Long-term trends and event based responses of solute concentrations in the Lamprey River Watershed

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University of New Hampshire

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Session: Unanswered Questions in Watershed Biogeochemistry
Is carbon and nitrogen coupled within the Lamprey River Watershed?

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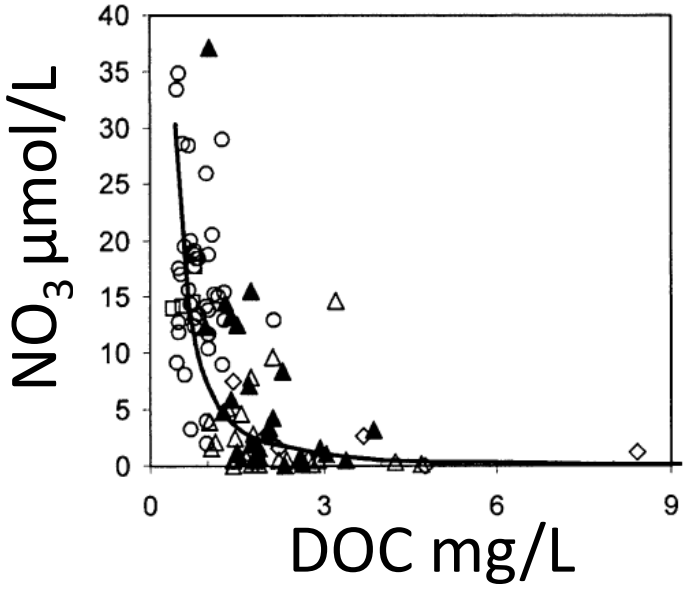
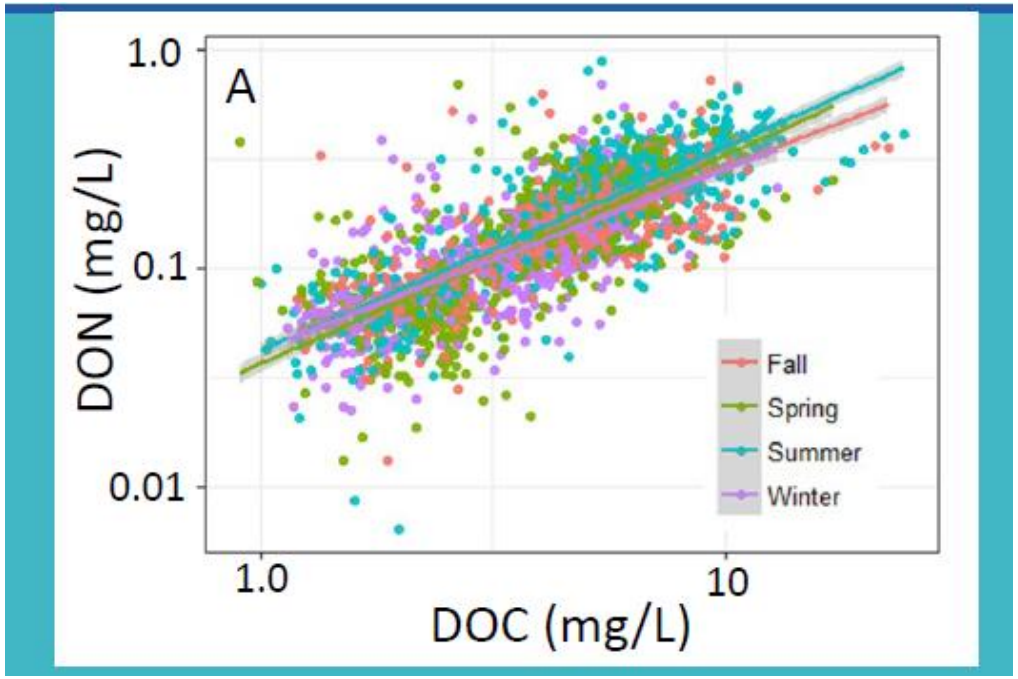


Goodale et al. 2005



Wymore et al. In Prep

(Data from Lamprey River Watershed and Hubbard Brook Experimental Forest)

**Observe both patterns at the global scale

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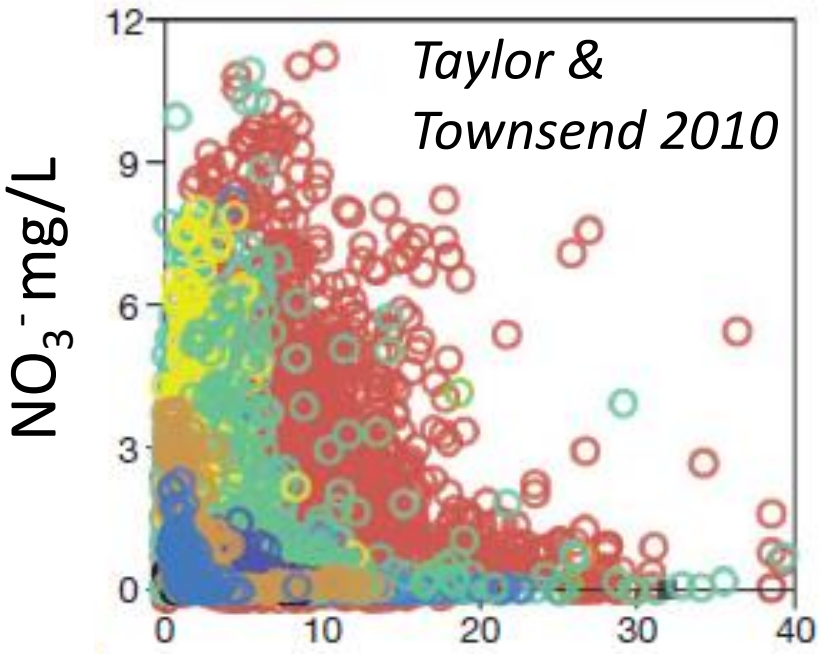
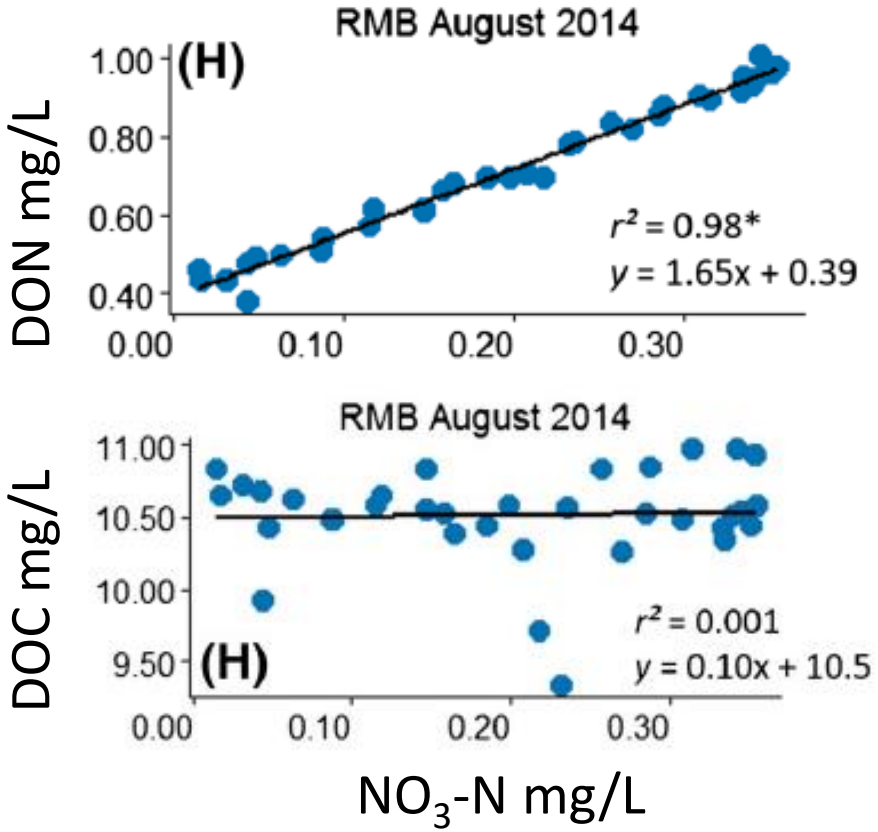
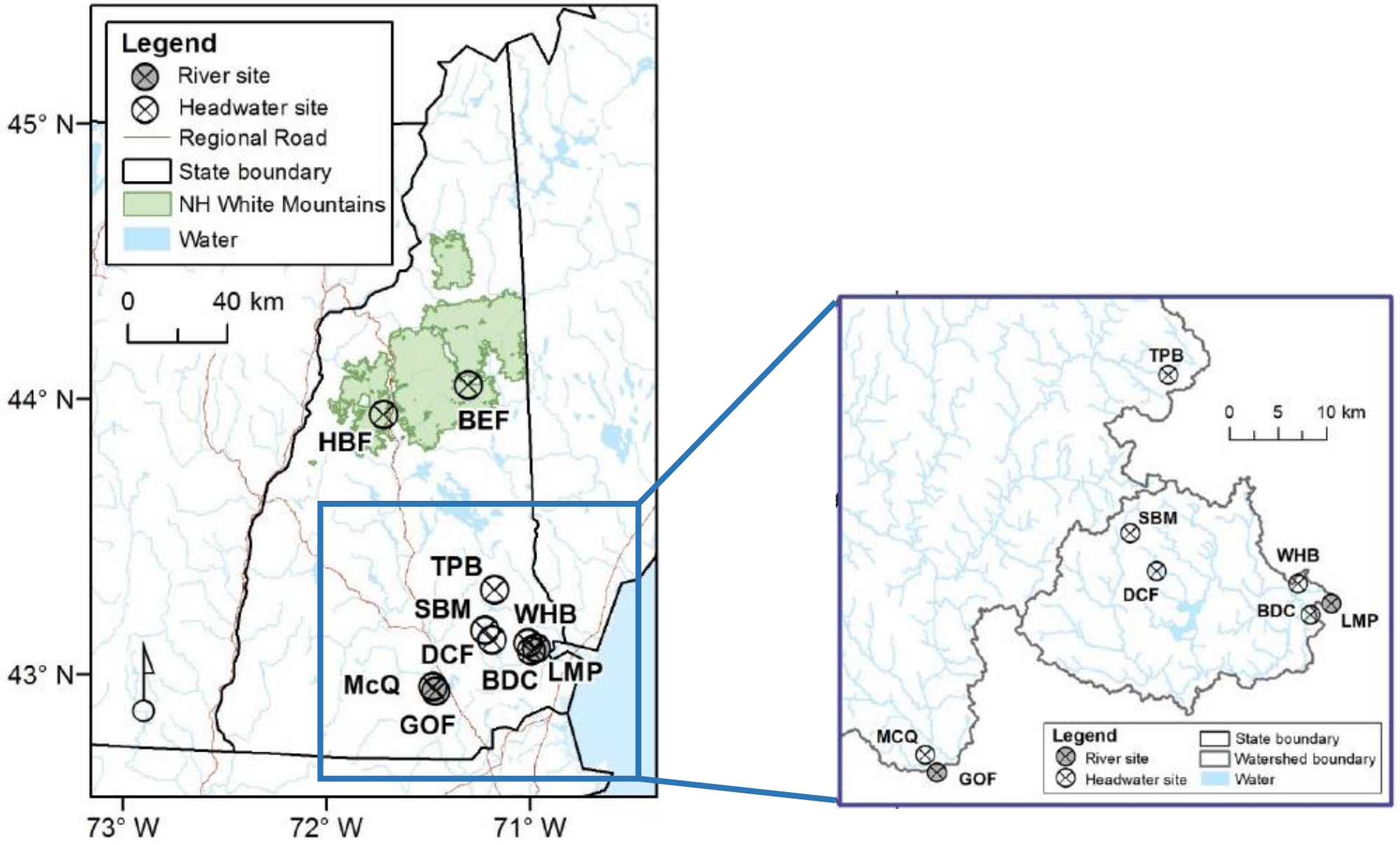


