Weather and climate modelling*

Monsoon is an important phenomenon that influences various aspects of India to a great extent, including its economy. Since India has an agro-based economy, it is absolutely crucial and important that various facets of monsoon and the associated rains be predicted as realistically as possible. It is a challenging task to all scientists for developing and improving models for finally obtaining societal beneficial forecasts. These improvements are to be acquired at all time scales with an emphasis on the initial state of the atmosphere. In order to achieve this goal, any additional data that are assimilated in the analyses system for providing the initial conditions for the model may improve the model performance. In addition, better skill can be obtained by improvement in the parameterization schemes of various physical processes. Increasing the resolution of models could resolve the orographic forcing, leading to a more realistic rainfall prediction. In the coming years, many new observations from satellites are going to be available in high-resolution all over the globe for use in modelling. India is also entering into an ambitious plan of launching various satellites with meteorological payloads. With development of proper assimilation technique the new satellite data could enhance the forecast capabilities.

The objective of the Indo-US workshop on Weather and Climate Modelling was to bring together the scientists involved in the areas of weather and climate modelling from both the countries for exchanging views and sharing experiences as well as planning future work. S. V. Singh of NCMRWF and Dr B. B. Rath of the Naval Research Laboratory, USA, coordinated the workshop. Twelve scientists from USA belonging to six major establishments participated in the deliberations. Indian scientists from various organizations like India Meteorological Department, NCMRWF, Indian Institute of Tropical Meteorology, ISRO (SAC) and Indian Institute of Technology (Delhi and Roorkee) had participated. In addition, representatives from user community like Indian Air Force, Indian Navy, Snow and Avalanche Study Establishment and Indian Council of Agricultural Research (Central Research Institute for Dryland Agriculture), and various universities participated in the workshop. In all, there were about 120 delegates. The presentations and discussions were mainly confined to three broad themes, viz. (i) improvement of global analysis –

forecast system, (ii) mesoscale models: cloud and land surface process, and (iii) dynamical extended range prediction.

The workshop was structured so that under each broad theme, scientists from both the countries presented the state-of-the-art available in their respective country and identified the problems encountered. There were eleven presentations from the US scientists and ten presentations from the Indian scientists. After presentations by the scientists, group discussions were held.

The presentations under the theme ‘Improvement of global analysis – forecast system’ focused on two aspects, viz. parametrization of physical processes and data assimilation. Thrust was on improving the forecast skill through assimilation of enhanced satellite-derived observations from the existing as well as future satellites, including Indian satellites, viz. INSAT 2E, METSAT, INSAT 3A and INSAT 3D. It was felt that the THORpex (The Hemispheric Observing System Research and Predictability Experiment) programme under WWRP (World Weather Research Programme) would provide the right kind of opportunity for India to make optimal usage of the enhanced operational observing system, including the new satellite data for improved predictions of high-impact weather systems. In order to improve the model performance, ensemble forecasting with more members and multi-model super ensemble-based unified schemes for various physical processes were suggested.

Related to mesoscale modelling aspects, many presentations emphasized the importance of the land surface processes and surface characteristics in prediction of circulation patterns and regional scale weather systems. Performance of various kinds of mesoscale models was shown both over US as well as Indian regions. NCAR’s effort in designing the next generation mesoscale model (WRF) was also discussed. Model performance of COAMPS (Coupled Ocean/Atmosphere Mesoscale Prediction System) in simulating tropical cyclone structure and track was presented. It was shown that the newly developed high-resolution initialization system improved the tropical cyclone structure analysis and forecast.

Joint cooperation in the field of disaster management in terms of cyclone warning systems was urged. In general, a consensus was reached for mesoscale assimilation with optimal usage of regional observations, along with improved representation of microphysical processes. Verification and validation aspects were also identified as key issues for future work.

Under the theme ‘Dynamical extended range prediction’, results on the simulation of Asian summer monsoon in the coupled ocean atmosphere (Cane-Zebiak) model and SST variability were presented. Presentations were also made on the procedure being followed for forecasting monsoon on long range in India. A need was felt to pursue studies on monsoon forecasts under the global warming scenario with specific role of snow cover and sensitivity of soil wetness.

Several topics identified for joint collaboration, may lead to long-term scientific arrangements with different organizations. As a follow-up of this workshop, NCMRF and NCAR have already signed an MOU for collaborative research on 26 July 2002.

S. V. Singh, National Centre for Medium Range Weather Forecasting, Mawsam Bhawan Complex, Lodhi Road, New Delhi 110 003, India (e-mail: svsingh@ncmrwf.gov.in).

MEETING REPORT

Emerging trends in biotechnology – stem cells*

Stem cell research has emerged as the most vibrant biological research activity. This is evidently a reflection of the fact that these cells have the capacity of self-renewal and the potential to differentiate into one or more cell types depending on the signals in vivo. The applications of such cells clearly go beyond medical imagination, as they can possibly be used in the treatment of diseases like Parkinson’s, Alzheimer’s, diabetes, heart disorders, spinal cord injuries or for development of in vitro assay system for drug discovery and toxicity or for understanding basic developmental process. Rightly so, the journal Science (published by the American Association for the Advancement of Science, USA) believes that stem cell research would be actively pursued not just by academia, but also by the industry.

The international conference to discuss advances in this area was therefore a very timely effort. B. S. Bajaj (Chairman, All India Biotech Association – Southern Chapter) welcomed the guests and explained briefly the objectives of the conference. Martin J. Evans (Director, Cardiff School of Biosciences, Cardiff University, UK), the discoverer of embryonic stem cells, delivering the keynote address on stem cells, described the events that resulted in the landmark discovery of mouse embryonic stem cells. He also discussed various potential applications, ethical and regulatory issues pertaining to stem cell research. He warned that stem cells are still in a research mode and have a long way to go before they are adopted in clinical practice.

He presented various aspects of embryonic stem cells and their ability to carry mutations introduced to test the function of a gene and an understanding of the disease process. He also covered new concepts in experimental mammalian genetics and their use in gene targeting, trapping and genetic manipulation. He highlighted the potential of embryonic

*A report on the international conference on ‘Emerging Trends in Biotechnology: Stem Cells – Technology, Potential and Trends’, organized by the All India Biotech Association – Southern Chapter, jointly with Andhra Pradesh Government, Centre for Cellular and Molecular Biology, Centre for DNA Fingerprinting and Diagnostics and Department of Animal Sciences, University of Hyderabad and supported by the Indian Council for Medical Research and other pharma and biotech industries, from 2 to 4 May 2002 at Hyderabad.