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Indian Meteorological Society, Pune Chapter (IMSP)

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International Monsoons Project Office (IMPO) and its Important Activities

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About IMPO

The International Monsoons Project Office (IMPO), hosted by IITM, is a joint effort by World Meteorological Organization (WMO) and IITM to help & coordinate monsoon research across the world. Earlier, IITM was hosting International CLIVAR Monsoons Project Office (ICMPO) for 6 years, mainly to coordinate CLIVAR/GEWEX Monsoons panel and its working groups. ICMPO was mainly involved with two important core projects, namely CLIVAR (Climate and Ocean: Variability, Predictability and Change) and GEWEX (The Global Energy and Water Exchanges) of the World Climate Research Programme (WCRP). ICMPO completed its scheduled tenure (2015-2020) in February 2020 and its tenure was extended for one more year. Subsequently, a new agreement was signed between World Meteorological Organization (WMO) and Indian Institute of Tropical Meteorology (IITM), with the approval of government of India to host an International Monsoons Project Office (IMPO) at IITM Pune India, initially for five years with effect from 30th July 2021, to support monsoon research activities of the World Weather Research Programme (WWRP) and the World Climate Research Programme (WCRP) of WMO. Hence, IMPO is India's contribution to global monsoon research coordination encompassing all monsoon research related matters in WMO programmes.

WCRP and WWRP strive to have its international project offices hosted by scientific and technical research centres of excellence such as IITM. This is the basis and the prime motivation for this Agreement between WMO & IITM, whereby IITM supports the IMPO functioning and operations, while WCRP and WWRP of WMO support the overall scientific activities. The Joint Scientific Committee (JSC) of the WCRP and the Scientific Steering Committee (SSC) of the WWRP endorsed the evolution of the ICMPO into IMPO at IITM with a broader mandate, and IITM indicated its willingness to host the IMPO with necessary approvals by the Ministry of Earth Sciences (MoES) of the Government of India. IMPO, through the Director of IITM, will liaise with the WCRP and WWRP Secretariat on all administrative and financial matters, and with the arrangements as decided by the JSC/WCRP and SSC/WWRP on scientific matters through the relevant monsoon-related substructures including CLIVAR, GEWEX and WGTMR (Working Group on Tropical Meteorology Research of WWRP).

An efficient international project office hosted by IITM and fruitful research activities resulting from international scientific coordination facilitated by WCRP & WWRP benefit the researchers worldwide and contribute to IITM and WCRP/WWRP in meeting their respective objectives. Dr. Rupa Kumar Kolli, former Executive Director of IMPO and Prof. Ravi Shankar Nanjundiah, former Director IITM contributed significantly for the establishment of IMPO at

IITM Pune, with kind support from the Secretary MoES, Government of India. IMPO is being funded by the MoES through the Monsoon Mission Programme and is hosted at IITM, Pune. Hosting of an international office, like IMPO, has provided a broad recognition of IITM as an internationally leading research institute in monsoon research. It has been instrumental in establishing fruitful cooperation of IITM scientists with the global community of weather and climate researchers, to get united under the auspices of WWRP and WCRP.

A high-level launch of IMPO was organized online on 28th February 2022, coinciding with the Indian National Science Day. Dignitaries from the Ministry of Earth Sciences (MoES), WMO, WWRP, WCRP, Dr. R. Krishnan, Director IITM, Dr. Rupa Kumar Kolli from IMPO, and two Senior Scientists of IMPO (Mr. Somnath Mahapatra and Dr. Susmitha Joseph) were present in this online launch event.

At present, Dr. E. N. Rajagopal is the Executive Head of IMPO and works in consultation with Director IITM and Project Director of Monsoon Mission for various activities of IMPO. He gets support and advice from Dr. Rupa Kumar Kolli, Honorary Scientist of IMPO. Mr. Somnath Mahapatra and Dr Susmitha Joseph are working as Senior Scientists of IMPO, in addition to regular duties in their official position of Scientist-F at IITM Pune. They provide necessary support for various activities of IMPO.

Functions of IMPO

The functions of IMPO, as envisaged as part of WMO-IITM Agreement, include the following:

a) Pursue activities and connections related to monsoon research around the world identified and fostered under the leadership of WCRP and WWRP.
b) Serve as the main coordination office for the activities of the CLIVAR/GEWEX Monsoons Panel including its regional working groups and other substructures that may be constituted during the course of its work, in consultation with the IPOs (International Project Offices) of WCRP's core projects CLIVAR and GEWEX.
c) With prior agreement of the Directors of the IPOs of the relevant WCRP core activities, support other monsoon-related activities within CLIVAR (such as those arising from the Indian Ocean Region Panel, Pacific Region Panel and the Atlantic Region Panel), GEWEX [such as the Global Land/Atmosphere System Study (GLASS) Panel and the Global Atmospheric System Studies (GASS) Panel] as well as activities of SPARC (Stratosphere-troposphere Processes And their Role in Climate) such as the Atmospheric Composition and the Asian Monsoon (ACAM) activity in order to better integrate WCRP's monsoon activities.
d) Support the monsoon activities of WMO's World Weather Research Programme (WWRP) as part of its Working Group on Tropical Meteorology Research (WGTMR).
e) Support the organization of the International Workshop on Monsoons (IWM) series co-led by the WWRP, as part of WMO's major quadrennial symposia and workshops series.
f) Support active collaboration with the relevant monsoon groups to effectively pursue the applications in monsoon regions of the Sub-seasonal to Seasonal (S2S) Prediction Project outputs, jointly coordinated by WWRP and WCRP.

g) Support activities (seminars, workshops, training events, etc.) related to the topic of monsoons on S2S timescales.
h) Actively contribute to and facilitate outreach and capacity building related to WCRP/WWRP monsoon research, in the host country as well as in the region.

IMPO functions include planning and coordinating meetings, arranging teleconferences for the Panel Members as well as the regional working groups of the Monsoons Panel, for Asian-Australian Monsoons, African Monsoons, and the American Monsoons. Other activities of IMPO include support to the newsletters of WMO, WWRP and WCRP on monsoon-relevant matters, development and maintenance of the Monsoons Panel web pages cataloguing current monsoon research initiatives, information, and resource relevant for the international monsoon community. This office also disseminates the latest information on WWRP/WCRP monsoon activities to the meteorological and oceanographic communities in the host country as well as in the region.

Some of the Important Activities of IMPO

IMPO is India's contribution to WMO's monsoon research coordination activities under WCRP and WWRP. IMPO functions as a global hub of monsoon research coordination, covering all monsoon regions of the world (Asian-Australian, American, and African regions) and spanning weather to climate change time scales. One of the core responsibilities of the IMPO is to support the activities of the CLIVAR/GEWEX Monsoons Panel and its 3 Working groups (WG), namely, WG on Asian-Australian Monsoons (WG-AAM), WG on American Monsoons (WG-AMM) and WG on African Monsoons (WG-AFM). IMPO also supports cross-panel linkages within the working structure of the WCRP and its core projects as well as WWRP substructures, on monsoon-related matters.

IMPO also supports WWRP Working Group on Tropical Meteorology Research (WGTMR) and WMO's International Workshop on Monsoons (IWM)) Series of workshops & the associated activities. The IWM series provide a forum for researchers and forecasters to discuss recent advances and current issues involving monsoons as an example of an earth-system phenomenon covering weather-to-climate time scales affecting large populations around the world. The emphasis is to address monsoon impacts as part of the societal challenges of the WWRP: high-impact weather, water, agriculture, urbanization, and new technologies, in monsoon regions around the world. The outcomes of IWM are sought to transfer new science and technology to National Meteorological and Hydrological Services (NHMS) over the relevant monsoon regions. The last workshop (IWM-7) had two components, an online training workshop in November 2021 and a scientific workshop in spring 2022 during March 2022 organised in India.

