Indian Meteorological Society, Chennai Chapter

NEWSLETTER
Vol. No.23, Issue No.1, June 2023

Editorial Board

Editor : R. Nallaswamy

Members : Dr. Y.E.A. Raj, Dr. B. Geetha and Dr. K.V. Balasubramanian

Contents :

Message from the Chairman.,

I am glad to see that the issue of June 2023 is being released. I am very happy to learn the response for the issue from the scientists and academia. IMS CC is very much delighted to receive the support from all the council members including the senior scientists.

I congratulate the editorial team of Breeze for their efforts in bringing out this issue.

I request all the IMS members and readers of the Breeze newsletter to write their views and suggestions to us for further improvement.

I also take this opportunity to invite you to participate in the forthcoming TROPMET—2023 being held at Birla Institute of Technology (BIT) Mesra during 22-24 November 2023.

Thank you very much,

Yours sincerely,

Dr. T.V. Lakshmi Kumar
Associate Professor
SRM Institute of Science and Technology, Kattankulathur

Editor's Desk :

Dear Esteemed members, greetings to you all.

I am happy the News Letter of IMSCC Breeze Vol 23 Issue 1

June 2023 is being released and also uploaded in the Website.

This issue contains 7 articles on various topics.

I thank all who have contributed good articles.

I request members to send more Scientific articles quizes etc on Meteorology and allied fields for future issues.

It is my pleasure to share the activities IMSCC since last issue of Breeze.

1.IMSCC coorgonised seminar on Monsoons 2022 arranged by IMD Chennai

2.IMSCC participated in the celebration of World Meteorological Day on 23rd March 2023 arranged by IMD Chennai.

3.IMSCC actively participated on all the webinars conducted by National Council and other Local Chapters like Hyderabad, Dehradun Pune etc

4.Local Council and Annual General Body meetings were held on 26th May 2023 Discussed the activities and future activities .

5.On invitation from SRMIST the Chairman and the participated in the inaugural Session of the Training course on Artificial Intelligent and Disaster Management arranged by them. I had delivered the Inaugural Address. Interacted with the faculties and student's

6.Dr.T.V.Lakshmikumar Chairman was felicitated for being elected as the Joint Secretary of the South Asia Meteorological Associations (SAMA) Indian Chapter.

7.As decided earlier an one day Symposium on "Technologies and Developments in Climate Action, Resilience and Sustainability " will be conducted during soon.

8.Three persons joined as new Life members

9.Some institutions are in contact to become institutional members of IMS

9.I thank the Editorial board for the helps rendered in finalising the issue.

10.I thank the Chairman and his assistants in SRMIST for compiling and preparing the BREEZE.

11.I request all the members continue to participate in all the activities and raise up the prestige of IMSCC.

With Thanks and regards.

(R.NALLASWAMY)

Local Council of IMS Chennai Chapter

2022 -2024

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Salient Features of Southwest Monsoon 2022 over the Southern Region

P. Senthamarai Kannan, IMD Chennai

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♦ The Onset of Southwest monsoon over Kerala took place on 29th May 2022 against the normal date of 01st June.

♦ The Southwest monsoon seasonal rainfall during June to September 2022 for the country as a whole had been above normal (105 -110% of Long Period Average (LPA)).

♦ Quantitatively, the country received 92.5 cm against the LPA of 87.0 cm based on data of 1971-2020 (106% of its LPA). • Out of the total 36 meteorological subdivisions of the country, 12 sub-divisions constituting 40% of the total area of the country received excess, 18 subdivisions (43%

The South Peninsular region recorded above normal rainfall (122% of LPA). The seasonal rainfall received over various subdivisions in the southern region is shown below.

SUB-DIVISION	Actual rainfall (mm)	Normal rainfall (mm)	PDN (%)
COASTAL ANDHRA PRADESH (CAP)	640.2	601.4	6
TELANGANA (TEL)	1073.3	734.8	46
RAYALASEEMA (RYS)	486.5	408.6	19
TAMIL NADU & PUDUCHERRY (TN)	477.1	328.4	45
COASTAL KARNATAKA (CK)	3235.4	3093.9	5
NORTH INTERIOR KARNATAKA (NIK)	647.3	480.8	35
SOUTH INTERIOR KARNATAKA (SIK)	1008.1	678.4	49
KERALA (KER)	1736.6	2018.6	-14
LAKSHADWEEP (LAK)	1391.2	1026.6	36

All subdivisions in the regions received Normal to Excess rainfall. Tamilnadu—Puducherry - Karaikal (TN), North Interior Karnakata (NIK), South Interior Karnataka (SIK), Telangana (TEL), & Lakshsdweep (LAK) received excess rainfall by 35% or more and Kerala (KER), Coastal Karnataka (CK), Coastal Andhra Pradesh (CAP), Rayalaseema (RYS) received normal rainfall during SWM season.

Spatially, Coastal Karnataka experienced highest Fairly Wide Spread(FWS) to Widespread(WS) rainfall activity days of 87% and 55 to 61% days are of Isolated rainfall/ Dry for TN and RAY subdivisions.

Spatial distribution	No. of days								
	CAP	TEL	RYS	TN	CK	NIK	SIK	KER	LAK
WS	11	28	6	1	93	26	36	65	69
FWS	28	24	21	15	13	32	28	22	22
SCT	54	31	27	31	10	39	37	17	17
ISOL	25	38	59	73	5	25	21	17	3
DRY	4	1	9	2	1	0	0	1	11

There were isolated heavy to very heavy rainfall activity on 76 days over TN, 117 days over SIK, 98 days over TEL, 101 days over CK ,82 days over KER, 71 days over CAP, 47 days over NIK, 36 days over RYS & 11 days over LAK area and their monthwise breakup is shown below.

SUB DIVISION	JUN			JUL			AUG			SEP			JUN - SEP		
	XH	VH	H	XH	VH	H	XH	VH	H	XH	VH	H	XH	VH	H
CAP	0	1	13	1	7	18	0	1	10	1	6	15	2	15	56
TEL	0	4	14	5	12	21	1	5	17	0	8	17	6	29	69
RYS	0	2	5	0	0	4	0	4	13	0	0	8	0	6	30
TNP		4	10	2	13	16	3	12	7		3	11	5	32	44
CK		1	12	6	18	22	1	11	19		3	15	7	33	68
NIK			3		2	17		2	12		2	9		6	41
SIK		2	18	2	17	23	3	16	20		5	16	5	40	77
KER	0	2	15	0	12	20	1	9	17	0	2	5	1	25	57
LAK	0	0	2	0	0	0	0	0	4	0	3	2	0	3	8

Table title: No. of days of heavy rainfall events

Legend: H: *Heavy* rain (≥ 7 cm (64.5 mm)/day); VH: *Very Heavy* rain (≥ 12 cm (115.6 mm) /day); XH: *Extremely Heavy* rain (≥ 21cm (204.5 mm) /day

TN, CK, SIK, TEL, CAP and KER experienced 5 , 7 , 5 , 6 , 2 a n d 1 day(s) respectively of *isolated extremely heavy rainfall (≥21cm (204.5 mm)/day) during the season.*

Twelve Low pressure systems of different intensities formed during this season and are shown below.

Systems / Month	CS	Deep Depression	Depression	Well-marked low-pressure area	Low-pressure area	Total systems
June	0	0	0	0	1	1
July	0	0	1	2	1	4
August	0	1	3	0	0	4
Sept.	0	0	1	0	2	3

The SWM withdrew from the entire country on 23rd October 2022.

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Salient features of Northeast Monsoon – 2022

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During the year 2022, the southwest monsoon withdrew from the Indian region on 23rd October and the Northeast monsoon (NEM) of 2022 commenced over the southeastern parts of peninsular India on 29th October against the normal date of 20th October. All the five meteorological sub divisions benefitted by the NEM [Tamil Nadu, Puducherry & Karaikal (TN), Coastal Andhra Pradesh & Yanam (CAP), Rayalaseema (RYS), Kerala & Mahe (KER), and South Interior Karnataka (SIK)] received **normal to excess** rainfall during the NEM season (October-December) (Table-1).

