An Assessment of Annual Load Estimation Methods in Small Watersheds for Cross Site Comparisons

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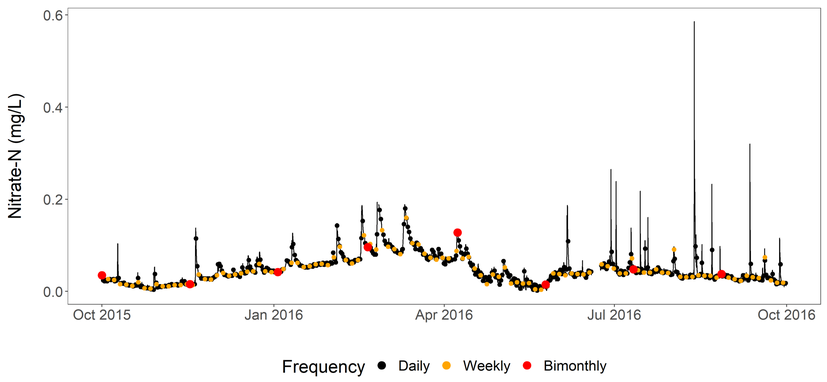
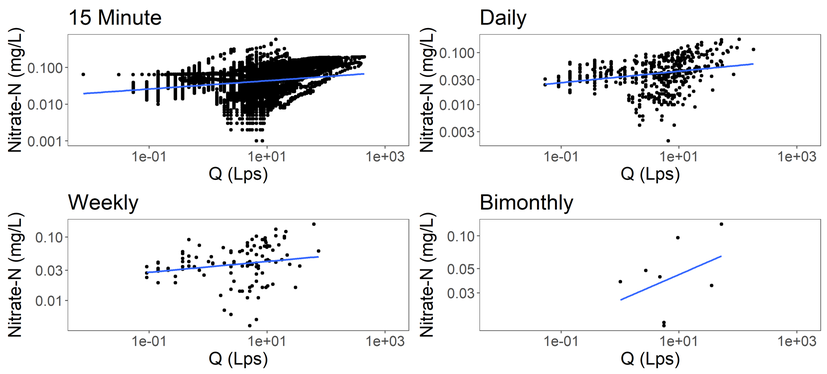
Load (*L*) is the mass of some solute of interest that moves past a point in a stream. It is calculated from discharge (*Q*) and solute concentration (*C*) data.

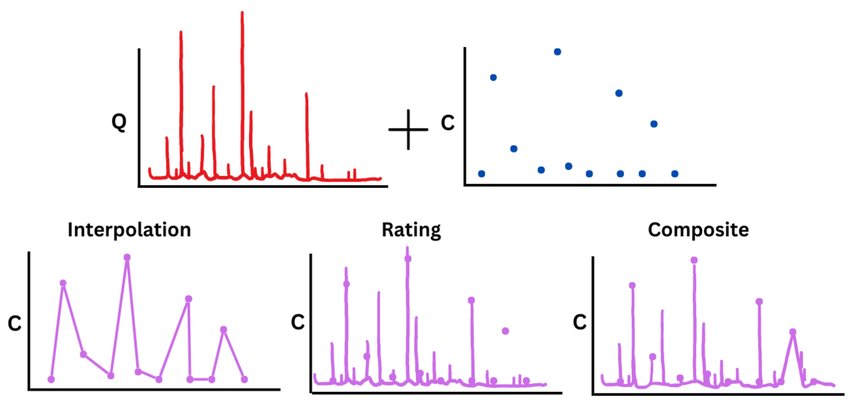
$$L = \int C(t)Q(t)dt$$

Solutes are sampled at varying intervals, both within sites as technology advances and between sites as research questions and funding differ. How frequently we sample informs our C:Q knowledge for the solute at the site.





To estimate annual load, researchers must fill in gaps using one of a variety of methods. All methods introduce error to load estimation. Selecting the most appropriate method is mostly dependent on the sampling frequency, C:Q relationship of the solute and the autocorrelation of samples through time.



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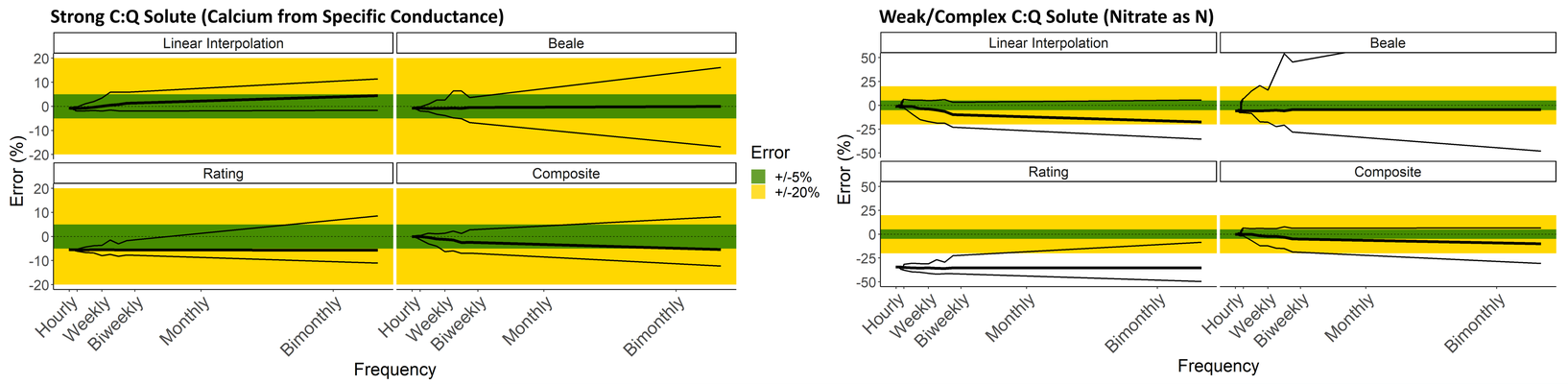
Works Cited

Appling et al, 2015, "Reducing bias and quantifying uncertainty in watershed flux estimates: The R package loadflex"

Aulenbach et al, 2016, "Approaches to stream solute load estimation for solutes with varying dynamics from five diverse small watersheds".

Nava et al, 2019, "An R package for estimating river compound load using different methods"

Load estimates are greatly improved with high frequency sampling, complete C:Q knowledge, and proper method selection. Solutes with low variability can estimated accurately with sparse data, but dynamic solutes require more frequent monitoring or effective modeling to accurately estimate.



To assess a load estimate's quality, we need to assess:

- Sampling frequency of underlying data
- Hydrologic regime
- C:Q relationship
- Completeness and stability of C:Q relationship