News and Views

Subject strapline: Climate extremes

Title: Africa and the Paris Agreement

Standfirst: The African continent is one of the most vulnerable regions to future climate change. Research now demonstrates that constraining anthropogenic warming to 1.5°C instead of 2°C will significantly lower the risk of heat waves to inhabitants.

Extreme climatic events have had devastating impacts in Africa, with drought alone killing ~850,000 people since 1900[1]. There is a consensus that the continent will also suffer strongly under anthropogenic forcing, both due to its relatively greater vulnerability and the magnitude of projected changes[2]. Reporting in *Nature Climate Change*[3], Nangombe Shingirai of the Meteorological Services, Zimbabwe, and colleagues demonstrate that the occurrence of extreme heatwaves – specifically those similar to the 1991/1992 southern African and 2009/2010 north Africa events - could be reduced by 20-25% if anthropogenic warming is constrained to 1.5°C instead of 2°C above preindustrial levels. Such differences between temperature targets act to further motivate mitigation efforts to minimize the socio-economic impacts of future extreme events across Africa.

As in other regions of the world[4], the African continent has experienced a range of weather and climate extremes in recent decades. In several instances, these have been record-breaking, and ultimately had dire socio-economic impacts. In 1991/1992, for example, extreme drought occurred across southern Africa (see Fig. 1), devastating agricultural production, and placing an estimated sixteen million people at risk of starvation; many countries throughout southern Africa consequently had to import large quantities of food to meet consumption needs, adding considerable financial stresses. On the opposite end of the hydrological spectrum, extreme rainfall occurred in February of 2000 in south-eastern Africa, resulting in extensive flooding and subsequent loss of life and infrastructure damage.

While it remains a contentious issue to assign specific extreme weather and climate events to anthropogenic climate change, efforts to ascribe said events to either natural climate variability and/or climate change have increased substantially in recent years[4,5]. The reasons for this research are arguably two-fold: Firstly, knowledge of the change of probabilities of extreme events will certainly assist in the planning or focusing of resources to appropriate climate change adaptation measures. Secondly, communicated increased certainty in the actual causes of extreme events will in all probability lead to greater confidence from the wider community on the scientifically backed expectations of the effects and impacts of climate change.

Given the significant impacts of extreme events, it is important to understand how these may change in the future. In that light, several studies have made projections of extreme events in Africa[6,7], with the abovementioned occurrences being harbingers for the future. Indeed, both Engelbrecht et al.[6] and Russo et al.[7] project a future in Africa where relatively higher warming and associated extremes will be the order of the day.

The Paris Agreement, however, now aims to constrain global warming to below 2°C, with efforts to further limit warming to 1.5°C[7]. The question naturally arises: How will African climate extremes vary under these different warming scenarios? Shingirai et al. tackle this question using the Community Earth Systems Model (CESM) low warming experiments, firstly verifying that it is able to capture similar extreme events to those described above. A high greenhouse gas emission scenario – RCP8.5, which implies a business-as-usual case - was then used to drive the climate projections into the future, until stabilized 1.5°C and 2°C global mean temperature rises were reached.

Consistent with previous studies, Africa is expected to warm faster than the global average[2,6,7,8]. As a result, a considerable increase in heat extremes is observed. However, constraining warming to 1.5°C relative to 2°C reduces the probability of heatwave events similar to 1991/1992 southern Africa and 2015 Africa-wide warming by 20% and 10%, respectively[3]. Drought events similar to that observed over southern Africa in 1991/1992 are also found to be 25% less likely if the more stringent Paris targets are met[2]. While a broad quantification of the increased likelihood of extreme temperature events could be made, no clear evidence was forthcoming for a future change in the likelihood of the extreme precipitation events investigated.

