



The Abdus Salam  
**International Centre  
for Theoretical Physics**



# 6<sup>th</sup> Summer School on Theory, Mechanisms and Hierarchical Modelling of Climate Dynamics: Artificial Intelligence and Climate Modelling

## DESCRIPTION:

Applications of ML/AI to weather and climate modelling have experienced an exponential growth. Weather forecasts based on AI models trained on re-analysis data are now possible with forecasting skills comparable to those of physical numerical models.

## MORE INFORMATION:

However, to what extent the AI approach can be extended to longer time scales is a research topic of increasing importance. At the same time, traditional atmospheric and ocean models based on numerical solutions of PDEs have increased their resolution to a few kilometers, which makes their application on climate time scale very challenging. In order to test the validity of these methodologies on climate time scales in a statistically sound way, experiments on several multi-decadal simulations are required. In this context, intermediate-complexity climate models provide convenient 'numerical laboratories'. The goal of this workshop is to present state-of-the-art applications of AI/ML, advanced numerical methods and innovative hardware/software solutions tested on intermediate-complexity models, such as the SPEEDY global model developed at ICTP. The workshop will also review the state-of-the-art of AI development.

## TOPICS:

- General introduction to AI/ML techniques.
- Review of state-of-the art of AI developments in global and regional Weather and Climate Modelling.
- AI/ML applications in Climate Modelling.
- Can AI be used to generate larger ensembles from physical simulations with just few members?
- Uncertainty estimation from numerical models and AI.
- Can AI replace physical numerical models on sub-seasonal to multi-decadal time scales for climate applications?
- AI for physical parameterizations: parameter calibration or full-AI modules?
- AI models and convection-permitting physical models: Complementary or contradictory ?
- Testing AI methods in an intermediate complexity modelling framework.

## SPEAKERS AND PANELIST INCLUDE:

Dhruv Balwada, Columbia University, USA  
Matthew Chantry, ECMWF, UK  
Alban Farchi, ECMWF, UK  
Shruti Nath, University of Oxford, UK  
Tim Palmer, University of Oxford, UK  
Julien Le Sommer, University of Grenoble, France



**5 - 16 May 2025**



**Trieste, Italy**



**Application and Deadlines:**  
Requesting financial and/or visa support:  
**15 March 2025**  
For remote participation:  
**15 April 2025**

## DIRECTORS:

Serafina Di Gioia, ICTP, Italy  
Riccardo Farneti, ICTP, Italy  
Franco Molteni, ECMWF, UK  
Adrian Tompkins, ICTP, Italy

## LOCAL ORGANISER:

Fred Kucharski, ICTP, Italy

## FURTHER INFORMATION:



E-mail: [smr4067@ictp.it](mailto:smr4067@ictp.it)

Web: <https://indico.ictp.it/event/10832/>

Female scientists are encouraged to apply

## GRANTS:

A limited number of grants are available to support the attendance of selected participants, with priority given to participants from developing countries. There is no registration fee.