Recent Important Activities of IMPO

❖ In association with IITM Pune, IMPO supported the organization of Online Training Workshop on "Sub-seasonal to Seasonal (S2S) Prediction of Monsoons", held during 1 - 12 November 2021, in conjunction with Seventh WMO International Workshop on Monsoons (IWM-7). For organization of the Online Training Workshop on S2S Prediction of Monsoons, IMPO was in constant touch with its International Organizing Committee (IOC), co-chaired by Dr. Àngel Muñoz, International Research Institute for Climate and Society (IRI), USA and Member, WCRP Working Group on Sub-seasonal to Interdecadal Prediction (WGSIP), and Dr Rupakumar Kolli, IMPO and Co-Lead, WMO Expert Team on Climate Services Information System Operations (ET-CSISO). The online training workshop focused on the sub-seasonal to seasonal (S2S) prediction of monsoons & provided short courses to NMHS (National Meteorological and Hydrological Services) forecasters. Specific topics included S2S predictability sources, Access to the S2S database and tools, Model validation and forecast verification and Calibration and ensemble techniques. A large number of participants (>100) from different countries attended this workshop after completing online Registration process. A pre-workshop orientation course was offered before the main training workshop to introduce and facilitate the data and tools to be compiled by the trainees in advance and to familiarize the trainees with the workshop procedures including the practical sessions. More information for the online training workshop is available at the following web page: https://impo.tropmet.res.in/iwm7training.php

❖ IMPO supported organization of the first Southern Asian Climate Research Forum (SACRF), held online on 30th November 2021. For the organization of this, IMPO was involved in several planning meetings with WCRP Secretariat, and various members & Regional Focal Points (RFPs) of SACRF.

❖ IMPO worked with the Ministry of Earth Sciences (MoES), WMO, WWRP and WCRP for organization of the high-level launch event of IMPO, on 28th February 2022, coinciding with the Indian "National Science-day". The event included pre-recorded address by Honourable Minister of Earth Sciences Dr. Jitendra Singh, addresses by Dr. M. Ravichandran (Secretary, MoES), Prof. Detlef Stammer (Chair, WCRP Joint Scientific Committee), Dr. Chris Davis, (Chair, WWRP Scientific Steering Committee), and a brief address by Dr R. Krishnan, Director, IITM. It included a key science talk by Prof. C. P. Chang, International monsoon expert, USA on the current highlights of global monsoons research. A video recording of the event is available at https://youtu.be/8nCGIbhRnb8.

❖ IWM-7 was jointly organized by the India Meteorological Department (IMD), Ministry of Earth Sciences, Government of India and the WWRP Working Group on Tropical Meteorology Research (WGTMR), in close cooperation with the CLIVAR/GEWEX Monsoons Panel and the IMPO during 23-26 March 2022.

❖ The first Joint WCRP/WWRP Webinar Series on "Global Monsoon" was organized by the WCRP's CLIVAR/GEWEX Monsoons Panel in collaboration with WWRP's WGTMR and with the active support of IMPO, online on 13th September 2023 during 7-8:30 UTC. This webinar featured talks by eminent scientists Prof. Bin Wang and Dr. Annalisa Cherchi. Dr. Suryachandra A. Rao, Co-Chair of CLIVAR/GEWEX Monsoons Panel, chaired the webinar. This event was conducted by CLIVAR/GEWEX Monsoons panel and supported by WWRP, WCRP Secretariat, and IMPO. Video recording of the webinar has been uploaded to IITM YouTube channel for wider reach & publicity. The recording of the Webinar is available in the IITM YouTube Channel Video. This Webinar series will be continued by periodically arranging online lectures by eminent scientists on topics related to Global monsoon. More details on the

Joint WCRP/WWRP webinar series are available on the dedicated WCRP webpage on Monsoons Webinars.

- IMPO's support to the CLIVAR/GEWEX Monsoons Panel (MP):
  - IMPO Coordinated with Monsoons Panel (MP) Co-Chairs for preparation of Annual Report (2021 & 2022) of the MP and its submission for consideration by GEWEX SSG (Scientific Steering Group) and CLIVAR SSG.
  - IMPO Coordinated with Monsoons Panel (MP) Co-Chairs for organizing online meetings of MP and prepares Minutes of the Meetings.
  - IMPO supported the MP membership revision proposals for the approval of the SSGs of GEWEX and CLIVAR. After both SSG's endorsement of the membership changes, IMPO completed the formalities of inviting the new members and thanking the departing members.

- IMPO's support to the Monsoon Panel's three regional Working Groups on Asian Australian Monsoons (WG-AAM), African Monsoons (WG-AFM) and American Monsoons (WG-AMM):
  - IMPO coordinated with Co-Chairs of the regional Working Groups (WGs) for supporting organization of their online meetings.
  - IMPO was involved in the selection process of new Co-chairs/members of the Working Groups and issues the appointment letters with the approval MP Co-chairs.

- IMPO's support to the Working Group on Tropical Meteorology Research (WGTMR):
  - As a part collaboration between WGTMR and IMPO on monsoon activities, a two-hour online meeting of potential users/stakeholders of S2S monsoon prediction with Co-chairs of WGTMR and IMPO was successfully organized by IMPO on 28th April 2023, to identify the needs and gaps of S2S monsoon prediction in agriculture planning. The deliberations in the meeting will help to define the objectives of a pilot project under WWRP's SAGE project.

Concluding Remarks:

IMPO is leading with its efforts in coordination of monsoons research in the world and associated activities, thus it is giving more visibility of India to the International community.

Acknowledgements:

We are thankful to Dr R. Krishnan, Director IITM for his kind support to IMPO during various activities of IMPO. We are thankful to Drs. Suryachandra Rao A., Rupa Kumar Kolli and Susmitha Joseph for their kind cooperation and support for IMPO activities.

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Importance of National Framework for Climate Services in India for better management of the risks of climate variability and change

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Background

The climate of India has a high degree of variability at various spatial and timescales. The frequency as well as intensity of extreme weather events in the country has increased in recent decades, largely attributable to climate change. All communities, especially the economically stressed and the most vulnerable, are struggling to cope with the growing risks due to enhanced extreme events. According to the recent sixth assessment report of the Intergovernmental Panel on Climate Change (IPCC) as well as the report of the Ministry of Earth Sciences (MoES), Government of India, on the assessment of climate change over the Indian region, it is indicated that the increased frequency and intensity of climate and hydrological extremes such as cyclones, heatwaves, droughts and, floods will be the new normal across India. The increased severe weather events will exacerbate the societal and environmental risks in the country.

Decision-makers in many climate-sensitive sectors, such as water, agriculture, fisheries, health, forestry, transport, tourism, energy, disaster risk management, and many, are increasingly concerned about growing adverse impacts due to climate risks. It is unequivocal that efforts in disaster preparedness, early warning systems, and climate adaptation measures are to be in place to manage/mitigate the risks associated with extreme weather events. In this regard, climate services play a critical role in addressing the challenges posed by climate change, helping societies prepare for climate related impacts, and promoting sustainable and resilient development.

The World Meteorological Organization (WMO) has promoted an innovative platform called the Global Framework for Climate Services (GFCS), to enable better management of the risks of climate variability and change and adaptation to climate change through the development and incorporation of science-based and actionable climate information. It is a global to local coordination mechanism essential to strengthen the production, availability, delivery and application of science-based climate prediction and services. The GFCS was established by the Heads of State and governments, ministers and heads of delegations, present at the World Climate Conference-3 (held in Geneva, 31 August–4 September 2009). The world leaders recognized a growing need for these services to enable societies to address the challenges associated with extreme climate events and take advantage of the available opportunities. Acting as one on climate knowledge, WMO, together with United Nations and other international organizations and WMO Members, established the GFCS. It was envisioned that improvements in climate services could only be realized if relevant institutions at global, regional and national levels work together to complement their efforts by sharing expertise and data in their respective areas of specializations and mandate to inform the development and delivery of high-quality user-oriented climate services. There are five overarching goals of GFCS:

a) Reducing the vulnerability of society to climate-related hazards through better provision of climate information and services
b) Advancing the key global development goals through better provision of climate information and services
c) Mainstreaming the use of climate information and services in decision-making
d) Strengthening the engagement of providers and users of climate services
e) Maximizing the utility of existing climate service infrastructure

Therefore, GFCS aims to enable society to better manage the risks and opportunities arising from climate variability and change, especially with a focus on those who are most vulnerable to such risks, by developing and incorporating science-based climate information and prediction into planning, policy and practice. The implementation of GFCS has five components (pillars): (i) Observations and Monitoring; (ii) Research, Modelling and Prediction; (iii) Climate Services Information System; (iv) User Interface Platform; and (v) Capacity Development.

