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The Drought Interest Group: Comparison of the performance of five indices for drought characterization in La Plata Basin. Perspectives towards a multi-scale monitoring system.

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The quantitative knowledge of the properties of droughts in a region is an important aspect of the planning and management of water resources. There are numerous natural drought indicators that should be monitored routinely to determine the onset and end of drought and its spatial characteristics. This work compares the performance of five indices for drought monitoring in the La Plata Basin (LPB) region, one of the largest basins in the world. The basin generates around 70% of the Gross National Product of Argentina, Brazil, Paraguay and Uruguay, and has a population of over 100 million inhabitants. The LPB is also one of the major producers of hydroelectric power in the world, generating around 95% of the energy used in Paraguay, 25% in Brazil, 40% in Argentina. Therefore, extreme low flows are critical for hydroelectric power and water resources management. The economic wealth of LPB strongly depends also on agriculture, which set a major challenge: the increase in the prediction capacity of the impacts of drought for stakeholders. Five drought indices have been selected for this study. They include the Standardized Precipitation Index (SPI), the Deciles Index (DI), the Effective Drought Index (EDI), the Percentage of Normal Precipitation (PRCT) and the Lack of Rain Index (LORI). These drought indices have been used to quantify deficits in water resources and as a drought monitoring tool in several regions of the world. A common feature of the indices selected is that they all are calculated using precipitation data only. Monthly rainfall data were obtained from the CLARIS LPB Data Base for 68 of its stations, which were subjected to quality control procedures and have less than 10% of missing values. We used a common comparison period of 48 years (1961-2008). The comparison was performed for the time scales of 3 and 12 months, in order to have a broad approach of the different precipitation shortages. The assessment criteria to determine the most appropriate index for monitoring droughts include their interpretability, a detailed spatial and temporal analysis of the major historical droughts, and their flexibility in the time scale, among others. In conclusion, the SPI, which is the most widely used drought index, is likely the best choice for detecting the onset of drought and its spatial and temporal variation in LPB. However, the spatial and temporal responses of the different indices point to the need of using several indices for drought monitoring in the study area. Besides the time scales evaluated, we suggest that the monitoring should be performed over a broad time scales, which allows the effects of precipitation deficits on different water resource components to be assessed. These results could be useful for forecasting and monitoring drought severity, to identify changes in drought frequency and magnitude, and for developing a drought preparedness plan in the region. We also plan to use these results for the validation of model outputs and global and continental monitoring systems based in gridded precipitation data, such as the VAMOS Atlas of Extremes for the Americas.