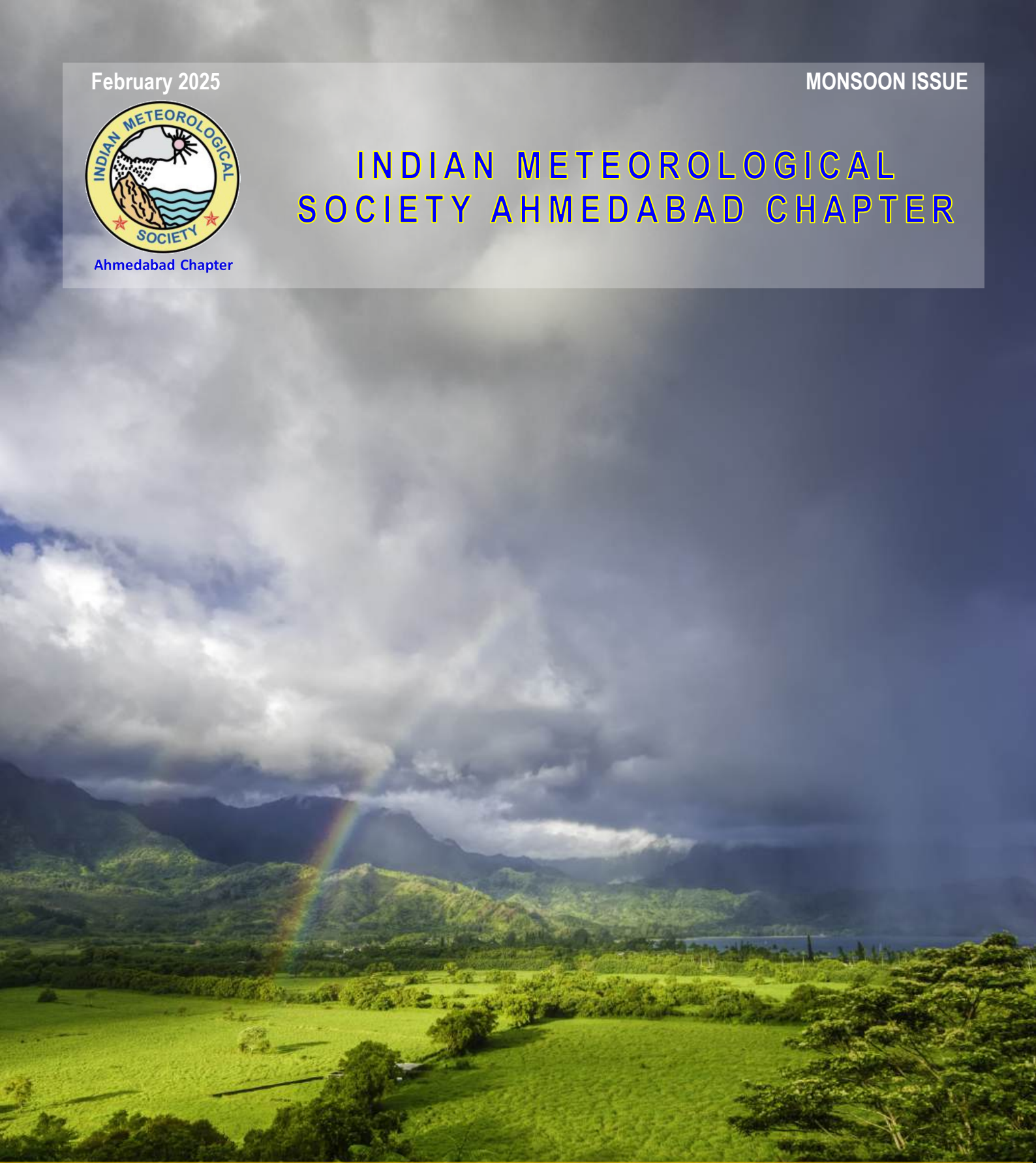
February 2025 MONSOON ISSUE

Ahmedabad Chapter

INDIAN METEOROLOGICAL SOCIETY AHMEDABAD CHAPTER



E-MEGHA

From the Chairman's desk

Dr. D Ram Rajak

rajakdr@sac.isro.gov.in

It is my pleasure to present this issue of e-Megha, which brings together a wealth of knowledge and insights from our scientific community. This edition is particularly special, as it highlights not just meteorological advancements but also critical environmental challenges and our ongoing efforts to address them.

One of the key highlights of this issue is the comprehensive analysis of the 2024 Southwest Monsoon, which saw extreme rainfall events and widespread flooding across India. The detailed studies on Gujarat and Vijayawada (AP) floods, Landslide in Wayanad (Kerala) provide a crucial understanding of how satellite-based monitoring can aid in disaster preparedness and response. The article on monsoon prediction using the CAM model also sheds light on the evolving techniques for seasonal forecasting, reinforcing the importance of accurate weather prediction.

A major focus in this issue is ISRO's latest advancements in Earth observation. The INSAT-3DS mission has opened new avenues for meteorological and oceanic studies, with its state-of-the-art payloads providing critical data for weather forecasting, disaster management, and climate research. The newsletter also brings attention to pressing environmental concerns, including the impact of wildfires on air quality and the role of satellite data in assessing pollution levels. With increasing incidents of extreme weather and environmental degradation, such studies emphasize the need for continuous monitoring and mitigation strategies.

On the technological front, the discussion on MOSDAC's latest data dissemination capabilities underscores how satellite data is becoming more accessible to researchers and operational agencies, enabling better decision-making in weather forecasting and climate studies. The latest advancements in AI-driven weather prediction, featured in the science news section, further illustrate the growing role of artificial intelligence in meteorology.

As we celebrate these achievements, I would also like to acknowledge the contributions of our scientific community in expanding the frontiers of knowledge. The dedication of researchers and engineers in developing new tools, refining prediction models, and enhancing data accessibility is truly commendable.

I extend my sincere appreciation to the e-Megha editorial team for their efforts in compiling this issue and to all contributors for sharing their valuable research. As we move forward, let us continue to collaborate and innovate in our pursuit of scientific excellence.

Wishing you all an insightful reading experience!

Secretary's Report

Dr. Suchandra Aich Bhowmick
suchandra@sac.isro.gov.in

It is a pleasure to share with you an update on the activities and initiatives undertaken by the IMSA Ahmedabad Chapter over the past year. Our society continues to be a hub of scientific exchange and outreach, fostering knowledge dissemination in meteorology, oceanography, and atmospheric sciences.

IMSA has been actively engaged in organizing popular lecture series, scientific talks, and outreach programs. We had the privilege of hosting distinguished speakers, including Dr. Mrutyunjay Mohapatra, Director General of IMD, who spoke on recent advancements in weather forecasting, and Dr. Sachin Ghude, who delivered an insightful talk on air quality modelling. Our National Space Day celebration featured a special session on Chandrayaan-3's historic landing, delivered by Dr. Mehul Pandya from SAC.

IMSA also collaborated with local scientific societies like ISRS, INCA, and ISG to conduct impactful programs. A notable highlight was the National Science Day celebration at M G Science Institute, where students had the opportunity to interact with experts and gain insights into Earth and space sciences. Our student outreach initiative, conducted in collaboration with the American India Foundation (AIF), reached several schools across Ahmedabad, inspiring young minds to explore the world of meteorology and remote sensing.

Beyond academic engagements, IMSA has been proactive in engaging with real-world environmental challenges. The society hosted discussions on monsoon extremes, flood events, and climate change, emphasizing the role of satellite data in monitoring and mitigating disasters. Our annual monsoon photography contest was met with great enthusiasm, with outstanding entries capturing the essence of India's dynamic monsoon season.

Looking ahead, IMSA has a series of exciting events planned, including the Prof. Satish Dhawan Lecture, World Meteorological Day celebrations, and continued collaborations with national and international experts. We encourage all members to actively participate in these initiatives, contributing to the society's mission of advancing meteorological and oceanographic sciences.

On behalf of the IMSA executive committee, I extend my gratitude to all members for their active involvement and to the e-Megha editorial team for their dedication in documenting our collective efforts. Let us continue to explore, innovate, and contribute to the ever-evolving field of atmospheric sciences.

E-Megha Team

Dr. Surisetty V V Arun Kumar

Dr. Som Kumar Sharma

Dr. Harish Seth

Dr. Smitha Ratheesh

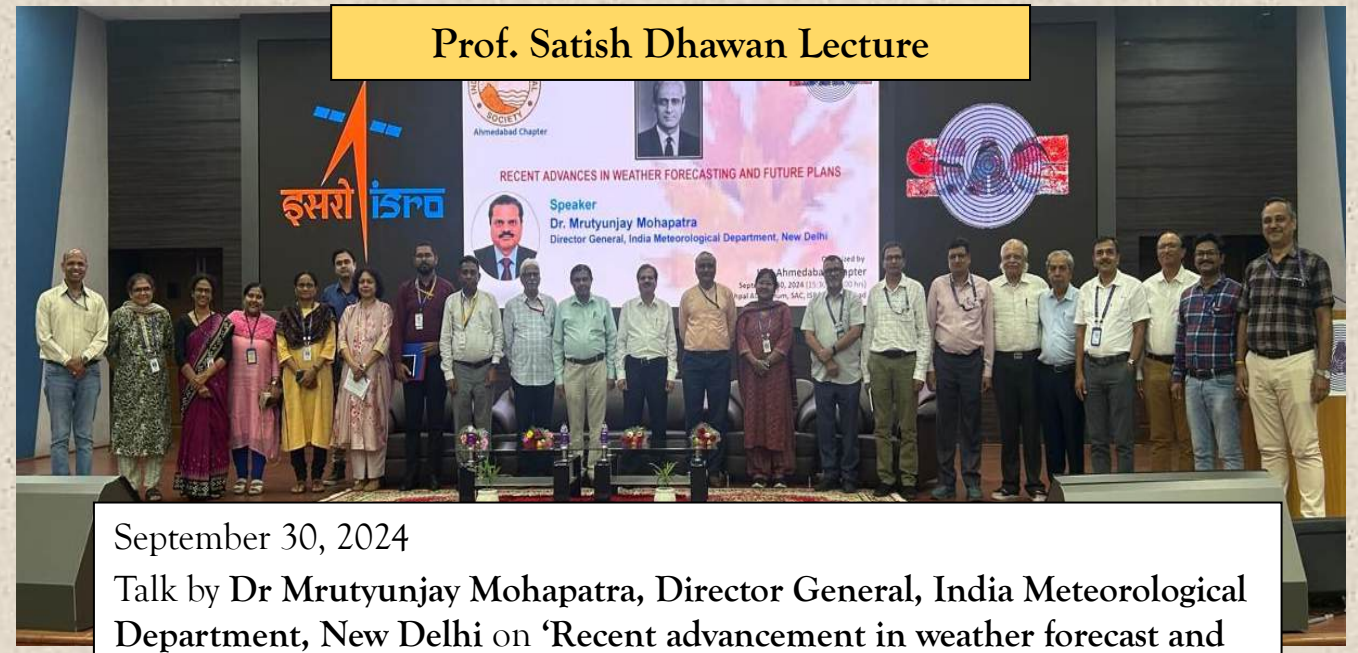
Smt. Ruchi Modi

Shri Danish Hussain

Shri Seemanth M

IMSA Activity Log

Prof. Satish Dhawan Lecture



September 30, 2024

Talk by **Dr Mrutyunjay Mohapatra, Director General, India Meteorological Department, New Delhi** on **'Recent advancement in weather forecast and future plans'**

World Environmental Health Day (September 26, 2024)

'Recent Advances in Air Quality Modelling'

