



A mathematical approach to understanding emergent constraints

Femke J. M. M. Nijse (2) and Henk A. Dijkstra (1)

(1) Utrecht University, Institute for Marine and Atmospheric Research Utrecht, Department of Physics, Utrecht, Netherlands (dijkstra@phys.uu.nl), (2) CEMPS, University of Exeter, UK

One of the approaches to constrain uncertainty in climate models is the identification of so-called emergent constraints. These are physically explainable empirical relationships between some characteristic of the current climate and long-term projections that appear in ensembles of climate models. Using concepts of statistical mechanics, in particular linear response theory and transfer operators, we will present a mathematical framework to understand the appearance of emergent constraints in models. Based on this framework, we also propose a classification for such emergent constraints. Applications will be shown for several idealized (climate) models and suggestions are given on how to apply this framework to results of global climate models.