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Models or Measures of Climate Change: Why Does It Matter?

Much of our understanding of anthropogenic climate change, and much of the debate over climate science and climate policy is based on information generated via mathematical modeling. Rarely, if ever, do we see much discussion of empirical measurements of climate change; global average temperature and sea level are rare exceptions. But empirical measurements of climate policy impacts, empirical measurements of changes that might, or might not, validate modeled projections of such climate changes, or empirical measurement of meteorological (weather) changes are scarce to non-existent in most media.

The list of modeled components of climate-change discourse is endless and model output information dominates nearly every element of discourse about the climate: modeling of how the climate works, modeling of what human activities influence the global climate, modeling of how human activities might influence the local climate, modeling of how climate changes manifest as weather or meteorological changes; modeling of how those activities might change over time, modeling of how public policies involving greenhouse gas controls might mitigate climate change; modeling of how people might respond to climate policies behaviourally (economically) and on and on.

At the same time, many of the input assumptions that are used to shape, or parameterize, such models are simply speculation about the future put to numbers. Modellers create scenarios and story-lines of future societal development, estimate greenhouse-gas emissions from those scenarios and story-lines, and plug those values into mathematical climate models that predict future warming, and the harms of that warming.

For those who believe that public policy—the enactment of rules and regulations that are, by their nature, coercive tools of governance—should be based on evidence of a calibre one might demand in a court of law to determine guilt or innocence of a crime, the almost complete reliance on model outputs is problematic. This is so because model outputs are not, in fact, empirical evidence of anything concrete in the physical world. The outputs of computer models are speculative simulations that portray how things might be, rather than how things actually are. It is a critical distinction between science and not-science, evidence and not-evidence.

And in fact, computer model outputs are often at odds with actual, empirically measured reality. This study examines only two such divergences within the broader subject of climate-change science and policy: the divergence between modeled estimates of the sensitivity of earth's atmosphere to greenhouse-gas enrichment, and the disagreement between modeled predictions and actual rates of greenhouse-gas enhancement.

As the study shows, the tendency of speculative mathematical climate models has been to over-estimate how sensitive the earth's atmosphere is to enrichment with greenhouse gases, when compared to estimates based on measurement of actual temperatures and greenhouse-gas enrichment. To put it simply, they over-predict atmospheric warming, and the derivative consequences that would flow from such warming. In addition, models used to predict the enrichment of the atmosphere with greenhouse gases have also been more extreme than reality has demonstrated. Combined, these two modeled parameters, the sensitivity of the climate and how much greenhouse gas would be emitted in the future, have generated the scenarios of extreme climate change that have dominated the discussion for the last 20 years.

The policy implications of the mismatch between model-based and measurement-based estimates of climate warming are fairly obvious. When compared with measurement-based estimates of climate sensitivity, model-based estimates appear to be running "too hot" and, as a consequence, policies to mitigate such changes are themselves likely running "too hot" and overly aggressive. Measurement-based estimates suggest an atmosphere less sensitive to greenhouse-gas enrichment. This would, in turn, suggest that less-aggressive efforts to mitigate greenhouse-gas emissions, perhaps also with longer time-horizons might suffice to protect the world from possible climate change.

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