Talk by

Dr. Sachin Ghude,

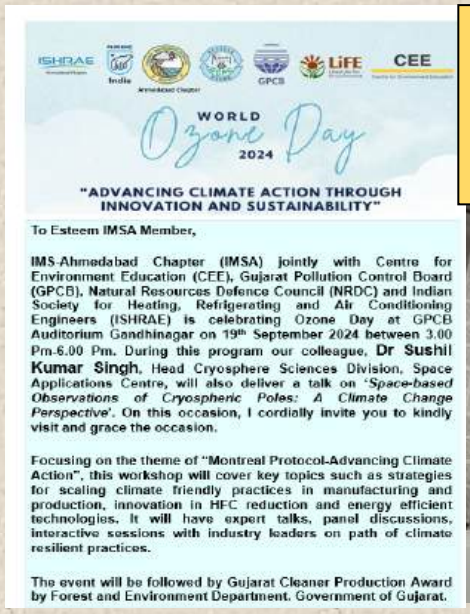
Lead Scientist, Indian Institute of Tropical Meteorology, Pune

'Urban Climate: Connecting the dots, Science, Technology and Human'

Talk by

Dr. Akshara Kaginalkar,

Former Senior Director, C-DAC



Space-based Observations of Cryospheric Poles by Dr. Sushil Kumar Singh,

Head, Cryosphere Sciences Division, SAC-ISRO

IMSA Activity Log

National space day celebrations (August 23, 2024)

Talk by Dr. Mehul Pandya, Group Director, Space Applications Centre, ISRO, Ahmedabad

On ' **India's historic Landing by Chandrayaan-3 on Moon'**

Popular Lecture series (August 1, 2024)

Talk by **Kanishka Mallick**, Sr. Lead R&T Scientist, Luxembourg Institute of Science and Technology (LIST)

On **'Thermal Remote Sensing for Advanced Modelling of Terrestrial Ecosystem Processes A TRISHNA perspective'**

Popular Lecture series (June 5, 2024)

Talk by **: Dr. Maulesh Nitinbhai Gadani,** Medical Officer, Space Applications Centre, ISRO, Ahmedabad

On **'Health Impact of unusual heat waves in perspective of climate change'**

IMSA Activity Log

"Role of Space Sector in supporting IMD" by

Shri Nilesh M Desai,

Director,

Space Applications Centre,

Indian Space Research Organisation

(November 18, 2024)

"Student Outreach Activity"

In Collaboration with The American India Foundation (AIF), IMSA has participated in four Student Outreach activities at followin locations

25-11-2024: Gota Housing Anupam Primary School, Ahmedabad
26-11-2024: Sabarmati Gujarati School No. 7, Ahmedabad
27-11-2024: Amraiwadi School No. 9, Ahmedabad
28-11-2024: Oganaj Primary School, Ahmedabad

Congratulations to our New Executive Committee Members

Dr. D. R. Ram Rajak
(Chairman)

Dr. Suchandra Aich Bhowmick
(Secretary)

Dr. Rucha Dave
(Joint Secretary)

Dr. Surisetty V V Arun Kumar
(Treasurer)

Dr. Satyendra M Bhandari
(Member)

Dr. Harish Seth
(Member)

Dr. Ashok Kumar Das
(Member)

Dr. Indrani Choudhury Singh (Member)

Dr. Anurag Kandya
(Member)

Dr. Amitava Guharay
(Member)

Dr. Arvind Sahay
(Member)

Shri. Ravi Kamal Choudhary
(Member)

Editorial

As we unveil this edition of e-Megha, we take immense pride in curating a diverse collection of articles that reflect the evolving landscape of meteorology, oceanography, climate science, and Earth observation. This issue is not just a compilation of scientific advancements but a testament to the collaborative efforts of researchers, scientists, and technology pioneers working toward a deeper understanding of our planet.

The past year has witnessed remarkable developments in meteorological science, from advancements in satellite-based weather monitoring to breakthroughs in numerical modeling. As we transition into an era of data-driven decision-making, the role of space-based observations in disaster management, climate resilience, and environmental monitoring has never been more crucial. This edition brings forward some of the most compelling discussions on these themes, shedding light on how cutting-edge research is shaping the future.

One of the exciting aspects of this issue is its focus on technological innovations in remote sensing and data dissemination. With platforms like MOSDAC introducing new capabilities, the accessibility and utilization of satellite data have reached new heights. These innovations are not just advancing weather forecasting but are also enhancing real-time decision-making for policymakers, disaster management authorities, and environmental researchers.

Beyond science and technology, this issue also celebrates the spirit of scientific collaboration and knowledge exchange. We are particularly thrilled to see an increasing number of young researchers and students engaging in discussions on meteorology and space sciences. Their enthusiasm and fresh perspectives continue to drive innovation and inspire the next generation of scientists.

As always, we extend our gratitude to all the contributors who have enriched this edition with their insights and expertise. Our sincere appreciation also goes to the IMSA leadership and the e-Megha editorial team for their relentless efforts in making this issue a success.

We hope this edition sparks curiosity, encourages dialogue, and fosters a deeper appreciation for the wonders of atmospheric and ocean sciences. Happy reading, and we look forward to your continued engagement in the issues ahead!

E-Megha Team

INSIDE THIS ISSUE:

PERFORMANCE OF THE SOUTHWEST MONSOON – 2024

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Officially, the Indian southwest monsoon season spans between 01 June and 30 September. In 2024, the southwest monsoon set-in over Kerala and northeast parts of India on 30 May, which was 2 days (6 days) before the normal date of onset over Kerala (northeast India). The monsoon continued advancing in early June, covering parts of central and northwest Bay of Bengal, coastal Andhra Pradesh, Telangana, Goa, and Karnataka. After a brief halt during 12-19 June 2024, the monsoon resumed its advancement. The southwest monsoon covered the entire country on 2 July 2024, which was six days before the normal date. Arrival of monsoon provided widespread rainfall across the country.

The extreme rainfall events were reported over Konkan & Goa, coastal Karnataka, Uttarakhand, Himachal Pradesh, Gujarat, West Madhya Pradesh, Telangana, Bihar, Orissa and Gangetic West Bengal.

India received 934.8 mm rainfall during the southwest monsoon season, which is 8% more than the long period average (LPA) of 868.6 mm. Month-wise rainfall over the country as a whole was below normal in June (89% of LPA) and above normal in remaining three months (109% in July, 115% in August and 112% in September). Second half of the monsoon season (August and September) received excess rainfall.

Region-wise, seasonal rainfall was above normal over three out of the four geographical regions of the country. Northwest India, Central India, South Peninsula and East & Northeast India received 107%, 119%, 114% and 86% of corresponding LPA respectively. Core monsoon zone received 122% rainfall. Withdrawal of the southwest monsoon commenced with a delay of six days on 23 September. Sub-division wise, rainfall distribution is shown in Fig.1. Two subdivisions [West Rajasthan and Saurashtra & Kutch – 9% of total area of the country (TAC)] received large excess rainfall, ten subdivisions [26% of TAC] received excess, twenty-one subdivisions [54% of TAC] received normal and three subdivisions [Arunachal Pradesh, Punjab, Jammu & Kashmir and Ladakh – 11% of TAC] received deficient rainfall.

Though favourable La Nina and positive Indian Ocean Dipole (IOD) conditions were predicted during the monsoon season, they came out as neutral conditions. Sea surface temperature anomalies over the equatorial Pacific did not cross the La Nina threshold of -0.5°C during the second half of the season. Neutral IOD condition was observed during the season. Unfavourable Madden Julian Oscillation phase prevailed (phases 8 & 1) during the first half whereas favourable phase (phases 2-4) prevailed during second half of the monsoon season. But overall, India received good rainfall during the monsoon season. This is mainly due to the formation of many low-pressure systems and absence of break-monsoon condition during the season.

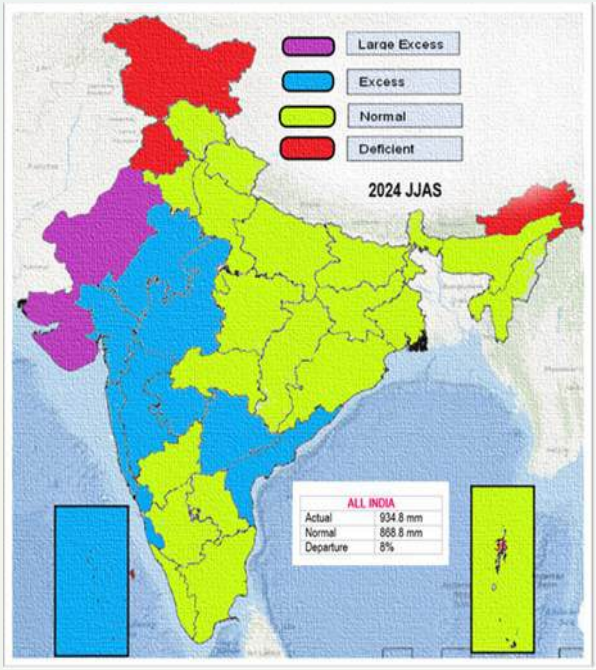

Figure 1: Spatial distribution of seasonal rainfall on sub-divisional scale over India during the southwest monsoon season of 2024

During the monsoon season, six monsoon depressions and deep-depressions formed, out of which one intensified into cyclonic storm (Fig. 2). Among the six depressions, one formed in July, three in August and two in September. Depressions along with relatively less intense low and well-marked low-pressure systems (in total 13), contributed heavy to very heavy rainfall over many parts of the country. Formation of only one low pressure system in June caused subdued rainfall over many subdivisions over Indo-Gangetic plains. Formation of depressions and low-pressure systems in September and the prevalence of active monsoon condition caused excess rainfall in September as well as slight delay in the withdrawal of the monsoon. During the season, monsoon

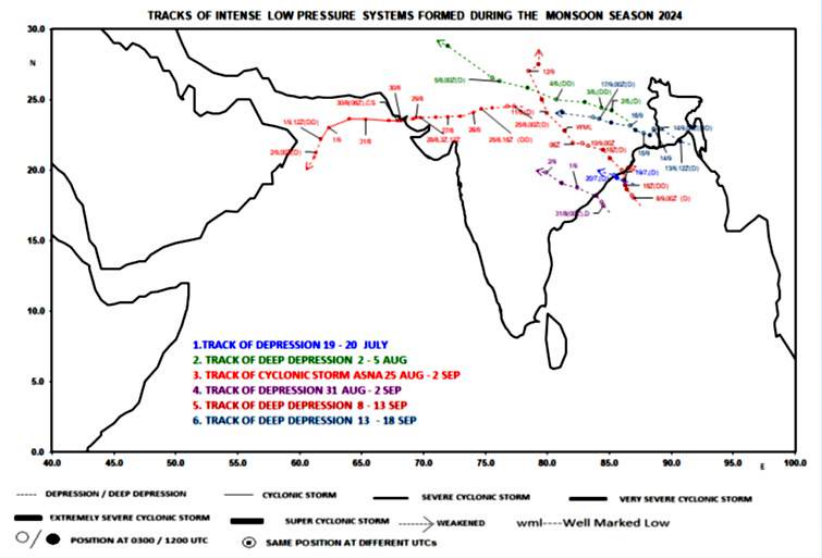

Figure 2: Tracks of the Cyclonic Storms and Depressions formed during Monsoon 2024 (Source: India Meteorological Department).

trough was active and found mostly over the climatological or south of the climatological position, which led to good rainfall over the core monsoon region. During the monsoon season, no active western disturbance was observed. This may be a reason for the below normal rainfall over the western parts of India. During the season, 473 extremely heavy rainfall (more than 204.4 mm per day) and 2,632 very heavy rainfall (115.6 to 204.4 mm per day) were reported across India. The extreme rainfall events were reported over Konkan & Goa, coastal Karnataka, Uttarakhand, Himachal Pradesh, Gujarat, West Madhya Pradesh, Telangana, Bihar, Orissa and Gangetic West Bengal.

Some Interesting features of Monsoon-2024

Predicted Vs realized rainfalls: Updated long range forecast outlook for the 2024 Southwest monsoon season was issued by India Meteorological Department on 27 May 2024. Rainfall forecast for the country as a whole was 106% of the LPA with a model error of ± 4%. The realized rainfall during the season was 108% of the LPA which is in close agreement with the forecast.

