CARIWIG Case Study Report 1

CARiDRO The Caribbean Assessment Regional DROught Tool

Abel Centella[1], Arnoldo Bezanilla[1], Alejandro Vichot[1], Malena Silva[1]

1. **Institute of Meteorology, Cuba**

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Summary

This case study summarizes the task done for the preparation of an online web-based tool (CARiDRO) that is able to facilitate the development of assessment of drought events at regional and grid-point levels using modelled and observed datasets. It also provides a brief overview of the structure and characteristics of the application of this tool which is considered as the first step in the development of the CARIWIG cases studies related with drought.

Aim and objectives

The Caribbean Assessment Regional DROught Tool (**CARiDRO**) has been designed to facilitate the development of assessment of drought events at regional and grid point levels by accessing and processing several datasets available from Regional Climate Model and a number of observed gridded datasets. The tool is able to provide results based on two Drought Indexes, the Standardized Precipitation Index and the Standardized Precipitation-Evaporation Index. The former (SPI) is a well known and very popular drought index being used in many regions to assess and to monitor drought events. The other one (SPEI) was designed mainly to evaluate the impact of climate change (i.e. warming) on drought and it is based on water balance instead of precipitation only. In this case, the evapo-transpiration values (used to compute the water balance) were calculated using the Thornwaite formulation. As both SPI and SPEI indexes are calculated at various time scales (i.e. 1-month, 2-months, 6-months, 36-months, etc) they enable the identification of different drought types such as meteorological or hydrological drought. Thus the application of the CARiDRO tool can help to assess the potential risk of these different kinds of drought in the future.

Which tools were used? How and why?

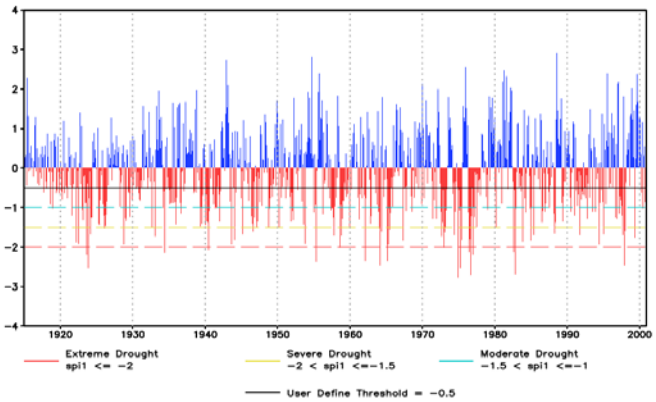
The core of **CARiDRO** is a combination of tools such as the Climate Data Operators (CDO), GrADS and Fortran codes. CDO and GrADS scripts are used for data processing and file manipulation, while Fortran codes make the SPI or SPEI calculations. The SPEI code is an adaptation of the original code available at http://sac.csic.es/spei/. GrADS scripts were built by the INSMET team to produce similar products (graphics and tables) to those used as part of the Drought Monitoring System in Cuba.

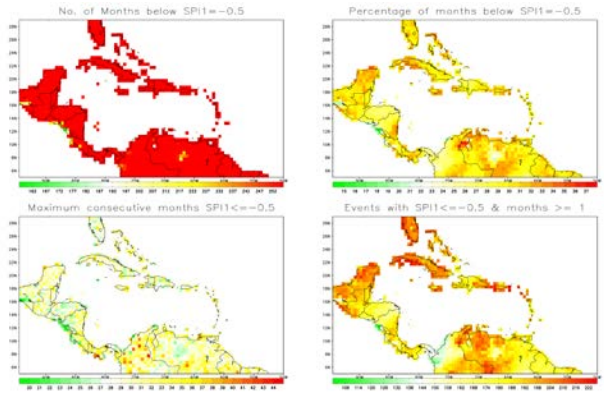
Seven experiments from the PRECIS regional climate model (RCM) as well as two observed grid point temperature and precipitation datasets are incorporated within CARiDRO. The RCM data at 25km of resolution from 1961 to 2070 comprise six perturbed parameters physics experiments driven by the Hadley Centre model (HadCM3) and one experiment driven by the ECHAM5 Global Climate Model. The observed data (from the Climatic Research Unit and University of Delaware) are at 50km and extend from 1901 to 2009.