Table-1: Seasonal sub-divisional rainfall during October-December 2022

OCT-DEC 2022			
Met sub division	Actual rainfall	Normal rainfall	PDN (%)
	(mm)	(mm)	
CAP & Yanam	**341.7**	**322.9**	6
RYS	**288.1**	**236.4**	22
TN, PDC & KKL	**445.6**	**443.3**	1
SIK	**300.1**	**199.0**	51
KER & Mahe	**476.2**	**492.0**	-3

Two cyclones, two depressions & one well marked low pressure area were the major synoptic systems that formed over the Bay of Bengal during the season. The **Cyclonic storm (CS)** '*Sitrang*' over the Bay of Bengal during 22nd-25th October moved northwards (Fig.1) and crossed Bangladesh coast and delayed the commencement of the NEM. The **Severe Cyclonic Storm (SCS)** '*Mandous*' over the Bay of Bengal during 06th-10th December crossed coast close the **Mamallapuram** (north Tamilnadu) (Fig.1) around the midnight of 09th December as a cyclonic storm with maximum sustained surface wind speed of **65-75 kmph gusting to 85 kmph**. Associated with the passage of cyclone 'Mandous', *very heavy to extremely heavy* rainfall occurred over the extreme north Tamilnadu and adjoining Rayalaseema with Vembakkam (Thiruvannamalai district, TN), Srikalahasti (Chittoor district, RYS) & Thottambedu (Chittoor district, RYS) reporting **25 cm, 23 cm & 22 cm** respectively during the 24-hour ending 0830 IST of 10th December.
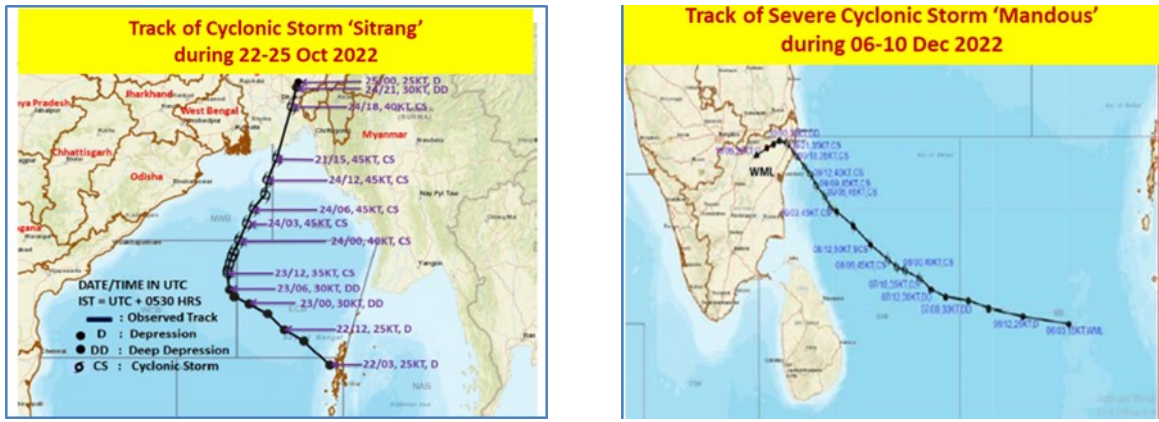
Fig.1: Tracks of Cyclonic Storm 'Sitrang' & Severe Cyclonic Storm 'Mandous' over the Bay of Bengal during Oct-Dec 2022

Two **Depressions** that formed over the Bay of Bengal – one in November (20th-22nd) and another in December (22nd-25th) did not contribute significantly to NEM rainfall over the peninsular India. Whereas the 20th-22nd November Depression weakened off North Tamilnadu coast, the Depression during 22nd-25th December crossed Sri Lanka coast, and weakened gradually.
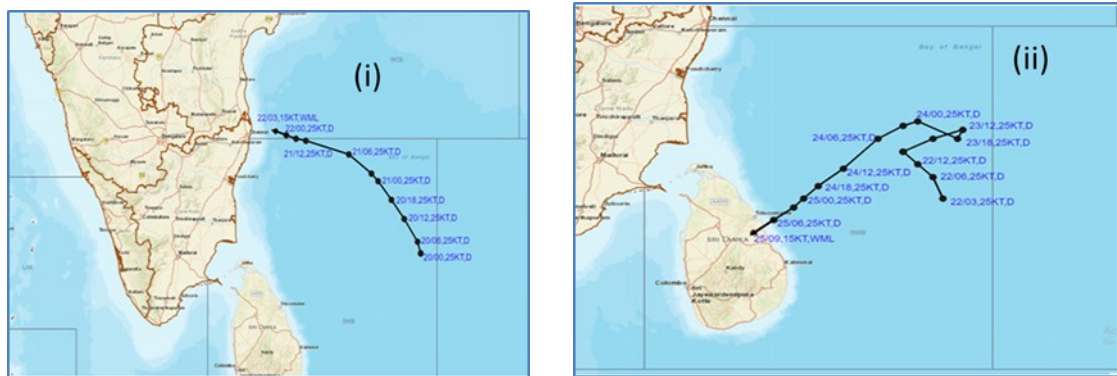

Fig.2: Tracks of Depressions over the Bay of Bengal (i) during 20-22 Nov 2022 & (ii) during 22 -25 Dec 2022

However, associated with the passage of a **Well marked Low pressure area (WML)** during 09th-13th November, isolated *heavy to very heavy/ extremely heavy* rainfall occurred during 12th-16th November with **Sirkazhi** (Mayiladuthurai district) reporting **44 cm of rain** followed by Kollidam (Mayiladuthurai district): **32 cm**, Chidambaram (Cuddalore district): **31 cm**, Annamalai nagar (Cuddalore district): **28 cm** & Bhuvanagiri (Cuddalore district): **21 cm** during the 24-hr ending 0830 IST of 12th November. Under the influence of this event, the seasonal rainfall of TN which was 'minus 4%' on 10th November rose to 'plus 15%' on 17th November.
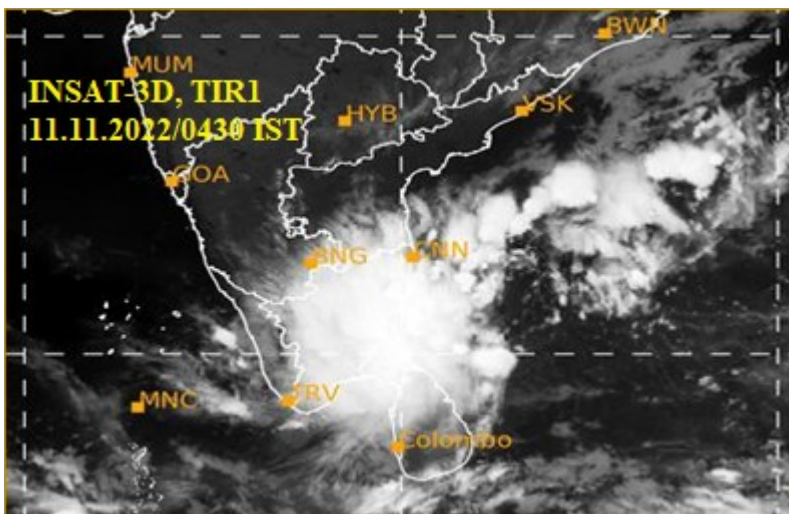
Fig.2 Satellite imagery associated with well marked low pressure area as on 11.11.2022/ 0430 IST

Under the influence of various synoptic systems, upper air cyclonic circulations and east-west shear zone over the southern peninsula there were 18 days of *active* to *vigorous* monsoon conditions over TN, SIK & KER during the season. Also, there were **51** days of *isolated heavy* rainfall activity with 20 days of *isolated very heavy* rain including 04 days of *isolated extremely heavy rainfall* activity over TN.

After the Depression during the last week of December, with the gradual decrease in rainfall activity, the cessation of NEM 2022 rainfall over peninsular India was declared on **12.01.2023**.

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Automatic Nowcast system during North East Monsoon (RACAST)
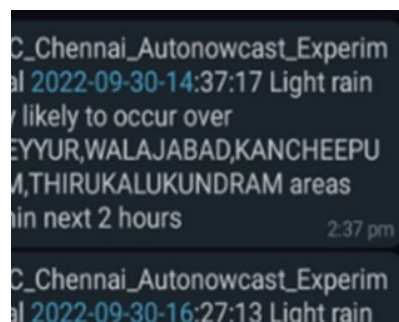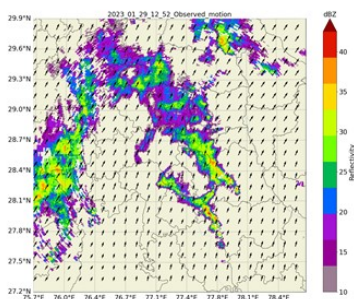
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Thunderstorms are meso-scale systems which occur in time scales of an hour to several hours and in spatial scale of few kilometers to hundreds of kilometers. Thunderstorms and its associated weather events have the potential to cause loss of lives as well as economic loss (Selvi and Rajapandian, 2016; Bhardwaj *et al*., 2017). The frequency of thunderstorms increases sharply in the premonsoon season over entire region of India (Tyagi, 2007). State disaster management authorities expect early warning of thunderstorms to effectively reduce the casualties as well as damage to their infrastructure and agriculture crops caused by heavy rainfall, hailstorm, lightning, dust storms and strong winds which are the severe-weather phenomena associated with thunderstorms. Early warning of thunderstorm is a challenge due to their highly localized phenomena, short life period and limited observational network (Sen Roy *et al.*, 2019). Observational networks are being upgraded and expanded on a large scale for better prediction of thunderstorms. Doppler Weather Radar has proved to be an important tool for forecasters to issue thunderstorm warnings as the DWR products provide useful information on the various characteristics of the thunderstorms. India Meteorological Department currently has installed 25 Radars in which 5 radars are dual polarized and the remaining radars are single polarized. The S band Single polarization Doppler radars have large spatial coverage of 500 km radius and provide base products such as reflectivity, radial velocity and spectrum width round the clock with a scan interval of ten minutes (Pradhan *et al.*, 2012). Dual-Polarization Radars have additional base products such as differential reflectivity, correlation coefficient and specific differential phase which can be effectively used along with single-polarization base

products to classify the different hydro-meteor types observed by the Doppler radar (Lim *et al*., 2005). Many expert systems have been developed based on Doppler weather Radar products to identify the features of the radar echo and provide usable now-casts for 0-3 h period using various techniques as detailed in Sen Roy *et al*. (2019). Forecaster's make use of data available from various observation along with expert systems to issue accurate now-cast alerts to the public/disaster management authorities. These alerts are issued for the geographical region of all districts and selected cities. The alerts are disseminated through various communication medium such as website, email and SMS. A simplistic approach for operational now-casting would be to analyze the DWR products such as MAX(Z), PPI(Z), PPI(V) every 10 minutes and find if there are any thunderstorm signatures in a particular district/city, then draft the warning message and finally update the communication channels to alert theauthorities. This could take several minutes depending on time taken for DWR products to update in the website, analysis time and time taken to disseminate the information.

