Bulletin of Indian Meteorological Society, Pune Chapter (BIMSP)

Special Issue

January – March 2023 Issue

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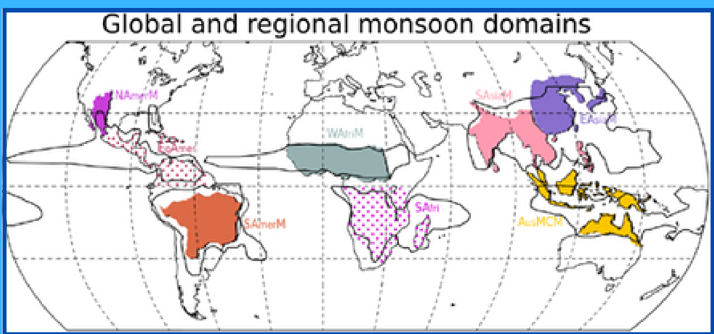

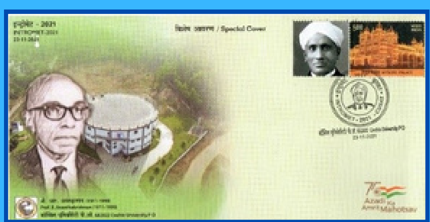

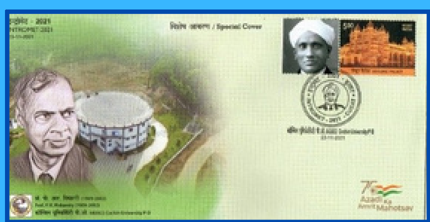

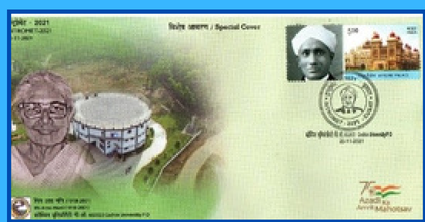

RELEASED ON THE OCCASION OF

Annual Monsoon Workshop

March 2023

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About IMSP and Bulletin of IMSP

The Indian Meteorological Society was established in 1956 and was registered on 26 May 1972 under the societies Registration act of 1860 as amended by Punjab Amendment Act 1957 applicable to Delhi. Registration No. of the society is 5403. The Society's headquarter is located at Delhi and its local chapters are functional at various places of India. The Society is a non-profit making organization and none of its income or assets accrues to the benefit of its members.

Objectives of the Society:

1. Advancement of Meteorological and allied sciences in all their aspects
2. Dissemination of the knowledge of such sciences both among the scientific workers and among the public and
3. Promotion of application of Meteorology and allied sciences to various constructive human activities

Any person, who is interested in above objectives of the society, is eligible to become a Life member. The Life membership fee is Rs. 3000/- only for Scientists/ Researchers from India. Please visit *https://imetsociety.org/wp-content/pdf/docs/forms/IMS_LM_form.pdf* for IMS life membership form.

"Bulletin of IMSP" is generally published quarterly. Correspondence and contributions to the bulletin may be sent to Editorial Board (*mahap@tropmet.res.in*), with copy (cc) to the IMSP Chairman (*ks_hosalikar@yahoo.co.in*). The manuscript should be typed at 1.15 space using Times New Roman font size 12, in MS-Word file. The author's name should be typed on the line below the title, the affiliation and email ID should follow on next line. The first author is requested to send softcopy of his/her passport size photograph.

Editors, Managing Editor/Editorial Board and the Society are not responsible for the views expressed by any author in his/her contribution(s) published in Bulletin of IMSP.

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From the Chairman's Desk

It gives me immense pleasure that the special issue of the IMSP Bulletin is being launched on the occasion of the Annual Monsoon Workshop organized by the Indian Meteorological Society on 28th March 2023 at the Indian Institute of Tropical Meteorology (IITM) Pune. This special edition of the IMSP Bulletin is intended to be a journey of the IMSP bulletins in the past few years. The bulletin comprises selected articles from the previous bulletins in addition to the new articles. I express my heartiest thanks to all my IMSP colleagues who have contributed to bringing this bulletin very well.

Indian Meteorological Society, Pune Chapter (IMSP) is the scientific society engaged in popularizing meteorology and related sciences among scientists, researchers and the public at large. IMSP also promotes public awareness about climate change, global warming and the environment for the betterment of the citizens. Annual Monsoon Workshop has always been a flagship program of the IMS Pune chapter. It is one full-day program in which professionals, researchers and students in the field of weather and climate sciences interact and share knowledge. The workshop aimed to meet the growing scientific challenges and societal demands in the field of meteorology. In previous years the event was organized in online mode due to the prevailing restrictions due to pandemic conditions. After 2 years, we are organizing the event in physical mode. My warm greetings to the members of Indian Meteorological Society (IMS) Pune chapter for organizing Annual Monsoon Workshop on 28th March 2023 and National Symposium on "Challenges in climate services for health sector in the warming environment" on 29th and 30th March 2023.

I am very thankful to all members and supporters of IMS, IMD, IITM, MoES, and all other organizations which have been there with us in bringing this important publication. I deeply cherish the long association with all and looking forward to more programs, events and scientific and non-scientific reports like this in the coming time.

K. S. Hosalikar
Chairman, IMSP

Contents

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Indian Scientific Research Stations in Antarctica

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India has been conducting scientific expeditions to Antarctica since 1981. The Indian Antarctic Program is managed by the National Centre for Polar and Ocean Research (NCPOR), which is a research institution under the Ministry of Earth Sciences. The program is aimed at conducting scientific research in various disciplines such as geology, oceanography, atmospheric sciences, and biology, geomagnetism. The first Indian expedition to Antarctica was launched in December 1981 with a team of 21 scientists and support staff. Since then, India has been sending expeditions to Antarctica every year. The expeditions are conducted in two phases - the summer phase (in South Hemisphere) from November to April, and the winter phase (in South Hemisphere) from May to October. **The Indian Antarctic expeditions are conducted from two research stations - Maitri and Bharati.** Maitri was established in 1989 and is located at a distance of 5,000 km from India's southernmost tip, while Bharati was established in 2012 and is located at a distance of 3,000 km from India's southernmost tip. The expeditions have led to significant scientific discoveries and contributions to the understanding of Antarctica and its role in global processes. Some of the major research areas include glaciology, meteorology, atmospheric chemistry, geology, biology, and oceanography. The expeditions have also contributed to the development of technology and infrastructure for polar research in India. Overall, the Indian Antarctic Program is a significant initiative for scientific research and international collaboration in the field of polar sciences.

Figure 1: View around Bharati Indian Antarctica Station after snowfall

Maitri Indian Antarctic Station

Maitri is one of the two research stations that India operates in Antarctica. It is located on the rocky mountainous region of the East Antarctic Ice Sheet, at an altitude of 2,500 meters above sea level. The station was established in 1989 and has since then been a hub of scientific research activities in Antarctica. Maitri is a modern facility with state-of-the-art infrastructure that enables it to operate in extreme conditions. It has accommodation facilities, laboratories, a meteorological observatory, geomagnetism observatory and other amenities that support the scientific research activities.

Figure 2: Summer time view around Maitri Indian Antarctica Station

The Maitri station is designed to accommodate up to 25 personnel during the summer months and 12 personnel during the winter months. The research conducted at Maitri covers a range of disciplines, including glaciology, geology, atmospheric sciences, biology, geomagnetism and more. The station is also used for logistical support for scientific expeditions to remote areas of Antarctica. In addition, Maitri serves as a platform for international collaboration in scientific research and exploration in Antarctica. India's presence in Antarctica through Maitri station has enabled the country to contribute significantly to the global understanding of Antarctica and its role in the Earth's climate system. The research carried out at Maitri has led to new discoveries and insights into the dynamics of the polar region and its impact on the global environment.

Bharati Indian Antarctic Station

Bharati is one of the two research stations operated by India in Antarctica. It is located in the Larsemann Hills region of East Antarctica, at an altitude of 1,340 meters above sea level. The station was established in 2012. Bharati station is a modern facility equipped with state-of-the-art infrastructure and amenities that enable it to function in the harsh Antarctic environment. The station has accommodation facilities, laboratories, a meteorological observatory, geomagnetism observatory and other facilities necessary for conducting scientific research. The research conducted at Bharati covers a wide range of disciplines, including glaciology, geology, atmospheric sciences, biology, geomagnetism and more. The station is also used for logistical support for scientific expeditions to remote areas of Antarctica. Bharati station is designed to accommodate up to 47 personnel during the summer months and 17 personnel during the winter months. The station's facilities are designed to operate sustainably and with minimum impact on the environment. India's presence in Antarctica through Bharati station has enabled the country to contribute significantly to the global understanding of the polar region and its impact on the Earth's climate system. The research carried out at Bharati has led to new discoveries and insights into the dynamics of the polar region and its role in the global environment. Additionally, the station has helped to strengthen India's scientific capabilities and its participation in global scientific research initiatives.

Figure 3: View around Bharati Indian Antarctica Station

Aurora in Antractica

Antarctica is one of the best places on Earth to observe the aurora, also known as the Northern and Southern Lights. This is because the continent is situated near the Earth's magnetic South Pole, which is one of the two locations on the planet where the magnetic field lines are perpendicular to the Earth's surface. This allows charged particles from the Sun to enter the Earth's atmosphere and collide with the gas particles, resulting in the beautiful and colourful auroras. During the austral (South Hemispheric) winter months (June to August), when the nights are longer, the aurora can be seen more frequently in Antarctica. The phenomenon is visible throughout the continent, including at India's research stations, Maitri and Bharati. The aurora is a natural light display that occurs in the polar regions of the Earth. It is caused by the interaction between the charged particles from the Sun and the Earth's magnetic field. When these charged particles enter the Earth's atmosphere, they collide with the gas particles and emit light in various colours, including green, red, pink, and blue. The colours of the aurora depend on the type of gas particles involved in the collision and their altitude in the atmosphere. The aurora is a beautiful natural spectacle that has fascinated people for centuries. It is also an important scientific phenomenon that provides insights into the dynamics of the Earth's magnetosphere and its interaction with the solar wind. Research conducted at Antarctica, including at Indian research stations, and has contributed significantly to the understanding of the aurora and its impact on the Earth's environment.

Figure 4: Aurora at Bharati Indian Antarctica Station

Figure 5: Aurora at Bharati Indian Antarctica Station

Wildlife in Antactica

Antarctica is home to a unique and diverse range of wildlife, including penguins, seals, whales, and seabirds. These animals have adapted to survive in the harsh and extreme conditions of the continent and its surrounding waters. Penguins are perhaps the most well-known and iconic species of wildlife in

Antarctica. They are found throughout the continent and its surrounding islands, with the largest colonies located on the Antarctic Peninsula. The most common penguin species found in Antarctica are Adelie, chinstrap, gentoo, and emperor penguins.

Figure 6: Adelie penguins near Bharati Indian Antarctica Station

Figure 7: Emperor penguins near Bharati Indian Antarctica Station

Seals are another common species of wildlife found in Antarctica. The two main types of seals found in the continent are the Weddell-seal and the Antarctic fur seal. These animals are adapted to living in the water and spend much of their time swimming and diving in the frigid waters surrounding the continent.

Figure 8: Seal near Bharati Indian Antarctica Station

Whales are also frequently seen in the waters around Antarctica. The most common species of whale found in the region are humpback, minke, and killer whales. These animals are adapted to the cold waters and are known for their spectacular displays of breaching and feeding. Seabirds, such as albatrosses, petrels, skuas and penguins, are found in large numbers in Antarctica. These birds are adapted to living in the harsh conditions of the continent and are known for their remarkable migrations across the Southern Ocean. The wildlife in Antarctica is an important part of the continent's ecosystem and plays a vital role in the global environment. The animals contribute to the region's biodiversity and are a critical link in the food chain of the Southern Ocean. Research conducted at India's research stations, Maitri and Bharati, has contributed significantly to the understanding of the wildlife in Antarctica and its role in the global ecosystem.

Figure 9: Skua near Bharati Indian Antarctica Station

Figure 10: Snow Petrel near Bharati Indian Antarctica Station

Acknowledgement

I respectfully thank the **Directors of IIG & NCPOR**, and the **Secretary, MOES** for their kind support.

B SUDARSAN PATRO

35th winter member of Bharati Research Station, Antarctica

37th Deputy Leader & winter member of Bharati Research Station, Antarctica

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Prof. P. R. Pisharoty as I Knew Him

Ranjan Ratnakar Kelkar

Former Director General of Meteorology (DGM), India Meteorological Department (IMD)
Former Permanent Representative of India at WMO Geneva & Member Executive Council
Former Secretary, Vice President & President, Indian Meteorological Society (IMS)
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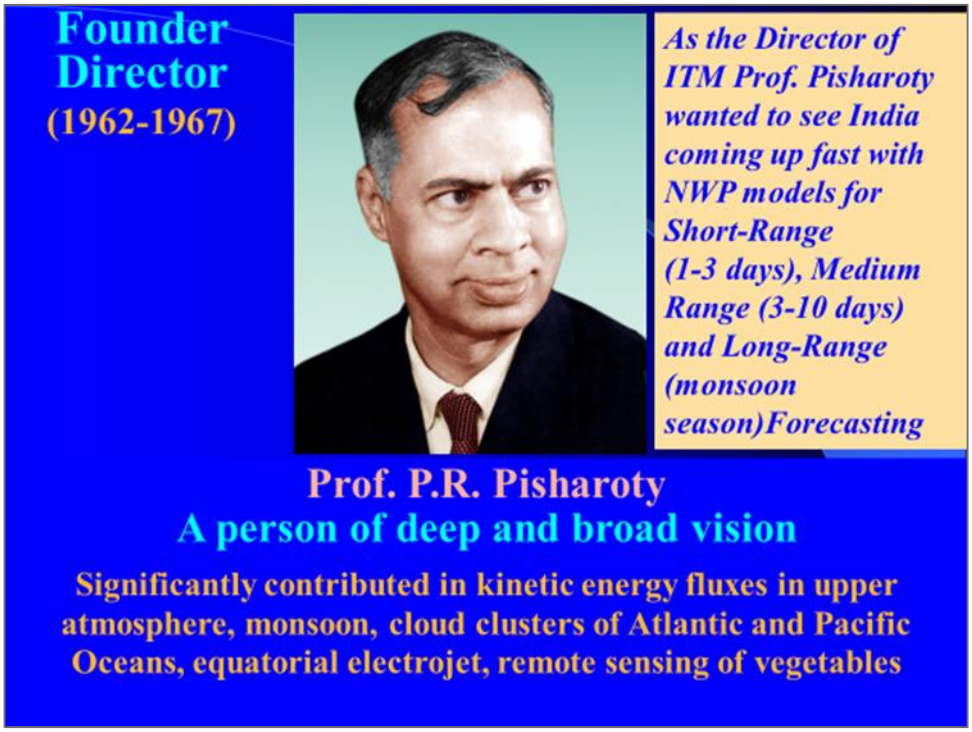
[Published in BIMSP October--December 2022 issue, Vol. 21, No. 10-12]

After getting my M. Sc. degree in Physics from the University of Pune (then Poona) in 1964, I had been working there as a Demonstrator in the Physics Department. On my way to the university, I would pass by the newly-established Institute of Tropical Meteorology and wonder what might be going on within it. I was soon to find it out for myself, after I joined ITM as a Senior Scientific Assistant in September 1965.

