



भारत सरकार

Government of India

पृथ्वी विज्ञान मंत्रालय

Ministry of Earth Sciences

Monsoon Mission

In recent decades dynamical numerical models have considerably improved and most of the global coupled models have good prediction skill of ENSO(El Nino Southern Oscillation) SST with six months lead time .The hindcast skill of seasonal mean rainfall over the central Pacific is very good, one season in advance. **However, not much breakthrough has taken place in improving the prediction skill of Indian summer monsoon rainfall.** In recent times, several new approaches (high resolution, super parameterizations, data assimilation etc.) have shown that the variability in tropics can be reasonably resolved, thereby creating a great scope for improving the monsoon prediction.

- ✚ Although many centers in the world use dynamical model framework to predict seasonal mean climate routinely, in India such a frame work has to be put in place. Keeping in view the above, Ministry of Earth sciences intends to launch a national mission on monsoon prediction. While the concerted efforts, by various research and academic institutes in India and abroad, are commendable towards developing/improving the current generation of dynamical models to improve the monsoon rainfall prediction, with improved insight of the entire complex phenomena, greater success can be achieved for prediction of monsoon rainfall on different time scales. Under this mission the computational facilities at various MOES institutes will be made available to academic institutes that will be participating in the national mission.
- ✚ In order to put such a framework in place and **make seasonal forecasts** using multi-model **ensemble system by 2010 monsoon season it is required to identify a core model.** For the mission it has been decided to use the NCEP-CFS model as the core model. However, a plan for improvement of prediction skill of this frame work is critical . Recognizing the fact that such a complex problem needs national effort involving academic and R&D institutes, **Ministry of Earth Sciences through the "National Mission of Monsoon" will involve all relevant organizations and research institutes** for improving the dynamical prediction of seasonal mean monsoon.
- ✚ For evolving the network required for this mission, **a meeting of stakeholders involving R&D and academic institutes along with the MoES units was held on 16th January, 2010 at 10.00 AM in the conference room of IMD, 6th Floor to evolve a workable strategy including constitution of the scientific steering committee.** The meeting was chaired by Secretary, MoES. Participants from various academic institutions and universities apart from the MoES units participated in the meeting.

1. The National Mission **to be implemented at IMD** will be undertaken through two sub-missions pertaining to two different time scales viz.

- (i) Monthly, seasonal and intraseasonal scale
- (ii) Medium range scale (upto 15 days)

It is important to borne in mind that whereas in research projects, the criteria for success is generally the demonstration of the potential for improvement in skill (with suggested changes in the model or more data on the clouds, ocean etc.), **the deliverable of a mission will have to be an unequivocal demonstration of improvement in skill.** The approach must take this into account

- (i) setting up a framework for generating dynamical forecasts
- (ii) improvement of the skill of forecasts.

Of these, (i) involves importing and porting the model and acquiring the data assimilation system.

(ii) The more difficult task, by far, is the requirement to improve the skill of the forecast of the Indian summer monsoon rainfall that can be achieved through improved parameterization, ingesting more observations (especially satellite observations), improved assimilation techniques, enhanced resolution and improved techniques for land-ocean-atmosphere coupling etc. It is equally important to have continuous assessment of any changes towards the improvement of the skill that needs to be pre-defined.

The major outcomes of the meeting are as follows:

For Monthly, seasonal and intraseasonal scale

Aim: Discernable improvement in the simulation/ retrospective prediction of the interannual variation of the all-India summer monsoon rainfall (and the summer monsoon rainfall over a few homogeneous zones, if possible) with dynamical models over a time span of 3-5 years

- 2. IITM will coordinate the national mission on improving seasonal and extended range prediction of monsoon rainfall. Since Climate Forecast System model of NCEP is reasonably capturing the seasonal mean and possesses some reasonable prediction skill, this model provides a reasonable base system for future development/improvements. All participants unanimously agreed for the proposal and extended their support towards the model development, improvement and diagnosis.
- 3. For improving this, we need to improve :
 - (a) The models: coupled (one tier system)
atmospheric and oceanic (two tier system)
 - (b) Initial conditions (depends on the quality of the data and assimilation procedures, this is particularly important for coupled models because otherwise the evolution of the ocean is not realistic)
 - (c) Forecast of SST for atmospheric models

The final skill depends on all these, hence it is important to try and improve all the above.

4. IITM will share its computing resources as well as share the model code with all the academic institutions to enable them to work towards its improvement.

For Medium range scale (upto 15 days)

Aim: Discernable improvement in the simulation/ retrospective prediction of the monsoon in the medium range scale (upto 15 days in advance) with dynamical models over a time span of 3-5 years

5. NCMRWF will coordinate the national mission for weather forecasting in the two week temporal scale. It was deliberated and decided that for extending the capability beyond seven days, it is pertinent that one should utilize coupled ocean atmosphere model. The agreement with UKMO (that uses 4D VAR assimilation system) will enable use of the unified UKMO system that has shown good promise to be utilized through the entire medium range scale.

6. For improving the skill of such model, it is essential to optimize all kind of observations (especially from satellite), land surface assimilation and parameterization of various physical processes.

7. NCMRWF will share its computing resources as well as share the model code with all the academic institutions to enable them to work towards its improvement.

Strategy for model improvement

- As in research projects, each scientist/ group will contribute to the effort depending on the expertise and interest of the scientists in the group.
- Once the facets to be investigated (such as cumulus parameterization, land surface modelling etc.) are decided on, it is necessary to ensure that each of these is investigated by at least one group.

8. All such research proposals will be encouraged from Indian as well as International scientists who will submit the proposals to work towards the above goal.

9. A steering committee will be constituted to oversee the successful accomplishment of the mission in a specific time frame.

List of Participants of the meeting on 16th January 2010

- Dr. Shailesh Nayak , Secretary, MoES
- Dr. Ajit Tyagi, DGM, IMD
- Prof. B.N. Goswami, Dir, IITM
- Dr. A.K. Bohra, Head, NCMRWF
- Dr. S.S.C. Shenoi, Director, INCOIS
- Shri. D. R. Sikka, Ex Director IITM
- Prof. Sulochana Gadgil, IISc. Bangalore
- Dr. Swati Basu, Adviser, MoES
- Dr. M. Rajeevan, NARL, ISRO
- Prof. U.C. Mohanty, IIT Delhi
- Prof. O.P. Sharma, IIT Delhi
- Prof. Ravi Nanjundiah, IISc. Bangalore
- Dr. (Mrs) Parvinder Maini MoES
- Dr. S . K. Roybhowmik IMD
- Shri D. R. Pattanaik, IMD
- Dr. D. S. Pai, IMD
- Dr. R. Krishnan , IITM
- Dr. Suryachandra A. Rao, IITM
- Dr.A.K. Sahai, IITM
- Dr. C. Gnanaseelan, IITM
- Dr. E. N. Rajagopal, NCMRWF
- Dr. S. C. Kar, NCMRWF
- Dr. Munmun Dasgupta, NCMRWF
- Dr. A. K. Mitra, NCMRWF
- Dr. P A Francis, INCOIS
- Prof. S K Dash, IIT Delhi
- Dr. Krishna AchutaRao , IIT Delhi
- Arun Chakraborty, IIT Kharagpur
- Dr. K. C. Gowda, CMMACS
- K. Rajendran, CMMACS
- T. N. Venkatesh, NAL
- Mrudula, NAL
- Prof. Suthapa Chaudhuri, Kolkata University
- Prof. K. V. S. R. Prasad, Andhra University
- Dr. C. M. Kishtawal, ISRO
- Dr. Janaki Raman , CDAC