

The Costs and Losses of Integrating Social Sciences and Meteorology

I would like to talk about some of the challenges (and opportunities) we face in a highly interdisciplinary journal such as *Weather, Climate, and Society (WCAS)*. A recent discussion with a colleague here at the National Center for Atmospheric Research (NCAR) helped crystallize some of my thoughts about what we are trying to do with *WCAS*.

This colleague stopped by to ask my advice on a manuscript concept he was considering submitting to *Weather, Climate, and Society*. He is an outstanding research meteorologist who has been working with a team on models to improve flood warning systems in developing countries. He was interested in demonstrating the economic benefits of the improved warning system and wanted to apply a cost–loss model. Based on his reading of a number of articles in meteorological journals, the cost–loss model was the method of choice for demonstrating economic value.

My initial reaction was largely visceral, because I have a dislike for the cost–loss model. The cost–loss model has been used extensively in the meteorology literature as “the economic model,” but it does not really show up in the economics literature (I should note that my Ph.D. is in economics and, in six years of graduate school, I never once heard of the cost–loss model). A simple search for “cost–loss model” in AMS publications yields 161 hits. A similar search of the economic literature yielded none.

Meteorologists have used and built upon the cost–loss model to explore issues of forecast value for at least 50 yr (e.g., Savage 1951). It is reasonable then that when meteorologists look to extend the meteorology–economics literature that they come upon the cost–loss model because that is the most prevalent approach in their literature. The problem this economist has with the model is not that it is incorrect. In fact, the basic model is consistent with economic theory on a very basic level.

My concern is that the cost–loss model as used in most articles in the meteorology literature does not even begin to capture the full value of economics and build upon the extensive literature in economics on the value of information and decision making under uncertainty. It is simply too simple. As stated in Katz and Lazo (2010), “Prototypical decision-making models can be viewed as greatly simplified versions of real-world situations, retaining only their most salient features. The *cost–loss decision-making model* is the most basic and frequently used member of this category.” However, although there certainly are exceptions, in the meteorology literature “economics” has largely come to mean “cost–loss model.”

That said, the first issue of *Weather, Climate, and Society* contained an article based on a theoretical extension of the cost–loss model (Millner 2009; in fact, I recommend reading Millner for an explanation of the cost–loss model). In that article, Millner showed that incorporating a specific behavioral feature in the cost–loss model resulted in net benefit estimates potentially significantly lower than those derived from the basic model. His article demonstrated that behavioral aspects limit the effectiveness of the cost–loss model. I feel this should be read as a demonstration that the meteorological community needs to move beyond the cost–loss model. Building in part on the limitations of the cost–loss model that

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Millner's work suggests, I encourage the meteorological community to move beyond the use of that model as the basis for defining economic value.

The point of all this is that there is a wealth of knowledge from economics that is being essentially ignored by those using the cost–loss model for assessment of the value of weather forecasts. For instance, some of the approaches economists have developed relevant to the value of weather forecasting include the following:

- a strong theoretical and applied understanding of public goods (which weather forecasts generally are) that 1) helps explain why we do not have information on the value of forecasts and 2) provides the theoretical justification for the public provision of weather information (e.g., Craft 2010);
- a long history of theory, methods, and applications looking at decision making under risk and uncertainty, which is applicable to the use of weather forecasts in decision making (e.g., Friedman and Savage 1948);
- nonmarket valuation methods for determining the value of public goods that is just beginning to be applied to the topic of weather forecasting (e.g., Lazo et al. 2010);
- applied methods for estimating the benefits and costs of specific changes in weather forecast systems (Sutter and Erickson 2010); and
- a whole range of other issues relevant to weather forecasting, such as risk preferences, information asymmetry, discounting, value of statistical life, and applications to specific industries.

This editor feels that similar shortcomings likely occur elsewhere where those writing in the meteorology literature make assertions about human behavior while not being cognizant of relevant work from the social sciences.

Weather, Climate, and Society aims to publish “scientific research and analysis on the interactions of weather and climate with society.” This editor's opinion is that this will largely involve the integration of the social sciences applied to topics of hydrometeorological concern (including weather, water, and climate broadly defined). In light of the prior discussion on cost–loss models, this means we need to better integrate valid economics as economic theory, methods, and practice frame economics with analysis of hydrometeorological issues. More broadly, we need to use appropriate theories and methods from all of the social sciences and not necessarily “accepted” versions of social sciences from the physical sciences perspective.

All of the social sciences have extensive bodies of knowledge they can bring to the study of hydrometeorological issues. Some have a longer history of examining issues related to weather, water, and climate; for instance, sociologists have long studied evacuation decision making during hurricanes. However, for the most part the research and literature is rather thin at the intersection of social and physical sciences relevant to audiences of *Weather, Climate, and Society*.

Given this landscape, there are definite challenges for the authors, reviewers, and editors for this journal. First, is that most of us (authors, reviewers, and editors) are fairly new to this effort at developing a highly disciplinary but very broadly focused journal combining atmospheric and social sciences. There is a learning curve at this early stage of the journal, because we are all developing and setting standards and expectations. There have been and will continue to be some frustrations as these are clarified. However, as these are clarified and we move forward, *Weather, Climate, and Society* will be the premier journal for interdisciplinary work “at the interface of weather and/or climate and society.”

There are also difficulties in writing, reviewing, and editing manuscripts for such a highly interdisciplinary journal. For instance, authors, reviewers, and editors for economics journals are almost always economists. I suspect authors, reviewers, and editors for meteorology journals are almost always meteorologists, or at least in general from the “hard” sciences. In addition to meteorologists, authors, reviewers, and editors for *Weather, Climate, and Society* are from the “harder sciences” such as economists, sociologists, geographers, anthropologists,

etc. One challenge for authors will be to maintain high standards for their research while also being able to respond to very diverse (and sometimes divergent) critiques from reviewers with expertise from different disciplines.

For the time being at least, this may make *Weather, Climate, and Society* the most difficult journal across all American Meteorological Society (AMS) publications to publish in and to be an editor for. However, it may well also make *Weather, Climate, and Society* the most valuable and dynamic journal in terms of moving the various disciplines forward in new, challenging, and interesting areas of societally relevant research, methods, and applications.

A final note about my colleague who asked for advice on the use of the cost–loss model in his manuscript: in discussing his project, he noted that part of his extended team included social scientists who were examining the societal impact of the improved flood warning system. Rather than using the cost–loss model, he decided to work closely with them to integrate their findings into a paper integrating the physical sciences and modeling he worked on and the social scientists' work on the impacts of improved flood forecasts. Now that is a manuscript I hope to see submitted to *Weather, Climate, and Society*!

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