Denitrification
(permanent removal of NO_3)



DOC and DON respond differently to pulses of NO_3


Legend
River site
Headwater site
Regional Road
State boundary
NH White Mountains
Water
0
40 km
45° N
44° N
43° N
73° W
72° W
71° W
HBF
BEF
TPB
SBM
WHB
DCF
McQ
BDC
LMP
GOF
0
5
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MCQ
Legend
River site
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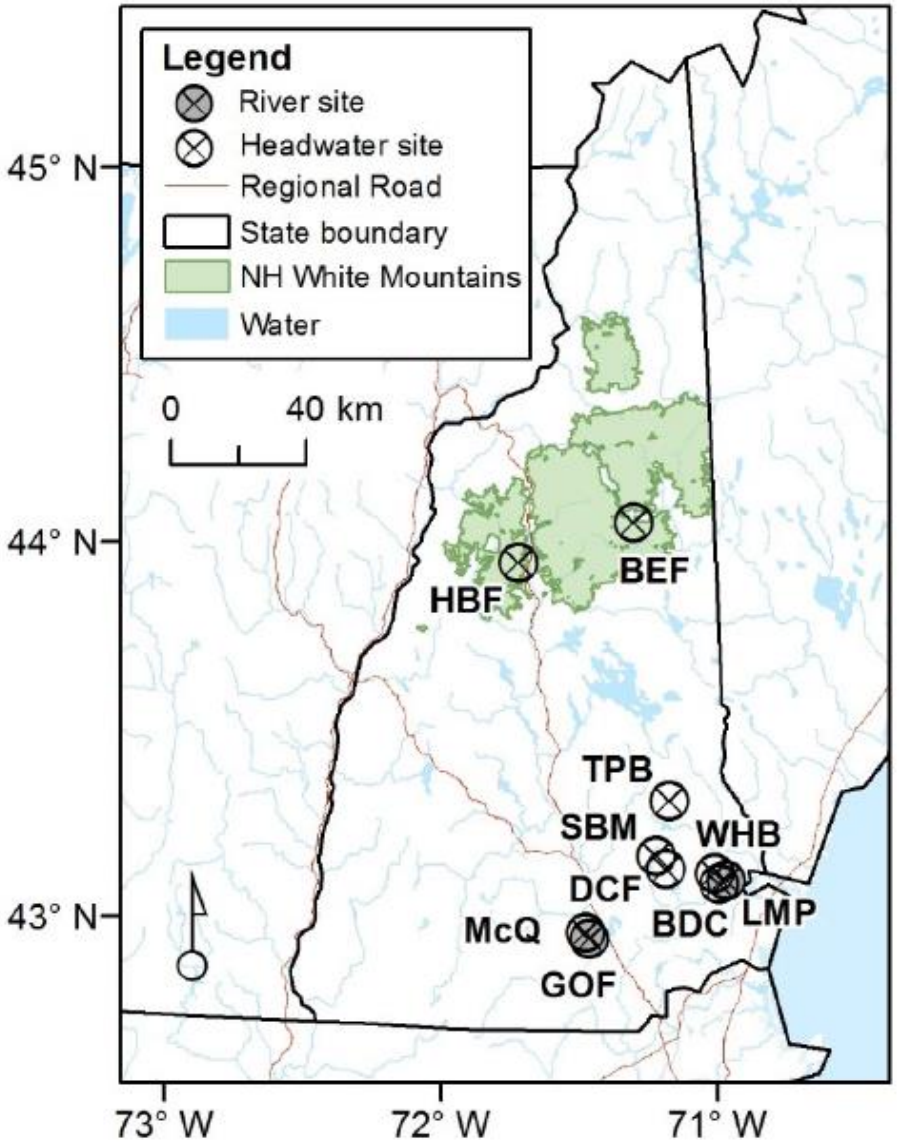
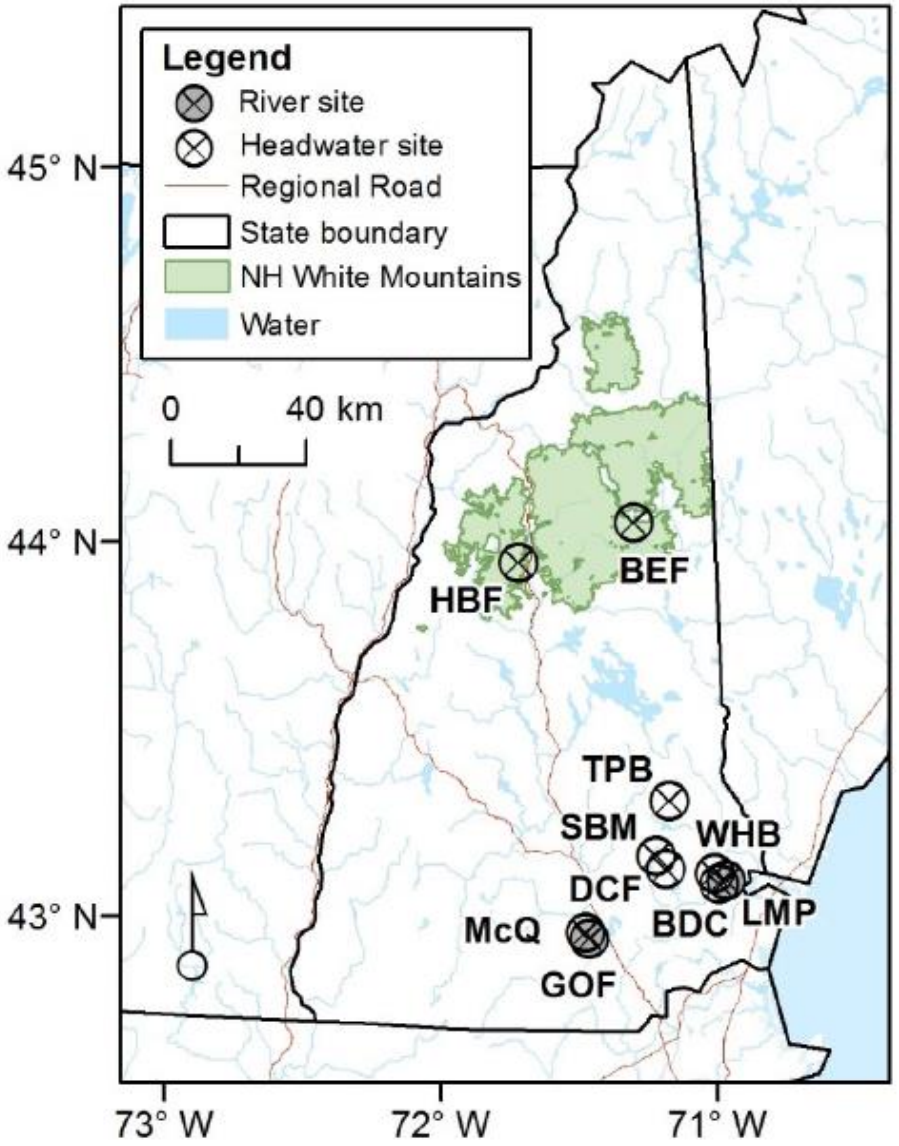
Watershed boundary
Water



1. Long-term trends in solute concentrations and response to extreme flood events

→ Lamprey mainstem

→ Coble et al. *in revisions* JGR-B



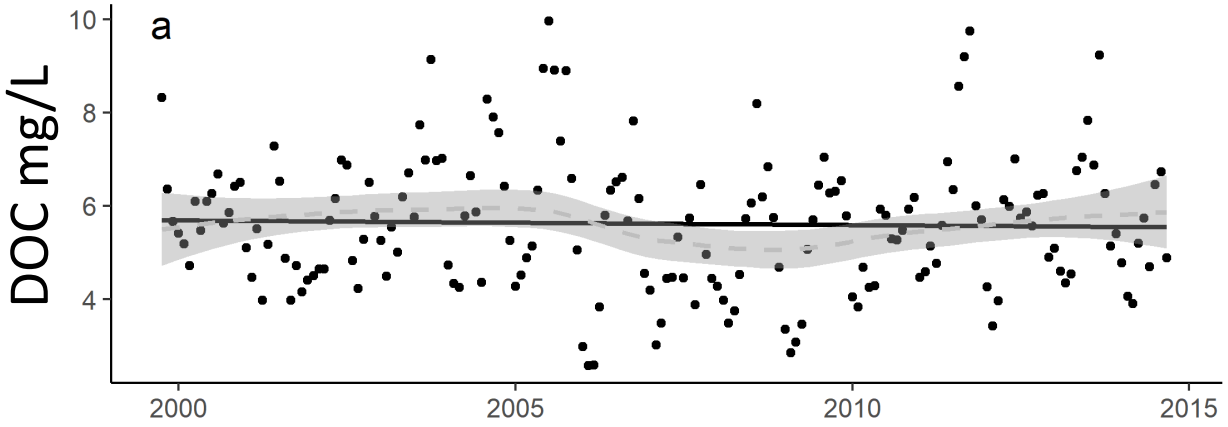
1. Long-term trends in solute concentrations and response to extreme flood events
   - → Lamprey mainstem
   - → Coble et al. *in revisions* JGR-B

2. Lessons from *in situ* high frequency sensors
   - → Across a stream network
   - → Response to storm events
   - → Koenig et al. 2017 (WRR)

Long-term trends in solute concentrations and response to extreme flood events

Dissolved organic carbon shows significant decline over period of record

In contrast to many other global studies



p = 0.02; Sen's slope = -0.0038

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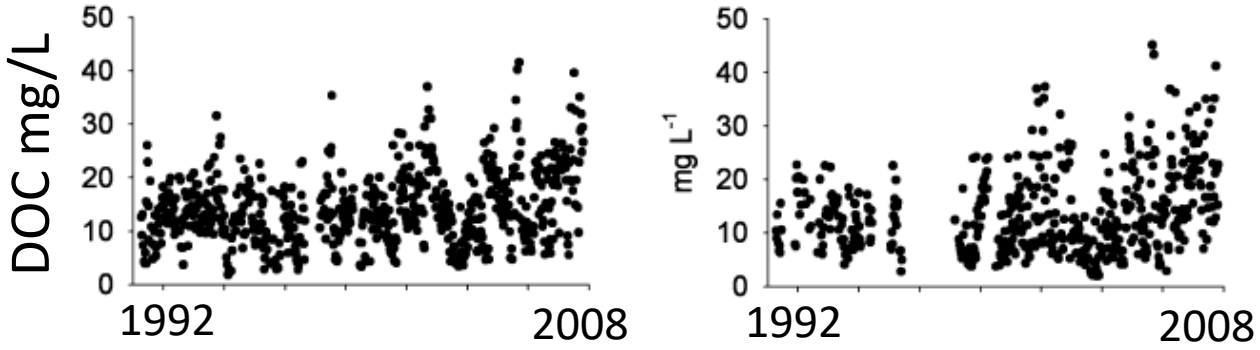
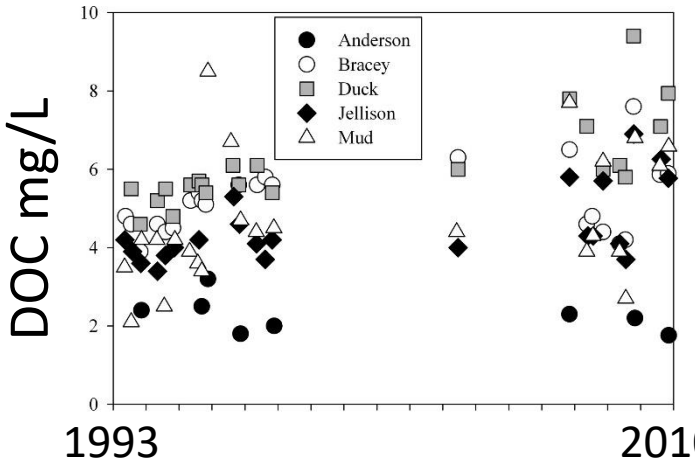
Czech Republic

