

INSTITUTE FOR ADVANCED  
RESEARCH IN SCIENCE

WORKSHOP ON ATMOSPHERIC SATELLITES FOR ASIAN  
MONSOON CLOUD-PRECIPITATION SCIENCE AND  
APPLICATIONS

# WASAMSA 2022

21-24 JUNE



Institute for Advanced Research in Science  
IARSc, Bangalore, India

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*Workshop on Atmospheric Satellites for Asian Monsoon  
cloud-precipitation Science and Applications (WASAMSA)*

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<https://events.iarsc.in>

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*will be held Online during 21-24 Jun 2022*

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Programme Document

**June 21-24 2022**

# Preface

The '**Workshop on Atmospheric Satellites for Monsoon cloud-precipitation Science and Applications**', known as WASAMSA2022, is a first of its kind workshop on Satellite missions and Scientific projects/programmes of India and international in the area of Atmospheric Sciences. The emphasis of the workshop is to make an assessment and evaluate our present understanding of cloud and precipitation systems in the Asian monsoon region and to identify gap areas for further research recommendations.

Many participating senior scientists are mission directors and chief investigators of Satellite missions and Science projects. International participation is from JAXA, NASA, CNRS, NOAA, University of Reading, UK, Kyoto University, Japan, UCAR, USA, The University of Tokyo, Japan, Dokkyo University, Japan, Chiba University, Japan, University of Toulouse, France. National participation is from IARSc, ISRO (ISRO Hq, NRSC, SPL-VSSC, SAC, PRL, IIST), MOES (IMD, IITM, NCMRWF), SERB, IISc, IIT Bombay, IIT Kharagpur.

About 50 Young scientists are participating and speaking in the workshop.

**“Professor Roddam Narasimha Best Research Award”** will be conferred on an young scientist for best research work and presentaiont.

WASAMSA2022 aims to add a New Dimension to Space-Based Observations profiling Cloud and Precipitation simultaneously.

Kusuma G Rao  
Director, IARSc

### **List of Participating organizations:**

- Institute for Advanced Research in Science (IARSc)
- Indian Space Research Organization (ISRO)
- Ministry of Earth Sciences (MOES)
- Japan Aerospace Exploration Agency (JAXA), Japan
- NASA Goddard Space Flight Center, Maryland, USA
- Indian Institute of Science (IISc)
- Indian Institute of Technology Bombay (IIT-Bombay)
- India Meteorological Department (IMD)
- Department of Meteorology, University of Reading, UK
- Indian Institute of Tropical Meteorology (IITM)
- Indian Institute of Technology Kharagpur (IIT- Kharagpur)
- Dokkyo University, Japan
- Chiba University, Japan
- National Remote Sensing Centre, (NRSC)
- Kyoto University, Japan
- Physical Research Laboratory
- The University of Tokyo, Japan
- National Center for Scientific Research, France
- NOAA's Atlantic Oceanographic and Meteorological Laboratory, USA
- Science and Engineering Research Board, Ministry of Science and Technology
- National Centre for Medium Range Weather Forecasting' (NCMRWF), Ministry of Earth Sciences
- Indian Institute of Space Science and Technology, Department of Space
- Laboratoire d'Aerologie, University of Toulouse/CNRS, France – Observatoire Midi-Pyrenees

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*CONTACT:*

*Dr. Kusuma G. Rao, Chairperson. WASAMSA2022 and Director, IARSc, Bangalore  
kusuma@iarsc.in, Mob: +91 8792449294*

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## **Organizing committee, WASAMSA2022**

**Dr D Jagadheesha**

**Deputy Director, Science Programme Office, ISRO Hq, Bangalore**

**Sujith Kumar**

**Member, Founding Council, IARSc, Bangalore & Managing Director, Reprise Digital, Malaysia**

**B S Raju**

**Software Consultant, IARSc, Bangalore**

**Dishi P. Thomas**

**Programme Manager, IARSc, Bangalore**

**Naveen Narayan**

**Digital Consultant, IARSc, Bangalore & Director, Media Bracket Private limited**

**Mr. Manu Gowda**

**Project Associate, Mithra Increst Private Limited, Bangalore**

**Rounaq Goenka**

**Scientist/Engineer SD, Land and Atmospheric Physics Division (LAPD), Climate Studies Group (CSG), ECSA, NRSC, Hyderabad, India**

## **I. Introduction:**

The Asian monsoon largely impacts agricultural production and hence economy of the countries under the influence of monsoon. On the other hand, the devastation due to extreme rain events is incredible in terms of loss of human life and infrastructure. Thus it is important to understand characteristics of precipitation systems and unravel the underlying processes to improve rainfall prediction. The Mesoscale Convective Systems (MCSs) are the building blocks of the Indian monsoon and precipitation systems observed over the Indian region (e.g., thunderstorms, extreme rain events, depressions and cyclones). Continuous measurements made in the past with ground and space-based platforms resulted in a wealth of observations. These data have significantly improved our understanding of precipitation organization in monsoons, cloud processes in precipitation systems and cloud microphysics.

