Decision Support in the Absence of Predictability as We Know It

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Abstract

The qualitative "looks-like" success of computational simulations has led to an explosion of model-based, often probabilistic forecasting in support of decision making in everything from American Football to Nuclear Stewardship. We question the utility of models justified by their "foundations" or the seductive beauty of their graphics, rather than their out-of-sample predictive performance. There are remarkable parallels between some challenges facing macro-economic modelling discussed at this meeting and difficulties faced by various types of "weather" forecasting (micro, meso, regional, global, medium-range, seasonal and climate) since the mid 1950's. Much ground on using nonlinear models in operational probabilistic forecasting was covered in Numerical Weather Prediction three decades ago in an attempt to foresee the likely error in individual weather forecasts. This aim slowly evolved into a very different goal: probability forecasts useful as such. Chaos made this a challenging, interesting and expensive but achievable goal. By the turn of the century, we could see that for physical phenomena, chaos was not the problem: Structural model error made probability forecasts misleading (wrong) well before chaos could make them uninformative.

To see that the hawkmoth effect (model error) trumps the butterfly effect (chaos), one has to come out of model-land and back to reality. Decision support in model-land with a structurally perfect model is simpler, effective, and rewarding. Staying in model-land has been remarkably easy, presumably due to the wonderful things one can do there. The nicety of these results, however, is lost in the move back to reality; very low probability events and model-inconceivable "big surprises" are much too frequent in applied meteorology, geology, and economics. We have found remarkably similar challenges to good model-based decision support in energy demand, fluid dynamics, hurricane formation, life boat operations, nuclear stewardship, weather forecasting, climate calculators, and the sustainable issuance of reindeer hunting licences. We will discuss decision support for disaster risk reduction just prior to the 2018 Pakistan heatwave.

There is little truly new here beyond a few mathematical flourishes, an openness to engage in discussions with all those involved, and embracing the plethora of warning from long dead philosophers, mathematicians, economists and physicists. Nevertheless computer simulation, misleadingly lovely graphics and personal comfort help to maintain large model-land populations of practitioners, advisors, advocates and some decision makers. In contrast, one can justifiably aim to transform simulations in model-land into information regarding the real word, but only where such information exists. Our aim is a decision making process that remains acceptable to all involved regardless of the outcome; ideally a process retained without modification and used again under similar conditions in the future, unless a deeper understanding of the system has been obtained. This cannot be accomplished in model-land without nontrivial tomfoolery. Uncomfortable departures from model-land are required for (good) decision support.