“The risk has already increased” – Droughts and flooding rains already more likely as climate change plays havoc with Pacific weather

Thursday 9 February 2017, by CHUNG Christine, DELAGE François, MURPHY Brad, YE Hua (Date first published: 8 February 2017).

Climate change is already delivering more extremes of wet and dry to the Pacific region.

Contents

Global warming has already increased the risk of major disruptions to Pacific rainfall, according to our research published today in *Nature Communications*. The risk will continue to rise over coming decades, even if global warming during the 21st century is restricted to 2°C as agreed by the international community under the Paris Agreement [1].

In recent times, major disruptions have occurred in 1997-98, when severe drought struck Papua New Guinea, Samoa and the Solomon Islands, and in 2010-11, when rainfall caused widespread flooding in eastern Australia and severe flooding in Samoa, and drought triggered a national emergency in Tuvalu.

These rainfall disruptions are primarily driven by the El Niño/La Niña cycle [2], a naturally occurring phenomenon centred on the tropical Pacific. This climate variability can profoundly change rainfall patterns and intensity over the Pacific Ocean from year to year.

Rainfall belts can move hundreds and sometimes thousands of kilometres from their normal positions. This has major impacts on safety, health, livelihoods and ecosystems as a result of severe weather, drought and floods.

Recent research [3] concluded that unabated growth in greenhouse gas emissions over the 21st century will increase the frequency of such disruptions to Pacific rainfall.

But our new research shows even the greenhouse cuts we have agreed to may not be enough to stop the risk of rainfall disruption from growing as the century unfolds.

Changing climate

In our study we used a large number of climate models from around the world to compare Pacific

rainfall disruptions before the Industrial Revolution, during recent history, and in the future to 2100. We considered different scenarios for the 21st century.

One scenario is based on stringent mitigation in which strong and sustained cuts are made to global greenhouse gas emissions [4]. This includes in some cases the extraction of carbon dioxide from the atmosphere.

In another scenario emissions continue to grow, and remain very high throughout the 21st century. This high-emissions scenario results in global warming of 3.2-5.4°C by the end of the century (compared with the latter half of the 19th century).

The low-emissions scenario - despite the cuts in emissions - nevertheless results in 0.9-2.3°C of warming by the end of the century.

Increasing risk

Under the high-emissions scenario, the models project a 90% increase in the number of major Pacific rainfall disruptions by the early 21st century, and a 130% increase during the late 21st century, both relative to pre-industrial times. The latter means that major disruptions will tend to occur every four years on average, instead of every nine.

The increase in the frequency of rainfall disruption in the models arises from an increase in the frequency of El Niño and La Niña events in some models, and an increase in rainfall variability during these events as a result of global warming [5]. This boost occurs even if the character of the sea-surface temperature variability arising from El Niño and La Niña events is unchanged from pre-industrial times.

Although heavy emissions cuts lead to a smaller increase in rainfall disruption, unfortunately even this scenario does not prevent some increase. Under this scenario, the risk of rainfall disruption is projected to be 56% higher during the next three decades, and to remain at least that high for the rest of the 21st century.

The risk has already increased

While changes to the frequency of major changes in Pacific rainfall appear likely in the future, is it possible that humans have already increased the risk of major disruption?

It seems that we have: the frequency of major rainfall disruptions in the climate models had already increased by around 30% relative to pre-industrial times prior to the year 2000.

As the risk of major disruption to Pacific rainfall had already increased by the end of the 20th century, some of the disruption actually witnessed in the real world may have been partially due to the human release of greenhouse gases. The 1982-83 super El Niño event, for example, might have been less severe if global greenhouse emissions had not risen since the Industrial Revolution.

Most small developing island states in the Pacific have a limited capacity to cope with major floods and droughts. Unfortunately, these vulnerable nations could be exposed more often to these events in future, even if global warming is restricted to 2°C.

These impacts will add to the other impacts of climate change, such as rising sea levels, ocean

acidification and increasing temperature extremes.

Brad Murphy
Manager, Climate Data Services, Australian Bureau of Meteorology

Christine Chung
Research Scientist, Australian Bureau of Meteorology

François Delage
Assistant scientist, Australian Bureau of Meteorology

Hua Ye
Climate IT Officer, Australian Bureau of Meteorology

P.S.

* The Conversation. 8 février 2017, 19:57 CET: https://theconversation.com/droughts-and-flooding-rains-already-more-likely-as-climate-change-plays-havoc-with-pacific-weather-71614?utm

* This research was supported by the National Environmental Science Programme and the Australian Climate Change Science Programme.

Footnotes

[1] https://theconversation.com/the-paris-climate-agreement-at-a-glance-50465

[2] http://www.bom.gov.au/climate/enso/history/ln-2010-12/ENSO-what.shtml

[3] http://www.nature.com/nclimate/journal/v5/n9/full/nclimate2743.html

[4] http://link.springer.com/article/10.1007/s10584-011-0152-3

[5] http://www.nature.com/nature/journal/v502/n7472/abs/nature12580.html