Under the auspices of the GFCS, the concept of National Framework for Climate Services (NFCS) has been developed to help all climate services stakeholders at the national level to join forces and work together with mutually agreed working arrangements to collectively pursue the common goal of achieving a climate-smart society. The NFCS is a multi-institutional mechanism to coordinate, facilitate and strengthen collaboration among the relevant national institutions and partners to use of science-based climate information, predictions and services. In view of the impact associated with the climate variability and change, it is important that the NFCS in India (NFCS-India) need to established and implemented.

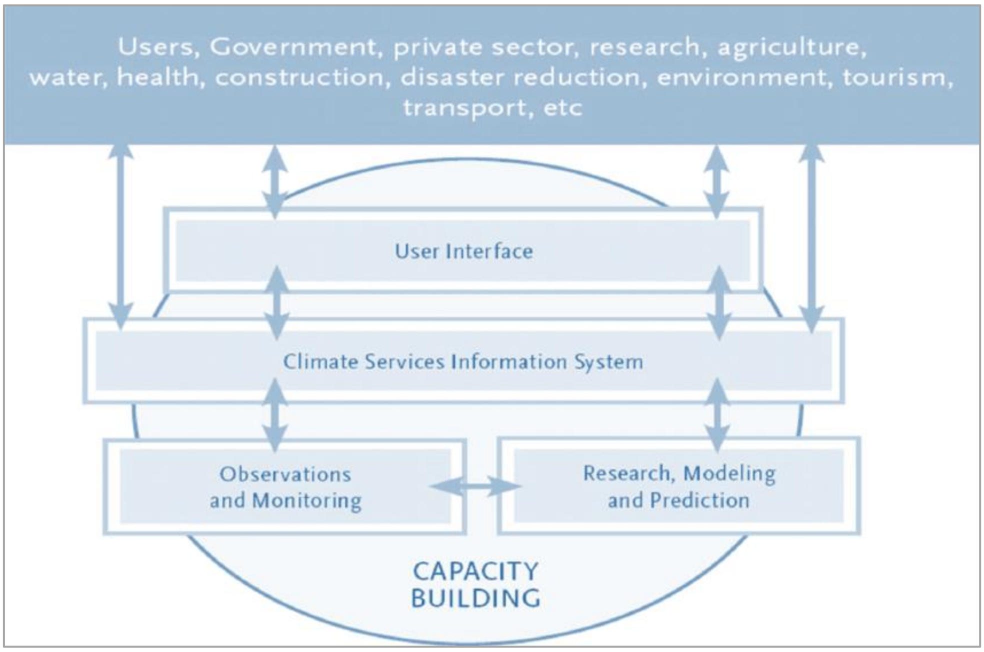

Figure 1: Functional components (pillars) of GFCS (Source: https://gfcs.wmo.int/)

NFCS India: Role of India Meteorological Department

As per the GFCS guidelines, it is envisaged that the NFCS would be initiated and led by the concerned country's National Meteorological and Hydrological Service (NMHS). Within the WMO context, the role of NMHS in India is played by the India Meteorological Department (IMD), which is under the MoES. India had played a leading role in developing and guiding the GFCS right from the outset. The IMD is playing a key role in organizing various activities of climate data, monitoring, forecasting and services with operationally sustained international collaboration and partnership. IMD routinely provides services to weather-sensitive sectors viz. agriculture, irrigation, shipping, aviation, health, tourism, marine, offshore oil explorations, etc. as well as the general public. Over the years, specialized services have also been built for state-of-the-art monitoring, detection and early warning of extreme weather phenomena including tropical cyclones, severe thunderstorms, dust storms, heavy rains and snowfall events, cold and heat waves, etc. It is widely recognized that these meteorological services have significant socio-economic benefits. The demand for actionable information including skillful prediction of weather and climate at various temporal and spatial scales is increasing due to greater awareness of the possible impacts of global climate variability and change. Continuous improvement of climate services requires effective conversion of research and technological advances into improved operational products, services and effective means to develop communication and linkages with decision-makers and users. The NFCS gives us an effective platform to establish and sustain interlinkages with various organizations to implement better and effective weather and climate services for the maximum benefits of the society.

Initial efforts under the proposed NFCS for India are to collaborate with all those agencies to whom IMD is already providing climate services, with a special focus on the five initial priority areas adopted by the GFCS, namely (i) Disaster risk reduction, (ii) Agriculture and food security, (iii) Water resources, (iv) Public health, and (v) Energy. Though the NFCS is not yet formally established in India, it is encouraging to note that different agencies are already connected through ad-hoc arrangements to facilitate need-based information exchange to some extent. Building on the existing arrangements and pursuing a more comprehensive approach to mainstream full value chain climate services, the NFCS could be realized through the setting up of formal yet flexible arrangements and mechanisms, including high-level governance, for regular and sustained dialogue and collaboration.

Stakeholder Consultation Workshop

A Stakeholder Consultation Workshop for Establishing the National Framework for Climate Services in India (NFCS–India), was organized by IMD and co-hosted by Christ University at Lavasa, Pune, Maharashtra, during 5-6 October 2023. The participants in this event included a wide range of experts relevant to climate services in the country, such as representatives from various central ministries (including earth sciences, water resources, agriculture, health, energy, defence and space), officials from various state governments, research organizations, academic institutions, professional bodies, industries, non-governmental organizations, students, and the media.

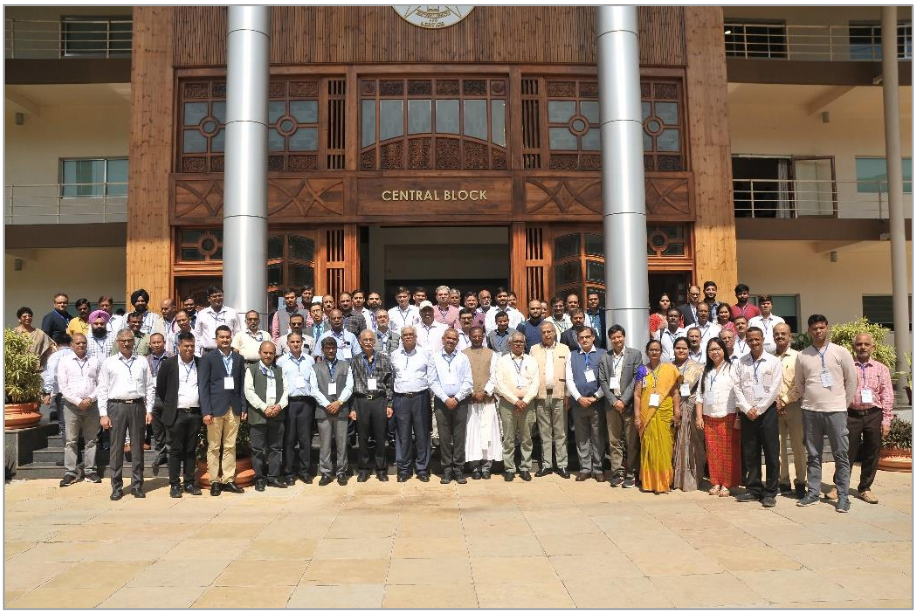

Figure 2: Participants at the stakeholder consultation workshop held in Lavasa, Pune during 5-6 October 2023

The workshop was comprised of presentations from both national and WMO experts, discussions, and breakout sessions focused on the development of well-coordinated climate services in the country. The workshop was graced by Dr. M. Ravichandran, Secretary, MoES and Dr. M. Mohapatra, Director General of Meteorology, IMD. The workshop was coordinated by the Office of the Climate Research and Services, IMD, Pune. At the end of the workshop, the participants agreed on a roadmap ahead to ensure a successful establishment and implementation of NFCS-India in a sustainable manner, considering the needs and capacities of all the relevant stakeholders.

Dr. M. Ravichandran, Secretary, MoES addressing the gathering.

Dr. M. Mohapatra, DGM, IMD addressing the gathering.

The signing of MoU between IMD and Chrst University.

Dignitaries at the dais during the workshop.

Figure 3: Various events at the stakeholder consultation workshop held during 5-6 October 2023.