Attempts have been made to issue automatic alerts using DWR data using various algorithms by Hering *et al.* (2015); James *et al.* (2018) and Bally (2004) to reduce the time taken for the alerts to reach the users. As thunderstorm is a meso-scale event, the lead time for warning is less and any increase in the lead time can lead to significant improvement in the response by the end users.

A system (RALERT) was designed using open_source libraries to issue thunderstorm alerts to the endusers automatically without manual intervention. The volumetric data generated from the Radar is used as the primary input. Identification of severe weather like Thunderstorm, Rainfall and lightning from Radar data by applying various thresholds has been shown by Voormansik *et al*. (2017); Li *et al*. (2012); Yang *et al*. (2020) and Shi *et al.* (2019). Vincent *et al*. (2004) had provided a reflectivity and height threshold for prediction of cloud to ground lightning. A similar approach was used in the system to predict the formation of Thunderstorms. Though meteorological events are not constrained by administrative boundaries, the forecaster's at state level are entrusted with providing thunderstorm warnings for each district/city. The geographical information of each district and city is also provided as one of the input to the system. Once the analysis is done the forecaster disseminates the information through website, SMS and email. The system essentially performs the complete process automatically, based on the thresholds of the severe weather, an automatic analysis is done on the Radar data and if any signature of the severe weather is present in the given geographical boundary, the warning is disseminated to the concerned authorities through email, SMS and represented through a live Display.

An advancement to the RALERT software is the RACAST software generates the nowcast from the past radar data and generates alerts based on the nowcast output. The short term ensemble prediction system is used for probablistic nowcast generation. The alerts are generated based on the probability thresholds provided in the configuration of the system. The observed reflectivity and the motion vectors are shown in the Figure . Based on the movement of the cloud cells in the next two hours, the alerts are generated in different taluks. The alerts are disseminated through whatsapp, email as well as social media handles such as twitter and facebook as shown in figures

Mission to Moon: Chandrayaan 3

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History was created on August 23, 2003 at 1804 IST with the flawless touchdown of Chandrayaan – 3's lander - Vikram - on the terrain of south polar region (~ 71 S) of the Moon. The whole country watched with awe the last 15 minutes of the descent with great nervousness and anxiety. A few hours later, the Rover - Pragyaan - rolled out from the Lander. . India became just the fourth country to successfully land on the Moon, and the first to do so near the region of the lunar south polar region.

Chandrayaan-3 consists of an indigenous propulsion module, lander module, and a rover (**Photo**). The propulsion module carried the lander and rover from injection orbit to till 100 km lunar orbit. Both Lander and the Rover, have carried out many scientific observations successfully for nearly 10 days, of Moon's surface and soil, around 100 m of Vikram.

Mission objectives for ISRO's Chandrayaan-3 are:

♦ Engineering and implementing a lander to land safely

and softly on the surface of the Moon.

♦ Observing and demonstrating the rover's driving

capabilities on the Moon.

♦ Conducting and observing experiments on the materials available on the lunar surface to better understand the composition of the Moon.
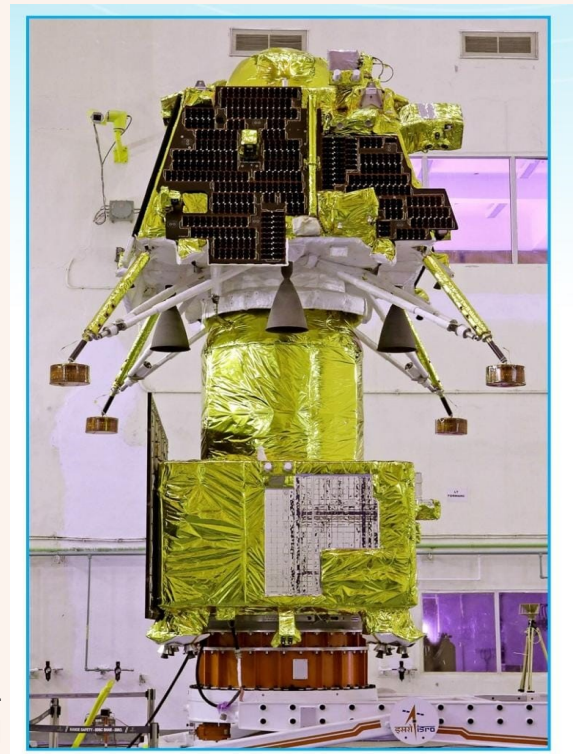
It would be in fitness of things to recall the various important stages through which this important milestone in ISRO's history was achieved. The Indian Space Research Organisation, after the successful development of PSLV by 1994, launched many operational Remote sensing Satellite missions for mapping earth's surface, ocean and the environment. By 2005 time frame, GSLV Mark 1 and 2 were also in the phase of being operational. By 1998, it was time to take the next major step of going beyond the earth and its atmosphere to explore the outer space.   The Indian Academy of Sciences (IASc) in its 1999 Annual meeting unanimously recommended to have a mission to Moon. The then Chairman ISRO, Dr Kasturi Rangan set up Dr George Joseph Committee of experts to explore the possibilities of studying outer space with the help of PSLV and other indigenously developed / being developed launch vehicles.

Thus, was born the Indian Moon Mission - Chandrayaan. The journey of Chandrayaan has been fascinating since its inception and has had a lasting impact on understanding our nearest cosmic neighbor.

Chandrayaan-1 was India's first lunar mission, launched by the Indian Space Research Organisation (ISRO) on October 22, 2008. One of Chandrayaan-1's primary goals was to generate a three-dimensional map of the Moon's surface with extensive information about its topography, mineralogy, and element distribution. The spacecraft, outfitted with sophisticated instruments, carried out a high-resolution mapping mission, exposing the Moon's hidden mysteries with unsurpassed precision.

On 14 November 2008, the Moon Impact Probe separated from the Chandrayaan orbiter at 1 and struck the south pole in a controlled manner. The probe hit near the crater Shackleton at The location of impact was named **Jawahar Point.**

The discovery of water molecules on the Moon's surface by Chandrayaan-1's Moon Mineralogy Mapper (M3) was a watershed moment for lunar exploration. This discovery was significant because the existence of water has far- reaching ramifications for future human space missions. The first wave of lunar exploration five decades ago, focused on landing humans on the Moon and returning them safely to Earth. The discovery of water on Moon rekindled enthusiasm in lunar exploration, making the Moon an even more appealing location for future space expeditions.

Unfortunately, Chandrayaan – 1 mission was declared lost in August 2009 after losing contact with the spacecraft. However, it was considered highly successful until that point

Chandrayaan-2 was the successor to Chandrayaan-1, launched in July 2019. It included an orbiter, a lander, and a rover.

The lander and rover lost communication during their last phase of descent to the lunar surface. Despite this setback with the lander and rover, the orbiter has continued to provide valuable data to date about the Moon.

The orbiter's instruments, such as the Terrain Mapping Camera-2 (TMC-2) and the Dual Frequency Synthetic Aperture Radar (DFSAR), have helped identify water ice in permanently shadowed regions of the Moon, particularly at the lunar south pole. This finding has significant implications for future lunar exploration and potential resource utilization.

The crash landing point of Chandrayaan 2 Lander has been named **Tiranga Point**.

Chandrayaan-3 was launched from Satish Dhawan Space Centre on 14 July 2023. By the fourth operational mission (M4) of LVM3 launcher.   The spacecraft entered lunar orbit on 5 August after a 22 day journey of about 1.5 million km, through various orbit maneuvers around the Earth and the Moon (Fig). The lander touched down the lunar south polar region on 23 August at 1804 IST, making India only the fourth country to successfully land on the Moon, and the first to do so near the region of the lunar south pole.   The site of touchdown has been named Shiv Shakti. On 3 September the lander Vikram hopped and repositioned itself 30–40 cm from its landing site to demonstrate the capability to make a possible return journey !.

