Seminar/Talk

The Death of Stationarity and the Runaway Greenhouse

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Host: Caroline Muller / ISTA Sustainability Group

It is common to refer to climate variability as being associated with processes that are internal to the climate system and to climate change as being associated with the effect of external forces that are time dependent. The “death of stationarity” poses a substantial challenge to climate predictability and to the climate sciences in general. This challenge is addressed herein by formulating the problems of change in the climate’s intrinsic variability within the framework of the theory of nonautonomous and random dynamical systems (NDSs and RDSs) with time-dependent forcing. A key role in this theory is played by the pullback attractors (PBAs) that replace the strange attractors of the more familiar theory of autonomous dynamical systems, in which there is no explicit time dependence of either forcing or coefficients.The concepts and methods of the NDS and RDS approach will be introduced and will be illustrated using a stochastically perturbed version of the Lorenz (1963) convection model. This illustration will be followed by an application to a minimal model of the interaction between the globally averaged temperature and carbon dioxide concentration, MinTC. This model exhibits multidecadal oscillations and bistability, with a runaway greenhouse for a severe scenario of anthropogenic greenhouse gas increase. MinTC is being coupled to a macroeconomic model of the social cost of carbon (SCC) and, time permitting, some preliminary results will be discussed.ReferencesBarnett, M., W. A. Brock, and L. P. Hansen, 2020: Pricing uncertainty induced by climate change. Rev. Financial Studies, 33(3), 1024–1066.Ghil, M., and V. Lucarini, 2020: The physics of climate variability and climate change, Rev. Mod. Phys., 92(3), 035002, doi: 10.1103/RevModPhys.92.035002.

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Mondi 1, Central Building & Online

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