Extreme rains and record number of Deaths: The 2024 southwest monsoon recorded maximum number of very-heavy and extremely-heavy rainfall events in the last five years. These extreme weather events and associated natural calamities of the monsoon claimed 1,492 lives this year. According to IMD, 895 people lost their lives due to floods and rain-related incidents, while 597 fatalities were caused by thunderstorms and lightning strikes.

Asna – A rare Cyclonic Storm: Rare cyclonic storm 'Asna' formed over the Arabian Sea on 30 August. First it was found as a low-pressure system over the Bay of Bengal on 16 August. It criss-crossed the entire Indian landmass from east to west during the second half of August 2024 and eventually intensified as a deep depression over Saurashtra and Kutch in Gujarat. Possibly, soil moisture from previous good rains over these regions would have helped the intensification of the depression. This is only the fourth cyclone to develop in the Arabian sea in August since 1944.

One of the most fatal landslides of India: Chooralmala and Mundakkai, two villages with scenic landscapes and waterfalls on the Vellarimala hill ranges of Western Ghats in Wayanad district of Kerala were struck by a massive landslide on 30 July 2024. Torrential rainfall (about 572 mm in 48 hours) over this region triggered the landslide. The landslide debris travelled about 8 km along the course of Iruvaniphuza river and claimed lives of more than 400 people.

Heavy Floods in Bihar: The state of Bihar faced flood situation in 18 districts due to heavy to very heavy rainfall from 26-28 September 2024 in Nepal and north Bihar and discharge of excessive water from Birpur and Valmiki Nagar barrages in Kosi, Gandak and Bagmati rivers. More than 500 villages submerged in flood and nearly 15 lakh people were affected by this flood.

Multi-decadal variability and Good Monsoon Rainfall: We are currently in positive mode of the multi-decadal variability of the Indian summer monsoon. According to Dr. M Rajeevan, former Secretary, MoES, Govt. of India, more rainfall during coming years may be expected due to the positive phase of multi-decadal variability. (Hindustan Times, 01 October 2024).

Impact of delayed withdrawal on Agriculture: Active monsoon condition in September and delayed withdrawal of monsoon have mixed effects on agriculture, potentially leading to both crop damage (soak the fields meant for harvest) and benefits for winter-sown crops.

References:

IMD 2024a: Updated Long Range Forecast Outlook for the 2024 Southwest Monsoon Season (June - September) (Press Release – 27 May 2024).

IMD 2024b: Salient Features of the 2024 Southwest Monsoon Season (Press Release – 01 October 2024).

30TH JULY WAYANAD LANDSLIDE: A RESULT OF EXTREME RAINFALL EVENT

Girish Gopinath

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On 30th July 2024, most disastrous landslide occurred in the eastern slope of Wayanad Plateau around 0100hrs and 0400hrs, this caused severe debris flow more than 8km from the source and claimed hundreds of human lives. Previous landslides in Kerala shows the main driving force of initiation of these landslides are steep slopes and short, intense rains that fall beyond the threshold; the frequency and intensity of these landslides are determined by the slope, type of soil saturation, overburden cover, and underlying geology of the region. The eastern slope of the Wayanad plateau composed of older rocks of charnockites and migmatites which dissected by younger faults and lineaments (Fig 1).

The Wayanad landslide initiated as a rock fall, later transforming into a debris flow due to extreme rainfall and unique topography, which led to a landslide lake outburst flood.

Rainfall characteristics

Based on the preliminary report published by Geological survey of India, the rainfall recorded from two stations, i.e., Puthumala and Chembra receives >350 mm and 300 mm respectively (www.gsi.gov.in). The rainfall distribution shows the thick overburden in the areas are exposed to short duration heavy rain fall which affected the soil shear strength and cohesion. The weathered, highly jointed rocks with thick overburden and steep slope accelerated the impact of Wayanad Landslide. Also the overturned foliation planes in the crown areas increased the pore pressure and later the landslide initiated along the river channel. More than 500 millimetres (Fig 2) of rain fell on the area, and the massive volumes of water that filled the vertically orientated foliations, fissures, and joints disrupted the cohesiveness of the soil. The straight river route served as the perfect conduit for the creation of the most catastrophic landslip in Kerala history, while the elevation added additional fuel in the form of gravity (potential energy) and steep slope (kinetic energy). (https://www.thehindu.com/news/national/kerala/dam-burst-effect-caused-wayanad-landslide-experts/article68529310.ece).

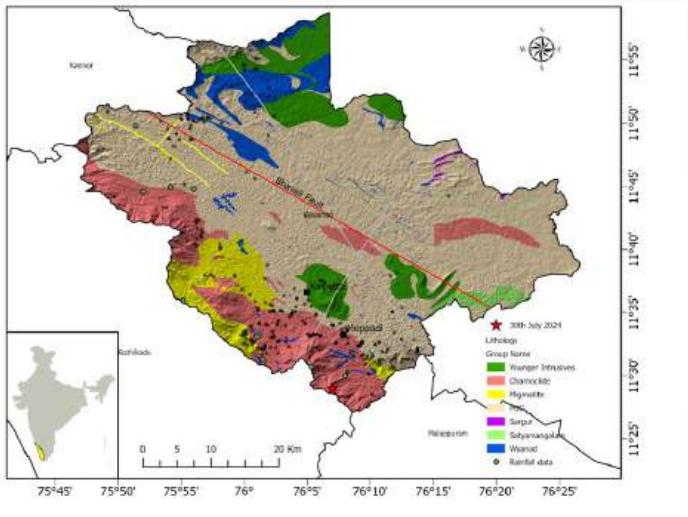

Figure 1: Map shows geological distribution of various group of rocks across the Wayanad District, red solid star shows the present 30th July 2024 Landslide location.

Preliminary assessment shows the basement rocks are folded and the vertical joints along the gniessosity created large blocks by the parallel set of joints. The landslides in the area concentrated along the crustal scale lineaments such as NW-SE

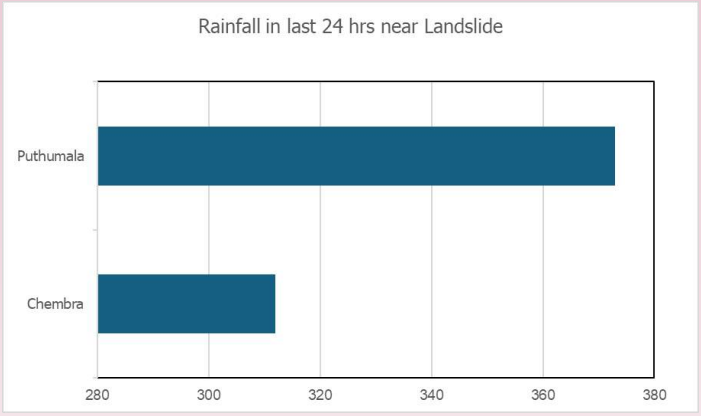

Figure 2: Rainfall data collected from GSI Preliminary report (https://www.gsi.gov.in/webcenter/portal/OCBIS/pageQuickLinks/pagelandslideincidents2024)

& NE-SW, which are making conjugate set of various small lineaments, act as conduit for groundwater seepages. Along with the brief period of water damming in the higher reaches, the substantial overburden produced extra pore pressure in the area's steeply foliated migmatite and other basement rocks, creating a tremendous amount of potential and kinetic energy. This is demonstrated by the enormous load that the landslide produced, with boulders ranging in size from centimetres to meters. (Fig 3). Moreover, blocky weathering was produced by the conjugate joints and the vertical shear zone that crossed the river channel; these blocks are prone to failure because of pore pressure fluctuations and cohesion loss. The crown area shows plannar failure with many dipping facture plains (Fig 4)

Figure 3: Oblique view of Landslides shows the massive runout and large boulders in the toe area.

The 30th July 2024, the Wayanad slide occurred as a rainfall induced debris flow due to planar failure in the crown area, detailed investigation is required for potential threat of similar channelized debris flows all along the Western

Figure 4: Plannar failure in the crown area, note the presence of larger boulders and debris present in the crown is thread to buildings in the down stream area.

Ghats. In the present scenario nodal agency for landslide identified potential landslide hotspots and susceptible areas but flow models yet to be developed for each region. Also, the shift in the monsoon and orographic elevations may cause landslide lake outburst floods in these regions due to unscientific slope alterations and urbanisations. Since the western ghats of Kerala have higher population density, the frequent multiple landslides possess a great threat to infrastructure and life. Development of a scientific land use policy across the Western Ghats and detailed site-specific landslide early warning is essential to mitigate future calamities. Detailed investigation and collaborative research of hydrosphere, atmospheric and geosphere will help to predict landslides in the tropical areas and reduction in the potential loss of lives.

ASSESSING THE EFFECTS OF RECENT WILDFIRES ON AMBIENT AIR QUALITY USING SATELLITE DATA

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The occurences of forest fires globally has been on the rise, with notable increases in their frequency, intensity and duration. Wildfires release vast amounts of particulate matter (PM2.5), carbon monoxide and other harmful pollutants into the atmosphere, leading to sharp decline in air qulaity. In many regions, this has resulted in dangerously elevated levels of pollution, often prompting public health warnings and air quality alerts. In addition to acute risks, prolonged exposure to wildfire smoke can contribute to chronic respiratory and cardio-vascular diseases. Forest fires can also alter atmospheric composition and transport huge amount of pollutant gases and aerosol into the upper atmosphere and faraway regions. Recent forest fires have significantly impacted ambient air quality, with devastating consequences for both human health and environment.

Satellite observations of wildfire events would help to monitor and assess the impact of biomass burning on air quality and climate.

Uttarakhand, a mountainous state in northern India, is particularly vulnerable to forest fires due to its dry climate, dense forests, and rugged terrain. These fires pose a significant threat to the state's rich biodiversity, ecological balance, and human communities. The causes of forest fires in Uttarakhand is both natural, such as lightning strikes and spontaneous combustion, and human-induced, including negligence, intentional acts, and land clearing practices. The peak fire season in Uttarakhand typically begins in mid-March, when the weather becomes dry and hot. However, even after the peak season has passed, forest fires can still break out. Recently, in the last week of April 2024, a new wave of forest fires flared up in various parts of Uttarakhand. The fire spread to the vicinity of the city of Nainital , calling for drastic disaster mitigation efforts (Figure 1).

To evaluate the impact of these forest fires, we used TROPOspheric Monitoring Instrument (TROPOMI) dataset of formaldehyde (HCHO) for the period 22-26 April 2024. Figure 2 shows mean HCHO concentration map for the period (a) 22-26 April 2023 and (b) 22-26 April 2024. Increased concentration of HCHO was observed over Uttrakhand extending up to entire Indo-Gangetic region for 22-26 April 2024 as

Figure 1: Fire and Smoke emanating from Uttarakhand wild fire

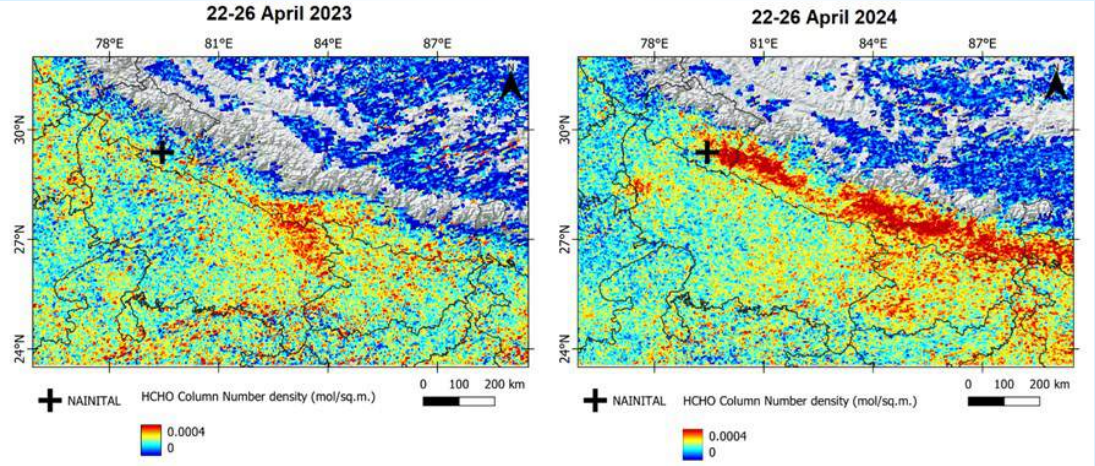

Figure 2: Mean HCHO concentration map for the period (a) 22-26 April 2023 and (b) 22-26 April 2024.

compared to 2023 for the same period because of the prevalent wind conditions.

