CARIWIG Case Study Report 4

An example of local assessment of future drought. Las Tunas province, Cuba

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Summary

From 2003 to 2005 a major drought event affected an Eastern portion of Cuba. Particularly in Las Tunas province (see Figure 1), the impacts were severe in almost all sectors. Water supply was critical and there was significant economic loss in agriculture. A post-event program of short and long term measures was implemented immediately (e.g. water saving, storage and hydraulic improvement systems).

In this case study, an assessment of future drought in Las Tunas province in Cuba is presented. The study was conducted using the CARiDRO tool and the estimates of SPI and SPEI drought indexes were used to investigate how frequent will drought events in Las Tunas become, particularly those with similar features to the event that occurred during 2003-2005. Results indicate that this kind of climate extreme event will become more frequent and intense over the next decades, reducing the water availability by a combination of a reduction in precipitation and increase in water losses due to evaporation. These findings highlight the relevance of the existing measures to reduce the negative impacts of drought, particularly those related with water management.

Aim and objectives

This short study explores if future drought events in Las Tunas (characterized by 4 and 6 months with moderate and severe meteorological and agriculture drought) will be more or less frequent in the future.

We expect to address questions such as: Are enough the implemented measures so far to respond to more frequent drought like 2003-2005 in Las Tunas?

Figure 1. Map of Cuba where Las Tunas province is highlighted in red

Which tools were used? How and why?

The Caribbean Assessment of Regional Drought (CARiDRO) tool described by Centella et al (CARIWIG Case-study report No. 1) was used in this study. The regional climate model (RCM) outputs from the seven experiments (which are incorporated within CARiDRO) were also taken into account to summarize the projections of future drought occurrence. The combination of both tools allows the computation of the SPI and SPEI drought indexes and hence to explore if some features of the very intense drought which occurred in Las Tunas will occur in the short and mid-term future (2011-2050). With these tools, the assessment of future drought in the selected region will include some aspects relating to uncertainties in climate change model projections.

The findings

Drought events such as the one that occurred in Las Tunas during 2003-2005 are projected to be more frequent and prolonged in time (i.e., the number of months with drought) during 2011-2050. This finding emerges from the analysis of the SPI (precipitation based drought index) and the SPEI (water balance based drought index) time series for all the RCM simulations, although Figure 2 only shows a representation of one of these simulations. It should be noted that SPEI time series indicate more intense and prolonged droughts by the second half of the 2011-2050 time period, reflecting a clear influence of water loss due to the increase in temperature which reduces the water availability and consequently produces SPEI values which progressively indicate the potential increase of droughts more prolonged than observed during 2003-2005.

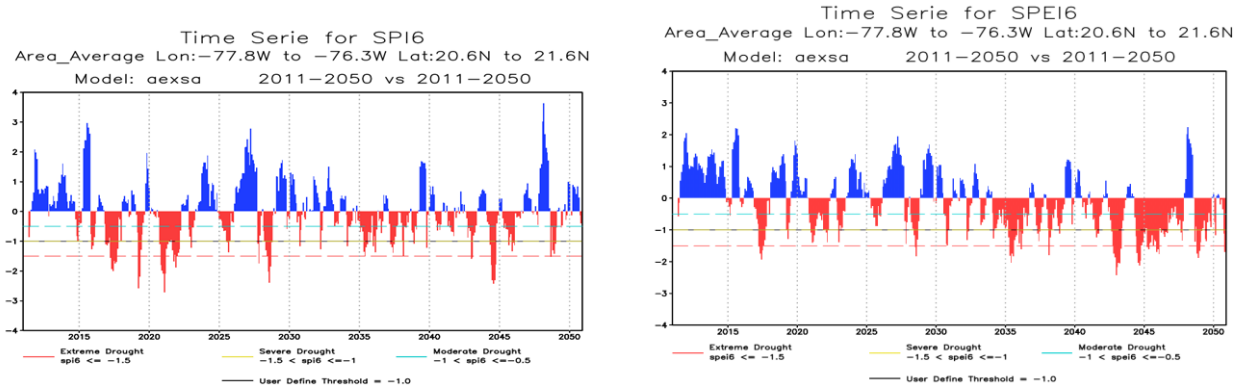

Figure 2. SPI (left) and SPEI (right) time series for Las Tunas province during 2011-2050 period. Red/blue shading indicates dry/wet conditions. Red bars falling below horizontal red, yellow and blue lines represent extreme, severe and moderate dry or drought.

Future frequency (2011-2050) of four or more consecutive months with moderate or extreme drought processes (Figure 3) will range from twelve to eighteen times for all the seven RCM experiments and for both drought indexes (being higher for SPEI). These values are larger than the observed frequencies during 1971-2000 time period.

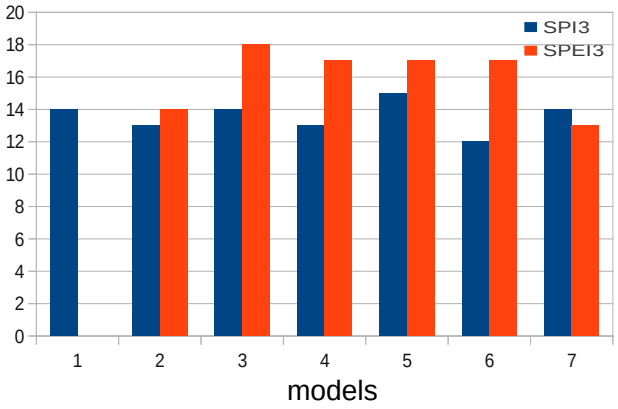

Figure 3. Future frequency of moderate or extreme drought with four or more consecutive months duration

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Implications for policy and planning

Currently the climate change issues are provoking serious concerns about the potential increase of drought. In this sense, the case study has been useful to show the relevance of the adaptation options identified in previous assessment of drought in the province and provides new knowledge to improve the implementation of existing plans. In particular, water management programs that include water saving, regulation of water use as well as controls to reduce fresh water loss by evaporation or by contamination. Similar studies can be carried out for other experienced drought events across the Caribbean, i.e., this really is an example of such an application.

Feedback on the tools

The tool is indeed an innovative application that can provide relevant outputs which can be assessed to produce relevant information. It is important to recognize that CARiDRO should be used by stakeholders in conjunction with climate experts to generate proper and relevant results. The developers should consider the inclusion of descriptive information about the graphical outputs, in order to facilitate the interpretation, making it more user-friendly.

What more could be done?

To include more climate projections in order to incorporate sources of uncertainties associated with different models and emission scenarios. Increased resolution in the model projection can be beneficial when conducting other studies at local scales.

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