The main objective of **WASAMSA** is to make an assessment and evaluate our present understanding of cloud and precipitation systems in the Asian monsoon region and to identify gap areas for further research recommendations.

*This Interactive Workshop will include Plenary and Invited talks by speakers of eminence and excellence on various satellite missions of ISRO, JAXA, NASA and ESA (such as, EOS-1, RISAT series, ScatSat-1, INSAT-3DR, Megha-Tropiques, OCEANSAT, TRMM, GPM, CloudSat, TROPICS, IRNSS series, GLONASS, COSMIC), National Research Programmes in Weather and Climate, WCRP new strategic plan, and on Atmosphere-Land-Ocean processes relevant to the monsoons, energy and water cycle, clouds and convection.*

*Oral presentations will be organized during the workshop by Identified Young scientists.*

### **Workshop themes are:**

1. Precipitation measurements using ground and space-based platforms
2. Regional and global precipitation characteristics
3. Science of precipitation systems of the Asian region
4. Cloud convection and precipitation
5. Cloud microphysics and cloud-resolving models
6. Mesoscale Convective Systems and Precipitation
7. Rainfall modelling/prediction with numerical models

# International Advisory Committee

**Shri A. S. Kiran Kumar**

**Chairman, International Advisory Committee, WASAMSA2022.**

**Vikram Sarabhai Professor, ISRO, Bangalore**

**Members, International Advisory Committee, WASAMSA2022**

**Dr. Somanath S**

**Secretary, Department of Space and Chairman, ISRO**

**Dr. M. Ravichandran**

**Secretary to Government of India, Ministry of Earth Sciences**

**Dr. Kusuma G Rao**

**Director, Institute for Advanced Research in Science, Bangalore**

**Dr. Riko Oki**

**Deputy Director, Earth Observation Research Center, Japan Aerospace Exploration Agency (JAXA), Japan.**

**Dr. Scott Braun**

**Project Scientist for GPM, AOS, and TROPICS.**

**Laboratory for Mesoscale Atmospheric Processes, NASA Goddard Space Flight Center, Greenbelt, MD**

**Prof. Pendyala Balarama Rao**

**Distinguished Faculty for Research, IARSc , Bangalore**

**Dr. Theodore (Ted) G. Shepherd FRS**

**Grantham Professor of Climate Science, Department of Meteorology, University of Reading**

**Dr. B. N. Suresh**

**Chancellor, Indian Institute of Space science and Technology, Thiruvananthapuram and Honorary Distinguished Professor at ISRO HQ, Bangalore.**

**Dr. S. N. Omkar**

**Adjunct faculty, IARSc, Bangalore and Chief Research Scientist (CRS) at the Indian Institute of Science, Bengaluru.**

# Workshop Programme Committee

**Dr. Kusuma G Rao**

Director, Institute for Advanced Research in Science, Bangalore

**Prof. Kenji Nakamura**

Department of Economics on Sustainability, Faculty of Economics in Dokkyo University, Japan

**Dr. Takuji Kubota**

Senior Researcher, Earth Observation Research Center, GPM Program Scientist & EarthCARE Mission Scientist, Japan Aerospace Exploration Agency, Japan

**Dr. Krishnan Raghavan**

Scientist-G & Executive Director, Centre for Climate Change Research (CCCR), Indian Institute of Tropical Meteorology (IITM), Pune, India

**Dr. Rajeev Kumar Mehajan**

Scientist "G" & Advisor, Science and Engineering Research Board, Ministry of Science and Technology, New Delhi

**Dr. Y. V. N. Krishna Murthy**

Senior Professor and Registrar, Indian Institute of Space Science and Technology (IIST), Thiruvananthapuram

**Dr. Ashis Kumar Mitra**

Head of 'National Centre for Medium Range Weather Forecasting' (NCMRWF), Ministry of Earth Sciences, Government of India.

**Dr. Tirtha Pratim Das**

Director, Science Programme Office, ISRO Headquarters, Bangalore, India.

**Prof. Yukari N. Takayabu**

Vice Director, Professor, Atmosphere and Ocean Research Institute, The University of Tokyo, Japan

**Prof. Subimal Ghosh**

Professor, Department of Civil Engineering, Convener, Interdisciplinary Program in Climate Studies, Indian Institute of Technology Bombay.

**Prof. V Venugopal**

Centre for Atmospheric and Oceanic Sciences (CAOS), Indian Institute of Science (IISc), Bangalore, India

**Dr. M. V. Ramana**

Head, Land and Atmospheric Physics Division (LAPD), Earth and Climate Sciences Area (ECSA), National Remote Sensing Centre (NRSC), Hyderabad, India.

