

## BIO DATA



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7. Professional Training			
Organisation	Period		Details of Training
	From	To	
University of East Anglia, UK	February, 1995	July, 1995	Undergone six months research-based training on “ <b>Climate Change</b> ”at the University of East Anglia, UK under the Technical Cooperation Training Programme sponsored by the British Council Division.
Indira Gandhi Agricultural University, Raipur	14 September 1992	30 October, 1992.	Attended first SERC School on Agrometeorology with the theme “ <b>Agricultural drought, concept, assessment and management</b> ”sponsored by the Science and Engineering Research Council (SERC) of the Department of Science and Technology (DST), Government of India at Indira Gandhi Agricultural University, Raipur
India Meteorological Department, Pune	29.January .1990	28.January .1991	Undergone one year Training of <b>Meteorologist Grade II</b> with specialization in Agricultural Meteorology, India Meteorological Department, Pune.

### 8. Employment records (in chronological order starting with the first job)

Name and address of employer/institution	Period	Designation
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	<b>From</b>	<b>To</b>	
Ministry of Agriculture, Department of Agriculture and Cooperation, Krishi Bhavan, New Delhi	01.2.1988	28.1.1990	Senior Technical Assistant
India Meteorological Department Ministry. of Earth Sciences	29.1.1990	28.1.1991	Trainee Meteorologist
India Meteorological Department Ministry. of Earth Sciences	29.1.1991	13.7.1997	Meteorologist Grade II
India Meteorological Department Min. of Earth Sciences	14.7.1997	10.2.2004	Meteorologist Grade I
India Meteorological Department Min. of Earth Sciences	11.2.2004	30.6.2011	Director
India Meteorological Department, Min. of Earth Sciences	1.7.2011	17.8.2018	Deputy Director General of Meteorology, Agricultural Meteorology Division
Department of Agricultural Extension (DAE), Ministry of Agriculture, Bangladesh	18.10.2018	17.10.2020	Senior International Agro-Meteorological Consultant
World Bank	30.7.2020	31.3.2021	Consultant

### **9. Research & Development:**

Research & Development have been carried out during last 36 years in the area of Agricultural Chemistry & Soil Science/Agricultural Meteorology. In the beginning, research work was done in collaboration with Bose Institute and Geology Department of Calcutta University on Mangrove Forest and soil. Afterwards, research work was oriented on recycling of organic waste and its use in crop production. During the assignments in UK, I had the opportunities to work in Climatic Research Unit of East Anglia, UK and worked on “Evaporation and potential evapotranspiration in India under conditions of recent and future climatic change”.and published the paper in Agricultural and Forest Meteorology

After joining in IMD, research has been carried out in different subjects of Agrometeorology like Pest & Disease forewarning models, crop water requirements, extreme weather events, food security, climate change and crop weather relationships etc. List of the paper published in different national and international journals is presented below.

Besides, under GraminKrishiMausamSeva (GKMS) project, research was carried out on subjects like Crop water management and its efficient use, Improved and more efficient input use in Agriculture, development of integrated crop / pest management and knowledge on response farming strategies, Crop pest/disease/climate dynamics, animal and climate relationships, Early Warning and Monitoring of Drought, Livestock, Climatic extremes affecting agricultural productivity, Latest improvements in information technologies to be used for better agricultural planning and management, Utilisation of agro-climatic information for Agromet Advisories, Develop and use modern tools in agrometeorology, Dry farming research, Microclimatic studies. The aim of these initiatives is to strengthen the operational activities in different parts of the country even upto block level.

