Bio-data

1. Name : **Madhavan Nair RAJEEVAN**

2. Date of Birth **:** **27 July 1961**

3. Present Affiliation **:** **Secretary, Ministry of Earth Sciences**
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6. Education **:** **M.Sc (Physics), Ph.D (Physics)**

7. Important Positions held:

Year	Institution	Position held
December 1983- August 1985	Tata Institute of Fundamental Research (TIFR), Mumbai	Senior Scientific Assistant IR Astronomy Group
September 1985- June 2008	Meteorological Centre Ahmedabad and National Climate Centre, India Meteorological Department, Pune	Meteorologist / Director of the National Climate Centre
July 2008- January 2012	National Atmospheric Research Laboratory, Department of Space, Tirupati	Senior Scientist, Scientist-F
February 2012- 02 March 2015	Ministry of Earth Sciences, Government of India, New Delhi	Scientist-G/Adviser
03 March 2015-06 December 2015	Indian Institute of Tropical Meteorology, Pune	Director
07 December 2015- till date	Ministry of Earth Sciences	Secretary

8. Research specialization:

- Monsoon Variability and Monsoon Prediction
- Climate Change and Extreme Weather Events
- Prediction of Mesoscale Convective Systems
- Cloud-Radiation Interaction and Satellite applications
- Aerosol Radiative Forcing.

9. Present research interests:

- Monsoon prediction using coupled models, decadal variability and prediction
- Land surface processes and monsoon predictability (role of land surface processes on monsoon variability and prediction)
- Extreme climate events (variability and prediction of extreme events like heavy rainfall events, droughts and heat waves).

10. Important Scientific Contributions:

- Contributed significantly for developing many application tools and prediction models for societal applications like long-range prediction models, gridded climate data sets and many other climate application products for regional climate services. **These models and application tools are being used by the India Meteorological Department for operational use.**
- Development of advanced statistical prediction models for operational long range forecasts of monsoon seasonal rainfall (over India and four homogeneous regions) and the monsoon onset over Kerala. These models are being used by IMD for operational use.
- Development of high resolution climate data sets like the high resolution gridded rainfall and temperature data sets. These data sets are extensively used by researchers around the Globe. **There are more than 750 citations on these data sets**.
- Diagnostic studies on the Inter-annual variability of southwest and northeast monsoons (tele-connections) and associated physical processes.
- Development of objective criteria for declaring the monsoon onset over Kerala and monitoring the active and break spells of the Indian summer monsoon. **These criteria are being used by the India Meteorological Department for operational use.**
- Analysis of extreme climate events (intense precipitation events, monsoon droughts and heat waves) and understanding physical processes.
- Understanding and development of prediction tools for Mesoscale weather systems over southeast India. Development of advanced prediction tool using hybrid method (dynamical and statistical) for prediction of thunderstorms and associated lightning over the SHAR (ISRO rocket launching site), which is being used by the ISRO for predictions.
- Role of land surface processes on monsoon variability using observations and regional climate models, development of a high resolution land surface data set for applications on hydrology.
- Analysis of active and break spells of the Indian monsoon, criteria for definition and its dynamics, extensively cited and used by researchers for studies on active and break spells of the Monsoon.
- Analysis of three dimensional structure of clouds and its variability over the monsoon region using advanced satellite data sets.
- Analysis of cloud-radiation interaction and cloud radiative forcing over the monsoon region using various satellite data sets. First time shown that cloud-radiation feedback is negative over the Asian Monsoon region.
- Evaluation and understanding of predictability of the Indian monsoon in coupled climate models.

11. Awards:

- 2001 **START Young Scientist** Award for the paper “Net cloud radiative forcing at the top of atmosphere in the Asian monsoon region” published in **Journal of Climate**, 2000, 13, 650-657.

- Award for the **Young Scientist** in Atmospheric Sciences by the Ministry of Earth Sciences (MOES), New Delhi in 2007 for the research contributions in Atmospheric Sciences.

- 20th **Biennial Mausam Award (2001)**, Department of Science and Technology, for the paper "Aerosol-Cloud-Climate Effect: Study with a radiative transfer model" published in **Mausam**, April 1998, 49,195-202.