My first couple of days at ITM were spent in completing the administrative formalities and visiting the library. Dr P. R. Pisharoty was the Director of ITM and he called me to his office. After knowing that I was fresh from the university, he said to me, “As a student, you were taught to believe all that was written in a text-book. Now that you have joined a research institute, you should learn to question everything that you read.” That was the first of the many lessons in life that I would be learning from Dr Pisharoty during the course of my career.

He then accompanied me to the library and asked me what I had been reading. I told him that I was browsing through a small book which was a brief introduction to meteorology. He picked up a bulky book from the shelves. I still remember that it was Reiter’s Jet Stream Meteorology. He handed it over to me and said, “Do some serious reading.” Soon afterwards, he assigned me to work with Mr Ramesh Godbole in the Division of Physical Meteorology and Aerology, which was in the process of being set up and did not yet have a Head. Dr Pisharoty used to have a round of the place twice a day and inquire about little things. Once he asked me where I signed my attendance and I told him that I had to go another section to do that. The next time he came on his rounds, he brought a new attendance register with him for me, so that I did not waste time going to another place. Although it was then a part of the India Meteorological Department, the atmosphere in ITM was very different from that of a typical government office, even from the next-door IMD establishment which I had to frequently visit for obtaining books, data or information. The scientists in ITM were eminent personalities but they did not throw around an air of seniority. They were friendly, approachable people. This atmosphere was Dr Pisharoty’s creation. ITM was established in a two-storey building named Ramdurg House and it did not have a seminar hall then. Curtains would be drawn across the long verandah in front of the Director’s Office on the first floor and steel chairs would be unfolded and laid out. The speakers had only blackboard and chalk as aids. But we used to hear stalwarts like Joseph Smagorinsky, Syukuro Manabe, Takio Murakami and William Gray, visiting ITM at the invitation of Dr Pisharoty.

It was due to Dr Pisharoty’s initiative that out of the first six IBM 1620 electronic computers that India got, one was installed at ITM. In an era in which the word software had just been coined and numerical weather prediction was looked upon with skepticism, Dr Pisharoty nudged us to construct what was, in a sense, one of the earliest numerical models of the Indian monsoon.



In 1971, ITM became IITM, the word Indian having been prefixed to its name to go with its new autonomous status. Dr Pisharoty had moved to the Physical Research Laboratory, Ahmedabad. I had happily joined the IMD mainstream with a promotion to the post of Assistant Meteorologist. But my six years of upbringing at ITM with Dr Pisharoty as its Director, had moulded my personality for ever. It had trained me to see things in a different light, had given me the courage to question established practices and equipped me to act with conviction when required.

It was several years later that I had occasion to meet Professor Pisharoty again in Pune when he gave a talk on the subject of remote sensing. For most of us in the audience, this was an entirely new field, and Pisharoty kept us spellbound. He showed us remotely sensed pseudo-colour images of coconut trees and explained how the wilted coconuts could be distinguished from the healthy ones by observing them from above in infrared and other wavelengths.

Years later again, he was talking at another seminar about INSAT imagery. There were many conventional meteorologists in the audience who still loved their synoptic charts and were not particularly impressed by satellite images. To them he said, “Each satellite image contains millions of bits of information. These images contain solutions. You have to find out the problems!”

The National Centre for Medium Range Weather Forecasting was established in 1989 and Professor Pisharoty had played a crucial role in its creation. I was in the Satellite Meteorology Division of IMD at New Delhi at that time and I had been watching the Cray supercomputer being set up on the first floor of the building where I worked. It had a glamour and attraction of its own, and one fine morning, I found myself facing Professor Pisharoty in the panel that was interviewing me as a candidate for a post in the

NCMRWF. In the middle of my interview, Pisharoty suddenly asked me, “What is your ambition?”, a question that caught me on the wrong foot and made me uncomfortable for the rest of the interview. Obviously, the NCMRWF post was not offered to me, but I was never sorry for it. In hindsight, I think that it was Professor Pisharoty’s subtle way of telling me that my future lay with IMD and not outside it. I had another chance of coming closer to Professor Pisharoty, when he was the President of the Indian Meteorological Society for the 1991-93 term, and I was its Secretary. He was living in Pune and I was in Delhi, and he used to write me long letters in his characteristic beautiful handwriting. He used to say, “the more you write, the better will be your handwriting and the more you think, the sharper will be your intellect!” We were organizing the TROPMET-93 conference in Delhi, the second one in the series after its very successful start in the previous year at Ahmedabad, and we were worried about finances. However, just a letter or phone call from Professor Pisharoty would be sufficient to get a grant, and in the end the event was a real success.

Once we were discussing the future of the Indian Meteorological Society and how to increase the membership figure. I still remember Pisharoty’s remark, “Every Indian breathes air and so is qualified to be a member of the IMS! We should work towards enrolling millions of members!”

The last interaction that I had with him was in 1998 in the chamber of Professor A. P. J. Abdul Kalam, then Scientific Adviser to Raksha Mantri, along with Professor G. C. Asnani, in a meeting called by Professor Kalam to discuss the Mountain Meteorology Project. The need to build observational systems in the mountain areas and issue specialised forecasts had been felt since long. But there were many difficulties: civilian meteorologists could not be posted in the forward areas, the army had limited expertise in the field, instruments could not be maintained in the hostile environment, communications and infrastructure were required, and there were no funds allocated. The meeting lasted just for an hour but the result was clear soon after Pisharoty had said, “For briefing airline pilots before take-off, you have established meteorological offices at airports. If you have to warn against snowfall or avalanches in the mountain areas, you must set up a meteorological centre in the mountains.” This was accepted as the direction in which to move and a team was formed for writing a project report. Solutions were found for all the problems. The project was implemented jointly by several agencies, resulting in the creation of a state-of-art infra-structure for mountain meteorology in India.

I remember the advice given by Pisharoty in one of his many speeches that I had the privilege to hear. To everybody’s amazement he had said, “It is a good idea to draft one’s own obituary while one is alive, and try to live up to it. Then, when the time comes, someone else will actually write it and it would ring true!”

We all have our own ideals and we strive to gain wisdom. But what distinguished Professor Pisharoty from the rest of us was that he lived up to his very high ideals in his own life, and that his profound words of wisdom flowed from what he actually practised. His greatness was characterised by simplicity, dignity and integrity, qualities that are becoming increasingly harder to find in today’s world.

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A Philatelic Tribute to the Doyens of Indian Meteorology

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[Published in BIMSP January-March 2022 issue, Vol. 21, No. 1-3]

National Science Day:

In 1928, an Indian scientist named Sir Chandrasekhara Venkata Raman discovered a phenomenon known as the Raman Effect. For his remarkable discovery, he received the Nobel Prize in 1930, and that was the first Nobel Prize for India in the field of "Science". In 1986, the National Council for Science and Technology Communication (NCSTC) requested that February 28 be designated as National Science Day by the Government of India, and in every year, on February 28, "National Science Day" be observed to celebrate this discovery. The occasion is now held in schools, colleges, universities, and other science, engineering, medical, and research organizations throughout India. In honor of Sir C.V. Raman, Department of Posts, Govt of India issued a 20 paisa stamp on Sir Chandrasekhar Venkat Raman, way back in 1971 (Figure 1). The theme of National Science Day 2022 (of this year) is "Integrated Approach in Science and Technology for a Sustainable Future".

Figure 1: A 20 paisa stamp on Sir C. V. Raman was issued by the Department of Posts, Govt of India way back in 1971.

In the present article, I am writing about three eminent Meteorologists of the Indian Subcontinent, who were the students of Sir C. V. Raman, namely, Prof. R. Ananthakrishnan, Prof P. R. Pisharoty and Ms. Anna Mani. A set of three special covers were released as a part of the INTROMET 2021 which was hosted by the Advanced Centre for Atmospheric Radar Research (ACARR) of the Cochin University of Science and Technology (CUSAT), Kochi, Kerala from 23-26. November, 2021. Three Public Memorial Lectures in the name of these eminent Meteorologists were also held and they were delivered by eminent scientists in their respective fields during the above seminar.

Prof. J. Srinivasan, Former, Director, Divecha Centre of Climate Change, IISc, Bangalore, delivered the Prof. R. Ananthakrishnan Memorial Public Lecture on the topic "What can we learn from the simulation of the monsoons for the past 20,000 years by climate models?" on 23rd November, 2021.

Dr. C. R. Sreedharan, Former, DDGM of IMD, Pune. delivered the Ms. Anna Mani Memorial Public Lecture on the topic "Down the Memory-lane with Ms. Anna Mani: The Passionate Perfectionist" on 24th November, 2021.

Prof. B. N. Goswami, Former Director, Indian Institute of Tropical Meteorology, Pune, delivered the Prof. P. R. Pisharoty Memorial Public Lecture on the topic "Advancing the Skill of Long-Range Forecasts of Indian Monsoon Rainfall: Prospects and Challenges" on 25th November, 2021.

Meteorology

Meteorology is a branch of the atmospheric sciences, with a major focus on weather forecasting. The study of meteorology dates back millennia, though significant progress in meteorology did not begin until the 18th century. The 19th century saw modest progress in the field after weather observation networks were formed across broad regions. Prior attempts at prediction of weather depended on historical data.

Meteorology, as we perceive it now, may be said to have had its firm scientific foundation in the 17th century after the invention of the thermometer and the barometer and the formulation of laws governing the behavior of atmospheric gases. It was in 1636 that Halley, a British scientist, published his treatise on the Indian summer monsoon, which he attributed to a seasonal reversal of winds due to the differential heating of the Asian land mass and the Indian Ocean.

The Asiatic Society of Bengal, founded in 1784 at Calcutta, and in 1804 at Bombay (now Mumbai), promoted scientific studies in meteorology in India. In the year 1875, the Government of India established the India Meteorological Department, bringing all meteorological work in the country under a central authority.

Prof. R. Ananthakrishnan:

Late Prof. R. Ananthakrishnan (Ex-Director and Honorary Fellow of IITM, Pune) started his research carrier as a research scholar in the field of light scattering under the guidance of Nobel laureate Prof. C. V. Raman and awarded D. Sc. in 1937 from University of Madras. Then he joined IMD and occupied several positions up to DDG and then he worked as Director IITM during 1968-1971. He was awarded Padmashree by President of India in 1969 and C.V. Raman Centenary Medal in 1988. He was elected as an INSA Fellow in 1961 and was also member of many learned and professional societies (like Indian Academy of Sciences, Maharashtra Academy of Sciences, etc.). He was associated with some technical committees and working groups of WMO, Geneva. He was editor of some national and international reputed journals in Meteorology. Prof. Ananthakrishnan was deeply associated in organizing and teaching M. Sc./M. Tech. courses in Meteorology in University of Cochin and University of Pune. Under his able guidance, 12 persons have been awarded Ph. D degree.

Research contribution of Prof. R. Ananthakrishnan includes various topics, viz. Light scattering and Raman Effect, Solar Physics and Meteor Astronomy and Meteorology. In the field of Meteorology, his work covers different topics: Aerology, Dynamics, Thermodynamics, Errors in upper air data, monsoon circulation, Tracks of storms and depressions, Atmospheric pressure and oscillations, Indian rainfall and features associated with onset of southwest monsoon.

In honor of Prof. R. Ananthakrishnan, a Special cover on Prof. R. Ananthakrishnan was released with a Mystamp of Sir C. V. Raman, on 23rd November, 2021 during the INTROMET 2021 at ACARR, CUSAT, Kochi, Kerala (Figure 2).

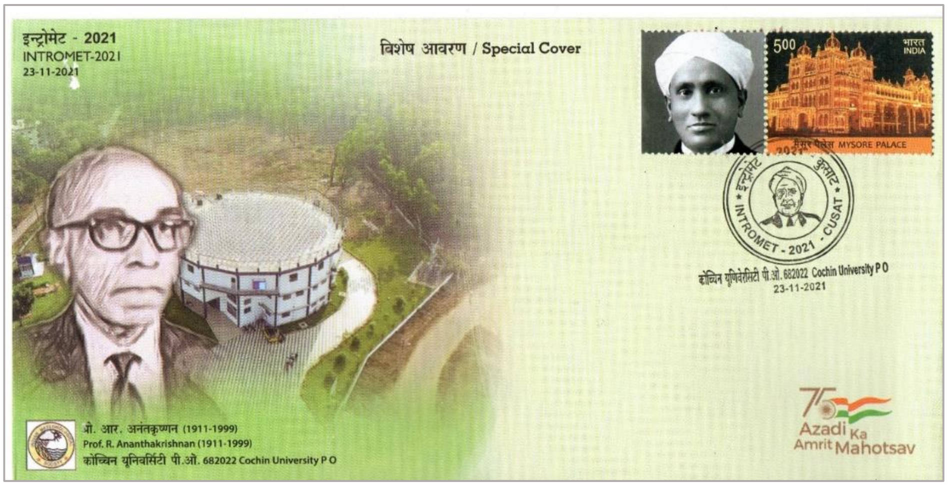

Figure 2: A Special cover on Prof. R. Ananthakrishnan was released with a Mystamp of Sir C. V. Raman, on 23rd November, 2021 during the INTROMET 2021 at ACARR, CUSAT, Kochi, Kerala.

