



Why and when ensembles are relevant in climate projections

Gabor Drotos (1,2), Tamas Bodai (3), and Tamas Tel (1)

(1) Institute for Theoretical Physics, MTA-ELTE Theoretical Physics Research Group, Eötvös University, Budapest, Hungary,

(2) Instituto de Física Interdisciplinar y Sistemas Complejos (UIB-CSIC), Palma de Mallorca, Spain, (3) Centre for the Mathematics of Planet Earth, Department of Mathematics and Statistics, University of Reading, Reading, UK

Ensemble approaches are becoming widely used in climate research. In contrast to weather forecast, however, in the climatic context one is interested in long-time properties, those arising on the scale of several decades. The well-known strong internal variability of the climate system implies the existence of a related dynamical attractor with chaotic properties. Under the condition of climate change this should be a snapshot attractor, naturally arising in an ensemble-based framework. Although ensemble averages can be evaluated at any instant of time, results obtained during the process of convergence of the ensemble towards the attractor are not relevant from the point of view of climate. In simulations, therefore, attention should be paid to whether the convergence to the attractor has taken place. We point out that this convergence is of exponential character, therefore, in a finite amount of time after initialization relevant results can be obtained. The role of the time scale separation due to the presence of the deep ocean is discussed from the point of view of ensemble simulations.