INSTITUTE OF INFRASTRUCTURE, TECHNOLOGY, RESEARCH AND MANAGEMENT

POPULAR LECTURE SERIES (2014 – 15)

Speaker : Professor Ulrike Feudel,
Institute for Chemistry and Biology of the Marine Environment
Carl von Ossietzky University Oldenburg, Germany

Title : Concepts of dynamical systems theory in environmental science

Time : Wednesday, 18 March, 2015 at 3:00 pm

Venue : Seminar Hall, First floor, IITRAM

Abstract

The dynamics of our environment is, in general, characterized by complex patterns which evolve in space and time such as circulation patterns in the oceans, weather patterns in the atmosphere or biodiversity patterns in the biosphere. The methodology of dynamical systems theory is focused on the one hand on characterizing spatio-temporal patterns and on the other hand on studying transitions between such patterns, when environmental parameters or forcings are varied. In her lecture Prof. Ulrike Feudel had discussed several approaches, originating from dynamical systems theory and their extension to in environmental science. As one example, she had demonstrated, how the concept of Lagrangian Coherent Structures and Finite Time/Size Lyapunov Exponents can be used to study the organization of ocean flows and its impact on marine biology. Furthermore she had discussed the notion of tipping points and their relation to transitions between patterns, e.g. alternative states of vegetation in arid areas, species dominance in oceans, lakes and sediments in the context of climate change. However, tipping points can also correspond to switches between states due to changing long-term trends or changing variability. Climate change is not only related to changes in means values, like e.g. increase of mean temperatures in ocean and atmosphere but also to a variation of the characteristics of fluctuations (noise) with e.g. an increasing number of extreme events. Prof. Ulrike Feudel had given various examples from different fields of environmental science to shed some light on the study of conceptual models by means of dynamical systems theory to understand basic principles of transitions in the earth system resulting from changing environmental conditions and the challenges to identify those transitions in complex models and natural systems.