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Analysis of air quality over Pune with reference to COVID episode

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Introduction:

As recent evidence, the betterment in air quality as a result of lockdown in response of COVID-19 pandemic were reported in spatially distinct settings. A significant reduction in the concentration of Nitrogen oxides (NO_x) and $PM_{2.5}$ was witnessed in main cities of China due to strong social distancing. Europe also experienced a drastic reduction in air pollution as an implication of the lockdown. Delhi witnessed significant reductions in Particulate matter (PM_{10}: and $PM_{2.5}$; 57% and 33% respectively) followed by a reduction in NO_x. Many authors also indicated a reduction in the Air Quality Index by 32% during the lockdown in cities located in the west zone of India. In light of these short-term transformations, it is also important to understand that quantifying air quality with episodic events may limit the understanding of air pollution reduction in total. Air pollution in urban dwellings is a primary environmental and health concern worldwide. The severe air pollution episodes, particularly in Indian cities, pose relentless health risks to the city dwellers. 8% of the total disease burden and 11% of premature deaths in India were attributed to air pollution. This is taking into account that large Indian cities experience the worst air quality due to rapid urbanization and emissions from diverse regional sources. For instance, the transport sector contributes majorly towards air pollution in the western cities. On the other hand, along with transport sector, industries, power generation, construction, and the household sector contribute notably in the cities in the developing world (Bai et al. 2020). In addition to the diversity in the sources, physical characteristics of a region also influence air pollution levels in urban areas. In particular, urban dynamics, geographical location and synoptic meteorology highly influence the air quality of Indian cities (Anand et al. 2019). Due to these multiple influences, reliance on short term improvements in air quality understates an explicit picture of air pollution in Indian cities. Although short-term improvements in air quality were reported during and after the lockdown in various cities, the results of these changes are hard to evaluate (Brimblecombe et al. 2020). It was observed that some studies concluded the results on the basis of insufficient data and limited monitoring stations. In view of this it was considered to study, the episodic improvements with spatio-temporal analysis of air quality over the most affected metropolitan regions: Pune (4 locations). In this study it is proposed to understand variations in SO2, NOx and PM10, comparing the variations before, during and unlock phase.

Data and Methodology:

The primary data generated from NAMP in the last decade (2010-2020) was used to assess the average air quality over the selected locations. Daily and monthly means of SO_2 and NO_x were computed using the four hourly (e.g., morning 06hrs to 10hrs and likewise) and (06hrs to 14hrs and likewise) for PM10. The different phases of COVID-19 episode are given in the

Table 1. Accordingly, the data sets were prepared and analysed. For computation of air quality, NAAQS (CPCB) categories and guidelines were considered.

Table 1: Distribution of time scale during the study period.

Phases	Time period	Duration
Pre-lockdown	December 01, 2019-March 17, 2020	4 months
Lockdown	April 01, 2020- May 31, 2020	2 months
Unlock 1	June 01, 2020-September 30, 2020	4 months
Unlock 2	October 01, 2020-January 31, 2020	4 months

Results and Discussions:

During the pre-lockdown period, the concentrations of NO_x and PM_{10} were generally above the prescribed NAAQ standards at all the locations. The conspicuous increase in SPM observed at Swargate can be attributed to the region's construction activity and heavy vehicular traffic. The Figure also depicts a drastic reduction in the concentration of all the pollutants during the lockdown period. At Swargate, a drastic reduction in PM_{10} was observed. For SO_2, the concentrations were marked far below the NAAQ standard, with very little variation at all the locations during the pre-lockdown and lockdown periods. There was a drastic reduction in all the pollutants marked with almost no violation of NAAQ standards during the lockdown period at all the locations. The concentration of SO_2 follows a continual decline as the sulphur emissions are arrested due to improvement in the fuel quality, diesel in particular, under the Bharat- Stage 4 norms implemented by the Government of India. However, a significant increase in the number of vehicles and combustion process surpasses improvements in fuel quality and technology, thereby aggravating the concentration of PM_{10} and NO_x.

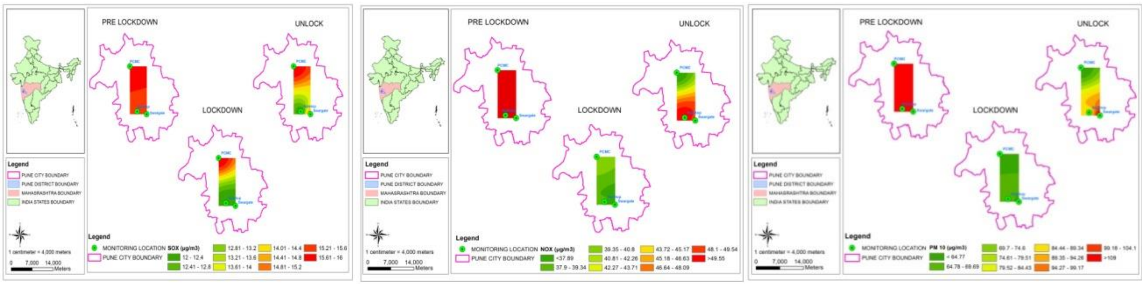

Figure 1. Daily concentrations of SO_2, NO_x, and PM_{10} during pre-lockdown, lockdown and unlock period.

On comparison with the decadal values of pollutants, NOx during, pre-lockdown period experienced a maximum reduction (78%) was observed at Swargate, followed by PCMC and Nalstop with 68%. Less variation in the concentration of SO_2 at all sites resulted in this minor change.

The percentage days of exceedances of pollutants were worked out and the same is reported in Table 2. There was almost no effect of the lockdown on the concentration of SO_2 due to less variation throughout the study period. This was further reflected during the lockdown period, where air quality was under the good category (Table 2B). Regarding NO_x, the air quality remained in the good/fair category on almost all the occasions for all the locations. Although the air quality is generally good during April, a significant shift on several occasions from the fair to the good category was noted during the lockdown period (Table 2C). On none of the occasions, the air quality was marked in the critical category at PCMC. Subsequently, it was also observed that sporadic events contributed to 9% of the occasions under the critical category at Swargate and Nalstop at various times during the lockdown period (Table 2B).

Table 2 (A, B & C): Status of air quality in terms of frequency of Exceedances (%) for the period April (2010-2019), **(B)** April 2020 (lockdown) and **(C)** Increase/Decrease in frequency

