

Preface

The year 2008-2009 has been a memorable year for C-MMACS. A number of new programs were initiated and work in existing programs resulted in consolidation of results. It is a matter of pride and a feeling of accomplishment that C-MMACS has achieved recognition in a number of areas.

The year 2008-2009 also marks the first year of the 11th Five Year Plan. One of the thrust areas of C-MMACS's research is sustainability and vulnerability in an environment of changing climate which is also the theme of the C-MMACS Supra Institutional Project. Several useful results have already emerged from the studies conducted so far, some of which are outlined below:

Given the large impact of the monsoon on India's economy, prediction of the monsoon is critical in many respects. Hence the development of a novel algorithm for the long range forecasting of the monsoon is an important achievement by C-MMACS.

Given the critical importance of climate change, it is necessary to obtain accurate and reliable data which can be used either for fine tuning appropriate models or as an input to crucial policy decisions. C-MMACS has initiated action on setting in place a network of climate profilers all over the country. An MoU has been signed for setting up a climate profiler with G B Pant Institute of Himalayan Environment & Development (GBPIHED) for this purpose. The first climate profiler has been installed at Kosi, Almora.

The commissioning of the Meso-scale Observation Network for Urban Systems (MONUS) was initiated. This marks a major milestone in the accurate and reliable acquisition of data for fine tuning existing models and for providing inputs for policy decisions.

An MoU was also signed with the Karnataka State Natural Disaster Monitoring Cell (KSNDMC) and a site for MONUS was identified over the Western Ghats.

A major CSIR program on climate change was initiated. This program involves a number of other CSIR laboratories and represents a major CSIR initiative in the area of climate change. The program will include a number of initiatives such as analysis of the impact of climate change with a regional focus on our environment, development of strategies for mitigation of the impact and also studies of long term sustainability of the environment under various scenarios. It is also proposed to involve a number of academic institutions in the scheme.

The technology demonstration project on precipitation commenced and a three dimensional dynamic cloud simulation model was installed and tested by C-MMACS's scientists. In addition the ARPEGE Global Circulation Model was installed at C-MMACS during this year.

A major 11th plan project on the establishment of a continuous Green House Gas monitoring station in the Andamans was approved during this period. The process of site selection at the National Institute of Ocean Technology (NIOT) campus in Port Blair has been completed and flask measurements have commenced. Efforts are underway to establish a tower and procure equipment for the station.

A parametric sensitivity analysis for the Coupled Physical – Biological Model in the Indian Ocean has been completed. This clearly indicated the importance of zooplankton grazing and regeneration of ammonium in controlling the ecosystem dynamics of the Arabian Sea and the Bay of Bengal. The marine ecosystem model has been extended to include multiple currencies (carbon and nitrogen)

and micro and macro nutrients including iron. This will be used for LOHAFEX (LOHA is Hindi for iron, FEX stands for Fertilization EXperiment) simulations in the southern oceans.

The Solid Earth Modeling group of C-MMACS continued to contribute at the national and international levels towards the development of surface deformation models in the Indian subcontinent. It is planned to integrate studies of GPS geodesy, geology, seismology and tectonics to address the long term earthquake hazard in the region. One of the major achievements of this group is the determination of precise surface deformation rates in the Andaman and Nicobar islands from 1996 to 2008 using satellite geodesy. These measurements yield significant insights into the earthquake cycle in this region. Volcano deformation studies in the Barren and Narcondam islands of this region have also been initiated.

The N-S and E-W deformation pattern in the Indian subcontinent has been quantified and the pole of rotation of the Indian plate has been determined. This is a major step towards defining the Indian reference frame for regional deformation studies in India.

It was noted that there were 'kinks' in the solutions obtained for the dynamics of periodically forced spheres in a quiescent fluid at low nonzero Reynolds Numbers. These kinks were found to be robust under changes of resolution in the calculation and the tolerance to which the solution was calculated.

An object oriented design of a FEM code was developed. It has been demonstrated that object oriented programming can provide strong support to desirable features of FEM systems such as reusability, extensibility and easy maintainability.

A quadratic element model has been developed with non – conforming displacement modes and modified shape functions. This will aid in overcoming mesh distortion problems in finite element modelling of structures.

The HPC facility of the center consisting of multi CPU computer servers, visualization systems and SAN based storage, has been operational on a round – the – clock basis and this has facilitated various modeling and simulation activities of C-MMACS as well as other organizations.

The SGI Altix 4700 Supercomputer at C-MMACS with 200 Itanium 2 cores and 400 GB memory is the largest shared memory system in India. It was also ranked 10th in the 'Top Supercomputers in India' list of November 2008.

Work was continued on secure communication using chaotic cryptography. An analysis of secure communication using chaotic synchronization with systems sampled at non uniform time steps was performed.

The year was also witness to a number of scientific events as well as a large number of visitors and seminars. Our scientists contributed 21 publications in internationally reputed journals, 12 publications in books and proceedings and 19 presentations in conferences/workshops. A number of students, as usual, visited C-MMACS for their project work.

My sincere thanks to all the concerned Departments and Organizations, both national and international, for supporting the research efforts at C-MMACS. We also thank DG, CSIR for his support and encouragement. Thanks are also due to Prof V K Gaur and Dr K S Yajnik for continuing to be involved with the activities of C-MMACS and providing advice and guidance to the scientists.

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