

Evaluation of changes in hydrological and vegetation indicators between 1970 and 2020 in the rainfed agricultural region of Córdoba, Argentina

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Summary

Thornthwaite water balance was used to evaluate hydrological dynamics of the agricultural region of Córdoba between 1970 and 2020, and to interpret both productive and sustainability aspects. Both, temporal and spatial variability of hydrological indicators was examined between 2000 and 2020, and their influence on the vegetation was determined using the MODIS NDVI as a proxy. The water balance was evaluated by comparing two alternatives to compute the water extraction from the soil when $PP-ETP < 0$, the original one that considers an exponential relationship with respect to Potential Evapotranspiration (ETP), and another that considers a linear relationship, finding no differences between both. In addition, different procedures to estimate ETP were assessed: Thornthwaite (ETP_{Th}), Hamon (ETP_H) and Penman-Monteith (ETP_{PM}). While the values of ETP_{Th} and ETP_H were similar, those of ETP_{PM} were systematically larger and more variable. Nonetheless, the slope of the linear relationship between different ETP procedures tended to 1. Water consumption (ETR_{Th}) was best correlated with the seasonal dynamics of NDVI at department level, especially when considering the 1-month delay with respect to the water stimulus. In general, the trends of the hydrological indicators evaluated in different points of the province were not significant, except in Pilar Observatorio where significant trends ($p < 0.05$) of T and ETP increases and PP and ETR decreases were detected.

Key words: climate change; deficiency/excess of water; NDVI; trend