Tropical cyclones in Asia could double in destructive power under a warming climate, new research finds

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In a new paper published in *Frontiers in Earth Science*, researchers investigated how tropical cyclones' destructive power has changed over

the eastern and southeastern regions of Asia between 1979 (hereafter) and 2016. They found that, during the last four decades, there has been a notable increase of tropical cyclone inland impacts over the studied regions. Future projections showed that by the end of the 21st century, western north Pacific (WNP) tropical cyclones could have doubled in destructive power over inland regions.

Tropical cyclones are one of the most dangerous types of natural disasters. They carry several hazards, such as heavy rainfall, high winds, and storm surges, which, alone or combined, can damage property and threaten life. Over the past 50 years, tropical cyclones have caused almost 780,000 human fatalities and US$ 1,408bn in economic losses.

"The extreme precipitation (>150mm/hr) in June 2021 in Zhengzhou, China, was caused by the Typhoon In-fa and Typhoon Cempaka which transported abundant water vapor to Henan Province, China. The remnants of Hurricane Ida in September 2021 caused torrential rain in New York. Both disasters caused huge economic and human losses," explained Dr. Chi-Yung Tam at the Chinese University of Hong Kong.

Over the past decades, research has shown an increase of strong tropical cyclones, especially over east and southeast Asian countries. Climate models have suggested that the climate crisis could influence tropical cyclones. Other research has also shown that heating oceans could intensify their strength. If a cyclone intensifies in strength at landfall, this will extend its distance travelled inland and amplify its destructive power.

"Tropical storm-related hazards can definitely affect inland regions, and we should pay more attention to this, especially under the climate crisis," continued Tam.

But research on the exact effects of the climate crisis on cyclones is still

scarce, and little is known about which effects future, more intense tropical cyclones will have over land.

Stronger tropical cyclones

Tam and his colleagues wanted to study the impacts of the WNP tropical cyclone on eastern and southeastern Asian inland regions. To do so, they first analyzed historical tropical cyclone data from the last four decades (between 1979 and 2016). They then projected future changes of cyclone related impacts on these regions under the Representative Concentration Pathway 8.5.

They found that, since 1979, there has been a dramatic increase of WNP tropical cyclone impacts on eastern and southeastern Asian inland regions. They observed stronger landfalling cyclones that last for longer periods and penetrate farther inland.

Overall, the landfalling cyclones have lasted between two and nine hours longer and have gone 30km-190km further inland (average of 100km). The most significant increase of tropical cyclone inland impacts occurred over Hanoi in Vietnam, and the south China region.

The researchers predict that compared to the present-day period (between 1979 and 2003), by the end of the 21st century (2075-2099), the average landfall intensity of tropical cyclones will increase by two meters per second (6%), while they will sustain for 4,9 hours longer (56%), and go 92,4km farther inland (50%). These results show that tropical cyclones will almost double in destructive power over Asian inland regions.

"The climate crisis will likely continue the increasing trend in landfalling typhoons and their impacts on inland regions, based on high-resolution climate model projections. More Asian inland regions may be exposed to

more severe storm-related disasters in the future as a result of the climate crisis," said Tam.

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