Similarly, a massive fire erupted near Ruidoso village in New Mexico on 17 June 2024. Figure 3 shows the elevated levels of NO_2, CO and HCHO during 17–18 June 2024 as compare to the levels before and after the event. Owing to CO's longer lifetime, CO plume extended nearly 100 km, unlike NO_2 and HCHO, which remained in the vicinity (~30 km) of Ruidoso. Such massive events impacts air quality at regional level not only through direct transport in the down-wind region but also through en-route photochemical production of secondary air pollutants (e.g., ozone).

Satellite observations of such events would help to monitor and assess the impact of biomass burning on air quality and climate. In addition, top-down emission inventories can be improved and hence the chemistry-transport model simulations, which are crucial for assessing the impact from such events. As wildfire frequency and intensity is projected to increase due to climate change, the impact on air quality is expected to worsen, highlighting the urgent need for comprehensive strategies to mitigate both the occurrence and effects of forest fires.

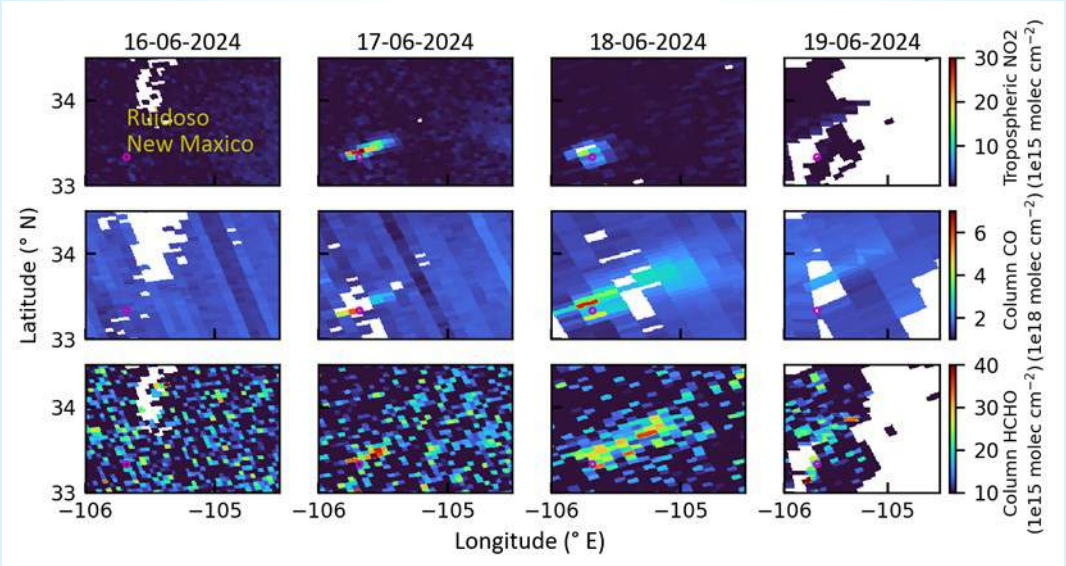

Figure 3: Spatial distribution of tropospheric NO2, columnar CO and HCHO concentration over the region of fire event in New Mexico during 16–19 June 2024.

MONSOON PREDICTION 2024 USING CAM MODEL

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Indian Summer Monsoon (ISM) rainfall during June to September (JJAS) for every year is a very important meteorological event widely monitored by different Indian as well as international agencies, because of its significant influence on socio-economical development of India and its neighbouring countries. This is also one of the most dominant features of the global hydrological cycle. Though the onset of the monsoon over Kerala in India takes place at the start of June with the seasonal reversal of wind over the Arabian Sea with a consistent manner from year to year, the monsoon rainfall is characterized by significant intra-seasonal and inter-annual variability over and around India. The long-term average of All-India rainfall (AIR) for the whole season is around 89 cm, of which up to ±5% deviation in AIR of a particular season is called normal monsoon season. After a drought year viz. 2023, the country received above normal rainfall this year that resulted significant boosting in food grain production; however, several part of the country was severely affected by floods. The prediction of ISM rainfall for the current year (viz. 2024) was 105% (93.6 cm) ± 4% of long-term mean. As observed by IMD, rainfall over the country as a whole during 2024 southwest monsoon season was 108% of its long-term mean of 89 cm that makes the seasonal rainfall above-normal. The spatial variability of rainfall also plays a critical role in regional development. Seasonal rainfall over Northwest India, Central India, South Peninsula and Northeast (NE) India were 107%, 119%, 114% and 86% of respective long-term mean of the region. The southwest monsoon seasonal rainfall over the monsoon core zone, which consists of most of the rain fed agriculture regions in the country, received 122% of long-term mean. Further, monthly average rainfall over the country as a whole was 89% of LPA in June, 109% of LPA in July, 115% of LPA in August, and 112% of LPA in September. Detail analysis may be seen in the table below.

The model forecast for the year 2024 suggests above-normal rainfall over the country during the season i.e. June to September.

Seasonal forecast of ISM rainfall has been conducted through ensemble Community Atmosphere Model (CAM) simulation in ~0.5°×0.5° resolution during May to September, 2024. The forecast has been generated in the month of April using the observed atmospheric and sea surface conditions, updated on monthly basis. Seasonal, monthly and weekly (four weeks in advance) accumulated rainfall has been predicted over Indian region and being updated on monthly basis during the monsoon season till September. The model initial conditions (atmosphere, land and ocean) at the synoptic hour 0000 UTC of different days of the month have been generated using different satellite observations and model reanalysis products viz. GFS. The monthly/ weekly sea surface temperature (SST) for the model boundary condition has been taken from NOAA OISST. Extensive validation has also being carried out on regular basis using different satellite derived rainfall products viz. GPM, INSAT-3DS satellite derived HE Rainfall, IMD gridded and in-situ observations etc. The forecast and validation results have been disseminated

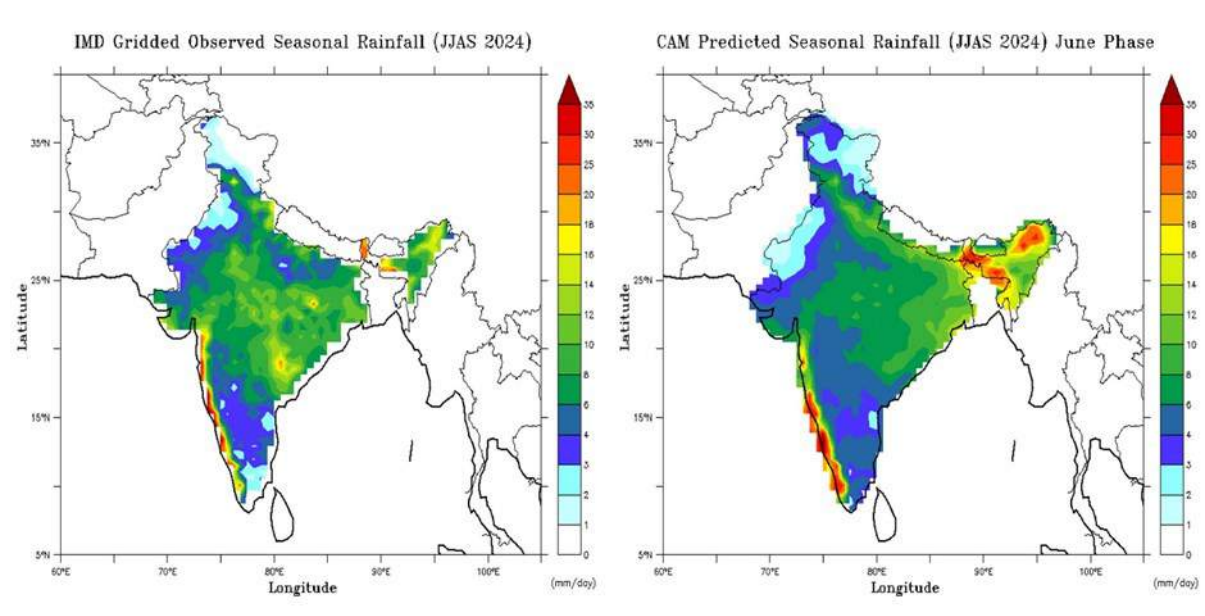

Figure 1: Comparison of CAM predicted seasonal rainfall (right) with IMD gridded rainfall (left)

Table 1: Accumulated monthly and seasonal All-India rainfall for the year 2024 along with the model normal (all figures are in cm)

	Model Normal	IMD Obs. Normal	IMD Obs. 2024	CAM Forecast
June	18.0	16.5	14.7 (89%)	18.8 (105%)
July	28.0	28.1	30.6 (109%)	29.6 (106%)
Aug	25.4	25.5	29.4 (115%)	27.2 (107%)
Sept.	17.5	16.8	18.7 (112%)	18.0 (103%)
Season	88.9	86.9	93.1 (108%)	93.6 (105%)

through the MOSDAC web-portal and updated with the evolution throughout the season.

The model forecast for the year 2024 suggests above-normal rainfall over the country during the season i.e. June to September. The All-India rainfall (AIR) has been computed from the model forecast and has been compared with IMD gridded rainfall product (**Table 1**). The All-India rainfall (AIR) is estimated to be 93.6 cm which is 105% of the long-term model mean of 88.9 cm. The monthly accumulated AIRs estimated by the model are 18.8 cm (105%), 29.6 cm (106%), 27.2 cm (107%) and 18.0 cm (103%) for the months of June to September respectively. The comparison of seasonal mean rainfall predicted by the ensemble CAM model and IMD gridded rainfall observation are presented in figure 1. Further, the area weighted cumulative weekly All-India rainfall has been predicted in near-real time mode four weeks in advance and updated monthly basis. The model predicted rainfall over central part of the country is under-estimated whereas the same for the season over East part of India over-estimated. Overall, the skill of the model forecast is significantly high as compared to previous years prediction exercise. Presently, the seasonal forecast of ISM rainfall has been performed on experimental basis and disseminated through MOSDAC web-portal.