12. Honours and Recognitions:

- Fellow of the Indian Academy of Sciences (IASc)
- Fellow of the Indian National Science Academy (INSA)
- Fellow of the National Science Academy of India (NASI)
- Member, International Academy of Astronautics (IIA)
- High-level Adviser on Climate Services, World Meteorological Organization (WMO)
- Expert Member, Research Board of the World Meteorological Organization (WMO).
- Chairman, Board of Governors, Indian Institute of Science Education and Research (IISER), Thiruvananthapuram.
- Chairman, Council of the Regional Integrated Multi-Hazard Early Warning System (RIMES) For Africa and Asia, Bangkok.
- Member of the International WCRP CLIVAR (UN Organization) Asian-Australian Monsoon Panel (AAMP) (2007-2012)
- Consultant to WMO to prepare the WMO Annual Climate Statement on the Status of Global Climate (in 2004 and 2005).
- Member, WMO CBS expert panel on long range forecasting, 2004-2008.
- Honorary Doctorate from GITAM University, Vishakapatnam.
- Honorary Doctorate from Satyabhama University, Chennai
- Chairman, Research Council, National Institute of Oceanography (NIO), CSIR, Goa
- Member, Governing Council of IISER Kolkata,
- Senior Associate, International Centre for Theoretical Physics (ICTP), Trieste, Italy, 2007-2013
- Associate Editor, Journal of Earth System Sciences, Indian Academy of Sciences, Bangalore, a Springer Publication (2007-2015).
- Associate Editor, Weather and Climate Extremes, Elsevier publication, 2015-2018

13. Academic Activity:

- Ph.D Research Guide at the University of Pune, Andhra University and S.V.University, Tirupati. Guided 9 Ph.D students, 5 M Tech students, and 10 M.Sc students for their research studies (list of the Ph.D students given below).

Details of Ph.D students completed:

S No	Name	Year	Title of the thesis	University
1	R.K.Yadav	2006	Variability of Winter Precipitation Over North- West India: Teleconnections and Long Range Forecasting	University of Pune
2	Pankaj Kumar	2006	Northeast Monsoon Rainfall Variability over India: Teleconnections and Long-Range Prediction	University of Pune
3	G. Krishna Kumar	2007	Impacts of Sea Surface Temperatures over the Indian Ocean on the Indian Monsoons- with a special reference to recent El Nino	University of Pune
4	S. Balachandran	2007	Surface Radiative Budget and its Relationship With Cloud Properties over the Globe : An Analysis Of Satellite Data"	University of Pune
5	A.K.Srivastava	2011	Role of extra tropical circulation features in modulating Indian Summer Monsoon rainfall	University of Pune
6	C.K.Unnikrishnan	2014	A study on role of Land Surface Processes on the Indian Summer monsoon variability using a regional climate model	S.V.University Tirupati
7	A Madhulatha	2015	Numerical Simulation of Mesoscale Convective Systems and Development of prediction schemes	Andhra University
8	Sreekala P.P.	2017	Northeast monsoon rainfall variability over south peninsular India in IPCC-AR5 models	S.V.University, Tirupati
9	Karuna Sagar	2017	Studies on Rainstorms over India : Observations and Predictability	S.V.University, Tirupati

14. **Research papers in peer reviewed journals:**

Summary of research papers (**Source: Google scholar as on 26 May 2020**)

Peer-reviewed publications: 118
Proceedings of Conferences: 15
Total citations: 7836
h-Index: 45
i-10 index: 100

15. List of peer reviewed research papers

1. Observational aspects of tropical mesoscale convective systems over southeast India, Madhulatha A., **Rajeevan M**., Mohan T.S., Thampi S.B., 2020, **J. Earth System Science**, 129, 10.1007/s12040-019-1300-9
2. Differences in CAPE between wet and dry spells of the monsoon over the southeastern peninsular India, Mohan T.S., Rao T.N., **Rajeevan M**., 2019, **Met and Atmospheric Physics**, 131, 657-668.

