

**Minutes of the IAMAS/ICTM Workshop on Monsoon Variability, Predictability and Prediction held at Indian Institute of Tropical Meteorology (IITM) Pune in Hybrid mode on 30 June 2025**

There were 11 invited/keynote talks from scientists from different parts of the globe on various aspects challenges of monsoon prediction. A panel discussion was arranged towards the end of the workshop. More than 75 participants attended the workshop and panel discussions in addition to many YouTube viewing . The prominent scientists delivered keynote talks are (i) Dr. Suryachandra Rao (IITM, Pune), Prof. Ravi Nanjundiah (Indian Institute of Science, Bangalore), Dr. Swadhin Behera (

Japan Agency for Marine-Earth Science and Technology, Japan) Dr. Yu Kosaka (University of Tokyo, Japan), Dr. Annalisa Cherchi (Istituto di Scienze dell'Atmosfera e del Clima, Italy), Prof. K. Ashok (university of Hyderabad, Hyderabad), Dr. C. Gnanaseelan (IITM, Pune), Dr. Roxy Mathew Koll (IITM, Pune). The other invited speakers are Dr. Subodh Saha (IITM, Pune), Dr. Jasti Chowdary (IITM, Pune), Dr. Nuncio Murukesh (National Centre for Polar and Ocean Research, Goa).

**Over all recommendations from the panel discussions**

**Artificial Intelligence/Machine Learning (AI/ML) techniques are emerging as reliable tools for monsoon prediction. Seasonal prediction of Indian monsoon is better even with 1-year lead (corr approx.. 0.6 to 0.7). Region specific AI models may be used for regional rainfall prediction.**

**AI plus physical based models may be useful for intraseasonal prediction.**

**More focused research on land-atmosphere interaction and other processes in climate prediction models is to be prioritized. Land surface processes and changes play an important role in predicting ISMR. Integrating hydrology and land-surface modelling with atmospheric modelling might benefit the seasonal prediction of ISMR. The representation of the diurnal cycle in models is an important science issue.**

**Proper representation of LPS/Synoptic scale activities and SST/convection response will improve the monsoon prediction. By improving freshwater flux and increasing the model resolution, we can improve the representation of synoptic-scale systems in models.**

**The prediction is subject to model bias, and AI/ML can be used to correct model bias. At the same time, understanding the physical processes is very important. The datasets, like soil moisture, are important for better representation of land atmospheric interaction and process understanding, so they have to be improved. Midlatitude dynamics and the interactions with tropics are needed to be explored more.**

**It is important to understand and model the interaction between decadal and interannual climate modes to improve the rainfall prediction skills in the monsoon regions.**

**The improvement of microphysics, by making use of our own observations, like CAIPEX data, Lidar and Radar data, is important. It is important to improve the dust and aerosols representation in the models in seasonal and extended range predictions.**