Estimating the Value of Weather Radars in Reducing Tornado Costs

How much are weather radars worth to society? Just in terms of reducing costs incurred by tornadoes, we estimate their value to be about $490 million per year in the United States. This estimate was made possible by a geospatial benefit model developed as part of a broader program to evaluate the viability of advanced technologies in replacing today's meteorological radar networks.

Weather radars are generally acknowledged to be a valuable asset to society. They provide observational data that improve weather forecasts and present essential situational awareness to many users. Radars, however, are not cheap to acquire, operate, and maintain. In planning for future sensor networks, monetization of their benefits is needed to assess the trade-off between more expensive options (higher performance and/or coverage) and benefits (people's lives and time saved).

Since tornadoes are perennially one of the top weather causes of fatalities in the United States, and because meteorological radars provide forecasters with information critical for timely and accurate tornado warning issuance, we focused first on estimating weather radar's impact on tornado cost reduction. Using historical tornado occurrence and warning data, we were able to build a statistically robust model that linked radar performance and coverage metrics to tornado warning performance (detection probability and false alarm ratio). In turn, tornado warning performance was related to casualty rate and time lost while sheltering on false alarms. Casualties were then monetized using the value of statistical life.

The benefit model operates on a high-resolution spatial grid capable of revealing regional variances. It can take as input any hypothetical radar network configuration. Thus, the model can be used to quantify the benefits provided by new technologies, different network densities, and individual gap-filling radar sites. For example, filling all gaps in coverage is estimated to yield tornado cost reduction of about $100 million per year in the United States.

Next, we are extending this benefit modeling approach to flash floods. In combination, the results will provide a solid, objective basis on which to perform cost/benefit assessments of potential future meteorological radar networks.—John Y. N. Cho (MIT Lincoln Laboratory) and J. M. Kurdzo, "Weather radar network benefit model for tornadoes," in the May issue of the *Journal of Applied Meteorology and Climatology*.