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Identification of structural breaks in hydrological maxima time series in Paraguay River, Pantanal Region, Brazil.

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The hydrological time series of the Paraguay River located in the Pantanal region of Brazil exhibits a complex and interesting behavior, which includes long memory characteristics, monotonic trends, multiple breaks and strong seasonality. Particularly, several abrupt changes from low to high flows and vice versa have been observed on annual maxima time series and have been responsible for the major flood damages in the region, even more significant than the largest floods that occurred in the period post 1974. The year of 1974 is historically known as the year of the most significant flood impact in region, especially on agriculture and cattle. Therefore, the identification and attribution of such step changes in the series is of particular interest to improve the flood management systems across the region. Here we apply the cumulative sum (CUSUM) procedure to identify the timing of the abrupt changes. Preliminary results for the Ladario streamflow gauge reveal multiple structural changes in 1936 (high flows to low flows), 1961 (high/low), 1974 (low/high) and 1999 (high/low). Rainfall records were also analyzed and the results obtained suggest that the Paraguay River basin in its upper reach, monitored by Caceres gauging station (32,400 km^2) and Cuiabá river basin (23,500 km^2) are the factors that most contribute to low frequencies oscillations in the Ladario maxima time series (253,000 km^2). These sub-basins are both located in the northern part of the catchment along with the boundary of the Amazon River basin, where the average rainfall is more expressive. In both basins the rainfall records show a structural break in 1973. Simple linear regression using rainfall and flow records in those sub-basins show that the rainfall data accounts for around 70% of the flow variance, indicating that the internal dynamics of the catchment plays a minor role on the streamflow variability. Low frequency variability is also observed in both rainfall series and may be the main cause of the long memory persistence and structural breaks in the Ladario streamflow gauge.