The figure below details how Chandrayan 3 was put into 100 km orbit around the moon.
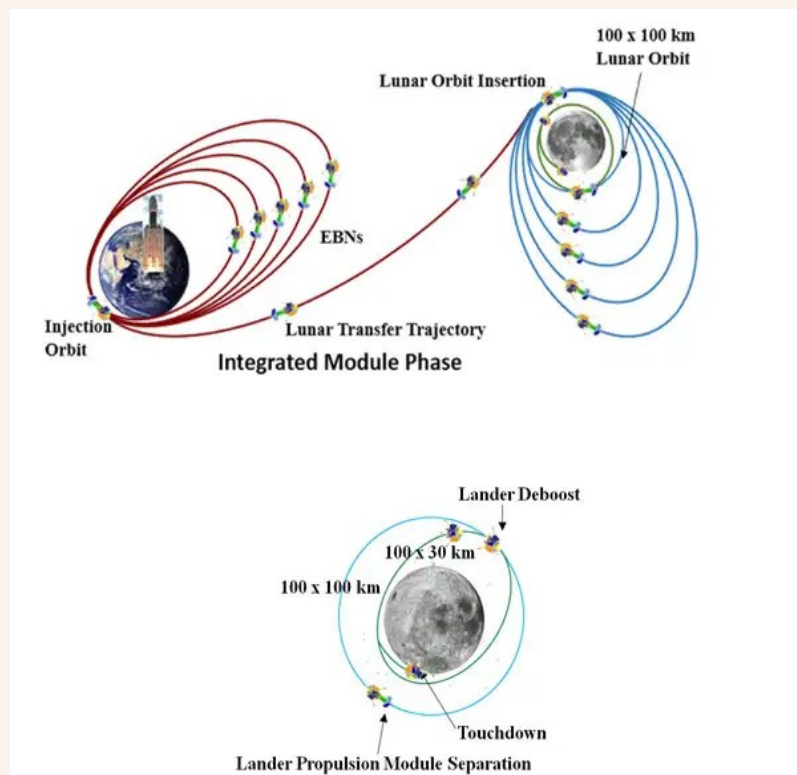
As shown in the diagram above, the Chandrayan 3 was launched first into a highly elliptical orbit and then slowly its apogee was raised by firing onboard Propulsion System with a sequence of commands from Ground. Then a Sling Shot Technique is used to send the Spacecraft towards the Moon, where it enters into an elliptical orbit around the Moon. The apogee of the Spacecraft is now reduced in a sequence of operations, until the Spacecraft reaches a circular orbit around 100 km around the Moon.

Watch this Video !!! https://youtu.be/Cc40A7_rcOs

The *Vikram* lander and *Pragyan* rover were set to sleep on 2 September and 4 September respectively due to depleting solar power with sunset at the landing site on moon. The lander and rover are planned to start working again at local sunrise on September 22.

Scientific Results :

The Scientific payloads on the Vikram Lander are : Chandra's Surface Thermophysical Experiment (ChaSTE) to measure thermal conductivity and temperature on the surface. Instrument for Lunar Seismic Activity (ILSA) to detect moonquakes, Langmuir Probe to estimate the density and variation of plasma, or superheated gas, in the moon's environment and a Laser Retroreflector Array (from NASA) to measure distances using laser ranging.

The Scientific payloads on Rover are: an Alpha particle X-ray spectrometer (APXS) to derive the chemical composition and infer the mineralogical composition of the lunar surface, Laser-induced breakdown spectroscopy (LIBS) to determine the elemental composition (Mg, Al, Si, K, Ca, Ti, Fe) of lunar soil and rocks around the lunar landing site.

In the first scientific finding from the Chandrayaan-3 mission, ChaSTE on its Rover, Vikram, has recorded an astonishing temperature drop of about 60 C from above the lunar surface to a depth of just about 8 cm. These findings could enhance the understanding of heat flow patterns in the lunar polar regions and supplement blueprints for future habitats.

This could also lead us to water-ice. If the location being probed now can itself throw up such low temperature at only 10 cm beneath the surface, there is a high possibility of finding water frozen beneath the craters !!

The Laser-Induced Breakdown Spectroscopy (LIBS) instrument onboard Chandrayaan-3 Rover has made the first-ever in-situ measurements on the elemental composition of the lunar surface near the south pole. These in-situ measurements confirm the presence of Sulphur (S) in the region unambiguously, This finding by Chandrayaan-3 compels scientists to develop fresh explanations for the source of Sulphur (S) in the area: intrinsic? volcanic? meteoritic?," Isro said.

Preliminary analyses, have unveiled the presence of Aluminum (Al), Calcium (Ca), Iron (Fe), Chromium (Cr), and Titanium (Ti) on the lunar surface. Further measurements have revealed the presence of manganese (Mn), silicon (Si), and oxygen (O). Thorough investigation regarding the presence of Hydrogen is underway.

RAMBHA-LP conducted the first-ever measurements of the near-surface lunar plasma environment over the south polar region, indicating that the plasma density near the lunar surface is relatively sparse.

Instrument for the Lunar Seismic Activity (ILSA) payload on Chandrayaan 3 Lander -- the first Micro Electro Mechanical Systems (MEMS) technology-based instrument on the moon -- has recorded the movements of Rover and other payloads. Additionally, it has recorded an event, appearing to be a natural one, on August 26, 2023.

ARTEMIS Programme

After Chandrayaan-1 mission of ISRO foundwater on the Moon, several missions are tasked with prospecting for water ice and other resources. And all these missions are just a prelude for a permanent human presence on the Moon. Scientifically too, the moon holds many unanswered mysteries. With no atmosphere and not much geological churning going on, the moon's surface rocks are around the age of the solar system. For researchers, it is akin to looking at the pristine state of the early universe through these missions. Moon has the profound potential to be a source of new scientific advances as well as economic growth.

The **Artemis program** is a robotic and human Moon exploration program led by the United States' National Aeronautics and Space Administration (NASA) along with collaboration of government space agencies and private spaceflight companies, bound together by the Artemis Accords and supporting contracts. As of July 2023, twenty-seven countries and one territory had signed the accords, including traditional U.S. space partners (such as the European Space Agency and agencies from India, Canada, Japan, and the United Kingdom) and emerging space powers (such as Brazil, South Korea, Mexico, and the United Artner agencies.

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Climate Change : The past, present and future
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Introduction:

The most talked, discussed, and researched topics during the present and recent past centuries are "Global Warming" and "Climate Change."

Originally it started with the name Green House Gases effect thereafter by observing that the Earth and Atmosphere are getting warmer it was called Global Warming. But it is not clear how the name Climate Change replaced perhaps after seeing the effects taking place.

In common usage, Climate Change describes Global Warming-The ongoing research in Global average temperature and its impacts on Earth Climate System.

Climate Change in broader term also includes previous long-term changes to Earth's climate.

Warming and cooling are not new, these happened during millions of years as well. Scientists used the Climate term inadvertent Climate modification to refer to human impacts on Climate Change.

In 1980's the terms Global Warming and Climate Change became more common, though the two terms are sometimes used interchangeably and scientifically.

Historically the studies of Climate Change started way back in 1824 by Joseph Fourier and later in the years 1827,1838,1856,1863,1901 and continuing still.

Global warming refers only to the increase on surface and ocean warming and Climate Change describes the full effects of greenhouse gases on the Earth's Climate System. Global Warming was used as early as 1975and became more popular after NASA Climate Scientist James Hansen used it in his 1988 testimony in the US Senate. Since 2000 usage of the Climate Change term has increased.

Climate Change can also refer broadly to human-caused change or natural change throughout the earth's history.

After lots of studies it is agreed that current changes are distinctly more rapid and not due to natural causes. Instead, they are caused by the emission of Green House Gases, mostly C02 Methane and Water vapor.

Burning of fossil fuels for energy usage creates most of the emissions. Certain agricultural activities, industrial processes and forest losses are added sources. Green House Gases are transparent to sunlight, allowing it to heat the Earth's surface. When the earth emits that heat as infrared radiation, the gases absorb it, trapping the heat near the earth surface and the atmosphere above.

Observed temperature rise had been recorded for the last 2000 years and later using instruments. Multiple instrumentation independent data set, show Climate Systems are warming.

The 2011-2020 decade warmed to an average 1.09 Deg Celsius to 1.2 Deg Celsius compared to pre-industrial base line 1850 -1900. Surface temperatures are increasing 0.2 Deg Celsius per decade with 2020 reaching 1.2 Deg Celsius above preindustrial era.

Since 1950 the number of warm days and cold nights decreased, and number of warm days and cold nights increased.

There was little net warming between the 18th and 19th century. Climate information came from Climate proxies such as trees and ice cores.

Thermometer records began 1850. Historical patterns of warming and cooling like the mediaeval, climate anomaly and little ice age did not occur at the same time across different regions. Temperatures have reached those of the 20th century in a limited region.

However modern rise in Temperature and C02 has been so rapid that even the abrupt geophysical events in the Earth history do not approach current rates.