## **10. Awards:**

- 2014-Award of silver medal for the best poster presentation for the paper entitled "Variability of Food Grain Production in India" in INTROMET – 2013 held at SRM University, Kattankulathur, Tamil Nadu during 21-24 February 2014.
- 2012-Best paper Award for paper on "Evaluating the Potential of Kalpana-1 Rainfall Product for Operational Agromet Advisory Services in India" for presenting in the workshop on Meteorological Satellite Kalpana: A Decade Service to the Nation.
- 2008-Young Scientist Award for 2008 in the Field of Atmospheric Sciences by the Ministry of Earth Sciences, Government of India.
- 2008-Best Employee Award in the Department on the occasion of in the celebration of 80 Years of India Meteorological Department (IMD), Pune.
- 2002-Best paper Award in "National Symposium on 2002 at Regional Agricultural Research Station, Patambi, Kerala Agricultural University.
- 2000-ISCA best poster presentation in the 89th session of the Indian Science Congress, University of Pune, 2000.
- 1997-Noel Deerr Gold Medal' Award for best paper in the 58th Annual Convention of Sugarcane Technologists' Association of India, Goa, in 1997.

## **11. Work experience:**

During the earlier phase of the professional carrier, I worked as Technical/ Senior Technical Assistant and was looking after various ongoing schemes of soil and water conservation in the Soil and Water Conservation Division, Department of Agriculture and Co-operation, Ministry of Agriculture, KrishiBhavan, New Delhi. After that, I joined as Meteorologist Grade II in India Meteorological Department at Regional Meteorological Centre, Madras, Tamil Nadu where I was assigned to issue Agromet Advisory Services Bulletin to the State Government and different users in Tamil Nadu twice a week. Then I was posted as Meteorologist Grade I and subsequently as Director & Deputy Director General in the Division of Agricultural Meteorology, India Meteorological Department, Pune. In Agrimet Division, I worked mainly on the research activities related to pest & diseases and other aspects of agrometeorology along with the improvement in Operational Agromet Advisory Services benefitting for farming communities in the country. Also worked with the Commission of Agricultural Meteorology, World Meteorological Organisation ( WMO),

Geneva on different aspects of agrometeorological research and operational agromet advisory services across the world. At present I have been working as Senior International Agro-Meteorological Consultant for World Bank funded Project in Bangladesh, Agro-Meteorological Information Systems Development Project, Component-C of Bangladesh Weather and Climate Services Regional Project, Department of Agricultural Extension (DAE), Ministry of Agriculture, Khamarbari, Farmgate, Dhaka. Besides, I am also working Consultant, World Bank for a brief period.

### **13. Prime activities on operational Agromet Advisory Services:**

Ministry of Earth Sciences (MoES), Government of India set up a committee to suggest structure of Integrated Agromet Advisory Services (IAAS) and nominated me as Member Secretary of this Committee. I worked for the framing up of IAAS project of Ministry of Earth Sciences which was launched in April 2007. Under this project, efforts were made to develop crop and location specific advisories and disseminate the same in real time basis to the farmers at district level. Regular interactions were made with State Agromet Centres (SAMCs) & Agromet Field Units (AMFUs) for strengthening the extension mechanism through Agricultural Technology Management Agency (ATMA), KrishiVigyanKendras (KVKs) and Non Governmental Organisations (NGOs). In the 12<sup>th</sup> Five Year Plan, the IAAS project was renamed as GraminKrishiMausamSewa for Operational Agromet Advisory Services in the country. Under this project various activities were carried out for the improvement in Agromet Advisory Service (AAS) project which are as follows:

- A. Generation of weather forecast & agromet advisory:** Based on the Medium Range Weather Forecast, Agromet Advisory Services (AAS) bulletins were prepared for 640 districts in the country on every Tuesday and Friday. Also State Composite bulletins (23) and national AAS bulletins were also issued under these services. Along with this, in collaboration with Indian Institute of Tropical Meteorology, Pune prepared AAS bulletins based on Extended Range Weather Forecast. Besides, monthly AAS bulletins based on monthly weather forecast by IIT, Bhubaneswar has also been prepared on experimental basis.
- B. Dissemination of Weather Forecast, Agromet advisories and extension activities:** Efforts were taken for disseminating agromet advisories to the farmers through different multi-channel system like All India Radio (AIR) and Doordarshan, Private TV and radio channels, Newspaper and Internet, SMS and IVRS under Public Private Partnership mode. In addition, agromet advisories are also disseminated as SMS through Kisan Portal (<http://farmer.gov.in>) launched by the Ministry of Agriculture. At present, large number of farmers are directly benefitted by these services. Initiative has been taken to include more and more private companies for dissemination of agromet advisories to the farmers.
- C. Farmers' Awareness Programmes (FAP):** To popularize the AAS services in the country, Awareness programmes on climate and weather information for the farmers were carried out at district level.
- D. Generation of new products for use in AAS bulletins:** Initiated the preparation of new products in collaboration with Space Application Centre (SAC), Ahmedabad