Hruška et al. 2009



New England Lakes**



**All lakes show significant increases in DOC

SanClements et al. 2012

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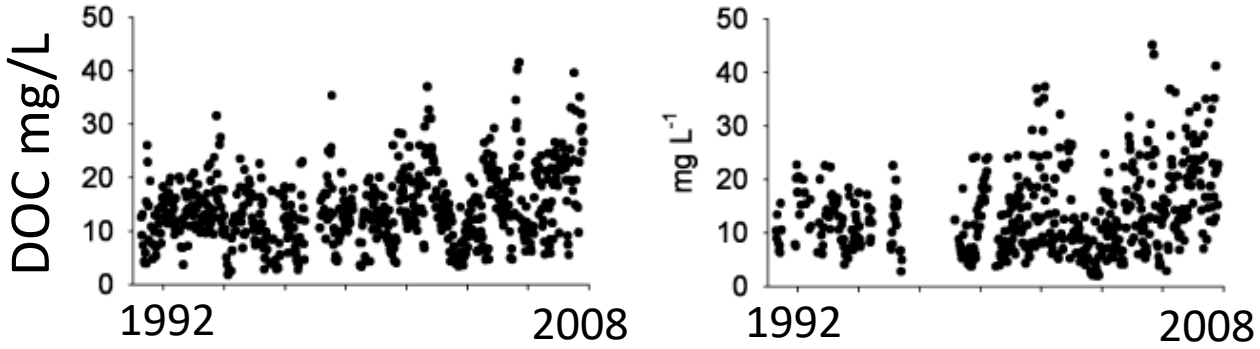

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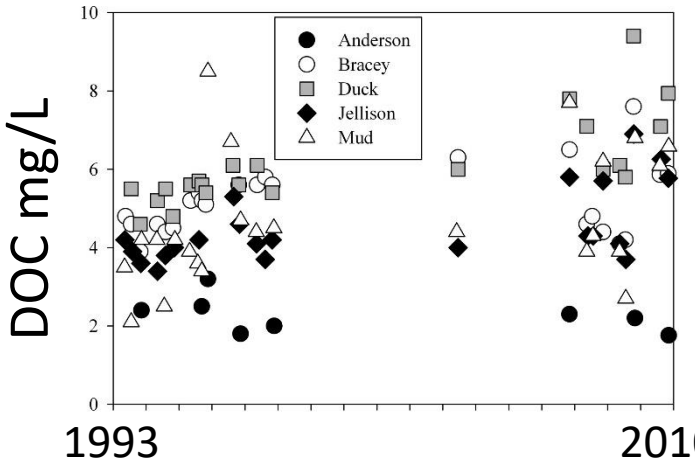


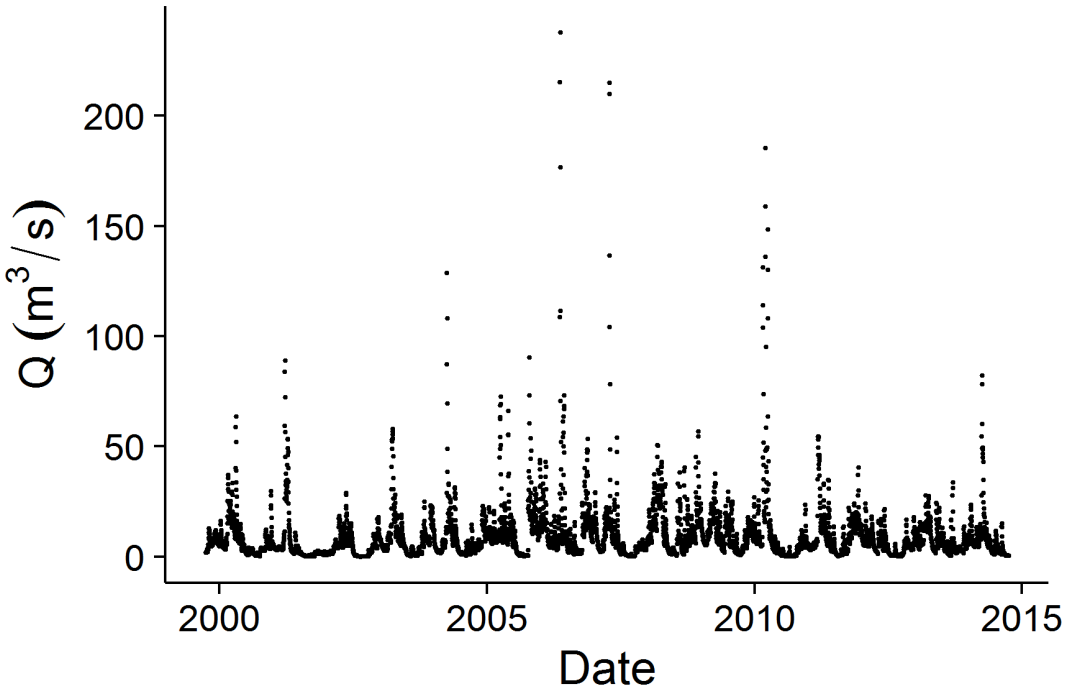
But… *no long term trends in dissolved organic nitrogen (DON) or nitrate (NO_3)*

**All lakes show significant increases in DOC

SanClements et al. 2012

Long-term trends in solute concentrations and response to extreme flood events

Two Major Flood Events (2006 and 2007)



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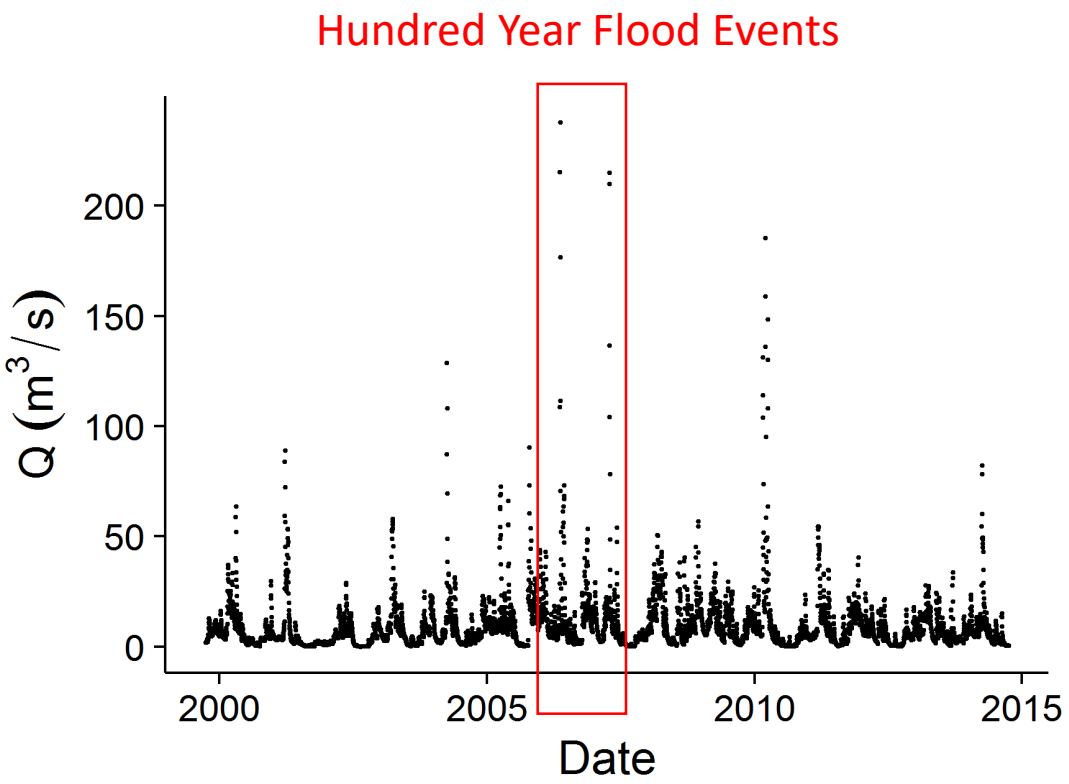

Hypothesis: *Extreme events may buffer long-term trends while revealing the decoupling of solutes*

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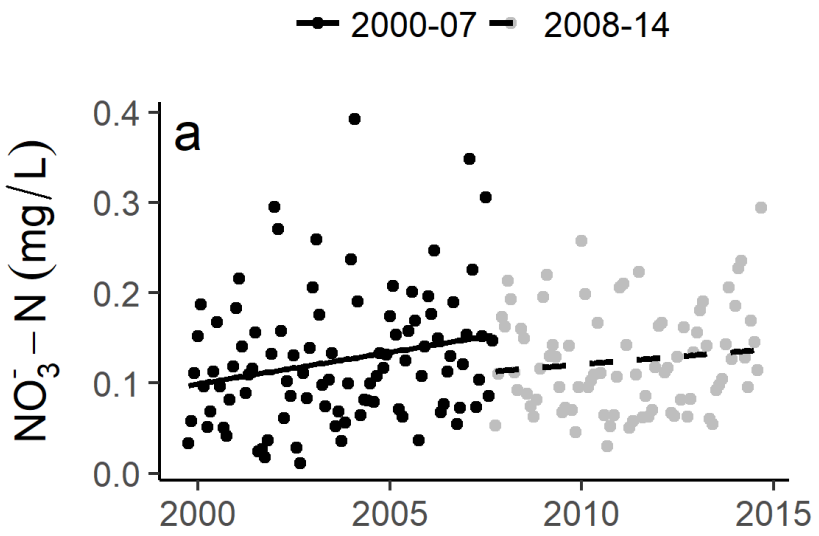

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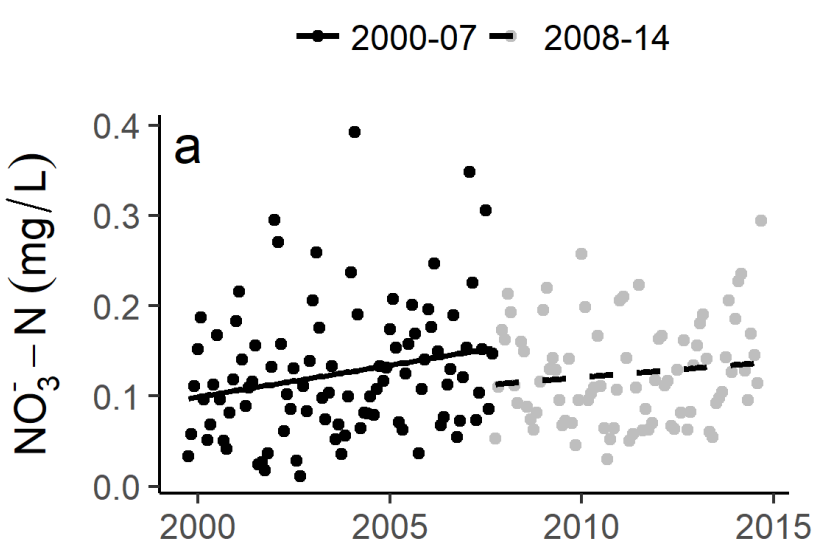