SO_2		April (2010-2019)				During Lockdown (April 2020)				Increase/Decrease in frequency of Exceedance during lockdown			
		A				B				C			
Time	Location	Good	Fair	Poor	Critical	Good	Fair	Poor	Critical	Good	Fair	Poor	Critical
Morning	PCMC	86	13	1	0	100	0	0	0	+13.8	-12.9	-0.8	0.0
	Nalstop	96	4	0	0	100	0	0	0	+3.8	-3.8	0.0	0.0
	Swargate	97	3	0	0	100	0	0	0	+2.8	-2.8	0.0	0.0
Early afternoon	PCMC	95	5	0	0	100	0	0	0	+5.3	-4.9	-0.4	0.0
	Nalstop	92	8	0	0	100	0	0	0	+8.1	-8.1	0.0	0.0
	Swargate	95	5	0	0	100	0	0	0	+4.6	-4.6	0.0	0.0
Afternoon	PCMC	93	7	0	0	100	0	0	0	+6.6	-6.6	0.0	0.0
	Nalstop	96	4	0	0	100	0	0	0	+4.3	-4.3	0.0	0.0
	Swargate	97	3	0	0	100	0	0	0	+2.5	-2.5	0.0	0.0
Evening	PCMC	91	9	0	0	100	0	0	0	+9.0	-9	0.0	0.0
	Nalstop	96	4	0	0	100	0	0	0	+3.6	-3.6	0.0	0.0
	Swargate	100	0	0	0	100	0	0	0	0.0	0.0	0.0	0.0
Late evening	PCMC	92	8	0	0	100	0	0	0	+7.5	-7.5	0.0	0.0
	Nalstop	96	4	0	0	100	0	0	0	+3.9	-3.9	0.0	0.0
	Swargate	95	5	0	0	100	0	0	0	+4.9	-4.9	0.0	0.0
Night	PCMC	92	7	0	0	100	0	0	0	+7.6	-7.2	-0.4	0.0
	Nalstop	98	2	0	0	100	0	0	0	+2.4	-2.4	0.0	0.0
	Swargate	99	1	0	0	100	0	0	0	+1.4	-1.4	0.0	0.0
NO_2		A				B				C			
Time	Location	Good	Fair	Poor	Critical	Good	Fair	Poor	Critical	Good	Fair	Poor	Critical
Morning	PCMC	19	62	15	3	58	32	11	0	+38.4	-30.4	-4.6	-3.3
	Nalstop	27	56	15	1	82	0	18	0	+54.3	-55.9	+2.8	-1.3
	Swargate	19	67	13	1	73	27	0	0	+53.7	-39.8	-12.5	-1.4
Early afternoon	PCMC	38	49	11	2	75	15	10	0	+36.8	-34.1	-0.7	-2.1
	Nalstop	26	59	14	1	82	9	9	0	+55.8	-49.6	-4.9	-1.3
	Swargate	20	59	21	0	82	9	0	9	+61.6	-50.1	-20.6	+9.1
Afternoon	PCMC	48	41	9	2	74	21	5	0	+26.0	-20.2	-4	-1.8
	Nalstop	38	50	12	0	73	9	9	9	+34.4	-40.8	-2.7	+9.1
	Swargate	27	54	15	4	73	18	9	0	+46.1	-36	-6.1	-4
Evening	PCMC	33	55	11	2	68	32	0	0	+35.7	-23.5	-10.6	-1.6
	Nalstop	38	48	11	3	82	0	9	9	+43.8	-48.2	-1.8	+6.2
	Swargate	30	58	10	3	73	27	0	0	+42.8	-30.4	-9.7	-2.6
Late evening	PCMC	40	51	7	2	63	37	0	0	+23.4	-14.2	-6.8	-2.4
	Nalstop	39	57	4	0	82	0	18	0	+42.9	-57.5	+14.6	0.0
	Swargate	36	51	10	3	82	9	9	0	+46.0	-41.6	-0.9	-3.5
Night	PCMC	37	52	8	3	63	32	5	0	+26.5	-20.7	-2.6	-3.3
	Nalstop	35	59	6	0	82	9	9	0	+47.0	-49.8	+2.8	0.0
	Swargate	38	43	17	1	82	18	0	0	+43.7	-25.3	-17	-1.4
PM_{10}		A				B				C			
Time	Location	Good	Fair	Poor	Critical	Good	Fair	Poor	Critical	Good	Fair	Poor	Critical
Morning	PCMC	6	58	25	11	11	68	16	5	+4.8	+10.1	-9	-5.8
	Nalstop	0	22	51	27	0	73	27	0	0.0	+50.8	-23.9	-26.9
	Swargate	3	59	31	7	9	73	18	0	+6.5	+13.3	-13	-6.7
Afternoon	PCMC	6	65	25	4	32	68	0	0	+25.4	+3.8	-24.9	-4.3
	Nalstop	3	41	34	23	0	82	18	0	-2.5	+40.9	-15.5	-22.8
	Swargate	5	73	16	6	27	73	0	0	+22.1	+0.1	-16.1	-6.1
Night	PCMC	22	64	12	2	47	53	0	0	+25.6	-11.7	-11.8	-2.1
	Nalstop	37	51	11	1	73	27	0	0	+36.2	-24	-11	-1.3
	Swargate	28	65	7	0	55	45	0	0	+26.3	-19.8	-6.5	0.0

On an average, the air quality was in good/fair category for PM_{10} during the morning and afternoon hours at PCMC and Swargate (**Table 2A**). Contrary to this, at Nalstop, the air quality dropped into the poor/critical category for up to 80% of the occasions in the morning and up to 60% in the afternoon. During the nighttime, the air quality remained in the good/appropriate category for most of the time at all the locations. The effect of lockdown in extending the period of good air quality is well reflected in Table 2. During the lockdown period, the air quality in the morning was in the good/fair category for around 80% of the occasions at all three sites for all the pollutants (**Table 2B**). The effect was more profound during the afternoon and night at PCMC and Swargate, where the quality remained good/fair on all the occasions. This effect is prolonged during the nighttime at all the locations. Remarkably, there was no single occasion of the quality being critical at Nalstop as an effect of lockdown (**Table 2B**). In a nutshell, the reduction in air pollution varied considerably between the pre-lockdown and lockdown period compared to that of the decadal average. The lockdown in Pune city resulted in a substantial reduction of NO_x (41%), PM_{10} (33%), and SPM (60%). Moreover, the increase in the frequency of occasions under the good category has led to the finer refinement of air quality over Pune city during the lockdown period (**Table 2C**).

Conclusions:

Reduction in air pollution varied considerably between pre-lockdown and lockdown periods compared to that of the decadal average. The lockdown in Pune city resulted in a substantial reduction of NO_x (41%) and PM_{10} (33%). Also, exceedances revealed the increase in the frequency of occasions under the good category has led to finer refinement of quality of air over Pune city during the lockdown period. The spatial variation in air pollutants within the urban dwellings reflects the contribution of regional sources. However, it is challenging to track the sources due to limited monitoring stations in a city like Pune. It is therefore, important to strengthen the ambient air monitoring network to track varied sources and formulate precise urban planning in megacities.

Considering the residential mobility, the air pollution-related health impacts may be understated due to diverse sources. Therefore, this study will help policy makers target region specific for framing policy for Pune city.

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Fascinating Global Space Programs – Some Answered Curiosities

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Global Space Program

S.N.	Curiosity	Answer
1.	Who was the first man to walk in space?	Aleksey Leonov
2.	Name the world's first satellite?	Sputnik 1
3.	Who was the first person to step foot on the moon?	Neil Armstrong
4.	The crew of which lunar mission were the first to take photograph of Earth's south polar ice cap?	Apollo
5.	What was the world's first ever space station?	Salyut
6.	Who was the first woman to fly into space?	Valentina Tereshkova
7.	Who was the first astronaut to float in space untethered?	Venus
8.	Which company launched the first ever commercial space mission in 2012?	Space X
9.	What is widely considered to be the first ever space movie?	Le Voyage
10.	Which was first spacecraft to successfully land on Mars?	Viking 1
11.	Who was the first human to travel to space?	Yuri Gagarin, Vostok 1
12.	Who was first American astronaut?	Alan Shepard in 1961.
13.	When was the first space flight without space suits?	3 Soviet astronauts in 1963
14.	When was the first sky lab launched?	1973 by NASA
15.	When was the first manned space flight launched?	1975, jointly by USA and Soviet Union
16.	Is there sound in space?	No
17.	How far is our Earth from its Sun?	Approx. 8 Light Minutes. ~ 15 Crore Km
18.	What is a Light Year?	Distance travelled by light in one year [at the rate of about 3 Lakh Km/sec]
19.	Where is the term 'Light Year' used?	In Space Science.
20.	What is Hindi name of Space Science?	अंतरिक्ष विज्ञान

21.	What is Hindi of Global Space Program?	वैश्विक अंतरिक्ष कार्यक्रम
22.	What is PARSEC?	Distance unit in Astronomy
23.	What is the value of one PARSEC?	3.262 Light Years.
24.	Which planets in the Solar system have the most moons (natural satellites)?	Jupiter (92 in number) * Saturn (82 in number)
25.	Which spacecraft photographed Mercury in mid 1970s?	Mariner 10
26.	Which planet comes closest to earth in its orbit around the Sun?	Mercury
27.	When did the first human landed on the moon surface.	July 20, 1969
28.	First human to land on the moon surface.	Neil Armstrong
29.	Name the lunar module which first landed on the moon?	Eagle
30.	Name of the Orbiting command module used in the first moon landing.	Columbia
31.	By what angle is earth tilted out of vertical during its spin around its axis?	23.0 Degrees.
32.	Who was the first scientist to propose that the earth rotates around the sun?	Aristarchus
33.	In what year did the space age begin?	1957
34.	In which spacecraft was LALKA, the first living creature sent in space?	Sputnik
35.	Which country sent first living creature LALKA in space?	Soviet Union
36.	What is the smallest planet the solar system?	Mercury
37.	Who discovered the laws of planetary motion?	KEPLAR
38.	Which Apollo mission brought the first rocks and other material from the Moon?	Apollo 11

[*After 12 new natural satellites were discovered, Jupiter has beaten Saturn to become the planet, which has the most moons in the Solar system. Jupiter is not just the largest planet in our Solar system, it also has the most moons. Number of Natural Satellites- Jupiter: 92, Saturn: 82, Uranus: 27, Neptune: 13, Mars: 2, Earth:1 , Mercury: 0, Venus:0]

Who made the first catalogue of stars?

