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Sediment and nutrient budgets are inherently dynamic: evidence from a long-term study of two subtropical reservoirs

K. R. O'Brien et al.

Correspondence to: Katherine R. O'Brien (k.obrien@uq.edu.au)

Supporting Information for

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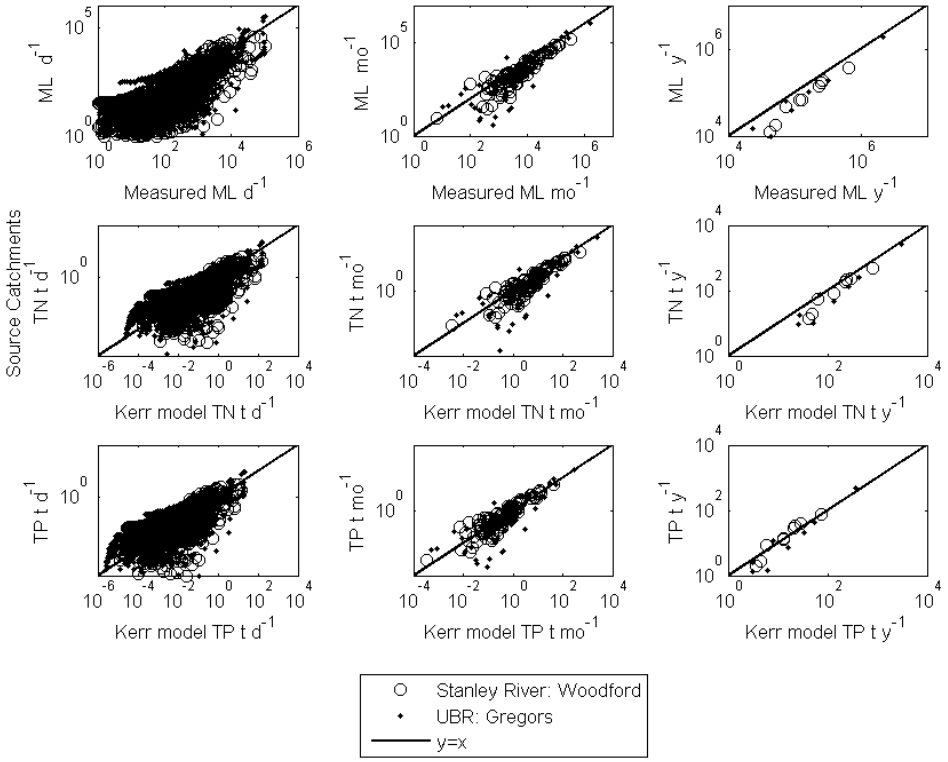

Figure S1. Source Catchment (SC) model predictions on daily, monthly and annual time steps at Stanley River and Upper Brisbane River (UBR) gauging stations, compared with measured flow, and TN and TP loads estimated from daily measured flow using the empirical model of Kerr (2009). TSS information was unavailable on these timescales.

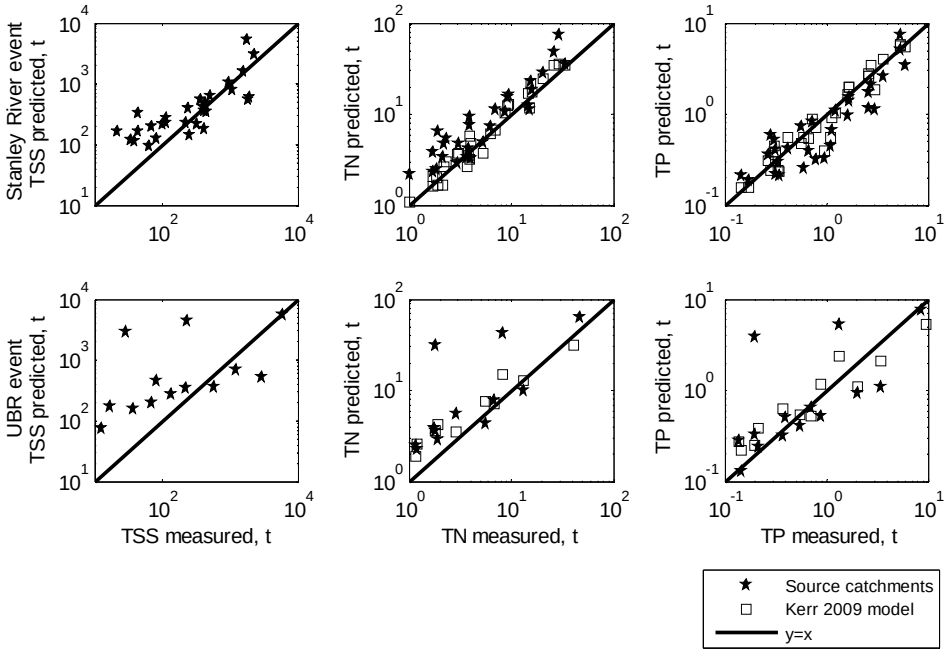

Figure S2. Predictions of TSS, TN and TP loads (t) during high flow events compared with loads estimated from direct measurement of concentration and flow at Stanley River and Upper Brisbane River (UBR) gauging stations. Predictions are shown for two models: Source Catchments (SC), and the empirical flow-based model of Kerr (2009).

