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Anyone for global warming?

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Last Tuesday's blizzard was big news not just because it shut down the city and much of the region, but also because the National Weather Service forecast was so spectacularly wrong. Monday evening, forecasters called for a chance of flurries, but the region awoke the next morning to blizzard-like conditions. The consequences of this blown prediction varied from the inconvenience of a missed appointment, to the chaos of air transportation networks that had little or no time to prepare for the storm. How could the no-surprise Weather Service, using some of the world's fastest computers and cutting-edge science, have been so wrong?

Actually, the idea that fast computers and sophisticated science can give us perfect weather predictions is nonsense. Weather forecasts are really quite good, but the Weather Service's goal of achieving "no surprises" is a guarantee of failure. Weather systems are complex phenomena whose behavior can only be approximated, even by the most advanced technologies. Every weather prediction is based on assumptions and simplifications that are valid in most cases but occasionally prove inadequate, especially when conditions are extreme.

The holy grail of science is accurate predictions of the future, but Tuesday's blizzard reminds us that predictions always contain some element of uncertainty. This is a crucial lesson for a society that increasingly relies on scientific information to guide its actions. Billions of dollars are spent every year on scientific predictions of phenomena as varied as asteroid impacts, stock market behavior, El Niño, and the life expectancy of cancer patients. These predictions can certainly help show what the future may look like, but if decision-makers hold false expectations about them, they will inevitably make poor decisions — just as the false expectation of good weather led to poor preparation and delayed response last Tuesday.

This lesson was learned at high cost in 1997 by the residents of Grand Forks, N.D., who interpreted the forecast of a 49-foot flood crest to mean "the flood will crest at exactly 49-feet." The town prepared for a 49-foot flood, but was inundated when the flood crested at 54-feet. This 10 percent forecast error was actually an accurate prediction by scientific standards, but a disaster for a town that expected "no surprises."

Understanding the strengths and limits of predictions is important because our sense of certainty about events in the future influences the actions we take today. But like the residents of North Dakota and indeed most East Coast residents this week, too often we accept scientific predictions uncritically. If we began to question predictions, we might find that in many cases we are better off hedging our bets and preparing for a wide variety of possible outcomes.

For example, predictions of global warming have focused international environmental efforts on reducing greenhouse gas emissions. But future economic trends, geopolitical events, and technological advances — three variables that defy predictive accuracy — will have a much greater impact on emissions than any conceivable international agreements. At the same time, such certainties as the aging of the global population, migration of people to urban areas, the spread of infectious diseases, and the destruction of coastal ecosystems, remain relatively neglected, even though they present interconnected threats to human and environmental welfare that are at least as serious as global warming.

Predictions of the future can be more dangerous than ignorance, if they induce us to behave in ways that reduce our resilience in the face of inevitable uncertainties and contingencies. When predictions are made about events decades or centuries hence, such as the level of the stock market or the conditions of a

changing climate, it is simply impossible to verify their accuracy, no matter how impressive the supporting science may be. Advances in science and technology mean that increasingly sophisticated predictions covering a widening variety of natural and societal phenomena will be available in the future.

But last week's snowstorm teaches us that our plans for the future should always include the possibility that some of these predictions will be wrong. The next time we wake up to an unpredicted blizzard, it should come as no surprise.

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