2025) and historical mean (June - September 2001 - 2024).

Figure10 breaks down the spatial distribution of the observations shown in Figure 9. Specifically selected districts (three districts for each state declared as deficient and normal categories by IMD in Kharif 2025) and the spatial mean of monthly NDVI for 2025 were compared to their counterparts in the long-term mean for these districts. In Uttar Pradesh, a clear contrast was observed between the eastern and western regions during the Kharif 2025 season, with the eastern districts experiencing rainfall deficiency and the western districts experiencing excess rainfall. The selected districts representing Eastern Uttar Pradesh were Basti, Kushinagar, and Deoria (Figure 10a–10c), while Muzaffarnagar, Bulandshahr, and Bareilly (Figure 10d–10f) represented the Western region. It is evident that the NDVI for 2025 in the eastern districts remained consistently below the long-term mean, indicating rainfall deficiency and its adverse impact on crop health throughout the season. In contrast, the western districts exhibited more variable trends. Although higher NDVI values in most western districts suggest better crop conditions than the long-term mean, the sharp decline observed in Bareilly indicates possible crop damage caused by excessive rainfall. However, the remaining western districts showed no significant signs of stress during the Kharif 2025 season.

In Bihar, contrasting rainfall patterns were evident during the season, with the northern districts experiencing deficient rainfall and the southern districts receiving near-normal rainfall. The representative districts selected for analysis in Northern Bihar included West Champaran, Madhubani, and Samastipur (Figure 10g–10i), whereas Patna, Aurangabad, and Gaya (Figure 10j–10l) were chosen to represent the Southern region. The northern districts exhibited noticeably lower NDVI values than the historical mean from July to September, reflecting the impact of meteorological deficits on crop growth throughout the season, as reported by the IMD and SADMS. Interestingly, the southern districts also showed a decline in NDVI during the latter part of the season (August–September 2025). Although these areas were classified under normal conditions by the IMD, the observed reduction in NDVI suggests that some degree of stress on crop productivity may have occurred. The countrywide propagation of areal Progressive difference in NDVI is presented in Figure A2 in Annexure.

In Assam, the rainfall distribution during the Kharif season did not exhibit a clear geographical separation between deficient and normal conditions. Instead, district selection was based on the IMD's early season classification, distinguishing areas identified as stressed or normal. Accordingly, Kamrup, Jorhat, and Dibrugarh were chosen to represent the deficient category (Figure 10m–10o), and Nagaon, Nalbari, and Tinsukia were selected to represent the normal category (Figure 10p–10r). The districts exhibited crop stress in mixed results, irrespective of being declared meteorological stress. However, Jorhat and Nagaon were clearly under stress, while other districts showed some stress towards the end of the season.

Conclusion

The Kharif 2025 season revealed the growing vulnerability of India's agricultural systems to climate variability, as demonstrated by widespread meteorological droughts and erratic rainfall patterns observed across Bihar, Assam, and Uttar Pradesh. In Uttar Pradesh, the growing unpredictability of the climate's impact on agriculture has been observed. Eastern districts, such as Deoria and Kushinagar, experienced severe droughts, whereas western regions faced excessive rainfall and flooding which damaged crops during key growth stages. This contrast between drought in some areas and floods in others shows the urgent need for better climate adaptation, water management, and support systems to handle such varied regional conditions within a single season. In addition, the spatial extent of drought in Bihar and Assam in Kharif 2025 was widespread in almost the entire state, although the severity varied across districts.