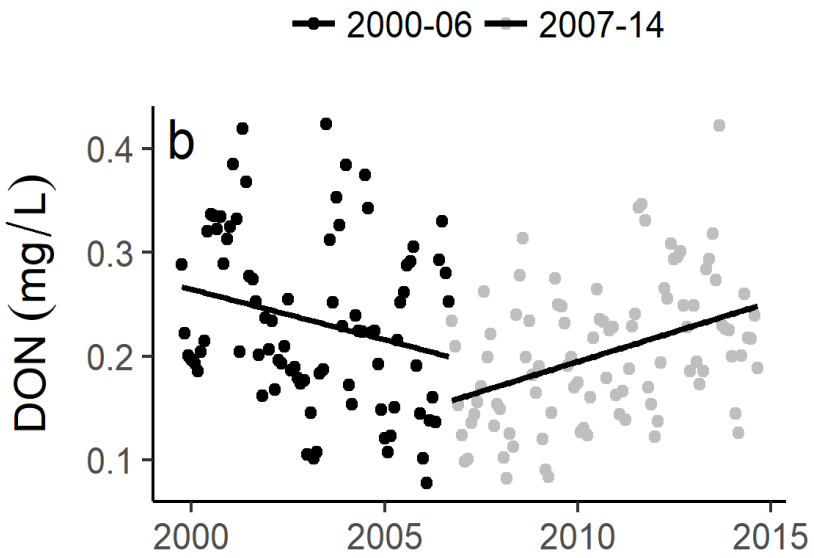

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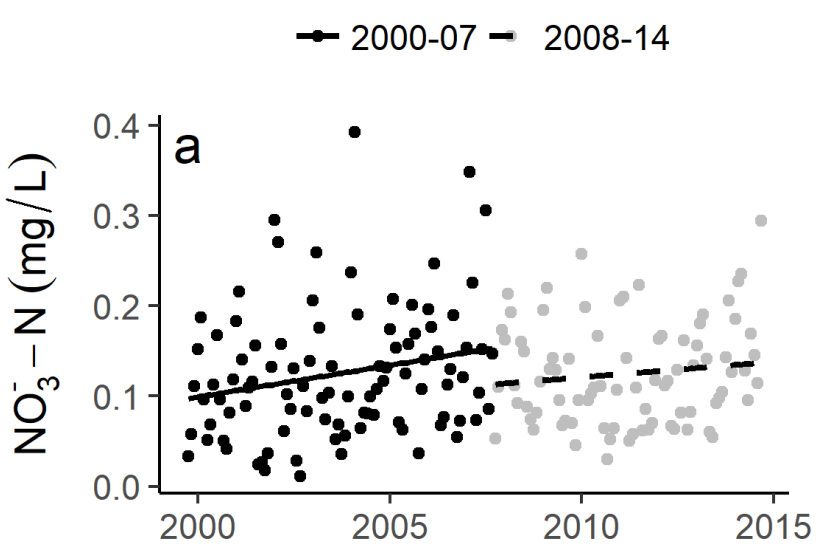
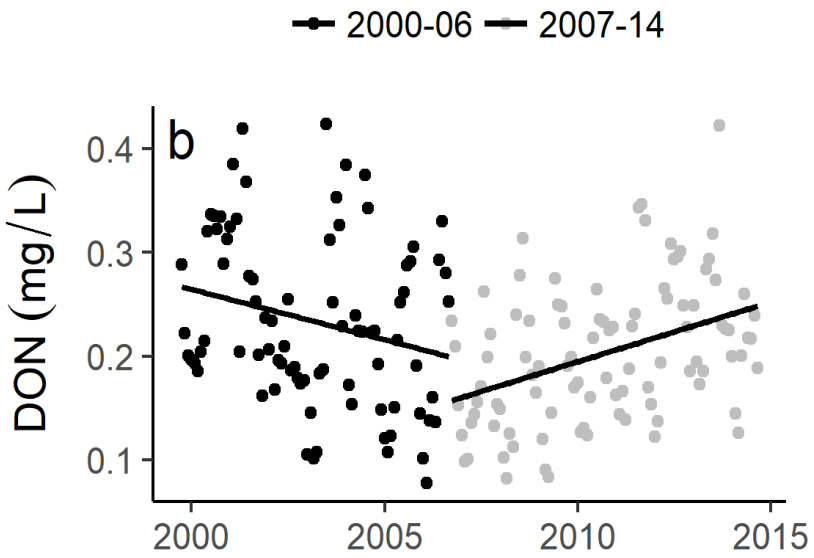
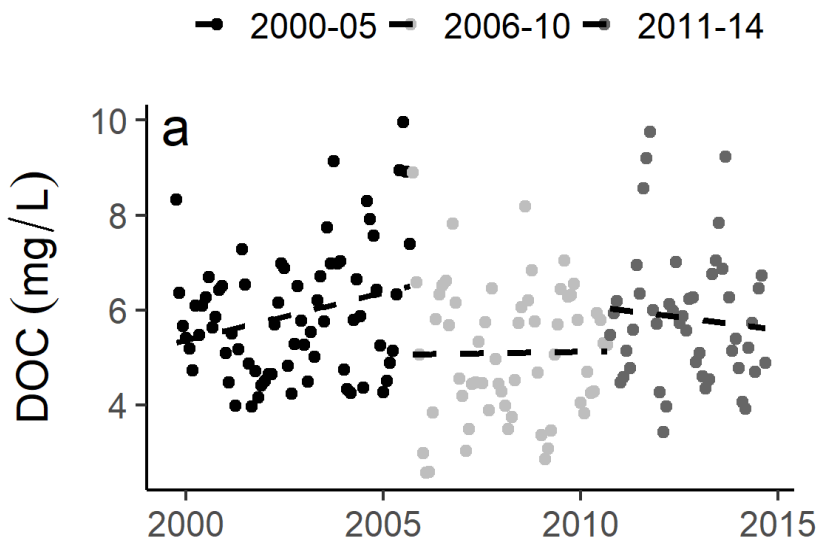


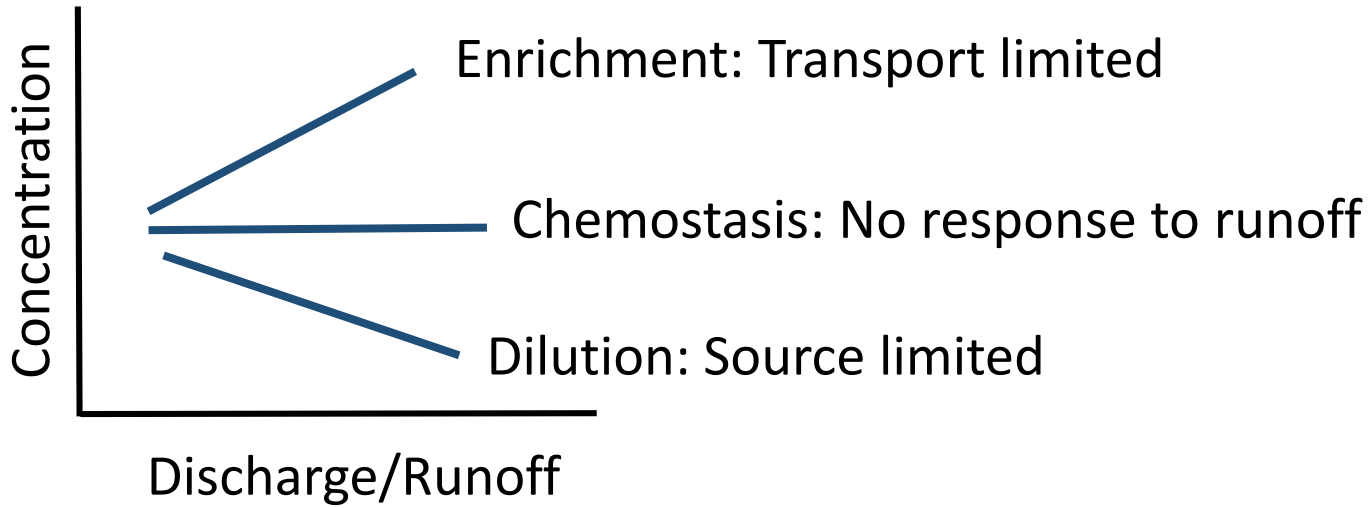




Long-term trends in solute concentrations and response to extreme flood events

Two Major Flood Events (2006 and 2007)

Concentration-Discharge (CQ) relationships powerful method to infer controls on the export of solutes to stream networks



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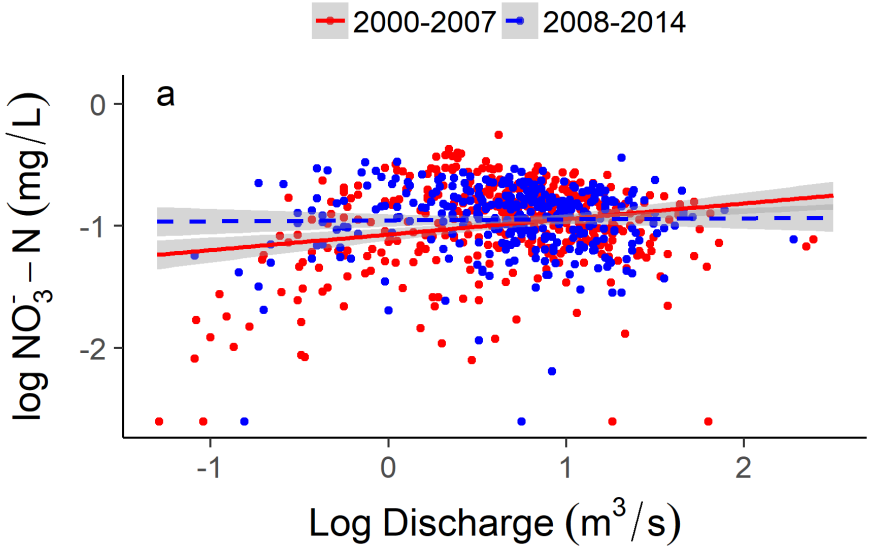

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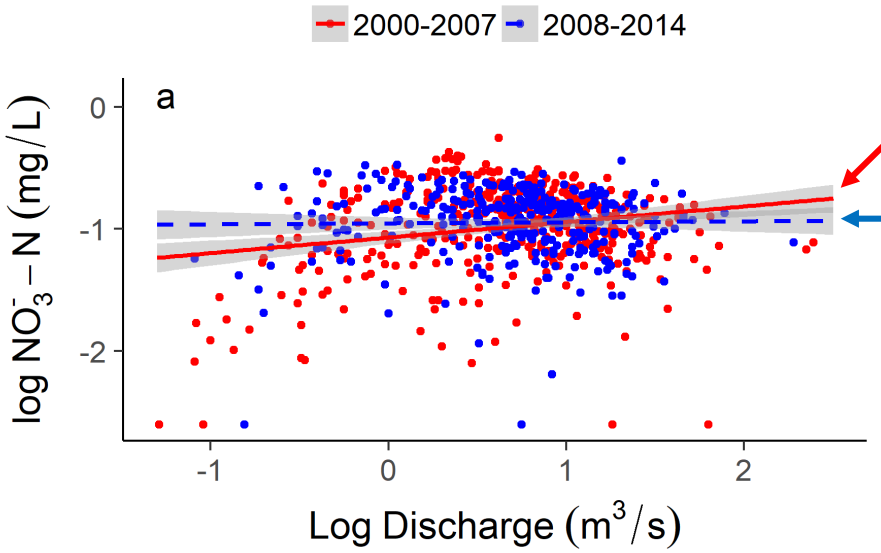

Enrichment

Chemostasis

(no response to discharge)