using the Normalised Difference Vegetation Index (NDVI) derived from INSAT 3A CCD for framing agromet advisories. A joint initiative has also been taken up by Indian Space Research Organization (ISRO), Indian Council of Agricultural Research (ICAR), India Meteorological Department, National Centre for Medium Range Weather Forecasting (NCMRWF), Noida, Mahalanobis National Crop Forecasting Centre (MNCFC), New Delhi under DAC (Department Agriculture and Cooperation) to prepare satellite derived products and value added products using geospatial data for the use in AAS Besides, started preparing the maps for Standardised Precipitation Index (SPI) on weekly, bi-weekly and seasonal basis and aridity anomaly maps on weekly basis.

- E. E Agromet Brochure:** For highlighting the activities of Agromet Advisory Services, Agromet Brochures have been published in 14 different languages viz., Hindi, English, Assamese, Gujarati, Manipuri, Nepali, Punjabi, Tamil, Marathi, Kannada, Telugu, Malayalam and Bengali and circulated for wider publicity.
- F. Teaching & Training Organization:** Organized different training courses in the Division like Agromet Field Unit (AMFU) Training course for Technical officers, Foreign Trainees' Course, Agromet Core course, Agromet Observers' Course, Basic Agromet Course, Refresher Course, Customized Familiarization Course in Agricultural Meteorology for the professionals at State Agricultural Universities/Indian Council of Agricultural Research Institutes and taught Agricultural Meteorology in different Agrometeorological trainings organized in the Division and also at different Agricultural Institutes/Universities, Workshops, Symposia, SERC Schools. Besides lectures were delivered on Crop Yield Forecasting using statistical and crop simulation models" for SRFs working under FASAL project.
- G. Extended range/monthly bulletin:** In collaboration with the Indian Institute of Tropical Meteorology (IITM), Pune initiated the work of preparation of Agromet Advisory bulletins based on extended range forecast in AAS particularly in forecasting of long dry spells and heavy rain on fortnightly basis during present monsoon season. These bulletins, thus prepared and were circulated through the network of AMFUs and KVKs for helping the farmers on strategic contingent planning.
- H. Dissemination of agromet advisories through DD KISAN:** Hon'ble Prime Minister Shri Narendra Modi, Govt. of India has launched a dedicated 24 hours DD Kisan channel for the farmers in the country. Inputs for crop specific weather based Agromet Advisories for the country are being prepared on daily basis and sent for telecasting through programs like 'KisanSamachar' and 'MausamKhabar' of DD Kisan Channel, New Delhi from the month of May, 2015.
- I. Block Level Agromet Advisories to Farmers:** Initiatives have been taken to upgrade its existing district level Agrometeorological Advisory Services to block level by using a high-resolution weather forecast at block level. As a part of GKMS, work was undertaken to establish District Agromet Units (DAMUs) in the country in existing Krishi Vigyan Kendras (Ministry of Agriculture) for preparation and dissemination of advisories at block level. Worked on generating block level medium range weather forecast and validation of the forecast. Memorandum of Understanding (MoU) has

been made with KVK Baramati as technical resource centre for DAMU. Agricultural experts to translate the weather forecasts into actionable farm advisories twice a week (Tuesday & Friday) using crop models, soil health card, integrated pest/disease and nutrient management.

