Study confirms climate change impacted Hurricane Florence's precipitation and size

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Kevin Reed, PhD, Professor in the School of Marine and Atmospheric Sciences at Stony Brook University uses a forecast attribution model to determine the effect of climate change on extreme storms. Credit: Stony Brook University

A study led by Kevin Reed, Ph.D., Assistant Professor in the School of

Marine and Atmospheric Sciences (SoMAS) at Stony Brook University, and published in *Science Advances*, found that Hurricane Florence produced more extreme rainfall and was spatially larger due to human-induced climate change.

Previous research has suggested that human influences such as emission of greenhouse gasses that alter climate does affect precipitation in extreme storms. The research in this study, however, is a first to use a "forecast attribution" framework that enables scientists to investigate the effect of climate change on individual storm events days in advance.

Changes in extreme weather are one of the most serious ways society experiences the impact of climate change. Severe weather and natural disasters account for much damage and has a major economic impact on countries. Reed and colleagues nationally are investigating ways to better forecast extreme storms in the context of climate change.

In 2018, prior to the landfall of Hurricane Florence, Reed and colleagues made predictions based on simulations of the storm given climate change models. They predicted Hurricane Florence would be slightly more intense for a longer portion of the forecast period, rainfall amounts over the Carolinas would be increased by 50 percent due to climate change and warmer water temperatures, and the hurricane would be approximately 80 kilometers larger due to the effect of climate change on the large-scale environment around the storm.

"With our ability for additional 'hindsight' numerical modeling of the storm around climate change factors, we found predictions about increases in storm size and increased storm rainfall in certain areas to be accurate, even if the numbers and proportions are not exact," explains Reed. "More importantly, this post-storm modeling around climate change illustrates that the impact of climate change on storms is here now and is not something only projected for our future."

He said that while the post-storm analysis did show that the storm was slightly more intense during the forecast period due to climate change—as they predicted—as measured by minimum surface pressure and near-surface winds, the finding remains the most uncertain from the hindsight model.

One key finding of the post-storm model showed that Hurricane Florence was about nine kilometers larger in mean maximum diameter due to climate change. Additionally, rainfall amounts over large ranges were significantly increased. Mean total overland rainfall amounts associated with the forecasted storm's core were increased by 4.9 ± 4.6% with local maximum amounts experiencing increases of 3.8 ± 5.7% due to climate change.

Reed emphasizes that by attributing climate change effects to individual storms, as his team did with Hurricane Florence, scientists are better able to communicate the direct impacts of climate change on extreme weather to the public.

More information: K. A. Reed et al, Forecasted attribution of the human influence on Hurricane Florence, *Science Advances* (2020). DOI: 10.1126/sciadv.aaw9253

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