

More big storms increase tropical rainfall totals

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Large thunderstoms are becoming more common in the tropics increasing total rainfall. Credit: Image courtesy of the Earth Science and Remote Sensing Unit, NASA Johnson Space Center.

Increasing rainfall in certain parts of the tropics, colloquially described as the wet get wetter and warm get wetter, has long been a projection of climate change. Now observations have shown that an increase in large thunderstorms is the primary reason for this phenomenon.



Joint research from the Monash branch of the Australian Research Council Centre of Excellence for Climate System Science (ARCCSS) and NASA published in *Nature* found even though other types of rainfall has decreased in frequency and the total number of thunderstorms remained the same, the increase in big storms had elevated total rainfall.

"The observations showed the increase in rainfall is directly caused by the change in the character of thunderstorms in the tropics rather than a change in the total number of thunderstorms," said lead author from ARCCSS Dr Jackson Tan.

"What we are seeing is more big and organised storms and fewer small and disorganised storms."

Thunderstorms play an important role in rainfall in the tropics. Despite organised deep convective storms only occurring 5% of the time in the world's equatorial regions, they deliver almost 50% of all its rainfall.

The research has also contributed to answering the important question whether the increase in rainfall observed in the tropics was simply caused by the fact of a warmer atmosphere or whether the underlying circulation in that region had changed.

The changes to the deep convection discovered in the study suggested a dynamic change in the climate system was responsible for the change in rainfall.

"If this rainfall change was caused simply by a warmer atmosphere holding more moisture, we would have expected an increase in the average rainfall when each system, organised or disorganised, occurs," said Dr Tan

"Instead, the number of organised storms, which is largely controlled by



the dynamics of the atmosphere, have increased in frequency, suggesting that the increase in rainfall is related to more than a simple warming of the atmosphere."

Climate model results have long suggested that we would see increased precipitation in the tropics as a result of <u>climate change</u>. However, the exact nature of this change remained unclear.

The revelation that large thunderstorms appear to be the source of increased precipitation in the tropics explains why <u>climate models</u> may have difficulties in accurately representing the details of <u>tropical</u> rainfall.

The small-scale processes giving rise to <u>thunderstorms</u> make their direct simulation in climate models impossible given current computing power.

"This limitation, which is a well-known issue in global climate models, might well be a contributing factor to the precipitation errors and the bias towards light rain," said another author from Monash University, Prof Christian Jakob.

"Given how important these large storms are to <u>rainfall</u> in the tropics, it is vital that there is a renewed effort to represent convective organisation in global climate models if we are to fully understand precipitation changes in the future."

More information: *Nature* , DOI: 10.1038/nature14339

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