**J. Preparation of Soil Moisture Estimation Maps:** In collaboration with International Centre for Radio Science (ICRS), Jodhpur preparation of maps for soil moisture estimation have been started for Gujarat, Madhya Pradesh, Assam, Andhra Pradesh, Kerala, West Bengal, Uttar Pradesh, Rajasthan, and Tamil Nadu. These maps are being generated on by using satellite data viz. soil moisture, NDVI and brightness temperature data from SMOS, MODIS and LST values from SSMIS sensors. Besides, based on water balance method and using gridded rainfall data, soil moisture maps at 60 cm depth at district level across the country were also prepared daily and displayed in the division's website.

**K. Rainfall Monitoring at Gram Panchayat:** In order to strengthen the Agromet advisory services at district level and also further extended these services to block level, initiatives have been taken up in setting up and monitoring of raingauge station at Gram Panchayat level. Pilot studies have been started taking 50 panchayat. Under this initiative, it is planned to develop web and mobile based applications to upload rainfall data on daily basis.

**L. Establishment of studio for recording and telecasting weather and agromet related programs:** In order to strengthen the service delivery through Television channels in respect of frequency of information, live programme on agromet advisory, customized programme from different AMFUs and also near real time information under extreme events, initiatives were taken to set up studio at IMD, Pune with satellite linkage to be provided by Doordarshan Kendra.

**M. Agromet stations with Micromet Tower for evapotranspiration estimation:** Initiatives were taken to establish Agromet Stations (AMS) with INSAT-based data transmission facility replacing existing network of lysimeters for estimation of ET on real time basis of international standards, so that the same was useful for the preparation of agromet products for framing agromet advisories.

#### **14. Major impact reported during the work done**

- All India AAS bulletins help Central and State Government organizations for taking policy decisions on agriculture.
- Multi-channel dissemination helps the farmers to adopt appropriate weather based farm management at appropriate time and increase crop productivity.
- Advisories during extreme events help farmers to save the crop loss.
- Agromet Advisories based on Extended Range Forecasting System (ERFS) help farmers to select contingency crops during long dry spell.
- Awareness Programme helps to aware of the Agromet Services and also to collect feedback to prepare need based advisories.

- In season yield forecast helps Ministry of Agriculture to prepare advance crop estimate.
- Capacity building programme helps to prepare and disseminate agromet advisories more efficiently.

### **15. Innovative content of work done**

- SMS/IVRS technology for dissemination of agromet advisories to extend the services more effectively and to help the farmers for day to day operational farming activities. This system becomes highly useful in case of extreme events.
- Development and utilization of remote sensing products based on INSAT 3A CCD NDVI composite to identify the regions experiencing impact of moisture stress / flood situation on crops.
- On line preparation and dissemination of agromet advisories to large number of farmers through Kisan Portal.

Such innovative works ultimately help to improve the economic condition of the small and marginal farmers by increasing the crop productivity/ minimising the crop loss by communication of customized Agromet Advisories in time.

### **16. Outstanding Achievements**

1. Preparation of **640** district level bulletins twice a week in different regional languages under GKMS project and communication of Agromet Advisories in 13 languages to 11.5 million farmers through SMS and Voice Messages.
2. Improvement in the economic condition of the small and medium farmers by increasing the crop productivity/minimising the crop loss by communicating customised Agromet Advisories on real time basis.
3. Member of Management Group of Commission of Agricultural Meteorology (CAgM) as Chairman of Open Panels of CAgM Experts WMO Commission on Agriculture Meteorology, United Nations.
4. Co-ordinator of Expert Group on Agrometeorology for Regional Association, World Meteorological Organisation, Geneva, United Nations.
5. Received Young Scientist Award in the Field of Atmospheric Sciences by the Ministry of Earth Sciences, Government of India.