# Workshop Distinguished Speakers

## Plenary Speakers

### **Dr. Scott Braun**

**Project Scientist for GPM, AOS, and TROPICS. Laboratory for Mesoscale Atmospheric Processes, NASA Goddard Space Flight Center, Greenbelt, MD**

### **Dr. Theodore (Ted) G. Shepherd FRS**

**Grantham Professor of Climate Science, Department of Meteorology, University of Reading**

### **Prof. Kenji Nakamura**

**Department of Economics on Sustainability, Faculty of Economics in Dokkyo University, Japan**

### **Dr. Thara Prabhakaran**

**Project Director and Scientist**

**Cloud Aerosol Interaction and Precipitation Enhancement Experiment (CAIPEEX) /Physics and Dynamics of Tropical Clouds  
Indian Institute of Tropical Meteorology, Pune**

### **Dr. Raj Kumar**

**Former Director, National Remote Sensing Centre, ISRO, Hyderabad**

### **Dr. Suryachandra Rao**

**Senior-scientist, Indian Institute of Tropical Meteorology, Pune**

### **Dr. Prakash Chauhan**

**Director, National Remote Sensing Centre, ISRO, Hyderabad**

### **Prof. Richard Anthes**

**President Emeritus, University Corporation for Atmospheric Research (UCAR), Boulder, Colorado, USA**

# Invited Speakers

## **Prof. Shoichi Shige**

Associate Professor, Division of Earth and Planetary Sciences, Graduate School of Science, Kyoto University, Japan

## **Prof. Yukari N. Takayabu**

Vice Director, Professor, Atmosphere and Ocean Research Institute, The University of Tokyo, Japan

## **Dr. Mrutyunjay Mohapatra**

The Director General of Meteorology, India Meteorological Department, New Delhi

## **Dr. Rémy Roca**

Directeur de Recherche with CNRS, France

## **Dr. Sundararaman G. Gopalakrishnan**

Senior meteorologist, NOAA's Atlantic Oceanographic and Meteorological Laboratory, Miami, Florida, USA

## **Dr. Takuji Kubota**

Senior Researcher, Earth Observation Research Center, GPM Program Scientist & EarthCARE Mission Scientist, Japan Aerospace Exploration Agency, Japan

## **Dr. Jean-Pierre Chaboureau**

Laboratoire d'Aerologie, University of Toulouse/CNRS, France

## **Dr. Parthasarathi Mukhopadhyay**

Scientist F, Indian Institute of Tropical Meteorology (IITM), Pune, India

## **Dr. Neerja Sharma**

Scientist-SF, Space Applications Centre, ISRO, Ahmedabad.

## **Dr. Higuchi Atsushi**

Center for Environmental Remote Sensing (CEReS), Chiba University, Japan

## **Dr. K. Kishore Kumar**

Head, The Atmospheric Dynamics Division, Space Physics Laboratory, Vikram Sarabhai Space Centre, Trivandrum

## **Dr. B. Amudha**

Scientist-E & Head, Aerodrome Meteorological Office, Regional Meteorological Centre, IMD Chennai

**Prof. Srikanthan Ramachandran**

Senior Professor, Space and Atmospheric Sciences Division Physical Research Laboratory, Ahmedabad, India.

**Dr. Prasad K. Bhaskaran**

Professor, Department of Ocean Engineering & Naval Architecture IIT Kharagpur, Kharagpur, India

**Dr. Rajendra Kumar Jenamani**

Head, Marines Met Services of IMD, New Delhi

**Dr. Pradeep Kumar Thapliyal**

Head, The Geophysical Parameters Retrieval Division. SAC, Ahmedabad, India

## **Lead Talks by**

**Dr. Kusuma G Rao**

Director, Institute for Advanced Research in Science, Bangalore

**Dr. Krishnan Raghavan**

Scientist-G & Executive Director, Centre for Climate Change Research (CCCR) Indian Institute of Tropical Meteorology (IITM), Pune, India

**Dr. Ashis Kumar Mitra**

Head of 'National Centre for Medium Range Weather Forecasting' (NCMRWF), Ministry of Earth Sciences, Government of India.

**Prof. Subimal Ghosh**

Professor, Department of Civil Engineering, Convener, Interdisciplinary Program in Climate Studies, Indian Institute of Technology Bombay.

**Prof. V Venugopal**

Centre for Atmospheric and Oceanic Sciences (CAOS)  
Indian Institute of Science (IISc)

**Dr. M. V. Ramana**

Head, Land and Atmospheric Physics Division (LAPD), Earth and Climate Sciences Area (ECSA), National Remote Sensing Centre (NRSC), Hyderabad, India.