Long-term trends in solute concentrations and response to extreme flood events
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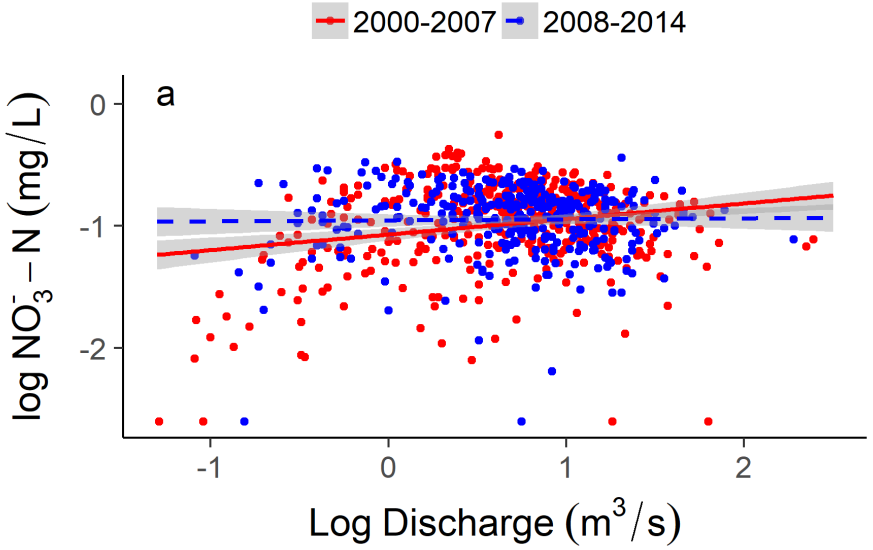

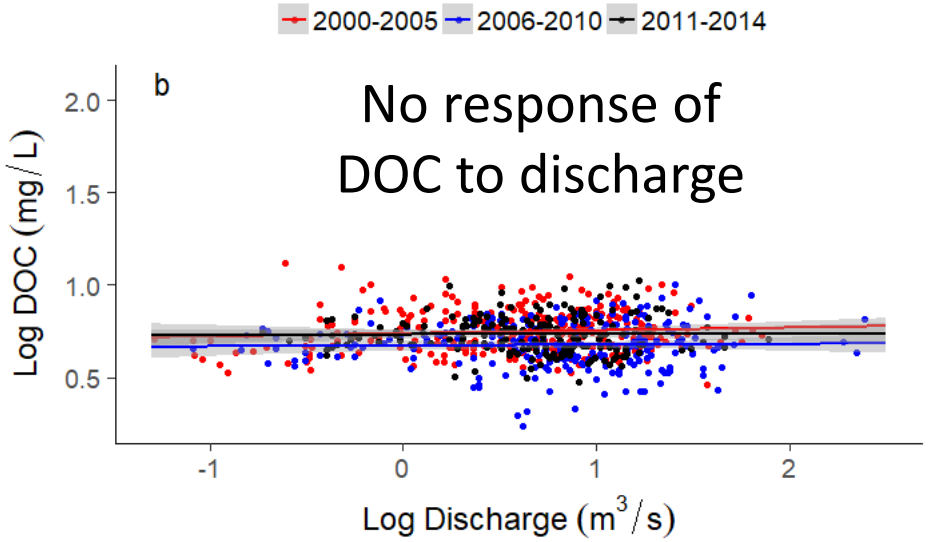

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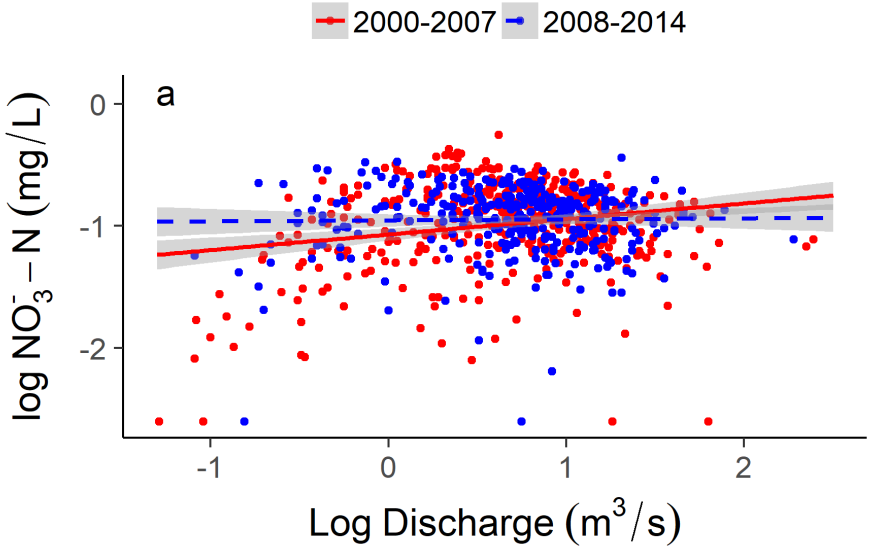

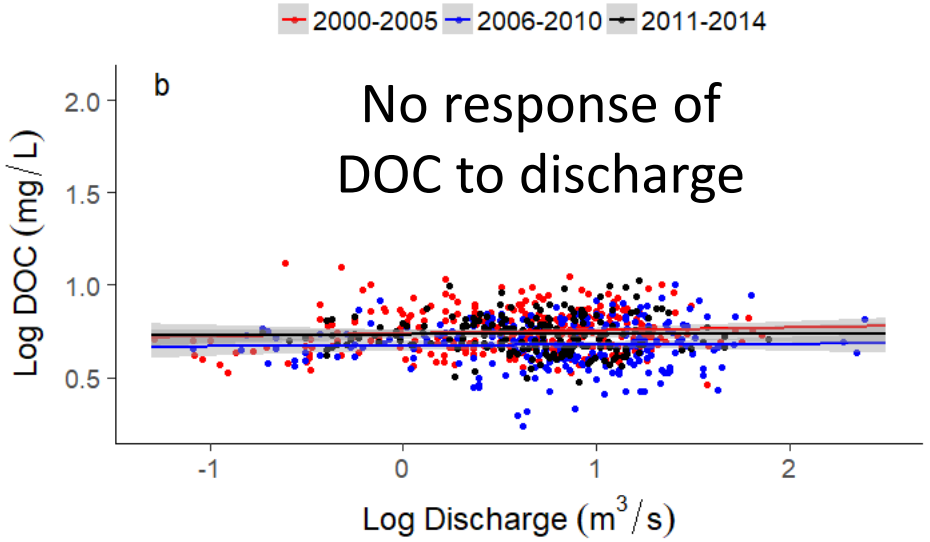

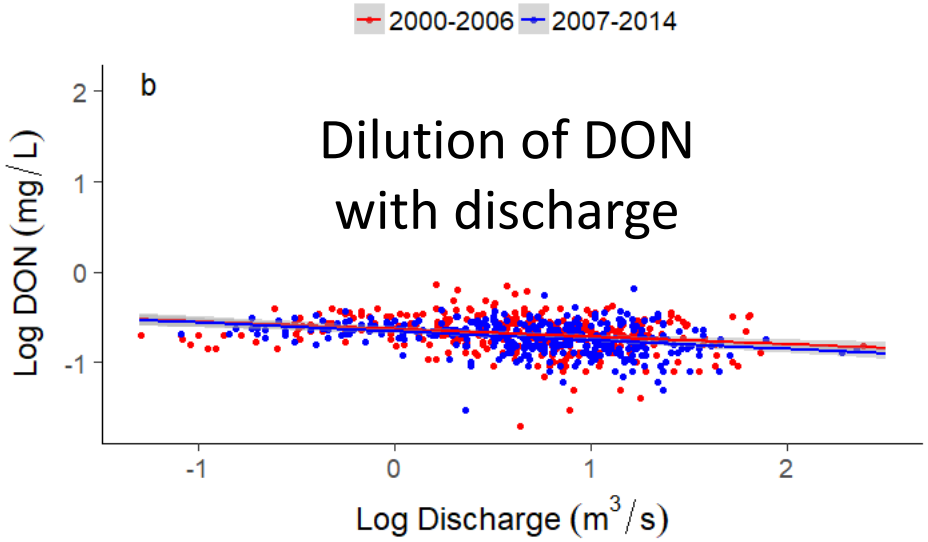

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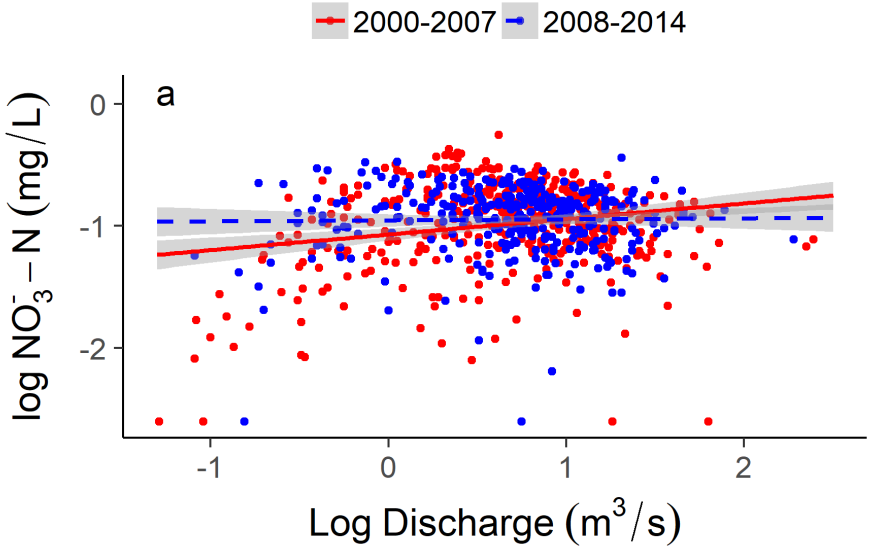

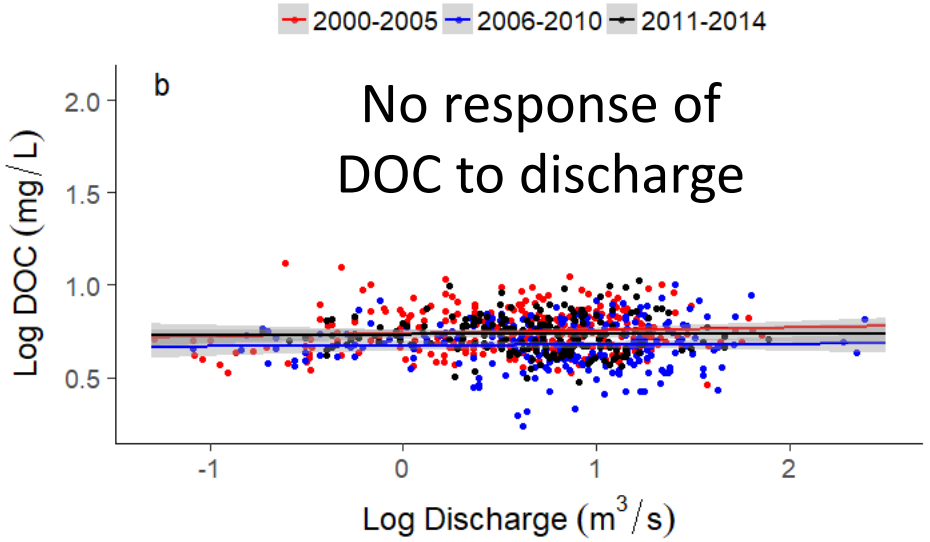

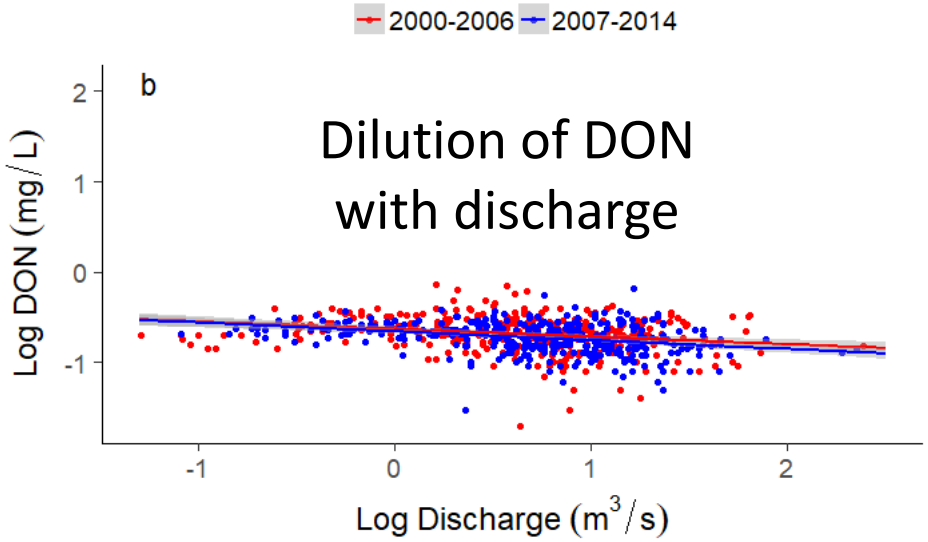

Long term record shows decoupling of DOC, DON and NO_3 and variable responses to discharge.