Prof. P. R. Pisharoty:

Born on February 10, 1909 at Kollengode in Kerala, Pisharoth Rama Pisharoty had a brilliant academic career and worked with Prof. C. V. Raman at Bangalore and Prof. J. Bjerkenes at Los Angeles. He got his Doctorate from University of California in 1954. He worked on various aspects of the general circulation, monsoon meteorology and climate and published more than hundred publications in national and international journals. One of the most distinguished Indian meteorologists of international repute and considered to be the father of Indian Remote Sensing, Prof. P. R. Pisharoty, passed away in the morning of September 24, 2002 at Pune when he was 93 years old.

One of his most significant contributions was the finding that the Indian summer monsoon is a delayed response to the inadequate poleward transport of heat in the northern hemisphere during the antecedent winter and a significant part of the moisture for an active monsoon period arises through evaporation from the Arabian Sea. He was instrumental in heralding the remote sensing in the country through his pioneering experiment to detect coconut wilt disease in Kerala in the late sixties.

Prof. Pisharoty had occupied many important positions in Indian scientific departments. He was a senior officer in the India Meteorological Department; Director, Colaba Observatory and Director, Indian Institute of Tropical Meteorology. In 1967, Prof. Pisharoty joined the Physical Research Laboratory at Ahmedabad as a Senior Professor. He was the Director, Remote Sensing and Satellite Meteorology, at ISRO Space Applications Centre, Ahmedabad during 1972-75 as well as Emeritus Professor at Physical Research Laboratory.

He was President of the Indian Meteorological Society; Fellow of Indian Academy of Sciences and Fellow of the Indian National Science Academy. On the International scene, Prof. Pisharoty was a member of the Scientific Advisory Board, World Meteorological Organization (1963-1968, WMO) and later became its Chairman, a member of Joint Organizing Committee for Global Atmospheric Research Programme (1969-77, GARP), and Vice President of the International Association for Meteorology and Atmospheric Physics (1972-79). Prof. Pisharoty was a recipient of Raman Centenary Medal (1988) and Prof K. R. Ramanathan Medal (1990) of Indian National Science Academy. He was conferred Padmashri by the Government of India in 1970. He was also a recipient of the prestigious International Meteorological Prize 1989 of the World Meteorological Organization. In honor of Prof. Pisharoty, a Special cover on Prof. P. R. Pisharoty with a Mystamp of Sir C V Raman, was released on 23rd November, 2021 during the INTROMET 2021 at ACARR, CUSAT, Kochi, Kerala (Figure 3).

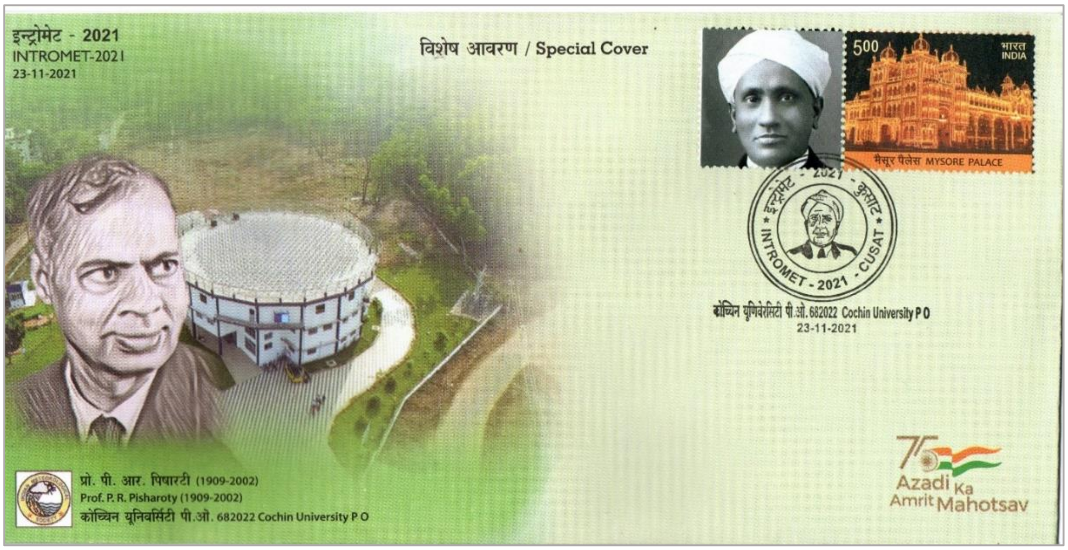

Figure 3: A Special cover on Prof P R Pisharoty with a Mystamp of Sir C V Raman, was released on 23rd November, 2021 during the INTROMET 2021 at ACARR, CUSAT, Kochi, Kerala.

Ms. Anna Mani

Ms. Anna Mani (23 August 1918 – 16 August 2001) was an Indian physicist and meteorologist. She retired as the Deputy Director General of the Indian Meteorological Department and further served as a visiting professor at the Raman Research Institute. She made several contributions to the field of meteorological instrumentation, conducted research and published numerous papers on solar radiation, ozone and wind energy measurements.

After graduating from the Pachai college, she worked under Prof. Solomon Pappaiah, researching the optical properties of ruby and diamond. She authored five research papers and submitted her Ph.D. dissertation, but she was not granted a Ph.D. degree because she did not have a master's degree in physics. After returning to India in 1948, she joined the Meteorological department in Pune. She published numerous research papers on meteorological instrumentation. She was mostly responsible for arranging for meteorological instruments, imported from Britain. By 1953, she had become the head of the division with 121 assisting her.

Anna Mani wished to make India independent in weather instruments. She standardized the drawings of close to 100 different weather instruments. From 1957-58, she set up a network of stations to measure solar radiation. In Bangalore, she set up a small workshop that manufactured instruments for the purpose of measuring wind speed and solar energy. She worked on the development of an apparatus to measure the ozone. She was made a member of the International Ozone Association. She set up a meteorological observatory and an instrumentation tower at the Thumba rocket launching facility.

Deeply dedicated to her work, Anna Mani never married. She was associated with many scientific organizations such as the Indian National Science Academy (INSA), American Meteorological Society (AMS), International Solar Energy Society (ISES), World Meteorological Organization (WMO), the International Association for Meteorology and Atmospheric Physics, etc. In 1987, she was a recipient of the INSA K. R. Ramanathan Medal.

She was transferred to Delhi in 1969 as the Deputy Director General. In 1975, she served as a WMO consultant in Egypt. She retired as the Deputy Director General of the Indian Meteorological department in 1976. In 1994 she suffered from a stroke, and died on 16 August 2001 in Thiruvananthapuram. The World Meteorological Organization remembered her on 100 birth anniversary and published her life profile along with Anna interview. In honor of Ms. Anna Mani, a Special cover on Ms. Anna Mani, was released on 23rd November, 2021 with a Mystamp of Sir C.V. Raman, during the INTROMET 2021 at ACARR, CUSAT, Kochi, Kerala (Figure 4).

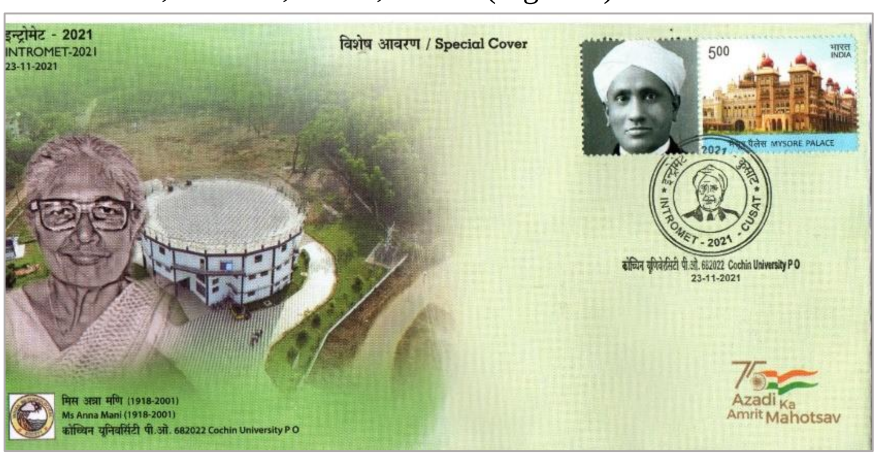

Figure 4: A Special cover on Ms Anna Mani, was released on 23rd November, 2021 with a Mystamp of Sir CV Raman, during the INTROMET 2021 at ACARR, CUSAT, Kochi, Kerala.

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CLIVAR/GEWEX Monsoons Panel of WCRP

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1. About World Climate Research Programme (WCRP):

WCRP coordinates climate research initiatives at an international level. It facilitates analysis and prediction of Earth system climate variability and change, for use in an increasing range of practical applications of direct relevance, providing benefit and value to the society. WCRP aims to determine the predictability of climate and the effect of human activities on climate (for details, please visit the website: *https://www.wcrp-climate.org/*). Basically, it is an International research coordination programme, co-sponsored by the World Meteorological Organization (WMO) (website: *https://public.wmo.int/en),* the Intergovernmental Oceanographic Commission (IOC) of the United Nations' Educational, Scientific and Cultural Organization (UNESCO) (website: *http://www.ioc-unesco.org/*) and the International Science Council (ISC) (website: *https://council.science/*). It may be noted that the ISC was created in 2018 as the result of a merger of two councils, namely, the International Council for Science (ICSU) and the International Social Science Council (ISSC).

WCRP supports various science activities to address cutting-edge topics, which cannot be tackled by a single nation or agency or any discipline alone. WCRP fosters innovation and collaboration through the organization of global meetings, workshops and conferences. The actual research projects are carried out by scientists worldwide within projects at their home institutions. To ensure that policy makers and end users can benefit from latest scientific advances, WCRP represents the state-of-the-art knowledge of its community toward high-level policy for all and toward the producers of operational climate predictions.

In the selection of its focus areas, WCRP is guided by the two main objectives (stated in its Sponsor's Agreement): (1) to determine the predictability of climate; and (2) to determine the effect of human activities on climate. The better we understand variability and change in the climate-system, the better will be society's knowledge on climate predictability and its own predictive capacity.

Equipped with tools for seamless climate predictions, global communities can better respond to impacts of climate variability and change on major social and economic sectors including food security, energy, transport, environment, health and water resources. WCRP contributes to such services to society by advancing and communicating the global state of the art in climate science. WCRP collaborates closely with related programmes at international and national level, including on observations, modelling, interactions between society and the climate system, and similar relevant topics.

Important activities of WCRP: WCRP organizes meetings, workshops and conferences to coordinate and facilitate climate research. The research itself is done by individual scientists working in national and regional institutes, laboratories and universities. WCRP committees, working groups and projects, assisted by the Joint Planning Staff (JPS) *(https://www.wcrp-climate.org/jps-contacts)*, are the main vehicles for setting the research agenda and mobilizing the broader research community on specific activities. WCRP utilizes a multidisciplinary approach, organizing large-scale observational and modelling projects and providing an international forum to align the efforts of thousands of climate scientists working to provide the best possible climate information.

WCRP Core Projects:

At present, there are **6 WCRP core projects to organize the core of WCRP research** through research communities (website: *https://www.wcrp-climate.org/core-projects*), where researchers from around the world work together to ensure and address the most pressing climate challenges. **These six WCRP core projects are**:

- **Climate and Cryosphere (CliC):** CliC encourages and promotes research into the cryosphere in order to improve understanding of the cryosphere and its interactions with the global climate system, and to enhance the ability to use parts of the cryosphere for detection of climate change (*https://www.wcrp-climate.org/clic*)
- **Climate and Ocean Variability, Predictability and Change (CLIVAR):** CLIVAR's mission is to understand the dynamics, the interaction, and the predictability of the coupled ocean-atmosphere system. To this end it facilitates observations, analysis, and predictions of changes in the Earth's climate system, enabling a better understanding of climate variability, predictability, and change. (*https://www.wcrp-climate.org/clivar)*
- **Earth System Modelling and Observations (ESMO):** ESMO will promote the science and technologies for modelling, observations, and model-data fusion. ESMO will unite and strengthen the work of the Working Group on Coupled Modelling (**WGCM**), (**including CMIP**), the Working Group on Numerical Experimentation (**WGNE**), the Working Group on Sub-seasonal to Inter-decadal Prediction (**WGSIP**), and the Sub-seasonal to Seasonal Prediction (**S2S**) Project. (*https://www.wcrp-climate.org/esmo-overview*)
- **Global Energy and Water Exchanges (GEWEX)**: GEWEX is an integrated program of research, observations, and science activities that focuses on the atmospheric, terrestrial, radiative, hydrological, coupled processes, and interactions that determine the global and regional hydrological cycle, radiation, and energy transitions and their involvement in global changes. (*https://www.wcrp-climate.org/gewex*)
- **Regional Information for Climate (RIfS)**: The science and capability needed for providing societally relevant climate information for regions, including the work of the Coordinated Regional Climate Downscaling Experiment (**CORDEX**). (*https://www.wcrp-climate.org/rifs-overview*)
- **Stratosphere-troposphere Processes And their Role in Climate (SPARC):** SPARC provides intellectual leadership to address key issues in atmospheric dynamics and predictability, chemistry and climate, and long-term records for climate understanding. (*https://www.wcrp-climate.org/sparc*)

Four of the WCRP Core Projects (namely, CliC, CLIVAR, GEWEX and SPARC) were established in the 1990s, and two (namely, ESMO and RifS) were established in 2021 in response to a need to bring together climate observations and modelling (ESMO) and to ensure that climate data and information are useful to and usable by society (RIfS).