## Special Sessions Speakers

Sl No	Speaker Name	Affiliation
1.	Dr. J. Indu	Department of Civil Engineering, IIT Bombay, Powai, India
2.	Dr. Ayantika Dey Choudhury	Centre for Climate Change Research, IITM, Pune, India
3.	Mr. Arulalan T.	Numerical Weather Prediction Division, IMD, New Delhi, India
4.	Dr. Bushair M. T.	Numerical Weather Prediction (NWP) Division, IMD, New Delhi, India
5.	Dr. Anoop Mishra	SATMET Division, DGM Office, IMD, New Delhi, India
6.	Dr. S. D. Sanap	Climate Research and Services, IMD, Pune, India
7.	Dr. Satya Prakash	National Satellite Meteorological Centre, IMD, New Delhi, India
8.	Dr. Moeka Yamaji	Earth Observation Research Center, Japan Aerospace Exploration Agency, Tsukuba, Japan
9.	Dr. Hitoshi Hirose	Japan Aerospace Exploration Agency, Japan
10.	Dr. Gayatri Kulkarni	IITM, Pune, India
11.	Dr. Krishna Kishore Osuri	Department of Earth and Atmospheric Sciences, NIT Rourkela, Odisha, India
12.	Mr. Pradeep Kushwaha	Centre for Atmospheric & Oceanic Sciences and Divecha Centre for Climate Change, IISc, Bangalore, India
13.	Mr. Pritam Jyoti Borah	Centre for Atmospheric & Oceanic Sciences and Divecha Centre for Climate Change, IISc, Bangalore, India
14.	Ms. Shivalli Verma	Earth and Climate Sciences Area, NRSC, ISRO, Hyderabad, India.
15.	Mr. Rounaq Goenka	Earth and Climate Sciences Area, NRSC, ISRO, Hyderabad, India.
16.	Dr. Kandula V. Subramanyam	Earth and climate Science Area, NRSC, ISRO, Hyderabad, India

17. Dr. Bidyut Bikash Goswami Yonsei University, Seoul, South Korea
18. Dr. Sudarsan Bera Indian Institute of Tropical Meteorology, Pune, India
19. Dr Charu Singh Marine and Atmospheric Sciences Department, Indian Institute of Remote Sensing, ISRO, Dehradun, India
20. Rojan Lamichhane Central Department of Hydrology and Meteorology, Tribhuvan University, Kathmandu, Nepal

### Participating Scientists

Sl No	Name	Designation	Affiliation
1.	Dr. Cuba P	Associate Scientist	ICRISAT, India
2.	Ms. Preeti Awas	Scientific assistant	IMD, Dehradun, India
3.	Ms. Meera M Nair	Junior Research Fellow	CUSAT, Kochi, India
4.	Dr. L Gnanappazham	Asso. Professor	IIST, Trivandrum, India
5.	Ms. Sayanee Haldar	Student	National Institute of Technology, Rourkela, India
6.	Mr. Ajit Kumar Mandal	Assistant Professor Cum-Junior Scientist	Dr. Kalam Agricultural College, Kishanganj, Bihar, India
7.	Ms. Angel Anita Christy	Junior Research Fellow	ACARR, CUSAT, Kochi, India
8.	Mr. Tulshidas Mahadeoji Jibhakate	Research Scholar	Visvesvaraya National Institute of Technology, Nagpur, India
9.	Mr. Utkarsh Verma	Junior Research Fellow	IITM, Pune, India
10.	Ms. Surya Santhosh V.	Student	CUSAT, Kochi, India
11.	Mr. Sai Krishna V. S. Sakuru	Scientist SE	NRSC, Hyderabad, India
12.	Dr. Rekha Bharali Gogoi	Scientist SE	NESAC, Meghalaya, India
13.	Ms. Mercy Verghese	Student	IITM, Pune, India

14.	Mr. Rafiuddin Mohammad	Student	JNCASR, Bangalore, India
15.	Mr. Karthik Venkataraman	Research Scholar (Senior)	Madurai Kamraj University, Madurai, India
16.	Mr. Sumesh R K	Scientist	National Centre for Earth Science Studies, Thiruvananthapuram, India
17.	Dr. Leena P. P.	Scientist	IITM, Pune, India
18.	Mr. Suryadev Pratap Singh	Student	JNCASR, Bangalore, India
19.	Mr. Swarnendu Bhattacharya	Junior Research Fellow	Banaras Hindu University, Varanasi, India
20.	Rona Maria Sunil	Junior Research Fellow	ACARR, CUSAT, Kochi, India
21.	Anindita Dasgupta	Student	Fergusson college, Autonomous
22.	Dr. Sujata K Mandke	Scientist	IITM, Pune, India
23.	Mihir Hareshbhai Prajapati	Graduate Research Assistant	University at Albany, State University of New York, USA
24.	Prabhath H Kurup	Research Scholar	ACARR, CUSAT, Kochi, India
25.	Mr Prajwal K	Junior Research Fellow	ACARR, CUSAT, Kochi, India
26.	Avinash Paul	Research Scholar	CUSAT, Kochi, India
27.	Ms Ipshita Bhasi	PhD student	NIT Rourkela
28.	Dr. Subhadeep Halder	Assistant Professor	Banaras Hindu University, Varanasi, India

## Inaugural Programme

INSTITUTE FOR ADVANCED  
RESEARCH IN SCIENCE



INAUGURAL PROGRAMME

# WASAMSA 2022

THE RITZ-CARLTON, BENGALURU  
21 JUNE

LIGHTING THE LAMP & WELCOME. 9:30 AM

OPENING REMARKS. 9:45 AM  
- BY DR. KUSUMA G RAO

ADDRESS- IARSC OUTREACH PROGRAMME. 10:00 AM  
- BY DR. B N SURESH

INAUGURAL ADDRESS- SATELLITE OBSERVATIONS FOR  
WEATHER AND CLIMATE APPLICATIONS. 10:15 AM  
- BY DR. M RAVICHANDRAN

KEYNOTE ADDRESS- OBSERVING ATMOSPHERE FROM SPACE:  
ISRO'S CONTRIBUTION. 10:30 AM  
- BY DR. KIRAN KUMAR

VOTE OF THANKS. 10:50 AM  
- BY MR. SUJITH KUMAR

HIGH TEA: 11:00 AM

## Workshop Programme

### Workshop on Atmospheric Satellites for Asian Monsoon cloud-precipitation Science and Applications WASAMSA2022 Programme: DAY-1 June 21 2022