Evidence of warming from actual Temperature measurements are reinforced with wide range of other observations. For example, changes in water cycles have been predicted and observations such as increase in frequency and intensity of precipitation, melting snow and land ice and increase in atmospheric humidity. Flora and fauna are also behaving on a manner consistent with warming. For instance, plants are flowering earlier in Spring. Another indication of cooling of the atmosphere which demonstrates that greenhouse gases is the trapping of heat near the earth surface precisely radiating into Space.

After lots of discussions, research new theories Computer modeling and counter theories it was generally accepted that the main cause for Climate Change is human made, due to increase of Green House Gases and agreed that calamities disasters happening and likely to happen. The effects ongoing or expected are as follows. Increase in Greenhouse Gases pumping into the atmosphere. Consequently increase in heat waves, expanding of deserts, droughts, more common wildfires, heavy rainfalls at times cloud bursts, flash floods, more intense Tropical Cyclones/Hurricanes, melting Perma frost in Arctic, glacial retreat, sea ice loss, sea level increase and other extreme events. Rapid environmental change in mountains, coral, and the Arctic forces many species to relocate or become extinct.

Climate Change also threatens with food, water scarcity, diseases and economic loss. Human migration and conflicts are also the result. The entire world realized the urgency to reduce or control the causes became imminent. To start with an Advisory Group on Green House Gases (AGGHG) Organizations were set up in 1986. These were the International of Sciences Unions, The United Nations Environment Program (UNEP) and World Meteorological Organization (WMO). The AGGHG reviewed Scientific research on Green House Gases and the increase in Green House Gases. Climate Science was becoming more complicated, covering more disciplines. Group of Scientists lacked the resources to cover the Climate Science. The United States Environmental Protection Agency sought an international Convention to monitor Green House Gas emissions. The WMO and UNEP therefore created an Inter-Governmental body of United Nations namely Intergovernmental Panel on Climate Change (IPCC) in 1988 with advancing scientific knowledge about anthropogenic Climate Change. It has the Secretariat in Geneva, Switzerland, hosted by WMO and is Governed by 195 member states including India.

IPCC is an internationally accepted authority on climate change. Its findings are endorsed by the leading climate scientists and all members of Govts while its reports are regularly cited by media, Govts, civil societies organizations and businesses. IPCC reports a key role in the Annual climate negotiations held by the United Nations Framework convention on climate (UNFCCC). The 5th assent report influenced landmark Paris Agreement in 2015.

The IPCC shared 2007 Noble Prize with AL Gore former Vice President of USA for contributions in understanding of Climate Change.

In October 2022 the IPCC and IPBES shared the Gulbenkian Prize for Humanity. The two intergovernmental bodies won the prize because they produced scientific knowledge, alert society, inform decisions makers to make better choices for combating climate change and the loss of biodiversity.

IPCC informs Govts about the state of knowledge on Climate Change, including possible response actions and the natural, economic, and social impacts and risks. IPCC doesn't do research but conducts periodic and systematic reviews of all the relevant scientific publications by enlisting thousands of volunteer Scientists and experts. Observers have described this work as the biggest peer review process in the Scientific community. Key findings are compiled into a periodic "Assessment Reports " for policy makers and the general public. The 5th Assessment influenced the landmark of Paris Agreement in 2015. [

Salient features of latest 2023, Synthesis Report of the IPCC Sixth Assessment Report (AR6)

10 very important findings from the 2023 IPCC report on Climate Change AR6 released in March 2023

1) Human induced Global Warming of 1.1 Degree C has spurred changes to earth's climate that are unprecedented in the reason Human History

2) Climate Change impacts on people and Eco systems are widespread and severe than expected and future risks will escalate rapidly with every fraction of a degree warming.

3) Adaptation measures can effectively build resilience, but more finance is needed to scale solution.

4) Some climate change impacts are already so severe, and they cannot be adapted leading to losses and damages.

5) Global GHG emissions peak before 2025 with 1.5 Degree C in aligned pathways.

6) The world must rapidly shift away from burning fossil fuels, the Number one cause of the Climate crisis.

7) We also need urgent systemwide transformation to net – zero climate – resilient future.

8) Carbon removal is now essential to limit Global Temperature rise to 1.5 Degree C.

9) Climate Finance for both mitigation and adaption must increase dramatically

in the decade.

10) Climate change – as well as our collective efforts to adapt and mitigate it – will exacerbate inequity should we fail to ensure just a transition.

The Synthesis Report of the IPCC Sixth Assessment Report (AR) summarizes the state of knowledge of Climate Change, its widespread impacts and risks, and Climate Change Mitigation and adaptation. It integrates the main findings of the Sixth Assessment Report (AR6) based on the contributions of the three Working Groups and three Special Reports. The Summary of Policy Makers (SPM) is structured in three parts:

SPM- A Current status and trends.

SPM-B Future Climate Change, risks and Long- term Responses and

SPM-C Responses in the Near Term.

The report recognizes the interdependence of Climate, Eco System, Biodiversity and human societies, the value of diverse forms of knowledge, and the close linkage between Climate Change adaptation and mitigation ecosystem health, human well- being and sustainable development, and reflects increasing diversity of actors involved in climate action. Based on the scientific understanding, key findings can be formulated as statements of fact or associated with an assessed level of confidence using IPCC calibrated language.

A - Current status and trends

Observed warming and causes.

Observed Changes and impacts.

Current progress in adaptation and gaps and challenges.

Current Mitigation Progress Gaps and Challenges.

B-Future Climate Change, Risks, and Long-Term Responses

Future Climate Change.

Climate Change Impacts and Climate-Related Risks. Likelihood and Risks of Unavoidable and/or irreversible or Abrupt Changes

C-Response in the Near Term:

Urgency of near-term integrated climate action.

The Benefits of near-term Action.

Mitigation and Adaptation Options across Systems.

Synergies and Trade-Offs with Sustainable Development.

Equity and Inclusion.

Govt and Policies

Finance, Technology and International Cooperation.

Consensus versus controversies:

There are 3 categories:

1 Accept the theory of Climate Change by taking full remedial measures.

Accept the theory but unable to implement it due to some constraints.

Not accepting the theory and calling the theory a hoax is exaggerated and not fully proved.

They are called Climate Change Deniers or Skeptics of Climate Change.

There are some groups that use media to support their denial. They are also taking up Scientific research to justify their claims. They are saying even up to 1970 there were symptoms of Global cooling. So many TV debates Films supporting and against the theories came up specially in USA and Britian. They are not prepared to accept effects projected by climate activists even the then President Mr. Donald Trump did not sign in the agreement.

But later the new US President Mr. Joe Biden accepted and joined the groups in Paris agreement. Only two or three states have not agreed.

The author of the book titled "The Politically Incorrect Guide to Climate Change, "Evil Personified " - Daily Kosan "Climate Denier" Marc Morano is popular in the USA tried to negate every claim of Climate Change supporters.

Even the strong activist Mr. Al Gore former Vice president of USA who produced the famous documentary came one step behind later. There are various results of different computer models. Oil producing countries have their own views and actions. Though the IPCC claims 97% of Consensus, there are some members who are not prepared to accept the Global warming and Climate Change.

Out of 195 member countries even if one does not agree then there will be problem. Eg. USA exiting from Paris Pact. Political and policy differences in the same country, litigations in courts sabotage the initiation. There are some good NGOs world over like Bill Gates Foundation that are prepared and appreciated the theory and trying to help to bring down C02 emissions. The scientific inputs are encouraging but the achievements are in the hands of Policy makers. To achieve the goal to contain Global Warming in turn Climate Change everyone should cooperate and save the Earth from the calamities and sufferings.

Some questions are in the minds of many.

1. Whether the activists are scaring people by over warning.

2. Is it possible to bring down the C02 level to Zero if not by 2070 as promised by many countries can achieve by 2100.

3. Is it possible for poor countries and developing countries to mobilize funds for achieving.

4. Will there be an understanding between Climate Change Activists and deniers.

5. Will the countries that are producing oil which is considered as main culprit will be reducing the productions?

6. Will the people get adapted and make sincere efforts to contain Global Warming by growing more plants, less usage of water, switching over to alternate energies with reducing CO2 will affect the places.

Climate Change recognizes that the climate of the Earth does change. It is certain to happen, and always has.

Climate Change can be a problem. It is worth remembering that the Earth has been much hotter and colder than it is today. It is not a fixed value. It is affected by variations of the Sun and activities of the planet life forms.

At times in the past the temperature was much cooler with the ice age.

The World Health Organization (WHO) calls Climate Change the greatest threat to Global health in 21st century.

Even if efforts to minimize future warming are successful, some effects will continue for centuries. These include sea level rise, warmer and more acidic oceans.

Many impacts are already felt at the current 1.2 Degree C level warming. Additional warming will increase these impacts and trigger tipping points such as the melting of the Green Land ice sheet.

Under the Paris agreement nations collectively agreed to keep warming well under 2.0 Deg C.

However, with pledges made under the agreement global warming may still reach 2.7deg C by the end of the century. Limiting 1.5 deg c will require halving the emissions by 2030 and achieving net-zero emissions by 2050. Reducing emissions will require switching away from human burning fossil fuels and switching to electricity generated from low carbon resources.