The first catalogue of the stars was made by a Greek astrologer and mathematician named HIPPARCHUS who lived around 2000 years ago. He made fundamental contributions to the advancement of Astronomy as a mathematical science and to the fundamentals of trigonometry. He was the first to notice that the stars change their position in the night sky – this is called the precession of the equinoxes. HIPPARCHUS made a list of the stars showing their brightness and position. HIPPARCHUS writings about astronomy were lost but his ideas were preserved by latter astronomers such as PLOTEMY. HIPPARCHUS recorded the stars he could see with the naked eye as he had no telescope.

Fascinating first human landing on the moon?

April 12, 1961, is one of the most important dates in the history of manned space flights. On that day, the first manned space flight took place. Only eight years later a man set foot on the surface of moon for the first time. At 2.56 on July 21, 1969, Neil Armstrong spoke words "One small step for a man but one giant step for the mankind" that have gone in the history of mankind. Equally famous were the words "The Eagle has landed", he spoke 6.5 hours earlier on July 20, 1969, when the lunar module was "Eagle" first landed down on the surface of the moon. The astronauts stay on the moon lasted for 21.5 hours before their module was lifted off to rejoin the command module Columbia.

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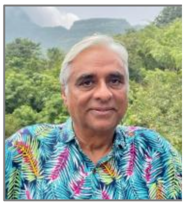
Vagaries' Visit to IITM on 29.08.2023



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Vagaries, a group of amateur meteorologists, were invited by the IMS Pune Chapter (IMSP) for a visit to IITM Pune campus on 29th August 2023, with kind permission from Director IITM, especially for visiting their new Laboratories and facilities. The full visit and lunch were kindly sponsored by the Pune Chapter of IMS. We profusely thank Mr. K. S. Hosalikar, Chairman IMSP, Dr. R. Krishnan, Director IITM, and Mr. Sikandar M. Jamadar, NEC Member of IMS for organizing this visit. We are grateful to Dr. Milind Mujumdar, Mr. Sikandar M. Jamadar, Mr. Somnath Mahapatra, Dr. Shivsai Dixit, Mr. Amey Datye, Mr. Mangesh M. Goswami, Mr. Sandeep Ingle, Mrs. Archana Rai, other members of IMS Executive Council and Scientists/Technicians of IITM laboratories & HPC, who spent their valuable time with us for showing us around IITM and giving us their valuable time & expertise for detailed explanations of various laboratories & facilities. The visitors (from the Vagaries of Weather group) included Mr. Rajesh Kapadia, Mr. Pavan Guddi, Mr. Nimish Thakkar, and Mr. Atul Phalke. It was an honor to visit such a prestigious institute.

Visit to Fluid Dynamics Laboratory of IITM

The very first lab we visited was the **Fluid Dynamics Laboratory (FDL)**. **Dr. Shivsai Dixit** oversees this laboratory (who contributed immensely for its establishment and is the In-Charge of the lab) and he is ably assisted by Mr. Harish Choudhary & others. They are involved in conducting laboratory experiments on atmospheric simulation of vertical structure of low-level jets (in the lower atmosphere) through physically simulated wall-jets in the laboratory. These types of experiments are carried out to measure the turbulence in wall jets, because in the atmosphere, turbulence measurements are extremely difficult at higher levels. Reynolds number is used to characterize such turbulence.

*Reynolds number = [(density * D * flow speed) / Viscosity], where "D" is the characteristic distance (~0.1 m), fluid (air) density is ~ 1.25 kg/m^3, fluid velocity (flow speed) ~ 35 m/s and dynamic viscosity~1.83*10^{-5} N s/m2 (acquired from data tables). Details of the calculation: Reynolds number (Re) = [(1.25 kg/m3) * (0.1 m) * (35 m/s) / (1.83*10^{-5} Ns/m^2)] = = 2.39*10^5.*

The correspondence between a "Wall-Jet" and the Lower-Level Jets (LLJ) in the atmosphere is being pursued recently in the FDL at IITM. Earlier LLJ observations were carried out over Baltic-sea by Norwegian meteorologist Smedman (Smedman et. al, 1996), who remarked that turbulence behaviour in LLJ was similar-to (like) a wall jet.

New terms learnt

Atmospheric Boundary Layer (ABL): The atmospheric boundary layer is defined as the lowest part of the troposphere that is directly influenced by the presence of the earth's surface and responds to surface forcing (like frictional effects) within a timescale of about an hour or less. Its extent can range upto few Km above the surface of the Earth and can vary depending on the local meteorology. The proposal at FDL is the contention that the presence of LLJ modifies the flux exchange in the ABL.

LiDAR: LiDAR (or Light Detection And Ranging) is an active remote sensing system. For Meteorology purpose, it involves velocity components measured with full profile in few seconds.

Visit to LASER ISOTOPE ANALYZER LAB

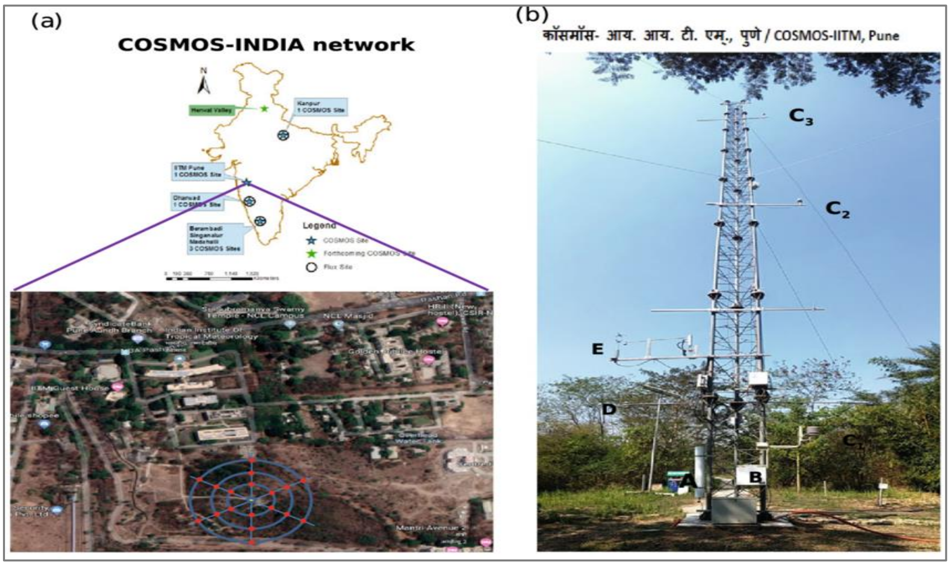
The Second laboratory, which was visited by us, was equipped with Green-house gas analyser and Water isotope analyser. The working of these instruments was explained thoroughly by Mr. Amey Datye, Scientist is in-charge of this laboratory. He is engaged in working with the Greenhouse gas analyser at IITM. He informed us that, one such analyser is installed at Singha- gad Fort also, since last 12 years. It has accumulated record amount of data (for a longer period). The Second instrument is Water Isotope analyser which analyses the isotopes from rainwater collected from at least 25 different locations across Indian subcontinent from Lakshadweep to Northeastern states. During evaporation, lighter isotopes escape into atmosphere earlier than heavier isotopes. These studies help in monsoon dynamics. These help in monsoon dynamics. He said that Samples collected from Tezpur region (in Assam state) were to be analysed in these days.

Visit to Cosmic Ray Soil Moisture Observation System (COSMOS), CCCR, IITM

Shri Mangesh M. Goswami of CCCR (Centre for Climate Change Research, at IITM Pune) showed us the details of research activities performed in COSMOS (Cosmic Ray Soil Moisture Observation System). This was installed at IITM campus in 2017 for collection of soil moisture data. Analysis range, i.e., Operating range is in 0.5 Km*0.5 Km. Low energy COSMIC rays react with the H^+ ions in the soil. This is a passive device, with Helium trifluoride and Barium tri- fluoride electrodes.

There are sensors installed at 2 m, 5 m, 10 m and 20 m heights above the surface. COSMOS-IITM site has been up graded for facilitating the real time monitoring of field scale soil moisture and surface fluxes. An extensive analysis on area average real time soil moisture (SM) variations has been carried out by IITM scientists, who measured SM variations using cutting edge technology.

