Explaining Annual Streamflow Variability of Amazonia Rivers

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This study analyzes the influence of El Nino events and oscillation of the Intertropical Convergence Zone (ITCZ) on Amazon rivers. El Nino events are known to be associated with negative anomalies of rainfall over the Amazon. However, different El Nino events had resulted in distinct responses in river streamflows, especially in 2005 and 2010, when very low discharges were observed following the only moderate El Nino events of 2003 and 2009. On the other hand, anomalous early northward displacement of the ITCZ has been recognized to trigger dry conditions over northeast of Brazil. That displacement, associated with cross Atlantic sea surface temperature gradient, could also reduce rainfall over part of the Amazon and reflect in low river discharges. Here, we employ empirical orthogonal function analysis (EOF) to quantify how much of the annual variability of Amazon rivers discharges can be explained by El Nino events and anomalous ITCZ displacement. Normalized time series of NINO 3.4 index and North Tropical Atlantic (NTA) index were analyzed together with reconstructed river discharge measurements spanning over 60 years. The results show that El Nino events explain a substantial part of streamflow annual variability while NTA index explains a smaller part. Rivers draining areas from the south of Amazon (Xingu and Araguaia) had their annual discharge variability less explained by El Nino. However, a large part of annual discharge variability remains to be explained by other phenomena besides those here considered.