WCRP Grand Challenges: The WCRP Grand Challenges represent areas of emphasis in scientific research, modelling, analysis and observations for WCRP and its affiliate projects in the coming decade (website: *https://www.wcrp-climate.org/grand-challenges/grand-challenges-overview*), developed by the WCRP Joint Scientific Committee (JSC) (*https://www.wcrp-climate.org/jsc-contacts*) through consultation with WCRP sponsors, stakeholders and affiliate networks of scientists. WCRP promotes the Grand Challenges through community-organized workshops, conferences and strategic planning meetings to identify exciting and high-priority research that requires international partnership and coordination, and that yields “actionable information” for decision makers. **The current Grand Challenges of WCRP are as follows:**

- Melting Ice and Global Consequences
- Clouds, Circulation and Climate Sensitivity
- Carbon Feedbacks in the Climate System
- Weather and Climate Extremes
- Water for the Food Baskets of the World
- Regional Sea-Level Change and Coastal Impacts
- Near-term Climate Prediction

WCRP Lighthouse Activities: WCRP developed **five new activities, called Lighthouse Activities,** that aim to make critical near-term progress towards meeting WCRP’s Vision, Mission, and four Scientific Objectives, as outlined in the WCRP Strategic Plan 2019–2028 (details available at weblink: *https://wcrp-climate.org/lha-overview*). These 5 Lighthouse activities are respectively: (1) **Digital Earths**, (2) **Explaining and Predicting Earth System Change**, (3) **My Climate Risk**, (4) **Safe Landing Climates**, and (5) **WCRP Academy.** These are designed to be ambitious and transdisciplinary (integrating across WCRP and collaborating with partners) so that they can rapidly advance some of the new science and technologies, and institutional frameworks, that are needed to manage climate risk and meet society’s urgent need for robust and actionable climate information more effectively. To do this, the Lighthouse Activities will need to draw on WCRP’s core scientific and technical capabilities, and strategic partnerships. Their scope encompasses building new knowledge of the Earth’s climate system, its near-term predictability, and longer-term trajectories, for harnessing emerging technologies to better simulate the Earth system via a digital “twin”, as well as exploring new approaches for managing climate risk that start with decision context and user needs. The science plans of the Lighthouse Activities were approved at the 42nd Session of the WCRP Joint Scientific Committee in July 2021.

2. About CLIVAR (Climate and Ocean: Variability, Predictability and Change):

CLIVAR was established in March 1993, based on the decision of the 14th Session of the WMO/ICSU/IOC Joint Scientific Committee (JSC) for WCRP, that endorsed CLIVAR as the WCRP project to study climate variability and predictability with a focus on the role of the coupled ocean and atmosphere within the climate system (based on the legacies of the WOCE and TOGA projects). **CLIVAR's mission** is to understand the dynamics and the predictability of the coupled ocean-atmosphere system, with a goal to improve the understanding and prediction of ocean-atmosphere interactions and their influence on climate variability and change on seasonal, inter-annual, decadal, and centennial time-scales, through the collection and analysis of observations, and the development & application of models of the coupled climate system, in cooperation with other relevant climate-research and observing activities. The International CLIVAR Project Office, or ICPO, supports these activities by planning meetings, implementing research goals, and producing newsletters called "CLIVAR Exchanges" to keep the CLIVAR community informed.

3. About GEWEX (Global Energy and Water cycle Exchanges):

The Global Energy and Water cycle Exchanges (GEWEX) project is dedicated to understand Earth's water cycle and energy fluxes at the surface and in the atmosphere. It has a network of scientists for gathering information on and researching the global water and energy cycles, which will help to predict changes in the world's climate. The International GEWEX Project Office, or IGPO, supports these activities by planning meetings, implementing research goals, and producing a quarterly newsletter to keep the GEWEX community informed. GEWEX coordinates science activities to facilitate research into the global water cycle and interactions between the land and the atmosphere. One of the primary influences on humans and the environments they live in, the global water cycle encompasses the continuous journey of water as it moves between the Earth's surface, the atmosphere, and beneath the Earth's surface. Clouds, precipitation, water vapour, surface radiation, aerosols, and other phenomena each play a role in the cycle. Many GEWEX scientists conduct research on those and other elements to help fine-tune our understanding of them and their impact on the climate. GEWEX also points out important gaps in knowledge and implements ways to fix those gaps, whether through new studies, reviews of datasets, gatherings of experts, or other opportunities.

4. CLIVAR/GEWEX Monsoons Panel (MP):

CLIVAR/GEWEX Monsoons Panel (MP) was established for taking a more global view of monsoon activities, and to coordinate global monsoons research over various regions of the Earth. Monsoons are identified as seasonal transitions of atmospheric circulation and precipitation regimes in response to the annual cycle of solar insolation and the distribution of moist static energy. Tropospheric temperature gradients, developing during spring-time, and differential heating of underlying land and ocean are precursors and triggers in most of the monsoon regions.

Monsoons are grouped into Asian-Australian, African and American, according to their location and summer versus winter precipitation regimes seasonality **(Figure-1**).

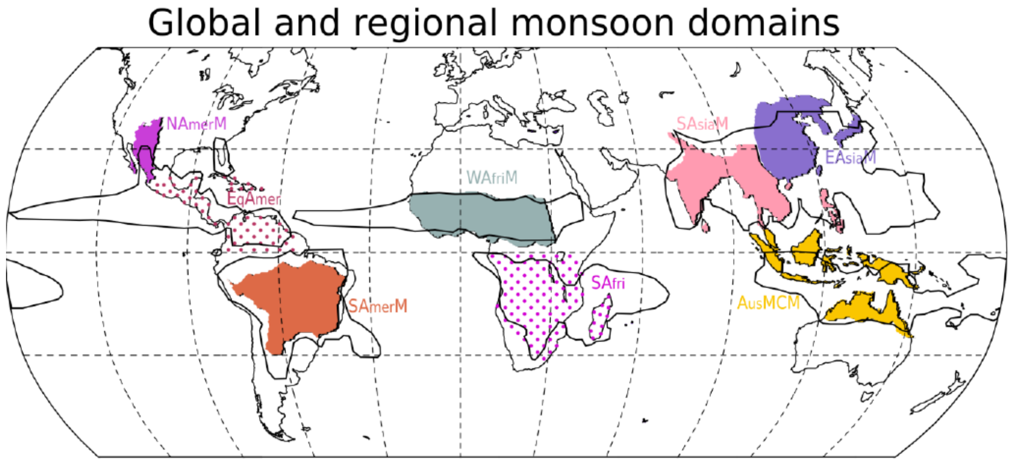

Figure 1: Global (black contour) and regional monsoons (colour shaded) domains. The global monsoon (GM) is defined as the area with a local summer-minus-winter precipitation rate exceeding 2.5 mm/day. The regional monsoon domains are defined based on published literature and expert judgement and accounting for the fact that the climatological summer monsoon rainy season varies across the individual regions (Source: IPCC, 2021).

Overall progress in our scientific understanding of monsoons will benefit by the interaction of individuals and groups, involved in study of the monsoon regions. The CLIVAR project is related to research into ocean-atmosphere interaction and the role of slowly varying modes (like ENSO, IOD, etc.) that lend predictability to the monsoons. Thus, CLIVAR is of direct relevance to the Monsoons. The efforts of the GEWEX project are highly relevant to the terrestrial & hydro-thermodynamic aspects of monsoons, especially for land-atmosphere interaction and convective scale processes, which are key to understanding monsoons from regional to global scales. As a result, a joint Monsoons Panel, spanning both CLIVAR and GEWEX, has been formed with membership drawn from both communities. The panel will make correspondences to both CLIVAR and GEWEX Scientific Steering Groups (SSGs).

CLIVAR/GEWEX Monsoons Panel was established in July 2014 (following the 7th International GEWEX Conference at Hague), with main objectives of (a) taking a more global view of monsoon activities, enabling knowledge and best practices to be shared between the various monsoon regions (like Asian-Australian Monsoons, African Monsoon & American Monsoons) regions, and (b) better coordination of monsoons research between GEWEX and CLIVAR, particularly in emphasizing the role of convection and the land-surface processes in monsoons. The Monsoons Panel membership crosses CLIVAR and GEWEX research interests and all monsoon regions. The Monsoons Panel explores a more global view of monsoon activities, enabling knowledge & best practices to be shared between the various monsoon regions. It attempts to better coordinate monsoons research between GEWEX and CLIVAR, particularly in emphasizing the role of convection and land surface in the monsoons, in addition to ocean-atmosphere interaction (details available at weblinks: *https://www.clivar.org/clivar-panels/ monsoons and https://impo.tropmet.res.in/wcrp-monsoon.html)* .

At present, this panel (MP) is being co-chaired by **Dr Suryachandra Rao Anguluri** from Indian Institute of Tropical Meteorology (IITM) Pune India, and **Dr Leila M.V. Carvalho** from Earth Research Institute (ERI), UCSB, USA. In addition to **2 Co-Chairs**, there are **12 other members** in this panel from various parts of the world. The panel conducts regular teleconferences for communications and decision making for various activities, from time to time. This panel is well supported by the International Monsoons Project Office **(IMPO),** which is hosted within the IITM campus at Pune, India, and operates under the overall supervision of the Director of IITM. IMPO is a joint effort by WMO and IITM to help coordinate monsoon research across the world [website: *https://impo.tropmet.res.in/*]. At present**, Dr E. N. Rajagopal** is the **Executive Head of IMPO** and **Dr Rupa Kumar Kolli** is involved with IMPO as Honorary Scientist, **Dr Susmitha Joseph and Mr. Somnath Mahapatra** are Senior Scientists (part time) at IMPO [details at the weblink: *https://impo.tropmet.res.in/aboutus.html*]. It may be noted that **I have been involved in the activities of IMPO and former ICMPO** (International CLIVAR Monsoons Project Office) **as a Senior Scientist** (part time) **for more than 5 years** (**the longest period for such a position**) for supporting coordination of global monsoons research.

Regional Monsoon Working Groups (WGs) of MP:

The Monsoons Panel has established a structure of **3 Regional Monsoon Working Groups** (WG) beneath it, comprising **(1) Asian-Australian Monsoons WG** (WG-AAM), **(2) African Monsoons WG** (WG-AFM) and **(3) American Monsoons Working Groups** (WG-AMM).

These three Regional Monsoon Working Groups (WGs) are responsible for focusing on the monsoon research over Asian-Australian, African & American monsoon regions respectively. Regional Monsoon Working Group activities have also been supported by IMPO, especially for organizing online teleconferences for important discussions among WG members, re-organization of WGs with new memberships (whenever tenures of some members are over or some members discontinue due to some reasons or due to some unfortunate events)**.** The scientific works include supporting Observational field campaigns and process modelling works (mainly in India, Africa and South China sea regions), coordinating the Global Monsoons MIP (Model Inter-comparison Project) contributions to CMIP6 (Coupled Model Inter-comparison Project, version-6), various aspects of Climate change detection, attribution and modelling and Sub-seasonal to Seasonal (S2S) activities.

At present, the **Asian-Australian WG** comprises of **2 Co-Chairs**, and **15 other members** from various parts of the world (details at the weblink: *https://impo.tropmet.res.in/mpwg-aam-members.html).* Their activities relate to South Asian monsoon, East Asian monsoon and Australian monsoon. Similarly, the **African WG** comprises of **2 Co-Chairs** along with **19 other members** from Africa, USA, France & UK (details at the weblink: *https://impo.tropmet.res.in/mpwg-afm-members.html*). Their activities relate to monsoons over Western Africa, Central Africa, Eastern Africa, Southern Africa, as well as Pan-Africa. The **American WG** comprises of **2 Co-Chairs**, along with **12 other members** (details at the weblink: *https://impo.tropmet.res.in/mpwg-amm-members.html*). Their activities mainly relate to monsoons over South America and North America.

Working groups under Monsoons panel will continue to lead the regionally-focused monsoon research in each of the three areas of globe. Defining concrete activities to be fostered in the coming years, coordinating the regional working groups, and acting as a hub to facilitate meetings and linkages among international research efforts, are parts of a continuous process. Advancing understanding of monsoon variability and improving prediction remain the principal goals promoted by the Monsoons Panel, but greater emphasis is being placed on linkages across scales and to phenomena that have historically been outside the purview of classical monsoon research. Observation and modelling are still the cornerstones of the research efforts, but scientists seek to bring new methods and fresh perspectives to the problem that can enhance monitoring, advance diagnostic efforts, and improve component and coupled models. Key to these efforts will be the development of new and better process studies, coordination with relevant modelling efforts including those related to climate change, and empowering the next generation of bright young scientists from around the world to advance our knowledge of monsoon systems. Scientific works include observational field campaign and process modelling work, coordination of and contribution to climate change efforts in CMIP, and utilising our understanding of sub-seasonal-to-seasonal variability to aid enhancement of monsoon prediction on these scales. For coordination of these activities, the Monsoons Panel is supported by the International Monsoons Project Office (**IMPO**), hosted by the Indian Institute of Tropical Meteorology (IITM) located in Pune, India.

Near-term and Long-term Plans of the CLIVAR/GEWEX Monsoons Panel:

The Monsoons Panel will actively pursue better integration of CLIVAR and GEWEX monsoons activities, such as CLIVAR Oceanic regional panels, e.g., Indian Ocean Regional Panel (**IORP**), GEWEX Global Land/Atmosphere System Study (**GLASS**), Global Atmospheric System Study (**GASS**) and Hydro-climatology panels (land-atmosphere interaction and convection, in particular). The Monsoons Panel will foster better utilization of model outputs such as those from the Global Monsoons **MIP and CMIP6 DECK experiments**, including through coordinated analysis at the regional and global monsoon scales. The panel can interact with communities of other core projects of WCRP (like **SPARC**), and also with Working Group on Tropical Meteorology Research (**WG-TMR**) of World Weather Research Program (**WWRP**), **through necessary support & coordination by IMPO**. **The regional working groups of this panel** will promote and facilitate active engagement and interaction among research and operational prediction stakeholders in the different monsoon regions, and provide authoritative information on processes understanding, models' fidelity in their monsoon representations, and forecast skill assessment. Members will participate in the many different Regional Climate Outlook Forums (**RCOFs**) to provide guidance on model strengths and weaknesses. The Monsoons Panel will continue to identify cross-regional commonalities in their activities. One of the key-identified-activities of interest across the regions is better understanding of sub-seasonal-to-seasonal variability and exploiting it for better prediction. Regional priorities will continue to be identified by the regional working groups. Monsoons Panel is also supporting the forthcoming **WRCP** Open Science Conference (**OSC**), scheduled to be held at **Kigali, Rawanda during 23-27 October 2023**, by arranging a special session (related to Global & Regional monsoons in Theme-1: Advances in Climate Research) and two poster clusters in this once in a decade Conference, with necessary support from **IMPO**. Monsoons panel also contributes for various cross-panel activities.