Lessons from *in situ* high frequency sensors fDOM (proxy for [DOC]) and NO_3

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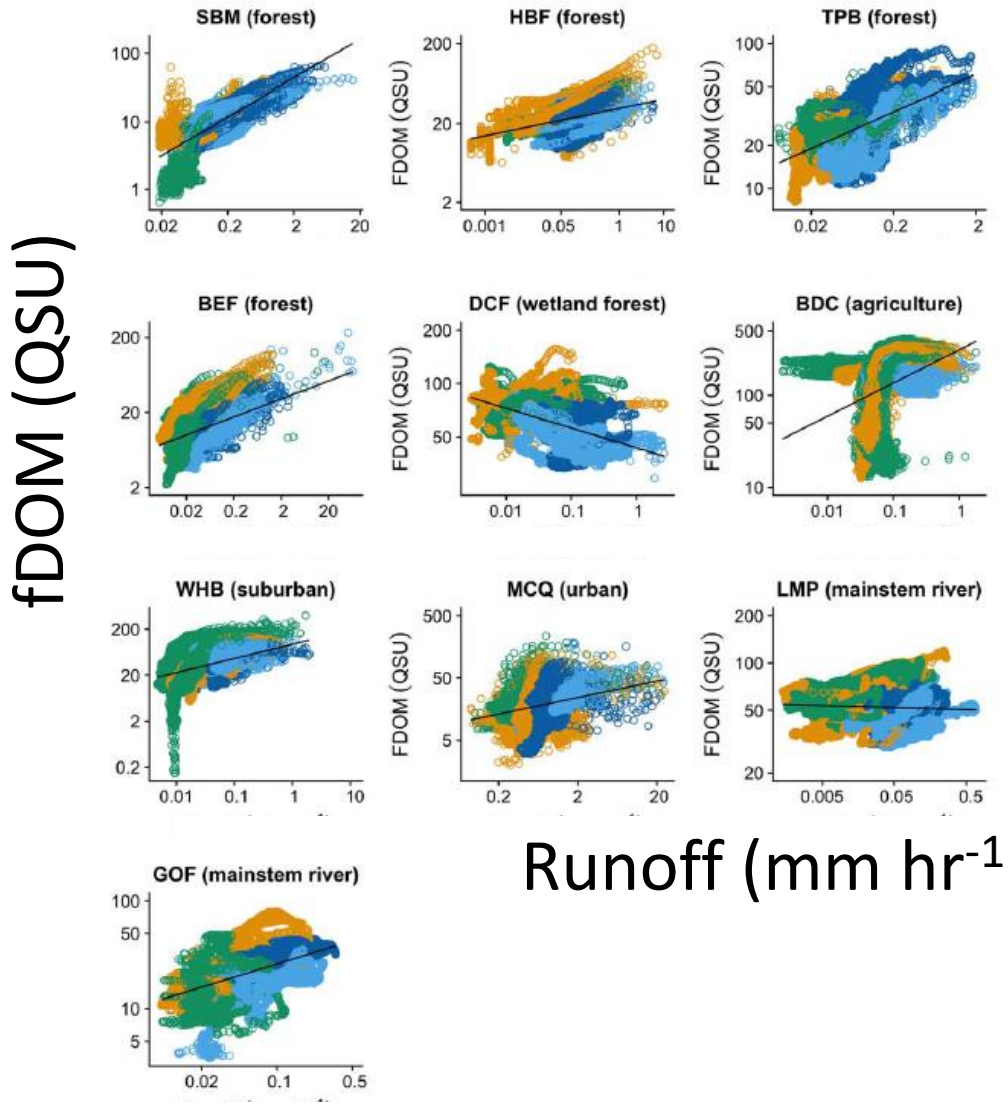

Koenig et al. 2017

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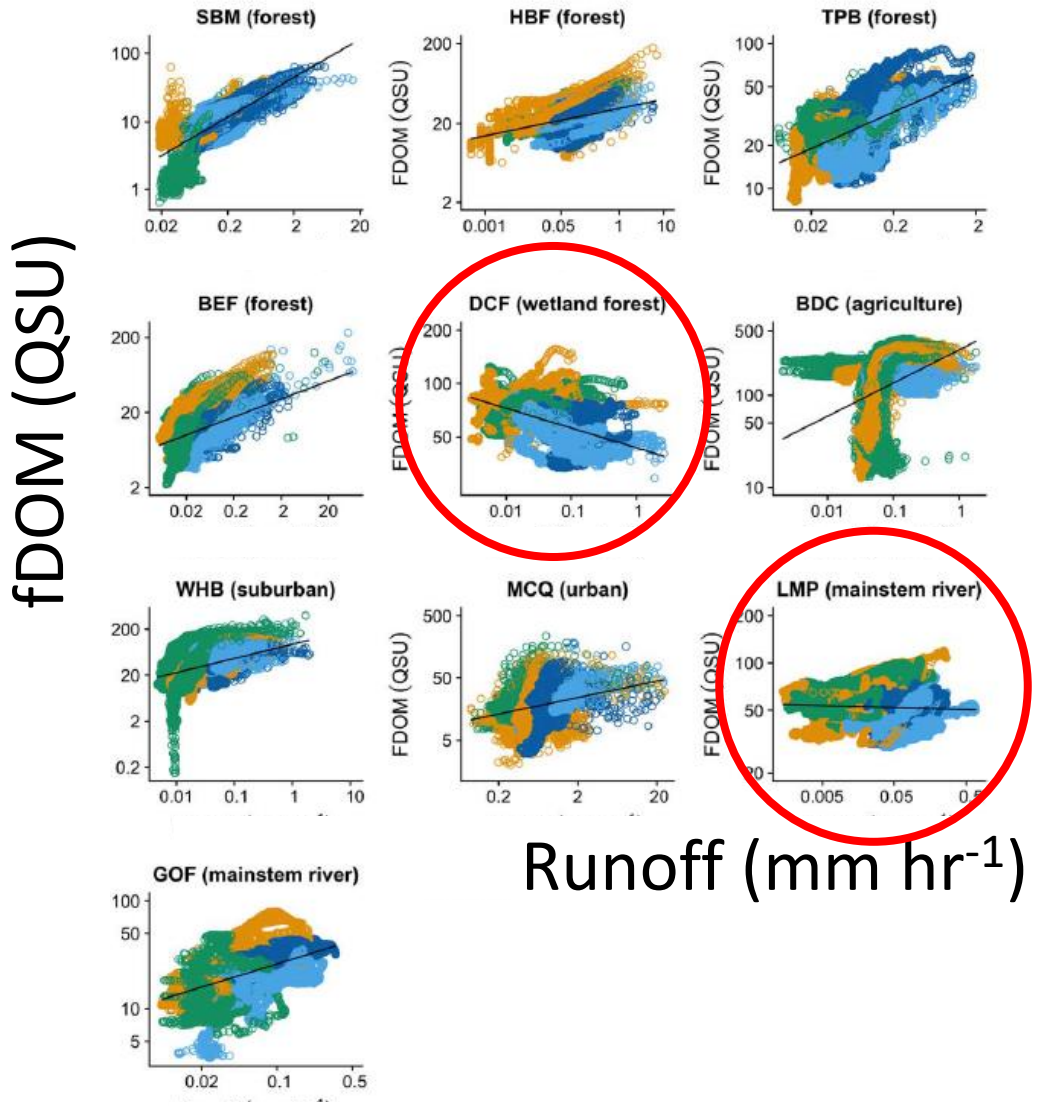

Koenig et al. 2017

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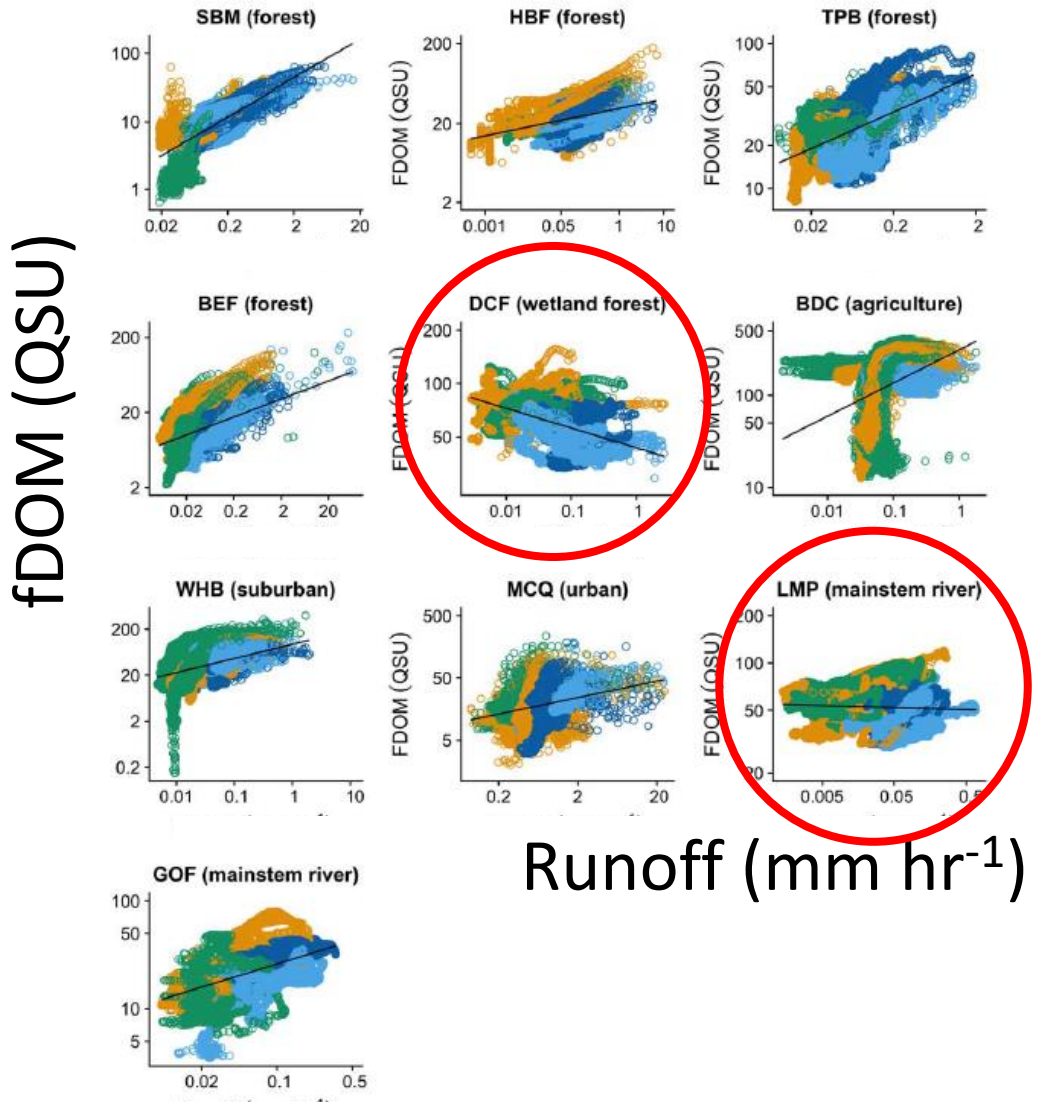