3. Future projections of heat waves over India from CMIP5 models, Rohini P., **Rajeevan M**., Mukhopadhay P., 2019, **Climate Dynamics**, 10.1007/s00382-019-04700-9

4. Monsoon mission a targeted activity to improve monsoon prediction across scales, Rao S.A., Goswami B.N., Sahai A.K., Rajagopal E.N., Mukhopadhyay P., **Rajeevan M.,** Nayak S., Rathore L.S., Shenoi S.S.C., Ramesh K.J., Nanjundiah R.S., Ravichandran M., Mitra A.K., Pai D.S., Bhowmik S.K.R., Hazra A., Mahapatra S., Saha S.K., Chaudhari H.S., Joseph S., Sreenivas P., Pokhrel S., Pillai P.A., Chattopadhyay R., Deshpande M., Krishna R.P.M., Das R.S., Prasad V.S., Abhilash S., Panickal S., Krishnan R., Kumar S., Ramu D.A., Reddy S.S., Arora A., Goswami T., Rai A., Srivastava A., Pradhan M., Tirkey S., Ganai M., Mandal R., Dey A., Sarkar S., Malviya S., Dhakate A., Salunke K., Maini P.,**Bulletin of the American Meteorological Society**, 2019, 100, 2509-2532, 10.1175/BAMS-D-17-0330.1

5. Role of enhanced synoptic activity and its interaction with intra-seasonal oscillations on the lower extended range prediction skill during 2015 monsoon season, Abhilash S., Mandal R., Dey A., Phani R., Joseph S., Chattopadhyay R., De S., Agarwal N.K., Sahai A.K., Devi S.S., **Rajeevan M**., 2018, **Climate Dynamics**, 51, 3435, 3446.

6. Atmospheric water budget over the South Asian summer monsoon region, Unnikrishnan, C.K, and **M Rajeevan**, 2018, **Met and Atmos Phys**., 130(2), 175-190.

7. High-resolution gridded soil moisture and soil temperature datasets for the indian monsoon region, Nayak, H.P., Osuri, K.K., Sinha, P., Nadimpalli, R., Mohanty, U.C., Chen, F., **Rajeevan, M.**, Niyogi, D., **Scientific Data**, Volume 5, 2018, Article number 180264

8. Impact of different parameterization schemes on simulation of mesoscale convective system over south-east India, Madhulatha, A., **Rajeevan, M**. , 2018 , **Meteorology and Atmospheric Physics** , (1) , 49-65

9. Impact of Assimilation of Conventional and Satellite Radiance GTS Observations on Simulation of Mesoscale Convective System Over Southeast India Using WRF-3DVar, Madhulatha, A., **Rajeevan, M**., Bhowmik, S.K.R., Das, A.K. 2018 , **Pure and Applied Geophysics** , (1) , 479-500

10. Prediction skill of rainstorm events over India in the TIGGE weather prediction models, Karuna Sagar, S., **Rajeevan, M.**, Vijaya Bhaskara Rao, S., Mitra, A.K., 2017, **Atmospheric Research**, 198, 2017, Pages 194-204.

11. North Atlantic controls on wintertime warm extremes and aridification trends in the Middle East,Kumar, K.N., Molini, A., Ouarda, T.B.M.J., **Rajeevan, M.N**., 2017, **Scientific Reports** , (1) , Article number 12301

12. A threefold rise in widespread extreme rain events over central India, M.K.Roxy, S.Ghosh, A. Pathak, R. Athulya, M.Mujumdar, R. Murtugudde, P. Terray and **M. Rajeevan**, 2017, **Nature Communications**, DOI: 10.1038/s41467-017-00744-9 |

13. Winter Fog Experiment over the Indo-Gangetic Plains of India, Sachin Ghude et al, 2017, **Current Science**, 112, 767-784.

14. Performance of the operational and experimental long-range forecasts for the 2015 southwest monsoon rainfall, Pai.D.S., Suryachandra Rao, A., Senroy, S., Pradhan, M., Pillai, P.A., and **M Rajeevan**, 2017, **Current Science**, 112, 68-75.

