

C-MMACS MANAGEMENT AND OFFICERS

A1.1 CENTRE GOVERNANCE COMMITTEE

MANAGEMENT COMMITTEE OF C-MMACS

Chairman
Dr S K Joshi
Director-General, CSIR

Members and Invitees

Dr J Das, Scientist, IICB; Dr B N Desai, Director, NIO; Prof V K Gaur, Distinguished Scientist, CSIR; Dr V B Kaulgji, Professor and Coordinator, IIM, Bangalore; Dr A P Mitra, CSIR Bhatnagar Fellow, NPL; Mr K R Shenoy, GGM

(Exploration), ONGC, Madras; Prof R Narasimha, Director, NAL; Dr T S R Prasada Rao, Director, IIP; Dr A V Rama Rao, Director, IICT; Dr N V Raman, Director, SERC, Madras; Dr R N Singh, Scientist, NGRI; Mr R Parathasarathy, Deputy Secretary General, ASSOCHAM, New Delhi. Dr P Rama Rao, Secretary, DOD; Dr S Mallick, Deputy Adviser, CSIR; Dr R Srinivasan, Head, Computer Support and Systems Division, NAL.

Member-Secretary
Dr K S Yajnik
Head, C-MMACS

A1.2 OFFICERS

Yajnik Dr K S, Ph.D., Sc (Director's Grade)

Gaur Prof V K, Ph.D., Distinguished Scientist.

James Dr M I, Ph.D., Sc C

Krishna Mohan Dr T R, Ph.D., Sc C (to be transferred to Centre for Cellular & Molecular Biology - CCMB)

Indira Dr N K, Ph.D., Sc C

Phani Kumar Dr M S, Ph.D., Sc C

Swathi Dr P S, Ph.D., Sc C

Sudhakar B, M.Tech., Sc B

Sharada M K, M.Sc., Sc B

Raghunath M D, B.E., Sc B

Sridevi Jade, M.E., Sc B

Sudhakar B, M Tech., Sc B

Padma R., M.Sc., SRF

Ruvva Koteswara Rao, M.Sc., SRF

Thangavelu R P., M.Sc., M.Phil., SRF

Nandini Harinath, M.Sc., JRF

Rajeevan P, M.Sc., JRF

Anandhan S T, S.O.

Ananda M.B., STA

Senior Associates

Dr J Das, IICB, Calcutta, Dr Gangan Pratap, NAL, Bangalore, Dr B D Kulkarni, NCL, Pune, Dr S Mallick, CSIR, Delhi, Prof P S Moharir, NGRI, Hyderabad, Dr T R Ramamohan, RRL, Triruvannathapuram, Prof M Shankar Rao, IISc, Bangalore, Dr S R Sheteye, NIO, Goa, Dr R N Singh, NGRI, Hyderabad, Dr N Somasekhara, IISc, Bangalore, Dr M D Zingde, NIO, RC, Bombay

Associates

Dr Ms Chitra Dutta, IICB, Calcutta, Mr S A Faruqi, NEERI, Nagpur, Dr P Goswami, IIT, Kanpur, Dr B Jagannadh, IICT, Hyderabad, Dr Ms Ranjana Mehrotra, NPL, Delhi, Dr Ms Roshan Sasikumar, RRL, Trivandrum, Dr S Savithri, RRL, Trivandrum, Dr Somadutta Sinha, CCMB, Hyderabad.

PROJECTS AND SERVICES

A2.1 R & D
PROJECTS

A2.1A EXTERNAL PROJECTS

The projects details appear in the following sequence: title, leader, sponsor and value (Rs/lakhs). This information has been retrieved from the projects database created at the ISS Section, and is based on the information available on 1 June 1993

- 1 Ocean modelling studies; DOD; Rs. 150.000 lakhs; CM-0-101
- 2 Coastal pollution modelling; DOD; Rs.19.52 lakhs; CM-0-102
- 3 Feasibility study of application of mathematical modelling to switch gear design; L & T; Rs.1.53 lakhs; CM-0-103 (completed)
- 4 Studies in geological fluid mechanics, jointly with NGRI; CM 1101
- 5 Characterisation of the dynamics of a model biochemical reaction pathway, jointly with CCMB; CM 3101
- 6 Studies on the phenomena of self-

