



Credit: NOAA

### The “Cone of Uncertainty” and Hurricane Forecasting CRED researchers analyze an iconic climate forecasting visual aid

New York, NY (June 1, 2007) -- 2007 is predicted to be a busy hurricane season. Scientists say last year's El Nino kept strong storms in check, but this year may see La Nina developing, bringing with it a bigger chance of more hurricanes. How will the millions of people living near coastlines in the southeastern United States react to hurricane forecasts presented this year?

The May 2007 issue of the Bulletin of the American Meteorological Society (BAMS) presents an article by CRED researchers examining the “cone of uncertainty”, a visual aid used by the National Hurricane Center and often adopted and adapted by the media to communicate hurricane risk to the public prior to landfall. CRED research indicates that this forecast product is subject to misinterpretation by both generalists and specialists alike, with serious consequences. Misinterpreting consequences of frequent and intense storm warnings can have much more dangerous consequences than misinterpreting a

daily weather forecast, where a 20% chance of rain can be interpreted in numerous ways (e.g., 20% chance of just one drop of rain falling, of raining over 20% of a specified area, of raining for 20% of the forecast period, etc.).

The "Cone of Uncertainty" represents the forecasted track of the center of a tropical storm or hurricane and the likely error in the forecast track based on predictive skill of past years. It contains numerous additional details about the storm (see above figure).

The manner in which weather forecasts are presented is critically important to risk management. Kenneth Broad (cultural anthropologist at the University of Miami) and Tony Leiserowitz (a geographer at Yale University) led a study that analyzed several factors that likely contribute to misunderstanding the visual device du jour for conveying hurricane warnings: the Cone of Uncertainty (also known colloquially in hurricane prone areas as 'the cone of death', 'cone of probability', and 'cone of error'). Broad is a co-Director of and Leiserowitz a senior investigator with the NSF-funded Center for Research on Environmental Decisions (CRED), based at Columbia University, that studies how people make decisions under environmental risk and climate uncertainty,

CRED researchers conducted a newspaper content analysis, interviewed government and television meteorologists, conducted an event analysis of the 2004 Hurricane Charlie, and reviewed third party surveys to identify the primary factors leading to the misperception of the "Cone of Uncertainty." The primary conclusion is that people put too much faith in the track line forecast, negating the uncertainty message that the cone is intended to convey. Additionally, there is confusion about what the cone represents, with many as the potential swath of destruction of the storm versus just the potential area the center ('the eye') of the storm may travel in. Over the past decade, storms have traveled within the cone about 2/3 of the time. Another major factor is that the hurricane warning graphic packs too much information into a single graphic, confusing the recipient and causing difficulty in pulling out the most relevant bits of information.

There is no perfect "one size fits all" image given the range of vulnerabilities and potential responses of a socio-economically and culturally diverse population in the southeastern US. Of course, many other factors influence risk perception and decision making, including the nature of the risk, the trustworthiness and credibility of the messenger, the knowledge, values and worldviews of the recipient, etc. Thus the utility of any single risk communication product must be evaluated within the individual, social and institutional contexts of the recipient. What to include and not include should in part be a function of who the intended audience is and their ability to handle different sorts of information.

It is critical that producers of information focus on the relevance of the information and whether it provides enough detail for particular decision makers to assess their own risks. For example, some individuals and areas are more vulnerable to storm surge (coastlines), others to wind speed (trailer parks), while others are more vulnerable to the loss of electricity (e.g., those who rely on refrigerated medication). Merely knowing the likelihood that a hurricane might strike a particular area does not provide the more

specific information people need to consider when assessing the risks and choosing a course of action.

The communication of hurricane risks is an essential function of both government and the private sector. Decision makers at all levels, from individuals to institutions, now rely, at least in part, on these messages to make critical decisions about hurricane preparedness and evacuation. The cone of uncertainty has quickly become a central figure in the communication of hurricane risks; yet we still know relatively little about how audiences actually interpret, evaluate or utilize this key graphic. Social science methods and approaches should be integrated into the design, development and evaluation of hurricane risk communications, so vital for the well-being of the public.

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CRED is an interdisciplinary center that studies individual and group decision making under climate uncertainty and decision making in the face of environmental risk. CRED's objectives address the human responses to climate change and climate variability as well as improved communication and increased use of scientific information on climate variability and change. Located at Columbia University, CRED is affiliated with the Earth Institute and the Institute for Social and Economic Research and Policy (ISERP). Major funding is provided by the National Science Foundation (NSF) under Grant No. SES-0345840.

Learn more at: [www.cred.columbia.edu](http://www.cred.columbia.edu).