15. Improved prediction of severe thunderstorms over the Indian monsoon region using high-resolution soil moisture and temperature initialization, Osuri, K.K., Nadimpalli, R., Mohanty, U.C., Chen, F., **M Rajeevan**, Niyogi, D., 2017**, Nature Scientific Reports**, 7, Article Number 41377, doi: 10.1038/srep41377

16. Past and future trends of hydroclimatic intensity over the Indian monsoon region, Mohan, T.S. and M Rajeevan, 2017, **J Geophysical Research (Atmospheres),** 122, 896-909.

17. A study on the role of land-atmosphere coupling on the south Asian monsoon climate variability using a regional climate model, Unnikrishnan, C.K., **M Rajeevan** and Vijaya Bhaskara Rao, S., 2017, **Theoretical and Applied Climatology**, 127, 949-964.

18. On increasing monsoon rainstorms over India, Karuna Sagar, S., M Rajeevan and Vijay Bhaskara Rao, 2017, **Natural Hazards**, 85, 1743-1757.

19. Atmospheric water budget over the South Asian summer monsoon region, Unnikrishnan, C.K., **Rajeevan, M.,** 2017, **Met and Atmos Physics**, 1-16.

20. Prediction of seasonal summer monsoon rainfall over homogenous regions of India using dynamical prediction system, Ramu, D.A., Rao.S.A., Pillai.P.A., Pradhan, M., George, G., Rao.D.N., Mahapatra, S., Pai, D.S., and **Rajeevan, M.,** 2017, **J.Hydrology**, 546, 103-112.

21. Anomalous Convective activity over sub-tropical east Pacific during 2015 and associated boreal summer monsoon teleconnections, M. Mujumdar, Sooraj, K.P., Krishnan, R., Preethi, B., Joshi, M.K., Varikoden, H., Singh, B.B., and **Rajeevan, M**., 2017, **Climate Dynamics,** 48, 4081-4091.

22. Potential of Collocated radiometer and wind profiler observations for monsoon studies, Balaji, B. Prabha, T.V. Jaya Rao, Y. Kiran, T. Dinesh, G. Chakravarty, K. Sonbawne, S. M., **M. Rajeevan**, 2017, **Atmospheric Research**, 194, 17-26.

23. Anomalous convective activity over sub-tropical east Pacific during 2015 and associated boreal summer monsoon teleconnections, Milind Mujumdar, KP Sooraj, R Krishnan, B Preethi, Manish K Joshi, Hamza Varikoden, Bhupendra B Singh, **M Rajeevan**, 2016, **Climate Dynamics**, DOI: 10.1007/s00382-016-3321-2.

24. How distinct are the two flavors of El Niño in retrospective forecasts of Climate Forecast System version 2 (CFSv2)?, Pillai, Prasanth A., Suryachandra A. Rao, Gibies George, D. Nagarjuna Rao, S. Mahapatra, **M. Rajeevan**, Ashish Dhakate, and Kiran Salunke, 2016, **Climate Dynamics**, DOI: 10.1007/s00382-016-3305-2

25. On the variability and increasing trends of heat waves over India, Rohini, P., **M.Rajeevan** and A.K.Srivastava, 2016, **Nature Scientific Reports**, Vol.6, **DOI:** 10.1038/srep26153

26. Anatomy of Indian heat waves, Ratnam, J.V., S.K.Behera, S.B.Ratnam, **M. Rajeevan** and T.Yamagata, 2016, **Nature Scientific Reports**, Vol.6., **DOI:** 10.1038/srep24395

27. CMIP5 Projected Changes in the Annual Cycle of Indian Monsoon Rainfall, Pravat Jena, Sarita Azad, **M. Rajeevan**, 2016, **Climate**, doi:10.3390/cli4010014

28. Possible shift in the ENSO-Indian Monsoon rainfall relationship under future global warming, Azad, S., and **M. Rajeevan**, 2016, **Nature Scientific Reports**, Vol.6, **DOI:** 10.1038/srep20145

29. Extremes in June rainfall during the Indian summer monsoons of 2013 and 2014: Observational analysis and extended-range prediction, Joseph, S., A.K.Sahai, R.Chattopadhyay, S.Sharmila, S.Abhilash, **M.Rajeevan**, R.Mandal, A.Dey, N.Borah, 2016, R.Phani, **Quart.Roy.Met.Society**, 142, 1276-1289

