

## Foreword

*It is a great pleasure and privilege to present the CSIR-4PI (erstwhile C-MMACS) Annual Report 2013-14. The celebration of its Silver Jubilee Year (2012-13) continued with organizing workshops, training programmes, and finally concluded with an International Conference in August 2013. It was CSIR-4PI (erstwhile C-MMACS)'s great honor to receive the Former President of India and one of the India's well known scientists Dr Abdul Kalam to inaugurate the International Conference. On the occasion of Silver Jubilee Year (1988-2013) CSIR-4PI (erstwhile C-MMACS) has brought out a publication "Compendium of Publications: Silver Jubilee Issue" with a collection of abstracts of all CSIR-4PI (erstwhile C-MMACS) publications since its inception. A "Coffee Table Book" has also been prepared to cover the events organised by CSIR-4PI (erstwhile C-MMACS) for the last 25 years with glimpses of the ongoing activities in CSIR-4PI (erstwhile C-MMACS). It will be released on the CSIR-4PI (erstwhile C-MMACS) Foundation Day 2014.*

*CSIR-4PI (erstwhile C-MMACS) continued its journey through XII Five Year Plan in cutting edge scientific research in multidisciplinary areas by publications in journals, research collaborations with national & international institute/organizations.*

*The main activities of CCOM were modelling and measurements of the carbon cycle. We performed extensive simulations of the ocean carbon model to illuminate several aspects of the oceanic carbon cycle: role of iron in photosynthesis and consequent effects on ocean fertilization, simulation of oxygen minimum zones, and climate change effects of increased sea surface temperatures on primary production. With the help of accurate carbon dioxide measurements at Hanle and an inverse transport model we showed the presence of a robust sink of 1.5 gigatonnes of carbon in Temperate Asia. A new forward transport model with increased resolution over Asia has been developed for future work.*

*The primary strength of CEMP is its multi-disciplinary research and outreach. The year 2013-14 has seen this potential and efforts of CEMP realized through several high-impact multi-disciplinary SCI publications. While novel methodology for assessing climate projections was formulated and developed (Nature: Scientific Reports), a mathematical model for pro-active malaria mitigation was validated (PLOS One); similarly model of air pollution forecasting was validated over Delhi. These models are developed completely in-house from computer coding to validation. Along with these applicable products, three students and scientists also received Ph D from CEMP. A number of international (UKIERI, CSRIO,..) and national (NDMA, ICRI, ICAR,..) agencies have approached us for collaborative R&D with CEMP. The year also marks the fifth consecutive year of successful operation of CSIR (COMoN), with two new installations over Siachen (in collaboration with SASE, DRDO) and Leh (in collaboration with Kashmir University). The experimental advance dynamical forecasting of Date of Onset of Monsoon saw the 12th successful year in 2013.*

*Computational Mechanics Group that continued their work on development and application of novel Homotopy Analysis Methods also demonstrated the advantage of using the modification of the Homotopy Analysis Method with a non homogeneous term for a system of equations for the first time. Computational nanomechanics focuses on nonlocal continuum modelling and molecular dynamics simulations in nanomaterials. Studies have been carried out on a nonlocal continuum theory for modeling the buckling of Carbon Nanotubes.*

*Multiscale Modeling and Simulation Group is involved in setting up a multiscale, earth system model to address climate and climate change issues specific to India. Studies of tropical climate and monsoon variability, and climate projections under different global warming scenarios are carried out using an unprecedentedly high resolution global climate model. Climate change projections for the state of Kerala are provided to the Directorate of Environment and Climate Change, Government of Kerala since 2012.*

*During the year, the 360 TFLOPS Supercomputing facility was thrown open to the CSIR scientific community to promote computational science based research in CSIR. The facility is operational on round-the-clock basis and it is being accessed by CSIR Scientists over the high speed National Knowledge Network. The supercomputer has been under high utilization since its release to users. The group is also actively involved in research in Cyber Security under the 12<sup>th</sup> Five Year Plan of CSIR. This effort has produced innovative results, including an international patent filing, in important areas like, security aspects of next generation communication protocol, algorithms for processing in encrypted domain and unsolicited network traffic analysis.*

*Solid Earth modelling group's major initiative on data intensive research for earthquake hazard assessment by modelling the solid-earth has been sanctioned as a part of a new CSIR XII Five year plan project, ARiEES (Advanced Data intensive Research in Engineering and Earth Sciences) with CSIR-4PI (erstwhile C-MMACS) as the nodal Lab. For first time in the country we have developed comprehensive buried dislocation models from Ladakh Himalaya in the west to Arunachal Himalaya in the east using surface deformation derived from a decade of GPS observations. We have developed neo-deterministic seismic hazard map of India as well as seismic hazard and risk estimates for Himalaya and surrounding regions. During this year we have established seismic broad band experiments in the Kashmir Himalayas and also set up real time data telemetry for the Andaman GPS network.*

*The academic programme of CSIR-4PI (erstwhile C-MMACS) is progressing very well with increasing number of students enrolling for the SPARK programme. The year saw a good number of students from premier institutions in India joining for their project work under the guidance of scientists in different areas. In this year, K C Gouda secured his Ph.D. degree.*

*My sincere thanks to all the concerned Departments and Organizations, both national and international, for supporting the research efforts of CSIR-4PI (erstwhile C-MMACS). It is my privilege to express my gratitude to DG, CSIR and members of our Advisory Committee for their support & guidance. I would like to thank Mr. Shyam Chetty, who despite his busy schedule as Director CSIR-NAL, took keen interest in nurturing CSIR-4PI (erstwhile C-MMACS) programmes. Our special thanks to all the divisions of CSIR NAL for their unstinted support. Thanks are also due to Prof V K Gaur, Dr K S Yajnik, Dr U N Sinha, Dr Ehrlich Desa and Dr T S Balganesha for continuing to be involved with the activities of CSIR-4PI (erstwhile C-MMACS) and providing advice and guidance to the scientists. I take this opportunity to thank all scientists and other staff members of CSIR-4PI (erstwhile C-MMACS) for their commitment to this unique organization.*

*Head, CSIR-4PI (erstwhile C-MMACS)*