Is Elevated DOC a Result of Low DO Rather than its Cause?

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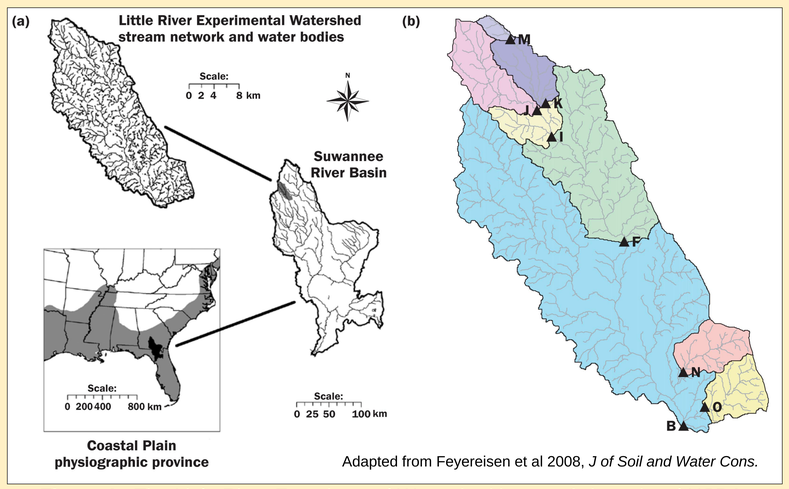
Introduction

- Dissolved organic carbon (DOC) is a major mobile fraction of organic carbon in blackwater rivers, and is utilized by oxygen-consuming bacteria.
- For this reason, it is a parameter in models developed to set new dissolved oxygen (DO) standards in oxygen-impaired blackwater rivers.
- The Little River Experimental Watershed (LREW, Fig. 1), located in the Suwannee River basin of South Georgia, displays low DO (<1 mg/L) and high DOC (up to 80 mg/L) concentrations.
- DOC undergoes large fluctuations throughout the year (Fig. 2).

Objectives

1. Determine causes of DOC fluctuations in the Little River.
2. Determine if elevated DOC concentrations result in low DO.



Adapted from Feyereisen et al 2008, *J of Soil and Water Cons.*

Figure 1. The Little River Experimental Watershed is one of six regional USDA research watersheds. At right, gauged weir stations are indicated by ▲.

Methods

- Flow-weighted water samples collected weekly at 8 gauged weir stations (Fig. 1) since 1972.
- Station B (Figs. 1 & 3) data were analyzed with multiple regression to determine factors affecting DOC concentration.
- Parameters: discharge, DO, temperature, NH_4, NO_3, TKN, PO_4, TP, ORP.
- Correlation between independent variables DO and temperature (Fig. 4) required exclusion of temperature from multiple regression analysis.

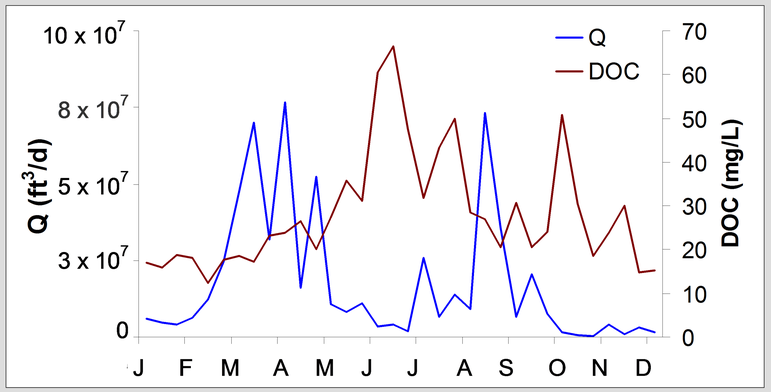


Figure 2. Discharge (Q) and [DOC] over time in station B of the Little River in 2003.

Figure 3. Gauged weir at station B of the LREW, March 2003.

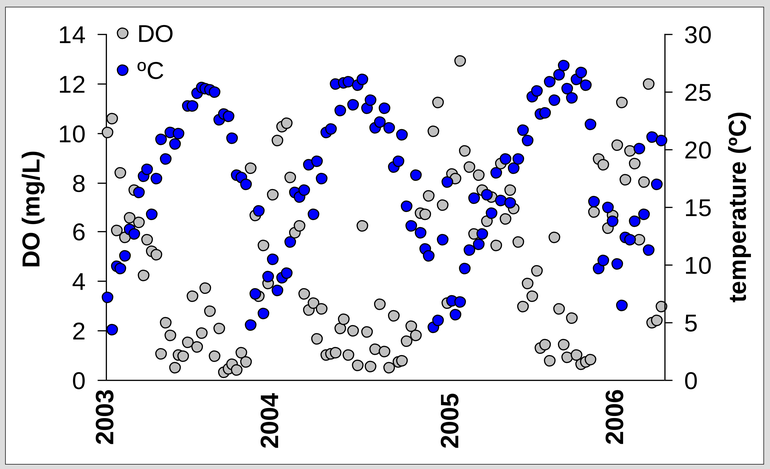


Figure 4. Negative correlation between DO and temperature over time.