organisation in living systems, jointly with IICB; CM 3401

7 Development of software package for simulation of solidification in castings, jointly with RRL, Tvm; CM 6501

8 Bodies of arbitrary shape approaching a plane wall in stokes flows, jointly with RRL, Tvm; CM 6502

9 Computer aided Chemistry, jointly with IICT; CM 2401

10 Pre- and post-processing package for general purpose finite element package, with NAL; CM 4401

11 Parallel version of linear solvers for a general purpose finite element package, with NAL; CM 4402

12 Computer simulation of air-frame and turbomachinery components for NC machining, with NAL; CM 4403

13 Modelling of Radiative Convective Heat Transfer in Laser Welding, jointly with NML; CM 5801

14 Statistical modelling of mechanical behaviour of ferrous alloys, jointly with NML; CM 5802

A2.1B INHOUSE PROJECTS

The project details appear in the following sequence: title, leader. This information has been retrieved from the projects database created at the ISS Section, and is based on the information available on 1 June 1993

1 Studies in stochastic modelling and data analysis, CM 8001

2 Modelling of transport sector with special emphasis on civil aviation; CM 8002

3 CSIR Centre for Mathematical Modelling & Computer Simulation (Augmentation of computing facilities); CM 9001

**A2.2****SERVICES ON
EXTERNAL
COMMITTEES****Gaur V K**

1) Proceedings of the Indian Academy of Sciences (Earth and Planetary Sciences), Editor. 2) CSIR Committee on Earth, Atmosphere, Ocean and Environmental Sciences, Chairman. 3) Research Advisory Committee of CSIR group on Human Resource Development, Member. 4) A evaluation committee of UGC Centres of Special Assistance at Indian School of Mines, Dhanbad, BHU Varanasi and Patna University, Member. 5) Indo-Russian Integrated Long Term Programme of Cooperation in Science and Technology for Earth Sciences, Area Chairman. 6) INSA-Russian Academy Cooperative Programme in Geomagnetism, Coordinator. 7) Indian National Committee for SCAR (Scientific Committee on Antarctic Research), Chairman. 8) International Association of Seismology and Physics of the Earth's Interior (INSPEI) working group on dynamics and earthquake prediction, Member. 9) Council of the Indian Academy of Sciences, Member. 10) Working Committee of the Current Science Association, Member.

Swathi Dr P S

1) IMACS Intl. symp. on Mathematical Modelling and Scientific Computing, Secretary. 2) 22nd International Thermal Conductivity Conference Arizona State University, USA, Member. 3) DOD Ocean Modelling Studies Project, Member Secretary. 4) Intensive Course on Inverse Problems in Science & Engi-

neering, C-MMACS, Jt. Coordinator.

Yajnik Dr K S

1) Council, the Court and the Finance Committee, Indian Institute of Science, Bangalore, Member. 2) Governing Council, Indira Gandhi Institute of Development Research, Bombay, Member. 3) Research Council, National Geophysical Research Institute, Member. 4) Research Council, Structural Engineering Research Centre, Ghazia- bad, Member. 5) Academic Council, Cochin University of Science and Tech- nology, Cochin, Member. 6) Working Group on Atmospheric and Marine Sci- ences, Indo-US S&T Subcommission, Member. 7) Standing Advisory Commit- tee, Department of Applied Mechan- ics, IIT Delhi, Member. 8) National Committee for IGBP, New Delhi, Member. 9) Steering Committee on Remote Sens- ing for Ocean Development, New Delhi, Member. 10) Steering Committee of Coastal Ocean Modelling and Predic- tion System Programme, Department of Ocean Development, New Delhi, Member. 11) Editorial Board, Proceed- ings (Math. Science), Indian Academy of Sciences, Bangalore, Member. 13) National Board for Higher Mathe- matics, Member. 14) Editorial Board for CFD Journal, Japan Society of Computational Fluid Dynamics, Member. 15) Editorial Board, Inte. J. for Engi- neering Analysis & Design, Member. 16) IMACS International Symposium on Mathematical Modelling and Scien- tific Computing, December 1992, Co- chairman.

SEMINARS AND VISITS

A3.1 MEETINGS, WORKSHOPS ORGANISED BY C-MMACS

Brief reports on all major meetings held at C-MMACS in 1992.