### **17. International Assignments and activities**

#### **Assignments in World Meteorological Organisation (WMO)**

Worked for the Commission of Agricultural Meteorology (CAgM) of World Meteorological Organisation (WMO), Geneva in different capacities like:

1. Member of the Expert Team (ET) of the Open Programme Area Group (OPAG) on “Agricultural Services-Agricultural Production” for RA II region of WMO
2. Member of Management Group of Commission of Agricultural Meteorology (CAgM) as Chairman of Open Panels of CAgM Experts
3. Co-Chair of Global Centre for Research and Excellence in Agrometeorology (GCREAM)
4. Co-ordinator of Expert Group on Agrometeorology for Regional Association II

Brief of the activities carried out in different international initiatives are mentioned below.

**a. Open Panels of CAgM Experts (OPCAMEs):** At the 16th session of the Commission of Agricultural Meteorology in Turkey in 2014, the Commission established four Open Panels of CAgM Experts (OPCAMEs) which will be referred to as Focus Areas. Focus Area (OPCAME) 1- Operational Agricultural Meteorology is one of them. Focus Area 1 emphasize the importance of improving the provision of agrometeorological products, services, services delivery and communication to users of agricultural services (e.g. for crops, rangelands, livestock, forestry, and fisheries). Also provide guidance to enhance the contribution of the field of agricultural meteorology for operational applications in agricultural sectors.

**b. Expert Group on Agrometeorology (EG-AgM) in Regional Association II with terms of reference**

(i) To survey RA II Members to identify agrometeorological experts/staff and training needs in the Region; (ii) To make recommendations on establishing Agromet Advisory Services in RA II countries; (iii) To review the monitoring and forecasting of soil moisture conditions and their use in assessing crop water requirements; (iv) To review the monitoring and preparedness strategies for drought including drought indices and early warning systems, and the extent of their implementation in RA II; (v) To review and evaluate the operational use of seasonal to inter-annual climate forecasts applications to agriculture in RAI and make recommendations to improve the presentation of these forecasts to the agricultural community; (vi) To review studies on the socio-economic impact of agrometeorological information in RA II to agriculture, livestock management, forestry, rangelands and fisheries sectors;

**c. Global Centre for Research and Excellence in Agrometeorology (GCREAM):** Being Co-Chair of the recent initiative of establishment of GCREAM, activities have been started to implement the GCREAM. First meeting of GCREAM was organised in IMD, Pune inviting the international participants. Strong inclusive partnerships through the network of global centers of research and excellence in natural resources will emphasize an inter-disciplinary approach to solving complex and interlinked problems for agriculture and water resource management in a safe environment to sustain future development.



**d. Collaboration with South American Countries:** Collaborative activities has been started with two South American countries i.e Chile and Paraguay on potential mutual interest particularly related to seasonal and extended range weather forecast and its application to agriculture sector.

**Asia-Africa Collaboration:** Collaborative work has been started with United States Agency for International Development (USAID), Washington DC, USA on “Improving Climate Services for Farmers in Africa and South Asia (ICSFASA)”. Project on “Farmer Network on Demand Driven Climate Services for Africa and South Asia” was conceived jointly by IMD & ICSFASA. The main aim of this collaboration would be laying the foundation to establish an effective network for farmers in Africa and South Asia to share knowledge and information on climate services and products for on-farm decision making and enhancing ICTs for effective dissemination of climate products and services between Asia and Africa.

**Global Federation of Agrometeorological Societies (GFAMS):**International cooperation, based on resources, knowledge sharing, and mutual understanding is absolutely essential to bring proactive tangible global advancement towards uplifting the living standards and contributing to agricultural and economic food production sustainability. In view of that Global Federation of Agrometeorological Society has recently formed based on the consciousness of sixteen Agrometeorological Societies across the world. The objective of Global FAMS is to further promote and advance all sectors of agricultural meteorology by improving international, inter-Society cooperation and partnership, exchange of knowledge and education in all the related scientific, technological, acts disinterestedly, in the sense that it does not pursue primarily its own economic gain.