In addition to the COSMOS-IITM observations, scientists also evaluated SM variations over this location using satellite, reanalysis data and model products for the same period for mutual comparisons. An important result from this analysis reveals the presence of biweekly (timescale ~ 10–20 days) and low-frequency intra-seasonal (timescale ~ 30–60 days) variations in the field-scale SM, which are linked to the dominant modes of Indian summer monsoon sub-seasonal variability. They found a pronounced enhancement of the low-frequency signal of SM variations during the 2019 monsoon which was characterized by abnormally excess precipitation and prolongation of rains well beyond the summer monsoon season, in contrast to 2018 monsoon.



The COSMOS site also has a Tipping Bucket rain gauge, which can continuously measure rainfall, rainfall duration, and rainfall intensity. Once the collected water reaches the predefined limit, the bucket will tip and hit the calibration/stop screw.

Tipping Bucket rain gauge at COSMOS site of IITM

Visit to HPC PRATYUSH of IITM

We had an opportunity to visit HPC PRATYUSH, India's supercomputer at IITM Pune. This has a peak computing speed of 4 Petaflops. The intricacies and working are beyond our imagination.

The details of this HPC system were explained to us by service Engineers of HPC Pratyush.

HPC PRATYUSH of IITM Pune

Acknowledgements

We, Vagarians, sincerely thank IITM, IMSP, IMD and each one of the scientists who hosted us for their valuable time and treat. We were humbled by the dedication and sincerity of all the Scientists involved into the various fields at IITM. We are confident our scientists at IITM are going to make a success story of India's achievements and progress. The luxury of a delicious lunch, hosted by IMS Pune Chapter at IITM Guest House, was an added attraction and was much appreciated by the visitors.

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How and Why of Cloudbursts

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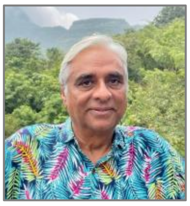

A lot is being mentioned recently about "Cloudbursts " in our Hill States...which are causing landslides and loss of lives and property.

But why is every heavy fall classified as a "Cloudburst"?

The term "cloudburst" arose from the notion that clouds were akin to water balloons and could burst, resulting in heavy precipitation. Generally, cloudburst refers to particularly heavy precipitation in a short period of time over limited geographical area. It is often defined as more than 100 mm/hour rainfall within a limited geographical area of a few square kilometers. More specifically, rainfall of 10 cm or more in an hour over a roughly 10 km x 10-km area is classified as a cloudburst event. By this definition, 5 cm of rainfall in a half-hour period over the same area would also be categorized as a cloudburst. Thus, a cloudburst is an extreme amount of precipitation, dumping large amounts of water, in a short period of time, sometimes accompanied by hail and thunder, capable of creating flooding (like flash floods) and landslides. Rainfall rate equal to or greater than 100 millimeter (~ 3.9 inch) per hour is a cloudburst. Cloudbursts can quickly pour 25 mm of the precipitation, which corresponds to 25,000 metric tons of water per square kilometer.

Cloudbursts are driven by the convergence of warm monsoon winds and cold air, often catalyzed by topography. Rather than falling, raindrops get larger in dimension and are forced up because of the air current. Finally, they will be heavier to carry and will fall down, directing to more rainfall than normal.

Cloudburst is a geo-hydrological hazard. The aggressiveness in nature and the scale of destruction of rainfall is scary at times. At times, a large amount of runoff from higher elevations is mistakenly conflated with a cloudburst.

Rapid precipitation from cumulonimbus clouds is possible in which large droplets can grow rapidly by coagulating with smaller droplets which fall down slowly. It is not essential that cloudbursts occur only when a cloud clashes with a solid body like a mountain, they can also occur when hot water vapor mingles into the cold resulting in sudden condensation. The magnitude of cloudbursts stands out, as India typically receives around 116 cm of annual rainfall. During these events, a small region can amass about 10% of this annual rainfall in just an hour.

[Note: Vagarians previously mentioned several times that it is not "Climate Change" which is responsible for causing casualties in HP or Uttarakhand. But it is the influx of large number of tourists to Himalayas defying warnings, and illegal unauthorized constructions which lead to catastrophic loss of life and property. With better connections and fast communication, the news spreads fast. There is no proof to show that the rainfall in HP, Uttarakhand has broken any records.]

Table 1. Record cloudbursts. These events are going on since more than 100 years.

Duration	Rainfall	Location	Date
1 minute	1.5 inches (38.10 mm)	Basse-Terre, Guadeloupe	26 November 1972
5.5 minutes	2.43 inches (61.72 mm)	Port Bell, Panama	29 November 1911
15 minutes	7.8 inches (198.12 mm)	Plumb Point, Jamaica	12 May 1916
20 minutes	8.1 inches (205.74 mm)	Curtea de Argeș, Romania	7 July 1947
40 minutes	9.25 inches (234.95 mm)	Guinea, Virginia, United States	24 August 1906
1 hour	9.84 inches (250 mm)	Leh, Ladakh, India	5 August 2010
1 hour	5.67 inches (144 mm)	Pune, Maharashtra, India	29 September 2010
1.5 hours	7.15 inches (182 mm)	Pune, Maharashtra, India	4 October 2010
2 hours	3.94 inches (100 mm)	Pithoragarh, Uttarakhand, India	1 July 2016

On 26 July 2005,

- 1-hour highest rainfall at Mumbai Scz (Santacruz): 190.3 mms (3.30 to 4.30 pm)
- 3-hour highest rainfall at Mumbai Scz: 381 mms (2.30 pm to 5.30 pm)
- 6-hour highest rainfall at Mumbai Scz: 648.4 mms (2.30 pm to 8.30 pm)

On July 18, 2009, 245 millimeters (9.6 in) of rainfall occurred in just 4 hours in Karachi, which caused massive flooding in the metropolis city.

On October 20, 2021, a cloudburst occurred above Pethanaickenpalayam town of Salem district, Tamil Nadu. This resulted in 213 mm rain in a single day.

On December 2, 2015, the city of Chennai recorded 494 mm rains eventually causing 2015 South India floods.

A rainfall of 2.47 inches (63 mm) in 3 minutes was registered by an automatic rain gauge at Porto Bello, Panama, on November 29, 1911, and one of 1.50 inches (38 mm) in 1 minute was registered at the Barot rain gauge near Les Abymes, Guadeloupe, **on November 26, 1970**.

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Commonly used bilingual English/Hindi administrative decisions

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SN	English – अंग्रेजी	Hindi – हिंदी
01.	above mentioned	उपर्युक्त
02.	above said	उपर्युक्त
03.	acceptance is awaited	स्वीकृति की प्रतीक्षा है
04.	acknowledgement is awaited	पावती की प्रतीक्षा है
05.	acknowledge receipt	पावती भेजें
06.	action may be taken as proposed	यथा प्रस्तावित कार्रवाई की जाए
07.	advance increment	अग्रिम वृद्धि
08.	all concerned may note	सभी संबंधित नोट करें
09.	approved as proposed	यथाप्रस्ताव अनुमोदित
10.	as amended	यथा संशोधित
11.	as an exceptional case	अपवाद के रूप में
12.	benefit of doubt	संदेह लाभ
13.	brief note is placed below	संक्षिप्त नोट नीचे रखा है
14.	call for an explanation	जवाब तलब किया जाए
15.	carry out	पालन करना
16.	charge handed over	कार्यभार सौंप दिया
17.	Dear Sir/Dear Madam	प्रिय महोदय/महोदया
18.	delay regretted	विलंब के लिए खेद है।
19.	dispose of	निपटाना
20.	draft for approval	अनुमोदनार्थ मसौदा
21.	final concurrence is accorded	अंतिम सहमति दी जाती है
22.	for approval	अनुमोदनार्थ
23.	for consideration	विचारार्थ
24.	for early compliance	शीघ्र अनुपालन के लिए

