Categorical ENSO Effects on Simulated Phosphorus Loading in South Florida

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The El-Niño/Southern Oscillation (ENSO) is a periodic global climate phenomenon with strong effects on the weather, stream flow, and precipitation patterns in Florida. This study investigates the effect of ENSO phase on simulated phosphorus (P) loads in runoff from a sub-basin of Lake Okeechobee. Water quality is an important topic of research and public concern in Florida, both for maintaining or improving environmental quality and standards of living. Reducing the negative effects of nutrient pollutants on ground, surface, and coastal waterways has been a major focus of hydrological and agricultural research in the past decades.

Major changes in land use and management in Florida over the last 50 years make the use of historical data impractical in this situation. To isolate effects of ENSO phase on nutrient loads, the Watershed Assessment Model (WAM) was used to simulate N and P from 1965-2001 in basin S-191, a 487 km^2 area northeast of Lake Okeechobee. By holding land use constant over the entire simulation time, the effects of climate variability on pollution were specifically explored for the three ENSO phases. ENSO phase classifications used are from the Japan Meteorological Agency (JMA) index, comprised of a six-month running mean of spatially averaged surface sea temperature anomalies over the tropical Pacific Ocean.

Results showed that ENSO strongly affected seasonal and monthly phosphorus runoff. El Niño years produced seasonal peak P loads significant at the 99% level during the spring (February-April), which indicates dominance of positive load anomalies. La Niña years produced significant seasonal peak loads in the summer (May-July), but with large variability. Neutral years exhibited less predictable seasonal loading, although simulated loads were generally similar to measured long term means. Nutrient loading patterns during specific ENSO phases were comparable to previously explored precipitation and stream flow patterns in south Florida. However, the use of categorical ENSO phase instead of a continuous measure of sea surface temperatures may not be adequate for capturing accurate fine scale regional nutrient load trends.

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