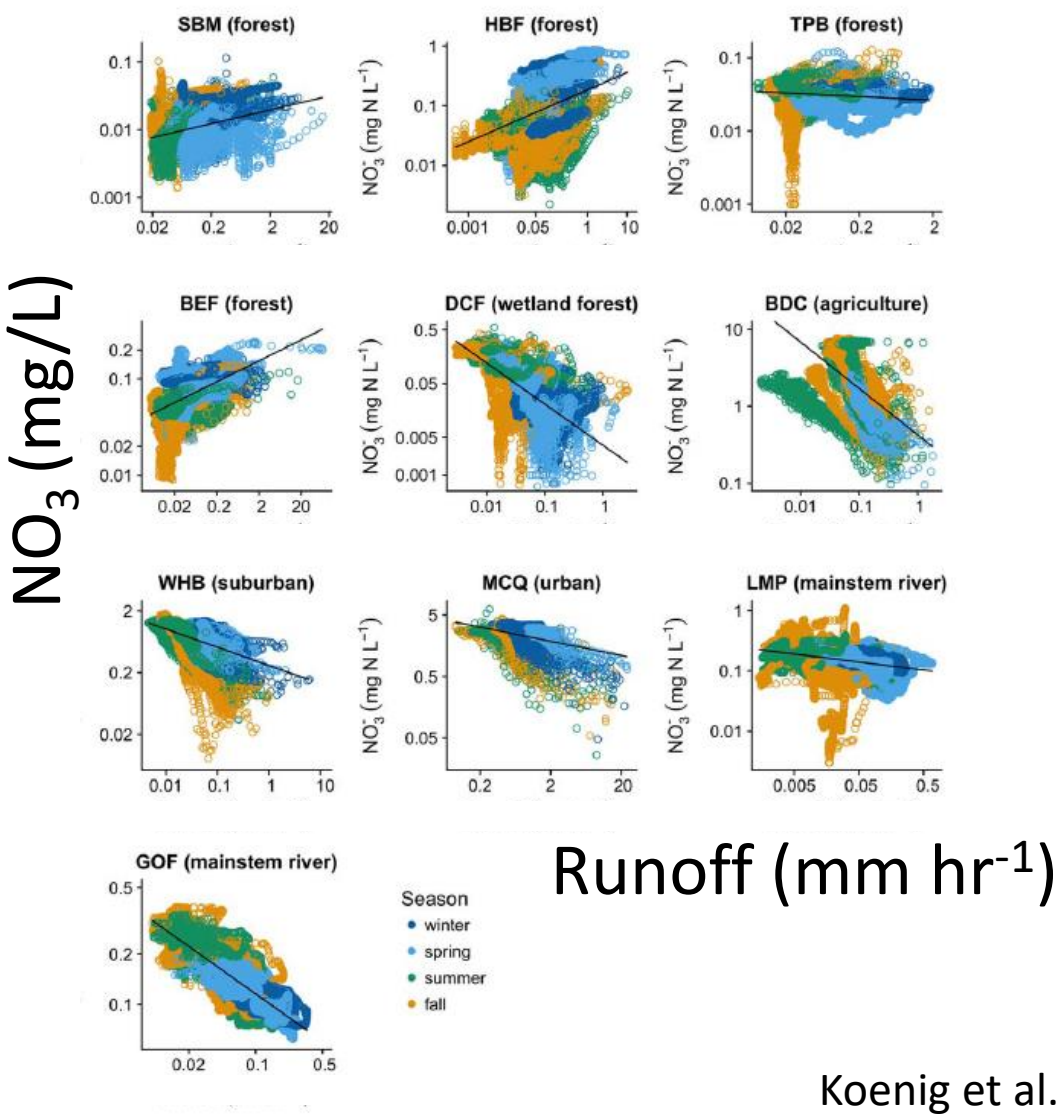

Koenig et al. 2017

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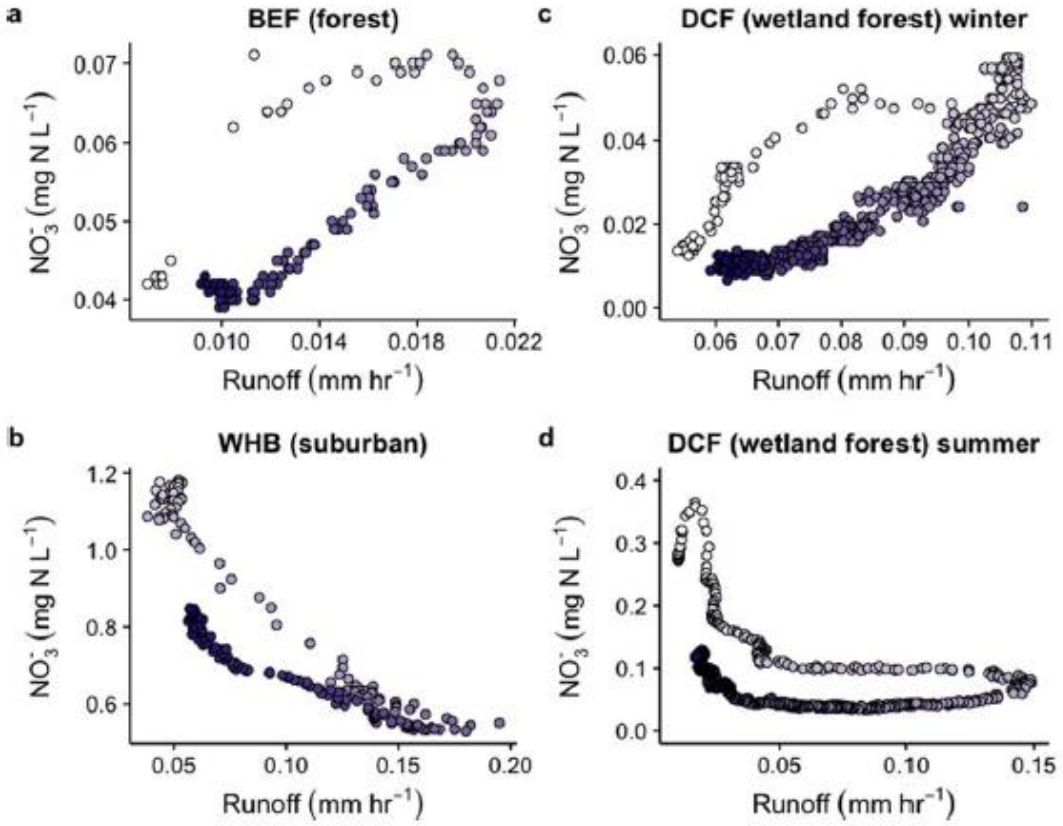

Higher NO_3 concentrations at the beginning of the storm

Koenig et al. 2017

Lessons from *in situ* high frequency sensors
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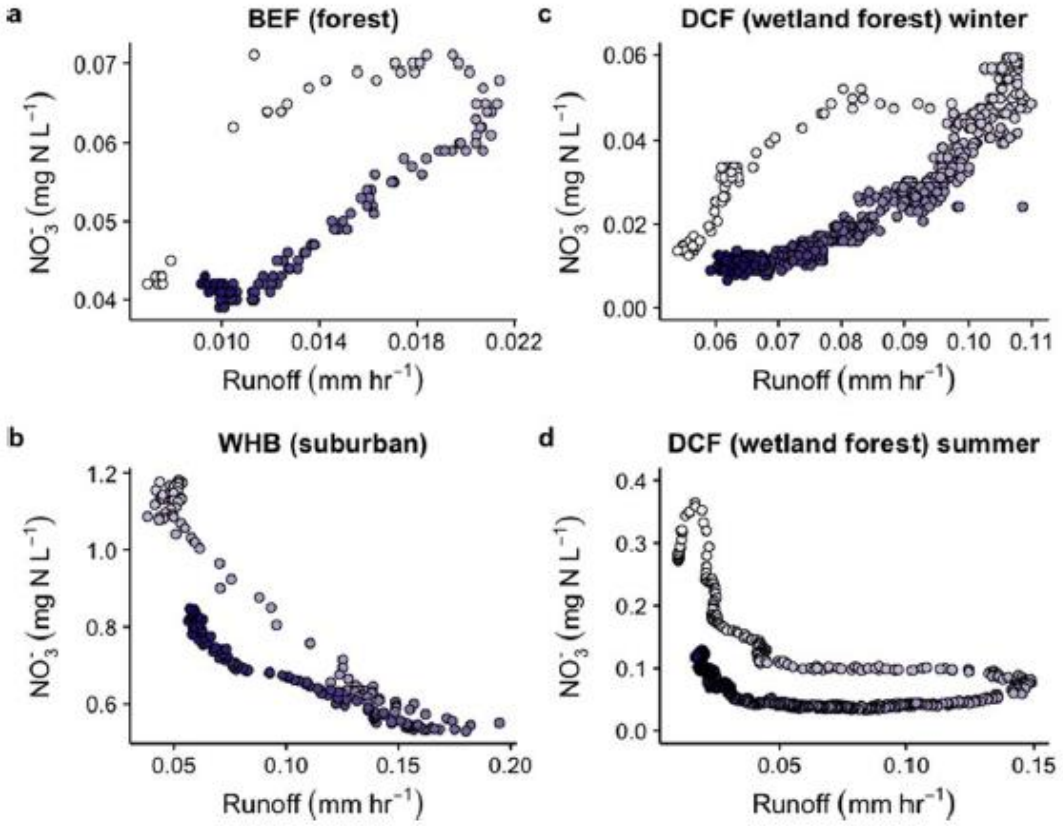