<b>1. Inaugural Function (Hybrid)</b>		09:00-11:00 hrs
<b>High Tea</b>		11:00-12:00 hrs
<b>2. Day-1 Online Session 1</b>		
Chairpersons:		
Dr Ajith Tyagi, Former DGM, IMD, New Delhi, India		
Prof Maithili Sharan Emeritus Professor, Center for Atmospheric Sciences, IIT Delhi, India		
L1	Lead Talk by Dr Kusuma G Rao IARSc, Bangalore, India	Extreme Rain events associated with MCSs of the Indian summer monsoon 12:30-12:50 hrs
L2	Lead Talk by Dr R Krishnan IITM, Pune, India	Hydrological cycle of the Indian summer monsoon 12:50-13:10 hrs
<b>3. Day-1 Online Session 2</b>		
Chairpersons:		
Prof P B Rao Distinguished Faculty for Research, IARSc, Bangalore, India		
Dr Kusuma G Rao, Director, IARSc, Bangalore, India		
P1	Plenary Talk by Prof Kenji Nakamura Dokkyo Univ, Japan	The progress from TRMM to GPM – Science to Applications 13:10-13:30 hrs
<b>Lunch Break</b>		
P2	Plenary Talk by Dr Takuji Kubota JAXA, Japan	Global Precipitation Measurement (GPM) mission in Japan: Overview, Achievements & Current status 14:30-14:50 hrs
<b>4. Day-1 Online Special Session-1</b>		14:50-16:00 hrs
Chairpersons		
Dr D Jagadheesha Deputy Director, SPO, ISRO Hq, Bangalore, India		
Dr M V Ramana Head, LAPD, ECSA, NRSC, Hyderabad, India		
Oral presentation by young scientists (10 mins each)		14:50-16:00 hrs
SS-1	J. Indu, Department of Civil Engineering, IIT Bombay, India	

	Scale issues in robust satellite constellations for precipitation measurement		
SS-2	Dr. Satya Prakash, National Satellite Meteorological Centre, IMD, New Delhi, India		
	How accurate are satellite-based precipitation products over the Indian region?		
SS-3	Dr. Moeka Yamaji, Earth Observation Research Center, Japan Aerospace Exploration Agency, Tsukuba, Japan		
	A Climatological Study on Precipitation Microphysical Characteristics over Asian Monsoon Region using GPM/DPR		
SS-4	Dr. Hitoshi Hirose, Japan Aerospace Exploration Agency, Japan		
	A correction method for improving GSMaP precipitation overestimation bias in the tropics		
<b>Coffee Break</b>			16:00-16:30 hrs
<b>5. Day-1, Online Session 3</b>			
Chairpersons			
Dr Rajkumar Former Director, NRSC, Hyderabad, India			
Prof V Venugopal Center for Atmospheric and Oceanic Sciences, IISc Bangalore, Bangalore			
P3	Plenary Talk by Dr Pradeep Thapliyal SAC, Ahmedabad, India	ISRO Satellite missions for observing Atmosphere and Ocean	16:30-16:50 hrs
I1	Invited Talk by Dr Takuji Kubota JAXA, Japan	Science with GSMaP	16:50-17:10 hrs
I2	Invited Talk by Dr Neeraja Sharma SAC, Ahmedabad, India	Rainfall measurements from ISRO Satellites & Data products: An overview	17:10-17:30 hrs

**Workshop on Atmospheric Satellites for Asian Monsoon cloud-precipitation  
Science and Applications  
WASAMSA2022  
Programme: DAY-2 June 22 2022**

<b>1. Day-2 Online Session 1</b>			
Chairpersons:			
Dr Krishnan, IITM, Executive Director, Centre for Climate Change Research (CCCR), IITM, Pune, India			
Dr Subimal Ghosh, Professor, Department of Civil Engineering, Convener, Interdisciplinary Program in Climate Studies, IIT Bombay			
L3	Lead talk by Dr Venugopal CAOS, IISc, Bangalore, India	Regional and Global characteristics of precipitation	09:30-09:50 hrs
I3	Invited Talk by Dr. Shoichi Shige	Characteristics of precipitation systems over Asia from a	09:50-10:10 hrs

