Brewing Bigger Storms

Climate change isn't increasing storm frequency so much as it is creating stronger, more intense storms.

Gordon A. McBean
Director of Policy, Institute for Catastrophic Loss Reduction

In late September 2003, Hurricane Juan hit Nova Scotia with sustained winds as high as 158 km-h, gusts up to 200 km-h and maximum wave heights of 20 metres. The result was eight deaths and major damage. According to the Canadian Hurricane Centre, it was the worst event of this type to hit the region in more than a century. Although Atlantic Canada receives most hurricane impacts, Hurricane Hazel in 1954 left a tragic and lasting impact in southern Ontario.

Hurricanes that affect North America begin as small atmospheric disturbances over the eastern tropical Atlantic Ocean where the sea surface temperature exceeds 26°C. They form at least a few degrees away from the equator to gain the effect of the earth's rotation, which also means that hurricanes do not cross the equator. The warm oceans provide much of the energy as the storm evolves from a "tropical depression" to a "tropical storm" and then, when the winds reach 118 km-h, to a "hurricane." As they develop they move west and then north before losing strength over land or colder waters and gradually change their characteristics. As in the case of Hazel, hurricanes affecting Canada are often in a state of transformation into mid-latitude storms. This process can sometimes re-energize the storm and concentrate the winds in narrower bands resulting in damages beyond what would have been expected from a decaying hurricane. Tropical cyclones or hurricanes strike Atlantic Canada about every one to three years (most often Newfoundland). The frequency is about one every six to seven years for Quebec and about once every 11 years for Ontario; hurricanes only very rarely affect British Columbia.

Hurricanes, also called typhoons outside the western hemisphere, are classified on a scale of one to five (the Saffir-Simpson Scale) based on their wind speed and destructive potential (which depends as well on precipitation). A category 4 storm has winds in the range of 211-249 km-h resulting in storm surges in excess of 4 metres. This category of storm typically results in damage to roofs and major flooding, leading to evacuations. The higher winds of category 5 storms cause major damage to buildings with some complete building failure and flooding leading to massive evacuations. Hurricane Juan was a category 2 hurricane. No category 4 or 5 hurricane has made landfall in Canada in the last 150 years.

IMPACT OF CLIMATE CHANGE

What is the impact of climate change on hurricanes? Since climate change will result in warmer oceans, with more areas above 26°C

Illustration by Sandi Nichols/www.threeinabox.com

and higher atmospheric water energy, a warmer climate would be expected to have more hurricanes. It is, however, more complicated because of other atmospheric factors such as wind shear and variations in El Niño-Southern Oscillation and monsoons. There is considerable scientific literature on this topic with analyses based on dynamical and modelling studies and detailed examinations of historical records from weather observations, satellite imagery and land-falling storms with human impacts. Each has its biases and sometimes the debate centres on these issues. This article will focus on the more intense category 4-5 hurricanes, which have the major impacts and where the scientific basis is stronger.

In the 2007 *Fourth Assessment Report of the Intergovernmental Panel on Climate Change* the IPCC noted that although changes in hurricane frequency and intensity are masked by large natural variability, total global numbers of cyclones and cyclone days has generally decreased slightly since 1970, but there has been a large increase in numbers and proportion of strong hurricanes. The number of category 4 and 5 hurricanes increased by about 75% with the largest increases in the western North Pacific, Indian and Southwest Pacific Oceans. The numbers of hurricanes in the North Atlantic had also been above normal in nine of the last 11 years, culminating in the record-breaking 2005 season. Based on a range of climate models, the IPCC concluded it is likely that future tropical cyclones will become more intense, with larger peak wind speeds and heavier precipitation associated with ongoing increases of tropical sea surface temperatures.

In 2009, an international team of leading scientists prepared *The Copenhagen Diagnosis, 2009: Updating the World on the Latest Climate Science*. Several studies since the IPCC report have found more evidence for an increase in hurricane activity over the past decades. A complete reanalysis of satellite data since 1980 confirmed a global increase of the number of category 4 and 5 tropical cyclones. A 1°C global warming corresponded to a 30% increase in these storms. However, they concluded that there is not yet "robust capacity" in models to project future changes in tropical cyclone activity.

EDUCATING ABOUT DISASTER RISK REDUCTION

From a disaster risk reduction point of view it seems very appropriate to assume that there will be increasing risk of more intense hurricanes, with stronger winds and heavier precipitation. Combined with rising sea levels, this will lead to more extreme storm surges and flooding. When Typhoon Nargis affected Myanmar in 2008, 113,000 people died — most drowned in oceanic storm surges. On Aug. 19, 2005, a single heavy rain event in the Greater Toronto Area, not a hurricane, resulted in flooded basements and other damages. The event cost the insurance industry $500 million — the costliest insurance event in Ontario's history. Heavier rain events, due to actual and transforming hurricanes does not fore-

tell well for the future. Hazards will continue to occur but they do not need to result in disasters. It is our vulnerabilities that allow these events to become disasters. Actions to reduce disaster risk and adapt to climate change have proven to be effective. Bangladesh and Myanmar are both densely populated countries with low-lying deltas vulnerable to typhoons. In 1970, Typhoon Bola struck Bangladesh causing 300,000 deaths; in 1991, Gorki killed 139,000 people. Bangladesh instituted a 48-hour early warning system and educational and construction programs leading to effective community-based disaster preparedness and mitigation. When Typhoon Sidr struck in 2007, only 3,000 people died — tragic, but a much smaller death count than the previous events. Myanmar did not have disaster risk reduction systems in place when Nargis struck.

Here in Canada, the first-ever Safer Living Home was completed in Prince Edward Island in November 2006. The home, paid for by The Co-operators

and based on the Institute for Catastrophic Loss Reduction's Safer Living Program, was designed and constructed to withstand winds of 200 km-h. New ICLR guidelines on reducing losses due to intense precipitation are now available.

The United Nations International Strategy for Disaster Reduction has joined with the International Council for Science and the International Social Sciences Council to create a new international research program, Integrated Research on Disaster Risk (IRDR). The program will address the challenge of natural and human-induced environmental hazards. Methods to reduce risk and curb losses through knowledge-based actions need to be built on disaster risk reduction research integrated across the hazards, disciplines (including natural, socio-economic, engineering and health sciences), and geographical regions. Research will focus on the characterization of hazards, including how they will change with climate, vulnerability and risk and effective decision making in complex and changing risk contexts. The desired legacy is that when similar events happen in the future there are major reductions in the impacts and loss of lives.

Research and implementation of knowledge-based disaster risk reduction strategies can save lives and reduce losses, even as the intensity of hurricanes augments with a warming climate.