



South Asian Meteorological Association (SAMA)
and



Savitribai Phule Pune University (SPPU)

Pune, India

Jointly Organize

Weekly Online Lecture Series on

Atmospheric Dynamics and its Applications to Climate Sciences

South Asian Meteorological Association (SAMA) is an association of 9 South Asian countries including Afghanistan, Bangladesh, Bhutan, India, Maldives, Myanmar, Nepal, Pakistan and Sri Lanka. It is a professional non-profit international scientific society having HQ in India for the promotion of Meteorological and allied sciences and their application for the safety, well-being, and sustainable development of the citizens of the South Asian countries. Established on 3rd August 2020, it has about 700 members (including professionals and students) from the nine South Asian countries, which are increasing day by day. SAMA organizes webinars, training workshops, capacity building programs, special day celebrations like the WMO-Day, Ozone-day, quiz contests for school children, special lectures on the works of the Nobel Laureates, etc. SAMA has conducted 4 online lecture series for 16-20 weeks each in Atmospheric Physics, Weather Research & Forecasting (WRF) modelling, Satellite Meteorology, and Radar Meteorology. About 2000 people from 60 countries across the world have attended the lecture series.

SAMA is organizing the 1st Olympiad on Meteorology, Weather & Climate Sciences for students (class 8 - 11) jointly with IMD, IMS and VVM to commemorate the establishment of 150 years of IMD during 2024-2025

Savitribai Phule Pune University (SPPU), established on February 10, 1949, under the Poona University Act, is a premier educational institution in Maharashtra, attracting students from across India and around the world. The university offers top-tier programs in various disciplines, including science, management, commerce, arts, and languages.

The Department of Atmospheric and Space Sciences at SPPU has emerged as a center of excellence in research and education, producing numerous distinguished atmospheric scientists. Among them is Dr. R.R. Kelkar, former Director General of the India Meteorological Department, who served as the ISRO Chair Professor from 2004 to 2008. The department has a rich legacy of hosting significant events, such as the National Space Sciences Symposium in 1983 and 2019, which have set benchmarks for scientific symposia in India. In 1988, it launched the country's first M.Tech. program in Atmospheric Physics, supported by the UGC for 11 years. Following UGC funding, SPPU partnered with the Indian Institute of Tropical Meteorology to jointly manage the program.

Recognized with the "Best Department of the Year" award in 2021, the department boasts excellent placements, with alumni pursuing Ph.D. programs globally and securing positions in prestigious organizations like NOAA, NASA, the U.K. Met Office, IMD, and IITM, highlighting its leadership in atmospheric sciences.

Atmospheric Dynamics and its Application to Climate Sciences examines the physical mechanisms that propel atmospheric motion and impact weather and climate patterns. With an emphasis on large-scale atmospheric systems including jet streams, cyclones, and anticyclones as well as oscillatory phenomena like the El Niño–Southern Oscillation (ENSO) and the Madden-Julian Oscillation (MJO), the topics cover fluid dynamics, thermodynamics, wave theory, and numerical modelling. In addition, radiative forcing, energy balance, and the crucial function of the atmospheric boundary layer in heat and moisture exchange are all covered in the series. With a focus on the Coriolis effect and thermal wind balance, the course will examine the physics of atmospheric instability, wave propagation, and the impact of planetary rotation on weather systems. From basic theoretical models to complex numerical climate models used for long-term climate projections and weather prediction, advanced seminars will cover atmospheric modelling approaches. The series will also discuss how climatic cycles affect global weather events, drought, and flooding through a thorough examination of atmospheric circulation patterns.

Prerequisite for this course is a fairly good knowledge of Mathematics & Physics. Further, this course is a Prerequisite for learning Numerical Weather Prediction (NWP) and Climate Modelling.

Given the significance of atmospheric dynamics and its applications to climate sciences, **SAMA and SPPU** are collaborating to host a weekly series of online lectures by subject-matter experts on these topics every Saturday from January 18, 2025 to July 12, 2025. Senior scientists, professors, and specialists from reputable institutions in the area will give the lectures. Postgraduate students and research scholars, professionals, and others with non-meteorological backgrounds who are interested in learning more about the topic are the target audience for the lecture modules.