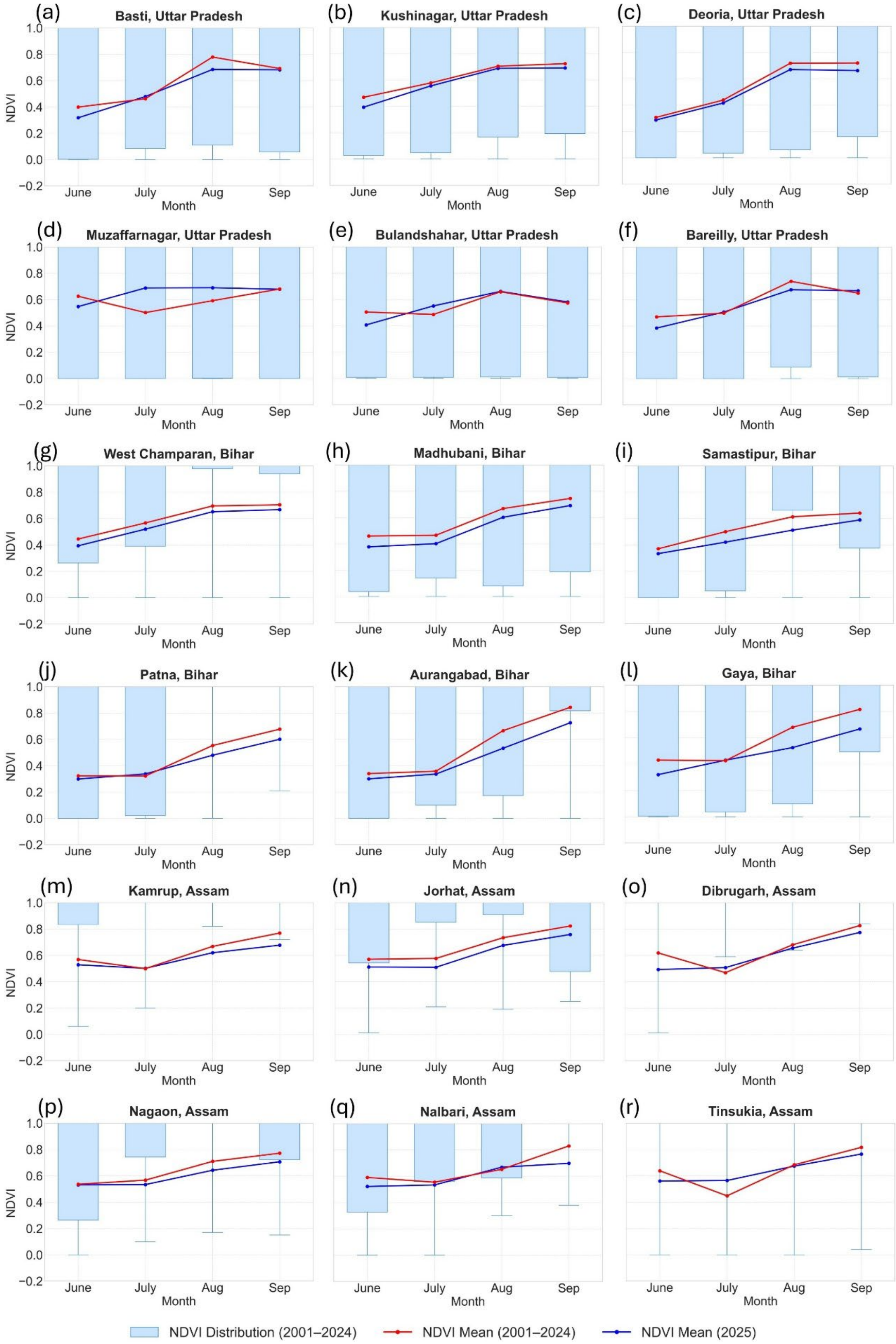

Figure 10: Comparison of spatial mean of monthly NDVI in 2025 against its long-term mean for selected districts in Uttar Pradesh, Bihar, and Assam.

This report highlights the growing reliability of short- to medium-term rainfall forecasting models for supporting early warning and mitigation strategies. Although not perfectly aligned with the observed data, the predictions made by the SADMS demonstrated a commendable level of skill in identifying regions at potential drought risk ahead of time. There is an urgent need for the policy makers to strengthen drought preparedness and resilience frameworks by integrating satellite-based monitoring systems into national and state-level planning. The clear spatial disparities between deficient and excess rainfall regions highlight the importance of localized, data-driven decision-making for efficient water resource allocation and contingency planning in the region. The results emphasize the necessity of improving forecast precision and coupling meteorological and vegetation-based indicators (such as SPI and NDVI) to develop more holistic early warning tools. Advancing regional calibration and integrating ground observations with satellite datasets will enhance predictive reliability and support adaptive agricultural management under changing climate conditions. Continuous monitoring of rainfall and vegetation conditions through accessible platforms can guide timely crop management decisions, irrigation scheduling, and contingency planning during drought years. Strengthening agricultural extension systems to translate scientific insights into field-level advisories is critical. As the country transitions toward the Rabi 2025–26 season, coordinated action among meteorological agencies, agricultural departments, research institutions and farmer networks are essential. Proactive monitoring, adaptive land and water management, and early advisories must be prioritized to mitigate the carry-over impacts of Kharif droughts and enhance overall drought resilience in the forthcoming season.