Terms of Reference of GEWEX/CLIVAR Monsoons Panel (MP):

- Indicate and update the research priorities, gaps and milestones regarding monsoon studies as outlined in the GEWEX/CLIVAR MP annual work plan.
- Coordinate strategies, advise on plans and define concrete activities, if possible, to carry out studies on the suggested research priorities, including selecting, limiting and concluding such activities as appropriate.
- Encourage studies on priority themes by groups from different monsoon domains, using common methods and tools, in order to allow global analyses or comparable results, and encourage, facilitate or promote collaboration between monsoon researchers (from existing groups).
- Enhance involvement/Promote/Stimulate the interest of researchers and students in monsoon-related topics, by organizing or supporting workshops and advanced schools, in addition to organizing, in scientific congresses, sessions on monsoon themes. Promote interactions among scientists from different disciplines (atmospheric scientists, oceanographers, hydrologists, and relevant others) interested in monsoon science activities.
- Coordinate the formation and function of regional working groups and to advise WCRP on the development of mechanisms of support for meetings of the regional working groups.
- Advise and coordinate with other WCRP and WWRP panels on issues important for advancing monsoon research, including new observational studies, process studies, and strategic priority setting for modelling/prediction studies.
- Support work in cooperation with regional, national and multinational programs that collaborate in improving the understanding of monsoon systems and are directed at improving regional weather forecasting, seasonal climate prediction and decadal to long-term climate projection.
- Communicate existing products and provide guidance on their (adequate) application and limitations to the operational community, (relevant) impacts community and participate in relevant training activities.
- Report to the CLIVAR and GEWEX Scientific Steering Groups (SSGs) on an annual basis or when requested.

References and Acknowledgements:

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4. All websites mentioned in this article at various places.

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Do we need to include the MJO information in the cyclone intensity prediction models?

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(Excerpt from Impact of the Madden–Julian Oscillation on North Indian Ocean Cyclone Intensity by MM Ali, UN Tanusha, C. Purna Chand, B. Himasri, M. A. Bourassa and Y. Zheng, Atmosphere, 2021, 12, 1554. https://doi.org/10.3390/atmos12121554)

Tropical cyclones are the deadliest and the most damaging natural disasters affecting people, livestock, agriculture, and the economics of the coastal areas. Storm surge is another aspect of the havoc that is created by cyclones in particular in the low-lying and flat surface areas. The severity of the storm surge depends upon the cyclone intensity, direction of the storm approaching the coast beside the topography of the place. Thus, predicting the cyclone intensity along with its track with a minimum uncertainty is of great benefit to the disaster management authorities to plan the evacuation and mitigation processes.

Most of the Indian Ocean depressions or cyclones originate in the ocean and dissipate either in the ocean itself or cross the land and then dissipate. Some of them even cross the landmass and enter the other basin. The cyclone tracks in terms of the above categories are shown in **Figure 1**.

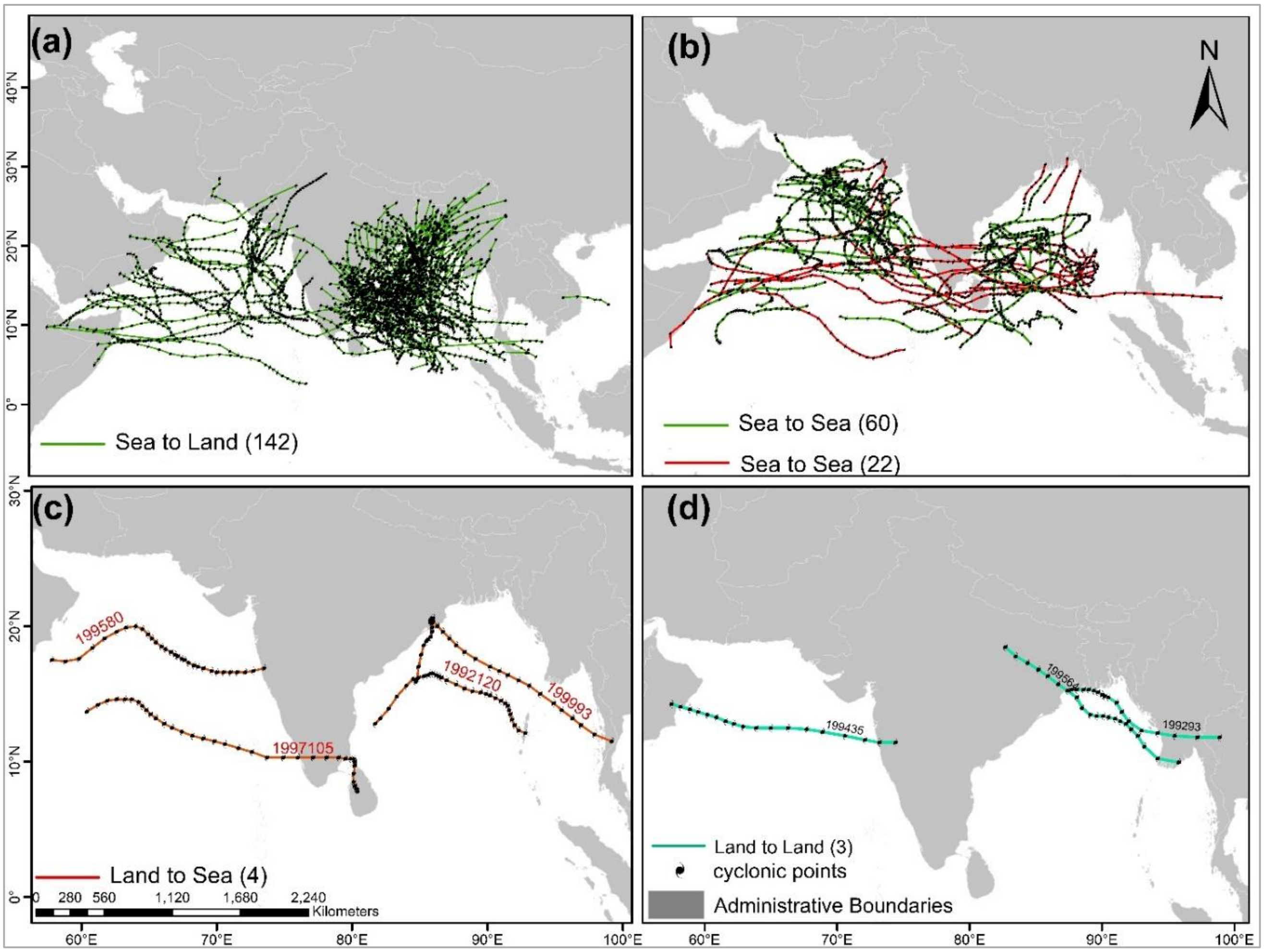

Figure 1 : Cyclone tracks that have (a) formed over the sea and dissipated over the land (no. of cyclones 142; green in colour); (b) formed over the sea and dissipated over the sea itself without crossing the land (no. of cyclones 60; green in colour), formed over the sea and dissipated over the sea after crossing the land (no. of cyclones 22; red in colour); (c) formed over land and dissipated over the sea (no. of cyclones 4; red in colour) and (d) formed over land and dissipated over land (no. of cyclones 3; green in colour).

Most of the cyclonic systems in the Indian Ocean form either from April to June with a peak in May or from September to December having a peak in November, as shown in **Figure 2**.

While sea surface temperature, ocean heat content, upper-level divergence, and many other atmospheric and oceanographic parameters and processes are known to influence cyclones, the impact of Madden-Julian Oscillation (referred to as M.J.O.) on the cyclone intensity is one of the least explored phenomena.

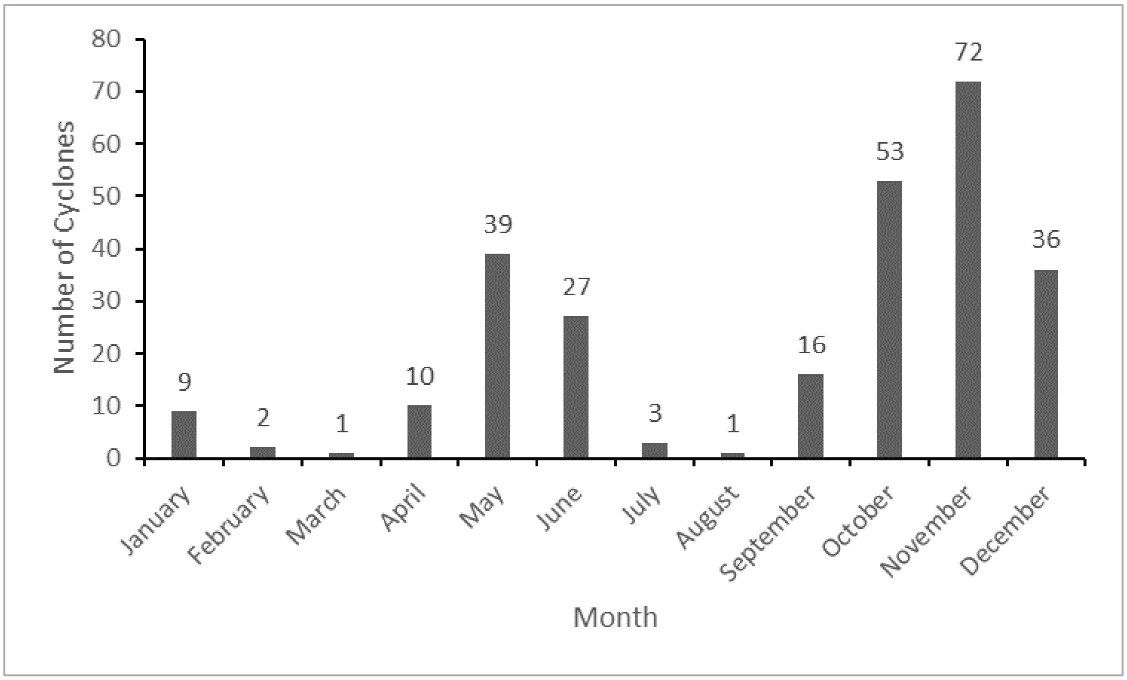

Figure 2: Number of cyclonic systems of all categories formed in different months during 1974–2019. The numbers on the bars indicate the number of systems in that month.

An M.J.O is the dominant sub-seasonal global tropical mode of variability in the tropics (Tian and Waliser, 2014). This has an area of relatively active convection that circles the globe (Zhang et al. 2020, Kikuchi et al. 2000). Thus, this phenomenon influences weather and climate variability on a global scale. In this context, Ali et al. (2021) explored the impact of M.J.O alone on cyclone intensity without considering the other factors. They used an Artificial Neural Network approach for this analysis. This approach is one of the powerful data mining or machine learning tools for computing input-output relationships. It is an information processing paradigm that works somewhat similar to a biological system in the human brain. Statistical analysis of their study revealed that M.J.O is another important phenomenon that needs to be considered for cyclone intensity predictions. The deviations between the wind speeds estimated using this approach and the actual observations are within -20 knots and +20 knots for 80% of the cases and for most of the cyclone categories (**Figure 3)**. In addition, they found that the influence of M.J.O on wind speed increases with increasing amplitude and has more impact on more intensity cyclones. They also observed that its impact is more when the activity is in the Indian Ocean and the two adjoining phases compared to the other four phases of M.J.O (**Table 1**).

Table 1: Influence of MJO amplitude on estimated wind speed scatter index (SI) for all the categories of the cyclonic systems for (i) all amplitudes, (ii) amplitudes ≥ 1, (iii) ≥ 1.5 and (iv) ≥ 2 separately for the validation dataset. The number of points for each category (D: Depression, DD: Deep Depression, CS: Cyclonic Storm, SCS: Severe Cyclonic Storm, and VSCS: Very Severe Cyclonic Storm) is also provided.

All Phases									
	Scatter Index (SI)				**Number of Points**				**Correlation Coefficient**
Category/ Phase	**All**	**≥1**	**≥1.5**	**≥2**	**All**	**≥1**	**≥1.5**	**≥2**	**All**
D	0.485	0.476	0.467	0.323	720	457	255	11 0	0.431
DD	0.428	0.428	0.383	0.278	505	328	189	84	0.423
CS	0.381	0.387	0.345	0.264	394	253	148	66	0.427
SCS	0.271	0.263	0.208	0.138	180	118	76	33	0.467
VSCS	0.183	0.152	0.149	0.085	94	63	40	21	0.638
Phases—1, 2, 3, 4									
	Scatter Index (SI)				**Number of Points**				**Correlation Coefficient**
Category/ Phase	**All**	**≥1**	**≥1.5**	**≥2**	**All**	**≥1**	**≥1.5**	**≥2**	**All**
D	0.473	0.463	0.447	0.430	432	291	170	77	0.435
DD	0.408	0.396	0.352	0.252	310	217	130	58	0.503
CS	0.370	0.342	0.310	0.248	240	166	102	43	0.478
SCS	0.255	0.259	0.206	0.134	110	74	50	21	0.605
VSCS	0.174	0.174	0.121	0.055	53	35	24	13	0.705

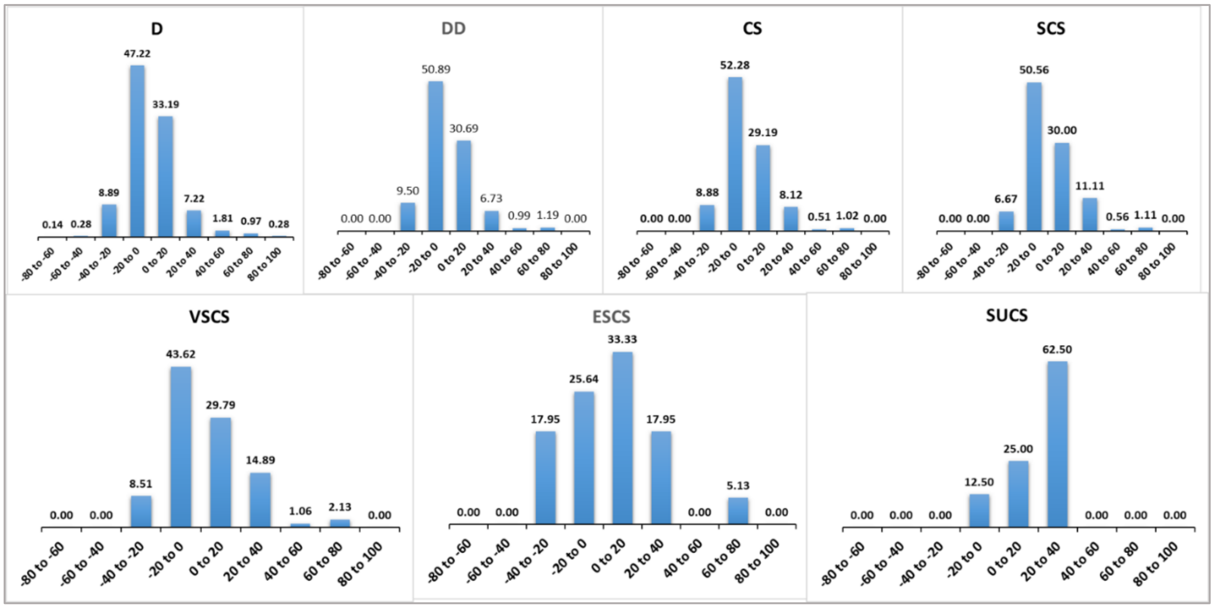

Figure 3: Percentage of Deviations for validation datasets divided into Categories of D, DD, CS, SCD, VSCS, ESCS and SUCS

This study is purely a statistical investigation. More detailed studies, particularly using dynamical models are required to come to a more physically-based conclusion and to answer whether incorporation of the M.J.O. information in the statistical and dynamical models will improve the cyclone predictability.

