

C-MMACS was established in 1988 by CSIR to be a world class centre of excellence in modelling and simulation of scientific and industrial complex systems. Its activities fall in three broad categories: comprehensive numerical solution of complex nonlinear partial differential equations describing geophysical / industrial systems, nonlinear dynamical system modelling to describe and predict characteristic processes, analysis of available large data sets using nonlinear / statistical techniques. In the areas of ocean/atmosphere modelling, the versatile Modular Ocean Model (MOM) has been used to predict three dimensional time varying circulation and thermal structure in the Indian Ocean using surface winds determined from satellite observations. Using the trajectories of particles in the Indian ocean from MOM simulations, chaotic diffusivity has been determined for further oceanographic applications. Ocean colour data has been used along with ship observations to constrain the large number of biological parameters occurring in the marine ecosystem model of the Arabian Sea. Various Indian monsoonal variabilities, unexplained earlier, have been explained using available climatic data and a realistic simple ocean/atmosphere coupled model. The neural network technique has again been used to successfully predict the amount of rainfall during the Indian summer monsoon in 1997 and beyond. The Indian lithosphere, a storehouse of natural resources and also the seat of destructive earthquake occurrences, has been

investigated by modelling crucial processes in its energetic region such as Himalayan wedge and by observing evolving strain fields using versatile GPS geodetic techniques. Finite simulations of elastic deformation of various geotechnical systems have been undertaken. Innovative applications of chaotic systems for useful purposes have been carried out to study control and synchronisation. Details of these investigations are given in the report.

I would like to express my grateful thanks to Dr. R.A. Mashelkar, FRS, DG-CSIR and Chairman of C-MMACS Advisory Committee and its distinguished members for guiding the directions of the Centre's activities and the CMMACS Team for its dedicated work. I also express my thanks to Dr. T.S. Prahlaad, Director, National Aerospace Laboratories for his generous support and to Dr. A.E. Muthunayagam, Secretary, Department of Ocean Development for supporting ocean modelling activities and also for making C-MMACS the nodal agency for their prestigious project on Indian Ocean Modelling and Dynamics (INDOMOD).

I thank all the staff of CMMACS for their support in various ways in the preparation of this report. I thank Ms Stella Margaret for compiling this report and Mr A S Rajasekar of ISS, NAL for composing it so well.

R N Singh
Scientist-in-Charge