MONITORING WEATHER THROUGH INSAT-3DS

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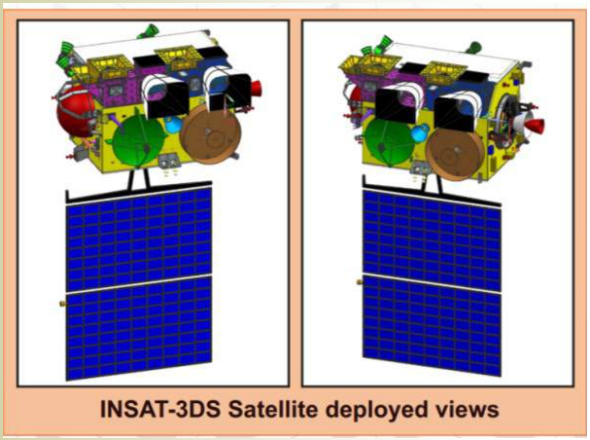
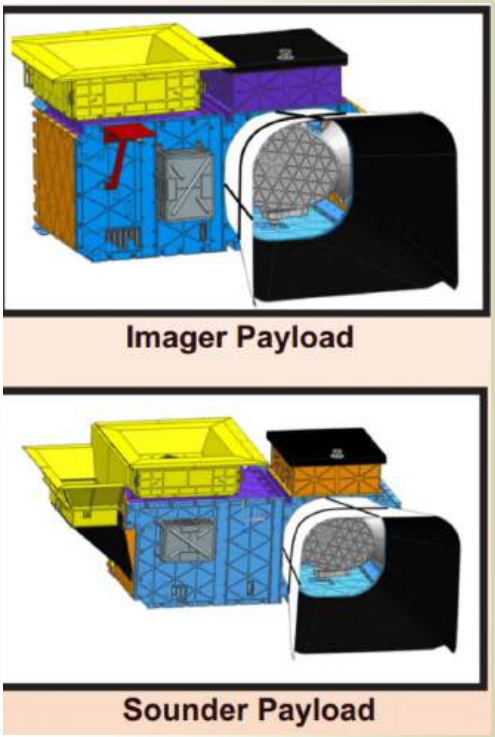
INSAT series of satellites are well known for providing dedicated metrological applications in Indian subcontinent. In this series INSAT-3DS is latest, aims to ensure the continuity and expansion of the capabilities provided by INSAT-3D and 3DR satellites in orbit. The mission goal is to provide an operational, environmental and cyclone warning system to protect life property and environment. This mission is equipped with cutting edge technology to provide meterological now-cast and forecast services. This mission is designed for three tier monitoring of land, ocean and atmosphere from Geostationary platform for enhanced meteorological observations and services and it is positioned at 82 deg East longitude. It is the first mission in all INSAT series which was launched from INDIA's SDSC SHAR on 17-2-2024 at 17:30 hrs using GSLV-F14 Launch Vehicle. Earlier all INSAT series of satellite was launched from ARIAN space French Guyana. Another interesting fact is, this mission is fully funded by Ministry of Earth Science (MoES) and the main user are various department under MoES. Some prominent user of INSAT-3DS are India Meterological Department (IMD), National Centre for Medium Range Weather Forecasting (NCMRWF), Indian Institute of Tropical Meteorology (IITM), National Institute of Ocean Technology (NIOT), Indian National Center for Ocean Information Services (INCOIS) and various other agencies and institutes.



INSAT-3DS Satellite deployed views

Mission Objectives:

- To monitor Earth's surface, carry out Oceanic observations and its environment in various spectral channels of meteorological importance.
- To provide the vertical profile of various meteorological parameters of the Atmosphere.
- To provide the Data Collection and Data Dissemination capabilities from the Data Collection Platforms (DCPs).
- To provide Satellite Aided Search and Rescue services



Imager Payload

Sounder Payload

Main products applications:

The geophysical parameters that will be extracted from INSAT-3DS are Outgoing long wave radiation (OLR), Sea and Land surface temperatures (SST, LST), Quantitative Precipitation estimation (QPE), Cloud properties & microphysical parameters, Fog, Rainfall, Snow Cover, Snow Depth, Fire, Smoke, Aerosol, Water Vapor Wind (WVW), Cloud motion vector (CMV), Upper Tropospheric Humidity (UTH), Atmospheric Motion Vector (AMV), Humidity Profile and Total Ozone and many other value added parameters.

Payloads Description:

INSAT-3DS is equipped with cutting edge technology and has total four payloads and in that two are Meteorological (MET) payloads named as Imager and Sounder. The other two are communication payloads namely, Data Relay Transponder (DRT) and Satellite Aided Search & Rescue transponder (SAS&R). These payloads are similar as earlier 3D and 3DS but has significant improvements in radiometric performance. The details of payloads are given below.

1. Imager Payload: It is a very high resolution radiometer (VHRR) produces images in six spectral channels, in the visible (VIS), Near Infrared (NIR), Mid wave Infrared (MWIR) and Infrared (IR) part of Electromagnetic signal.

Table 1: Channels and resolution of different bands of INSAT-3DS sensor

Channel #	Wavelength (um)	Resolution (Km)
1	0.55-0.75	1
2	1.55-1.70	1
3	3.8-4.0	4
4	6.5-7.1	8
5	10.2-11.3	4
6	11.5-12.5	4

Imaging in MWIR band is beneficial for night time pictures of low cloud and fog while thermal band imaging is for estimation of Sea Surface Temperature (SST) with better accuracy. The channel description along with resolution is given in Table 1.

2. Sounder Payload: INSAT-3DS satellite carries 19 channel Sounder payload having 1 Visible channel and eighteen narrow spectral channels (Table 2). Sounder payload has capability of new dimension of weather monitoring through its atmospheric sounding system, which provides vertical profile of temperature (40 levels from surface to 70 km height), Humidity (21 levels from surface to 15 km) and integrated ozone from surface to top of the atmosphere. To retrieve it spectral channels of sounder are selected at various positions of absorption wavelength of atmospheric gases (CO_2, H_2O and N_2O) as on its availability at different height of the atmosphere. Central wavelengths of these channel along with the typical noise sensitivity is summarized in table 2

3.Data Relay Transponder (DRT): This payload is designed to Receive and transmit global Meteorological, Hydrological and Oceanographic data from automatic Data collection platforms/ Automatic Weather Stations (AWS) for augmenting weather forecasting accuracy.

4. Satellite aided Search and Rescue (SA&SR) transponder:

This payload plays critical role in global search and rescue operations by Relaying a distress signal / alert detection from the beacon transmitters for Search and Rescue purposes. It has global receive coverage in UHF band to ensure comprehensive coverage worldwide.

Table 2: Central wavelengths of INSAT-3DS channels along with the typical noise sensitivity

Ch#	lc	Δl	Principal absorbing gas	Purpose
1	14.67	0.385	CO_2	Stratosphere Temperature
2	14.31	0.305	CO_2	Troposphere Temperature
3	14.03	0.321	CO_2	Upper Level Temperature
4	13.64	0.351	CO_2	Mid Level temperature
5	13.33	0.352	CO_2	Low Level Temperature
6	12.59	0.541	Water Vapor	Total Precipitable water
7	11.98	0.768	Water Vapor	Surface Temperature Moisture
8	10.99	0.611	Window	Surface temperature
9	9.69	0.262	Ozone	Total Ozone
10	7.43	0.299	Water Vapor	Low-Level Moisture
11	7.04	0.426	Water Vapor	Mid Level Moisture
12	6.52	0.269	Water Vapor	Upper Level Moisture
13	4.61	0.054	N_2O	Low Level Temperature
14	4.54	0.053	N_2O	Mid Level Temperature
15	4.48	0.057	CO_2	Upper Level Temperature
16	4.15	0.078	CO_2	Boundary Level Temperature
17	4.01	0.075	Window	Surface temperature
18	3.79	0.143	Window	Surface Temperature Moisture.

FLOODS OF 2024 IN GUJARAT AND VIJAYAWADA

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The year of 2024 was marked by severe flooding in both Gujarat and Andhra Pradesh. Gujarat faced severe flooding and disruptions due to a significant weather disturbance that originated as a low-pressure area over north Madhya Pradesh on 25 August 2024.

The rapid rise in river water levels of Krishna and its tributaries and the discharge of water from dams intensified the floods, leading to significant disruptions and widespread damage in several districts.

This disturbance intensified into a deep depression causing significant rainfall over the next two days. The impact of the flooding was widespread, with 12 districts of south and central Gujarat being severely affected, including Navsari, Surat, Bharuch, Vadodara, Ahmedabad, Anand, Kheda and Panch Mahals. Sentinel-1A Synthetic Aperture Radar acquired data over the affected regions on 28-Aug-2024 showing this widespread flooding (Figure 1). AMSR2 brightness temperature derived flood index product hosted on VEDAS was also able to capture inundation over Gujarat region from its onset on 27 August 2024 (Figure 2). AMSR2 observed Brightness Temperature at 36.5 GHz is used to estimate flood index at 0.1° spatial resolution. BT in H and V polarizations are used to compute Microwave Polarization Difference Index (MPDI), which is then converted to a flood index using a linear interpolation. High values of MPDI suggest intense flooding since emissivity of water in H and V polarisations vary significantly. AMSR2 derived daily flood index product is available at VEDAS [*https://vedas.sac.gov.in/hydro/index.html*].

Starting 31st August 2024, parts of Andhra Pradesh experienced severe flooding caused by heavy to extremely heavy rainfall. The rapid rise in river water levels of Krishna and its tributaries and the discharge of water from dams intensified the floods, leading to significant disruptions and widespread damage in several districts. The districts of Krishna and Guntur were severely impacted by continuous heavy rain. For the first time in the last three decades, Vijayawada witnessed over 290 mm of rainfall in a single day which instigated a severe flooding situation in the area. Sentinel-1A SAR acquired data over the affected regions on 01-Sep-2024 showing this widespread flooding (Figure 3).

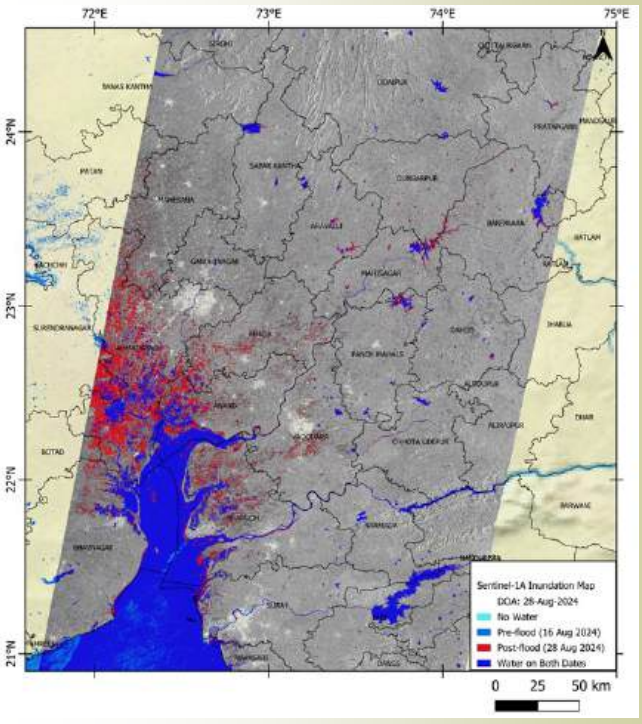

Figure 1. Sentinel-1A derived inundation map for South and Central Gujarat using pre- (16-Aug-2024) and post-flood (28-Aug-2024) SAR images

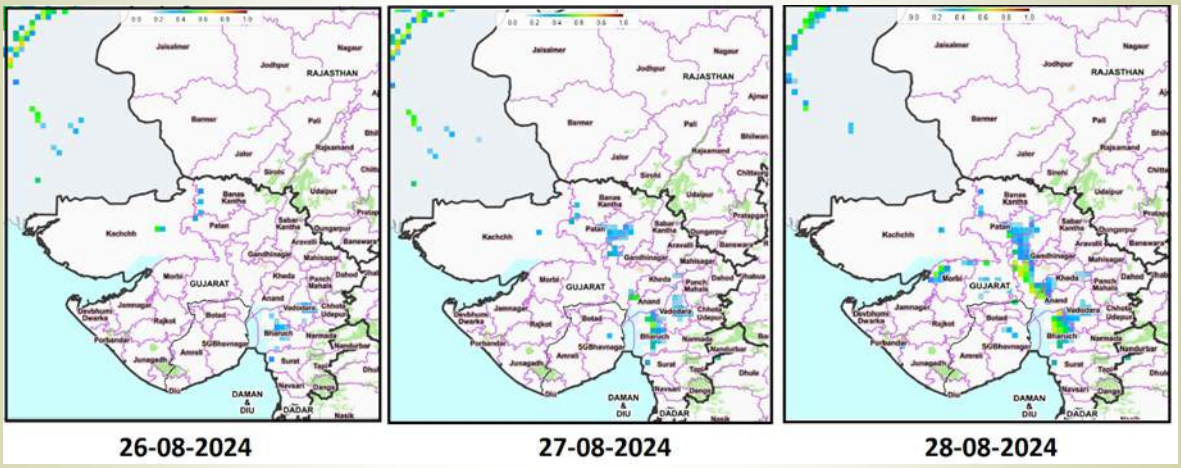

Figure 2. Flood index observed from AMSR2 36.5 GHz BT over Gujarat for 26-28 August 2024.