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वैज्ञानिक और शिक्षक – ज्ञान की प्रेरणा और स्रोत्र

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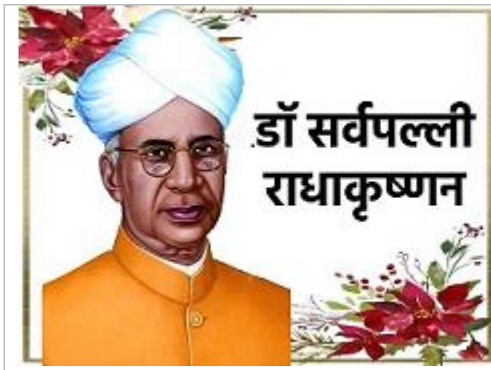
शिक्षक ईश्वर का दिया हुआ वह उपहार है, जो बिना किसी स्वार्थ व भेद भाव के अपने हर शिष्य को अच्छी से अच्छी शिक्षा देने का प्रयास करता है। शिक्षक का दर्जा हमेशा से ही पूजनीय रहा है। एक शिष्य के लिए उसके शिक्षक की बताई हुई बात पत्थर की लकीर के समान होती है, वह अपने पूजनीय माता-पिता को तो गलत बता देता है परंतु अपने शिक्षक की बात को समर्थन देने में पीछे नहीं हटता। शिक्षक ही अपने विद्यार्थी का जीवन गढ़ता है। वर्तमान में विद्यार्थी अपना आधा समय अपने शिक्षक, जो उसके जीवन में अलग-अलग किरदार निभा रहें हैं, उनके साथ व्यतीत करता है। वह सही-गलत से लेकर जीवन के अनेक रंग अपने शिक्षक को देख व सुन कर सीखता है। शिक्षक के योगदान से ही एक व्यक्ति समाज में रहने योग्य बनता है।

इसीलिए शिक्षक को समाज का शिल्पकार कहा जाता है। जिस प्रकार एक डॉक्टर मरीज को ठीक करने का हर मुमकिन प्रयास करता है, ठीक उसी प्रकार एक शिक्षक अपने विद्यार्थी को हर मोड़ पर राह दिखाता है। हर परिस्थिति में उसका हाथ थामने के लिए सदैव तैयार रहता है। इसीलिए शिक्षक को ईश्वर तुल्य माना जाता है। इतिहास भी इस बात का साक्षी है कि एक सफल व्यक्तित्व के लिए गुरु का हाथ होना अनिवार्य है। इतिहास में ऐसे काफी उदाहरण हैं जो इस बात को सिद्ध करते हैं तथा गुरु की महिमा का गुणगान करते हैं। वह गुरु ही है, जो बच्चों को उनके व्यक्तित्व से परिचित कराते हैं। उनके अवगुणों को दूर कर, उनके समस्त गुणों से अवगत कराते हैं और उन्हें प्रोत्साहित कर सर्वहित की ओर उनका मार्गदर्शन करते हैं। आचार्य द्रोणाचार्य ने कहा था- 'शिक्षक कभी साधारण नहीं होता, प्रलय और निर्माण उसकी गोद मे खेलते हैं'। आज हर चीज का व्यवसायीकारण व बाजारीकरण हो गया है। कुछ लोग शिक्षा को भी एक व्यवसाय के रूप में देखते हैं। अब तो लोग कहने भी लगे हैं - शिक्षकों की तो चांदी है कुछ करते हैं नहीं पर फीस भरपूर चाहिए। शिक्षा के व्यवसायीकरण के कारण शिक्षा के स्तर में लगातार गिरावट देखी जा सकती है। पुराने समय में शिक्षा कभी भी व्यवसाय या धंधा नहीं थी

परंतु आज जिस प्रकार लोग एक अच्छे व्यवसाय के रूप में इसको अपना रहे है वह अफसोस जनक है। यहां तक कि शिक्षा के व्यापारी शिक्षकों द्वारा विद्यार्थी पर दवाब डलवाते हैं कि उनको उनके उपयोग की वस्तुएं कहां से लेना है और यदि ऐसा ना किया जाए तो उसको उपेक्षा का सामना करना पड़ता है। शिक्षक कभी नहीं चाहता कि उसके विद्यार्थी को प्रताड़ना या उपेक्षा सहनी पड़े, परंतु शिक्षा के व्यापारियों के कारण उसको ऐसा करना ही पड़ता है।

सही क्या है और गलत क्या |
ये सब पढ़ाते हैं शिक्षक ||
झूठ क्या है और सच क्या |
ये बात समझाते हैं शिक्षक ||
जब सूझता नहीं कुछ भी |
राहों को सरल बनाते हैं शिक्षक ||
जीवन के हर अँधेरे में |
रौशनी दीखाते हैं शिक्षक ||
बंद हो जातें हैं जब सब दरवाजे |
नया रास्ता दीखाते हैं शिक्षक ||
सिर्फ किताबी ज्ञान ही नहीं |
जीवन जीना भी सिखाते हैं शिक्षक ||

शिक्षा का व्यवसायीकरण देश के समक्ष बड़ी चुनौती है। एक शिक्षक ही हमें इस समस्या का हल बता सकता है। शिक्षक ही है, जो एक शिक्षार्थी में उचित आदर्शों की स्थापना करता है व पथप्रदर्शक भी है। एक शिक्षार्थी को अपने शिक्षक का सम्मान करना चाहिए व आदर और कृतज्ञता का भाव रखना चाहिए। परंतु आज के समय में जब तक शिक्षार्थी अपने शिक्षक का नाम नहीं बिगाड़ लेता, उनका दूसरा नामकरण नहीं कर लेता तब तक उनको अपना शिक्षक नहीं समझता। शिक्षक की आज्ञा का अनादर करना शिक्षार्थी अपना अधिकार समझते हैं। शिक्षक को शिक्षार्थी की ऐसी सभी गतिविधियों की जानकारी होती है परंतु वह इसे शिक्षार्थी की नादानी समझ माफ कर देता है। संयम, सदाचार, विवेक, सहनशीलता, सृजनशीलता, शुद्ध उच्चारण, शोध-वृत्ति, प्रभावशाली वक्तृता, आदि विशेषताएं शिक्षक को एक अच्छा शिक्षक बनाती हैं। शिक्षार्थी भी अपने शिक्षक के इन गुणों को ग्रहण करता है। परंतु कुछ शिक्षार्थी अपने शिक्षक की ओर अपने कर्तव्य को भूल गए हैं। जिस कारण आज देश भर से शिक्षार्थी द्वारा शिक्षक पर हो रहे हमलों की घटनाएं सामने आ रही हैं। **भारत के भूतपूर्व राष्ट्रपति डा. राधाकृष्णन के जन्मदिन ५ सितम्बर को शिक्षक दिवस के रूप में पूरे भारत में श्रद्धा से मनाते है | डॉ. राधाकृशणन शिक्षक दिवस की प्रेरणा और प्रेरक थे |**



शिक्षक दिवस ५ सितम्बर

शिक्षक दिवस ही शिक्षक का असली सम्मान दिवस नहीं है। उसका असली सम्मान दिवस तब होता है जब उसका पढ़ाया हुआ कोई विद्यार्थी सार्वजनिक रूप से उसको नतमस्तक प्रणाम करें, बड़े ओहदे पर बैठा हुआ व्यक्ति जब अहंकार त्याग कर अपने कर्मचारियों के सामने अपने शिक्षक के समक्ष आदर व्यक्त करता है। यही एक शिक्षक की वास्तविक कमाई है। भारतीय धर्म में तीन प्रकार के ऋणों का उल्लेख किया गया है - पहला पितृ ऋण, दूसरा ऋषि ऋण, तीसरा देव ऋण। तीनो ऋणों को चुकाने के बाद ही परमात्मा से मिलन होना संभव है। ऋषि ऋण शिक्षक की सेवा व उसे सम्मान देकर ही चुकाया जा सकता है। बिना विद्यालय शिक्षा ग्रहण की जा सकती है, **बिना पुस्तक भी शिक्षा प्राप्त हो सकती है, पर बिना शिक्षक या गुरु के शिक्षा प्राप्त कर पाना असंभव है**। किसी भी देश के विकास में शिक्षक द्वारा शिक्षार्थी को दी गई शिक्षा का परम महत्व है। आज शिक्षक दिवस है, पर हम उन्हीं शिक्षकों को याद करते है जिन्होंने हमें प्रयोगात्मक परीक्षाओं में अंक दिए हैं और बाकी शिक्षकों को तो हम कुछ समझते ही नहीं हैं।

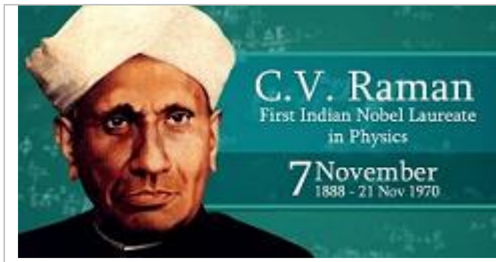
मैं हर एक पल का शिक्षक हूँ |
हर एक पल मेरी शिक्षा है ||
हर एक पल मेरी कहानी है |
हर एक पल मेरी वाणी है ||
हल एक पल मेरी हस्ती है |
हर पल का मैं हिस्सा हूँ ||
हर एक पल का मैं शिक्षक हूँ |
हर शिक्षा का मैं हिस्सा हूँ ||
कल और आएंगे शिक्षा की |
नयी रचना करने वाले ||
मुझ से बेहतर कहने वाले |
तुम से बेहतर सुनने वाले ||

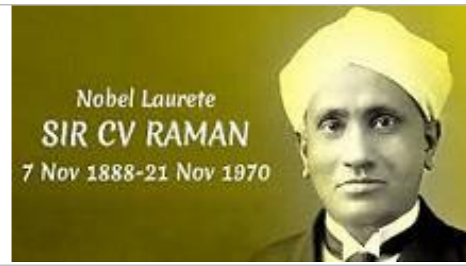
मुझ से पहले कितने शिक्षक |
आये और आ कर चले गए ||
वह भी हर पल के शिक्षक थे |
मैं भी हर पल का शिक्षक हूँ ||
मैं हर एक पल का शिक्षक हूँ |
हर एक पल मेरी शिक्षा है ||

शिक्षा के तेजी से होते बाज़ारीकरण और व्यवसायीकरण से शिक्षक की प्रतिमा , प्रतिष्ठा , इज्जत और सम्मान को ठेस पहुंची है | एक शिष्य ने अपने शिक्षक की भगवान से तुलना कर यह कहा की शिक्षक की सूरत से अलग भगवान की सूरत क्या होगी | शिक्षक वह है, जो प्रेम के साथ अपने विद्यार्थियों का मित्र बनकर उनके जीवन रूपी बगिया को अपनी देख रेख में सर्वागण विकास की ओर बढ़ाता है। एक अच्छा शिक्षक मोमबत्ती की तरह होता है, जो खुद को जला कर दूसरों के लिए प्रकाश करता है | निकट भविष्य में इंटरनेट शिक्षा के क्षेत्र में एक महत्वपूर्ण, प्रभावशाली और प्रगतिशील भूमिका निभायेगा | इंटरनेट ई-शिक्षा के क्षेत्र में शिक्षक की भूमिका और परिभाषा को एक नया रूप देगा | निकट भविष्य में इंटरनेट से शिक्षा और अनुसन्धान के क्षेत्रों में प्रबल और दूरगामी परिवर्तन लाने की आशा की जा रही है | शिक्षा और अनुसन्धान सम्बंधित परिवर्तनों के स्वरुप ई-शिक्षक और ई-वैज्ञानिक नामक श्रेणियों का जन्म होगा |

शिक्षक का सम्मान नहीं है |
शिक्षक को सम्मान नहीं है ||
कैसे रंग रंगी यह दुनिया |
शिक्षा भी अब दान नहीं है ||
शिक्षा का बाज़ार यहाँ है |
खरीदार हर छात्र यहाँ है ||
शिक्षक अगर नहीं दिखे तो |
तो बोलो ध्रोणाचार्य कहाँ है ||

आज की प्रौद्योगिकी संचालित दुनिया में, प्रौद्योगिकी कभी भी महान शिक्षकों की जगह नहीं ले पाएगी। लेकिन महान शिक्षकों के हाथों में प्रौद्योगिकी अभूतपूर्व परिणाम दे सकती है। शिक्षक वैज्ञानिक को शिक्षा देता है और वैज्ञानिक उसी शिक्षा को अनुसन्धान के रूप में समाज को देता है ।





