

Title: Expertise, Uncertainty, and Modelling

Recent calls for "Responsible modelling" (for example in Saltelli, A., G. Bammer, et al (2020). "Five ways to ensure that models serve society: a manifesto." *Nature* 582(7813): 482-484; and, Saltelli, A. and M. Di Fiore (2023). *The politics of modelling: Numbers between science and policy.*) from people with wide expertise in modelling and policy making, have set out challenges to the modelling community that require a conceptual response alongside a purely technical one. While the challenges they set out are wide ranging, we collectively need to make a start to constructively address some of these issues.

Here, we argue that conventional uncertainty frameworks offer a mechanism for communication, between scientists about the possible forms of modelling and the state of the art, and with policy makers about the state of the (currently) possible, but do not provide an operational and formative approach for problem owners. They do not give an adequate framework to include the different types of knowledge available or take account of Box's famous view that "All models are wrong but some are useful". Here we develop a different approach which acknowledges the many roles of expertise alongside the possibilities of using multiple models of different types. These contribute to the form and content of modelling and hence impact on the reproducibility of the modelling process.