30. Precipitation Climatology over India: Validation with observations and reanalysis datasets and spatial trends, Kishore, P., Jyothi, S., G.Basha, S.V.B.Rao, **M Rajeevan**, Velicogna, I., and T.C. Sutterley, 2016, **Climate Dynamics**, 46, 541-556

31. A study on the role of land-atmosphere coupling on the south Asian monsoon climate variability using a regional climate model, C.K.Unnikrishnan, **M. Rajeevan** and S.Vijaya Bhaskara Rao, 2015, **Theoretical and Applied Climatology**, DOI: 10.1007/s00704-015-1680-y

32. Role of vertical structure of cloud microphysical properties on cloud radiative forcing over the Asian monsoon region, Ravi Kiran, **M. Rajeevan**, Gadhavi, H, S.V.B. Rao, A. Jayaraman, 2015, **Climate Dynamics**, 45, 3331-3345

33. An Indian Ocean precursor for Indian Summer Monsoon Rainfall variability, Sreejith, O.P., Swapna, P., Pai.D.S., and **Rajeevan, M**., 2015, **Geophys. Res.Letters**, *42*(21), 9345-9354

34. Prediction of Indian rainfall during the summer monsoon season on the basis of links with equatorial Pacific and Indian Ocean Climate indices, Sajani, S., Gadgil, S., Francis, P.A., and **Rajeevan, M**., 2015, **Environ Res. Letters**, 10 (9), DOI 10.1088/1748-9326/10/9/094004.

35. Unprecedented hailstorms over north peninsular India during February–March 2014, Kulkarni, J. R., Morwal, S. B., Narkhedkar, S. G., Maheskumar, R. S., Padmakumari, B., Sunitha Devi, S., & **Rajeevan, M**, 2015, ***Journal of Geophysical Research: Atmospheres*****,** *120*(7), 2899-2912.

36. Development and Evaluation of an Objective Criterion for the Real-Time Prediction of Indian Summer Monsoon Onset in a Coupled Model Framework, Susmitha Joseph, A. K. Sahai, S. Abhilash, R. Chattopadhyay, N. Borah, B. E. Mapes, **M. Rajeevan**, and A. Kumar, 2015: ***J. Climate***, **28**, 6234–6248. doi: 10.1175/JCLI-D-14-00842.1

37. Improved Spread–Error Relationship and Probabilistic Prediction from the CFS-Based Grand Ensemble Prediction System, S. Abhilash, A. K. Sahai, N. Borah, S. Joseph, R. Chattopadhyay, S. Sharmila, **M. Rajeevan**, B. E. Mapes, and A. Kumar, 2015: ***J. Appl. Meteor. Climatol.***, **54**, 1569–1578, doi: 10.1175/JAMC-D-14-0200.1

38. Rethinking Indian monsoon rainfall prediction in the context of recent global warming, B. Wang, B. Xiang, J.Li, P.J. Webster, **M. Rajeevan**, J.Liu and K.J.Ha, 2015, **Nature Communications**, 6:7154, DOI: 10.1038/NCOMMS8154

39. Precipitation climatology over India: validation with observations and reanalysis datasets and spatial trends, P. Kishore, S. Jyothi, G.Basha, Rao, S.V.B., **M. Rajeevan**, I. Velicogna and T.C. Sutterley, 2015, **Climate Dynamics**, DOI**:** 10.1007/s00382-015-2597-y.

40. Role of vertical structure of cloud microphysical properties on cloud radiative forcing over the Asian monsoon region, V. Ravi Kiran, **M. Rajeevan**, H.Gadhavi, S.V.B.Rao, and A. Jayaraman, 2015, **Climate Dynamics**, DOI: 10.1007/s00382-015-2542-0

41. Analysis of the daily rainfall events over India using a new long period (1901-2010) high resolution (0.25° × 0.25°) gridded rainfall data set, Pai, D.S., Sridhar, L., Badwaik, M.R., **Rajeevan, M.** (2014) **Climate Dynamics,** DOI**:** 10.1007/s00382-014-2307-1