सर सी वी रमन ने "रमन इफ़ेक्ट" ("रमन प्रभाव") की खोज २८ फेब्रुअरी १९२८ को की थी | सर सी वी रमन को "रमन इफ़ेक्ट" के लिए 1930 में नोबेल पुरुस्कार से सम्मानित किया गया | "२८ फेब्रुअरी" को भारत में "राष्ट्रीय विज्ञान दिवस" के रूप में मनाया जाता है | भारत के विख्यात वैज्ञानिक प्रोफेसर सी वी रमन को इंग्लैंड की महारानी एलिज़ाबेथ ने 'सर' की उपाधि से सम्मानित किया था | सर रमन "राष्ट्रीय विज्ञान दिवस" की प्रेरणा और प्रेरक थे | डॉ. राधाकृष्णन और सर रमन, भारत के बुद्धिजीविओं के लिए ज्ञान और प्रेरणा के स्रोत्र हैं | अनुसन्धान का विकास वैज्ञानिक करते हैं जबकि शिक्षा का विकास शिक्षक करते हैं | आज के प्रौद्योगिकी नियन्त्रित समाज में, वैज्ञानिक शिक्षक के रूप में भी दिखते हैं और शिक्षक वैज्ञानिक के रूप में भी दिखते हैं |

वैज्ञानिक शिक्षक दोनों मिले, किस की करूँ मैं वंदना |
बलिहारी मैं दोनों के, आप दोनों ही हो मेरी कल्पना ||

यह सर्व विदित सत्य है की प्रत्येक वैज्ञानिक अपने जीवनकाल में कभी न कभी किसी शिक्षक से शिक्षा प्राप्त करने के लिए उसका शिष्य बनता है और यह शिक्षा उसे अनुसन्धान की लिए प्रेरित करती है | शिक्षक मानव जाति के लिए ईश्वर का एक महान, अनमोल और अनोखा उपहार है। जीवन में अगर कुछ पाना है तो शिक्षक का सम्मान करो | एक शिक्षक की शिक्षा भक्ति ही उसकी वास्तविक पहचान है । वैज्ञानिक और शिक्षक ज्ञान के दो पहलू हैं | शिक्षक और वैज्ञानिक दोनों को ज्ञान का शिल्पकार कहा जाता है | **शिक्षक की उच्च श्रेणी की शिक्षा ही वैज्ञानिक को जन्म देती है |**

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पाउस आणी मी ...

होसाळीकर के.एस.

वैज्ञानिक - जी एवं प्रमुख, जलवायु अनुसंधान एवं सेवाएँ

किती वाट बघू तुझी, कधी रे येशील तु...

निळ्या आभाळी, कधी रे येशील दाटून तु ।

पाना पानांतून तुझ्या आगमनाची सळसळ जाणवता,

मन माझे वेडावून जाते, वाट तुझी पाहता पाहता ।

अंगणातला आम्रवृक्ष, बघ जणू डोलतो स्वानंदे,

जसा पंढरीच्या वाटेवरचा, माझा वारकरी आनंदे ।

चैतन्य घेवून येशीलच, तु माझीया दारी,

तु सगुण, तुच निर्गुण, मला ठावं आहे अंतरी ।

येरे येरे पावसा म्हणता, बालपणीचा स्मरतोस,

मात्र बरसण्याच्या अगोदरच, नयनी तु तरतोस ।

अंबरी भरुनी येता, मनात माझीया धडधडते,

सावळ्या तुझा आठव, अंत:करण ओलं करते ।

ये रे घना, ये रे घना, माया भरून भरून ये,

शेतांवर, माळांवर, पानांवर, ह्रदयी अमृतासम ये ।

मनी माझ्या मोर नाचू दे, तु फक्त तिच्यासम ये,

सरु दे सगळी चिंता मग, तु करुणाकरासम ये।।

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Fascinating Indian Space Program – Some Answered Curiosities

Compiled by:

Manoj Kumar Tandon

Former Scientist, IITM, Pashan Road, Pune.
Former Secretary, Computer Society of India, Pune Chapter.
E-Mail ID: mkbtandon@gmail.com

Indian Space Program		
S.N.	**Curiosity**	**Answer**
1.	In which year was ISRO formed?	1969
2.	Which city is home to ISRO's headquarters?	Bangalore … Now Bengaluru
3.	Who set up the Indian National Committee for Space Research?	Dr. Vikram Sarabhai
4.	What was India's first satellite called?	Aryabhata
5.	True or False? India is the first country to reach Martian orbit in its maiden attempt?	True
6.	What was India's first lunar probe called?	Chandrayaan – I
7.	Which planet will the proposed Shukrayaan – I orbiter explore?	Venus
8.	Where is Vikram Sarabhai Centre?	Thiruvananthapuram
9.	From where was Mangalyaan launched?	Satish Dhawan Space Centre in Sriharikota
10.	Name ISRO's longest serving Chairman?	Satish Dhawan
11.	What does acronym ISRO represent?	Indian Space Research Organization
12.	Who is known as the father of Indian Space Program?	Dr. Vikram Sarabhai
13.	Who is rocket woman of India?	RITU KARIDHAL*
14.	When did Indian Space Program begin?	1962 with Dr. Vikram Sarabhai as Chairman.
15.	Who launched India's first rocket?	NASA's Nike Apache (2.11.1963, Thumba)
16.	How was India's first rocket taken to the launch site?	On a bullock cart
17.	Which Indian space scientist awarded 'Bharat Ratna'?	None
18.	Who was the first Indian in space?	Wing Commander Rakesh Sharma, Indian Air Force pilot, aboard Soyuz T11, 3 April 1984.
19.	What is the Indian version of NASA?	ISRO
20.	Hindi name of Indian Space Program?	भारतीय अंतरिक्ष कार्यक्रम

21.	What is India's rank in Space Science.	29th
22.	Name first satellite launched by ISRO?	KALPANA – I
23.	When was CHANDRAYAN I launched?	20 October 2008.
24.	What is the full form of GSLV?	Geostationary Satellite Launch Vehicle
25.	Which is India's first satellite exclusively used for education purpose?	EDUSAT GSAT 3 also known as EDUSAT
26.	What is earth's axis?	Imaginary line from its one pole to another.
27.	By what angle is the earth tilted out of the vertical during its spin around its axis?	about 23.5 degrees.
28.	Who is the missile man of India?	Dr. A. P. J. Abdul Kalam
29.	Who is the missile lady of India?	TESSY THOMAS
30.	Which Indian state is known as space city of India?	KARNATAKA
31.	Name India's first satellite?	ARYABHATTA
32.	Who launched India's first satellite?	Soviet Union on 19April 1975.
33.	Who made India's first rocket?	RH-75 (ROHINI 75) was India's first rocket developed indigenously by ISRO.
34.	When was India's first rocket launched?	India's first rocket RH-75 was launched from TERIS at Thumba in Kerala.
35.	When was India's first indigenously developed rocket 'ROHINI 75' launched?	November 20, 1967.
36.	**Independent India's Iconic Space Conversation** During Wing Commander Rakesh Sharma's space visit, the then Indian Prime Minister Late Mrs. Indira Gandhi asked Wing Commander Sharma "ऊपर से भारत कैसा दिखता है" to which Wing Commander Sharma proudly replied "सारे जहां से अच्छा". This brief piece of conversation has become iconic space conversation of independent India and was proudly broadcasted again and again by the All India Radio (AIR).	

***Ritu Karidhal is known as the 'Rocket Woman of India'. She joined ISRO in 2007. She was the Mission Director of the Chandrayaan-2 mission. Chandrayaan-2 is India's lunar mission. She was the Deputy Operations Director of the ISRO's Mars mission named 'Mangalyaan'.**

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Fascinating World of Fractions

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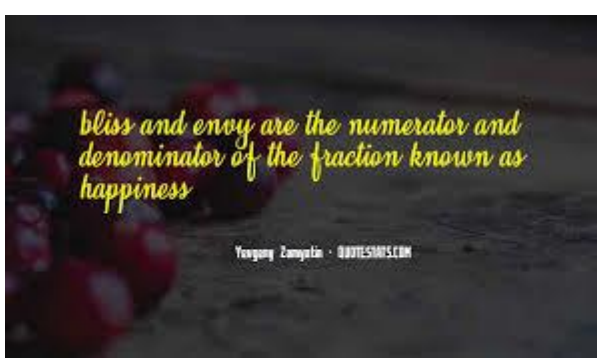
The word "**fraction (हिंदी में अंश)**" comes from the Latin word "fractio" which means "to break". Fraction represents a numeric value which is always less than one. A fraction represents collection of two unequal integers and a line which separates them. Fraction is written in two forms namely Vertical Form and Horizontal Form (like ⅜, ⅓, ⅔, ⅛, ⅜, ⅝ and ⅞, Here / is Vinculum). In each form of a fraction, a line separates two integers of the fraction. In the vertical form of a fraction, a Horizontal Line, like –, separates two integers of the fraction and this horizontal line is called by any of these two names SOLIDUS and VIRGULE. Integer appearing above Solidus/Virgule is called NUMERATOR (हिंदी में मीटर) of the fraction and integer appearing below Solidus/Virgule is called DENOMINATOR (हिंदी में भाजक) of the fraction. In the horizontal form of a fraction, a diagonal line likes, ⁄, separates two integers of the fraction and this diagonal line is called VINCULUM. Integer appearing before VINCULUM is called NUMERATOR of the fraction and the integer appearing after the VINCULUM is called DENOMINATOR of the fraction. Numerator and denominator of a fraction, in its both forms, are always unequal with numerator always less than the denominator. Value of proper fraction neither equals nor exceeds one, it is always less than one. Two fascinating analogies of a fraction are given below.

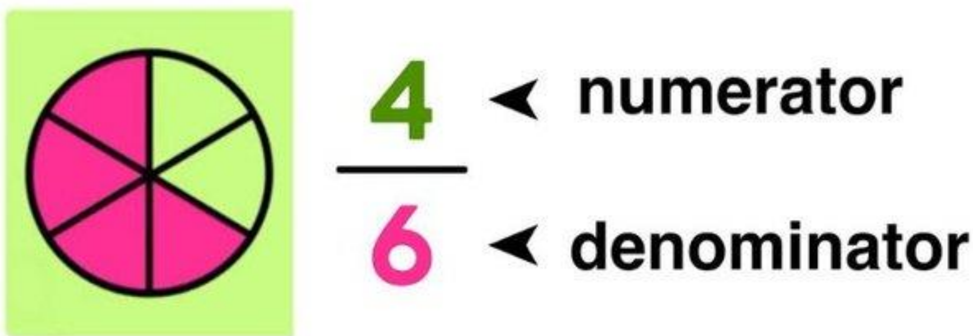
Man's body is like a Fraction whose numerator is what "He Is" and whose denominator is what he thinks about "Him". Larger the denominator smaller the value of the fraction.

By — Leo Tolstoy



Fraction in which numerator is less than denominator is also called "**Proper Fraction**". Examples of a proper fraction in its horizontal for are 2/3 and 5/7. Value of either numerator or denominator or both of an evaluable proper fraction can never be zero and they both must always be nonzero.

Geometrical figure and vertical form of an evaluable Proper Fraction. whose Numerator (4) and Denominator (6) are separated by Horizontal Line (—) which is called either SOLIDUS or VIRGULE.



A fraction is either an evaluable fraction or an undefined fraction. A faction is an evaluable and defined fraction if both its numerator and denominator are ether specific values or are defied variables.

Tabulation of broad features of any Proper Fraction

No.	**Kinds of line separating numerator and denominator of a fraction in its both horizontal and vertical forms.**		
1.	Form of fraction.	Vertical	Horizontal
2.	Kind of line separating numerator and denominator.	Horizontal	Diagonal
3.	Name(s) of line separating numerator and denominator.	Vinculum	**(i)** Solidus **(ii)** Virgule
4.	Shape of line separating numerator and denominator.	—	⁄
5.	Relation shown by numerator and denominator of fraction.	Numerator < Denominator	
6.	Value of fraction.	Always less than one.	

In Mathematics a fraction is defined as part of a whole. In ancient times, the fraction was represented using words. Later it was introduced in numerical form. A faction is an undefined fraction if either numerator or denominator or both are undefined variables. A fraction is a portion of a whole object. Fraction represents how many parts you have any of anything when it is divided into several pieces. It is expressed as a number of equal parts counted (the numerator) by the total number of parts (the denominator).

Fractions are of the following seven types.

Proper Fractions — In these fractions, numerator is less than denominator like (3/9).
Improper Fractions — In these fractions, numerator is greater than denominator like (6/4).
Mixed Fractions — These fractions consist of a whole and a part like 2 + (4/6)
Unlike Fractions — Different fractions having same numerator like (4/5), (4/6).
Like Fractions — Different fractions having same denominator like (6/8), (7/8).
Equivalent Fractions — Different fractions representing same value like (1/2), (4/8).
Unit Fractions — Fractions having unit (one) as numerator like (1/2), (1/5). **Unit Fractions are also known as Unique Fractions.**

We should however remember that **Happenings of life are made up of minute fractions**.

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Sonnet on "Monsoon Onset"

Somnath Mahapatra

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Monsoon, Monsoon -
Will you come soon?
Onset in early June -
Will be a great boon.

Clouds will hide the Moon -
Will hide the Sun in the noon.

Kerala onset date,
Scientists want to get.
Parameters have been set -
For making a proper bet.

You may become great,
If you tell the exact date.

From websites in internet,
Lot of things, you can get.