Titles of the modules

Part - A: Basics of Dynamic Meteorology (Modules 1 to 4)

Module – 1: Fundamental Forces, Coordinate System and Equation of Motion

Module – 2: Balanced motion and thermal wind

Module – 3: Continuity equation, Divergence, Vorticity, Kinematics of pressure and wind field

Module – 4: Circulation & vorticity

Part - B: Advanced level Dynamic Meteorology (Modules 5 to 8)

Module – 5: Perturbation technique and atmospheric waves.

Module – 6: Hydro-Dynamic Instability

Module – 7: Dynamical aspects of General circulation

Module – 8: Atmospheric Boundary layer

Advisory Panel and Organizing Committee of the Lecture Series

Sr No.	Advisory Panel	Sr No.	Organizing Committee
1	Prof. U.C. Mohanty (IIT, Bhubaneswar)	1	Dr. Rohini Bhawar, Asst. Professor, SPPU, India
2	Prof. D.V. Bhaskar Rao (Andhra University, Waltair)	2	Dr. Aditi Deshpande, Asst. Professor, SPPU, India
3	Prof. Deepak Aryal (Tribhuvan University, Kathmandu, Nepal)	3	Mr. Ashwin Jadhav, SRF, SPPU, India
4	Prof. Towhida Rashid (University of Dhaka, Bangladesh)	4	Dr. Swagata Payra, Assoc. Professor, BIT, Mesra, India
5	Prof. Pradeep Kumar (Savitribai Phule Pune University, Pune)	5	Dr. T.V. Lakshmi Kumar, Assoc. Professor, JNU, Delhi
6	Prof. S.B. Roy (IIT-Delhi)	6	Dr. Divya Prakash, Asst. Professor, PU, Jaipur, India
7	Dr. S.N. Dutta (IMD, Pune)	7	Dr. Mili Ghosh nee Lala, Asst. Prof., BIT, Mesra, India
8	Dr. M. V. Ratnam (NARL/ISRO, Tirupati)	8	Dr. Poulomi Chakravarty, DST INSPIRE Fellow
9	Prof. C.A. Babu (CUSAT, India)	9	Dr. Mohan Kumar Das, Exec Director, NOAMI, Bangladesh
10	AVM (Retd.) Prof. Ajit Tyagi, President, SAMA	10	Dr. Fatima Akter, Assoc. Professor, University of Dhaka, Bangladesh
11	Prof. (Dr.) Someshwar Das, Secretary, SAMA	11	Dr. Madan Sigdel, Assoc. Professor, Tribhuvan University, Kathmandu, Nepal
		12	Dr. S. Abhilash, Director, ACARR/ CUSAT

Books for Reference:

1. An introduction to Dynamic Meteorology - by J. R. Holton
2. Atmospheric Science -An introductory survey by Wallace and Hobbs
3. Dynamic and physical Meteorology by Haltinar and Martin
4. Ceaseless wind by Dutton
5. Fundamental of atmospheric energetics by Wein Neilson
6. Dynamic Meteorology by Panchev
7. Fundamentals of atmospheric physics by Murry L. Salby

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(Prerequisite for this course is a fairly good knowledge of Mathematics & Physics. Further, this course is a Prerequisite for learning Numerical Weather Prediction (NWP) and Climate Modelling.)

Registration Link: <https://forms.gle/DzoJWsAhUChCiCrn8>

(Tentative Schedule)