42. High-resolution operational monsoon forecasts: an objective assessment, Sahai, A.K., Abhilash, S., Chattopadhyay, R., Borah, N., Joseph, S., Sharmila, S., **Rajeevan, M**.,(2014) **Climate Dynamics,** DOI**:** 10.1007/s00382-014-2210-9

43. Examining pathways for modulation of Indian Summer Monsoon Rainfall by extratropical tropospheric temperature pattern, Srivastava, A.K., **Rajeevan, M.,** Kshirsagar, S.R., (2014) **International Journal of Climatology,** DOI**:** 10.1002/joc.3940

44. Gridded daily Indian monsoon rainfall for 14 seasons: Merged TRMM and IMD gauge analyzed values ,Mitra, A.K., Momin, I.M., Rajagopal, E.N., Basu, S., **Rajeevan, M**., Krishnamurti, T.N. (2013) **Journal of Earth System Science**, 122 (5), pp. 1173-1182.

45. Development of a high resolution land surface dataset for the South Asian monsoon region, C.K.Unnikrishnan, **M Rajeevan**, S.Vijayabhaskara Rao, Manoj Kumar, 2013, **Current Science**, 1235-1246.

46. On the epochal variation of intensity of tropical cyclones in the Arabian Sea, **M Rajeevan**, J.Srinivasan, K.Niranjan Kumar, C.Gnanaseelan and M.M. Ali, 2013, **Atmos.Sci.Letters**, 14, 249-255.

47. On the observed variability of monsoon droughts over India, K Niranjan Kumar, **M Rajeevan**, D.S.Pai, A.K.Srivastava and B. Preethi, 2013, **Weather and Climate Extremes,** 1, 42-50.

48. Enhancement of inland penetration of monsoon depressions in the Bay of Bengal due to prestorm ground wetness, Kishtawal, C.M., Niyogi, D., Rajagopalan, B., **M.Rajeevan**, Jaiswal, N., Mohanty, U.C., 2013**, Water Resources Research 49 (6)** , 3589-3600**.**

49. Large scale features and assessment of spatial scale correspondence between TMPA and IMD rainfall datasets over Indian landmass, Uma, R., Kumar, T.V.L., Narayanan, M.S., **M. Rajeevan**, Bhate, J., Kumar, K.N. 2013**, Journal of Earth System Science 122 (3) , 573-588.**

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51. Diurnal variability of stability indices observed using radiosonde observations over a tropical station: Comparison with microwave radiometer measurements, Ratnam, M.V., Santhi, Y.D., **M. Rajeevan,** Rao, S.V.B. 2013, **Atmospheric Research 124 , 21-33**

52. Identification and validation of homogeneous rainfall zones in India using correlation analysis, Saikranthi, K., Narayana Rao, T., **M. Rajeevan,** Vijaya Bhaskara Rao, S., 2013, **Journal of Hydrometeorology 14 (1) ,** 304-317

53. Nowcasting severe convective activity over southeast India using ground-based microwave radiometer observations, Madhulatha, A., **M. Rajeevan,** Venkat Ratnam, M., Bhate, J., Naidu, C.V., 2013, **Journal of Geophysical Research D: Atmospheres 118 (1) , 1-13**

54. Characteristic features of winter precipitation and its variability over northwest India, Yadav, R.K., Rupa Kumar, K., **M. Rajeevan,** 2012, **Journal of Earth System Science,** 121 (3) , 611-623

55. Northeast monsoon over India: Variability and prediction, **M.Rajeevan**, Unnikrishnan, C.K., Bhate, J., Niranjan Kumar, K., Sreekala, P.P. 2012, **Meteorological Applications** 19 (2) , 226-236.

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58. Evaluation of the ENSEMBLES multi-model seasonal forecasts of Indian summer monsoon variability, 2011, **M. Rajeevan**, C.K.Unnikrishnan and B.Preethi, **Climate Dynamics**, DOI 10.1007/s00382-011-1061-1

59. Role of intra-seasonal oscillations in modulating Indian summer monsoon rainfall, 2011, Ashwini Kulkarni, R. Kripalani, S.Sabade, and **M. Rajeevan**, **Climate Dynamics**, DOI 10.1007/s00382-010-0973-1

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