## 18. Foreign Assignments

Sr. No.	Name	Country
1	Six months research based training on “Climate Change” at the University of East Anglia, UK under the Technical Cooperation Training Programme sponsored by the British Council Division from February to July, 1995	United Kingdom
2	Workshop on “Monitoring and early warning of drought at SAARC Meteorological Research Centre, Dhaka, Bangladesh during 28 to 30 <sup>th</sup> November 2005	Bangladesh
3	Regional symposium on climate change, food security, sea level rise and environment in south Asia, Dhaka, Bangladesh, 25-29 <sup>th</sup> August 2008	Bangladesh
4	International Workshop on the Content, Communication and Use of Weather and Climate Products and Services for Sustainable Agriculture, Toowoomba, Australia during 18-20 May 2009	Australia
5	Climate & Agricultural Risk Management in Phnom Penh in Combodia during 15-23 November, 2009	Cambodia
6	SWFDP-Eastern Africa Training Workshop, Arusha during 28 November to 2 December 2011	Tanzania
7	International workshop on “Scaling up Climate Services for Farmers in Africa and South Asia” in Senegal, South Africa organized by World	Senegal

	Meteorological Organisation (WMO), United States Agency for International Development (USAID), CCAFS and Climate Services Partnership (CSP) during 10-12 December 2012	
8	Meeting of the Commission of Agricultural Meteorology (CAgM) Expert Team on Strengthening Operational Agrometeorological Services, Bucharest, Romania during 25-26 April 2013	Romania
9	International Conference on Promoting Weather and Climate Information for Agriculture and Food Security, Antalya, Turkey during 7-9 April 2014	Turkey
10	CAgM Management Group Meeting, WMO, Geneva, 25-27 September 2014 and Meeting on the Implementation and Coordination of the Global Framework for Climate Services, WMO, Geneva during 29 <sup>th</sup> September to 1 <sup>st</sup> October 2014.	Geneva
11	Sixth Session of Regional Conference on Management of National Meteorological and Hydrological Services (NHMSs) in Regional Association II (Asia), Doha. Qatar during 2-4 December 2014.	Qatar
12	Meeting of CAgM Implementation/ Coordination Team from 7-9 <sup>th</sup> October, 2015 in Bucharest, Romania	Romania
13	Improving Climate Services Delivery in Africa and South Asia RENOFASA from 29-30 <sup>th</sup> January 2015	Uganda
14	Senior International Agro-Meteorological Consultant Bangladesh Weather and Climate Services Regional Project Department of Agricultural Extension (DAE), Ministry of Agriculture	Bangladesh
15	CAgM meeting on Agromet Products and Services for Forestry, Livestock and Fisheries from 15-17 March 2017	Brazil
16	South Asia Hydromet Forum II, from 19-21 November, 2019.	Nepal

### 19. Books edited

- 75 Years Services to the Nation (1932-2007): A Retrospective and Futuristic Overview: Agricultural Meteorology Division, India Meteorological Department, Pune.
- AMFU training course on “Agrometeorology towards better advisories for serving end users’ requirements.
- Operational Agromet Advisory Services in the World: World Meteorological Organisation, Geneva, Switzerland (On-going)

### 20. Contributed chapters in Books

- Agro-Meteorological Advisory Services for Informed Decision Making in India, Biodiversity and Climate Change in Tropical Island. 2018
- Role of Agrometeorological Advisory Services in Managing Risk under Changing Climate, Doubling Farmers’ Income: KISAN–MITrA 15–16 March 2017 Vivekananda International Foundation (VIF) No: 3, Proceedings of National Workshop on Doubling

Farmers' Income through Scaling-up: KISAN–MITrA (Knowledge-based Integrated Sustainable Agriculture Network – Mission India for Transforming Agriculture)

