Extreme Climate Events and Sugarcane Crop Yield in São Paulo/ Brazil

Andrea Koga-Vicente[1], Luiz E. Vicente[2], Zullo Jr. Jurandir[3], Michael J. Friedel[4] and Daniel C. Victoria[2]
[1]Centre for Meteorological and Climatological Researches in Agriculture - UNICAMP, Campinas, Brazil
[2]EMBRAPA - Brazilian Agricultural Research Corporation, Campinas, Brazil
[3]Centre for Meteorological and Climatological Researches in Agriculture, UNICAMP, Campinas, Brazil
[4]United States Geological Survey, Lakewood, CO, USA
E-mail: andrea.kvicente@gmail.com

Abstract - Surveys conducted by the Brazilian Ministry of Agriculture show that periods of drought and excessive rainfall are the factors that cause most losses in agricultural crops in Brazil. Anomalous weather conditions were cited as the mainly reason for the decrease in sugarcane crops productivity in recent years in São Paulo state, which is responsible for 60% of sugarcane production in Brazil. There was an expansion in sugar cane sector due from the global increase demand for ethanol and sugar, and the crops shortfall causes a net of social and economic impacts. Brazil is the largest producer of ethanol from sugar cane and the performance in this region is important for the world market. Aiming to understand the relationships between climate, weather extremes and the influence of these conditions on variations in crop yields of sugar cane in São Paulo / Brazil, were analyzed multisource data from (i) government database on sugar cane (i.e. planted area, production and productivity); (ii) Remote Sensing time series dataset on climatic conditions (i.e. temperature and precipitation variability, El Niño and La Niña occurrence) and weather extremes (i.e. droughts and heavy rainfall). We selected shortfall crops events of sugar cane over 21 years caused by weather extremes conditions. We designed a database with production of sugar cane, climatic conditions for each period and the socio-economic impacts data (i.e. economic losses, anomalies in the rates of Total Recovered Sugar and Gross National Product of municipalities). A model was developed using multiple linear regression technique in order to analyze the relations among climatic, meteorological, agricultural and socio-economic variables. The outcomes pointed the influence of the variables in the decrease of the crop yield and in the economic losses, represented by the index for each variable. In the episodes investigated were observed relations between the La Niña phenomenon and the weather extremes which affected the crop yield. Although the decrease in yield has been caused by the weather extreme events, the public policies had a strong influence in the impacts observed. Thus, the results represent an overview of a range of variables that can be used in forecasting models for oscillations related to extreme events in sugar cane crops.