Results & Discussion

- [DOC] is best explained by [DO] and [PO_4] ($r^2 = 0.42$).
- [DOC] is negatively correlated with DO (Fig. 5, $p < 0.0001$).
- Elevated [PO_4] (Fig. 6, $p = 0.037$) not necessarily causative of [DOC].
- Co-precipitates of DOC, iron, and PO_4 may dissolve in anoxic conditions, increasing their concentrations in the water column.

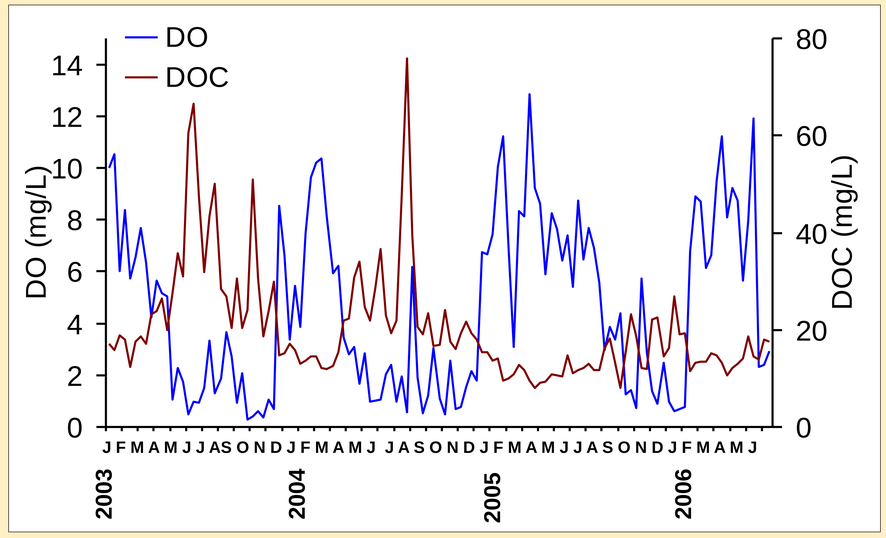


Figure 5. DO and DOC display an inverse relationship over time. Note large pulses of DOC during low oxygen events.

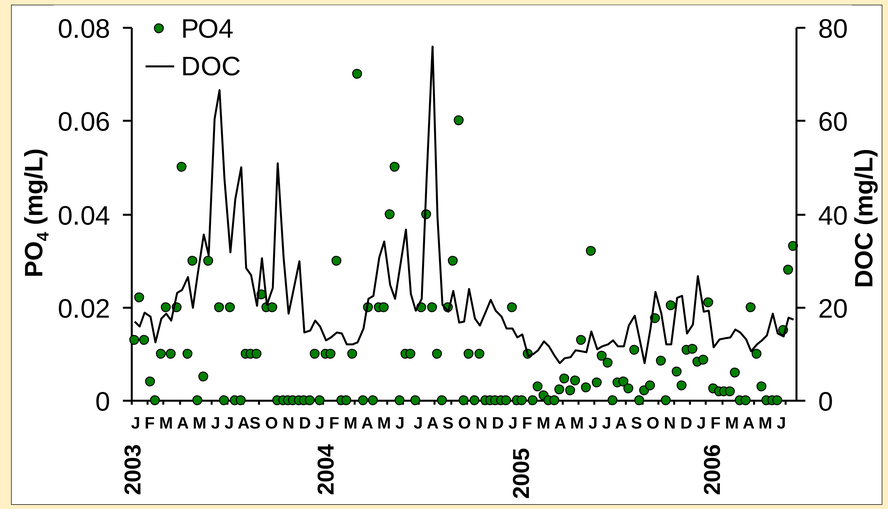


Figure 6. Highest PO_4 levels are clustered around [DOC] peaks in 2003 and 2004.

Conclusions

- Elevated [DOC] may be a result of low [DO] rather than an explanation for it.
- Separation of temperature and DO effects is difficult (Fig. 4), but elevated iron concentrations during DOC pulses would support the idea of dissolved co-precipitates during anoxia.

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