	Kyoto Univ, Japan	TRMM PR observation data set spanning 16 years	
I4	Invited Talk by Dr Yukari Takayabu The Univ of Tokyo, Japan	Atmospheric Rivers associated rainfall characteristics: Implications on Heavy Rainfall Events based on GPM/TRMM'	10:10-10:30 hrs
P4	Plenary Talk by Dr Scott Braun NASA, USA	NASA's Earth System Observatory: Architecture and Status of the Atmosphere Observing System (AOS)	10:30-10:50 hrs
<b>2. Coffee Break</b>			10:50-11:20 hrs
<b>3. Day-2 Online Session 2</b>			
Chairpersons			
Prof S Ramachandran, Senior Professor, Space and Atmospheric Sciences Division Physical Research Laboratory, Ahmedabad, India			
Dr Manish Naja, Chairman, Atmospheric Science Division, Aryabhata Research Institute of Observational Sciences (ARIES), Nainital, India			
P5	Plenary Talk by Dr Surya Chandra Rao IITM, Pune, India	Monsoon mission: Achievements and challenges in Seasonal monsoon prediction	11:20-11:40 hrs
P6	Plenary Talk by Dr Thara Prabhakaran IITM, Pune, India	CAIPEEX: The science experiment on aerosol-cloud-precipitation interactions- key highlights	11:40-12:00 hrs
<b>4. Day-2, Online Special Session-2</b>			
Chairpersons:			
Dr D Jagadheesha Deputy Director, SPO, ISRO Hq, Bangalore, India			
Dr M V Ramana Head, LAPD, ECSA, NRSC, Hyderabad, India			
Oral presentation by 7 young scientists (10 mins each)			12:00-13:30 hrs 90 minutes
SS-1	Dr. Anoop Mishra, SATMET Division, DGM Office, IMD, New Delhi, India		
	Investigation of Changes in Precipitation Patterns over India using High Resolution Precipitation Estimates from space		
SS-2	Dr. Ayantika Dey Choudhury, Centre for Climate Change Research, IITM, Pune, India		
	On the unprecedented rainfall intensification over Western India during monsoon 2019		
SS-3	Dr. S. D. Sanap, Climate Research and Services, IMD, Pune, India		
	Extended Euro-Atlantic Blocking and Precipitation Extremes Over Indian Region During Boreal Winter		
SS-4	Ms. Shivalli Verma, Earth and Climate Sciences Area, NRSC, ISRO, Hyderabad, India.		

	Can cloud top temperature observations from satellites indicate heavy rainfall events? A case study over Hyderabad – Part I: Cloud parameters and their importance in detection of heavy rainfall events.		
SS-5	Mr. Rounaq Goenka, Earth and Climate Sciences Area, NRSC, ISRO, Hyderabad, India.		
	Can cloud top temperature observations from satellites indicate heavy rainfall events? A case study over Hyderabad – Part II: Precipitation data retrieval using Doppler Weather Radar and its linkage to cloud properties.		
SS-6	Dr Gayatri Kulkarni, IITM, Pune, India		
	How robust is aerosol invigoration effect over Indian subcontinent?		
SS-7	B. B. Goswami, Irreversible Climate Change Research Center (IRCC), Yonsei University, Seoul, South Korea		
	A shallow-deep unified stochastic mass flux cumulus parameterization		
<b>5. Lunch Break</b>			<b>13:30-14:30 hrs</b>
<b>6. Day-2 Online Session 3</b>			
Chairpersons:			
Dr Kusuma G Rao, Director, IARSc, Bangalore, India			
Dr Krishnan, IITM, Executive Director, Centre for Climate Change Research (CCCR), IITM, Pune, India			
I5	Invited Talk by Dr Remy Roca CNRS, France	Mesoscale Convective Systems and Global water budget	14:30-14:50 hrs
I6.	Invited Talk Dr P Mukhopadhyay IITM, Pune, India	The mechanism of heavy rain over Kerala and global model fidelity of predicting these events	14:50-15:10 hrs
I7	Invited Talk Jean-Pierre Chaboureau University of Toulouse, CNRS, France	Simulating tropical deep convection at convective and turbulence scales: successes and challenges	15:10-15:30 hrs
<b>7. Coffee Break</b>			<b>15:30-16:00 hrs</b>
<b>Day-2 Online Session 4</b>			
Chairpersons			
Dr Thara Prabhakaran, Project Director and Scientist F, CAIPEEX /Physics and Dynamics of Tropical Clouds, IITM, Pune, India			
Dr Rajeev Mehajan, Scientist “G” & Advisor, Science and Engineering Research Board, DST, New Delhi, India			
I8	Invited Talk by Dr. Rajendra Jenamani, IMD, New Delhi, India	Prediction of extreme rain events: Current status & new initiatives	16:00-16:20 hrs
P7	Plenary Talk by Dr Ted Shepherd University of Reading, UK	WCRP lighthouse activities, with a particular focus on My Climate Risk	16:20-16:40 hrs
L4	Lead talk by Dr Subimal Ghosh IIT Mumbai	Global & Regional Climate Change and Climate Services"	16:40-17:10 hrs

**Workshop on Atmospheric Satellites for Asian Monsoon cloud-precipitation  
Science and Applications  
WASAMSA2022  
Programme DAY-3: June 23, 2022**

