Trends in ENSO Based Precipitation and Nutrient Load Oscillations in the Little River Watershed

Victoria W. Keener[1], J. W. Jones[1], G. Feyereisen[2], and U. Lall[3]
[1]Department of Agricultural and Biological Engineering, University of Florida, Gainesville, FL
[2]USDA-ARS, Southeast Watershed Research Laboratory, Tifton, GA
[3]Department of Earth and Environmental Engineering, Columbia University, New York, NY

The El-Niño/Southern Oscillation (ENSO) is a periodic global climate phenomenon with strong effects on the weather patterns of the southeast United States. ENSO has been shown to have predictable seasonal 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.

To better understand the relationship between Sea Surface Temperature (SST) anomalies in the equatorial Pacific Ocean and hydrology in the southeast United States, we have done an analysis in the frequency domain on 30 years of precipitation, flow, and nutrient load data from an agricultural coastal plain watershed in Tifton, Georgia. To specifically understand the low-frequency oscillations and inter-annual or decadal variability inherent in these hydrological 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 within geophysical data, and direct comparisons between ostensibly causal time series.

We found that the 3-7 year periodicity known in ENSO cycles exists in the Little River Watershed's precipitation, flow, nitrate and total phosphorus time series. SST's and both nutrient loads and precipitation time series also demonstrated shared periodicity and high covariance from 3-7 years in cross and coherence wavelet analysis. This indicates that the ENSO signal could 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 one input-- ENSO phase-- that is free from process-based error and can provide stakeholders with information on runoff risk in upcoming seasons.

Contact Information: Victoria W. Keener, Graduate Student, Department of Agricultural and Biological Engineering, University of Florida, PO Box 110570, Gainesville, FL 32611, USA; Phone: 352-392-1864 #288; Fax: 352-392-4092; Email: vicko@ufl.edu