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# Building virtual planets with global climate models: a scientific endeavour (David Bates Medal Lecture)

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On the basis of the Global Climate Models (GCMs) originally developed for the Earth, it has been possible to develop GCMs for the other terrestrial environments in our solar system: Venus, Mars, Titan, Triton and Pluto.
The ambition behind the development of GCMs is high: the ultimate goal is to build numerical simulators only based on universal physical or chemical equations, yet able to reproduce or predict all the available observations on a given planet, without any ad-hoc forcing. In other words, we aim at creating in our computers virtual planets "behaving" exactly like the actual planets. In reality of course, nature is always more complex than expected, but we learn a lot in the process. On the basis of our experience in the solar system, we can also envisage to build realistic climate models to predict the environment on any terrestrial planets that we can imagine. Such a tool is useful for conducting scientific investigations on the possible climates on terrestrial extrasolar planets, or to study past environments in the solar system. Can we trust such a model when no direct observation is available? In this talk, I will review the lessons learned from the modelling of observable planets, the successes and failures of GCMs, and present recent and exotic applications.