<b>Day-3 Online Session 1</b>			
Chairpersons:			
Dr K J Ramesh, Former DGM, IMD, New Delhi			
Dr Rajkumar Choudhary, Head, RSIM Section, ITMP Space Physics Laboratory, Vikram Sarabhai Space Center, Trivandrum			
P8	Plenary talk by Dr Richard A. Anthes UCAR, Colorado, USA	Radio occultation observations in the tropics and subtropics- Accuracy of observations in tropical cyclones	09:30-09:50 hrs
I9	Invited Talk by Dr Karanam Kishore Kumar, SPL, VSSC, Trivandrum, India	Characteristics of Deep cloud systems of Indian summer monsoon based CLOUDSAT measurements	09:50-10:10 hrs
I10	Invited Talk by Dr Higuchi Atsushi Chiba University, Japan	Rainfall Estimations from Himawari measurements using the Machine-Learning Method	10:10-10:30 hrs
Coffee Break			10:30-11:00 hrs
<b>Day-3 Online Session 2</b>			
Chairpersons:			
Dr Ashok Karumuri, Centre for Earth, Ocean and Atmospheric Sciences (CEOAS), Univ of Hyderabad, Hyderabad			
Dr P Mukhopadhyay, Scientist, IITM, Pune			
I11	Invited Talk by Prof S Ramachandran, PRL, Ahmedabad, India	Recent aerosol trends over Asia revealed by observations and model simulations	11:00-11:20 hrs
L5	Lead talk by Dr M V Ramana, NRSC, Hyderabad, India	Satellite observations on the causal relationships between Aerosols, Water Vapour and Clouds	11:20-11:40 hrs
<b>Day-3 Online Special Session-3</b>			
Chairpersons:			
Dr D Jagadheesha Deputy Director, SPO, ISRO Hq, Bangalore, India			
Dr M V Ramana Head, LAPD, ECSA, NRSC, Hyderabad, India			
Oral presentation by young scientists (10 mins each)			11:40-13:00 hrs
SS-1	Kandula V Subrahmanyam, Earth and climate Science Area, National Remote Sensing Centre, Hyderabad, India		
	A comprehensive study on the role of dynamics in distribution of various types of clouds in the Indian Monsoon region using CloudSat observations		

SS-2	Mr. Pritam Jyoti Borah, Centre for Atmospheric & Oceanic Sciences, Indian Institute of Science and Divecha Centre for Climate Change, Indian Institute of Science, Bangalore		
	North Atlantic Influence on the Sub-seasonal Variability of Indian Summer Monsoon Rainfall.		
SS-3	Sudarsan Bera, Indian Institute of Tropical Meteorology, Pune, India		
	Statistical and Microphysical Descriptions of Droplets in Monsoon Cumulus Clouds		
SS-4	Dr Charu Singh, Marine and Atmospheric Sciences Department, Indian Institute of Remote Sensing, ISRO, Dehradun, India		
	Response of the Indian summer monsoon system to natural dust aerosols		
SS-5	M. T. Bushair, India Meteorological department (IMD), New Delhi		
	Multi-Model Ensemble Based Districts Level Rainfall Forecasts over India		
SS-6	T. Arulalan, Numerical Weather Prediction Division, India Meteorological Department, Mausam Bhawan, New Delhi and Centre for Atmospheric Sciences, Indian Institute of Technology Delhi, New Delhi		
	Unusual Heavy, Extreme Rainfall Probabilistic Prediction by the Medium-Range Multi-Model Ensembles over Indian States		
<b>Lunch Break</b>			13:00-14:00 hrs
<b>Day-3 Online Special Session-3</b>			
Chairpersons:			
Dr D Jagadheesha Deputy Director, SPO, ISRO Hq, Bangalore, India			
Dr M V Ramana Head, LAPD, ECSA, NRSC, Hyderabad, India			
Oral presentation by young scientists (10 mins each)			14:00-15:00 hrs
SS-7	Rojan Lamichhane, Central Department of Hydrology and Meteorology, Tribhuvan University, Kathmandu, Nepal		
	Simulation of extreme rainfall event in Nepal using Weather Research and Forecasting model		
SS-8	Pradeep Kushwaha, Centre for Atmospheric & Oceanic Sciences and Divecha Centre for Climate Change, Indian Institute of Science, Bangalore, India		
SS-9	Krishna K Osuri, Department of Earth and Atmospheric Sciences, NIT Rourkela, Odisha, India		
	Modeling of Intensity and size changes of tropical cyclones over the Bay of Bengal: Influence of microphysical processes at cloud-resolving resolution		
<b>Coffee Break</b>			15:00-15:30 hrs
<b>Day-3 Online Session 3</b>			
Chairpersons:			
Dr A K Mitra, Director, NCMRWF, New Delhi, India			
Dr Virendra Singh, Former Head of Satellite Meteorology at India Meteorological Department, IMD, New Delhi, India			
P9	Plenary Talk by Dr Rajkumr, SAC, Ahmedabad, India	Scatsat Satellite Mission and its applications	15:30-15:50 hrs