The gravity of impact of Climate change was realized in 1990's. The Climate fictional movie "The Day after Tomorrow (2004) and the Documentary "An Inconvenient Truth (2006) focused on Climate Change.

The Global warming reached 1.1 Deg C to 1.20 deg C during 2011-2020 above the preindustrial base line 1850-1900. Global surface temperature has increased faster since 1970 than any other 50 years over in at least the 2000 years. Widespread increase and rapid changes in the Atmosphere, Ocean, Cryosphere and Biosphere have occurred. If the GHG emission level in 2030 happens as announced in Oct 2021 make it likely warming will exceed 1.5 Deg C during 21st century and make it harder to limit warming below 2.0Deg C.

Since the situation may be grim, we need to do the following:

Reducing GHG emissions to 50 % by 2030 and 0 % by 2070.

Keep in control the surface temperature increases below 1.5 Deg C

Reduction of Fossil fuel burning of all oil-based products.

Improving generation of alternative energies like Solar and wind.

Switching over to Electrical transportation.

Funding is a main problem so the underdeveloped countries and developing countries need support. Sincere efforts of policy makers of Govts in mitigation by taking the scientific guidance finding ways to adapt to any situation.

Cooperation among member states and within the states.

Views of Experts:

"The Climate Change is being undermined at a time where we should be accelerating action there is a backtracking" – said Secretary General Antonio Guterres. He also described the fight against the Climate crisis as the top priority for the 21st century in a passionate, uncompromising speech delivered at Columbia University, New York. He also said, "Our planet is in a state of Climate Emergency, but I also see a hope there is a momentum carbon reduction."

As more data surfaces, we see that climate change is accelerating at a fast pace, throwing off extreme weather events one after the other. This is faster than what was thought earlier. South Asia has become a poster child of climate change. The entire region, not just India, is witnessing a clear trend increasing heat waves, floods, cyclones, landslides, food and water short fall. Climate crisis could spell the end of the world for many underprivileged who have low capacity to adapt to changes.

Many cities are becoming greener. The climate crisis is accelerating at a faster pace than expected. Climate meeting that held in Bonn, Germany put Climate Scientists and most of their recommendations in the back seat - Roxy Mathew Koll Climate Scientist IITM Pune. He mentioned that WMO forecast temperature to rise 1.5 deg C in the next 5 years at least temporarily.

Environmental laws may help as many people are taking climate action. Some experts are of the opinion that the world could hit climate change milestone by 2024.

CONCLUSION:

WMO IPCC and Climate Scientists in most of the countries unambiguously accept that Global Warming is increasing, irreversible and the efforts of climate change are already felt and likely to increase.

The Global average temperature is likely to increase up to 1.5 deg C in the next 5 years and likely to surpass 1.5 Deg C because the warming is faster than expected.

Hence all the nations must cooperate using all available tools and contain the Greenhouse Gases incursion the main cause of Climate Change

Climate Change is Global emergency that is beyond national boundaries. It is an issue that requires international cooperation at all levels.

A world that is safer, more secure, more prosperous, free from calamities is required.

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Books

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(b)Climate Change a very short introduction by Mark Maslin.

(c) "The politically incorrect guide to climate change evil personified"– Climate Denier Marc Morona.

(d) Scientific articles by Climate Change Scientist Dr. Roxy Matthew Koll IITM Pune, India.

(e) Many papers from Indian and foreign authors.
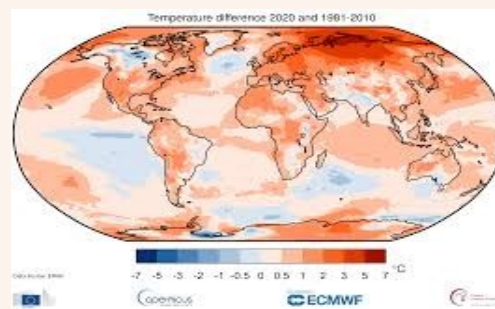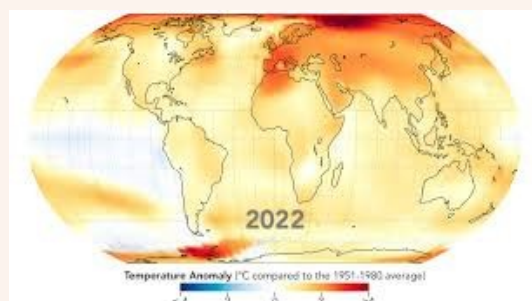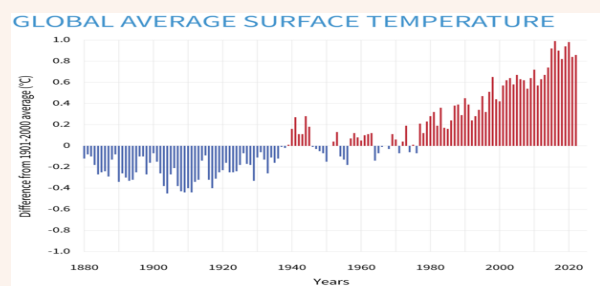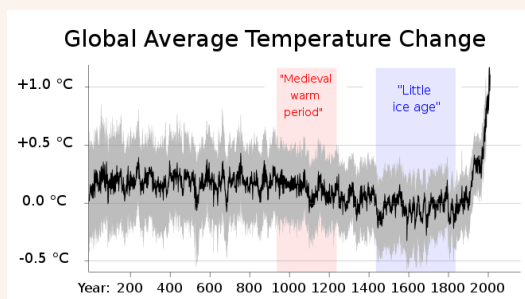
பொழில் எனும் மழைக்காடு
முனைவர் கு.வை. பாலசுப்பிரமணியன்

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மழைக்காடு என்பது அதிகமான மழைப்பொழிவினால் உருவாகும் காடுகளாகும். பொதுவாக இக்காடுகள் உள்ள பகுதிகளில் ஓராண்டில் குறைந்தது 172 முதல் 198 செமீ மழை பெய்யும். மழைக்காடுகள் மிகவும் மென்மையான அல்லது சூடான காலநிலைகளைக் கொண்டிருக்கின்றன மற்றும் உலகில் பல்லுயிரிகள் மிக அதிகமாக வாழும் பகுதிகளாகவும் உள்ளன. கூடுதலாக, வெப்பமண்டல மழைக்காடுகள் "பூமியின் நுரையீரல்" எனக் கருதப்படுகின்றன, ஏனெனில் இங்கே அதிக அளவு ஒளிச்சேர்க்கை ஏற்படுகிறது; அதாவது கரியமில வாயு உள் வாங்கப்பட்டு, உயிர்வளி வெளியிடப் படுகிறது.

படம் 1: மழைக்காடுகள்

தமிழகத்தில் கொடைக்கானல், ஊட்டி பகுதிகளில் சோலைக் காடுகள் (shola forests) பல காணப்படுகின்றன. இவை புல்வெளியும் அதன் நடுவே காடுகளும் அமைந்த மலைச் சரிவுப் பகுதிகளாகக் காணப்படும். மழைக்காடுகளைத் தமிழில் **பொழில்** என அழைக்கிறார்கள். 'பொழிதல்' என்ற சொல் 'மழை பெய்தல்' எனப் பொருள்படும். இதுவே காடுகளுக்காகிவந்து 'பொழில்' என்று மாறிவிட்டது. இச்சொல் இன்றைய அறிவியலில் மழைக்காட்டினைக் குறிக்கப் பயன்படுகிறது.

அதிக மழையும், சூடான தட்பவெப்பமும் உயரமான மரங்களும் கொண்ட பூமத்தியரேகைப் பகுதியில் இத்தகைய காடுகள் காணப்படும். இந்த மழைக்காடுகள் ஆப்பிரிக்கா, ஆசியா, ஆஸ்திரேலியா, மத்திய மற்றும் தென் அமெரிக்கப் பகுதிகளில் பரவியுள்ளது. இப்பூமியின் பரப்பளவில் இரண்டு பங்கிற்கும் குறைவாகவே இருந்தாலும் இவ்வுலகின் ஐம்பதுக்கும் மேற்பட்ட தாவரங்களையும் விலங்குகளையும் இக்காடுகள் தன்னகத்தே கொண்டுள்ளன. உலகில் வேறெங்கும் வசிக்காத உயிரினங்கள் பலவற்றை இம்மழைக்காடுகளில் காணலாம்.

