

## **IIT Bombay Swarnajayanti Fellow to work on eco-hydro- meteorological system for formulating better resilience**

Dr. Subimal Ghosh, Associate Professor at the Indian Institute of Technology, Bombay, one of the fourteen recipients of this year's Swarnajayanti Fellowship of the Department of Science and Technology (DST) will work on understanding the eco-hydro- meteorological system which can help to design the human intervention through adaptation for better resilience of the system.

Dr. Subimal Ghosh is an Associate Professor at the Indian Institute of Technology, Bombay. In his proposal for Swarnajayanti Fellowship, he has proposed to develop physics guided systems approach to understand the eco-hydro- meteorological system for a better understanding of inter-state dynamics of the integrated system towards defining the resilience. This will help in designing of the human intervention through adaptation among many options that may lead to the highest resilience of the system as a whole.

The Earth System comprises of the interactive spheres of Hydrosphere, Biosphere, Atmosphere, and Lithosphere, which constantly reorganizes itself into new states adjusting to inter-system feedbacks. Perturbations of any given part of the system may cause drastic changes in the states of both individual subsystems and that of the system as a whole.



Dr. Ghosh's proposed work aims to understand these dynamics, with special emphasis on land-vegetation-atmosphere interactions through the water cycle. This will further help to understand the resilience of the system along with the possibility of the existence of tipping point.

Changing the pattern of the water cycle has huge impacts on ecology and human society. To adapt to these natural and anthropogenic changes of climate variables, human activities intensify, leading to conversion from the natural system to a human-natural system. Vegetation acclimatize with changing phenology along with the human-induced changes such as applying irrigation, agro-forestry, conversion from forest land to cropland, and so on. This helps in understanding the dynamics of the Earth System Complex. The trajectory of the human-natural earth system in Anthropocene is still an open science question. Dr. Roy's work will focus in this direction at a regional scale with special emphasis on vegetation-human-land-atmosphere interactions for the Indian monsoon region.

Through his proposal Dr. Ghosh aims to address the questions of the regional hydro-climatic system, which consists of multiple sub-systems (human, land, atmosphere, vegetation) and how does it reacts to different levels of stresses. He will also work on the analytical framework to represent the dynamics of the regional earth system (with forcings and feedbacks) under perturbation induced by stress and analytically define and quantify the resilience and tipping point of the regional hydro-climatic system considering the perturbation dynamics of individual sub-system and inter-system feedback.

He will develop a new computational framework on land-atmosphere-vegetation-human interactions along with a novel technique based on a process network that will consider the

variables as nodes and connecting processes as links. His objective is to understand this topology under stress and its dynamics.

The novelty of the proposed work lies in the development of physics guided systems approach to understanding the eco-hydro-meteorological system for a better understanding of inter-state dynamics of the integrated system towards defining resilience.

Such an integrated framework will also help in designing human intervention through adaptation among many options that may lead to the highest resilience of the system as a whole. Considering human and human-induced changes as parts of water cycle dynamics and then simulating them with an innovative process network as opposed to state of the art modelling of the natural system make the proposed work novel and unique.