I12	Prof. Prasad K. Bhaskaran, IIT, Kharagpur, India	Early detection of Tropical Cyclogenesis in the Bay of Bengal using Eddy detection techniques	15:50-16:10 hrs
L6	Lead talk by Dr. A K Mitra, NCMRWF, New Delhi, India	Modelling and Data Assimilation for Cyclones of Indian Seas:	16:20-16:40 hrs
I13	Invited Talk by Dr B Amudha IMD, Chennai, India	Precipitation characteristics of Storms of the Indian seas using Doppler weather radar measurements	16:40-17:10 hrs
I14	Invited Talk by Dr S G Gopalkrishna Atlantic Oceanographic and Meteorological Laboratory, Miami, Florida, USA	Advancement in forecasting Tropical Cyclones	17:10-17:30 hrs

**Workshop on Atmospheric Satellites for Asian Monsoon cloud-precipitation  
Science and Applications  
WASAMSA2022  
Programme DAY- 4: June 24, 2022**

<b>Online Panel Discussion on: Can we propose a Satellite mission on profiling cloud and precipitation systems simultaneously?</b>		
1.	Welcome and Announcement of Best Research award	09:30-09:40
2.	Opening remarks by Dr. Kiran Kumar Chairman, WASAMSA2022 Panel discussion Vikram Sarabhai Professor, ISRO, Bangalore, India & Former Chairman, ISRO	09:40-09:55
3.	On the Scope of the workshop by Dr. Kusuma G. Rao, Chairperson, WASAMSA2022 & Director, IARSc, Bangalore, India	09:55-10:10
4.	Views, suggestions and recommendations from Expert Panellists	
	1. Prof. Kenji Nakamura Dokkyo University, Japan	10:10-10:25
	2. Prof P B Rao Distinguished Faculty for Research, IARSc , Bangalore, India	10:25-10:40
	3. Dr R Krishnan Executive Director, CCCR, IITM, Pune, India	10:40-10:55
	4. Dr. Mrutyunjay Mohapatra DGM, IMD, New Delhi, India	10:55-11:10

5.	<p>Views and suggestions by Members, Programme Committee:</p> <ol style="list-style-type: none"> <li>1. <a href="#">Dr. Takuji Kubota</a> Senior Researcher, Japan Aerospace Exploration Agency, Japan</li> <li>2. <a href="#">Dr. Rajeev Kumar Mehajan</a> Scientist G &amp; Advisor, SERB, DST, New Delhi</li> <li>3. <a href="#">Dr. Y. V. N. Krishna Murthy</a> Senior Professor and Registrar IIST, Thiruvananthapuram</li> <li>4. <a href="#">Dr. Ashis Kumar Mitra</a> Head, NCMRWF, MOES, New Delhi</li> <li>5. <a href="#">Dr. Tirtha Pratim Das</a> Director, Science Programme Office, ISRO Hq, Bangalore</li> <li>6. <a href="#">Prof. Yukari N. Takayabu</a> Vice Director, The University of Tokyo, Japan</li> <li>7. <a href="#">Prof. Subimal Ghosh,</a> Indian Institute of Technology, Bombay</li> <li>8. <a href="#">Prof. V Venugopal</a> CAOS, Indian Institute of Science (IISc), Bangalore</li> <li>9. <a href="#">Dr. M V Ramana</a> Head, LAPD, ECSA, NRSC, Hyderabad, India</li> </ol>	11:10-12:10
6.	<p>Views &amp; Suggestions from All Delegates</p> <ol style="list-style-type: none"> <li>1. <a href="#">Dr Ted Shepherd,</a> Grantham Professor of Climate Science, Department of Meteorology, University of Reading, UK</li> <li>2. <a href="#">Dr Scott Braun</a> Project Scientist for GPM, AOS, and TROPICS. Laboratory for Mesoscale Atmospheric Processes, NASA GSFC, Greenbelt, MD</li> <li>3. <a href="#">Prof. Shoichi Shige</a> Division of Earth and Planetary Sciences, Graduate School of Science, Kyoto University, Japan</li> <li>4. <a href="#">Dr. Rémy Roca</a> Directeur de Recherche with CNRS, France</li> </ol>	12:10-13:10

	<p>5. <b>Dr. Sundararaman G. Gopalakrishnan</b> Senior meteorologist, NOAA's Atlantic Oceanographic and Meteorological Laboratory, Miami, Florida, USA</p> <p>6. <b>Dr. Thara Prabhakaran,</b> Project Director and Scientist, CAIPEEX /Physics and Dynamics of Tropical Clouds, IITM, Pune</p> <p>7. <b>Prof. Richard Anthes</b> President Emeritus,  University Corporation for Atmospheric Research (UCAR), Boulder, Colorado, USA</p> <p>8. <b>Dr. Suryachandra Rao</b> Senior-scientist, Indian Institute of Tropical Meteorology, Pune</p> <p>9. <b>Dr Jean-Pierre Chaboureau</b> Laboratoire d'Aerologie, University of Toulouse/CNRS, France</p> <p><b>OPEN TO ALL</b></p>	
7.	Concluding remarks & Final recommendations by Chairman, WASAMSA2022 Panel discussion	13:10-13:30