Lecture No.	Date	Time	Speaker	Topic	Module
1.	18 Jan 2025	3 - 5 PM IST (UTC + 5:30 hrs)	Prof. U. C. Mohanty, IIT, Bhubaneswar and Prof. P. K. Sen, IMD, SPPU (Retd)	Inauguration & Introductory lecture by an Expert	Applications of Atmospheric Dynamics on weather & climate predictions.
2.	25 Jan 2025	3 - 4 PM IST (UTC + 5:30 hrs) +30min Interaction	Prof. S.B. Roy, CAS, IIT, Delhi	Fundamental Forces, Basics of Vector Algebra & Vector Calculus	Module-1: Fundamental Forces, Coordinate System and Equation of Motion
3.	01 Feb 2025	3 - 4 PM IST (UTC + 5:30 hrs) +30min Interaction	Dr. Akhilesh Mishra, NCMRWF	Vector Equation of Motion in an Absolute and Rotating Frame of Reference	Module-1: Fundamental Forces, Coordinate System and Equation of Motion
4.	08 Feb 2025	3 - 4 PM IST (UTC + 5:30 hrs) +30min Interaction	Prof. D.V. Bhaskar Rao, Andhra University (Retd.)	Component Wise Equation of Motion in a Rectangular Cartesian Co-ordinate, Eulerian	Module-1: Fundamental Forces, Coordinate System and

				and Lagrangian Derivatives	Equation of Motion
5.	15 Feb 2025	3 - 4 PM IST (UTC + 5:30 hrs) +30min Interaction	Prof. P. K. Sen, IMD, SPPU(Retd.)	Concept of Order of Magnitude and Scales of Atmospheric Motion	Module-1: Fundamental Forces, Coordinate System and Equation of Motion
6.	22 Feb 2025	3 - 4 PM IST (UTC + 5:30 hrs) +30min Interaction	Dr. Anandakumar Karipot, SPPU, Pune	Natural Co-ordinate System, Cyclonic and Anti-Cyclonic Gradient Flow	Module-2: Balanced Motion and Thermal Wind
7.	01 Mar 2025	3 - 4 PM IST (UTC + 5:30 hrs) +30min Interaction	Dr. Ravi Nanjundiah, IISc	Hydrostatic Balance, Geopotential, Use of Pressure as a Vertical Co-ordinate, Ageostrophic Wind and Horizontal Acceleration	Module-2: Balanced Motion and Thermal Wind
8.	08 Mar 2025	3 - 4 PM IST (UTC + 5:30 hrs) +30min Interaction	Dr. E.N. Rajagopal, NCRWF	Vertical Variation in Geostrophic Wind, Thermal Wind, Barotropic and Baroclinic Atmosphere	Module-2: Balanced Motion and Thermal Wind
9.	15 Mar 2025	3 - 4 PM IST (UTC + 5:30 hrs)	Dr. Aditi Deshpande, SPPU, Pune	Concept of Divergence and Vorticity, Their Expression in Different Co-ordinate Systems	Module-3: Continuity Equation, Divergence and Vorticity, Kinematics of Pressure and Wind Field
10.	22 Mar 2025	3 - 4 PM IST (UTC + 5:30 hrs) +30min Interaction	Dr. A.K. Sahai, IITM, (Retd.)	Equation of Continuity in Cartesian and Isobaric Co-ordinate System, Dine's Compensation Principle, Concept of Level of Non-Divergence	Module-3: Continuity Equation, Divergence and Vorticity, Kinematics of Pressure and Wind Field

11.	29 Mar 2025	3 - 4 PM IST (UTC + 5:30 hrs) +30min Interaction	Prof. SVS Ramakrishna, Andhra University	Kinematics of Wind Field, Balton's Equation, Trough/Ridge and their Equation with Interpretation	Module-3: Continuity Equation, Divergence and Vorticity, Kinematics of Pressure and Wind Field
12.	05 Apr 2025	3 - 4 PM IST (UTC + 5:30 hrs) +30min Interaction	Prof. C.A. Babu, CUSAT (Retd.)	Stoke's Theorem, Circulation (absolute and relative), Kelvin's Circulation Theorem, Bjerkness Circulation Theorem, Potential Vorticity	Module-4: Circulation and Vorticity
13.	12 Apr 2025	3 - 4 PM IST (UTC + 5:30 hrs) +30min Interaction	Prof. C.A. Babu, CUSAT (Retd.)	Vorticity Equation in Cartesian Co- ordinate, Scale Analysis of Vorticity Equation, Relation Between Cyclonic/ Anti-Cyclonic Vorticity Advection	Module-4: Circulation and Vorticity
14.	19 Apr 2025	3 - 5 PM IST (UTC + 5:30 hrs)	Online Exam on Part-A: Basics of Dynamic Meteorology and Equation of Motion (Module 1 to 4)		
15.	26 Apr 2025	3 - 4 PM IST (UTC + 5:30 hrs) +30min Interaction	Dr. A.K. Sahai, IITM, (Retd.)	Linear Perturbation Theory, Basic Important Parameters for Wave Equation	Module-5: Perturbation Technique and Atmospheric Waves
16.	03 May 2025	3 - 4 PM IST (UTC + 5:30 hrs) +30min Interaction	Dr. Somnath Dutta, IMD	Atmospheric Waves: Haurwitz Wave, Rossby Wave, External and Internal Gravity Waves	Module-5: Perturbation Technique and Atmospheric Waves
17.	10 May 2025	3 - 4 PM IST (UTC + 5:30 hrs)	Dr. Somnath Dutta, IMD	Equatorial Wave Theory, Mixed Rossby Gravity	Module-5: Perturbation Technique

