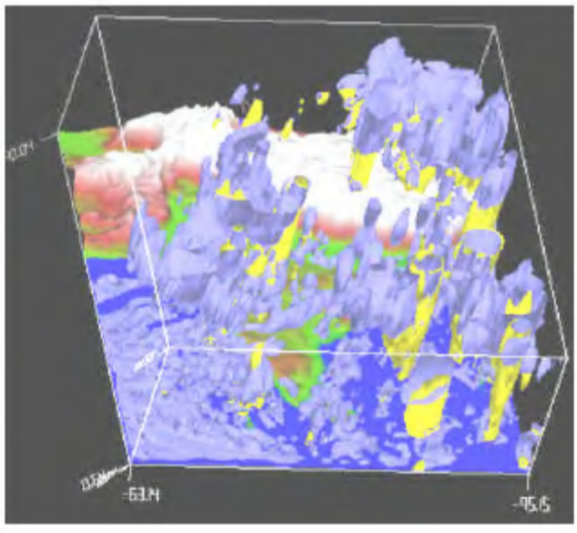
In this issue

Mesoscale modelling for mountain weather forecasting

Severe weather has calamitous effect in mountainous regions as the terrain is complex, development is poor and economy fragile. Northwest India and the Himalayan region are prone to vagaries of weather both in summer and in winter, claiming casualties every year. Cloudbursts, squall winds and flash floods cause loss of life and damage to properties worth billions of rupees.

The year 2002 was recognized as the International Year of Mountains. The declaration was built on the process initiated at Rio in 1992, which recognized the crucial role played by mountain ecosystems and encouraged governments to ensure sustainable mountain development. In view of the large impact caused by the mountain weather systems on human life and society and to take stock of available knowledge of the mesoscale models in India and its application in forecasting, a workshop on mesoscale modelling with special emphasis on mountain weather forecasting was jointly organized by the National Centre for Medium Range Weather Forecasting (NCMRWF) of India and the National Centre for Atmospheric Research (NCAR) of USA at New Delhi during 29–30 July 2002. Various issues discussed during the workshop were: (1) Mountain weather forecasting, (2) Mesoscale atmospheric modelling, (3) Mesoscale observations and data assimilation, (4) Radar and satellite applications, and (5) Severe weather phenomena. The special section on Mountain Weather Forecasting (**page 899–951**) contains the papers presented at this workshop.

Real-time forecasting of severe weather conditions including western disturbances over the mountain regions remains a challenging task. With sparse data over such regions where there are also problems of communication, accurate forecasting is important for undertaking mountaineering expeditions, avalanche prediction, etc. To enhance meteorological observations over the western Himalayas, 26 surface observatories and 2 upper air stations have been set up. Considering the importance of forecasting the severe weather over the Northwest India, particularly the Himalayan region the Government of India has established a mountain meteorology programme involving the India Meteorological Department (IMD), the Snow and Avalanche Study Establishment (SASE), and NCMRWF. Currently, mountain weather forecasting over the Western Himalayas is carried out through a combination of various products, viz. regional/mesoscale model outputs, global model products, *in situ* observations, and satellite observations along with synoptic conditions.



Simulated cloud image over India for 27 June 2002 using MM5 mesoscale model at 30 km resolutions.

At NCMRWF, high-resolution mesoscale models such as MM5 and ETA are run on real-time basis in nested domains at 90, 30 and 10 km resolutions for forecasting mesoscale systems, viz. the western disturbances, severe thunderstorms, tropical cyclones and heavy rainfall episodes. Studies of intense atmospheric vortices, particularly the tropical cyclones over the Indian region, have been carried out using mesoscale models by different groups in India. Some experiments have also been carried out with four-dimensional data assimilation. These studies have shown that the mesoscale data assimilation, appropriate parameterization of land surface processes and setting up of meso-network of observations are very important for improving the quality of forecasts.

One of the major problems of mesoscale modelling is the paucity of data at high spatial resolution. The present observing systems comprising surface, radiosonde, satellite-derived cloud drift winds and soundings are much below the scales required by mesoscale models. Mesoscale analyses therefore have increasing reliance on high resolution satellite data and other remote sensing systems like radars. Increasing efforts are being made at NCMRWF to generate and study high resolution satellite data in the mesoscale analyses. Satellite data from SSM/I, Quickscat, TMI, ATOVS, AIRS and the Indian satellites MSMR, INSAT and METSAT are being studied and archived. Some of these data are already used in the NCMRWF global data assimilation and forecast system.

In order to meet the challenging task of mountain weather forecasting, mesoscale network of automatic weather stations and Doppler Weather Radars covering the entire Himalayan belt will have to be set up. Concerted efforts need to be made towards development of mesoscale models and data assimilation techniques.

S. V. Singh
Someshwar Das

Note: It is with deep sadness that I report the passing away of S. V. Singh, the co-guest editor of this special section, on 7 November 2004 (see page 993 for an obituary).