Shingirai et al.[3] thus demonstrate that stringent mitigation efforts should be pursued as determinedly as possible, particularly to minimize risk in the vulnerable communities of the world, such as Africa; after all, a 25% reduction in the probability of some natural hazards is certainly the lesser of two evils. However, the results demonstrate the need for increased preparedness and adaptation efforts to alleviate the future socio—economic impacts of heat and drought, especially when factoring in the time delay in quantifying the full costs of extreme events. Uncertain projections of rainfall extremes further highlight known limitations in our simulations of precipitation and its processes, necessitating continued model development and knowledge understanding to fully quantify the changing risk of climatic extremes, both within Africa, as well as globally.

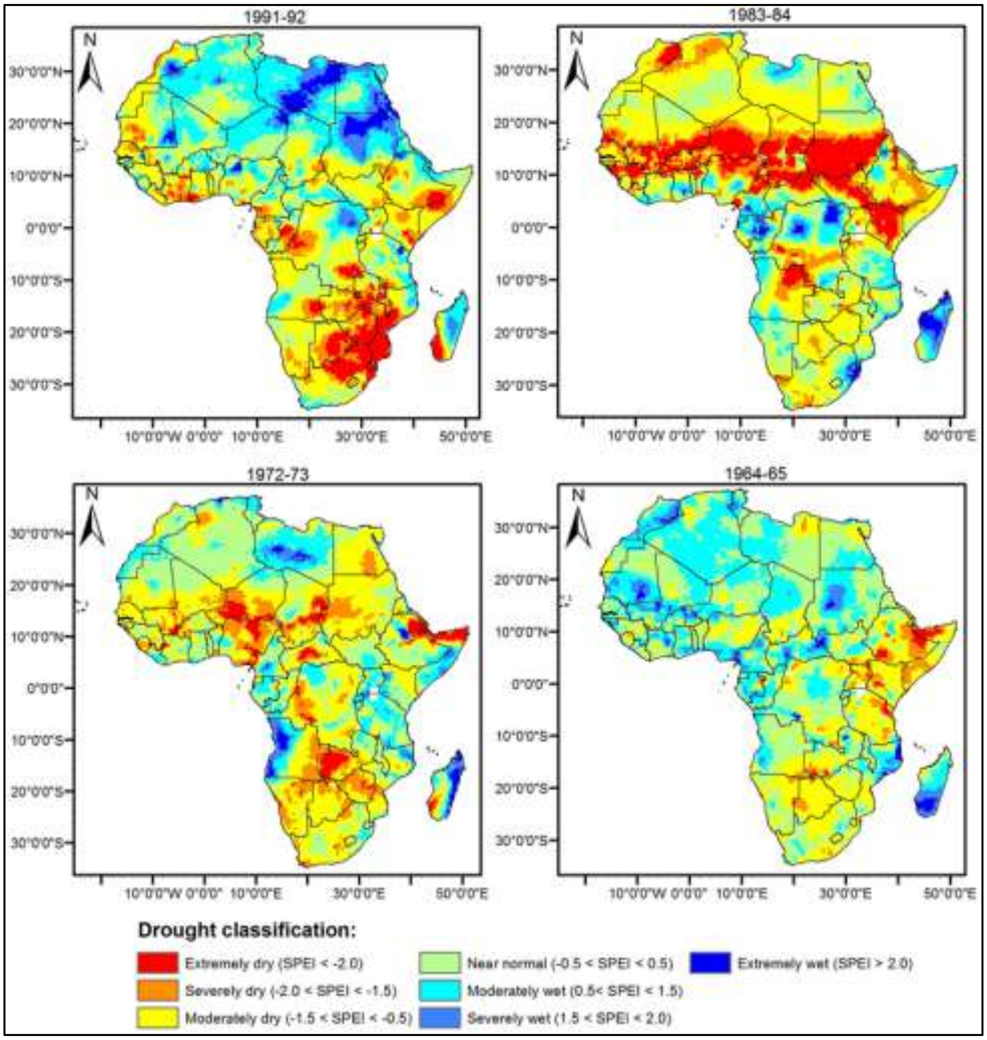

Fig. 1. *Maps of four severe droughts that occurred over various parts of the African continent It is apparent that the 1991-92 drought was the worst for southern Africa[8]*

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