Deaths versus dollars

Past and future changes in tropical cyclones and the damage they cause are fiendishly difficult to detect and project. For the Atlantic, progress is being made; other ocean basins lag behind.

The economic damage inflicted by hurricanes that made landfall over the United States (US) has increased over the past decades. Why this is the case, and whether this trend will continue, are urgent questions: these large-scale storms take an enormous toll in terms of economic losses and human suffering. Research on these storms has rightly surged, in particular following Hurricane Katrina, which destroyed large parts of New Orleans in 2005. Tropical cyclones in the US top the list of the costliest tropical cyclones. But the deadliest tropical cyclones of the twentieth and twenty-first century have hit Asia. At *Nature Geoscience*, we expressed the hope in 2008 (ref. [1]) that tropical cyclone Nargis, with more than 130,000 fatalities, might set off a wave of scientific investigations into tropical cyclones in ocean basins outside the Atlantic. Not so. It is symptomatic that three high-profile papers on tropical cyclones published last month[2–4] focus on Atlantic hurricanes, with only one[2] extending at least part of the analysis to other regions of the world ocean.

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These studies of Atlantic hurricanes are important for understanding tropical cyclones. Two of the studies recast historical storms and compare computer simulations with and without anthropogenic influences to look into the impacts of climate change[2] and urbanization[3] on wind speeds, rain and flooding — the main agents of destruction. A third paper[4] investigates the causes for the unusually active Atlantic hurricane season in 2017, also with the help of high-resolution computer simulations. The picture emerges that the difference in sea surface temperatures between the tropical Atlantic Ocean and other basins has played an important role in the destructive 2017 season. And whereas rain and flooding have probably already been exacerbated by human activities, an effect on wind speeds is not yet detectable.

Specifically, rainfall and flooding are likely to have increased as a result of urbanization in the area around Houston, Texas, during Hurricane Harvey, through changes in surface roughness, surface warming and infiltration[3]. In addition, an influence of anthropogenic climate change[2] was documented in simulations of average and extreme rainfall during Hurricanes Katrina (2005), and Irma and Maria (both 2017). However, wind speeds in these latter three storms were not significantly different between pre-industrial and present-day conditions. Simulations of a larger range of historical events[1] — including five that struck outside the US — under possible future climate conditions project more robust increases in both rainfall and wind speed in the future.

In the US, increases in economic losses from hurricanes have been reported by the insurance industry. Debates have raged for over a decade[5] whether these increases have been caused almost exclusively by placing more and more valuable buildings and assets in harm's way[6], or if a change in tropical cyclone intensity has also played a role[7].

It is not straightforward to disentangle the causes of damage and their change over time. High natural variability and the lack of consistent long-term records of tropical cyclone occurrence frequency, intensity and damages in all ocean basins, but particularly outside the Atlantic, have been a key sticking point for progress[8].

Death tolls in Asia deserve as much research attention as devastation in the US. Nevertheless, hurricanes — tropical cyclones in the Atlantic or East Pacific — have received most attention by some margin: Clarivate Analytics records over 6,000 relevant publications since 1980, and a rate of over 400 papers per year in the past five years. Typhoons — the equivalent in the West Pacific — were studied in somewhat over 2,000 publications, and the rate of papers per year has surpassed 200 only in 2015. Indian Ocean tropical cyclones, such as Nargis, are the focus of only just over 300 publications.

For a deeper understanding of the natural and anthropogenic influences on tropical cyclone damage, we need to branch out to all ocean basins. High-quality records that are homogeneously collected in the long term, and high-resolution climate and weather forecasting models will be key to facilitate future studies and thereby help with preparedness in the future. ❐

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