Webinaires CLIMERI-France

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Are GCMs obsolete?

Traditional general circulation models, or GCMs -- i.e. 3D dynamical models with unresolved terms represented in equations with tunable parameters -- have been a mainstay of climate research for several decades, and some of the pioneering studies have recently been recognized by a Nobel prize in Physics. Yet, there is considerable debate around their continuing role in the future. Frequently mentioned as limitations of GCMs are the structural error and uncertainty across models with different representations of unresolved scales; and the fact that the models are tuned to reproduce certain aspects of the observed Earth. We consider these shortcomings in the context of a future generation of models that may address these issues through substantially higher resolution and detail, or through the use of machine learning techniques to match them better to observations, theory, and process models. It is our contention that calibration, far from being a weakness of models, is an essential element in the simulation of complex systems, and contributes to our understanding of their inner workings. Models can be calibrated to reveal both fine-scale detail, or the global response to external perturbations. New methods enable us to articulate and improve the connections between the different levels of abstract representation of climate processes, and our understanding resides in an entire hierarchy of models where GCMs will continue to play a central role for the foreseeable future.

A preprint of an article under review related to the theme of this seminar is available at https://arxiv.org/abs/2204.06957