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COMPARATIVE HYDROLOGY OF THE LARGE SOUTH AMERICAN WETLANDS

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INTRODUCTION

South America hosts some of the largest rivers on Earth, and major wetland complexes as the Pantanal and Amazon ones, which maximum extent accounts for 5-12% of the continent territory (Fluet-Chouinard et al., 2015). Yet the hydrologic functioning of many of these wetlands remain poorly described and understood. The understanding of wetlands can largely benefit from a comparative hydrology approach (Hamilton et al., 2002), aiming at understanding differences towards a better comprehension of wetlands' hydrological processes in general. Then, in this study we integrate multiple remote sensing-based observations of wetlands' hydrology for 12 South American wetland areas, and assess the unique hydrologic characteristics of each of these systems.

METHODOLOGY

We use state-of-the-art remote sensing datasets to apply a comparative hydrology approach to 12 wetlandscapes in South America, from temperate to tropical and equatorial ones. Estimates of precipitation (MSWEP), surface water extent (GIEMS-2), total water storage (GRACE), river and wetlands' water levels (ENVISAT, ICESat, SARAL, TOPEX, JASON2, SENTINEL3, totaling 888 satellite altimetry virtual stations), evapotranspiration (SEBAL algorithm), and other ancillary data (MODIS EVI and land surface temperature, and GLDAS net radiation) are combined to understand the drivers of flood and evapotranspiration dynamics. Multiple correlations among the variables are then performed.

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RESULTS

We show that wetlands associated to river floodplains (e.g., Magdalena, Pantanal, Central Amazon, Paraná) have a slower flood propagation associated to river routing and feature a higher annual water level amplitude, while the interfluvial ones (e.g., Llanos de Orinoco, Llanos de Moxos, Bananal) are more dependent on local runoff and have a smaller delay between precipitation and flood peak as well as water level amplitude. While most wetlands have a regular annual flood pulse, the Pampas in Argentina stand out as having a very erratic pattern with flood-rich years followed by drought-rich ones. Regarding evapotranspiration, we show that major differences between wetlands and uplands occur in temperate climates (water-limited environments), while in equatorial ones the difference is smaller. In Central Amazon, the high forest cover in upstream reaches compensates the higher flood fraction but lower forest cover in the downstream ones, maintaining high evapotranspiration year round. Flood propagation along river floodplains is showed to be a major control of evapotranspiration dynamics in wetlands associated with a river flood pulse, especially for the Pantanal where the flood wave takes months to propagate across the system.

CONCLUSIONS

We present a comparative hydrology approach to understand hydrological processes across 12 major wetland complexes in South America. We show the different responses and timing of processes in various wetland types, from river floodplains (e.g., Paraná, Amazon, Paraguay) to interfluvial areas (e.g., Pampas, Llanos de Orinoco). This large collection of wetland hydrology data has the potential to foster our comprehension of South American wetlands' hydrology.

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