The findings

The **CARiDRO** tool was designed successfully and can facilitate drought assessment in the context of the Caribbean and Central America regions. It is a flexible system that accommodates as many different users' requirements as possible. The on-line tool is now comprised of two main sections: a descriptive section where the user can find information on how use the tool as well as definitions of terms and concepts that are useful. The other section is where the user can fill out a form with different fields that allows the production of results accordingly.

The user can easily create different statistics and graphical outputs (Figure 1) that can be analysed to permit a variety of drought assessments at spatial scales that ranges from local to regional. The incorporation of observed datasets facilitates the study of past drought processes, while future drought assessments are based on the seven currently available RCM outputs.





General Drought Statistics
Area_Average
Lon:−94.5W to −50W Lat:5N to 29N
Model: crudata
Index: SPI1 Threshold: −0.5
1915−2000 vs 1915−2000

Months below threshold	329
Percentage	31.9
Maximum consecutive	40
No. Drought Events*	177

*with 1 or more months

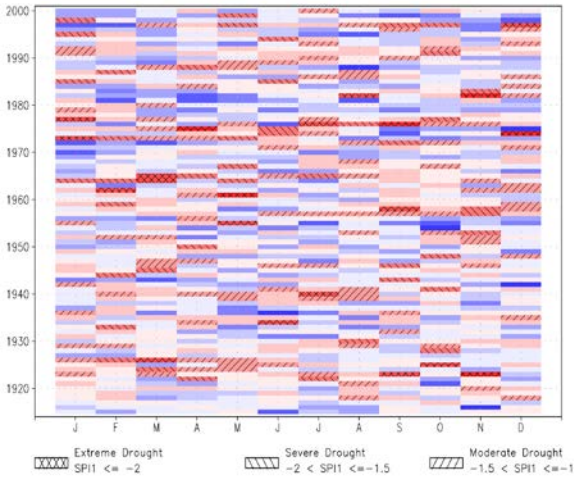


Figure 1.Examples of CARiDRO graphical and statistical outputs. Time series of SPI/SPEI (top left), spatial distribution of drought categories (top right), summary statistics (bottom left) and time cross sections (bottom right)

For further information please contact: arnoldo.bezanilla@insmet.cu
www.cariwig.org

Implications for policy and planning

The CARiDRO tool was designed to produce relevant information in order to facilitate the assessment of future drought, including the analysis of uncertainties associated with model projections. The tool have the potential to generate products that can be incorporated in Geographical Information Systems and by this to facilitate further analysis of drought related impact on different sectors, particularly in Agriculture and Water Resources sectores. Although the system is quite simple to use, it is important to clarify that at this stage, the tool is not considered suitable for general users/stakeholders without technical background on climatology, and thus advisory from climate experts should still be needed. We think that CARIDRO have many facilities that ensure that a variety of analysis can be make in a simpler way by users with some experience in meteorology/climatology. For those teams that combine persons with different technical backgrounds this tool could be extremely useful.

Feedback on the tools

The CARiDRO tool represents a very easy way to access observed and modelled data to do drought analysis without the need to get the raw data. The way the tool has been developed allows many people access to the observed datasets or climate model outputs without going to the original and post-processed databases, which could be hard to manage for general users.

Further development of the tool is needed such as improving the interface in incorporating a more user-friendly way to select the work area, as well as adding more information/details to describe the graphical outputs.

CARiDRO can be used as a teaching support platform for climatology courses and for the calculation of drought thresholds.

What more could be done?

CARiDRO must be improved and its development must be a continuous process in the next future to:

- Incorporate more climate model simulations, either from RCMs or GCMs
- Add more descriptive information on the outputs the tool produces
- Produce a better user graphical interface
- Add more output products, including the possibility to undertake ensemble analysis to better explore uncertainties

Further improvements can be identified once the tool can be widely used by the user community in the Caribbean region

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