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Annexures

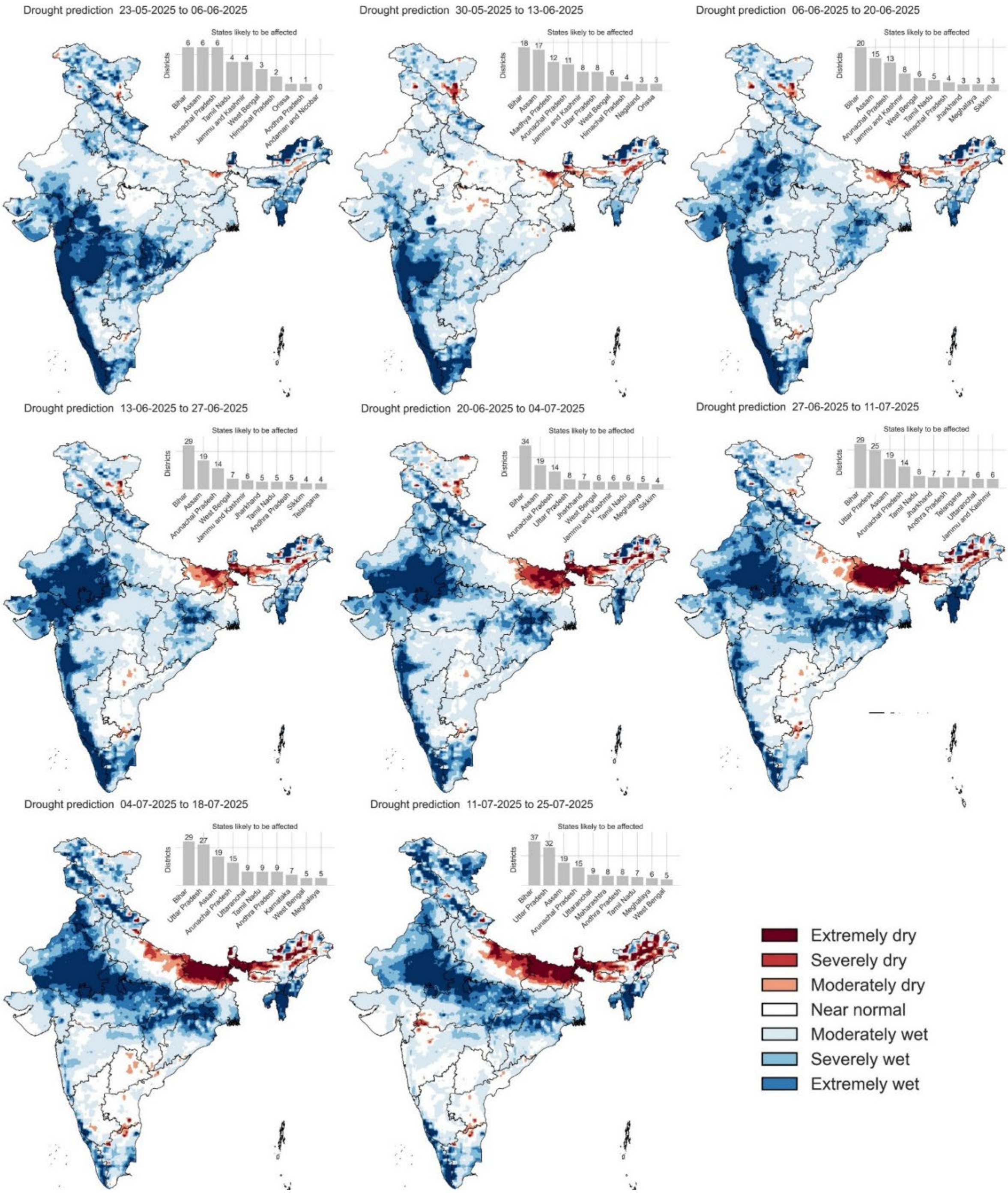

Figure A1 (a): Fortnightly drought predictions from SADMS generated at weekly operational intervals during Kharif 2025.