IMACS INTERNATIONAL SYMPOSIUM ON MATHEMATICAL MODELLING AND SCIENTIFIC COMPUTING
7-11 December 1992

C-MMACS organised an International Symposium on Mathematical Modelling and Scientific Computing during 7-11 December 1992. It was held under the auspices of the International Association of Mathematics in Computers and Simulation (IMACS) It was co-sponsored by C-DAC, CSIR, DST, IISc, INSA, NIO, ONGC and SERC-M Prof S K Dey, Eastern Illinois University, USA and Dr K S Yajnik, C-MMACS were Chairman and Co-Chairman of the IMACS organising committee.

Several distinguished speakers like S Chakravarthy, R Hardy, R C J Somerville, J R Bunch, R Plemmons, B N Datta, T Platt, D Kahaner, D Kincaid, I Babuska, K Gustafson, S S Abyankar, P K Basu, S Munukutla etc from abroad and India gave invited lectures and chaired sessions.

Prof R Narasimha in his inaugural talk described the direct simulation of turbulent flows using FLOSOLVER at NAL. The Symposium was widely regarded by delegates as highly successful despite rather difficult prevailing conditions.

The Symposium dealt with current developments in modelling and computing and their applications to varied fields. There were 33 technical sessions and one poster session in the following areas:

- ◆ Computational Fluid Dynamics
- ◆ Numerical Schemes
- ◆ Parallel Processing
- ◆ Scientific Computing
- ◆ Modelling in Biology and Chemistry

- ◆ Geophysics
- ◆ Atmosphere and Ocean Models
- ◆ Modelling: General issues
- ◆ Geophysics
- ◆ Computational methods in control
- ◆ Computational problems in power systems
- ◆ Finite element techniques
- ◆ Large scale structures
- ◆ Statistical modelling methods

A total of 122 papers were presented, including six in the poster session. One hundred and seventy delegates participated in the symposium, which included 80 from 15 foreign countries.

MEETING ON WORKING GROUP ON OCEAN MODELLING
29 September 1992

The third Working Group Meeting was held on 29 September 1992 at NAL Bangalore. The participants included K S Yajnik and V K Gaur, C-MMACS, R R Rao, NPOL, A Nath, NRSA, M S Rajagopal, CMFRI, P C Pandey, SAC, R Mahadevan, and J S Mani, IIT Madras and other C-MMACS scientists engaged in ocean modelling. Dr Yajnik gave a brief overview of the activities of ocean modelling at C-MMACS followed by presentations by C-MMACS scientists on several aspects of ocean models, namely, coastal and deep sea circulation, marine biological activity and SST retrieval. Dr Rao presented NPOL research at NPOL on mixed layer models, Dr Rajagopal spoke about the modelling of fish production and harvesting, Dr Nath described some new fish catch statistics related to the use of SST maps. Dr Mahadevan described storm surge modelling at IIT Madras, Dr Pandey gave a brief review of the data assimilation work at SAC. In the following discussion several needs were pointed out, namely bringing together modellers and experimentalists, validating models, strengthening computing facilities and

networking for better interaction.
**WORKSHOP ON MODELS OF SOUTH
INDIAN GRANULITE TERRAIN**
30-31 October 1992

CSIR Centre for Mathematical Modelling & Computer Simulation organised a two-day workshop on models of South Indian Granulite Terrain. Scientists from Jadhavpur University, IIT Kharagpur, Osmania University, NGRI, BHU, Mysore University, Geol. Sur. of India and C-MMACS presented their work on structure, geochemistry, isotope studies, geothermometry and geobarometry of the South Indian granulite terrain. It was followed by lively discussions on models of granulite evolution.

**INTENSIVE COURSE ON RECENT
DEVELOPMENTS IN LARGE SCALE
AND PARALLEL MATRIX COMPUTA-
TIONS AND THEIR APPLICATIONS,**
14-18 December 1992

This was held in conjunction with IMACS symposium to tap the expertise of a few eminent researchers who attended the symposium. The faculty for this course were Prof Biswa Nath Dutta, Northern Illinois University, USA and Prof J R Bunch, University of California, USA. Prof B N Dutta delivered lectures on basic concepts and core algorithms for Matrix computation, large scale sequential computations, parallel matrix computations, applications of large-scale matrix techniques to solutions of control and power systems problems. The course ended with a panel discussion on future directions of scientific computing in India. Prof L M Patnaik and Prof V Rajaraman from IISc, Bangalore and Dr K S Yajnik participated in the discussion.

