

The 2017 perfect storm season, climate change, and environmental injustice



The 2018 North Atlantic hurricane season is underway, accompanied by the timely publication of advances in atmospheric science that confirm what was observed during the hyperactive 2017 experience.¹ During 2017, atmospheric and oceanic conditions combined to generate 17 named storms that collectively and repetitively emphasised the connections among climate drivers, storm hazards, and destructive impacts on vulnerable human populations.² In many ways, the expression “perfect storm”³ (a reference to a ferocious 1991 nor’easter) could well be extended to refer to 2017 as an entire perfect storm season that raised issues of environmental injustice intrinsic to climate change, particularly in relation to its disproportionate effect on Caribbean small island developing states (SIDS).²

Climate change has been aptly conceptualised as “an environmental hazard operating on a global scale” and 2017 provided a strong illustration of this paradigm.⁴ On key metrics tracked by the Colorado State University’s Tropical Meteorology Project—named tropical cyclone numbers and days, hurricane numbers and days, and major hurricane numbers and days—the 2017 season far exceeded the 1981–2010 baseline norms.² As a further distinction, the accumulated cyclone energy, a summative measure of storm intensity for the entire basin, was the highest on record for the month of September and seventh overall for the complete hurricane season.² In addition to warm ocean temperatures, high thermal potential, and minimal vertical wind shear, 2017 illustrated how environmental warming can produce extreme precipitation rates and rainfall accumulations as storms stall over populated areas.^{1,5}

The UN formally recognises the heightened disaster risks faced by 57 SIDS situated along the midsection of the globe worldwide. The 29 Caribbean SIDS are extraordinarily vulnerable to strikes by Atlantic basin hurricanes.² Depending upon storm properties, time, and place, SIDS residents were exposed to various hurricane hazards: cyclonic and tornadic winds, deluging rains, storm surge, wave action, coastal inundation, inland flooding, and mudslides. As a consequence of their distinctive disaster risk landscape, SIDS inhabitants

bore much of the brunt of hurricane-induced human harm and environmental destruction (panel).²

For the 2017 Atlantic storms, public health consequences accrued continuously over a period of months. Modest impact-phase mortality figures were tabulated for Hurricanes Harvey (91 deaths) and Irma (134 deaths; 90 US mainland citizens, 44 Caribbean). Puerto Rico, however, had prolonged and crippling island-wide power outages following the impacts of Irma and Maria and substantial post-storm mortality.⁶

Millions of Caribbean SIDS and mainland US residents experienced traumatic effects due to wind and water hazards. In addition to injuries during clean-up, SIDS experienced elevated rates of morbidity including epidemics of infectious and vector-borne diseases.

Mental health issues become evident several months into the recovery phase. Traumatic, life-threatening exposures to storm hazards during impact, experienced by millions in the Caribbean, followed by extreme

Panel: Disaster risk landscape for small island developing states (SIDS)

- SIDS are primarily located in tropical latitudes where hurricanes occur frequently
- Climate scientists predict sea level rise and increasing tropical storm intensity over the next few decades
- As island nations with an ocean perimeter, SIDS are extremely vulnerable to sea level rise and related risks for storm surge
- SIDS with minimal elevation above sea level are susceptible to pummelling from wave action and inundation from downpours
- SIDS with steep, mountainous terrain are prone to mudslides
- Mass off-island population evacuation is logistically unfeasible when storms approach and most SIDS are too small to achieve meaningful inland evacuation away from coastlines
- Many SIDS are composed of multiple inhabited islands, thereby complicating emergency response activities that must reach geographically isolated pockets of citizens affected by storm
- Island infrastructure, particularly electrical power, is fragile and easily destroyed when strong storms strike
- SIDS disaster management services are typically rudimentary and under-resourced
- Tropical and sub-tropical SIDS are endemic for vector-borne infectious diseases
- SIDS have scarce economic resources to expend at any phase of disaster: preparedness, mitigation, response, or recovery
- Elevated climate-related risks for SIDS are largely determined by the actions of high-income, highly-industrialised countries

hardships in the aftermath, and exacerbated by months without power, can lead to increases in post-traumatic stress disorder, major depressive disorder, suicidality, and substance use.^{5,7}

Population displacement and outmigration adds another element to the public health consequences of these storms.^{2,8} The inhospitable conditions on the Caribbean SIDS following the 2017 storms triggered a mass, largely unidirectional, exodus of islanders to off-island, continental destinations, especially for survivors of Hurricanes Irma and Maria, which rendered most of Puerto Rico without power for months.⁷

SIDS are very sensitive to the effects of climate change. As powerfully demonstrated by the 2017 season, climate-driven increases in the hazard properties of tropical cyclones, combined with progressive increases in sea level, pose both disproportionate disaster risks and existential threats to SIDS.^{1,2} Moreover, SIDS residents serve unwittingly as sentinel populations for detecting and documenting the first signs of climate change effects on population health.²

Ironically, SIDS by necessity contribute minimally to the production of greenhouse gases. Yet, despite being among those least responsible for environmental change, SIDS populations are those most likely to experience severe public and environmental health consequences.^{1,4,9}

Climate change magnifies health inequities. Issues of environmental injustice and health inequity are central to the understanding of the contribution of the actions of high-income countries to the pace and magnitude of climate change. The behaviours of wealthy industrialised nations set off effects that spread globally and result in the involuntary exposure^{4,9} of vulnerable populations to climate-associated hazards not of their own creation.^{4,10,11}

This gross asymmetry, illustrated by the experience of the Caribbean SIDS, represents an enormous, global scale environmental injustice.²

Large industrialised nations hold the fate of SIDS in their hands, as they delay needed climate solutions in favour of profit-driven and self-interested policy objectives. Even as many of the SIDS have established themselves as independent, sovereign states, the subjugation of their economic, ecological, and existential survival to the behaviour of large, high-income countries extends colonial dependence of these smaller countries' wellbeing on actions beyond their control.

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