		+30min Interaction		Waves, Kelvin Waves, Vertically Propagating Planetary Waves	and Atmospheric Waves
18.	17 May 2025	3 - 4 PM IST (UTC + 5:30 hrs) +30min Interaction	Dr. Somnath Dutta, IMD	Definition and Categorization of Hydro Dynamic Instability, Brunt – Vaisala Instability	Module-6: Hydro- Dynamic Instability
19.	24 May 2025	3 - 4 PM IST (UTC + 5:30 hrs) +30min Interaction	Dr. Somnath Dutta, IMD	Inertial Instability and Barotropic Instability	Module-6: Hydro- Dynamic Instability
20.	31 May 2025	3 - 4 PM IST (UTC + 5:30 hrs) +30min Interaction	Dr. Somnath Dutta, IMD	Baroclinic Instability	Module-6: Hydro- Dynamic Instability
	07 June 2025	Holiday on account of Bakri Eid			
21.	14 Jun 2025	3 - 4 PM IST (UTC + 5:30 hrs) +30min Interaction	Dr. Somnath Dutta, IMD	Atmospheric Energetics	Module-7: Dynamical Aspects of General Circulation
22.	21 Jun 2025	3 - 4 PM IST (UTC + 5:30 hrs) +30min Interaction	Dr. Md. Abdul Mannan, BMD	Proportionality of Internal and Potential Energy in a Hydrostatic and Stably Stratified Atmosphere.	Module-7: Dynamical Aspects of General Circulation
23.	28 Jun 2025	3 - 4 PM IST (UTC + 5:30 hrs) +30min Interaction	Dr. E.N. Rajagopal, NCRWF	Angular Momentum: Global Angular Momentum Budget Equation	Module-7: Dynamical Aspects of General Circulation
24.	05 July 2025	3 - 4 PM IST (UTC + 5:30 hrs) +30min Interaction	Dr. Anandakumar Karipot, SPPU, Pune	Definition, Turbulent Characteristics, Convective and Mechanical Turbulence, Bousisnesq flow	Module-8: Atmospheric Boundary Layer
25.	12 July 2025	3 - 4 PM IST (UTC + 5:30 hrs) +30min	Dr. Anandakumar Karipot, SPPU, Pune	Governing Equation for Mean Flow in	Module-8: Atmospheric Boundary Layer

		Interaction		the PBL, Concept of Turbulent Eddy Flux Convergence of Momentum, Vertical Eddy	
26.	19 July 2025	3 - 4 PM IST (UTC + 5:30 hrs) +30min Interaction	Prof. C.A. Babu, CUSAT (Retd.)	Mixing Length Theory, Vertical Profile of Mean Horizontal Wind Ekman Layer in Viscous Sublayer	Module-8: Atmospheric Boundary Layer
27.	26 July 2025	3 - 5 PM IST (UTC + 5:30 hrs)	Final Online Exam on Part-A & B (Module 1 to 8)		
28.	02 August 2025	3 - 4 PM IST (UTC + 5:30 hrs)	Valedictory function and feedback from trainees and experts.		