**TRAINING PROGRAMME ON WATER
QUALITY MODELLING**
25-30 January 1993

A training programme on Water Quality Modelling was organised by C-MMACS and NEERI. Dr A K Runchal, Dr S K Dube, Prof TP Halappa Gowda, Prof K Sridharan and Dr M S Phankumar gave lectures on theoretical and numerical aspects of Water Quality Modelling as applied to marine and subsurface water environment. Participants, who were from R&D Laboratories and academic institutions were introduced to the 'TIDAL' and 'PORFLOW' packages and provided with an opportunity for hands-on experience in using these packages.

**INTENSIVE COURSE ON INVERSE
PROBLEMS IN SCIENCE AND ENGI-
NEERING, C-MMACS**
15-20 February 1993

The Technology Advisory Board (TAB) for Physical and Earth Sciences of CSIR recommended that an intensive course on inverse problems and a panel discussion on CSIR Initiatives in Tomography should be held to acquaint scientists with current developments in inverse problems in general and tomography in particular. C-MMACS organised this course during 15-20 February 1993. The course was inaugurated by Prof B V Srikantan, Scientist Emeritus, IISc and Chairman, TAB with a welcome by Prof R Narasimha, introduction by Dr K S Yajnik and a keynote address by Prof V K Gaur. Participation of over fifty scientists from twenty institutions indicates a growing recognition of the importance of inverse problems in a wide variety of problems in Science and Engineering.

The core faculty comprised of Prof V K Gaur, C-MMACS, Prof P Bhimasankaram, ISI, Prof G V Anand, IISc, Prof Sri Niwas and Dr P K Gupta, U of Roorkee, Prof P S Moharir and Dr R N Singh, NGRI. The course covered several topics such as generalised inverses, singular value decomposition, resolution and spread of inverse solutions, Backus-Gilbert technique and nonlinear and nongaussian inversion. An important component of the programme was a series of lectures on diverse applications. Dr S S Rai, NGRI outlined applications in seismic tomography, Dr S.A. Ahmed, NGRI described applications in hydrogeology, Dr Phoolan Prasad, IISc talked on inverse scattering, Dr N K Indira, C-MMACS spoke on time series modelling, Dr G V Anand, IISc on ocean acoustic tomography and Dr B B Bhat-tacharya, ISM Dhanbad on VES tomography and Prof P S Naidu, IISc on diffraction tomography. An important feature of the course was the intensive hands-on exercises programme and introduction to available public domain software for inversion available at C-MMACS. A diskette containing several public domain packages was also given to the participants to enable them to apply the techniques learned by them during the course.

The panel discussion on the status and future of tomography was chaired by Prof V K Gaur and featured the faculty members of the course and Prof P S. Naidu. One of the recommendations made at this meeting was the constitution of a think-tank, to work on systems at various scales ranging from the relatively large scales (e.g., earth, atmosphere, ocean systems) to relatively smaller scales (e.g. engineering systems).



INVITED LECTURES AT C-MMACS

The details are in the following sequence: title, name, affiliation of speaker and date of lecture.

