National Award in the field of Atmospheric Science & Technology

Prof. Om Prakash Sharma

Prof. Om Prakash Sharma is presently an Emeritus Professor in the Centre for Atmospheric Sciences, Indian Institute of Technology (IIT) Delhi. Prof. Sharma completed his primary and higher education in Rajasthan. After completing his M.Sc. degree in Mathematics from Udaipur University (now Mohanlal Sukhadia University) in 1970, he went to IIT Bombay to pursue a research path in fluid dynamics and he was awarded Ph.D. degree in Applied Mathematics in 1975. Soon after submitting the Ph.D. thesis, prof. Sharma joined IIT Delhi as a CSIR Senior Research Fellow / Post-Doctoral Fellow under the supervision of Professor M. P. Singh of Mathematics Department. In the year 1976, Professor M. P. Singh (IIT Delhi) and Professor J. L. Lions (INRIA, France) started a joint Indo-French Collaboration Programme in "Applications of Mathematics", fully funded by the French Foreign Ministry. Under this Indo-French Programme, his mentors Prof. M. P. Singh and Prof. P. K. Das (IMD) initiated Prof. Sharma to carry out research in meteorology under the guidance of Professor Robert Sadourny at the Dynamic Meteorology Laboratory (LMD) of CNRS, Ecole Normale Superieure, Paris (France). This marked the beginning of his research career in atmospheric science with special emphasis on numerical modelling of large-scale meteorological flows. Prof. Sharma was appointed as Research Associate in 1977 and as Lecturer in 1979 under the Applications of Mathematics Programme in the Department of Mathematics at IIT Delhi. In the Centre for Atmospheric Sciences (CAS), Prof. Sharma became a Senior Scientific Officer in 1981 and a Principal Scientific Officer in 1987. He was appointed as Professor in CAS in 1997 and he retired from IIT Delhi in 2014 after attaining the age superannuation.

In the early years of research in meteorology, Prof. Sharma applied the then newer technique of finite elements to atmospheric flow problems. However, during the entire year in 1979, the First Global GARP Experiment (FGGE) was conducted in which India sponsored the Monsoon Experiment (MONEX). The availability of global FGGE data opened new avenues of research in numerical modelling of atmospheric flows, especially to design, develop and evaluate GCMs. Soon at LMD, Professor Sadourny and Prof. Sharma started working on the design of a new GCM by modelling the vertical structure in sigma coordinate and performed comparatives experiments with FFGE data. Realizing the limited success of the new model, Prof. Sharma and his friend and colleague Dr. H. C. Upadhyaya under Prof. Sadourny promptly began a pioneering work on the design and development of a unique and efficient Monsoon General Circulation Model (MGCM) with medium-range weather

forecasting capability, using the mathematical concept of co-ordinate stretching which allowed finer resolution over the Indian monsoon region gradually becoming coarser away from it on the globe. In a 7-day forecast experiment with FGGE data, the variable grid MGCM successfully simulated the 1979 summer monsoon onset and the subsequent progression of monsoon. Later, MGCM was used as one of the benchmarks by the Department of Science and Technology (Government of India) to select the first Supercomputer for India Meteorological Department to strengthen monsoon modelling. Based on benchmark evaluation, the first supercomputer CRAY-XMP was imported in 1988, and installed at the then newly created NCMRWF for medium-range forecasting of monsoons and research. The design and development of MGCM under the bilateral Applications of Mathematics programme became a unique example of successful international cooperation. This model was redesigned at LMD Paris, as LMDZ for its implementation on supercomputers; and it is unique among the global models with its "zoom" capability over a region of interest.

Prof. Sharma continued collaborative research work with LMD on monsoon modelling and model development with the generous support of IIT Delhi, French Embassy in India, Indo-French Centre for the Promotion of Advanced Research (IFCPAR/CEFIPRA), French Ministry of Education and Higher Research. More recently, the Ministry of Earth Sciences is supporting his modelling activity. Besides, he always enjoyed immense support from his outstanding Ph.D. students, wonderful friends and collaborators within IIT Delhi and outside. Using a GCM, Prof. Sharma studied the sensitivity of interannual variations of summer monsoons to radiative forcing of clouds and underscored two important points: 1) the cloud-SST patterns, together, affect the interannual variability; and 2) with both SST and clouds externally imposed, model is less sensitive to initial conditions. This study also emphasized the importance of dynamically consistent cloudiness developing in response to dynamical, thermal and moist state of the atmosphere during simulations. Towards understanding the role of microphysical properties of clouds, Prof. Sharma made a significant contribution by developing and incorporating successfully an interactive chemistry-aerosol module in the existing LMDZ atmospheric model. This model was then used for INDOEX-IFP to predict both particle mass and number concentration for the Aitken and accumulation modes as prognostic variables. This study also showed that Indian emissions are not the sole cause for the higher sulphate concentrations and AOD over the Indian Ocean. The model could successfully simulate the annual budget of sulphur cycle and it was used for calculating the direct and indirect radiative forcing of aerosols. Prof. Sharma also participated in the Indo-US Science & Technology Initiative and made an original contribution in theoretical meteorology with Prof. T. N. Krishnamurti of Florida State University, USA.

The availability of vast and fast computing resources permits GCMs to run at very high resolutions but lat-lon grid point models have limitations due to the pole problem. With a bunch of brilliant and dedicated students, Prof. Sharma and his colleagues commenced the development of an icosahedral-hexagonal (Ico-hex) model to achieve a regular discretization of the spherical earth into hexagonal cells, which could be used for weather and climate predictions seamlessly. Both IIT Delhi and LMD, Paris participated in the development of the Ico-hex model under a project sponsored by ICPAR/CEFIPRA. The MoES is currently sponsoring the Ico-hex model development with a generous project grant to support a team of dedicated Ph.D. students who are working for its implementation on a GPU Cluster and the design of a forecasting system. Such a model is futuristic with the promise to meet the public demand of accurate and high-resolution weather forecasts.

Prof. Sharma took keen interest in teaching of mathematics to B.Tech students of IIT Delhi. He played a key role in starting the MoES sponsored M.Tech Programme in "Atmospheric-Oceanic Science and Technology" and to establish "Sir Gilbert Walker MoES Distinguished Chair Professorship" in CAS at IIT Delhi. Prof. Sharma has guided 16 PhDs, 15 M.Tech and 2 B.Tech students to complete their degrees. He has published 62 papers in journals. He has recently contributed an online web course "Physics of Atmosphere and Ocean" to the NPTEL portal funded by MHRD.

In recognition of outstanding contributions to the Atmospheric Science & Technology, the Ministry of Earth Sciences honors Professor Om Prakash Sharma with the "National Award in the field of Atmospheric Science & Technology" for the Year 2015.