படம் 2: மேற்குத் தொடர்ச்சி மலைப் பகுதியில் காணப்படும் மழைக்காடுகளில் வாழும் சில சிறப்பு விலங்குகள் (அ) கருஞ்சிறுத்தை, (ஆ) செந்நாய், (இ) யானை, (ஈ) காட்டுமாடு

பூமத்திய ரேகைக்கு அருகாமையில் அமைந்துள்ளதால் அதிக சூரிய ஒளியைப் பெற்று தாவரங்கள் ஒளிச்சேர்க்கை புரிகின்றன. இதனால் தாவரங்களில் சேமிக்கப்பட்ட அதிகமான இச்சக்தி மழைக்காட்டியுள்ள விலங்குகளுக்கு உணவாக அமைகிறது. அதிக உணவு இருப்பதால் அதிக விலங்குகளும் மழைக்காடுகளில் வாழ்கின்றன. இப்புவியின் உயிர்ச்சூழ்நிலைக்கு மழைக்காடுகளின் சேவை மிகவும் முக்கியமானது. ஏனெனில் மழைக்காடுகள் பலவிதமான தாவரங்களுக்கும் விலங்குகளுக்கும் உறைவிடமாகிறது. உலகின் தட்பவெப்பநிலையை சமப்படுதுகிறது. வெள்ளம், வறட்சி மற்றும் மண்ணரிப்பிலிருந்து பாதுகாக்கிறது.

உலக அளவில் முக்கியத்துவம் வாய்ந்த சில மழைக்காடுகள் உள்ளன. அவற்றுள் ஹரப்பன் மழைக்காடுகள் ஒன்றாகும். இந்த மழைக்காடுகள் 98,555 ஹெக்டேரில் சுமத்ரா, இந்தோனேஷியா, ஜாம்பி என்று பல தீவுகளில் விரிந்து கிடக்கிறது. The British Royal Society for the Protection of Birds என்ற அமைப்பு ஒரு மில்லியன் மரங்களை நட்டு இந்த காடுகளை மறு உற்பத்தி செய்துள்ளனர். ஏனெனில் சுமத்திரா புலி, சுமத்திரா காண்டாமிருகம் போன்ற அழியும் நிலையில் உள்ள முந்நூறுக்கும் மேற்பட்ட பல உயிரினங்கள் இந்த வனத்தில் வசிக்கின்றன.

ஆசியக்கண்டத்தில் உள்ள மற்றொரு முக்கியமான மழைக்காடு சிங்கராஜா மழைக்காடுகள் ஆகும். சிங்கராஜா வனம் இலங்கையில் அமைந்துள்ளது. இது UNESCOவால் பாதுகாக்கப்படும் தேசிய வனமாகும். இது இலங்கையின் தென் மாகாணங்களின் எல்லையில் இரத்தினபுரி, கலாலி, மாத்தறை மாவட்டங்களில் அமைந்துள்ளது. சிங்கராஜா வனம் கடல் மட்டத்தில் இருந்து 300 மீட்டர் முதல் 1170 மீட்டர் உயரம் கொண்ட மழைக்காடாகும்.

இலங்கையின் வெப்பமண்டல மற்றும் ஈரப்பதமான பசுமை மாறாத வனங்களில் மிகுதியாக இருக்கும் வனமாக சிங்கராஜ வனம் காணப்படுகின்றது. கோண்டுவானா நிலப்பரப்பின் நினைவுச்சின்னமான தாவரங்கள் சில இருக்குமிடமாகவும், கண்டப்பெயர்ச்சி குறித்த அறிவியல் மற்றும் உயிரியல் சம்பந்தமான ஆய்வுகளினை மேற்கொள்வதற்கு சிறந்ததொரு தளமாகவும் விளங்குகிறது.

இது மலர்களின் பூர்வீக நிலமாக காணப்படுகின்றது. இங்கு 139 வகை தாவர இனங்கள் காணப்படுவதோடு அவற்றுள் சில அரிதானவையாகவும் திகழ்கின்றன. இங்கு விலங்கினங்களும் அதிகம். நாட்டின் 50 விழுக்காட்டிற்கும் மேற்பட்ட பாலூட்டிகள், பறவைகள் மற்றும் பட்டாம்பூச்சிகள் இங்கு காணப்படுகின்றன. இலங்கையை சேர்ந்த 20 உள்ளூர் பறவை இனங்களில், 19 பறவை இனங்கள் இந்த காட்டில் தான் வாழ்கின்றன. அதுமட்டுமல்லாது பயங்கரமான வன விலங்கினங்களான சிறுத்தை மற்றும் இலங்கையின் ஈரநில யானைகளின் வாழ்விடமாகவும் சிங்கராஜ வனம் காணப்படுகின்றது.

படம் 3: இலங்கையில் உள்ள சிங்கராஜக் காடு

இந்தியாவில் இவ்விதமான மழைக்காடுகள் அடர்ந்து இருப்பது மேற்குத் தொடர்ச்சி மலைப்பகுதிகளிலும், அஸ்ஸாம், அருணாசல பிரதேசம் போன்ற வடகிழக்கு மாநிலங்களிலும்தான்.

மழைக்காடுகள் மிகுந்திருந்த மேற்குத்தொடர்ச்சி மலைப்பகுதிகள் தேயிலை, காப்பி போன்ற ஒரே வகையான பயிர்த் தோட்டங்களுக்காகவும், நீர்மின் திட்டங்களுக்குகாகவும், மரம் வெட்டும் தொழிலுக்காகவும் கடந்த சில நூற்றாண்டுகளாக அழிக்கப்பட்டு வருகிறது. இதனால் மழைக்காடுகள் பல இடங்களில் முற்றிலுமாக அழிக்கப்பட்டு, தொடர்பற்று துண்டுதுண்டாகிப்போனது.

மேற்குத் தொடர்ச்சி மலையில் ஆனைமலைப் பகுதியிலுள்ள வால்பாறையில் கண்ணுக்கெட்டும் தூரம் வரை பச்சைப்பசேலென தேயிலைத் தோட்டங்களைக் காணலாம். காப்பி, தேயிலை, ஏலம், யூக்கலிப்டஸ் போன்ற ஒரே வகையான தாவரத் தோட்டங்களின் நடுவே இவை பயிரிடத் தகுதியில்லாத இடங்களில் இன்னும் அழிக்கப்படாத மழைக்காடுகள் சிறியதும் பெரியதுமாக ஆங்காங்கே தீவுகளைப் போல காட்சியளிக்கும். இவற்றை மழைக்காட்டுத்தீவுகள், துண்டுச்சோலை என்றும் அழைக்கின்றனர்.

இத்துண்டுச் சோலைகள் மிகவும் முக்கியத்துவம் வாய்ந்தவை. ஏனெனில் வால்பாறையைச் சுற்றிலும் ஆனை மலை புலிகள் காப்பகம், பரம்பிகுளம் புலிகள் காப்பகம், வாழச்சால் வனப்பகுதி, எரவிகுளம் தேசியப் பூங்கா, சின்னார் சரணாலயம் போன்ற இடங்களில் தொடர்ந்த பரந்து விரிந்து பாதுகாக்கப்பட்ட வனப்பகுதிகளாக அமைந்துள்ளன. இதனால் சுற்றிலும் வனத்தைக் கொண்ட வால்பாறை பகுதியில் பலவிதமான அரிய, அழிவின் விளிம்பில் இருக்கும் விலங்குகளையும், தாவரங்களையும் பார்க்க முடியும். இந்த உயிரினங்களுக்கெல்லாம் புகலிடமாக இத்துண்டுச் சோலைகள் உள்ளன.

ஒரு மழைக்காட்டு மர விதை முளைத்து, துளிர்விட்டு, நாற்றாகி மரமாக உயர்ந்து வளர்வதற்குள் பலவிதமான இன்னல்களை சந்திக்க நேரிடுகின்றது. வறட்சியிலிருந்தும், நாம் காட்டுக்குள் கொண்டு செல்லும், ஆடு, மாடுகளிடமிருந்தும், அங்கு வாழும் தாவர உண்ணிகளிடமிருந்தும், சூரிய ஒளிக்காக, நீருக்காக அதனைச் சுற்றியுள்ள தாவரங்களிடமிருந்தும், களைச்செடிகளிடமிருந்தும் எல்லாவற்றிற்கும் மேலாக மரவெட்டியின் கோடாலியிடமிருந்தும் தப்பிக்க வேண்டும். ஒரு மரம், நடப்பட்த்திலிருந்து 15 மீட்டர் வரை வளர்வதற்கு சுமாராக 12 ஆண்டுகள் பிடிக்கிறது. தாவரங்களைப் போல, மழைக்காடுகள் வனப்பகுதிகளில் பல்வேறு உயிரினங்கள், விலங்குகளுக்கு ஆதரவு அளிக்கிறது. உதாரணமாக குரங்குகள் வெப்பமண்டல மழைக்காடு தோப்புகளில் வாழ்கின்றன, அதே நேரத்தில் ஆந்தைகளும் வழ்கின்றன. காட்டுப்பகுதி முழுவதும் பாலூட்டிகள், ஊர்வன, பறவைகள் ஆகியவை பொதுவானவை. கூடுதலாக, பல்வேறு வகையான பூஞ்சைகள் இங்கே உள்ளன. உலகெங்கிலும் உள்ள தாவர மற்றும் விலங்கு வகைகளில் பாதிக்கும் மேலானவை மழைக்காடுகளிம் வசிக்கின்றன.

