Short-term climate variability prediction and its social applications: Emerging activities as a common ground where science and society meet and dynamics and statistics are used in a complementary fashion

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Dynamics and statistics (and/or probability theory) are a couple of indispensible disciplines upon which mathematical sciences totally depend. Conceptually, those two are mutually exclusive approaches, but as it was substantiated in the course of history of science, they provide helpful complementary views or practical means of problem-solving. To the best of my knowledge, the first monumental encounter of those two was the celebrated notion of entropy introduced by Boltzmann in 19th century and the subsequent 20th century witnessed a profound alteration of the paradigm of physics through quantum mechanics.

As to dynamical prediction of weather and climate, its origin goes back to a far-off dream of Norwegian physicist called Vilhelm Bjerknes who foresaw a possible application of the classical physics for the prediction of atmospheric and oceanic motions, of which the first substantial step was taken by a group of scientists led by von Neumann's leading project on using the world's first computer. The main difficulties of the problem arise from the fact that it is not only nonlinear but also a problem with immense degree of freedom whose complete description is impossible even with cutting-edge the fastest and biggest computer. The incomplete aspects of our models are loosely parameterized in seemingly reasonable fashions, but experiences accumulated so far tell us that it often happens that model performance depends sensibly upon the ways of parameterization through complicate scale interactions and hence models cannot be free from unfavorable large prediction bias.

In my talk, a new challenge of coupling climate prediction model and a novel type of the global crop model so far not developed yet will be presented as an important socio-climate application study preparing for pressing the global food crisis in the foreseeable future. Practical ways of parameterization in a novel crop model and the control of climate model bias are focal points of our research, to which the Bayesian approach of statistical decision and the method of Maximum Entropy of information theory are respectively applied as complementary improving measures for dynamic approaches.