ENSO based low-frequency precipitation and nutrient load oscillations in the Little River Watershed, Georgia

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The El-Niño/Southern Oscillation (ENSO) is a low-frequency global climate phenomenon with strong effects on the weather patterns of the southeast United States. ENSO has previously been shown to have predictable effects on stream flow, rainfall, crop yield, and nutrient loads in runoff. In monitoring and research efforts during the last century, ENSO indices have emerged as one of the most consistent for describing low-frequency climate variability on both global and regional scales. Using 30 years of data from an agricultural coastal plain watershed in Tifton, Georgia, we have explored the relationship between Sea Surface Temperature (SST) anomalies in the equatorial Pacific Ocean and precipitation, flow, and nutrient loads in the Little River Watershed. To specifically understand the low-frequency oscillations and inter-annual variability inherent in precipitation, flow, and runoff time series as a non-stationary process, wavelet analysis was used. Wavelet analysis allows the identification of long term periodic trends, localized variations of power associated with geophysical data, and direct comparisons between ostensibly causal different time series. We found that the 3-7 year periodicity inherent in ENSO cycles exists in the Little River Watershed's precipitation as well as nitrate and total phosphorus time series. SST's and both nutrient loads and precipitation time series also demonstrated shared periodicity from 3-7 years in cross and coherence wavelet analysis. This indicates that the ENSO signal can be used as a predictor for both nutrient loads and precipitation in the southeast United States. Reconstructed Components (RC) from the 3-7-year period were then used to quantify the amount of variance captured from the original time series. These RC's will be used to create a local monthly and seasonal nutrient load model based on ENSO phase that is free from process-based error, and can quantify the uncertainty involved in the model.

keywords: El Niño/Southern Oscillation, inter-annual variability, wavelet analysis, nutrient loads, modeling.