Monetized Value of Weather Radars in Reducing Thunderstorm Casualties

Weather radars yield valuable data, not only to meteorologists and forecast models, but also to the public via phone apps and websites. These powerful systems, however, are costly to acquire, operate, and maintain, with decades-long life cycle costs for the federal networks in the billions of dollars. As the government makes long-term plans to refurbish, replace, or augment the current radar networks, benefit monetization is required to assess the trade-offs between coverage and cost.

In response, we developed econometric geospatial models for quantifying radar's impact in reducing severe weather–related costs to society. The first two of our studies dealt with tornado and flash flood benefits. In this third and final study, we present a model for nontornadic severe thunderstorm casualty reduction, which estimates about a $200 million per year benefit in the United States is provided by today's weather radars.

We developed the model through historical data analyses. Regression statistics on 22 years (1998–2019) of storm event and warning data showed, likely for the first time, a clear dependence of nontornadic severe thunderstorm warning performance on radar coverage. Furthermore, nontornadic thunderstorm casualty rates were observed to be negatively correlated with better warning performance. These statistical relationships, together with the value of statistical life to monetize casualties, formed a geospatial cost model dependent

on radar coverage. The resulting costs were differenced between various network configurations to generate benefit estimates.

The benefit model operates on a high-resolution geospatial grid capable of revealing regional variability. It can take as input any hypothetical radar network configuration. Thus, the model can be used to quantify benefits provided by different network densities and individual gap-filling radar sites. For example, the cost density of a network with "perfect" coverage (as defined by the model coverage parameters) can be subtracted from the cost density for the present radar network to yield a map of the remaining benefit pool.

Adding these new severe thunderstorm results with estimates from our tornado and flash flood models yields an aggregate U.S. benefit of $1.1 billion per year for the current radars, and a remaining radar-based benefit pool of about $780 million per year.

In the future, we plan to quantify other weather radar benefits, such as improvements to forecast models and water resource management. The ultimate goal is to provide a comprehensive and objective basis with which to perform cost/benefit evaluations of potential future meteorological radar networks.—John Y. N. Cho (MIT Lincoln Laboratory) and J. M. Kurdzo, "Weather radar network benefit model for nontornadic thunderstorm wind casualty cost reduction," in the October 2020 issue of *Weather, Climate, and Society*. ●

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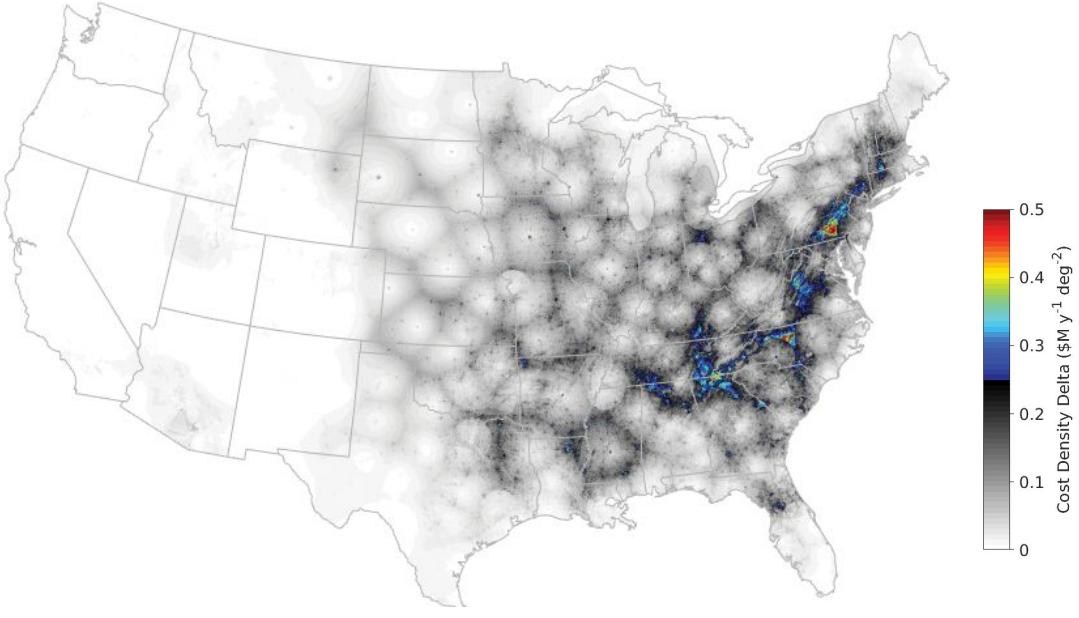

Remaining benefit pool. Difference in modeled mean annual thunderstorm wind casualty cost density between "perfect" radar coverage and the current weather radar network. This difference highlights areas that would most benefit from additional radar coverage with respect to thunderstorm casualty reduction.