Ministry of Earth Sciences (MoES)
Government of India
Indian Institute of Tropical Meteorology
(IITM)

Call for Research Proposals under
"National Monsoon Mission-III"

Earth System Sciences Organization (ESSO) of Ministry of Earth Sciences (MoES), Government of India, launched the "National Monsoon Mission" (NMM), a mission mode project with a vision to develop a state-of-the-art dynamical prediction system for monsoon rainfall on all different time scales in 2012. It has completed its first and second phases by setting up high resolution coupled dynamical prediction system with reasonable prediction skills for seasonal and extended range time scales and a very high-resolution atmospheric model for weather prediction. In the second phase, the focus was on improving extremes and developing applications. MoES has approved the continuation of the Monsoon Mission program as "National Monsoon Mission-III (MM-III)" for the next five years (2021-2026) with an emphasis on the development of next-generation coupled seamless prediction systems and development of applications.

The Indian Institute of Tropical Meteorology (IITM) has been given the responsibility of the overall execution of the monsoon mission by MoES. Other MoES institutes partnering with this mission are National Centre for Medium Range Weather Forecasting (NCMRWF), India Meteorological Department (IMD) and the Indian National Centre for Ocean Information Services (INCOIS). NCMRWF will use the UKMO-based NCUM (NCMRWF Unified Model) for global and regional (deterministic and ensemble) seamless forecasting and data assimilation, IITM will use the modified NCEP CFS/GFS (a.k.a MMCFS), and INCOIS will be working on improving the ocean data assimilation system based on GODAS and further improving the Ocean Model component of the CFS to achieve the objectives of the MM-III.

For the Monsoon mission, IITM, NCMRWF, IMD and INCOIS are collaborating with NCEP (USA), Met Office (UK) and various academic institutions/organizations in India and abroad to improve the prediction skill of the next generation models and extensive use of AI/ML to improve these forecasts further.

With this background, research proposals are invited from individuals/institutes in the following broad areas.

A. Next generation coupled seamless prediction systems

1. Develop a framework and demonstrate consistent improvement of forecasts of heavy precipitation events in GFS/NCUM at short range scale with lead time of at least 3 days. (Benchmarks for at least 4 seasons may be demonstrated)

2. Enhance the skill of sub-seasonal predictions at sub divisional scale beyond 3 weeks and achieve skill score of ~ 0.6 for seasonal forecasts, for homogenous regions over India.

3. Incorporating new methods to enhance the quality of analysis from coupled data assimilation (presently used at IITM/NCMRWF) compared to the state-of-the-art analysis products available at present with focus on land data assimilation system.

4. Global and regional Indian Ocean model development based on MOM6 including (i) high-resolution global model (~1/12°) with sea-ice module (preferably CICE5) and data assimilation, (ii) very high-resolution Indo-Pacific regional model (~1/25°) and nested (1/48°) basin-scale north Indian Ocean model with appropriate open boundary conditions, (iii) data assimilation modules in the global/regional/basin-scale model and (iv) science modules such as river discharge/freshwater flux to the ocean, open boundary conditions, mixing parameterization, biogeochemical module, etc. to augment the MOM6 based model developments.

5. Process-specific observation campaigns in the Arabian Sea for improvement of bulk flux algorithms, understanding of evolution and collapse of warm pool dynamics and understanding air-sea interaction processes in seasonal and intra-seasonal time scales.

6. Development of hybrid models with AI/ML and conventional modeling for seamless predictions in the areas of Cumulus convection, radiation and boundary layer parameterizations.

B. Development of applications based on MoES models' products
   1. Improvement in the spatial and temporal scales of the forecasts reaching out to Block/Village level and for location specific forecast up to 7 days through post processing and extensive use of AI/ML techniques.
   2. Generation of customized NWP products through the statistical post processing of the model outputs (deterministic and ensemble) for applications in the sectors like:

      a. **QPF & ensemble based PQPF for Urban, Flash Flood & Riverine Flood**
      b. **Aviation weather products -a)**Trend forecast during next 2-h over an airport from Model like Rainfall, winds, temperature, trend in occurrences and intensity changes of major likely weather event spells e.g. rainfall, convective events and thunderstorm etc. b)Significant weather products in map form for Asia-Icing level, wind shear product at lower level and mid-level, CAT, Turbulence at various flight levels, area of potential convection with intensity types (all products with intensity based weak, moderate and intense), level of maximum winds and jet Core. Fog Forecast products.
      c. **Energy(Solar and Wind): a)Wind products at different levels of boundary layer-30, 50, 80, 100, 120 and 150m**

   3. Development of Extreme Weather Forecast (Thunderstorms with lightning, Hail and Squall).
      Support from/through IITM/NCMRWF/INCOIS will be available to configure the modelling system for a planned research study. The computing facility of IITM/NCMRWF HPC will be made available to execute the components of the research proposal by researchers from India.

Project proposals are invited from national and international organizations/Universities/Institutes in the thrust areas of National Monsoon Mission-III, as indicated above). Formats for National and International proposals and other information are available at the IITM website at the link http://www.tropmet.res.in/monsoon/index_3.php and at NCMRWF and MoES websites.

It is proposed that interested PIs who wish to participate in the National Monsoon Mission-III should first submit concept notes (about two pages indicating the title, names and organizations of the PIs, objectives and work plan of the proposed project, along with pertinent references which establish the expertise in the area of the project) by email: to

mm_3@tropmet.res.in. These concept notes will be reviewed and based on the review; the proposals will be shortlisted for the submission of full proposals. This will be communicated to the successful PIs with a request to submit the full proposal in the appropriate format, initially by e-mail. Final Proposals along with all essential endorsements and certificates in the prescribed format may be forwarded through the proper channel and should be sent to the office of the Director, Indian Institute of Tropical Meteorology (IITM), Dr. Homi Bhabha Road, Pashan, Pune – 411008, INDIA. The envelope should be clearly superscripted "MM-III PROPOSAL".

It may be noted that **the date has been kept OPEN for submission of the proposals to National Monsoon Mission-III.** However, it is advisable to send the proposals at the earliest. The proposals, for which the concept notes are received by January 30th, 2023, will be considered in the first round. The successful PIs will be requested by the second week of February to submit the full proposal.