மழைக்காடுகளால் மனித இனம் பெறும் பயங்கள்

தாவர இனங்களும் உயிர் இனங்களும் மிகுதியாக இருப்பதால், மனிதர்கள் நூறாயிரக்கணக்கான ஆண்டுகளாக மழைக்காடுகளைப் பயன்படுத்துகின்றனர். பூர்வீக மக்கள் விலங்குகளையும் உணவு, கட்டுமான பொருட்கள், மருந்துகள் ஆகியவற்றையும் இந்தக் காடுகளில் இருந்து பெறுகின்றனர். இன்று, மழைக்காடுகள், காய்ச்சல்கள், மற்றும் தீக்காயங்கள் போன்ற பல்வேறு வியாதிகளுக்கு மருந்து அளிக்கின்றன.

மழைக்காடுகள் மனிதர்களுக்கு மிகவும் பயன்தருவதாக இருந்தபோதிலும் மனிதர்கள் காட்டினை அழித்து நாட்டினை உருவாக்குகின்றனர். மிதமான மழைக்காடுகளில், மரங்கள் பெரும்பாலும் கட்டிடப் பொருட்களுக்காக வெட்டப்படுகின்றன. வெப்பமண்டல மழைக்காடுகளும் காடழிப்புக்கு உட்படுகின்றன. ஆனால் இந்த பகுதிகளில் நிலங்களை வேளாண் பயன்பாட்டிற்காக மாற்றுவதற்கு காடழிப்பு செய்கிறார்கள்.

மழைக்காடுகளின் பல பகுதிகள் மனித நடவடிக்கைகளின் விளைவாக, தங்கள் காடுகளில் கணிசமான பகுதியை இழந்துள்ளன, நூற்றுக்கணக்கான தாவர மற்றும் விலங்கு இனங்கள் அழிக்கப்படுகின்றன. இதன் காரணமாக பிரேசில் நாட்டில் காடழிப்பினை எதிர்த்து ஒரு தேசிய அவசர நிலை அறிவிக்கப்பட்டுள்ளது. இதனால் உலகெங்கிலும் உள்ள நாடுகளில் இப்போது மழைக்காடுகளைப் பாதுகாப்பதற்கான திட்டங்களை அமைத்து வருகின்றனர்.

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Studies on Variability of Aerosol Optical Thickness and Ice-Covered Fraction over Antarctica during the years 2001 to 2021 using MERRA-2 Reanalysis datasets

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Antarctica being the fifth largest continent on Earth which has 98% of the surface being covered by thick ice and snow has an important role in the global climate process. In this study we have focused on the temporal distribution of various aerosols such as dust, sea salt, black carbon and sulphate obtained from Modern Era-Retrospective analysis for Research and Applications, Version 2 (MERRA-2) database for the years 2001 to 2021 at a spatial resolution of 0.5° x 0.625°. We have tried to understand the relationship between aerosol optical thickness (AOT) and ice-covered fraction over the study region. Aerosol optical depth and aerosol concentration in the atmosphere can be related using the Beer-Lambert equation.

$$\text{AOD} = - \ln (\text{TOA Reflectance}) / mu$$

where, TOA Reflectance is the top-of-atmosphere reflectance measured by satellite instruments and mu is the cosine of the solar zenith angle which lies between the sun and the zenith (the point in the sky directly above the observer) at a particular location on Earth. The negative sign in the formula is used to convert reflectance to transmittance, and the natural logarithm (ln) is used to convert transmittance to optical depth.

The percentage of the overall area that is covered by sea ice is the standard definition of sea ice concentration. This sea ice concentration is referred to as ice covered fraction in the MERRA-2 documentation.

$$\text{Ice Covered Fraction} = (\text{Sea ice area}) / (\text{Total area})$$

where the sea ice area is the area covered by sea ice within the grid cell or region of interest, and the total area is the area of the same grid cell or region. With values ranging from 0% (no sea ice present) to 100%, the sea ice fraction is usually expressed as a percentage (the entire area is covered by sea ice).

During the summer (DJF), the concentration of sea-salt aerosol increases and it reaches its lowest point during spring season (SON). Sulphate aerosol concentration begins to rise in the late spring and reaches its peak in the summer, whereas dust aerosol rises in the spring and begins to fall in the early winter (MAM) season. During spring season, the concentration of black carbon is high, from early summer the concentration decreases.

begins to fall in the early winter (MAM) season. During spring season, the concentration of black carbon is high, from early summer the concentration decreases.
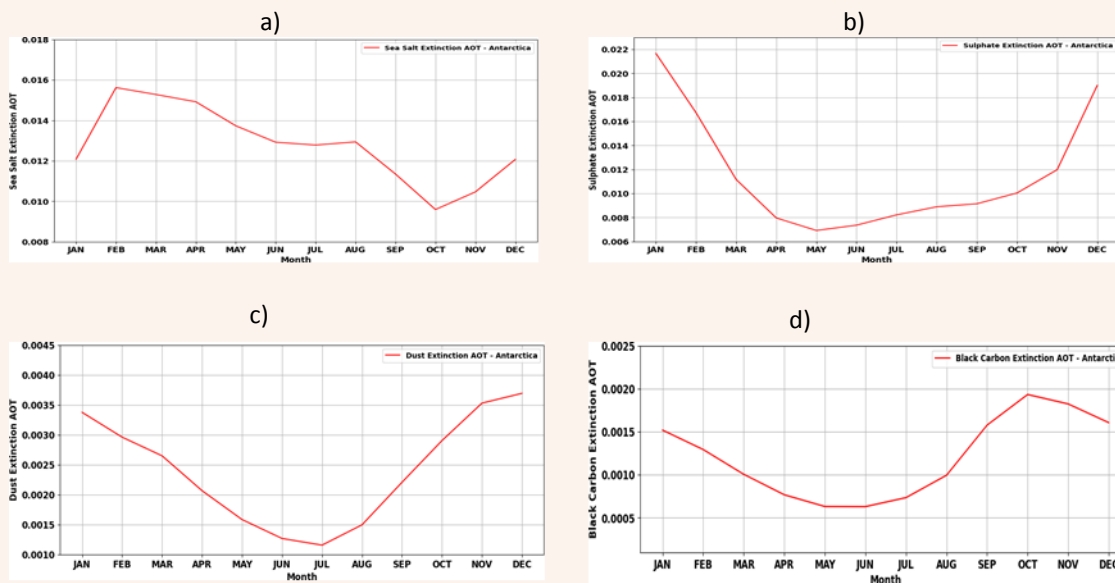

Fig 1. Monthly mean distribution of a) Sea-Salt Extinction AOT b) Sulphate Extinction AOT c) Dust Extinction AOT d) Black Carbon Extinction AOT over Antarctica for the years 2001 to 2021.

Sea salt and sulphate being the dominant aerosols, the respective AOT lies between 0.01 to 0.02 while dust AOT values are between 0.001 to 0.004. The Black carbon aerosol being the least dominant, the AOT concentration as low as 0.001 to as high as 0.002. This study confirms that even though aerosols concentrations are in fractions, finer changes can influence greater impact to the atmosphere.
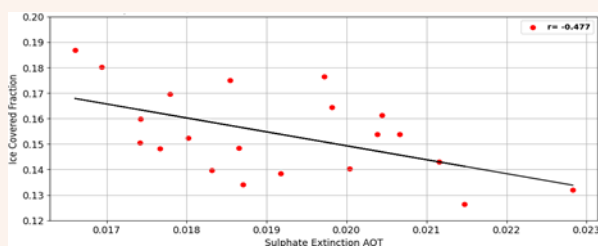

Fig 2. Correlation between Sulphate Extinction AOT and Ice-covered fraction over Antarctica during summer season (DJF)
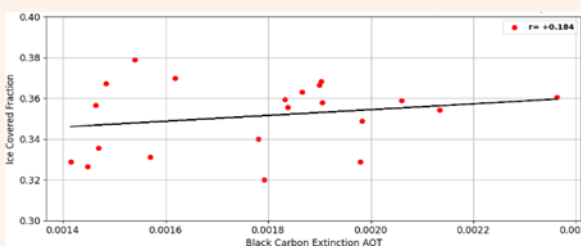
Fig 3. Correlation between Black Carbon Extinction AOT and Ice-covered fraction over Antarctica during spring season (SON)

The sea ice fraction over Antarctica varies throughout the year due to seasonal changes. In general, the sea ice extent reaches its maximum in late September and minimum in late February or early March. Fig 2 and Fig 3 shown are the spearman's correlation coefficient between the ice-covered fraction and AOT. Based on the dominance of aerosols during different seasons, the correlation analysis is performed between ice covered fraction and the AOT of various aerosols such as dust, sea salt, black carbon and sulphate. The correlation coefficient with ice-covered fraction being negative for sea-salt and sulphate AOT, shows their inverse relationship. Correlation coefficient is found to be minimum (+0.184) between black carbon AOT and ice-covered fraction, whereas between sulphate AOT and ice-covered fraction, the correlation coefficient is -0.477 which shows a strong dependency among the other aerosols considered in our study.

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Photographs of the event "Seminar on Monsoons 2022" 08-03-2023, RMC, Chennai