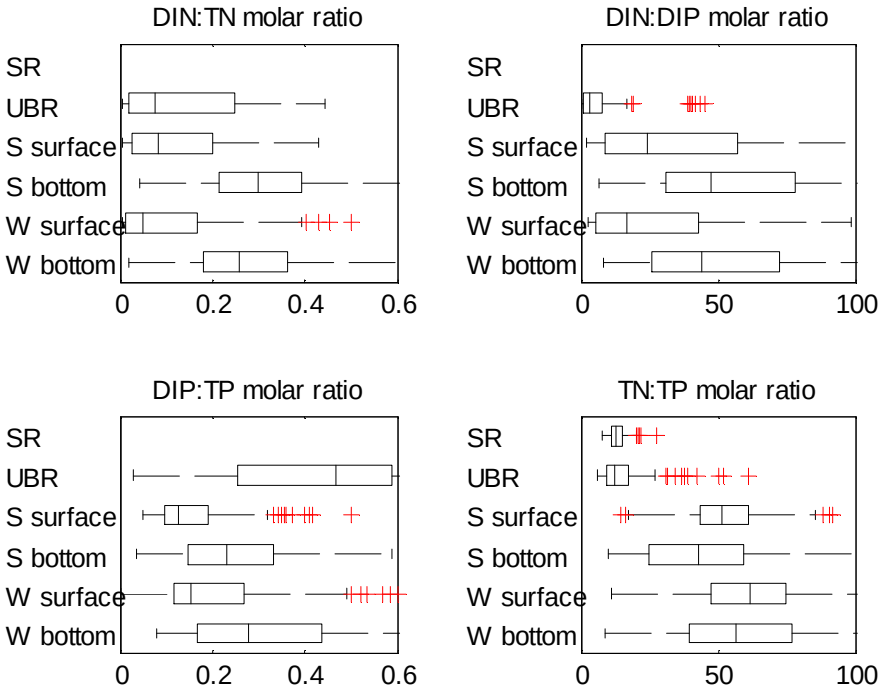

Figure S3. Molar ratios of dissolved to total nutrients (DIN:TN, DIP:TP), and N:P ratios for dissolved and total nutrients (DIN:DIP and TN:TP respectively) at the dam wall of Somerset and Wivenhoe Reservoirs June 1997-July 2011, and at the gauging stations for Stanley River (SR) and Upper Brisbane River (UBR) July 2002- June 2009.

Table S1. Relative uncertainty in catchment inputs and reservoir outputs. Uncertainty in annual catchment inputs is approximated by the root mean square difference between flow predicted by Source Catchments (SC) and annual gauged flow, as a proportion of mean annual flow. Uncertainty in reservoir outputs is estimated from the mean relative error between Method 3 (monthly monitoring as primary data source) and Method 4 (turbidity profiles as primary data source) during non-flood years. Errors for TSS and TP output loads have been averaged to produce a common value for these two variables, which are closely associated with suspended sediment.

	Catchment inputs	Reservoir outputs
Flow	70 %	negligible
TSS		40%
TN		10%
TP		40%

Table S2. Correlation between [TSS], [TN], [TP] (mg L^{-1}) and turbidity (NTU) measured at the dam wall in Somerset and Wivenhoe reservoirs (Eqn 1), from linear regression between monthly monitoring and mean daily turbidity at surface and bottom of water column, on days when both measurements are available. TSS correlation used pooled surface and bottom data in each reservoir. TN, TP correlations used pooled surface and bottom data in Wivenhoe reservoir when NTU>15.

y (mg L^{-1})	Data source	Intercept *a* (mg L^{-1})	Slope *b*, (mg L^{-1} NTU^{-1})	Adjusted R^2	Number of observations
[TSS]	Somerset	1.0±0.8	0.28±0.04	0.86	31
	Wivenhoe	2.3±0.8	0.21±0.2	0.86	84
[TN]	pooled	0.6 ±0.08	0.001±0.0005	0.69	8
[TP]	pooled	0.05±0.03	0.0006±0.0002	0.86	9

Table S3. Mean [TSS], [TN], [TP] measured by monthly monitoring at the dam walls, July 1997-May 2011. Mean [TSS] is based on log-transformed data, because [TSS] is skewed by small number of very high concentrations.

	Depth	Mean [TSS] ($mg\ L^{-1}$)	Mean [TN] ($mg\ L^{-1}$)	Mean [TP] ($mg\ L^{-1}$)
Somerset	surface	2.8	0.58	0.028
	bottom	2.9	0.62	0.045
Wivenhoe	surface	2.6	0.50	0.022
	bottom	2.6	0.57	0.035

Table S4. Comparison of two different methods for estimating output loads of TSS, TN and TP (kt) during the flood month (January 2011), flood year (July 2010-Jun 2011) and entire study period (July 1997- June 2010): Method 1 uses historical mean concentrations and Method 3 uses monthly monitoring data supplemented by turbidity profile data. TSS and TP output loads are substantially underestimated over all three timeframes if calculated using mean historical concentrations. S = Somerset reservoir, W = Wivenhoe reservoir.

	January 2011			Water year 2010			Full study period		
Export loads	**Method 1**	**Method 3**	**Method 3: Method 1**	**Method 1**	**Method 3**	**Method 3: Method 1**	**Method 1**	**Method 3**	**Method 3: Method 1**
TSS, kt:									
S	2.5	19	7.5	5	27	5.5	12	37	3.0
W	7.7	104	14	13	120	9.7	24	154	6.5
TN, kt:									
S	0.52	0.59	1.1	1.0	1.1	1.1	2.6	2.8	1.1
W	1.5	2.2	1.5	2.4	3.4	1.4	4.5	5.8	1.3
TP, kt:									
S	0.032	0.082	2.6	0.06	0.14	2.3	0.16	0.27	1.7
W	0.066	0.43	6.5	0.11	0.57	5.3	0.20	0.74	3.6