- Multi-purposeful Application of Geospatial Data, Intech Open Publisher 2015
- Development of eAgromet Prototype to Improve the Performance of Integrated Agromet Advisory Service: Springer Publication in lecture notes of Computer Science, Volume 8381, 2014.
- Reaching farming communities in India through Farmer Awareness Programmes: Climate Exchange, World Meteorological Organisation (WMO), Tudor Rose publication, United Kingdom, (UK), 2013.
- Delivering advisory services by mobile phones: Climate Exchange, World Meteorological Organisation (WMO), Tudor Rose Publication, United Kingdom, (UK), 2013.
- Water and Agriculture: Usefulness of Agrometeorological Advisories: Natural Resources Technology, Economics and Policy, CRC Press, Taylor and Francis Group, London, UK, 2012.
- Climate change and food security in India: Climate Change and Food Security in South Asia, Springer Publication, 2011.
- Integrated Agromet Advisory Services in India: Challenges and Opportunities in Agrometeorology, Springer Publication, New York. 2009.
- Strategies for minimizing crop loss due to pest and disease incidences by adoption of weather based plant protection: Challenges and opportunities in Agrometeorology Springer Publication, New York, 2009.
- Agrometeorological Risk and Coping Strategies-Perspective from Indian Subcontinent: Managing Weather and Climate Risks in Agriculture, Springer Publication, New York, 2007.

## **21. Reports prepared**

19. Monsoon 2014 – A Report published by National Climate Centre, ADGM(R), IMD Met. Monograph: Synoptic Meteorology No. 14/2014, pp189-200.
20. Report of “Expert Team on Strengthening Operational Agrometeorological Services (ETSOAS)”, World Meteorological Organisation (WMO), Geneva in the year 2014.
21. Annual Report of Integrated Agromet Advisory Services.
22. Report of Farmer Awareness Programme.

23. Report on Extreme Events: Weather service for Indian Agriculture”, in Geography and You (2013), Vol. 13, Issue 79, July – August 2013.
24. Impact of Indian Summer Monsoon 2013 on Kharif Crop Production. Monsoon 2013 – A Report, IMD Met. Monograph: Synoptic Meteorology No.: ESSO/IMD/SYNOPTIC MET/01-2014/15, pp 199-214.
25. Monsoon 2012–A Report published by National Climate Centre, ADGM(R), IMD Met. Monograph: Synoptic Meteorology No. 13/2013.
26. Country report on “Impact of climatic parameters on agricultural production and minimizing crop productivity losses through weather forecast and advisory services” for SAARC countries in 2011.
27. Integrated Agromet Advisory Services in India, IMSP News letter, Vol. XII No.1 April-June, 2008, 7-10.
28. Study of weather based agricultural folklores of West Bengal (Sayings of Khana) (2004),Pre-Published Scientific Report, India Meteorological Department, No. 1/2003.
29. Weather and pest and disease problem in India, IMSP News letter, Vol. 3 No.1 April-June 1998.
30. Climate change and its implication to Indian Agriculture, IMSP News letter, Vol. 1 No.2 January-March, 1996.

## **22. Papers presented in Seminars/Workshops and abstracts published in the proceedings**

### **National:**

- Weather information and services to agriculture: 2nd Workshop on Crop Insurance in 2014 at Mumbai.
- Integrated Agromet Advisory Service in India in Regional Conference on Climate Variability and Cash Crops of Maharashtra, TERI, Mumbai in January 2013.
- Programme on “Index Based Weather Insurance – Concepts, Design and implementation held at Hyderabad during 20-22 August 2012.
- “Service to the farmers through Agromet Advisory Services at 8th Convention of GrameenGyanAbhiyan held at M.S.Swaminathan Research Foundation, Chennai in October 2012.
- Brainstorming Session on “Standardization and Integration of Automatic Weather Stations under National Umbrella on 3<sup>rd</sup> September 2012 at IITM, Pune.
- Evaluating the potential of Kalpana -1 Rainfall product for operational Agromet Advisory Services in India Workshop on ‘Meteorological Satellite Kalpana’: A decade of service to the Nation, held at Space Applications Centre, Ahmedabad in 2012.