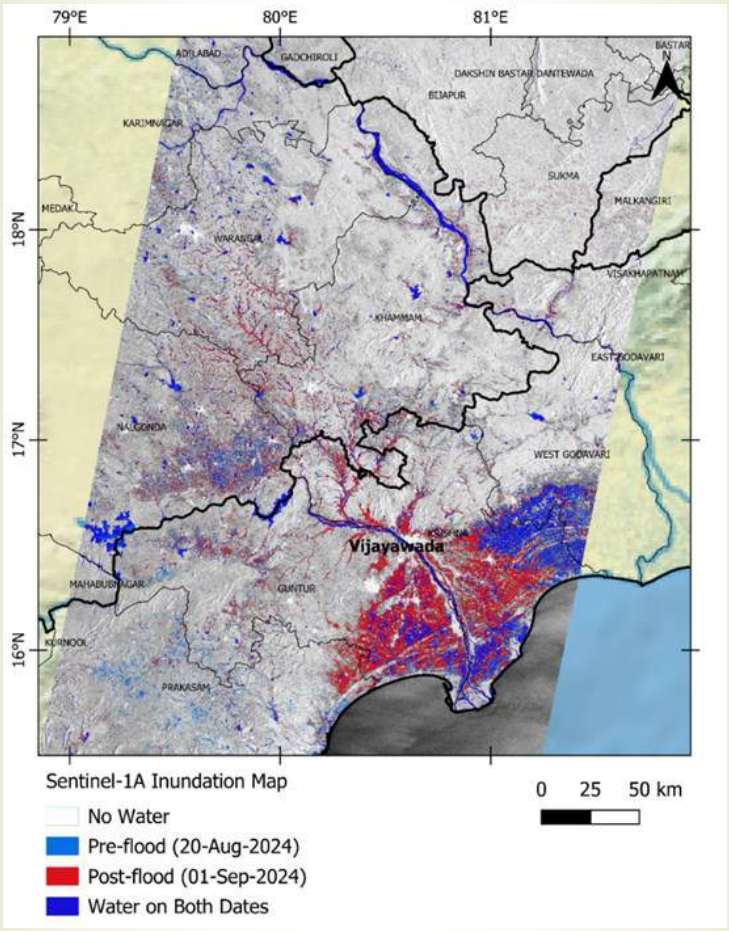

Figure 3. Sentinel-1A derived inundation map around Vijayawada, Andhra Pradesh using pre-(20-Aug-2024) and post-flood (01-Sep-2024) SAR images

FEATURES OF SOUTHWEST MONSOON SEASON 2024 OVER GUJARAT

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Introduction

The southwest monsoon season of 2024 in Gujarat was characterized by an early onset, delay in withdrawal and occurrence of extreme rainfall events, leading to significant socio-economic impacts across the state. The monsoon arrived on June 11, 2024, four days ahead of the usual onset date of June 15, and persisted until October 15, 2024, ten days longer than the normal withdrawal date of October 5. This prolonged and active monsoonal conditions resulted in heavy rainfall in several occasions in the region caused widespread flooding, particularly in urban areas, and severely impacted agriculture, especially in the later months of the season. With an overall 48% excess rainfall with compare to long period average (1971-2020) in the state Gujarat, the state experienced many heavy rainfall spells, particularly in the Saurashtra-Kutch region, leading to floods.

The overall state recorded 1,055.5 mm of rainfall, which is 48% above the normal value of 711.9 mm. The 2024 monsoon season in Gujarat was characterized by above-normal rainfall.

2. Rainfall Statistics

In the State Gujarat, there are two meteorological sub divisions namely i. Gujarat region and ii. Saurashtra & Kutch. During southwest monsoon 2024 (June to September), the State Gujarat experienced significant rainfall which resulted with positive departure in rainfall from normal values, with many districts recording large excess rainfall with departure +60% and more with compare long period average (1971-2020). The spatial distribution of rainfall of various categories of rainfall is shown in fig 1 along with legends. No districts was left in the state which was received below normal rainfall. All districts received normal or above category of rainfall during the season. The overall state recorded 1,055.5 mm of rainfall, which is 48% above the normal value of 711.9 mm.

(i) Regional Rainfall Distribution

Gujarat Region: The Gujarat subdivision recorded 30% excess rainfall which is 1202.9 mm cumulative and ranged from 614 mm in Banaskantha to 3,086.5mm in Dadra & Nagar Haveli. In the Gujarat Met sub division most of the districts received excess category of rainfall except Bahruch which has receipt Large excess category of rainfall and Banaskantha, Sabarkantha, Aravalli, Dahod and Dang received normal category of rainfall.

Saurashtra & Kutch: The Saurashtra & Kutch subdivision recorded the highest rainfall departure in Gujarat with 75% excess rainfall i.e. 942.7mm cumulative. The districts Kutch, Morbi, Jamnagar, Debbhumi Dwarka, Porbandar, Junagarh, Rajkot received Large Excess Category of rainfall and Surendar Nagar, Amreli, Bhavnagar districts received Excess category of rainfall whereas only Botad and Gir Somnath received normal category of rainfall.

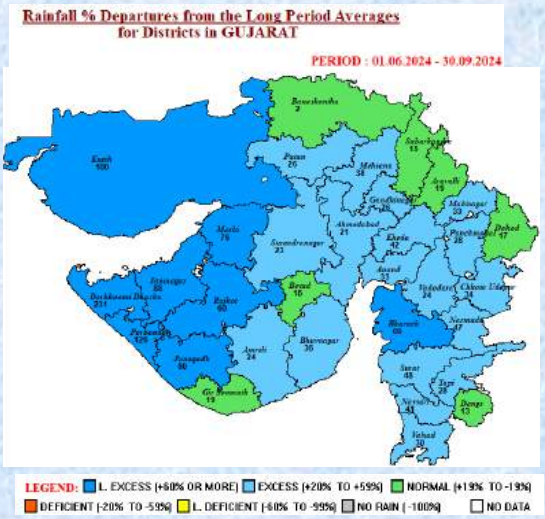

Figure 1. District wise Rainfall distribution

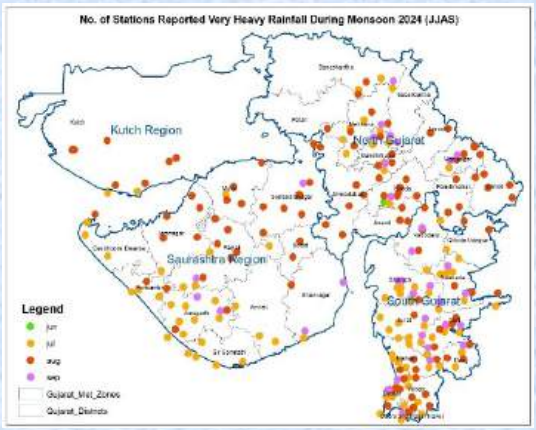

Figure 2. Stations reported very heavy rainfall

(ii) Subdivision-Specific Analysis

Saurashtra & Kutch: In the sub division, district Devbhumi Dwarka saw rainfall 231% above normal, while district Porbandar recorded 126% excess rainfall which led to flood in the areas.

Gujarat Region: In the subdivision, districts Bharuch, Anand, Surat, and Narmada experienced above-average

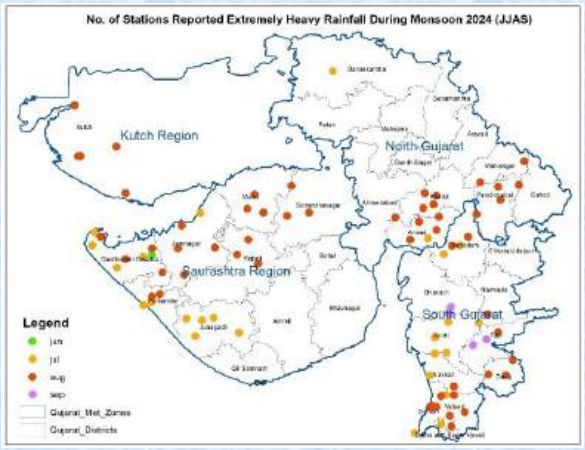

Figure 3. Stations reported extremely heavy rainfall

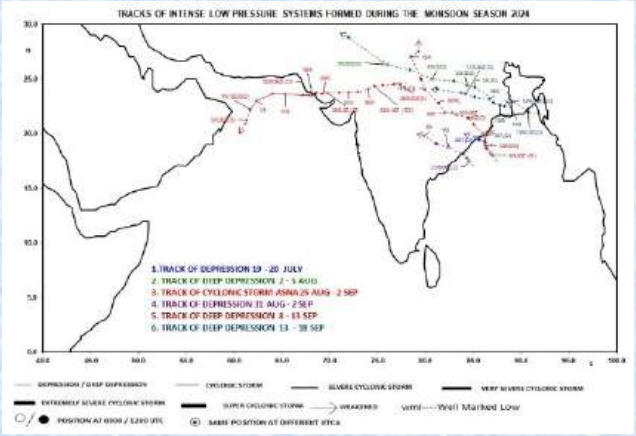

Figure 4. Track of Intense Low-Pressure systems

rainfall, with rainfall departure ranging from 28% to 69% above the normal. Where as districts, Vadodara and Ahmedabad saw excess rainfall of 24% and 21%, respectively, which contributed to localized flooding in urban areas.

3. Extreme and Very Heavy Rainfall Events

(i) Very Heavy Rainfall Events

Gujarat state recorded 26 days of extremely heavy rainfall and 53 days of very heavy rainfall events in the monsoon of 2024 (fig. 2). These events were scattered throughout the season, with the highest concentration of these events occurring in August.

(ii) Extremely Heavy Rainfall Events

These extreme events led to flood like situation in urban areas, especially in Vadodara, Ahmedabad, and Surat, where heavy rains caused rapid waterlogging and disrupted daily life (fig. 3).

4. Factors Contributing to the good rainfall activity

Several key meteorological factors contributed to the good rainfall activity during the 2024 monsoon season specially in the month of September in the region:

Increased Frequency of systems:

The formation of cyclonic systems, including Cyclone Asna and various low-pressure systems, significantly increased rainfall over Gujarat state. The systems formed over the Bay of Bengal typically moved in a north-northwest direction, bringing heavy rains to Gujarat.

Even though Sea Surface Temperature anomaly did not cross the threshold value (-0.5 ° C) of La Nina, the circulation features were similar to La Nina pattern which is also favourable to get good rainfall activity.

MJO was in the favourable phase 3-5 in many days, which helps to get good rainfall

Monsoon trough: Along the normal or south of the normal position in the month of September and it remained active, organized, south of the normal position till 16 Sept and then during 19-21 Sept.

5. Cyclonic and Low-Pressure Systems

The 2024 monsoon season observed many numbers of low-pressure systems and cyclonic disturbances which were formed over the Bay of Bengal and moved generally north-northwest ward direction and produced good amount of rainfall over the central part and western region of the country. Also, few low-pressure systems originated over Arabian Sea which impacted Gujarat (fig. 4).

Cyclonic Storm Asna: Cyclonic Storm 'ASNA' formed over the Arabian Sea (remnants of the Bay of Bengal system) in the monsoon season from the 25th of August to the 2nd of September 2024. Originally the system formed in the North west Bay of Bengal and adj west Bengal & Bangladesh on 16 August and initially moved towards northward and later moved towards westerly. It further intensified into depression over NW MP on 25 August in land and then it intensified into deep depression on 26 over North Gujarat. On 30 August it entered in to the Arabian sea through Kutch and intensified into cyclonic storm. Since 1891 there were only three such Cyclonic storm formed over Arabian sea (1944, 1964 and 1976) during August.