- 1 MEASUREMENT OF ATMOSPHERIC MINOR CONSTITUENTS USING LASER HETERODYNE SYSTEMS, Dr S L Jain, NPL, New Delhi; 16 Apr 93
- 2 SEGREGATION OF SOLUTE DURING SOLIDIFICATION OF ALLOYS, Dr S Chattopadhyay, NML, Jamshedpur; 1 Apr 93
- 3 GLOBALLY COUPLED CHAOS, Dr Sudeshna Sinha, Visiting Scientist, BARC, Bombay; 3 Mar 93
- 4 NONLINEAR RAY THEORY, Prof Phoolan Prasad, IISc, Bangalore; 2 Mar 93
- 5 WIDE AREA NETWORKING IN INDIA, Dr S P Nawathe, ERNET, DOE, New Delhi; 26 Feb 93
- 6 SIMULATION OF THE EVOLUTION AND STRUCTURE OF A TROPICAL CYCLONE USING AN AXISYMMETRIC MODEL, R Koteswara Rao, C-MMACS, Bangalore; 12 Feb 93
- 7 PROBLEMS SOLVING USING NEURAL NETWORKS, Prof. L.M. Patnaik, IISc, Bangalore; 22 Jan 93
- 8 SIMPLIFICATION OF THREE BODY EQUATIONS, Dr (Ms) Priyadarsini Padhy, 20 Jan 93
- 9 RECENT DEVELOPMENTS IN ANTARTIC OZONE HOLE, Dr S Chandra, NASA Goddard Space Fl. Centre, USA; 11 Jan 93
- 10 CLIMATE MODELLING AND THE GREENHOUSE EFFECT, Dr R C J Sommerville, Scripps Instt. of Oceanography, USA; 16 Dec 92
- 11 OPTIMISATION OF PHYSIO-CHEMICAL AND STRUCTURAL PARAMETERS IN DRUG DEVELOPMENT, Dr Y S Prabhakar, CDRI, Lucknow; 24 Nov 92
- 12 ANALYSIS AND PARAMETER ESTIMATION IN A TWO LAYER GROUND WATER SYSTEM, M Sekhar, Department of Civil Engineering, IISc, Bangalore; 29 Oct 92
- 13 UNSTEADY NON-SIMILAR COMPRESSIBLE BOUNDARY LAYER FLOW OVER A ROTATIONAL SPHERE, Dr Amalendu Sau, Dept. of Maths, IISc, Bangalore; 27 Oct 92
- 14 INTRODUCTION TO TIDES AND THEIR PREDICTION, R V Sarma, NIO, Bombay; 20 Aug 92
- 15 OVERVIEW OF DCM R&D ACTIVITIES, DK Agarwal, Assit. Manager for Software (R & D), DCM, Delhi; 30 July 92
- 16 A UNIFIED MECHANISM FOR TROPICAL INTRASEASONAL OSCILLATIONS, Dr P Goswami, IIT, Kanpur; 27 July 92
- 17 PROBLEMS AND PROSPECTS OF NUMERICAL WEATHER FORECASTING, Prof R V Madala, NRL, Washington, DC, USA; 24 Jul 92
- 18 PRINCIPLES OF TECHNIQUES OF INITIALIZATION, Prof R V Madala, NRL, Washington, DC, USA; 28 Jul 92
- 19 AN INTRODUCTION TO A DIRECT SOLVER FOR NON SEPARABLE ELLIPTIC EQUATIONS, Prof R V Madala, NRL, Washington, DC, USA; 29 Jul 92
- 20 MATHEMATICAL MODELLING OF DIABETES, Prof J Subba Rao, School of Env. Sc., JNU, New Delhi; 2 Jul 92
- 21 STRESS DISPLACEMENT OF LITHOSPHERE: APPLICATIONS OF FINITE ELEMENT METHOD, Dr John Paul, C-MMACS, Bangalore; 25 Jun 92
- 22 WESTERN BOUNDARY CURRENT OF THE SEASONAL SUBTROPICAL GYRE IN BAY OF BENGAL, S R Shetye, NIO, Goa, 14 May 92
- 23 PERFORMANCE EVALUATION OF LINEAR SOLVER ALGORITHMS ON A PARALLEL COMPUTER, Mahua Sinha, C-MMACS, Bangalore 30 Apr 92

A3.3 VISITORS

A list of visitors to C-MMACS in 1992 arranged in alphabetical order of visitors' names. This list contains the name and affiliation of the visitor and the date of visit.

