Applied Mathematics Seminar

UCC
University College Cork, Ireland
Coláiste na hOllscoile Corcaigh

Johannes Jakob Lohmann

University of Copenhagen

Predictability of the climate in the presence of tipping points

Due to non-linear dynamics of the climate system, Earth's safe operating space is limited. Beyond a certain level of a control parameter, such as the atmospheric Greenhouse gas concentration, qualitative regime shifts in one or more sub-systems may take place. Additionally, theoretical studies suggest that abrupt, irreversible change can happen already prior to the crossing of a critical threshold in a control parameter. In these so-called rate-induced transitions, the effective parameter level to induce tipping depends on the rate of change of the control parameter. Here we show rate-induced tipping points of the overturning circulation in a global ocean model. Due to chaotic dynamics, whether there will be tipping or not depends both on the rate and initial conditions in a very sensitive, non-smooth way. This raises questions about whether the safe operating space is still well-defined, and whether an approach of its boundary can be predicted. For tipping points associated with slow passages across a bifurcation, generic early-warning signals have been developed for these purposes. Due to the fast parameter changes involved in rate-induced tipping, early-warning is more challenging. In many cases the tipping involves a saddle escape, which results in a delay of the actual transition and can be exploited for early-warning. Here a time series indicator is proposed that may allow issuing a warning as the system gets close to tipping.

Thursday, 01.04.2021 · 12pm online (via MS Teams)

Contact Andrew Keane (andrew.keane@ucc.ie) for details

University College Cork · Western Road · Cork · T12 XF62