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Zero – Perceptions Through Ages

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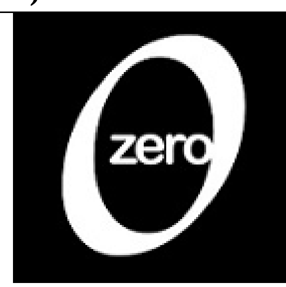
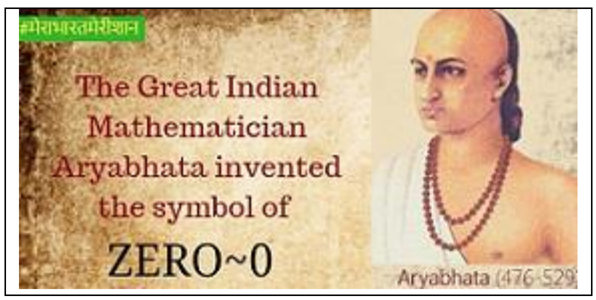
Zero (**हिन्दी में शून्य**) was invented independently by the Babylonians, Mayans and Indians although some researchers say the Indian number system was influenced by the Babylonians. The Babylonians got their number system from the Sumerians who were the first people in the world to develop a counting machine. **The number 0 is the only number which is neither positive nor negative, neither a prime number nor a composite number, nor a unit.** The number 0 (zero) is the least non-negative number.

Numeric Digits (0 to 9)



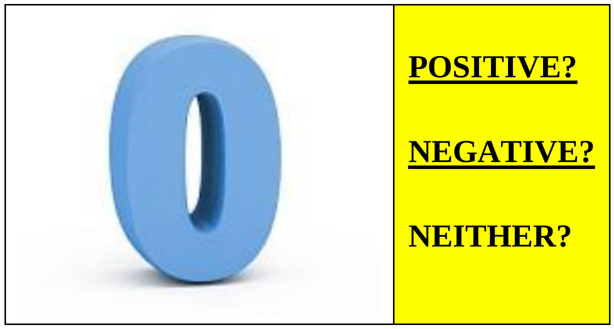
There are two uses of zero that are both extremely important but are somewhat different. One use is as an empty place indicator in place-value number system. Place-value number system is the Sumerian number system. In a number like 2106 in place-value system, zero is used so that the positions of the 2 and 1 are correct. Clearly 216 mean something quite different. The second use of zero is as a number itself in the form we use it as 0. There are also different aspects of zero within these two uses, namely the concept, the notation, and the name. Name "zero" derives from the Arabic word 'sifr – सिफर' and the word "zero" came from Italy. Neither of the above uses has an easily described history. It just did not happen that someone invented the ideas, and then everyone started to use them. Also, it is fair to say that the number zero is far from an intuitive concept. Mathematical problems started as 'real' problems rather than abstract problems. Numbers in early historical times were thought of much more concretely than the abstract concepts, which are our numbers today. One might think that once a place-value number system came into existence then the 0 as an empty place indicator is a necessary idea, yet the Babylonians had a place-value number system without this feature for over 1000 years. Moreover, there is absolutely no evidence that the Babylonians felt that there was any problem with the ambiguity, which existed. Remarkably, original texts survive from the era of Babylonian mathematics. The Babylonians wrote on tablets of unbaked clay, using cuneiform writing. The symbols were pressed into soft clay tablets with the slanted edge of a stylus and so had a wedge-shaped appearance. Many tablets from around 1700 BC survived and we can read the original texts. Of course, their notation for numbers was quite different from ours and not based on 10 but on 60. To translate into our notation, they would not distinguish between 2106 and 216 as the context would show which was intended. It was not until around 400 BC that the Babylonians put two wedge symbols into the place where we would put zero to indicate which was meant, 216 or 21 " 6. The two wedges were not the only notation used, however, and on a tablet found at Kish, an ancient Mesopotamian city located east of Babylon in what is today south-central Iraq, a different notation is used. This tablet, thought to date from around 700 BC, uses three hooks to denote an empty place in the positional notation. Other tablets dated from around the same time use a single hook for an empty place. There is one common feature to this use of different marks to denote an empty position. This is the fact that it never occurred at the end of the digits but always between two digits. So, although we find 21 " 6 we never find 216 ". One has to assume that the older feeling that the context was sufficient to indicate which was intended still applied in these cases. We can see from this that the early use of zero to denote an empty place is not really the use of zero as a number at all, merely the use of some type of punctuation mark so that the numbers had the correct interpretation.



The first known calculator, viz. abacus (2400 BC), was probably invented by Babylonians as an aid to simple arithmetic around this date. This laid the foundations for positional notation and other computational developments. The ancient Greeks began their contributions to mathematics around the time when zero as an empty place indicator was coming into use in Babylonian mathematics. The Greeks however did not adopt a positional number system. It is worth thinking just how significant this fact is. How could the brilliant mathematical advances of the Greeks not see them adopt a number system with all the advantages that the Babylonian place-value system possessed? Greek mathematical achievements were based on geometry. Greek mathematicians did not need to name their numbers since they worked with numbers as lengths of lines. Merchants, not mathematicians, used numbers, which required to be named for records, and hence no clever notation was needed. There was however exception to what have just been stated. The exceptions were the mathematicians who were involved in recording astronomical data. Here we find the first use of the symbol, which we recognize today as the notation for zero, and the Greek astronomers began to use the symbol O. There are many theories why this particular notation was used. Some historians favor the explanation that it is omicron, the first letter of the Greek word for nothing namely "ouden". **Otto Neugebauer** (1899-1990), Austrian American Mathematician, however, dismissed this explanation since the Greeks already used omicron as a number and it represented 70 (the Greek number system was based on their alphabets). Other explanations offered include the fact that it stands for "obol", a coin of almost no value, and that it arises when counters were used for counting on a sand board. The suggestion here is that when a counter was removed to leave an empty column it left a depression in the sand which looked like O. Zero represents nothingness and emptiness. The idea of nothingness and emptiness has always inspired mathematicians, physicists and even philosophers. Though the humans have always understood the concept of nothingness or having nothing, the concept of zero is relatively new as it only fully developed in the 5th century AD. Before these mathematicians struggled to perform even the simplest arithmetic calculations.

Ptolemy – Greco Egyptian Mathematician, Astronomer, Geographer and Astrologer, in the Almagest written around 130 AD, used the Babylonian sexagesimal system (base 60 numeral system) together with the empty placeholder O. By this time **Ptolemy** was using this symbol both between digits and at the end of a number and one might be tempted to believe that at least zero as an empty place holder had firmly arrived. This, however, is far from what happened. Only a few exceptional astronomers used the notation and it would fall out of use several more times before finally establishing it. Zero was certainly not thought of as a number by Ptolemy who still considered it as a sort of punctuation mark. The idea of zero made its next appearance in Indian mathematics. The scene now moved to India where it is fair to say the numerals and number system were born which have evolved into the highly sophisticated ones which we use today. Of course, that is not to say that the Indian system did not owe something to earlier systems and many historians of mathematics believe that the Indian use of zero evolved from its use by Greek astronomers. Some historians seem to want to play down the contribution of the Indians in a most unreasonable way. There are also those who make claims about the Indian invention of zero, which seem to go far too far. What is certain is that by around 650 AD, the use of zero as a number came into Indian mathematics. The Indians also used a place-value system and zero was used to denote an empty place. In fact, there is evidence of an empty placeholder in positional numbers from as early as 200 AD in India but some historians dismiss these as later forgeries. First use of zero by mathematicians in India is dated around 500 BC. Indian Jaina mathematicians invented logarithms around 200AD. Around 200AD, Indian mathematician Brahmagupta was the first to describe the modern place-value numeral system (Hindu-Arabic numeral system).

In 1400AD, Kerala School of Astronomy and Mathematics in South India invented the floating-point number system. In 300 BC, Indian mathematician, scholar and musician Pingala was the first to describe the binary number system consisting of 0 and 1, which is now used in the design of essentially all modern computing-equipment. Pingala also conceived the notion of a binary code (collection of bits 0 and 1). Similar to the Morse code, Binary codes of numbers are the lifeline of present- day classic computers and will perhaps remain so till the design of classic computers is based on digital technology wherein both bits have digital representations of 0 and 1 and will perhaps continue to remain so till the arrival of **“Quantum Computers”** wherein both bits are represented by waves.



The brilliant work of Indian mathematicians was transmitted to the Islamic and Arabic mathematicians further west. Hindu Art of Reckoning describes the Indian place-value system of numerals based on 1, 2, 3, 4, 5, 6, 7, 8, 9, and 0. Ibn Ezra, in the 12^{th} century, wrote three treatises on numbers, which helped to bring the Indian symbols and ideas of decimal fractions to the attention of some of the learned people in Europe. **“The Book of the Number”** describes the decimal system for integers with place values from left to right. In this work Ibn Ezra uses zero, which he calls ‘galgal‘(meaning wheel or circle). The Indian ideas spread east to China as well as west to the Islamic countries. In 1247 the Chinese mathematician **Ch'in Chiu-Shao** wrote “Mathematical Treatise” in nine sections which uses the symbol O for zero. A little later, in 1303, **Zhu Shijie** wrote “Jade mirror of the four elements” which again uses the symbol O for zero. **Fibonacci** was one of the main people to bring these new ideas about the number system to Europe. It is significant that **Fibonacci** was not bold enough to treat 0 in the same way as the other numbers 1, 2, 3, 4, 5, 6, 7, 8, 9 since he speaks of the "sign" zero while the other symbols he speaks of as numbers. One might have thought that the progress of the number systems in general, and zero in particular, would have been steady from this time on. However, this was far from the case. **Cardan** solved cubic and quartic equations without using zero. He would have found his work in the 1500's so much easier if he had a zero but it was not part of his mathematics. By the 1600s zero began to come into widespread use but still only after encountering a lot of resistance.

The differences between zero and nothing are critical. Many civilizations could not solve tricky calculations due to their ignorance towards the magical figure of zero. “Zero” is considered to be a number while “nothing” is considered to be an empty or null set. Zero has a numeric value of “0”. A zero placed after a number increases the value of the number while zero placed before a number does not change the number. Imagine there are two students, “A” and “B” in a class. In a mathematics examination of 100 marks, “A’ attends classes and appears is the examination while “B” neither attends classes nor appears in the examination. Student “A” got zero marks in the examination while student “B” got nothing. The fact that “B” got zero marks in irrelevant. Zero has a measurable beginning and measurable end while “nothing” has neither any beginning nor any end. Zero is a relative term while absence of anything measurable is reflected in nothing.

The Roman number system did not need any value to represent zero. Instead of zero, the word 'nulla' was used by the Romans to specify zero. In Latin language, the word "nulla" means none, but there is no specific symbol to represent zero in the Roman literal system. Hence "nulla" is used to represent zero. Of course, there are still signs of the problems caused by zero. Recently many people throughout the world celebrated the new millennium on 1 January 2000. Of course, they celebrated the passing of only 1999 years, since when the calendar was set up no year zero was specified. Although one might forgive the original error, it is a little surprising that most people seemed unable to understand why the third millennium and the 21st century began on 1 January 2001. **Zero is still creating anxieties about its different perceptions through ages.**

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IMSP News

1. IMS-IITM-IMD National Seminar, delivered by Prof. Elena Surovyatkina, on 17th January 2023

Indian Meteorological Society, Pune Chapter (IMSP), Indian Institute of Tropical Meteorology, Pune (IITM) and Climate Research & Services, Pune (IMD) jointly organized a Special Lecture in IMS-IITM-IMD National Seminar on " **Two types of critical transitions to monsoon**" by **Prof. Elena Surovyatkina** of Potsdam Institute for Climate Impact Research (PIK), Potsdam, Germany & Space Research Institute of Russian Academy of Sciences (IKI), Moscow, Russia on 17th January 2023 (Tuesday, at 16.00 IST) at Meghdoot Auditorium, IITM, Pune-411008.

Prof. Dr. Dr.Sc. Elena Surovyatkina

Prof. Dr. Dr.Sc. Elena Surovyatkina is a Leader of Monsoon research group in Potsdam Institute for Climate Impact Research (PIK), Potsdam, Germany and leading researcher in Space Dynamics Department at Space Research Institute of Russian Academy of Sciences (IKI), Moscow, Russia. Her specialties include interdisciplinary research, practical implementation of theoretical findings, and international collaboration. During her seminar, she showed how to evaluate the effect of climate change on the transition to monsoon in every state of the Indian subcontinent. She discussed that the classical understanding of monsoon onset implies a sudden increase in precipitation and sustainable rains. However, initial rain often gets stalled after monsoon onset for a week or even longer, causing disaster for farming. She showed that there are two types of critical transitions to monsoon: a direct transition, with a sudden increase in precipitation, and a two/multiple-step transition, with a dry spell after the initial rain. She presented evidence that 70 % of the last 47 years show two/multiple-step transition, which went overlooked. Significantly, the second type of transition prevails under climate change. She uncovered that the cause of rainfall cessation is the hidden phenomenon of intermittence emerging between two successive phase transitions. The new theoretical finding opens a door for the universal definition of local monsoon onset.

2. Annual Monsoon Workshop (AMW-2022) and National Symposium on "Challenges in climate services for health sector in the warming environment"

Indian Meteorological Society, Pune Chapter (IMSP), Indian Institute of Tropical Meteorology, (IITM) Pune, and Climate Research & Services, Pune (IMD) are jointly organizing Annual Monsoon Workshop (AMW-2022) and National Symposium on "Challenges in climate services for health sector in the warming environment", during 28th to 30th March 2023, at Meghdoot Complex of IITM, Pune. AMW-2022 is scheduled on 28th March 2023, to discuss various aspects of Indian monsoon of 2022 (both SW monsoon & NE monsoon seasons) on different time scales, related agricultural aspects and other important topics. The National Symposium is scheduled during 29th & 30th March 2023, and has the following sub-themes for abstract submission:

Theme-1: Understanding Weather and Climate extremes in changing climate.
Theme-2: Improving the prediction skills of extremes in changing climate.
Theme-3: Impact of Extreme weather on Human & Animal health
Theme-4: Extreme weather and crop health
Theme-5: Climate change and communicable diseases
Theme-6: Climate change and Pandemic risk
Theme-7: Pollution and Human health
Theme-8: Data driven health impact modelling using AI/ML
Theme-9: Effective communication of climate services to general public
Theme-10: Tailoring of climate information for decision making in the health sector

Both oral and poster presentations will be arranged during the National Seminar. The best oral and poster presentations will be awarded. It is proposed to felicitate dignitaries (Chief Guest, Guest of honours, session chairs, etc.), life members having remarkable achievements during recent past, and some very senior life members of IMSP.

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