6. Conclusion

The overall state recorded 1,055.5 mm of rainfall, which is 48% above the normal value of 711.9 mm. The 2024 monsoon season in Gujarat was characterized by above-normal rainfall, a series of extreme weather events, and substantial damage to infrastructure and agriculture. The state faced 26 days of extremely heavy rainfall and 53 days of very heavy rainfall spell, with particular regions in Saurashtra & Kutch and Gujarat Region experiencing significant positive rainfall departure. The delayed monsoon withdrawal and numerous low-pressure systems contributed to the prolonged impact, causing widespread floods and agricultural loss. The heavy rainfall also highlighted the vulnerabilities of Gujarat's urban infrastructure, which faced significant challenges in coping with the rapid onset of floods in major cities. In the coming years, improving flood management infrastructure and disaster preparedness will be crucial for mitigating the impact of future extreme weather events.

MY EXPERIENCE AT 75TH REPUBLIC DAY PARADE 2024

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It was a pleasant surprise for me, when I got the information that my name is among the SAC women scientists nominated for witnessing 75th Republic Day Parade 2024. On evening of 25th January 2024, we reached New Delhi. Dense foggy early morning of 26th January, we started from the hotel to reach Kartavya Path by Delhi metro and a long walk, but worth it. As an invited guest, we all sat in a special VIP pavilion. The Republic Day parade began with the President of India unfurling the national flag. The RD parade is a spectacular display of the cultural diversity and military power of our country. It makes you feel patriotic when you see the army and other military troops marching. The Jets displaying their manoeuvre was breath-taking event. When there is enchanting of National Anthem, you get goose bumps. Chief Guest this year was the president of France Mr. Emmanuel Macron. This year, there were a few new things like the French army marching & an all-women tri-services contingent participated in the parade. To top it off, the Prime Minister Shri Narendra Modi walked near the pavilions and waved at the crowd. This year the Parade showcased the themes of 'Viksit Bharat' and 'Bharat-Loktantra ki Matruka', emphasising a women-centric focus with special emphasis on "Nari Shakti". ISRO's tableau featured Chandrayaan-3 landing, Aditya L-1 mission, Gaganyaan, Bhartiya Antariksh Station. Watching the Republic Day parade was an awesome, thrilling and unforgettable experience for me. The experience was so much special from watching the parade on television. Overall, I would recommend that one should see it live at least once in lifetime.

WHAT'S NEW IN MOSDAC

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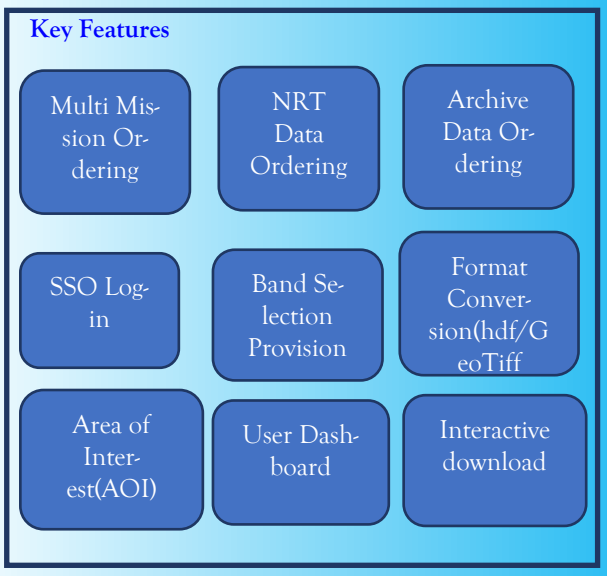
Meteorological and Oceanographic Satellite Data Archival Centre (MOSDAC) is a Data Centre of Space Applications Centre (SAC), Indian Space Research Organization (ISRO) and has facility for satellite data reception, processing, analysis and dissemination. MOSDAC is operationally supplying earth observation data from Indian meteorology and oceanography satellites through portal https://www.mosdac.gov.in

MOSDAC distributes data in Near Real Time (NRT) through in-house developed state-of the art application. MOSDAC keeps on improvising the application in terms of ease of use, features enhancement by utilizing current technology and tools. Following are recently developed major applications at MOSDAC:

MOSDAC User Order Processing Software (UOPS): Recently MOSDAC has operationalized its in-house developed application MOSDAC User Order Processing Software (UOPS) to disseminate Satellite and In-situ data. One has to be a registered user of MOSDAC to access UOPS. UOPS has capability for placing online order not only for archived data but also for upcoming data through its Standing order capability. This facility is used by operational agency and many other users to get NRT data continuously from MOSDAC. As soon as data products are published on MOSDAC, it is ready to be downloaded by User. MOSDAC is disseminating digital data to more than 12000 registered users. Key features of the application are:

Figure1 is the snapshot of UOPS home page. Homepage of UOPS displays product catalog. Datasets disseminated by UOPS include ISRO's meteorological and oceanographic mission viz. EOS-06, EOS -07, INSAT-3DS, INSAT-3DR, INSAT-3D, KALPANA-1, INSAT-3A, SCATSAT-1, OCEANSAT-2, Megha-Tropiques, SARAL, Doppler Weather Radar & Automatic Weather Stations (AWS).
Currently UOPS is hosting around 230 different data products. Each product available under this is associated with its unique Document Object Identifier (DOI). This also contains detailed information like duration, processing level, resolution, description, Granules count in a calendar view, version etc. User has capability to search data based on processing level, parameter, satellite, sensor, description etc. User is intimated through email and at UOPS portal about the request completion. User utilizes all this search facility to order and get the digital data on the fly from MOSDAC.

API based information dissemination: API-based dissemination of information has revolutionized how systems communicate, enabling efficient data sharing across diverse platforms. MOSDAC has developed series of APIs for dissemination of extreme weather events, WRF forecast, in situ data etc. These APIs are developed using next generation set of tools and techniques including open specifications, interoperability, easy integration and security.
The significance of open specifications, such as OpenAPI, cannot be overstated. OpenAPI provides a standardized way to describe RESTful APIs, allowing developers to outline endpoints, request/response formats, and authentication methods in a clear, machine-readable



format. This standardization enhances collaboration, improves documentation, and facilitates automated client generation, making it easier for developers to interact with APIs.

Interoperability is a key advantage of MOSDAC API-based systems. By adhering to open specifications, MOSDAC APIs can work seamlessly with other services and applications, regardless of their underlying technology stack. This interoperability allows organizations to combine resources from multiple vendors, enabling innovative solutions that leverage the best of various technologies.
Easy integration is another vital aspect of MOSDAC API-based dissemination. MOSDAC APIs enable organizations to connect separate systems without extensive modification to existing infrastructure. This agility supports rapid development cycles and helps organisations adapt to changing demands.
Security is also a critical consideration in API design. MOSDAC API Gateway serve as a protective layer between clients and back-end services, managing traffic and enforcing security protocols. It implement features like rate limiting, authentication, and monitoring, ensuring that only authorized users access data. API keys are a fundamental security measure, allowing providers to authenticate clients and control access to their APIs. By issuing unique keys, MOSDAC can track usage and revoke access when necessary, safeguarding data against unauthorized use.
In summary, API-based information dissemination leverages open specifications, promotes interoperability, facilitates easy integration, and incorporates robust security measures, empowering MOSDAC users to innovate and respond to the dynamic digital landscape. Here are some examples of front end user applications developed using this landscape.

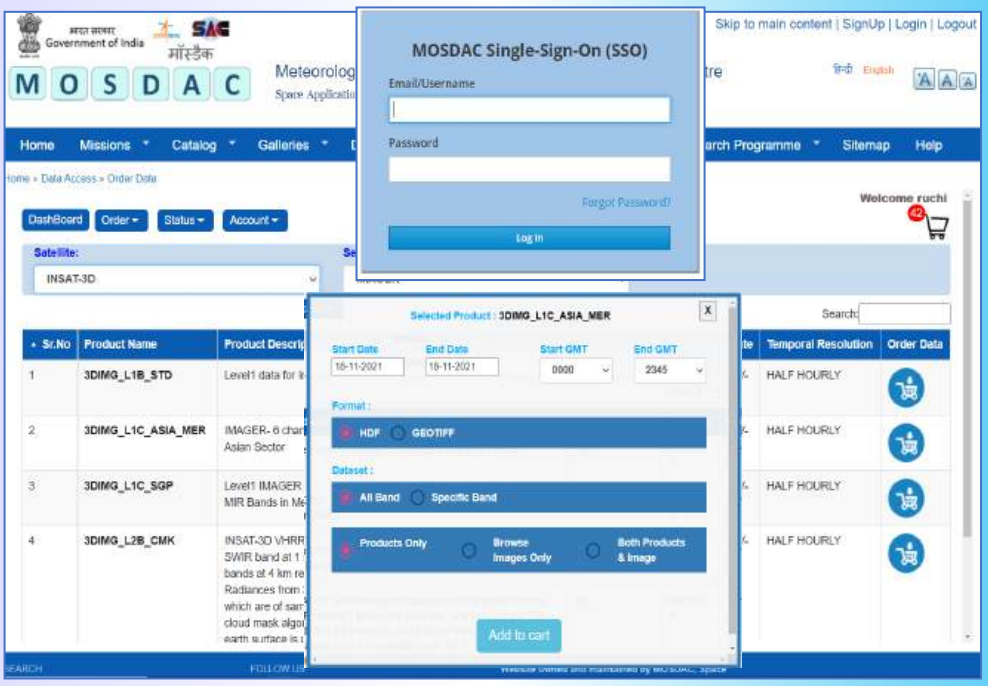


Figure 1: MOSDAC User Order Processing Software (UOPS)

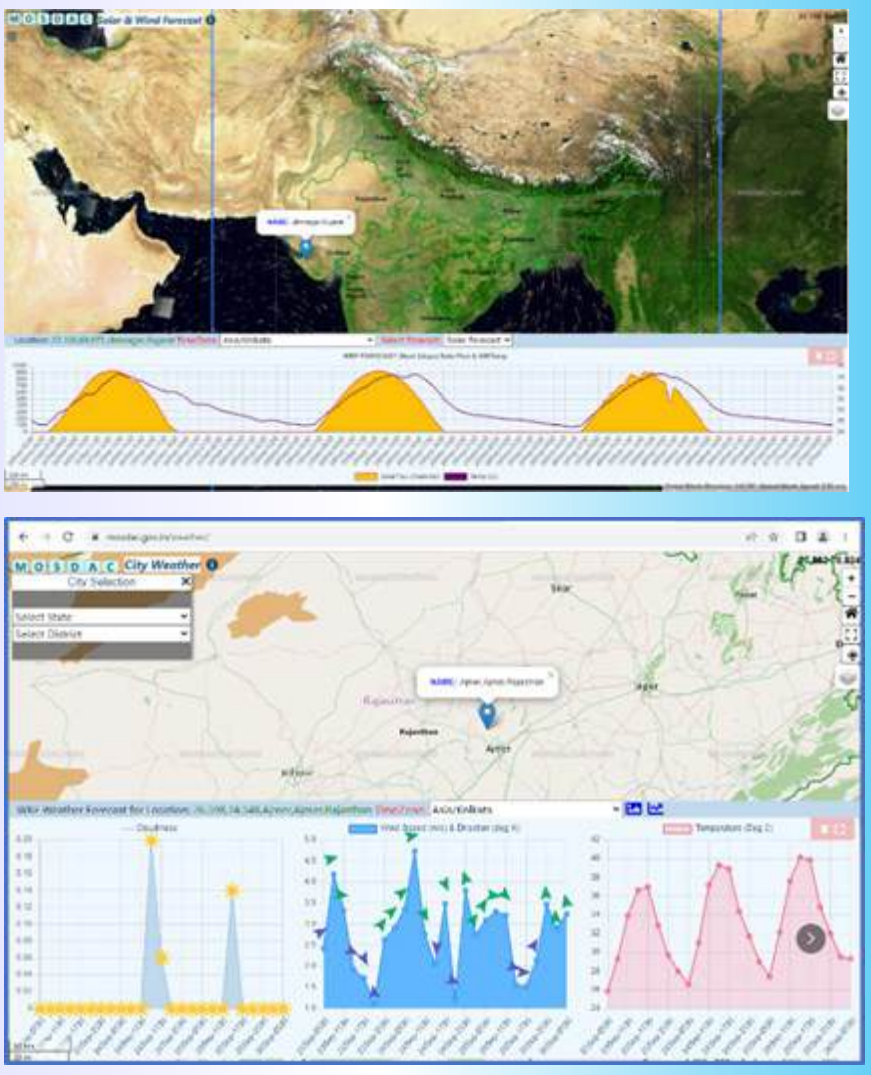
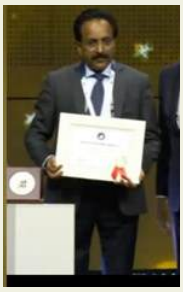


Figure 2: MOSDAC Weather & Energy Portal with Point Probes

SCIENCE NEWS

Global Recognition: ISRO Chief S Somanath Wins IAF World Space Award for Chandrayaan-3



ISRO Chairman S. Somanath has received the International Astronautical Federation's (IAF) prestigious World Space Award on October 14, 2024 for Chandrayaan-3's remarkable achievement. This recognition celebrates India's contributions to space exploration.