- National Level Workshop on “Micro Level Action Plan at Taluka Level for Climate Resilient Agriculture” held at NASC, New Delhi during 2-3 November 2012.
- Consultation meeting on “Operational Agrometeorological Services in SAARC and other countries in RA II region” at National Meteorological Training Institute, Pune from 20-21 April 2012.
- State of art technology in weather services to Agriculture in India” Sixth Edition of India’s largest Information and Communication Technology (ICT) event in 2010 at Hyderabad.
- Agromet Advisory Services in India for Enabling Farmers to cope up with Climate Variability and Change: National Symposium on Climate Change and Rainfed Agriculture, 18-20 February 2010, CRIDA, Hyderabad, India.
- “Strategies for minimizing the negative impact of climate change on Indian Agriculture through Agromet Advisory Services” in Second Annual Review Meeting (ARM) and Third National Seminar on Agrometeorological Services for Farmers (NSASF) at Anand Agricultural University, Gujarat, 2008.
- “Forewarning of pests and diseases of major crops in India-IMD’s approach” in National Symposium on “Emerging trends of researchers in INSECTS PEST Management & Environmental Safety” held at Haridwar, 2008.
- Influence of weather parameters on population dynamics of rice bug” at Pattambi, Kerala in Tropmet 2007.
- One day consultation on Agrometeorology” held at M.S. Swaminathan Research Foundation, Chennai on 25th August, 2005.
- Agricultural productions loss due to extreme weather events in some states of India, Tropmet 2002.
- Irrigation scheduling of cotton at different agroclimatic regions of the country”, National seminar on Agroclimatological Research for Sustainable Agricultural production – Anand Agricultural University, Anand, 2001.
- Role of meteorological information in saving the crop losses due to pest and diseases attack”, 87th session of Indian Science Congress, University of Pune, 2000.
- Sensitivity of weather parameters to cotton growth at selected stations of India, Tropmet 2000.
- Possibility of inclusion of weather based information for plant protection measures in agromet advisory service.” Proceedings of TROPMET 1999 National Symposium, 479.
- Forewarning of pink bollworm outbreak and pest weather calendar for operational crop protection in Vidarbha and Marathwada regions of Maharashtra”, Tropmet 1999.
- Models of forewarning of stemborer attack on sugarcane and pest weather calendar for operational crop protection at Muzaffarnagar, West Uttar Pradesh”, Proceedings of 58<sup>th</sup> Annual Convention of Sugar Technologists, Association of India, New Delhi, 1996.

**International:**

- Progress & Future Plan of Agrometeorological Services in RA II Countries in Regional Conference in Regional Association II (Asia), Doha, Qatar, 2-4 December 2014.
- International Conference on Promoting Weather and Climate Information for Agriculture and Food Security, Antalya, Turkey during 7-9 April 2014.
- Meeting of the CAgM Expert Team on Strengthening Operational Agrometeorological Services, Bucharest, Romania during 25-26 April 2013.
- India's Integrated Agro-Met Advisory Services in International workshop on "Scaling up Climate Services for Farmers in Africa and South Asia" in Senegal, South Africa, December organized by World Meteorological Organisation (WMO), United States Agency for International Development (USAID), CCAFS and Climate Services Partnership (CSP) during 10-12 December 2012.
- SWFDP-Eastern Africa Training Workshop, Arusha during 28 November to 2 December 2011.
- Climate change and Indian Agriculture" at International conference on "Eliminating Hunger and Poverty : Priorities in Global Agricultural Research and Development Agenda in an Era of Climate change and Rising Food prices held during 7-9 August, 2010 at MS Swaminathan Foundation at Chennai.
- Weather based risk management in agriculture & Integrated Agromet Advisory Services in India, International Symposium:Climate Risk Management in Rural Communities in Developing Countries of the Asia-Pacific Region, 19-22, November, Phnom Penh, Cambodia 2009.
- Operational Agrometeorological Service in India and associated RA countries in International Workshop on the Content, Communication and Use of Weather and Climate Products and Services for Sustainable Agriculture, Toowoomba, Australia, 18- 20 May 2009.
- Integrated Agrometeorological Advisory services in India" in International Conference on Challenges and Opportunities in Agrometeorology' (INTROMET-2009) held at New Delhi during 23-25 February, 2009.
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