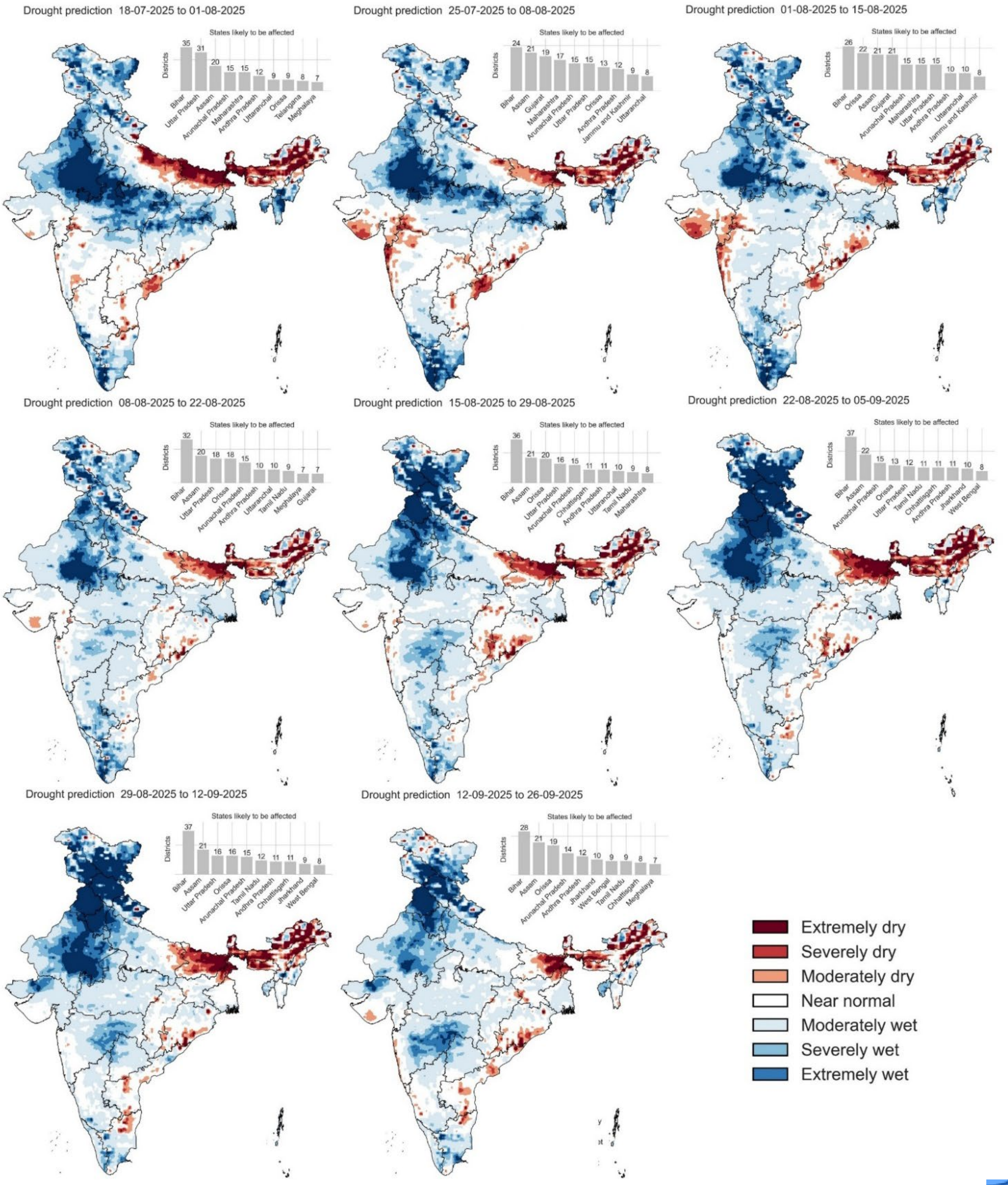

Figure A1 (b): Fortnightly drought predictions from SADMS generated at weekly operational intervals during Kharif 2025 (continued).

