

Assessment of droughts at a continental scale under different climate change scenarios. Case study: La Plata Basin

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In this study, we characterized and diagnosed the droughts across La Plata Basin for the reference (1961 – 2005) and future (2007 – 2040, 2041 – 2070 and 2071 – 2099) scenarios. La Plata Basin is located in the Centre-South of South America and comprises 3.174.229 km² and five countries. Despite the significant impact of droughts on agriculture, cattle, water supply, natural water courses and wetlands, droughts are still difficult to predict in the region, both in time and space. We used the Standardized Precipitation-Evapotranspiration Index (SPEI) to characterize droughts based on Potential Evapotranspiration (PET) and Precipitation (P) at a monthly scale. PET and P were obtained for all 10 x 10 km-size cells within the basin by using the regional climatic model Eta, under the boundary conditions of the HadGEM2-ES model and the CO₂ emissions scenario RCP 4.5. Cell to cell information was integrated into a sub-basin level in order to show and analyze the results. For each sub-basin, climate scenario, and temporal scale of SPEI (1, 3, 6 and 12 months), we identified the beginning of each drought, calculated its duration, magnitude, maximum and mean intensities, and the duration between drought events. Additionally, for each SPEI temporal scale and sub-basin, we described the spatial coverage of droughts for the temporal series of all climate scenarios.

Spatially, we found a decrease of PET from North to South. Temporally, results showed a future increase of PET for the Paraguay river basin and upper Parana river basin but similar to present values for the remaining basin. Results showed that P will be similar in the future for the Paraguay river basin and upper Parana river basin, but will increase within the remaining basin. During the 2007 – 2040 scenario, we expect that the northern sub-basins suffer from several droughts while the southern ones have wetter climate with few short drought events. As we analyzed more distant future scenarios the wet climate spreads towards northern sub-basins and droughts became less intense. Similarly, the area covered by droughts for each sub-basin, in general, tended to decrease in the farther future. Finally, the results highlight a significant heterogeneity of droughts (occurrence and drought characteristics) in La Plata Basin.