Image Credit: https://www.businesstoday.in/

Aditya L1 and Proba-3 to Unite for Solar Research in 2025

India's Aditya L1 and the European Space Agency's (ESA) Proba-3 missions are set to revolutionize solar research with joint observations starting in 2025. Aditya L1, operational since January 2024 from the Lagrange point (L1) 1.5 million km from Earth, launched in September 2023. Proba-3, launched on December 5, 2024 by ISRO's PSLV-C59, is the first mission involving two satellites, Coronograph Spacecraft and Occulter Spacecraft, flying together in a fixed configuration as a 'large rigid structure' in space to prove formation flying technologies.

ISRO SpaDex Mission: India joins elite club of nations

SpaDex: Space Docking experiment is a technology demonstration mission for in-space Docking (ability to mate two spacecraft in space) using two small spacecrafts. The two satellites SDX01 (Chaser) and SDX02 (Target) which were launched by the PSLV C60 on December 30, 2024, successfully docked on January 16, 2025. Through this mission, India has become the fourth country in the world after the USA, Russia and China to have space docking technology.

This technology is essential for India's future mission like Chandrayaan-4, Bharatiya Antariksh Station (BAS), Satellite refuelling etc.

Google's AI Model Outperforms Top Weather Forecast System

Google DeepMind has introduced a groundbreaking artificial intelligence (AI) model called 'GenCast' that is capable of providing highly accurate weather forecasts.

They have introduced GraphCast, a machine learning–based method trained directly from reanalysis data. It predicts hundreds of weather variables for the next 10 days at 0.25° resolution globally within 1 minute. GraphCast significantly outperforms the most accurate operational deterministic systems on 90% of 1380 verification targets, and its forecasts support better severe event prediction, including tropical cyclone tracking, atmospheric rivers, and extreme temperatures. GraphCast is a key advance in accurate and efficient weather forecasting and helps realize the promise of machine learning for modelling complex dynamical systems.

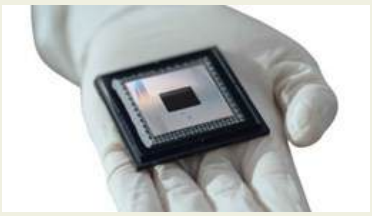
Image credit: https://techwireasia.com

Google's Quantum Leap: Unveiling the Revolutionary 'Willow' Chip

Google has unveiled Willow, a revolutionary quantum chip achieving exponential error correction and unmatched computational speed. Willow completed a task in five minutes that would take supercomputers 10 septillion years.

Image Credit: https://www.digit.in/

World's Highest Imaging Cherenkov Telescope Unveiled in Ladakh



On October 4, 2024, Dr. Ajit Kumar Mohanty, Secretary DAE & Chairman of the Atomic Energy Commission, inaugurated the Major Atmospheric Cherenkov Experiment (MACE) Observatory at Hanle, Ladakh. MACE is the largest imaging Cherenkov telescope in Asia. Located at an altitude of ~4,300 m, it is also the highest of its kind in the world. The telescope is indigenously built by BARC with support from ECIL and other Indian industry partners.

Image Credit: https://dae.gov.in/

ISRO's GSAT-N2 Communication Satellite Deployed by SpaceX

On November 18, 2024, SpaceX successfully launched the Indian Space Research Organisation's (ISRO) GSAT-N2 communication satellite from Canaveral Space Force Station in Florida. This advanced satellite, designed to enhance broadband connectivity and support India's Smart Cities Mission.

Image Credit: https://isro.gov.in/

China Becomes First Country to Retrieve Rocks From the Moon's Far Side

China's Chang'e 6 spacecraft has successfully brought samples from the far side of the moon back to Earth on June 25, 2024, marking the first-ever return of materials from this scarcely seen lunar region. The lunar lander drilled and scooped up about 2 kilograms of material that scientists will scrutinize for clues to the Moon's origins and evolution.

India experienced Extreme weather on 93% of the days in the first 9 months of 2024: CSE Report

Report by Centre for Science and Environment (CSE) highlighted the impact of climate change on Indian weather system. India was struck by a series of extreme weather events in the first nine months of 2024, affecting 93% of the days - 255 out of 274. These events included heatwaves, coldwaves, cyclones, lightning, heavy rainfall, floods, and landslides, which results in 3238 deaths, affected 3.2 million hectares of crops, destroyed 235,862 buildings and killed around 9457 livestock. CSE director general Sunita Narain said that events that occurred once every century are now happening every five years or even less affecting the most vulnerable populations, who lack the resources to adapt to this relentless cycle of loss and damage.

Slowing ocean currents may slightly alleviate Arctic warming

Slowing of the Atlantic Meridional Overturning Circulation (AMOC) could reduce projected Arctic Warming by up to 2°C by the end of the century. The study published in the Proceedings of National Academy of Sciences, examined the effect of AMOC on Arctic climate. Study shows that when the weaker AMOC transport less heat to the higher latitudes, Arctic temperatures will rise by only 8°C, although the projected temperature rise is 10°C. However, the rising temperature poses severe threats to Artic ecosystems primarily due to the disappearance of ice. The AMOC is a critical component of our climate system in regulating heat around the globe. The slowdown of AMOC may cause other climatic disruptions such as potential shift in the intertropical convergence zone which would severely affect the regions that depend on its rainfall.

COP29 concluded with compromising Finance deal for Climate crisis

The 29th Conference of Parties to the UN Framework Convention on Climate Change (UNFCC) concluded

on 24th November 2024 in Baku, Azerbaijan with an agreement urging developed countries to contribute $300 billion annually to developing countries to support climate adaptation and helping them shift to a low -carbon economy. The overall target is to reach at least $1.3 trillion by 2035. Developing countries facing devastating costs to adapt to the extreme climate conditions say this agreement for $300 billion is too little, too late. The year 2024 is on track to be the hottest on record and temporarily hit 1.5°C, WMO state on climate updates. "*The time for action is now. If you want a safer planet, it's our responsibility. It's a common responsibility, a global responsibility*", said Celeste Saulo, WMO Secretary-General

Compiled by

Ruchi Modi & Smitha Ratheesh

Monsoon Poems

Dr Satyendra Bhandari

जाते जाते अब आ पहुँचा है मानसून
अपने पूरे शबाब पर
देखने को मिल रही हैं
भारी बारिशें
जब देखो तब
यहाँ वहां इधर उधर
*
नहीं नाले है सब अब उफान पर
तालाब पोखर गये हैं सब भर
नदियों ने पुकड़ ली है तेज रफ्तार
दबाव है बाँधों के पैबंधों पर
व्यवस्थाओं पर पड़ रहा है बुरा असर
गिर रहे हैं पुल
टूट रही है सड़कें
जन जीवन हो रहा है तितर बितर
*
जहाँ भी जायें
जिधर भी जायें
बचना है अगर
परेशानी और हादसों से
चलें इसका संज्ञान लेकर
सावधानी से बढ़ायें
कदम फूँक फूँक कर
*
जाते जाते अब आ पहुँचा है मानसून
अपने पूरे शबाब पर
*
डॉ. सत्येन्द्र भंडारी - "अलग"

Shri. Utkarsh Tyagi

Fickling Mood and Rain

In skies that shift from clear to gray,
The rain comes down in gentle play.
It drizzles soft, then pours so wild,
Like moods that change from mild to riled.

One moment calm, the next unsure,
A storm of thoughts we can't secure.
The rain, like mind, both fickle, free—
A dance of change in uncertainty.

So when you see the rain's embrace,
Think of the mind's own changing face.
Both fall and rise, and come and go,
In patterns only time can show.

The rain falls soft, then starts to roar,
Unpredictable, it shifts and soars.
One minute light, the next a storm,
Just like the mind, in varied form.

It drizzles doubt, then floods with grace,
A dance of thoughts we can't replace.
Both change with whims, from calm to wild,
A fleeting mood, a restless child.

So when the skies are gray and strained,
Remember how the mind is swayed.
Both rain and thought, so changeable,
In patterns vast and mutable.

Dr Pratibha Gupta

बूंद बोली बादल से -"लो तुम में मैं समा जाऊँ",
बादल बोला बूंद से -"तुम्हें मैं कैसे संभाल पाऊँ?"
"मुझ मस्त-मौला को तुम उड़ने न दोगी",
"हवा के संग मेरी अटखेलियों को तुम भला कैसे झेलोगी?"
बूंद बोली बादल से – "बिन बूंद बादल भला किसी के काम आया?"
"जब मिटा स्वयं तभी तो किसी की प्यास बुझा पाया।"
"इस मिटने से भला तुम क्यों घबराते हो,"
"जीवन के इस सृजन चक्र को क्यों आत्मसात नहीं कर पाते हो?"
बादल बोला बूंद से –"ठहराव तो मेरे जीवन का अंत है,"
"गगन में विचरण करना ही मेरा नियम है।"
"तुम तो धरती पर मुझे बरसा दोगी,"
"मेरे अस्तित्व को ही मिटा दोगी।।"
बूंद बोली बादल से-" मिटता वही है जो बनता है,"
"पर इससे बनने की प्रेरणा का त्याग नहीं किया जा सकता है।"
"धूप-छाँव, बनने-मिटने के यथार्थ को तुम आत्मसात करो,"
"जीवन के इस सत्य को तुम मत नकारो।।"
यह सुन बादल ने बूंद को अपने में समाया,
कुछ दूर आकाश में उड़, अपने को धरती पर बरसाया।
प्यास बुझी धरती की तब, नव हरियाली छा गई,
पौधों पर पड़ी बूंद, प्रकृति के नियम का पाठ बादल को सिखला गई।।

Student's Corner: The World as we see it

THE STOLEN GLANCE

ANANYA
Class: VII
APOLLO INTERNATIONAL SCHOOL

GUARDIAN OF THE WILD

ANIKA
Class: X
UDGAM SCHOOL FOR CHILDREN

BEAUTY IN CLAY

POORNIMA
Class: IX
KENDRIYA VIDYALAYA SAC

Student's Corner: The World as we see it

CHOTA BHEEM

KUSHAGRA
Class: JR. KG
DPS Ahmedabad

MYSTIC MOON

KUSUMITHA
Class: X
NEW TULIP INTERNATIONAL SCHOOL
Ahmedabad

SUPER CROC

KIYANSH
Class: JR. KG
DPS
Ahmedabad

Student's Corner: The World as we see it

STARRY SKY

PRANAV
Class: IV
KENDRIYA VIDYALAYA SAC

SAVE WATER– SAVE OUR EARTH

PAKHI
Class: V
DAV INTERNATIONAL SCHOOL
Ahmedabad

GEOMETRICAL ODE TO NATURE

SOHAM
Class: VII
DAV INTERNATIONAL
Ahmedabad

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