25.	forwarded and recommended	अग्रेषित एवं संस्तुत
26.	for further action	आगे की कार्रवाई हेतु
27.	forwarding letter	अग्रेषण पत्र
28	for onward transmission	आगे भेजने के लिए
29.	further orders will follow	आगे आदेश भेजे जाएंगे
30.	Granted	प्रधानित
31.	I agree with 'A' above	मैं ऊपर 'क' से सहमत हूँ।
32.	I am directed	मुझे निदेश हुआ है
33.	in accordance with	के अनुसार
34.	in addition to	के अतिरिक्त
35.	in connection with	के संबंध में
36.	In consultation with	से परामर्श करके
37.	joining report	कार्यग्रहण रिपोर्ट
38.	job specification	कार्य विनिर्देश
39.	judicial process	न्यायिक प्रक्रिया
40.	justifiable	न्यायोचित
41.	key note address	आधार व्याख्यान
42.	know how	तकनीकी जानकारी
43.	labour charges	मज़दूरी
44.	lack of knowledge	ज्ञान का अभाव
45.	Launch	प्रारंभ करना, प्रमोचन
46.	leave and license	इज़ाजत और अनुज्ञप्ति
47.	leave encashment	छुट्टी नक़दीकरण
48.	medical reimbursement	चिकित्सा व्यय प्रतिपूर्ति
49.	meeting in camera	बंद कमरे में बैठक
50.	memorandum of understanding	समझौता ज्ञापन
51.	necessary action	आवश्यक कार्रवाई
52.	noting and drafting	टिप्पणी एवं मसौदा
53.	note sheet	टिप्पणी पत्रक
54.	office hour	कार्यालय समय
55.	office memorandum	कार्यालय ज्ञापन

56.	officiating arrangement	स्थानापन्न व्यवस्था
57.	passed for payment	भुगतान के लिए पारित
58.	permitted	अनुमत / अनुमतिप्राप्त
59.	Perusal	अवलोकन / देखना
60.	physical verification	प्रत्यक्ष सत्यापन
61.	presentation	प्रस्तुतीकरण
62.	proper channel	उचित माध्यम
63.	Recommendation	सिफारिश
64.	Recommended	सिफारिश की गई
65.	renewal	नवीकरण
66.	top priority	परम अग्रता
67.	tour programme	दौरा कार्यक्रम
68.	Transfer	स्थानांतरण करना
69.	Transferred	तबादला
70.	travelling allowance	यात्रा भत्ता
71.	under consideration	विचाराधीन
72.	valuation	मूल्यांकन
73.	undertaking	वचनबंध, उपक्रम
74.	working knowledge	कार्यसाधक ज्ञान
75.	write off	बट्टे खाते में डालना

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IMSP News

1. Annual Monsoon Workshop (AMW)-2022, and National Symposium on "Challenges in Climate Services for Health Sector in a Warming Environment" - *Inputs from Divya Surendran, Somnath Mahapatra and Aparna Khedkar*

In March 2023, IMSP held its Annual Monsoon Workshop 2022 and National Symposium on "Challenges in Climate Services for Health Sector in a Warming Environment" at the Meghdoot Auditorium of the India Institute of Tropical Meteorology in Pune. The event attracted over 400 participants from various regions of India, as well as numerous organizers and volunteers. The event was sponsored by a variety of organizations, including IITM, MoES, NCPOR, IMS NC, SGS, Vaisala, Microsteps, Astra Microwave Private Ltd, ONGC, Azista Industries Private Ltd, Suzlon, and CDAC. On March 28, 2023, the **Annual Monsoon Workshop (AMW-2022)** held three scientific sessions to delve into various aspects related to the monsoon season. The first session focused on discussing the observed features and predictions of the South-West and North-East monsoons, while the second session highlighted the sectoral applications of monsoon predictions in fields such as Agriculture, Hydrology, and Oceanography. The third session of the workshop centred around the advancements in Numerical Weather Predictions. Throughout the event, 14 lectures were presented to the attendees. Moreover, during the inauguration function of the workshop, IMSP recognized and honoured the contributions of scientists, students, and citizens who have made significant contributions to the field of meteorology and climate science.

The National Symposium on "Challenges in Climate Services for the Health Sector in a Warming Environment" successfully brought together scientists and experts from both Climate and Health backgrounds (including animal and plant health) to discuss common challenges. The symposium, held on March 29-30, 2023, consisted of six sessions and received 100 abstracts, which were divided into six themes and classified into oral and poster presentations. Of these, 43 abstracts were chosen for oral presentations, while the remaining abstracts were presented as posters during morning and afternoon tea breaks over the two-day event. The symposium provided an excellent opportunity for the research students and early career scientists to present their work in front of senior and expert delegates, and prizes were awarded for the best oral and poster presentations by a panel of judges. In addition to the presentations by the participants, keynote lectures and invited talks were given by 16 expert delegates from renowned organizations. All the abstracts were compiled into a proceedings volume, which was released by the chief guest during the symposium's inauguration function and uploaded to the IMSP website (https://www.imdpune.gov.in/imsp/). On March 30, 2023, there was a one-hour media interaction session also, which was attended by journalists from Pune city and some who joined online. This session was helpful for operational meteorologists and journalists to better report and communicate weather/climate forecasts and information. Overall, the events were highly appreciated by the participants. On 29th March 2023 evening, a cultural program was organized, focusing on Lok-Geet of Maharashtra, cultural songs & filmy songs, including Abhang praising Lord Vitthal (Shree Vishnu) & Gondal (Meddly in Marathi) of Maharashtrian culture, Hindi/Urdu Gazal, Fusions of famous A. R. Rahman and some Bollywood popular hit songs.

2. Media Workshop on Southwest Monsoon 2023, jointly organized by CRS, IMD, Pune and IMSP on 1st June 2023 - *Inputs from Divya Surendran and Somnath Mahapatra*

The Climate Research and Services (CRS), India Meteorological Department (IMD) Pune, in collaboration with Indian Meteorological Society Pune chapter (IMSP) organized a media workshop on 1st June 2023 (during 2 pm to 5 pm), at Map Discussion Hall of CRS, IMD, Shivajinagar, Pune. This workshop focused on “Enhancing Weather Reporting and Climate Communication” and aimed at strengthening the role of the press and media in disseminating accurate and timely weather and climate information. Several Journalists / reporters from different press & media from Pune and Maharashtra, and scientists from IMD and IMSP attended the workshop. The timing of the workshop was relevant as the Southwest Monsoon was likely to commence in a few days, which was holding immense significance for the country including Maharashtra. Recognizing the importance of accurate and timely communication during this period, the workshop highlighted each other’s role in exchange of weather updates and climate forecasts to all the users and society. Key highlights of the workshop included:

- Discussions on the long-range forecast of Monsoon 2023 and Maharashtra state.
- Discussions on latest initiatives by IMD in weather forecasting services and it’s dissemination; IBF, Weather Apps, Observational network etc.
- Strengthening the interactions of media professionals in engaging discussions, exchange ideas, and network with experts in the field of meteorology.

The schedule of the workshop was as follows:

14.00-14:15:	Welcome address by Sh. K. S. Hosalikar, Head CRS IMD & IMSP Chairman
14:15-14:30:	Introduction of all participants & their welcome with roses
14.30-14.45:	“Long range forecast of SW monsoon 2023” by Dr O. P. Sreejith/ Dr Satyaban B. Ratna
14.45-15.00:	“New initiatives (by IMD) in weather forecasting, like Impact based forecast (IBF), etc.” by Dr Anupam Kashyapi/ Dr S. D. Sanap
15.00-15.15:	“Observational Network over Maharashtra and other initiatives” by Sh. Anjit Anjan
15.15-15.30:	“Rainfall statistics for Pune and Maharashtra” by Dr. Rajib Chattopadhyay / Dr. Divya Surendran
15.30-16.00:	Presentations from media participants
16.00-16.30:	Discussions, followed by High Tea and Group Photograph

All members of the media were invited to actively participate in this workshop and take advantage of this valuable opportunity to interact with experts in the field of meteorology. Their participation contributed to the improved understanding and effective dissemination of crucial weather and climate information to the public. Further, this interaction also enhanced our understanding of the media's specific weather-related requirements. Along with the media persons & scientific experts of IMD, the IMSP Executive Council members, Mr. S. M. Jamadar (NEC member, IMS) and Sh. S. Mahapatra (BIMSP Managing Editor) participated in this workshop.

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Information for becoming a member

Scientists, researchers, students and persons interested in Meteorology/Atmospheric Sciences/Allied Sciences, can become a member of Indian Meteorological Society (IMS).

The detailed information for becoming a member of IMS is available at,

https://imetsociety.org/become-member/

or by scanning this QR Code,

Indian Meteorological Society, Pune Chapter (IMSP)

(A Scientific Society registered under Govt. of India, New Delhi)

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