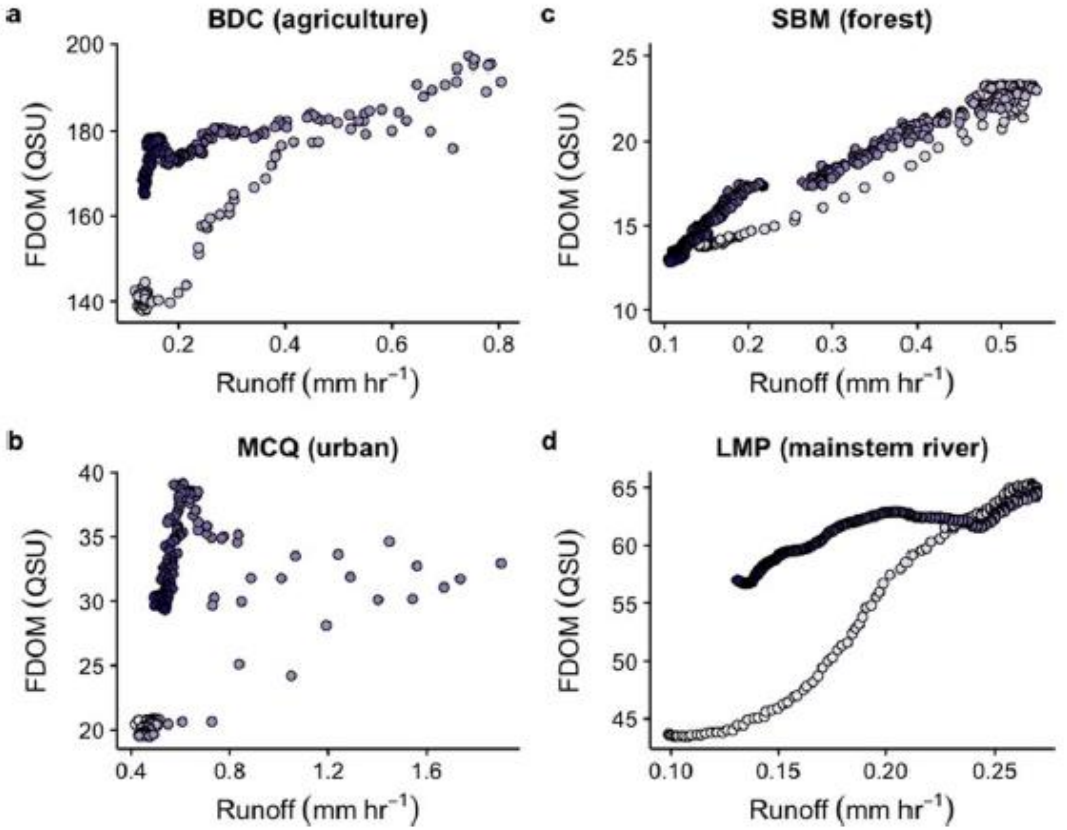

Higher NO_3 concentrations at the beginning of the storm

Higher DOC concentrations at the end of the storm

Koenig et al. 2017

Observations and Unanswered Questions

O1: Concentrations and CQ relationship of NO_3 different post extreme floods.
UQ1a: Do major floods serve as a flushing mechanism in the Lamprey River Watershed?
UQ1b: How can we identify future tipping points in NO_3? (e.g. back to enrichment)

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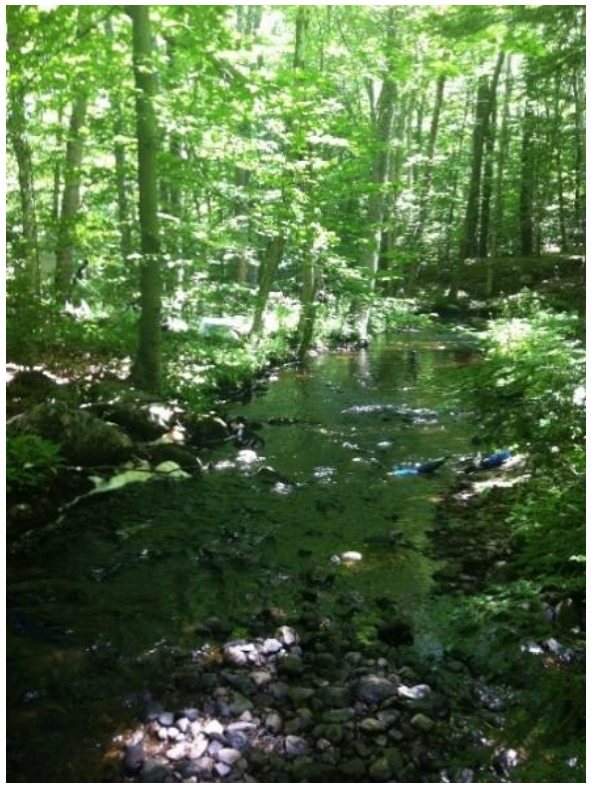
O3: DON is more response to changing environmental conditions compared to DOC
UQ3: How does the interaction of DON and NO_3 influence their export?

Thank you!

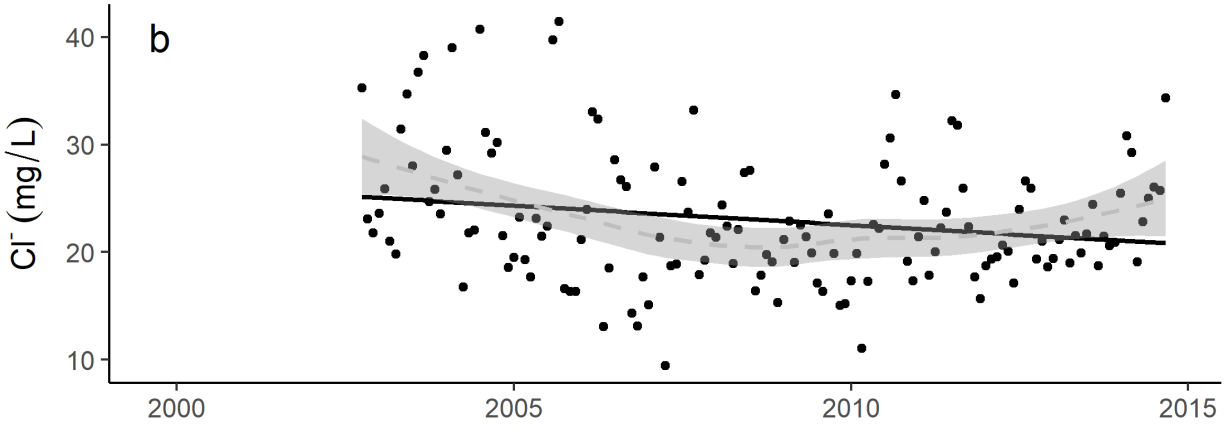


Questions?

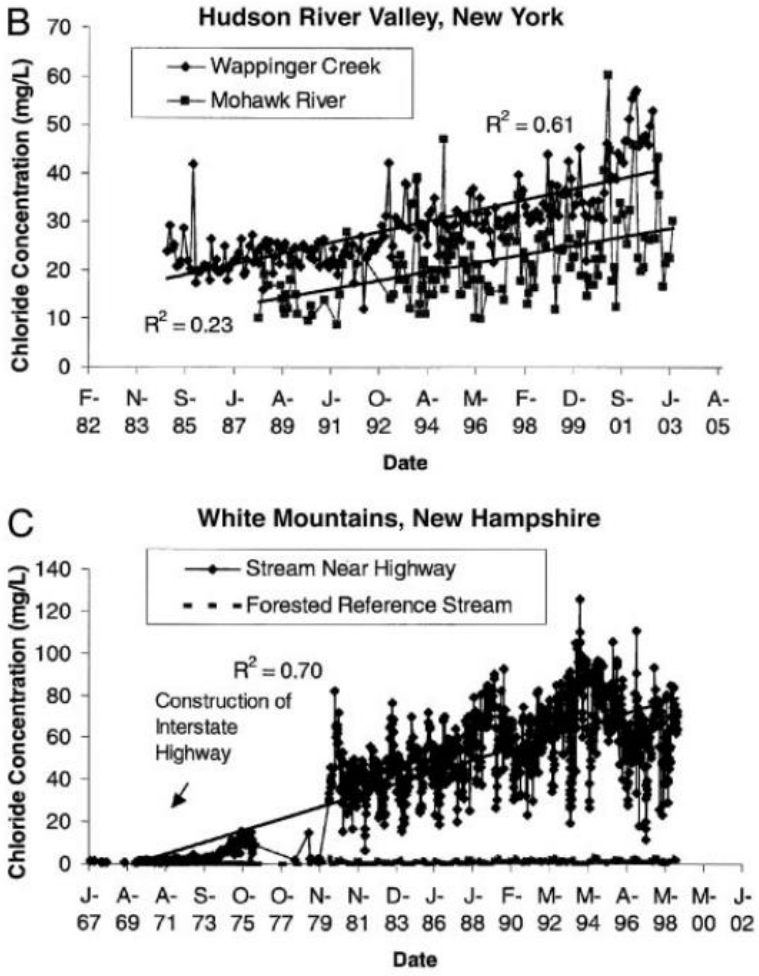
Long-term trends in solute concentrations and response to extreme flood events

3 major solutes show declines in concentrations over the record of observation

Patterns for DOC and Chloride Opposite of Global Trends



p = 0.01; Sen's slope = -0.023



Kaushal et al. 2005

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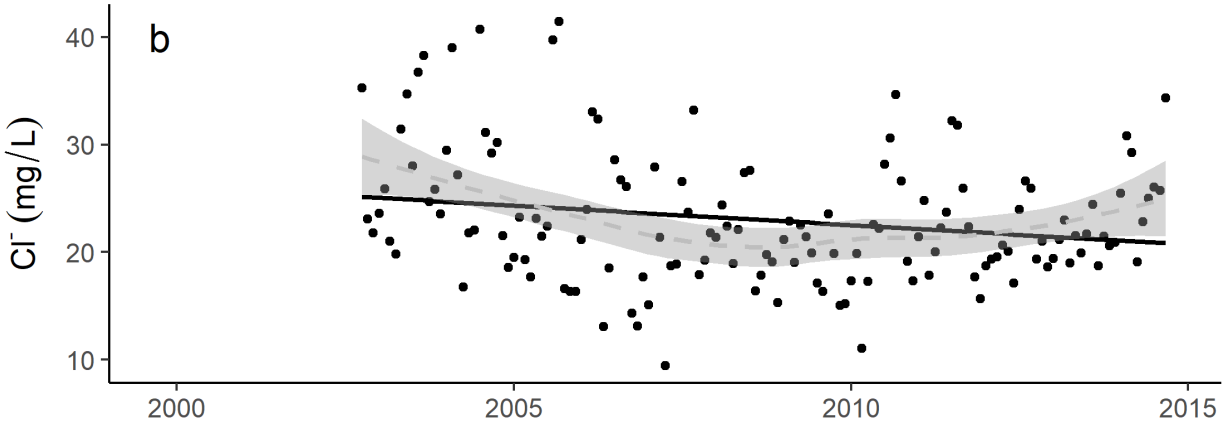

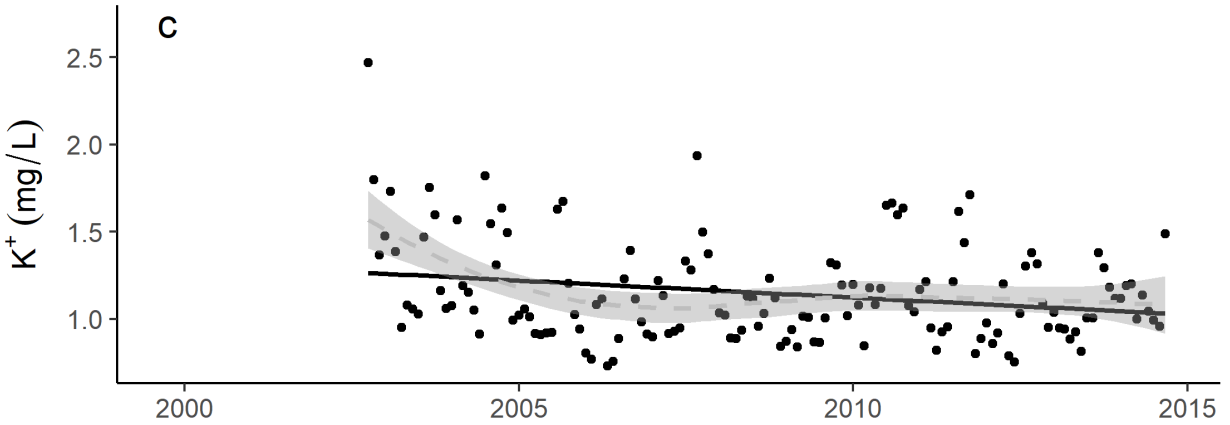

Assessed via Mann Kendall test and estimated Sen's slope using flow weighted monthly mean concentrations