Geophysical Research Abstracts
Vol. 17, EGU2015-15453, 2015
EGU General Assembly 2015

Assessing and mapping drought hazard in Africa and South-Central America with a Meteorological Drought Severity Index

Hugo Carrao, Paulo Barbosa, and Jürgen Vogt

European Commission, Joint Research Centre (JRC), Institute for Environment and Sustainability (IES), Climate Risk Management Unit

Drought is a recurring extreme climate event characterized by a temporary deficit of precipitation, soil moisture, streamflow, or any combination of the three taking place at the same time. The immediate consequences of short-term (i.e. a few weeks duration) droughts are, for example, a fall in crop production, poor pasture growth and a decline in fodder supplies from crop residues, whereas prolonged water shortages (e.g. of several months or years duration) may, amongst others, lead to a reduction in hydro-electrical power production and an increase of forest fires. As a result, comprehensive drought risk management is nowadays critical for many regions in the world. Examples are many African and South-and Central American countries that strongly depend on rain-fed agriculture for economic development with hydroelectricity and biomass as main sources of energy.

Drought risk is the probability of harmful consequences, or expected losses resulting from interactions between drought hazard, i.e. the physical nature of droughts, and the degree to which a population or activity is vulnerable to its effects. As vulnerability to drought is increasing globally and certain tasks, such as distributive policies (e.g. relief aid, regulatory exemptions, or preparedness investments), require information on drought severity that is comparable across different climatic regions, greater attention has recently been directed to the development of methods for a standardized quantification of drought hazard.

In this study we, therefore, concentrate on a methodology for assessing the severity of historical droughts and on mapping the frequency of their occurrence. To achieve these goals, we use a new Meteorological Drought Severity Index (MDSI). The motivation is twofold: 1) the observation that primitive indices of drought severity directly measure local precipitation shortages and cannot be compared geographically; and that 2) standardized indices of drought do not take into account the intra-annual variability of precipitation in estimating the severity of events that can impact on seasonal activities. The MDSI is standardized in space and time, and considers the relative monthly precipitation deficits and the seasonal influence of precipitation regimes in the meteorological drought severity computation. In this study, the calculation of the MDSI is performed with monthly precipitation totals from the Full Data Reanalysis Monthly Product Version 6.0 of the Global Precipitation Climatology Centre (GPCC). This dataset provides a global analysis at 0.5 dd latitude/longitude grid spacing of monthly precipitation over land from operational in situ rain gauges collected between January 1901 and December 2010. Using the MDSI, we estimated the severity of drought events that occurred in the past 100 years in Africa and South-Central America, and produced drought hazard maps based on the probability of exceedance the median historical severity. Overall, results indicate that drought hazard is high for semiarid areas, such as Northeastern and Southern South America, as well as Eastern and Southwestern Africa. Since available water resources in semiarid areas are already insufficient to permanently meet the demands of human activities, the outcomes highlight the aggravated risk for food security and confirm the need for the implementation of disaster mitigation measures in those regions.