Australia facing increased intense rain storms

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Landmark study shows how heavy, short rain storms are intensifying more rapidly than would be expected with global warming. Researchers say this is likely to lead to increasing flash floods and urban flooding.

The team of international scientists, led by Dr. Selma Guerreiro at the School of Engineering, Newcastle University, UK, has for the first time found increases in short, intense rain storms over Australia over the past 50 years.

The storms are substantially larger than would be expected under climate change.

Published today in *Nature Climate Change*, the study shows that in Australia:

- Extreme daily rainfall events are increasing as would be expected from the levels of regional or global warming that we are experiencing
- the amount of water falling in hourly rain storms (for example thunderstorms) is increasing at a rate 2 to 3 times higher than expected, with the most extreme events showing the largest increases.
- this large increase has implications for the frequency and severity of flash floods, particularly if the rate stays the same into the future.

Dr. Selma Guerreiro, lead author, explains:

"It was thought there was a limit on how much more rain could fall during these extreme events as a result of rising temperatures.

"Now that upper limit has been broken, and instead we are seeing increases in rainfall, two to three times higher than expected during these short, intense rainstorms.

"This does not mean that we will see this rate of increase everywhere. But the important thing now is to understand why rainfall is becoming so

much more intense in Australia and to look at changes in other places around the world. How these rainfall events will change in the future will vary from place to place and depend on local conditions besides temperature increases."

Implications for flooding

The paper shows future changes in short, intense rain storms might be being underestimated, with implications for flooding.

Professor Seth Westra, co-author from the University of Adelaide, Australia, said:

"These changes are well above what engineers currently take into account when determining Australia's flood planning levels or designing stormwater management and flood defence infrastructure.

"If we keep seeing this rate of change, we risk committing future generations to levels of flood risk that are unacceptable by today's standards."

The authors recommend that a wide range of possible futures should be used to test existing and planned infrastructure, thus contributing to a robust adaptation to climate change.

The team analysed changes in hourly and daily rainfall extremes, between 1990-2013 and 1966-1989, from 107 weather stations from all over Australia. While daily extremes can cause river flooding, hourly (and multi-hourly) extremes often cause urban flooding, flooding in small, steep rivers, and landslides.

Between the two periods of analysis, global mean temperature increased by 0.48 °C. Because the amount of humidity that air can hold depends

on the temperature (for each degree the atmosphere can hold around 6.5% more water), it was possible to calculate how much worse rainfall events could be expected to become.

The observed increases in daily rainfall averaged over the whole Australian continent followed what would be expected for the current increases in warming. However, they are still within the bounds of what could be considered natural fluctuations of the climate and therefore cannot, at this point, be attributed to climate change.

The hourly increases were 2 to 3 times higher than expected and even higher when looking just at the tropical north of Australia instead of the whole continent. These changes are outside what we would expect from natural fluctuations and could not be explained by changes in other factors like El Niño-Southern Oscillation or the seasonality of extreme rainfall. This research has shown that future hourly extreme rainfall cannot be projected using just temperature, but is a complex phenomenon that depends on many other atmospheric changes.

More information: Selma B. Guerreiro et al, Detection of continental-scale intensification of hourly rainfall extremes, *Nature Climate Change* (2018). DOI: 10.1038/s41558-018-0245-3

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