- 1 ASIMKAR, 27-29 Apr 92
- 2 DR BERNARD J ZAHURANEC, Scientific Officer, Oceanic Biology, Office of Naval Research, Arlington; 15 Jul 1992
- 3 DR A K BHANDARI, B CHANDRASEKHAR, Vittal Mallya Scientific Research Foundation; 28 Oct 1992
- 4 PROF J R BUNCH, University of California, USA; 7-18 Dec 1992
- 5 DR K DOOS, IOS Deacon Laboratory, UK; 6-17 Dec 1992
- 6 PROF B N DUTTA, Northern Illinois University, USA; 8-18 Dec 1992
- 7 S K DUTT, Chief, Physical & Material Sciences Division, Office of Science & Technology, American Embassy, New Delhi; 15 Jul 1992
- 8 DR GEETHA SUBBA RAO, AIIMS, Delhi; 6 Jul 1992
- 9 DR P GOSWAMI, IIT, Kanpur; 24-28 Jul 1992
- 10 DR K S HEBBAR, Department of Aeronautics & Astronautics, Monterey, CA; 9 Jul 1992
- 11 JAGANNATH, DANIEL, L&T, Bombay; 22-26 Jun 92
- 12 DR JAGANNADH, B, Scientist, ICT, Hyderabad; 9-24 Aug 92
- 13 DR JAYANT MODAK, Professor, Chemical Engineering, IISc, Bangalore; 28 Oct 1992
- 14 DR JOHN PAUL, NGRI, Hyderabad; 15-26 Jun 92
- 15 MR L M JOSHI, MR V V P SINGH, MR SUBHASH CHANDU, MR O S LAMDA, CEERI, Pilani; 8 Jan 1993
- 16 DR KAUJALGI V.B, IIM, Bangalore; 9 Jun 92
- 17 KRISHNA MURTHY B.M, DOD, New Delhi; 17 Jun 92
- 18 Professor LAXMIKANTA, Scientist, NCAR, Boulder, Colorado; 18 Feb 1993
- 19 DR B LOGANADAM, Scientist, CLRI, Madras; 23 Dec 1992
- 20 DR R V MADALA, Naval Research Laboratory, Washington, D.C., USA; 24 -30 Jul 1992
- 21 DR MALLICK S, Deputy Advisor, CSIR, New Delhi; 27-28 Aug 92
- 22 DR M MANJUPRASAD, Scientist, Structural Engineering Research Centre, Madras; 28 -29 Dec 1992
- 23 Professor MARC LUTHER, Florida State University, USA; 27 Aug 92
- 24 ACAD G I MARCHUK, Chairman Committee of Presidents of Academics of Sciences of CSI Republics; 2 Feb 1993
- 25 DR J McCREARY, Nova University, Florida, USA; 5-8 Dec 1992
- 26 DR S K MISHRA, Indian Institute of Tropical Meteorology, Pune; 2 Sep 1992
- 27 DR U C MOHANTY, IIT, New Delhi; 2 Sep 1992
- 28 DR D MUKESH, Alchemic Research Centre, Thane, Maharashtra; 14 Jul 1992
- 29 DR K S NARASIMHAN, Director, CFRI, Dhanbad; 30 Dec 1992
- 30 NARESH KUMAR, NISTADS, New Delhi; 25 Jan - 5 Feb 1993
- 31 DR PAT WILDE, Marine Geologist & Oceanographer, Former: Chairman, Ocean Engineering, Head, Marine Sciences Group, University of California, Berkeley; Office of Naval Research, Asian Office, Tokyo; 15 Jul 1992
- 32 PRASADA RAO, Joint Secretary, Department of Ocean Development, Delhi; 8 Mar 1993
- 33 MRS V G PURANIK, NCL, Pune; 14 Jul 1992
- 34 C R RAJASEKARA MURTHY, Research Scientist, National Water Research Institute, Professor, McMaster

University, Canada; 12 Nov 1992

35 DR RAMAMOCHAN T.R, RRL, Trivandrum; 11 Jun 92

36 DR V V RAMANAPRASAD, Scientist, CMRS, Roorkee; 19 -20 Oct 1992

37 SANJAY RAZDAN, NPL, New Delhi; 25 Jan - 5 Feb 1993

38 DR R V SARMA, National Institute of Oceanography, Bombay; 10-27 Aug 1992

39 DR SATISH SHETYE, Scientist, National Institute of Oceanography, Goa; 27 Aug 92

40 DR SETHURAMAN, Professor of Meteorology & Oceanography, Department of Marine Earth & Atmospheric Sciences, Raleigh, North Carolina; 17 Jul 1992

41 DR SHARMA S.P, Scientist, NEERI, Jaipur; 6 Aug 92

42 DR S P SINGAL, National Physical Laboratory, New Delhi; 2 Sep 1992

43 P K SINGH, Scientist, Central Institute of Medicinal and Aromatic Plants (CIMAP), Lucknow; 20 -31 Jul 1992

44 DR R N SINGH, Scientist, NGRI,

Hyderabad; 28-30 Jul 1992, 24 -27 Aug 1992

45 PROF R C J SOMMERVILLE, Head, Climate Research Programme, Scripps Institute of Oceanography, USA; 9-18 Dec 1992

46 PROF N SREENATH, Case western Reserve University, USA; 14-16, Dec 1992

47 PROF J SUBBA RAO, School of Environmental Sciences, JNU, New Delhi; 2 Jul 1992

48 Dr S Chandra, NASA Goddard Fl.Centre, USA; 10-11 Jan 1993

For further information, write to

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