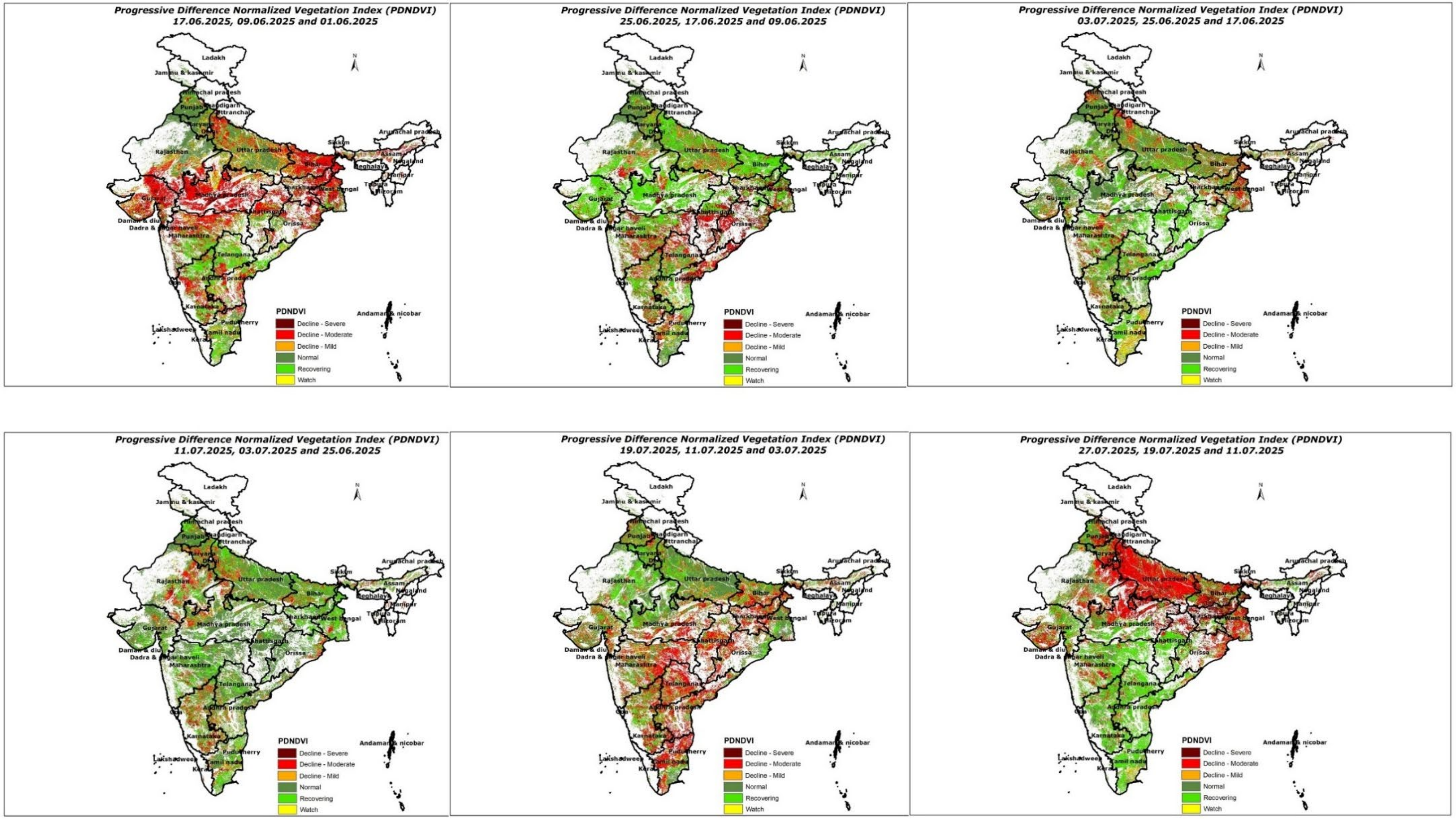

Figure A2 (a): Weekly progression of PDNDVI (Progressive Difference NDVI), to reflect decline/recovery of crops in Kharif 2025 (9 June – 19 July).

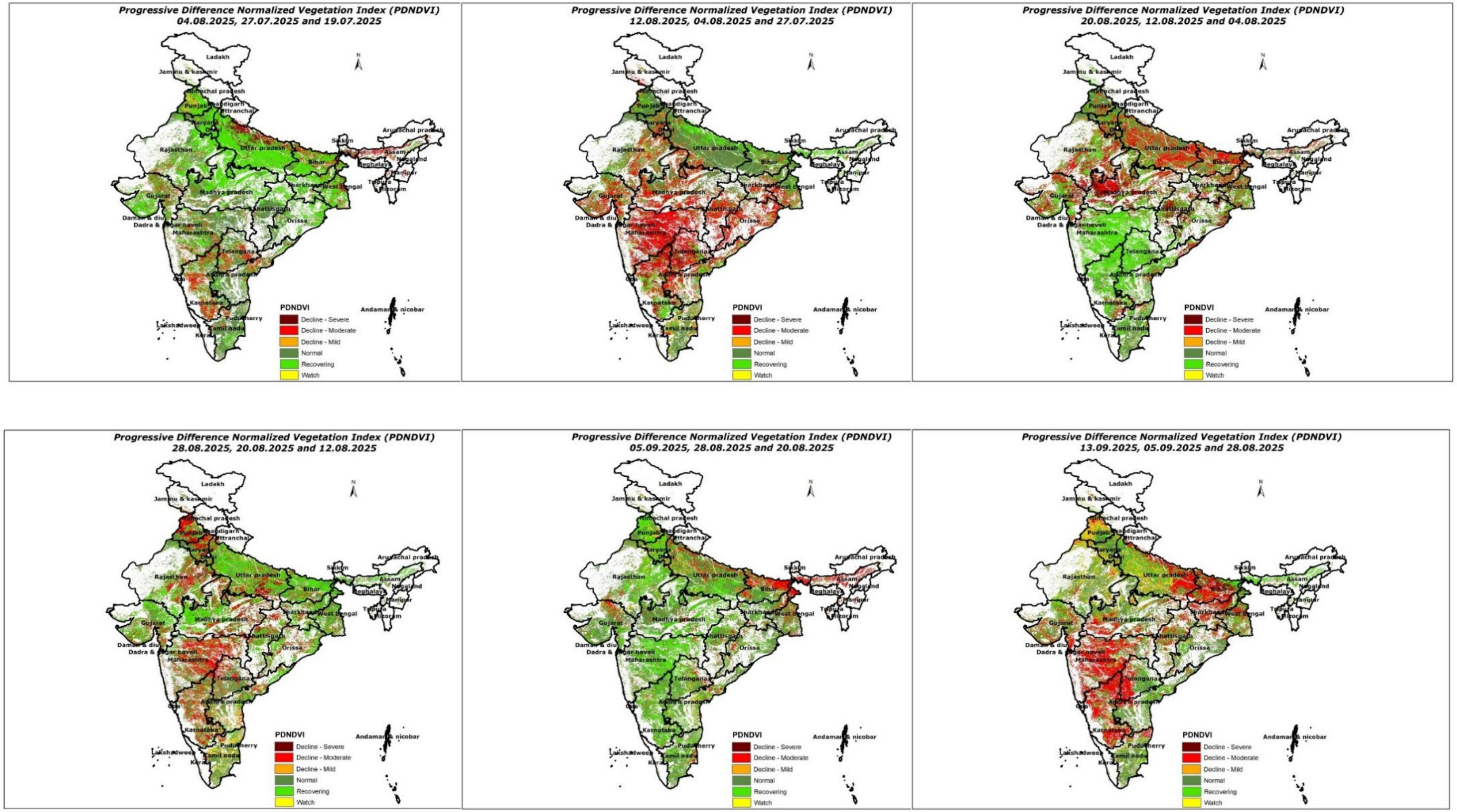

Figure A2 (b): Weekly progression of PDNDVI (Progressive Difference NDVI), to reflect decline/recovery of crops in Kharif 2025 (27 July – 5 September).

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